Columbia River Instream Atlas Project

Washington Department of Fish and Wildlife

Final Report

Ecology Contract C1000090 - WDFW Contract 09-1471
Ecology Publication Number: 11-12-015

November 2011

Executive Summary

The Columbia River Instream Atlas (CRIA) is a compilation of existing data products and best professional knowledge that provides tools (workbooks, maps, reports, GIS data) to aid in prioritizing stream reaches for flow restoration and augmentation. CRIA provides detailed information for 189 stream reaches in eight fish- and flow-critical watersheds in Eastern Washington: Okanogan, Methow, Wenatchee, Upper Yakima, Naches, Lower Yakima, Walla Walla, and Middle Snake Rivers.

As directed in 90.90 RCW, the Washington Department of Ecology Office of Columbia River (OCR) is developing a 2011 Columbia Basin Long-term Water Supply and Demand Forecast that includes information developed through CRIA. OCR will also use CRIA to aid project funding decisions and water rights determinations as called for in statute.

CRIA brings together data on fish status, distribution, and life history utilization with information on salmonid habitat and flow conditions. An important objective is to make salmonid species and habitat information available to the lay person through interactive map products.

Independent scores for fish status/utilization, habitat condition, and flow condition were generated for each stream reach. The three scoring elements were then combined, for display and interpretation purposes, into a triplet score characterizing each reach. In this way, a broader range of stream reach information is available to the user than would be available under a single-score system.

Using the tools created with this project, it is determined that great opportunity to improve salmonid production exists by pursuing water acquisitions in smaller, lower elevation streams with good to excellent habitat. However, streams with good to excellent habitat in higher elevations or less populous areas should not be overlooked, nor should lower mainstems through which most stocks/species must migrate. Any flow augmentation could be helpful in salmonid restoration efforts, especially in smaller systems that have limited flow, in over-appropriated basins, and/or in combination with other recovery measures.

WDFW CRIA Team:
Teresa Scott (Habitat Water Resources Policy Coordinator)
Jonathan Kohr (Habitat Water Science Team)
Dayv Lowry (Fish Science; Habitat Science)
Andrew Weiss (Fish Science)
Aaron Bosworth (King County District Fish Biologist)
Jim Cummins (Yakima District Fish Biologist)
Dale Gombert (Fish Science)
Paul La Riviere (Habitat Water Science Team)
Peggy Miller (Habitat Major Projects)
Brianna Murphy (Fish Science)

Acknowledgements:
The CRIA Team thanks Hal Beecher, Perry Harvester, and Bob Vadas for their ideas and support throughout project development. Thanks also go to Alex Conley, Carolyn Comeau, Dan Haller, and Rick Roeder for reviewing results with team members and providing comments.

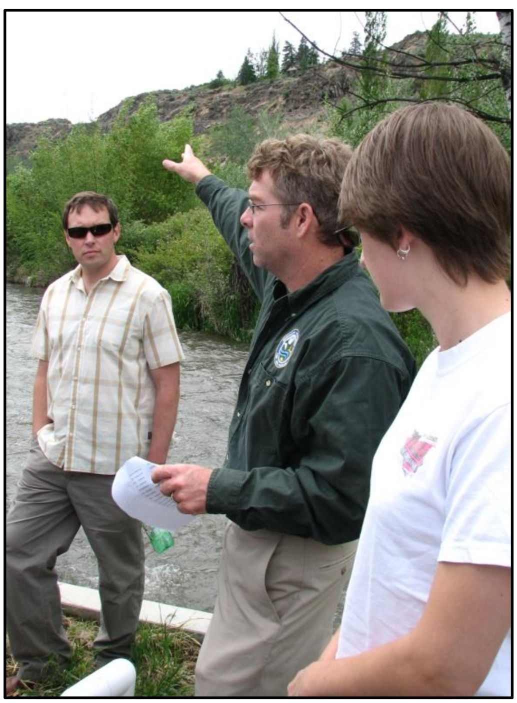
Recommended Citation:
Scott, T., Kohr, J., Lowry, D., Weiss, A., Bosworth, A., Cummins, J., Gombert, D., La Riviere, P., Miller, P., and Murphy, B (2011) Columbia River Instream Atlas Project Final Report. Washington Department of Fish and Wildlife. Olympia, Washington. Ecology Publication No. 11-12-015. 38 pp. plus 7 appendices.

Funding provided by Ecology Office of Columbia River as part of the 2011 Columbia Basin Long-term Water Supply and Demand Forecast

Cover Photo: Jonathan Kohr

Table of Contents

WDFW CRIA Team Members: (from left) Dale Gombert, Teresa Scott, Jonathan Kohr, Andrew Weiss, Aaron Bosworth, Dayv Lowry, Jim Cummins, Peggy Miller, and Brianna Murphy. (Missing: Paul La Riviere)



On June 2, 2010, Jon Kohr (left photo, center) and Jim Cummins led a CRIA Team tour in the Naches basin (WRIA 38) to test habitat condition scoring criteria and to do some birdwatching.

I. Introduction

The need for stream flow restoration is well established in Endangered Species Act (ESA) salmonid recovery plans, Northwest Power and Conservation Council Subbasin Plans, limiting factors analyses, local watershed plans, and others[1]. Recent legislation[2] coupled objectives to provide new water in the Columbia Basin and the need for stream flow restoration, directing Washington State Department of Ecology (Ecology) to develop new water supplies that meet both out-of-stream and instream needs. Program implementation questions include *"Where is flow restoration most needed to help instream resources?"* and *"How much water is needed, and where, to meet out-of-stream needs in the Basin?"* Chapter 90.90 RCW[3] directs Ecology's Office of Columbia River (OCR) to develop a 2011 forecast of water supply and demand for the Columbia River Basin, designed to answer some of these questions. As a component of that activity, Ecology asked the Washington Department of Fish and Wildlife (WDFW) to develop a product that would not only contribute to demand forecasting, but also help OCR select projects that are cost-effective in targeting the instream side of the water supply equation with specific focus on salmonid conservation/restoration. Thus, an interagency agreement was developed between Ecology and WDFW[4] to fund work leading to the Columbia River Instream Atlas for eight eastern Washington fish- and flow-critical watersheds.

A. Why an Instream Atlas?

As part of developing the 2011 water supply and demand forecast, OCR asked WDFW to update the stream reach prioritization presented in the 2003 *Washington Water Acquisition Program* report[5]" to incorporate more recent – and in some cases, more extensive – data on flow restoration needs. Since 2003, subbasin plans and regional ESA recovery plans, and associated salmon production modeling projects, have been completed for Columbia and Snake River tributaries. OCR also asked WDFW to integrate evaluations of salmonid habitat and flow, and the data on which they are based, into geographic information systems so the information is more readily available to a wide audience. The Columbia River Instream Atlas (CRIA) project was developed to respond to these needs.

---

1 A bibliography of references used in CRIA development and scoring is provided in Appendix A.

2 E2SHB 2860 2006 Columbia River Basin Water Supply. http://www.leg.wa.gov/pub/billinfo/2005-06/Pdf/Bills/Session%20Law%202006/2860-S2.SL.pdf;
E2SSB 6874 2008 Columbia River Water Delivery http://apps.leg.wa.gov/documents/billdocs/2007-08/Pdf/Bills/Senate%20Passed%20Legislature/6874-S2.PL.pdf ;
2SHB 1803 2011 Columbia River Basin Management Program http://apps.leg.wa.gov/documents/billdocs/2011-12/Pdf/Bills/Session%20Law%202011/1803-S2.SL.pdf

3 Chapter 90.90 RCW. Columbia River Basin Water Supply http://apps.leg.wa.gov/RCW/default.aspx?cite=90.90

4 Ecology Agreement C1000091 (WDFW agreement 09-1470) *Columbia River Instream Atlas*

5 Washington Department of Ecology and Washington Department of Fish and Wildlife. 2003. Washington Water Acquisition Program: Finding Water to Restore Streams. Ecology Publication No. 03-11-005.

The purpose of CRIA is to evaluate stream reaches for their potential to improve salmonid (salmon, steelhead, bull trout) production through stream flow enhancement. The CRIA product, along with WDFW professional knowledge, will also help Ecology identify salmon-inhabited stream reaches for emphasis during water right permitting processes. In addition, the CRIA project will provide an updated tool for Ecology's Water Acquisition and Irrigation Efficiencies Programs to prioritize flow enhancement projects in scored watersheds, and for OCR to evaluate investments in water-supply and fish-benefit projects.

Washington State is divided into 62 Water Resource Inventory Areas[6] (WRIAs) based on geographic watershed drainage systems. The CRIA project currently centers on eight fish/flow critical WRIAs in eastern Washington (Figure 1). CRIA analyses integrate the three Yakima Basin WRIAs into one complex for simplicity of scoring.

Table 1 WRIAs Included in 2011 CRIA

WRIA NAME	WRIA NUMBER
Walla Walla Basin (Washington portion)	WRIA 32
Middle Snake River & Tributaries (Washington portions)	WRIA 35
Yakima Basin Complex	
Lower Yakima River	WRIA 37
Naches Basin	WRIA 38
Upper Yakima Basin	WRIA 39
Wenatchee Basin	WRIA 45
Methow Basin	WRIA 48
Okanogan Basin	WRIA 49

6 Washington Administrative Code 173–500–040 Water resource inventory areas

Figure 1 CRIA focus WRIAs

B. What's included?

The project brings together several sources of information on instream resources and displays them in formats friendly to the non-fish biologist. Maps showing stream reaches prioritized for targeted flow restoration projects are the primary products, together with representations of fish stock status and life history utilization. Included are:

- Defined stream reaches in which flow restoration is possible based on the existence of surface water diversions or groundwater withdrawals within and above the reach that are capable of being acquired and transferred into the Trust Water Program;
- Salmonid Stock Inventory (SaSI) information on species, stocks, and status;
- ESA status;
- Information on fish distribution and monthly habitat utilization by life history stage;
- Stream reach habitat condition, based on key habitat attributes like flood plain connectivity and condition of riparian vegetation;
- Stream flows at key points; and
- Target flows for salmonids by stream reach, where available. Flow targets used for CRIA analysis are instream flow levels set in Washington Administrative

Code[7], and stream flow levels set for the Yakima Basin federal reclamation project[8].

C. CRIA Objectives

Objectives for the CRIA project are to:

- Update stream reach prioritization done for 2003 Water Acquisition Program
- Incorporate new information from recovery, Subbasin, and watershed plans
- Develop scoring that reflects improvements from completed restoration projects
- Improve & simplify project selection
- Screening OCR grant proposals, and proposals for Irrigation Efficiencies & Water Acquisition Programs
- Bring together fish status, distribution, and life history utilization data
- Update species/stock presence and status
- Publish product in simple format for use by permit writers
- Make both available on interactive GIS

II. Intended use

CRIA is intended as a tool to help visualize the environmental cost/benefit evaluation of capital investments for Ecology's Office of Columbia River. CRIA can aid decisionmaking for any project or program having a goal of instream flow restoration, including Ecology's Water Acquisition (Trust Water) and Irrigation Efficiencies grant programs. In addition, CRIA can be used to support permitting, mitigation analysis, project design, and water conservation project funding decisions, as long as geographic scope and data comprehensibility limitations of the CRIA project are taken into account.

A. CRIA benefits

Simple concepts, powerful presentation: One key objective is to depict elements of fish life history, habitat condition, and flow condition in a manner that is meaningful to laypeople, not just to fish biologists or hydrologists.

Data foundation: CRIA comprises data about salmonids and their habitats that are collated from established sources or using established methodologies. Fish presence, status, and life history information are collected from WDFW's Salmonid Stock

---

7 WAC 173-501 through 173-559 provide Instream resources protection programs for WRIAs for which instream flow rules have been developed.

8 Title XII of Public Law 103-434 on October 31, 1994 and
U.S. Department of the Interior, U.S. Bureau of Reclamation. November 2002. Interim Comprehensive Basin Operating Plan for the Yakima Project, Washington.

Inventory (SaSI) database and associated "fish distribution" spatial data. Habitat scoring criteria are based on the best available science, and though the criteria seem subjective on the surface, they are based in a firm foundation of the habitat attributes and quality most associated with high salmonid productivity. Flow data are collected from gauges maintained by the U.S. Geological Survey, U.S. Bureau of Reclamation, or Washington Department of Ecology.

Data organization: Data are organized in such a way that individual data components can be accessed using GIS. For example, while individual-reach scoring for "fish status/utilization" is based on an aggregated score for all species present, data are organized such that a user can access individual species/stock information for any given reach. Likewise, scores for individual habitat and flow attributes are accessible to the user in addition to the "roll-up" score used for decisionmaking at the broader scale.

Geographic scale: Watersheds are parsed into "reaches" based on criteria discussed below. This allows examination of data at a finer scale than basin-wide. In most cases the mainstem river(s) within a WRIA are broken into several reaches and smaller tributaries are each considered single reaches.

Flexible scoring: CRIA is designed to easily accommodate changes in scoring methodology, including the application of variable weighting factors to specific scoring attributes of interest (e.g., ESA status component of fish score).

Three-dimensional evaluation: CRIA scores for each of the three elements - fish status/utilization, habitat condition, and flow condition - are maintained separately. This allows each scoring element to be viewed separately (e.g., "I only want to look for reaches that are severely flow impaired") or combined to provide a gross overview of reach suitability for flow restoration (e.g., "Which reaches have the best habitat and fish species utilization but are severely flow impaired?").

B. CRIA limitations

Narrow objectives: The use of CRIA pre-supposes that the area of interest is already identified as being flow-impaired and having value to critical salmonid fish stocks. Indeed, to-date the atlas has been completed only for watersheds in which flow impairment has already been identified as a factor limiting salmon production. Because of this, a high CRIA score might be confusing, or conflict with, a determination on that component made with other objectives in mind.

Species limitations: Currently, CRIA is geared towards conditions for salmon, steelhead, and bull trout. Conditions and prioritization of reaches in relation to other fish and wildlife values are not included, though they are important when considering a more ecosystem-based approach to watershed restoration and protection.

Feasibility: A high CRIA score does not mean a project will successfully provide "high value for fish restoration" or "high value for flow restoration" because externalities such as legal constraints, availability of funding, and willingness to sponsor/fund a project can render a project infeasible. Conversely, a low CRIA score doesn't mean flow restoration will not benefit fish.

Limited upstream extent: CRIA is limited because, at this time, CRIA reaches extend upstream only so far as water is available to realistically contribute to stream flow augmentation (i.e. surface water diversions or groundwater withdrawals occur within or above the reach and can be purchased and transferred into the trust water program). This means that most upper stream reaches, especially those within public lands, are excluded from CRIA analysis. This will be confusing to some users, who will note a lack of data for the uppermost stream reaches that are critical to salmonid production and/or may be flow-impaired.

Subjectivity in scoring: Many of CRIA's component scores are based on "best professional knowledge" (BPK) instead of more objective metrics. Scores for particular habitat attributes were assigned in consultation with local agency biologists, not necessarily through direct observation by a CRIA team member. Effort was taken to reduce subjectivity in scoring by obtaining input from multiple experts, but it is not eliminated altogether. This is a limiting factor most often in the context of habitat condition scores that are based on "BPK." Scoring on some habitat attributes could eventually be replaced with more objective data as those data come available.

Data limited: Employing a subjective scoring method for habitat condition is one way the CRIA Team worked around the lack of direct-observation data for many reaches. Likewise, only about 50% of reaches identified for this product include flow gauges (Table 2), so alternative data sets and scoring methods were employed to score flow condition for each reach. CRIA structure was developed with flexibility in mind, both in its application and in its data foundation – components that now are subjective can be replaced with objective data when those data come available.

Table 2 Watershed statistics for numbers of reaches, gauges, and flow targets evaluated for CRIA

WATERSHED	REACHES	GAUGES	FLOW TARGETS
Walla Walla Basin (Washington portion)	33	19	4
Middle Snake River & Tributaries	29	13	0
Yakima River Complex	50	29	See note
Wenatchee Basin	17	11	6
Methow Basin	35	9	4
Okanogan Basin	25	14	4
TOTALS	189	95	18

Note: Yakima Basin flow targets are provided in Appendix D.

Limited peer review: The timeline under which CRIA was developed prohibited broad consultation with experts internal to, and outside of, WDFW and Ecology, some of whom have superior knowledge of local stream reaches. This is a critical step (or round of steps) that should be re-traced as CRIA products become more broadly used.

Cross-watershed comparisons: CRIA component scores are based on within-basin analysis and may not be helpful for choosing between projects in two separate watersheds. For example, it will be difficult to choose between a high-scoring reach in a watershed with many fish stocks and a high-scoring reach in a watershed having fewer stocks.

Complements, not replaces, expert judgment: Finally, while CRIA was created to display as much readily-available "fish-relevant" information as possible, its availability does not eclipse the need for direct professional consultation on a project- or application-specific basis.

C. Use of CRIA beyond stream flow restoration

While some CRIA tools can help visualize benefits from types of projects beyond stream flow restoration/augmentation, exclusive use of CRIA to guide decisions for other types of projects is not advised. For example, while users can get a feel for stream reach fish passage conditions, CRIA would not be a good tool to use to determine which fish passage barriers are most important to remove (though this feature could be integrated in the future).

On the other hand, CRIA is built with flexibility in mind. Many uses beyond development of water projects can be imagined. CRIA is built on a foundation of basic salmonid fish status/utilization and habitat/flow information. Small changes or additions to the Atlas can benefit a broader range of decisions; for example, employing CRIA information at a finer scale might be helpful in determining mitigation priorities for water right permitting. CRIA's applicability to any particular project or activity type very much depends on the nature of the decision being considered in relation to the data provided through CRIA. In the end, decisions at the project-level require project-specific, on-site assessment.

D. Relationship to other planning process outcomes

CRIA tools are not intended to replace priorities set in salmonid recovery planning, water management planning, or any other consensus-building processes. CRIA provides data on a narrow set of fish life, and does not, at this time, consider other wetland values except as relevant to the salmonid focus. This means CRIA will not be very helpful to users hoping to find a broad ecosystem perspective on these eastern Washington watersheds.

So, CRIA has high value for inquiry and decisionmaking around stream flow restoration intended to improve or maintain salmonid production. CRIA can also be extremely valuable to users in a broader context as long as CRIA's limitations are kept in mind.

III. Approaches to Scoring & Ranking

Eight major Columbia Basin watersheds (tributaries) are segmented into "reaches" to facilitate scoring. Information about fish stock/species status and habitat utilization, habitat condition, and flow condition is collated for each stream reach, and attributes for each element are scored. For each of these three CRIA elements, raw scores are stratified ("binned") into three categories: high/good (3), average/fair (2), or low/poor (1). As a result, stream reaches each have three elemental "bin" scores, one each for: "fish status/utilization," "habitat condition," and "flow condition."

Previous flow restoration project prioritization efforts consolidated scores for all components into a single score for each stream reach, and then arranged scores serially to establish a ranking among reaches within a WRIA. After discussion within the project team, a decision was made not to rank CRIA stream reaches serially. Instead, scores for each of the elements – fish, habitat, and flow – are maintained independently, providing greater flexibility in the application of the information to decisionmaking. This approach avoids confusion arising from the evaluation of disparate attributes of a reach and their contribution to one "composite score unit" used for ranking.

A. "The Cube"

As noted above, scoring for the 2003 Water Acquisition Program project combined results for all scored components, and provided one final score upon which serial ranking and prioritization was based. This was a successful approach because the "right" components were chosen for scoring and the outcome desired was an ordinal ranking of reaches within a watershed. We modified that approach for CRIA, choosing to score three elements independently. By doing this, CRIA becomes more than just a flow restoration tool; it can answer general questions about salmon and habitats, and can also inform other types of decisions being considered by managers.

The three-element approach lent itself well to a common method of displaying complicated relationships – a three-dimensional array we call the "CRIA Cube" (Figure 2). The three axes (elements) are: Fish Status/Utilization (providing information on anadromous salmonid species diversity, habitat utilization by life history stage, and population status); Habitat Condition (representing instream and riparian habitat functions and values); and Flow Condition (assessing overall flow as well as potential seasonal flow regime limitations). These scores may be used by decisionmakers in awareness of a fourth dimension - feasibility and opportunity – that addresses issues like water availability, water right status, habitat restoration effects,

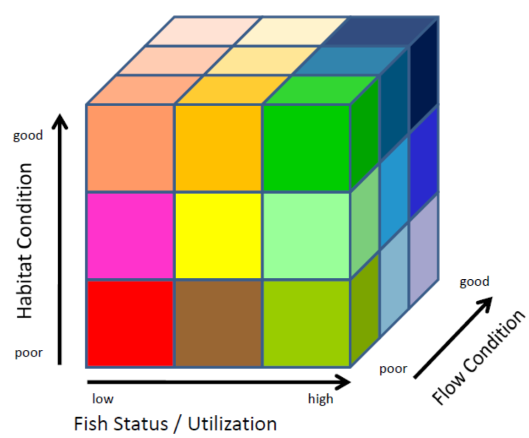


Figure 2 The CRIA Cube

funding availability, willing land owners, political will, ecosystem effects, etc.

B. Reaches

Reaches, or stream segments, were defined based on their relevance to benefit salmonid production and potential for flow restoration. Consideration was also given to having the ability to measure stream flow. Reach lengths range from a quarter-mile to almost eighty miles. Half of the identified stream reaches contain flow gauges; 95 of the 189 total reaches across eight WRIAs.

Upstream boundaries for most reaches were determined based on the nearest landmark (e.g., city, bridge, gauge, waterfall, confluence of another tributary, boundaries) above which no practical contributions to stream flow could be achieved. For example, for a stream flowing out of a national forest through private lands, the upstream terminus of the evaluated reach would be either the most upstream water diversion or the private/federal ownership boundary. Uppermost stream reaches that may be critical to salmonid production and/or may be flow-impaired are excluded from CRIA scoring because they don't contain water supply opportunities that would contribute to stream flow.

While it would be preferable to prioritize reaches entirely from a biological perspective for the entire creek to ensure maximum benefits to fish life, the opportunities to acquire water where it is most limiting to salmon restoration may be rare. Therefore, prioritizing instream flow restoration where flow benefits may be achieved is a practical approach for implementing restoration programs.

Further details about reach definitions for each WRIA are included in the appendices.

C. Fish Status/Utilization

The fish status/utilization score is a measure of the population status and life history utilization of salmonid stocks in a given stream reach. The fish scoring is organized around the eight chosen WRIAs and five species of salmonids (Chinook, coho, steelhead, sockeye and bull trout) in the Columbia Basin. Fish scoring is based primarily on information in the Salmonid Stock Inventory (SaSI) database maintained by WDFW, as well as on available literature, knowledge of WDFW regional biologists, and staff of other agencies such as the Confederated Tribes of the Umatilla Indian Reservation and Yakama Nation. These references can be found in the "references" tab of each WRIA's workbook, in SalmonScape, or in Appendix A of this report.

Species/stocks: In recognition of the biological distinctness and independence of salmonid populations, information was provided at the stock scale, instead of species scale, where possible. For bull trout, stock structure is comparatively poorly understood and annual distribution and status monitoring is limited, so while SaSI bull trout are identified at the stock scale, only species scale information is provided (i.e. "bull trout" rather than "special-name bull trout").

Life history utilization: Using information gathered for each fish stock/species present, each stream reach matrix is populated based on the monthly presence or absence of three life stage categories (spawning/early rearing, juvenile rearing and outmigration, and adult in-migration) of each relevant stock/species. These scores are summed across all the species/stocks within a reach for each month.

Stock Status: Monthly summed presence scores are then given additional influence by altering the weighting factors associated with stock-specific ESA, SaSI, or Regional Technical Team (RTT) status determinations.

Binning: The final numeric scores for each reach, based on life-stage specific occurrence for all stocks and weighted by status, were binned into high (3), average (2), and low (1) categories after standardizing by the highest fish score within the WRIA. Scores were not standardized by the maximum theoretically possible score for the WRIA (i.e., presence of every stock at every life history stage) because attaining this value is impossible, as part of stock separation is geographic isolation. Bin separations were defined as thirds of the highest score assigned to any single reach. Scoring and binning reaches in this way means it is possible, though unlikely, to have all reaches in a WRIA fall into a single bin. In practice, this did not occur.

An important note about scoring and binning fish status/utilization in this way is that, from the composite score, it is impossible to distinguish a reach used by several life stages of a single, ESA-listed stock from a reach used by several non-listed stocks. This method of scoring is intentional in order to simplify presentation, but it is possible to isolate the contribution of a given species, stock, or life stage using the root scoring spreadsheets for each WRIA.

Table 3 provides an overview of the ESA listing units (Evolutionarily Significant Units, “ESU,” or Distinct Population Segments, “DPS”) in the scored WRIAs, their ESA listing status, and their associated SaSI stocks. Stocks in parenthesis were not scored for CRIA purposes, but are included on this table in order to provide a more complete picture for the region. Several stocks are not associated with ESA Units and/or aren’t included in SaSI, but were scored for CRIA purposes; these are listed at the end of the table. In general, stocks that have been extirpated and reintroduced are not included in ESA Units or SaSI, but because the management intent for these stocks is to re-establish naturally-reproducing salmon runs, they are included in scoring as important components of the fish presence/utilization picture.

Table 3 ESA Unit Name, ESA Listing Status, and SaSI stock name for stocks scored for CRIA

ESA Unit Name	ESA Listing Status	SaSI stocks
Snake River Sockeye	Endangered	(Snake River Sockeye)
Snake River Basin Steelhead	Threatened	Middle Snake Summer Steelhead: Tucannon, Asotin Creek, Lower Grande Ronde, Joseph Creek
Snake River Spring and Summer Run Chinook	Threatened	Tucannon Spring Chinook, Wenaha Spring Chinook
Snake River Fall Chinook	Threatened	Snake River Fall Chinook
Snake River Bull Trout	Threatened	Middle Snake Bull Trout: Upper Tucannon, Asotin Creek, Wenaha
Touchet/Walla Walla (Oregon Recovery Unit) Bull Trout	Threatened	Touchet Bull Trout, Mill Creek Bull Trout
Middle Columbia Steelhead	Threatened	Walla Walla Summer Steelhead, Touchet Summer Steelhead
		Lower Yakima Summer Steelhead: Satus Creek, Toppenish Creek
		Naches Summer Steelhead
		Upper Yakima Summer Steelhead
Mid-Columbia River Spring Run Chinook	Not Warranted	Naches Spring Chinook, American River Spring Chinook
	Not Warranted	Upper Yakima River Spring Chinook, Naches Spring Chinook, American River Spring Chinook
Middle Columbia River Bull Trout	Threatened	Yakima River Bull Trout, Ahtanum Creek Bull Trout
		Naches Bull Trout: South Fork Tieton, Indian Creek, North Fork Tieton River, Rattlesnake Creek, American River, Crow Creek, Deep Creek
		Upper Yakima Bull Trout: North Fork Teanaway River, Cle Elum/Waptus Lakes, Box Canyon Creek, Kachess River, Gold Creek
Lake Wenatchee Sockeye	Not Warranted	Wenatchee Sockeye
Okanogan River Sockeye	Not Warranted	Okanogan Sockeye
Upper Columbia Steelhead	Threatened	Wenatchee Summer Steelhead
		Methow Summer Steelhead
		Okanogan Summer Steelhead
Upper Columbia River Spring Run Chinook	Endangered	Chiwawa Spring Chinook, Nason Creek Spring Chinook, Little Wenatchee Spring Chinook, White River (Wenatchee) Spring Chinook
		Methow Spring Chinook, Twisp Spring Chinook, Chewuch Spring Chinook, Lost River Spring Chinook

Table 3, continued

ESA Unit Name	ESA Listing Status	SaSI stocks
Upper Columbia River Summer and Fall Run Chinook	Not Warranted	Yakima River Bright Fall Chinook, Marion Drain Fall Chinook
		(Hanford Reach Fall Chinook)
		Wenatchee Summer Chinook
		Methow Summer Chinook
		Okanogan Summer Chinook
Upper Columbia River Bull Trout	Threatened	Wenatchee Bull Trout: Ingalls Creek, Icicle Creek, Chiwaukum Creek, Chiwawa, Chikamin Creek, Rock Creek, Phelps Creek, Nason Creek, Little Wenatchee, White River, Panther Creek
		Methow Bull Trout: West Fork Methow, Gold Creek (Methow), Beaver Creek, Twisp, West Fork Buttermilk Creek, East Fork Buttermilk Creek, Lost River, First Hidden Lake, Middle Hidden Lake, Monument Creek, Reynolds Creek, Cougar Lake, Lake Creek, Wolf Creek, Goat Creek, Early Winters Creek, Cedar Creek
No ESA Unit	n/a	Yakima Basin Sockeye
		Walla Walla Spring Chinook
		Walla Walla Coho
		Yakima Basin Coho
		Wenatchee Coho
		Methow Coho

D. Habitat Condition

The habitat score is a measure of six attributes evaluating salmonid fish habitat condition for a given stream reach. Scores are given on an annual basis rather than by month as in the fish status/utilization scoring. The score is based on four tiers of review; 1) literature, 2) best professional knowledge (BPK) of project biologists, 3) personal communication with those who have on-the-ground knowledge of specific stream reaches, and 4) actual on-the-ground site evaluations of stream reaches by CRIA team biologists. Much of the literature cited is also based on BPK.

Attributes: The six habitat attributes are: 1) Off-channel habitat, 2) Floodplain connectivity, 3) Riparian conditions, 4) Spawning suitability, 5) Rearing suitability, and 6) Passage conditions. Each of these habitat parameters are rated from 1 to 4 (1=Poor, 2=Fair, 3=Good, 4=Excellent) for each stream reach based on criteria found in Appendix A. Within many reaches, habitat quality may vary significantly in different portions of the reach. In these cases, an average score for an entire reach would be calculated. For example, a 10 mile stream reach may have poor rearing habitat suitability in the lower end, fair habitat in the middle and good habitat at the upper half, resulting in a "fair" rating ("2" score) for rearing habitat suitability overall.

At the time of review, all present salmonid species are taken into consideration for the habitat scoring parameters. The six scores are added to get an overall habitat score for each reach. Therefore the lowest possible score is 6 (all rated as poor) and the highest is 24 (all rated excellent). For each WRIA, reaches are then binned using their total Habitat score.

Binning: For each WRIA, binning of the reach habitat scores is determined using a range between the lowest and highest scores stratified into thirds. For example, if the lowest reach habitat score is 6 and the highest score is 20, the range is 6 to 20, which when divided evenly among three units (poor, fair, good) yields bins with scores ranging from 6-10 (poor), 11-15 (fair), and 16-20 (good).

E. Flow Condition

Several approaches were tested before finalizing the flow scoring approach for CRIA. Flow data collected from stream flow gauges were loaded and summarized, and a "period of record" chosen for use when comparing monthly mean flows to flow targets. In reaches lacking gauge data, estimates of flow based on precipitation and watershed size were adapted from the National Hydrological Data "Plus"[9] database. Information was also collected from Ecology regarding permitted water withdrawals in each reach. These data were viewed from several angles to develop scoring, and while the methodology isn't perfect, the scores it yields make sense in context with the other scored components and the planned application.

Gauges: Once reach definitions were finalized, staff paired reaches with stream flow gauges. To the extent possible, we used gauges matching Ecology's stream flow "control points." Where two gauges occurred within a particular reach, we chose based on Ecology criteria for length of period-of-record. Gauge data were downloaded in their native format and summarized to "monthly mean flows" for each month within the dataset. The minimum monthly mean flow for a period of record was also calculated. Both the mean and the minimum were compared with flow targets, where they are available.

Period of Record: Most gauges in smaller stream reaches are new gauges operated by Ecology. These gauges typically have very short periods of record, primarily within the last decade. For USGS or Bureau of Reclamation gauges we examined all years of data, but typically only used the last 20 or 30 years. We attempted to use only contemporary years on reaches with known operations changes. Still, some reaches had too few records for us to use: Our criterion was a minimum of three years of data for each time-step.

---

9 NHDPlus Home Page: http://www.horizon-systems.com/nhdplus/ USGS/EPA NHDPlus User Guide. 2010. available at: ftp://ftp.horizon-systems.com/NHDPlus/documentation/NHDPLUS_UserGuide.pdf

Missing Flow Data: In the end, ninety-four out of 189 reaches (50%) lacked flow gauge data (Table 2). This presented a difficult barrier to providing a consistent scoring scheme across all stream reaches. After consultation to ensure data source consistency with Dr. Jennifer Adams of the WSU forecast team, the CRIA team embarked upon an analysis of streamflow data from the NHD-Plus GIS-based system, which uses watershed area (upstream of a point of interest) and local precipitation information to estimate normative flow at that point. These normative flows were then adjusted to account for withdrawals and used as a basis of comparison in further scoring steps.

Flow targets: Instream flows set in administrative rule were used as "flow targets" for most analyses; the exception is Yakima basin, for which mainstem flow targets are set through federal action, and tributary flow targets have been determined by the YRBWEP work group as part of the YRBWEP water supply planning process. Flow rules or targets were matched as closely as possible with stream reach boundaries. Since flow rules are often provided on a weekly basis, the CRIA team used the highest value within a month as the flow target for that month. This method will often overstate the severity of flow deficits, but this impact was deemed acceptable given the scale at which the analysis is being conducted.

Water Rights: Late in CRIA development, team members were able to access water rights information for our eight watersheds. Rights were assigned to stream reach using latitude/longitude of place-of-use, which was believed to be more reliably helpful than point-of-diversion coordinates. Water right volumes were not available for claims at the time this scoring method was finalized[10]. However, because volumes for claims have not been evaluated for extent and validity, but it is reasonable to assume that claims indicate water is being used, we needed an approach to account for this potential additional use. The team chose the "count-of-claims" scoring method because we judged that the risk of vastly overestimating the total quantity of diversion using this method outweighed the risk of underestimating the quantity of water being diverted. Two calculations were made to aid scoring: the sum of diversion quantity for certificated water rights was compared with the flow for that reach, and the count of claims in a reach was totaled as a surrogate for the risk that withdrawals are actually higher than the database indicates. It is hoped that, as water right data become better examined and validated, some more direct scoring methods can be employed.

Scoring: Four separate scoring metrics were used: A) percentage of months when mean monthly flows were below the flow target; B) deviation of withdrawals from average monthly flow; C) number of claims in a stream reach; and D) the deviation between flow and target in August. Results for each analysis were converted to a score using the rubrics shown below (Table 4). A fifth component E) Flow volume factor was used to weight the sum of the other scores yielding the final score.

---

[10] Nor has the issue of claims in adjudicated basins been resolved "in the books."

Scoring is initially conducted using high value as “bad” (“highly impaired”) and low value as “good,” then reversed in the final scoring step. We started analyses by focusing on degree of flow impairment (high value is highly impaired flow condition), but when display of results showed this perspective to be confusing, we reversed the bins to be consistent with the other scoring elements (high value is good flow condition).

Component A (% of months flow<target) is helpful for scoring element because it captures the true management risk associated with underachievement of instream flow rules. Reaches having mean monthly flow below the flow target for nine months or more annually score worst.

Component B (withdrawals as a percentage of average mean monthly flow) makes sense – and might logically be the only scoring element used – if total volume of withdrawals was known with certainty and targets existed for every reach. For the current project, withdrawals over 15% of total flow were deemed worst.

Component C refers to the count of claims for a particular stream reach. As mentioned above, this metric represents the level of risk that actual withdrawals are greater than depicted in the database. Reaches having over nine claims score worst for this risk factor.

Component D (August mean monthly flow as a percentage of mean annual flow) gives us a means to determine whether the reduction in summer flow is severe: August flows more than 66% below average are worst.

Flow Volume factor E is computed using mean annual flows, either directly from gauge data or estimated using the NHD plus method. The thinking for this factor is that any of the already scored elements are less likely to be a problem in a high-flow reach than in a low-flow reach. We multiplied a bad score by three, for example, for a reach having less than 5 cfs, and halved the score for reaches of 1000 cfs or more.

Binning: Simplicity in presentation of results led us to employ “bins” with one bin containing all the “best” scoring reaches, another the worst. Binning for flow scores was done based on percentiles, with the worst (most flow impaired) 33% of scores binning as “1” and the best (least flow impaired) binning as “3,” thus reversing the scores so they compare to scores for other elements.

A reach binned as “1” in one watershed will not necessarily be of the same overall priority as a reach binned as “1” in another watershed; several other factors, including fish status/utilization, habitat condition, and feasibility considerations must be considered before priorities across WRIAs can be made. Reaches binned as “1” however are the highest priority for flow restoration - based on flow condition alone – within a particular watershed.

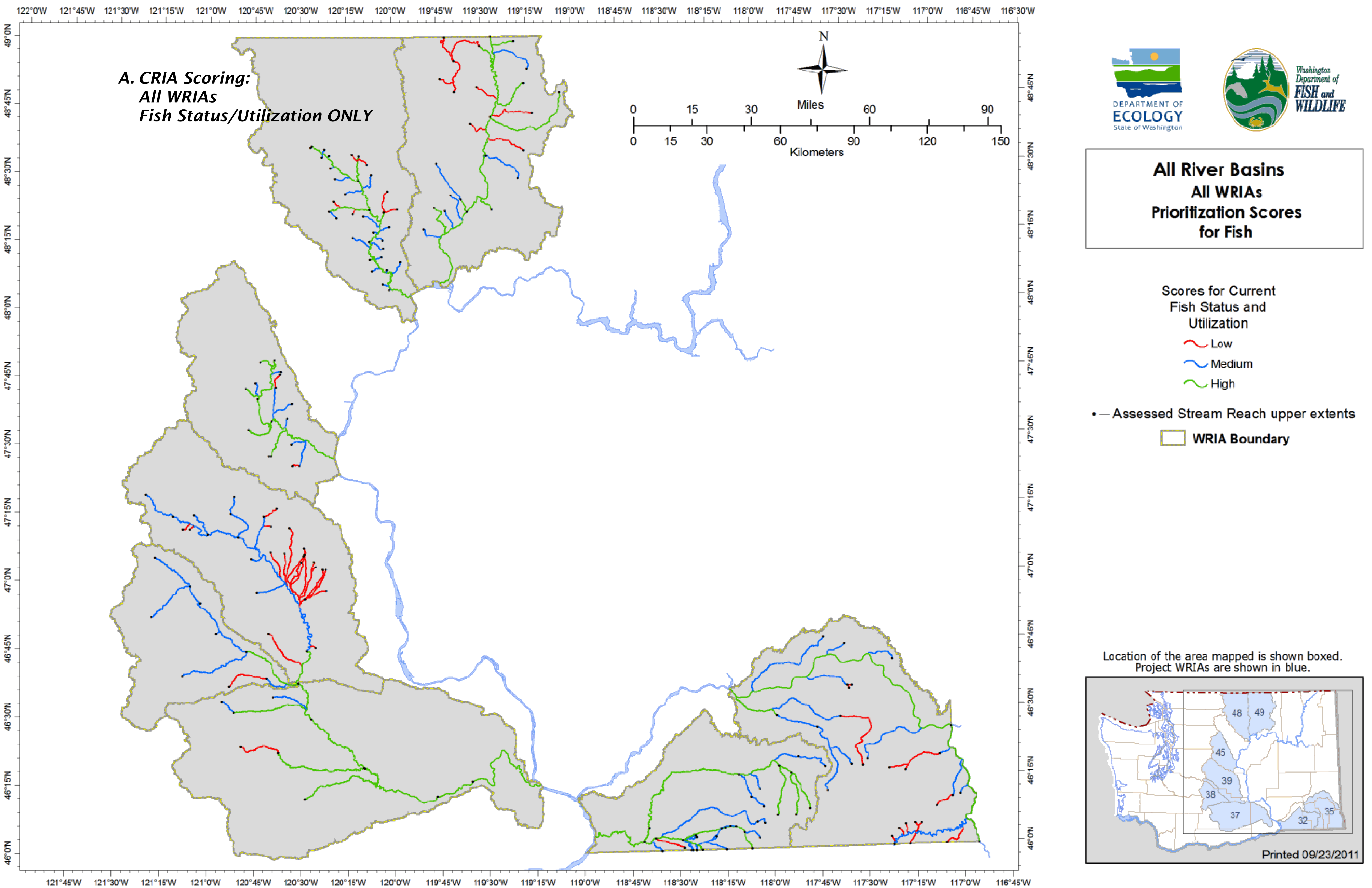
Table 4 Flow Condition Scoring Metrics

ITEM	METRIC	RUBRIC
A	Percent of months that monthly mean flow is less than target	%> .75 = 4 %>.5 = 3 %>.25 = 2 Else 1
B	Withdrawals as a proportion of mean annual flow	Qi/Flow>.15 = 3 Qi/Flow>.05 = 2 Else 1
C	Number of claims	Claims<2 = 1 Claims<9 = 2, Else 3
D	August flows as percent of mean annual flow	Aug/Avg > 66 = 3 Aug/Avg > 33 = 2 Else 1
E	Flow (mean annual flow) Volume Factor	>1000 cfs = 0.5 >100 cfs = 1 >50 cfs = 2 >5 cfs = 3 Else 4

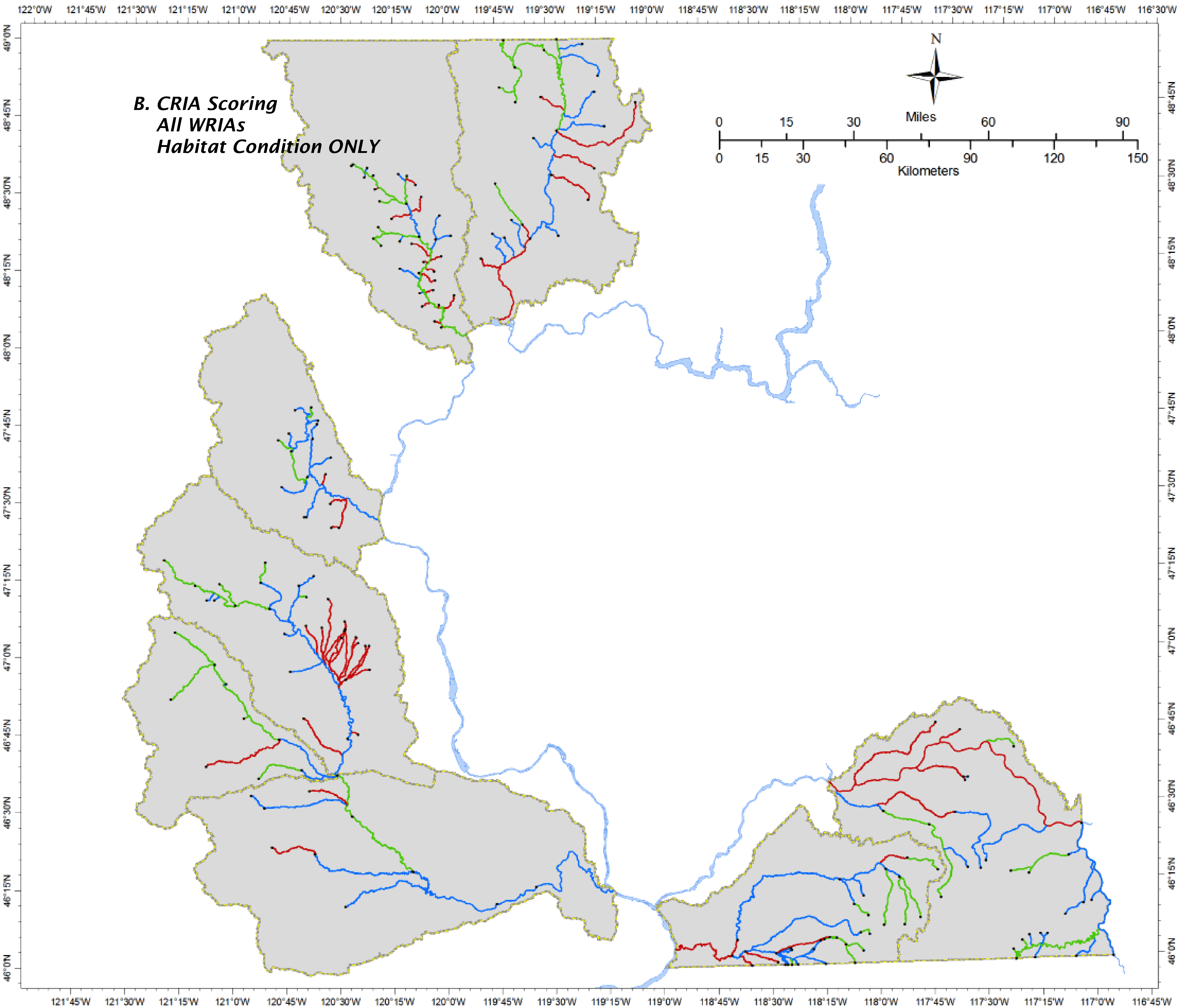
IV. Results

Following are eight maps depicting the results of CRIA scoring. The first three maps depict the element scores individually for Fish Status/Utilization, Habitat Condition, and Flow Condition across all WRIAs. The fourth map provides the combined results for all three elements across all WRIAs, and the last four maps show combined scoring results for WRIA groups as follows: Walla Walla (32) / Middle Snake (35); Yakima Basin (37, 38, 39); Wenatchee (45); and Methow (48) / Okanogan (49). The legend for the first three maps uses a simple color scale to depict scores. The legend changes starting with the fourth map to a combination of color scale for Fish and Habitat elements and line width for the Flow element. In this way, the three-dimensionality of the scores can be conveyed while maintaining a certain level of simplicity for the reader.

Detailed descriptions of scoring methodology are found in Appendix A, and WRIA-specific details are found in Appendices B through G.


A. CRIA Scoring:
All WRIAs
Fish Status/Utilization ONLY
N
Miles
0 15 30 60 90
0 15 30 60 90 120 150
Kilometers
DEPARTMENT OF ECOLOGY State of Washington
Washington Department of FISH and WILDLIFE
All River Basins
All WRIAs
Prioritization Scores
for Fish
Scores for Current Fish Status and Utilization
Low
Medium
High
Assessed Stream Reach upper extents
WRIA Boundary
Location of the area mapped is shown boxed.
Project WRIAs are shown in blue.
48
49
45
39
38
37
32
35
Printed 09/23/2011
All WRIAs - Fish

[intentionally blank]



DEPARTMENT OF ECOLOGY State of Washington

Washington Department of FISH and WILDLIFE

All River Basins
All WRIAs
Prioritization Scores
for Habitat

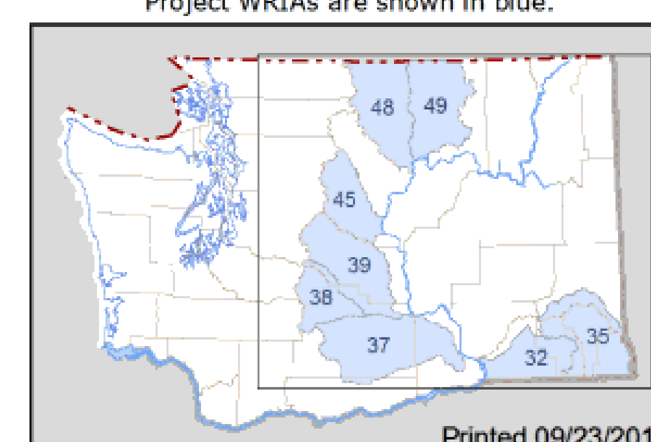
Scores for Current Habitat Condition

- Poor
- Fair
- Good

• — Assessed Stream Reach upper extents

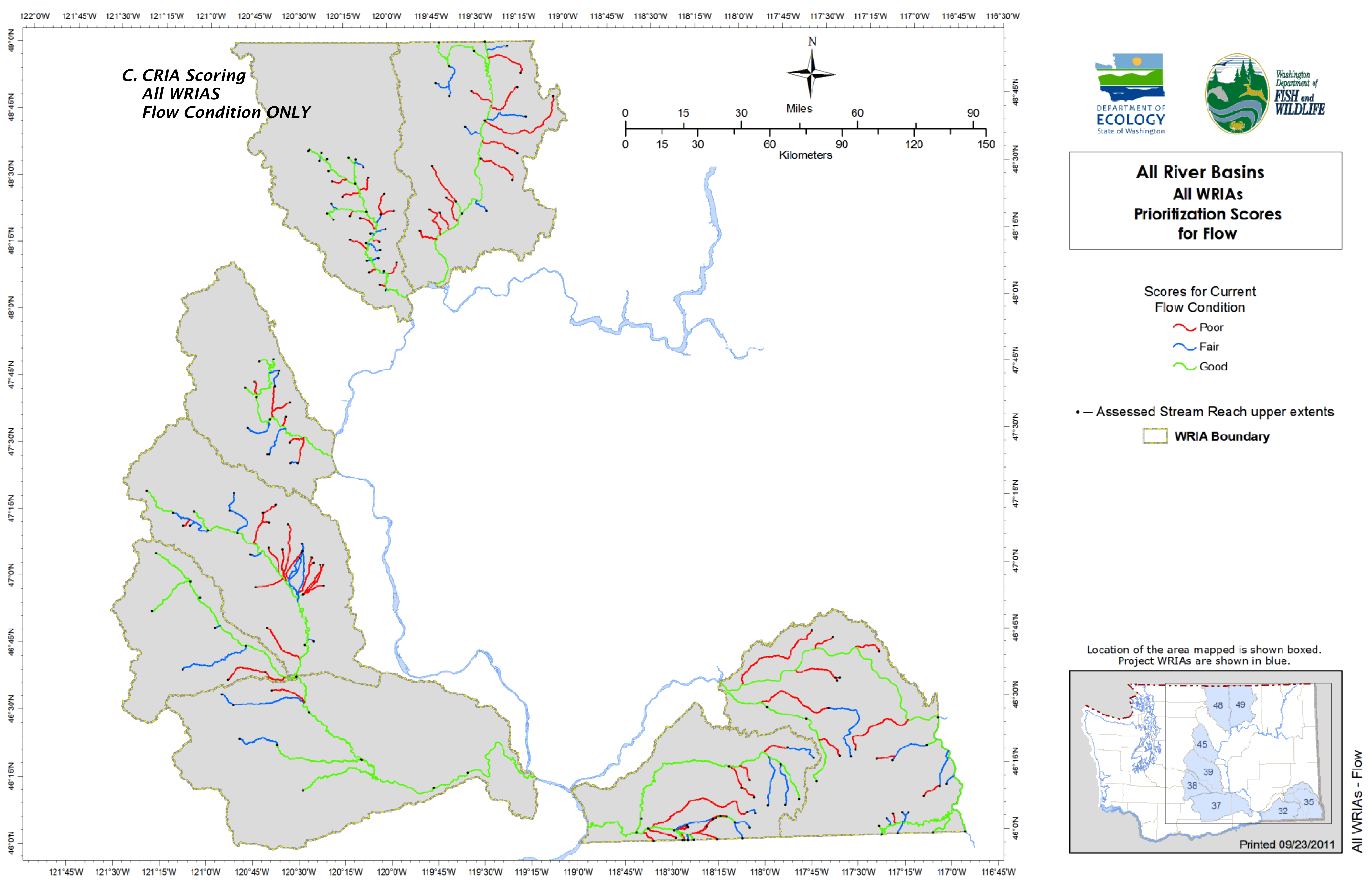
WRIA Boundary

Location of the area mapped is shown boxed.
Project WRIAs are shown in blue.



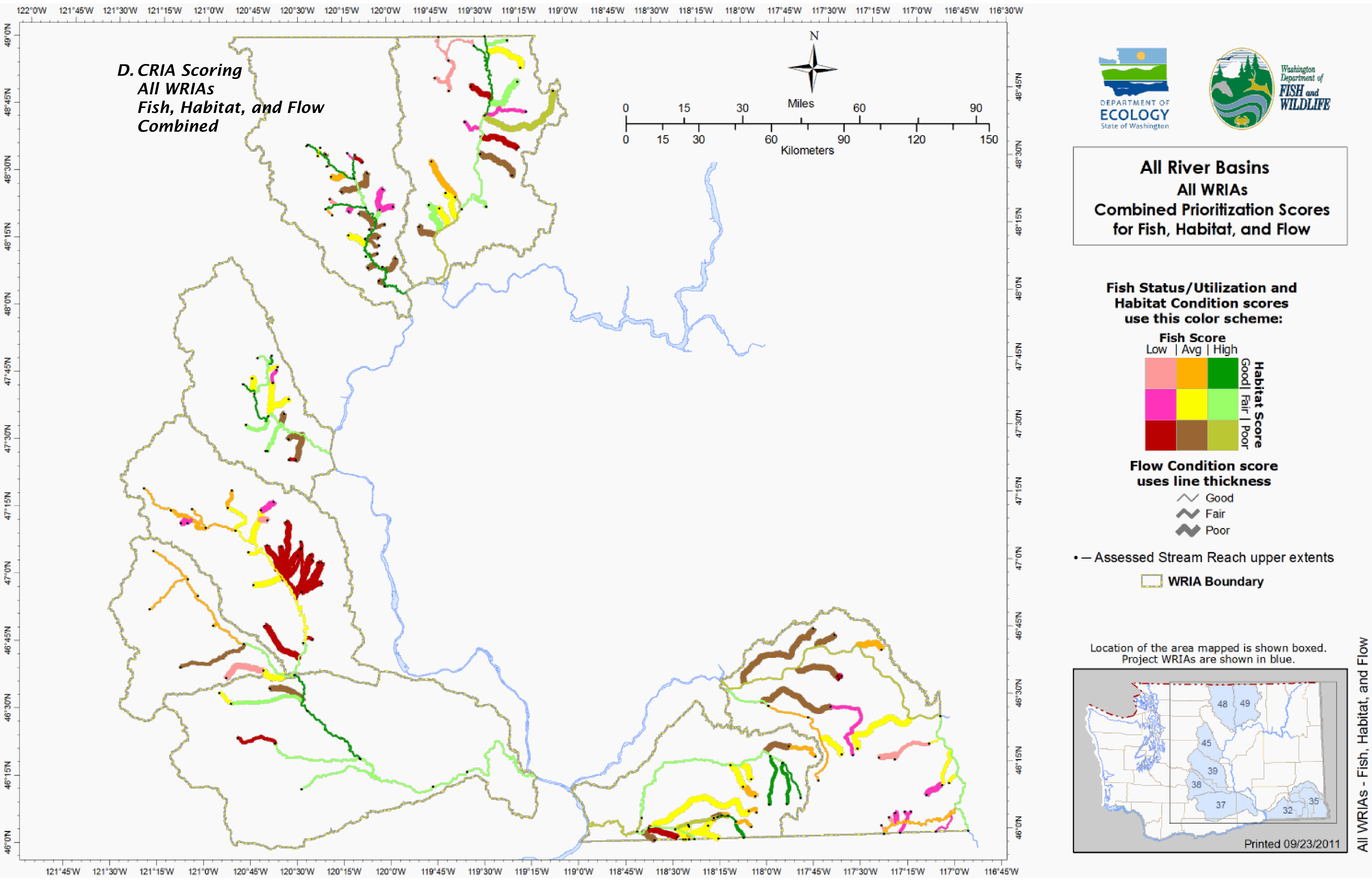
All WRIAs - Habitat

[intentionally blank]



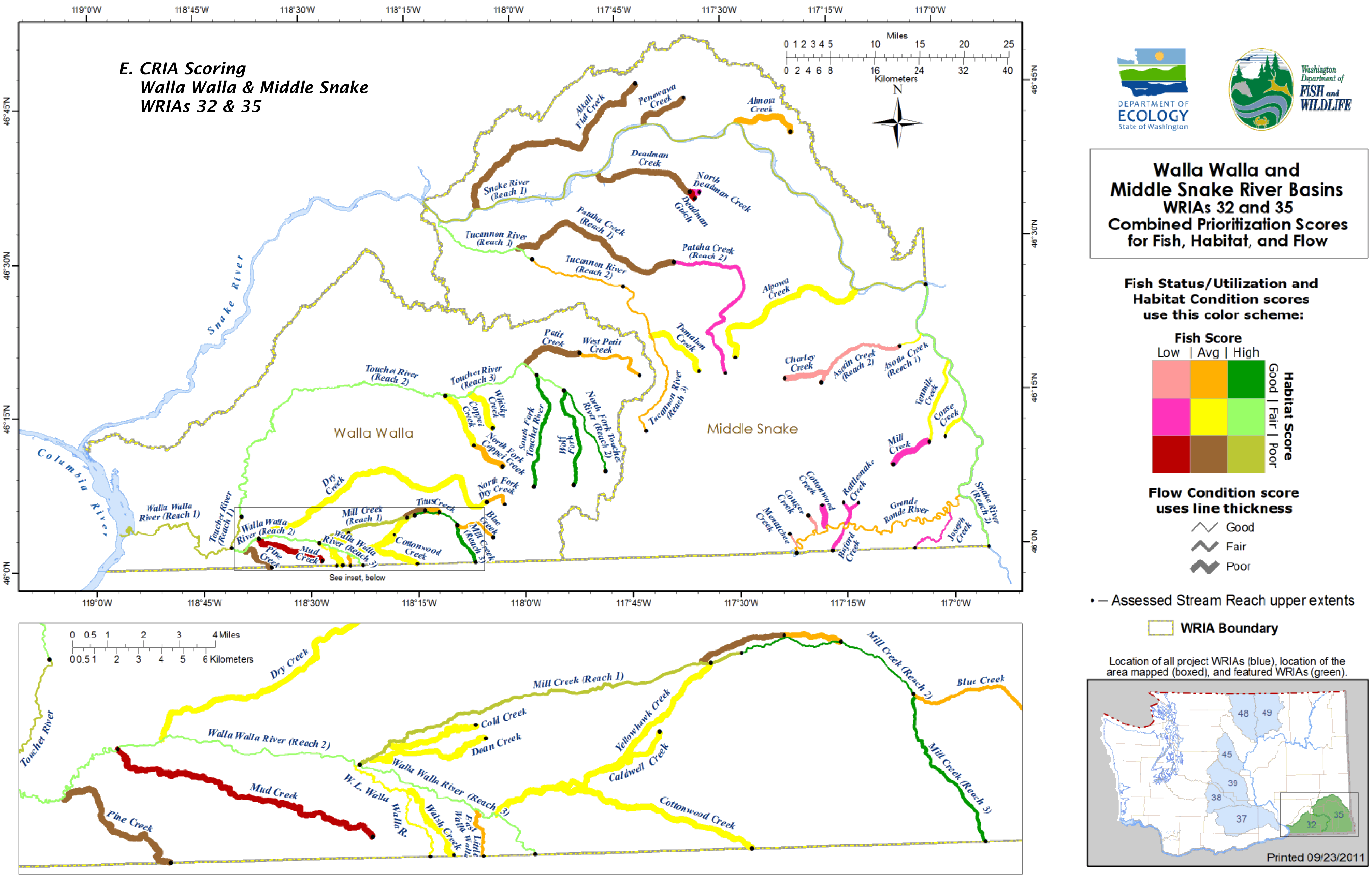
C. CRIA Scoring
All WRIAS
Flow Condition ONLY
All River Basins
All WRIAs
Prioritization Scores
for Flow
Scores for Current
Flow Condition
Poor
Fair
Good
Assessed Stream Reach upper extents
WRIA Boundary
N
Miles
0 15 30 60 90
0 15 30 60 90 120 150
Kilometers
DEPARTMENT OF
ECOLOGY
State of Washington
Washington
Department of
FISH and
WILDLIFE
Location of the area mapped is shown boxed.
Project WRIAs are shown in blue.
48
49
45
39
38
37
32
35
Printed 09/23/2011
All WRIAs - Flow
122°0'W 121°45'W 121°30'W 121°15'W 121°0'W 120°45'W 120°30'W 120°15'W 120°0'W 119°45'W 119°30'W 119°15'W 119°0'W 118°45'W 118°30'W 118°15'W 118°0'W 117°45'W 117°30'W 117°15'W 117°0'W 116°45'W 116°30'W
49°0'N 48°45'N 48°30'N 48°15'N 48°0'N 47°45'N 47°30'N 47°15'N 47°0'N 46°45'N 46°30'N 46°15'N 46°0'N

[intentionally blank]



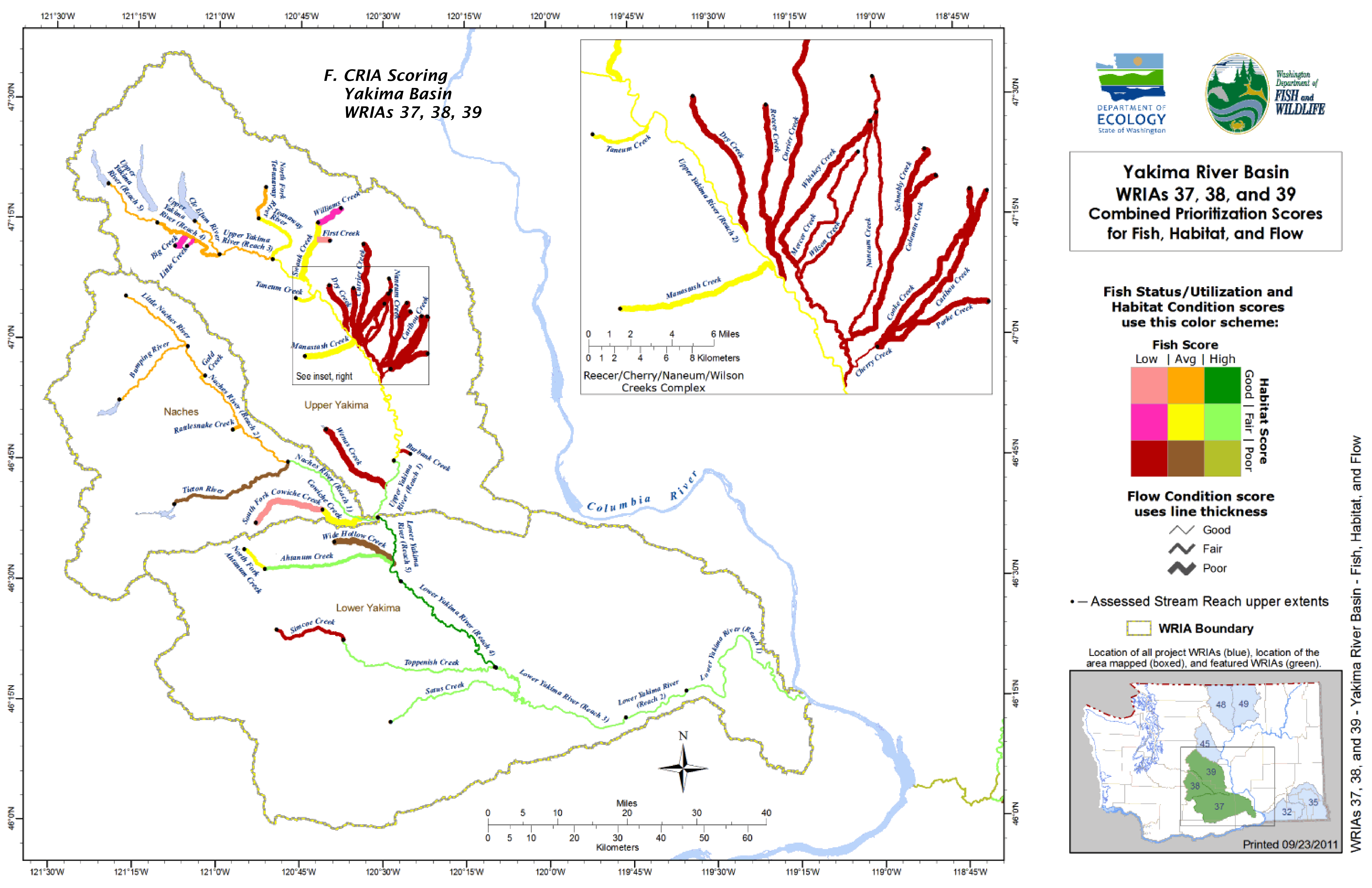
D. CRIA Scoring
All WRIAs
Fish, Habitat, and Flow
Combined
N
Miles
0 15 30 60 90
0 15 30 60 90 120 150
Kilometers
DEPARTMENT OF ECOLOGY
State of Washington
Washington Department of FISH and WILDLIFE
All River Basins
All WRIAs
Combined Prioritization Scores
for Fish, Habitat, and Flow
Fish Status/Utilization and
Habitat Condition scores
use this color scheme:
Fish Score
Low | Avg | High
Habitat Score
Good | Fair | Poor
Flow Condition score
uses line thickness
Good
Fair
Poor
• — Assessed Stream Reach upper extents
WRIA Boundary
Location of the area mapped is shown boxed.
Project WRIAs are shown in blue.
48
49
45
39
38
37
32
35
Printed 09/23/2011
All WRIAs - Fish, Habitat, and Flow

[Intentionally blank]



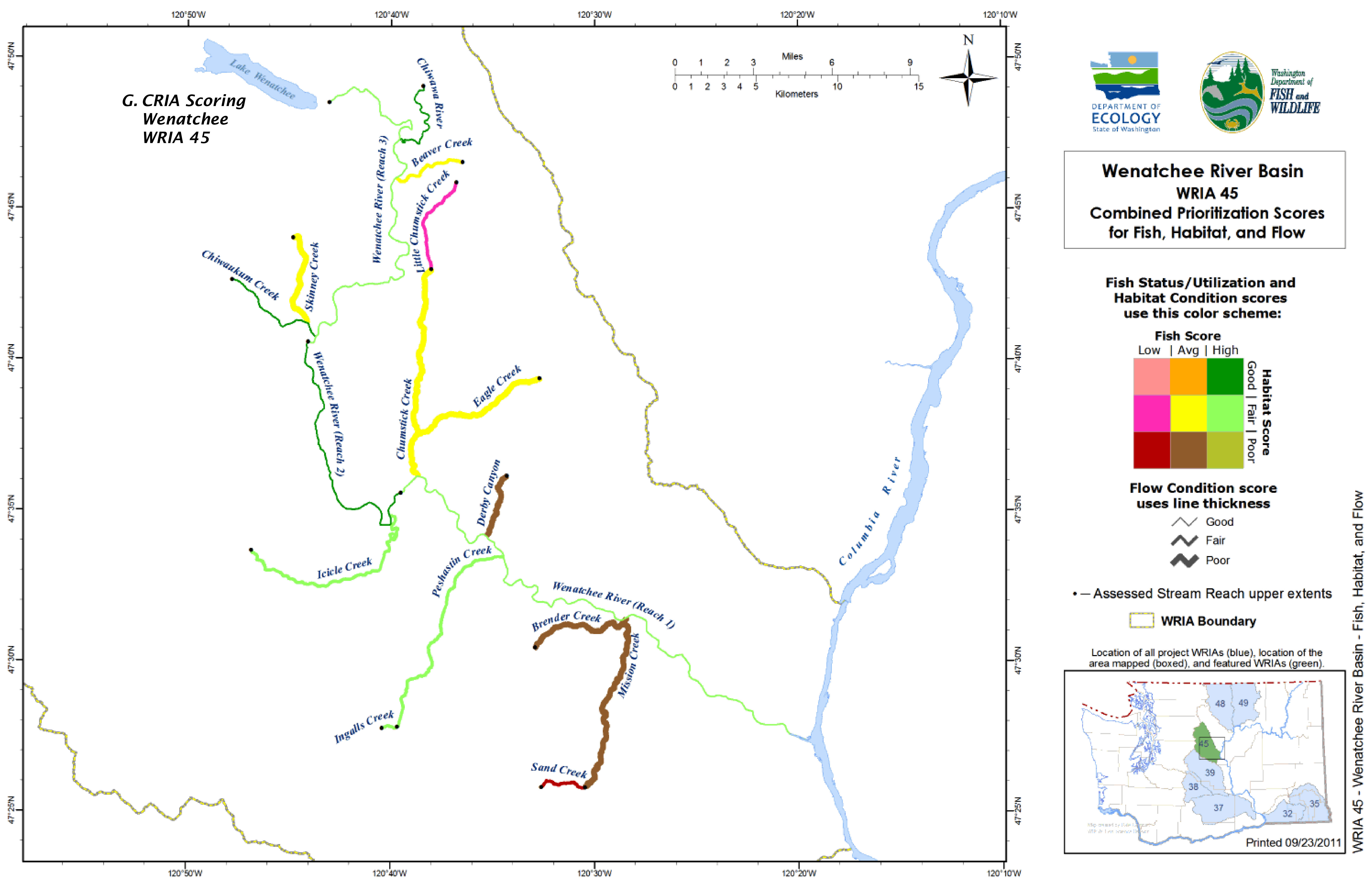
WRIAs 32 and 35 - Walla Walla and Middle Snake River Basins - Fish, Habitat, and Flow

[intentionally blank]

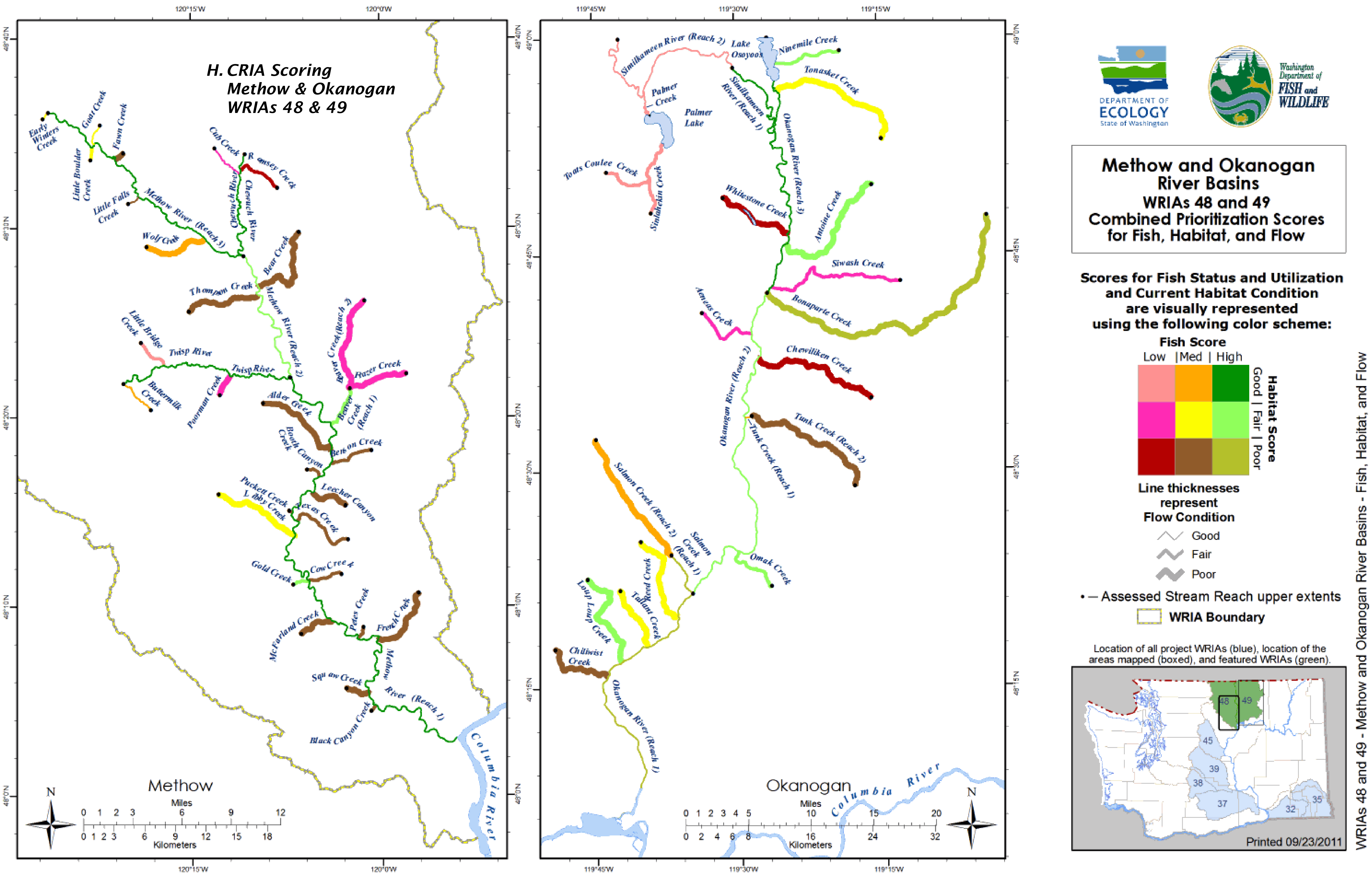

F. CRIA Scoring
Yakima Basin
WRIAs 37, 38, 39
DEPARTMENT OF ECOLOGY State of Washington
Washington Department of FISH and WILDLIFE
Yakima River Basin
WRIAs 37, 38, and 39
Combined Prioritization Scores
for Fish, Habitat, and Flow
Fish Status/Utilization and
Habitat Condition scores
use this color scheme:
Fish Score
Low | Avg | High
Habitat Score
Good | Fair | Poor
Flow Condition score
uses line thickness
Good
Fair
Poor
Assessed Stream Reach upper extents
WRIA Boundary
Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).
48
49
45
39
38
37
32
35
Printed 09/23/2011
WRIAs 37, 38, and 39 - Yakima River Basin - Fish, Habitat, and Flow
Reecer/Cherry/Naneum/Wilson
Creeks Complex
0 1 2 4 6 Miles
0 1 2 4 6 8 Kilometers
Taneum Creek
Upper Yakima River (Reach 2)
Dry Creek
Reecer Creek
Currier Creek
Whiskey Creek
Mercer Creek
Wilson Creek
Naneum Creek
Schnebly Creek
Coleman Creek
Manastash Creek
Cooke Creek
Caribou Creek
Parke Creek
Cherry Creek
See inset, right
Upper Yakima River (Reach 5)
Upper Yakima River (Reach 4)
Cle Elum River
Big Creek
Little Creek
Upper Yakima River (Reach 3)
North Fork Teanaway River
Teanaway River
Williams Creek
First Creek
Swauk Creek
Little Naches River
Bumping River
Gold Creek
Naches River (Reach 2)
Rattlesnake Creek
Naches
Upper Yakima
Wenas Creek
Burbank Creek
Naches River (Reach 1)
Upper Yakima River (Reach 1)
Tieton River
South Fork Cowiche Creek
Cowiche Creek
Wide Hollow Creek
Lower Yakima River (Reach 5)
North Fork Ahtanum Creek
Ahtanum Creek
Lower Yakima
Lower Yakima River (Reach 4)
Simcoe Creek
Toppenish Creek
Satus Creek
Lower Yakima River (Reach 3)
Lower Yakima River (Reach 2)
Lower Yakima River (Reach 1)
Columbia River
N
Miles
0 5 10 20 30 40
0 5 10 20 30 40 50 60
Kilometers
121°30'W
121°15'W
121°0'W
120°45'W
120°30'W
120°15'W
120°0'W
119°45'W
119°30'W
119°15'W
119°0'W
118°45'W
47°30'N
47°15'N
47°0'N
46°45'N
46°30'N
46°15'N
46°0'N

[intentionally blank]

G. CRIA Scoring Wenatchee WRIA 45



[intentionally blank]


H. CRIA Scoring
Methow & Okanogan
WRIAs 48 & 49
Methow
Okanogan
Methow River (Reach 1)
Methow River (Reach 2)
Methow River (Reach 3)
Chewuch River
Twisp River
Okanogan River (Reach 1)
Okanogan River (Reach 2)
Okanogan River (Reach 3)
Similkameen River (Reach 1)
Similkameen River (Reach 2)
Lake Osoyoos
Palmer Lake
Columbia River
Early Winters Creek
Goat Creek
Fawn Creek
Little Boulder Creek
Little Falls Creek
Wolf Creek
Cub Creek
Ramsey Creek
Bear Creek
Thompson Creek
Little Bridge Creek
Buttermilk Creek
Poorman Creek
Beaver Creek (Reach 1)
Beaver Creek (Reach 2)
Frazer Creek
Alder Creek
Booth Canyon Creek
Benson Creek
Leecher Canyon
Texas Creek
Libby Creek
Gold Creek
Cow Creek
McFarland Creek
Peters Creek
French Creek
Squaw Creek
Black Canyon Creek
Ninemile Creek
Tonasket Creek
Palmer Creek
Toats Coulee Creek
Sinlahekin Creek
Whitestone Creek
Antoine Creek
Siwash Creek
Aeneas Creek
Bonaparte Creek
Chewiliken Creek
Tunk Creek (Reach 1)
Tunk Creek (Reach 2)
Salmon Creek (Reach 1)
Salmon Creek (Reach 2)
Omak Creek
Loup Loup Creek
Tallant Creek
Reed Creek
Chiliwist Creek
Miles
Kilometers
N
DEPARTMENT OF ECOLOGY State of Washington
Washington Department of FISH and WILDLIFE
Methow and Okanogan River Basins
WRIAs 48 and 49
Combined Prioritization Scores for Fish, Habitat, and Flow
Scores for Fish Status and Utilization and Current Habitat Condition are visually represented using the following color scheme:
Fish Score
Low | Med | High
Habitat Score
Good | Fair | Poor
Line thicknesses represent Flow Condition
Good
Fair
Poor
Assessed Stream Reach upper extents
WRIA Boundary
Location of all project WRIAs (blue), location of the areas mapped (boxed), and featured WRIAs (green).
48
49
45
39
38
37
35
32
Printed 09/23/2011
WRIAs 48 and 49 - Methow and Okanogan River Basins - Fish, Habitat, and Flow

[intentionally blank]

V. Discussion

In general, CRIA scoring worked well, yielding results that are intuitive and consistent with existing information. For example, most of the Methow and Okanogan tributaries are depicted with fat lines, meaning they scored low for flow condition (i.e. would benefit from flow augmentation). Likewise, Upper Yakima basin tributaries upstream from Taneum Creek score low for flow (fat lines) but higher for habitat condition, as expected. On the other hand, many mainstems are shown with thin green lines, meaning they have high fish value, and good habitat and flow condition. For streams like the Okanogan, which flows through shrub steppe and suffers from high temperatures and low summer flows, this result is counterintuitive.

As expected, stream reaches that flow through heavily populated or highly irrigated agricultural areas tended to score lower for most habitat parameters. In more forested, less populous areas, stream reaches scored higher for habitat. For instance, reaches in the lower elevation areas in the Wenatchee River watershed (WRIA 45), which flow through mixed urbanization and intensive agriculture, received low to medium habitat scores overall. Reaches in the higher elevations with less agriculture and lower population density such as the Chiwawa River received higher habitat scores.

Note that the stream habitat scoring and priorities identified in the *Columbia River Instream Atlas* reflect a snapshot of conditions that existed at the time the inventories took place. Thus, the products should be reviewed and updated periodically to determine if there have been any enhancement projects or other recent changes in habitat condition within the reaches that might affect the score and priority of the streams in the CRIA project.

In addition to these comments about the scoring results, the CRIA team had a few observations about application of the tool and opportunities for improvement.

A. Broad tool, narrow application

One conclusion is that the intended application of the tool necessarily narrowed the scope of the project. In embarking on this project, team members hoped to develop a broadly applicable tool. However, while we believe the tool is excellent for its intended application, and makes best use of the elements incorporated, the potential applications are so numerous and varied that no single tool will serve them all. Our main hope as a team is that the CRIA products will become widely available, and our next steps in CRIA development will become clear based on feedback received.

B. Assumptions

Fish Presence/Distribution/Utilization: A few assumptions were necessary (noted in the scoring sheets) in order to fill out life cycle habitat utilization. For example, one assumption is that juveniles generally rear in the lower reaches of tributaries that are downstream from where they hatch but NOT upstream. We were also missing information for a few reaches because they aren't surveyed, but local wisdom was the basis for assigning values in the absence of monitoring and we were risk-averse in adding fish to a reach (that is, if there was a reasonable chance fish could be there during a given life stage we assumed they were).

Data are accurate: The key assumption in CRIA development is that our data sources are accurate, but we were cautious. Indeed, several additions and corrections were made to SaSI as this work unfolded.

Flow data are consistent: We made a major assumption that flows obtained from the NHD Plus dataset for non-gauged reaches were comparable to our gauge data for other reaches. Staff compared NHD Plus data from known-flow reaches with the actual gauge data in order to develop a transformation methodology to align the two sources. Although this assumption is tenuous, scoring non-gauged reaches (over half the identified CRIA reaches) without employing this method would have been impossible.

C. Topics for future consideration

Is fish rearing data added-value? In many watersheds, distinguishing the rearing component of the fish score has not measurably improved scoring. This is because fish from one group or another are ALWAYS rearing. Any stock with fry that rear within the stream for 9-10 months or more will have overlaps with the next year-class such that every month has the same value for that stock. This is also true in watersheds containing multiple salmonid species. Still, distinguishing adult spawn timing and locations and juvenile rearing is an overall improvement in helping visualize salmonid life cycles.

Flow and water rights data accessibility: Ecology is progressively improving accessibility to flow and water right data. As these data become more accessible and reliable, the information on which flow scoring is based will improve. Some improvements occurred during the progression of CRIA development, however, not all data used for scoring were updated because time did not allow.

Habitat scoring for stream reaches was more difficult than first anticipated. For each attribute, time and discussion was needed to ensure the ability to score habitat equally across reaches and within WRIA's. Individual habitat attributes also garnered their own difficulties for assessments. All in all, it's difficult to develop a scheme for rating habitat attributes that does not suffer from some form of subjectivity.

Here are a few of the questions discussed for each attribute:

- Off channel habitat — Exactly how much off-channel habitat is poor to excellent?
- Floodplain connectivity — Does cover and substrate make a difference in scoring?
- Riparian conditions — What about native vs. non-native plants?
- Spawning suitability — What species are we reviewing for?

- Rearing suitability — What species are we reviewing for?
- Passage conditions — What if it's only a partial barrier to certain species at certain times of the year?

These questions and more were reviewed, discussed, and answered by creating a habitat criteria rubric that guided scoring for each stream reach.

Bull trout: Bull trout are underrepresented in CRIA because less is known about them than is known about other salmonids.

Resident fish excluded: CRIA does not include resident fish, primarily because the Columbia River water statute (Ch. 90.90 RCW) directs emphasis on salmonids. However, because the resident fish community probably doesn't vary too substantially among reaches and WRIAs in this area, scores for these WRIAs would not have changed significantly if resident fish had been included. Should CRIA be expanded into other WRIAS, species such as coastal cutthroat, Dolly Varden, sculpin, etc. would need to be included in order to reflect the different species management emphasis.

Visualization of results: Because depiction of combined scores is complex, it takes a bit of study to understand the results, and ever further thought to consider some of the seeming outliers. Again, the CRIA team hopes to get feedback from users on whether this mechanism works as a decision support tool, and/or how to improve visualization of results.

D. "It all depends on the question…"

"Which fish species/stock (or WRIA) is most important for flow restoration emphasis?" Because data for all fish species are reduced to a single score, CRIA doesn't help identify species initially (these data are available in detail in associated workbooks). CRIA doesn't help prioritize across WRIAs (at least in this initial version) because scoring and binning are not uniform across WRIAs. But even beyond that, there will be circumstances where adding water in a particular low-fish-scoring reach is critical for one life stage of a single species, which might be a high priority if that species is ESA listed. Likewise, increasing flows might be a good idea because it benefits a broad suite of species and life stages (potentially high fish score), even if some of them aren't listed under ESA. If one is looking for project locations in a WRIA that will benefit a particular species/stock, information is available through CRIA maps and workbooks to help identify those locations. But the success of those locations is also dependent on whether water is available for acquisition.

“Where should I spend my last water acquisition dollar in the eight eastern Washington critical basins?” Answering this question won’t be as simple as choosing all the reaches with thick red lines (scoring “low”/”poor” for all elements) or even thin green lines (“high” for fish and habitat, “Good” for flow). This question can’t be answered using CRIA alone, because it depends on which species/stock is most needy, on the extent to which flow augmentation can improve conditions for that species/stock, and on whether it is even feasible to acquire water that contributes measurably to stream flows. These are all questions that CRIA can help answer, but none of these can be answered using the CRIA products alone.

“Where can I add water to benefit the most fish during the most life stages?” CRIA without exception points to lower mainstem reaches. This sets up some potential conflicts with other analyses and recovery action plans, which point specifically to upper tributaries as the most needy for salmonid recovery. The reality is, mainstems are used by nearly every stock to get in and out of the watershed, and in most of these flow-critical watersheds there are times in which extra flow could improve migration conditions. So while the percent contribution to overall flow is likely minimal in lower mainstems (unless a huge influx of water is provided) this is still a good place to implement flow augmentation, all other considerations being equal.

“Where can I add water to create the largest percent increase in reach flow?” CRIA’s answer is usually in the smaller/upper tributaries and headwaters. This is because it doesn’t take much additional flow to cause a large percentage increase in overall flow. In addition, focusing flow restoration efforts on relatively small streams with functional or good-to-excellent habitat will likely provide the greatest benefits at the lowest cost. This does not always match well with the potential for water acquisition, because most diversions (potential for stream flow change) are lower in the stream systems.

