APPENDIX H
Watershed, Soils, and Aquatic Species and Habitat

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Appendix H – Watershed, Soils, and Aquatic Species and Habitat

Watersheds (Water And Soil Resources)

Watershed condition was evaluated for every 6th code HUC (hydrologic unit code) within the Forest boundaries. The analysis included a variety of physical measures reflecting the sensitivity and resiliency of watersheds, combined with measures of human-caused disturbances. Following is a description of how watershed condition was evaluated for each Forest.

Watershed Condition Evaluation on the IPNF

Methods for Estimating Watershed Condition at the Mid-Scale

The concepts of watershed condition are consistent with those defined in the Proposed Unified Federal Policy for Ensuring a Watershed approach to Federal Land and Resource Management (policy published in the Federal Register on February 22, 2000 (65 FR 8834) and effective October 18, 2000). These concepts were used to indicate the status and trend of the watershed based on:

- Physical characteristics and processes (e.g., hydrologic, geomorphic, landscape, topographic, vegetative cover, and aquatic habitat)
- Water flow characteristics and processes (e.g., volume and timing), and
- Water quality characteristics and processes (e.g., chemical, physical and biological), as it affects water quality and water resources.

A variety of physical measures that reflect the inherent (i.e., natural) sensitivity and resiliency of watersheds, combined with measures based on human-caused disturbance histories of those watersheds will be assessed at the sub-watershed (6th- code hydrologic unit) scale. The measures focus on the slopes (the land system), the riparian areas, and the streams and lakes within the watershed.

The database of watershed characteristics related to 1) Watershed Sensitivity and 2) Watershed Disturbance Regime was developed for all the sub-watersheds that are within or are influenced by the Forest.

First, each sub-watershed [6th code HUCs] (and in some situations, watershed [5th code HUCs]) were characterized in terms of watershed sensitivity as high, moderate, or low. This characteristic relates to the resiliency of the watershed system; its ability to absorb or adapt to disturbances; and its ability to adjust to or recover from intense events. Most of the variability between watersheds for sensitivity on the Idaho Panhandle National Forests is assumed to be defined primarily by:

- **Sensitive lands –** the proportion of the watershed system that is made up of sensitive landtypes. Sensitive landtypes in this context reflect those land units that have a substantial natural risk of mass failure, or are very susceptible to disturbances that induce mass failure or excessive surface erosion; and that have the delivery potential to move large amounts of those erosion products to the surface water networks of the watershed.

- **Sensitive snow –** the proportion of the watershed system that frequently supports snowpack conditions that are susceptible to the common midwinter warm-moist marine air invasions common to the north Idaho panhandle and northwest Montana regions. The climatic events are sometimes called "rain-on-snow" events, and the watershed response is rapid melt sometimes resulting in local flooding, slope failures, and severe channel adjustments, including scour.
- **Annual precipitation –** mean annual precipitation for the watershed system. This variable appears to explain some of the differences in watershed sensitivity where it itself is widely variable, particularly on the Kootenai NF.

These variables are assumed to be related to watershed sensitivity as a linear relationship or function T = Watershed sensitivity:

T = a(% sensitive landtypes) + b(% sensitive snow) + c(average annual precipitation)

Where a, b, and c are simply linear coefficients and the dependent variables may be linear or transformed as necessary for best fit. It is anticipated that the calculated range of T was subdivided into high, moderate, and low sub-ranges that reflect known, measured, or observed conditions of sensitivity in certain watersheds.

- Second, each sub-watershed (or watershed) was characterized by its anthropogenic disturbance history and any recent natural extreme disturbance events, again classified as high, moderate, or low. Disturbances are described as structural or ecological modifications to watershed processes or functions that can or do lead a stress, onsite, or downstream adjustments to the watershed system. The variability between watersheds for disturbance in the IPNF is defined primarily by:
- **ECA –** The extent of the watershed affected by logging (tree crown removal) over time (which includes regeneration and vegetative recovery), and the area disturbed by roads and landings is characterized as "Equivalent Clearcut Acres" (ECA). Note that the area disturbed by a road is considered to be permanently equivalent to 100% clearcut.
- **Intact Riparian Area –** the extent of all of the riparian areas within a watershed affected by logging (without recovery), roads, and other clearing activities reflects the intensity and history of disturbance in this most sensitive part of most watersheds. Intact Area is essentially the inverse of disturbed area within the riparian area.
- **Road-Stream Crossing Frequency –** the frequency of intersections of roads and streams are assumed to be related to the level of the risks associated with the direct and indirect disturbances associated with bridges, culverts, fords, hydraulic modifications, and the erosion associated with the approaches to those structures.
- **Watershed-scale Detrimental Disturbance –** the equivalent proportion of the watershed disturbed by logging, roads, yarding systems, and site preparation accounts for a focused disturbance activity at the watershed scale. This is related to the Detrimental Disturbance calculations for soil quality (FSM 2554), but at the scale of the watershed.
- **Riparian Road Density –** the density of roads within the riparian portion of the watershed can reflect the disturbance and risk associated with erosion and delivery of sediments, as well as the direct hydraulic modification caused by encroaching roads that result in the loss of floodway, modification of stream flow velocities, and inhibit the ability of streams to adjust to both natural and induced sediment and flood flows.

- **Sensitive Road Density –** a measurement of the extent of road disturbances on the most sensitive landtypes in the watershed reflects a focused disturbance factor. Sensitive Road Density is the miles of road on sensitive landtypes compared to the entire watershed area. Therefore both the roads on sensitive landtypes and the extent of sensitive landtypes are necessary for this factor to become significant. Sensitive landtypes generally reflect landtypes with moderate or high mass erosion hazards, or high surface erosion hazards, and high delivery efficiencies.
- **Watershed Road Density –** although total road density by itself is not generally indicative of the level or intensity of disturbance to watershed functions and processes, it is anticipated that in some circumstances it may explain some of the variability never the less.

These variables are assumed to be related to watershed disturbance levels as a linear relationship or function **Y =** Watershed disturbance level:

Y = d(ECA) + e(% Intact Riparian Area) + f(Crossing Frequency) + g(Detrimental Disturbance) + h(Riparian Road Density) + i(Sensitive Road Density) + j(Total Road Density), where **d, e, f, g, h, i,** and **j** are simply linear coefficients and the dependent variables may be linear or transformed as necessary for best fit. It is anticipated that the calculated range of **Y** was subdivided into high, moderate, and low sub-ranges that reflect known, measured, or observed disturbance levels in certain watersheds.

Watershed Condition was then be derived as a function of watershed sensitivity (T), watershed disturbance (Y), and professional interpretations and judgments based on inventories, monitoring, and other supporting analyses. Watershed condition was characterized as Properly Functioning Condition (PFC), Functioning at Risk (FAR), or Not Properly Functioning (NPF) based initially on a matrix of watershed sensitivity (T) and watershed disturbance (Y), and then further adjusted as necessary.

This information was then further refined using additional field measurements, monitoring, and professional judgment based on scientific principles to determine the condition of each 6th-code watershed, i.e., whether it is:

- In properly functioning condition;
- Functioning at risk; or
- Not properly functioning.

Watersheds in **"properly functioning condition"** (PFC) are essentially in good condition in terms of physical, hydrologic, and water quality characteristics and function. PFC watersheds have generally high integrity in terms of those same characteristics and processes. The streams are in dynamic equilibrium with their watersheds (i.e. they adjust appropriately to natural fluctuations of stream flow and sediment loading), and the watershed systems are fully functional, operating within their potential. The systems are adjusting to disturbances within their apparent natural ranges of variability; and they can be expected to respond to disturbances with a trend toward a good condition within a reasonable time period.

Watersheds that are **"functioning at risk"** (FAR) continue to have adequate physical, hydrologic and water quality integrity; however, present or ongoing adverse disturbances are likely to compromise that integrity if the present adverse disturbances are not modified or corrected. FAR watersheds have at least moderate physical, hydrologic, and water quality integrity even though they may have been substantially compromised by adverse disturbances.

Watersheds that are **"not properly functioning"** (NPF) are operating and adjusting outside what can be considered dynamic equilibrium; or the physical, hydrologic, or water quality integrity has been so compromised that restoration efforts may be difficult without significant funding and very long recovery time periods. Watershed systems that are NPF are essentially not physically capable of fully supporting beneficial uses. These systems will likely require substantial intervention and/or extremely long recovery periods to restore their capability to fully support beneficial uses. They may contain aquatic resources that are seriously degraded or that are not likely to sustain themselves over time.

Table H-1 displays the resulting watershed condition by HUC for the IPNF.

Table H-1Estimated Sub-Watershed Conditions for the IPNF.

HUC	Descriptive Name	Drainage Area (miles2)	Watershed Condition
17010104	***Kootenai River blw Yaak River***	**920**	
170101040101	Kootenai R abv Curley Cr	26	FAR
170101040102	Pine Cr	19	NPF
170101040201	Boulder Cr abv MF Boulder Cr	30	PFC
170101040202	Boulder Cr blw MF Boulder Cr (incl MF Boulder Cr)	18	FAR
170101040203	EF Boulder Cr	15	PFC
170101040401	Deep Cr abv McArthur Lake outlet	29	PFC
170101040402	Deep Cr abv Brown Cr	31	NPF
170101040403	Fall Cr	29	FAR
170101040404	Ruby Cr	15	FAR
170101040406	Brown Cr (incl Twentymile Cr)	26	FAR
170101040407	Caribou Cr	13	FAR
170101040408	Snow Cr	21	FAR
170101040501	Kootenai Valley	168	FAR
170101040502	Myrtle Cr	43	FAR
170101040503	Ball Cr	27	PFC
170101040504	Trout Cr	20	PFC
170101040505	Parker Cr	16	PFC
170101040506	Long Canyon Cr	30	PFC
170101040601	Mission Cr	31	FAR
170101040701	Smith Cr abv Cow Cr	34	FAR
170101040702	Cow Cr	22	PFC
170101040703	Smith Cr blw Cow Cr	16	PFC
170101040801	Boundary Cr abv Grass Cr	27	NPF
170101040802	Grass Cr	27	FAR
170101040803	Boundary Cr blw Grass Cr	41	PFC
17010105	***Moyie River***		
170101050101	Hawkins Cr	34	FAR
170101050102	Moyie River abv Placer Cr	53	NPF
170101050103	Round Prairie Cr	34	FAR
170101050104	Meadow Cr	24	NPF
170101050105	Lower Moyie River	30	NPF
170101050106	Deer Cr	31	FAR
170102131105	EF Blue Cr	13	NPF

HUC	Descriptive Name	Drainage Area (miles2)	Watershed Condition
170102131106	Blue Cr abv EF Blue Cr	18	PFC
170102131301	Lightning Cr abv Rattle Cr	21	PFC
170102131302	Middle Lightning Cr (incl Porcupine & Wellington Cr)	44	FAR
170102131303	East Fork Cr	20	PFC
170102131304	Lightning Cr blw EF Lightning Cr	32	FAR
17010214	***Pend Oreille Lake***	**1,210**	
170102140101	Pend Oreille Lake basin	423	FAR
170102140102	Gold Cr	22	FAR
170102140103	North Gold Cr	16	PFC
170102140104	Granite Cr	27	FAR
170102140105	Trestle Cr	20	PFC
170102140201	Pack River abv Jeru Cr	41	PFC
170102140202	Pack River abv Sand Cr	81	FAR
170102140203	Lower Pack River	58	FAR
170102140204	Grouse Cr	58	FAR
170102140205	Rapid Lightning Cr	49	FAR
1701021403	Cocalalla Cr	76	FAR
17010215	***Priest River***	**990**	
170102150101	Upper Priest River abv Malcom Cr	28	PFC
170102150102	Upper Priest River abv Upper Priest Lake	52	PFC
170102150103	Lower Upper Priest River (incl Lower Hughes Fk)	26	PFC
170102150104	Hughes Fork abv Gold Cr	27	PFC
170102150105	Gold Cr	21	FAR
170102150201	Priest Lake riparian	123	FAR
170102150206	Kalispell Cr	39	FAR
170102150301	SF Granite Cr	35	FAR
170102150302	NF Granite Cr	30	PFC
170102150303	Lower Granite Cr	35	FAR
170102150401	Lamb Cr	24	FAR
170102150402	Priest River blw Outlet Bay (incl Binarch Cr)	27	FAR
170102150403	Priest River abv East River	26	FAR
170102150404	Big Cr	30	FAR
170102150405	Priest River blw Big Cr	30	FAR
170102150501	Upper West Branch abv Solo Cr	32	FAR
170102150502	Upper West Branch blw Solo Cr	17	NPF
170102150503	Goose Cr (Upper West Branch)	22	FAR
170102150602	Lower East River	8	FAR
170102150701	Lower West Branch abv Flat Cr	29	NPF
170102150702	Lower West Branch blw Flat Cr	38	NPF
170102150703	Moores Cr (Lower West Branch)	19	NPF
17010216	***Lower Pend Oreille River***		
170102161101	SF Salmo River	21	FAR
17010301	***NF Coeur d'Alene River***	**896**	
170103010101	NF Coeur d'Alene River abv Marten Cr	37	FAR

HUC	Descriptive Name	Drainage Area (miles2)	Watershed Condition
170103010102	NF Coeur d'Alene River abv Tepee & blw Marten Cr	65	PFC
170103010201	Tepee Cr abv Trail Cr	35	FAR
170103010202	Trail Cr	30	NPF
170103010203	Tepee Cr blw Trail Cr	19	PFC
170103010204	Independence Cr	60	PFC
170103010301	NF Coeur d'Alene River abv Yellowdog Cr	51	NPF
170103010302	NF Coeur d'Alene River abv Prichard Cr & blw Yellowdog Cr	49	NPF
170103010303	Lost Cr	24	PFC
170103010401	Shoshone Cr abv Falls Cr	42	NPF
170103010402	Shoshone Cr blw Falls Cr	14	NPF
170103010403	Falls Cr (Shoshone Cr)	14	NPF
170103010501	Prichard Cr abv Eagle Cr	50	NPF
170103010502	Eagle Cr	45	NPF
170103010503	Lower Prichard Cr	3	NPF
170103010601	Lower NF Coeur d'Alene River blw Prichard Cr	86	NPF
170103010602	Beaver Cr	42	NPF
170103010603	Steamboat Cr	42	NPF
170103010604	Cougar Gulch	19	NPF
170103010701	Little NF Coeur d'Alene River abv Burnt Cabin Cr	76	NPF
170103010702	Little NF Coeur d'Alene River blw Burnt Cabin Cr	94	NPF
17010302	***SF Coeur d'Alene River***	**298**	
170103020101	SF Coeur d'Alene River abv Ninemile Cr	50	NPF
170103020102	Ninemile Cr	23	NPF
170103020104	Placer Cr	16	FAR
170103020301	Big Cr	30	FAR
17010303	***Coeur d'Alene Lake***	**644**	
170103030102	Fourth of July Cr	28	NPF
170103030501	Wolf Lodge Cr	43	FAR
170103030502	Wolf Lodge Bay (incl Beauty Cr)	64	FAR
170103030503	Fernan Lake basin	19	NPF
17010304	***St Joe River***	**1,848**	
170103040101	St Joe River abv Ruby Cr	77	PFC
170103040102	St Joe River abv Simmons Cr & blw Ruby Cr	89	PFC
170103040103	Simmons Cr	39	PFC
170103040201	St Joe River abv Fishhook Cr & blw Simmons Cr	146	FAR
170103040202	Gold Cr	28	NPF
170103040203	Bluff Cr	34	NPF
170103040204	Quartz Cr	23	NPF
170103040205	Sisters Cr	46	NPF
170103040206	NF St Joe River	113	FAR
170103040207	Fishhook Cr	41	NPF
170103040301	Lower St Joe River reach	206	FAR
170103040302	Slate Cr	66	PFC
170103040303	Marble Cr	142	FAR

HUC	Descriptive Name	Drainage Area (miles2)	Watershed Condition
170103040304	Big Cr	57	PFC
170103040306	Trout Cr	20	FAR
1701030404	***St Maries River***	**488**	
170103040401	WF St Maries River	37	NPF
170103040402	MF St Maries River	69	NPF
170103040404	Emerald Cr	37	NPF
170103040405	Carpenter Cr	20	FAR
170103040408	Santa Cr	74	FAR
170103040409	John Cr	26	NPF
17010305	***Rathdrum Prairie/Upper Spokane River***	**595**	
170103050101	NF Hayden Cr	28	FAR
170103050102	Hayden Lake basin	36	NPF
17060308	***Lower NF Clearwater River***		
170603083001	Little NF Clearwater River abv Twin Cr	45	FAR
170603083002	Little NF Clearwater River abv Bear Cr	67	PFC
170603083003	Canyon Cr	45	FAR
170603083004	Sawtooth Cr	27	PFC
170603083005	Foehl Cr	26	PFC
170603083006	Lower Little NF Clearwater River abv Breakfast Cr	60	FAR
170603083007	Stoney Cr	64	FAR
170603083009	Floodwood Cr	52	FAR

Method for Estimating Soil Condition at the Mid-Scale

To approximate current soil conditions at the mid-scale, residual impacts from past management-related disturbances on soils were estimated from the TSMRS record. The record was queried using GIS techniques with the results in Table H-2. For areas that were treated or harvested more than once, the most likely impacting logging system was selected (e.g., tractor has a greater impact potential than helicopter) to reflect the acres of affected land.

Table H-2: Estimated past management and impacted soil acres on the IPNF based on TSMRS records in GIS and the Soil Disturbance Model

Equipment Class	Estimated Past Management Acres	Disturbance Coefficient	Estimated Impacted Acres*
Tractor	281,253	13 % and 25%	53,438
Site Preparation	15,231	8% and 13%	1,599
Horse Logging	40,079	2%	802
Cable Yarding	71,888	6%	4,313
Skyline	36,762	2%	735
Helicopter	21,815	2%	436
TOTAL	467,028	13%	61,323

*detailed spreadsheet results are available in the project file

The resulting acres were entered into the Soil Disturbance Spreadsheet Model to further estimate detrimental disturbance acres and percentages. The following assumptions were made:

- Tractor logging acres where split in half to represent logging after and before 1990 (13% to 25% respectively).
- It can be assumed that more than half of the tractor acres displayed in Table H-2 were logged prior to 1990 and that impacts around 25% would therefore prevail; however, the spreadsheet model does not account for recovery over time. Based on field monitoring, most activities that occurred before 1990 have undergone some recovery so that the evaluator feels that the equal split gives a representative estimate.
- Site Preparation impacts were estimated between 8% to 13%.

Watershed Condition Evaluation on the KNF

Measures of disturbance and inherent sensitivity were combined to determine watershed condition.

Watershed Disturbance

To measure disturbance, five factors were used: Percent equivalent clearcut acres (ECA), Percent Intact Riparian, Stream Crossing Density, Stream Crossing Density and Riparian Area Road Density.

1. **Percent equivalent clearcut acres (ECA)** – The amount of ECA within each 6th code HUC was determined by querying timber harvest activity from the Forest's Timber Stand Management Record Systems (TSMRS) data base. Table H-3 describes the TSMRS activity codes queried and the associated amount of ECA.

Table H-3 TSMRS Activity Codes and ECA

TSMRS CODE	TSMRS ACTIVITY DESCRIPTION	CROWN REMOVAL % [1/]	ECA Factor (prior to Recovery)
4111	Clearcut- patch	100	1.0
4112	Clearcut- strip	100	1.0
4113	Clearcut- stand	100	1.0
4114	Clearcut- with reserves	100	1.0
4131	Seed cut- shelterwood	85	.92
4132	Seed cut- seed cut	90	.96
4133	Seed cut- SW with reserves	85	.92
4134	Seed cut- seed cut w/reserves	95	.98
4146	Shelterwood – Final Cut	100	1.0
4147	Seed cut – Final cut	100	1.0
4148	Shelterwood – Final w/ reserves	100	1.0
4149	Seed cut – Final w/ reserves	100	1.0
4151	Selection cut- single tree	15	0
4152	Selection cut- group select.	95	.98
4210	Intermed. Hvst- improvement	20	.03
4211	Intermed. Hvst- liberation	33	.16
4220	Intermed. Hvst- thinning	33	.16
4230	Intermed. Hvst- sanit/salvage	33	.16
4231	Intermed. Hvst- mortality cut	33	.16
4232	Intermed. Hvst- sanitation	33	.16

TSMRS CODE	TSMRS ACTIVITY DESCRIPTION	CROWN REMOVAL % [1/]	ECA Factor (prior to Recovery)
4240	Intermed. Hvst- special cut	33	.16
4241	Intermed. Hvst- spec products	33	.16
4250	Natural changes-High wildfire	80	.88
4251	High Severity Wildfire	100	1.0
4252	Mixed Severity Wildfire	45	.50
4253	Low Severity Wildfire	15	.15
4270	Permanent land clearing	100	1.0
4981	Natural changes-Low wildfire	20	.03
4988	Trampling	100	1.0

Source: WATSED files, hydro team meetings over many years
[1/] Crown Removal item is for information only, and was not used in the ECA calculation

The ECA factor for each activity code was then adjusted for recovery, based the number of years since the activity. For permanent land clearings (activity code 4270), there was no recovery.

To account for activities on other ownership lands that had no management information, the following ECA values were used:

- 70% ECA for private forest lands
- 50% ECA for urban lands

Roads were also included in the ECA calculation. Road ECA values were calculated as four acres per mile with 1.0 ECA factor and no recovery.

2. **Percent Intact Riparian** – the total amount of riparian areas without disturbance. Disturbance acres are defined as harvest activities (all TSMRS codes from the ECA table) and all roads. There is no ECA or recovery factor applied. Acres are those that have been harvested or are in roads.

3. **Stream Crossing Density** – number of stream crossings (roads crossing streams) per square mile of watershed.

4. **Percent Detrimental Compaction** – the amount of detrimental soil compaction within a 6th code HUC. The TSMRS database was queried to determine past activities and assign a coefficient for detrimental disturbance. Coefficient values were based timber harvest activities, along with the date of the harvest and the type of equipment used to accomplish the harvest, site preparation and the type of equipment used to accomplish the site prep.