It’s all good: The compromise position seems to be that great opportunity for salmonid production benefits can be achieved by pursuing water acquisitions in smaller, lower elevation streams with good to excellent habitat. However, streams with good to excellent habitat in higher elevations or less populous areas should not be overlooked, nor should lower mainstems through which all stocks/species must migrate. Any flow augmentation could be helpful in restoration efforts, especially in smaller systems that have limited flow, in over-appropriated basins, and/or in combination with other recovery measures.

The reality in these eight watersheds is that flow is needed in lower mainstems AND in upper tributaries, that opportunities for water right acquisition are limited and more market-driven than resource-driven, that the easy solutions have already been implemented, and the next steps toward salmonid rebuilding will be difficult, expensive, and controversial. These truths should in no way diminish the interest and drive to provide as much flow augmentation as possible throughout eastern Washington salmon-bearing streams if for no other reason then as a hedge against climate change.

VI. For Further Information:

… on the CRIA Project:
Washington Department of Fish and Wildlife
Teresa Scott 360-902-2713 teresa.scott@dfw.wa.gov .
Jonathan Kohr 509-575-2740 X306 jonathan.kohr@dfw.wa.gov
Dayv Lowry 360-902-2558 dayv.lowry@dfw.wa.gov
Andy Weiss 360-902-2487 andrew.weiss@dfw.wa.gov

… on OCR's Columbia Basin Long-term Water Supply & Demand Forecast:

http://www.ecy.wa.gov/programs/wr/cwp/wsu_supply-demand.html

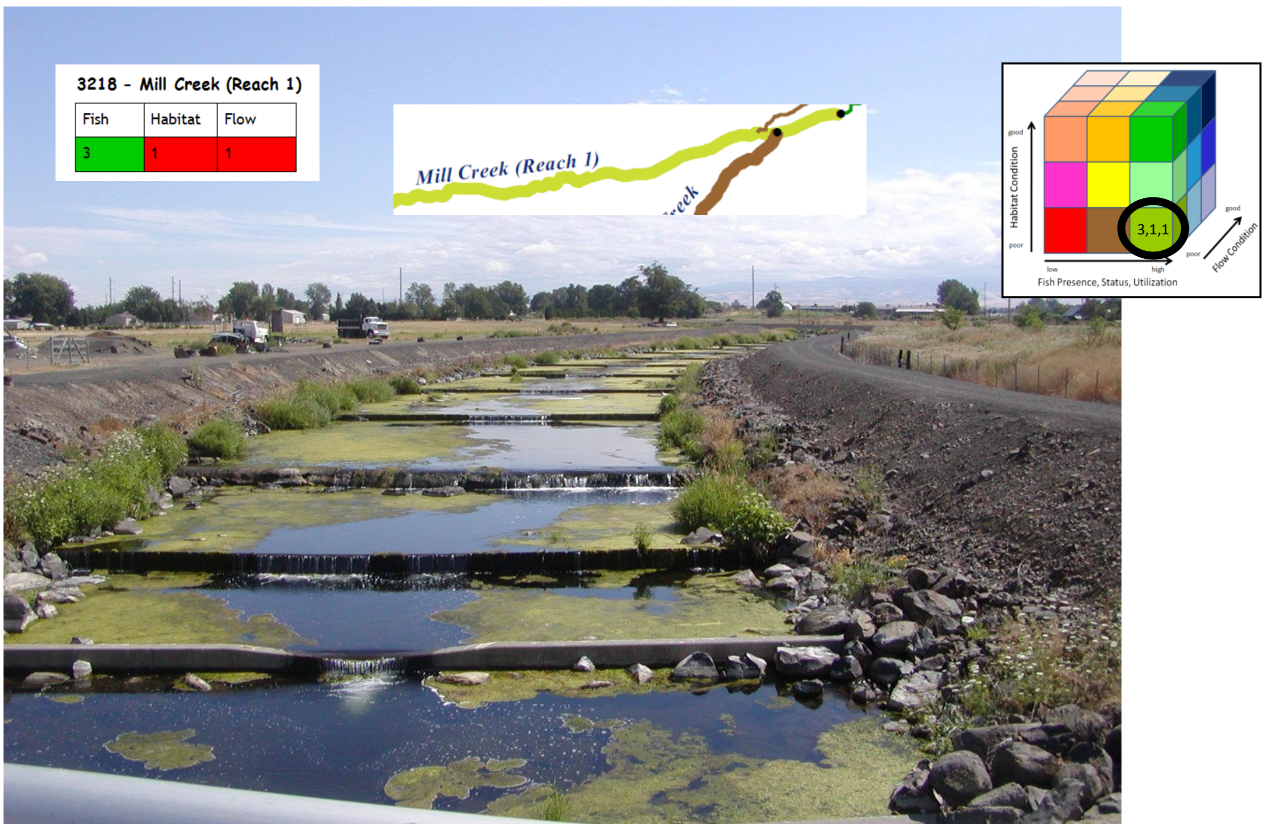


Figure 3 Mill Creek (WRIA 32) is an example of a reach having poor habitat and flow condition, but high fish utilization. This reach would be a good candidate for flow restoration along with habitat work. For more information, refer to Appendix B.

(Photo by Jonathan Kohr)

VII. Appendices and Workbooks

A. Methodology
B. Walla Walla WRIA 32
C. Middle Snake WRIA 35
D. Yakima Basin WRIAs 37, 38, 39
E. Wenatchee WRIA 45
F. Methow WRIA 48
G. Okanogan WRIA 49

Workbooks (xls, xlsx):

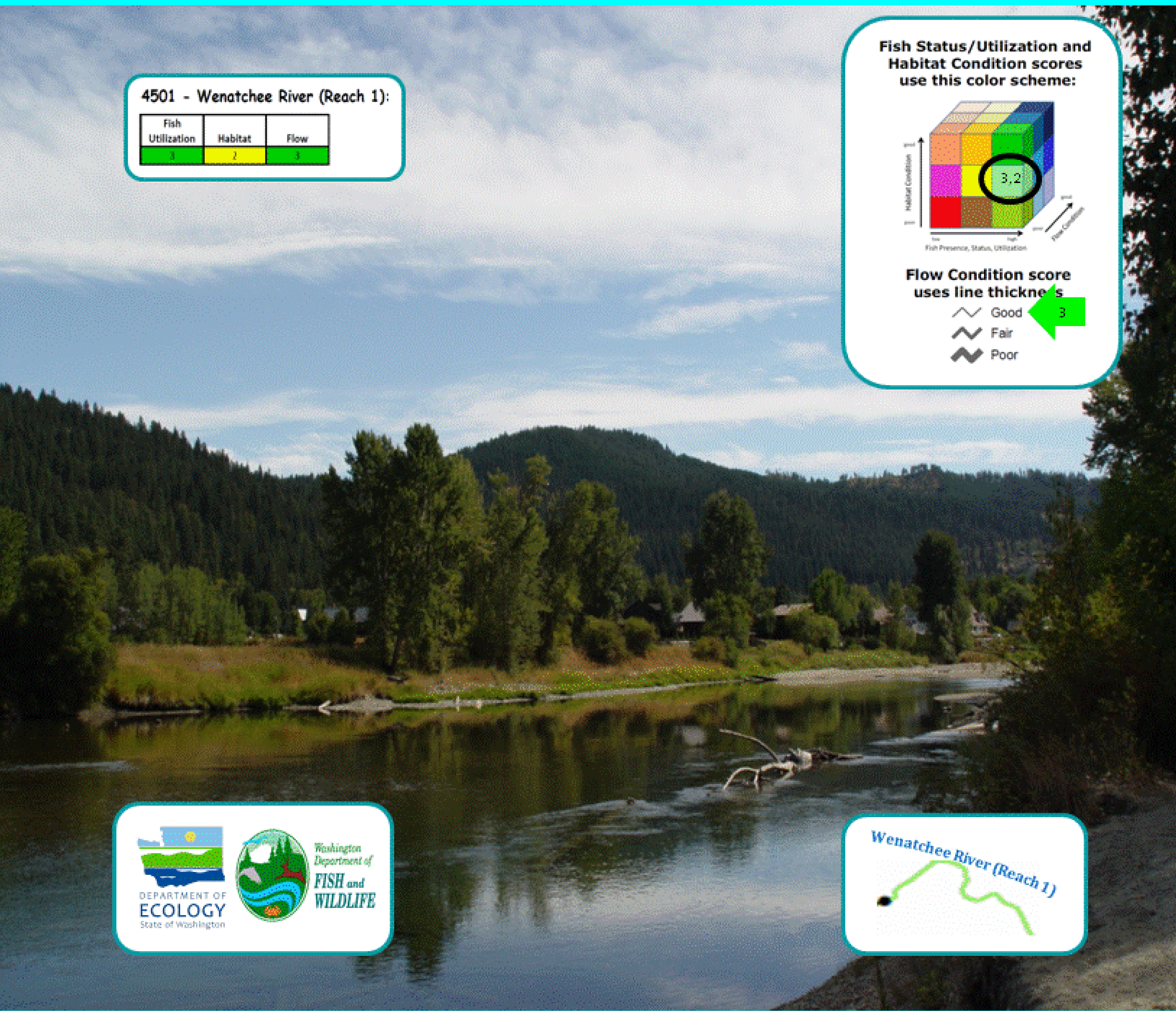
- All_Encompassing_Reach_Information
- CRIA Habitat Condition Scores
- Individual workbooks, as follows:

WRIA	WATERSHED	WORKBOOK/INFORMATION
32	Walla Walla	• Fish • Flow • WR (water rights)
35	Middle Snake	• Fish • Flow • WR
37, 38, 39	Yakima Basin	• Fish • Flow • WRIA 37 WR • WRIA 38 WR • WRIA 38 WR
45	Wenatchee	• Fish • Flow • WR
48	Methow	• Fish • Flow • WR
49	Okanogan	• Fish • Flow • WR

Columbia River Instream Atlas Project

Washington Department of Fish and Wildlife

Final Report – APPENDIX A
METHODOLOGY



Ecology Contract C1000090 - WDFW Contract 09-1471
Ecology Publication Number: 11-12-015

September 2011

Columbia River Instream Atlas Project - Final Report
Appendix A – Methodology September 23, 2011

Washington Department of Fish and Wildlife CRIA Team:

Teresa Scott (Habitat Water Resources Policy Coordinator)
Jonathan Kohr (Habitat Water Science Team)
Dayv Lowry (Fish Science; Habitat Science)
Andrew Weiss (Fish Science)
Aaron Bosworth (King County District Fish Biologist)
Jim Cummins (Yakima District Fish Biologist)
Dale Gombert (Fish Science)
Paul La Riviere (Habitat Water Science Team)
Peggy Miller (Habitat Major Projects)
Brianna Murphy (Fish Science)

Funding provided by Ecology Office of Columbia River as part of the 2011 Columbia Basin Long-term Water Supply and Demand Forecast

Ecology Contract C1000090

WDFW Contract 09-1471

Ecology Publication Number: 11-12-015

Cover Photo: WDFW Water Science Team

Columbia River Instream Atlas Project

Final Report

Appendix A – Methodology

September 23, 2011

Table of Contents

Figures

Tables

I. Introduction

In 2002, WDFW was asked to help Ecology choose projects for stream flow restoration. In response, a method was developed whereby stream reaches were defined and scored based on the relative likelihood that flow restoration, through acquisition or other means, would be successful in benefiting instream flow and fish.[1]

To develop the 2011 Columbia River Instream Atlas (CRIA), the team considered the components identified as ideal for developing a stream reach prioritization scheme in 2002, the components ultimately employed in 2002, and potential surrogates when direct measurements were not available.

The first substantial deviation from the 2002 methodology was to choose to score fish status/utilization, habitat condition, and flow condition separately rather than summing them into a grand total reach score. By doing this, CRIA becomes more than just a flow restoration tool; it can answer general questions about salmon and habitats, and can also inform other types of decisions being considered by managers.

The second major deviation was to eliminate speculation on future conditions, thus limiting CRIA to elements that can be scored as objectively as possible with regard to current condition.

So, although the 2011 CRIA effort represents an updating or continuation of the previous method, several changes were made that make comparisons with 2002 scores difficult. Attributes within the 2002 matrices were consulted frequently, however, to provide validation as we developed the newer assessment components.

II. CRIA Data Structure

The four foundational data elements are: Stream Reach Definition (distinguishing stream segments for which scoring will occur), Fish Status/Utilization (providing information on anadromous salmonid species diversity, habitat utilization by life history stage, and population status); Habitat Condition (representing riparian and aquatic habitat functions and values); and Flow Condition (assessing overall flow as well as seasonal flow regime limitations). CRIA data are contained within five workbook (Excel spreadsheet) types:

<u>Fish Status/Utilization ("Fish Prioritization")</u>

The Fish Status/Utilization workbooks contain reach-scale data on fish stock occurrence, utilization by life history stage, and status, plus roll-up tabs for scores and seasonal periodicity tables. Data are organized into one workbook per WRIA; with one CRIA reach per tab, plus "References," "Fish Priority Score," and "Periodicity" tabs.

---

[11] Reprinted from the 2003 Ecology publication 03-11-005, "Washington Water Acquisition Program, Finding Water to Restore Streams" Appendix II. Prioritizing Where and When to Acquire Water Rights (Page 63). Credit goes to WDFW biologist Perry Harvester for developing the original scheme.

Habitat scoring ("Habitat Scores")

One workbook contains a tab for each WRIA. Within each tab, data include reach number, name, and descriptions, as well as scores for each of the six habitat attributes and a final score. Bins are indicated using color codes.

Water Rights ("WR")

Contains the water rights data records gleaned from the Ecology Water Rights Tracking System (WRTS) database on September 10, 2010; one workbook per WRIA, one CRIA reach per tab plus a rollup tab.

Flow

One workbook per WRIA contains a tab for each flow gauge, plus tabs for web links, flow rules, and the roll-up "Reaches" tab containing summarized flow data and the scoring components.

All_Encompassing_Reach_Information

This workbook contains the reach definitions, data from NHD landcover analysis and the 305b Water Quality Inventory, Habitat scores by attribute and reach, and the raw and binned fish status/utilization, habitat condition, and flow condition scores. Scores from this file have been incorporated into georeferenced layers and are accessible as underlying attribute tables for each WRIA.

III. CRIA Scoring and Binning

In general, scoring for each CRIA element was conducted using simple integers. Fish scores were tallied based on each stock/life-stage/month occurrence, summed across stock-months, weighted by stock status, then summed for all stocks, yielding one reach score.

Habitat scores were assigned a value of one through four for each habitat attribute based on the rubric developed for each attribute. Habitat scores were then summed across attributes for each reach.

Flow condition is scored using five metrics, each of which is scored from 0.5 to 4.0 depending on the rubric. Scores for four of the metrics are summed, then multiplied by the fifth, yielding a total score for flow condition for each reach.

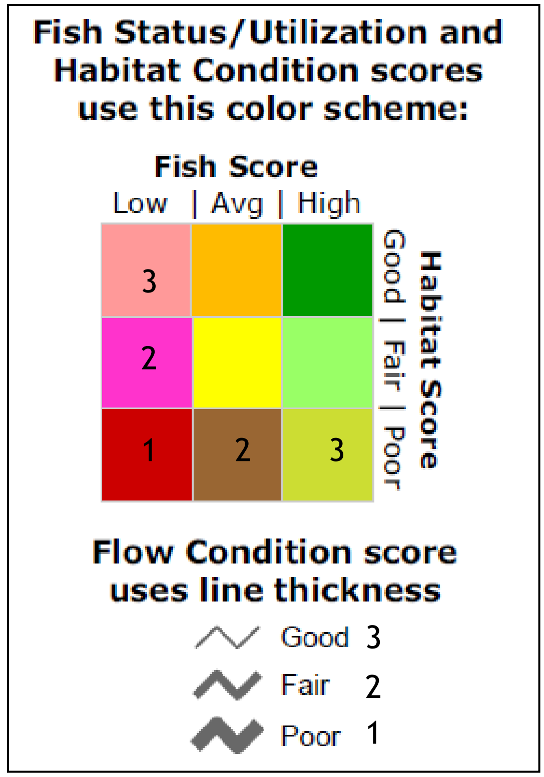
Reaches within each watershed are not ranked ordinally as was done for the 2002 effort. Instead, reach scores are sorted into bins, as shown on Figure A-1 for each CRIA element.

Score	Color	Name
3	Green	Good / High
2	Yellow	Fair / Average
1	Red	Poor / Low

Figure A-1 Scoring Bins

Each reach has three "bin" scores, one each for fish status/utilization, habitat condition, and flow condition. Each triplet score is mapped using unique color/line-width symbology, as shown in Figure A-2.

Figure A-2 CRIA Scoring "Cube"



IV. Stream Reach Definitions

Stream reaches were selected based on the presence or absence of salmonids, their relevance to benefit salmonid production, and their potential for flow restoration. Upstream boundaries for most reaches were determined based on the next obvious landmark above which no practical contributions to stream flow could be achieved (e.g., no additional upstream water diversions, or diversions occur on federal land). This means uppermost stream reaches that may be critical to salmonid production and/or may be flow-impaired are excluded from CRIA scoring because they don't contain water supply opportunities that would contribute to stream flow.

Despite the selection criteria just mentioned not all CRIA stream reaches support salmonids, or may support salmonids only in a limited part of a reach. Still, the focus was on locations where acquisition of water may benefit fish downstream.

Stream reaches that extend into Oregon, Idaho, and British Columbia end at the Washington State border. The upstream end of some reaches may extend beyond anthropogenic or natural fish migration barriers because those barriers may be removed as part of fish recovery projects or because water that flows downstream will benefit downstream fish populations. Human-caused or natural fish migration barriers above upstream most diversions are often used as convenient upstream boundaries for some reaches.

The 2002 reach definitions, modified by more current literature, provided a starting point for identifying CRIA stream reaches. Subdivisions of stream segments were determined using natural (e.g., confluences, waterfalls) and human-made (e.g., flow gauges, bridges, major points of diversion) features of the landscape. Attempts were made to divide stream reaches with significantly different habitat characteristics, to shorten reaches at the confluence of tributaries that significantly change reach character, and to partition reaches to optimize water acquisition opportunities. The result is that CRIA stream reach scoring and prioritization contains more defined reaches than did the 2002 "Priority Stream Reach" product – 189 compared with 116 in the 2002 effort.

Reaches are identified by a code for data management purposes. Codes are four digits, with the first two digits representing the WRIA code, and the last two digits designating a unique stream reach, generally starting at each WRIA's mouth and moving upstream.

Stream reach definitions, plus a summarization of all scores, are provided in the "All_Encompassing_Reach_Information" workbook (Table A-1; all tables are located at the end of the document). The spreadsheet lists all of the stream reaches defined by the CRIA project, a short description of the reach, the associated WRIA, the CRIA reach identification code, the LLID (WDFW stream ID number), GIS river miles (RM), and reach length in feet and miles.

Reach definitions with descriptive details are found on Table A-2. Further details about reach definitions for each WRIA are included in the WRIA appendices.

V. Fish Status and Utilization

The fish status and utilization score was generated from a variety of information sources. WDFW's Salmonid Stock Inventory (SaSI) formed the basis for identifying populations/stocks of Chinook, steelhead, coho, sockeye, and bull trout in each WRIA. Only wild stocks (fish spawning naturally), or artificially produced fish stocks intended to spawn naturally, are included in CRIA, including all introduced sockeye and coho in the mid- and upper-Columbia.

The known, documented distribution of these stocks, vetted through contact with regional WDFW and tribal biologists, was then used to assign presence/absence values for each stock to each reach. Substantial knowledge gaps with regard to the distribution of specific bull trout stocks, and ambiguity about the independence of stocks, lead to bull trout being considered as a single unit in each WRIA. Occurrence was reported for three life stage categories: adult in-migration, spawning and incubation, and rearing and outmigration. Occurrence was also partitioned monthly. When stock-specific incubation and outmigration timing were unavailable, local expertise was used to assign values to reaches based "typical" behavior of other stocks of the same species/run/race elsewhere in the Columbia Basin. Occurrence across all life history stages for all months was then summed and weighted by an ESA status factor and a SaSI status factor. The final scoring spreadsheet was designed to allow for easy manipulation of these weighting factors to reprioritize reaches based on federal, state, or other status evaluations.

A. Basic Structure and Function

Components: Data components include stock-specific evaluations of:

- Months spent in the reach for spawning/incubation
- Months spent rearing/smolt migration
- Months spent in adult migration
- SaSI status
- ESA status

Updates/improvements relative to 2002 assessment: Monthly, life-stage specific evaluations were not included in the 2002 assessment. For a given reach, a stock was recorded simply as present or absent, with its SaSI status used as a weighting factor. For reaches in which a given stock was known only to rear this was recorded, but this was not done systematically or comprehensively. Because some stocks have prolonged in-migration periods but brief temporal spawning windows, we felt it was important in the 2011 CRIA to partition this information into two components and formalize handling of rearing information.

The 2002 assessment included ESA status by performing 'blanket' upgrading or downgrading of SaSI status based on ESA status. This approach is flawed in that the demographic unit of ESA listing is the Evolutionarily Significant Unit (ESU) or Distinct Population Segment (DPS), which are discrete from SaSI "stocks." Though as a whole the ESU/DPS may be threatened or endangered, individual SaSI stocks within this aggregation have the potential to have a range of viabilities. By incorporating both an ESU/DPS-specific ESA status and a stock-specific SaSI status component into the 2011 CRIA score, we allow the flexibility to adequately characterize subtle variation in status, making finer-scale prioritization possible.

B. Assumptions

The following are the assumptions made while populating the CRIA Fish Prioritization Worksheet.

Juvenile migration: We assumed that after juvenile fish become mobile and begin to emigrate to the ocean, they don't ascend any other reaches, tributaries or rivers upstream from their natal reaches. They may hold in the mouths of downstream reaches, tributaries, or rivers during their emigration and therefore may also rear in those same areas (e.g., Naches Spring Chinook might rear in Toppenish Creek, in lower Yakima reaches, or in the Walla Walla, but not in Upper Yakima or the Wenatchee).

Bull trout life history: Bull trout (*Salvelinus confluentus)* have a complex life-history composed of multiple strategies. They exhibit four forms of life-history: anadromous, adfluvial, fluvial, and resident. Anadromous bull trout leave their natal streams to rear in the ocean then migrate upriver again to spawn. Anadromy has not been noted within any bull trout stocks occurring in the interior Columbia River or Snake River basins but is common in Puget Sound bull trout stocks. The adfluvial form of bull trout leaves the natal stream to rear in larger bodies of freshwater (e.g., lakes, large rivers) and migrate back to spawn. The fluvial form rears in streams to which their natal stream is a tributary, but does not rear in mainstem or lake habitats. The resident form lives its entire life in their natal streams. Since it is difficult to tell adfluvial, fluvial, and resident forms apart without detailed individual tracking data, we assumed that bull trout may rear anywhere they are found, downstream of that site, and most likely into the mouths of downstream tributaries.

Bull trout distribution: Bull trout predominantly seek out high elevation, cold, clear streams for their life stages and are not as prevalent as other salmonid species in the lower reaches defined by CRIA. Since bull trout ascend to the highest reaches of streams and have very strong site fidelity, there is the opportunity for rapid onset genetic divergence. In all basins, we combined all known and potentially unknown stocks of bull trout into one set of generalized bull trout information instead of separating them out into distinct populations. However, emphasis can add value to individual stocks by increasing the weighted scoring. Research into the genetic variation now recognized in bull trout populations is currently ongoing and we expect that substantial improvement in our handling of bull trout stock information could be possible within the next several years.

Sockeye salmon rearing: Sockeye salmon (*Oncorhynchus nerka)* rear in lakes and rivers. We assumed that they rear in Cle Elum Lake (above the dam) due to the difficulty of finding suitable rearing habitat downstream and of passing the dam. Fish are now trucked up over the dam as adults and pass down through a flume as juveniles. We also assume rearing in the main rivers or tributaries during outmigration is minimal because of the rearing time spent in Cle Elum Lake.

C. Caveats

Resident fish excluded: Resident fish species like rainbow and cutthroat trout, perch and other warmwater fish are not addressed in CRIA. They are presumed to reside uniformly across the Columbia Basin, and are generally not assessed for distribution and status. Furthermore, Chapter 90.90 RCW limits the focus of Office of Columbia River (OCR) to salmonids.

Weighting for status: A reach having one important stock is difficult to distinguish from reaches having several less important stocks in the aggregate scoring. However, data are provided that allow drill-down to the stock level for each reach.

Cross-watershed comparisons problematic: High fish status/utilization scores in two watersheds don't necessarily mean they are of equal importance in overall salmonid recovery because of differences in the numbers of stocks present in each WRIA. See "It depends on the question" in the main report for a fuller discussion of this issue.

Insufficient monitoring data: We used the best available monitoring data, but as noted for bull trout, monitoring might be infrequent or limited in geographic area. We have strived to ensure that assumptions are conservative in this regard, meaning we assume presence where presence has not been confirmed through monitoring but is possible based on available habitat and adjacent monitoring data. This is a common concern for fish stocks for which active restoration efforts are occurring, and better coordination is leading to better monitoring information for those stocks. Still, natural resource monitoring will always necessarily be limited by available financial resources, so not all questions important to all species/stocks will be answered.

Current stock status: State SASI status reviews were last done in 2002 (few exceptions) so state status information may be a bit out of date. Federal ESA status review for Interior Columbia domain was last published in 2007, though updates are occurring periodically as new assessments are completed by NMFS. Data represented in CRIA are best available data as it exists in June 2011.

Introduced coho and sockeye: Coho salmon, and sockeye introduced into the Yakima Basin, were not included in SaSI. The CRIA team developed new information for these stocks for inclusion in the SaSI database. These are the sole exceptions to the 2002 status limitation noted above.

D. Workbook Description

As mentioned above, data components include stock-specific evaluations of months spent in the reach for spawning/incubation, months spent rearing/smolt migration, months spent in adult migration, SaSI status, and ESA status.

Scores are organized into an Excel workbook – one for each Basin – with tabs for each stream reach, a tab for references, and a tab containing a roll-up of reach-scale scoring. The notes provide observations for each stock on spawning, rearing, and migration, along with information regarding unique characteristics of the given stock. The roll-up tab shows fish use timing data for each stream reach. Each workbook also has tabs containing a basin-wide periodicity spreadsheet visually charting the fish use timing by species, the 2002 rating worksheet for reference purposes, and a list of references.

The basic elements of the rating workbook follow (The Walla Walla worksheets have been provided as examples):

1. Fish Priority Score Tab

The fish priority score spreadsheet is the summary sheet for the entire fish biodiversity ranking workbook (Table A-3). There is only one fish priority score worksheet in each rating workbook. The fish priority score worksheet has three primary components: 1) a list of each reach under review with total and monthly ranking scores, 2) a list of each relevant fish stock (and its associated SaSI Stock number and Status) that is present in the WRIA, and 3) an Endangered Species Act (ESA) weighting factor. An additional component is a weighting factor for major or minor spawning areas designated by the local Technical Recovery Team (TRT).

Reach Scores: These are the raw final scores that will be used to assess relative fish Status/Utilization value, and will be converted to some normalized scale so they can be used in conjunction with the habitat and flow scores. The final and monthly scores on the summary sheet for each reach will change automatically as values are assigned in the individual reach specific worksheets (or as weighting factors for different fish stocks are modified). The scores are calculated in the individual reach-specific worksheets, and are linked to these cells located on the summary sheet. It might be a good idea to check once in awhile to make sure the final scores are still linked to the appropriate reach-specific worksheets.

SaSI Stock Rating Factor: The SaSI stock status rating numbers that are assigned to each fish stock are crucial to the CRIA system, as they are linked to each individual rating sheet and act as one of the primary "weighting" factors in this ranking workbook. The stock-specific weighting factors are meant to be changed (if desired) on the summary sheet only rather than in the individual worksheets, resulting in the new weighting factor being automatically

SaSI Status Rating	Weighting Factor
Healthy	1
Depressed	2
Unknown	2
Critical	3

Figure A-3 Weight Factor Values for SaSI Stocks

applied to the individual reach-specific worksheets. This feature is also useful because these weighting factors can be turned "off" by changing them all to a "0." This allows the user to look at rating scores using just one stock at a time, or with some smaller sub-set of stocks.

ESA Weighting Factor: The ESA weighting factor provides an optional mechanism for elevating the scores of reaches used by fish stocks listed as threatened or endangered under the Endangered Species Act. The ESA weighting factor is meant to be used in the same way as the SaSI stock status weighting values. It can be turned "off" by entering "0", it can be turned on by entering "1", or it can be given a higher value than "1" if the user wants to give ESA-listed fish relatively more importance in the rating scheme.

Weighting Factor for Federally Listed Species	
Assign additional weight to stocks that are listed as Threatened or Endangered under the ESA?	Yes=1; No=0

Figure A-4 Weight Factor Values for ESA Listing Status

TRT-Designated Major/Minor Spawning Areas (MaSA, MiSA): Fish stocks that use reaches designated by the TRT as Major or Minor Spawning Areas can be given additional influence to their score by increasing/decreasing the weight factor associated with the relevant Major/Minor Spawning Areas.

Weighting Factor for Spatial Structure and Diversity of Fish Stocks	
Assign additional weight to reaches within Interior Columbia TRT-designated Major or Minor Spawning Areas (MaSAs or MiSAs)?	Yes=1; No=0

Figure A-5 Weight Factor Values for TRT-Designated Major/Minor Spawning Areas

2. Reach-specific Tabs

The reach specific fish prioritization worksheets (Table A-4) have the same main components as the Fish Priority Score Worksheet; the monthly life history usage of each relevant fish stock, and its TRT, SaSI and ESA designations. There is one worksheet for each priority stream reach, which directs all data into the Fish Priority Score Worksheet.

3. Basin-wide Periodicity Tab

This worksheet (Table A-5) provides a visual summarization of fish use timing by life stage by species/stock across the entire basin. It also displays peak timing of habitat use during each life history stage.

4. Reference Tab

The reference sheet (Table A-6) contains a list of all the literature that is cited in the reach specific worksheets. Literature is usually cited in the "notes" section associated with each fish stock listed on each reach-specific worksheet. The literature provides the best available information concerning run timing and geographic distribution of all the relevant stocks. There is only one reference sheet in each rating workbook. References to personal communications with local biologists may not always be listed on the reference sheet.

E. Binning

Once a fish status and utilization score was assigned to each reach using the process described above the reach-specific scores were standardized and binned into high, medium, and low categories for use in mapping and overview assessments of the WRIA (Table A-7). Each reach score was divided by the highest score of any single reach in the WRIA. Breaks between bins were defined as thirds of this highest reach score such that, theoretically, all reaches in a WRIA could potentially fall into a single bin. In practice this did not occur. While binned scores for reaches allow a quick assessment tool it should be noted that reach scores often fall immediately adjacent to the separations between bins. When evaluated in light of habitat and flow scores, it is these 'cusp' reaches in which small changes in another factor might drive fish use into the next higher strata of fish utilization.

F. For Further Information

Dayv Lowry, Nearshore Ecologist
Washington Department of Fish and Wildlife
360-902-2558; dayv.lowry@dfw.wa.gov

Brianna Murphy, Fish Biologist
Washington Department of Fish and Wildlife
360-902-2796; brianna.murphy@dfw.wa.gov

VI. Habitat Condition

Many components of habitat condition represent important limiting factors for stream reaches within the Columbia River Basin. It is critical for quantity and condition of the important habitat parameters necessary for salmonid productivity to be known and considered when evaluating flow restoration projects within a reach.

Habitat scoring was based on literature review of the *Washington Water Acquisition Program* report (Ecology 2003), Washington Conservation Commission Limiting Factors Analyses, and *Fish Life Qualitative Parameters for Assessment of Instream Flow Proposals* (WDFW 2007), enhanced by first- and second-hand field knowledge collected from local WDFW biologists.

In order to score habitat within a limited timeframe for the numerous reaches identified in the CRIA assessment, many steps were taken. A team of three biologists reviewed as much relevant literature as possible for an initial habitat reference point. Where there were little, outdated, or no data for a stream reach, local biologists were consulted to determine current habitat condition scores. Those contacts were documented, and represent best available science and best professional knowledge (BPK) about the given stream reach. If after these steps, there still wasn't sufficient evidence to definitively score reach habitat condition, a CRIA team member conducted a site visit to determine scores.

Habitat scoring for all WRIAs is contained in one workbook having one tab per WRIA. Within each tab, data include reach ID number, name, and length descriptions, as well as scores for each of the six habitat attributes and a final score. Bins of low, medium, and high scores are indicated using color codes.

A. Habitat Scoring Attributes

After much consideration, six habitat attributes were chosen by the CRIA team as best representing overall habitat condition relative to salmonid utilization: Off-channel habitat; Floodplain connectivity; Riparian condition; Spawning suitability; Rearing suitability; and Passage conditions.

A four step scale of poor, fair, good, and excellent (scores 1, 2, 3, and 4, respectively) was developed to score each component. Scoring criteria for each attribute are detailed below. Definitions remain the same throughout the evaluation process.

B. Workbook Description

All habitat condition scores are contained in one workbook having separate tabs for each WRIA/group (Table A-8). The worksheet contains rows for each reach within a WRIA, and habitat attributes are assigned to columns, with an additional column for the raw sum score, which is color-coded to identify bins.

C. *Habitat Scoring Criteria*

In order to score the habitat of stream reaches with regard to the habitat needs of fishes, a standardized protocol was developed to ensure repeatability for each review. The six parameters chosen describe the habitat needs most easily identified without major field data collection. Following are descriptions of the scoring rubrics for each habitat attribute.[2]

Floodplain Zone

1. Off Channel Habitat (OCHs)

Off-channel habitats provide important flood and winter refuge for fish as well as spawning habitat for some salmon species. OCH's are considered as side channels or backwaters (including floodplain sloughs, oxbows, ponds, and wetlands).

1=Poor - Reach has few or no (<10% of reach length) OCHs.

2=Fair - Reach has OCHs that are present within 10-50% of the reach, including both side channels and backwaters.

3=Good - Reach has OCHs are present within 50-80% of reach length, including both side channels and backwaters.

4=Excellent - Reach is virtually undisturbed (near-pristine), such that OCHs (including both side channels and backwaters) are present in over 80% of reach length.

2. Floodplain Connectivity

Floodplain connectivity addresses the relative condition of native flora, streambank erosion, stream crossings, and roads. These are visible signs of the relative value of wetland function in preserving water quality, temperature, and cover for rearing and migrating salmonids.

Floodplain connectivity addresses the relative condition of native flora, streambank erosion, stream crossings, and roads. These are visible signs of the relative value of wetland function in preserving water quality, temperature, and cover for rearing and migrating salmonids.

1=Poor - Reach has a severe reduction in hydrologic surface water connectivity and wetland function via loss of overbank (channel-forming) flows, such that riparian vegetation is altered significantly (<25% natural vegetation within the riparian corridor) . Greater than 50% of floodplain surface water connectivity is lost due to incision/channelization, roads, trails, powerlines, dikes, bank armoring, etc., such that streambank erosional damage is extensive (>50%), stream crossings (by roads, trails, powerlines, etc.) greatly exceed 3 per stream mile, and road density is high (>3 mi/mi^2 of watershed area).

2=Fair - Reach has a moderate reduction in hydrologic surface water connectivity and wetland function via loss of overbank (channel-forming) flows, such that

[2] References for habitat attribute development and scoring criteria include Vadas (1991, 1997); Vadas and Orth (1998); WDOE and WDFW (2003); and Vadas et al. (2008), as well as findings of the fish-landscape Priority Habitats and Species (PHS) project (Vadas, unpubl.).

riparian vegetation is altered significantly (25-50% natural vegetation within the riparian corridor). Up to 50% of floodplain surface water connectivity is lost, such that streambank erosional damage is moderate (20-50%), stream crossings exceed 3 per stream mile, and road density is moderately high (2-3 mi/mi^2 of watershed area).

3=Good - Reach has a moderately low reduction in hydrologic surface water connectivity and wetland function via loss of overbank (channel-forming) flows, such that riparian vegetation is altered to some extent (50-85% natural vegetation within the riparian corridor). Up to 20% of floodplain surface water connectivity is lost, such that streambank erosional damage is moderately low (10-20%), stream crossings are below 3 per stream mile, and road density is moderately low (1-2 mi/mi^2 of watershed area).

4=Excellent - Reach is virtually undisturbed (near-pristine), such that hydrologic surface water connectivity and wetland function are excellent and riparian vegetation is virtually unaltered (>85% natural vegetation within the riparian corridor). There is little or no loss of floodplain surface water connectivity, such that streambank shows minor (<10%) erosion damage and stream crossings (<<3 per stream mile), and road density (<1 mi/mi^2 of watershed area) are both low.

3. Riparian Condition

Riparian vegetation provides shade, cover (including large wood that later provides channel complexity), and food-sources to salmonids, all of which are needed for adequate spawning and rearing. The right kind of vegetation can shield streams from adjacent land use impacts.

1=Poor - Reach has a severe reduction in riparian condition (<70% intactness of native-growth forms), by being fragmented (poor connectivity) and with little woody vegetation, thus providing inadequate habitat (shade, refugia, and wood- and food-source) protection (buffering of land-use impacts) for sensitive aquatic species.

2=Fair - Reach has a moderate reduction of riparian condition, with moderately low woody vegetation, intactness of native-growth forms (70-80%), and thus habitat protection for sensitive aquatic species.

3= Good - Reach has a moderately low reduction of riparian condition, with moderately high woody vegetation, intactness of native-growth forms (>80%), and thus habitat protection for sensitive aquatic species.

4=Excellent - Reach is virtually undisturbed (near-pristine), such that the riparian corridor has a good mix of taller (including woody) and shorter vegetation, i.e., obvious growth-form diversity and high intactness of native-growth forms (>>80%).

Aquatic Zone

4. Spawning Suitability

Spawning salmonids need good hyporheic flow (mixing of shallow groundwater and surface water) free of fine sediments that can smother eggs. Substrates having large rocks and/or a high degree of fine sediment are poor for salmonid spawning.

1=Poor - Reach has a major reduction in suitable salmonid and riffle-invertebrate (salmonid-food) substrata, because lotic-reach embeddedness (% sandy/muddy fines) and/or large-rock composition (LRC) greatly exceeds 30%. Reach is lacking in hyporheic flow, and thus salmonid spawning and zoobenthic rearing. Fast-water (riffle/run) habitats show embeddedness levels of 50% or more.

2=Fair - A moderate portion of the reach is suitable for salmonid spawning because reach embeddedness and LRC are both moderately high (<30% each) and fast-water habitats show embeddedness levels of 15-50%.

3= Good – A majority of the reach is suitable for salmonid spawning because reach embeddedness and LRC are both moderately low (<20% each) and fast-water habitats show embeddedness levels of 5-15%.

4=Excellent - Reach is is virtually undisturbed (near-pristine), with reach embeddedness and LRC both low (<<20% each), such that gravel recruitment and substratum conditions are optimal for salmonid spawning and riffle-zoobenthic rearing. Fastwater habitats show embeddedness levels under 5%.

5. Rearing Suitability

High mesohabitat diversity (i.e. various morphological stream habitats such as a pool, riffle, pool tail-out, or glides/runs) and moderate cover levels (e.g., large-woody debris) are important components for salmonid rearing because they provide food and refuge for juvenile fish. Stream reaches having swift flow and few pools do not provide enough sanctuary or feeding sites.

1=Poor - A majority of the reach is unsuitable for salmonid and pool zoobenthic rearing, for which aquatic cover (consisting of woody debris, undercut banks, boulders, overhanging vegetation, etc.) is low (<2%) or causes major choking (>>25%). Large-woody debris (LWD) is low (<<80 vs. <<20 pieces/mi on the West- vs. East-side, respectively). Few (<<3) mesohabitat types are evident here, and the reach is dominated by swiftly-moving water.

2=Fair - A moderate portion of the reach length is suitable for salmonid and pool-zoobenthic rearing, for which aquatic cover is moderately low (2-5%) or causes moderate choking (>25%). LWD is moderately low (<80 vs. <20 pieces/mi on the West- vs. East-side, respectively). Few (<3) mesohabitat types are evident here, and the reach is somewhat dominated by swiftly moving water.

3= Good - A majority of the reach is suitable for salmonid and pool-zoobenthic rearing, for which aquatic cover is moderate (5-10%) or with moderately low choking (<25%). LWD is moderately high (>80 vs. >20 pieces/mi on the West- vs. East-side, respectively). Several (>3) mesohabitat types should be important here, notably a good mix of pools and riffles, with less dominance of swiftly moving water.

4=Excellent - Reach is virtually undisturbed (near-pristine), with moderately high (10-25%) levels of vegetative and other aquatic cover for fishes and pool zoobenthos. LWD is high (>>80 vs. >>20 pieces/mi on the West- vs. East-side, respectively). Several (>>3) mesohabitat types are evident here, notably a good mix of pools and riffles, without dominance by swiftly moving water.

6. Passage Conditions

Passage conditions can be affected by barriers (both natural and artificial) and presence of shallow or long riffles that inhibit fish distribution. Some barriers only become impassable at lower flow levels, while others are impassable only at high flows. Some stream reaches without visible barriers can inhibit adult fish movement when flows are too low, either because the water level is too low for swimming through dewatered riffles, or because there is not enough flow attracting fish to move upstream to their spawning grounds. The ability to freely move up and/or downstream is critical for anadromous salmonids returning to spawn or migrating to the ocean, but is also important for resident salmonids in order to find food, refuge, and avoid predation.

1=Poor - Numerous (> 3) artificial barriers and/or critical riffles exist within the reach that impede up- and/or downstream salmonid migrations at a broad range of flows (i.e., including one or more complete barriers for all fishes). Much money and time will be needed in repairs or project completion for salmonid passage.

2=Fair - A few (2-3) artificial barriers and/or critical riffles exist that reduce up- and/or downstream salmonid migrations at low (late summer/early fall) flows (i.e., no complete barriers). Minimal amounts of time and money will be needed for repairs or project completion.

3= Good - Minor impediments to salmonid passage exist, as artificial barriers have passage structures that allow adequate up- and/or downstream salmonid migrations at all but perhaps extremely low ('drought') flows.

4=Excellent - Reach lacks impediments to upstream and/or downstream salmonid migrations (i.e., no partial or complete barriers).

D. Binning

Bins are determined using a range between the lowest and highest reach scores within a watershed, then stratified into thirds (Figure A-6). For example, if the lowest reach habitat score is 6 and the highest score is 20, the range is 6-20, which when divided evenly among three units (low, medium, high) yields bins with scores ranging from 6-10 (poor), 11-15 (fair), and 16-20 (good).

WRIA Score Range	Description /Color
Top 1/3	Good
Middle 1/3	Fair
Lowest 1/3	Poor

Figure A-6 Habitat Score Binning Criteria

Bin scores for each stream reach within a WRIA are shown as the last column in the Habitat Scoring workbook under each WRIA tab, and copied to the "All_Encompassing_Reach_Information" workbook.

E. Caveats

One weakness in the above scoring attributes is the absence of a metric for water quality – specifically, for temperature. Temperature can be a major limiting factor for these Eastern Washington WRIAs; for example, mid- to late-summer thermal blockages can prevent upstream migration of summer Chinook and sockeye returning to spawn, leading to significant pre-spawning mortality, low fecundity and increased vulnerability to disease.

Another weakness was our inability, through lack of time, to seek broader peer review of reach scoring. This is still a step that needs to be taken in order to broaden the acceptance of the scoring results CRIA presents, and therefore CRIA's application across a broader audience.

F. Other Methodologies Available

The CRIA Team invested significant time into attempts to employ two additional data sets in habitat scoring, either in lieu of BPK or in addition. These data sets were the National Land Cover Dataset developed by USGS and the EPA (NLCD 2001, http://www.mrlc.gov/, Homer et al 2004) and the Washington Dept. of Ecology / EPA Clean Water Act section 305(b) Water Quality Inventory Report. These were used to complement the BPK scoring by the habitat team by providing replicable quantitative metrics for each CRIA priority reach, such as the proportion of human modified land within certain distances along that reach, or what percentage of the reach has Dissolved Oxygen below the standard. The team was able to compare several of the BPK attributes (especially riparian condition) with selected landscape and water quality metrics, and to reevaluate the BPK scores where there were large discrepancies.

It was eventually determined that not enough time was available to fully develop these methods, but the Team recommends further investigation. In particular, deriving physical stream attributes via GIS modeling (such as gradient, bank-full width, confinement, sinuosity, or measuring toe widths via high resolution orthophotography) could expand the ability of biologists to provide this level of stream reach assessment in the absence of on-the-ground information. In particular, we might be able to derive metrics to address habitat attributes such as off channel habitat, floodplain connectivity, spawning suitability and rearing suitability.

1. NHD Land Cover

The National Land Cover Dataset (NLCD) was developed by USGS and the EPA to provide consistent land cover / land use data across the conterminous U.S. at a 30-m resolution. There are 16 types based on physiognomic vegetation structure and human modification. Depending on the analysis, we aggregated these types to more general classes, as well as natural versus human-modified landscapes (Table A-9).

Potentially useful streamside metrics include percent canopy closure within 50 m of the stream as a surrogate for stream shading; percent impervious surfaces within 50 m of the stream and percent developed as a surrogate for bank modification, armoring, and runoff; and percent agriculture within 50 m as a surrogate for sediment / nutrient inputs and agricultural modifications to the channel and banks. At 500 m, we looked at percent human modified landcover types (agriculture + developed) to develop a metric for 'naturalness', as well as the broad classes of landcover to indicate the landscape context through which the stream reach runs (primarily shrub steppe, forested, agriculture).

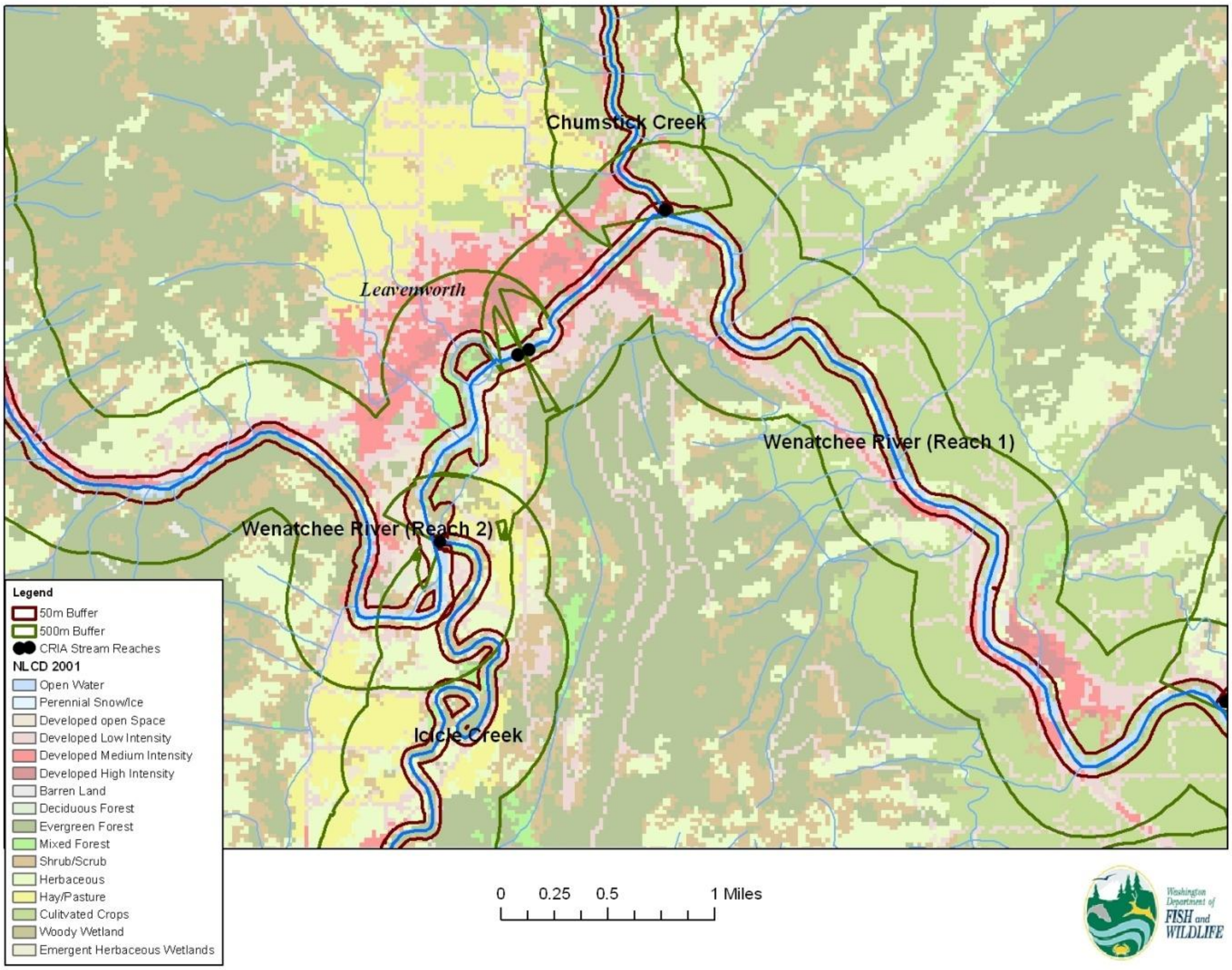


Figure A-7 Example CRIA analysis of 50 m (red line) and 500 m (green line) NLCD data by cover type

For each CRIA reach, we measured the proportions and areas for different land cover types and classes within 50 m of the stream as a metric for immediate streamside land cover and condition and within 500 m as a metric for the overall landscape context (Figure A-7). Figure A-7 provides a detail of the Leavenworth area (WRIA 45) showing landcover classes within the 50 m (dark red line) and 500 m (dark green line) widths. We used GIS to compute areas by type, and then standardized the sums of each landcover class to percent cover. For example, this NLCD 2001 data show that Wenatchee River Reach 1 is dominated by agriculture and developed land, whereas lower Icicle Creek runs primarily through pasture. Similar analyses were done using the NLCD impervious surface layer, and the NLCD canopy cover layer.

These metrics provided important supplementary data for the habitat team's BPK attribute scores. In particular, for each WRIA we compared the rank order of the GIS derived landcover metrics for each CRIA reach to the rank order of the BPK attribute scores (particularly riparian condition) and overall BPK combined score. Discrepancies were then re-examined by the Habitat Team to understand the differences, and as appropriate, change the BPK scores.

Example box plots comparing the BPK attribute scores (X-axis) with the distribution of GIS landscape metrics (in this case, percent of human modified landscape within 500 m of the stream) are shown in Figure A-8. These plots demonstrate that as BPK attribute scores increase (better habitat), the percent of human modified land cover decreases.

Most of the BPK habitat attribute scores, especially spawning and rearing suitability, reflect combinations of factors such as bank armoring, canopy shading, stream gradients, width, sinuosity, substrate (gravel size, sediment loads), water temperature, and dissolved oxygen. Combining these land cover metrics with physical stream attributes and water quality data has great potential to help biologists score habitat attributes directly, and in a quantitative and repeatable way. This would involve modeling detailed physical stream attributes, preferably on a high resolution LiDAR derived DEM (digital elevation model), and applying hydrologic models for attributes like stream power, bed load transport, erosion / sediment delivery, and large woody debris inputs using the NetMap/NetTrace program. There is also the possibility of applying some of the more sophisticated hydrologic and ground water models such as those developed by USGS in the Yakima Basin.

Ideally, initial prioritization mapping using habitat scores could be developed directly from these quantitative, replicable landscape metrics. However, many of the BPK attributes are difficult or impossible to adequately measure using GIS-derived landcover metrics, at least without significant investment of time and resources. For the current activity, the CRIA Team believes that BPK scores combining literature with on-the-ground knowledge by field biologists gives a better, and more cost-effective, measure of habitat condition.

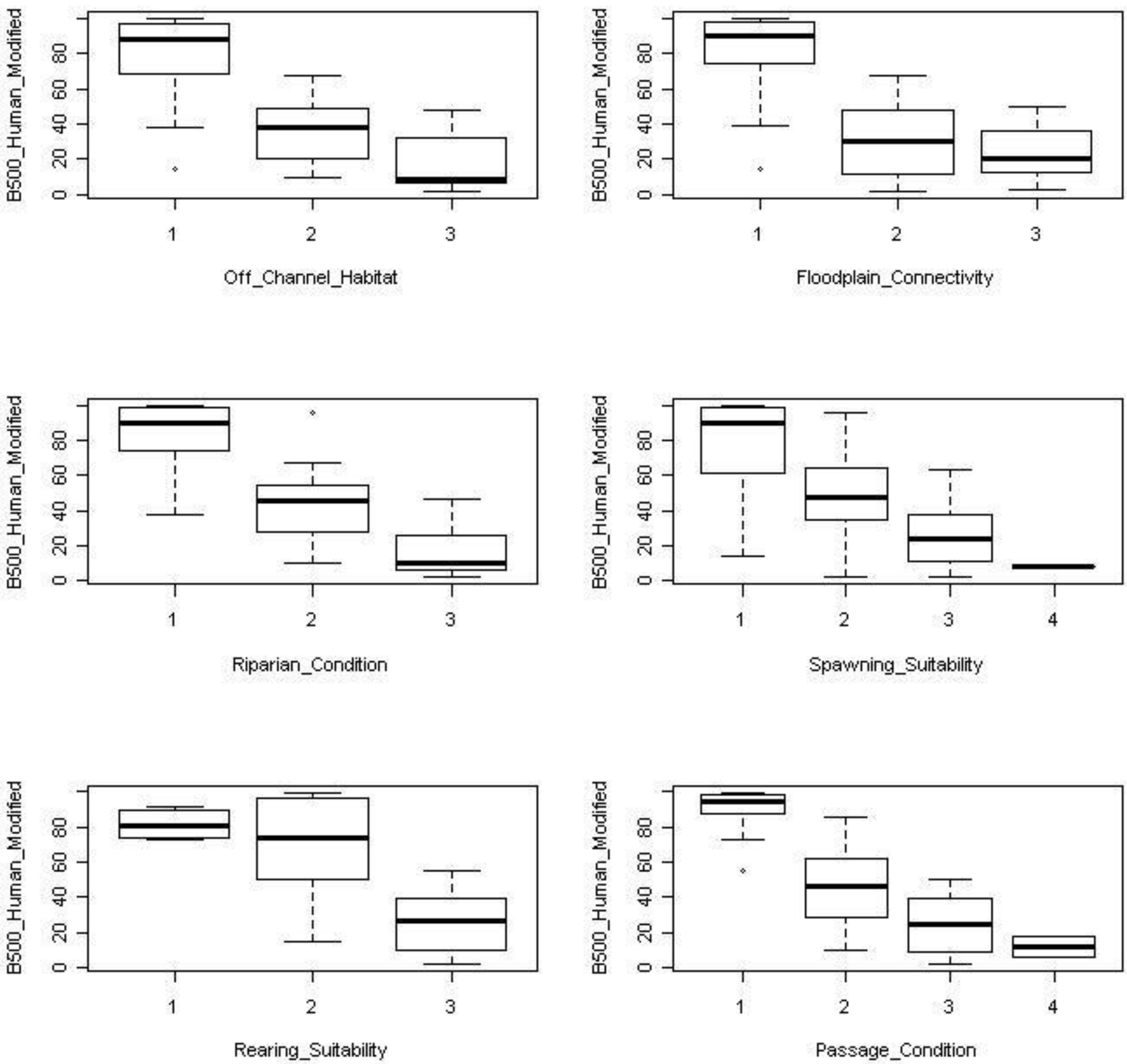


Figure A-8 Example box plots comparing the BPK scores for each habitat attribute with the distribution of GIS landscape metrics for the "human modified" attribute

2. 305(b) Water Quality Inventory

Water quality parameters, such as temperature, dissolved oxygen, and turbidity can have a direct impact on fish distributions, suitability for various life stages, and health. Water quality standards under the federal Clean Water Act, as administered by Washington State Department of Ecology, are set in part by effects on fish. To investigate this, we used Ecology's 305(b) Water Quality Inventory[3]. The 305(b) list includes the location, the parameter of concern (temperature, DO2, Flow, and/or turbidity), and the severity of the impairment using categories 2, 4, 4a, 4b, 4c, and 5, standards described on Table A-10. The 303(d) impaired waters list is a subset of the 305(b) Water Quality Inventory where the severity category = 5 (polluted waters that require a TMDL).

For our analysis we included all of the 305(b) categories. Even if a TMDL is in place, we included that impairment as an indicator of "something is wrong in this reach that requires active monitoring and management." For each CRIA reach, and for each of the four WQ parameters, we computed the percent of the length of that reach that had a potential impairment. Example results are provided on Figure A-9 and Figure A-10. Figure A-9 shows the maximum (worst) category of impairment for each reach; Figure A-10 is keyed for the water quality parameter that is impaired.

We did not have sufficient time to develop this analysis further, but we believe this is another data source with potential to inform habitat condition scoring in the future.

[3] http://apps.ecy.wa.gov/wats08/

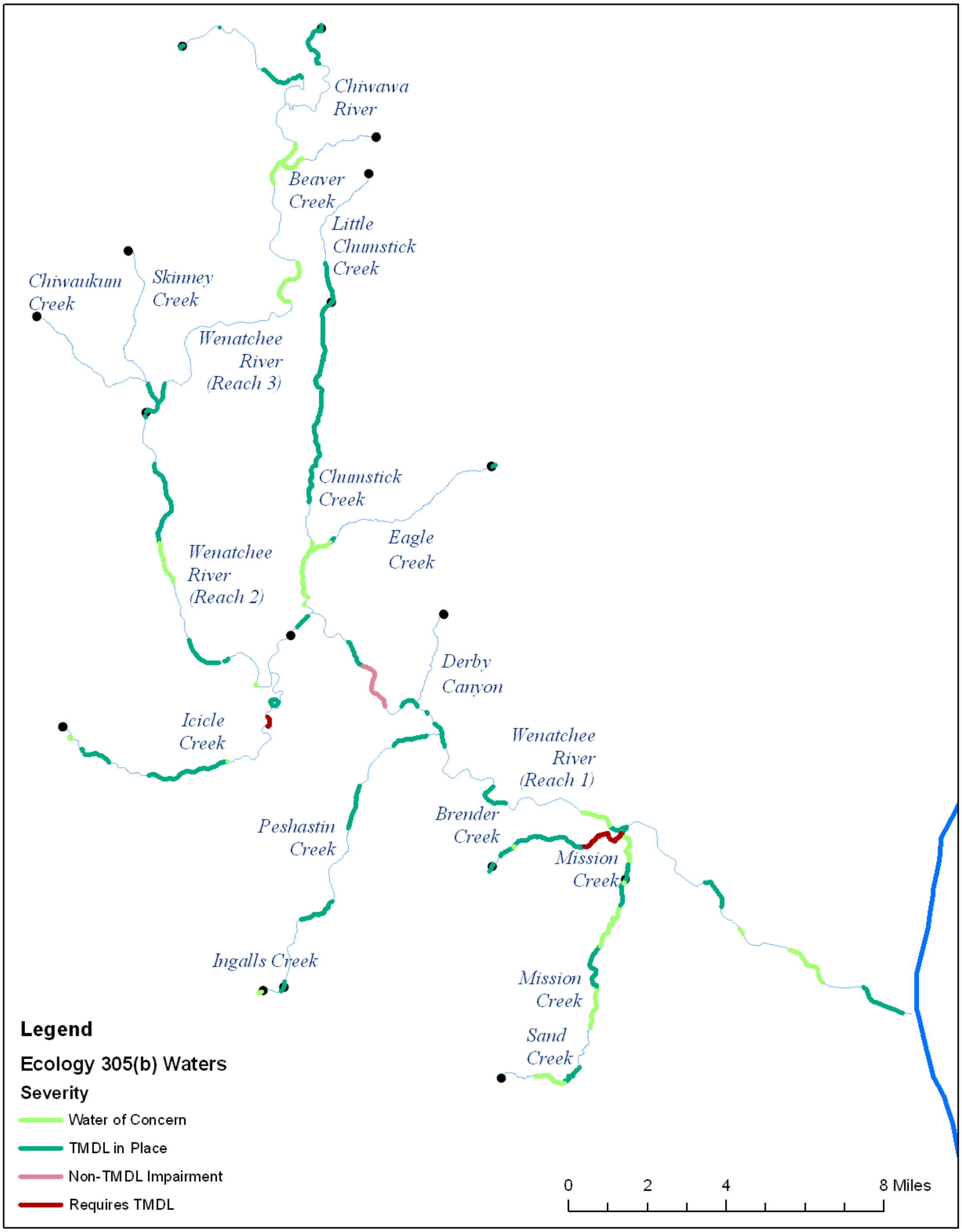


Figure A-9 Example (WRIA 45) stream reaches showing 305(b) water quality inventory data

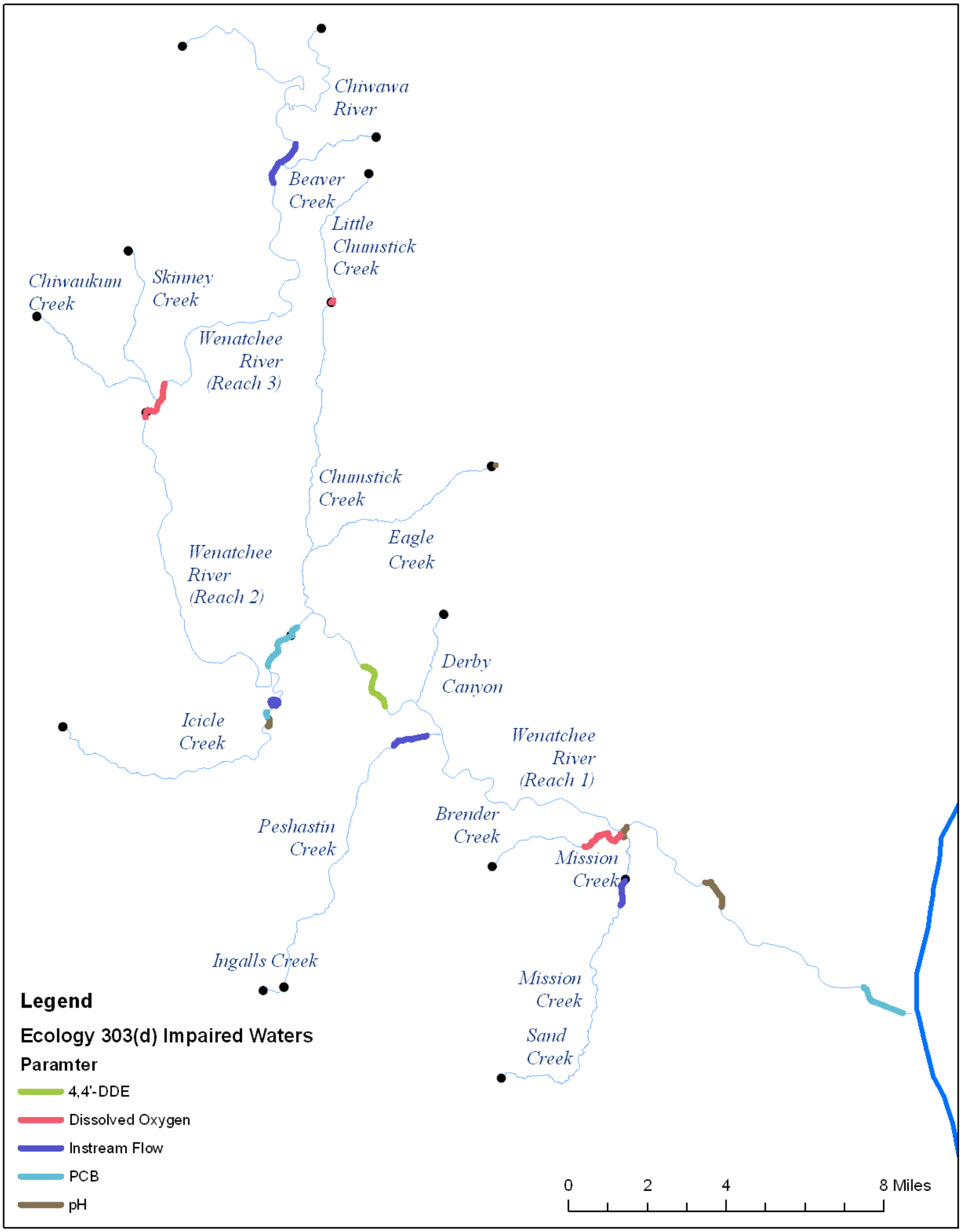


Figure A-10 Example (WRIA 45) CRIA stream reaches showing 303(d) Category 5 impaired waters by impairment type

3. Potential future investigations

Five additional parameters affecting salmonid productivity should be considered for future iterations. They are: 1) fine sediment loading; 2) temperature; 3) channel complexity or presence of Large Woody Debris to expand rearing habitat; 4) flood scour usually from a channelized system; and 5) predation and poaching.

Fine sediment loading - This parameter would be difficult to measure and is not readily known in all reaches; currently sediment loading is used indirectly (if known to be a detriment) for scoring the "spawning condition" attribute.

Temperature – Stream temperature is a limiting factor commonly encountered, especially in eastern Washington. Input of cooler water is necessary in substantial amounts in order to decrease stream temperatures. The amount and temperature of increased flow would be unique to each reach and therefore difficult to score. Also, providing enough water volume to decrease temperatures may conflict with other salmonid-directed flow management objectives (i.e. when flow is higher than optimal for fish). Providing additional instream flow to a stream where temperature is a limiting factor may not improve conditions if no other measures are implemented to maintain/decrease water temperatures (e.g., riparian vegetation complexity and maturity, stream cover).

Lack of LWD or instream cover - Preservation of riparian vegetation and production of aquatic invertebrates that provide important cover and food for salmonids may be important, even if temperature thresholds are exceeded. Hish-resolution GIS-based land cover information may enhance our ability to score this metric in future iterations.

Flood scour – A channelized stream will scour more readily than a sinuous stream when flows are high. This parameter is important in measuring suitability of substrate for spawning and can also help determine rearing suitability. This parameter was not scored as an individual parameter, but is indirectly scored in association with spawning conditions of a reach.

Predation and Poaching – Low flows can leave fish vulnerable to predation (concentrating predators and prey into smaller habitat) and poaching (concentrating food fish such that harvest is easy). Certain habitat parameters are associated with conditions that enable predation/poaching. These types of habitat conditions were only indirectly evaluated as part of the "rearing suitability" parameter.

G. References

Literature sources used to score habitat included but were not limited to:

- Northwest Power and Conservation Council Subbasin Plans, (http://www.nwcouncil.org/fw/subbasinplanning/Default.htm),
- Salmon Recovery Plans (http://www.nwr.noaa.gov/Salmon-Recovery-Planning/index.cfm) developed by local Salmon Recovery Boards, and
- Limiting Factors Analysis reports (http://www.scc.wa.gov/).

In addition, a large number of reports produced by the Colville Tribes Fish and Wildlife Department (http://nrd.colvilletribes.com/obmep/default.htm), Washington Department of Fish and Wildlife (http://wdfw.wa.gov/publications/), and Annual Reports of Projects funded by Bonneville Power (http://www.efw.bpa.gov/IntegratedFWP/technicalreports.aspx) were used to score habitat. Specific citations are provided in the bibliography, below.

H. For Further Information

Jonathan Kohr, Habitat Biologist
Washington Department of Fish and Wildlife
(509) 457-9306 jonathan.kohr@dfw.wa.gov

Andrew D. Weiss
GIS Section Lead, Fish Program
Washington Department of Fish and Wildlife
(360) 902-2487 andrew.weiss@dfw.wa.gov

VII. Flow Condition

The flow data manipulation and scoring process involved five steps for each WRIA as follows:

1) Collect and summarize water rights data;
2) Collect, review, and summarize flow gauge data;
3) Collect instream flow rule data;
4) Collect and summarize NHD+ normative flow data;
5) Scoring and binning

For this report, the following definitions apply:

Period of record: The years for which data are summarized for CRIA scoring.

Mean Monthly Flow: The average of flows for a particular month in the period of record.

Mean Annual Flow: The average of flows over the year in the period of record (average of "mean monthly flows" for all months)

Mean August Flow: The average of August flows in the period of record.

These terms may or may not have been used consistently or correctly within any of the workbooks. In particular, the term "average Mean Monthly Flow" is often used when the term "Mean Annual Flow" is more correct.

A. Workbook Description

Excel workbooks were created to contain water right data for each WRIA. Reach-specific water right data are grouped under individual reach tabs (Table A-11), and a rollup of scoring for all reaches occurs as the first spreadsheet tab (Table A-12).

The flow workbooks are organized into tabs, including separate tabs for each stream reach for which flow gauge data are available, a tab containing flow targets copied from workbooks provided by Ecology OCR, and a "reaches" tab containing data used in scoring, along with the final scoring metrics, and bins. Other tabs that might occur include data for gauges that were not used for scoring, and a tab for references and/or gauge data web links.

B. Data Manipulation

1. Water Rights Data

Water rights data records were copied from Ecology's Water Rights Tracking System (WRTS) database on September 10, 2010. At that time, we were not able to download annual (Qa) or instantaneous (Qi) water quantity data for records identified as claims. Steps to manipulate the data included:

1) Extract water rights data from WRTS by WRIA
2) Apportion water right data records to CRIA reach;
3) Create workbook; Format and summarize records: number of claims, total Qa, number of records for each reach. Excluded Categories and Purposes as noted

in Table A-11 and Table A-12. Summarized data appear at the top of each reach spreadsheet.

4) Scan for irregularities: Qa or Qi too high for acreage, purpose of use questionable, GPM units; noted disposition, corrected as appropriate

5) Copy summary results to "reaches" tab.

WRTS Data are available online at: http://www.ecy.wa.gov/programs/wr/rights/tracking-apps.html. The following information for each data record was examined when scoring for CRIA:

Type of water right: Only "S" code (surface water) rights were examined, even though groundwaters in continuity with surface flow are also important.

Status: Document type and status (see Table A-13)

Q(i) (Instantaneous Quantity): the maximum diversion or withdrawal rate requested by the applicant; in cubic feet per second for surface water and gallons per minute for ground water.

Q(a) (Acre Feet/Year): the annual volume or quantity of water requested by the applicant; one acre foot per year is equal to one foot of water over one acre of land or 325,850 gallons of water.

Purpose of Use: See Table A-14 for codes and definitions.

In general, many records were missing withdrawal Qi (instantaneous flow) data, not just for "stock watering" uses but for other purposes as well, and this anomaly was fairly consistent within a WRIA. In some cases it was difficult to apportion records to CRIA reaches; questionable records were investigated and decisions noted on the spreadsheet.

As noted above, data were summarized at the top of each spreadsheet. Metrics include "Claims," which is a count of records of the document type "Claim," "Claim L," and "Claim S;" a sum of the instantaneous flow (cfs) permitted within that reach ("Qi"); and a count of the number of records for each reach. The sum of flow did not include document types and purposes of use as noted in Table A-13 and Table A-14. Once summarization was completed for each reach tab, those results were copied to an opening "Reaches" tab containing CRIA reach number, reach name, number of claims, sum of instantaneous flow, and number of records. Data from this water rights "Reaches" tab are copied into the "Flow" workbook, "Reaches" tab.

2. Flow gauge data

Flow data collected from stream flow gauges for each WRIA were copied into a "Flow" workbook, with one tab for each CRIA reach (Table A-15). The data were then formatted, a "period of record" chosen for use when comparing monthly mean flows to flow targets, and summarized. When two or more gauges were located within a particular reach, we chose the one with the period of record that best matched our needs, the one with the specific location more aligned with our reach boundaries, or a gauge designated as a control point for stream flow monitoring. A roll-up "Reaches" tab contains mean monthly flow, mean August flow, and mean annual flow, plus other metrics summarized from the individual reach tabs.

Figure A-11 shows a graphic depiction of a typical hydrograph. Table A-15 shows a sample flow data tab.

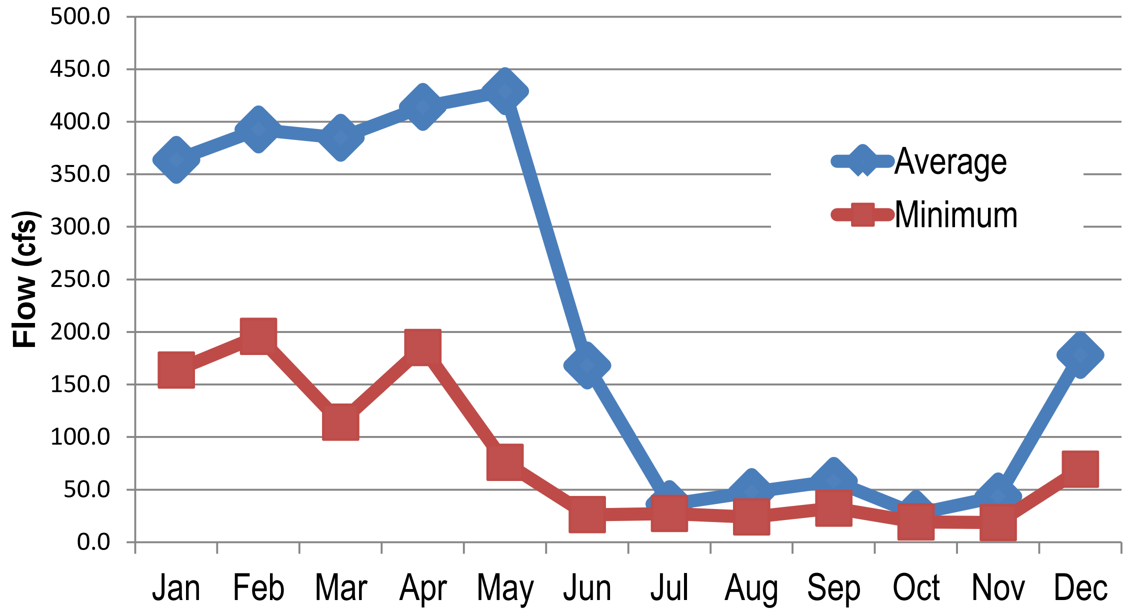


Figure A-11 Sample Hydrograph (Walla Walla at Beet Road; 2002-2009)

3. Instream flow rule data

Data for instream flow targets (rules) was provided by Ecology in a series of Excel spreadsheets called "Processed Data;" one for each gauge within a WRIA. Ecology recorded instream flow rules for each week of the year. These data were copied to the CRIA "Flow" workbook into the "Flow Rules" tab (Table A-16), and copied to individual reach tabs, as appropriate.

4. NHDPlus Flow Estimates for Non-gauged Reaches

To provide estimates of Mean Annual Flow (MAF) for non-gauged stream reaches, we used NHDPlus[4]. While the hydrography we used was not exactly congruent with NHDPlus, it was easy to visually identify those NHDPlus reaches that corresponded to the downstream extent of the CRIA reach and extract the estimated MAF.

To estimate the monthly flow for non-gauged reaches, we developed annual hydrographs for the gauged streams in a given WRIA, calculated the ratio of each month's flow to the MAF, then computed the mean ratio for each month across all the gauged streams in that WRIA. This mean ratio was then applied to the estimated MAF of non-gauged stream reaches in that WRIA to create the monthly estimates. We used

[4] http://www.horizon-systems.com/nhdplus/, ftp://ftp.horizon-systems.com/NHDPlus/documentation/NHDPLUS_UserGuide.pdf

the MAF estimate and the mean August flow as metrics for scoring in the absence of gauge data.

While these estimates often give quite reasonable results, there are several problems with this methodology. First, it assumes that all the annual hydrographs are the same shape, with similar monthly contributions to the annual total. In reality, different reaches in different positions in the watershed (e.g., lower main stems vs. upper tributaries) can have different shaped hydrographs (i.e. peak flow earlier in the year for upper tributaries responding to snowmelt, later attenuated peak flow for mainstem tributaries). Second, this method does not account for managed hydrography, where flows are controlled by dam releases rather than natural runoff (September releases on the Tieton River from Bumping Reservoir are a good example of this). Third, this model does not account for groundwater base flows, which can be significant both for flows and for water temperature.

A possible future approach would be to model monthly flows directly using the upstream contributing area of each reach as computed from the DEM, along with the monthly precipitation grids from the PRISM dataset (Daly et al 2008, http://www.prism.oregonstate.edu). The same software package we propose to use to develop physical stream attributes (NetTrace/ Netmap, http://www.netmaptools.org/, Miller 2003a, 2003b) would be helpful in processing these data. Comparing the results of this model with gauged stream reaches will allow calibration of the model results to true field measurements.

Direct measurements of flow will always be superior to estimates such as the ones we made for CRIA. WDFW will work with Ecology to identify currently non-gauged reaches that should be gauged in order to better manage fish and water resources.

Summarized NHDPlus data for Mean Annual Flow and Mean August Flow in each reach were copied into the “Reaches” tab of the “Flow” workbook.

5. Information not used in scoring

Several summarization results, that are interesting in themselves, were left out of the final scoring method but remain in the workbook as artifacts. In particular, Limiting Factors Analysis and Ecosystem Diagnostic and Treatment results were evaluated for use in scoring, as discussed below.

Limiting Factors Analysis (LFA): While LFA reports were a critical data source for habitat scoring, an attempt to develop a meaningful metric from LFA summaries was not successful. LFAs available for the CRIA watersheds were reviewed, and a summary table created for each WRIA that among other things indicated whether instream flow is the primary factor (3), a secondary factor, or “one of the primary factors,” (2), one of many factors (1), or not a factor (0) limiting salmonid production in that WRIA.

Similarly, 2006 Ecosystem Diagnostic and Treatment (EDT) model results were assessed based on the level of salmonid production benefits provided by increasing stream flow. High benefits scored “3,” medium benefits scored “2,” low level of benefits scored “1,” and indirect or general benefits scored “0.”

In general, CRIA reaches and LFA/EDT geographic subdivisions were difficult to correlate. Also, both LFA and EDT resulting scores tended to vary little among reaches within a WRIA, and were therefore not of much help as a component of flow scoring to distinguish among WRIA reaches. We determined that we would expect little value-added from further consideration, so abandoned these two tools for use in flow scoring.

C. Flow Scoring and Binning

The "Reaches" tab of the "Flow" workbook contains all the summary information used to score for flow condition (Table A-17). This spreadsheet contains the reach number and name; mean monthly and mean annual flow data copied from gauge tabs; NHD+ flow estimates copied from the "All_Encompassing_Reach_Information" workbook; and several intermediate computations. Scoring for the key attributes represents a measure of flow impairment, meaning high scores = high impairment (poor condition). The key attributes for reach flow scoring are:

- "Flow-For-Scoring" = Mean Annual Flow and Mean August Flow, or NHD estimates thereof.
- Count of months when Mean Monthly Flow is lower than instream flow rule.
- "Qi" = sum of appropriate Qi for each reach from WRTS data.
- "Claims" = number claims in a reach. We interpreted a higher number of claims as meaning a potentially higher risk that withdrawals are higher than Qi.
- "August Deviation" is Mean August Flow / Mean Annual Flow; as a measure of severity of difference from low summer flows to mean

The five CRIA scoring metrics and their rubrics are

Item	Criteria	Score =
A	Percent of months Mean Monthly Flow is below rule	
	>.75	4
	>.5	3
	>.25	2
	else	1
B	Qi Deviation from (divided by) Mean Annual Flow	
	>.15	3
	>.05	2
	else	1
C	Number of Claims in reach	
	<2	1
	<9	2
	else	3

D	August as a proportion of (divided by) Mean Annual Flow	
	>.66	1
	>.33	2
	else	3
E	Flow Volume (cfs for Mean Annual Flow)	
	>1000	0.5
	>100	1
	>50	2
	>5	3
	else	4

Because we scored for impairment (low score = low impairment = good condition), scores are inverted in the next step to align with other CRIA scores (low score = poor condition, high score = good condition). Reaches lacking gauge data and for which reliable NHD+ estimates could not be made were given high impairment scores for the relevant attribute.

A raw score for each reach is derived by summing items A through D, then multiplying by item E. Raw scores are stratified into percentiles (using Excel spreadsheet functions) in order to determine scoring bins. The highest 1/3 of scores (interpreted as the most flow impaired) are assigned to the "1" (poor condition) bin, the middle 1/3 to the "2" (average condition) bin, and the lowest 1/3 (least flow impaired) to the "3" (good condition) bin. In this way, scores are transformed to coincide with the other CRIA scores, which use a low-to-high condition convention (i.e. a high score for flow impairment indicates poor flow condition status).

D. Caveats

Inverse scoring: The current scoring scheme, with higher scores denoting worse condition, is admittedly awkward in context with scoring schemes developed for the other components. However, it is easier to develop measures of impairment than it is to find measures of "goodness." Although this approach provides a useful lens through which to view stream reach attributes, we would probably look for other ways to score in future iterations that are not so counter-intuitive with scoring for the other CRIA elements..

Flow targets: Absence of an instream flow rule doesn't inhibit ability to score flow condition, but does reduce the applicability of CRIA for the water demand forecast.

Claims attribute: The use of the count of claims for a reach (rather than including sums of Qa - water volume) is a surrogate that seems to help capture the vulnerability of flows in smaller reaches. This is especially true in reaches lacking flow targets. The team considered whether to retrace our steps to collect the Qa and Qi for claims, but decided that because these values have not been reviewed for extent and validity, using these values could lead us even farther astray than the current metric.

Lowest-flow month: Use of August as the month for which to compute deviation from "monthly average" flow is inappropriate in some WRIAs or reaches where low flow occurs in September, July, or even December.

Opportunities for improvement: The three best flow metrics, if they could be developed for all reaches, would be a) Qi relationship to mean flow on a monthly or seasonal basis instead of annual, b) deviation between low-month flow (not always August) and Mean Annual Flow (or peak annual flow), c) deviation between Mean Annual Flow and the flow associated with some physical metric of channel capacity, d) a more rigorous comparison of Mean Monthly Flows to instream flow rules and/or other surrogates for instream flow rules where they don't currently exist, all in some combination with e) flow volume factor.

E. For Further Information

Teresa Scott
Water Resource Policy Coordinator
Washington Department of Fish and Wildlife
360-902-2713 teresa.scott@dfw.wa.gov .

VIII. Suggested Improvements

Should further work on this activity be commissioned, the CRIA team suggests several improvements.

- First, all data should be stored in a single database that can be dynamically updated as water right, flow gauge data, SaSI, and fish distribution data are updated. It would be ideal if these individual data points could be displayed in interactive geospatial applications.
- CRIA scoring criteria and results should be more broadly vetted among WDFW biologists, Ecology water resources specialists, and tribal and local partners.
- Theoretically, CRIA should reflect habitat improvements over time as improving habitat scores. To this end, a mechanism should be created to dynamically link other external inventories (e.g., fish passage barriers, fish screen locations/status, Habitat Work Schedule information on salmon habitat restoration projects) and incorporate those data into habitat scoring.
- We recommend expansion of CRIA into the Entiat (WRIA 46) in the short term (because ESA-listed salmonid stocks originate there), to Westside salmonid streams (particularly those that contain ESA-listed salmonids), and finally to additional WRIAs containing other ESA-listed fish stocks.

Finally, work should be done to evaluate changes in timing of peak flows and other hydrological attributes, and whether those fluctuations represent trends that negatively affect fish at the population scale.

IX. Bibliography

Anchor Environmental, L.L.C. and EES Consulting, Inc. 2007. Peshastin Subbasin Needs and Alternatives Study. Prepared for Chelan County Natural Resource Department, Wenatchee, WA.

Anderson E. and M. Mizell. 2010. 2010 Draft: An Investigation into the migratory behavior, habitat use and genetic composition of fluvial and resident bull trout (*Salvelinus confluentus*) in the Yakima River basin. Yakima Basin radio telemetry report. Washington Department of Fish and Wildlife, Yakima Regional Office, Yakima, Washington. 104 p.

Andonaegui, C. 2000. Salmon, Steelhead, and Bull Trout Habitat Limiting Factors: Water Resource Inventory Area 48. Prepared for the Washington State Conservation Commission, Olympia, WA.

Andonaegui, C. 2001. Salmon, Steelhead, and Bull Trout Habitat Limiting Factors for the Wenatchee Subbasin (Water Resource Inventory Area 45) and Portions of WRIA 40 within Chelan County (Squilchuck, Stemilt, and Colockum drainages). Final Report. Prepared for the Washington State Conservation Commission Headquarters Office, Olympia, WA.