   Soil disturbance coefficients were assigned on the basis of a presumed sequence of activities, i.e. a harvest followed by some type of site prep and/or fire. Because multiple sequences of harvest/site prep/fire can be difficult to track spatially in an automated fashion in TSMRS, this query looks for the sequence of activities following last harvest in a stand and applies a coefficient based on this sequence to the entire stand.

5. **Riparian Area Road Density** – the number of miles of roads (all roads) per total square miles of riparian areas within each 6th code HUC stratified by the watershed's mean annual precipitation.

The five watershed disturbance factors were then combined as shown in Table H-4 to generate an overall rating of watershed disturbance for each 6th code HUC.

Table H-4 Watershed Disturbance Calculation

Watershed Condition Disturbance Evaluation Factors	Factor Weight	Disturbance Factor Scaling		
		High (3x)	Moderate (2x)	Low (1x)
1) % ECA for the Watershed	3	>30%	15-30%	<15%
2) % Intact Riparian	2	<70% intact	70-80% intact	>80% intact
3) Stream Crossing Density (#/mi_2 of Watershed)	3	>3/mi_2	1.5-3/ mi_2	<1.5/ mi_2
4) % Detrimental Compaction	1	>10%	4-9.9%	<4%
5) Riparian Area Road Density (Factor based on Mean Annual Precipitation (MAP) for the 6th HUC Watershed)				
MAP >45”	2	>2.0mi/ mi_2	0.5-2.0mi/ mi_2	<0.5mi/ mi_2
MAP 20-45”	2	>3.0mi/ mi_2	1.0-3.0mi/ mi_2	<1.0mi/ mi_2
MAP <20”	2	>3.0mi/ mi_2	1.5-3.0mi/ mi_2	<1.5mi/ mi_2

A Watershed Disturbance Score is the product of the listed factor scaling and the factor weighting, for each of the five disturbance indicators. A total score is generated for each evaluated 6th code watershed. For example, a watershed with 38% of its area in an ECA condition would have 9 points towards a total score for watershed disturbance. A value of 20% for the same (ECA) factor would only generate a score of 6.

Watershed Sensitivity

To measure inherent sensitivity of watersheds, two factors were used:

1. **Mean Annual Precipitation (MAP)** – the average annual precipitation within a 6th code HUC.

2. **Percent of Stream with Gradient <2% –** the percent of streams within a 6th code HUC that have a gradient of less than 2 percent.

These two factors were combined as shown in Table H-5. Watershed sensitivity was evaluated as having high (H), moderate (M), or low (L) sensitivity.

Table H-5 Watershed Sensitivity

Mean Annual Precipitation	<2% Stream Gradient	Watershed Sensitivity
MAP >45”	-----	H
MAP 30-45”	>21%	H
	10-21%	M
	<10%	M
MAP 20-29.9”	>21%	H
	10-21%	M
	<10%	L
MAP <20”	>21%	M
	10-21%	L
	<10%	L

Modeled Watershed Condition

Watershed Condition is a combination of Sensitivity and Disturbance indicators, and is evaluated as shown in Table H-6.

Table H-6 Watershed Condition

Watershed Sensitivity	Disturbance Score for the Watershed	Modeled Watershed Condition Concern Rating	Modeled Watershed Condition Class
High	> 19	High	Class III
	14 - 19	Moderate	Class II
	<14	Low	Class I
Moderate	> 25	High	Class III
	17 - 25	Moderate	Class II
	<17	Low	Class I
Low	≥19	Moderate	Class II
	<19	Low	Class I

A watershed condition concern rating of High means a high concern for or indicator of compromised watershed condition. This means high potential from natural watershed characteristics (i.e., mean annual precipitation, or high amount of basin in sensitive snow zone); or high probability (i.e., % riparian logged) of compromised watershed function from disturbances, particularly in riparian zones or on stream channels. Conversely, a rating of Low means low potential, or low probability of compromised watershed function from these disturbances or natural watershed characteristics.

In the AMS Technical Report, Watershed System Condition was defined as one of the following:

1. Properly functioning condition;
2. Functioning, at risk;
3. Not properly functioning.

The terminology for Watershed Condition status for the KNF has been updated since the AMS was written and is now based on FSM 2521.1 – Watershed Condition Classes:

1. Watersheds in **Condition Class I** (referred to as properly functioning condition or PFC in the AMS Technical Report) exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. The drainage network is generally stable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are predominantly functional in terms of supporting beneficial uses.

2. Watersheds in **Condition Class II** (referred to as functioning at risk or FAR in the AMS Technical Report) exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Portions of the watershed may exhibit an unstable drainage network. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian.

3. Watersheds in **Condition Class III** (referred to as not properly functioning or NPF in the AMS) exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. A majority of the drainage network may be unstable. Physical, chemical, and biologic conditions suggest that soil, riparian, and aquatic systems do not support beneficial uses.

Final Watershed Condition

The modeled watershed condition is a reflection of forestwide data and the above described modeling system. Field review and site specific data resulted in a change to some of the ratings shown in Table H-4. Based on District review and accomplished restoration, table H-7 displays the modeled and adjusted watershed condition rating for each 6th code HUC, as well as the change in terminology from the AMS to the Proposed Plan.

Table H-7 Final Watershed Condition Rating

HUC6 Name	HUC6	AMS Modeled Predicted Rating	AMS Final Rating	Final Watershed Condition Rating
Wigwam River	170101010101	FAR	FAR	CLASS II
Bloom Creek	170101010201	PFC	PFC	CLASS I
Sink Creek	170101010202	NPF	NPF	CLASS III
Young Creek	170101010203	NPF	FAR	CLASS II
Dodge Creek	170101010204	NPF	FAR	CLASS II
Phillips Creek	170101010205	PFC	FAR	CLASS II
Sullivan Creek	170101010206	FAR	PFC	CLASS I
Upper Pinkham Creek	170101010207	FAR	FAR	CLASS II
Pinkham Creek	170101010208	NPF	FAR	CLASS III
Lake Koocanusa	170101010209	FAR	FAR	CLASS II
Swamp Creek	170101010301	FAR	FAR	CLASS II
Upper Fortine Creek	170101010302	NPF	FAR	CLASS II
Edna Creek	170101010303	NPF	FAR	CLASS II
Middle Fortine Creek	170101010304	NPF	FAR	CLASS II
Deep Creek	170101010305	PFC	FAR	CLASS II
Meadow Creek	170101010306	FAR	FAR	CLASS III
Fortine Creek	170101010307	NPF	NPF	CLASS II
Upper Grave Creek	170101010401	FAR	FAR	CLASS II
Grave Creek	170101010402	FAR	FAR	CLASS II
Therriault Creek	170101010403	NPF	NPF	CLASS III
Sinclair Cr	170101010404	NPF	FAR	CLASS II
Indian Cr	170101010405	PFC	FAR	CLASS II
Tobacco River	170101010406	NPF	NPF	CLASS II
Boulder Creek	170101010501	FAR	PFC	CLASS II
Sutton Creek	170101010502	NPF	FAR	CLASS III
Upper South Fork Big Cr	170101010503	PFC	PFC	CLASS I
South Fork Big Creek	170101010504	FAR	FAR	CLASS II
Big Creek	170101010505	FAR	FAR	CLASS II
McGuire Creek	170101010506	FAR	PFC	CLASS II
Lake Koocanusa	170101010507	FAR	FAR	CLASS II
Parsnip Creek	170101010508	FAR	FAR	CLASS II
Tenmile Creek	170101010509	PFC	PFC	CLASS II
Lake Koocanusa	170101010510	PFC	PFC	CLASS I
Fivemile Creek	170101010601	FAR	FAR	CLASS II
Bristow Creek	170101010602	FAR	FAR	CLASS II
Barron Creek	170101010603	NPF	FAR	CLASS II
Warland Creek	170101010604	FAR	FAR	CLASS II
Cripple Horse Creek	170101010605	FAR	FAR	CLASS II
Jackson Creek	170101010606	FAR	FAR	CLASS II
Canyon Creek	170101010607	FAR	FAR	CLASS II
Lake Koocanusa	170101010608	PFC	PFC	CLASS I
Dunn Creek	170101010609	NPF	FAR	CLASS II

HUC6 Name	HUC6	AMS Modeled Predicted Rating	AMS Final Rating	Final Watershed Condition Rating
Rainy Creek	170101010610	FAR	NPF	CLASS III
Kootenai River	170101010611	FAR	PFC	CLASS I
Upper Libby Creek	170101010701	FAR	FAR	CLASS II
Swamp Creek	170101010702	NPF	NPF	CLASS III
Granite Creek	170101010703	PFC	PFC	CLASS I
Big Cherry Creek	170101010704	FAR	FAR	CLASS II
Libby Creek	170101010705	FAR	FAR	CLASS II
Flower Creek	170101010801	PFC	FAR	CLASS II
Parmenter Creek	170101010802	PFC	PFC	CLASS I
East Fork Pipe Creek	170101010803	NPF	NPF	CLASS III
Upper Pipe Creek	170101010804	FAR	FAR	CLASS II
Pipe Creek	170101010805	NPF	FAR	CLASS II
Bobtail Creek	170101010806	NPF	NPF	CLASS III
Quartz Creek	170101010807	FAR	FAR	CLASS II
Kootenai River	170101010808	FAR	FAR	CLASS II
Ross Creek	170101010901	PFC	PFC	CLASS I
Stanley Creek	170101010902	NPF	NPF	CLASS III
Upper Lake Creek	170101010903	FAR	FAR	CLASS II
Keeler Creek	170101010904	NPF	NPF	CLASS III
Lake Creek	170101010905	NPF	NPF	CLASS III
OBrien Creek	170101011001	NPF	NPF	CLASS III
South Callahan Creek	170101011002	NPF	FAR	CLASS II
North Callahan Creek	170101011003	FAR	FAR	CLASS II
Callahan Creek	170101011004	FAR	FAR	CLASS II
Ruby Creek	170101011005	NPF	NPF	CLASS III
Star Creek	170101011006	NPF	NPF	CLASS III
Kootenai River	170101011007	FAR	NPF	CLASS III
Island Creek	170101020102	NPF	NPF	CLASS III
Pleasant Valley Creek	170101020103	NPF	NPF	CLASS III
Pleasant Valley-Fisher R.	170101020104	NPF	NPF	CLASS III
Pleasant Valley-Fisher R.	170101020105	FAR	FAR	CLASS II
Elk Creek	170101020201	NPF	NPF	CLASS III
McGinnis Creek	170101020202	NPF	NPF	CLASS III
East Fisher Creek	170101020203	FAR	FAR	CLASS II
Silver Butte Fisher River	170101020204	PFC	PFC	CLASS I
West Fisher Creek	170101020205	FAR	FAR	CLASS II
Weigel Creek	170101020301	FAR	FAR	CLASS II
Upper Wolf Creek	170101020302	NPF	NPF	CLASS III
Dry Fork Creek	170101020303	NPF	NPF	CLASS III
Little Wolf Creek	170101020304	FAR	FAR	CLASS II
Middle Wolf Creek	170101020305	FAR	FAR	CLASS II
Wolf Creek	170101020306	NPF	NPF	CLASS III
Pleasant Valley-Fisher R.	170101020401	NPF	NPF	CLASS III
Fisher River	170101020402	NPF	NPF	CLASS III
McKillop Creek	170101020403	FAR	FAR	CLASS II
Cow Creek	170101020404	FAR	FAR	CLASS II
Fisher River	170101020405	NPF	NPF	CLASS III
Fisher River	170101020406	FAR	FAR	CLASS II
North Fork Yaak River	170101030101	FAR	FAR	CLASS II
Basin Creek	170101030102	FAR	FAR	CLASS II
East Fork Yaak River	170101030103	FAR	FAR	CLASS II
West Fork Yaak River	170101030104	FAR	FAR	CLASS II

HUC6 Name	HUC6	AMS Modeled Predicted Rating	AMS Final Rating	Final Watershed Condition Rating
Yaak River	170101030105	FAR	FAR	CLASS II
South Fork Yaak River	170101030201	FAR	FAR	CLASS II
Pete Creek	170101030202	FAR	FAR	CLASS II
Spread Creek	170101030203	FAR	FAR	CLASS II
Hellroaring Creek	170101030204	FAR	FAR	CLASS II
Meadow Creek	170101030205	FAR	FAR	CLASS II
Yaak River	170101030206	FAR	FAR	CLASS II
Burnt Creek	170101030301	PFC	FAR	CLASS II
Yaak River	170101030302	FAR	FAR	CLASS II
Upper Seventeenmile Creek 2.83	170101030303	FAR	FAR	CLASS II
Seventeenmile Creek	170101030304	PFC	FAR	CLASS II
Yaak River	170101030305	FAR	FAR	CLASS II
Pine Creek	170101040101	FAR	FAR	CLASS II
Curley Creek	170101040102	FAR	FAR	CLASS II
Kootenai River2	170101040103	NPF	NPF	CLASS III
Hawkins Creek	170101050201	FAR	FAR	CLASS II
Stillwater River	170102100101	PFC	PFC	CLASS I
Sunday Creek	170102100102	NPF	FAR	CLASS II
Stillwater River	170102100103	PFC	PFC	CLASS I
Upper Little Bitterroot R	170102120102	FAR	FAR	CLASS II
Upper Thompson R	170102130100	FAR	FAR	CLASS II
McGregor Creek	170102130101	FAR	FAR	CLASS II
Thompson River	170102130102	NPF	NPF	CLASS III
Clark Fork River	170102130704	NPF	NPF	CLASS III
Clark Fork River	170102130705	PFC	FAR	CLASS II
Upper Big Beaver Cr.	170102130801	NPF	NPF	CLASS III
Little Beaver Creek	170102130802	FAR	FAR	CLASS II
White Pine Creek	170102130803	PFC	FAR	CLASS II
Big Beaver Creek	170102130804	FAR	NPF	CLASS III
Upper Vermilion River	170102130805	FAR	FAR	CLASS II
Vermilion River	170102130806	PFC	FAR	CLASS II
Noxon Reservoir	170102130807	NPF	NPF	CLASS III
Upper Trout Creek	170102130901	PFC	PFC	CLASS I
Trout Creek	170102130902	PFC	FAR	CLASS II
Marten Creek	170102130903	FAR	FAR	CLASS II
Swamp Creek	170102130904	PFC	PFC	CLASS I
Noxon Reservoir	170102130905	FAR	FAR	CLASS II
South Fork Bull River	170102131001	PFC	PFC	CLASS I
East Fork Bull River	170102131002	FAR	FAR	CLASS II
Upper Bull River	170102131003	PFC	PFC	CLASS I
Bull River	170102131004	PFC	PFC	CLASS II
Rock Creek	170102131101	FAR	FAR	CLASS II
Pilgrim Creek	170102131102	FAR	FAR	CLASS II
East Fork Elk Creek	170102131103	PFC	PFC	CLASS II
Elk Creek	170102131104	FAR	FAR	CLASS II
East Fork Blue Creek	170102131105	PFC	PFC	CLASS II
Blue Creek	170102131106	FAR	FAR	CLASS II
Cabinet Gorge Reservoir	170102131108	FAR	FAR	CLASS II
Clark Fork (IPNF)	170102131201	PFC	PFC	CLASS I
Clark Fork (IPNF)	170102131299	FAR	FAR	CLASS II

Aquatic Species And Habitat

Desired Stream Habitat Features

The desired condition for aquatic habitat in the Proposed Plans includes descriptions of desired stream habitat features. The following provides detailed information on the desired condition for water temperature.

Water Temperature

Following are Idaho and Montana State requirements for water temperature.

Idaho

The following are the temperature requirements for Cold Water Biota as established by DEQ in the Idaho Administrative Code (IDAPA 58.01.02 – Water Quality Standards and Wastewater Treatment Requirements; Section 250), and the EPA bull trout temperature criteria (40 CFR 131.E.1.i.d (1997)).

250: SURFACE WATER QUALITY CRITERIA FOR AQUATIC LIFE USE DESIGNATIONS:

02. Cold Water. Waters designated for cold water aquatic life are to exhibit the following characteristics (3-15-02):

b. Water temperatures of twenty-two (22) degrees C or less with a maximum daily average of no greater than nineteen (19) degrees C (8-24-94);

f. Salmonid spawning: waters designated for salmonid spawning are to exhibit the following characteristics during the spawning period and incubation for the particular species inhabiting those waters (8-24-94):

i. Water temperatures of thirteen (13) degrees C or less with a maximum daily average no greater than nine (9) degrees C (8-24-94).

g. Bull Trout Temperature Criteria. Water temperatures for the waters identified under Subsection 250.02.g.i. shall not exceed thirteen degrees Celsius (13C) maximum weekly maximum temperature (MWMT) during June, July and August for juvenile bull trout rearing, and nine degrees Celsius (9C) daily average during September and October for bull trout spawning. For the purposes of measuring these criteria, the values shall be generated from a recording device with a minimum of six (6) evenly spaced measurements in a twenty-four (24) hour period. The MWMT is the mean of the daily maximum water temperatures measured over the annual warmest consecutive seven (7) day period occurring during a given year (3-30-01).

i. The bull trout temperature criteria shall apply to all tributary waters, not including fifth order main stem rivers, located within areas above fourteen hundred (1400) meters elevation south of the Salmon River basin-Clearwater River basin divide, and above six hundred (600) meters elevation north of the Salmon River basin-Clearwater basin divide, in the fifty-nine (59) Key Watersheds listed in Table 6, Appendix F of Governor Batt's State of Idaho

Bull Trout Conservation Plan, 1996, or as designated under Sections 110 through 160 of this rule (3-23-98).

03. Season Cold Water. Between summer solstice and autumn equinox, waters designated for seasonal cold water aquatic life are not to vary from the following characteristics due to human activities. For the period from autumn equinox to summer solstice the cold water criteria will apply (3-15-02):

b. Water temperatures of twenty-six (26) degrees Celsius or less as a daily maximum with a daily average of no greater the twenty-three (23) degrees C (3-30-01).

EPA Bull Trout Criteria (40 CFR 131.E.1.i.d (1997)

This rule establishes a maximum weekly maximum temperature (MWMT) criterion of 10° C for the months of June, July August and September for the protection of Bull trout spawning and rearing in natal streams, expressed as an average of daily maximum temperatures over a consecutive 7-day period.

Montana

The following is excerpted from the Montana Water Quality Standards (ARM 17.30.6 - Surface Water Quality Standards and Procedures). The EPA bull trout criteria listed above also applies.

17.30.609 WATER-USE CLASSIFICATIONS--KOOTENAI RIVER DRAINAGE

(1) The water-use classifications adopted for the Kootenai River are as follows:

(a) All waters except those listed in (1)(a)(i) below - B-1

(i) Deep Creek drainage (tributary to the Tobacco River) to the Fortine water supply intake - A-1

(ii) Rainy Creek drainage to the W.R. Grace Company water supply - A-1

(iii) Rainy Creek (mainstem) from the W.R. Grace Company water supply intake to the Kootenai River - C-1

(iv) Flower Creek drainage to the Libby water supply intake (approximately at latitude 48.356, longitude -115.5676)

17.30.622 A-1 CLASSIFICATION STANDARDS:

(e) A 1ºF maximum increase above naturally occurring water temperature is allowed within the range of 32ºF to 66ºF; within the naturally occurring range of 66ºF to 66.5ºF, no discharge is allowed which will cause the water temperature to exceed 67ºF; and where the naturally occurring water temperature is 66.5ºF or greater, the maximum allowable increase in water temperature is 0.5ºF. A 2ºF-per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55ºF A 2ºF maximum decrease below naturally occurring water temperature is allowed within the range of 55ºF to 32ºF.

17.30.623 B-1 CLASSIFICATION STANDARDS

(e) A 1ºF maximum increase above naturally occurring water temperature is allowed within the range of 32ºF to 66ºF; within the naturally occurring range of 66ºF to 66.5ºF, no discharge is allowed which will cause the water temperature to exceed 67ºF; and where the naturally occurring water temperature is 66.5ºF or greater, the maximum allowable increase in water

temperature is 0.5ºF. A 2ºF per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55ºF. A 2ºF maximum decrease below naturally occurring water temperature is allowed within the range of 55ºF to 32ºF. This applies to all waters in the state classified B-1 except for Prickly Pear Creek from McClellan Creek to the Montana Highway No. 433 crossing where a 2ºF maximum increase above naturally occurring water temperature is allowed within the range of 32ºF to 65ºF; within the naturally occurring range of 65ºF to 66.5ºF, no discharge is allowed which will cause the water temperature to exceed 67ºF; and where the naturally occurring water temperature is 66.5ºF or greater, the maximum allowable increase in water temperature is 0.5ºF.

17.30.626 C-1 CLASSIFICATION STANDARDS

(e) A 1ºF maximum increase above naturally occurring water temperature is allowed within the range of 32ºF to 66ºF; within the naturally occurring range of 66ºF to 66.5ºF, no discharge is allowed which will cause the water temperature to exceed 67ºF; and where the naturally occurring water temperature is 66.5ºF or greater, the maximum allowable increase in water temperature is 0.5ºF. A 2ºF per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55ºF. A 2ºF maximum decrease below naturally occurring water temperature is allowed within the range of 55ºF to 32ºF.

Background and Analysis Process (Excerpted and adapted from Region 1 Aquatic Science Paper—Draft 4/3/06 by Ann D. Carlson)

Introduction

This paper describes the process and science principles related to aquatic resources considered and followed for revision of the Bitterroot, Lolo, Flathead, Kootenai, Idaho Panhandle, Clearwater and Nez Perce National Forest Plans (Plans) under the 2005 Forest Service planning rule (36 CFR Part 219 2005 Final Rule).

Aquatic resource specialists working on plan revision followed the Multi-scale Aquatic Assessment and Planning Framework developed by Rocky Mountain Research Station for overall development and documentation of Plan components and the Plan Set of Documents including the comprehensive evaluation report (CER) and monitoring plan. The Multi-scale Aquatic Assessment and Planning Framework is described in Section I of this paper.