Arterburn, J., and K. Kistler. 2005. Okanogan Basin Monitoring and Evaluation. Colville Confederated Tribes (CCT) Report for 2004. Prepared for U.S. Department of Energy, Bonneville Power Administration (BPA), Division of Fish and Wildlife. Portland, OR. CCT Project No. 3159. BPA Project No. 200302200. BPA Contract No. 17421.

Arterburn, J., and K. Kistler. 2005, 2006, 2007, 2008. Okanogan Basin Steelhead Spawning Surveys. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. CCT Account No. 315805 through 315808, respectively. BPA Project No. 200302200.

Arterburn, J., and B. Miller. February 2009. Spring Spawner Estimates for the Okanogan River Basin (2008). Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. BPA Project No. 200302200.

Arterburn, J., K. Kistler, and C. Fisher. January 2007. Barriers to Anadromous Fish in the Okanogan River Basin. Prepared for the Colville Tribes, Department of Fish and Wildlife, Anadromous Fish Division-Omak Office, Omak, WA.

Arterburn, J., K. Kistler, and M. Rayton. June 2008. Okanogan Basin Monitoring and Evaluation Program. 2007 Annual Report. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. CCT Project No. 315806. BPA Project No. 200302200. BPA Contract No. 26654

Arterburn, J., K. Kistler, and P. Wagner. March 2007. Okanogan Monitoring and Evaluation Program Field Manual Redd Survey Methodology, final draft. The Colville Confederated Tribes.

Arterburn, J., K. Kistler, C. Fisher, and M. Rayton. September 2007. Okanogan Basin Spring Spawner Report for 2007. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. CCT Account No. 315807. BPA Project No. 200302200.

Ashbrook, C.E., K.W. Yi, and J. Arterburn. May 2005. Tangle Nets and Gill Nets as a Live Capture Selective Method to Collect Fall Chinook Salmon Broodstock in the Okanogan River: 2004. Annual Report, Pilot Study. Prepared for Bonneville Power Administration. Portland, OR. Project No. 200302200.

Browne, D., F. Koch, D. Schlee, C. Johnson, J. Holzmiller, S. Polumsky, and G. Thiessen. 1995. Asotin Creek Model Watershed Plan Asotin County, Washington. Prepared for The Asotin County Conservation District. Prepared by the Asotin Creek Conservation District Landowner Steering Committee. Clarkston, WA.

Baldwin, C.M. 2007. Steelhead Spawning Ground Surveys, Temperature, and Discharge Monitoring in Small Tributaries of the Columbia River Upper Middle Mainstem Subbasin, 2005-2007. Washington Department of Fish and Wildlife, Science Division, Conservation Biology Unit. Wenatchee, WA. FPT 07-10.

Baldwin, C. 2008. Barrier Prioritization Framework, memorandum. Prepared for the Upper Columbia Salmon Recovery Region and Chelan County NRD. Prepared by Upper Columbia Regional Technical Team. Chelan County, WA.

Bartels, D. 1998. Pataha Creek Model Watershed. Project No. 1997-08800. BPA Report DOE/BP-37117-1.

Bartels, D. 1999. Pataha Creek Model Watershed. Project No. 1999-02100. BPA Report DOE/BP-14994-1.

Bartels, D. 2003. Pataha Creek Model Watershed; Habitat Conservation Project. 2000-2002 Progress Report, Project No. 199902100. BPA Report DOE/BP-14994-2.

Bartels, D. 2007. Garfield County Habitat for Fall Chinook and Steelhead. 2006 Annual Report. Project No. 199401807. BPA Report DOE/BP-00026584-1.

Bartels, D. 2008. Habitat for Fall Chinook and Steelhead. January – December 2007 Habitat Conservation Projects. Prepared for U.S. Department of Energy, Bonneville Power Administration. Annual Report for Parent Project 1994-018-07. Contract No. 31784.

Bartels, D., W. Conner, M. Faler, R. Ashley, G. Mendel, K. Lawrence, and T. Hanrahan. 2001. Lower Snake Subbasin Summary, draft. Prepared for Northwest Power Planning Council.

Bennett, S., and N. Bouwes. 2009. Southeast Washington Intensively Monitored Watershed Project: Selection Process and Proposed Experimental and Monitoring Design for Asotin Creek. Final Report. Prepared for State of Washington, Recreation and Conservation Office. Olympia, WA.

BioAnalysts, Inc. 2004. Movement of Bull Trout within the Mid-Columbia River and Tributaries, 2001-2004. Final Report. Prepared for Public Utility District No. 1

of Chelan County, Wenatchee WA; Public Utility District No. 1 of Douglas County, East Wenatchee, WA; and Public Utility District No. 1 of Grant County, Ephrata, WA. Rocky Reach Hydroelectric Project FERC Project No. 2145, Rocky Island Hydroelectric Project FERC Project No. 943, Wells Hydroelectric Project FERC Project No. 2149, and Priest Rapids Hydroelectric Project FERC Project No. 2114.

Blankenship, S.M., C. Bowman, K.I. Warheit, and A. Murdoch. 2009. Methow Basin Steelhead – Evaluating the Effects of the Supplementation Program. Developed for Douglas County PUD, and Wells Habitat Conservation Plan Hatchery Committee. Washington Department of Fish and Wildlife. Olympia, WA.

Blankenship, S., C. Busack, C. Dean, A. Fritts, T. Kassler, T. Pearsons, S. Schroder, M. Small, J. Von Bargen, K. Warheit, C. Knudsen, W. Bosch, D. Fast, M. Johnston, and D. Lind. 2007. Yakima/Klickitat Fisheries Project Genetic Studies, Yakima/Klickitat Fisheries Project Monitoring and Evaluation. Annual Report 2005-2006. U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. Project No. 199506325. Contract No. 00027871.

Blankenship, S., C,. Busack, A. Fritts, D. Hawkins, T. Kassler, T. Pearsons, S. Schroder, J. Von Bargen, C. Knudsen, W. Bosch, D. Fast, M. Johnston, and D. Lind. 2008. Yakima/Klickitat Fisheries Project Genetic Studies, Yakima/Klickitat Fisheries Project Monitoring and Evaluation. Annual Report 2006-2007. U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. Project No. 199506325. Contract No. 00034450.

Blankenship, S.M., C.A. Dean, J. Von Bargen, and A. Murdoch. 2008. Assessing the Genetic Diversity of Lake Wenatchee Sockeye Salmon and Evaluating the Effectiveness of its Supportive Hatchery Supplementation Program. Prepared for Chelan County PUD and Habitat Conservation Plan's Hatchery Committee.

Blankenship, S.M., J. Von Bargen, and K.D. Truscott. 2006. Genetic analysis of White River juveniles retained for captive brood at AquaSeed to assess the hatchery status of contributing parents. Prepared for Grant County PUD.

Blankenship, S.M., J. Von Bargen, K.I. Warheit and A. Murdoch. 2007. Assessing the Genetic Diversity of Natural Chiwawa River Spring Chinook Salmon and Evaluating the Effectiveness of its Supportive Hatchery Supplementation Program. Prepared for Chelan County PUD and Habitat Conservation Plan's Hatchery Committee.

Blankenship, S.M. and A.R. Murdoch. 2006. Study Plan for assessing the genetic diversity of natural Chiwawa River Spring Chinook salmon and evaluating the effectiveness of its supportive hatchery supplementation program. Prepared for Chelan County PUD and the Habitat Conservation Plan's Hatchery Committee.

Bonneville Power Administration. June 2007. Yakima-Klickitat Fisheries Project Coho Reintroduction Feasibility Study Phase II Project Description and Environmental Analysis White Paper.

Bosch, Bill, David Fast. 2006. Yakima/Klickitat Fisheries Project; Monitoring and Evaluation. 2005-2006 Annual Report. Prepared for Bonneville Power Administration. Project No. 199506325. BPA Report DOE/BP-00022449-1.

Bosch, W.J., T.H. Newsome, J.L. Dunnigan, J.D. Hubble, D. Neeley, D.T. Lind, D.E. Fast, L.L. Lamebull, and J.W. Blodgett. 2007. Evaluating the Feasibility of Reestablishing a Coho Salmon Population in the Yakima River, Washington. North American Journal of Fisheries Management 27:198-214.

Bottman, B., B. Johnson, T. Bruegman. And D. Bartels. 1997. Model Watershed Development in Eastern Washington. Administrative Project Support. Annual Progress Report: 1996-1997. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. Project No. 92-026-02. Contract No. 97BI81613.

Bumgarner, J.D. 2002. Asotin Creek Instream Habitat Alteration Projects - Habitat Evaluation, Adult and Juvenile Habitat Utilization and Water Temperature Monitoring. 2001 Progress Report. Prepared for Asotin County Conservation District. Clarkston, WA. Contract No. 0006230. Project No. 199905400. BPA Report DOE/BP-0006230-1.

Bumgarner, J., L. Ross, and M. Varney. 2000. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. 1998-1999 Annual Reports. Prepared for U.S. Fish and Wildlife Service. Boise, ID. Cooperative Agreements: 1448-1411098-J057 and CA-14110-9-J070.

Bumgarner, J. L., J. Dedloff, M. Herr, and M. Small. 2004. Lyons Ferry Complex Hatchery Evaluation: Summer Steelhead Annual Report 2003 Run Year. For U.S. Fish and Wildlife Service. Boise, ID. Cooperative Agreements: 14110-2-J050 and 14110-3-J051.

Bureau of Reclamation. 2007. Assessment of Sockeye Salmon Production Potential in the Cle Elum River Basin, Storage Dam Fish Passage Study, Yakima Project, Washington. Technical Series No. PN-YDFP-008. Bureau of Reclamation. Boise, Idaho.

Burgert, R., P. Seidel, P. LaRiviere, D. Marbach, S. Martin, and L. Ross. 1989. Lower Snake River Compensation Plan. Lyons Ferry Evaluation Program. 1988 Annual Report. Prepared for U.S. Fish and Wildlife Service. Boise, ID. Cooperative Agreement 14-16-0001-88519.

Burgert, R., C. Busack, G. Mendel, L. Ross, K. Petersen, D. Marbach, and J. Dedloff. 1991. Lower Snake River Compensation Plan. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. 1990 Annual Report. For USFWS, Boise, ID. Cooperative Agreement 14-16-0001-90524.

Burgert, R., K. Petersen, G. Mendel, L. Ross, D. Milks, J. Dedloff, and M. Alexandersdottir. 1992. Lower Snake River Compensation Plan. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. 1991 Annual Report. Prepared for U.S. Fish and Wildlife Service. Boise, ID. Cooperative Agreement 14-16-0001-91534.

Busack, C., A. Fritts, T. Kassler, J. Loxterman, T. Pearsons, S. Schroder, M. Small, S. Young, C. Knudsen, G. Hart, and P. Huffman. 2006. Yakima/Klickitat Fisheries Project Genetic Studies; Yakima/Klickitat Fisheries Project Monitoring and Evaluation. 2005-2006 Annual Report. Portland, OR. Project No. 199506325. BPA Report DOE/BP-00022370-5.

Call, J. 2008. The Integrated Status and Effectiveness Monitoring Program. U.S. Forest Service Fish Abundance and Steelhead Redd Surveys Annual Report. Jan. 1 – Dec. 31, 2008. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. Project No. 2003-017-00. Contract No. 37149.

Chilcote, M. 2003. Relationship between natural productivity and the frequency of wild fish in mixed spawning populations of wild and hatchery steelhead (Oncorhynchus mykiss). Canadian Journal of Fisheries and Aquatic Sciences 60:1057–1067.

Crampton, B, and B. Espenson. 2009. Sockeye Spawning in Upper Cle Elum River Basin for First Time in 100 Years. Columbia River Basin Bulletin (October 2): Archives. http://www.cbbulletin.com/358400.aspx.

Colville Confederated Tribes. 2002. ISRP Review of Project 199604200: Restore and Enhance Anadromous Fish Populations and Habitat in Salmon Creek. Prepared for Northwest Power Planning Council. Portland, OR.

Confederated Tribes of the Umatilla Indian Reservation and U.S. Fish and Wildlife Service. 2005. Walla Walla River Spring Chinook Salmon. Hatchery and Genetic Management Plan. Pendleton, OR.

Daly, C., Halbleib, M., Smith, J.I., Gibson, W.P., Doggett, M.K., Taylor, G.H., Curtis, J., and Pasteris, P.A. 2008. Physiographically-sensitive mapping of temperature and precipitation across the conterminous United States. International Journal of Climatology, 28: 2031-2064.

Dasher, R. 2009. 2008 Annual Report: Improvement of Anadromous Fish Habitat and Passage in Omak Creek. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. BPA Project 2000-001-00. Document ID No. P111998.

Doulos, S., S. Croci, and J. Evered. 2008. Mid-Columbia Coho Production at U.S. Fish & Wildlife Service Facilities: Entiat National Fish Hatchery, Leavenworth National Fish Hatchery, Olympia Fish Health Center, Willard National Fish Hatchery, and Winthrop National Fish Hatchery. Annual Report. BPA Project No. 1996-040-00. Contract No. 31048.

Entrix Inc. and Golder Associates. 2004. Salmon and Steelhead Habitat Limiting Factors Assessment. Watershed Resource Inventory Area 49: Okanogan Watershed. Prepared for Confederated Tribes of the Colville Reservation. Okanogan, WA.

Evenson, D.F., and A.J. Talbot. 2003. Development of a Stock Assessment and Research Plan for Mid-Columbia River Summer Chinook salmon. Technical Report 03-03. Columbia River Inter-Tribal Commission. Portland, OR.

Faler, M., G. Mendel, and C. Fulton. 2003, 2004, 2005. Evaluate Bull Trout Movements in the Tucannon and Lower Snake Rivers. Prepared for Bonneville Power Administration. Portland, OR. Project No. 2002-00600. BPA Report DOE/BP-00009774-1, BPA Report DOE/BP-00009774-2, and BPA Report DOE/BP-00009774-3.

Fisher, C., et al. 2001. Okanogan/Similkameen Subbasin Summary. Prepared for the Northwest Power Planning Council.

Fisher, J. A. and K. S. Wolf. 2002. Salmon and steelhead limiting factors analysis for WRIA 49. Golder Associates, Inc. Report to the Washington Conservation Commission and the Colville Tribes.

Flagg, T.A., T. E. Ruehle, L. W. Harrell, J. L. Mighell, C. R. Pasley, A. J. Novotny, E. Statick, C. W. Sims, D. B. Dey, C.V.W. Mahnken - National Marine Fisheries Service. Seattle, WA. 2000. Cle Elum Lake Anadromous Salmon Restoration Feasibility Study: Summary of Research. Final Report to Bonneville Power Administration. Portland, OR. Contract No. 86AI64840. Project No. 86-045. BPA Report DOE/BP-64840-4.

Flesher, M.W., R.W. Carmichael, and J.R. Ruzycki. 2004. Lower Snake River Compensation Plan: Summer Steelhead Creel Surveys on the Grande Ronde, Wakkiwam and Imnaha rivers for the 2001-02 Run Year. Oregon Department of Fish and Wildlife.

Freudenthal, J., D. Lind, R. Visser, and P. Mees. 2005. Yakima Subbasin Salmon Recovery Plan draft. Prepared for the National Oceanic and Atmospheric Administration. Yakima Basin Fish and Wildlife Planning Board.

Galbreath, P.F., Beasley, C.A., Berejikian, B.A., Carmichael, R.W., Fast, D.E., Ford, M.J., Hesse, J.A., McDonald, L.L., Murdoch, A.R., Peven, C.M., and Venditti, D.A. 2008. Recommendations for Broad Scale Monitoring to Evaluate the Effects of Hatchery Supplementation on the Fitness of Natural Salmon and Steelhead Populations. Final Report. Ad Hoc Supplementation Monitoring And Evaluation Group.

Gallinat, M.P. 2004. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. 2003 Annual Report. Washington Department of Fish and Wildlife. Prepared for U.S. Fish and Wildlife Service. Boise, ID. Cooperative Agreement: 1411-03-J051.

Gallinat, M.P., J.D. Bungarner, L. Ross, and M. Varney. 2001. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. 2000 Annual Report. Washington Department of Fish and Wildlife. Prepared for U.S. Fish and Wildlife Service. Boise, ID. Cooperative Agreement: 1411-09-J070.

Gallinat, M.P., and L.A. Ross. 2005. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. 2004 Annual Report. Washington Department of Fish and Wildlife. Prepared for U.S. Fish and Wildlife Service. Boise, ID. Cooperative Agreement: 1411-04-J072.

Gallinat, M.P., and L.A. Ross. 2006. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. 2005 Annual Report. Washington Department of Fish and

Wildlife. Prepared for U.S. Fish and Wildlife Service. Boise, ID. Cooperative Agreement: 1411-05-J056.

Gallinat, M.P., and L.A. Ross. 2007. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. 2006 Annual Report. Washington Department of Fish and Wildlife. Prepared for U.S. Fish and Wildlife Service. Boise, ID. Cooperative Agreement: 1411-06-J013.

Gallinat, M.P., L.A. Ross, and M. Varney. 2003. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program. 2002 Annual Report. Washington Department of Fish and Wildlife. Prepared for U.S. Fish and Wildlife Service. Boise, ID. Cooperative Agreement: 1411-02-J050.

Geomatrix Consultants, Inc. 2007. Current Water Use Characterization and Monitoring Needs: Chumstick Creek Subwatershed, Wenatchee Watershed. Water Resource Technical Assistance, Chelan County, Washington. Chelan County Natural Resource Department. Wenatchee, WA.

Geomatrix Consultants, Inc. 2007. Current Water Use Characterization and Monitoring Needs: Mission Creek Subwatershed, Wenatchee Watershed. Water Resource Technical Assistance, Chelan County, Washington. Chelan County Natural Resource Department Wenatchee, WA.

Grabowski, S. 2007. Assessment of Sockeye Salmon Production Potential in the Cle Elum River Basin, Storage Dam Fish Passage Study, Yakima Project, Washington. Technical Series No. PN-YDFP-008. Bureau of Reclamation. Boise, Idaho.

Groot, C. and L. Margolis. 1991. Pacific Salmon Life Histories. Department of Fisheries and Oceans Biological Science Branch. UBC Press, Vancouver.

Harza/BioAnalysts, Inc. 2003. Chelan County Fish Barrier Inventory, draft. Prepared for Chelan County Planning Department. Chelan County, WA.

Haring, D. 2001. Habitat Limiting Factors: Yakima River Watershed. Water Resources Inventory Area 37-39 Final Report. Prepared for Washington Conservation Commission. Olympia, WA.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook--American River Spring Chinook Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Asotin Creek Summer Steelhead Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Lower Yakima Mainstem Fall Chinook Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Marion Drain Fall Chinook Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Methow River Spring Chinook Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Methow River Summer Chinook Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Methow River Summer Steelhead Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Methow River Coho Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Naches Spring Chinook Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Naches Summer Steelhead Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Okanogan River Spring Chinook Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Satus Creek Summer Steelhead Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Toppenish Creek Summer Steelhead Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Touchet River Summer Steelhead Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Upper Yakima Summer Steelhead Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Walla Walla River Summer Steelhead Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Walla Walla River Spring Chinook Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Wenatchee River Coho Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Wenatchee River Spring Chinook Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Wenatchee River Sockeye Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Wenatchee River Summer Chinook Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hatchery Scientific Review Group. 2009. Columbia River Hatchery Reform System-wide Report. Appendix E: Chinook—Yakima River Coho Population and Related Hatchery Programs. Prepared for U.S. Fish and Wildlife Service.

Hemmingsen, A.R., B.L. Bellerud, D.V. Buchanan, S.L. Gunckel, J.K. Shappart, and P.J. Howell. 2001. Bull Trout Life History, Genetics, Habitat Needs, and Limiting Factors in Central and Northeast Oregon. 1997 Annual Report. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. Project No. 95-54. Contract No. 94B134342.

Homer, C. C. Huang, L. Yang, B. Wylie and M. Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7, July 2004, pp. 829-840.

Hubble J., T. Newsome, and J. Woodward. 2004. Yakima Coho Master Plan. Prepared by Yakama Nation in cooperation with Washington State Department of Fish and Wildlife. Prepared for Yakima Klickitat Fisheries Project. Toppenish, WA.

Hubble, J., J. Woodward. 2003. Yakima Coho Master Plan. Yakima/Klickitat Fisheries Project. Toppenish, WA.

Hyatt, K.D., M.M. Stockwell, and D.P. Rankin. 2003. Impact and adaptation responses of Okanogan River sockeye salmon (Oncorhynchus nerka) to climate variation and change effects during freshwater migration: stock restoration and fisheries management implications. Canadian Water Resources Journal 28(4):689–713.

Interior Columbia Basin Technical Recovery Team. 2003. Independent Populations of Chinook, Steelhead, and Sockeye for Listed Evolutionarily Significant Units

Within the Interior Columbia River Domain- working draft. Northwest Fisheries Science Center, NOAA Fisheries. Seattle, WA.

Interior Columbia Basin Technical Recovery Team. 2007. Wenatchee River Spring Chinook Salmon Population- technical review draft. Prepared for Hatchery Scientific Review Group.

Johnson, B. 2000. Habitat Projects Completed within the Asotin Creek Watershed. Prepared for Bonneville Power Administration. Portland, OR. Project No. 1998-04600. BPA Report DOE/BP-11197-1.

Johnson, B. 2002. BPA Instream Habitat Projects Completed within Asotin Creek Watershed. Prepared for Bonneville Power Administration. Portland, OR. Project No. 2000-06700. BPA Report DOE/BP-00006202-1.

Johnson, B. 2002. Riparian Planting Projects Completed within Asotin Creek Watershed. Prepared for Bonneville Power Administration. Portland, OR. Project No. 2000-05300. BPA Report DOE/BP-00006436-1.

Johnson, B. 2002. BPA Riparian Fencing and Alternative Water Development Projects Completed within Asotin Creek Watershed. Prepared for Bonneville Power Administration. Portland, OR. Project No. 2000-05400. BPA Report DOE/BP-00006228-1.

Johnson M.V., D.E. Fast, B. Saluskin, W.J. Bosch, and S.J. Grabowski. 2008. Restoring Sockeye Salmon to the Yakima River Basin. Yakima/Klickitat Fisheries Project- poster. Toppenish, WA.

Johnson, P., M. Rayton, B.L. Nass and J. Arterburn. 2007. Enumeration of Salmonids in the Okanogan Basin Using Underwater Video. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. BPA Project No. 200302200.

Johnson, P., M. Rayton, and J. Arterburn. 2008. Enumeration of Salmonids in the Okanogan Basin Using Underwater Video. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. BPA Project No. 200302200.

Johnson, P.N., M.D. Rayton, and J.E. Arterburn. 2009. Enumeration of Salmonids in the Okanogan Basin Using Underwater Video. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. BPA Project No. 200302200.

Johnson, P., J. Arterburn, M. Rayton, and B. Miller. 2009. Okanogan Basin Monitoring and Evaluation Program 2008 Report. Colville Tribes Fish & Wildlife Department Anadromous Fish Division. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. CCT Account No. 3158. BPA Project No. 200302200. Contract No. 26654.

Jones & Stokes Environmental Consulting. 2004. Chelan County Natural Resource Program, Final Wenatchee River Channel Migration Zone Study - Phase II. April 16. Prepared for the Chelan County Natural Resource Program, Wenatchee, WA.

Kamphaus, C.M., K.G Murdoch, G.C. Robison, M.B. Collins, and R.F. Alford. 2009. Mid-Columbia Coho Reintroduction Feasibility Study: 2008 Annual Report. Prepared by Yakama Nation Fisheries Resource Management. Prepared for U.S. Department of Energy, Bonneville Power Administration, P.U.D. No. 1 of Chelan County, and P.U.D. No. 2 of Grant County. Project No. 1996-040-00. Contract No. 00022180.

Keefer, M.L. and C.A. Perry. 2008. A Literature Review Relevant to Juvenile Fall Chinook Salmon Habitat Use, Migration Behavior, and Survival in the Lower Snake River. Prepared for U.S. Army Corps of Engineers, Walla Walla District. Contract No. W912EF-08-D-0005.

Kistler, K., and J. Arterburn. 2007. The Okanogan Subbasin Water Quality and Quantity Report for Anadromous Fish in 2006. Prepared for U.S. Department of Energy, Bonneville Power Administration. BPA Project No. 200302200.

Kistler, K., J. Arterburn, and M. Rayton. 2006. 2005 Okanogan Basin Snorkel Surveys. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. BPA Project No. 200302200.

Kistler, K., J. Arterburn, and M. Rayton. 2007. 2006 Okanogan Basin Snorkel Surveys. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. BPA Project No. 200302200.

Kistler, K., J. Arterburn, C. Fisher, and M. Rayton. 2008. 2007 Okanogan Basin Snorkel Surveys. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, OR. BPA Project No. 200302200.

Kuttel, M. 2001. Salmonid Habitat Limiting Factors: Water Resource Inventory Area 32 Walla Walla Watershed. Prepared for Washington State Conservation Commission. Lacey, WA.

Kuttel, M. 2002. Salmonid Habitat Limiting Factors WRIA 33 (Lower) and 35 (Middle) Snake Watersheds, and Lower Six Miles of the Palouse River. Prepared for Washington State Conservation Commission. Lacey, WA.

Lawrence, S., and H. Alex. 2003. Okanogan River Sockeye Spawner Enumeration and Biological Sampling for 2002. Prepared by Okanagan Nation Fisheries Commission, Westbank, BC. Prepared for Douglas County Public Utility District Fish Water Management Tools Project.

Lindland, R.L. and B. Bowler. 1988. Clearwater River Development of Spring Chinook and Steelhead Stocks, Columbia River Fisheries Development Program. Annual Project Closing Report. Prepared for National Marine Fisheries Service. Contract No. NA-87-ABH-0006.

Long, K., M. Sqaukin, and C. Louie. 2006. Steelhead Spawner Enumeration in the Okanagan River mainstem and tributaries: Inkaneep, Vaseux and Shuttleworth creeks – 2006. Prepared for John Arterburn: Colville Confederated Tribes.

Mahoney, B.D. 2002. Walla Walla Basin Summer Steelhead and Bull Trout Radio Telemetry Project, 2001-2002 Progress Report. Prepared by Confederated

Tribes of the Umatilla Indian Reservation. Prepared for U.S. Department of Energy, Bonneville Power Administration. Portland, OR.

Mahoney B.D., M.B. Lambert, T.J. Olsen, E. Hoverson, P. Kissner, and J.D.M. Schwartz. 2006. Walla Walla Basin Natural Production Monitoring and Evaluation Project Progress Report, 2004 - 2005. Prepared by Confederated Tribes of the Umatilla Indian Reservation. Prepared for Bonneville Power Administration. Portland, OR. Project No. 2000-039-00.

Marmorek, D.R., M. Porter, D. Pickard and K. Wieckowski. 2007. Collaborative Systemwide Monitoring and Evaluation Project (CSMEP) – Year 4, Annual Report for FY 2007. Prepared by ESSA Technologies Ltd., Vancouver, B.C. on behalf of the Columbia Basin Fish and Wildlife Authority. Portland, OR. Project No. 2003-036-00.

Martin, K.D. 2005. Upper Charley Subwatershed Ecosystem Restoration Projects. Final Supplemental Environmental Impact Statement. Prepared by U.S. Department of Agriculture, Forest Service, Umatilla National Forest, Pomeroy Ranger District, Garfield County, WA.

Mastin, M.C. and J.J. Vaccaro. 2002. Watershed Models for Decision Support in the Yakima River Basin, Washington. U.S. Geological Survey. Tacoma, WA. Report 02-404.

Mayer, K., M. Schuck, and D. Hathaway. 2008. Assess Salmonids in the Asotin Creek Watershed: 2007 Annual Report. Prepared for U.S. Department of Energy, Bonneville Power Administration. Portland, OR. BPA Project No. 2002-053-00. Intergovernmental Contract No. 30626.

Mayer, K., M. Schuck, S. Wilson, and B.J. Johnson. 2006. Assess Salmonids in the Asotin Creek Watershed: 2005 Annual Report. Prepared for U.S. Department of Energy, Bonneville Power Administration. Portland, OR. Project No. 2002-053-00. Contract No. 00018229 and 00022720.

McGowan, V.R., R.M. Powell, and S.P. Stennfeld. 2001. Grande Ronde Basin Fish Habitat Enhancement Project: 2000 Annual Report. Prepared for U.S. Department of Energy, Bonneville Power Administration. Portland, OR. Project No. 8402500. Contract No. DE-BI79-84BP16114 and 99BI16565.

McIntosh, B., S. Clarke, and J. Sedell. 1990. Bureau of Fisheries Stream Habitat Surveys. Project No. 1989-10400. BPA Report DOE/BP-02246-1.

Mendel, G., C. Fulton, and R. Weldert. 2003. An Investigation into the Migratory Behavior of Bull Trout (Salvelinus confluentus) in the Touchet River Basin. Prepared by Washington Department of Fish and Wildlife. Dayton, WA.

Mendel, G. M., Gembala, J. Trump, and C. Fulton. 2006. Baseline Assessment of Salmonids in Tributaries of the Snake and Grande Ronde Rivers in Southeast Washington: 2005 Annual Report. Prepared by Washington Department of Fish and Wildlife. Prepared for Asotin County Conservation District.

Mendel, G., D. Karl, and T. Coyle. 2000. Assessment of Salmonid Fishes and Their Habitat Conditions in the Walla Walla River Basin of Washington: 1999 Annual Report. Prepared by Washington Department of Fish and Wildlife. Prepared for U.S. Department of Energy, Bonneville Power Administration. Portland, OR. Project No. 98020-00. Contract No. 98BI07035.

Mendel, G., V. Naef, and D. Karl. 1999. Assessment of Salmonid Fishes and Their Habitat Conditions in the Walla Walla River Basin: 1998 Annual Report. Prepared by Washington Department of Fish and Wildlife. Prepared for U.S. Department of Energy, Bonneville Power Administration. Portland, OR. Project No. 98-20. Contract No. 98BI07035.

Mendel, G., K. Petersen, R. Bugert, D. Milks, L. Ross, J. Dedloff, and L. LaVoy. 1992. Lower Snake River Compensation Plan: Lyons Ferry Fall Chinook Salmon Hatchery Program. 1991 Evaluation Report. Prepared for U.S. Fish and Wildlife Service. Boise, ID. Cooperative agreement 14-16-0001-91534. AF 1/LSR-92-12.

Mendel, G., J. Trump, and M. Gembala. 2003. Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin within Washington. Project No. 1998-02000. BPA Report DOE/BP-00006502-1.

Mendel, G., J. Trump, M. Gembala. 2004. Assessment of Salmonids and their Habitat Conditions in the Walla Walla River Basin within Washington: 2003-2004 Annual Report. Project No. 199802000. BPA Report DOE/BP-00006502-2.

Mendel, G., J. Trump, M. Gembala, S. Blankenship, and T. Kassler. 2007. Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin within Washington: 2006 Annual Report. Prepared by Washington Department of Fish and Wildlife. Prepared for U.S. Department of Energy, Bonneville Power Administration. Portland, OR. Project No. 199802000. Contract No. 00021599.

Miller, D.J. 2003a. Programs for DEM analysis (Netstream). Available online at www.fsl.orst.edu/clams/prj_wtr_millerprg.html ; Earth Systems Institute, Seattle, WA. 38 p.

Miller, D. J. 2003b. Programs for DEM Analysis, Netstream. in Landscape Dynamics and Forest Management, General Technical Report RMRS-GTR-101CD. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO, USA.

Miller, J., T. Hillman, M. Miller, M. Tonseth, T. Miller, K. Truscott, and A. Murdoch. 2009. Monitoring and Evaluation of the Chelan County PUD Hatchery Programs. 2008 Annual Report. Prepared for HCP Hatchery Committee. Wenatchee, WA.

Miller, J., T. Hillman, C. Peven, M. Miller, M. Tonseth, T. Miller, K. Truscott, and A. Murdoch. 2008. Monitoring and Evaluation of the Chelan County PUD Hatchery Programs. 2007 Annual Report. Prepared for HCP Hatchery Committee. Wenatchee, WA.

Miller, T. 2005. 2004 Upper Columbia River Summer Chinook Spawning Ground Surveys. Prepared by Washington Department of Fish and Wildlife. Prepared for Chuck Peven, Wenatchee, WA.

Miller, T., and M. Tonseth. 2009. The Integrated Status and Effectiveness Monitoring Program Expansion of Existing Smolt Trapping Program and Steelhead Spawner Surveys. Prepared for Bonneville Power Administration. Portland, OR. Project No. 2003-017-00. Contract No. 31661.

Mizell, M. and E. Anderson. 2008. Draft Report Monitoring Federally Listed Bull Trout (Salvelinus confluentus) Movements Proximate to Bureau of Reclamation Dams in the Yakima Basin. Prepared for Bureau of Reclamation.

Montgomery Water Group, Inc., Economic and Engineering Services, Inc., and Pacific Groundwater Group, Inc. 2003. Wenatchee River Basin Watershed Assessment. Prepared for Wenatchee Watershed Planning Unit and Chelan County Natural Resource Program. Wenatchee, WA.

Moran, P. 2003. Genetic structure of Oncorhynchus mykiss populations in the Grande Ronde River, Imnaha River, and adjacent regions of the Snake River Basin. Final Report submitted to the U.S. Fish & Wildlife Service, Lower Snake River Compensation Plan Office. Boise, Idaho. In partial fulfillment of Contract No.14110-1-H070 between the U.S. Fish & Wildlife Service and the National Marine Fisheries Service.

Mosey, T.R. and L.J. Murphy. 2002. Spring and summer Chinook spawning ground surveys on the Wenatchee River Basin: 2001. Prepared for Chelan County Public Utility District. Wenatchee, WA.

Murdoch, A. 2005. Integrated Status & Effectiveness Monitoring Program Expansion of Existing Smolt Trapping Program and Steelhead Spawner Surveys: draft annual report 2005. Prepared for Bonneville Power Administration. Portland, OR. BPA Project No. 2003-017-00. Contract No. 17447.

Murdoch, A.R. and C. Peven. 2005. Conceptual Approach to Monitoring and Evaluating the Chelan County Public Utility District Hatchery Programs. Final Report. Prepared for Chelan PUD Habitat Conservation Plan's Hatchery Committee.

Murdoch, A.R., T.N. Pearsons, T.W. Maitland, C.L. Deason, M.F. Ford, and K. Williamson. 2007. Monitoring and the reproductive success of naturally spawning hatchery and natural spring Chinook salmon in the Wenatchee River. Prepared for Bonneville Power Administration. Portland, OR. BPA Project No. 2003-039-00. Contract No. 00020391.

Murdoch, A.R., T.N. Pearsons, T.W. Maitland, M.F. Ford, and K. Williamson. 2005. Monitoring the reproductive success of naturally spawning hatchery and natural spring Chinook salmon in the Wenatchee River. Prepared for Bonneville Power Administration. Portland, OR. BPA Project No. 2003-039-00.

Murdoch, A.R., T.N. Pearsons, T.W. Maitland, M.F. Ford, and K. Williamson. 2006. Monitoring the reproductive success of naturally spawning hatchery and natural spring Chinook salmon in the Wenatchee River. Prepared for Bonneville Power Administration. Portland, OR. BPA Project No. 2003-039-00, Contract No. 0002139.

Murdoch, A.R., T. Pearsons, T.W. Maitland, M. Ford, and K.S. Williamson. 2009. Monitoring the reproductive success of naturally spawning hatchery and natural spring Chinook salmon in the Wenatchee River. Prepared for Bonneville Power Administration. Portland, OR. BPA Project No. 2003-039-00. Contract No. 41346 and 41826.

National Marine Fisheries Service. 2003. NMFS Endangered Species Act (ESA) Section 7 Consultation, Biological Opinion, and Magnuson-Stevens Act- Essential Fish Habitat Consultation. ESA Section 7 Consultation No. 1999/01883. BiOp UCR unlisted species and permit 1347.

National Marine Fisheries Service. 2009. Proposed Middle Columbia River Steelhead Distinct Population Segment. Prepared by National Marine Fisheries Service: Northwest Region. ESA Recovery Plan. Pp 241.

National Marine Fisheries Service, U.S. Fish and Wildlife Service, U. S. Forest Service, Washington Department of Fish and Wildlife, Confederated Tribes of the Yakama Indian Nation, Confederated Tribes of the Colville Indian Reservation, Confederated Tribes of the Umatilla Indian Nation, Chelan County Public Utility District, Douglas County Public Utility District and Grant County Public Utility District. 1998. Aquatic Species and Habitat Assessment: Wenatchee, Entiat, Methow, and Okanogan Watersheds. Prepared for Chelan County Public Utility District No. 1. Wenatchee, WA.

Nelle, R.D., and J. Moberg. 2008. A Field Manual of Scientific Protocols for Steelhead Redd Surveys within the Upper Columbia Monitoring Strategy. 2008 Working Version 1.0. Prepared for Bonneville Power Administration's Integrated Status and Effectiveness Monitoring Program.

Nelson, M.C. and R.D. Nelle. 2007. Upper Columbia Recovery Unit Bull Trout Telemetry Project: 2005 Progress Report for the Methow River Core Area. Upper Columbia Bull Trout Project FONS # 2001-002. Prepared by U.S. Fish and Wildlife Service, Mid-Columbia River Fishery Resource Office. Leavenworth, WA.

Nelson, M.C, A. Johnsen, D. Pearson, and R.D. Nelle. 2009. Seasonal movements of adult fluvial bull trout in Icicle Creek, WA: 2008 Annual Report. Prepared by U.S. Fish and Wildlife Service. Leavenworth WA.

Nichols, R. 2006. A place to come home to: Ceremony marks return of salmon, tradition to Colville Reservation. USDA, Natural Resources Conservation Service, Conservation Showcase. Online

Northwest Power and Conservation Council. "Asotin Subbasin Plan." In Columbia River Basin Fish and Wildlife Program. Portland, Oregon, 2005a.

Northwest Power and Conservation Council. "Methow Subbasin Plan." In Columbia River Basin Fish and Wildlife Program. Portland, Oregon, 2005b.

Northwest Power and Conservation Council. "Okanogan Subbasin Plan." In Columbia River Basin Fish and Wildlife Program. Portland, Oregon, 2005c.

Northwest Power and Conservation Council. "Snake Lower Subbasin Plan." In Columbia River Basin Fish and Wildlife Program. Portland, Oregon, 2005d.

Northwest Power and Conservation Council. "Tucannon Subbasin Plan." In Columbia River Basin Fish and Wildlife Program. Portland, Oregon, 2005e.

Northwest Power and Conservation Council. "Walla Walla Subbasin Plan." In Columbia River Basin Fish and Wildlife Program. Portland, Oregon, 2005f.

Northwest Power and Conservation Council. “Wenatchee Subbasin Plan.” In Columbia River Basin Fish and Wildlife Program. Portland, Oregon, 2005g.

Northwest Power and Conservation Council. “Yakima Subbasin Plan.” In Columbia River Basin Fish and Wildlife Program. Portland, Oregon, 2005h.

ODFW Natural Resources Information Management Program. October 2006. Snake River Steelhead MPG. Joseph Creek Steelhead Population.

Oregon Department of Fish and Wildlife. 2006. Joseph Creek Steelhead Population Limiting Factors and Threats. Draft. Prepared by Oregon Department of Fish and Wildlife, Fisheries Research. Salem, OR.

Parametrix, Inc., and Hardin-Davis. 1984. Initial Flow Recommendations Yakima River Basin. Appendices to Final Report. U.S. Department of Interior Bureau of Reclamation. Boise, ID. Document No. 84-1016-0017F.

Parametrix, Inc., and Hardin-Davis. 1984. Review of Existing IFIM Data Yakima River Basin. Final Report. Prepared for U.S. Department of Interior Bureau of Reclamation. Boise, ID. Document No. 84-10310018F.

Parametrix, Inc., and Hardin-Davis. 1984. Initial Flow Recommendations: Yakima River Basin. Final Report. Prepared for U.S. Department of Interior Bureau of Reclamation. Boise, ID. Document No. 84-1031-0019F.

Peven, C. 2003. Population Structure, Status and Life Histories of Upper Columbia Steelhead, Spring and Summer/fall Chinook, Sockeye, Coho Salmon, Bull Trout, Westslope Cutthroat Trout, Non-migratory Rainbow Trout, Pacific Lamprey, and Sturgeon.

Park, Donn L. 1990. Status and Future of Spring Chinook Salmon in the Columbia River Basin—Conservation and Enhancement. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS F/NWC-187.

Quinn, T.P. 2005. The Behavior and Ecology of Pacific Salmon and Trout. University of Washington Press, Seattle, WA.

Rayton, M.D. and J.E. Arterburn. 2008. 2007 Okanogan Basin Monitoring & Evaluation Program Rotary Screw Trap Report. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, PO Box 3621, Portland, OR 97208. BPA Project No. 200302200.

RH2 Engineering, Inc. 2007. Watershed Plan WRIA 40A (Squilchuck/Stemilt). Final Plan- May 2007. Prepared for WRIA 40A Planning Unit.

Schwartz, J.D., P. Kissner, M. Lambert, B. Mahoney, and C. Contor. 2005. The Walla Walla Basin Natural Production Monitoring and Evaluation Project Progress Report 2003. Prepared by Confederated Tribes of the Umatilla Indian Reservation. Pendleton, OR. Prepared for U.S. Department of Energy, Bonneville Power Administration. Portland, OR. Project No. 2000-039-00. Contract No. 13171.

Small, M.P., C. Dean, and A. Murdoch. 2009. Genetic Monitoring of Methow Spring Chinook – Progress Report. Prepared by Washington Department of Fish and Wildlife Genetics Lab.

Smith, C.J. 2005. Salmon Habitat Limiting Factors in Washington State. Prepared by and for Washington State Conservation Commission. Olympia, WA.

Smith, S.G., W.D. Muir, D.M. Marsh, J.G. Williams and J.R. Skalski. 2005. Survival Estimates for the Passage of Spring-Migrating Juvenile Salmonids through Snake and Columbia River Dams and Reservoirs, 2004. Prepared for U.S. Department of Energy, Bonneville Power Administration. Contract No. 00004922, Project No. 199302900.

Snake River Salmon Recovery Board. 2007. Technical Document. Snake River Salmon Recovery Plan for SE Washington. December 2006 Version. Prepared by Snake River Salmon Recovery Board. Prepared for Washington Governor's Salmon Recovery Office. Olympia, WA.

Snow, C., C. Frady, A. Fowler, A. Murdoch, M. Small, K.I. Warheit, and C. Dean. 2007. Monitoring and Evaluation of Wells and Methow Hatchery Programs in 2006. Prepared by Washington Department of Fish and Wildlife, Supplementation Research Team, Methow Field Office, Twisp, WA, and Washington Department of Fish and Wildlife, Conservation Unit, Genetics Lab, Olympia, WA. Prepared for Douglas County Public Utility District and Wells Habitat Conservation Plan Hatchery Committee.

Snow, C., C. Frady, A. Fowler, and A. Murdoch. 2008. Monitoring and Evaluation of Wells and Methow Hatchery Programs in 2007. Prepared for Douglas County Public Utility District and Wells Habitat Conservation Plan Hatchery Committee. Prepared by Washington Department of Fish and Wildlife, Supplementation Research Team, Methow Field Office, Twisp, WA.

Underwood, K., S. Martin, M. Schuck, A. Scholz. 1992. Investigations of Bull Trout (Salvelinus confluentus), Steelhead Trout (Oncorhynchus mykiss), and Spring Chinook Salmon (0. tshawytscha) Interactions in Southeast Washington Streams. Project No. 1990-05300. BPA Report DOE/BP-17758-2.

Upper Columbia Salmon Recovery Board. 2007. Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan, Appendix H. June 2002 Draft. Prepared by Upper Columbia Salmon Recovery Board, Chelan, Washington. Prepared for NOAA Fisheries and U.S. Fish and Wildlife Service.

U.S. Army Corps of Engineers. 2007. Lower Snake River Compensation Plan Annual Report. Fiscal Year 2007. Prepared by Lower Snake River Compensation Plan Program Office. Prepared for U.S. Department of Energy, Bonneville Power Administration and U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service. 2002. Chapter 24, Snake River Washington Recovery Unit, Oregon. In: U.S. Fish and Wildlife Service. Bull Trout (Salvelinus confluentus) Draft Recovery Plan. Portland, OR.

U.S. Forest Service, U.S. Fish and Wildlife Service, Bureau of Reclamation, and The Wild Fish Conservancy. 2008. Methow Sub-Basin Bull Trout Redd Survey Reports.

U.S. Forest Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, and Washington Department of Fish and Wildlife. 2006. Methow Sub-Basin Bull Trout Redd Survey Reports.

Homer, C., J. Dewitz, J. Fry, M. Coan, N. Hossain, C. Larson, N. Herold, A. McKerrow, J.N. VanDriel, and J. Wickam. 2001. Completion of the 2001 National Land Cover Database for the Coterminous United States. USGS National Land Cover Data Set. Land Use and Land Cover by Subbasin. http://www.mrlc.gov/index.php

Vadas, R.L. Jr. 1991. Seasonal habitat use, species associations, and assemblage structure of forage fishes in Goose Creek, northern Virginia. 1. Macrohabitat patterns. Journal of Freshwater Ecology 6(4):403-417.

Vadas, R.L. Jr. 1997. Integrity of riparian and aquatic habitat in two agriculturally impacted stream valleys of southern British Columbia. Prepared for Environment Canada, Environmental Conservation Branch, Aquatic and Atmospheric Sciences Division. DOE FRAP 1998-27. (http://research.rem.sfu.ca/frap/9827.pdf).

Vadas, R.L. Jr., H.A. Beecher, S.N. Boessow, and K.A. Enseñat. 2008. Coastal cutthroat trout ecohydrology and habitat use in Irely Creek, Washington (extended abstract). In P.J. Connolly, T.H. Williams, and R.E. Gresswell (eds). The 2005 coastal cutthroat trout symposium: status, management, biology, and conservation. American Fisheries Society, Oregon Chapter. Portland, OR.

Vadas, R.L. Jr., and D.J. Orth. 1998. Use of physical variables to discriminate visually determined mesohabitat types in North American streams. Rivers 6:143-159

Volkhart, G., P. Toppping, L. Fleischer, T. Miller, S. Schonning, D. Rawding, and M. Groesbeck. 2005. 2004 Juvenile Salmonid Production Evaluation Report Green River, Wenatchee River and Cedar Creek. Prepared for The Washington Salmon Recovery Funding Board.

Wahle, R.J. and R.E. Pearson. 1984. History of artificial propagation of coho salmon Oncorhynchus kisutch, in the Mid-Columbia River system. Marine Fisheries Review 46(3):34 – 43.

Wargo, L., and M. Schuck. 2000. Touchet River Instream Habitat Alteration Projects-1999 Habitat Evaluation Surveys. Prepared for Columbia Conservation District Dayton, WA.

Wargo, L., J. Bumgarner, and M. Schuck. 2000. Asotin Creek Instream Habitat Alteration Projects-1999 Habitat Evaluation Surveys. Prepared for Asotin County Conservation District Clarkston, WA.

Washington State Department of Ecology and Washington Department of Fish and Wildlife. 2003. Washington Water Acquisition Program: Finding Water To Restore Streams. Ecology Publication No. 03-11-005.

Washington Department of Fisheries, et al. 1990. Snake River Subbasin (Mainstem from Mouth to Hells Canyon Dam) Salmon and Steelhead Production Plan.

Prepared for Northwest Power Planning Council and Agencies and Indian Tribes of the Columbia Basin Fish and Wildlife Authority.

Washington Department of Fish and Wildlife. 2005. Chiwawa River Spring Chinook Hatchery and Genetic Management Plan-draft. Wenatchee, WA.

Washington Department of Fish and Wildlife. 2005. Lake Wenatchee Sockeye Hatchery and Genetic Management Plan-draft. Wenatchee, WA.

Washington Department of Fish and Wildlife. 2005. WDFW Tucannon River Endemic Stock Summer Steelhead-Tucannon River Release, Hatchery and Genetic Management Plan. Dayton, WA.

Washington Department of Fish and Wildlife. 2005. Upper Columbia River Fall Chinook Salmon Hatchery Program, Priest Rapids Hatchery. Hatchery and Genetic Management Plan. Mattawa, WA.

Washington Department of Fish and Wildlife. 2005. Upper Columbia River Spring-run Chinook Salmon-White River Supplementation Hatchery and Genetic Management Plan. Wenatchee, WA.

Washington Department of Fish and Wildlife. 2005. Wenatchee River Summer Chinook (Dryden Acclimation Pond) Hatchery and Genetic Management Plan. Wenatchee, WA.

Washington Department of Fish and Wildlife. 2006. Guidance Ranking Puget Sound Streams for Low Flow Enhancement A Watershed Based Methology-draft. Olympia, WA.

Washington Department of Fish and Wildlife. 2007. Fish Life Qualitative Parameters for Assessment of Instream Flow Proposals. White paper utilized during Procedures for Evaluating 2007 Yakima Basin Reverse Water Auction.

Washington Department of Fish and Wildlife. Survey memos.

Washington Department of Fish and Wildlife and Washington Department of Ecology 2004. Instream flow study guidelines: technical and habitat-suitability issues. Publication 04(11-07). 65 pp. (http://www.ecy.wa.gov/pubs/0411007.pdf).

Washington Department of Fish and Wildlife, Confederated Tribes and Bands of the Yakama Nation, Chelan County Public Utility District, and BioAnalysts, Inc. 2009. Monitoring and Evaluation of the Chelan County PUD Hatchery Programs, 2008 Annual Report. Prepared for HCP Hatchery Committee. Wenatchee, WA.

WRIA 45 Planning Unit. 2006. Final Wenatchee Watershed Management Plan. Document No. 043-1284.203.

The Watershed Company, and ICF Jones and Stokes. 2009. Draft Shoreline Inventory and Analysis Report for Shorelines in Chelan County and the Cities of Cashmere, Chelan, Entiat, Leavenworth and Wenatchee. Prepared for Chelan County Natural Resources Department. Wenatchee, WA.

Upper Columbia Salmon Recovery Board 2007. Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan. Upper Columbia Salmon Recovery Board 352 pp.

Yakama Nation - Yakima/Klickitat Fisheries Project. 2007. Yakima/Klickitat Fisheries Project Monitoring and Evaluation Final Report. The Confederated Tribes and

Bands of the Yakama Nations. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 1995-063-25. Contract No. 00027798.

Yakama Nation - Yakima/Klickitat Fisheries Project. 2008. Yakima/Klickitat Fisheries Project Monitoring and Evaluation Final Report. The Confederated Tribes and Bands of the Yakama Nation. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 1995-063-25. Contract No. 00035037.

Yakama Nation - Yakima/Klickitat Fisheries Project. 2009. Yakima/Klickitat Fisheries Project Monitoring and Evaluation Final Report. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 1995-063-25. Contract No. 00037822. Document ID No. P112744.

Yakima/Klickitat Fisheries Project Genetic Studies Annual Report. 2008. DNA-Based Stock-of-Origin Assignments of Chinook Salmon Smolts Outmigrating Past Chandler Trap (Yakima River) in 2007. Chapter 4 of the Yakima/Klickitat Fisheries Project Genetic Studies Annual Report. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Project No. 1995-063-25. Contract No. 00034450. Document ID No. P106829.

Yakima Basin Fish and Wildlife Recovery Board. 2009. 2009 Yakima Steelhead Recovery Plan. Extracted from the 2005 Yakima Subbasin Salmon Recovery Plan. Final Plan, September 30, 2009.

X. Tables

Table A-1 Sample of All_Encompassing_Reach_Information spreadsheet

	A	B	C	D	E	F	G	H	I	J	K	L	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF
1	CRIA_ID	WRIA	Reach_Name	LLID	GAUGE	OLD_STUDY	REACH_DESCR	TRIBUTARY_TO	GIS_BEG	GIS_END	RCH_LNGTH_FT	RCH_LNGTH_MI	Off_Channel_Habitat	Floodplain_Connectivity	Riparian_Condition	Spawning_Suitability	Rearing_Suitability	Passage_Condition	FISH_SCO	FISH_BIN	FLOW_SCO	FLOW_Old	FLOW_BIN	HAB_SCO	HAB_BIN	
2	3224	32	Blue Creek	1181536460611	USGS 14013500	Yes	Mouth to Laird Creek	Mill Creek (Reach 2)	0.0	5.0	26,586	5.04	1	1	2	2	3	2	0.66	2	9	3	2	15	3	
3	3234	32	Caldwell Creek	1183374460341		No	Mouth to Shelton Road (whole strea	Yellowhawk Creek	0.0	2.4	12,623	2.39	1	1	2	2	2	1	0.40	2	12	1	1	11	2	
4	3223	32	Cold Creek	1184604460466		No	To upper extent of frog ponds E of M	Mill Creek (Reach 1)	0.0	3.5	18,656	3.53	1	1	1	2	1	1	0.50	2	20	1	1	12	2	
5	3208	32	Coppei Creek	1181741462722	ECY 32G060	Yes	Mouth to Coppei Creek forks	Touchet River (Reach 2)	0.0	8.0	42,323	8.02	1	1	2	2	2	2	0.50	2	18	1	1	11	2	
6	3229	32	Cottonwood Creek	1183638460272	ECY 32M100	Yes, but NF is exclude	Mouth to North Fork Cottonwood Cre	Yellowhawk Creek	0.0	6.6	35,111	6.65	1	1	2	1	2	2	0.40	2	12	3	1	10	1	
7	3222	32	Doan Creek	1184710460409		No	Mouth to Last Chance Road? At lon	Mill Creek (Reach 1)	0.0	4.4	23,184	4.39	1	1	1	1	2	1	0.50	2	12	1	1	12	2	
8	3215	32	Dry Creek	1185925460511	ECY 32F150	Yes	Mouth to North Fork Dry Creek	Walla Walla River (Reach 2)	0.0	35.2	185,668	35.16	2	2	2	1	2	2	0.50	2	18	1	1	10	1	
9	3225	32	East Little Walla Walla River	1184113460197	ECY 32H090	No	Mouth to Oregon border	Walla Walla River (Reach 3)	0.0	2.0	10,568	2.00	1	2	1	2	2	1	0.50	2	32	1	1	15	3	
10	3218	32	Mill Creek (Reach 1)	1184778460386	ECY 32C070	Yes, but as two reache	Mouth to Bennington Dam	Walla Walla River (Reach 2)	0.0	12.4	65,410	12.39	1	1	1	2	2	1	1.00	3	14	1	1	8	1	
11	3219	32	Mill Creek (Reach 2)	1184778460386	USGS 14015000, US	Yes, but as two reache	Bennington Dam to Blue Creek	Mill Creek (Reach 1)	12.4	18.3	31,268	5.92	2	2	2	3	3	2	0.88	3	6	3	3	16	3	
12	3220	32	Mill Creek (Reach 3)	1184778460386	USGS 14013000	Yes, but as two reache	Blue Creek to Oregon border	Mill Creek (Reach 2)	18.3	23.5	27,185	5.15	3	2	2	3	3	2	1.00	3	10	1	2	16	3	
13	3214	32	Mud Creek	1186189460476		No	Mouth (lower) to Locher Road	Walla Walla River (Reach 2)	0.0	10.1	53,089	10.05	1	1	1	1	1	1	0.27	1	16	1	1	6	1	
14	3209	32	North Fork Coppei Creek	1181085461900		Yes	Confluence to falls above Coppei Sp	Coppei Creek	0.0	4.5	23,756	4.50	2	2	2	3	3	2	0.40	2	12	1	1	16	3	
15	3216	32	North Fork Dry Creek	############		No	Mouth to tributary at GIS RM 3.0	Dry Creek	0.0	3.0	15,979	3.03	1	1	1	1	1	1	0.40	2	6	3	3	16	3	
16	3211	32	North Fork Touchet River (Reach 1)	1179588463015	ECY 32E050	Yes	Mouth to Wolf Fork	Touchet River (Reach 3)	0.0	3.9	20,357	3.86	1	1	1	3	3	2	0.88	3	4	3	3	13	2	
17	3212	32	North Fork Touchet River (Reach 2)	1179588463015	ECY 32E150	Yes	Wolf Fork to Forest Service boundry	North Fork Touchet River (Reach 1)	3.9	15.4	60,813	11.52	2	2	2	3	3	2	1.00	3	12	3	1	16	3	
18	3226	32	Patit Creek	1179841463198		Yes	Mouth to confluence of North and W	Touchet River (Reach 3)	0.0	7.8	41,297	7.82	1	1	1	2	2	1	0.50	2	12	2	1	8	1	
19	3213	32	Pine Creek	1186528460280		Yes	Mouth to Oregon border	Walla Walla River (Reach 2)	0.0	5.3	27,817	5.27	1	1	1	1	1	2	0.50	2	12	1	1	6	1	
20	3210	32	South Fork Touchet River	1179588463025	ECY 32L070	Yes	Mouth to Griffen Fork	Touchet River (Reach 3)	0.0	14.8	78,014	14.78	1	2	1	3	3	3	0.86	3	15	2	1	15	3	
21	3231	32	Titus Creek (Reach 1)	1182772460768		No	Mouth to Five Mile Bridge	Mill Creek (Reach 1)	0.0	2.7	14,441	2.74	1	1	2	1	2	1	0.40	2	0.5	1	3	8	1	
22	3232	32	Titus Creek (Reach 2)	1182772460768		No	Five Mile Bridge to Mill Creek	Mill Creek (Reach 1)	2.7	4.5	9,357	1.77	1	1	2	1	2	1	0.40	2	0.5	2	3	15	3	
23	3205	32	Touchet River (Reach 1)	1186823460337	ECY 32B075	Yes, but as two reache	Mouth to Hofer Dam	Walla Walla River (Reach 1)	0.0	5.0	26,341	4.99	1	1	1	1	1	2	0.94	3	4	3	3	8	1	
24	3206	32	Touchet River (Reach 2)	1186823460337	ECY 32B100	Yes, but as two reache	Hofer Dam to Coppei Creek	Touchet River (Reach 1)	5.0	50.7	241,441	45.73	1	1	2	2	2	3	0.78	3	7	1	2	11	2	
25	3207	32	Touchet River (Reach 3)	1186823460337	ECY 32B110	Yes, but as two reache	Coppei Creek to Touchet River forks	Touchet River (Reach 2)	50.7	64.2	70,972	13.44	2	2	2	3	3	3	0.85	3	6	1	3	14	2	
26	3201	32	Walla Walla River (Reach 1)	1189393460624	USGS 14018500	Yes	Mouth to Touchet River	Columbia River	0.0	23.1	122,219	23.15	2	2	2	2	2	2	0.94	3	6	1	3	9	1	
27	3202	32	Walla Walla River (Reach 2)	1189393460624	ECY 32A100	Yes	Touchet River to Mill Creek	Walla Walla River (Reach 1)	23.1	37.5	75,984	14.39	1	1	1	2	2	2	0.94	3	7	1	2	10	1	
28	3203	32	Walla Walla River (Reach 3)	1189393460624	ECY 32A105, ECY 32	Yes	Mouth to Oregon border	Walla Walla River (Reach 2)	37.5	44.5	36,912	6.99	1	1	1	2	2	2	0.85	3	6	1	3	11	2	
29	3233	32	Walsh Creek	1184406460167		No	Mouth to pond on farm bordering Or	West Little Walla Walla River	0.0	2.8	14,720	2.79	1	1	1	1	1	1	0.40	2	16	1	1	13	2	
30	3217	32	West Little Walla Walla River	1184802460383		No	Mouth to Oregon border	Walla Walla River (Reach 2)	0.0	5.7	30,328	5.74	1	1	1	1	2	1	0.50	2	3	3	3	10	1	
31	3227	32	West Patit Creek	1178565463363		No	Mouth to Forest Service boundary	Patit Creek	0.0	9.3	49,310	9.34	1	1	1	1	2	1	0.50	2	6	3	3	15	3	
32	3230	32	Whisky Creek	1181170462728		Yes	Mouth to tributary at GIS RM 6.0	Touchet River (Reach 3)	0.0	6.0	31,505	5.97	1	1	2	2	2	2	0.47	2	12	2	1	11	2	
33	3235	32	Wolf Fork	1178953462742	ECY 32K070	No	Mouth to USFS boundary	North Fork Touchet River (Reach 1)	0.0	12.5	65,926	12.49	1	2	2	3	3	2	1.00	3	15	3	1	17	3	
34	3228	32	Yellowhawk Creek	1183998460169	ECY 32D060	Yes	Mouth to Mill Creek	Walla Walla River (Reach 3)	0.0	9.0	47,319	8.96	1	1	1	1	1	3	0.61	2	21	1	1	10	1	
35	3511	35	Alkali Flat Creek	1180869465756		Yes	Mouth to Little Alkalai Flat Creek	Snake River (Reach 1)	0.0	30.5	160,915	30.48	1	1	1	1	1	1	0.51	2	12	1	1	8	1	
36	3512	35	Almota Creek	1174691466997	ECY 35L050	No	Mouth to La Follette Road	Snake River (Reach 1)	0.0	7.9	41,705	7.90	1	2	2	2	2	3	0.46	2	12	3	1	16	3	
37	3513	35	Alpowa Creek	1171999464202	ECY 35K050	Yes, but as two reache	Mouth to Road 128 crossing	Snake River (Reach 1)	0.0	23.5	124,167	23.52	2	2	2	2	2	3	0.46	2	21	1	1	14	2	
38	3508	35	Asotin Creek (Reach 1)	1170531463443	USGS 13335050	Yes	Mouth to George Creek	Snake River (Reach 2)	0.0	3.2	16,759	3.17	1	1	1	1	2	3	0.58	2	10	2	2	13	2	
39	3509	35	Asotin Creek (Reach 2)	1170531463443	ECY 35D100	Yes	George Creek to Asotin Creek forks	Asotin Creek (Reach 1)	3.2	15.3	63,847	12.09	2	1	2	3	3	2	0.38	2	12	2	1	15	3	

Reach_Data_Aggregate | Non-GIS_Scores | NHD_Flow | Dictionary | Reachstatstls

Ready 70%

Table A-2 CRIA Stream Reach Definitions

CRIA_ID	Reach_Name	LLID	GAUGE	OLD_STUDY	REACH_DESCR	Start RM	End RM	Length (Ft.)	Length (Mi.)
3201	Walla Walla River (Reach 1)	**1189393460624**	USGS 14018500	Yes	Mouth to Touchet R	0.0	23.1	122,219	23.15
3202	Walla Walla River (Reach 2)	1189393460624	ECY 32A100	Yes	Touchet R to Mill Ck	23.1	37.5	75,984	14.39
3203	Walla Walla River (Reach 3)	1189393460624	ECY 32A105, ECY 32A120	Yes	Mouth to Oregon border	37.5	44.5	36,912	6.99
3205	Touchet River (Reach 1)	1186823460337	ECY 32B075	Yes, but as two reaches, not three	Mouth to Hofer Dam	0.0	5.0	26,341	4.99
3206	Touchet River (Reach 2)	1186823460337	ECY 32B100	Yes, but as two reaches, not three	Hofer Dam to Coppei Ck	5.0	50.7	241,441	45.73
3207	Touchet River (Reach 3)	1186823460337	ECY 32B110	Yes, but as two reaches, not three	Coppei Ck to Touchet R forks	50.7	64.2	70,972	13.44
3208	Coppei Creek	1181741462722	ECY 32G060	Yes	Mouth to Coppei Ck forks	0.0	8.0	42,323	8.02
3209	North Fork Coppei Creek	1181085461900		Yes	Confluence to falls above Coppei Springs	0.0	4.5	23,756	4.50
3210	South Fork Touchet River	1179588463025	ECY 32L070	Yes	Mouth to Griffen Fork	0.0	14.8	78,014	14.78
3211	North Fork Touchet River (Reach 1)	1179588463015	ECY 32E050	Yes	Mouth to Wolf Fork	0.0	3.9	20,357	3.86
3212	North Fork Touchet River (Reach 2)	1179588463015	ECY 32E150	Yes	Wolf Fork to Forest Service boundary	3.9	15.4	60,813	11.52
3213	Pine Creek	1186528460280		Yes	Mouth to Oregon border	0.0	5.3	27,817	5.27
3214	Mud Creek	1186189460476		No	Mouth (lower) to Locher Rd	0.0	10.1	53,089	10.05
3215	Dry Creek	1185925460511	ECY 32F150	Yes	Mouth to North Fork Dry Ck	0.0	35.2	185,668	35.16
3216	North Fork Dry Creek	1203967462535		No	Mouth to tributary at GIS RM 3.0	0.0	3.0	15,979	3.03
3217	West Little Walla Walla River	1184802460383		No	Mouth to Oregon border	0.0	5.7	30,328	5.74
3218	Mill Creek (Reach 1)	1184778460386	ECY 32C070	Yes, but as two reaches, not three	Mouth to Bennington Dam	0.0	12.4	65,410	12.39
3219	Mill Creek (Reach 2)	1184778460386	USGS 14015000, USGS 14013700	Yes, but as two reaches, not three	Bennington Dam to Blue Ck	12.4	18.3	31,268	5.92
3220	Mill Creek (Reach 3)	1184778460386	USGS 14013000	Yes, but as two reaches, not three	Blue Ck to Oregon border	18.3	23.5	27,185	5.15
3222	Doan Creek	1184710460409		No	Mouth to Last Chance Rd? At long. 118°24' 17.3" W	0.0	4.4	23,184	4.39
3223	Cold Creek	1184604460466		No	To upper extent of frog ponds E of McKinney Rd	0.0	3.5	18,656	3.53
3224	Blue Creek	1181536460611	USGS 14013500	Yes	Mouth to Laird Ck	0.0	5.0	26,586	5.04

CRIA_ID	Reach_Name	LLID	GAUGE	OLD_STUDY	REACH_DESCR	Start RM	End RM	Length (Ft.)	Length (Mi.)
3225	East Little Walla Walla River	1184113460197	ECY 32H090	No	Mouth to Oregon border	0.0	2.0	10,568	2.00
3226	Patit Creek	1179841463198		Yes	Mouth to confluence of North and West Patit Cks	0.0	7.8	41,297	7.82
3227	West Patit Creek	1178565463363		No	Mouth to Forest Service boundary	0.0	9.3	49,310	9.34
3228	Yellowhawk Creek	1183998460169	ECY 32D060	Yes	Mouth to Mill Ck	0.0	9.0	47,319	8.96
3229	Cottonwood Creek	1183638460272	ECY 32M100	Yes, but NF is excluded here	Mouth to North Fork Cottonwood Ck	0.0	6.6	35,111	6.65
3230	Whisky Creek	1181170462728		Yes	Mouth to tributary at GIS RM 6.0	0.0	6.0	31,505	5.97
3231	Titus Creek (Reach 1)	1182772460768		No	Mouth to Five Mile Bridge	0.0	2.7	14,441	2.74
3232	Titus Creek (Reach 2)	1182772460768		No	Five Mile Bridge to Mill Ck	2.7	4.5	9,357	1.77
3233	Walsh Creek	1184406460167		No	Mouth to pond on farm bordering Oregon	0.0	2.8	14,720	2.79
3234	Caldwell Creek	1183374460341		No	Mouth to Shelton Rd (whole stream)	0.0	2.4	12,623	2.39
3235	Wolf Fork	1178953462742	ECY 32K070	No	Mouth to USFS boundary	0.0	12.5	65,926	12.49
3501	Snake River (Reach 1)	1190296461886		No	Palouse R (WRIA boundary) to Clearwater R	57.3	136.5	418,159	79.20
3502	Snake River (Reach 2)	1190296461886	USGS 13334300	No	Clearwater R to Oregon border	136.5	173.3	194,504	36.84
3503	Tucannon River (Reach 1)	1181740465575	USGS 13344500	Yes	Mouth to SR 12 bridge in Tucannon	0.0	14.1	74,276	14.07
3504	Tucannon River (Reach 2)	1181740465575	ECY 35B150	Yes	SR 12 bridge to Turner Rd / SR 126 bridge, Marengo	14.1	25.9	62,556	11.85
3505	Tucannon River (Reach 3)	1181740465575		Yes	Turner Rd / SR 126 bridge to Panjab Ck	25.9	48.6	119,572	22.65
3506	Pataha Creek (Reach 1)	1179867465091	ECY 35F050	Yes	Mouth to Geiger Gulch in Pomeroy	0.0	23.7	125,300	23.73
3507	Pataha Creek (Reach 2)	1179867465091	ECY 35F100	Yes	Geiger Gulch in Pomeroy to USFS boundary	23.7	48.3	129,865	24.60
3508	Asotin Creek (Reach 1)	1170531463443	USGS 13335050	Yes	Mouth to George Ck	0.0	3.2	16,759	3.17
3509	Asotin Creek (Reach 2)	1170531463443	ECY 35D100	Yes	George Ck to Asotin Ck forks	3.2	15.3	63,847	12.09
3510	Charley Creek	1172777462887		Yes	Mouth to WDFW boundary	0.0	5.2	27,284	5.17
3511	Alkali Flat Creek	1180869465756		Yes	Mouth to Little Alkali Flat Ck	0.0	30.5	160,915	30.48
3512	Almota Creek	1174691466997	ECY 35L050	No	Mouth to La Follette Rd	0.0	7.9	41,705	7.90
3513	Alpowa Creek	1171999464202	ECY 35K050	Yes, but as two reaches, not one	Mouth to Rd 128 crossing	0.0	23.5	124,167	23.52
3514	Penawawa Creek	1176836467017		Yes	Mouth to Little Penewawa Ck	0.0	6.3	33,480	6.34

CRIA_ID	Reach_Name	LLID	GAUGE	OLD_STUDY	REACH_DESCR	Start RM	End RM	Length (Ft.)	Length (Mi.)
3515	Deadman Creek	1178006466242	ECY 35M060	Yes	Mouth to forks with Deadman Gulch and N Deadman Ck	0.0	13.0	68,652	13.00
3516	North Deadman Creek	1175832465906		No	Mouth to small gulch about 1 mile	0.0	1.1	6,005	1.14
3517	Deadman Gulch	1175832465916		No	Mouth to small gulch about 1 mile	0.0	1.1	5,630	1.07
3518	Tenmile Creek	1169884462992	ECY 35J050	Yes	Mouth to Mill Ck	0.0	10.8	57,035	10.80
3519	Mill Creek	1170448461697		Yes	Mouth to USGS gauge 13334400	0.0	5.3	27,972	5.30
3520	Couse Creek	1169650462050	ECY 35H050	No	Mouth to Montgomery Gulch	0.0	3.2	17,100	3.24
3521	Tumalum Creek	1176872463591		No	Mouth to GIS RM 8.0	0.0	8.0	42,266	8.00
3522	Grande Ronde River	1169845460718		No	Mouth to Oregon border	0.0	36.7	194,010	36.74
3523	Buford Creek	1172530460346		No	Mouth to Oregon border	0.0	3.0	15,915	3.01
3524	Menatchee Creek	1173643460072		No	Mouth to barrier falls at 117°22'45.0"W 46°1'42.7"N	0.0	1.7	9,074	1.72
3525	Joseph Creek	1170059460526	ECY 35G060	No	Mouth to Oregon border	0.0	8.4	44,530	48.34
3526	Cottonwood Creek	1172943460388		No	Mouth to Cottonwood Ck forks	0.0	2.7	14,184	2.69
3527	Cougar Creek	1173185460326		No	Mouth to confluence of Swank Springs inflow	0.0	2.1	11,182	2.12
3528	Rattlesnake Creek	1172521460418		No	Mouth to gulch about 1.5 miles past West Branch Rattlesnake Ck	0.0	3.2	16,761	3.17
3529	West Branch Rattlesnake Creek	1172368460606		No	Mouth to gulch at about 1.5 miles	0.0	1.4	7,383	1.40
3701	Lower Yakima River (Reach 1)	1192269462537	USBR Kiona (KIOW)		Mouth to Chandler Canal Return	0.0	36.6	193,411	36.63
3702	Lower Yakima River (Reach 2)	1192269462537	USBR Prosser (YRPW)		Chandler return to Prosser Dam	36.6	47.7	58,329	11.05
3703	Lower Yakima River (Reach 3)	1192269462537	USGS 12508990 Mabton	Yes, but as three reaches, not 5	Prosser Dam to Toppenish Ck	47.7	81.8	179,963	34.08
3704	Lower Yakima River (Reach 4)	1192269462537	USBR Parker (PARW)		Toppenish Ck to Parker (Sunnyside) Dam	81.8	107.1	133,873	25.35
3705	Lower Yakima River (Reach 5)	1192269462537	USGS 12500450 (Union Gap)		Parker (Sunnyside) Dam to Naches R	107.1	120.0	68,008	12.88
3706	Satus Creek	1201103462619		No	Mouth to Logy Ck	0.0	25.7	135,833	25.73
3707	Toppenish Creek	1201675463242		Yes	Mouth to Simcoe Ck	0.0	34.0	179,309	33.96
3708	Simcoe Creek	1206172463768		Yes	Mouth to Wahtum Ck	0.0	13.7	72,347	13.70
3709	Ahtanum Creek	1204721465289	USGS 12502500	Yes	Mouth to Ahtanum Ck forks	0.0	24.5	129,479	24.52
3710	North Fork Ahtanum Creek	1208534465232	USGS 12500500	Yes	Mouth to Nasty Ck	0.0	4.9	25,987	4.92

CRIA_ID	Reach_Name	LLID	GAUGE	OLD_STUDY	REACH_DESCR	Start RM	End RM	Length (Ft.)	Length (Mi.)
3711	Wide Hollow Creek	1204693465374		No	Mouth to Dazet Rd, Harwood	0.0	11.5	60,757	11.51
3801	Naches River (Reach 1)	1205138466304	USBR Naches (NRYW)	Yes, but as one reach, not two	Mouth to Tieton R	0.0	18.3	96,799	18.33
3802	Naches River (Reach 2)	1205138466304	USBR Naches @ Cliffdell (CLFW)		Tieton R to source	18.3	45.4	143,025	27.09
3803	Cowiche Creek	1205675466279	ECY 38G070	Yes	Mouth to Cowiche Ck forks	0.0	7.5	39,353	7.45
3804	South Fork Cowiche Creek	1206808466479	ECY 38H050	Yes	Mouth to Reynolds Ck	0.0	12.5	65,973	12.49
3805	Tieton River	1207857467464	USBR Tieton (TICW)	No	Mouth to Tieton Dam	0.0	21.7	114,435	21.67
3806	Rattlesnake Creek	1209291468203	ECY 38C070	Yes	Mouth to McDaniel Diversion at 120°57'15.3"W 46°48'47.1"N	0.0	1.3	7,060	1.34
3807	Gold Creek	1210488469231		No	Mouth to first left bank tributary	0.0	0.6	3,133	0.59
3808	Little Naches River	1210935469898	USBR Little Naches (LNRW)	No	Mouth to North Fork Naches R	0.0	14.3	75,538	14.31
3809	Bumping River	1210935469888	USBR Bumping (BUM)	No	Mouth to Bumping Dam	0.0	15.9	83,864	15.88
3901	Upper Yakima River (Reach 1)	1192269462537	USBR Roza (RBDW)	Yes	Naches R to Roza Dam	120.0	131.5	60,859	11.53
3902	Upper Yakima River (Reach 2)	1192269462537	USBR Umtanum (UMTW)	Yes	Roza Dam to Teanaway R	131.5	180.2	256,920	48.66
3903	Upper Yakima River (Reach 3)	1192269462537	USBR Cle Elum (YUMW)	Yes	Teanaway to Cle Elum R	180.2	190.4	53,955	10.22
3904	Upper Yakima River (Reach 4)	1192269462537	USBR Easton (EASW)	Yes	Cle Elum R to Easton Dam	190.4	205.5	79,730	15.10
3905	Upper Yakima River (Reach 5)	1192269462537	USBR Martin (KEE)	Yes	Easton Dam to Keechelus Dam	205.5	217.1	61,466	11.64
3906	Wenas Creek	1204907466951	ECY 39F050	Yes	Mouth to Wenas Dam	0.0	15.0	79,457	15.05
3907	Burbank Creek	1204494467688		No	Mouth to GIS RM 1.9	0.0	1.9	10,030	1.90
3908	Wilson Creek	1204996469262		Yes, as part of Wilson/Cherry/Naneum Complex	Mouth to upper confluence with Naneum Ck	0.0	18.1	95,420	18.07
3909	Cherry Creek	1205084469164	USBR Cherry (CHRW)		Mouth to Parke Ck / Cooke Ck confluence	0.0	1.8	9,529	1.80
3910	Parke Creek	1204747469396			Mouth to Mundy Rd, near East Kittitas	0.0	6.6	34,771	6.59
3911	Cooke Creek	1204591469539			Mouth to KRD North Branch Canal	0.0	10.3	54,233	10.27
3912	Caribou Creek	1204591469529			Mouth to KRD North Branch Canal	0.0	9.8	51,588	9.77
3913	Naneum Creek	1205030469443	USGS 12483800		Mouth to USGS gauge 12483800 near Naneum Rd	0.0	15.3	80,913	15.32

CRIA_ID	Reach_Name	LLID	GAUGE	OLD_STUDY	REACH_DESCR	Start RM	End RM	Length (Ft.)	Length (Mi.)
3914	Coleman Creek	1204991469477			Mouth to KRD North Branch Canal	0.0	10.5	55,195	10.45
3915	Schnebly Creek	1204441470284			Mouth to KRD North Branch Canal	0.0	4.0	21,379	4.05
3916	Mercer Creek	1205541469864			Mouth to KRD North Branch Canal	0.0	8.6	45,650	8.65
3917	Reecer Creek	1205793469955		No	Mouth to KRD North Branch Canal	0.0	9.5	50,183	9.50
3918	Whiskey Creek	1205661470032		Yes, as part of Wilson/Cherry/Naneum Complex	Mouth to Wilson Ck	0.0	9.4	49,802	9.43
3919	Currier Creek	1205819470067		No	Mouth to KRD North Branch Canal	0.0	7.8	41,143	7.79
3920	Manastash Creek	1205793469945	ECY 39J090	Yes	Mouth to Manastash Ck forks	0.0	8.7	45,836	8.68
3921	Dry Creek	1206092470196		No	Mouth to KRD North Branch Canal	0.0	7.9	41,808	7.92
3922	Taneum Creek	1207081470923	ECY 39P080	Yes	Mouth to Knudson Diversion	0.0	3.5	18,738	3.55
3923	Swauk Creek	1207370471233	ECY 39M100	Yes	Mouth to Williams Ck.	1.0	11.0	57,817	10.95
3924	First Creek	1206994472081		No	Mouth to First Ck Water User Diversion	0.0	2.0	10,565	2.00
3925	Williams Creek	1206954472430		Yes, as part of Wilson/Cherry/Naneum Complex	Mouth to the Rd crossing 2.4 miles above Liberty	0.0	4.4	23,412	4.43
3926	Teanaway River	1208336471670	USBR Teanaway/Forks (TNAW)	Yes	Mouth to Teanaway R forks	0.0	11.3	59,527	11.27
3927	North Fork Teanaway River	1208768472513		Yes	Mouth to Jack Ck	0.0	6.2	32,675	6.19
3928	Cle Elum River	1209901471771	USBR Yakima @ Cle Elum (CLE)	No	Mouth to Cle Elum Dam	0.0	7.8	41,060	7.78
3929	Big Creek	1210966472175	ECY 39Q060	Yes	Mouth to removed dam site	0.0	2.9	15,313	2.90
3930	Little Creek	1210761472100		No	Mouth to KRD Main Canal	0.0	1.6	8,356	1.58
4501	Wenatchee River (Reach 1)	1203156474560	USGS 12462500	Yes	Mouth to middle of Leavenworth	0.0	24.3	128,311	24.30
4502	Wenatchee River (Reach 2)	1203156474560	USGS 12459000	Yes	Middle of Leavenworth to Tumwater Canyon / Campground	24.3	35.4	58,841	11.14
4503	Wenatchee River (Reach 3)	1203156474560	USGS 12457000	Yes	Tumwater Canyon / Campground to Lake Wenatchee	35.4	53.8	96,836	18.34
4504	Mission Creek	1204734475234	ECY 45E070	Yes	Mouth to Sand Ck	0.0	8.0	42,014	7.96
4505	Brender Creek	1204748475215	ECY 45D070	Yes	Mouth to Brisky Canyon Ck	0.0	4.3	22,631	4.29
4506	Peshastin Creek	1205732475578	ECY 45F070	Yes	Mouth to Ingalls Ck	0.0	9.1	48,154	9.12
4507	Ingalls Creek	1206599474630		Yes	Mouth to Ingalls Ck trailhead	0.0	0.6	3,379	0.64

CRIA_ID	Reach_Name	LLID	GAUGE	OLD_STUDY	REACH_DESCR	Start RM	End RM	Length (Ft.)	Length (Mi.)
4508	Derby Canyon	1205875475692		Yes	Mouth to North Fork Derby Canyon	0.0	2.7	14,346	2.72
4509	Chumstick Creek	1206431476022	ECY 45C060	Yes	Mouth to Little Chumstick Ck	0.0	9.0	47,636	9.02
4510	Eagle Creek	1206439476252	ECY 45Q060	Yes	Mouth to Van Ck	0.0	5.8	30,465	5.77
4511	Little Chumstick Creek	1206322477166		Yes	Mouth to headwaters	0.0	4.0	21,177	4.01
4512	Icicle Creek	1206661475803	ECY12458000	Yes	Mouth to Bridge Ck	0.0	9.5	50,174	9.50
4513	Chiwaukum Creek	1207271476789	ECY 45G060	Yes	Mouth to Barrier	0.0	4.5	23,882	4.52
4514	Sand Creek	1205061474300		No	Mouth to GIS RM 2	0.0	2.0	10,560	2.00
4515	Skinney Creek	1207345476870		Yes	Mouth to SW of Winton	0.0	4.1	21,649	4.10
4516	Beaver Creek	1206608477671		Yes	Mouth to Beaver Ck forks	0.0	3.1	16,414	3.11
4517	Chiwawa River	1206585477882	USGS 12456500	Yes	Mouth to Deep Ck	0.0	4.3	22,443	4.25
4801	Methow River (Reach 1)	1198933480501	USGS 12449950	Yes	Mouth to Twisp R	0.0	41.8	220,930	41.84
4802	Methow River (Reach 2)	1198933480501	USGS 12449500	Yes	Twisp R to Chewuch R	41.8	52.1	54,100	10.25
4803	Methow River (Reach 3)	1198933480501	USGS 12448500	Yes	Chewuch R to Early Winters Ck	52.1	70.4	96,819	18.34
4804	Squaw Creek	1200168480905		No	Mouth to Squaw Ck Rd crossing	0.0	1.6	8,501	1.61
4805	French Creek	1200060481359		No	Mouth to DNR boundary	0.0	4.8	25,197	4.77
4806	Petes Creek	1200309481381		No	Mouth to Highway 123	0.0	0.9	4,759	0.90
4807	McFarland Creek	1200647481537		No	Mouth to 2nd McFarland Rd Crossing	0.0	2.4	12,570	2.38
4808	Cow Creek	1200945481894		No	Mouth to Rd crossing at 120°03'10.24", 48°11'40.18"	0.0	2.3	11,965	2.27
4809	Libby Creek	1201133482280		Yes	Mouth to uppermost extent of USFS boundary	0.0	6.1	32,012	6.06
4810	Texas Creek	1201024482488		No	Mouth to North Fork Texas Ck	0.0	4.6	24,202	4.58
4811	Puckett Creek	1201156482494		No	Mouth to Biggers Rd	0.0	0.3	1,329	0.25
4812	Leecher Canyon	1200889482669		No	Mouth to USFS boundary	0.0	2.5	13,369	2.53
4813	Benson Creek	1200645482929		No	Mouth to USFS boundary	0.0	2.9	15,089	2.86
4814	Alder Creek	1200688483070		No	Mouth to USFS boundary	0.0	5.9	31,070	5.88
4815	Beaver Creek (Reach 1)	1200653483267	USGS 12449710	Yes, but as one reach, not two	Mouth to Frazer Ck	0.0	3.0	15,712	2.98
4816	Beaver Creek (Reach 2)	1200653483267	USGS 12449600		Frazer Ck to South Fork Beaver Ck	3.0	9.4	34,154	6.47
4817	Black Canyon Creek	1200086480794		Yes	Mouth to USFS boundary	0.0	0.4	2,356	0.45
4818	Booth Canyon Creek	1200804482810		No	Mouth to Booth Canyon Ck forks	0.0	1.0	5,502	1.04