The plan revision process for aquatic resources has been heavily influenced by pre-existing direction for native fishes including: the Inland Native Fish Strategy (INFISH, 1995); the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH, 1995); 1998 USFWS bull trout Biological Opinion; 1998 NMFS Biological Opinion on salmon and steelhead in the Upper Columbia and Snake River Basins; 1995 NMFS Biological Opinion on land and resources management plans; 2000 Interior Columbia Basin Interim Watershed Restoration Strategy, January 2003 Interior Columbia Basin Strategy; and the July 9, 2004 Framework for Incorporating the Aquatic and Riparian Component of the Interior Columbia Basin Strategy into BLM and Forest Service Plan Revisions.

Although these documents were developed from some of the best science on native fish and protection of native fish they do not provide a specific restoration strategy for recovery of native fish species. In addition, they do not specifically identify risks and threats to native fish

populations within their sub-watersheds and they fail to discuss the role of disturbance in relation to desired ecosystem conditions and desired native fish populations. Much scientific literature on aquatic ecosystems, on the impact of human activities on aquatic ecosystems, and on conservation strategies for fish and other aquatic organisms has been produced since INFISH and PACFISH were written in 1995. This document summarizes key science findings used during Plan revision and development of Plan components (desired conditions, objectives, suitability, special areas, and guidelines) and the plan set of documents (monitoring strategy and comprehensive evaluation report) to provide for the protection and restoration of aquatic resources.

This paper does not review all of the scientific literature about aquatic ecosystems, impacts of human impacts on these ecosystems and natural processes. Documents that provide excellent reviews and synthesis on these and other relevant topics include: Forest Ecosystem Management: an Ecological, Economic, and Social Assessment (FEMAT 1993), An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins Volume III (1997), Emerging concepts for management of river ecosystems and challenges to applied integration of physical and biological sciences in the Pacific Northwest, USA (Rieman et al. 2005), The Effects of Wildland Fire on Aquatic Ecosystems in the Western USA (Young et al. 2003), and A disturbance-based ecosystem approach to maintaining and restoring freshwater habitats of evolutionary significant units of anadromous salmonids in the Pacific Northwest (Reeves et al. 1995).

Aquatic Issues and Plan Revision

Plan revision under the 2005 rule presents many challenges. Plans do not make commitments of final decision approving projects and activities – Plans provide broad guidance and information for project and activity decision making (36 CFR Part 219 2005 Final Rule, 219.2 (b) and 219.7). The revised plans are more strategic and less prescriptive in nature (36 CFR Part 219 Preamble, pg 1024). Also the revised plans are more flexible and adaptive than Plans written under the 1982 rule. For aquatic specialists this is a major shift in Plan level direction regarding management of aquatic resources. Aquatic strategies such as INFISH and PACFISH, which amended the Forest Plans in 1995, are no longer in place. Key management direction provided in these strategies, such as standards, watershed analysis requirements, and riparian management objectives do not fit comfortably within Plan components under the 2005 rule. So the key question is how to provide direction for conservation and restoration of aquatic ecosystems, federally listed fish species, and other rare aquatic species of concern and interest in the revised plans?

The scientific literature clearly outlines what actions are needed for aquatic ecosystem conservation and restoration: 1) protection and restoration of ecological patterns and processes that contribute to persistence of aquatic ecosystems including aquatic species (Thurow et al. 1997, Naiman et al. 2000, Rieman et al 2005), 2) implementation of management that seeks to conserve natural variability, ecosystem and species diversity, and strengthen population resilience and resistance to disturbance (ESA 1995, Angermeier 1997, Rieman et al. 2005), 3) protection and restoration of habitats needed for all life stages of aquatic species (NMFS 2000), 4) providing for aquatic species genetic diversity (Soule 1987, Allendorf and Leary 1988, Liknes and Graham 1988, Rieman et al 1993), and 5) providing for linkages and spatial geometry of suitable habitats to form species-specific ‘metapopulations’ or several local populations that provide for dispersal, recolonization, and occupation of habitat patches (Rieman et al. 1993, Sheldon 1996, Dunham and Rieman 1999, Rieman and Dunham 2000, NMFS 2000).

The Multi-scale Aquatic Assessment and Planning Framework

The aquatic resource specialists working on Plan revision followed the Multi-scale Aquatic Assessment and Planning Framework developed by Rocky Mountain Research Station (RMRS) Boise, Idaho. The Aquatic Multi-scale Assessment and Planning Framework was developed to help aquatic specialists collect, organize, document and use natural resource data for assessing and designing management actions to protect, maintain and restore native salmonid populations. Forests in the Northern Region (Region 1) used this Framework during Plan revision to develop plan components to protect, maintain and restore native salmonid populations, aquatic habitats and overall watershed conditions. The Framework template lent itself well to this purpose because it is a web-based hierarchical decision support tool organized in a step-wide design for hyper-linking relevant data to data collection protocols, tabular/graphical/spatial displays, and supporting scientific information and examples. In addition, several steps of the Framework can incorporate use of professional judgment in conjunction with data.

The six steps of the Aquatic Multi-scale Assessment and Planning Framework used for R1 Plan revision include:

Step 1 – Describe the current condition and distribution of native fish populations of interest (using the R1 Fish Status Assessment Version 10,) and watershed condition by 6th Hydrologic Unit Code (HUC).

Step 2 – Describe the desired condition for native fish population status and distribution, aquatic habitats and watersheds.

Step 3 – Identify risks and threats that influence native fish populations, aquatic habitats and watershed conditions.

Step 4 – Multi-Scale assessment analysis

Step 5 – Develop conservation and restoration strategies for aquatic resources. A multi-scale strategy is developed to identify priority subbasins, watersheds, subwatersheds (Figure 1) and streams for protecting, maintaining and restoring water quality, healthy watershed conditions, native aquatic species metapopulations, local populations, life stages and habitat integrity.

Step 6 – Multi-scale monitoring

Aquatic Hierarchical Approach

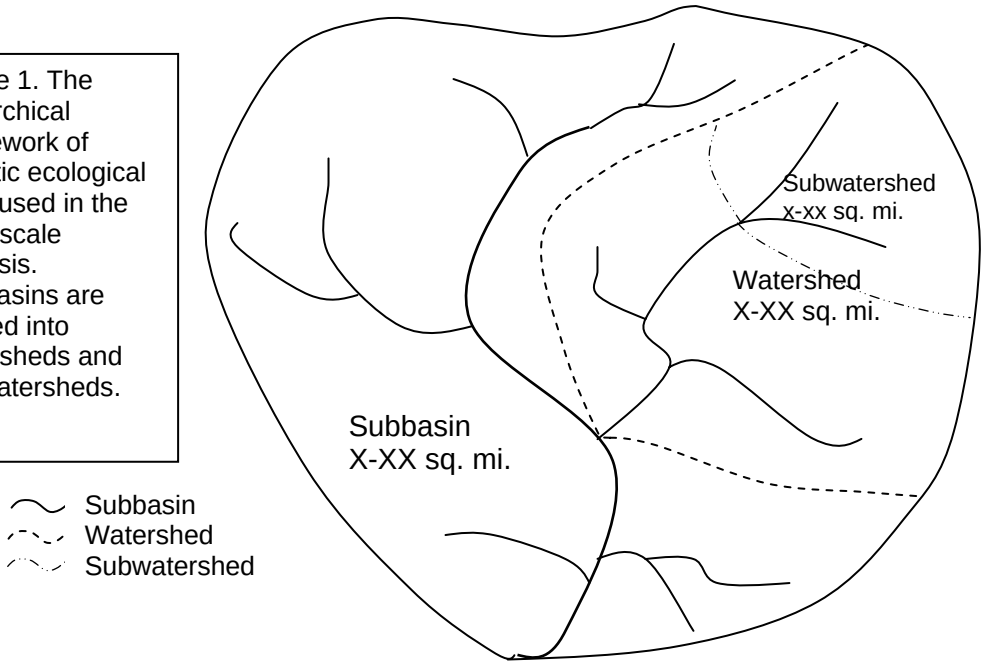
The aquatic specialists working on Plan revision used a hierarchical approach to evaluate current conditions and desired conditions and to provide guidance for ensuring ecosystem and species diversity are provided for in the revised plans. Use of a hierarchical approach helps to integrate spatial scale into the evaluation of ecosystem processes and the patterns they create (Jensen et al. 1996). There is no single scale of ecological organization that is correct for all purposes (Jensen at al. 1996). Most land management activities are analyzed at the subbasin scale or smaller, and projects are often implemented at the sub-watershed scale or smaller.

All aquatic data used for Plan revision is summarized by 6th code hydrologic unit (sub-watersheds). The subwatershed is the primary fine scale for summarizing reach and habitat data. The subwatershed is often synonymous with local populations and/ or their life stages, risks and threats, and project level management action assessments. Some of this information is summarized and interpreted at the sub-basin (4th code hydrologic units) to determine how conditions are distributed across a larger geographic area. The subbasin is the primary broadscale

summary unit for salmonids. The subbasin acts as a terminal aquatic environment, aligning with the salmonid meta-population - a collection of local populations interacting to hedge against extinction through the migratory life stage. Self sustaining populations (strongholds), act as source populations for supporting weaker populations or recolonizing extirpated populations or new habitats. This multi-scale approach allows for broader interpretations of current conditions in terms of salmonid metapopulations and movement throughout several sub-watersheds.

The base unit and smallest scale land unit used for revision of the Plans is the subwatershed. Subwatershed data were aggregated up to the watershed and subbasin scale to develop the aquatic habitat and watershed desired conditions (Figure 1). Each scale contains valuable information about how the ecosystem functions. All the scales of a drainage system function together to create and maintain habitats (Wissmar 1997). This multi-scale analysis incorporated professional interpretations from numerous data sources such as subbasin assessments, species recovery plans, watershed analysis, TMDL implementation plans, or other broad or mid-scale information. Subsequent project decisions would incorporate annually updated progress toward meeting desired conditions at the watershed and subbasin scale using data summarized at the subwatershed scale.

Figure 1. The hierarchical framework of aquatic ecological units used in the multi-scale analysis. Subbasins are divided into watersheds and subwatersheds.



Details of the Aquatic Multi-scale Assessment and Planning Framework

Step 1. Provide a description of the current condition and distribution of native fish populations of interest (Using the R1 Fish Status Assessment Version 10) and watershed condition by 6th Hydrologic Unit Code (HUC).

This step provides the environmental baseline for federally listed species. It also addresses the effectiveness of the current Plan direction. Much of the information provided by Step 1 was used by the aquatic specialists to develop the Plan components and the plan set of documents. All

known current data on native fish populations was used for this step. Sources of data included State fish survey records, Forest and District fish survey records, and Tribal fish survey records.

Step 2. Provide a description of the desired condition for native fish population status and distribution, aquatic habitats and watersheds.