CRIA_ID	Reach_Name	LLID	GAUGE	OLD_STUDY	REACH_DESCR	Start RM	End RM	Length (Ft.)	Length (Mi.)
4819	Frazer Creek	1200396483584		Yes	Mouth to USFS boundary	0.0	3.9	20,612	3.90
4820	Twisp River	1201177483686	USGS 12448998	Yes	Mouth to Buttermilk Ck	0.0	13.4	70,626	13.38
4821	Poorman Creek	1201976483696		Yes	Mouth to USFS boundary	0.0	1.4	7,386	1.40
4822	Little Bridge Creek	1202851483790		No	Mouth to upper diversion	0.0	2.2	11,619	2.20
4823	Buttermilk Creek	1203382483627		No	Mouth to Buttermilk Ck forks	0.0	2.6	13,715	2.60
4824	Thompson Creek	1202038484336		No	Mouth to USFS boundary	0.0	5.1	26,735	5.06
4825	Bear Creek	1201619484547		No	Mouth to USFS boundary	0.0	6.5	34,250	6.49
4826	Chewuch River	1201819484759	USGS 12448000	Yes	Mouth to USGS gauge 12447600	0.0	8.5	44,750	8.48
4827	Cub Creek	1201847485474		No	Mouth to USFS boundary	0.0	2.4	12,641	2.39
4828	Ramsey Creek	1201810485510		No	Mouth to Rd crossing at USFS boundary	0.0	3.0	16,007	3.03
4829	Little Boulder Creek	1203796485714		No	Mouth to USFS boundary	0.0	0.8	4,256	0.81
4830	Wolf Creek	1202305484907	USGS 12447387	Yes	Mouth to diversion dam	0.0	4.3	22,491	4.26
4831	Little Falls Creek	1203152485266		No	Mouth to South Fork Little Falls Ck	0.0	0.8	4,293	0.81
4832	Fawn Creek	1203491485599		No	Mouth to USFS boundary	0.0	0.7	3,494	0.66
4833	Goat Creek	1203780485742		Yes	Mouth to Goat Cr Rd (AKA FR 52)	0.0	1.4	7,369	1.40
4834	Gold Creek	1200941481881		Yes	Mouth to South Fork Gold Ck	0.0	1.1	5,863	1.11
4835	Early Winters Creek	1204364486012	USGS 12447382	Yes	Mouth to Early Winters Diversion	0.0	0.5	2,743	0.52
4901	Okanogan River (Reach 1)	1197334480985	USGS 12447200	Yes, but as two reaches, not three	Mouth to Salmon Ck	0.0	25.9	136,734	25.90
4902	Okanogan River (Reach 2)	1197334480985	USGS 12445000		Salmon Ck to Bonaparte Ck	25.9	57.7	167,946	31.81
4903	Okanogan River (Reach 3)	1197334480985	USGS 12439500		Bonaparte Ck to Canada border	57.7	83.3	134,975	25.56
4904	Tonasket Creek	1194229489371	ECY49H080	Yes	Mouth to USFS boundary	0.0	12.2	64,525	12.22
4905	Bonaparte Creek	1194456487053	ECY49F070	Yes	Mouth to Bonaparte Lake	0.0	28.9	152,556	28.89
4906	Loup Loup Creek	1197043482804		Yes	Mouth to weir	0.0	10.2	53,764	10.18
4907	Ninemile Creek	1194333489670	USGS 12438900	Yes	Mouth to diversion at 119°18'52.096"W, 48°59'02.9"N	0.0	6.1	32,412	6.14
4908	Aeneas Creek	1194730486588		Yes	Mouth to North Lamanasky Rd	0.0	5.8	30,632	5.80
4909	Omak Creek	1195003484078	ECY49C100	Yes	Mouth to USGS gauging station 12445900	0.0	5.7	30,061	5.69
4910	Palmer Creek	1196576489408		No	Mouth to Palmer Lake - conduit for Sinlahekin	0.0	3.5	18,468	3.50
4912	Antoine Creek	1194112487614	ECY49G060	Yes	Mouth to Fanchers Dam	0.0	11.9	63,060	11.94

CRIA_ID	Reach_Name	LLID	GAUGE	OLD_STUDY	REACH_DESCR	Start RM	End RM	Length (Ft.)	Length (Mi.)
4913	Siwash Creek	1194384487121		Yes	Mouth to South and Middle Forks Siwash Ck	0.0	12.8	67,510	12.79
4914	Tunk Creek (Reach 1)	1194868485618		Yes, but as one reach, not two	Mouth to Natural Barrier at 119°28'32.9"W 48°33'48.5"N	0.0	0.6	3,133	0.59
4915	Tunk Creek (Reach 2)	1194868485618	ECY49E080		Natural Barrier to Colville Indian Reservation	0.6	14.1	71,354	13.51
4916	Salmon Creek (Reach 1)	1195804483599		Yes	Mouth to OID diversion dam	0.0	4.1	21,494	4.07
4917	Salmon Creek (Reach 2)	1195804483599		Yes	OID diversion dam to Conconully Reservoir	4.1	17.0	68,345	12.94
4918	Chiliwist Creek	1197369482463		No	Mouth to Chiliwist Rd	0.0	6.4	33,920	6.42
4919	Tallant Creek	1196594482977		No	Mouth to northernmost crossing of SR 20	0.0	6.1	31,978	6.06
4920	Reed Creek	1196643484138		No	Mouth to Rd crossing above Reed Pond	0.0	8.5	44,861	8.50
4921	Whitestone Creek	1194047487762	USGS 12444100	Yes	Mouth to mouth of Spectacle Lake	0.0	6.7	35,553	6.73
4922	Chewiliken Creek	1194627486305		No	Mouth to USFS boundary	0.0	11.7	61,956	11.73
4923	Similkameen River (Reach 1)	1194285488918	ECY49B070-MDQ	Yes, but as one reach, not two	Mouth to Enloe Dam	0.0	9.3	49,318	9.34
4924	Similkameen River (Reach 2)	1194285488918	USGS 12442500		Enloe Dam to Canada border	9.3	28.6	101,780	19.28
4925	Toats Coulee Creek	1196483488390	ECY49K090	No	Mouth to DNR boundary	0.0	4.5	23,505	4.45
4926	Sinlahekin Creek	1196456489112	49L100	No	Palmer Lake (inclusive) to Cecile Ck	0.0	11.1	58,391	11.06

Table A-3 Sample fish status/utilization score worksheet

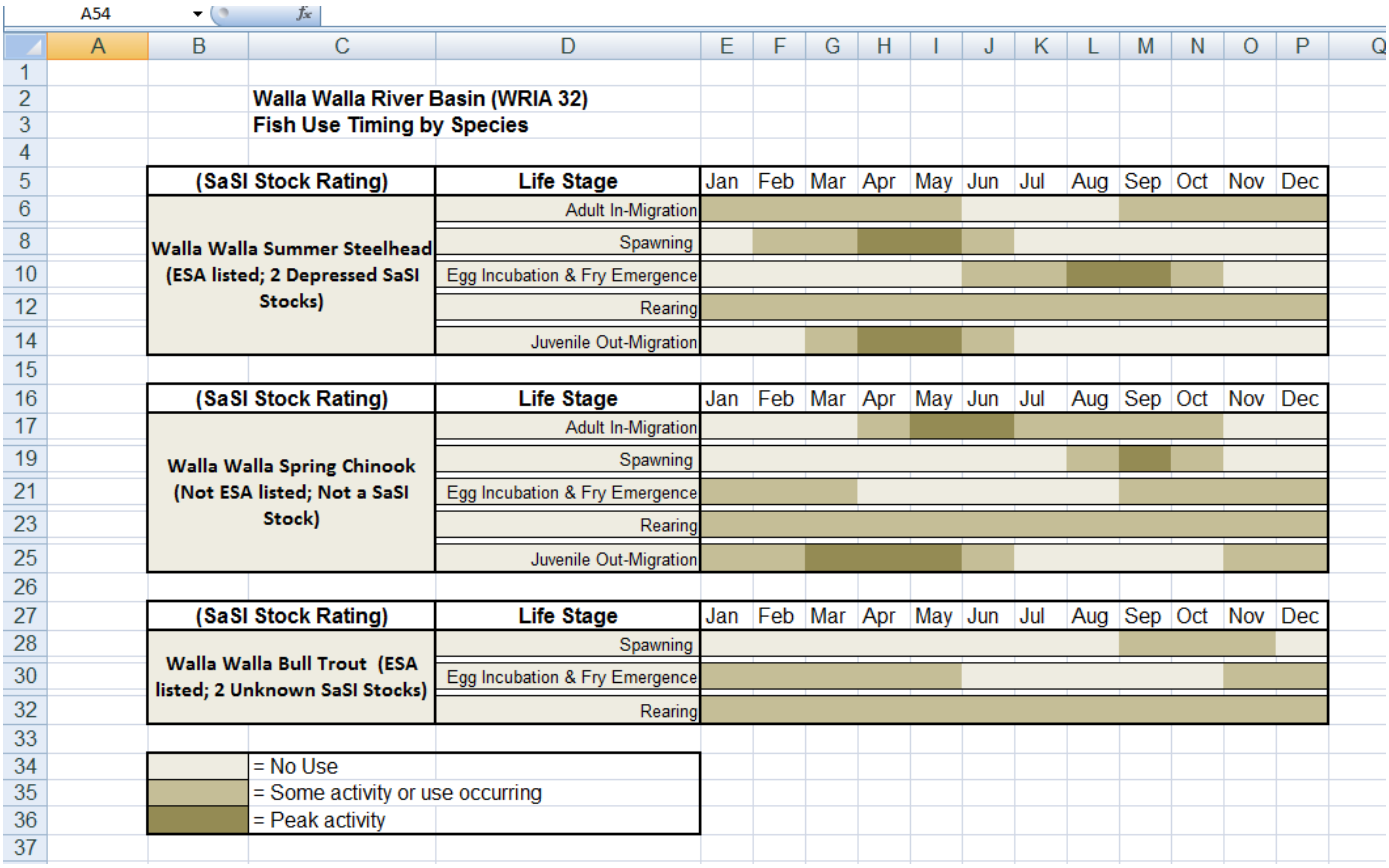
Reach Name	Prioritization Score	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Fork Touchet River (Reach 2)	225	16	19	19	19	19	16	16	18	24	24	19	16
Mill Creek (Reach 3)	225	16	19	19	19	19	16	16	18	24	24	19	16
Wolf Fork	225	16	19	19	19	19	16	16	18	24	24	19	16
Mill Creek (Reach 2)	225	13	16	16	16	16	16	16	18	21	21	16	13
Touchet River (Reach 1)	224	17	20	20	22	22	19	16	16	19	19	17	17
Walla Walla River (Reach 1)	224	20	20	20	22	22	16	13	13	19	19	20	20
Walla Walla River (Reach 2)	224	17	20	20	22	22	19	16	16	19	19	17	17
Walla Walla River (Reach 3)	204	0	19	19	19	19	16	13	15	18	18	16	16
Touchet River (Reach 3)	204	16	19	19	19	19	16	13	15	18	18	16	16
Mill Creek (Reach 1)	198	16	19	19	19	19	16	16	18	24	24	19	16
North Fork Touchet River (Reach 1)	198	13	16	16	16	16	16	16	18	21	21	16	13
South Fork Touchet River	195	14	17	17	17	17	14	14	14	20	20	17	14
Touchet River (Reach 2)	188	14	17	17	19	19	16	13	13	16	16	14	14
Blue Creek	150	11	14	14	14	14	11	11	11	14	14	11	11
Yellowhawk Creek	138	11	14	14	14	14	11	8	8	11	11	11	11
East Little Walla Walla River	114	8	11	11	11	11	8	8	8	11	11	8	8
West Little Walla Walla River	114	8	11	11	11	11	8	8	8	11	11	8	8
Dry Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
Pine Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
Patit Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
Coppei Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
Cold Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
Doan Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
West Patit Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
Whisky Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
Titus Creek (Reach 1)	90	6	9	9	9	9	6	6	6	9	9	6	6
Titus Creek (Reach 2)	90	6	9	9	9	9	6	6	6	9	9	6	6
Walsh Creek	90	6	9	9	9	9	6	6	6	9	9	6	6
North Fork Coppei Creek	90	6	9	9	9	9	6	6	6	9	9	6	6
North Fork Dry Creek	90	6	9	9	9	9	6	6	6	9	9	6	6
Cottonwood Creek	90	6	9	9	9	9	6	6	6	9	9	6	6
Caldwell Creek	90	6	9	9	9	9	6	6	6	9	9	6	6
Mud Creek	60	5	5	5	5	5	5	5	5	5	5	5	5
Monthly Grand Total		337	446	446	454	454	361	340	356	470	470	374	353

Table A-4 Sample fish status/utilization reach-specific worksheet (partial)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Location (River Reach):		**Walla Walla River (Reach 1)**	January	February	March	April	May	June	July	August	September	October	November	December	Subtotal	
2	Cumulative Total Score:		**224**	20	20	20	22	22	16	13	13	19	19	20	20	224	
3																	
4																	
5																	
6																	
7	**Stock Name**		**Walla Walla Summer Steelhead - 6854**	Score		Notes											
8	Walla Walla Summer Steelhead - 6854	Is this stock listed under the ESA? (Yes=1; No=0)		1		Spawning:	Walla Walla Summer Steelhead are not known to spawn in this reach of the Walla Walla River mainstem. Spawning occurs ups										
9		SaSI Status rating: (Healthy=1; Depressed, or Unknown=2; Critical=3)		2		Rearing:	This is not a spawning area for Walla Walla Summer Steelhead, but juvenile Walla Walla Summer Steelhead use this reach as r										
10	Part of a TRT-designated spawning area? (MaSA=1; MiSA=0.5; no=0)			1		Migration:	Adult Walla Walla Summer Steelhead use this reach as a migration corridor from September to late April/early May, although lov										
11			Total Weight Factor=	3													
12									Time duration of fish use								
13	Species	Weight Factor	Fish use characterization for stream reach	January	February	March	April	May	June	July	August	September	October	November	December	Subtotal	Total
14	Walla Walla Summer Steelhead - 6854	3	Is the reach used for Spawning and Incubation? (no=0, yes=1)	0	0	0	0	0	0	0	0	0	0	0	0	0	63
15			Is the reach used for Rearing and/or Smolt Migration? (no=0, yes=1)	1	1	1	1	1	1	1	1	1	1	1	1	36	
16			Is the reach part of an adult migration corridor? (no=0, yes=1)	1	1	1	1	1	0	0	0	1	1	1	1	27	
17			Monthly Total	6	6	6	6	6	3	3	3	6	6	6	6	63	
18																	
19	**Stock Name**		**Touchet Summer Steelhead - 6861**	Score		Notes											
20	Touchet Summer Steelhead - 6861	Is this stock listed under the ESA? (Yes=1; No=0)		1		Spawning:	Touchet Summer Steelhead are not known to spawn in this reach. The spawning distribution for Touchet Summer Steelhead ir										
21		SaSI Status rating: (Healthy=1; Depressed, or Unknown=2; Critical=3)		2		Rearing:	This is not a spawning area for Touchet Summer Steelhead, but juvenile Touchet Summer Steelhead may use the lower portion										
22	Part of a TRT-designated spawning area? (MaSA=1; MiSA=0.5; no=0)			0		Migration:	Touchet Summer Steelhead must pass through this reach to access their spawning areas in the Touchet River Basin. Adult Su										
23			Total Weight Factor=	3													
24									Time duration of fish use								
25	Species	Weight Factor	Fish use characterization for stream reach	January	February	March	April	May	June	July	August	September	October	November	December	Subtotal	Total
26	Touchet Summer Steelhead - 6861	3	Is the reach used for Spawning and Incubation? (no=0, yes=1)	0	0	0	0	0	0	0	0	0	0	0	0	0	63
27			Is the reach used for Rearing and/or Smolt Migration? (no=0, yes=1)	1	1	1	1	1	1	1	1	1	1	1	1	36	
28			Is the reach part of an adult migration corridor? (no=0, yes=1)	1	1	1	1	1	0	0	0	1	1	1	1	27	
29			Monthly Total	6	6	6	6	6	3	3	3	6	6	6	6	63	
30																	
31	**Stock Name**		**Bull Trout - 8396, 8408**	Score		Notes											
32	Bull Trout - 8396, 8408	Is this stock listed under the ESA? (Yes=1; No=0)		1		Spawning:	Bull Trout do not spawn in this reach of the Walla Walla River mainstem. Bull Trout in the Walla Walla Basin primarily spawn in t										
33		SaSI Status rating: (Healthy=1; Depressed, or Unknown=2; Critical=3)		2		Rearing:	This reach of the Walla Walla River may be a sub-adult foraging/rearing area for small numbers of bull trout. Bull Trout are kno										
34	Part of a TRT-designated spawning area? (MaSA=1; MiSA=0.5; no=0)			0		Migration:	This reach of the Walla Walla River may be part of an adult migration corridor for small numbers of bull trout. Bull Trout are kno										
35			Total Weight Factor=	3													
36									Time duration of fish use								
37	Species	Weight Factor	Fish use characterization for stream reach	January	February	March	April	May	June	July	August	September	October	November	December	Subtotal	Total
38	Bull Trout - 8396, 8408	3	Is the reach used for Spawning and Incubation? (no=0, yes=1)	0	0	0	0	0	0	0	0	0	0	0	0	0	60
39			Is the reach used for sub-adult foraging or juvenile migration? (no=0	1	1	1	1	1	1	1	1	1	1	1	1	36	
40			Is the reach part of an adult migration corridor? (no=0, yes=1)	1	1	1	1	1	1	0	0	0	0	1	1	24	
41			Monthly Total	6	6	6	6	6	6	3	3	3	3	6	6	60	

Fish Priority Score | Periodicity Walla Walla Basin | Sheet1 | 2010 Priority Streams | **WallaWalla (R1)** | WallaWalla (R2) | WallaWalla (R3) | Touchet (R1) | To

Table A-5 Sample basinwide periodicity worksheet



Walla Walla River Basin (WRIA 32)
Fish Use Timing by Species

(SaSI Stock Rating)	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Walla Walla Summer Steelhead (ESA listed; 2 Depressed SaSI Stocks)	Adult In-Migration												
	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

(SaSI Stock Rating)	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Walla Walla Spring Chinook (Not ESA listed; Not a SaSI Stock)	Adult In-Migration												
	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

(SaSI Stock Rating)	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Walla Walla Bull Trout (ESA listed; 2 Unknown SaSI Stocks)	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												

	= No Use
	= Some activity or use occurring
	= Peak activity

Table A-6 Sample fish status/utilization references table

	A	B
1	References	
2	1	Mahoney B.D., M.B. Lambert, T.J. Olsen, E. Hoverson, P. Kissner, and J.D.M. Schwartz. 2006. Walla Walla Basin Natural Production Monitoring and Evaluation Project Progress Report, 2004 - 2005. Confederated Tribes of the Umatilla Indian Reservation, report submitted to Bonneville Power Administration, Project No. 2000-039-00.
3	2	Mendel, G., J. Trump, M. Gembala, S. Blankenship, and T. Kassler. 2007. Assessment of Salmonids and Their Habitat Conditions in the Walla Walla River Basin within Washington: 2006 Annual Report (Performance Period March 1, 2006 - March 1, 2007). Prepared by Washington Department of Fish and Wildlife. Prepared for U.S. Department of Energy, Bonneville Power Administration, Portland, OR. Project Number 199802000. Contract Number 00021599.
4	3	Walla Walla Subbasin Plan. 2004. Prepared for the Northwest Power and Conservation Council. Prepared by the Walla Walla Watershed Planning Unit and the Walla Walla Basin Watershed Council.
5	4	Mahoney, B.D. 2002. Walla Walla Basin Summer Steelhead and Bull Trout Radio Telemetry Project, 2001-2002 Progress Report. Prepared by Confederated Tribes of the Umatilla Indian Reservation. Prepared for United States Department of Energy Bonneville Power Administration.
6	5	Mendel, G., C. Fulton, and R. Weldert. 2003. An Investigation into the Migratory Behavior of Bull Trout in the Touchet River Basin. Washington Department of Fish and Wildlife.
7	6	Walla Walla Subbasin Plan. 2004. Prepared for the Northwest Power and Conservation Council. Prepared by the Walla Walla Watershed Planning Unit and the Walla Walla Basin Watershed Council. Washington State Conservation Commission.
8	7	Columbia River Hatchery Reform Project. 2009. Walla Walla River Summer Steelhead Population Report.
9	8	National Marine Fisheries Service: Northwest Region. 2008. Proposed Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan.
10		
11		

Table A-7 Sample fish status/utilization weighting and binning worksheet

SaSI Stocks in the Walla Walla Basin	SaSI Stock Rating	Weight Factor**
Walla Walla Summer Steelhead - 6854	Depressed	2
Touchet Summer Steelhead - 6861	Depressed	2
Touchet Bull Trout - 8396	Unknown	2
Mill Creek Bull Trout - 8408	Healthy	
Walla Walla Spring Chinook- SaSI stock	Unknown	2

Weighting Factor for Federally Listed Species	ESA Weight Factor
Assign additional weight to stocks that are listed as Threatened or Endangered under the ESA? (yes=1; no=0)	1
Assign additional weight to reaches within Interior Columbia TRT-designated spawning areas (MaSAs or MiSAs)? (yes=1; no=0)	0

** Weight Factor Values for SaSI Stocks	
SaSI Stock Rating	Weight Factor
Healthy	1
Depressed	2
Critical	3
Unknown	2
Enter "0" to calculate score without using a particular stock	

REACH	top score 225 percentage of top score
North Fork Touchet River (Reach 2)	100.0%
Mill Creek (Reach 3)	100.0%
Wolf Fork	100.0%
Mill Creek (Reach 2)	100.0%
Touchet River (Reach 1)	99.6%
Walla Walla River (Reach 1)	99.6%
Walla Walla River (Reach 2)	99.6%
Walla Walla River (Reach 3)	90.7%
Touchet River (Reach 3)	90.7%
Mill Creek (Reach 1)	88.0%
North Fork Touchet River (Reach 1)	88.0%
South Fork Touchet River	86.7%
Touchet River (Reach 2)	83.6%
Blue Creek	66.7%
Yellowhawk Creek	61.3%
East Little Walla Walla River	50.7%
West Little Walla Walla River	50.7%
Dry Creek	50.7%
Pine Creek	50.7%
Patit Creek	50.7%
Coppei Creek	50.7%
Cold Creek	50.7%
Doan Creek	50.7%
West Patit Creek	50.7%
Whisky Creek	50.7%
Titus Creek (Reach 1)	40.0%
Titus Creek (Reach 2)	40.0%
Walsh Creek	40.0%
North Fork Coppei Creek	40.0%
North Fork Dry Creek	40.0%
Cottonwood Creek	40.0%
Caldwell Creek	40.0%
Mud Creek	26.7%

Table A-8 Sample habitat condition scoring worksheet

Habitat Scores

WRIA	Reach Name	Reach Description	RM	Off Channel Habitat Conditions	Floodplain Connectivity Conditions	Riparian Conditions	Spawning Suitability	Rearing Suitability	Passage Conditions	Total
32	Blue Creek	Mouth to Laird Creek	RM 0-5.0	2	2	2	3	3	3	15
32	Caldwell Creek	Mouth to School Avenue	RM 0-2.4	2	2	2	1	2	2	11
32	Cold Creek	Mouth to Frog Ponds	RM 0-3.5	2	2	1	3	3	1	12
32	Coppei Creek	Mouth to Coppei Creek Forks	RM 0-8.0	1	1	2	2	2	3	11
32	Cottonwood Creek	Mouth to North Fork Cottonwood Cr	RM 0-6.6	1	1	2	2	2	2	10
32	Doan Creek	Mouth to Last Chance Road	RM 0-4.4	1	2	1	2	3	3	12
32	Dry Creek	Mouth to Dixie	RM 0-35.2	1	1	2	2	2	2	10
32	East Little Walla Walla River	Mouth to Oregon Border	RM 0-2.0	3	2	2	3	3	2	15
32	Mill Creek (Reach 1)	Mouth to Bennington Dam	RM 0-12.4	1	1	1	1	2	2	8
32	Mill Creek (Reach 2)	Bennington Dam to Blue Creek	RM 12.4-18.3	2	2	3	3	3	3	16
32	Mill Creek (Reach 3)	Blue Creek to Oregon boarder	RM 18.3-23.5	2	2	3	3	3	3	16
32	Mud Creek	Mouth (lower) to Locker Road	RM 0-10.1	1	1	1	1	1	1	6
32	North Fork Coppei Creek	Mouth to falls above Coppei Springs	RM 0-4.5	2	2	3	3	3	3	16
32	North Fork Dry Creek	Mouth to tributary at GIS RM 3.0	RM 0-3.0	2	2	3	3	3	3	16
32	North Fork Touchet River (Reach	Mouth to Wolf Fork	RM 0-3.9	1	1	2	3	3	3	13
32	North Fork Touchet River (Reach	Wolf Fork to Forest Service bounda	RM 3.9-15.4	2	2	3	3	3	3	16
32	Patit Creek	Mouth to N. F/W. F. confluence	RM 0-7.8	1	1	1	1	2	2	8
32	Pine Creek	Mouth to Oregon Boarder	RM 0-5.3	1	1	1	1	1	1	6
32	South Fork Touchet River	Mouth to Griffen Fork	RM 0-14.8	2	2	2	3	3	3	15
32	Titus Creek (Reach 1)	Mouth to Five Mile Bridge	RM 0-2.7	1	2	1	1	2	1	8
32	Titus Creek (Reach 2)	Five Mile Bridge to Mill Creek	RM 2.7-4.5	2	3	3	2	3	2	15
32	Touchet River (Reach 1)	Mouth to Hofer Dam	RM 0-5.0	1	1	1	1	1	3	8
32	Touchet River (Reach 2)	Hofer Dam to Coppei Creek	RM 4.2-50.7	1	1	2	2	2	3	11
32	Touchet River (Reach 3)	Coppei Ck to Forks	RM 50.7-64.2	2	1	2	3	3	3	14
32	Walla Walla River (Reach 1)	Mouth to Touchet River	RM 0-23.1	1	1	1	1	2	3	9
32	Walla Walla River (Reach 2)	Touchet River to Mill Creek	RM 23.1-37.1	2	1	1	2	2	2	10
32	Walla Walla River (Reach 3)	Mill Ck to State Line	RM 37.1-44.5	2	1	2	2	2	2	11
32	Walsh Creek	Mouth to pond on farm bordering Or	RM 0-2.8	2	2	2	2	3	2	13
32	West Little Walla Walla River	Mouth to Oregon Boarder	RM 0-5.7	2	2	2	1	2	1	10

WRIA_32_Walla Walla | WRIA 35 Mid_Snake | WRIA_37_38_39_Yakima | WRIA__45_Wenatchee | WRIA_48_Methow | WRIA_49_Okanogan

Table A-9 NLCD Codes, Code Descriptions, and Classes

NLCD Code	Code_Description	Description	Classes	Modification
TRS_11	11_Open_Water	Open Water	Water	Natural
TRS_12	12_Perennial_Snow_Ice	Perennial Snow Ice	Barren	Natural
TRS_21	21_Developed_Open_Space	Developed Open	Developed	Human_Modified
TRS_22	22_Developed_low_intensity	Developed Low	Developed	Human_Modified
TRS_23	23_Developed_Medium_Intensity	Developed Medium	Developed	Human_Modified
TRS_24	24_Developed_High_Intensity	Developed High	Developed	Human_Modified
TRS_31	31_Barren_Land	Barren Land	Barren	Natural
TRS_41	41_Deciduous_Forest	Forest Deciduous	Forest	Natural
TRS_42	42_Evergreen_Forest	Forest Evergreen	Forest	Natural
TRS_43	43_Mixed_forest	Forest Mixed	Forest	Natural
TRS_52	52_Shrub_Scrub	Shrub Scrub	Shrub	Natural
TRS_71	71_Herbaceous	Herbaceous	Shrub	Natural
TRS_81	81_Hay_Pasture	Hay Pasture	Agriculture	Human_Modified
TRS_82	82_Cultivated_Crops	Cultivated Crops	Agriculture	Human_Modified
TRS_90	90_Woody_Wetlands	Woody Wetlands	Riparian	Natural
TRS_95	95_Emergent_Herbaceous_Wetland	Emergent Herbaceous Wetland	Riparian	Natural

Table A-10 Water Quality - Clean Water Act Section 305(b) severity categories

Category 1	Meets tested standards. Placement in this category means that the water body segment meets the criteria it was tested for. It does not necessarily mean that a water body is free of all pollutants. Most water quality monitoring is designed to detect a specific array of pollutants, so placement in this category means that the water body met standards for all the pollutants for which it was tested. Specific information about the monitoring results may be found in the individual listings.
Category 2	Waters of concern. This category lists waterbody segments where there is some evidence of a water quality problem, but not enough to require development of a Total Maximum Daily Load (TMDL) standard. There are several reasons why a water body would be placed in this category. A water body might have pollution levels that are not quite high enough to violate the water quality standards, or there may not have been enough violations to categorize it as impaired according to Ecology's listing policy. There might be data showing water quality violations, but the data were not collected using proper scientific methods. In all of these situations, these are waters that we will want to continue to test.
Category 3	Insufficient or No data. This category houses those listings where the assessed data was insufficient to determine a proper categorization of the water. Water bodies that have not been tested will not be individually listed, but if they do not appear in one of the other categories, they are assumed to belong in Category 3.
Category 4	Polluted waters that do not require a TMDL. This category is for water body segments that have pollution problems that are being solved in one of three ways:
4a	Water body segments that have an approved TMDL in place and are actively being implemented.
4b	Water body segments that have a pollution control plan in place that is expected to solve the pollution problems. While pollution control plans are not TMDLs, they must have many of the same features and there must be some legal or financial guarantee that they will be implemented.
4c	Water body segments impaired by causes that cannot be addressed through a TMDL (not due to a pollutant). These impairments include low water flow, stream channelization, and dams. These problems require complex solutions to help restore streams to more natural conditions.
Category 5	Polluted waters that require a TMDL. Category 5 represents the 303(d) list, the traditional list of impaired water bodies. Placement in this category means that Ecology has data showing that the water quality standards have been violated for one or more pollutants, and there is no TMDL or pollution control plan. TMDLs are required for the water bodies in this category.

Table A-11 Sample water rights data by reach tab (partial)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Walla Walla River (Reach 1)**																
2	Reported By:																
3	Report Date: 9/10/2010				Claims	Qi	Records										
4	**SELECTION CRITERIA**				2	153.68	85										
5	WRIA	Walla Walla															
6	Region	Central,Eastern,Northwest,Southwest															
7	WR Class	Surface water															
8	Status	Active															
9	**File #**	**Cert #**	**Person**	**Stat**	**Doc**	**Priority Dt**	**Purpose**	**Qi**	**UOM**	**Qa**	**Ir Acres**	**WRIA**	**County**	**TRS**	**QQ/Q**	**Src's**	**1stSrc**
10	S3-*19920C	10191	Byerley Farms Inc	A	Cert	10/07/1966	IR	4.80	CFS	960.00	240	32	WALLA WALLA	06N 32E 01	S2/SE	1	WALLA WALLA RIVER
11	S3-*19921C	10190	Byerley Farms Inc	A	Cert	10/07/1966	IR	1.28	CFS	256.00	64	32	WALLA WALLA	06N 32E 01	S2/SE	1	WALLA WALLA RIVER
12	S3-*18785C	9335	Byerley Farms Inc	A	Cert	11/23/1964	IR	2.40	CFS	480.00	120	32	WALLA WALLA	06N 32E 01	SW/NW	1	WALLA WALLA RIVER
13	S3-*18787C	9327	Byrnes Edward	A	Cert	11/23/1964	IR	0.40	CFS	80.00	20	32	WALLA WALLA	06N 32E 01	SW/NW	1	WALLA WALLA RIVER
14	S3-*19007	9515	Byerley Richard	A	Cert	05/10/1965	IR	0.60	CFS	150.00	30	32	WALLA WALLA	06N 32E 01	SW/SE	1	WALLA WALLA RIVER
15	S3-*17560C	8751	Byrnes Edward	A	Cert	10/04/1962	IR	1.06	CFS	320.00	80	32	WALLA WALLA	06N 32E 01	S2/SE	1	WALLA WALLA RIVER
16	S3-*12495C	7065	Byerley Farms Inc	A	Cert	08/07/1953	IR	3.20	CFS	960.00	240	32	WALLA WALLA	06N 32E 01	S2/SE	1	WALLA WALLA RIVER
17	S3-30304		Byerley Farms Inc	A	NewApp	05/03/2000	IR	3.00	CFS		40	32	WALLA WALLA	06N 32E 01		5	WALLA WALLA RIVER
18	S3-CV1-3P86	10190	Byerley Farms Inc	A	CertChg	10/07/1966	IR		CFS			32	WALLA WALLA	06N 32E 01	NE/SW	1	WALLA WALLA RIVER
19	CS3-*19007	9515	Billy Hindman Marital Trust	A	Chng/ROE	06/20/2007	IFlow	0.50	CFS		125	32	WALLA WALLA	06N 32E 01	SW/SE	1	WALLA WALLA RIVER
20	S3-*19007(10-026)	9515	Billy Hindman Marital Trust	A	Temp Use	05/10/1965	IFlow	0.10	CFS	25.00		32	WALLA WALLA	06N 32E 01	SW/SE	1	WALLA WALLA RIVER
21	S3-*19006	9508	Byerley Farms Inc	A	Cert	05/10/1965	IR	1.40	CFS	350.00	70	32	WALLA WALLA	06N 32E 02	SE/NE	1	WALLA WALLA RIVER
22	S3-*16971C	8416	WA Ecology Department	A	Cert	10/11/1961	IFlow	0.46	CFS	109.00		32	WALLA WALLA	06N 32E 02	SE/NE	1	WALLA WALLA RIVER
23	S3-*16972C	8511	Byrnes A	A	Cert	10/11/1961	IR	0.36	CFS	140.00	28	32	WALLA WALLA	06N 32E 02	SE/NE	2	WALLA WALLA RIVER
24	CS3-*19006	9508	Billy Hindman Marital Trust	A	Chng/ROE	06/20/2006	IFlow	0.07	CFS		25	32	WALLA WALLA	06N 32E 02	SE/NE	1	WALLA WALLA RIVER
25	S3-*19006(10-017)	9508	Billy Hindman Marital Trust	A	Temp Use	05/10/1965	IFlow	1.30	CFS	325.00		32	WALLA WALLA	06N 32E 02	SE/NE	1	WALLA WALLA RIVER
26	S3-*20918CWRIS	11286	CONKEY V G	A	Cert	04/23/1968	IR	1.41	CFS	210.00	70	32	WALLA WALLA	06N 33E 02	NW/SW	1	WALLA WALLA RIVER
27	S3-*07955CWRIS	3641	DUNNING R	A	Cert	07/28/1947	IR	1.21	CFS		91	32	WALLA WALLA	06N 33E 02	E2/NW	2	WALLA WALLA RIVER
28	S3-CV2P930	645	Dunning Bessie	A	CertChg	01/01/1904	IR	1.58	CFS	0.00		32	WALLA WALLA	06N 33E 02		1	WALLA WALLA RIVER
29	S3-CV3P1051	645	Dunning Rolland	A	CertChg	01/01/1904	IR	1.05	CFS	0.00		32	WALLA WALLA	06N 33E 02		1	WALLA WALLA RIVER
30	S3-CV1P350	3641	Dunning Rolland	A	CertChg	07/28/1947	IR		CFS			32	WALLA WALLA	06N 33E 02	NE/NW	2	WALLA WALLA RIVER
31	S3-*11340CWRIS	5884	DEERINGHOFF W L	A	Cert	05/12/1952	IR	0.40	CFS		20	32	WALLA WALLA	06N 33E 03	NE/SE	1	WALLA WALLA RIVER
32	S3-*12701C(A)	06523(A)	Saranto Charles	A	Cert	12/23/1953	IR	3.15	CFS	1212.00	303	32	WALLA WALLA	06N 33E 03		2	WALLA WALLA RIVER
33	S3-*12701C(B)	06523(B)	Hamada Land Co.	A	Cert	12/23/1953	IR	0.15	CFS	53.20	14	32	WALLA WALLA	06N 33E 03		1	WALLA WALLA RIVER
34	S3-*10288CWRIS	5797	FOWLER M T	A	Cert	05/02/1951	IR	0.40	CFS		40	32	WALLA WALLA	06N 33E 04		1	WALLA WALLA RIVER
35	S3-*11203C	4844	Moore Robert	A	Cert	04/01/1952	IR	0.44	CFS	0.00	40	32	WALLA WALLA	06N 33E 04		1	WALLA WALLA RIVER
36	S3-*08786CWRIS	4920	WORKMAN W P	A	Cert	05/10/1949	IR	0.63	CFS		47.2	32	WALLA WALLA	06N 33E 04	NW/NW	1	WALLA WALLA RIVER
37	S3-*04450CWRIS	1201	MONNICH/AULT	A	Cert	08/12/1937	IR	3.04	CFS		155	32	WALLA WALLA	06N 33E 04	NE/NE	1	WALLA WALLA RIVER
38	S3-29148		Stone Allen	A	NewApp	02/18/1992	IR	2.80	CFS	244.00	126	32	WALLA WALLA	06N 33E 04		1	WALLA WALLA RIVER
39	S3-*20150CWRIS	10948	MUNNS A / H S	A	Cert	03/03/1967	IR	0.78	CFS	47.00	77	32	WALLA WALLA	06N 33E 05	NE/SW	2	WALLA WALLA RIVER
40	S3-*20151C	10949	Munns Hazel	A	Cert	03/03/1967	IR	0.59	CFS	71.00	43	32	WALLA WALLA	06N 33E 05	NE/SW	2	WALLA WALLA RIVER

Table A-12 Sample water rights summary tab

CRIA_ID	WRIA	Stream Name	Description	Claims	Qi	Records
3201	32	Walla Walla River (Reach 1)	Mouth to Touchet River	2	153.681	85
3202	32	Walla Walla River (Reach 2)	Touchet River to Mill Creek	0	162.815	195
3203	32	Walla Walla River (Reach 3)	Mouth to Oregon border	1	157.307	31
3205	32	Touchet River (Reach 1)	Mouth to Hofer Dam	0	18.517	28
3206	32	Touchet River (Reach 2)	Hofer Dam to Coppei Creek	11	143.168	150
3207	32	Touchet River (Reach 3)	Coppei Creek to Touchet River forks	6	158.504	174
3208	32	Coppei Creek	Mouth to Coppei Creek forks	7	5.4	31
3209	32	North Fork Coppei Creek	Confluence to falls above Coppei Springs	0	1.69	5
3210	32	South Fork Touchet River	Mouth to Griffen Fork	5	5.35	24
3211	32	North Fork Touchet River (Reach 1)	Mouth to Wolf Fork	0	16.922	45
3212	32	North Fork Touchet River (Reach 2)	Wolf Fork to Forest Service boundry	0	1.85	8
3213	32	Pine Creek	Mouth to Oregon border	1	24.609	34
3214	32	Mud Creek	Mouth (lower) to Locher Road	2	43.231	55
3215	32	Dry Creek	Mouth to North Fork Dry Creek	5	80.254	130
3216	32	North Fork Dry Creek	Mouth to tributary at GIS RM 3.0	1	0.005	2
3217	32	West Little Walla Walla River	Mouth to Oregon border	2	13.954	34
3218	32	Mill Creek (Reach 1)	Mouth to Bennington Dam	12	91.641	165
3219	32	Mill Creek (Reach 2)	Bennington Dam to Blue Creek	0	1.9	8
3220	32	Mill Creek (Reach 3)	Blue Creek to Oregon border	1	64.758	20
3222	32	Doan Creek	Mouth to Last Chance Road? At long. 118°24' 17.3" W	0	7.016	19
3223	32	Cold Creek	To upper extent of frog ponds E of McKinney Road	3	11.864	33
3224	32	Blue Creek	Mouth to Laird Creek	1	0.623	9
3225	32	East Little Walla Walla River	Mouth to Oregon border	1	2.946	13
3226	32	Patit Creek	Mouth to confluence of North and West Patit Creeks	3	1.772	4
3227	32	West Patit Creek	Mouth to Forest Service boundary	2	0.027	3
3228	32	Yellowhawk Creek	Mouth to Mill Creek	6	30.6738	130
3229	32	Cottonwood Creek	Mouth to North Fork Cottonwood Creek	0	0	29
3230	32	Whisky Creek	Mouth to tributary at GIS RM 6.0	3	1.59	6
3231	32	Titus Creek (Reach 1)	Mouth to Five Mile Bridge	0	11.348	28
3232	32	Titus Creek (Reach 2)	Five Mile Bridge to Mill Creek	0	0	1
3233	32	Walsh Creek	Mouth to pond on farm bordering Oregon	0	5.712	15
3234	32	Caldwell Creek	Mouth to Shelton Road (whole stream)	1	1.912	13
3235	32	Wolf Fork	Mouth to USFS boundary	2	4.01	26

Table A-13 Water right document type definitions

Code	Definition	Use for CRIA Scoring
Cert	Certificate (legal record of water right)	Yes
Pmt	Permit (to develop a water right)	Yes
CertChg	Certificate of change (to a permit or claim)	Yes
Claim	Claim only; not confirmed	No
Chng/ROE	Record of Examination for a Change	No
Temp Use	Temporary Use	Yes
ChgApp	Change Application (not processed)	No
Adjct Cert	Adjudicated certificate (legal record of a claim or water right verified through adjudication)	Yes
NewApp	New application (not processed)	No, unless noted

Table A-14 Water right purposes of use code definitions

Purpose Code	How the water will be used - categories include:	Purposes included for CRIA Scoring*
CO	Cooling for industrial purposes	Yes
CI	Commercial and Industrial Manufacturing (includes food processing and packaging, sand and gravel processing, asphalt plant, metal processing and manufacturing, pulp and paper manufacturing, aquatic plant culture, petroleum refining, car washes, and laundries)	Yes
DG	Domestic General (use of water for all domestic uses not specifically defined in the water right record or not defined by the other specific domestic use categories. Includes sewage treatment, farm supply, and laboratory use)	Yes
DM	Domestic Multiple (more than one dwelling, i.e. motels, trailer courts, campgrounds, parks, schools, port districts, public utility districts, diking and drainage districts, water districts, reclamation districts, and counties, none of which are under municipal control)	Yes
DS	Domestic Single (one dwelling with lawn and garden, up to one-half acre)	Yes
DY	Dairy	Yes
EN	Environmental Quality (includes pollution control, dust control, flood control, or any water use which improves or maintains the quality of the environment)	Yes
FP	Frost Protection (frost protection other than cranberries)	Yes
FR	Fire Protection (includes sprinkling log storage facilities)	Yes
FS	Fish Propagation (includes water service to ponds, reservoirs, hatcheries, and all other facilities involved in the overall purpose of fish propagation)	No; primarily non-consumptive
HE	Heat Exchange (use of such equipment as heat pumps, refrigeration equipment, and other cooling devices)	Yes
HP	Heat Protection For Crops (Water used during the summer months to protect such crops as apples and cranberries from the heat.)	Yes
HW	Highway (maintenance and construction)	Yes
IR	Irrigation (includes cranberry farming, lawn/garden watering with definite acreage, golf courses, greenhouses, etc.)	Yes
IF; Iflow	Instream flow	No

Purpose Code	How the water will be used - categories include:	Purposes included for CRIA Scoring*
IT	Municipal Intertie System	No
MI	Mining (includes washing coal, dredge mining, and hydraulic mining)	Yes
MU	Domestic Municipal (serves general domestic, commercial, and industrial needs of an incorporated municipality, i.e. cities, towns, and outlying areas)	Yes
NoID'd	No purpose identified	Yes
OT	Other (No purpose identified)	Yes
PO	Power (includes hydro-electric, hydraulic ram, and thermo-electric)	No; non-consumptive
RE	Recreation and Beautification (includes beautifying private and public grounds and supplying water to swimming pools, boating ponds, etc)	Yes
RW	Railway (use of water to serve railway equipment and facilities)	Yes
ST	Stock Watering (includes domestic uses of water for dairy/cattle farms, game bird farming, poultry farming, and fur-bearing animal farming)	Yes if cert or adj cert, else No
SR	Storage (Storage of water)	No; non-consumptive
TW-P	Trust Water-Permanent (Water in a permanent trust)	No
TW-T	Trust Water-Temporary (Water in a temporary trust.)	No
UN	Unknown	Yes
WL	Wildlife Propagation (includes water to service non-domesticated animals such as birds, game and non-game species)	Yes
*	Used everything I encountered EXCEPT FS (note issues), PO, IT, SR, Iflow (check codes - some codes for IF) 20100915 tls jk aw dg	

Table A-15 Sample flow gauge data tab

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Walla2@BeetRd ECY 32A105		RM 36.50			https://fortress.wa.gov/ecy/wrx/wrx/flows/station.asp?sta=32A105&historical=true													
2																			
3	Mean Monthly	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG	PEAK	Peak Month	Count Months where Avg < Rule	Count Months where Min < Rule	
4	Average	363.6	392.6	384.7	414.0	429.0	168.0	36.1	47.6	58.2	26.9	43.5	178.0	212	429	May	0	0	
5	Minimum	163.7	195.8	114.1	185.1	75.9	26.1	27.3	24.0	32.3	19.2	18.5	69.4						
6	Rule																		
7	Min/Avg	0.45	0.50	0.30	0.45	0.18	0.16	0.75	0.50	0.55	0.71	0.43	0.39						
8	Avg/Rule																		
9	Min/Rule																		
10																			
11																			
12	Year	Monthly mean in cfs (Calculation period: 2002-04-01 -> 2009-12-31)																	
13		1	2	3	4	5	6	7	8	9	10	11	12						
14	2002						29.1	32.9	35.0	46.7	30.0	28.5	69.4						
15	2003	421.7	673.5	672.0	398.8	210.5	32.1	37.6	40.4	62.1	36.8	33.5	173.6						
16	2004	457.1	547.7	431.3	350.6	601.3	323.2	47.9	46.2	52.7	27.7	61.3	201.9						
17	2005	206.0	195.8	114.1	192.0	186.0	27.7	31.4	31.6	41.5	21.6	18.5	166.7						
18	2006	521.0	352.2	310.5	843.1	334.8	386.0	27.3	24.0	32.3	19.2	117.0	322.5						
19	2007	282.5	471.9	504.6	221.5	75.9	26.1	55.1	100.2	121.1	23.4	21.4	136.5						
20	2008	163.7	246.8	219.6	185.1	914.0	423.0	27.3	37.6	56.5	32.6	39.1	228.2						
21	2009	493.5	260.3	440.5	707.2	680.5	97.2	29.7	66.1	52.8	23.5	28.4	125.7						
22																			

Reaches | Flow Rules | 3201 | 3202 | 3203 | 3205 | 3206 | 3207 | 3208 | 3210 | 3211 | 3212 | 3215 | 3218 | 3219 | 3220 | 3224 | 3225 | 3228 | 3229 | 3235 | 3201-USGS14018500WWR1nrTouch

Table A-16 Sample flow targets tab (partial)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	WRIA 32														
2									Note: used May value for summer months, even though "closed"						
3				1	2	3	4	5	6	7	8	9	10	11	12
4	USGS 14018500	3201	Walla Walla River (Reach 1)												
5	ECY 32A100	3202	Walla Walla River (Reach 2)	250	250	350	350	250	**250**	**250**	**250**	**250**	**250**	**250**	250
6	ECY 32A105	3203	Walla Walla River (Reach 3)												
7	ECY 32B075	3205	Touchet River (Reach 1)												
8	ECY 32B100	3206	Touchet River (Reach 2)	150	150	200	200	200	125	74	48	56	82	150	150
9	ECY 32B110	3207	Touchet River (Reach 3)												
10	ECY 32G060	3208	Coppei Creek												
11	No	3209	North Fork Coppei Creek												
12	ECY 32L070	3210	South Fork Touchet River												
13	ECY 32E050	3211	North Fork Touchet River (Reach 1)	95	95	125	125	125	95	65	53	51	63	95	95
14	ECY 32E150	3212	North Fork Touchet River (Reach 2)												
15	No	3213	Pine Creek												
16	No	3214	Mud Creek												
17	ECY 32F150	3215	Dry Creek												
18	No	3216	North Fork Dry Creek												
19	No	3217	West Little Walla Walla River												
20	ECY 32C070	3218	Mill Creek (Reach 1)												
21	USGS 14015000	3219	Mill Creek (Reach 2)												
22	USGS 14013000	3220	Mill Creek (Reach 3)	110	125	150	150	125	100	53	41	41	48	100	110
23	No	3221	Doan Creek												
24	No	3222	Cold Creek												
25	USGS 14013500	3224	Blue Creek												
26	ECY 32H090	3225	East Little Walla Walla River												
27	No	3226	Patit Creek												
28	No	3227	West Patit Creek												
29	ECY 32D060	3228	Yellowhawk Creek												

Table A-17 Sample flow scoring ("Reaches") tab (partial)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	WRIA 32 Walla Walla		Scored 20110920 tls Corrected Column "D" computation so that Aug/Avg>66% scores low impairment, or "1" (not "3"); no-data scores "4" in cols "B" "D" "E"												
2	NHD Avg Mon Mean Data Copied 20100923 tls														
3	LFA/EDT Copied 20100920 tls								GOOD IS HIGH	BAD IS HIGH; GOOD IS LOW >>>	>>>>>>>>	>>>>>>>>	>>>>>>>>	>>>>>>>>	
4	WRTS Data copied 20100920 tls		33				19	4			A	B	C	D	E
5	Reach Code	Reach Name	Stream Reach (description)	Target Reach (RM)	Gauges	RM	Gauge exists?	Rule exists?	BIN Worst 1/3 = 1 Mid 1/3 = 2 Best 1/3 = 3	Sum scores (A:D) * E	% of Mo Avg Below Rule %> .75=4 %>.5=3 %>.25=2 Else 1	Qi Deviation Factor Qi/Flow>.15=3 Qi/Flow>.05=2 Else 1	No. Claims Claims<2 = 1 Claims<9 = 2, Else 3	August Deviation Factor Aug/Avg>.66=1 Aug/Avg>.33=2 Else 3	Flow Volume Factor >1000=.5 >100=1 >50=2 >5=3 Else 4
6	3201	Walla Walla River (Reach 1)	Mouth to Touchet River	0.0-23.1	USGS 14018500	18.2	Yes	No	3	7		3	1	3	1.0
7	3202	Walla Walla River (Reach 2)	Touchet River to Mill Creek	23.1-37.5	ECY 32A100	32.8	Yes	Yes	3	9	2	3	1	3	1.0
8	3203	Walla Walla River (Reach 3)	Mouth to Oregon border	37.5-44.5	ECY 32A105	36.5	Yes	No	3	7		3	1	3	1.0
9	3205	Touchet River (Reach 1)	Mouth to Hofer Dam	0.0-5.0	ECY 32B075	3	Yes	No	3	6		2	1	3	1.0
10	3206	Touchet River (Reach 2)	Hofer Dam to Coppei Creek	5.0-50.7	ECY 32B100	40.4	Yes	Yes	3	11	2	3	3	3	1.0
11	3207	Touchet River (Reach 3)	Coppei Creek to Touchet River forks	50.7-64.2	ECY 32B110	46.3	Yes	No	3	8		3	2	3	1.0
12	3208	Coppei Creek	Mouth to Coppei Creek forks	0.0-8.0	ECY 32G060	0.1	Yes	No	1	24		3	2	3	3.0
13	3209	North Fork Coppei Creek	Confluence to falls above Coppei Springs	0.0-4.5	No		No	No	1	24		3	1	4	3.0
14	3210	South Fork Touchet River	Mouth to Griffen Fork	0.0-14.8	ECY 32L070	1	Yes	No	2	21		2	2	3	3.0
15	3211	North Fork Touchet River (Reach 1	Mouth to Wolf Fork	0.0-3.9	ECY 32E050	5	Yes	Yes	3	8	2	2	1	3	1.0
16	3212	North Fork Touchet River (Reach 2	Wolf Fork to Forest Service boundry	3.9-15.4	ECY 32E150	7.5	Yes	No	3	12		1	1	2	3.0
17	3213	Pine Creek	Mouth to Oregon border	0.0-5.3	No		No	No	1	24		3	1	4	3.0
18	3214	Mud Creek	Mouth (lower) to Locher Road	0.0-10.1	No		No	No	1	32		3	1	4	4.0
19	3215	Dry Creek	Mouth to North Fork Dry Creek	0.0-35.2	ECY 32F150	?	Yes	No	1	24		3	2	3	3.0
20	3216	North Fork Dry Creek	Mouth to tributary at GIS RM 3.0	0.0-3.0	No		No	No	2	18		1	1	4	3.0
21	3217	West Little Walla Walla River	Mouth to Oregon border	0.0-5.7	No		No	No	3	7		2	1	4	1.0
22	3218	Mill Creek (Reach 1)	Mouth to Bennington Dam	0.0-12.4	ECY 32C070	0.5	Yes	No	2	18		3	3	3	2.0
23	3219	Mill Creek (Reach 2)	Bennington Dam to Blue Creek	12.4-18.3	USGS 14015000	10.5	Yes	No	3	10		1	1	3	2.0
24	3220	Mill Creek (Reach 3)	Blue Creek to Oregon border	18.3-23.5	USGS 14013000	21.2	Yes	Yes	2	18	2	3	1	3	2.0
25	3222	Doan Creek	Mouth to Last Chance Road? At long. 118°24' 17.	0.0-4.4	No		No	No	1	24		3	1	4	3.0
26	3223	Cold Creek	To upper extent of frog ponds E of McKinney Ro	0.0-3.5	No		No	No	1	36		3	2	4	4.0
27	3224	Blue Creek	Mouth to Laird Creek	0.0-5.0	USGS 14013500	?	Yes	No	2	15		1	1	3	3.0
28	3225	East Little Walla Walla River	Mouth to Oregon border	0.0-2.0	ECY 32H090	?	Yes	No	2	20		3	1	1	4.0

Reaches / Flow Rules / 3201 / 3202 / 3203 / 3205 / 3206 / 3207 / 3208 / 3210 / 3211 / 3212 / 3215 / 3218 / 3219 / 3220 / 3224 / 3225 / 3228 / 3229 / 3235 / 3201-USGS14018500WWR1nrTouch

Ready

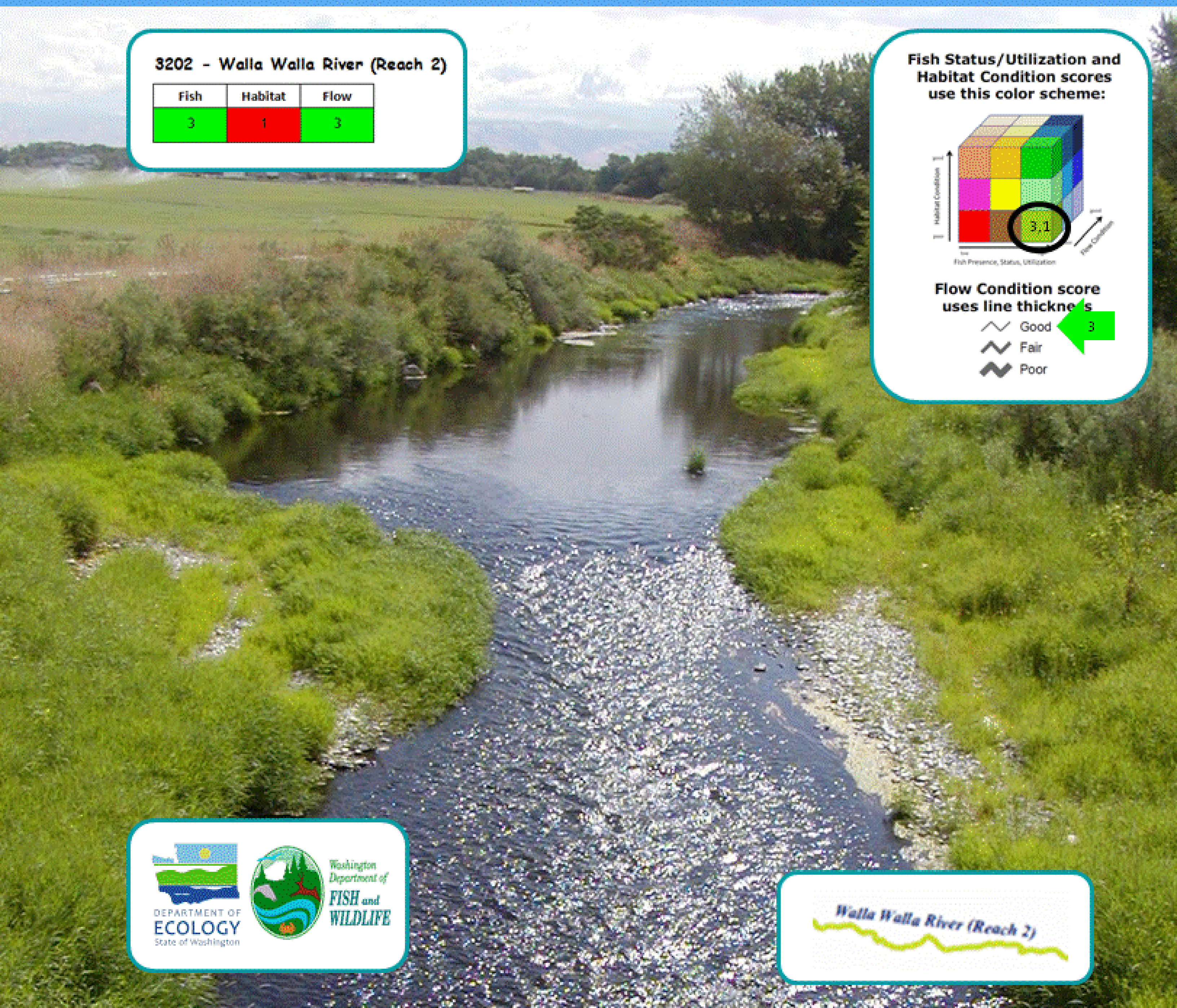
Start | Inbox - Microsoft Outlook | C:\data\Columbia River ... | CRIA_Appendix_A_Meth... | Microsoft Excel - WRI... | Links | Water | DFW

Columbia River Instream Atlas Project

Washington Department of Fish and Wildlife

Final Report – APPENDIX B

WRIA 32 WALLA WALLA



Ecology Contract C1000090 - WDFW Contract 09-1471
Ecology Publication Number: 11-12-015

November 2011

Columbia River Instream Atlas Project - Final Report Appendix B –WRIA 32 Walla Walla

November 21, 2011

Washington Department of Fish and Wildlife CRIA Team:

Teresa Scott (Habitat Water Resources Policy Coordinator)
Jonathan Kohr (Habitat Water Science Team)
Dayv Lowry (Fish Science; Habitat Science)
Andrew Weiss (Fish Science)
Aaron Bosworth (King County District Fish Biologist)
Jim Cummins (Yakima District Fish Biologist)
Dale Gombert (Fish Science)
Paul La Riviere (Habitat Water Science Team)
Peggy Miller (Habitat Major Projects)
Brianna Murphy (Fish Science)

Funding provided by Ecology Office of Columbia River as part of the 2011 Columbia Basin Long-term Water Supply and Demand Forecast

Ecology Contract C1000090

WDFW Contract 09-1471

Ecology Publication Number: 11-12-015

If you need this document in a format for the visually impaired, call the Office of Columbia River at (509) 575-2490. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

Cover Photo: Jonathan Kohr

Columbia River Instream Atlas Project

Final Report

Appendix B - WRIA 32 - Walla Walla

November 21, 2011

Table of Contents

Tables

Figures

1. Description

The Walla Walla Subbasin encompasses 1,758 square miles located in Walla Walla and Columbia Counties in southeast Washington State and Umatilla County in northeast Oregon State. “Walla Walla” means area of many springs, which is indicative of the history and the value of the springs in the valley. Only the streams reaches in Washington are considered here.

Primary waterbodies include the Walla Walla River and Touchet River, both of which originate in the Blue Mountains. The Touchet River and Mill Creek are major tributaries to the Walla Walla, which is a direct tributary to the Columbia River. Melting snow from the Blue Mountains provides much of the annual runoff to the streams and rivers in the subbasin; the water level in many streams diminishes greatly during the summer months. Vegetation in the subbasin is characterized by grassland, shrub steppe, and agricultural lands at lower elevations and evergreen forests at higher elevations. Approximately 90 percent of the subbasin is privately owned, with 9 percent managed by federal/state agencies. The Confederated Tribes of the Umatilla Indian Reservation also owns approximately 8,700 acres within the subbasin[1].

2. Reach Definitions

Boundary delineation for individual reaches in the larger WRIA 32 streams occurs at major tributary confluences and dams. Surface flows and instream habitat often change significantly below these boundaries and in some cases are the points that mark the fork for a specific fish stock. Some reaches terminate at the Oregon border but in many of the small streams the riparian conditions, floodplain functions, fish passage problems, and adjacent land uses change very little until another fork or a tributary flows into it. On these respective small streams reach boundaries are established to reflect the change in flow, and instream and streamside habitat. Headwaters are not often delineated because there are no water rights that provide Ecology opportunities for water acquisition. The urban streams are either distributaries of Mill Creek or the Walla Walla River or flow from springs within the urban environment. Some of the urban streams adjoin underground stormwater systems and the respective boundaries terminate where the stream goes subsurface.

Table B-1 Reach Definitions

Stream Name	Code	Stream Reach Description
Walla Walla River (Reach 1)	3201	Mouth to Touchet River
Walla Walla River (Reach 2)	3202	Touchet River to Mill Creek
Walla Walla River (Reach 3)	3203	Mill Creek to Oregon border
Touchet River (Reach 1)	3205	Mouth to Hofer Dam
Touchet River (Reach 2)	3206	Hofer Dam to Coppei Creek
Touchet River (Reach 3)	3207	Coppei Creek to Touchet River forks
Coppei Creek	3208	Mouth to Coppei Creek forks
North Fork Coppei Creek	3209	Confluence to falls above Coppei Springs
South Fork Touchet River	3210	Mouth to Griffen Fork
North Fork Touchet River (Reach 1)	3211	Mouth to Wolf Fork
North Fork Touchet River (Reach 2)	3212	Wolf Fork to Forest Service boundary
Pine Creek	3213	Mouth to Oregon border
Mud Creek	3214	Mouth (lower) to Locher Rd
Dry Creek	3215	Mouth to North Fork Dry Creek
North Fork Dry Creek	3216	Mouth to tributary at GIS RM 3.0

1 Adapted from Northwest Power and Conservation Council 2005f.

Stream Name	Code	Stream Reach Description
West Little Walla Walla River	3217	Mouth to Oregon border
Mill Creek (Reach 1)	3218	Mouth to Bennington Dam
Mill Creek (Reach 2)	3219	Bennington Dam to Blue Creek
Mill Creek (Reach 3)	3220	Blue Creek to Oregon border
Doan Creek	3222	Mouth to Last Chance Rd at long. 118°24' 17.3" W
Cold Creek	3223	To upper extent of frog ponds E of McKinney Rd
Blue Creek	3224	Mouth to Laird Creek
East Little Walla Walla River	3225	Mouth to Oregon border
Patit Creek	3226	Mouth to confluence of North and West Patit Creeks
West Patit Creek	3227	Mouth to Forest Service boundary
Yellowhawk Creek	3228	Mouth to Mill Creek
Cottonwood Creek	3229	Mouth to North Fork Cottonwood Creek
Whisky Creek	3230	Mouth to tributary at GIS RM 6.0
Titus Creek (Reach 1)	3231	Mouth to Five Mile Bridge
Titus Creek (Reach 2)	3232	Five Mile Bridge to Mill Creek
Walsh Creek	3233	Mouth to pond on farm bordering Oregon
Caldwell Creek	3234	Mouth to Shelton Rd (whole stream)
Wolf Fork	3235	Mouth to USFS boundary

3. WRIA Results

Fish Status and Utilization

Components of the fish utilization score and ranking are SaSI status, ESA status, fish diversity and time spent in the reach for spawning/incubation, rearing/smolt migration and adult migration. TRT designation was not considered in this rating but is available on the spreadsheets for inclusion in future evaluations.

Four salmonid stocks are scored for the Walla Walla River Basin. Those stocks are Walla Walla Summer Steelhead, Touchet Summer Steelhead, bull trout, and Walla Walla Spring Chinook. Though fall Chinook and coho are also present in the Walla Walla, we did not include them in scoring for this basin.

Spring Chinook were effectively extirpated from the Walla Walla River Basin in the late 1950's. The extripation was ascribed to dewatering of the mainstem Walla Walla River below Ninemile Dam and irrigation withdrawals throughout the basin during the important months of adult migration. Efforts by the CTUIR to reintroduce spring Chinook to the Walla Walla River Basin using adult out-planting, have met with some success, so the reintroduced stock is included in CRIA. An "unknown" status is assigned to spring Chinook here, and the known distribution of reintroduced fish is represented in the CRIA fish tables.

SaSI status for Walla Walla Summer Steelhead, Touchet Summer Steelhead, and bull trout are unknown, depressed, and depressed respectively. In addition, bull trout and the two summer steelhead stocks are classified by ESA as threatened (Table B-2). Fish status/utilization periodicity is depicted on Table B-3.

The weighting factor (ESA and SaSI) for the each stock remains the same within the basin whereas the life cycle stages and duration will change depending on the stream reach. SaSi status, and ESA listing will not be repeated for each stream reach.

Table B-2 SaSI Stock Name, Status, ESA Listing Unit, & Listing Status

SaSI Stock name	SaSI Status	ESA Unit Name	ESA Listing Status
Walla Walla Spring Chinook	n/a	n/a	n/a
Walla Walla Summer Steelhead	Unknown	Middle Columbia Steelhead	Threatened
Touchet Summer Steelhead	Depressed	Middle Columbia Steelhead	Threatened
Touchet Bull Trout	Unknown	Touchet/Walla Walla Bull Trout (Oregon Recovery Unit)	Threatened
Mill Creek Bull Trout	Healthy	Touchet/Walla Walla Bull Trout (Oregon Recovery Unit)	Threatened

Table B-3 Fish status & utilization periodicity for five life stages.

Fish Species - SaSI Stock (SaSI	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Walla Walla Summer Steelhead (ESA Threatened; 2 Depressed SaSI Stocks)	Adult In-Migration	Some activity	Some activity	Some activity	Some activity	Some activity	No Use	No Use	No Use	Some activity	Some activity	Some activity	Some activity
	Spawning	No Use	Some activity	Some activity	Peak activity	Peak activity	Some activity	No Use	No Use	No Use	No Use	No Use	No Use
	Egg Incubation & Fry Emergence	No Use	No Use	No Use	No Use	No Use	Some activity	Some activity	Peak activity	Peak activity	Some activity	No Use	No Use
	Rearing	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity
	Juvenile Out-Migration	No Use	No Use	Some activity	Peak activity	Peak activity	Some activity	No Use	No Use	No Use	No Use	No Use	No Use

Fish Species - SaSI Stock (SaSI	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Walla Walla Spring Chinook (No ESA stock; No SaSI Stock)	Adult In-Migration	No Use	No Use	No Use	Some activity	Peak activity	Peak activity	Some activity	Some activity	Some activity	Some activity	No Use	No Use
	Spawning	No Use	No Use	No Use	No Use	No Use	No Use	No Use	Some activity	Peak activity	Some activity	No Use	No Use
	Egg Incubation & Fry Emergence	Some activity	Some activity	Some activity	No Use	No Use	No Use	No Use	No Use	Some activity	Some activity	Some activity	Some activity
	Rearing	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity
	Juvenile Out-Migration	Some activity	Some activity	Peak activity	Peak activity	Peak activity	Some activity	No Use	No Use	No Use	No Use	Some activity	Some activity

Fish Species - SaSI Stock (SaSI	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Walla Walla Bull Trout (ESA Threatened; 2 Unknown SaSI Stocks)	Spawning	No Use	No Use	No Use	No Use	No Use	No Use	No Use	No Use	Some activity	Some activity	Some activity	No Use
	Egg Incubation & Fry Emergence	Some activity	Some activity	Some activity	Some activity	Some activity	No Use	No Use	No Use	No Use	No Use	Some activity	Some activity
	Rearing	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity	Some activity

Note: Stock presence varies by stream reach
- = No Use
- = Some activity or use occurring
- = Peak activity

Table B-4 Fish status/utilization score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Normalized Score	Bin	Bin Equivalent
3201	Walla Walla River (Reach 1)	224	0.94	3	High
3202	Walla Walla River (Reach 2)	224	0.94	3	High
3203	Walla Walla River (Reach 3)	204	0.85	3	High
3205	Touchet River (Reach 1)	224	0.94	3	High
3206	Touchet River (Reach 2)	188	0.78	3	High
3207	Touchet River (Reach 3)	204	0.85	3	High
3208	Coppei Creek	114	0.50	2	Medium
3209	North Fork Coppei Creek	90	0.40	2	Medium
3210	South Fork Touchet River	195	0.86	3	High
3211	North Fork Touchet River (Reach 1)	198	0.88	3	High
3212	North Fork Touchet River (Reach 2)	225	1.00	3	High
3213	Pine Creek	114	0.50	2	Medium
3214	Mud Creek	60	0.27	1	Low
3215	Dry Creek	114	0.50	2	Medium
3216	North Fork Dry Creek	90	0.40	2	Medium
3217	West Little Walla Walla River	114	0.50	2	Medium
3218	Mill Creek (Reach 1)	198	1.00	3	High
3219	Mill Creek (Reach 2)	225	0.88	3	High
3220	Mill Creek (Reach 3)	225	1.00	3	High
3222	Doan Creek	114	0.50	2	Medium
3223	Cold Creek	114	0.50	2	Medium
3224	Blue Creek	150	0.66	2	Medium
3225	East Little Walla Walla River	114	0.50	2	Medium
3226	Patit Creek	114	0.50	2	Medium
3227	West Patit Creek	114	0.50	2	Medium
3228	Yellowhawk Creek	138	0.61	2	Medium
3229	Cottonwood Creek	90	0.40	2	Medium
3230	Whisky Creek	114	0.47	2	Medium
3231	Titus Creek (Reach 1)	90	0.40	2	Medium
3232	Titus Creek (Reach 2)	90	0.40	2	Medium
3233	Walsh Creek	90	0.40	2	Medium
3234	Caldwell Creek	90	0.40	2	Medium
3235	Wolf Fork	225	1.00	3	High

Habitat Condition

Water Resource Inventory Area (WRIA) 32 represents about 73 percent of the entire Walla Walla watershed; the remainder is in Oregon. Instream habitat and riparian conditions tend to reflect the local land use practices. The upper watershed tributaries, such as the upper North Fork Touchet River, Wolf Fork, and upper Mill Creek flow through managed US Forest Service lands that retain the natural functions and values of an aquatic environment to a much greater extent than the middle or lower reaches of the major tributaries and rivers within the Walla Walla Basin. High water temperatures and summer low flows create lower quality habitat conditions in the mainstem river below College Place on the Walla Walla River and downstream of Dayton on the Touchet River.

The Spring Branch system, known as the East and West Little Walla Walla Rivers is very dependent on alluvial groundwater levels that are heavily influenced from river flows as they leave the rocky mountain terrain and enter the large Walla Walla Basin alluvial fan. Most of the small streams in the valley originate from one of the many groundwater springs. Walla Walla means area of many springs, which is indicative of the history and the value of the springs in the valley. Flow and riparian restoration on the small tributaries coupled with the increasing numbers of steelhead spawning and rearing demonstrates the value of the cool groundwater influence within the smaller systems, plus the influence on temperature in the Walla Walla River.

Large scale agriculture practices dominate the landscape outside of the US Forest Service lands. Dry land and irrigated wheat are primary crops. There are numerous high water duty crops such as alfalfa, alfalfa seed, corn, onions, and apples, in addition to grapes, pasture, and rangeland. The high irrigation demand during the summer often puts surface flows at risk in the lower reaches resulting in a dry stream bed in the lower Touchet and Walla Walla Rivers. The erosion levels into the river from the deep soils are excessive and contribute to the loss of spawning gravels, poor water quality, and degraded food supply for rearing juvenile salmonids. Municipalities, small farms, levees, and other development also contribute to the loss of instream flow and habitat in the middle to lower reaches throughout WRIA 32.

The stream flow is dependent on snow pack in the Blue Mountains. A majority of salmonids spawn in higher elevation reaches because of fewer limiting factors; juvenile survival is higher because of better cover, considerable woody debris, cold clean water, and less competition from warm water fishes; and fluvial migration is not hindered due to low flows. Spring droughts affect the adult migration success of two key basin stocks: steelhead and spring Chinook. Mature bull trout often incur fluvial migrations only, which limits their migration to the upper reaches and makes them less vulnerable to low flow conditions due to drought in the middle to lower reaches.

It should be noted that inadequate diversion screening was not evaluated for this project, though it is identified as a serious source of immediate fish mortality in basin-specific planning documents.

Table B-5 Habitat condition score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Bin	Bin Equivalent
3201	Walla Walla River (Reach 1)	9	1	Poor
3202	Walla Walla River (Reach 2)	10	1	Poor
3203	Walla Walla River (Reach 3)	11	2	Fair
3205	Touchet River (Reach 1)	8	1	Poor
3206	Touchet River (Reach 2)	11	2	Fair
3207	Touchet River (Reach 3)	14	2	Fair
3208	Coppei Creek	11	2	Fair
3209	North Fork Coppei Creek	16	3	Good
3210	South Fork Touchet River	15	3	Good
3211	North Fork Touchet River (Reach 1)	13	2	Fair
3212	North Fork Touchet River (Reach 2)	16	3	Good
3213	Pine Creek	6	1	Poor
3214	Mud Creek	6	1	Poor
3215	Dry Creek	10	1	Poor
3216	North Fork Dry Creek	16	3	Good
3217	West Little Walla Walla River	10	1	Poor
3218	Mill Creek (Reach 1)	8	1	Poor
3219	Mill Creek (Reach 2)	16	3	Good
3220	Mill Creek (Reach 3)	16	3	Good
3222	Doan Creek	12	2	Fair
3223	Cold Creek	12	2	Fair
3224	Blue Creek	15	3	Good
3225	East Little Walla Walla River	15	3	Good
3226	Patit Creek	8	1	Poor
3227	West Patit Creek	15	3	Good
3228	Yellowhawk Creek	10	1	Poor
3229	Cottonwood Creek	10	1	Poor
3230	Whisky Creek	11	2	Fair
3231	Titus Creek (Reach 1)	8	1	Poor
3232	Titus Creek (Reach 2)	15	3	Good
3233	Walsh Creek	13	2	Fair
3234	Caldwell Creek	11	2	Fair
3235	Wolf Fork	17	3	Good

Flow Condition

Water supply in the Walla Walla basin originates in the Blue Mountains of Southeast Washington/Northeast Oregon. A major deep aquifer comprised of basalt layers hundreds of feet in thickness underlies the entire watershed, and contains a substantial amount of ground water flowing slowly through fractures in the rock. A shallower gravel aquifer about 120,000 acres in size overlies the basalt aquifer from Milton-Freewater downstream to the town of Touchet, and has substantial hydraulic continuity with the Walla Walla River. A number of tributaries in this basin are spring-fed, and many creeks run dry naturally in late summer months. Sections of the lower Touchet River, lower Mill Creek, and the Walla Walla River between the city of Milton-Freewater and the Oregon-Washington border can become completely dewatered in summer and early fall. Recent efforts at flow restoration in the lower basin have resulted in significant flow improvements in these reaches.[2] [3]

It is important to distinguish between naturally-low-flow creeks and reaches in which low flows are caused by water diversions from the stream. Although that distinction has not been directly identified in CRIA flow scoring, reaches with low “flow” scores all have some component of water diversion.

Fourteen of the thirty-three reaches in WRIA 32 have no flow gauge and a couple of those have only intermittent gauge data. For reaches without gauges, flow scores were derived based on estimated flow levels and the status of diversions for each reach. Only a couple of reaches have no (recorded) diversions. In some cases the gauge data were so sparse that we decided not to use them for scoring; those cases are noted in the workbook tabs. Likewise, some of the NDH+ estimated Mean Annual Flows were incongruous with the little gauge data available, or with the habitat narrative, and were manually deleted from the analysis. These cases are noted on the “Reaches” tab of the Flow workbook. Removing these data points from the analysis has the effect of binning the reach “poor” for flow condition, which was consistent with scores for the other scoring elements.

Flow patterns across months are normative for most reaches (with gauges), though most curves are truncated as irrigation comes online. Several reaches (Cottonwood Creek, East Little Walla Walla River, Blue Creek, Mill Creek (Reach 2), Dry Creek, and Coppei Creek) have summer-fall flows below 2cfs; Mill Creek Reach 1 has July flow (4.9 cfs) that is 2% of the peak spring flow on average, and South Fork Touchet River has August/September flow (3.2 cfs) that is about 3% of the peak spring flow.

---

2 Adapted from SALMONID HABITAT LIMITING FACTORS WATER RESOURCE INVENTORY AREA 32 WALLA WALLA WATERSHED FINAL REPORT 4/1/2001 Mike Kuttel, Jr. Washington State Conservation Commission; and

3 *Walla Walla Subbasin Plan* Prepared for Northwest Power and Conservation Council Submitted by Walla Walla County (on behalf of the Walla Walla Watershed Planning Unit) And the Walla Walla Basin Watershed Council, May 28, 2004.

Walla Walla Reach 2, Touchet Reach 2, North Fork Touchet Reach 1, and Mill Creek Reach 3 each have instream flow levels set in WAC (Table B-6)[4]. On average, WAC instream flows are not met in July through November (June through November in Mill Creek Reach 3). Monthly minimum flows (minimum flow for each month within a period of record) are lower than WAC instream flows 9, 8, 11, and 12 months out of the year (respectively) in these four reaches.

Table B-6 Minimum Instream Flows set in Chapter 173-532 WAC

Time Period	Reach 3202 Walla Walla River Reach 2 at East Detour Road ECY Gage 32A100	Reach 3206 Touchet River Reach 2 at Bolles Road ECY Gage 32B100	Reach 3211 N.F. Touchet River Reach 1 above Dayton ECY Gage 32E050	Reach 3220 Mill Creek Reach 3 near Walla Walla. USGS Gage 14013000
Jan	250	150	95	110
Feb	250	150	95	125
Mar	350	200	125	150
Apr	350	200	125	150
May	250	200	125	125
Jun	Closure	125	95	100
Jul	Closure	74	65	53
Aug	Closure	48	53	41
Sep	Closure	56	51	41
Oct	Closure	82	63	48
Nov	Closure	150	95	100
Dec	250	150	95	110

4 WAC instream flow rules are set by approximately weekly periods. Because CRIA scoring was evaluated at a monthly time scale, we choose the highest WAC value for each month to compare with Mean Monthly Flow. In closed periods, we used the most recent (earlier) WAC value.

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table B-7 Flow condition score & bin by stream reach

Reach Code	Reach Name	Prioritization Score (High = Poor)	Bin (High = Good)
3201	Walla Walla River (Reach 1)	7	3
3202	Walla Walla River (Reach 2)	9	3
3203	Walla Walla River (Reach 3)	7	3
3205	Touchet River (Reach 1)	6	3
3206	Touchet River (Reach 2)	11	3
3207	Touchet River (Reach 3)	8	3
3208	Coppei Creek	24	1
3209	North Fork Coppei Creek	24	1
3210	South Fork Touchet River	21	2
3211	North Fork Touchet River (Reach 1)	8	3
3212	North Fork Touchet River (Reach 2)	12	3
3213	Pine Creek	24	1
3214	Mud Creek	32	1
3215	Dry Creek	24	1
3216	North Fork Dry Creek	18	2
3217	West Little Walla Walla River	7	3
3218	Mill Creek (Reach 1)	18	2
3219	Mill Creek (Reach 2)	10	3
3220	Mill Creek (Reach 3)	18	2
3222	Doan Creek	24	1
3223	Cold Creek	36	1
3224	Blue Creek	15	2
3225	East Little Walla Walla River	20	2
3226	Patit Creek	24	1
3227	West Patit Creek	18	2
3228	Yellowhawk Creek	40	1
3229	Cottonwood Creek	36	1
3230	Whisky Creek	24	1
3231	Titus Creek (Reach 1)	36	1
3232	Titus Creek (Reach 2)	36	1
3233	Walsh Creek	32	1
3234	Caldwell Creek	24	1
3235	Wolf Fork	15	2

4. Reach Results

3201 - Walla Walla River (Reach 1)

Fish	Habitat	Flow
3	1	3

Fish Status/Utilization

All four stocks are present in Walla Walla River (Reach 1), which contributes to the high Fish Status/Utilization rating. Walla Walla and Touchet Summer Steelhead utilize this reach for adult migration and juvenile rearing. Most steelhead spawn higher in the system or in the headwaters of this basin beyond the borders of Washington. Walla Walla Spring Chinook and bull trout also rear and migrate in Walla Walla River River (Reach 1) but spawn elsewhere.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The lowest reach on the Walla Walla River is a low gradient meandering stream channel that is surrounded by farms and grazing lands from the mouth to the Touchet River confluence. There are no tributaries, very few side channels, and floodplain connectivity is limited. Instream habitat is limited to slow moving water, pools, and long series of runs. Warm water temperatures during the summer limit juvenile rearing values to the late fall, winter, and spring months. Riparian zones are degraded, streambank erosion is high, and the river channel is incised.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 21 cfs in August and the peak is 1,292 cfs in February. Minimum flow is 4 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Contrary to the overall score of "good," this reach can be severely flow and temperature impaired in summer months. The average of June through October flows is 5 times less than the average for other months. With a minimum Mean Monthly Flow of 21 cfs (August) and a peak of 1,292 cfs (February), the usefulness of average monthly flow as a scoring basis can be questioned. Diversions evaluated for this project represent 27 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. While this reach demonstrates classic flow impairment, the overall flow volume bins this reach as "good" in comparison to the many very-low-flow reaches in this WRIA.

Flow scoring detail is available on Table B-10.

3202 - Walla Walla River (Reach 2)

Fish	Habitat	Flow
3	1	3

Fish Status/Utilization

Walla Walla River (Reach 2) also rates high for Fish Status/Utilization. Walla Walla Summer Steelhead stock expresses spawning, rearing and migration life cycle behaviors in this reach. The other three stocks limit behavior to rearing and adult migration life cycle stages.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The middle reach (2) flows between the confluences of Mill Creek and the Touchet River. A large unconfined gravel aquifer that underlies the area roughly from Milton-Freewater downstream to the town of Touchet is highly connected to the river through hydraulic continuity and is the source of gaining flows in this reach. Numerous agricultural points of diversions (POD) often reduce flow during the spring, summer, or early fall to less than 10 cfs. This creates a physical and thermal passage barrier at critical riffle zones.

Several tributaries flow into the Walla Walla River Reach 2 that offer cool water refuge for juveniles at the confluence. There is very little public land that borders the river, except at McDonald Road. The riparian zones are narrow and limited in plant diversity because of farming. There are several levees that affect floodplain connectivity. There is limited side channel habitat and a few riverine wetlands in the lower gradient zones. Biologists observed steelhead spawning in the upper part of Reach 2 in 2010 near the mouth of Mill Creek. Rearing habitat values increase in the upper portions, as cool water complements greater mesohabitat complexity, and better cover.

Habitat scoring detail is available on Table B-9.

Flow

'Gauge:Yes Rule:Yes Comments: The minimum of monthly mean flows in this reach is 40 cfs in August and the peak is 635 cfs in May. Minimum flow is 14 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 57 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. The instream flow rule is higher than Mean Annual Flow in 5 months of the year, on average. Reaches with flow rules greater than Mean Annual Flow for between 6 and 9 months of the year are considered to be in 'fair' condition. Again, this reach demonstrates classic flow impairment; however the overall flow volume bins this reach as “good” in comparison to the many very-low-flow reaches in this WRIA.

Flow scoring detail is available on Table B-10.

3203 - Walla Walla River (Reach 3)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

The Fish Status/Utilization rating for Walla Walla River (Reach 3) is high. Even though only three stocks are present, Walla Walla Spring Chinook start to spawn within this reach. Walla Walla Summer Steelhead stock continues to utilize the river for spawning, rearing and adult migration whereas Touchet Steelhead is no longer present. Bull trout maintain rearing and adult migration in Walla Walla River (Reach 3).

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The Walla Walla River Reach 3 flows between the Mill Creek confluence and the Oregon state line. Its primary value lies in rearing habitat and access to the upper watershed in Oregon. There are several major irrigation PODs that historically dried up most of the river bed in this reach up to the mouth of Yellowhawk Creek. The lack of surface flow was a primary cause of poor fish production, especially bull trout, in this reach and upstream. Starting in 2000, bypass flows up to 25 cfs restored surface flows throughout the irrigation season. These flows resulted from an agreement between Washington/Oregon irrigators and federal agencies in response to ESA concerns.