Because of the strategic nature of Plans written under the 2005 Planning Rule, the desired condition component is the primary guiding component of these Plans. All forest actions must be compatible with desired conditions. Desired conditions are the social, economic, and ecological attributes toward which management of the land and resources of the plan area is to be directed (36 CFR 219.7(a)(2)(i)). Aquatic desired conditions in the revised plans describe in detail the desired values for desired stream habitat features including riparian features and desired condition for aquatic species including T & E species, species of concern (SOC) and species of interest (SOI). Aquatic specialists considered many items when creating their desired condition descriptions for aquatic ecosystems including:

- Key aquatic ecosystem characteristics, including key parameters for aquatic-dependent species abundance, productivity, spatial structure, and diversity.
- Natural variability and the role of disturbance in key environmental patterns and processes.
- Spatial and temporal scales.

Key aquatic and riparian ecosystem characteristics identified in the Plans focus on those characteristics that together provide for aquatic ecosystem and watershed integrity. Riparian ecosystem characteristics are included because riparian areas form an ecotone or interface between the terrestrial and aquatic ecosystems (Gregory et al. 1991). The land-water interface that occurs in riparian areas is important to recognize when identifying aquatic ecosystem patterns and processes for protection and restoration (Gregory et al. 1991, Vannote et al. 1980). In addition, it was important that trend toward, or achievement of, these key characteristics be measurable using tested standardized protocols. Key aquatic/riparian characteristics for the Plan desired condition component were primarily generated from the PACFISH and INFISH Strategies (USDA 1995) which are based on the best science for conservation of native fish. This same body of scientific literature also applies well to conservation of all aquatic species and their habitats. FEMAT (1993) contains a fairly complete compilation of literature on key aquatic characteristics (see pgs V-12 thru V-29). Reeves (2003) provides a review of scientific literature produced since FEMAT on two key topics 1) spatial and temporal scales and disturbance and 2) headwater streams.

All revised Plans provide a desired condition plan component for aquatics which includes a description of the following key ecosystem characteristics in the context of the Forest's unique local geomorphology, climatic regimes, natural disturbances, and watershed settings:

- Water quality, to a degree that provides for stable and productive riparian and aquatic ecosystems. Including specific values for water temperatures needed to support all life stages of native fish.
- Stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed. Including specific desired values for stream habitat features: 1) pool frequency, 2) large woody debris, 3) bank stability, 4) lower bank angle, and 5) width/depth ratio.

- Instream flows to support healthy riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood discharges.

- Natural timing and variability of the water table elevation in meadows and wetlands.
- Diversity and productivity of native and desired non-native plant communities in riparian zones.
- Riparian vegetation to:
  (a) Provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;
  (b) Provide adequate summer and winter thermal regulation within the riparian and aquatic zones; and
  (c) Help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.

- Riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region.
- Habitat to support populations of well-distributed native and non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

In addition to key aquatic ecosystem characteristics, aquatic specialists working on Plan revision also considered natural variability and the role of disturbance to key aquatic environmental patterns and processes. Managing toward a range of ecosystem attribute values given natural disturbance processes is an important concept because 'pristine' or 'minimally managed' values cannot be achieved everywhere in every aquatic habitat nor would it be desirable to manage for values that did not consider natural variation. Ecologically healthy watersheds are maintained by natural disturbances (e.g. fire, landslides, and debris torrents, channel migration) that create spatial heterogeneity and temporal variability to the physical components of the system (Naiman et al 1992). Management consistent with natural variation should lead to more diverse, resilient, and productive biological systems (Rieman et al. 2005). A desired outcome for Forest Service land management is to retain resiliency of watersheds and aquatic ecosystems in response to natural disturbance regimes. Resiliency of an ecosystem is the degree to which the system can be disturbed and recover to a state where processes and interaction function as before (Holling 1973 in Reeves et al 1995).

Aquatic specialists working on Plan revision considered spatial and temporal scales matched to the scale of forest planning. In addition, they also considered spatial and temporal scales of ecological processes and disturbance regimes which necessitates a larger than planning view. Management to maintain or restore ecological integrity must consider how different processes operate at different scales, particularly with reference to how physical and biological processes are functionally organized (Urban et al. 1997 in Rieman et al. 2005). There is a degree of uncertainty with multi-scale approaches that is not recognized by many current management regulations or applications (Rieman et al. 2005). Even with perfect information, we cannot precisely predict how aquatic ecosystems will respond to alternative management actions (Rieman et al. 2005). Scale is particularly import when trying to manage for fish species conservation and recovery. Recent work on inland salmonids at larger-scales suggests spatial pattern, including habitat size and isolation, may drive processes affecting species persistence (Rieman and McIntyre 1995, Dunham et al. 1997, Rieman and Dunham 2000). Aquatic specialists considered the value of metapopulations (interacting groups of two or more local or

sub- populations (Hanski 1999)) for both development of the desired condition Plan component and identification and prioritization of conserve and restore subwatersheds related to native fish conservation.

Aquatic desired conditions described in the draft Plans should be achievable, except in areas influenced by permanent dams and diversions. The intent of the Plan aquatic desired condition component is to maintain and restore aquatic ecosystem integrity (natural patterns and processes that influence structure, integrity, diversity and resilience) at watershed and landscape scales to protect or restore habitat for fish and other aquatic/riparian-dependent species. Recovery of watersheds and riparian and aquatic ecosystems is based on natural disturbance processes and it may take decades, possibly more than a century, to accomplish. Some improvements in aquatic ecosystems, however, can be expected in 5 to 20 years. Reliance on desired conditions to guide management actions requires a commitment by all levels of the Forest Service to provide for the ecological health of watersheds and aquatic ecosystems on public lands. Plan guidelines and Forest Service directives help to achieve this commitment.

Step 3 – Identify risks and threats that influence native fish populations, aquatic habitats and watershed conditions.

Aquatic specialists identified risks and threats to native fish species of interest by 6th code HUC and tracked them in a spreadsheet. Risks identified during Step 3 included deterministic, stochastic and genetic extinction risk factors (Rieman et al. 1993). Extinction risks included influences at several spatial and temporal scales. An understanding of the processes of extinction and the characteristics of native fish populations that make them more or less likely to persist was fundamental to the risk assessments (Rieman et al. 1993). The list of threats includes land use practices, invasive species, or landscape conditions that may directly or indirectly affect native fish population life stages, aquatic habitats and watersheds. Aquatic specialists evaluated the threats and prioritized those that Forest Service management or cooperative partnership actions could influence.

Step 4 – Multi-Scale Assessment Analysis.

During Step 4 aquatic specialists analyzed and interpreted information from the previous three steps and developed analysis influence diagrams to provide a transparent view of the link between threats and risks data (qualitative & quantitative) and the population, habitat or watershed expected outcome. The spatial and temporal interaction of biological, physical, chemical, and social processes at work in the watershed are explained in this step. The implications of these interactions for attainment of Plan components were identified and used as a basis for management recommendations and prioritization of areas for conservation and restoration actions (Step 5).

Step 5 – Develop conservation and restoration strategies for aquatic resources. A multi-scale strategy is developed to identify priority subbasins, watersheds, subwatersheds and streams for protecting, maintaining and restoring water quality, healthy watershed conditions, native aquatic species metapopulations, local populations, life stages and habitat integrity.

Information gained in Steps 1-4 was used by the aquatic specialists to develop an Aquatic and Riparian Conservation and Restoration Strategy as part of Plan revision. The Aquatic and Riparian Conservation and Restoration Strategy is designed to maintain and restore ecosystem health at watershed and landscape scales to protect or restore habitat for fish and other riparian dependent species. This approach seeks to prevent further degradation and restore processes and

habitat at the watershed scale. Step 5 identifies how passive (Plan guidelines and other design criteria such as best management practices (BMP)) and active restoration can be applied to protect, maintain and restore native aquatic species populations, their life stages and habitats.

Implementation of the Aquatic and Riparian Conservation and Restoration Strategy through the Plans relies on the agency commitment to the plan components, specifically: 1) desired conditions, 2) suitability of areas, 3) objectives and 4) guidelines. These four components together set goals (desired conditions), identify where certain activities are not appropriate (suitability of areas), provide measurable performance targets (objectives), and constrain activities (guidelines) in ways that ensure protection of physical and biological resources. All plan components work together to guide and constrain management in the pursuit of desired conditions. The intent is to ensure that proposed management activities move an area toward the aquatic and riparian desired conditions. In other words, management actions that do not maintain existing healthy aquatic and riparian conditions or lead to improved conditions in the long-term when measured against desired conditions would not be implemented.

The nine elements of the Aquatic and Riparian Conservation and Restoration Strategy work together and supplement each other to achieve the goal of a distribution of watershed conditions that are resilient to natural disturbance and that provide habitats for aquatic and riparian dependent resources. The Plan revision Aquatic and Riparian Conservation and Restoration Strategy elements are a combination of Plan components and key elements from the INFISH and PACFISH strategies (1995). Interaction of all the elements at the watershed or landscape scales provides the basis for watershed, riparian and aquatic ecosystem management, conservation and restoration. The nine elements of the Aquatic and Riparian Conservation and Restoration Strategy are:

1. Desired Conditions
2. Riparian Conservation Areas (RCAs)
3. Objectives
4. RCA Suitability
5. Guidelines
6. Conserve Watersheds
7. Watershed Analysis
8. Watershed Restoration
9. Monitoring

The following describes each of the Aquatic and Riparian Conservation and Restoration strategy elements:

> <u>1. Desired Conditions</u>: Desired conditions are the attributes toward which management of the land and resources of the plan area are to be directed. Aquatic and riparian desired conditions in the revised plans describe in detail the desired values for desired stream habitat features including riparian features and desired condition for aquatic species.
>
> <u>2. Riparian Conservation Areas (RCA):</u> RCAs are to be designated for lands along streams, lakes, ponds, wetlands, seeps and springs and unstable and potentially unstable areas where any management activities that occur are designed to maintain, restore or enhance the ecological health of aquatic and riparian ecosystems (as described in the desired conditions). RCAs are portions of the landscape where riparian-dependent and stream resources receive primary emphasis. All Plans include an RCA suitability statement and specific RCA guidelines.

3. Objectives: Objectives are the means of measuring progress toward achieving or maintaining desired conditions. Objectives are concise projections of measurable, time-specific intended outcomes. Plans include aquatic specific objectives. However revised Plan objectives are limited by past accomplishments (over the past 5 years) and projected budgets. Due to these limitations, it is not likely that accomplishment of objectives identified in the revised Plans will result in restoration needed to provide for ecosystem or species diversity throughout the planning area.

4. RCA Suitability: The following RCA suitability statement is included in all Plans: *"Riparian Conservation Areas are generally suitable for activities that improve, restore, or maintain aquatic and riparian ecosystems desired conditions. (See Guidelines)."*

[Note: The 2005 planning rule uses "generally suitable" because identification of suitability is guidance and must be approved through project and activity decision making.]

5. Guidelines: Guidelines provide information and guidance for project and activity decision making to help achieve desired conditions and objectives. Guidelines and other design criteria including RCA Best Management Practices (BMPs) are the foundation for passive restoration. Passive restoration is the maintenance of watershed/ riparian/ aquatic processes and habitat conditions through application of Plan management direction, land use practices and coordination. Passive restoration primarily maintains current conditions while allowing for a natural rate recovery, and active restoration is often needed to move a degraded system toward recovery. Three key RCA guidelines are included in all Plans. These guidelines are used to evaluate and 'screen' all activities potentially influencing riparian and aquatic resources:

Guideline 1: When Riparian Conservation Areas are intact and functioning at desired condition, then management activities influencing RCAs should maintain or improve that condition.