The Walla Walla River channel is incised and bordered by levees at various locations. Reach 3, which is a losing reach for instream flow, is the primary source of groundwater water for the Spring Branch distributary system of the Little Walla Walla River. Riparian zones are fragmented because of agriculture and residential developments. Instream habitat complexity improves enough (compared to downstream reaches) to support higher levels of juvenile rearing and staging for migration.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 27 cfs in July and the peak is 429 cfs in May. Minimum flow is 13 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 75 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. Total flow volume combined with improved flows in recent years boost this reach's score to "good" in comparison with other reaches in this WRIA.

Flow scoring detail is available on Table B-10.

3205 - Touchet River (Reach 1)

Fish	Habitat	Flow
3	1	3

Fish Status/Utilization

The Fish Status/Utilization rating is still high for Touchet River (Reach 1). Within this reach designation Touchet Summer Steelhead spawn, rear and migrate whereas Walla Walla Summer Steelhead behavior is limited to juvenile rearing. Walla Walla Spring Chinook and bull trout express the rearing and adult migration life cycle stages, although few spring Chinook exist in the Touchet basin.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The Touchet River Reach 1 is short in river miles, all below Hofer Dam at river mile (RM) 4.1. Historically and near Hofer Dam, this reach usually went dry during the irrigation season. Since 2006, local farmers installed irrigation efficiencies that improve summer and fall surface flows from historic conditions. Fish passage is functional at the dam, and flow improvements (as much as 23 cfs in early November) below the dam improved passage over previous critical riffles.

Warm water temperatures, lack of instream refuge and habitat complexity, such as large woody debris (LWD), boulders, or deep pools, limit the Touchet River Reach 1 to adult and juvenile migration life history phases. Some winter juvenile staging probably occurs in this reach.

The river channel is incised, lacks wide meanders, and is surrounded by active irrigation farming activities. The river substrate is highly embedded. The riparian zones are narrow and consist of linear communities of brushy willows, very few tall canopy trees, and reed canary grass. There are no perennial tributaries, and very few side channels.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 10 cfs in August and the peak is 474 cfs in March. Minimum flow is 5 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 10 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component. Total flow volume combined with improved flows in recent years boost this reach's score to "good" in comparison with other reaches in this WRIA.

Flow scoring detail is available on Table B-10.

3206 - Touchet River (Reach 2)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

Fish Status/Utilization for Touchet River (Reach 2) is also high. This point in the river is beyond the range for Walla Walla Summer Steelhead but Touchet Summer Steelhead expresses all three life cycle stages. Bull trout and Walla Walla Spring Chinook continue to rear and migrate in this reach.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Touchet River Reach 2 flows entirely through dry land and irrigated wheat farms and terminates at Coppei Creek. The riparian zones lack tall canopy trees and thus contribute very little structural woody debris. In the open farmlands, the reduced natural riparian buffers lead to high soil erosion levels, embedded substrate, and lack of instream complexity such as cover. The upper portion of Reach 2 flows through the city of Waitsburg and has levees that disconnect the river from the floodplain.

There are a number of ephemeral drainages that contribute flow during the wet seasons, but they do not support anadromous fish life. There are side channels that offer some refuge for juveniles during high flows. The lack of large woody debris limits the stream bed scour that creates pool habitat. Pools are used by adults and juveniles for instream refuge habitat. Warm summer waters and poor water quality also limit juvenile production in this reach, and probably limits the use by bull trout subadults and adults to winter and high spring flow conditions.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:Yes Comments: The minimum of monthly mean flows in this reach is 41 cfs in September and the peak is 693 cfs in March. Minimum flow is 15 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 52 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. The instream flow rule is higher than Mean Annual Flow in 5 months of the year, on average. Reaches with flow rules greater than Mean Annual Flow for between 6 and 9 months of the year are considered to be in 'fair' condition. Higher flow volume alone boosts this reach’s score to “good” in comparison with other reaches in this WRIA.

Flow scoring detail is available on Table B-10.

3207 - Touchet River (Reach 3)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

Touchet River (Reach 3) also rates high for fish ultilization. Wlla Walla Summer Steelhead are no longer present in the river. In contrast Walla Walla Spring Chinook and Touchet Summer Steelhead express all three life cycle stages. Bull trout is limited to rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The Touchet River Reach 3 is the transition zone between the lower elevation farm and shrub steppe lands and the forest zone. Flood control projects in and around populated areas have disconnected the Touchet River from over 50% of the historic 100-year floodplain. The land use transitions from farms in the lower portion of Reach 3, to the city of Dayton, to the series of small land parcels with residential development that are bordered by pine forests. Agricultural activities including dikes, filling of wetlands, conversion of riparian forest to cropland, and channelization eliminated nearly all the off-channel habitat along this reach.

Woody debris recruitment along with pool habitat and cover is moderate. Stream bed substrate supports minimal steelhead spawning. Bull trout use the upper portions of this reach for winter refuge habitat. Flow can become a limiting factor during late summer for passage and fish production, especially during drought years. Water quality is fair, with warm water temperature limiting the presence of salmonids. A couple of small tributaries drain into Reach 3 that provide off channel rearing opportunities near the confluence.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 37 cfs in August and the peak is 392 cfs in April . Minimum flow is 19 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 83 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. Higher flow volume alone boosts this reach’s score to “good” in comparison with other reaches in this WRIA.

Flow scoring detail is available on Table B-10.

3208 - Coppei Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Coppei Creek, a tributary to the Touchet River, Fish Status/Utilization is medium. Bull trout and Walla Walla Summer Steelhead are not present in this creek. Touchet Summer Steelhead spawn, rear and migrate here whereas Walla Walla Spring Chinook utilize the creek for rearing.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Coppei Creek enters the Touchet River within the city of Waitsburg. Riparian condition ranges from highly degraded on the lower mainstem of Coppei Creek near Waitsburg to a mix of mature deciduous and coniferous trees in the headwaters. The riparian zone from McCowan Road downstream to Waitsburg is a very narrow buffer of immature trees, often growing in the stream channel. Residential developments continue along the stream edge and much of the remaining area is farmed to the stream edge. Many areas of the Coppei Creek system are still open to cattle grazing.

Extensive areas of riprap and armored dikes are found from RM 8.0 downstream. Many gravel dikes have been built here as well. Channel modifications including straightening, removal of gravel from the streambed, and construction of gravel dikes have caused reduced sinuosity (stream meander) and channel incision.

About 90% of the 37 square mile Coppei Creek Watershed is highly erodible dry cropland. Fine sediment inputs have caused severely embedded gravel in many areas from RM 8.0 downstream. Large woody debris is rare from RM 8.0 downstream. A significant amount of channel straightening and downcutting have occurred on this portion of stream. Most off-channel habitat is eliminated. Fish passage is probably impaired during the summer months from warm water temperatures.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is less than 1 cfs in August and the peak is 44 cfs in March. Minimum flow is 3 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. This reach is ultra-impaired, as noted in the habitat comments. Gauge data suggest that surface flows cease for this reach in July-September. Diversions evaluated for this project represent 32 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table B-10.

3209 - North Fork Coppei Creek

Fish	Habitat	Flow
2	3	1

Fish Status/Utilization

Fish Status/Utilization rating for North Fork Coppei Creek is medium. The only stock present in the reach is Touchet Summer Steelhead which expresses all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Many of the same conditions noted in the Coppei Creek Reach apply to the North Fork Coppei Creek reach. Stream temperatures are cooler than the lower reaches. Riparian buffer zones include taller canopy trees such as pine trees because of the proximity to forest lands. Stream substrate and water quality is healthy enough to sustain a steelhead spawning and rearing population. There is less encroachment on the stream channel from residential development, but agricultural and forest practices still impact instream habitat complexity.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 8 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 22 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table B-10.

3210 - South Fork Touchet River

Fish	Habitat	Flow
3	3	2

Fish Status/Utilization

South Fork Touchet River maintains the high Fish Status/Utilization rating also seen in Touchet River (Reach 3). Walla Walla Summer Steelhead is not present but Touchet Summer Steelhead is present and expresses spawning, rearing and adult migration. Bull trout also express all three life cycle behaviors. In contrast Walla Walla Spring Chinook utilize the River for juvenile rearing.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The South Fork (SF) Touchet River lacks LWD and shade and it is a highly unstable channel. Grazing impacts affect the mid and lower portions. The SF Touchet riparian zones are narrow buffers with minimal mature trees providing some shade. Approximately 2.0 miles of valley bottom road between the Griffin Fork and the Dry Touchet disrupt floodplain function and disturb the streambed. Dikes, levees, and roads disconnect the floodplain in places. There is a loss of LWD recruitment due to riparian timber harvest, land clearing for agriculture and homes, and removal of wood from the channel.

Off-channel habitat is nearly nonexistent and roads, dikes, and shifting channels limit formation and or maintenance of off-channel areas. Dewatering occurs on the lower mile of the SF Touchet during the summer months. This dewatering does not occur during juvenile or adult salmonid migration to and from the ocean respectively, but it impairs movement of juveniles rearing in the system. No artificial obstructions to fish passage are known to occur in this reach.

Confederated Tribes of the Umatilla Indian Reservation has made improvements to the road and road crossings, and riparian timber harvest has been curtailed on CTUIR property, so conditions here will continue to improve over the years.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 3 cfs in August and the peak is 100 cfs in April. Minimum flow is 7 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 13 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component.

Flow scoring detail is available on Table B-10.

3211 - North Fork Touchet River (Reach 1)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

The Fish Status/Utilization is high for North Fork Touchet River (Reach 1). Three stocks are present in this reach of the river. Touchet Summer Steelhead and Walla Walla Spring Chinook spawn, rear and migrate in the river whereas bull trout is limited to rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The riparian zone has some mature trees present, but often in a narrow buffer. In many areas this buffer is disconnected from the river by dikes or fragmented by agricultural land conversion practices. In the lower portion of the North Fork Touchet River Reach 1, some channelization, straightening, and dikes occur, which were attempts to control flood waters.

A significant amount of spawning habitat is available on this reach. However, in some areas the stream has downcut close to bedrock. Wood is often removed from the channel during flood control work and LWD recruitment is limited by dikes that separate riparian vegetation from the river.

Pools are generally lacking on this reach; pools comprise 2.79% of total water surface on this reach. Many of the pools present on this reach are caused by the stream contacting the base of bedrock hillsides. Off-channel habitat is lacking along this reach. Agricultural land conversion, draining of wetlands, and dike construction destroyed or disconnected off-channel areas from the main river channel. Several small tributaries, including intermittent streams are a significant source of fine sediment laden runoff.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:Yes Comments: The minimum of monthly mean flows in this reach is 39 cfs in September and the peak is 255 cfs in April. Minimum flow is 32 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 14 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component. The instream flow rule is higher than Mean Annual Flow in 5 months of the year, on average. Reaches with flow rules greater than Mean Annual Flow for between 6 and 9 months of the year are considered to be in 'fair' condition.

Flow scoring detail is available on Table B-10.

3212 - North Fork Touchet River (Reach 2)

Fish	Habitat	Flow
3	3	3

Fish Status/Utilization

North Fork Touchet River (Reach 2) maintains the high Fish Status/Utilization rating. The three stocks present express all three life cycle behaviors. Walla Walla Summer Steelhead is not present.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Habitat conditions in the Upper Touchet, though not pristine, are more favorable to salmonids than those found in the Lower Touchet. No artificial obstructions have been identified on the North Fork Touchet River. A large portion of the reach is located on U.S. Forest Service (USFS) lands. Cattle ranching, recreational cabins, and small acreage home sites are also present. In general, riparian vegetation is composed of a diverse mixture of native trees and shrubs, providing adequate shade and LWD recruitment on USFS lands in the upper portion of Reach 1. Large woody debris is deficient in the reach between Lewis Creek and Wolf Fork. Very little livestock is present in the riparian zone on private lands.

The floodplain gets inundated on USFS lands during flood flows. Pools are lacking in quality and quantity. The lack of pools is caused by channel disturbances including removal of LWD and instream work performed following flood events as well as channel constrictions that minimize sinuosity. Off-channel habitat would not typically be found in abundance in a reach of this nature (2-4% gradient), but some is present. Water temperatures in this reach are the best found within the Touchet River Basin. Dewatering does not occur on this reach.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 20 cfs in September and the peak is 88 cfs in May. Minimum flow is 45 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score. Diversions evaluated for this project represent a little under 5 percent of the Mean Annual Flow; reaches with diversions under 5% of Mean Annual Flow scored 'good' for this scoring component.

Flow scoring detail is available on Table B-10.

3213 - Pine Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Pine Creek is a primary tributary to the mainstem Walla Walla River. The Fish Status/Utilization score for this creek is “average.” Two stocks are presumed to be present in Pine Creek, Walla Walla Summer Steelhead and Walla Walla Spring Chinook. Walla Walla Spring Chinook shows rearing behavior whereas Walla Walla Summer Steelhead expresses all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Little or no riparian vegetation is present along much of Pine Creek as a result of farming to the edge of the streambank. Pine Creek is deeply incised to RM 7.0 (Oregon). This incision is the result of unstable banks caused by conversion of native riparian buffers to crop land. Stream banks frequently cave in forming temporary silt dams. Channel incision limits floodplain connectivity. Highly unstable streambanks caused by removal of riparian vegetation and channel incision contribute to a large fine sediment load.

Several large steep passage barriers exist on Pine Creek in Oregon and Washington, and one is a concrete slide that extends over 20 feet.

Substrate embeddedness is a problem. No data on off-channel habitat is available, but channel incision and conversion of floodplains to cropland suggest that off-channel habitat would be rare. Maximum water temperatures on Pine routinely exceeded 80°F (26.7°C) during July and August. Average temperatures commonly exceeded 70°F from late July through late August. Irrigation withdrawals in October and November periodically dewater Pine Creek. Flows are highly dependent upon irrigation activities upstream in Oregon.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 41 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 60 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table B-10.

3214 - Mud Creek

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Mud Creek is also a primary tributary to the mainstem Walla Walla River but Fish Status/Utilization is low. Two stocks are present. These are Walla Walla Summer Steelhead and Walla Walla Spring Chinook. Both stocks behavior is limited to rearing in Mud Creek.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

There is very little woody vegetation, and almost completely void of tall canopy trees in the riparian zones of Mud Creek. There is no LWD or medium woody debris (MWD). The stream gradient is low and meanders almost entirely through farms and crop fields.

Bank erosion, which is high due to grazing activity and crop production, contributes large quantities of fine soils to the streambed. There is very little spawning size gravel for steelhead.

Various reaches of Mud Creek are intermittent, probably due to direct irrigation diversions and conjunctive wells. The lack of flow during the irrigation season creates a fish passage barrier for adults and juveniles. Several culverts also present obstructions to fish passage. There is perennial flow and more temperate water temperatures near the confluence with the Walla Walla River. The lower reach provides juvenile refuge and rearing habitat year round; cooler in the summer and warmer in the winter.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. Diversion data used for this evaluation are many times higher than the Mean Annual Flow.

Flow scoring detail is available on Table B-10.

3215 - Dry Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Fish Status/Utilization in Dry Creek, a primary tributary to the mainstem Walla Walla, is rated as medium. Walla Walla Summer Steelhead and Walla Walla Spring Chinook are present and express all three behaviors and juvenile rearing respectively.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The riparian zone a few miles above the town of Dixie is characterized by a relatively dense forest. From Dixie downstream the buffer becomes a thin strip often only one tree in width and often of non-native black locust trees. A severe passage barrier is present on Mud Creek (right bank tributary at RM 28.8, east of the town of Dixie) at a failed culvert under an abandoned rail line. A wide riparian buffer is present above the barrier on Mud Creek. About two miles of potential summer steelhead spawning and rearing habitat are upstream of this blockage. At least two concrete grade control structures just downstream of the Highway 12 Bridge are potential barriers.

Deep channel incision eliminated large woody debris recruitment from the buffer along the majority of the lower reaches. Some areas are downcut 40 to 50 feet below the old floodplain in response to channel straightening and removal of riparian vegetation. Substrate conditions are extremely poor. A lack of riparian vegetation along stream banks, and severe downcutting of the channel eliminated access to much of the floodplain, thereby limiting LWD recruitment. Off-channel habitat is nearly nonexistent in the lowest reaches of Dry Creek. Dry Creek carries a huge fine sediment load eroded from dryland agricultural fields throughout the drainage.

Dry Creek has very low summer flows, causing mostly standing and/or stagnant water. The channel has been straightened downstream of Dixie. The upper portion of Dry Creek is a narrow canyon with a narrow floodplain. This area is rapidly being converted to home sites. Floodplain connectivity is good at this time. Biologists report 9.9 pieces of large woody debris (LWD) per mile, which is extremely low. Pools generally range from 1 to 1.5' deep. Although LWD is lacking, some undercut banks provide pools with cover. No information on off-channel habitat is available and very substrate data exists. Temperatures on the Dry Creek mainstem are not as favorable as in the North Fork Dry Creek. Previous studies show maximum temperatures frequently exceed 70°F and averaged ≥65°F from mid July through mid August.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is around 1 cfs in August and the peak is 44 cfs in April. Minimum flow is 5 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversion data used for this evaluation exceed the Mean Annual Flow.

Flow scoring detail is available on Table B-10.

3216 - North Fork Dry Creek

Fish	Habitat	Flow
2	3	2

Fish Status/Utilization

North Fork Dry Creek is a tributary to Dry Creek and also maintains a medium Fish Status/Utilization rating. The only stock present is Walla Wall Summer Steelhead which utilizes the creek for all three life cycle behaviors.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The county road along the North Fork of Dry Creek has seven fords across the stream, disturbing spawning and rearing functions and water quality values. The North Fork of Dry Creek has relatively cool summer water temperatures, and flows through forest lands. The riparian conditions vary, but have tall canopy trees and some shoreline native vegetation shrubs. Substrate consists of small to large cobble with medium amount of embeddness.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 9 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 1 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component.

Flow scoring detail is available on Table B-10.

3217 - West Little Walla Walla River

Fish	Habitat	Flow
2	1	3

Fish Status/Utilization

Two stocks are present in the West Little Walla Walla River, a tributary of the mainstem Walla Walla River. Walla Walla Spring Chinook utilize the River for juvenile rearing whereas Walla Walla Summer Steelhead uses the river for all three life cycle stages. Stock presence, life cycle stages and duration within the stream attribute to the medium Fish Status/Utilization rating.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The stream channel meanders through farms, pasture, and crop fields before draining into the Walla Walla River downstream of the Mill Creek confluence. Woody shrubs are intermittently spread along the riparian zones. Flow is the extreme limiting factor because of the numerous irrigation withdrawals and a loss of groundwater connectivity to its source water, the mainstem Walla Walla River. The groundwater influence provides cooler water during the summer, but the reduced groundwater influence means water temperatures exceed salmonid limits in most reaches of the stream. Year round juveniles rearing values persist in the lowest reaches, with added benefit during the winter months further upstream. Fish passage is limited in the middle to upper reach by flow and by a number of small culverts.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 161 cfs Mean Annual Flow was used to score this reach[5]. Diversions evaluated for this project represent 9 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component. The bin of “good” for this reach is highly influenced by the NHD+ estimated flow volume, which is high relative to other WRIA reaches.

[5] A comment received in October 2011 indicates that the NHD-derived 161cfs is not a reasonable flow for the capacity of this stream, which is frequently dry between the state boundary and its mouth in summer months.

Flow scoring detail is available on Table B-10.

3218 - Mill Creek (Reach 1)

Fish	Habitat	Flow
3	1	2

Fish Status/Utilization

Mill Creek (reach 1) is another primary tributary of the mainstem Walla Walla River. Fish Status/Utilization for this creek is high. Three stocks present and the life cycles expressed help make the Fish Status/Utilization rating high. Touchet Summer Steelhead is the missing stock in this reach. Walla Walla Summer Steelhead and Walla Walla Spring Chinook show the full range of life cycle stages whereas bull trout is limited to juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Mill Creek was channelized in 1948 from Bennington Lake Diversion Dam downstream to Gose Road. The upper and lower portions of this wide channel are characterized by rip rapped banks and cross weirs spaced about every 100 feet. The middle portion of the channel (through the City of Walla Walla) is concrete lined with a low flow channel and baffles placed at regular intervals in an attempt to allow fish passage. Juvenile passage is still impeded through this reach during both low and high flow conditions. Remediation of fish passage problems is under study and planned throughout much of the lower portion of this reach. Summer low flows are most critical about a mile below Bennington Lake Diversion Dam just below the Yellowhawk/Garrison Creek division dam.

Riparian vegetation is sparse and disconnected from the stream by the Mill Creek flood control project downstream to Gose Road. Channelization and floodplain development eliminated natural floodplain processes. Substrate embeddedness in the channelized portion of Mill Creek is very poor because of the concrete lined channel. Large woody debris is nearly nonexistent on this reach. Channelization and floodplain development also eliminated off-channel habitat. Springs in the Walla Walla City limits and outflow from the City of Walla Walla sewage treatment plant prevent complete drying of the channel. High chlorine levels create suboptimal conditions for salmonids from Gose Road upstream to the City of Walla Walla sewage treatment plant.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 5 cfs in July and the peak is 239 cfs in January. Minimum flow is 5 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 94 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean

Annual Flow scored 'poor' for this scoring component. This reach is ultra-impaired, as noted in the habitat comments, but was saved from binning ‘poor’ because overall volume is high relative to other reaches in this WRIA.

Flow scoring detail is available on Table B-10.

3219 - Mill Creek (Reach 2)

Fish	Habitat	Flow
3	3	3

Fish Status/Utilization

Fish Status/Utilization in Mill Creek (Reach 2) is also rated high. Bull trout, Walla Walla Spring Chinook and Walla Walla Summer Steelhead stocks all spawn, rear and migrate in this reach.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The Mill Creek Reach 2 is characterized by high plateaus where dryland farming is the dominant land use. Riparian zones are a mixture of deciduous and coniferous trees with varying degrees of disturbance depending upon property ownership. Roads and dikes limit floodplain connectivity on private lands. Large woody debris is deficient throughout this reach. The forebay area of Bennington Lake Diversion Dam (upstream side) has created a large delta area with several meandering stream channels, contributing to high quality salmonid rearing habitat. However, a gravity diversion into Titus Creek (RM 14.3) does cause complete dewatering (in the vicinity of the diversion only) during the summer months.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 1 cfs in August and the peak is 179 cfs in March. Minimum flow is 1 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Gauge data suggest that surface flows cease for this reach in August-September. Diversions evaluated for this project represent 3 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component. In spite of the de-watering mentioned above and summer low flows, the overall flow volume score helps this reach bin in the upper one-third for this WRIA.

Flow scoring detail is available on Table B-10.

3220 - Mill Creek (Reach 3)

Fish	Habitat	Flow
3	3	2

Fish Status/Utilization

Fish Status/Utilization in Mill Creek (Reach 3) is the same as for Mill Creek (Reach 2). Both rate high for Fish Status/Utilization. In addition bull trout, Walla Walla Spring Chinook and Walla Walla Summer Steelhead utilize the designated reach for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Mill Creek originates on U.S. Forest Service lands in Washington high in the West flanks of the Blue Mountains. The upper portion of this creek is protected by the Mill Creek Watershed, an area closed to public. Much of the upper portion of the subbasin is remote forest land. Riparian vegetation within "the watershed" is dominated by large Douglas fir, white fir, grand fir, and alder trees. The floodplain is fully connected. Side channels comprise 3.6% of stream surface area on USFS lands. Regardless, large woody debris remains deficient throughout the reach.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:Yes Comments: The minimum of monthly mean flows in this reach is 30 cfs in August and the peak is 169 cfs in March. Minimum flow is 31 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 68 percent of the Mean Annual Flow[6]; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. The instream flow rule is higher than Mean Annual Flow in 6 months of the year, on average. Reaches with flow rules greater than Mean Annual Flow for between 6 and 9 months of the year are considered to be in 'fair' condition.

Flow scoring detail is available on Table B-10.

[6] A comment received in October 2011 indicated that 68% is too high and is probably attributable to an undeveloped municipal permit in this reach.

3222 - Doan Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Fish Status/Utilization for Doan Creek, a tributary to Mill Creek, is medium. Touchet Summer Steelhead and bull trout are not present in the reach. Walla Walla Spring Chinook utilizes the creek for juvenile rearing whereas Walla Walla Summer Steelhead uses Doan Creek for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Local biologists continue to restore stream channel, riparian, floodplain, and fish passage functions in lower Doan Creek, especially the portion that flows through U. S. National Park lands. Middle reaches still flow underground through pipes that originate near the groundwater springs that are the source of flow for the stream.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 9 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 83 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table B-10.

3223 - Cold Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Cold Creek, another tributary to Mill Creek, also has a medium Fish Status/Utilization rating. As with Doan Creek, Walla Walla Spring Chinook utilize the creek for juvenile rearing whereas Walla Walla Summer Steelhead use Cold Creek for all three life cycle stages. Touchet Summer Steelhead and bull trout are not present.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The source flow originates in groundwater springs that are located in an urban neighborhood. The stream flows through underground pipes, though is occasionally exposed in a residential backyard before disappearing back underground. The entire surface water stream channel flows through small farms and rural residential zones. Riparian buffers are of minimal width and retain minimal large canopy trees. Many of the land owners farm to the stream edge. Fish passage conditions throughout the drainage are not well documented.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 4 cfs Mean Annual Flow was used to score this reach. Diversion data used for this evaluation exceed the Mean Annual Flow.

Flow scoring detail is available on Table B-10.

3224 - Blue Creek

Fish	Habitat	Flow
2	3	2

Fish Status/Utilization

Fish Status/Utilization for Blue Creek is rated at medium. This creek is a tributary to Mill Creek and is utilized by bull trout, Walla Walla Spring Chinook and Walla Walla Summer Steelhead. Bull trout and Walla Walla Spring Chinook express juvenile rearing life stage whereas Walla Walla Summer Steelhead express all three.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Blue Creek remains a relatively healthy stream system that continues to support steelhead life histories. Historic logging practices and fires continue to contribute excessive levels of fine sediment. The basin terrestrial habitat is a mix of forest lands, mixed deciduous trees, and grasslands. The Tribes of the Umatilla Indian Reservation (CTUIR) replanted and fenced riparian buffers along Blue Creek. The floodplain, substrate, side-channel, and instream habitat functions and values are not very well documented.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The dataset for this reach is very old: 1939-1971. Based on those data, the minimum of monthly mean flows in this reach is around 1 cfs in July and the peak is 34 cfs in March. Minimum flow is 5 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 4 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component.

Flow scoring detail is available on Table B-10.

3225 - East Little Walla Walla River

Fish	Habitat	Flow
2	3	2

Fish Status/Utilization

East Little Walla Walla River is a primary tributary to the Walla Walla River mainstem and rates medium for Fish Status/Utilization. Walla Walla Summer Steelhead and Walla Walla Spring Chinook are present in this reach whereas Touchet Summer Steelhead and bull trout are not. Life cycle behavior expressed by Walla Walla Summer Steelhead and Walla Walla Spring Chinook are spawning, rearing, and migration, and juvenile rearing respectively.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Habitat is generally characterized by impaired riparian conditions and a relatively high amount of fine sediment in the substrate. The adjacent land is used for cattle grazing which impacts the habitat in and along the stream. Large woody species native to the area are largely absent in all except the lower portion of the system. There is very little instream structure. The summer low flows naturally limit recruitment from upstream habitat, plus LWD recruitment may be limited throughout the year because of small culverts upstream. Dense areas of reed canary grass are common habitat areas used for rearing juveniles. Many of the road culverts are functional at normal flows, but not during high flows. Woody debris blockage occurs at the culvert crossing regularly, resulting in the flooding of adjacent upstream property. There are numerous livestock crossings that create wide shallow reaches of stream where streambed and soil disturbances impact sediment loads during high water.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach hovers near 3 cfs in winter months and the peak Mean Annual Flow is 5 cfs in June. Minimum flow is 80 percent of the average; reaches with August flows greater than 66% of average scored 'good' for this component of the flow element score. This small stream has a relatively flat hydrograph with lower flows occurring in winter months. Diversions evaluated for this project represent 75 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. Flow data from the stream gage in the East Little Walla Walla River shows a range of 3 to 16 cfs. During a survey in August 2005, it was visually estimated that stream flow was approximately 3 to 4 cfs. Channel capacity has been estimated to be between 16 and 20 cfs.

Flow scoring detail is available on Table B-10.

3226 - Patit Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Patit Creek is a tributary to the Touchet River. This creek has a medium Fish Status/Utilization rating. Touchet Summer Steelhead is present rather than Walla Walla Summer Steelhead. Walla Walla Spring Chinook is also present but Bull trout is not. Touchet Summer Steelhead utilizes the stream for all three life cycle stages whereas Walla Walla Spring Chinook only utilize Patit Creek for juvenile rearing.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Patit Creek flows through dryland, irrigated crop lands, pasture lands, and the city of Dayton. The confluence with the Touchet River is within the city of Dayton. The riparian zone is fragmented, depending on the adjacent land use. Some riparian replanting is ongoing in the farm zones; in the city, lawns often go to the stream edge. There are spawning gravels available, but embeddedness is high due to the erosion and fine sediments that come from agricultural activities. The stream is incised and bedrock is exposed is several areas of the stream. Patit Creek often dewaters from the forks downstream during the summer months.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 21 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 9 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component.

Flow scoring detail is available on Table B-10.

3227 - West Patit Creek

Fish	Habitat	Flow
2	3	2

Fish Status/Utilization

Walla Walla Spring Chinook and Touchet Summer Steelhead are present in West Patit Creek, a tributary to Touchet River. Walla Walla Spring Chinook utilize the creek for juvenile rearing. In contrast Touchet Summer Steelhead utilizes West Patit Creek for spawning, rearing and adult migration. The utilization by the two stocks leads to a medium Fish Status/Utilization rating.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

West Patit Creek has marginal steelhead habitat, with low to no flows in summer; there are some better flows upstream about 2 to 3 miles from the confluence. This is a short, somewhat steep drainage with farmlands on the top. The direct riparian area has some grasses and a mix of shrubs (hawthorne, etc.) and some trees (cottonwood and hardwoods with a few Ponderosa pines). The riparian area gets decent about 2 to 3 miles from the confluence and in the upper reaches riparian habitat is good. Overall, sedimentation is an issue, as is flow and temperature.

CTUIR staff did some habitat work several years ago in this stream, adding large woody debris etc. to add channel complexity. This is now the area in which the majority of Patit Steelhead spawn.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 10 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 1 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good for this scoring component.

Flow scoring detail is available on Table B-10.

3228 - Yellowhawk Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Yellow Creek is a tributary to the mainstem Walla Walla River. As such Walla Walla Summer Steelhead is present rather than Touchet Summer Steelhead. Walla Walla Summer Steelhead utilizes the creek for all three life cycle stages. Bull trout and Walla Walla Spring Chinook are also present and utilize the stream for adult migration and juvenile rearing respectively. These stocks and activities lead to a medium Fish Status/Utilization rating.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Yellowhawk Creek is used as a bypass corridor for salmonids to get around the channelized portion of Mill Creek. Four channel spanning barriers have been identified on Yellowhawk Creek. Irrigation activity is high, with 34 pump and three gravity diversions on Yellowhawk Creek. Yellowhawk Creek flows through both highly urbanized areas and relatively natural riparian areas. Streambanks are very unstable;

43% of banks assessed were actively eroding. Unstable banks are attributed to urban development and increased flows from irrigation diversions out of Mill Creek.

Flows are controlled year-round, preventing "flushing flows" that would clean gravel and reduce embeddedness. Urban development and regulations of flows both severely limit floodplain connectivity. Gravels and cobbles are highly cemented by fine sediment. Yellowhawk Creek is deficient of LWD; only 12.6 pieces of LWD per mile. Off-channel habitat is very limited. Yellowhawk Creeks would go dry during the summer months without the additional water diverted from Mill Creek.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: There are very few data points with which to evaluate this reach; no gauge data are available from December through April. Neither gauge data nor the NHD+ estimate provided a reasonable basis for scoring, and were manually removed from the scoring matrix. Of the gauge data available, Mean Annual Flow is 46cfs, the minimum of monthly mean flows reported for this reach is 17 cfs in August-September and the peak is 153 cfs in May. Diversion data used for this evaluation exceed the gauged Mean Annual Flow[7].

Flow scoring detail is available on Table B-10.

3229 - Cottonwood Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Fish Status/Utilization rating for Cottonwood Creek, a tributary to the mainstem Walla Walla River, is medium. The only stock present is Walla Walla Summer Steelhead, but the ESA rating, SaSI status and expression of all three life cycle stages in this creek leads to the medium rating.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Cottonwood Creek originates in wooded ravines in the Oregon portion of the Blue Mountains. The stream flows through vast areas of dryland agriculture. In many cases the land is farmed to the edge of the streambank, leaving no riparian buffer. Where woody vegetation is present it is usually found in a thin strip, often growing up out of an incised stream channel. Many reaches are deeply incised as a result of removal of riparian vegetation from the historic floodplain. The lower portion of Cottonwood Creek has dikes. No data exists on off-channel habitat. Portions of Cottonwood Creek from

[7] An October 2011 review comment indicates that actual diversions are probably lower than those used for this analysis.

the mouth to the state line go dry during the summer. No man-made physical barriers are identified on Cottonwood Creek.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: There are too few gauge data points with which to evaluate this reach. NHD+ estimates are not reasonable in context with those few gauged points, and were also removed from the scoring matrix. Diversion data used for this evaluation exceed the Mean Annual Flow. Lacking flow data upon which to score, the reach bins as ‘poor’ condition.

Flow scoring detail is available on Table B-10.

3230 - Whisky Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Whisky Creek is a tributary to Touchet River. Two stocks are present in this creek, Touchet Summer Steelhead and Walla Walla Spring Chinook. Walla Walla Spring Chinook use Whisky Creek for juvenile rearing whereas Touchet Summer Steelhead utilize the stream for spawning, rearing and adult migration. The utilization of Whiskey Creek by these two stocks ascribes to a medium Fish Status/Utilization rating.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Whiskey Creek is one of the few perennial tributaries to the lower portion of the Touchet River Reach 2. Juvenile rearing values are good primarily due to cool summer temperatures; maximum temperatures never exceeded 65°F during the summer of 1999, and average temperatures were <58°F. Minimal instream and riparian habitat data is available for Whiskey Creek.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 18 cfs MAF was used to score this reach. Diversions evaluated for this project represent 9 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table B-10.

3231 - Titus Creek (Reach 1)

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Titus Creek (Reach 1) is a tributary to Mill Creek. The only stock present is Walla Walla Summer Steelhead, but the ESA rating, SaSI status and expression of all three life cycle stages in this creek leads to the medium rating.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The lower reach of Titus Creek (Reach 1) is approximately two miles in length and flows through irrigated crop land and the local community college campus. The community college and local officials are restoring passage, riparian, and instream habitat structure in the lower reaches of Titus Creek. The farm areas still have diversion weirs and livestock access that cause juvenile passage barriers. Records show at least 13 pump and two gravity diversions in Reach 1. Groundwater influences the water temperatures, keeping it cool in the summer and warmer in the winter. This temperature cycle provides juvenile rearing and refuge habitat year round. The riparian zone is almost void of tall canopy trees, except in the upper portions. Future conditions are likely to improve with the increased community focus.

Habitat scoring detail is available on Table B-9.

Flow

Gauge? No Rule? No. Comments: There are few data available with which to score this reach. While Qi data were available, no NHD+ estimate of Mean Annual Flow was used.

Flow scoring detail is available on Table B-10.

3232 - Titus Creek (Reach 2)

Fish	Habitat	Flow
2	3	1

Fish Status/Utilization

Titus Creek (Reach 2) Fish Status/Utilization is rated as medium. Walla Walla Summer Steelhead is the only stock present in the reach, but shows all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The upper reach of Titus Creek represents close to 1.5 miles of distributary or side channel habitat to Mill Creek. Migration of the Mill Creek channel resulted in erosion of the right bank, causing the majority of Mill Creek flow to be directed into Titus Creek. A push-up dam about 500 yards down Titus Creek directs about 10 cfs of flow back into Mill Creek below the critical flow reach of Mill Creek. Areas of Titus Creek are separated from Mill Creek by a levee. The levee reduces the floodplain functions and values. The stream flows through a tall cottonwood gallery in the upper portions of Reach 2. Residential and agricultural activities surround much of the lower portion of Reach 2. Groundwater cools the stream flow during the summer.

Habitat scoring detail is available on Table B-9.

Flow

Gauge? No Rule? No. Comments: There are no data available with which to score this reach; No NHD+ estimate was used.

Flow scoring detail is available on Table B-10.

3233 - Walsh Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Walsh Creek is a primary tributary to the Walla Walla mainstem. Again only one stock is present, Walla Walla Summer Steelhead. The medium Fish Status/Utilization rating is based on ESA and SaSI status and the the utilization of the Creek for spawning, rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Walsh Creek is spring fed and provides juvenile rearing habitat because of the cool summer water habitat. The groundwater relationship to surface flows may be a cause for the stream going dry during the summer. The stream flows through farm areas where there is grazing and access for stock watering. Stream substrate consists of fine sediments and a few gravel zones. The riparian zones are fragmented into thin strips of willows, rose bushes, a few deciduous tall canopy trees, and reed canary grass. The channel gradient is low resulting in slow flows. Fish passage is hindered by small road culverts that also prevent LWD from mobilizing downstream.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 1 cfs Mean Annual Flow was used to score this reach. Diversion data used for this evaluation exceed the Mean Annual Flow.

Flow scoring detail is available on Table B-10.

3234 - Caldwell Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Fish Status/Utilization in Caldwell Creek is similar to Walsh Creek. Caldwell Creek is a tributary to the mainstem Walla Walla River with only one stock present. Walla Walla Summer Steelhead utilize the creek for all three life cycle stages and the Fish Status/Utilization rating is medium.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

Caldwell Creek is a small left bank (LB) tributary of Yellowhawk Creek. Irrigation withdrawals consist of three pumps and one gravity diversion. The riparian zones are fragmented into narrow woody shrubs, a few tall canopy deciduous trees, reed canary grass, or bare shorelines. Springs feed the stream within the city of Walla Walla and thus offer some cool water habitat during the summer for juvenile salmonids. There is very little source of rocky substrate and the floodplain consists of small fields of annual crops and residential backyards. The stream flows through several undersized culverts.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 8 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 23 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table B-10.

3235 - Wolf Fork

Fish	Habitat	Flow
3	3	2

Fish Status/Utilization

The high Fish Status/Utilization rating for Wolf Fork is based on the presence and utilization of three stocks. Wolf Fork is a tributary to Touchet River. Touchet Summer Steelhead, Walla Walla Spring Chinook and bull trout utilize the reach for spawning, rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table B-8.

Habitat

The riparian zones on the Wolf Fork are relatively intact and are dominated by immature coniferous trees, some alder, and willow. The riparian zone is nearly intact with the exception of a road that parallels the stream. Streambanks are very stable with the exception of road crossings. No manmade barriers are identified although several fords cross the channel, which is heavily used by spawning bull trout. There are no known diversions on this reach of the Wolf Fork. The road in the valley bottom receives little use or maintenance and rarely isolates the stream from its floodplain. Previous studies show that embeddedness is less than 30%, which is still elevated for a high mountain stream. Unfortunately, there are numerous intermittent and perennial streams that carry a significant amount of fine sediment laden runoff from clearcuts and logging roads in the uplands.

Upland timber harvest and channel cleanouts have resulted in a lack of LWD on the Wolf Fork. Officials report that less than 50% of the pools measured contained woody debris, while 33% and 17% of run and riffle habitat, respectively, contained LWD. The predominant instream cover type was woody debris in scour pools and turbulence in plunge pools. Off-channel habitat is rare. Wolf Fork is considered a cool water stream during the summer; in 1991, the maximum water temperature recorded in the Wolf Fork at Whitney Creek was 55°F on August 25. Dewatering does not occur.

Habitat scoring detail is available on Table B-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 23 cfs in September and the peak is 75 cfs in April. Minimum flow is 50 percent of the average; reaches with August flows more than 66% of average scored 'good' for this component of the flow element score. Diversions evaluated for this project represent 9 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component.

Flow scoring detail is available on Table B-10.

[intentionally blank]

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

5. Scoring Sheets

Table B-8 Fish Scoring Sheet

Code	Reach Name	Reach Score & Bin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3201	Walla Walla River (Reach 1)	224	20	20	20	22	22	16	13	13	19	19	20	20
3202	Walla Walla River (Reach 2)	224	17	20	20	22	22	19	16	16	19	19	17	17
3203	Walla Walla River (Reach 3)	204	0	19	19	19	19	16	13	15	18	18	16	16
3205	Touchet River (Reach 1)	224	17	20	20	22	22	19	16	16	19	19	17	17
3206	Touchet River (Reach 2)	188	14	17	17	19	19	16	13	13	16	16	14	14
3207	Touchet River (Reach 3)	204	16	19	19	19	19	16	13	15	18	18	16	16
3208	Coppei Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
3209	North Fork Coppei Creek	90	6	9	9	9	9	6	6	6	9	9	6	6
3210	South Fork Touchet River	195	14	17	17	17	17	14	14	14	20	20	17	14
3211	North Fork Touchet River (Reach 1)	198	13	16	16	16	16	16	16	18	21	21	16	13
3212	North Fork Touchet River (Reach 2)	225	16	19	19	19	19	16	16	18	24	24	19	16
3213	Pine Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
3214	Mud Creek	60	5	5	5	5	5	5	5	5	5	5	5	5
3215	Dry Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
3216	North Fork Dry Creek	90	6	9	9	9	9	6	6	6	9	9	6	6
3217	West Little Walla Walla River	114	8	11	11	11	11	8	8	8	11	11	8	8
3218	Mill Creek (Reach 1)	198	16	19	19	19	19	16	16	18	24	24	19	16
3219	Mill Creek (Reach 2)	225	13	16	16	16	16	16	16	18	21	21	16	13
3220	Mill Creek (Reach 3)	225	16	19	19	19	19	16	16	18	24	24	19	16
3222	Doan Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
3223	Cold Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
3224	Blue Creek	150	11	14	14	14	14	11	11	11	14	14	11	11
3225	East Little Walla Walla River	114	8	11	11	11	11	8	8	8	11	11	8	8
3226	Patit Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
3227	West Patit Creek	114	8	11	11	11	11	8	8	8	11	11	8	8

3228	Yellowhawk Creek	138	11	14	14	14	14	11	8	8	11	11	11	11
3229	Cottonwood Creek	90	6	9	9	9	9	6	6	6	9	9	6	6
3230	Whisky Creek	114	8	11	11	11	11	8	8	8	11	11	8	8
3231	Titus Creek (Reach 1)	90	6	9	9	9	9	6	6	6	9	9	6	6
3232	Titus Creek (Reach 2)	90	6	9	9	9	9	6	6	6	9	9	6	6
3233	Walsh Creek	90	6	9	9	9	9	6	6	6	9	9	6	6
3234	Caldwell Creek	90	6	9	9	9	9	6	6	6	9	9	6	6
3235	Wolf Fork	225	16	19	19	19	19	16	16	18	24	24	19	16
		Month Scores	337	446	446	454	454	361	340	356	470	470	374	353

Note: Reach names link to workbook tabs.

SaSI Stocks in the Walla Walla Basin	SaSI Stock Rating	Weight Factor**
Walla Walla Summer Steelhead - 6854	Depressed	2
Touchet Summer Steelhead - 6861	Depressed	2
Touchet Bull Trout - 8396	Unknown	2
Mill Creek Bull Trout - 8408	Healthy	
Walla Walla Spring Chinook- SaSI stock not assigned	Unknown	2

** Weighting Factor Values by SaSI Stock Status:	Weight
Healthy	1
Depressed	2
Unknown	2
Critical	3

Weighting Factor for Federally Listed Species:	ESA Weight Factor
Assign additional weight to stocks that are listed as Threatened or Endangered under the ESA? (yes=1; no=0)	1
Assign additional weight to reaches within Interior Columbia TRT-designated spawning areas (MaSAs or MiSAs)? (yes=1; no=0)	0

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table B-9 Habitat Scoring Sheet

Reach Code	Reach Name	Reach Score & Bin	Off Channel Habitat (OCHs)	Flood-plain Connec-tivity	Riparian Cond-ition	Spawning Suita-bility	Rearing Suita-bility	Passage Condi-tion
3201	Walla Walla River (Reach 1)	9	1	1	1	1	2	3
3202	Walla Walla River (Reach 2)	10	2	1	1	2	2	2
3203	Walla Walla River (Reach 3)	11	2	1	2	2	2	2
3205	Touchet River (Reach 1)	8	1	1	1	1	1	3
3206	Touchet River (Reach 2)	11	1	1	2	2	2	3
3207	Touchet River (Reach 3)	14	2	1	2	3	3	3
3208	Coppei Creek	11	1	1	2	2	2	3
3209	North Fork Coppei Creek	16	2	2	3	3	3	3
3210	South Fork Touchet River	15	2	2	2	3	3	3
3211	North Fork Touchet River (Reach 1)	13	1	1	2	3	3	3
3212	North Fork Touchet River (Reach 2)	16	2	2	3	3	3	3
3213	Pine Creek	6	1	1	1	1	1	1
3214	Mud Creek	6	1	1	1	1	1	1
3215	Dry Creek	10	1	1	2	2	2	2
3216	North Fork Dry Creek	16	2	2	3	3	3	3
3217	West Little Walla Walla River	10	2	2	2	1	2	1
3218	Mill Creek (Reach 1)	8	1	1	1	1	2	2
3219	Mill Creek (Reach 2)	16	2	2	3	3	3	3
3220	Mill Creek (Reach 3)	16	2	2	3	3	3	3
3222	Doan Creek	12	1	2	1	2	3	3
3223	Cold Creek	12	2	2	1	3	3	1
3224	Blue Creek	15	2	2	2	3	3	3
3225	East Little Walla Walla River	15	3	2	2	3	3	2
3226	Patit Creek	8	1	1	1	1	2	2
3227	West Patit Creek	15	2	2	2	3	3	3
3228	Yellowhawk Creek	10	1	1	2	2	2	2
3229	Cottonwood Creek	10	1	1	2	2	2	2
3230	Whisky Creek	11	2	1	1	2	2	3
3231	Titus Creek (Reach 1)	8	1	2	1	1	2	1
3232	Titus Creek (Reach 2)	15	2	3	3	2	3	2
3233	Walsh Creek	13	2	2	2	2	3	2
3234	Caldwell Creek	11	2	2	2	1	2	2
3235	Wolf Fork	17	3	2	3	3	3	3

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table B-10 Flow Scoring Sheet

Code	Reach Name	GOOD is HIGH BIN	POOR is HIGH; GOOD is LOW >>>>>>>>>>>>>>>>>>> Sum scores (A:D) * E	A % of Mo Avg Below Rule	B Qi Deviat ion	C No. Claims	D August Deviation from Mean Annual Flow	E Flow Volume Factor
3201	Walla Walla River (Reach 1)	3	7		3	1	3	1.0
3202	Walla Walla River (Reach 2)	3	9	2	3	1	3	1.0
3203	Walla Walla River (Reach 3)	3	7		3	1	3	1.0
3205	Touchet River (Reach 1)	3	6		2	1	3	1.0
3206	Touchet River (Reach 2)	3	11	2	3	3	3	1.0
3207	Touchet River (Reach 3)	3	8		3	2	3	1.0
3208	Coppei Creek	1	24		3	2	3	3.0
3209	North Fork Coppei Creek	1	24		3	1	4	3.0
3210	South Fork Touchet River	2	21		2	2	3	3.0
3211	North Fork Touchet River (Reach 1)	3	8	2	2	1	3	1.0
3212	North Fork Touchet River (Reach 2)	3	12		1	1	2	3.0
3213	Pine Creek	1	24		3	1	4	3.0
3214	Mud Creek	1	32		3	1	4	4.0
3215	Dry Creek	1	24		3	2	3	3.0
3216	North Fork Dry Creek	2	18		1	1	4	3.0
3217	West Little Walla Walla River	3	7		2	1	4	1.0
3218	Mill Creek (Reach 1)	2	18		3	3	3	2.0
3219	Mill Creek (Reach 2)	3	10		1	1	3	2.0
3220	Mill Creek (Reach 3)	2	18	2	3	1	3	2.0
3222	Doan Creek	1	24		3	1	4	3.0
3223	Cold Creek	1	36		3	2	4	4.0
3224	Blue Creek	2	15		1	1	3	3.0
3225	East Little Walla Walla River	2	20		3	1	1	4.0
3226	Patit Creek	1	24		2	2	4	3.0
3227	West Patit Creek	2	18		1	1	4	3.0
3228	Yellowhawk Creek	1	40		4	2	4	4.0
3229	Cottonwood Creek	1	36		4	1	4	4.0
3230	Whisky Creek	1	24		2	2	4	3.0

Code	Reach Name	GOOD is HIGH BIN	POOR is HIGH; GOOD is LOW >>>>>>>>>>>>>>>>>>> Sum scores (A:D) * E	A % of Mo Avg Below Rule	B Qi Deviat ion	C No. Claims	D August Deviation from Mean Annual Flow	E Flow Volume Factor
3231	Titus Creek (Reach 1)	1	36		4	1	4	4.0
3232	Titus Creek (Reach 2)	1	36		4	1	4	4.0
3233	Walsh Creek	1	32		3	1	4	4.0
3234	Caldwell Creek	1	24		3	1	4	3.0
3235	Wolf Fork	2	15		2	1	2	3.0

6. Maps

[intentionally blank]

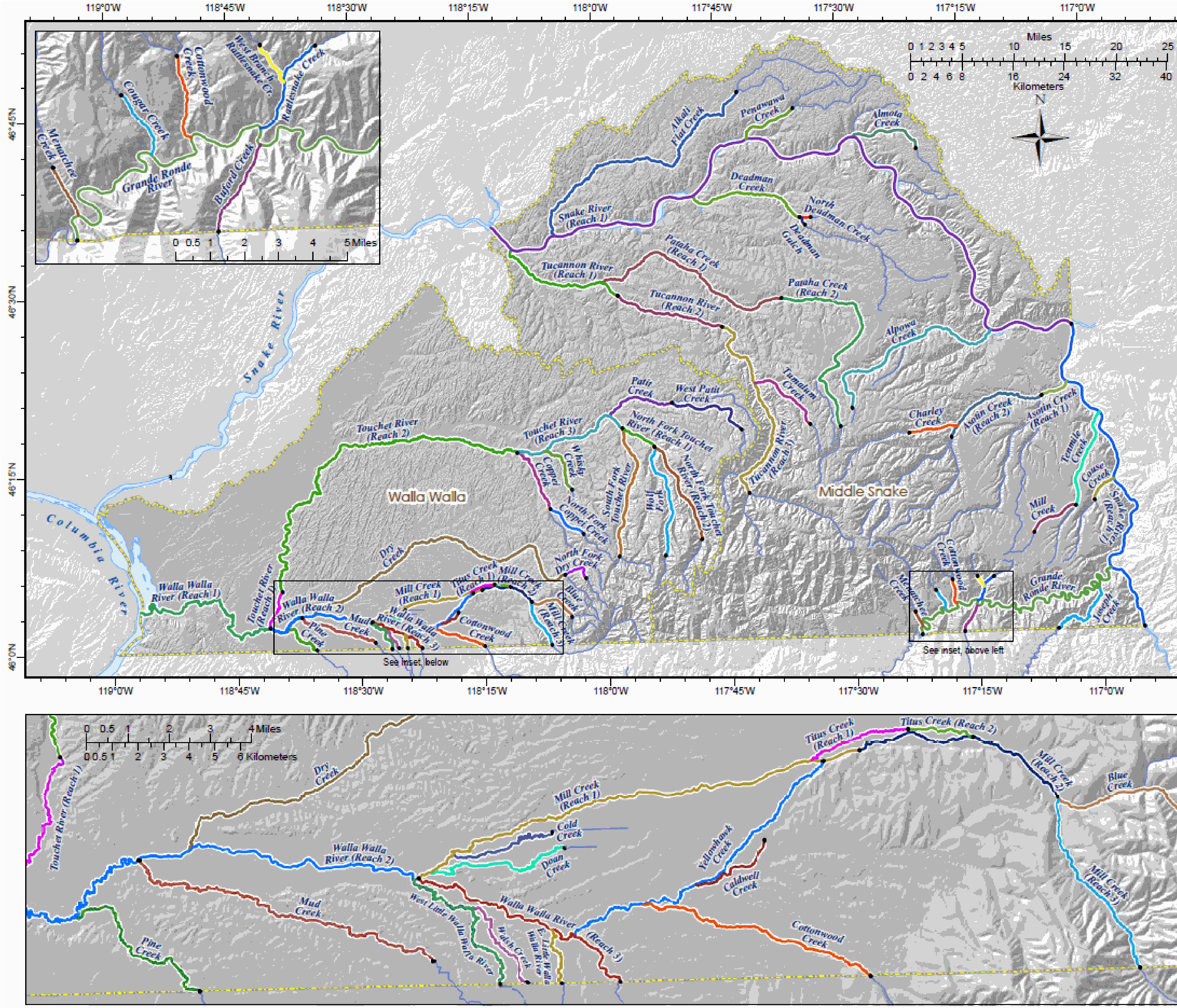
Figure B-1 Assessed Stream Reaches

Walla Walla and Middle Snake River Basins

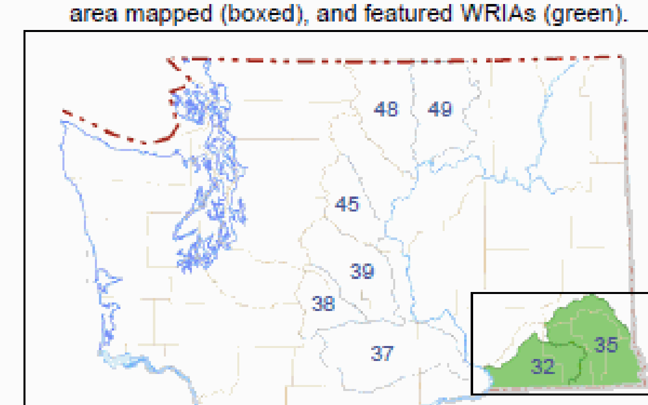
WRIAs 32 and 35 Assessed Stream Reaches colored for visual reference

• — Assessed Stream Reach upper extents

Continuation of Assessed Streams to Headwaters



Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

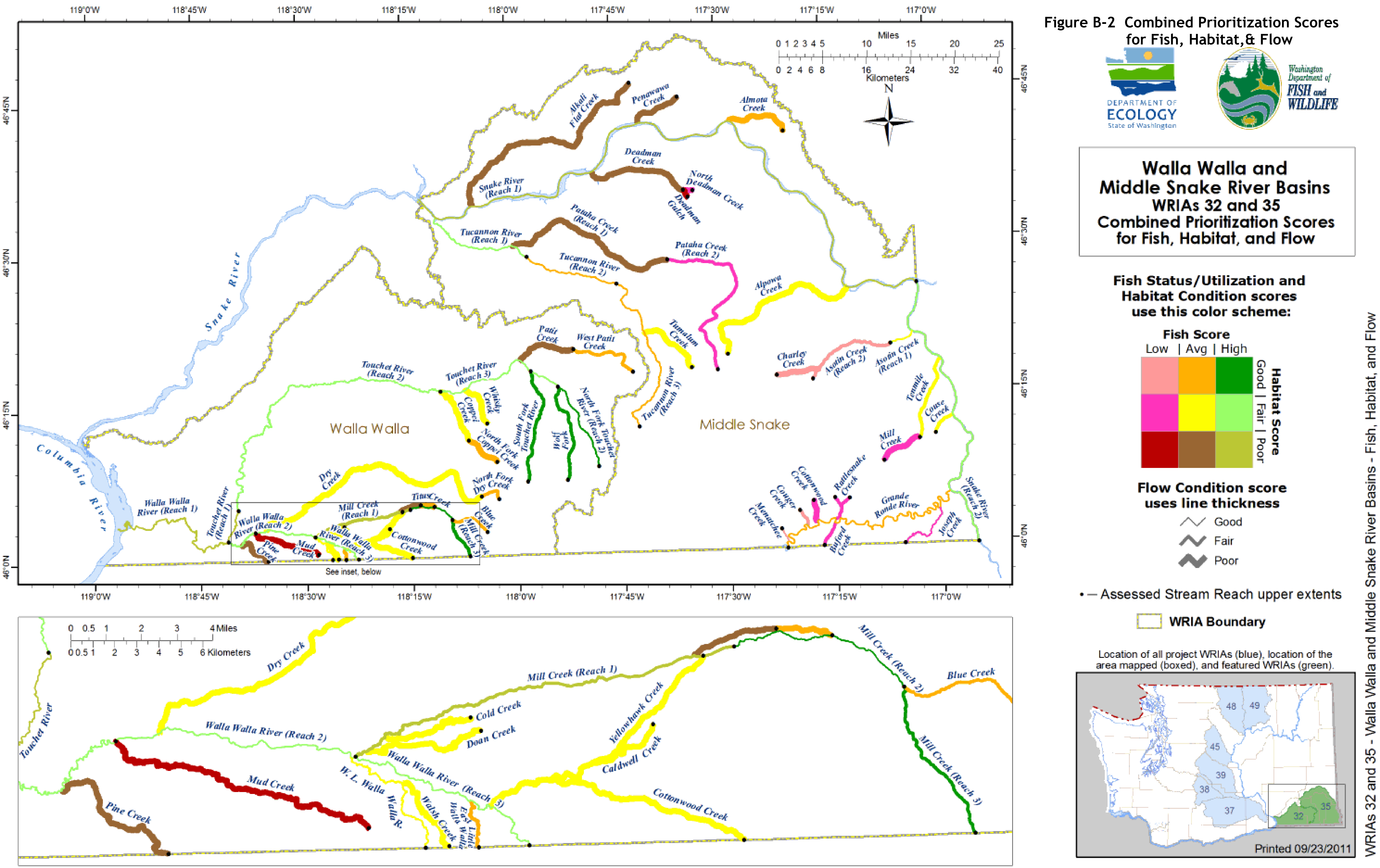


Printed 08/17/2011

WRIAs 32 and 35 - Walla Walla and Middle Snake River Basins - Priority Streams

[Intentionally Blank]

Figure B-2 Combined Prioritization Scores for Fish, Habitat, & Flow



[Intentionally Blank]

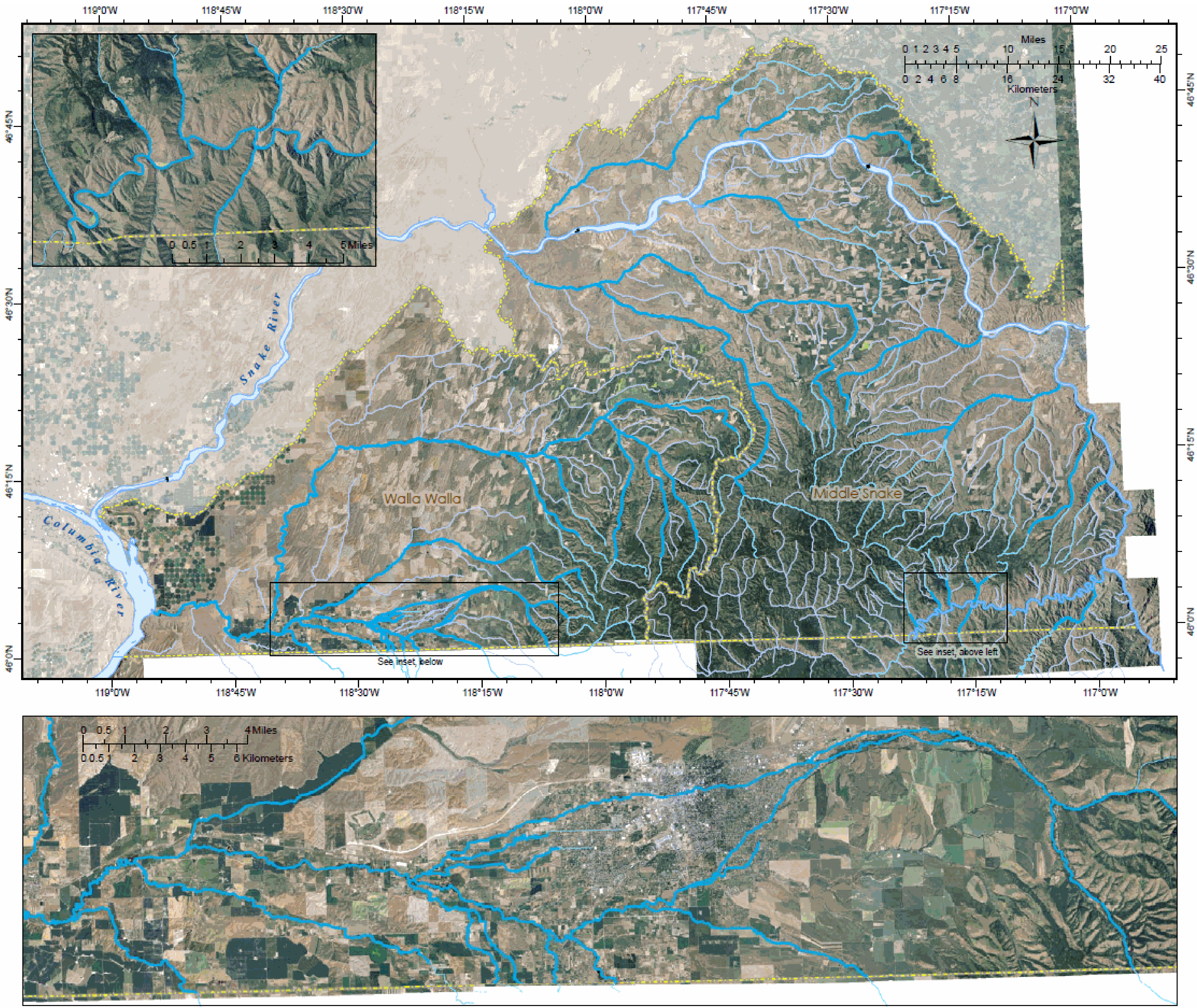
Figure B-3 2001 Statewide 1m Orthophoto

DEPARTMENT OF ECOLOGY State of Washington

Washington Department of FISH and WILDLIFE

Walla Walla and Middle Snake River Basins

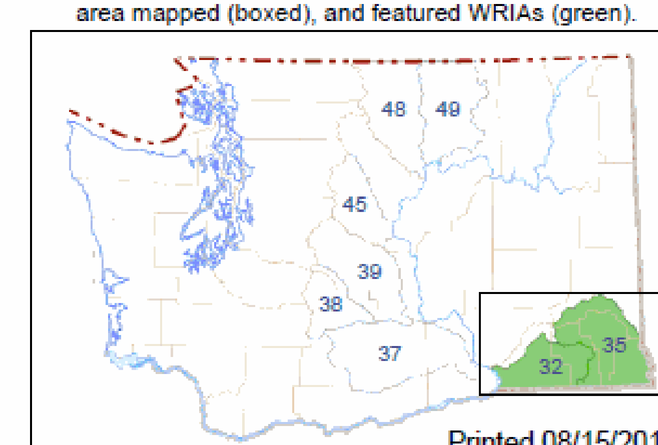
WRIAs 32 and 35
2009 Statewide 1m Orthophoto



Stream Distinctions

- Assessed Reaches
- Headwaters of Assessed Reaches
- Other Named Streams
- **WRIA Boundary**

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

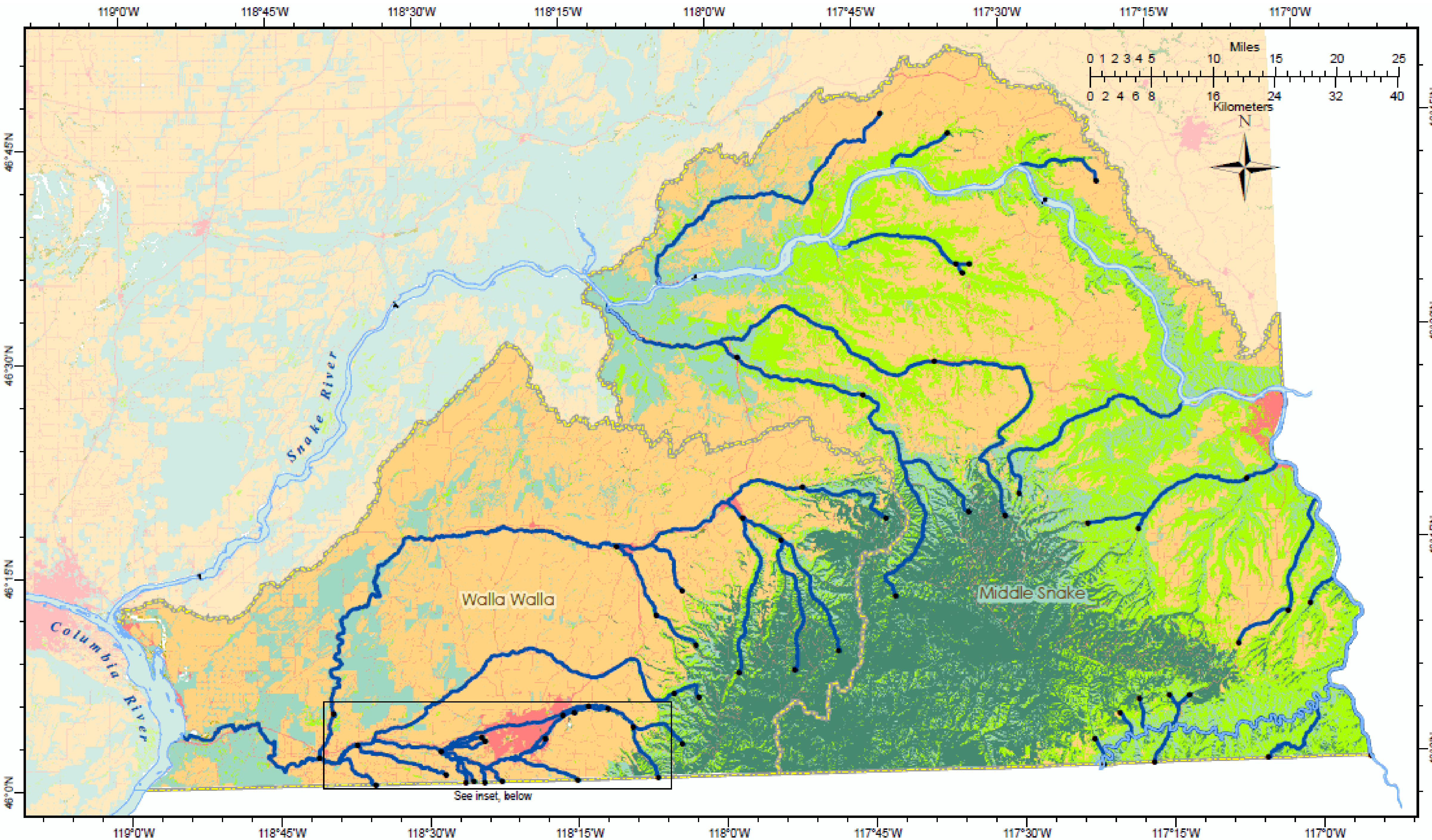


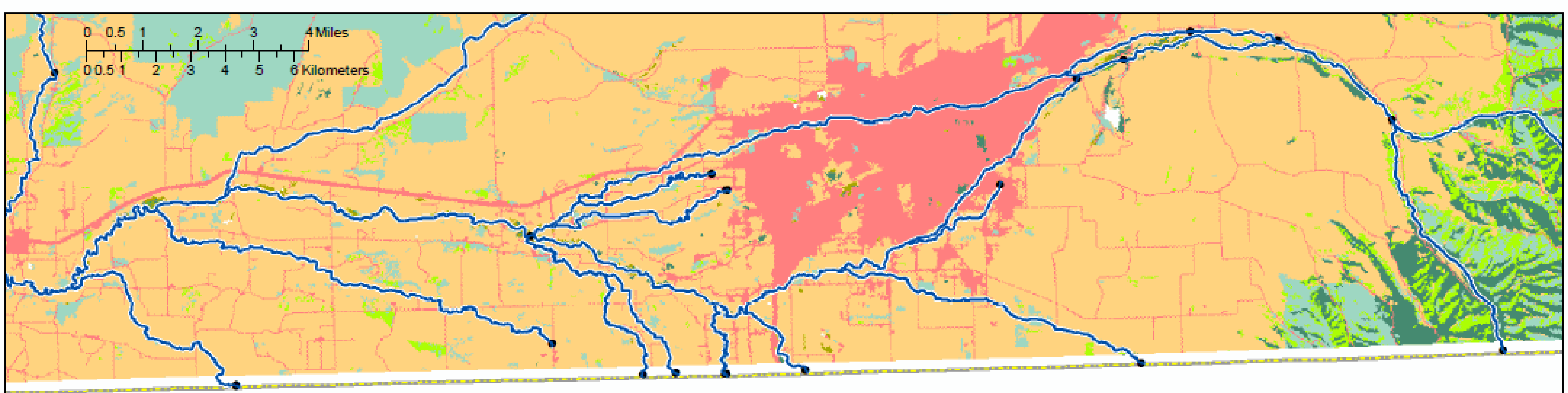
Printed 08/15/2011

WRIAs 32 and 35 - Walla Walla and Middle Snake River Basins - Orthophoto

[Intentionally Blank]

Figure B-4 2001 National Land Cover Database





DEPARTMENT OF ECOLOGY State of Washington

Washington Department of FISH and WILDLIFE

Walla Walla and Middle Snake River Basins

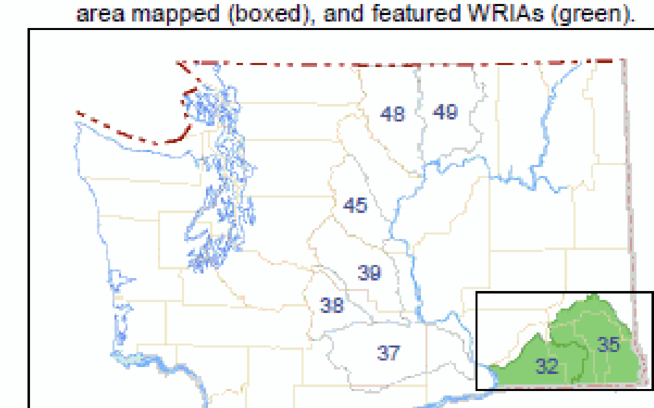
WRIAs 32 and 35 2001 National Land Cover Database

Land Cover and Use

- Snow and Ice
- Developed
- Barren
- Forest
- Scrub
- Grasslands
- Agriculture
- Riparian

Assessed Stream Reaches with upper extents marked

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

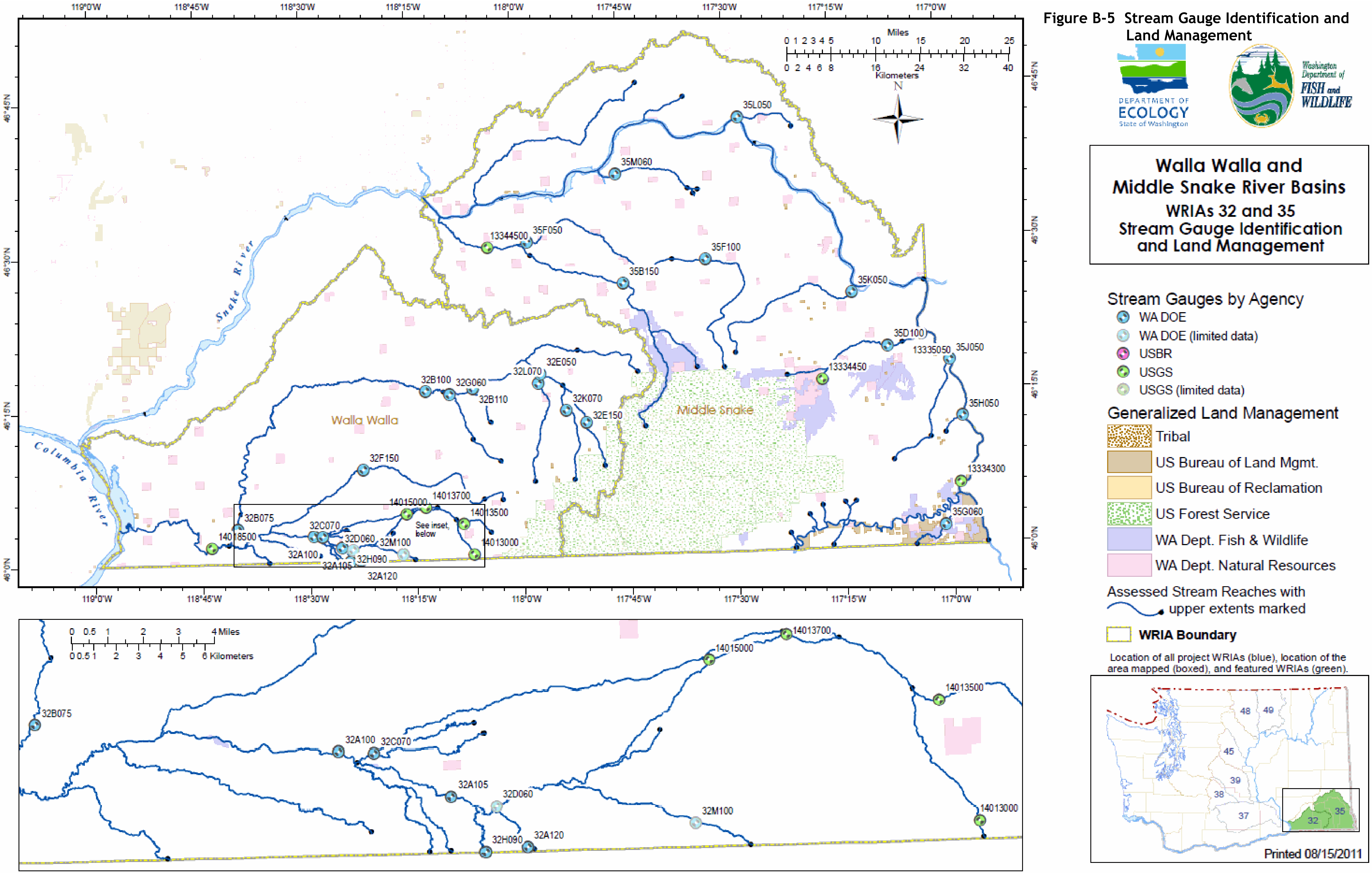


Printed 08/15/2011

WRIAs 32 and 35 - Walla Walla and Middle Snake River Basins - NLCD

[Intentionally Blank]

Figure B-5 Stream Gauge Identification and Land Management



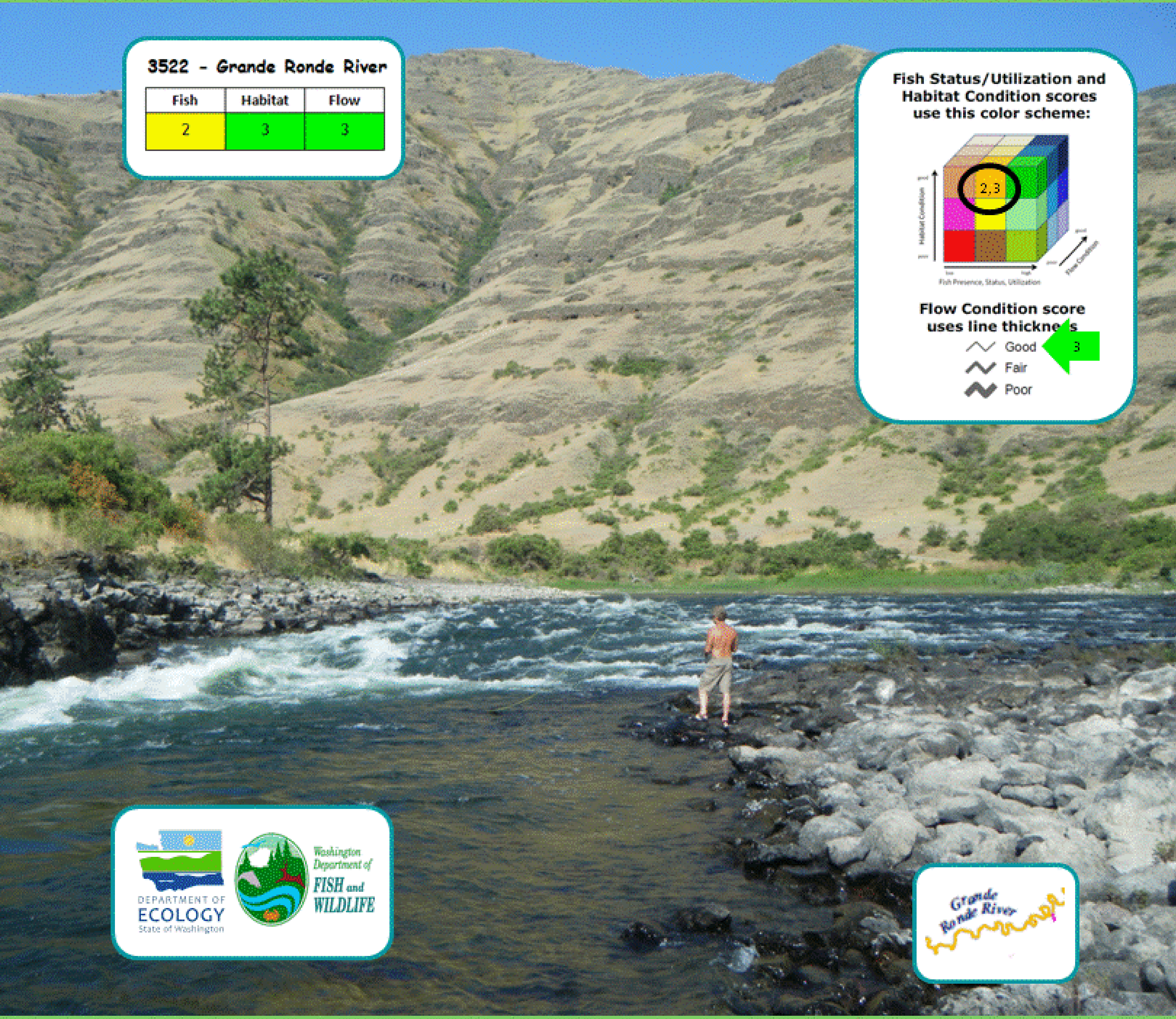
WRIAs 32 and 35 - Walla Walla and Middle Snake River Basins - Gauges, Lands

Columbia River Instream Atlas Project

Washington Department of Fish and Wildlife

Final Report – APPENDIX C

WRIA 35 MIDDLE SNAKE



Fish	Habitat	Flow
2	3	3

Ecology Contract C1000090 - WDFW Contract 09-1471
Ecology Publication Number: 11-12-015

September 2011

Columbia River Instream Atlas Project - Final Report
Appendix C – WRIA 35 Middle Snake

September 23, 2011

Washington Department of Fish and Wildlife CRIA Team:

Teresa Scott (Habitat Water Resources Policy Coordinator)
Jonathan Kohr (Habitat Water Science Team)
Dayv Lowry (Fish Science; Habitat Science)
Andrew Weiss (Fish Science)
Aaron Bosworth (King County District Fish Biologist)
Jim Cummins (Yakima District Fish Biologist)
Dale Gombert (Fish Science)
Paul La Riviere (Habitat Water Science Team)
Peggy Miller (Habitat Major Projects)
Brianna Murphy (Fish Science)

Funding provided by Ecology Office of Columbia River as part of the 2011 Columbia Basin Long-term Water Supply and Demand Forecast

Ecology Contract C1000090

WDFW Contract 09-1471

Ecology Publication Number: 11-12-015

If you need this document in a format for the visually impaired, call the Office of Columbia River at (509) 575-2490. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

Cover Photo: David Child, 2011

Columbia River Instream Atlas Project

Final Report

Appendix C - WRIA 35 Middle Snake

September 23, 2011

Table of Contents

Tables

Figures

1. Description

WRIA 35 – the Middle Snake River and its tributaries - drains about 2,250 square miles of southeast Washington. This WRIA begins at the confluence of the Snake River with the Palouse River (river mile 57.3), and terminates just upstream of the mouth of the Grande Ronde River where the Oregon, Washington, and Idaho borders meet (river mile 173.3).

Climate is generally arid to semi-arid in the summer and early fall. Winters are cold with moderate snowfall at low elevations and substantial snowfall in the Blue

Mountains. Basalt flows covered by a blanket of highly erodible loess soil are the dominant geologic feature of the region. Folding and faulting of bedrock and downcutting of streams have created numerous deep canyons throughout the drainage network. Vegetation in the Middle Snake River basin is characterized primarily by grasslands and agricultural lands with some ponderosa pine, shrub steppe, and wetland areas. This WRIA includes a portion of the Snake River mainstem and a number of its tributaries, including Asotin Creek, the Tucannon River, Deadman Creek, Almota Creek, Alpowa Creek, Penawawa Creek, and the Grande Ronde River. Little Goose Dam (RM70) and Lower Granite Dam (RM107) impound the Snake River in WRIA 35. The backwater from Lower Granite Dam extends upstream to the City of Asotin (RM146). The Snake River is free-flowing from this point up to Hells Canyon Dam (RM247) located upstream from the upper end of WRIA 35.

Approximately five percent of the Snake River's total watershed is located downstream of the Clearwater River at Lewiston, Idaho. This downstream portion is relatively arid compared to the Snake River's upper drainage areas. As such, only a small portion of the Snake River mainstem flow is derived from tributaries located within WRIA 35[1].

2. Reach Definitions

Reach delineation methodology in WRIA 35 varies by the functions and values reflected in the stream. The larger and lengthy streams tend to exhibit more reaches because of greater variability in flow quantity, geographic terrain, or instream habitat conditions. These are key values that determine the magnitude of biological benefits from flow supplementation. Smaller streams or major forks stand alone as a single reach because of the similarity of these respective functions and values within the entire reach. The largest stream, the Snake River is split into two major reaches; the Clearwater River confluence is the mid-boundary. The entire lower Snake River Reach 1, which starts at the lowest basin tributary confluence, the Palouse River, is inundated by reservoirs from the large dams, while the upper reach is mostly free flowing. The Tucannon River reach boundaries reflect changes in land use and habitat that include large farms in Reach 1, shrub steppe that turns into grasslands and transitional forest in Reach 2, and transitional forest that becomes National Forest land in Reach 3.

Most of watersheds that drain into the mainstem Snake River within the state of Washington all flow through agricultural lands. Even the upper Snake River and Grande Ronde tributaries pass through small farms and pastures before flowing into the larger river. Fish passage problems and loss of riparian result from the many culverts and pastures managed by the private landowners at the mouth of these streams. The upper Snake River and Grande Ronde tributaries drain from steep basalt hills, shrub steppe slopes, or transitional forest terrain that all have a long history of cattle grazing. The near surface basalt aquifers in these smaller streams provide the

1 Adapted from Northwest Power and Conservation Council 2005a, Northwest Power and Conservation Council 2005d, Northwest Power and Conservation Council 2005e and from the Snake River Limiting Factors Report (Washington Conservation Commission, 2002)

cool water that supports the entire steelhead life history, in some cases juvenile spring Chinook, and sporadically supports bull trout spawning and rearing.

Most of the major middle Snake River basin headwaters start in the National Forest lands. Farmers converted the lower reaches from historic arid grasslands or shrub steppe into wheat, alfalfa, apples, and pasture land. The upper reaches still retain the large woody debris (LWD), riparian, and floodplain connectivity values, while the transitional zones and the lower reaches are modified heavily and lack LWD, have reduced vegetation buffers, and the streams are often incised from channel straightening and a dysfunctional floodplain.

Reach descriptions are found in **Error! Not a valid bookmark self-reference.**.

Table C-1 Reach Definitions

Stream Name	Code	Stream Reach Description
Snake River Reach 1	3501	Palouse River (WRIA boundary) to Clearwater R
Snake River Reach 2	3502	Clearwater River to Oregon border
Tucannon River Reach 1	3503	Mouth to SR12
Tucannon River Reach 2	3504	SR 12 bridge to Turner Rd/SR 126 bridge, Marengo
Tucannon River Reach 3	3505	Turner Rd / SR 126 bridge to Panjab Creek
Pataha River Reach 1	3506	Mouth to Geiger Gulch in Pomeroy
Pataha River Reach 2	3507	Geiger Gulch in Pomeroy to USFS boundary
Asotin Creek Reach 1	3508	Mouth to George Creek
Asotin Creek Reach 2	3509	George Creek to Asotin Creek Forks
Charley Creek	3510	Mouth to WDFW boundary
Alkali Flat Creek	3511	Mouth to Little Alkali Flat Creek
Almota Creek	3512	Mouth to La Follette Rd
Alpowa Creek	3513	Mouth to headwaters
Penewawa Creek	3514	Mouth to Little Penewawa Creek
Deadman Creek	3515	Mouth to forks with Deadman Gulch & N Deadman Creek
North Deadman Creek	3516	Mouth to gulch upstream 1.1 mile
Deadman Gulch	3517	Mouth to gulch upstream 1.1 mile
Tenmile Creek	3518	Mouth to Montgomery Ridge Rd
Mill Creek	3519	Mouth to driveway bridge NE of Anatone
Couse Creek	3520	Mouth to Montgomery Gulch
Tumalum Creek	3521	Mouth to GIS RM 8
Grande Ronde River	3522	Mouth to Oregon Border
Buford Creek	3523	Mouth to Oregon Border
Menatchee Creek	3524	Mouth to falls
Joseph Creek	3525	Mouth to Oregon Border
Cottonwood Creek	3526	Mouth to Cottonwood Creek forks

Stream Name	Code	Stream Reach Description
Cougar Creek	3527	Mouth to Swank Springs
Rattlesnake Creek	3528	Mouth to gulch ≈ 1.5 miles past W Branch Rattlesnake Ck
West Branch Rattlesnake Ck	3529	Mouth to gulch at 1.4 miles

3. WRIA Results

Fish Status and Utilization

Components of the fish status/utilization score and ranking are SaSI status, ESA status, fish diversity and time spent in the reach for spawning/incubation, rearing/smolt migration and adult migration. TRT designation was not considered in this rating but is available on the spreadsheets for inclusion in future evaluations.

Nine salmonid stocks frequent this basin. They are Snake Fall Chinook, Tucannon Spring Chinook, Wenaha Spring Chinook, Tucannon Summer Steelhead, Asotin Creek Summer Steelhead, Lower Grande Ronde Summer Steelhead, Joseph Creek Summer Steelhead, bull trout, and Snake River Sockeye. This WRIA primarily acts as an adult and juvenile migration corridor for sockeye, with no spawning or rearing known to occur.

Historically, ESA threatened fall chinook spawning in the Washington portion of the Snake River was concentrated near the mouths of the Palouse and Clearwater Rivers. However, the majority of fall chinook spawning took place much higher in the watershed prior to construction of numerous dams from Hells Canyon upstream. The majority of mainstem fall chinook spawning occurs in the free-flowing reaches still remaining from Hells Canyon Dam downstream to the City of Asotin, WA. Limited fall chinook spawning also occurs in the tailraces of the four lower Snake River dams, and the lower portions of the Grande Ronde and Tucannon Rivers in Washington and the lower Clearwater River in Idaho. Fall chinook juveniles rear throughout the lower Snake River.

All the stocks in the Middle Snake River Basin are recognized by SaSI and ESA. Snake Fall Chinook is classified as threatened under ESA and critical by SaSI. The two stocks of spring Chinook are also classified as threatened by ESA but SaSI status for Tucannon Spring Chinook is critical and Wenaha Spring Chinook is unknown. All stocks of summer steelhead in the Snake River Basin are classified as threatened under the ESA, and SaSI considers two of these stocks depressed (Asotin Creek and Tucannon) and two stocks as unknown (Joseph Creek and Lower Grande Ronde). ESA and SaSi classify bull trout as threatened and unknown respectively. ESA has designated the Snake River Sockeye as endangered whereas the SaSI designation is critical.

The weighting factor (ESA and SaSI) for the each stock remains the same within the basin whereas the life histories and duration will change depending on the stream reach. SaSi status, and ESA listing will not be repeated for each stream reach.

Table C-2 SaSI Stock Name, Status, ESA Listing Unit, & Listing Status

SaSI Stock name	SaSI Status	ESA Unit Name	ESA Listing Status
Snake Fall Chinook	Depressed	Snake River Fall Run Chinook	Threatened
Tucannon Spring Chinook	Depressed	Snake River Spring and Summer Run Chinook	Threatened
Wenaha Spring Chinook	Unknown		
Tucannon Summer Steelhead	Depressed	Snake River Basin Steelhead	Threatened
Asotin Creek Summer Steelhead	Depressed		
Lower Grande Ronde Summer Sthd	Unknown		
Joseph Creek Summer Steelhead	Unknown		
Upper Tucannon Bull Trout	Healthy	Snake River Bull Trout	Threatened
Asotin Creek Bull Trout/Dolly Varden	Unknown		
Wenaha Bull Trout/Dolly Varden	Unknown		
Snake River Sockeye	Critical*	Snake River Sockeye	Endangered

Table C-3 Fish status & utilization periodicity for five life stages

Fish Species - SaSI Stock	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Snake Fall Chinook (ESA Threatened; 1 Critical SaSI Stock)	Adult In-Migration												
	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Snake Spring Chinook (ESA Threatened; 1 Depressed, 1 Unknown, and 1 Extinct SaSI Stock)	Adult In-Migration												
	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Snake Summer Steelhead (ESA Threatened; 2 Depressed, 2 Unknown SaSI Stocks)	Adult In-Migration												
	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Snake Bull Trout (ESA Threatened; 2 Unk, 1 Healthy SaSI Stocks)	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												

Fish Species - SaSI	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Snake River Sockeye (ESA Endangered; No SaSI Stock)	Adult In-Migration												
	Juvenile Out-Migration												

Note: Stock presence varies by stream reach

= No Use
= Some activity or use occurring
= Peak activity

Color / Bin Score

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table C-4 Fish status/utilization score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Normalized Score	Bin
3501	Snake River (Reach 1)	572	1.00	3
3502	Snake River (Reach 2)	411	0.72	3
3503	Tucannon River (Reach 1)	408	0.71	3
3504	Tucannon River (Reach 2)	340	0.59	2
3505	Tucannon River (Reach 3)	296	0.52	2
3506	Pataha Creek (Reach 1)	232	0.41	2
3507	Pataha Creek (Reach 2)	165	0.29	1
3508	Asotin Creek (Reach 1)	292	0.51	2
3509	Asotin Creek (Reach 2)	156	0.27	1
3510	Charley Creek	192	0.34	1
3511	Alkali Flat Creek	292	0.51	2
3512	Almota Creek	256	0.45	2
3513	Alpowa Creek	256	0.45	2
3514	Penawawa Creek	292	0.51	2
3515	Deadman Creek	256	0.45	2
3516	North Deadman Creek	84	0.15	1
3517	Deadman Gulch	84	0.15	1
3518	Tenmile Creek	256	0.45	2
3519	Mill Creek	36	0.06	1
3520	Couse Creek	256	0.45	2
3521	Tumalum Creek	240	0.42	2
3522	Grande Ronde River	317	0.55	2
3523	Buford Creek	148	0.26	1
3524	Menatchee Creek	148	0.26	1
3525	Joseph Creek	184	0.32	1
3526	Cottonwood Creek	148	0.26	1
3527	Cougar Creek	148	0.26	1
3528	Rattlesnake Creek	148	0.26	1
3529	West Branch Rattlesnake Creek	84	0.15	1

Habitat Condition

Little Goose Dam (RM 70) and Lower Granite Dam (RM 107) impound the Snake River in WRIA 35. The mainstem is highly influenced by those impoundments until about river mile 146 (city of Asotin), which is the upper extent of the backwater from Lower Granite Dam. Fish passage and water quality (temperature) are concerns in the mainstem.

Land use impacts associated with dryland agriculture, logging, flood control, concentrated recreational use of public lands, rural and recreational development, roads, and to a lesser extent irrigated agriculture have had significant negative effects on salmonid habitat in WRIA 35 tributary streams. Conversion of floodplains and riparian forest buffers to agricultural fields and residences, and channel modifications including straightening, dikes, and bank armoring, have dramatically altered the lower portions of the Tucannon River and Asotin Creek as well as smaller systems such as Alpowa and Deadman Creeks. Logging, conversion of perennial grasslands to annually planted dry cropland, and grazing have led to increased runoff and erosion of fine sediment throughout the region.

Habitat conditions are generally fair to poor on private lands in the lower portions of watersheds. Mid-elevation reaches are generally in fair condition, with patches of degradation. Conditions on public lands in headwater areas, particularly the Wenaha-Tucannon Wilderness Area are generally fair to good. Unfortunately headwater streams drain very steep portions of the Blue Mountains. The geology of these areas leads to naturally low numbers of pools and limited spawning gravel. The largest pools and significant levels of spawning gravel are generally found in the middle or lower portions of the watersheds where alterations of stream channels, removal of riparian vegetation, and surface water withdrawals (which exacerbate naturally low summer stream flows) have combined to increase water temperatures above the tolerance levels of salmonids. Fine sediment deposition is also a problem in these low gradient stream reaches.

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table C-5 Habitat condition score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Bin
3501	Snake River (Reach 1)	9	1
3502	Snake River (Reach 2)	14	2
3503	Tucannon River (Reach 1)	13	2
3504	Tucannon River (Reach 2)	15	3
3505	Tucannon River (Reach 3)	17	3
3506	Pataha Creek (Reach 1)	7	1
3507	Pataha Creek (Reach 2)	14	2
3508	Asotin Creek (Reach 1)	13	2
3509	Asotin Creek (Reach 2)	15	3
3510	Charley Creek	15	3

Reach Code	Reach Name	Prioritization Score	Bin
3511	Alkali Flat Creek	8	1
3512	Almota Creek	16	3
3513	Alpowa Creek	14	2
3514	Penawawa Creek	8	1
3515	Deadman Creek	9	1
3516	North Deadman Creek	12	2
3517	Deadman Gulch	6	1
3518	Tenmile Creek	14	2
3519	Mill Creek	12	2
3520	Couse Creek	14	2
3521	Tumalum Creek	12	2
3522	Grande Ronde River	15	3
3523	Buford Creek	11	1
3524	Menatchee Creek	16	3
3525	Joseph Creek	14	2
3526	Cottonwood Creek	14	2
3527	Cougar Creek	15	3
3528	Rattlesnake Creek	11	2
3529	West Branch Rattlesnake Creek	11	2

Flow Condition

Much of the tributary area for this WRIA is groundwater influenced. Groundwater flows through cracks in basalt layers as well as the porous sediments sandwiched between the basalts. Fractured zones and sedimentary interbeds in the Columbia River Basalts carry considerable quantities of groundwater that supply water for irrigation and municipal use. Springs provide substantial flow to streams in areas where the channel has cut into a fractured layer of basalt.[2]

Forty-five percent (13) of this WRIA's 29 reaches are gauged and there are no WAC instream flow levels set within this WRIA. NHDPlus mean annual flow and mean August flow volume estimates were made available for each of these thirteen reaches. Water right diversions are recorded for all but five of WRIA 35's stream reaches.

Of the gauged Middle Snake tributary reaches, flow hydrographs are normative for most, although hydrographs for Almota, Alpowa, Deadman, Tenmile, and Couse

[2] Adapted from SALMONID HABITAT LIMITING FACTORS WATER RESOURCE INVENTORY AREAS 33 (LOWER) & 35 (MIDDLE) SNAKE WATERSHEDS, & LOWER SIX MILES OF THE PALOUSE RIVER, Final Report March 18, 2002, Mike Kuttel, Jr., Washington State Conservation Commission.

Creeks show some deviations. Peak flows are in April or May and minimum flows occur in August. Ten reaches are estimated or measured at 1 cfs or less in August.

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table C-6 Flow condition score & bin by stream reach

Reach Code	Reach Name	Prioritization Score (Low is good)	Bin (High is Good)
3501	Snake River (Reach 1)	3	3
3502	Snake River (Reach 2)	2	3
3503	Tucannon River (Reach 1)	7	3
3504	Tucannon River (Reach 2)	7	3
3505	Tucannon River (Reach 3)	6	3
3506	Pataha Creek (Reach 1)	27	1
3507	Pataha Creek (Reach 2)	15	2
3508	Asotin Creek (Reach 1)	10	3
3509	Asotin Creek (Reach 2)	12	2
3510	Charley Creek	20	1
3511	Alkali Flat Creek	18	1
3512	Almota Creek	20	1
3513	Alpowa Creek	21	1
3514	Penawawa Creek	16	1
3515	Deadman Creek	24	1
3516	North Deadman Creek	32	1
3517	Deadman Gulch	28	1
3518	Tenmile Creek	15	2
3519	Mill Creek	24	1
3520	Couse Creek	12	2
3521	Tumalum Creek	16	1
3522	Grande Ronde River	3	3
3523	Buford Creek	12	2
3524	Menatchee Creek	9	3
3525	Joseph Creek	5	3
3526	Cottonwood Creek	16	1
3527	Cougar Creek	12	2
3528	Rattlesnake Creek	12	2
3529	West Branch Rattlesnake Creek	12	2

4. Reach Results

3501 -Snake River (Reach 1)

Fish	Habitat	Flow
3	1	3

Fish Status/Utilization

All nine stocks utilize Snake River (Reach 1) in some capacity leading to a high fish status/utilization rating. Most stocks utilize this reach for juvenile rearing and adult migration. Spawning occurs elsewhere. The exception is Snake Fall Chinook which utilizes the reach for spawning, rearing and adult migration.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Two of the four lower Snake River dams operate in Middle Snake River Reach 1. The dams inundated mainstem salmonid habitat throughout the entire reach. Instream habitat consists mostly of large reservoirs of slow moving water. There are limited shallow waters below each dam and at the mouth of the Palouse River that are used sporadically by fall Chinook for spawning.

Much of the shoreline is lined with levees and railroad infrastructure. Dryland agriculture is the dominant land use on ridge tops while livestock grazing dominates on the steep canyon slopes. Shoreline vegetation and tall canopy trees are sparse and contributes very little LWD to the instream habitat values.

Passage of salmonids through the lower Snake River dams and their associated reservoirs is a primary limiting factor on the Washington portion of the mainstem Snake River. Juvenile salmonid bypass systems and a transportation system of barges and trucks are currently operated at each dam. More than 50% of juvenile salmonids (up to 15 million) migrating down the lower Snake River are captured for transport. The reservoirs impounded by each dam have slowed river currents thereby increasing outmigration time of juvenile salmonids. The slow moving, warm water reservoirs also provide habitat for predatory species including northern pikeminnow, smallmouth bass, and channel catfish. Increased travel time and higher predator populations combine to reduce survival of juvenile salmonids in the lower Snake River.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 41,529 cfs Mean Annual Flow was used to score this reach. No recent gauge data were provided for Snake River Reach 1. Older USGS gauge data (1940-1972 average; Snake River at Clarkston, WA.) show minimum Mean Monthly Flows (MMFs) for this reach at around 14,200 in August 1940 and maximum flows at 199,400 cfs in May 1957. The NHD+ estimated minimum August flow is 27% of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Flows are highly regulated in this reach. Diversions evaluated for this project represent less than 1 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component.

Flow scoring detail is available on Table C-9.

3502 - Snake River (Reach 2)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

Snake River (Reach 2) is also rated high for fish status/utilization. The seven stocks present utilize Snake River (Reach 2) for juvenile rearing and adult migration. Those stocks are Snake Fall Chinook, Wenaha Spring Chinook, Asotin Summer Steelhead, Lower Grande Ronde Summer Steelhead, Joseph Creek Summer Steelhead, bull trout and Snake River Sockeye.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Snake River Reach 2 terminates just above the mouth of the Grande Ronde River at the border between the states of Idaho, Oregon, and Washington. The reach is free flowing, although between the mouth of the Clearwater River and Asotin, the Lower Granite Pool effects begin to create slow deep moving reservoir waters. Above Asotin, the Snake River consists of large rapids, deep pools, and large islands. About half the shoreline areas are lined with residential units and recreational sites that are mostly setback behind a county road.

The riparian zones consist of woody shrubs, large basalt rock shorelines, and often shrub steppe to the waters' edge. There is very little side channel habitat. Several small streams that support steelhead populations and the larger Grande Ronde River enter into the Snake River in this reach. There is a significant increase in fall Chinook spawning throughout the entire reach above Asotin. All the salmon stocks use the mainstem as an adult and juvenile migration corridor, including the ESA Endangered sockeye population that migrates up into Idaho basins.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is around 17,800 cfs in August and the peak is 69,600 cfs in June. Minimum flow is 51 percent of the average; reaches with August flows more than 66% of average scored 'good' for this component of the flow element score. Diversions evaluated for this project represent less than 1 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component.

Flow scoring detail is available on Table C-9.

3503 - Tucannon River (Reach 1)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

Tucannon River (Reach 1) also has a high fish status/utilization rating. A different suite of seven stocks are present in Tucannon River (Reach 1) than Snake River (Reach 2). Two stocks, Snake Fall Chinook and Tucannon Summer Steelhead, utilize this reach for all three life cycle stages. Bull trout, and Tucannon Spring Chinook use the river for juvenile rearing and adult migration where as Wenaha Spring Chinook, Lower Grande Ronde Summer Steelhead, and Joseph Creek Summer Steelhead only use Tucannon (Reach 1) for juvenile rearing.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

The Tucannon basin encompasses a 503-square-mile drainage area in Garfield and Columbia counties. Pataha Creek is the Tucannon's major tributary. The Tucannon River originates in the Blue Mountains and enters the Snake River at River Mile 62.2. The area has an average annual rainfall of 23 inches which includes winter snowfall. Melting snow from the Blue Mountains provides much of the annual runoff to the streams and rivers in the subbasin; the water level in many streams diminishes greatly during the summer months. Vegetation in the subbasin is characterized by grasslands and agricultural lands at lower elevations and evergreen forests at higher elevations. Approximately 75 percent of the Tucannon subbasin is in private ownership; most of this land is in the lower portion of the watershed

Large alders and cottonwoods dominate the riparian zone on this reach of the Tucannon River. Recovery of the riparian zones is continuous as farm activities, flooding, and grazing reduces the functional values. A riprapped railroad bed constructed in the 1880s runs from Pataha Creek to Smith Hollow. The dike keeps the river from cutting into the north valley wall, but does not constrain other processes. Post flood channel maintenance between 1937 and 1978 reduced the entire Tucannon River stream's length by seven to 20% and sinuosity reduced by 50%. Altering the system led to continual maintenance followed by more extensive flood damages, followed by more maintenance. Following the 1964-65 floods the (then) Soil Conservation Service (SCS) and the US Army Corps of Engineers (COE) installed up to

40,000 feet of riprapped levees along the Tucannon River (Reaches 1, 2, and 3 combined), while the state, county, and private parties installed between 20,000 and 40,000 additional feet of levees. Each road or rail crossing of the Tucannon River typically consists of a bridge and causeway that often extends the full width of the valley floor.

A fish ladder was installed at Starbuck Dam (RM 5.5) in 1992. The ladder is primarily used by fall Chinook and is designed to prevent northern pikeminnow and suckers from migrating from the Snake River reservoirs into the majority of the Tucannon River.

This reach of the Tucannon River is subject to high inputs of fine sediments eroded from crop land and transported through the drainage network, particularly Pataha Creek. Long periods between major flood events likely contributes to high embedded substrate ratios that make redd construction difficult and likely reduce survival of incubating juvenile salmonids. The bed of the Tucannon is composed primarily of coarse gravel and cobbles held together by a silt-clay matrix. Little sand or fine gravel are present.

Large woody debris is much less abundant than it was historically. Off-channel habitat is relatively common. Backwaters, side channels, and swampy areas are all present. Dissolved oxygen levels at some sites on this reach were low enough to preclude survival of juvenile salmonids. August water temperatures on this reach are high enough to stress juvenile salmonids. The majority of landowners on the lower 30 miles of the Tucannon River divert water from the river for irrigation.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 64 cfs in August and the peak is 304 cfs in May. Minimum flow is 37 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score. Diversions evaluated for this project represent 10 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component.

Flow scoring detail is available on Table C-9.

3504 - Tucannon River (Reach 2)

Fish	Habitat	Flow
2	3	3

Fish Status/Utilization

Four stocks utilize Tucannon River (Reach 2). Even though fewer stocks are present at this reach, three express all three life cycle stages. Those stocks are Snake Fall Chinook, Tucannon Spring Chinook, and Tucannon Summer Steelhead. The fourth stock, bull trout utilizes the reach for juvenile rearing and adult migration. Between ESA and SaSI status and utilization, Tucannon River (Reach 2) is rated high for fish status/utilization.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

The Tucannon River Reach 2 is a transition zone for several of the instream functions and values. The presence of rearing or staging juveniles and holding subadults and adults occurs throughout the reach but is very dependent on water quality, especially water temperature. Water temperatures are slightly cooler and more tolerant of salmonids than in the lower reach. All of the reach flows through farms, pastures, and crop lands. Most of the riparian values, side channels, and floodplain conditions noted in the Tucannon River Reach 1 also exist in Reach 2. There are very few tributaries that drain into this reach, except ephemeral drainages. Springs within the floodplain also contribute to some cool water refuge habitat values.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 63 cfs in September and the peak is 362 cfs in May. Minimum flow is 44 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score. Diversions evaluated for this project represent 12 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component.

Flow scoring detail is available on Table C-9.

3505 - Tucannon River (Reach 3)

Fish	Habitat	Flow
2	3	3

Fish Status/Utilization

Fish status/utilization for Tucannon River (Reach 3) is rated as ‘average’. Snake Fall Chinook are no longer utilizing the river at this reach. The remaining three stocks, Tucannon Spring Chinook, Tucannon Summer Steelhead and bull trout utilize the reach for spawning, rearing and adult migration.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

The Tucannon River Reach 3 starts in USFS lands (close to the Tucannon-Wenaha Wilderness Area boundary) and flows downstream through a high recreational use area and then into farm lands that are scattered over the floodplain. Twenty-seven campgrounds, 16 on USFS lands, and 11 on the Wooten Wildlife Area are located along the Tucannon River. Except in the recreational areas, riparian zones are functional with tall canopy deciduous and evergreen trees, along with woody shrubs and some grasses. Large woody debris recruitment is on the increase as a result of major fires throughout the basin. Floodplain connectivity is healthy, except in areas where elevated roads are close to and parallel the river. Numerous ephemeral and several perennial streams flow out of the steep terrain into the Tucannon River in Reach 3. The only passage obstruction is the Tucannon Fish Hatchery adult collection weir. Outside of collection periods, all fish are able to pass upstream and downstream at the weir. Steelhead spawning can occur anywhere in the reach, but the majority takes place in the USFS zones. Spring Chinook utilize the middle to upper areas of Reach 3, and often move upstream of Reach 3 into the wilderness area to spawn. All life history phases of bull trout utilize this reach.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 114 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 3 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component.

Flow scoring detail is available on Table C-9.

3506 - Pataha Creek (Reach 1)

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Pataha Creek (Reach 1) is a primary tributary to the lower Tucannon River mainstem. This reach is rated ‘average’ for fish status/utilization. Four stocks utilize this reach. Life Cycle stages for Snake Fall Chinook and Tucannon Spring Chinook are limited to juvenile rearing whereas bull trout utilize the reach for juvenile rearing and adult migration. Tucannon Summer Steelhead utilize Pataha Creek (Reach 1) for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Woody riparian plants on this reach consist primarily of shrubs growing on the floodplain forming in the bottom of the incised channel or the sides of the channel. Reed canary grass is the dominant riparian plant. Canopy cover ranges from 5% to 15%. Current practices of tilling to the edge of the terrace, grazing, and herbicide application are contributing to the degraded riparian conditions. In the lower portions, there are culverts that present partial fish passage barrier at some flows. No barriers are known to be present from Dodge to Tatman Gulch (RM 19). A concrete slab poured over a pipe at 20th Street in Pomeroy is impassable to most fish.

Extensive channel incision and the associated drop in ground water table, along with livestock grazing, land clearing, tillage, and herbicide use removed the majority of native woody trees and shrubs from banks along this reach. The channel modification coupled with conversion of thousands of acres of perennial grasslands to dryland wheat production led to rapid downcutting throughout the length of the stream channel. The historic floodplain became a terrace which no longer had a water table to support riparian vegetation.

Biologists found gravel and cobble substrate, boulders, and bedrock shelves throughout portions of this reach. Most rock surfaces were covered with a layer of silt. Gravel and cobble are often embedded to 100%. Very little LWD data is available, but LWD is suspected to be uncommon because of the highly degraded riparian conditions and channel incision. Little or no off-channel habitat is present because of channel incision.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 2 cfs in August and the peak is 37 cfs in April . Minimum flow is 19 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Flows are naturally low in this reach and get very low in summer months. Diversions evaluated for this project represent 21 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table C-9.

3507 - Pataha Creek (Reach 2)

Fish	Habitat	Flow
1	2	2

Fish Status/Utilization

Fish status/utilization for Pataha Creek (Reach 2) is low. The difference between Pataha Creek (Reach 2) and Pataha Creek (Reach 1) is the number of stocks present and the life cycle stages represented. Only two stocks are present in this reach. Those stocks, bull trout and Tucannon Summer Steelhead, utilize Pataha Creek (Reach 2) for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Cattle grazing is common and causes severe impacts throughout Pataha Creek Reach 2. Previous studies show almost no riparian vegetation was present from the Davis Farm to one mile below Columbia Center. Riparian vegetation is present from Columbia Center about one mile downstream and consists of grasses, forbs, and a variety of tall canopy trees. Canopy cover ranged from 5% to 37%.

Refuse dams just upstream from Columbia Street in Pomeroy may impede passage. Abandoned concrete slabs covered with mud and reed canary grass had formed a dam downstream from the well site for the town of Pataha. This dam appears to be impassable to all fish except at high flows. A bedrock shelf near the Clay Bar Ranch is likely a barrier at low flows, but is likely passable by steelhead during high spring flows.

Large portions of streambanks are eroding. The majority of the reach is characterized by an incised channel, particularly near Pomeroy. The stream has access to the floodplain, mainly in the upper portion of the reach where the channel is not incised. Gravel and rubble are the dominant substrate at Columbia Center. Biologists measured embeddedness at 55% with fine sediment covering 100% of all rock surfaces. Embeddedness tends to increase downstream. In some cases gravels and cobbles are completely obscured by mud.

Woody debris is very limited, almost non- existent on this reach. Channel incision makes off-channel habitat very rare. Bihmaier Spring provides a cool water influence just upstream from Benjamin Gulch Road.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 5 cfs in August and the peak is 40 cfs in April. Minimum flow is 34 percent of the average;

reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Flows are naturally low in this reach and get very low in summer months. Diversions evaluated for this project represent 2 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component.

Flow scoring detail is available on Table C-9.

3508 - Asotin Creek (Reach 1)

Fish	Habitat	Flow
2	2	3

Fish Status/Utilization

Asotin Creek is a primary tributary to the Snake River above Tucannon River. Six stocks frequent Asotin Creek (Reach 1). Joseph Creek Summer Steelhead, Lower Grande Ronde, Wenaha Spring Chinook, and Snake Fall Chinook utilize the reach for juvenile rearing. Asotin Summer Steelhead is the only stock to use Asotin Creek (Reach 1) for all three life cycle stages. Bull trout express juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

The Asotin Creek tributary comprises 325 square miles located in Asotin and Garfield Counties drained by Asotin Creek, Couse Creek, Tenmile Creek and their tributaries. Asotin Creek originates in the Blue Mountains and is a tributary to the Snake River, draining an area of 208,000 acres. Rainfall ranges from more than 45 inches in the higher elevations to 12 inches in the lower elevations. Melting snow from the Blue Mountains provides much of the annual runoff to the streams and rivers in the subbasin; the water level in many streams diminishes greatly during the summer months. Vegetation in the subbasin is characterized by grasslands and agricultural lands at lower elevations and evergreen forests at higher elevations. Approximately 67 percent of the Asotin basin is in private ownership; most of this land is in the lower portion of the watershed.

Conversion of perennial bunchgrass prairies to production of annual crops has led to widespread and massive quantities of fine sediment erosion and deposition in WRIA 35 streams. The majority of fine sediment deposition in the Asotin Subbasin occurs in the lower end of Reach 1 on private lands where other habitat features including riparian buffers, channel morphology, floodplain function, and instream structure are moderate to severely degraded. The riparian buffer along Asotin Creek Reach 1 is very constricted by development. Grazing leads to severe damage along the stream. No passage barriers are known on this reach. This reach is channelized and armored extensively to protect roads and private property. Cobble berms are often constructed in some areas. The channelization and dike construction eliminated all floodplain connectivity on this short reach. Previous studies show high substrate embeddedness. Very little LWD is present and there is little potential for near-term recruitment because of channelization and the immaturity of trees found in the limited riparian buffer. Channelization and dikes eliminated the off-channel habitat.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 34 cfs in September and the peak is 223 cfs in May. Minimum flow is 35 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score. Diversions evaluated for this project represent 2 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component.

Flow scoring detail is available on Table C-9.

3509 - Asotin Creek (Reach 2)

Fish	Habitat	Flow
1	3	2

Fish Status/Utilization

Asotin Creek (Reach 2) also rates 'average' for fish status/utilization, but many of the stocks in Asotin Creek (Reach 1) no longer frequent the creek at this reach. Only two stocks remain, Asotin Creek Summer Steelhead and bull trout. Asotin Creek Summer Steelhead express all three life cycle stages in this reach whereas bull trout utilize the reach for juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

In Asotin Creek Reach 2, the cycle of catastrophic floods, over grazing, flood control measures, and road building is a primary cause of the present degraded riparian condition. Asotin Road parallels the stream for the entire length of this reach. There is high substrate embeddedness in the pebble material from Charley Creek downstream, however, minimal cobble embeddedness. Large woody debris (LWD) levels increased substantially in recent years. Off-channel habitat is very limited but some is present. No dewatering occurs. About 90,390 acres (43%) of the entire Asotin Creek Watershed are used as pasture and rangeland. Livestock are wintered in canyon bottoms from December through March. Forests cover about 62,620 acres (30%) of the Asotin Creek Watershed. The majority of timberlands are found within the Umatilla National Forest. Summer flows average about 20 cfs.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 32 cfs in August and the peak is 165 cfs in May. Minimum flow is 49 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score. Diversions evaluated for this project represent 3 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component.

Flow scoring detail is available on Table C-9.

3510 - Charley Creek

Fish	Habitat	Flow
1	3	1

Fish Status/Utilization

Charley Creek is a tributary to Asotin Creek and rates ‘average’ for fish status/utilization. Like Asotin Creek (Reach 2), two stocks frequent the creek. Those stocks are bull trout and Asotin Creek Summer Steelhead. Both stocks utilize Charley Creek for spawning, rearing and adult migration.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

The 1996 winter flood removed or damaged a large amount of riparian vegetation along Charley Creek, especially the lower reaches upstream from the mouth. Livestock grazing and channel incision with the associated drop in water table also contributes to riparian degradation. The stream is highly entrenched in places and banks are actively eroding as the stream attempts to recreate a floodplain. Cattle grazing activities leave very little bank cover and causes very unstable streambanks from the mouth to about RM 8. The majority of the lower five miles of Charley Creek lost access to the historic floodplain because of channel incision. The stream is confined between dikes from the Asotin Creek Road downstream to the mouth.

There is little information on fish passage. Embeddedness on the USFS portion of Charley Creek averaged 15.3% in 1993. Substrate is highly embedded downstream from the Asotin Creek Road. Large woody debris levels are poor throughout the reach. No off-channel habitat is present on Charley Creek. No artificial dewatering occurs on Charley Creek.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 5 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table C-9.

3511 - Alkali Flat Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Alkali Flat Creek is a primary tributary to the Snake River mainstem. Seven stocks frequent the creek, the majority of which utilize the creek for juvenile rearing. Those stocks are bull trout, Joseph Creek Summer Steelhead, Lower Grande Ronde Summer Steelhead, Asotin Creek Summer Steelhead, Wenaha Spring Chinook and Snake Fall Chinook. The exception is Tucannon Summer Steelhead which utilize the creek for spawning, rearing and adult migration. Alkali Flat Creek is rated 'average' for fish status/utilization.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Very little instream, riparian, and floodplain information is known about Alkali Creek, but there is a recent effort by various agencies to obtain more information. Periodically agency biologists survey Alkali Flat Creek for steelhead spawning. No spawning activity is documented. The lower reaches provide juvenile salmonid rearing and refuge habitat. Alkali Flat Creek is listed on the 303(d) list for high water temperatures at various locations along the creek.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 13 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 12 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component.

Flow scoring detail is available on Table C-9.

3512 - Almota Creek

Fish	Habitat	Flow
2	3	1

Fish Status/Utilization

Almota Creek is also a primary tributary to the mainstem Snake River. Fish status/utilization for the creek is rated as 'average'. Six stocks frequent Almota Creek. Asotin Creek Summer Steelhead utilizes the creek for all three life cycle stages. Snake Fall Chinook, Wenaha Spring Chinook, Lower Grande Ronde Summer Steelhead, Joseph Creek Summer Steelhead and bull trout utilize the creek for juvenile rearing.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Forbs and deciduous trees are the primary riparian vegetation on Almota Creek from the mouth to RM 1.0. Grasses, sedges, rushes, and deciduous trees are found on Almota Creek from RM 2.0 to RM 4.7. The riparian buffer averages 38 feet wide. The riparian vegetation upstream is degraded by intensive agriculture and roads. Portions of Almota Creek from RM 1.0 downstream did not have access to a floodplain. A floodplain is present from RM 2.0 to RM 4.7 on Almota Creek.

No fish passage barriers are known to exist on Almota Creek. Wild steelhead adults and redds are common in Almota Creek. Gravel and cobble are the dominant substrates on Almota Creek from RM 1.0 downstream. Embeddedness is generally 25 to 50% from RM 1.0 downstream and >25% between RM 2.0 and RM 4.7. No LWD is present on Almota Creek from RM 1.0 downstream, but small amounts are found between RM 2.0 and RM 4.7. No off-channel habitat is present on the lower mile of Almota Creek, but several side channels exist from RM 2.0 to RM 4.7.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is less than 1 cfs in summer months and the peak is 6 cfs in April. Minimum flow is 31 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Flows are naturally low in this reach and get very low in summer months. Diversions evaluated for this project represent 5 percent of the Mean Annual Flow; reaches with diversions equal to or less than 5% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table C-9.

3513 - Alpowa Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Six stocks frequent Alpowa Creek, a primary tributary to the Snake River mainstem. This creek is rated 'average' for fish status/utilization. Most of the stocks, Snake Fall Chinook, Wenaha Spring Chinook, Lower Grande Ronde Summer Steelhead, Joseph Creek Summer Steelhead and bull trout, utilize the creek for juvenile rearing. Asotin Creek Summer Steelhead use the creek for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Alpowa Creek is a fourth order tributary to the Snake River with its headwaters originating in the Blue Mountains, continuing east into the Snake River at Lower Granite Lake, about seven miles west of Clarkston, Washington. There is generally a large difference in elevation between the valley bottoms and the surrounding plateaus. Intermittent and/or ephemeral streams are present throughout the watershed.

Riparian degradation is a major limiting factor on Alpowa Creek. The alder, cottonwood, and willows form a narrow, but nearly continuous buffer from Stember Creek downstream to Alpowa Ranch. The riparian buffer from Alpowa Ranch to the mouth is patchy. No physical passage barriers are known above Stember Creek. Pomeroy Conservation District estimates that 10 surface water diversions are in use in the Alpowa Creek Watershed. The stream generally has access to the floodplain, but some reaches are incised.

Alpowa Creek continues to support numerous steelhead adults and redds, including wild stocks. Substrate above the Stember Creek confluence consists of an assortment of gravel, rubble, cobble, and boulders. In 1999 embeddedness was 50% with a layer of fine sediment covering all rock surfaces. Little LWD is present. Overgrazing and channelization damages or removes riparian vegetation that severely limits LWD recruitment.

Groundwater springs provide perennial flow to Alpowa Creek. Alpowa Creek is somewhat unique in the fact that the headwaters are not wooded like other streams in southeast Washington. The entire watershed is either grazed or farmed. The system is more "flashy" because of these land uses. Channelization and removal of woody riparian vegetation makes off-channel habitat rare on Alpowa Creek, but a few off-channel areas exist.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 5 cfs in July and the peak is 16 cfs in April. Minimum flow is 56 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score. Diversions evaluated for this project represent 96 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table C-9.

3514 - Penewawa Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Fish status/utilization at Penewawa Creek is also rated as 'average' and seven stocks frequent the creek. Tucannon Summer Steelhead is the only stock that utilizes Penewawa Creek for all three life cycle stages. The remaining stocks utilize the creek for juvenile rearing. Those stocks are Snake Fall Chinook, Wenaha Spring Chinook, Asotin Creek Summer Steelhead, Lower Grande Ronde Summer Steelhead, Joseph Creek Summer Steelhead and bull trout.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

No characterization or comments on habitat condition for Penewawa Creek are available.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 3 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table C-9.

3515 - Deadman Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Deadman Creek, a primary tributary to the mainstem Snake River, has an 'average' rating for fish status/utilization. The majority of the six stocks present utilize the creek for juvenile rearing. Those stocks are Snake Fall Chinook, Wenaha Spring Chinook, Asotin Creek Summer Steelhead, Lower Grande Ronde Summer Steelhead, and Joseph Creek Summer Steelhead. Tucannon Summer Steelhead is the only stock that expresses all three life cycle stages.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Deadman Creek and its tributaries flow from springs in the Palouse hills south of the Snake River. The stream flows into the Snake River at RM 83. Deadman Creek has no forestland as it meanders through mostly dryland farms. Deadman Creek is listed on the 303(d) list for excessive fecal coliform concentrations and high water temperatures along various segments of the creek. In addition, low pH and low dissolved oxygen concentrations may be of concern as potential limiting factors to salmonid rearing in Deadman Creek. Grazing and mechanical or chemical removal of vegetation are responsible for degraded riparian areas along Deadman Creek. Some mature deciduous trees are present, but the most are within the incised channel. Grasses, sedges, rushes, and a few small trees are the dominant riparian vegetation in portions of the upper reach. A large forest of willows is present from the mouth of Deadman Creek upstream to Willow Gulch.

Irrigation weirs and beaver dams obstruct fish passage in various portions of Deadman Creek. The historic floodplain connectivity is fragmented throughout and is dysfunctional on most of the incised reaches. In the incised reaches, the floodplain is used for agricultural production of wheat and alfalfa.

In the past, biologists documented several steelhead adults and redds in Deadman Creek. Cobble and gravel are the dominant substrate from RM 8.2 to RM 9.2. Mud and cobble are the dominant substrate from RM 1.5 to RM 4.5. Embeddedness is generally >50%. Little woody debris is present from RM 8.2 to RM 9.2. Woody debris is rare or absent from RM 1.5 to RM 4.5. Numerous side channels are present from RM 8.2 to RM 9.2. There is no off-channel habitat from RM 2.9 to RM 4.5. Some side channel habitat is present from RM 1.5 to RM 2.9

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 1 cfs in August and the peak is 6 cfs in April. Minimum flow is 36 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score. Diversion data used for this evaluation equal or exceed the Mean Annual Flow.

Flow scoring detail is available on Table C-9.

3516 - North Deadman Creek

Fish	Habitat	Flow
1	2	1

Fish Status/Utilization

Fish status/utilization for North Deadman Creek is rated as low. Only Tucannon Summer Steelhead is present in the creek, but this stock continues to express all three life cycle stages.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Mature deciduous trees dominate the lower ¼ mile of North Deadman Creek, but new recruitment is sparse. With the exception of a few scattered trees, little woody riparian vegetation is present up to a farmstead at the intersection of Guild City-Mayview and North Deadman Creek Roads. Farmers plant crops to the edge of the stream from this farmstead downstream to the buffer above the forks. Grazed pasture and small trees are the primary vegetation from RM 1.0 to RM 1.4 on North Deadman Creek. Shrub steppe is the dominant shoreline vegetation in the other areas. The surrounding area is dryland crops, although the landowners still maintain a dense vegetation buffer along this reach.

No fish passage barriers are found on North Deadman Creek from RM 1.0 to RM 1.4. North Deadman Creek also lacks floodplain access from RM 1.0 to RM 1.4. Gravel and rubble are the dominant substrates in both forks of Deadman Creek. Embeddedness is 26% in North Deadman Creek. A layer of fine sediment covers 100% of rock surfaces in both streams. Cobble is the dominant substrate in North Deadman Creek from RM 1.0 to RM 1.4. Embeddedness is usually >50%. There is no LWD in North Deadman Creek from RM 1.0 to RM 1.4. No off-channel habitat is found on North Deadman Creek from RM 1.0 to RM 1.4.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. Diversion data used for this evaluation exceed the Mean Annual Flow.

Flow scoring detail is available on Table C-9.

3517 - Deadman Gulch or South Deadman Creek

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Fish status/utilization for Deadman Gulch is also rated as 'low.' Tucannon Summer Steelhead is the only stock present. This stock utilizes the gulch for spawning, rearing and adult migration.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Little or no woody riparian vegetation is present along South Deadman Creek, but a few mature deciduous trees are scattered along the stream adjacent to Guild City-Mayview Road. Forbs, grasses, sedges, and rushes are the primary riparian plants along South Deadman Creek from RM 0.8 to RM 1.5. The buffer averages 4 feet in width with no shading. The majority of South Deadman Creek from RM 0.8 to RM 1.5 does not have access to a floodplain.

Biologists located four fish passage barriers on South Deadman Creek from RM 0.8 to RM 1.5. No descriptions are available. Gravel and rubble are the dominant substrates in both forks of Deadman Creek. Embeddedness ranges from 10% to 33% in South Deadman Creek. Biologists found cobble and bedrock are the dominant substrates in South Deadman Creek from RM 0.8 to RM 1.5. Embeddedness is usually >25%. No woody debris is present on South Deadman Creek from RM 0.8 to RM 1.5. No off-channel habitat is found from RM 0.8 to RM 1.5 on South Deadman Creek.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 4 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 44 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table C-9.

3518 - Tenmile Creek

Fish	Habitat	Flow
2	2	2

Fish Status/Utilization

Tenmile Creek is another primary tributary to the mainstem Snake River. Fish status/utilization for this creek is rated as 'average'. Six stocks are present in Tenmile Creek. Bull trout, Joseph Creek Summer Steelhead, Lower Grande Ronde Summer Steelhead, Wenaha Spring Chinook and Snake Fall Chinook utilize the creek for juvenile rearing. Asotin Creek Summer Steelhead use the creek for spawning, rearing and adult migration life cycle stages.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Portions of the Tenmile Creek channel from RM 2 upstream go dry during the summer and early fall delaying or blocking adult steelhead migration and stranding both adults and juveniles in isolated pools. No other physical barriers are identified from RM 0.1 to RM 6.1. There may be passage barriers farther upstream. In the lower portion of Tenmile Creek riparian vegetation ranges from partial stands to no vegetation in areas of severe scour and flood deposition. The lower 1.5 to 2 miles of the stream is relatively dense riparian buffer in some areas, but portions are damaged by cattle grazing. Hawthorn, cottonwood, willows, and conifers are present in the upper portion of Tenmile Creek. Buffer width and conditions vary. Cobble berms and high banks restrict floodplain access from RM 0.1 to RM 0.7. Floodplain connectivity is fragmented due to incised channel zones and natural basalt canyon walls. There are no dikes or roads.

Cobble is the primary substrate from RM 0.1 to RM 3.7. Embeddedness is usually <25%. Embeddedness increases to 25 to 50% from RM 3.7 to RM 6.1. Woody debris is rare or non-existent from RM 0.1 to RM 6.1. Small amounts of LWD are present in the upper portions of Tenmile Creek. Little or no off-channel habitat is present. Some side channel habitat is present from RM 1.2 to RM 3.7. Tenmile Creek is one of the most productive steelhead streams for spawning and rearing that flow into this reach of the Snake River (RM 150). Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 1 cfs in July-October and the peak is 18 cfs in February. Minimum flow is 10 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. The hydrographs for this reach appears to be truncated in March. The lowest MMFs are very low for this reach year-round. No diversion data are available in this reach. Flow scoring detail is available on Table C-9.

3519 - Mill Creek

Fish	Habitat	Flow
1	2	1

Fish Status/Utilization

Mill Creek is a tributary to Tenmile Creek and is rated as 'low' for fish status/utilization. Only one stock is found in Mill Creek, Asotin Creek Summer Steelhead. This stock utilizes Mill Creek for juvenile rearing.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Tall grass and an occasional hawthorn are the primary riparian vegetation along Mill Creek near Anatone. Bank stability on Mill Creek ranges from active erosion to moderately stable. Several culverts on Mill Creek in the town of Anatone may be barriers. Mill Creek has moderate to heavy fine sediment levels with high turbidity at times. The gradient of Mill Creek is steep with small riffles and plunge pools. Summertime water temperatures can be tolerant of juvenile salmonids, although portions of Mill Creek do go dry during the summer.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 12 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table C-9.

3520 - Couse Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Six stocks frequent Couse Creek, a tributary to the Snake River mainstem. Fish status/utilization is average for this creek. Bull trout, Joseph Creek Summer Steelhead, Lower Grande Ronde Summer Steelhead, Wenaha Spring Chinook and

Snake Fall Chinook utilize the creek for juvenile rearing. Asotin Creek Summer Steelhead use the creek for spawning, rearing and adult migration life cycle stages.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Grasses, sedges, rushes, shrubs, and deciduous trees are the primary riparian vegetation along Couse Creek from RM 0.1 to RM 1.6. The riparian buffer averages 29 feet in width with a mean height of 7 feet. Further upstream to the bridge at Montgomery Gulch (RM 3.1) the riparian buffer is nearly nonexistent. A patchy buffer of scattered trees and shrubs is present from Montgomery Gulch upstream. The floodplain along Couse Creek is naturally small, although functional, because of the relatively narrow valley bottom.

Low flows caused by evaporation, drought, or subsurface flows restrict migration of juvenile salmonids or delay adult salmonid migration periodically. There are physical fish passage barriers (natural) on Couse Creek, including log jams and steep gradient. No surface water diversions are present on Couse Creek. Cobble and boulders are the dominant substrate. Embeddedness ranges from <25% to a high of 50%. Couse Creek consists of riffles that flow between the small plunge and lateral scour pools. Some large pools with cover are present, but not plentiful. Off-channel habitat is very limited. In past summers, Couse Creek went dry from about 1.5 miles above the mouth to 0.5 miles above the bridge at Montgomery Gulch. However, juvenile steelhead/rainbow trout were still found in isolated pools.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No Comments: Peak Mean Annual Flow in this reach is 6 cfs in April, and minimum flow is less than 1cfs in other months. Minimum flow is 34 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score. This is a small creek with a typical spring runoff and otherwise very low flows. No diversion data are available in this reach.

Flow scoring detail is available on Table C-9.

3521 - Tumalum Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Tumalum is a tributary to the mainstem Tucannon River. Fish status/utilization rating is ‘average’ for this creek with three stocks present. Bull trout and Tucannon Summer

Steelhead utilize the creek for spawning, rearing and adult migration. Tucannon Spring Chinook only utilize Tumalum Creek for juvenile rearing.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

The Garfield County portion of upper Tumalum Creek has a riparian zone dominated by grand fir and alder with a grass and forb understory. Previous studies showed canopy cover for this reach averaged 66%. The Cummings Creek fire in 1961 burned the entire canyon of Tumalum Creek. Little vegetation was left to collect water and stabilize soil and streambanks when the 1964 flood occurred that caused massive destruction and erosion. Large sections of Tumalum Creek go subsurface during the summer months, causing a potential fish passage problem. No irrigation diversions are known to be in use on the Tumalum Creek. Average width to depth ratio for Tumalum Creek in 1993 on USFS lands was 10.9. Embeddedness in Tumalum Creek on USFS lands averages 32%. Tumalum Creek has moderate levels of LWD to help form pools, with an average of 18 pieces per mile. The middle and lower reaches of Tumalum Creek are intermittent.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table C-9.

3522 - Grande Ronde River

Fish	Habitat	Flow
2	3	3

Fish Status/Utilization

Fish status/utilization rating for Grande Ronde River is 'average.' This tributary to the mainstem Snake River has five stocks present. Of the five stocks, Snake Fall Chinook, and Lower Grand Ronde Summer Steelhead utilize the river for all three life cycle stages. Bull trout utilize the reach for juvenile rearing whereas Joseph Creek Summer Steelhead and Wenaha Spring Chinook rear and migrate in the reach.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Grasses and a few small shrubs are the dominant riparian vegetation along the majority of this reach. Limited riparian vegetation, large cobble substrate, and high intensity flood events combined over time to create unstable banks. Riparian vegetation such as trees and shrubs is naturally limited by the narrow valley bottom and arid climate. The Grande Ronde flows through a very deep basalt canyon that constrains the channel. Because of this, floodplains are rare and generally small where present. A large amount of riprap is placed along roads paralleling the Grande Ronde River; otherwise floodplain access is not limited. No fish passage barriers are known to exist on the mainstem Grande Ronde within Washington.

Low summer flows and high water temperatures as well as high turbidity during high intensity runoff events may hinder migration. Substrate embeddedness is suspected to be a problem, but there is no data available. Logging and stream cleaning activities in the upper watershed within Oregon reduced LWD abundance from historic levels. Large pools are common and off-channel habitat is uncommon except along gravel bars and islands.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 4,784 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent less than 1 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table C-9.

3523 - Buford Creek

Fish	Habitat	Flow
1	2	2

Fish Status/Utilization

Fish status/utilization for Buford Creek, a tributary to the Grande Ronde River, is low. Three stocks are present. Snake Fall Chinook and Wenaha Spring Chinook use the creek for juvenile rearing. In contrast Lower Grande Ronde Summer Steelhead utilize Buford Creek for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Buford Creek flows from the RB into the Grande Ronde River at RM 25.7. Channel gradients (up to 12%) typically limit anadromy to the lower few miles of the stream. The flood events of 1996-97 caused considerable damage to overstory vegetation in Buford Creek. The flood uprooted trees and caused severe downgrading within the existing stream channel. As a result, canopy coverage declined and is now patchy.

The increased solar radiation impacts the stream temperatures. Logging, wheat, and hay farming are land uses in the basin. Other habitat information is unavailable.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 3 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table C-9.

3524 - Menatchee Creek

Fish	Habitat	Flow
1	3	3

Fish Status/Utilization

Menatchee Creek is also a tributary to Grande Ronde River and has low fish status/utilization. Lower Grande Ronde Summer Steelhead utilize the creek for spawning, rearing and adult migration. Snake Fall Chinook and Wenaha Spring Chinook juveniles migrate to this reach for the rearing conditions.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Riparian buffers in lower Menatchee Creeks is in marginal condition. Cattle grazing near the mouth of Menatchee Creek cause some of the degradation. The stream has a very steep gradient. Floodplains are minimal in size. A falls near RM 1.5 on Menatchee Creek is a barrier to upstream migration. Embeddedness is not a problem on Menatchee Creek with an average value of only 8.4% on 5.5 miles of stream surveyed on USFS lands. Large wood is relatively plentiful on Menatchee Creek with an average of 40 pieces per mile reported on USFS lands. An average of 12.5 pools per mile was reported for Menatchee Creek on USFS lands. Pools on the USFS portion of Menatchee Creek are large, occupying an average of 43% of stream surface area. Turbulence, pocket pools, and rocks provided “good to excellent” fish cover. Side channels comprised an average of 5.25% of stream surface area on the USFS portion of Menatchee Creek.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 6 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table C-9.

3525 - Joseph Creek

Fish	Habitat	Flow
1	2	3

Fish Status/Utilization

Joseph Creek, another tributary to the Grande Ronde River, hosts four stocks in its waters. Joseph Creek Summer Steelhead display all three life cycle stages in the creek. The rest of the stocks, Snake Fall Chinook, Wenaha Spring Chinook, and Lower Grande Ronde Summer Steelhead, utilize Joseph Creek for juvenile rearing.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

The 1996 flood scoured Joseph Creek a great deal but it is a naturally 'flashy' system. Joseph Creek is dominated by a relatively narrow buffer of deciduous trees about 20 to 30 feet in height from the mouth upstream to the end of the Joseph Wildlife Area. Ownership is split between national forest and private lands. Private ranching and grazing is the primary land use. Upper Joseph Creek has low gradient reaches passing through a mix of Forest Service and private lands. Lower Joseph below Cottonwood Creek is mostly in a confined canyon. Joseph Creek basin (includes tributaries) has 223 miles of steelhead spawning habitat. Sediment and temperature have the biggest impacts on instream habitat. High summer water temperatures limit salmonid use of lower Joseph Creek. Channel scouring, road construction impacts, and loss of flow from irrigation reduce instream juvenile rearing habitat values. There are suitable levels for gravels throughout the drainage for egg incubation, although marginal in places because of sediment impacts. Tributary reaches are likely the source of the identified sediment impacts. Information on other instream habitat functions is limited.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 18 cfs in August and the peak is 390 cfs in April. Minimum flow is 16 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 2 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component.

Flow scoring detail is available on Table C-9.

3526 - Cottonwood Creek

Fish	Habitat	Flow
1	2	1

Fish Status/Utilization

Fish status/utilization in Cottonwood Creek is low. This tributary to the Grande Ronde River sports three stocks. Lower Grande Ronde Summer Steelhead spawn, rear and migrate in this reach. Snake Fall Chinook and Wenaha Spring Chinook use the creek for rearing.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Deciduous trees in a relatively contiguous buffer dominate riparian vegetation along the majority of Cottonwood Creek. Cottonwood Creek has a steep gradient and historically supported a very sparse marginal riparian vegetation community of willow and sumac. There is an intake structure for the juvenile fish acclimation facilities located at the mouth of Cottonwood Creek and an adult collection weir 600 feet further upstream. There are numerous cascades and boulders that are passable with difficulty. In the past, the average width of the stream was eight feet, average stream depth was 5 inches, average boulder banks were steep and from two to six feet high. The floodplain is about ¼ mile wide.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 1 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table C-9.

3527 - Cougar Creek

Fish	Habitat	Flow
1	3	2

Fish Status/Utilization

Cougar Creek fish status/utilization is low. This creek is also a tributary to the Grande Ronde River. Like Cottonwood Creek, Cougar Creek has three stocks present. Snake Fall Chinook and Wenaha Spring Chinook utilize the creek for juvenile rearing and lower Grande Ronde Summer Steelhead for spawning, rearing and adult migration.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

No characterization or comments on habitat condition for Cougar Creek are available.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 1 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table C-9.

3528 - Rattlesnake Creek

Fish	Habitat	Flow
1	2	2

Fish Status/Utilization

Three stocks frequent this tributary to the Grande Ronde River. Fish status/utilization for Rattlesnake Creek is low. Snake Fall Chinook and Wenaha Spring Chinook utilize the creek for juvenile rearing and lower Grande Ronde Summer Steelhead for spawning, rearing and adult migration.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

Rattlesnake Creek is a tight steep draw with the access road running along side of it from the junction with the state highway up for just over one mile till the main access road climbs out of the canyon. Biologists conducted instream habitat surveys in Rattlesnake Creek as early as 1940 and more recently in the 1990's. Large increases to the stream width appear to reflect scour impacts from major flood events since the 1940's. The average width in the lower reaches changed from a 7-ft width to a 19-ft width. The riparian zone is wider in the lower 0.5 miles of the drainage and consists mostly of alder, sumac, some cottonwood, and invasive tree species. The adjacent lands are steep grassy hills used for grazing. The floodplain is narrow and is functional, although very little value exists because of the small footprint of the floodplain. The culvert under State Route 129 at Rattlesnake Creek may be a barrier. The upper reaches of Rattlesnake Creek are dominated by coniferous trees in the bottom of a steep canyon. The stream gradient is fairly steep. The instream habitat is dominated by large cobble, small boulders, and series of cascades. There is very little LWD, side-channel, and floodplain connectivity data available.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table C-9.

3529 - West Branch Rattlesnake Creek

Fish	Habitat	Flow
1	2	2

Fish Status/Utilization

Lower Grande Ronde Summer Steelhead is the only stock present in the West Branch Rattlesnake Creek. The steelhead in this low fish status/utilization stream use West Branch Rattlesnake Creek for spawning, rearing, and adult migration.

Fish Status/Utilization scoring detail is available on Scoring Sheets

Table C-7.

Habitat

The West Branch Rattlesnake Creek flows through similar terrain as the lower mainstem Rattlesnake Creek. Cattle operations impact the riparian buffers, including fords that affect riffle areas. There is a fish passage obstruction in the lower end that is scheduled for restoration in 2012. Landowners claim that adult steelhead spawn in the lower one mile of the West Branch Rattlesnake Creek. Biologists observed juveniles rearing in the same stream reach. Instream water temperatures are cooled by groundwater seepage and surface springs throughout the drainage.

Habitat scoring detail is available on Table C-8.

Flow

Gauge:No Rule:No An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table C-9.

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

5. Scoring Sheets

Table C-7 Fish Scoring Sheet

Code	Reach Name	Reach Score & Bin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3501	Snake River (Reach 1)	572	41	41	41	56	40	56	60	49	49	49	45	45
3502	Snake River (Reach 2)	411	27	27	27	38	29	42	46	39	39	35	31	31
3503	Tucannon River (Reach 1)	408	29	32	32	40	33	36	37	33	33	37	33	33
3504	Tucannon River (Reach 2)	340	24	27	27	35	28	27	28	28	28	32	28	28
3505	Tucannon River (Reach 3)	296	23	26	26	30	27	26	23	23	23	23	23	23
3506	Pataha Creek (Reach 1)	232	16	19	19	23	20	23	20	20	20	20	16	16
3507	Pataha Creek (Reach 2)	165	12	15	15	15	12	15	12	15	15	15	12	12
3508	Asotin Creek (Reach 1)	292	21	24	24	28	25	28	25	25	25	25	21	21
3509	Asotin Creek (Reach 2)	156	12	15	15	15	12	15	12	12	12	12	12	12
3510	Charley Creek	192	15	18	18	18	15	18	15	15	15	15	15	15
3511	Alkali Flat Creek	292	21	24	24	28	25	28	25	25	25	25	21	21
3512	Almota Creek	256	18	21	21	25	22	25	22	22	22	22	18	18
3513	Alpowa Creek	256	18	21	21	25	22	25	22	22	22	22	18	18
3514	Penawawa Creek	292	21	24	24	28	25	28	25	25	25	25	21	21
3515	Deadman Creek	256	18	21	21	25	22	25	22	22	22	22	18	18
3516	North Deadman Creek	84	6	9	9	9	6	9	6	6	6	6	6	6
3517	Deadman Gulch	84	6	9	9	9	6	9	6	6	6	6	6	6
3518	Tenmile Creek	256	18	21	21	25	22	25	22	22	22	22	18	18
3519	Mill Creek	36	3	3	3	3	3	3	3	3	3	3	3	3
3520	Couse Creek	256	18	21	21	25	22	25	22	22	22	22	18	18
3521	Tumalum Creek	240	19	22	22	22	19	22	19	19	19	19	19	19
3522	Grande Ronde River	317	22	25	25	32	22	28	29	26	26	30	26	26
3523	Buford Creek	148	9	12	12	16	13	16	13	13	13	13	9	9
3524	Menatchee Creek	148	9	12	12	16	13	16	13	13	13	13	9	9

Code	Reach Name	Reach Score & Bin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3525	Joseph Creek	184	12	15	15	19	16	19	16	16	16	16	12	12
3526	Cottonwood Creek	148	9	12	12	16	13	16	13	13	13	13	9	9
3527	Cougar Creek	148	9	12	12	16	13	16	13	13	13	13	9	9
3528	Rattlesnake Creek	148	9	12	12	16	13	16	13	13	13	13	9	9
3529	West Branch Rattlesnake Creek	84	6	9	9	9	6	9	6	6	6	6	6	6
		Cumulative Monthly Total	471	549	549	662	544	646	588	566	566	574	491	491

Note: Reach names link to workbook tabs.

SaSI Stocks in Middle Snake River Basin	SaSI Stock Rating	Weight Factor**
Snake Fall Chinook	Depressed	3
Tucannon Spring Chinook	Depressed	3
Wenaha Spring Chinook	Unknown	2
Tucannon Summer Steelhead	Depressed	2
Asotin Creek Summer Steelhead	Depressed	2
Lower Grande Ronde Summer Sthd	Unknown	2
Joseph Creek Summer Steelhead	Unknown	2
Upper Tucannon Bull Trout	Healthy	2
Asotin Creek Bull Trout	Unknown	2
Wenaha Bull Trout	Unknown	2
Snake River Sockeye	Critical*	3

Weighting Factor Values by SaSI Stock Status:	**Weight**
Healthy	1
Depressed	2
Unknown	2
Critical	3
Weighting Factor for Federally Listed Species:	**ESA Weight Factor**
Assign additional weight to stocks that are listed as Threatened or Endangered under the ESA? (yes=1; no=0)	1
Assign additional weight to reaches within Interior Columbia TRT-designated spawning areas (MaSAs or MiSAs)? (yes=1; no=0)	0

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table C-8 Habitat Scoring Sheet

Reach Code	Reach Name	Reach Score & Bin	Off Channel Habitat (OCHs)	Flood-plain Connec-tivity	Riparian Cond-ition	Spawning Suita-bility	Rearing Suita-bility	Passage Condi-tion
3501	Snake River (Reach 1)	9	2	1	1	1	2	2
3502	Snake River (Reach 2)	14	2	2	1	3	3	3
3503	Tucannon River (Reach 1)	13	2	2	2	2	2	3
3504	Tucannon River (Reach 2)	15	2	2	2	3	3	3
3505	Tucannon River (Reach 3)	17	3	2	3	3	3	3
3506	Pataha Creek (Reach 1)	7	1	1	1	1	2	1
3507	Pataha Creek (Reach 2)	14	2	2	2	2	3	3
3508	Asotin Creek (Reach 1)	13	2	2	2	2	2	3
3509	Asotin Creek (Reach 2)	15	2	2	3	3	3	2
3510	Charley Creek	15	2	2	2	3	3	3
3511	Alkali Flat Creek	8	1	1	1	2	2	1
3512	Almota Creek	16	2	2	3	3	3	3
3513	Alpowa Creek	14	2	1	2	3	3	3
3514	Penawawa Creek	8	1	1	1	2	2	1
3515	Deadman Creek	9	1	1	1	2	2	2
3516	North Deadman Creek	12	2	2	2	2	2	2
3517	Deadman Gulch	6	1	1	1	1	1	1
3518	Tenmile Creek	14	2	2	2	3	3	2
3519	Mill Creek	12	2	2	2	2	2	2
3520	Couse Creek	14	2	2	2	3	3	2
3521	Tumalum Creek	12	2	2	2	2	2	2
3522	Grande Ronde River	15	3	2	2	3	2	3
3523	Buford Creek	11	2	2	2	2	2	1
3524	Menatchee Creek	16	2	2	3	3	3	3
3525	Joseph Creek	14	2	2	2	2	3	3
3526	Cottonwood Creek	14	2	2	3	3	3	1
3527	Cougar Creek	15	2	2	3	3	3	2
3528	Rattlesnake Creek	11	2	2	2	2	2	1
3529	West Branch Rattlesnake Ck	11	2	2	2	2	2	1

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table C-9 Flow Scoring Sheet

		GOOD IS HIGH	POOR IS HIGH, GOOD IS LOW >>>>>>>>>>>>>>>>>>>					
				A	B	C	D	E
Reach Code	Reach Name	BIN	Sum scores (A:D) * E	% of Mo Avg Below Rule	Qi Devia tion	No. Claims	August Deviation from Mean Annual Flow	Flow Volume Factor
3501	Snake River Reach 1	3	3		1	2	2	0.5
3502	Snake River Reach 2	3	2		1	1	2	0.5
3503	Tucannon River Reach 1	3	7		2	3	2	1.0
3504	Tucannon River Reach 2	3	7		2	3	2	1.0
3505	Tucannon River Reach 3	3	6		1	3	2	1.0
3506	Pataha River Reach 1	1	27		3	3	3	3.0
3507	Pataha River Reach 2	2	15		1	2	2	3.0
3508	Asotin Creek Reach 1	3	10		1	2	2	2.0
3509	Asotin Creek Reach 2	2	12		1	3	2	2.0
3510	Charley Creek	1	20		0	2	3	4.0
3511	Alkali Flat Creek	1	18		2	1	3	3.0
3512	Almota Creek	1	20		1	1	3	4.0
3513	Alpowa Creek	1	21		3	2	2	3.0
3514	Penewawa Creek	1	16		0	1	3	4.0
3515	Deadman Creek	1	24		3	1	2	4.0
3516	North Deadman Creek	1	32		3	2	3	4.0
3517	Deadman Gulch	1	28		3	1	3	4.0
3518	Tenmile Creek	2	15		0	2	3	3.0
3519	Mill Creek	1	24		2	1	3	4.0
3520	Couse Creek	2	12		0	1	2	4.0
3521	Tumalum Creek	1	16		0	1	3	4.0
3522	Grande Ronde River	3	3		1	2	2	0.5
3523	Buford Creek	2	12				3	4.0
3524	Menatchee Creek	3	9				3	3.0
3525	Joseph Creek	3	3		1	2	2	0.5
3526	Cottonwood Creek	3	2		1	1	2	0.5
3527	Cougar Creek	3	7		2	3	2	1.0
3528	Rattlesnake Creek	3	7		2	3	2	1.0
3529	West Branch Rattlesnake Ck	3	6		1	3	2	1.0

6. Maps

[Intentionally blank]

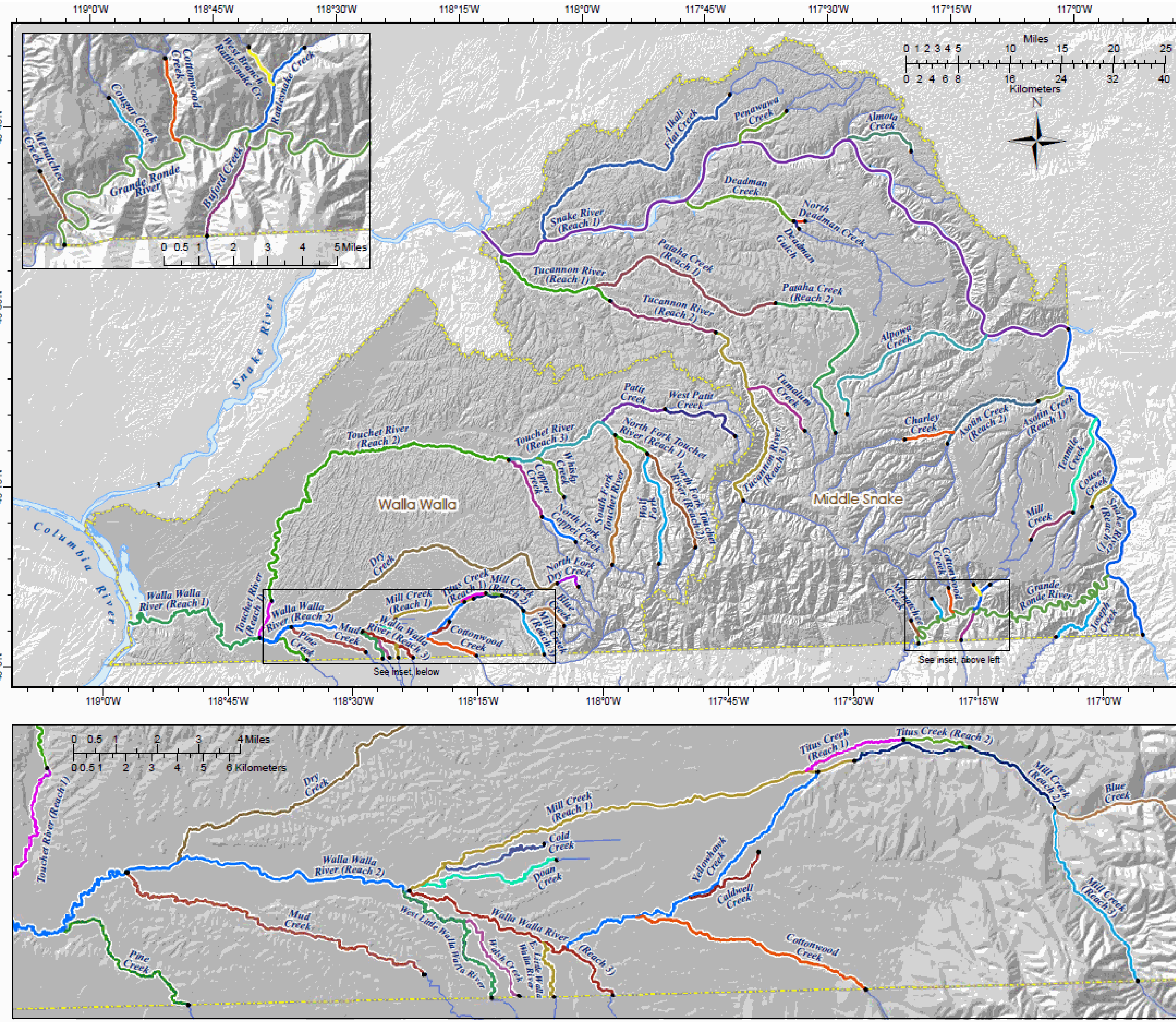
Figure C-1 Assessed Stream Reaches

Walla Walla and Middle Snake River Basins

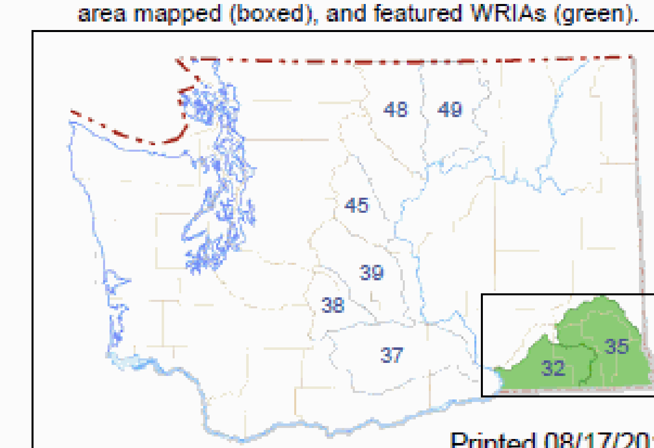
WRIAs 32 and 35 Assessed Stream Reaches colored for visual reference

• — Assessed Stream Reach upper extents

Continuation of Assessed Streams to Headwaters



Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

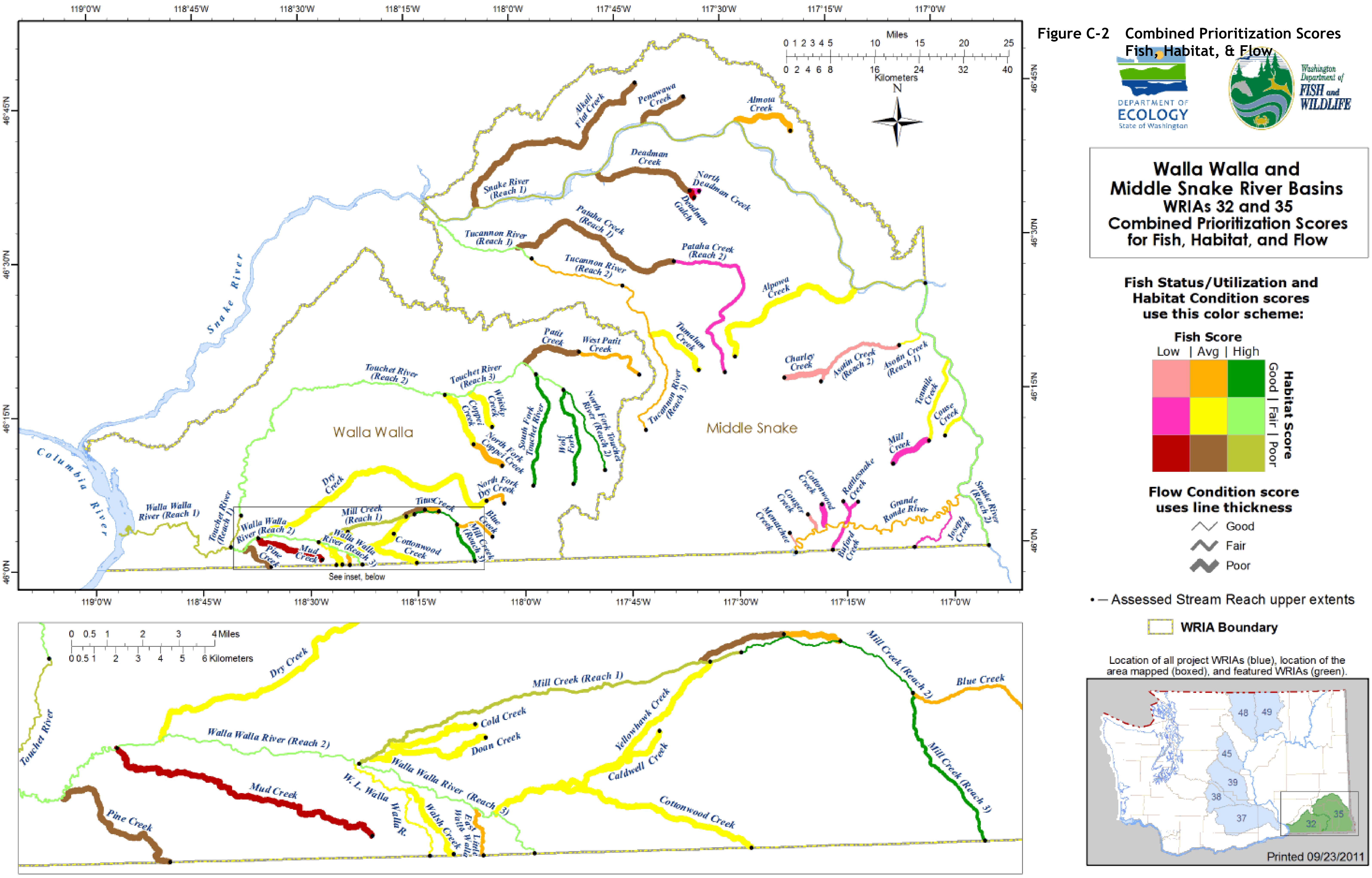


Printed 08/17/2011

WRIAs 32 and 35 - Walla Walla and Middle Snake River Basins - Priority Streams

[Intentionally Blank]

Figure C-2 Combined Prioritization Scores Fish, Habitat, & Flow

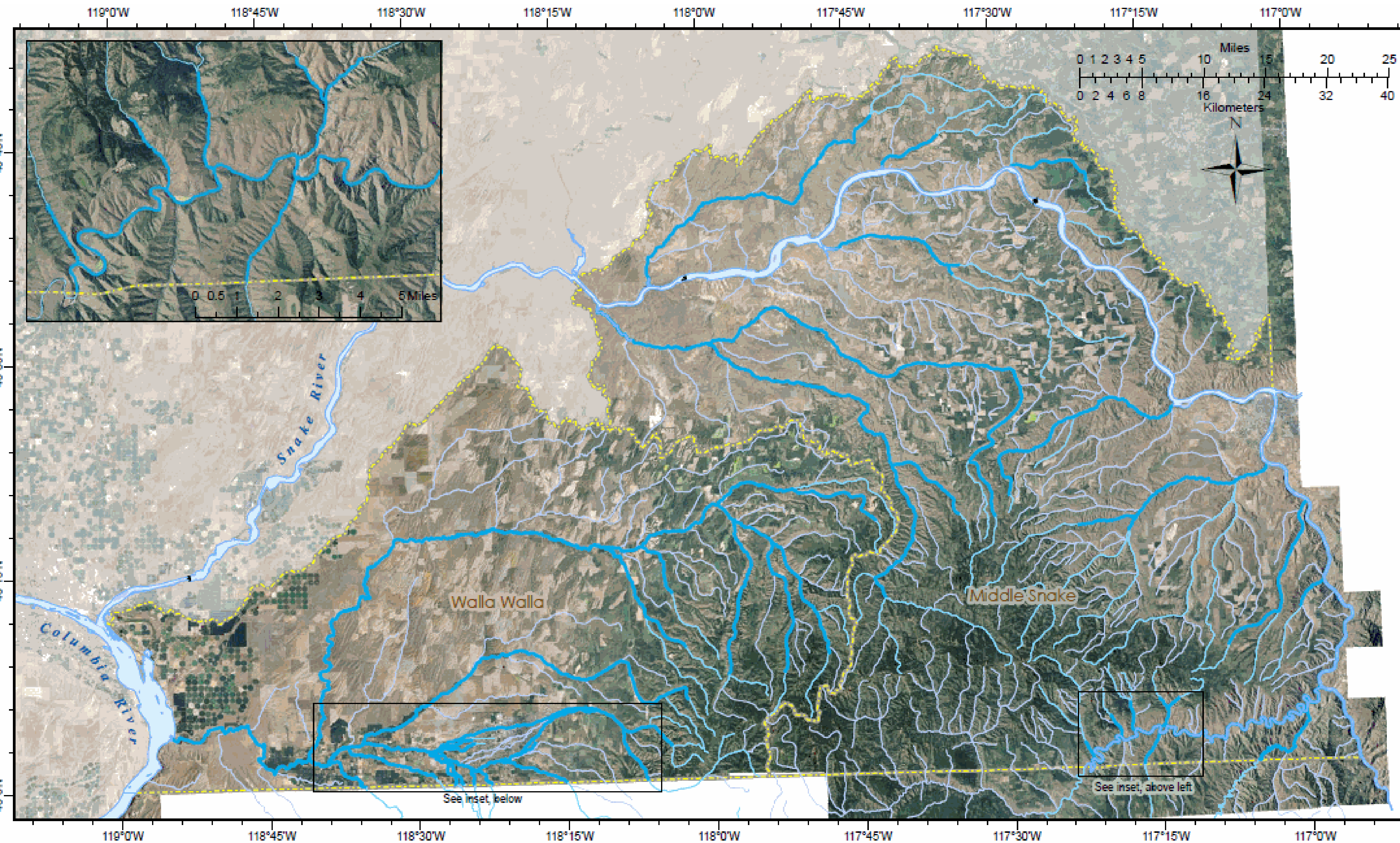


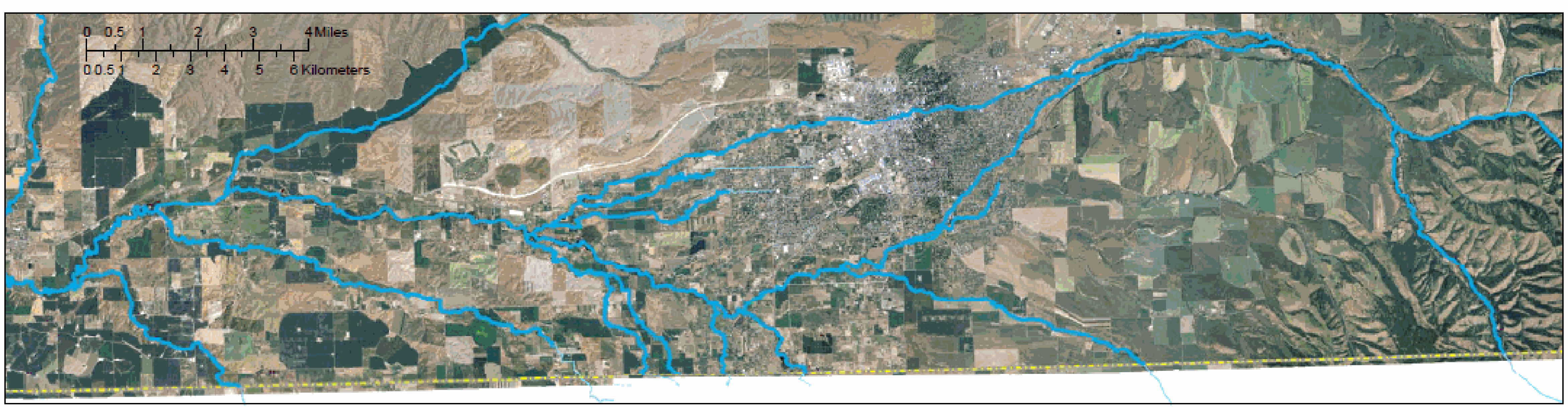
[Intentionally Blank]

Figure C-3 2001 Statewide 1m Orthophoto

Walla Walla and Middle Snake River Basins

WRIAs 32 and 35
2009 Statewide 1m Orthophoto

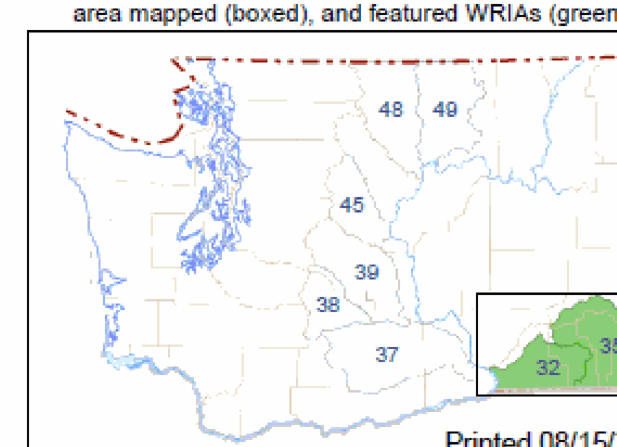




Stream Distinctions

- Assessed Reaches
- Headwaters of Assessed Reaches
- Other Named Streams
- **WRIA Boundary**

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).