Guideline 2: When Riparian Conservation Areas are not intact and functioning at desired condition, then management activities influencing RCAs should include restoration components that exceed full compensation for project effects to promote a trend toward desired conditions.

Guideline 3: Management activities in Riparian Conservation Areas (RCAs) should not result in long-term degradation to aquatic conditions. Limited short-term effects from activities in the RCAs may be acceptable when they support long-term benefits to the RCAs and aquatic resources.

The following activity-specific RCA guidelines are also provided in each Plan:

Guideline 4: Soil and snow should not be sidecast into surface water.

Guideline 5: New, replacement, and reconstructed crossing sites (culverts, bridges and other stream crossings) should be designed to:

a. Accommodate 100 year flood including associated bedloads and debris.

b. Prevent diversion of stream flow out of the channels.

c. Provide and maintain fish passage up to bankfull discharge.

Guideline 6: Crossing locations on roads being put into long-term storage should provide fish passage.

Guideline 7: Grazing Management should prevent trampling of native fish redds by livestock.

Guideline 8: Minimum impact suppression tactics should be used within Riparian Conservation Areas.

Guideline 9: Trees felled in RCAs for safety concerns should be left on site.

Guideline 10: When drafting water from streams, pumps should be screened to prevent entrainment of fish and aquatic organisms.

6. Conserve Watersheds: A network of subwatersheds (6th code HUC) was selected by the Forest aquatic specialists to serve as strongholds for important aquatic species and/or have high values for water resources. They are crucial to federally listed fish species, aquatics species of concern and/or interest and areas that provide high quality water that is important for maintenance of downstream populations. Conserve watersheds are intended to provide a pattern of protection across the landscape where habitat for aquatic species of interest would receive special attention and treatment. Management would emphasize minimizing risk and retaining their ecological health. The following 'rules-of-thumb' were considered in the selection of conserve (and restore, see below) watersheds:

1. The larger the population size, the greater the chance of persistence.
2. Population recovery potential is greater the closer you are to a source population.
3. Preserving genetic and phenotypic diversity requires maintaining populations through a wide geographic range in a variety of habitats.
4. Project assessments and planning should address habitat disruption and population responses at both the local and regional scales.

Management in conserve watersheds should be focused on protection and maintenance of quality aquatic habitat and strong native fish populations. Habitats supporting the most productive, diverse, and otherwise critical populations provide the best opportunities for ensuring short-term persistence (Rieman et al. 2000). They also provide an essential nucleus for rehabilitating more complete networks in the future (Rieman et al. 2000). An emphasis on conservation in these subwatersheds does not necessarily mean forest management activities must stop. It does imply that any management must clearly minimize or eliminate risks that might compromise the ability of native fish populations to persist (Rieman et al. 2000). Because there is a strong association in the condition of aquatic and forest communities, conservation of existing highly functional landscapes should be a common goal for both fisheries and forest managers (Rieman et al. 2000).

Aquatic specialists working on Plan revision recognize that long-term persistence of aquatic biological diversity and sustainable and productive fisheries depends on more than protection of the current distribution of productive habitats (Rieman et al. 2000). Protection of fish strongholds will not be sufficient to maintain biological diversity; such reserves will never be large or well distributed enough (Franklin 1993). It will also depend on restoring watershed processes (see #8 below) that create and maintain habitats across stream networks (Rieman et al. 2000) and the use of ecologically compatible land use polices to ensure the long-term productivity of aquatic and riparian ecosystems (Thurow et al. 1997). There are three primary restoration elements that must be integrated to be successful: 1) conservation of key remnant aquatic and associated terrestrial habitats and populations as building blocks for the future; 2) restoration of degraded watersheds to a more functional condition; and 3) restoration of more natural spatial patterns of forest

structure and composition, including patterns of dead and down structure that would reduce the landscape risk of large damaging wildfires (Reiman et al. 2000).

7. Watershed Analysis: Watershed analysis is a critical part of the Aquatic and Riparian Conservation and Restoration Strategy. Watershed analysis provides a systematic procedure for conducting analysis that evaluates geomorphic and ecologic processes operating in specific watersheds. This analysis evaluates the condition and trend of watersheds, riparian zones and aquatic ecosystems and provides the context for management. Watershed analysis can help to identify key processes and protection/treatment objectives specific to a watershed. This information supports decisions for implementing management activities, including identification of objectives for management within RCAs, developing restoration strategies and priorities, and revealing the most useful indicators for diagnosing existing and potential conditions and for monitoring environmental changes. The intent of watershed analysis is to prevent disruption of watershed processes through careful, before-the-fact analysis (Montgomery 1995).

Decision makers can use watershed analysis to diagnose the condition and trend of watershed and riparian dependent resources and to determine appropriate activities to attain aquatic and riparian desired conditions. Watershed analysis provides the context for understanding riparian systems within a watershed. A site-specific analysis and plan amendment can refine the width of RCAs and identify the need for management activities within the RCA to maintain or move toward desired conditions.

8. Watershed Restoration: Watershed restoration, designed to benefit aquatic and riparian resources, is an integral element of the Aquatic and Riparian Conservation and Restoration Strategy. Watershed restoration is designed to facilitate the recovery of watershed functions and related physical, biological and chemical processes to promote recovery of riparian and aquatic ecosystem structure and function and native aquatic species. Plan revision aquatic specialists are recommending a two pronged approach to restoration that includes passive restoration in combination with active restoration to produce outcomes that achieve or move toward healthy ecological conditions.

Active restoration is the direct intervention/manipulation of ecosystems to re-establish or facilitate the restoration of selected ecosystem processes. It is generally applied through the use of integrated treatments strategically located and implemented at the watershed scale. Active restoration relies on identifying and treating root causes (e.g. threats identified in Step 3) for the loss of watershed/ riparian and aquatic ecosystem health. Integrated treatments that address several ecosystem characteristics can influence the desired trajectory of conditions at a watershed scale. It may be impossible to achieve former (pre-human disturbance) conditions through restoration; however, it is desirable to restore ecosystem patterns and processes to support native species even if the best that can be achieved is a facsimile of a former condition.

High priority work for active restoration should serve to protect or retain the integrity of existing high quality habitat and naturally functioning watershed/aquatic/riparian ecosystems. Conserve subwatersheds are not the place to experiment with landscape scale restoration. It is prudent and preferable to experiment with restoration in ecologically less important areas such as restoration subwatersheds. Restoration subwatersheds generally have degraded habitat conditions, but have a high potential for improvement. Restoration activities would be accomplished by identifying and treating risk factors (e.g., unstable

roads or poorly located and/or drained roads, certain invasive plants and animals, major obstructions to physical and biological connectivity) which threaten aquatic and riparian ecosystem integrity and are likely to adversely influence achievement of desired conditions. Identification, prioritization and integrated treatment of watersheds with limited loss of function and condition is also a priority. These watersheds will likely serve as the next generation of strongholds for fish and water quality. Selection of high priority restoration subwatersheds considers the extent of habitat degradation and the degree to which their natural diversity and ecological processes are retained. Active restoration activities consider and complement recovery plans for fish, water quality and other riparian dependent species.

Passive restoration relies on the implementation of guidelines, other sources of design criteria (e.g., Forest Service Manual and Handbook direction) and best management practices to maintain watershed/ riparian/ aquatic processes and habitat conditions and allow for a natural rate of recovery. Because passive restoration primarily maintains current conditions, active restoration is often needed to move a degraded system toward recovery. Proposed watershed restoration in the Revised Plans includes both passive and active components to achieve aquatic and riparian desired conditions.

To be successful at restoration it is important to have solid linkages to other plans (e.g., Idaho and Montana State Wildlife Conservation Plans, Federal Recovery Plans, water quality plans) and strong working relationships with other land owners and stakeholders. Watershed scale restoration is an interdisciplinary effort and requires close coordination between multiple resource programs, watershed councils, adjacent landowners, other stakeholders and partners. Cooperation with land owners and interested parties such as watershed councils, state agencies, tribes, National Parks and the Natural Resource Conservation Districts often results in the greatest benefits and returns on investments because mutual priorities and opportunities are identified and resources can be pooled to accomplish conservation and restoration actions.

9. Monitoring: The aquatic and riparian monitoring strategy is described below under Step 6. Monitoring is critical to the success of the Aquatic and Riparian Conservation and Restoration Strategy. Given the strategic nature of the Plans, monitoring will serve many important purposes for current and future land management. Monitoring is needed to determine if management actions are resulting in achievement of, or trend toward, desired conditions. Monitoring can help to determine if projects are consistent with the Plan. Monitoring will be used for adaptive management to adjust actions so that they are consistent with the Plan and help to achieve desired conditions. Monitoring is needed to validate assumptions made during planning and analysis.

At scales smaller than the Plan, Forests can further refine their Aquatic and Riparian Conservation and Restoration Strategy to establish individual subwatershed or aquatic habitat implementation strategies as projects progress forward through planning and implementation.

Step 6 – Multi-scale Monitoring.

There are three types of monitoring that occur in relation to the Plan: 1) effectiveness, 2) implementation, and 3) validation.

The goal of the Plan aquatic and riparian effectiveness monitoring strategy is to assess the progress of Forest management in attaining Plan desired conditions. Essentially Plan monitoring

attempts to answer two basic questions: “How will we recognize achievement of desired conditions?” And “how will progress be measured?” Effectiveness monitoring is designed to collect data on aquatic and riparian condition and trend.

Region 1 Forests west of the Continental Divide have the PACFISH/INFISH Biological Opinion Effectiveness Monitoring (PIBO EM) Program (Kershner et al. 2004) already in place. The PIBO EM program was started in 2000. PIBO is designed to yield consistent, scientifically defensible, credible data with which to compare and interpret aquatic ecosystem status, condition and trend. Through the collection of a fairly large data set that includes managed and reference watersheds across the forest, PIBO EM can be used to measure and evaluate the effectiveness of Plan design criteria (guidelines, best management practices, etc) in restoring and maintaining aquatic ecosystem desired conditions on National Forest System lands. Forests going through Plan revision have decided to continue the PIBO EM Program to meet their Plan effectiveness monitoring needs.

Plan implementation monitoring is designed to measure success toward achieving Plan objectives and by association, desired conditions. In addition, project-scale implementation monitoring is essential for answering questions about the use of guidelines, design criteria, and best management practices to protect aquatic and watershed resources. Project-scale implementation monitoring is critical to successful passive restoration. Implementation monitoring at both the Plan- and project-scales can help to interpret results of effectiveness monitoring. The PIBO implementation monitoring (IM) program is currently being used by Forests west of the Continental Divide to assess grazing activity on Category 1 pastures (pastures the have streams which support threatened or endangered fish species). Forests have decided to continue the PIBO IM for grazing where PIBO EM sites overlap.