Printed 08/15/2011

WRIAs 32 and 35 - Walla Walla and Middle Snake River Basins - Orthophoto

[Intentionally Blank]

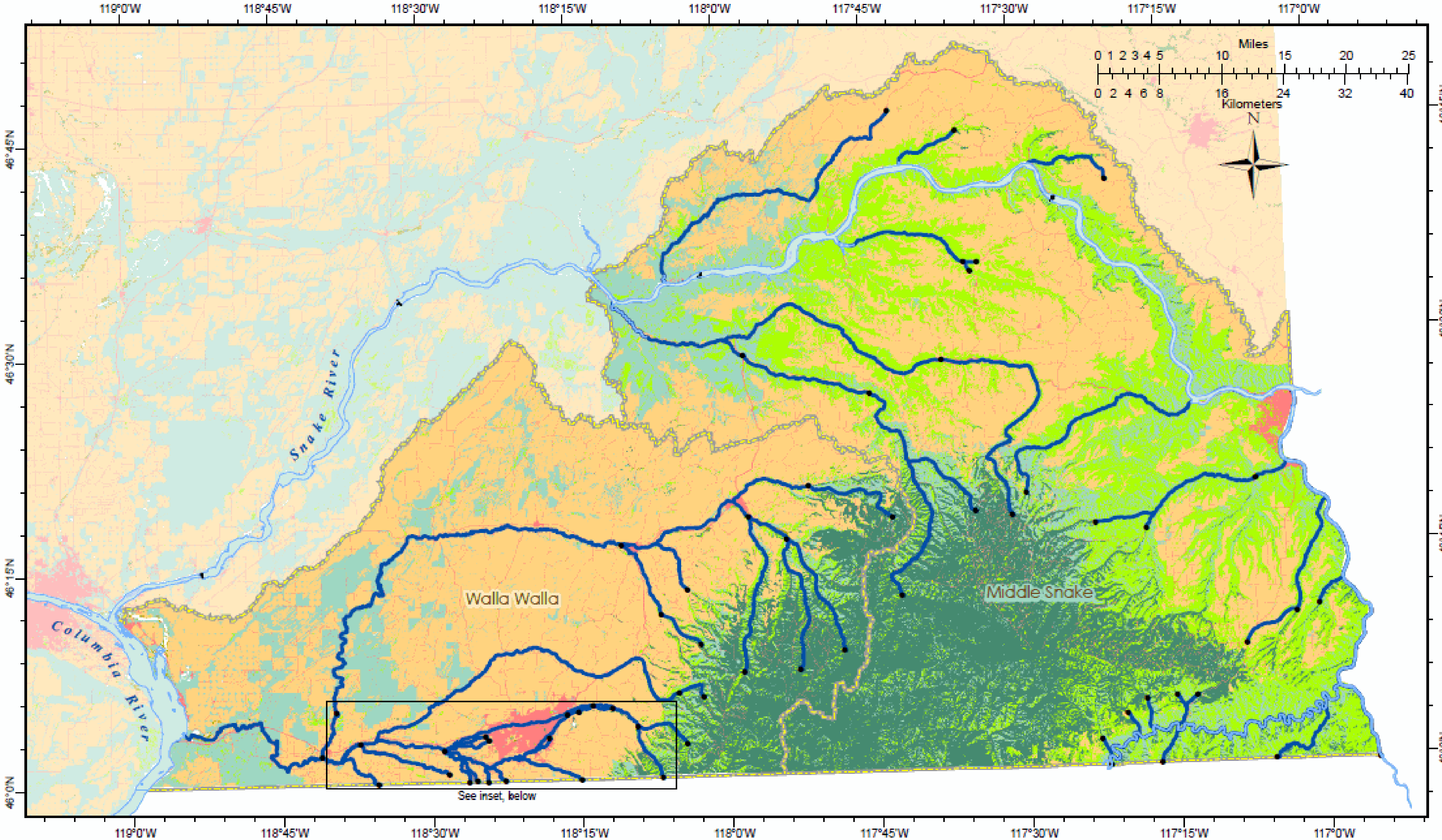
Figure C-4 2001 National Land Cover Database

DEPARTMENT OF ECOLOGY State of Washington

Washington Department of FISH and WILDLIFE

Walla Walla and Middle Snake River Basins

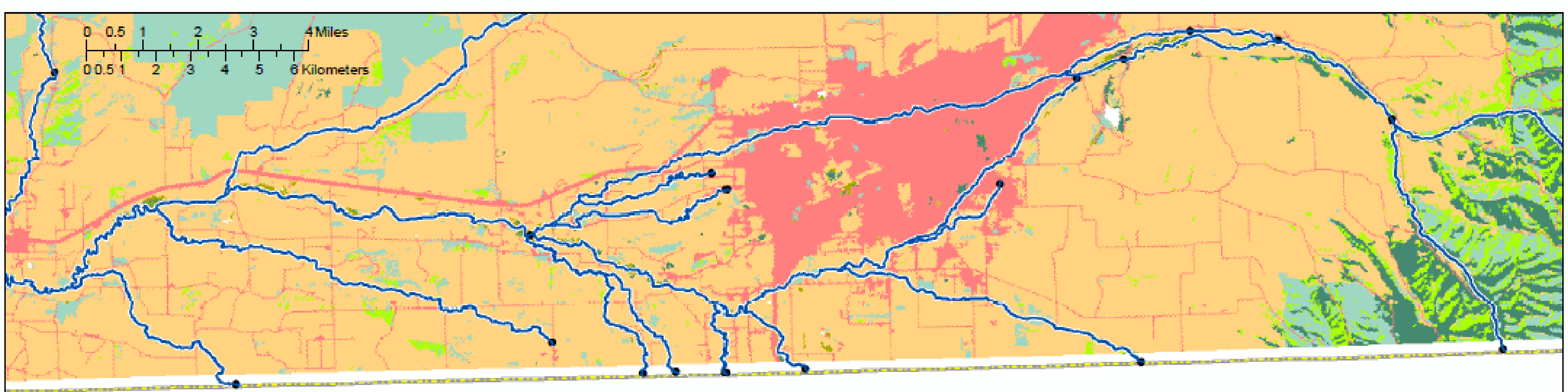
WRIAs 32 and 35
2001 National Land Cover Database



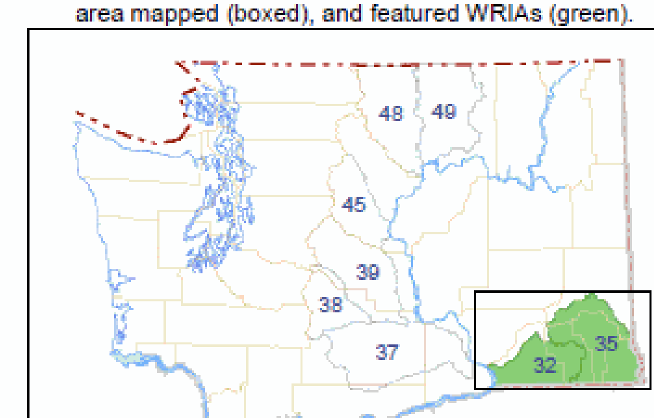
Land Cover and Use

- Snow and Ice
- Developed
- Barren
- Forest
- Scrub
- Grasslands
- Agriculture
- Riparian

Assessed Stream Reaches with upper extents marked



Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

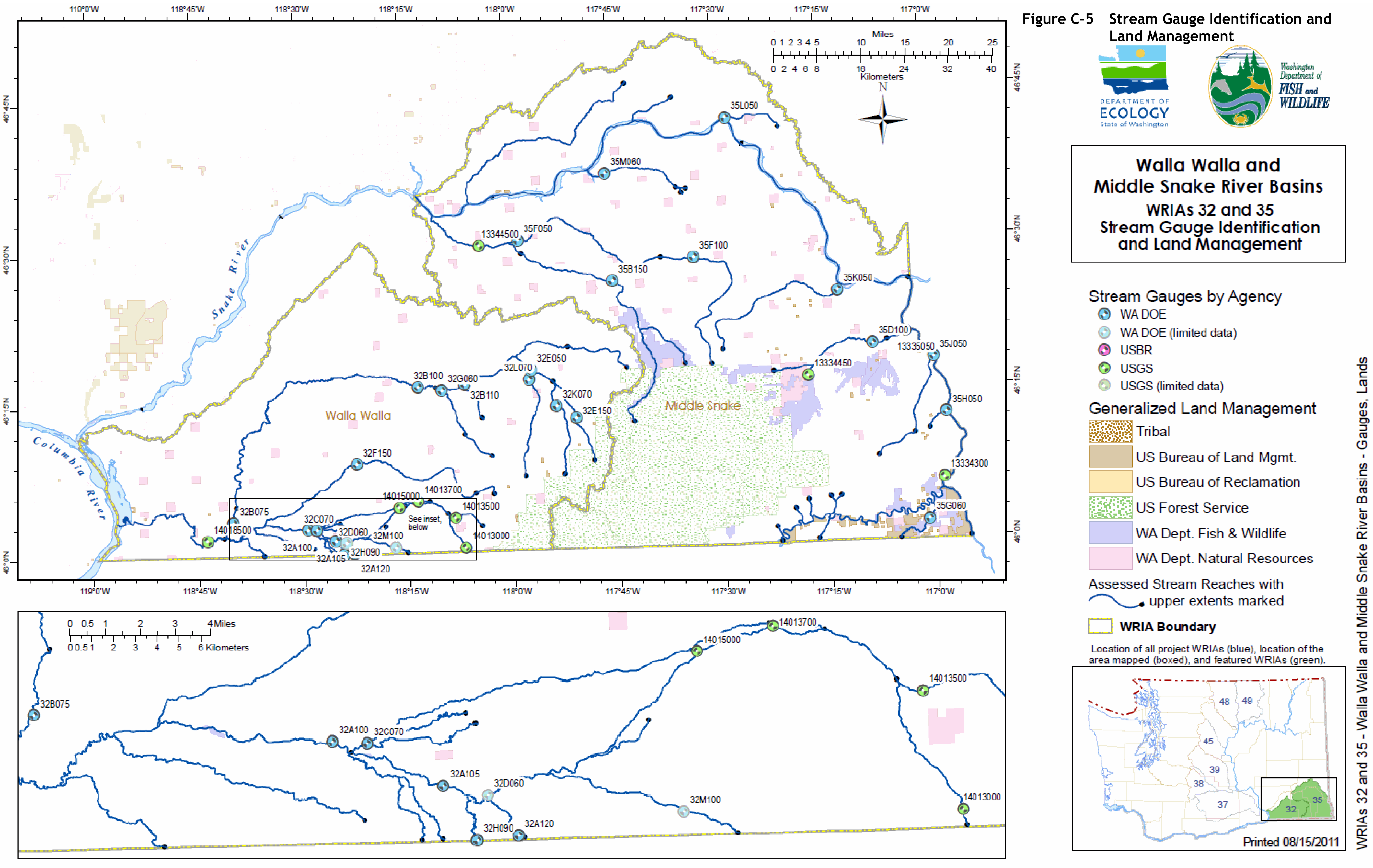


Printed 08/15/2011

WRIAs 32 and 35 - Walla Walla and Middle Snake River Basins - NLCD

[Intentionally Blank]

Figure C-5 Stream Gauge Identification and Land Management

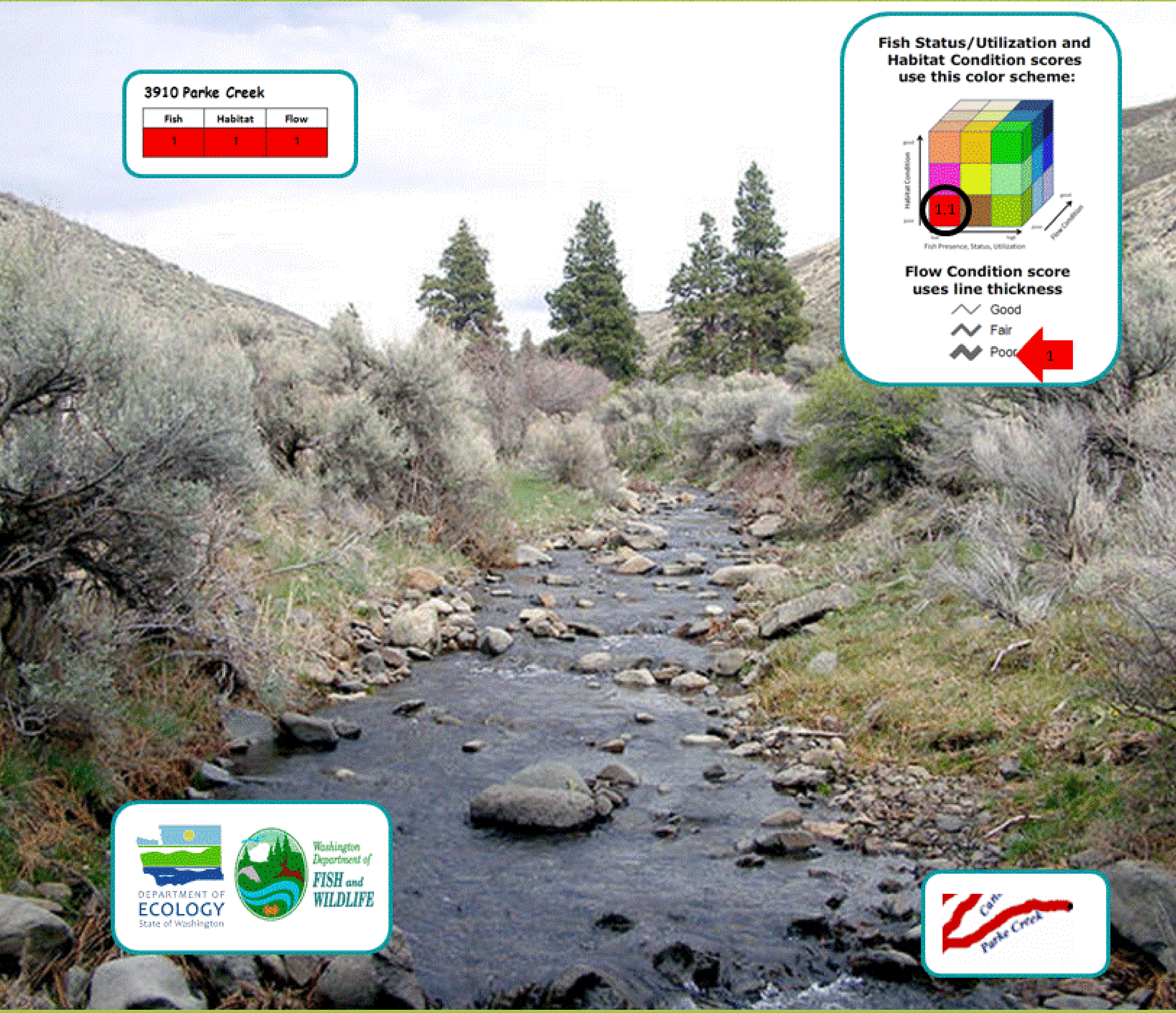


Columbia River Instream Atlas Project

Washington Department of Fish and Wildlife

Final Report – APPENDIX D

WRIAs 37, 38, 39 YAKIMA BASIN



Ecology Contract C1000090 - WDFW Contract 09-1471
Ecology Publication Number: 11-12-015

September 2011

Columbia River Instream Atlas Project - Final Report
Appendix D – WRIAs 37, 38, 39 Yakima Basin
September 30, 2011

Washington Department of Fish and Wildlife CRIA Team:
Teresa Scott (Habitat Water Resources Policy Coordinator)
Jonathan Kohr (Habitat Water Science Team)
Dayv Lowry (Fish Science; Habitat Science)
Andrew Weiss (Fish Science)
Aaron Bosworth (King County District Fish Biologist)
Jim Cummins (Yakima District Fish Biologist)
Dale Gombert (Fish Science)
Paul La Riviere (Habitat Water Science Team)
Peggy Miller (Habitat Major Projects)
Brianna Murphy (Fish Science)

Funding provided by Ecology Office of Columbia River as part of the 2011 Columbia Basin Long-term Water Supply and Demand Forecast
Ecology Contract C1000090
WDFW Contract 09-1471

Ecology Publication Number: 11-12-015

If you need this document in a format for the visually impaired, call the Office of Columbia River at (509) 575-2490. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

Cover Photo: Jim Cummins

Columbia River Instream Atlas Project

Final Report

Appendix D – WRIAs 37, 38, 39 - Yakima Basin

September 30, 2011

Table of Contents

Tables

Figures

1. Description[1]

The Yakima River basin is located in south central Washington and contains a diverse landscape of rivers, ridges, and mountains totaling just over 6,100 square miles. Within the basin are three WRIAs; Lower Yakima River (WRIA 37), Naches River (WRIA 38), and Upper Yakima River (WRIA 39). Along the western portion of the basin, the glaciated peaks and deep valleys of the Cascade Mountains exceed 8,000 feet. East and south from the Cascade crest, the elevation decreases to the broad valleys and the lowlands of the Columbia Plateau. The lowest elevation in the basin is 340 feet at the confluence of the Yakima and Columbia Rivers at Richland. Total runoff from the

1 Adapted from Northwest Power and Conservation Council 2005h, and Yakima River Basin Proposed Integrated Water Resource Management Plan, 2011.

basin averages approximately 3.4 million acre-feet per year, ranging from a low of 1.5 to a high of 5.6 million acre-feet.

The basin contains a variety of aquatic habitats; the large mainstem of the Yakima River; medium-size rivers such as the upper Yakima, Cle Elum, and Naches; and many smaller tributaries, such as the Little Naches River, Satus, Ahtanum, and Taneum creeks, and the headwaters above the basin's reservoirs. The construction and operation of the irrigation reservoirs significantly altered the natural seasonal hydrograph of all downstream reaches of the mainstem and some tributaries.

The basin is dominated by the U.S. Bureau of Reclamation Yakima Project. The Yakima Project is a federal reclamation project authorized in 1905. It is operated by Reclamation and provides irrigation water for fertile land that extends for 175 miles along both sides of the Yakima River in south-central Washington. The irrigable lands presently being served by Reclamation total approximately 464,000 acres, with an additional 45,000 acres irrigated by private interests under water supply contracts with Reclamation. Storage dams and reservoirs on the project are Bumping Lake, Clear Lake, Tieton, Cle Elum, Kachess, and Keechelus. Total storage capacity of all reservoirs is approximately 1.07 million acre feet, total diversions average over 2.5 million acre feet.

The Yakima River historically supported large runs of anadromous salmonids, with estimated runs of 300,000 to 960,000 fish a year in the 1880s. These numbers have declined drastically, and three salmon species were extirpated (eliminated) from the basin – sockeye, summer Chinook, and coho. While still well below historic levels, in more recent years anadromous fish populations have improved through a combination of fisheries management, habitat, facility improvements, hatchery supplementation, and reintroduction efforts. Habitat conditions are improving for steelhead. Reintroduction efforts by the Yakama Indian Nation (YIN) using hatchery fish have re-established naturally reproducing coho salmon, and YIN and Washington Department of Fish and Wildlife (WDFW) have begun reintroduction of sockeye and summer Chinook salmon.

Historic bull trout abundance is not well defined in the basin, but there is recognition that its historic distribution was broader than is presently observed, with many distinct populations. The basin was recently designated as critical bull trout habitat, and there is a need to reinstitute year-round connectivity of bull trout habitat between lakes and reservoirs and mainstem rivers, including the Columbia River.

The Yakima River Basin is affected by a variety of water problems that impact fish, agriculture, and municipal and domestic water supplies. Since at least the 1970s, the basin's federal, state and local agencies, and YIN natural resource managers have participated in federal and state planning efforts to identify solutions to water shortages and restore native fisheries. Building on previous planning efforts, the Yakima River Basin Water Enhancement Plan Workgroup developed a 2011 proposed Yakima Basin Integrated Water Resource Management Plan (Integrated Plan), which is the most comprehensive effort to-date in proposing water resource and habitat protection and restoration solutions in the Yakima Basin.

Elements of Integrated Plan goals and objectives are incorporated throughout this report, but the priorities and analysis methods differ from this Columbia River Instream Atlas. Integrated Plan evaluations considered first the system as a whole, and then a reach's role within the system. Planners evaluated how a reach should operate in order to optimize system objectives for out-of-stream and instream needs. An Instream Needs subcommittee identified gaps between present and future desired conditions, and prioritized specific actions in order to achieve instream needs.

This prioritization method differs from, and is much more sophisticated than the methods used for the Columbia River Instream Atlas. Also, prioritization in the Integrated Plan is limited to major stream reaches. The Atlas' strength and usefulness in the Yakima Basin is its singular focus on water supply development (i.e. stream flow enhancement), and its evaluation of smaller streams and stream reaches.

CRIA is a great starting place for the layperson, or people unfamiliar with Reclamation water management in the Yakima Basin. Users can learn basic information about salmonid species utilization, get a feel for salmonid habitat condition, and start to understand flow condition in the basin. Deeper understanding of water management and salmon habitat conditions can be achieved by moving on to material available from Bureau of Reclamation at http://www.usbr.gov/pn/programs/yrbwep/index.html and Department of Ecology Office of Columbia River at http://www.ecy.wa.gov/programs/wr/cwp/cr_yak_storage.html.

2. Reach Definitions

The Yakima Basin comprises three WRIAs: Lower Yakima River (WRIA 37), Naches River (WRIA 38), and Upper Yakima River (WRIA 39). Within each WRIA, major rivers and large streams are divided into reaches that start and stop at dams or major tributaries. Most of the larger river reaches coincide with state and federal jurisdictional management units that are specific to water management, fish stock management, or WRIA boundaries. CRIA reaches were aligned with YRBWEP reaches to ensure consistency.

These designated reaches represent the most contemporary breakout of mainstem channel reaches based on hydrologic function. Streams that drain into or are above reservoirs are not delineated as there are very few non-exempt water rights large enough to provide significant flow supplementation. In some cases reaches begin or terminate at a flow gauge location, making it easier to account for flow supplementation.

The lower Yakima River (WRIA 37) smaller streams are designated based on differences in fish stock utilization and instream habitat conditions when compared to mainstem reaches. Within WRIA 37 flow is a limiting factor for salmonid production in all of the smaller streams.

In the Naches (WRIA 38) the smaller stream reach boundaries start where there is a significant change in flow value, such as a confluence with another stream and stop at a point where there are no further diversions upstream. The Tieton and Bumping Rivers start at a major confluence and terminate at the first dam upstream. Instream habitat and flow values change very little within a major river reach boundary.

The mainstem Yakima River reaches in the Upper Yakima Basin (WRIA 39) all start at either a major confluence or a dam and end at a comparable situation upstream. Other than the Teanaway River, the remaining streams are denoted as a single reach. Most of the smaller stream reaches start at their mouth and terminate where the streams crosses a highline irrigation canal or at a point where no further points of diversion exist on the stream. Most of the smaller WRIA 39 tributaries flow out of National Forest lands where there are very few water rights; hence the federal ownership boundary forms the upper extent of those reaches. Exceptions include the Teanaway River and the First Creek drainage. These respective reaches start where there is a significant change in flow value (stream confluence) and terminate at the most upstream irrigation diversion.

Table D-1 Reach Definitions

Stream Name	Reach Code	Stream Reach Description
Lower Yakima (WRIA 37)		
Lower Yakima River (Reach 1)	3701	Mouth to Chandler Canal Return
Lower Yakima River (Reach 2)	3702	Chandler return to Prosser Dam
Lower Yakima River (Reach 3)	3703	Prosser Dam to Toppenish Creek
Lower Yakima River (Reach 4)	3704	Toppenish Creek to Parker (Sunnyside) Dam
Lower Yakima River (Reach 5)	3705	Parker (Sunnyside) Dam to Naches River
Satus Creek	3706	Mouth to Logy Creek
Toppenish Creek	3707	Mouth to Simcoe Creek
Simcoe Creek	3708	Mouth to Wahtum Creek
Ahtanum Creek	3709	Mouth to Ahtanum Creek forks
North Fork Ahtanum Creek	3710	Mouth to Nasty Creek
Wide Hollow Creek	3711	Mouth to Dazet Road, Harwood
Naches River (WRIA 38)		
Naches River (Reach 1)	3801	Mouth to Tieton River
Naches River (Reach 2)	3802	Tieton River to Bumping River
Cowiche Creek	3803	Mouth to Cowiche Creek forks
South Fork Cowiche Creek	3804	Mouth to Reynolds Creek
Tieton River	3805	Mouth to Tieton Dam
Rattlesnake Creek	3806	Mouth to McDaniel Diversion at 120°57'15.3"W 46°48'47.1"N
Gold Creek	3807	Mouth to first left bank tributary
Little Naches River	3808	Mouth to North Fork Little Naches River
Bumping River	3809	Mouth to Bumping Dam

Stream Name	Reach Code	Stream Reach Description
Upper Yakima (WRIA 39)		
Upper Yakima River (Reach 1)	3901	Naches River to Roza Dam
Upper Yakima River (Reach 2)	3902	Roza Dam to Teanaway River
Upper Yakima River (Reach 3)	3903	Teanaway to Cle Elum River
Upper Yakima River (Reach 4)	3904	Cle Elum River to Easton Dam
Upper Yakima River (Reach 5)	3905	Easton Dam to Keechelus Dam
Wenas Creek	3906	Mouth to Wenas Dam
Burbank Creek	3907	Mouth to GIS RM 1.9
Wilson Creek	3908	Mouth to upper confluence with Naneum Creek
Cherry Creek	3909	Mouth to Parke Creek / Cooke Creek confluence
Parke Creek	3910	Mouth to Mundy Road, near East Kittitas
Cooke Creek	3911	Mouth to KRD North Branch Canal
Caribou Creek	3912	Mouth to KRD North Branch Canal
Naneum Creek	3913	Mouth to USGS gauge 12483800 near Naneum Road
Coleman Creek	3914	Mouth to KRD North Branch Canal
Schnebly Creek	3915	Mouth to KRD North Branch Canal
Mercer Creek	3916	Mouth to KRD North Branch Canal
Reecer Creek	3917	Mouth to KRD North Branch Canal
Whiskey Creek	3918	Mouth to Wilson Creek
Currier Creek	3919	Mouth to KRD North Branch Canal
Manastash Creek	3920	Mouth to Manastash Creek forks
Dry Creek	3921	Mouth to KRD North Branch Canal
Taneum Creek	3922	Mouth to Knudson Diversion
Swauk Creek	3923	Mouth to Williams Creek.
First Creek	3924	Mouth to First Creek Water User Diversion
Williams Creek	3925	Mouth to the road crossing 2.4 miles above Liberty
Teanaway River	3926	Mouth to Teanaway River forks
North Fork Teanaway River	3927	Mouth to Jack Creek
Cle Elum River	3928	Mouth to Cle Elum Dam
Big Creek	3929	Mouth to removed dam site
Little Creek	3930	Mouth to KRD Main Canal

3. WRIA Results

Fish Status and Utilization

Components of the Fish status and utilization score and ranking are SaSI status, ESA status, fish diversity, and time spent in the reach for spawning/incubation, rearing/smolt migration and adult migration. TRT designation was not considered in this rating but is available on the spreadsheets for inclusion in future evaluations.

Twelve salmonid stocks frequent this basin complex. There are three stocks of spring Chinook: American River; Upper Yakima River; and Naches and two fall Chinook stocks: Yakima River Bright and Marion Drain. In contrast there are four stocks of summer steelhead: Naches; Satus Creek; Toppenish Creek; and Upper Yakima. Other stocks include bull trout, coho, and sockeye.

Of these twelve stocks, steelhead and bull trout are listed as threatened under ESA and unknown for SaSI. In contrast, stocks of spring Chinook and fall Chinook do not warrant a rating by ESA and are considered healthy under SaSI. Even though Marian Drain Fall Chinook is a self-sustaining population that occurs in a 19-mile irrigation ditch for the Wapato Irrigation Project, SaSI recognizes Marion Drain Fall Chinook as a distinct stock. Coho, sockeye, and summer Chinook have been reintroduced to the basin complex, therefore not recognized by ESA or SaSI. As such coho, sockeye, and summer Chinook status is rated as unknown for this project

Sockeye, coho, and summer Chinook were all extirpated from the Yakima Basin Complex. Endemic coho salmon were extirpated in the early 1980's, whereas endemic anadromous sockeye were extirpated from the Yakima River Basin after access to their spawning grounds was severed by dams at Kachess, Cle Elum, Keechelus and Bumping rivers. Summer Chinook spawned in the gap to gap reach near Yakima up until the early 1970's. Since 2009, progeny of reintroduced sockeye have been returning to these same areas, and are being trucked around the dam to spawn. The coho that presently spawn in the Yakima Basin are returns from both hatchery supplementation fish (smolt and parr releases) and from stocked coho that are reproducing in the basin complex streams. The YIN Fish Management Program started to release summer Chinook sub yearlings in 2009.

The weighting factor (ESA and SaSI) for the each stock remains the same within the basin whereas the life cycle stages and duration will change depending on the stream reach. SaSi status, and ESA listing will not be repeated for each stream reach.

Table D-2 SaSI Stock Name, Status, ESA Listing Unit, & Listing Status

SaSI Stock name	SaSI Status	ESA Unit Name	ESA Listing Status
Lower Yakima (WRIA 37)			
Yakima River Bright Fall Chinook	Healthy	Upper Columbia River Summer and Fall Run Chinook	Not Warranted
Marion Drain Fall Chinook	Healthy	No ESU Specified	Not Warranted
Upper Yakima River Spring Chinook	Depressed	Mid-Columbia River Spring Run Chinook	Not Warranted
Naches Spring Chinook	Depressed		
American River Spring Chinook	Depressed		
Satus Creek Summer Steelhead	Unknown	Middle Columbia Steelhead	Threatened
Toppenish Creek Summer Steelhead	Unknown		
Naches Summer Steelhead	Unknown		
Upper Yakima Summer Steelhead	Unknown		
Yakima River Bull Trout	Critical	Middle Columbia River Bull Trout	Threatened
Ahtanum Creek Bull Trout	Critical		
Sockeye - SaSI stock not assigned	Unknown	n/a	n/a
Coho - SaSI stock not assigned	Unknown	n/a	n/a
Naches River (WRIA 38)			
Naches Spring Chinook	Depressed	Mid-Columbia River Spring Run Chinook	Not Warranted
American River Spring Chinook	Depressed		
Naches Summer Steelhead	Unknown	Middle Columbia Steelhead	Threatened
South Fork Tieton Bull Trout	Healthy	Middle Columbia River Bull Trout	Threatened
Indian Creek Bull Trout	Depressed		
North Fork Tieton River Bull Trout	Unknown		
Rattlesnake Creek Bull Trout	Depressed		
American River Bull Trout	Depressed		
Crow Creek Bull Trout	Critical		
Deep Creek Bull Trout	Depressed		
Coho - SaSI stock not assigned	Unknown	n/a	n/a
Upper Yakima (WRIA 39)			
Upper Yakima River Spring Chinook	Depressed	Mid-Columbia River Spring Run Chinook	Not Warranted
Upper Yakima Summer Steelhead	Unknown	Middle Columbia Steelhead	Threatened
North Fork Teanaway River Bull Trout	Critical	Middle Columbia River Bull Trout	Threatened
Cle Elum/Waptus Lakes Bull Trout	Unknown		
Box Canyon Creek Bull Trout	Critical		
Kachess River Bull Trout	Critical		
Gold Creek (Yakima) Bull Trout	Critical		
Sockeye - SaSI stock not assigned	Unknown	n/a	n/a
Coho - SaSI stock not assigned	Unknown	n/a	n/a

Table D-3 Fish status & utilization periodicity for five life stages

Fish Species - SaSI Stock (SaSI	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Yakima Fall Chinook (ESA Not Warranted; 2 Healthy SaSI Stocks)	Adult In-Migration												
	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock (SaSI	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Yakima Spring Chinook (ESA Not Warranted; 3 Depressed SaSI Stocks)	Adult In-Migration												
	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock (SaSI	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Yakima Summer Steelhead (ESA Threatened; 4 Unknown SaSI Stocks)	Adult In-Migration												
	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock (SaSI	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Yakima Sockeye (No ESA stock; No SaSI Stock)	Adult In-Migration												
	Juvenile Out-Migration												

Fish Species - SaSI Stock (SaSI	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Yakima Coho (No ESA stock; 1 Unknown SaSI Stock)	Adult In-Migration												
	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock (SaSI	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Yakima Bull Trout (ESA Threatened; 14 Depressed SaSI Stocks)	Spawning												
	Egg Incubation & Fry Emergence												
	Rearing												

Note: Stock presence varies by stream reach

= No Use
= Some activity or use occurring
= Peak activity

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table D-4 Fish status/utilization score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Normalized Score	Bin
	Lower Yakima (WRIA 37)			
3701	Lower Yakima River (Reach 1)	422	0.96	3
3702	Lower Yakima River (Reach 2)	422	0.96	3
3703	Lower Yakima River (Reach 3)	422	0.96	3
3704	Lower Yakima River (Reach 4)	438	1.00	3
3705	Lower Yakima River (Reach 5)	382	0.87	3
3706	Satus Creek	321	0.75	3
3707	Toppenish Creek	296	0.68	3
3708	Simcoe Creek	131	0.30	1
3709	Ahtanum Creek	316	0.72	3
3710	North Fork Ahtanum Creek	203	0.46	2
3711	Wide Hollow Creek	244	0.56	2
	Naches River (WRIA 38)			
3801	Naches River (Reach 1)	343	0.78	3
3802	Naches River (Reach 2)	275	0.63	2
3803	Cowiche Creek	220	0.50	2
3804	South Fork Cowiche Creek	131	0.30	1
3805	Tieton River	241	0.55	2
3806	Rattlesnake Creek	259	0.59	2
3807	Gold Creek	233	0.53	2
3808	Little Naches River	259	0.59	2
3809	Bumping River	280	0.62	2
	Upper Yakima (WRIA 39)			
3901	Upper Yakima River (Reach 1)	303	0.69	3
3902	Upper Yakima River (Reach 2)	221	0.50	2
3903	Upper Yakima River (Reach 3)	221	0.50	2
3904	Upper Yakima River (Reach 4)	221	0.50	2
3905	Upper Yakima River (Reach 5)	221	0.50	2
3906	Wenas Creek	84	0.19	1
3907	Burbank Creek	84	0.19	1
3908	Wilson Creek	110	0.25	1
3909	Cherry Creek	110	0.25	1
3910	Parke Creek	110	0.25	1
3911	Cooke Creek	110	0.25	1

Reach Code	Reach Name	Prioritization Score	Normalized Score	Bin
3912	Caribou Creek	110	0.25	1
3913	Naneum Creek	110	0.25	1
3914	Coleman Creek	110	0.25	1
3915	Schnebly Creek	110	0.25	1
3916	Mercer Creek	110	0.25	1
3917	Reecer Creek	110	0.25	1
3918	Whiskey Creek	110	0.25	1
3919	Currier Creek	110	0.25	1
3920	Manastash Creek	169	0.39	2
3921	Dry Creek	110	0.25	1
3922	Taneum Creek	169	0.39	2
3923	Swauk Creek	179	0.41	2
3924	First Creek	69	0.16	1
3925	Williams Creek	93	0.21	1
3926	Teanaway River	241	0.55	2
3927	North Fork Teanaway River	241	0.55	2
3928	Cle Elum River	221	0.50	2
3929	Big Creek	143	0.33	1
3930	Little Creek	143	0.33	1

Habitat Condition [2]

The Yakima River drains an area of 15,900 square km (6,155 square miles) and contains about 3058 km (1,900 river miles) of perennial streams. Originating near the crest of the Cascade Range above Keechelus Lake, the Yakima River flows 344 km (214 miles) southeastward to its confluence with the Columbia River at RM 335.2. Major tributaries include the Kachess, Cle Elum and Teanaway rivers in the northern part of the subbasin, and the Naches River in the west. The Naches has four major tributaries, the Bumping, American, Tieton and Little Naches rivers. Ahtanum, Toppenish and Satus creeks join the Yakima in the lower subbasin. Six major reservoirs are located in the subbasin and form the storage component of the federal Yakima Project, managed by the Bureau of Reclamation. The Yakima River flows out of Keechelus Lake (157,800 acre feet), the Kachess River from Kachess Lake (239,000 acre feet), the Cle Elum River from Cle Elum Lake (436,900 acre feet), the Tieton from Rimrock Lake (198,000 acre feet), and the Bumping from Bumping Lake (33,700 acre feet). The North Fork of the Tieton River connects Clear Lake (5,300 acre feet)

[2] Adapted from *Habitat Limiting Factors: Yakima River Watershed. Water Resources Inventory Area 37-39 Final Report,* D. Haring, 2001

with Rimrock Lake. All reservoirs except Rimrock and Clear Lake were natural lakes before impoundment.

Vegetation in the subbasin is a complex blend of forest, range (grass lands and shrub steppe) and cropland. Over one-third of the land in the Yakima Subbasin is forested. Rangeland lies between cultivated areas, located in the fertile lower valleys, and the higher-elevation forests. Almost all shrub-steppe habitats in the subbasin are supported by highly fragile soils that are easily eroded. Riparian conditions are extremely varied, ranging from severely degraded to nearly pristine. Good riparian habitat generally is found along forested, headwater reaches, whereas degraded riparian habitat is concentrated in the valleys, frequently associated with agricultural and residential activity (especially streamside grazing, tillage, or mowing).

The predominant types of land use in the Yakima Subbasin include irrigated agriculture (1,000 square miles), urbanization (50 square miles), timber harvest (2,200 square miles) and grazing (2,900 square miles). Cropland accounts for about 16% of the total subbasin area of which 77% is irrigated. About two-thirds of the floodplain gravel mining in Washington State occurred along the Yakima River or the lower reaches of two of its tributaries, the Cle Elum and Naches Rivers. The Selah Pit and surrounding pits comprise the largest pit complex in the state, at more than 230 acres in 1986.

Five distinct channel provinces are very apparent along the altitudinal gradient from source to mouth; 1) high gradient, largely constrained headwaters, 2) braided alluvial flood plains, 3) constrained canyons, 4) meandering with expansive flood plains containing oxbows, and 5) delta flood plain at the confluence with the Columbia River.

The Columbia River basalts, located within the Columbia Plateau, represent a locally important aquifer system. The overlying alluvial aquifers are highly permeable and are heterogeneous and anisotropic, due to their deposition within the fluvial environment. The rocks of the Cascade Mountain province store and transmit little water via aquifer system while the majority of runoff occurs as overland flow.

Scientists characterized the historical hydrologic cycle in the Yakima Basin as an extensive exchange between the surface, hyporheic, and groundwater zones. This exchange occurred mainly in the vast alluvial valleys and flood plains, which functioned as hydrologic buffers, distributing the energy of peak flows and moving cool, spring melt water out onto the flood plains. This annual recharge of the shallow, near surface aquifers often occurred well into summer due to extensive and long-lasting snow pack in the Cascades. Groundwater recharge of this nature provides a source of groundwater that maintains base flow and a cool thermal refuge as summer progresses and air temperatures increase, as well as maintaining warmer winter temperatures that prevent or reduce the risk of anchor ice.

Reaches associated with alluvial flood plains are centers of biological productivity and ecological diversity in gravel-bed rivers. In the Yakima basin, bedrock constrictions between alluvial subbasins control the exchange of water between streams and the aquifer system. Under pre-development conditions, vast alluvial flood plains were connected to complex webs of braids and distributary channels. Side channels and sloughs provided a large area of edge habitat and a variety of thermal and velocity regimes. Areas of upwelling often occur at the confluence of streams (Columbia/Yakima, Yakima/Toppenish, Toppenish/Simcoe, Yakima/Ahtanum/Wide Hollow, Naches/Rattlesnake, Yakima/Teanaway), and these areas are especially diverse. For salmon and steelhead, the side channel complexes and cool water refuges increase productivity, carrying capacity, and life history diversity by providing suitable habitat for all freshwater life stages in close physical proximity.

Table D-5 Habitat condition score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Bin
	Lower Yakima (WRIA 37)		
3701	Lower Yakima River (Reach 1)	13	2
3702	Lower Yakima River (Reach 2)	11	2
3703	Lower Yakima River (Reach 3)	14	2
3704	Lower Yakima River (Reach 4)	16	3
3705	Lower Yakima River (Reach 5)	16	3
3706	Satus Creek	13	2
3707	Toppenish Creek	12	2
3708	Simcoe Creek	10	1
3709	Ahtanum Creek	12	2
3710	North Fork Ahtanum Creek	14	2
3711	Wide Hollow Creek	9	1
	Naches River (WRIA 38)		
3801	Naches River (Reach 1)	14	2
3802	Naches River (Reach 2)	16	3
3803	Cowiche Creek	14	2
3804	South Fork Cowiche Creek	18	3
3805	Tieton River	10	1
3806	Rattlesnake Creek	16	3
3807	Gold Creek	15	2
3808	Little Naches River	18	3
3809	Bumping River	18	3
	Upper Yakima (WRIA 39)		
3901	Upper Yakima River (Reach 1)	11	2
3902	Upper Yakima River (Reach 2)	15	2
3903	Upper Yakima River (Reach 3)	16	3
3904	Upper Yakima River (Reach 4)	19	3
3905	Upper Yakima River (Reach 5)	18	3
3906	Wenas Creek	6	1
3907	Burbank Creek	9	1
3908	Wilson Creek	7	1
3909	Cherry Creek	8	1

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Reach Code	Reach Name	Prioritization Score	Bin
3910	Parke Creek	7	1
3911	Cooke Creek	7	1
3912	Caribou Creek	7	1
3913	Naneum Creek	6	1
3914	Coleman Creek	7	1
3915	Schnebly Creek	7	1
3916	Mercer Creek	7	1
3917	Reecer Creek	9	1
3918	Whiskey Creek	6	1
3919	Currier Creek	9	1
3920	Manastash Creek	12	2
3921	Dry Creek	6	1
3922	Taneum Creek	12	2
3923	Swauk Creek	14	2
3924	First Creek	16	3
3925	Williams Creek	13	2
3926	Teanaway River	15	2
3927	North Fork Teanaway River	17	3
3928	Cle Elum River	18	3
3929	Big Creek	14	2
3930	Little Creek	14	2

Flow Condition[3]

Surface water supply for the Yakima Reclamation Project comes from the natural, unregulated runoff of the Yakima River and its tributaries, irrigation return flows, and releases of stored water from the five main reservoirs in the upper Yakima and Naches river basins: Keechelus, Kachess, Cle Elum, Tieton, and Bumping. The reservoirs store approximately 30 percent of the average annual runoff in the basin and are operated to meet irrigation demands, flood-control needs, and instream flow requirements. The Yakima Project also provides water for hydroelectric power generation, fish and wildlife benefits, and recreation.

The Yakima Project depends heavily on the timing of unregulated spring and summer runoff from snowmelt and rainfall. The spring and early summer natural runoff supplies most river basin demands through June in an average year. Since the majority of spring and summer runoff is from snowmelt, the snowpack is often considered a "sixth reservoir." In most years, the five major reservoirs are operated to maximize storage in June, which typically coincides with the end of the major natural runoff. Demand for water from the Yakima River cannot always be met in

[3] Adapted from Proposed Yakima Basin Integrated Water Resource Management Plan, 2011; and *Yakima River Basin Study Instream Flow Needs Technical Memorandum,* Anchor QEA with YRBWEP Instream Flow Needs Subcommittee, 2011

years with below-average runoff. A poor water year sets in motion the process of equally reducing the amount of water delivered to junior ("proratable") water-right holders during the irrigation season.

The reservoirs have a combined storage capacity of about 1.07 million acre-feet. The irrigation divisions in the Yakima Project (Kittitas, Roza, Sunnyside, Tieton, Wapato and Kennewick) have entitlements totaling 2.04 million acre-feet. Most of those entitlements (1.94 million acre-feet) are diverted above the Reclamation stream gauge at Parker, the main control point for the Yakima Project. Other surface-water users that are not part of the Yakima Project rely on flow in the Yakima and Naches rivers. Entitlements above the Parker Gage total 470,000 acre-feet for these users.

Yakima Project operations cause reduced summer, early fall and winter stream flows, and unnaturally high summer flows in some river reaches, inhibiting migration, spawning, and rearing conditions for anadromous fish populations in the basin. In most years, as a result of Yakima Project operations, spring flows in the middle and lower Yakima River are not sufficient to optimize smolt outmigration. Summer flows in many reaches of the basin are too low in most years to provide desired conditions for salmonid survival and production. In other stream reaches, late-summer high flows related to project operations disrupt salmonid rearing

Through the YRBWEP Integrated Planning process, consultants and an Instream Needs Subcommittee characterized Yakima Basin reach-specific flow problems and developed recommended flow objectives, reach prioritization (high, medium or low), species benefitted, and actions to address the flow objectives, including both qualitative and quantitative targeted improvements. Fifteen mainstem reaches and eight tributaries or groups of tributaries within the Yakima Basin were reviewed, and ultimately nine mainstem reaches with high priority flow objectives were identified (Table D-6).

A number of instream flow studies and recommendations have been published for the Yakima River Basin[4]. Flow recommendations by reach for selected instream flow studies including the following:

- Flow recommendations from the Instream Flow Technical Advisory Group (IFTAG) published in 1984 (IFTAG, 1984)
- Flow recommendations from U.S. Fish and Wildlife Service (USFWS) provided in 1981 to Yakima County Superior Court for the Acquavella adjudication (Simmons, 1981)
- Operational flows described in the Interim Comprehensive Operating Plan (IOP) (Reclamation, 2002)
- Flow recommendations provided in Draft Planning Report/EIS Yakima River Water Storage Feasibility Study (Reclamation and Ecology, 2008)

4 Flow recommendations by reach for selected instream flow studies are summarized in Table A-1 in Appendix A of the Yakima River Basin Study *Instream Flow Needs Technical Memorandum,* U.S. Bureau of Reclamation Contract No. 08CA10677A ID/IQ, Task 3, Anchor QEA with YRBWEP Instream Flow Needs Subcommittee, 2011.

- Flow recommendations provided in Discussion of Biologically Based Flows for the Purpose of Determination of Average Water Year Instream Flow Demand for the Yakima River Basin Study (Hubble, undated but provided to subcommittee in 2010). Joel Hubble is a fisheries biologist for Reclamation.

Table D-6 YRBWEP Integrated Plan High Priority Reaches and Flow Objectives

Reach	High-Priority Flow Objectives
Yakima River, Keechelus Dam to Lake Easton	• Reduce flows to 500 cfs during July. • Ramp flows down from 500 cfs beginning August 1 to 120 cfs by the first week of September. • Increase base flow to 120 cfs year-round. • Provide one pulse flow (500 cfs peak) in early April. • In drought years, provide an additional pulse of 500 cfs in early May.
Yakima River, Easton Reach	• Increase September and October spawning flows to 220 cfs. • Increase minimum flows to 250 cfs all other times for rearing which provides access to side channels.
Cle Elum River	• Increase minimum flow to 500 cfs (previous analyses performed for Integrated Water Resource Management Alternative: Final EIS [Ecology, 2009] indicated 300 cfs could be provided so a range of 300-500 cfs will be tested in the hydrologic modeling). • Decrease flows by 1,000 cfs beginning the first of August.
Yakima River, Cle Elum to Teanaway River	• Ramp flows down starting July 1 to 1,000 cfs flow rate by August 31.
Yakima River, Teanaway River to Roza Dam (Ellensburg Reach)	• Reduce flow by 1,000 cfs beginning July 1. • Reach a flow of 1,000 cfs by August 31.
Yakima River, Roza Dam to Naches River	• Increase flows in the spring to a minimum of 1,400 cfs. • Increase flows in the fall and winter to a minimum of 1,000 to 1,400 cfs.
Tieton River	• Increase minimum flows to 125 cfs from late October to April 1.
Lower Naches River	• Increase minimum flow rate to 550 cfs from June 1 to November 1. • Change the ramping rates from spring to summer flows to a more gradual decline. • Reduce September flows to as close as possible to unregulated conditions.
Yakima River, Parker to Toppenish Creek (Wapato Reach)	• Provide a spring pulse of 15,000 to 20,000 acre-feet in early May in dry years. • Change ramping rate at end of high flows that occur in June-July in average to wet years.
Manastash, Taneum, Cowiche Creeks	• Replace current diversions with Yakima or Naches River water; deliver water directly to tributaries if supply replacement is not feasible. No specific flow objectives were identified.
Ahtanum Creek	• No flow objectives or augmentation alternatives were identified by subcommittee.

Of the fifty reaches defined in the Yakima Basin, twenty-nine have gauge data that contributed to this project. There are two un-gauged streams for which NHD+ flow estimates could not be generated. We did not attempt to use federal flow targets for CRIA evaluation because of their complexity related to water supply forecast, nor did we attempt to use the objectives provided in the Integrated Plan; evaluations of actual regulated flows against both those sets of objectives and others are available in the vast body of literature devoted to the Yakima River Basin.

The water right data we evaluated for CRIA do not incorporate diversions for the federal Reclamation Project, so while they were useful for evaluating tributaries to the Yakima mainstem, this information has limited usefulness when evaluating diversions on the mainstem.

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table D-7 Flow condition score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Bin
	Lower Yakima (WRIA 37)		
3701	Lower Yakima River (Reach 1)	4	3
3702	Lower Yakima River (Reach 2)	5	3
3703	Lower Yakima River (Reach 3)	2	3
3704	Lower Yakima River (Reach 4)	5	3
3705	Lower Yakima River (Reach 5)	2	3
3706	Satus Creek	3	3
3707	Toppenish Creek	2	3
3708	Simcoe Creek	15	2
3709	Ahtanum Creek	16	2
3710	North Fork Ahtanum Creek	12	2
3711	Wide Hollow Creek	24	1
	Naches River (WRIA 38)		
3801	Naches River (Reach 1)	24	3
3802	Naches River (Reach 2)	7	3
3803	Cowiche Creek	10	1
3804	South Fork Cowiche Creek	12	1
3805	Tieton River	4	2
3806	Rattlesnake Creek	2	2
3807	Gold Creek	24	2
3808	Little Naches River	7	3
3809	Bumping River	10	3
	Upper Yakima (WRIA 39)		
3901	Upper Yakima River (Reach 1)	4	3
3902	Upper Yakima River (Reach 2)	4	3
3903	Upper Yakima River (Reach 3)	3	3
3904	Upper Yakima River (Reach 4)	7	2
3905	Upper Yakima River (Reach 5)	3	3

Reach Code	Reach Name	Prioritization Score	Bin
3906	Wenas Creek	27	1
3907	Burbank Creek	12	2
3908	Wilson Creek	7	2
3909	Cherry Creek	3	3
3910	Parke Creek	27	1
3911	Cooke Creek	27	1
3912	Caribou Creek	27	1
3913	Naneum Creek	12	2
3914	Coleman Creek	44	1
3915	Schnebly Creek	24	1
3916	Mercer Creek	12	2
3917	Reecer Creek	21	1
3918	Whiskey Creek	44	1
3919	Currier Creek	24	1
3920	Manastash Creek	18	1
3921	Dry Creek	27	1
3922	Taneum Creek	14	2
3923	Swauk Creek	18	1
3924	First Creek	24	1
3925	Williams Creek	24	1
3926	Teanaway River	9	2
3927	North Fork Teanaway River	6	2
3928	Cle Elum River	5	3
3929	Big Creek	24	1
3930	Little Creek	15	2

4. Reach Results

Following are results of reach-by-reach CRIA scoring. We have also included information gleaned from the YRBWEP process for reference. The nine high-priority flow objective reaches are listed below, along with their associated CRIA reach name and number[5].

CRIA Reach	YRBWEP High Priority Reach
3704 Lower Yakima River (Reach 4)	Toppenish to Parker Dam(“Wapato Reach”)
3801 Naches River (Reach 1)	Lower Naches River
3805 Tieton River	Tieton River
3901 Upper Yakima River (Reach 1)	Naches River to Roza Dam
3902 Upper Yakima River (Reach 2)	Roza Dam to Teanaway (“Ellensburg Reach”)
3903 Upper Yakima River (Reach 3)	Teanaway River to Cle Elum River
3904 Upper Yakima River (Reach 4)	Cle Elum River to Lake Easton (“Easton Reach”)
3905 Upper Yakima River (Reach 5)	Lake Easton to Keechelus Dam
3928 Cle Elum River	Cle Elum River

Summaries of the YRBWEP Instream Needs Subcommittee recommendations for these nine reaches are included within the CRIA reach scoring descriptions provided below, and can be identified by their different text font and color, as demonstrated by this paragraph.

3701 Lower Yakima River (Reach 1)

(Mouth to Chandler Canal Return)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

The lower mainstem Yakima River has high use by most stocks. Many of the stocks utilize the mainstem as a migration corridor, both as adults returning to their natal spawning grounds and as juveniles rearing and moving to the ocean. As a result the Lower Yakima River Reach 1 ranks ‘high’ for fish utilization. The only stock not present in this reach is bull trout , which is typically found in cooler waters. The other eleven stocks utilize this reach for adult migration and juvenile rearing. The Yakima River Bright Fall Chinook is the only stock to spawn in this reach.

Fish Status/Utilization scoring detail is available on Table D-8.

[5] from Section 5.0 of *Yakima River Basin Study Instream Flow Needs Technical Memorandum*

Habitat

The Lower Yakima River Reach 1 includes the Yakima River Delta. The delta and the lower 2.1 miles are in USCOE ownership to accommodate the 500-year floodway for McNary Dam pool. Riparian areas include mature tall canopy trees dominated by cottonwood, alder, Russian olive trees, and scrub willows up to RM 9.0. Some of the tall canopy continues upstream but there is more thick underbrush interspersed with reed canary grass up to RM 18.0. Five miles of this respective shoreline and 2,000 acres of connected floodplain is managed an extensive natural wetland complex with healthy natural riparian buffers.

The reach from Kiona to the mouth contains good riffles and pools. There are several islands that consist mostly of grasses and willow shrubs. Floodplain connectivity is moderately healthy except along a 1.3 mile right bank[6] levee and a short state highway section, which can limit channel migrations.

The upper portion of Lower Yakima River Reach 1 is surrounded by basalt cliffs that limit the riparian values. There are several small natural drainages that provide spawning and rearing habitat at the confluences and in the respective lower tributary reaches. The source of flow in the small drainages, which is cool water during the summer and warm in the winter, is from springs, groundwater seepage, and irrigation return flows. Many of the small islands act as side channels during low flows.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 1,695 cfs in August and the peak is 4,046 cfs in March. Minimum flow is 57 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score.

Flow scoring detail is available on Table D-10.

3702 Lower Yakima River (Reach 2)

(Chandler return to Prosser Dam)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

Lower Yakima River Reach 2 is also highly used by eleven out of twelve stocks as a migration corridor, both by adults returning to their natal spawning grounds and juveniles rearing and moving to the ocean. Yakima River Bright Fall Chinook is the only stock to spawn in this reach and bull trout are not present.

6 "Right bank" (RB) and 'left bank" (LB) are codes for shorelines of the river when the viewer is facing downstream. For the Yakima system, RB is usually the south or west shore of the stream.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Lower Yakima River Reach 2 is the most flow critical reach in the Lower Yakima River. A large irrigation and hydropower point of diversion (POD) is at the upper end of the reach at Prosser Dam. As much as 75% of the total river is diverted during the summer. Dewatering of fall chinook redds in the bypass reach is an issue when power generation resumes after the fall screen maintenance period. Water depth late in the summer can limit upstream passage for large bodied spring and summer Chinook as well as smaller sockeye. Other than the critical low flow impacts, this reach provides some cool water refuge to juveniles and adults in the few pools that exist.

There are a few islands and side channels, naturally narrow riparian buffers, and a small floodplain because of natural steep shorelines. Small creeks and seeps drain into the Yakima River in this reach. Most of the developed land is above the floodplain terrace, and includes orchards, pastures, alfalfa fields, and residences.[7]

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 627 cfs in August and the peak is 4,409 cfs in May. Minimum flow is 24 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. As noted above, there are significant diversions in this reach. Although most flow attributes in this reach scored 'fair' to 'poor,' the overall high mean annual flow volume for this reach weighted the "bin" score to the 'good' range.

Flow scoring detail is available on Table D-10.

3703 Lower Yakima River (Reach 3)

(Prosser Dam to Toppenish Creek)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

Like reaches 1 and 2, Lower Yakima River Reach 3 has a high fish utilization rating. All stocks of spring and fall Chinook, Summer Steelhead, coho and sockeye continue to use this reach for a migration corridor, both as adults returning to their natal spawning grounds and as juveniles rearing and moving to the ocean. Not only do

---

7 This and the following habitat descriptions are liberally adapted from *Habitat Limiting Factors: Yakima River Watershed Water Resources Inventory Area 37-39 Final Report* (D. Haring, 2001) and updated to reflect current conditions.

Yakima River Bright Fall Chinook utilize the reach for juvenile and adult migration, this stock spawns in Lower Yakima River Reach 3. Bull trout are not present.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

The upper 15 miles of this reach includes side channels, backwater areas, and diverse habitat types; the downstream 18 miles are characterized by a low-gradient single channel with little habitat diversity. Small and large irrigated farms as well as residential developments occupy most of the shorelines downstream of Mabton (RM 59.8). Throughout much of this reach the river channel is incised and disconnected from the natural floodplain. Many of the old river oxbows are undeveloped but remain perched above the surface waters except during severe flood events. Below Mabton there is very little natural riparian buffer except along the 3.5 miles of WDFW Wildlife Area. The RB upper portions of the Lower Yakima River Reach 3 border the Yakama Indian Nation Reservation. Satus and Toppenish creeks are the two major tributaries in this reach, with additional significant inflow from ground water and irrigation returns.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 1,500 cfs in August and the peak is 4,930 cfs in May. Minimum flow is 45 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score.

Flow scoring detail is available on Table D-10.

3704 Lower Yakima River (Reach 4)

(Toppenish Creek to Parker [Sunnyside] Dam)

Fish	Habitat	Flow
3	3	3

"The instream flow objectives in the Wapato reach (Parker Dam to Toppenish) are to improve spring smolt outmigration in dry years and summer rearing conditions. From March through June, the Wapato reach is a primary migration corridor for all salmonid smolts produced upstream in the basin (spring and fall Chinook, steelhead, coho, and sockeye). Providing an early May flow pulse of 15,000 to 20,000 acre-feet in dry years would improve flow conditions over current conditions, which can be inadequate to support outmigration in drought years. A spring pulse may also provide a small benefit to adult spring Chinook and steelhead migrating through this reach in May to upstream spawning areas.

"The Wapato Reach is also a primary rearing area for coho and fall Chinook, and although fall Chinook smolts migrate out of this reach by the end of June, coho rear in this reach year-round. This reach is an important overwintering area for juvenile spring Chinook, coho, and steelhead. Maintaining an increased base flow condition year-round would benefit all rearing salmonids that remain in this reach year-round. It would also improve spawning conditions for fall Chinook and coho that spawn in this reach in fall through early winter."

Fish Status/Utilization

Fish utilization in Lower Yakima River Reach 4 begins to differ from reaches 1 through 3. Stocks that only use lower tributaries begin to drop out and other stocks begin to utilize the reach for spawning. The spring Chinook, Marion Drain Fall Chinook, and Upper Yakima River Summer Steelhead continue to use the reach for adult migration and juvenile rearing and migration. Naches Summer Steelhead and coho are utilizing the reach for spawning, juvenile rearing and adult migration life cycle stages a long with Yakima River Bright Fall Chinook. Satus Creek Summer Steelhead is no longer present and Toppenish Creek Summer Steelhead has reduced utilization to juvenile rearing. In addition, this is the lowest reach on the Lower Yakima River mainstem in which bull trout are present. Bull trout use Reach 4 for juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

This reach is considered one of the most structurally complex and diverse sections of the Yakima River. For most of the reach, the highway constrains the floodplain on the west side of the river, whereas the other side of the floodplain is in a semi-natural state with numerous side-channels, braids, and backwater areas. The historic Yakima River floodplain was miles wide in Reach 4, and remnant sections remain, albeit at a much reduced cross sectional value. Before irrigation shut off (September 15 to October 1) fish passage can be problematic because of surface flows spreading amid the numerous braided channels. The riparian zones are wide with tall canopy trees. **Habitat** Condition

The Yakima River drains an area of 15,900 square km (6,155 square miles) and contains about 3058 km (1,900 river miles) of perennial streams. Originating near the crest of the Cascade Range above Keechelus Lake, the Yakima River flows 344 km (214 miles) southeastward to its confluence with the Columbia River at RM 335.2. Major tributaries include the Kachess, Cle Elum and Teanaway rivers in the northern part of the subbasin, and the Naches River in the west. The Naches has four major tributaries, the Bumping, American, Tieton and Little Naches rivers. Ahtanum, Toppenish and Satus creeks join the Yakima in the lower subbasin. Six major reservoirs are located in the subbasin and form the storage component of the federal Yakima Project, managed by the Bureau of Reclamation. The Yakima River flows out of Keechelus Lake (157,800 acre feet), the Kachess River from Kachess Lake (239,000 acre feet), the Cle Elum River from Cle Elum Lake (436,900 acre feet), the Tieton from Rimrock Lake (198,000 acre feet), and the Bumping from Bumping Lake (33,700 acre feet). The North Fork of the Tieton River connects Clear Lake (5,300 acre feet) with Rimrock Lake. All reservoirs except Rimrock and Clear Lake were natural lakes before impoundment.

Vegetation in the subbasin is a complex blend of forest, range (grass lands and shrub steppe) and cropland. Over one-third of the land in the Yakima Subbasin is forested. Rangeland lies between cultivated areas, located in the fertile lower valleys, and the higher-elevation forests. Almost all shrub-steppe habitats in the subbasin are supported by highly fragile soils that are easily eroded. Riparian conditions are extremely varied, ranging from severely degraded to nearly pristine. Good riparian habitat generally is found along forested, headwater reaches, whereas degraded riparian habitat is concentrated in the valleys, frequently associated with agricultural and residential activity (especially streamside grazing, tillage, or mowing).

The predominant types of land use in the Yakima Subbasin include irrigated agriculture (1,000 square miles), urbanization (50 square miles), timber harvest (2,200 square miles) and grazing (2,900 square miles). Cropland accounts for about 16% of the total subbasin area of which 77% is irrigated. About two-thirds of the floodplain gravel mining in Washington State occurred along the Yakima River or the lower reaches of two of its tributaries, the Cle Elum and Naches Rivers. The Selah Pit and surrounding pits comprise the largest pit complex in the state, at more than 230 acres in 1986.

Five distinct channel provinces are very apparent along the altitudinal gradient from source to mouth; 1) high gradient, largely constrained headwaters, 2) braided alluvial flood plains, 3) constrained canyons, 4) meandering with expansive flood plains containing oxbows, and 5) delta flood plain at the confluence with the Columbia River.

The Columbia River basalts, located within the Columbia Plateau, represent a locally important aquifer system. The overlying alluvial aquifers are highly permeable and are heterogeneous and anisotropic, due to their deposition within the fluvial environment. The rocks of the Cascade Mountain province store and transmit little water via aquifer system while the majority of runoff occurs as overland flow.

Scientists characterized the historical hydrologic cycle in the Yakima Basin as an extensive exchange between the surface, hyporheic, and groundwater zones. This exchange occurred mainly in the vast alluvial valleys and flood plains, which functioned as hydrologic buffers, distributing the energy of peak flows and moving cool, spring melt water out onto the flood plains. This annual recharge of the shallow, near surface aquifers often occurred well into summer due to extensive and long-lasting snow pack in the Cascades. Groundwater recharge of this nature provides a source of groundwater that maintains base flow and a cool thermal refuge as summer progresses and air temperatures increase, as well as maintaining warmer winter temperatures that prevent or reduce the risk of anchor ice.

Reaches associated with alluvial flood plains are centers of biological productivity and ecological diversity in gravel-bed rivers. In the Yakima basin, bedrock constrictions between alluvial subbasins control the exchange of water between streams and the aquifer system. Under pre-development conditions, vast alluvial flood plains were connected to complex webs of braids and distributary channels. Side channels and sloughs provided a large area of edge habitat and a variety of thermal and velocity regimes. Areas of upwelling often occur at the confluence of streams (Columbia/Yakima, Yakima/Toppenish, Toppenish/Simcoe, Yakima/Ahtanum/Wide Hollow, Naches/Rattlesnake, Yakima/Teanaway), and these areas are especially diverse. For salmon and steelhead, the side channel complexes and cool water refuges increase productivity, carrying capacity, and life history diversity by providing suitable habitat for all freshwater life stages in close physical proximity.

Table D-5Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 514 cfs in September and the peak is 3,408 cfs in May. Minimum flow is 23 percent of the average. Although flow in this reach is poor, as noted above, the overall high mean annual flow volume for this reach weighted the score to the 'good' range.

Flow scoring detail is available on Table D-10.

3705 Lower Yakima River (Reach 5)

(Parker [Sunnyside] Dam to Naches River)

Fish	Habitat	Flow
3	3	3

Fish Status/Utilization

Nine stocks use Lower Yakima River Reach 5, leading to a 'high' fish utilization rating. Of the stocks present American River, Upper Yakima River, and Naches Spring Chinook, Upper Yakima Summer Steelhead, bull trout and sockeye use the reach for rearing and adult migration. The other three stocks, Yakima Bright Fall Chinook, Naches Summer Steelhead, and coho, utilize the reach for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Lower Yakima River Reach 5 borders the Cities of Yakima and Union Gap and is characterized by numerous side channels, islands, and backwater areas. The full extent of the natural floodplain through much of this reach is confined by I-82/US 12, levees, rock quarries, and other development. Union Gap is a natural basalt geographic pinch point that divides the complex upstream and downstream floodplains.

Riparian values are healthy except where development has occurred. At Parker Dam a significant portion of the surface flow is diverted. When combined with the larger diversion that also lies in the 4 mile reach between Union Gap and Parker Dam, flows often reach a minimum for the entire Yakima River. There are numerous irrigation return flows that supplement the river downstream of Parker Dam.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 1,871 cfs in October and the peak is 6,252 cfs in May. Minimum flow is 52 percent of the average. Although flow in this reach can be poor, as noted above, the overall high mean annual flow volume for this reach weighted the score to the 'good' range.

Flow scoring detail is available on Table D-10.

3706 Satus Creek

(Mouth to Logy Creek)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

Satus Creek is primary tributary to the lower Yakima River Mainstem. This reach also has a ‘high’ fish utilization rating. Of the twelve stocks in this basin complex, only two stocks utilize this reach for spawning, rearing, and adult migration. Those stocks are Satus Creek Summer Steelhead and coho. In contrast, sockeye, and bull trout are not present whereas the remaining eight stocks utilize this reach for juvenile rearing.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Satus Creek enters the right bank of the Yakima River at RM 69.6. The Satus Creek watershed is topographically steep, ranging from 5,500 feet at the headwaters of Satus Creek on the north slope of the Simcoe Mountains to 650 feet at its confluence with the Yakima River. The headwaters of Satus Creek and all of its major tributaries start in the forest zone. The majority of the watershed (approximately 75% of the total area) is comprised of shrub-steppe rangelands. Streams run through deep canyons. The lower eight stream miles of Satus Creek flow through irrigated valley to the confluence with the Yakima River. Barrier falls are located in the upper reaches of Satus Creek.

Large areas of the Satus watershed have suffered riparian damage in both headwater source areas and spawning and rearing habitat in the forested portions of the anadromous fish bearing streams. In general, riparian function is degraded in the lower watershed, but improves with increasing elevation.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 117 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3707 Toppenish Creek

(Mouth to Simcoe Creek)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

Fish utilization in Toppenish Creek is high. Six stocks utilize this reach for juvenile rearing, many for the entire year. These stocks are American River, Upper Yakima River, and Naches Spring Chinook, Marion Drain Fall Chinook, Naches Summer Steelhead and Upper Yakima River Summer Steelhead. Along with juvenile rearing, Toppenish Creek Summer Steelhead, coho, and Yakima River Bright Fall Chinook use the creek for spawning and adult migration. Satus Creek summer Steelhead, bull trout and sockeye are not present.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Toppenish Creek enters the RB of the Yakima River at River Mile 80.4. The watershed is subdivided into two topographic portions; the upper watershed is comprised of largely undeveloped forest and rangelands, and the lower watershed is agricultural valley bottom. Habitat conditions in the uppermost 25 miles of Toppenish Creek are good, with the major problem in these upper reaches being a number of large, slightly perched culverts that present partial or complete barriers to upstream juvenile or adult fish passage. Substrate condition is excellent in the upper 25 miles of Toppenish Creek with abundant gravel of very high quality. Toppenish Creek channel throughout much of the lower reach is in poor condition, with problems related to passage, stranding, entrainment, and temperature.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 2,845 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3708 Simcoe Creek

(Mouth to Wahtum Creek)

Fish	Habitat	Flow
1	1	2

Fish Status/Utilization

Simcoe Creek is a tributary to Toppenish Creek. This creek rates 'low' for fish utilization. The only two stocks present are coho and Toppenish Creek Summer Steelhead, which utilize the reach for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Simcoe Creek is a LB tributary to Toppenish Creek, entering at RM 32.7. The entirety of the NF and SF of Simcoe Creek, are canyon streams, draining forested plateaus and mountains. Simcoe Creek is diverted at the Simcoe Feeder Canal (RM 13.9), and can dry up in a 4-mile reach downstream. At the lower end of the dewatered reach, springs maintain surface flow. Much of the Simcoe Creek channel is moderately to severely incised and disconnected from its historic floodplain, resulting in channel erosion, straightening, and simplification, along with poor substrate quality. Riparian is characterized by patches of very dense riparian vegetation interspersed with larger open areas with little or no vegetation, resulting in few reaches with extensive shade. Riparian condition in mainstem Simcoe Creek is poor to fair.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 41 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3709 Ahtanum Creek

(Mouth to Ahtanum Creek forks)

Fish	Habitat	Flow
3	2	2

Fish Status/Utilization

Ahtanum Creek is a primary tributary to the lower Yakima River mainstem. Many of the stocks that utilize the mainstem for adult migration and juvenile rearing also use Ahtanum Creek for juvenile rearing. American River, Naches, and Upper Yakima River Spring Chinook, along with Yakima River Fall Bright, and Upper Yakima Summer Steelhead use this reach for juvenile rearing. Adult and juvenile bull trout move downstream for feeding and rearing. In addition, coho and Naches Summer Steelhead utilize the creek for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Ahtanum Creek is a RB tributary to the lower Yakima River, entering at RM 106.9. The NF and SF merge to form Ahtanum Creek at RM 23.1. Low elevation riparian areas are highly modified, scoring 'fair' for each of the habitat attributes.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 18 cfs in August and the peak is 193 cfs in May. Minimum flow is 23 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Flow scoring detail is available on Table D-10.

3710 North Fork Ahtanum Creek

(Mouth to Nasty Creek)

Fish	Habitat	Flow
2	2	2

Fish Status/Utilization

Fish utilization in North Fork Ahtanum Creek is rated 'average.' Three stocks are present, two of which are listed under the ESA. Naches Summer Steelhead and coho utilize the creek for spawning, rearing and adult migration whereas bull trout use the reach for juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Disturbance and structures within the channel migration zone occur in the lower segment of NF Ahtanum Creek, confining channels and resulting in the failure of channels to naturally respond to channel disturbances. Fine sediments recruit to the streambed, undermining culverts in this area. Riparian condition is generally fair but differs from Ahtanum Creek in that off-channel habitat and rearing conditions are good. Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 21 cfs in October and the peak is 199 cfs in May. Minimum flow is 29 percent of the average. Flow scoring detail is available on Table D-10.

3711 Wide Hollow Creek

(Mouth to Dazet Road, Harwood)

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Wide Hollow is another tributary to the lower Yakima River mainstem, but in this case the creek rated 'average' for fish utilization. Marion Drain Fall Chinook, Satus Creek Summer Steelhead, Toppenish Creek Summer Steelhead, bull trout, and sockeye are not present. Of the remaining seven stocks, Upper Yakima Summer Steelhead, Yakima River Bright Fall Chinook, and Naches, Upper Yakima River and American river Spring Chinook utilize Wide Hollow Creek for juvenile rearing. The remaining two stocks, Naches Summer Steelhead and coho, utilize the reach for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Wide Hollow Creek is a RB tributary to the lower Yakima River, entering at RM 107.4. The stream flows along the southern edge of Union Gap and Yakima, and suffers many of the problems associated with urban streams, including stormwater runoff, leaky septic tanks, and poor riparian condition, consisting of narrow buffer with clumps of mature willow that provide shaded areas interspersed with sunny areas.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 8 cfs Mean Annual Flow was used to score this reach.
Flow scoring detail is available on Table D-10.

WRIA 38 – Naches Basin

3801 Naches River (Reach 1)

(Mouth to Tieton River)

Fish	Habitat	Flow
3	2	3

"The instream flow objective in the Lower Naches River is to improve fish-rearing conditions. Summer flows are low and the ramping rate from high spring flows to summer flows is abrupt, negatively affecting rearing conditions for steelhead, coho, and spring Chinook. Changing the ramping rates so the decline from spring flows to summer flows is less abrupt, and increasing base flows to 550 cfs from early June to early November, would benefit spring Chinook, steelhead, and coho rearing in this reach year-round. A more gradual decrease in flow to a higher base flow would allow rearing salmonids to more easily avoid stranding and entrapment, provide access to additional available rearing habitat, and potentially contribute to improving water quality. Habitat access benefits would be most pronounced during drought years.

"Coho spawn in this reach from mid-September to mid-December. Coho may benefit from an increase in available spawning habitat due to increased base flows. Adult species that migrate through the lower Naches River during summer (spring Chinook and sockeye) and fall (steelhead and coho) would also have more habitat and improved water quality due to increased base flows. The effect on those benefits from flow loss to groundwater in the lower parts of this reach was identified as an issue by the subcommittee but is unknown.

"Reducing fall flows as much as possible in September, when high flows occur as a result of the flip-flop operations, would benefit spring Chinook, steelhead, and coho juveniles that rear in the lower Naches River and may overwinter there if not pushed out by high flows during flip-flop operations."

Fish Status/Utilization

Naches River Reach 1, a major tributary to the Yakima River mainstem, is rated 'high' for fish utilization. Eight stocks are present in this reach. Those species specific to the Lower Yakima River Basin or are just migrating along the mainstem to the upper basin are not present. Coho, Naches Summer Steelhead, and Yakima River Bright Fall Chinook utilize this reach for all three life cycle stages. In comparison bull trout, American River and Naches Spring Chinook utilize Naches River Reach 1 for juvenile rearing and adult migration. Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook use the reach for juvenile rearing.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Riparian condition in this reach is impacted by levee encroachment and roads, most notably, SR 12. Wetted channel substrate is composed primarily of large cannon ball-sized material embedded with sands and fines; it is unknown to what extent these substrate conditions are associated with flip-flop flows and interrupted sediment transport from the Tieton River. The floodway in this reach is broad, but flows during much of the year are confined to a narrow deep thalweg. There is gravel present in side-channels and high on the floodplain, but these areas are generally watered only during peak flows and flip-flop. Steelhead have greater access to these spawning gravels during spring runoff flows, but there is a high amount of sand present even on the floodway fringe. Low flows during the winter and early spring, and prolonged high and fluctuating flows in the summer are key characteristics of Naches River Reach 1.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 538 cfs in October and the peak is 3,741 cfs in May. The braided channels of the Naches River downstream of Wapatox Dam (RM 9.7-17.1) are substantially dewatered at flows of 125 cfs and below. In spite of these conditions, this reach ranks “good” for flow overall due to the magnitude of Mean Annual Flow.

Flow scoring detail is available on Table D-10.

3802 Naches River (Reach 2)

(Tieton River to Bumping River/Little Naches confluence)

Fish	Habitat	Flow
2	3	3

Fish Status/Utilization

Fish utilization for Naches River Reach 2 is rated as ‘average.’ Three stocks found in Naches River Reach 1 are no longer present, leaving a total of five stocks utilizing Naches River Reach 2. Bull trout and American River Spring Chinook use this reach for juvenile rearing and adult migration. Naches Spring Chinook, Naches Summer Steelhead and coho spawn, rear, and migrate in this reach.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

The upper extent of Naches River Reach 2 is defined as the point where the Little Naches River and Bumping River converge to form the Naches. Riparian conditions in Naches River Reach 2 are dominated by SR 410, which runs the full length of this reach. There are also residences immediately adjacent to the stream, some agriculture, and several campgrounds that adversely affect riparian and channel conditions. In spite of this, the reach from Wapatox upstream to Bumping River is one of the best spawning reaches in the Naches watershed, with abundant spawning beds interspaced with deep, clear resting pools. There is increasing presence of gravels moving upstream from the Tieton, although there are still fines present in the gravels. Floodplain connectivity is moderate with problems areas near the residential developments. The floodplain is often narrow in size due to natural basalt canyons and mountainous terrain.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 526 cfs in October and the peak is 3,532 cfs in May. Flow scoring detail is available on Table D-10.

3803 *Cowiche Creek*

(Mouth to Cowiche Creek forks)

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Cowiche Creek is a primary tributary to the lower Naches River mainstem. This creek is rated as 'average' for fish utilization. Six stocks are present here, the majority of which only utilize the reach for juvenile rearing. Those stocks are American River and Naches Spring Chinook, Yakima River Bright Fall Chinook, and bull trout. Coho and Naches Summer Steelhead utilize Cowiche Creek for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Cowiche Creek is a RB tributary to the Naches River, entering at RM 2.7. Lower Cowiche Creek and a number of tributary channels are used as off-channel winter refuge for pre-smolt spring chinook and steelhead. The lower two miles of the watershed are primarily agricultural, and the channel is re-routed against the side of the valley for agricultural convenience. Upstream for two to three miles, the channel is located in a naturally confined canyon, with few pools and LWD; fish use in this reach is primarily passage only. Upstream of the canyon, the mainstem extends through a low gradient agricultural area for about two miles to the forks. The stream in this area is confined and incised in the floodplain, and has lost floodplain function. Riparian condition is generally good through the canyon (RM 2-5), but is generally poor through the agricultural areas.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is less than 1 cfs in August and the peak is 86 cfs in May. Minimum flow is 5 percent of the average; reaches with August flows less than 33% of average scored ‘poor’ for this component of the flow element score. Flow scoring detail is available on Table D-10.

3804 South Fork Cowiche Creek

(Mouth to Reynolds Creek)

Fish	Habitat	Flow
1	3	1

Fish Status/Utilization

Fish utilization for South Fork Cowiche Creek is low. Only two stocks are present, Naches Summer Steelhead and coho. Both stocks utilize South Fork Cowiche Creek for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Conditions are ‘good’ for every habitat attribute.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 1 cfs or less in July-September and the peak is 29 cfs in May. Minimum flow is 8 percent of the average. Flow scoring detail is available on Table D-10.

3805 Tieton River

(Mouth to Tieton Dam)

Fish	Habitat	Flow
2	1	2

“The instream flow objective in the Tieton River is to improve fish-rearing conditions. Under present operations, winter flows are low (50 to 100 cfs) with limited variation in flow from November to early April. In September, flows are too high as a result of flip-flop operations (reducing flows in the upper arm of the

Yakima River and increasing flows in the Naches River with increased water releases from Rimrock Reservoir). Increasing winter base flows to 125 cfs from November to early April would benefit rearing spring Chinook and steelhead in the Tieton River. Early adult steelhead migrants into the Tieton River could also benefit by increased base flows. Adult steelhead migrate into the Tieton River from February through May.

"Spring Chinook and steelhead smolt outmigrants would benefit slightly because smolt outmigration may start as early as mid-March. Reducing flows in the Tieton River as much as possible in September would benefit spring Chinook and steelhead juveniles because they may overwinter in the Tieton River if they do not get pushed out by high flows during the flip-flop operation."

Fish Status/Utilization

Tieton River is another tributary to the Naches River mainstem. Fish utilization for this river is rated 'average.' Five fish stocks are present, two of which limit their use to juvenile rearing. Those stocks are bull trout and American River Spring Chinook. Naches spring Chinook, Naches Summer Steelhead and coho utilize the Tieton River for spawning, rearing, and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

The Tieton River is a RB tributary to Naches River, entering at RM 17.5. Except for Oak Creek, tributaries to the Tieton downstream of Tieton Dam are small, flow through shrub-steppe, and sometimes go dry in the summer. The Tieton River and its floodplain are affected by development within the riparian zone including riprap associated with SR 12.

Because of the presence of Rimrock Dam, transport of bedload (coarse sediment, gravels) and LWD is essentially eliminated, impacting the substrate quality of the Tieton River. The increased incidence of bank-full flow events likely moved suitable spawning gravels out of the channel downstream of the dam, leaving an armored streambed that is less suitable for salmonid spawning and rearing. Riparian development and resulting erosion impair function through much of this reach. Low flows in the winter reduce the quality and quantity of rearing habitat, and high flows during flip-flop in late summer probably physically displace juveniles from the Tieton and lower Naches Rivers downstream into the Yakima River.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 114 cfs in November and the peak is 1,510 cfs in September. Flow scoring detail is available on Table D-10.

3806 Rattlesnake Creek

(Mouth to McDaniel Diversion at 120°57'15.3"W, 46°48'47.1"N)

Fish	Habitat	Flow
2	3	2

Fish Status/Utilization

Rattlesnake Creek is also a tributary to the Naches River mainstem and has an 'average' fish utilization rating. Five stocks are present. Coho, Naches Summer Steelhead, and Naches Spring Chinook utilize the creek for all three life cycle stages. In comparison, American River spring Chinook use the reach for juvenile rearing, and bull trout utilize the reach for juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Rattlesnake Creek is a RB tributary to the Naches River, entering at RM 27.8. In general, conditions in Rattlesnake Creek are 'fair' to 'good.' Downstream reaches have moderate slopes (2%) and a riffle/pool character, providing excellent fish habitat, although these channel habitats are very sensitive to disturbance. The alluvial fan is highly modified by channelization. This limits the area available for sediment deposition in the floodplain, resulting in chronic sediment build-up at the confluence with the Naches.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes Rattlesnake Creek drains very steep topography, and as a result has a very flashy runoff pattern, with widely varying flows. The minimum of monthly mean flows in this reach is 35 cfs in September and the peak is 254 cfs in June. Minimum flow is 43 percent of the average. There are few gauge data points for this reach. Flow scoring detail is available on Table D-10.

3807 Gold Creek

(Mouth to first left bank tributary at ~ RM 0.6)

Fish	Habitat	Flow
2	2	2

Fish Status/Utilization

Fish utilization for Gold Creek, a tributary to the Naches River mainstem, is rated as 'average.' Of the five stocks present, coho and Naches summer steelhead utilize the creek for spawning, rearing, and adult migration. Bull trout uses Gold Creek for juvenile rearing and adult migration whereas Naches and American River Spring Chinook limit themselves to juvenile rearing.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Gold Creek is a small LB tributary to the Naches River, entering at RM 38.5. Riparian functions remain intact except at the mouth, where there is an irrigation diversion. Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 14 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3808 Little Naches River

(Mouth to North Fork Little Naches River)

Fish	Habitat	Flow
2	3	3

Fish Status/Utilization

The Little Naches River is a primary tributary to the lower Naches River mainstem. The 'average' fish utilization rating can be attributed to the five stocks present in this reach. Coho, Naches Spring Chinook and Naches Summer Steelhead utilize the Little Naches River for spawning, rearing, and adult migration whereas bull trout use the reach for adult migration and juvenile rearing, and American River Spring Chinook use the reach for juvenile rearing.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

The Little Naches River enters the Naches River from the west at RM 44.6; the confluence of the Little Naches with Bumping River marks the upstream end of Naches River Reach 2. There are no passage barriers to migrating fish at any of the forks of the Little Naches or the mouths of most tributaries, and a significant amount of suitable habitat is available.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 43 cfs in September and the peak is 761 cfs in May. Minimum flow is 16 percent of the average. Flow scoring detail is available on Table D-10.

3809 Bumping River

(Mouth to Bumping Dam)

Fish	Habitat	Flow
2	3	3

Fish Status/Utilization

Five stocks utilize Bumping River, a tributary to the lower Naches River mainstem. Four of those stocks, Naches Spring Chinook, Naches Summer Steelhead, bull trout and coho spawn, rear, and migrate in this river. The remaining stock, American River Spring Chinook, uses Bumping River for juvenile rearing.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

The terminus for the Bumping River reach is Bumping Dam, which the Bureau of Reclamation constructed in 1910 at RM 15.7. Channel gradient downstream of Bumping Dam is 1-2%; much of the substrate upstream of the American River confluence is boulders, with patches of spawning gravels used by spring chinook and steelhead. Bumping Road is located immediately adjacent to the Bumping River or within the floodplain for approximately 80% of the lower 12 miles of the river. The riparian corridor on the Bumping River is generally excellent, except in areas of streamside development.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 145 cfs in October and the peak is 661 cfs in June. Minimum flow is 49 percent of the average. This reach has a regulated hydrograph. Through the spring and summer, much of the Bumping Lake outflow is passed downstream to support instream flows and meet downstream irrigation demands. Additional reservoir drawdown typically occurs in September to augment flip-flop operations.

Flow scoring detail is available on Table D-10.

3901 Upper Yakima River (Reach 1)

(Naches R. to Roza Dam)

Fish	Habitat	Flow
3	2	3

"The instream flow objectives in the Roza Dam to Naches River reach are to improve conditions for fall and winter spawning and rearing and spring smolt outmigration. Increasing base flows from around mid-September through May would improve habitat quality and quantity for spring Chinook, steelhead, and coho that rear in this reach. Increased base flows during that period would also benefit adult salmonids, mostly coho, which migrate through this reach mid-September through mid-December on their way to spawning grounds in the upper Yakima River Basin, but also spawn in this reach during the fall and early winter. Increased flows could provide additional spawning habitat and may improve water quality conditions in the fall.

"Steelhead, which migrate through this reach beginning as early as March, would also benefit from increased base flows. Spring Chinook and sockeye also migrate through this reach on their way to spawning grounds, but they would benefit the least among the adult migrants because the majority of their spawning migration falls outside the period of increased base flows.

"Additional flows during smolt outmigration in the spring (March to May) would benefit all [anadromous] salmonid species in the Yakima River Basin: spring Chinook, steelhead, coho, and sockeye. Increasing spring flows should be coordinated with floodplain restoration efforts in this reach to maximize benefits."

Fish Status/Utilization

Upper Yakima River Reach 1 from the Naches River to Roza Dam, is rated as 'high' for fish utilization. Nine stocks are present in this reach. Three stocks utilize Upper Yakima River Reach 1 for all three life cycle stages. Those stocks are Yakima River Bright Fall Chinook, Upper Yakima Summer Steelhead, and coho. Four stocks present limit their utilization of this reach to juvenile rearing. They include bull trout, Naches Summer Steelhead, Naches spring Chinook, and American River spring Chinook. The remaining two stocks, Upper Yakima River spring Chinook, and sockeye, utilize the river section for juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

This reach borders the City of Yakima and is characterized by numerous side-channels, islands, and backwater areas. However, the full extent of the natural floodplain through much of this reach is confined by levees, and Yakima River floodplain function in the reach from the Naches River to Wenas Creek is degraded. Channel conditions from the Naches River confluence upstream to Wenas Creek are poor, with sparse riparian vegetation, collapsed streambanks, large width to depth ratio, and extremely scarce LWD presence. The river is confined in a canyon through the upper portion of this reach, with no side-channel complexes, few islands, and only a few backwater areas. As the river leaves the lower end of the canyon, it flows across a deep alluvial floodplain that is heavily mined for gravel.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 594 cfs in October and the peak is 1,923 cfs in May. Minimum flow is 47 percent of the average. This reach has a regulated hydrograph. Flow scoring detail is available on Table D-10.

3902 Upper Yakima River (Reach 2)

(Roza Dam to Teanaway River)

Fish	Habitat	Flow
2	2	3

"The instream flow objective in the Ellensburg reach is to improve fish-rearing conditions. Under present operations, flows are too high from July through early September when juvenile Chinook, steelhead, and coho are rearing in this reach. High summer flows reduce the amount of suitable rearing habitat for these species as a result of high water velocities. Juvenile salmon seek low-velocity habitat as protection against being pushed out of a reach and to minimize energy expenditures. The negative effects on rearing juvenile salmonids from high summer flow conditions in this reach occur during all water year types, but are most significant in wet years.