Plan validation monitoring is used to validate the assumptions made during Plan revision and analysis including modeling. Validation monitoring will be important for determining if restoration activities result in the projected fish population response and watershed conditions.

Ecological Sustainability (From Region 1 Aquatic Science Paper—Draft 4/3/06 by Ann D. Carlson)

In the 2005 Rule, Ecosystem Diversity and Species Diversity are the major anchor points to conserve the diversity of plant and animal communities (Samson 2006). Section II of the Region 1 Aquatic Science Paper (Carlson 2006) provides an overview of how aquatic specialists working on plan revision used information from the Aquatic Multi-Scale Assessment and Planning Framework (described in Section I) and pertinent scientific literature to address ecosystem and species diversity.

<u>Ecosystem Diversity</u>
Ecosystem Diversity is the primary means by which a plan contributes to sustaining ecological systems (Samson 2006). “Plan components must establish a framework to provide the characteristics of ecosystem diversity in the plan area" (Federal Register January 5 2005 70: 1059). "The specific characteristics chosen for evaluation must be meaningful to describe and evaluate ecosystem composition, structure, and processes" in the plan area. The ecosystem diversity approach seeks to protect or restore sufficient habitat to sustain native biological diversity.

An assumption of the ecosystem diversity approach to Plan revision is that by providing for aquatic and riparian ecosystem diversity, habitats will be provided for the vast majority of

aquatic-dependent species and further measures will not be needed for these species. This is a somewhat valid assumption given the strong linkage between aquatic physical and biological systems, including species and their habitat quality and quantity (Hynes 1970, Gregory et al. 1991, Vannote et al. 1980). However, this assumption does not apply very well when non-habitat related risks or threats to species outweigh habitat influences. For example, where competition from non-native fish is the primary factor influencing native fish populations (e.g. Rieman et al. 2005), providing for protection and restoration of habitat would not be enough to provide for sustainable native fish populations. Whirling disease is another factor influencing fish species persistence where providing for ecosystem diversity will not provide for sustainable native fish populations. Spatial scales of management actions for conservation of species is problematic, it is likely that in addition to providing habitat at a reach or subwatershed scale, native fish species also need a network of refugia at a larger scale that can provide for meta-populations (population redundancy) and population resiliency to disturbance.

The ecosystem diversity approach may not conserve species with 1) very large home ranges, 2) consistently sparse population densities, 3) highly specialized or unique habitats, or 4) occupy highly fragmented and isolated habitats (Gustafenson 1998, Panzer 1998, Haufler et al. 1996). Therefore, rare endemic aquatic species with limited distribution may not be adequately provided for though the ecosystem diversity approach.

Aquatic specialists working on plan revision took a multi-faceted approach to aquatic ecosystem diversity in the revised Plans to help ensure further species-specific measures would not be needed. Plan component elements developed to help provide for ecosystem diversity include:

- Desired conditions, guidelines, and other design criteria for management activities that will strive to: 1) provide for attainment of key aquatic characteristics, 2) protect and restore ecological patterns and processes that contribute to persistence of aquatic ecosystems and aquatic species, 3) conserve natural variability and strengthens population resilience and resistance to disturbance, 4) protect and restore habitats needed for all life stages of aquatic species, 5) provide for aquatic species genetic diversity, and 6) provide for linkages and spatial geometry of suitable habitats to form species-specific ‘metapopulations’ (several local populations) that provide for dispersal, recolonization, and occupation of habitat patches.
- Designation of riparian conservation areas (RCAs) for all aquatic habitats.
- Suitable uses described for RCAs are limited to activities that result in maintenance of or trend toward aquatic and riparian ecosystem desired conditions.
- Conserve and restoration watersheds will provide a network of fish strongholds and high priority areas for restoration of high quality fish habitat and water resources.

The assumptions of this approach are that activities in and near RCAs will protect and restore ecological patterns and processes and native aquatic species and activities will not occur in and near RCAs that would result in excessive ground disturbance and/or long-term negative impacts. Due to the strategic nature of the Plans the assurances that this assumption will be met are limited.

<u>Species Diversity</u>
If the Responsible Official determines that provisions in Plan components are needed to provide appropriate ecological conditions for specific threatened and endangered species, species-of-concern and species-of-interest, beyond ecosystem diversity, then the Plan must include additional provisions for these species (36 CFR Part 219.10 (b)(2)).

A detailed description of the process used to provide for ecological sustainability and the identification of threatened and endangered species, species of concern, and species of interest (aquatic, terrestrial, and plants) is found in Appendix F: Plant and Animal Diversity.

Salmonids Status Assessment

Following is a copy of Version 10 of the Region 1 Salmonids Status Assessment. This process was used in assessing the status of salmonids on the planning zone.

Region 1 Salmonids Status Assessment (Version 10, –8/10/04)

Present –Strong: Spawning & Rearing Habitat (code = 111)

The subwatershed has ALL of the following conditions:

- The species is present in the subwatershed based on sample data using accepted fish sampling methods in the last 10 years; AND
- All major life histories (e.g., stream resident or migratory) that historically occurred in the subwatershed are still present; AND
- Numbers are stable or increasing, and the local population is likely to be half or more of its historic size or density; AND
- The population or metapopulation in the subwatershed, or in the larger region of which it is part, likely is at least 5,000 individuals or 500 adults. If the population size is based on a population that extents outside of this subwatershed, the subwatershed presently constitutes an important core area for this larger population.

Note: Number of individuals and/or adults may need revision based on population characteristics or species that do not occur within the Interior Columbia River Basin.

Present- Depressed: Spawning and Rearing Habitat (code = 112)

The species is present in the subwatershed based on sample data using accepted fish sampling methods in the last 10 years; AND the subwatershed has ONE or MORE of the following conditions:

- A major life-history component (e.g. migratory or resident form of cutthroat trout) has been eliminated; OR
- Numbers are declining, or species occurs in less than half of its historic habitat, or numbers are less than half of historic; OR

Note: If historic habitat is unavailable, densities are less than half of comparable undamaged streams where the species is well-distributed. Hybridized cutthroat issues would be described and displayed in Status of westslope cutthroat trout (Oncorhynchus clarki lewisi) in the United States (Shepard et al 2002).

The population or metapopulation in the subwatershed, or in the larger region of which it is part, is less than 5,000 individuals or 500 adults (fish in the watershed are isolated by distance or natural barriers from other populations that would collectively exceed these numbers).

Note: Number of individuals and/or adults may need revision based on population characteristics or species that do not occur within the interior Columbia River basin.

Present- Small & Stable Population: Spawning and Rearing Habitat (code = 113)

The subwatershed has the following conditions:

The species is known to be present in this subwatershed

The species is using spawning and rearing habitat in this subwatershed

The population in this subwatershed is small (number of individuals in population is less than 500) and the population is believed to be relatively stable and comparable to historic size.

Notes regarding this call: Small populations that are reduced in size from historic are coded as depressed. In general these are physically isolated populations or populations that occupy relatively small amounts of habitat.

Present- Unknown Pop Status: Spawning and Rearing Habitat (code = 119)

The subwatershed has the following conditions:

The species is present in the subwatershed based on sample data using accepted fish sampling methods in the last 10 years; AND

Sampling has not been conducted at the level to characterize the status of the population.

Present – Migratory Corridor (code = 120)

The subwatershed has the following conditions:

The species is known to be present in this subwatershed

The species uses habitat in this subwatershed for migration

Notes regarding this call:Migratory corridors are habitat that do not support spawning or rearing and function solely as routes for migrating fish. In general these areas are main stem rivers contained within composite subwatersheds that do not contain any other spawning and rearing habitat for this species in the tributaries.

This call is not used for resident populations except for adfluvial fish (stream reaches between lakes and spawning areas) and for anadromous fish (although it is recognized that there is some juvenile rearing that occurs in these corridors).

Absent based on rigorous sampling (code = 210)

The subwatershed has the following conditions:

Sampling for this species in this subwatershed has been completed using recognized protocol for detecting small, sporadic fish presence (Must have used AFS Western Division protocol for bull trout).

Notes regarding this call: This protocol does not need to be applied for introduced fishes. For introduced fishes the species has not been detected in the subwatershed based on sample data using accepted fish sampling methods in the last 10 years.

Absent – Historically and Currently Inaccessible or Unsuitable (code = 220)

The subwatershed has the following conditions:

This subwatershed (or all suitable habitat for the species in this subwatershed) has been inaccessible or is unsuitable to this species since the last ice age, and currently remains inaccessible or is unsuitable to this species.

Notes regarding this call: This call is not used to represent temporary or small barriers to the species. A determination of unsuitable habitat in this call is generally used for anadromous species.

Presence Unknown – Suitable Habitat Present and Connected (code = 311)

The subwatershed has the following conditions:

- The species has not been detected in this subwatershed
- Rigorous sampling protocols have not been implemented to determine the presence of the species.
- The subwatershed contains suitable habitat that is physically connected to areas outside the subwatershed that contain the species.

Presence Unknown – Suitable Habitat Present but Unconnected (code = 312)

The subwatershed has the following conditions:

- The species has not been detected in this subwatershed
- Rigorous sampling protocols have not been implemented to determine the presence of the species.
- The subwatershed contains suitable habitat that is not physically connected to areas outside the subwatershed that contain the species.

Presence Unknown – Suitable Habitat Not Present (code = 320)

The subwatershed has the following conditions:

- The species has not been detected in this subwatershed.
- Rigorous sampling protocols have not been implemented to determine the presence of the species.
- The subwatershed does not contain suitable habitat.

Assumed Extirpated: Known Historical Habitat (code = 400)

The subwatershed has the following conditions:

- The species has been historically detected or assumed to be historically present based on environmental parameters in this subwatershed.
- Assumed that the species no longer occurs in subwatershed.

Presence Unknown – Habitat Unknown (code = 999)

The subwatershed has the following conditions:

- The species has not been detected in this subwatershed
- Rigorous sampling protocols have not been implemented to determine the presence of the species.
- Habitat conditions in this subwatershed are unknown.

Salmonid Status Coding

Each of the three digits in the salmonid status assessment numerical code represents presence or absence, habitat, species status, or unknown (e.g. 113 = species present – spawning and rearing habitat – small and stable population). This code structure is intended to for use in a database that could be queried to identify occupied, unoccupied, and potential habitat. Under those separate headings you could then query further but you could not query on the second or third digits independently of the previous digits and get any meaningful results.

First digit – Presence, absence, or unknown

Second digit

Third digit

1 present
- 1 spawning and rearing habitat
  - 1 strong
  - 2 depressed
  - 3 small and stable
  - 9 no information
- 2 migratory corridors
  - 0 place mark

2 absent
- 1 rigorous sampling has confirmed species absence[1]
- 2 historically absent or currently inaccessible or unsuitable
  - 0 place mark

3 unknown – some data available, high uncertainty
- 1 Suitable habitat present
  - 1 connected
  - 2 un-connected
- 2 Suitable habitats not present
  - 0 place mark

4 assumed extirpated – may or may not have data on historical presence and current species absence
- 0 place mark
  - 0 place mark

9 unknown (999)
- 9 unknown
  - 9 unknown

[1] Must have used Western Division AFS protocols for bull trout.

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