"It is desirable to occasionally augment spring flows to promote riparian restoration (with large flow pulses approximately every five years). In winter, flow pulses would provide access to available habitat when juvenile Chinook, steelhead, and coho are rearing in this reach."

Fish Status/Utilization

Fish utilization in upper Yakima River Reach 2 is 'average.' Seven stocks that are present downstream are no longer present in this reach. Of the five remaining stocks, three of them utilize the reach for all three life cycle stages. The three stocks are Upper Yakima River Spring Chinook, Upper Yakima Summer Steelhead, and coho. Bull trout utilize the reach for juvenile rearing whereas sockeye uses upper Yakima River Reach 2 for juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Upper Yakima River Reach 2 flows through some distinct geographic features including the Yakima River Canyon between Selah and Ellensburg, the Ellensburg Valley, lower Kittitas Valley, and Ellensburg Canyon. In the Yakima River Canyon, the river is bordered almost continually on the right bank by a railroad tracks, and on the left by SR 821. The canyon's natural confinement limits development of multiple channels, accumulations of LWD, or other channel complexity elements.

The river is confined through many of the other areas by levees, bank protection, and highways. Instream habitat complexity in the valleys features braided channels, islands, and healthier riparian zones. About three fourths of the river above Manastash Creek confluence is narrowed to a single thread, leaving a considerable number of isolated side channels. Bank sloughing is common, the riparian corridor is constricted or severely degraded, and LWD is swept away by constriction-induced increases in water velocity. At the upper end of this reach is a very complex floodplain, with a primary zone of upwelling and braiding around the Teanaway-Yakima confluence.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 1,125 cfs in October and the peak is 3,725 cfs in August. Minimum flow is 46 percent of the average. This reach has a regulated hydrograph. The 'good' flow rating for this reach is primarily attributed to the high overall flow volume.

Flow scoring detail is available on Table D-10.

3903 Upper Yakima River (Reach 3)

(Teanaway River to Cle Elum River)

Fish	Habitat	Flow
2	3	3

"The highest priority instream flow objective in the Cle Elum to Teanaway River reach is to improve fish-rearing conditions. Under present operations, flows are too high from July through early September (as high as 3,000 cfs in August) when juvenile Chinook and steelhead are rearing in this reach. Once coho are firmly reestablished in the upper Yakima River Basin, juvenile coho would also be rearing in this reach. High summer flows reduce the amount of suitable rearing habitat for these species as a result of high water velocities. Juvenile salmon seek low-velocity habitat as protection against being pushed out of a reach and to minimize energy expenditures. The negative effects on rearing juvenile salmonids from high summer flow conditions in this reach occur during all water year types, but are most significant in wet years.

"It is desirable to occasionally augment spring flows to promote riparian restoration (with large flow pulses approximately every five years) and benefit migrating adult steelhead with smaller flow pulses when available. I n winter, flow pulses would provide access to available habitat when juvenile Chinook, steelhead, and coho are rearing in this reach."

Fish Status/Utilization

Upper Yakima River Reach 3 has the same fish utilization as Reach 2 therefore is rated as 'average.' Coho, Upper Yakima River Spring Chinook, and Upper Yakima Summer Steelhead all utilize Reach 3 for spawning, rearing, and migration. Sockeye use the river for juvenile rearing and adult migration whereas bull trout limit utilization to juvenile rearing. Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

This reach is primarily a large main channel, with only a few side channels. Substrate in the upper reaches is composed mostly of cobble and large gravel, with some boulders, sand, and silt; there are many gravel bars. Floodplain connectivity is fragmented by development, and levees protect the City of Cle Elum and highways. This area contains valuable juvenile rearing habitat. Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 543 cfs in October and the peak is 3,455 cfs in July. Minimum flow is 33 percent of the average. This reach has a regulated hydrograph. Flow scoring detail is available on Table D-10.

3904 Upper Yakima River (Reach 4)

(Cle Elum R to Easton Dam)

Fish	Habitat	Flow
2	3	2

"The instream flow objectives in the Easton reach are to increase spawning and rearing habitat and improve outmigration conditions. These objectives can be met by adding flow during the fall and winter and adding a spring pulse. Increasing base flows to 220 cfs in September and October in dry years and to 250 cfs during the rest of the year would benefit spring Chinook and steelhead, which spawn and rear in the Easton reach. Once coho are firmly reestablished in the upper Yakima River Basin, this species would also benefit from increased base flows, especially if increasing base flows reconnects side-channel habitat.

"Side-channel habitat would provide access to more variable habitat conditions, accommodating coho spawning needs more readily and providing low-velocity habitat for rearing juveniles of all salmonid species in the Yakima River Basin. Adult sockeye salmon, once reestablished, would migrate through the Easton reach on their way to upper-basin lake spawning and rearing habitat. Sockeye would benefit from increased September base flows as they migrate upstream from late June through September.

"Adding one pulse flow (1,000 cfs peak) in early April and an additional pulse in drought years in early May would benefit all salmonid outmigrants in the Yakima River Basin, especially sockeye, once reestablished. Sockeye have the most compressed outmigration, likely to occur in April based on mid- and upper-Columbia River transponder tag data for Wenatchee and Okanogan sockeye populations. Spring flows would be augmented occasionally for channel maintenance (every five years for riparian recruitment and bank-full flows during wet years) to improve habitat conditions."

Fish Status/Utilization

Upper Yakima River Reach 4 fish utilization is rated as 'average.' The same stocks in Reach 2 and 3 are found in Reach 4. Juvenile bull trout use this reach for rearing and juvenile and adult sockeye utilize the reach for rearing and migration. In contrast, Upper Yakima River spring Chinook, Upper Yakima Summer Steelhead, and coho use the reach for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

The Cle Elum River to Easton Dam (RM 185.6 to 202.5) reach is considered to be a high quality area for spawning and rearing, characterized by numerous side channels, complex structures in the channel, and good riparian vegetation. There is some development within the floodplain in this reach. Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 233 cfs in October and the peak is 703 cfs in May. Minimum flow is 50 percent of the average. This reach has a regulated hydrograph. Flow scoring detail is available on Table D-10.

3905 Upper Yakima River (Reach 5)

(Easton Dam to Keechelus Dam)

Fish	Habitat	Flow
2	3	3

"The instream flow objective for the Lake Easton to Keechelus Dam reach is to improve fish-rearing conditions. Currently, flows are too high from July through early September when juvenile Chinook and steelhead (and potentially coho if reestablished) are rearing in this reach. Juvenile salmon seek protection against high-velocity flows to avoid being pushed downstream into less desirable habitat and minimize energy expenditures. High summer flows reduce the amount of suitable rearing habitat for these same species as a result of high water velocities. The negative effects on rearing juvenile salmonids from high summer flow conditions in this reach occur during all water year types but are most significant in wet years. Flows in summer during a wet year such as 2002 average about 1,000 cfs.

"During winter, flows are lower than desired by fish biologists, and flow pulses are absent in the spring due to runoff being captured by Keechelus Reservoir. Lower flows reduce available rearing and overwintering habitat throughout the fall and winter, and into early spring in dry years. Flow pulses in spring are needed to mimic natural conditions and support juvenile outmigration. Increasing base flows should increase available juvenile rearing and overwintering habitat in the Keechelus Dam to Lake Easton reach.

"An early April flow pulse would benefit spring Chinook and steelhead juveniles and smolts moving down into the lower basin to rear or outmigrate as smolts. Once reestablished in the upper Yakima River Basin, coho and sockeye would also benefit from increased base flows and spring pulses. During dry years, an additional pulse in early May would further benefit spring Chinook, steelhead, and coho rearing juveniles and outmigrants. (Sockeye smolts likely would already have outmigrated by this time.) Additionally, increased base flows year-round, as well as spring pulses, would benefit all anadromous salmonids – spring Chinook, steelhead, coho, and sockeye – returning to the upper Yakima River Basin to spawn. Increased base flows could also increase available spawning habitat for both spring spawners (steelhead) and fall spawners (spring Chinook and coho)."

Fish Status/Utilization

The same stocks in reaches 2-4 utilize upper Yakima River Reach 5. Coho, Upper Yakima Summer Steelhead, and Upper Yakima River Spring Chinook use Reach 5 for spawning, rearing, and migration. Bull trout use the reach for juvenile rearing and sockeye for juvenile rearing and adult migration. This fish utilization in Upper Yakima River Reach 5 leads to an 'average' rating.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

The Easton to Keechelus Dam (RM 202.5 to 214.5) reach is characterized by numerous side channels, logjams, and braided channels, and is considered to be high quality spawning and rearing habitat with little influence from development. The channel has an excellent riparian corridor, with a lot of complex in-channel structure, and has excellent floodplain function. Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 95 cfs in November and the peak is 922 cfs in July. Minimum flow is 28 percent of the average. This reach has a regulated hydrograph. Flow scoring detail is available on Table D-10.

3906 Wenas Creek

(Mouth to Wenas Dam)

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Wenas Creek is a primary tributary to the upper Yakima River mainstem. Fish utilization for this creek is low. Three stocks are present in Wenas Creek. They are coho, Upper Yakima steelhead, and Upper Yakima River Spring Chinook. These stocks limit their use in the creek to juvenile rearing.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Wenas Creek is a RB tributary to the lower Yakima River, entering at RM 122.4. Floodplain function downstream of the dam (RM 14.7) was altered by the combined effects of channelization, gravel mining from bars in the channel, and unrestricted livestock access to the channel. In addition, some historic floodplain side channels are filled and graded, and converted to agriculture.

A control structure at RM 12 diverts the stream into two channels to facilitate irrigation withdrawals. These channels reconnect six miles downstream. Summertime irrigation withdrawals from the creek and the channels remove all surface water from RM 9-14. Flows downstream of RM 9 are intermittent, and only minimal where present. These low-flow conditions persist into the winter as Wenas Reservoir is refilled.

Bank sloughing is common in the grazed areas downstream of RM 9 and riparian vegetation is virtually nonexistent. The streambed consists of mud and silt.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes Gauge data are only available for April through December 1999. During that period, the lowest monthly flow in this reach was 2.5 cfs in July, and the peak was 104 cfs in April. Flow scoring detail is available on Table D-10.

3907 Burbank Creek

(Mouth to river mile 1.9)

Fish	Habitat	Flow
1	1	2

Fish Status/Utilization

Burbank Creek, a tributary to the upper Yakima River mainstem, also has a low fish utilization rating. Coho, Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook utilize the creek for juvenile rearing only. Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Burbank Creek is a LB tributary to the Yakima River that enters at RM 130.0. It is small stream that drains a vast shrub steppe basin. Fish can access the lower reaches where juvenile coho and steelhead rearing are documented. Very little riparian or floodplain habitat information is available as most of the stream drainage is in private ownership with limited access. The source of flow is exclusively springs. Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

Kittitas Valley tributaries – The Wilson/Cherry Complex

The Wilson/Cherry watershed drains an area of 407.8 mi^2 including most of the Kittitas Valley agricultural area. For this evaluation, the Wilson/Cherry complex comprises Wilson, Cherry, Parke, Cooke, Caribou, Naneum, Coleman, Schnebly, Mercer, and Whiskey Creeks, along with Reecer, and Currier Creeks. All streams in this watershed are heavily diverted on the valley floor, and are channelized into an intricate drainage and irrigation system that bears little resemblance to the historic drainage pattern. Most reaches are straight, high-velocity chutes with few pools, no LWD, and poor riparian vegetation. Floodplain connectivity is fragmented and dysfunctional. Many of the channels are deep and incised and dredged to serve as agricultural drains. The lower reach instream flows are now artificially high during the summer and early fall because of irrigation return flows. Gravel quality and size distribution is good upstream of the Kittitas Valley floor, but in the lower reaches irrigation operations deliver high levels of fine sediment to the channels. Urban runoff from Ellensburg and Kittitas is discharged directly into Wilson Creek and its tributaries. Grazing, channelization, and other agricultural practices impact the riparian zones in the valley reaches. Of the many creeks in this complex, only Cherry and Naneum have gauge data sufficient for use in flow scoring.

3908 Wilson Creek

(Mouth to upper confluence with Naneum Creek)

Fish	Habitat	Flow
1	1	2

Fish Status/Utilization

Wilson Creek is part of the Wilson Creek Complex. Anadromous fish have not been able to utilize this watershed as widely as they historically did. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Wilson Creek enters the LB of the Yakima River at RM 147.0. Wilson Creek and its three man-made branches pass through the heart of Ellensburg, often underground in culverts. Fish passage is impaired by these long culverts, although adult salmonids have been observed upstream.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 116 cfs Mean Annual Flow was used to score this reach. Twenty-three flow gauge data points ranging from 1 to 70 cfs (and excluding June-through-October measurements) from 1957-1960 were not used for scoring. Flow scoring detail is available on Table D-10.

3909 Cherry Creek

(Mouth to Parke Creek/Cooke Creek confluence)

Fish	Habitat	Flow
1	1	3

Fish Status/Utilization

Cherry Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.
Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Cherry Creek is a tributary to Wilson Creek. Wilson and Cherry creeks converge approximately 0.5 miles upstream of the Wilson Creek confluence with the Yakima River. In 2011, local conservation efforts removed the lowest barriers on Cherry Creek. Cherry Creek and its tributaries [Caribou, Cooke, Parke, and Badger (Wipple Wasteway)] are used as irrigation delivery systems, and were rerouted, channelized, and dredged for that purpose. Riparian values vary from poor as the stream flows through croplands to fair where riparian is dominated by thick willow patches. The riparian buffers are narrow, and much of the drainage is disconnected from its floodplain because of channelization and adjacent land use. Woody debris is almost non-existent.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes Stream flow in lower Cherry Creek is dominated by irrigation return flow from the eastern side of Kittitas Valley. The minimum of monthly mean flows in this reach is 85 cfs in November and the peak is 362 cfs in May. Minimum flow is 45 percent of the average. Gauge data show two peaks for this reach in May and Sep, with a sharp decline between June and July. Cherry Creek is one of two gauged creeks in the Wilson/Cherry complex, and overall flow volume at the gauge pushed the flow score to ‘good’ in relation to other Yakima Basin stream reaches.

Flow scoring detail is available on Table D-10.

3910 Parke Creek

(Mouth to Mundy Road near East Kittitas)

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Parke Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho. Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Parke Creek is a tributary to Caribou Creek, which in turn flows into Cherry Creek, then Wilson Creek. As in the other eastern Kittitas Valley drainages, fish passage remains a problem due to irrigation weirs, perched culverts, and unscreened diversions. The stream channel lacks meanders and is disconnected from the floodplain in most areas within the Kittitas Valley floor. Poor riparian and floodplain function reflect the degree of stream modification in the drainage.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 17 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3911 Cooke Creek

(Mouth upstream to KRD[8] North Branch Canal)

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Cooke Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.

Fish Status/Utilization scoring detail is available on Table D-8.

---

[8] Kittitas Reclamation District

Habitat

Cooke Creek was formerly a direct tributary to the Yakima River, but the modified stream channel now flows into lower Cherry Creek. As in the other eastern Kittitas Valley drainages, fish passage remains a problem due to irrigation weirs, perched culverts, and unscreened diversions. The stream channel lacks meanders and is disconnected from the floodplain in most areas within the Kittitas Valley floor. A few riparian areas have clumps of shrubby willows and reed canary grass.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 49 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3912 Caribou Creek

(Mouth to KRD North Branch Canal)

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Caribou Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Caribou Creek is tributary to Cherry Creek. Fish passage is open for 0.7 miles into the Caribou Creek drainage, which crosses the valley and has headwaters in the Colockum Wildlife area. Most of the riparian and floodplain conditions of Wilson/Cherry complex drainages apply to the Caribou Creek watershed.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 14 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3913 Naneum Creek

(Mouth to gauge near Naneum Road)

Fish	Habitat	Flow
1	1	2

Fish Status/Utilization

Naneum Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Naneum Creek is a LB tributary to Wilson Creek. The headwaters originate from land that is in public ownership. There is a high presence of fine sediments due to ground disturbances and surface erosion in the mainstem Naneum within the forest zone. Much of the mainstem of Naneum Creek and its major tributaries lack sufficient amounts of LWD in the channel because there are no trees along the banks for recruitment. This causes a homogenous channel structure that is disconnected from the floodplain and lacks suitably complex fish habitat. Restoration of woody riparian vegetation in the agricultural lands on the valley floor is inhibited by active spraying to control weeds and by massive stands of reed canary grass in many riparian areas that suppress and compete with native woody vegetation. Fish passage remains a problem in most of the creek north of I-90.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The USGS maintained a flow gage station for 20 years (1957-1978) in the Naneum Creek Canyon, making Naneum one of two creeks in the Wilson/Cherry complex having sufficient stream gauge data for flow scoring. This gauge station record shows tributary flow variation considered typical of the numerous creeks feeding the eastern Kittitas Valley.

The minimum of monthly mean flows in this reach is 18 cfs in October and the peak is 197 cfs in May. Minimum flow is 31 percent of the average. Maximum flows reached 350 cfs in June 1974, and the lowest recorded flow during the gauged era was 7.6 cfs in August 1977. Even with these low flows, Naneum scores “fair” for flow condition in relation to other Yakima Basin streams.

Flow scoring detail is available on Table D-10.

3914 Coleman Creek

(Mouth to KRD North Branch Canal)

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Coleman Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Coleman Creek flows into lower Naneum Creek. Coleman is used as conveyance drainage for irrigation water delivery and for return flows. Fish passage is restored in lower Coleman Creek but remains a problem in reaches near I-90. The stream channel lacks meanders and is disconnected from its floodplain. A few riparian areas have clumps of shrubby willows and reed canary grass.

Habitat scoring detail is available on Table D-9.

Flow

No flow information is available for Coleman Creek, so 'poor' conditions are assumed. Flow scoring detail is available on Table D-10.

3915 Schnebly Creek

(Mouth to KRD North Branch Canal)

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Schnebly Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

There is no habitat information available for Schnebly Creek. Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 7 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3916 Mercer Creek

(Mouth to KRD North Branch Canal)

Fish	Habitat	Flow
1	1	2

Fish Status/Utilization

Mercer Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

There is no habitat information available for Mercer Creek. Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 18 cfs Mean Annual Flow was used to score this reach. Estimated flow in the double-digits boosted the flow condition score for this reach to 'fair.' Flow scoring detail is available on Table D-10.

3917 Reecer Creek

(Mouth to KRD North Branch Canal)

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Reecer Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Reecer Creek is a LB tributary to the upper Yakima River, entering at RM 153.7. The floodplain of Reecer Creek is constrained by a levee on the west side of the creek from Dollar Way to I-90. Upstream, the creek is channelized for several miles. There is perennial stream flow in the headwaters of Reecer Creek, but surface flow is intermittent from the base of the canyon to the Highline Canal during the late summer. Below the Highline Canal, Reecer Creek is used for irrigation delivery and return flows.

There is a lack of LWD throughout most of Reecer Creek. Riparian condition is generally poor, with sporadic narrow patches of mature non-native willow trees. The few pools that are present are in the immediate vicinity of these willow patches.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 19 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3918 Whiskey Creek

(Mouth to Wilson Creek)

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Whiskey Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Whiskey Creek is a distributary of the Wilson Creek drainage, connected to Wilson Creek on the lower end and both Wilson and Naneum creeks on the upper end. There are several irrigation weirs that remain as upstream fish passage barriers. The stream provides one of the remaining pathways for steelhead around the City of Ellensburg to access the upper Naneum Creek drainage. The lower two miles of floodplain and riparian functions are degraded severely.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No No flow information is available for this creek. Flow scoring detail is available on Table D-10.

3919 Currier Creek

(Mouth to KRD North Branch Canal)

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Currier Creek is part of the Wilson Creek Complex. Current fish utilization in the complex is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Currier Creek is a large LB tributary of Reecer Creek at about RM 1.5. It is the larger of the two channels at that location because of accumulated irrigation return flows. The stream is perennial and salmonid presence is verified to the KRD Canal. Flows in Currier Creek are likely a mix of irrigation return flows and natural flow, although it is difficult to quantify contributions. Although there is a history of channelization and removal of woody debris, Currier Creek has sufficient flows and riparian cover to provide fair rearing habitat for salmonids upstream to Town Ditch. Currier Creek has a narrow intermittent riparian zone of large willow trees from its confluence with Reecer Creek upstream to the John Wayne Trail. Further upstream the creek flows through pastures and woody riparian patches of willows and hawthorn.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 11 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

Upper Basin Tributaries

3920 Manastash Creek

(Mouth to NF/SF confluence)

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Manastash Creek is a primary tributary to the upper Yakima River mainstem. This creek has an 'average' fish utilization rating. Three stocks are present here. Upper

Yakima River spring Chinook, Upper Yakima Summer Steelhead, and coho spawn, rear, and migrate in Manastash Creek.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Manastash Creek is a RB tributary to the lower Yakima River, entering at RM 154.5. The confluence of the north and south forks occurs at RM 8.5. The lower five miles of Manastash Creek flow through fields and pastures. From the mouth to Barnes Road (RM 1.25), the channel is naturally incised and fish passage across the delta fan is impaired during low flow periods. From Barnes Road upstream to the diversion at RM 4.2, the channel is channelized and incised, with no LWD or pools. Vegetation and streambank cover are favorable to salmonid production in nearly all areas of the mainstem, with shade present in most areas.

The creek contains excellent spawning and rearing habitat for anadromous salmonids, but instream flows are impacted severely by irrigation diversions during the irrigation season. Typically, there is no surface flow from mid-July through October from approximately RM 1.5 to just below the diversion at RM 4.2.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 15 cfs in October and the peak is 236 cfs in May. Minimum flow is 18 percent of the average. Flow scoring detail is available on Table D-10.

3921 Dry Creek

(Mouth to KRD North Branch Canal)

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Current fish utilization is low and limited to juvenile rearing by Upper Yakima Summer Steelhead and Upper Yakima River Spring Chinook and all three life cycle stages by coho. Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Dry Creek is a LB tributary to the upper Yakima River, entering at RM 157.6. There are fish passage barriers in lower reaches, and low flow limits fish passage in Upper Dry Creek. Dry Creek is channelized from essentially its confluence with the old river meander to very near the KRD canal crossing. There is a gallery of mature cottonwoods at the confluence of Dry Creek with the historic Yakima side-channel and throughout the side channel. Dry Creek scored ‘poor’ for all habitat attributes.

Flow

Gauge:No An NHD+ estimated 11 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3922 Taneum Creek

(Mouth to Knudson Diversion)

Fish	Habitat	Flow
2	2	2

Fish Status/Utilization

Taneum Creek, a tributary to the upper Yakima River mainstem, supports three stocks and has an 'average' fish utilization rating. Upper Yakima River Spring Chinook, Upper Yakima Summer Steelhead, and coho utilize the creek for spawning, rearing, and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Taneum Creek is a RB tributary to the upper Yakima River, entering at RM 166.1. Taneum Creek watershed has narrow valleys with steep sides. The primary land use adjacent to Taneum Creek is agricultural crop production and forestry. The moderately steep gradient in the lower reaches tends to limit pool frequency. There is significant bank erosion downstream of I-90. Substrate in the moderately steep lower reaches is composed primarily of rubble, however patches of good gravel are numerous.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 7 cfs in September and the peak is 194 cfs in May. Minimum flow is 11 percent of the average. Most of the natural summer flow of Taneum Creek is fully appropriated for irrigation. Recent trust water projects restored significant amounts of flow during the summer as well as during the winter. Flow scoring detail is available on Table D-10.

3923 Swauk Creek

(Mouth to Williams Creek ~ RM 11.0)

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Fish utilization for Swauk Creek is rated 'average.' This creek supports four stocks. Upper Yakima River Spring Chinook and bull trout utilization of the reach is limited to juvenile rearing. The remaining two stocks, Upper Yakima Summer Steelhead and coho, express all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Swauk Creek is a LB tributary to the upper Yakima River, entering at RM 169.9. Swauk Creek is confined naturally from the mouth upstream to Hidden Valley. The lower three miles of the watershed are located in a steep arid canyon. Progressing upstream, willows, alder, and cottonwoods gradually increase until, by RM 8, the stream flows through a conifer forest of increasing density.

Historic road construction and mining resulted in the straightening of most stream reaches, steeper channel gradients, and downstream bank erosion. Culverts are undersized in places, causing debris blockages, fish passage barriers, and localized erosion during peak flows.

The drainage area of Swauk Creek is fairly large and unregulated summer stream flows are low. Recent trust water projects restored six cfs during the summer period and another six cfs during the winter period. Lack of instream flow in lower Swauk Creek during late summer and early fall is considered to be a natural occurrence.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in Swauk Creek is 6 cfs in September and the peak is 164 cfs in May. Minimum flow is 11 percent of the average. Flow scoring detail is available on Table D-10.

3924 First Creek

(Mouth to First Creek Water Users Diversion at RM 2.0)

Fish	Habitat	Flow
1	3	1

Fish Status/Utilization

First Creek is a tributary to Swauk Creek. The low fish utilization rating can be attributed to the number of stocks present. Upper Yakima Summer Steelhead is the only stock found in this reach but the stock expresses all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

First Creek instream habitat is limited by summer low flows. Irrigation diversions and natural late summer low flows create potential fish passage problems in the lower half mile of the stream. The stream flows out of high elevation rocky basins and has been measured with temperatures in the mid 40 degrees F, even during the late summer period. The stream gradient is steep, and instream habitat consists of LWD piles, sufficient amount of cover pools, riffles, and a few small side channels.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 13 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3925 Williams Creek

(Mouth to road crossing 2.4 miles above Liberty [~ RM 4.4])

Fish	Habitat	Flow
1	2	1

Fish Status/Utilization

Williams Creek, a tributary to Swauk Creek, supports two stocks, which leads to a low fish utilization rating. Juvenile coho use the creek for rearing whereas Upper Yakima Summer Steelhead use the creek for spawning, rearing, and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Williams Creek flows through the town of Liberty, as well as several nearby small farms. The riparian habitat is extremely modified in the developed areas, but riparian conditions improve further upstream. Lower Williams Creek is heavily grazed, with little riparian vegetation. Floodplain function is impaired along much of Williams Creek, as a result of channel incision caused by a combination of grazing, mining, and road impacts.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 20 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3926 Teanaway River

(Mouth to forks at ~ RM 11.3)

Fish	Habitat	Flow
2	2	2

Fish Status/Utilization

Fish utilization is 'average' for the four stocks in the Teanaway River, a tributary to the upper Yakima River mainstem. Three stocks, Upper Yakima River Spring Chinook, Upper Yakima summer Steelhead and coho, use the river for spawning, rearing and adult migration whereas bull trout use the river for juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

The Teanaway River is a LB tributary to the Yakima, entering at RM 176.1. The lower Teanaway (downstream of the forks) flows through a broad valley consisting mainly of irrigated hayfields, with recent heavy conversion to recreational/residential home sites. The Teanaway River has a high flow variation due to the watershed topography. Lack of LWD reduces the quality and quantity of pool habitat, and thus limits gravel deposition zones, although biologists agree that that substrate condition in the mainstem is fair to good.

The river is disconnected from its floodplain and the floodplain itself is highly altered. These alterations include the draining of ponds and wetlands and the filling of side channels, significant loss of beaver presence in the lower watershed, straightening of the river, and levee construction. Many mature cottonwoods still line the banks, but channel widening and the lack of LWD minimize the shade benefit from the trees in the summer.**Error! Reference source not found.**

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 23 cfs in September and the peak is 932 cfs in May. Minimum flow is 7 percent of the average. Flow scoring detail is available on Table D-10.

3927 North Fork Teanaway River

(Mouth to Jack Creek at ~ RM 6.2)

Fish	Habitat	Flow
2	3	2

Fish Status/Utilization

North Fork Teanaway River also has an 'average' fish utilization rating. The reach supports spawning, rearing, and adult migration life cycle stages for Upper Yakima River Spring Chinook, Upper Yakima Summer Steelhead, and coho. Bull trout utilize the river for juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Suitable spawning gravels and gradients for all three species are present in the lower portions of the NF. The upper reaches of the NF provide additional spawning habitat for steelhead and coho. Substrate condition in the NF is rated as fair, with little sedimentation. Instream cover in the form of LWD is lacking in the NF. There is a good mix of pools, runs, and riffles despite the extensive areas of very high erosion risk.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 141 cfs Mean Annual Flow was used to score this reach. Flow scoring detail is available on Table D-10.

3928 Cle Elum River

(Mouth to Cle Elum Dam)

Fish	Habitat	Flow
2	3	3

"The instream flow objective for the Cle Elum River is to improve fish-rearing conditions. Under present operations, flows are too high during July and August, and low flow and a lack of flow variation from September 10 through March limits access to available side channels when juvenile Chinook and steelhead (and potentially coho if reestablished) are rearing in this reach. Juvenile salmon seek low-velocity habitat as protection against being pushed out of a reach and to minimize energy expenditures. High summer flows reduce the amount of suitable rearing habitat for these species as a result of high water velocities.

"During the remainder of the year, flows are lower than desired for fish, and flow pulses are absent in the spring. Lower flows result in reduced available rearing and overwintering habitat throughout the fall and winter and extending through early spring. Flow pulses that mimic natural conditions in spring are needed to support juvenile outmigration. Increasing base flows should increase available juvenile rearing and overwintering habitat in this reach. An early April flow pulse would benefit spring Chinook and steelhead juveniles and smolts that are moving down into the lower basin to rear or outmigrate as smolts.

"Once reestablished in the upper Yakima River Basin, coho and sockeye would also benefit from these flow changes. Increased base flows year-round, as well as a spring pulse, would benefit all anadromous salmonids – spring Chinook, steelhead, coho, and sockeye – returning to the upper Yakima River Basin to spawn. Integrated with floodplain restoration efforts in this reach, increased base flows and spring pulses can have additive benefits to Yakima River Basin salmonid species."

Fish Status/Utilization

The Cle Elum River supports five stocks but has an 'average' fish utilization rating. Upper Yakima River Spring Chinook, Upper Yakima Summer Steelhead and coho express all three life cycle stages in this reach. Bull trout utilize the reach for juvenile rearing where as sockeye use the Cle Elum River for juvenile rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

The Cle Elum River is a LB bank tributary to the upper Yakima River, entering at RM 185.6. The Cle Elum River downstream of Cle Elum Dam is characterized by a large channel with several large side channel complexes that do not become connected to the mainstem unless flows exceed 500 cfs. The numerous side channels along the river below the dam are excellent rearing habitat for fry and parr in the spring and summer. Substrate condition in this reach is fair to good, with little sedimentation. Riparian condition here is good, including good forest buffer areas.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 215 cfs in October and the peak is 2,918 cfs in July. Minimum flow is 23 percent of the average. The natural hydrology of the Cle Elum River is significantly altered by water storage for flood control and irrigation water delivery. Flow scoring detail is available on Table D-10.

3929 Big Creek

(Mouth to removed dam site at ~ RM 2.9)

Fish	Habitat	Flow
1	2	1

Fish Status/Utilization

Fish utilization rating for Big Creek, a tributary to the upper Yakima River mainstem, is low. This can be attributed to the limited number of stocks found in Big Creek. Coho and Upper Yakima Summer Steelhead utilize the creek for all three life cycle stages whereas Upper Yakima River Spring Chinook use is limited to juvenile rearing.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Big Creek is a RB tributary to the Yakima River, entering at RM 195.8. This reach is channelized, with associated channel instability and bedload deposition in the lowermost 0.25 mile. Sediment recruitment is likely caused by channel and bank instability upstream and downstream of the KRD crossing, possibly associated with the lack of LWD and riparian vegetation through this area. Habitat complexity is limited in the lower reach, which is now almost exclusively a single channel providing pocket-water habitat.

Habitat scoring detail is available on Table D-9.

Flow

Gauge:Yes The minimum of monthly mean flows in this reach is 7 cfs in September and the peak is 169 cfs in May. Minimum flow is 15 percent of the average. Flow scoring detail is available on Table D-10.

3939 Little Creek

(Mouth to KRD Canal at ~ RM 1.6)

Fish	Habitat	Flow
1	2	2

Fish Status/Utilization

Fish utilization in Little Creek is low. Coho and Upper Yakima Summer steelhead use the creek for spawning, rearing, and adult migration and Upper Yakima River Spring Chinook utilize Little Creek for juvenile rearing.

Fish Status/Utilization scoring detail is available on Table D-8.

Habitat

Little Creek is a RB tributary to the Yakima River, entering at RM 194.6. Lack of LWD is a significant concern in the Little Creek Watershed. The channel upstream from the Nelson Siding Road appears to be unstable. There is extensive bedload movement and accretion during peak flows. Habitat scoring detail is available on Table D-9.

Flow

Gauge:No An NHD+ estimated 30 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table D-10.

5. Scoring Sheets

Table D-8 Fish Scoring Sheet

Code	Reach Name	Reach Score & Bin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3701	Lower Yakima River (Reach 1)	422	35	33	37	43	42	32	30	22	39	37	37	35
3702	Lower Yakima River (Reach 2)	422	35	33	37	43	42	32	30	22	39	37	37	35
3703	Lower Yakima River (Reach 3)	422	35	33	37	43	42	32	30	22	39	37	37	35
3704	Lower Yakima River (Reach 4)	438	37	35	39	45	44	38	33	25	36	36	36	34
3705	Lower Yakima River (Reach 5)	382	34	32	35	41	40	34	29	22	29	29	29	28
3706	Satus Creek	321	30	28	30	30	30	25	22	20	25	27	27	27
3707	Toppenish Creek	296	28	26	28	28	27	22	19	17	24	26	26	25
3708	Simcoe Creek	131	15	13	13	13	13	8	5	5	10	12	12	12
3709	Ahtanum Creek	316	30	28	29	29	29	24	21	20	25	27	27	27
3710	North Fork Ahtanum Creek	203	21	19	19	19	19	14	11	11	16	18	18	18
3711	Wide Hollow Creek	244	24	22	23	23	23	18	15	14	19	21	21	21
3801	Naches River (Reach 1)	343	31	29	30	34	33	28	25	20	27	29	29	28
3802	Naches River (Reach 2)	275	25	23	23	27	27	22	21	17	22	24	22	22
3803	Cowiche Creek	220	22	20	21	21	21	16	13	12	17	19	19	19
3804	South Fork Cowiche Creek	131	15	13	13	13	13	8	5	5	10	12	12	12
3805	Tieton River	241	24	22	22	22	22	17	16	14	19	21	21	21
3806	Rattlesnake Creek	259	24	22	22	22	22	20	19	17	22	24	24	21
3807	Gold Creek	233	22	20	20	20	20	18	15	15	20	22	22	19
3808	Little Naches River	259	24	22	22	22	22	20	19	17	22	24	24	21
3809	Bumping River	280	27	25	22	22	22	20	19	20	25	27	27	24
3901	Upper Yakima River (Reach 1)	303	28	26	29	31	30	27	22	19	23	23	23	22
3902	Upper Yakima River (Reach 2)	221	22	20	22	22	22	19	16	14	16	16	16	16
3903	Upper Yakima River (Reach 3)	221	22	20	22	22	22	19	16	14	16	16	16	16
3904	Upper Yakima River (Reach 4)	221	22	20	22	22	22	19	16	14	16	16	16	16
3905	Upper Yakima River (Reach 5)	221	22	20	22	22	22	19	16	14	16	16	16	16

Code	Reach Name	Reach Score & Bin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3906	Wenas Creek	84	7	7	7	7	7	7	7	7	7	7	7	7
3907	Burbank Creek	84	7	7	7	7	7	7	7	7	7	7	7	7
3908	Wilson Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3909	Cherry Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3910	Parke Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3911	Cooke Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3912	Caribou Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3913	Naneum Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3914	Coleman Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3915	Schnebly Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3916	Mercer Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3917	Reecer Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3918	Whiskey Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3919	Currier Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3920	Manastash Creek	169	19	17	17	17	17	12	11	9	11	13	13	13
3921	Dry Creek	110	11	9	9	9	9	7	7	7	9	11	11	11
3922	Taneum Creek	169	19	17	17	17	17	12	11	9	11	13	13	13
3923	Swauk Creek	179	20	18	18	18	18	13	10	10	12	14	14	14
3924	First Creek	69	9	9	9	9	9	6	3	3	3	3	3	3
3925	Williams Creek	93	11	11	11	11	11	8	5	5	5	5	5	5
3926	Teanaway River	241	25	23	23	23	23	18	17	15	17	19	19	19
3927	North Fork Teanaway River	241	25	23	23	23	23	18	17	15	17	19	19	19
3928	Cle Elum River	221	22	20	22	22	22	19	16	14	16	16	16	16
3929	Big Creek	143	17	15	15	15	15	10	7	7	9	11	11	11
3930	Little Creek	143	17	15	15	15	15	10	7	7	9	11	11	11

Note: Reach names do NOT link with workbook tabs (apologies).

Table D-8 Fish Scoring Sheet - continued

WRIA Subtotals	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Grand Total (WRIA 37)	324	302	327	357	351	279	245	200	301	307	307	297
Monthly Grand Total (WRIA 38)	214	196	195	203	202	169	152	137	184	202	200	187
Monthly Grand Total (WRIA 39)	457	405	418	420	419	334	295	274	328	368	368	367
Monthly Grand Total (Yakima Basin)	995	903	940	980	972	782	692	611	813	877	875	851

SaSI Stocks in the Yakima Basin	WRIA	SaSI Stock Rating	Weight Factor**
American River Spring Chinook - 1760	38	Depressed	2
Upper Yakima River Spring Chinook - 1747	39	Depressed	2
Naches Spring Chinook - 1752	38	Depressed	2
Yakima River Bright Fall Chinook - 1728	37	Healthy	1
Marion Drain Fall Chinook - 1744	37	Healthy	1
Naches Summer Steelhead - 6892	38	Unknown	2
Satus Creek Summer Steelhead - 6888	37	Unknown	2
Toppenish Creek Summer Steelhead - 6890	37	Unknown	2
Upper Yakima Summer Steelhead - 6894	39	Unknown	2
Coho - 3805	All	Unknown	2
Sockeye - SaSI stock not assigned	39	Unknown	2

SaSI Stocks in the Yakima Basin	WRIA	SaSI Stock Rating	Weight Factor**
South Fork Tieton Bull Trout - 8459	38	Healthy	2
Indian Creek Bull Trout - 8462	38	Depressed	
North Fork Tieton River Bull Trout - 8465	38	Unknown	
Yakima River Bull Trout - 8468	37,39	Critical	
Ahtanum Creek Bull Trout - 8480	37	Critical	
Rattlesnake Creek Bull Trout - 8495	38	Depressed	
American River Bull Trout - 8498	38	Depressed	
Crow Creek Bull Trout - 8501	38	Critical	
Deep Creek Bull Trout - 8504	38	Depressed	
North Fork Teanaway River Bull Tr - 8516	39	Critical	
Cle Elum/Waptus Lakes Bull Trout - 8528	39	Unknown	
Box Canyon Creek Bull Trout - 8543	39	Critical	
Kachess River Bull Trout - 8547	39	Critical	
Gold Creek Bull Trout - 8552	39	Critical	

Table D-8 Fish Scoring Sheet - continued

Weighting Factor for Federally Listed Species	ESA Weight Factor
Assign additional weight to stocks that are listed as Threatened or Endangered under the ESA? (yes=1; no=0)	1
Weighting Factor for Spatial Structure and Diversity of Fish Stocks	**Weight Factor**
Assign additional weight to reaches within Interior Columbia TRT-designated Major or Minor Spawning Areas (MaSAs or MiSAs)? (yes=1; no=0)	0

Table D-9 Habitat Scoring Sheet

Reach Code	Reach name	Reach Score & Bin	Off Channel Habitat (OCHs)	Flood-plain Connec -tivity	Riparian Cond-ition	Spawn ing Suita-bility	Rearing Suita-bility	Passage Condi-tion
3701	Lower Yakima River (Reach 1)	13	2	3	2	1	2	3
3702	Lower Yakima River (Reach 2)	11	2	2	2	1	2	2
3703	Lower Yakima River (Reach 3)	14	2	2	2	2	3	3
3704	Lower Yakima River (Reach 4)	16	3	3	2	2	3	3
3705	Lower Yakima River (Reach 5)	16	3	2	2	3	3	3
3706	Satus Creek	13	2	2	2	3	2	2
3707	Toppenish Creek	12	1	2	2	3	2	2
3708	Simcoe Creek	10	1	1	2	2	2	2
3709	Ahtanum Creek	12	2	2	2	2	2	2
3710	North Fork Ahtanum Creek	14	3	2	2	2	3	2
3711	Wide Hollow Creek	9	1	1	2	2	2	1
3801	Naches River (Reach 1)	14	2	2	2	3	3	2
3802	Naches River (Reach 2)	16	2	2	3	3	3	3
3803	Cowiche Creek	14	2	2	2	3	3	2
3804	South Fork Cowiche Creek	18	3	3	3	3	3	3
3805	Tieton River	10	1	1	2	1	2	3
3806	Rattlesnake Creek	16	2	3	2	3	3	3
3807	Gold Creek	15	2	2	3	3	3	2
3808	Little Naches River	18	3	3	3	3	3	3
3809	Bumping River	18	3	2	3	3	3	4
3901	Upper Yakima River (Reach 1)	11	1	1	2	2	2	3
3902	Upper Yakima River (Reach 2)	15	2	2	2	3	3	3
3903	Upper Yakima River (Reach 3)	16	2	2	3	3	3	3
3904	Upper Yakima River (Reach 4)	19	3	3	3	3	3	4
3905	Upper Yakima River (Reach 5)	18	3	3	3	3	3	3
3906	Wenas Creek	6	1	1	1	1	1	1
3907	Burbank Creek	9	1	2	1	1	2	2

Reach Code	Reach name	Reach Score & Bin	Off Channel Habitat (OCHs)	Flood-plain Connec-tivity	Riparian Cond-ition	Spawn ing Suita-bility	Rearing Suita-bility	Passage Condi-tion
3908	Wilson Creek	7	1	1	1	1	2	1
3909	Cherry Creek	8	1	1	2	1	2	1
3910	Park Creek	7	1	1	1	1	2	1
3911	Cooke Creek	7	1	1	1	1	2	1
3912	Caribou Creek	7	1	1	1	1	2	1
3913	Naneum Creek	6	1	1	1	1	1	1
3914	Coleman Creek	7	1	1	1	1	2	1
3915	Schnebly Creek	7	1	1	1	1	2	1
3916	Mercer Creek	7	1	1	1	1	2	1
3917	Reecer Creek	9	1	1	1	2	2	2
3918	Whiskey Creek	6	1	1	1	1	1	1
3919	Currier Creek	9	1	1	1	2	2	2
3920	Manastash Creek	12	2	2	2	2	3	1
3921	Dry Creek	6	1	1	1	1	1	1
3922	Taneum Creek	12	2	2	2	2	2	2
3923	Swauk Creek	14	2	2	2	2	3	3
3924	First Creek	16	3	2	3	2	3	3
3925	Williams Creek	13	2	2	2	2	3	2
3926	Teanaway River	15	2	2	2	3	3	3
3927	North Fork Teanaway River	17	3	2	3	3	3	3
3928	Cle Elum River	18	3	2	3	4	3	3
3929	Big Creek	14	2	2	2	3	3	2
3930	Little Creek	14	2	2	3	2	3	2

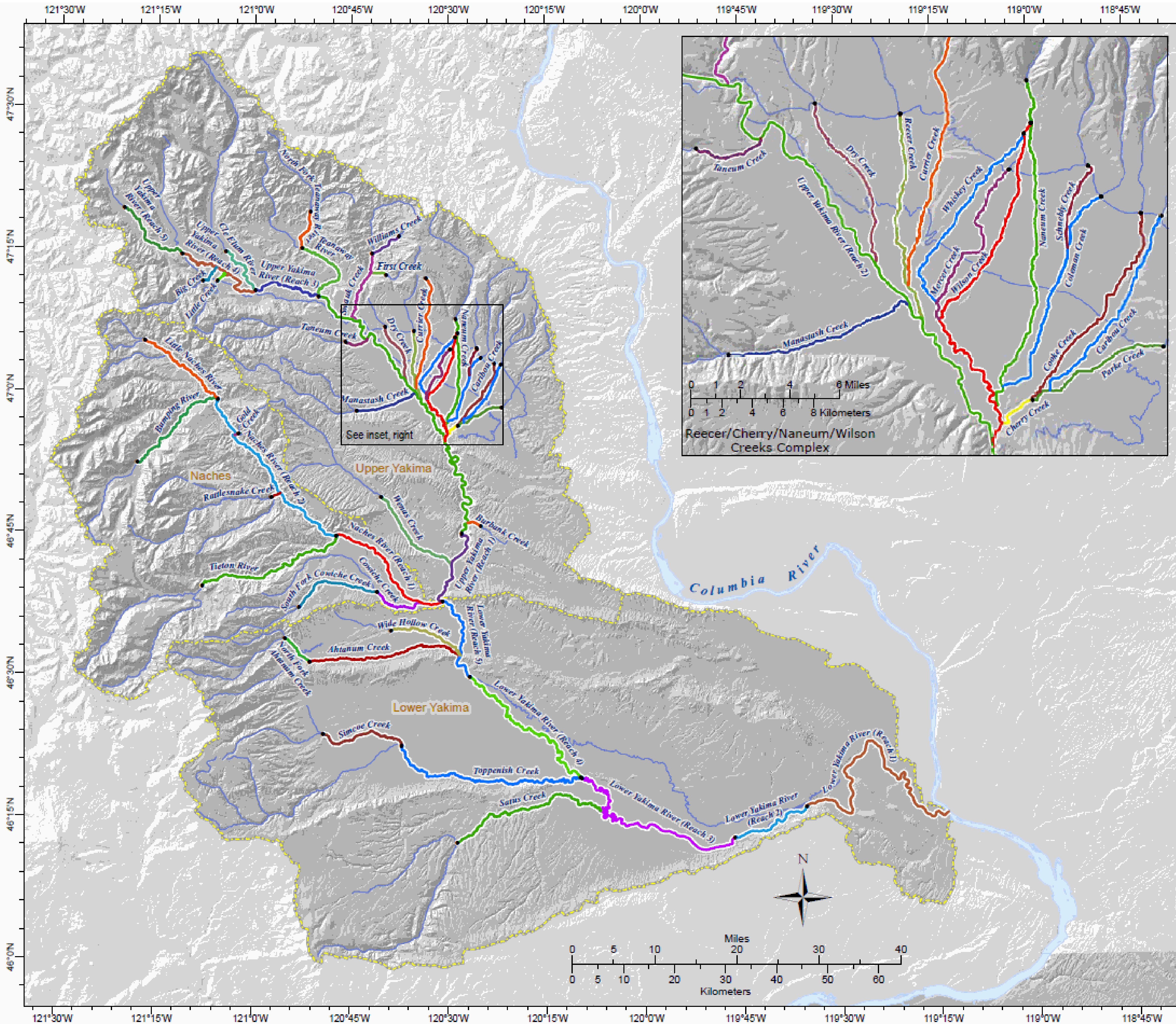
Table D-10 Flow Scoring Sheet

Reach Code	Reach Name	GOOD IS HIGH BIN	POOR IS HIGH, GOOD IS LOW >>>>>>>>>>>>>>>>>>> Sum scores (A:D) * E	A % of Mo Avg Below Rule	B Qi Deviation	C No. Claims	D August Deviation from Mean Annual Flow	E Flow Volume Factor
3701	Lower Yakima River (Reach 1)	3	4		2	3	2	0.5
3702	Lower Yakima River (Reach 2)	3	5		3	3	3	0.5
3703	Lower Yakima River (Reach 3)	3	2		1	1	2	0.5
3704	Lower Yakima River (Reach 4)	3	5		3	3	3	0.5
3705	Lower Yakima River (Reach 5)	3	2		0	3	1	0.5
3706	Satus Creek	3	3		0	1	2	1.0
3707	Toppenish Creek	3	2		0	2	1	0.5
3708	Simcoe Creek	2	15		0	2	3	3.0
3709	Ahtanum Creek	2	16		3	2	3	2.0
3710	North Fork Ahtanum Creek	2	12		3	1	2	2.0
3711	Wide Hollow Creek	1	24		3	2	3	3.0
3801	Naches River (Reach 1)	3	5		3	3	3	0.5
3802	Naches River (Reach 2)	3	3		1	3	2	0.5
3803	Cowiche Creek	1	27		3	3	3	3.0
3804	South Fork Cowiche Creek	1	24		3	2	3	3.0
3805	Tieton River	2	7		3	3	1	1.0
3806	Rattlesnake Creek	2	10		1	2	2	2.0
3807	Gold Creek	2	12		0	2	2	3.0
3808	Little Naches River	3	4		0	1	3	1.0
3809	Bumping River	3	2		0	1	1	1.0
3901	Upper Yakima River (Reach 1)	3	4		3	3	1	0.5
3902	Upper Yakima River (Reach 2)	3	4		3	3	1	0.5
3903	Upper Yakima River (Reach 3)	3	3		1	3	1	0.5
3904	Upper Yakima River (Reach 4)	2	7		3	3	1	1.0
3905	Upper Yakima River (Reach 5)	3	3		0	2	1	1.0
3906	Wenas Creek	1	27		3	3	3	3.0
3907	Burbank Creek	2	12				3	4.0
3908	Wilson Creek	2	7		2	3	2	1.0
3909	Cherry Creek	3	3		1	1	1	1.0
3910	Park Creek	1	27		3	3	3	3.0
3911	Cooke Creek	1	27		3	3	3	3.0
3912	Caribou Creek	1	27		3	3	3	3.0
3913	Naneum Creek	2	12		1	3	2	2.0
3914	Coleman Creek	1	44		4	3	4	4.0

Reach Code	Reach Name	GOOD IS HIGH BIN	POOR IS HIGH, GOOD IS LOW >>>>>>>>>>>>>>>>>>>> Sum scores (A:D) * E	A % of Mo Avg Below Rule	B Qi Deviation	C No. Claims	D August Deviation from Mean Annual Flow	E Flow Volume Factor
3915	Schnebly Creek	1	24		3	2	3	3.0
3916	Mercer Creek	2	12		0	2	2	3.0
3917	Reecer Creek	1	21		1	3	3	3.0
3918	Whiskey Creek	1	44		4	3	4	4.0
3919	Currier Creek	1	24		3	2	3	3.0
3920	Manastash Creek	1	18		3	3	3	2.0
3921	Dry Creek	1	27		3	3	3	3.0
3922	Taneum Creek	2	14		2	2	3	2.0
3923	Swauk Creek	1	18		3	3	3	2.0
3924	First Creek	1	24		3	2	3	3.0
3925	Williams Creek	1	24		2	3	3	3.0
3926	Teanaway River	2	9		3	3	3	1.0
3927	North Fork Teanaway River	2	6		3	1	2	1.0
3928	Cle Elum River	3	5		1	3	1	1.0
3929	Big Creek	1	24		3	2	3	3.0
3930	Little Creek	2	15		0	2	3	3.0

6. Maps

Figure D-1 Assessed Stream Reaches



DEPARTMENT OF ECOLOGY State of Washington

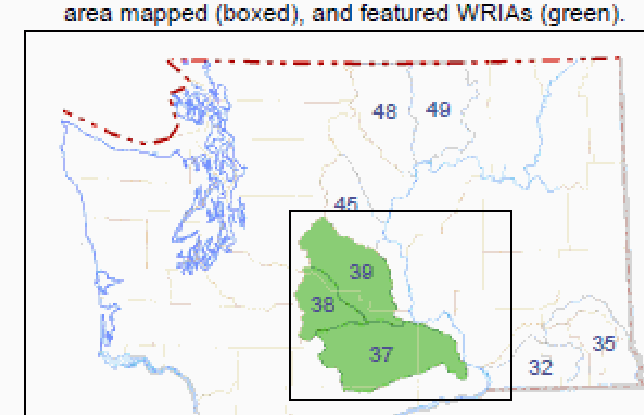
Washington Department of FISH and WILDLIFE

Yakima River Basin
WRIAs 37, 38, and 39
Assessed Stream Reaches
colored for visual reference

• — Assessed Stream Reach upper extents

Continuation of Assessed Streams to Headwaters

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

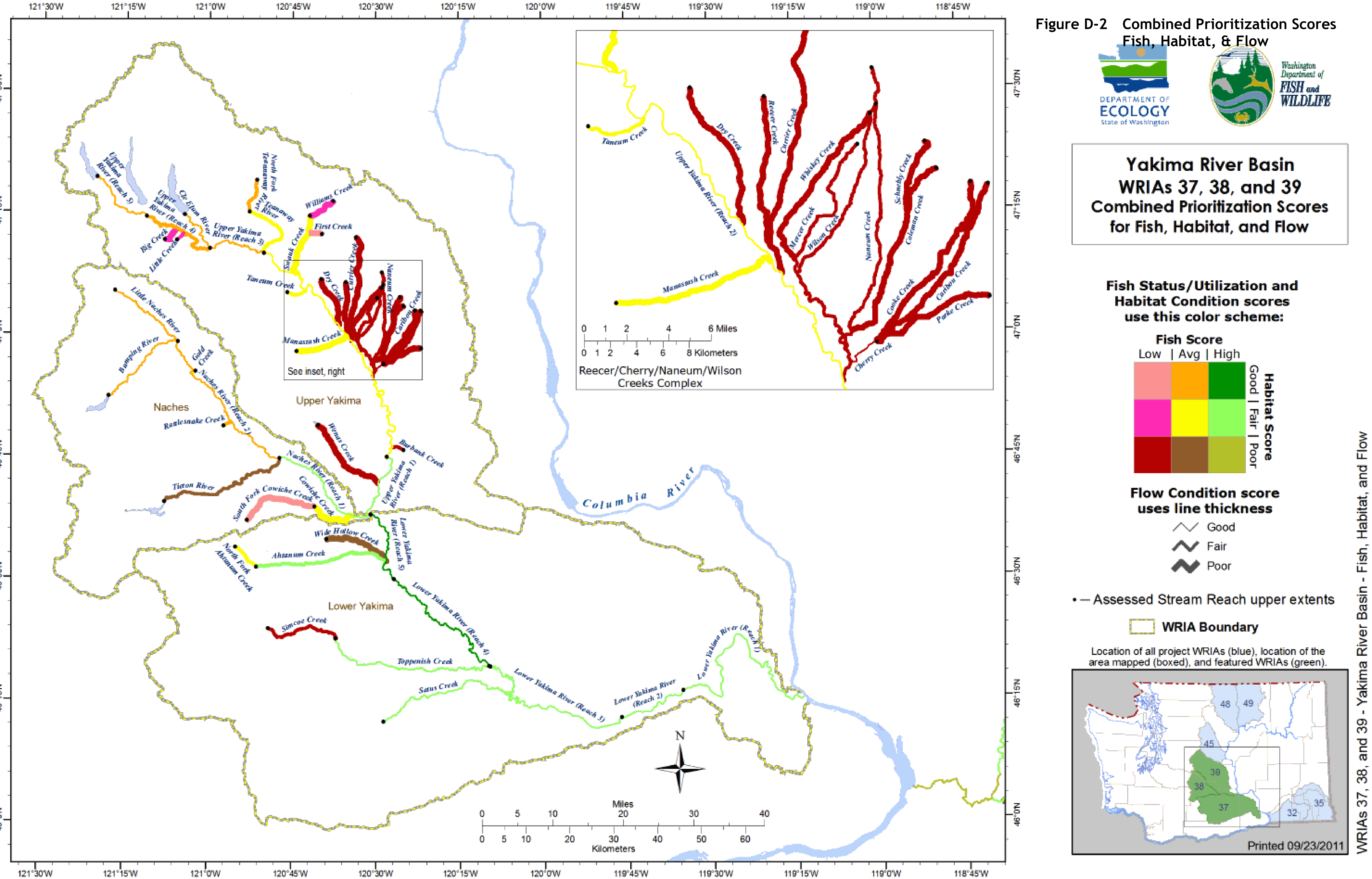


Printed 08/15/2011

WRIAs 37, 38, and 39 - Yakima River Basin - Priority Streams

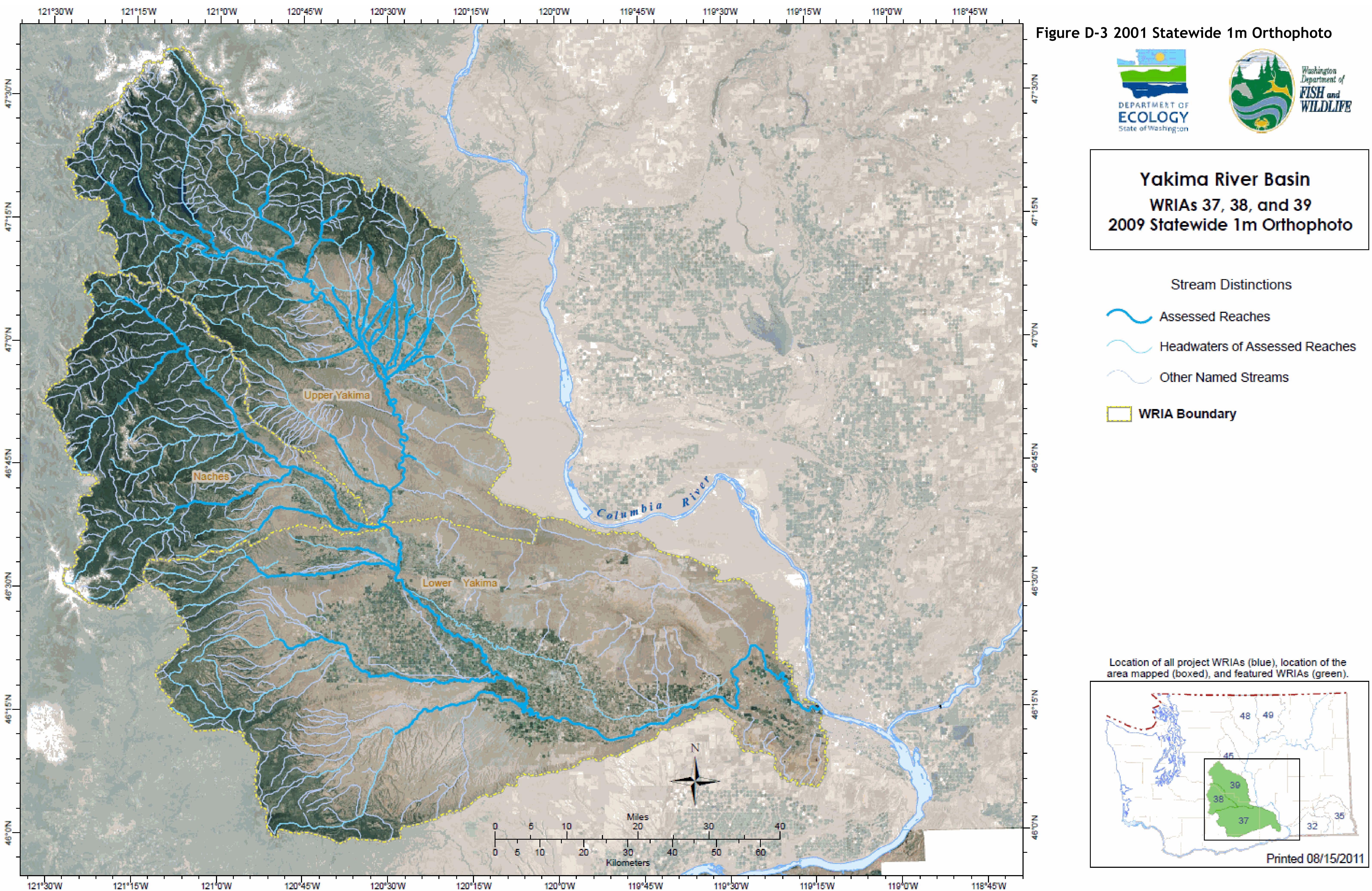
[Intentionally Blank]

Figure D-2 Combined Prioritization Scores Fish, Habitat, & Flow



[Intentionally Blank]

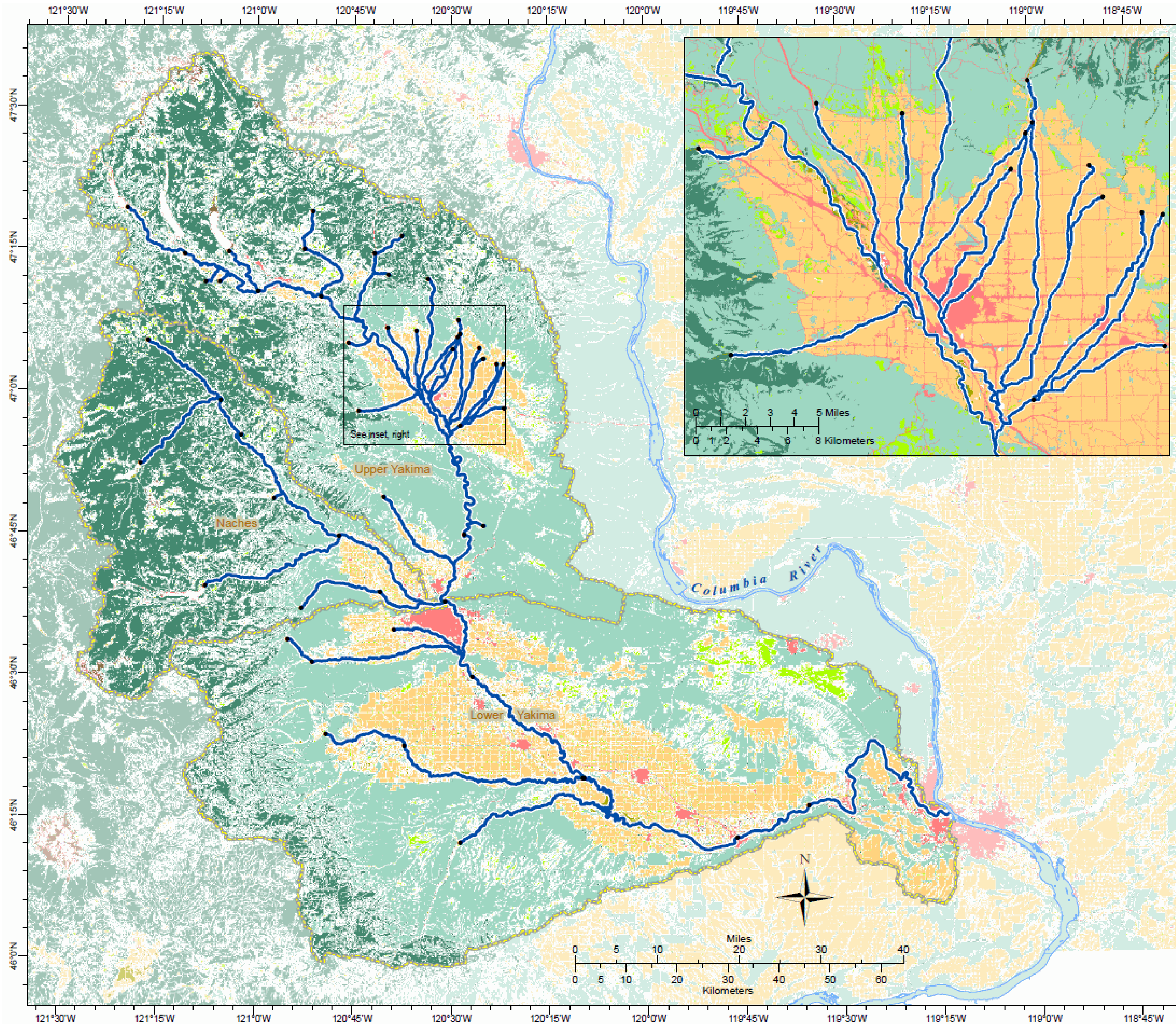
Figure D-3 2001 Statewide 1m Orthophoto



WRIAs 37, 38, and 39 - Yakima River Basin - Orthophoto

[Intentionally Blank]

Figure D-4 2001 National Land Cover Database



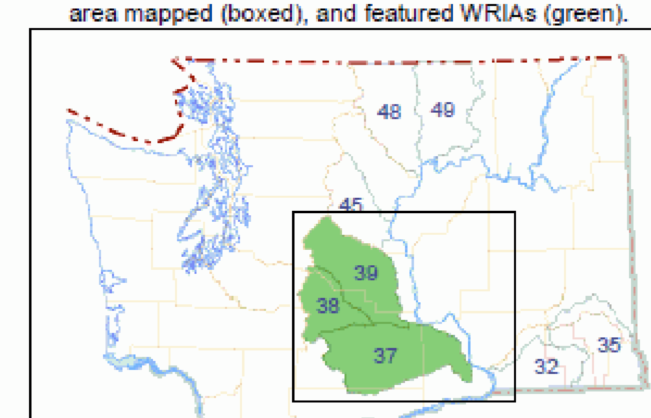
Yakima River Basin
WRIAs 37, 38, and 39
2001 National Land Cover Database

Land Cover and Use

- Snow and Ice
- Developed
- Barren
- Forest
- Scrub
- Grasslands
- Agriculture
- Riparian

Assessed Stream Reaches with upper extents marked

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

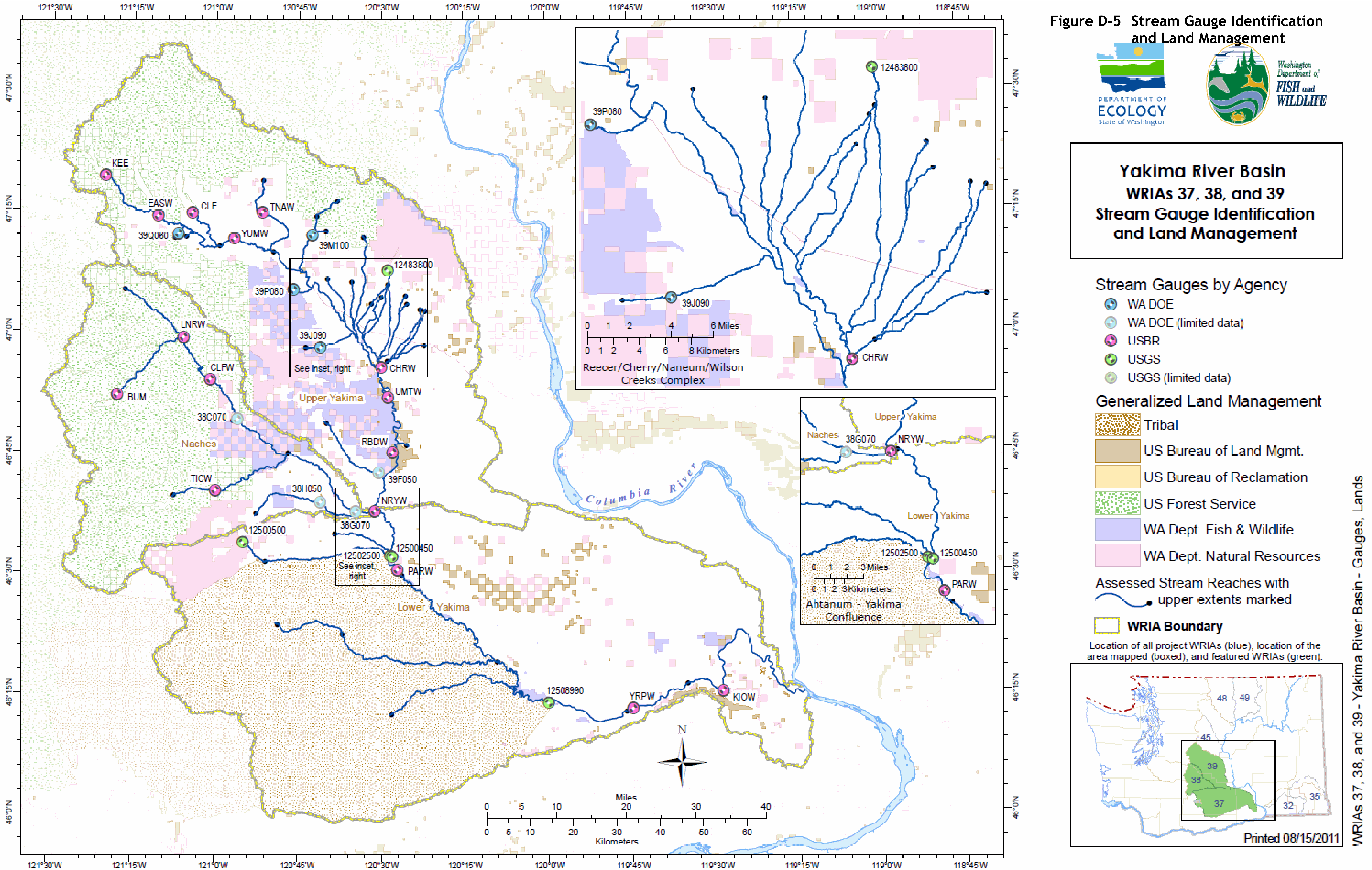


Printed 08/15/2011

WRIAs 37, 38, and 39 - Yakima River Basin - NLCD

[Intentionally Blank]

Figure D-5 Stream Gauge Identification and Land Management

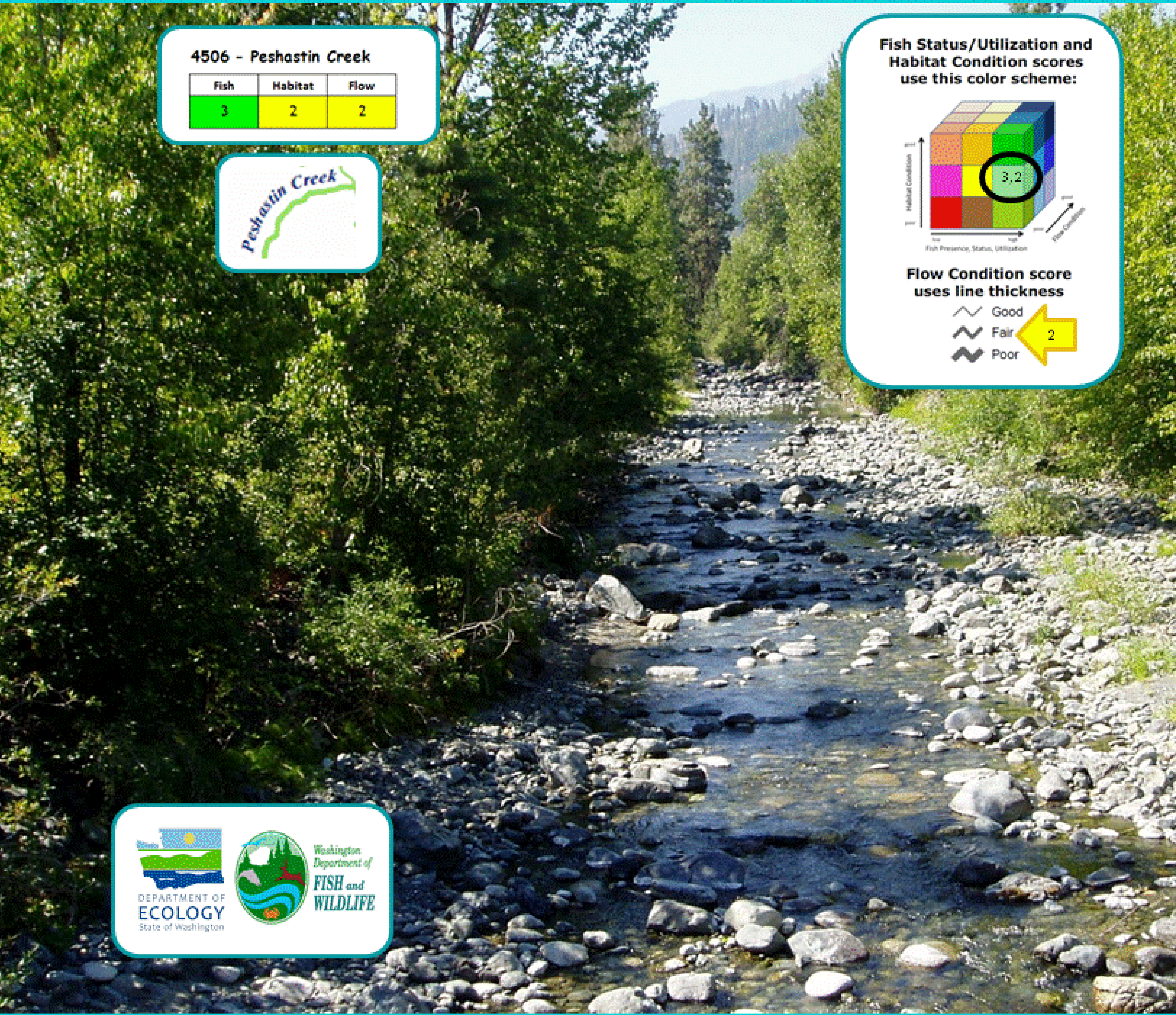


Columbia River Instream Atlas Project

Washington Department of Fish and Wildlife

Final Report – APPENDIX E

WRIA 45 WENATCHEE



Ecology Contract C1000090 - WDFW Contract 09-1471

Ecology Publication Number: 11-12-015

September 2011

Columbia River Instream Atlas Project - Final Report Appendix E –WRIA 45 Wenatchee

September 23, 2011

Washington Department of Fish and Wildlife CRIA Team:

Teresa Scott (Habitat Water Resources Policy Coordinator)
Jonathan Kohr (Habitat Water Science Team)
Dayv Lowry (Fish Science; Habitat Science)
Andrew Weiss (Fish Science)
Aaron Bosworth (King County District Fish Biologist)
Jim Cummins (Yakima District Fish Biologist)
Dale Gombert (Fish Science)
Paul La Riviere (Habitat Water Science Team)
Peggy Miller (Habitat Major Projects)
Brianna Murphy (Fish Science)

Funding provided by Ecology Office of Columbia River as part of the 2011 Columbia Basin Long-term Water Supply and Demand Forecast

Ecology Contract C1000090

WDFW Contract 09-1471

Ecology Publication Number: 11-12-015

If you need this document in a format for the visually impaired, call the Office of Columbia River at (509) 575-2490. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

Cover Photo: Jonathan Kohr

Columbia River Instream Atlas Project

Final Report

Appendix E – WRIA 45 Wenatchee River

September 23, 2011

Table of Contents

Tables

Figures

1. Description

The Wenatchee subbasin is located in north-central Washington and lies entirely within Chelan County. The WRIA extends from the snowfields, glaciers and steep, forested Cascade Mountains, through orchards in the Wenatchee River Valley, to the shrub-steppe of the eastern watershed at the confluence of the Wenatchee and Columbia Rivers. About 90% of the approximately 854,000 acre subbasin is in public ownership. The remaining 10% is privately owned and is primarily within the valley bottoms. The subbasin consists of nine primary watersheds: Mission, Peshastin, Chumstick, Icicle, Chiwaukum, and Nason creeks, the Chiwawa, White, and Little

Wenatchee rivers, and two mainstem Wenatchee River “watersheds:” the lower and upper Wenatchee River (the upper river includes Lake Wenatchee). Spring Chinook, steelhead, and bull trout spawn and rear in the subbasin[1].

2. Reach Definitions

Most stream reaches in the Wenatchee basin were delineated using the 2002 Water Acquisition priorities stream reaches. Seven streams were added and upper reach extents included confluences of large tributaries and a barrier on Chiwaukum Creek. Most streams in the basin extend into public lands (Forest Service) and there are few, if any opportunities for stream flow augmentation beyond these boundaries. All streams downstream reaches begin at the stream mouths except for the mainstem Wenatchee River’s middle and upper reaches. Reaches in the Wenatchee subbasin were defined largely on physical differences in the tributaries and not reliant on water diversions. This was based on the diversity of each stream as influences from smaller tributaries would change habitat and flow for the stream being evaluated. For example, Mission Creek extends to the Sand Creek confluence where the contribution of water into Mission Creek is substantial, therefore considerably changing the stream’s habitat downstream. In some reaches, there was still an effort to use a physical location immediately upstream of the uppermost diversion point.

Table E-1 Reach Definitions

Stream Name	Code	Stream Reach Description
Wenatchee River (Reach 1)	4501	Mouth to middle of Leavenworth
Wenatchee River (Reach 2)	4502	Middle of Leavenworth to Tumwater Canyon / Campground
Wenatchee River (Reach 3)	4503	Tumwater Canyon / Campground to Lake Wenatchee
Mission Creek	4504	Mouth to Sand Creek
Brender Creek	4505	Mouth to Brisky Canyon Creek
Peshastin Creek	4506	Mouth to Ingalls Creek
Ingalls Creek	4507	Mouth to Ingalls Creek trailhead
Derby Canyon	4508	Mouth to North Fork Derby Canyon
Chumstick Creek	4509	Mouth to Little Chumstick Creek
Eagle Creek	4510	Mouth to Van Creek
Little Chumstick Creek	4511	Mouth to headwaters
Icicle Creek	4512	Mouth to Bridge Creek
Chiwaukum Creek	4513	Mouth to Barrier
Sand Creek	4514	Mouth to GIS RM 2
Skinney Creek	4515	Mouth to SW of Winton
Beaver Creek	4516	Mouth to Beaver Creek forks
Chiwawa River	4517	Mouth to Deep Creek

[1] Adapted from Northwest Power and Conservation Council 2005g and Upper Columbia Salmon Recovery Board 2007

3. WRIA Results

Fish Status and Utilization

TRT designation was not considered in this rating but is available on the spreadsheets for inclusion in future evaluations. See the Methods Appendix for additional information regarding the Fish Status/Utilization rating procedures.

Nine salmonid stocks utilize the Wenatchee River Basin. Of these, four stocks are Spring Chinook and their status is complicated. Historically WDFW has recognized four separate stocks of spring Chinook in the SaSI ratings and continue to do so. Recent genetic analysis suggests that the stocks may actually be one stock or an integration of several stocks. WDFW manage the stocks as one stock for fisheries even though they are separated in SaSI. All spring Chinook stocks are listed as Endangered under ESA. Chiwawa and Nason Creek Spring Chinook stock status are listed in SaSI as depressed where as Little Wenatchee and White River Spring Chinook are listed as critical. The weighting of spring Chinook stocks are handled differently in the Wenatchee River Basin compared to the other basins. Rather than tracking the stocks independently, it is assumed that if spring Chinook are found in a reach then all four stocks are present in that reach. This is based on combining SaSI status and fisheries management as well as the reach definitions utilized in this report. Nason Creek, Little Wenatchee, and White River are not evaluated in this project and are upstream of Chiwawa Creek (the most upstream defined reach in the project). Therefore presence of spring Chinook in tributaries below Chiwawa Creek could potentially be all four stocks.

The status of three of the remaining five stocks is not as complicated as the spring Chinook. Wenatchee Summer Chinook and Wenatchee Sockeye are not listed under ESA and are considered healthy where as Wenatchee Summer Steelhead are listed as endangered and depressed.

Coho stock is a little more complicated because the endemic stock was extirpated from the Wenatchee Basin in the early 1900s. The federal ESA and Washington State SaSI do not recognize or address extinct or extirpated species. The present stock is a reintroduced hatchery stock associated with efforts by the Yakama Nation to bring Coho salmon back to the Wenatchee Basin. For this project Coho in the Wenatchee River Basin are considered as not listed under ESA with an unknown status.

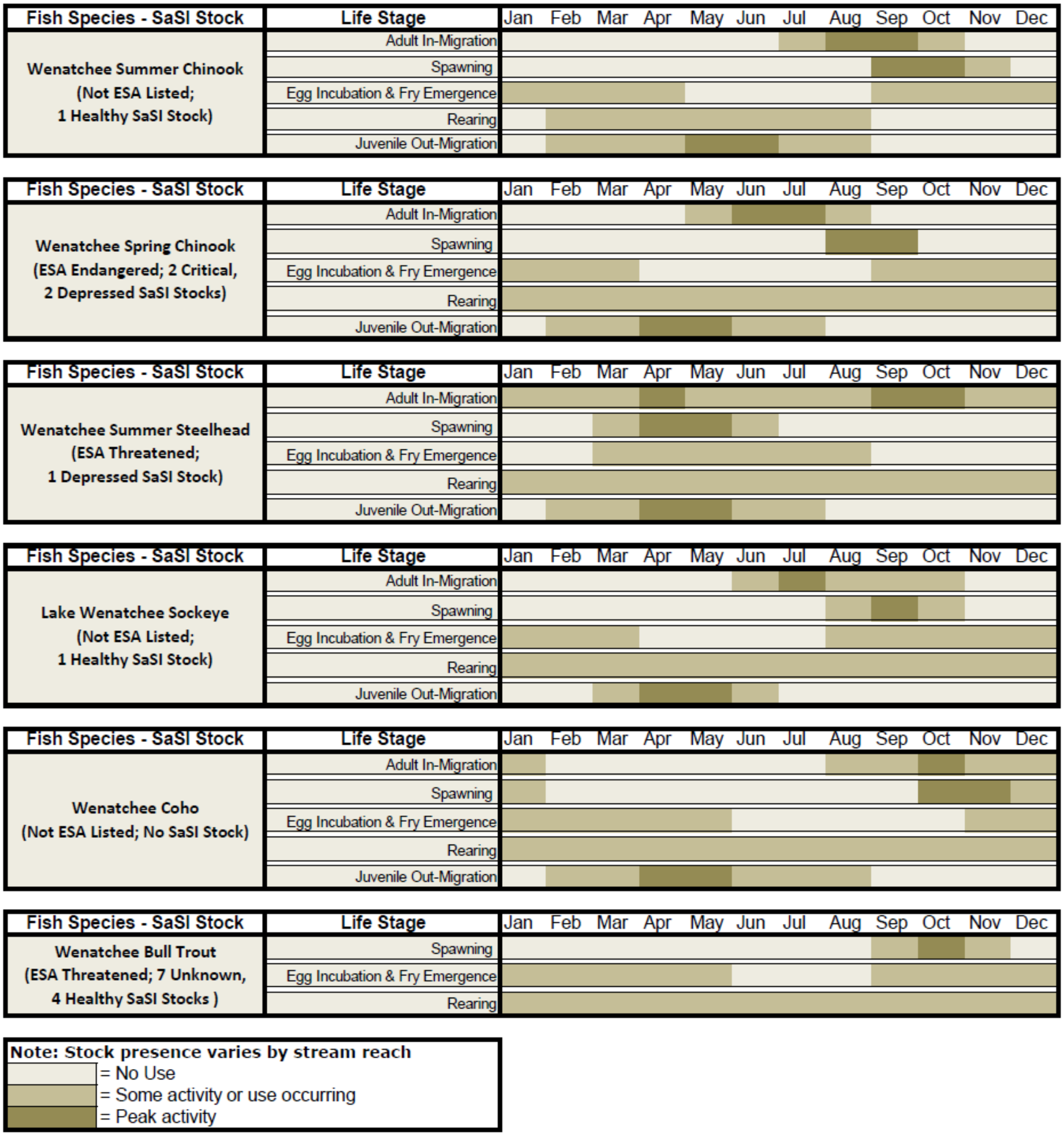
The remaining stock is bull trout. Like spring Chinook SaSI lists multiple bull trout stocks within the basin but even less is known about bull trout. Even though bull trout show site fidelity indicating a potential for multiple stocks, genetic analysis has not been completed to verify separate stocks. For this project bull trout stocks have been lumped into a single stock. The status for the single stock of bull trout is listed as threatened under ESA and status unknown.

The weighting factor (ESA and SaSI) for the each stock will remain the same within the basin whereas the life cycle stages and duration will change depending on the stream reach. Stock SaSI status and ESA listing will not be repeated for each stream reach.

Table E-2 SaSI Stock Name, Status, ESA Listing Unit, & Listing Status

SaSI Stock name	SaSI Status	ESA Unit Name	ESA Listing Status
Wenatchee Summer Chinook	Healthy	Upper Columbia River Summer and Fall Run Chinook	Not Warranted
Chiwawa Spring Chinook	Depressed	Upper Columbia River Spring Run Chinook	Endangered
Nason Creek Spring Chinook	Depressed		
Little Wenatchee Spring Chinook	Critical		
White River (Wenatchee) Spring Chinook	Critical		
Wenatchee Sockeye	Depressed	Lake Wenatchee Sockeye	Not Warranted
Wenatchee Summer Steelhead	Depressed	Upper Columbia Steelhead	Endangered
Ingalls Creek Bull Trout	Unknown	Upper Columbia River Bull Trout	Threatened
Icicle Creek Bull Trout/Dolly Varden	Unknown		
Chiwaukum Creek Bull Trout/Dolly Varden	Unknown		
Chiwawa Bull Trout/Dolly Varden	Unknown		
Chikamin Creek Bull Trout/Dolly Varden	Healthy		
Rock Creek Bull Trout	Healthy		
Phelps Creek Bull Trout	Healthy		
Nason Creek Bull Trout/Dolly Varden	Unknown		
Little Wenatchee Bull Trout/Dolly Varden	Unknown		
White (Wenatchee) Bull Trout/Dolly Varden	Unknown		
Panther Creek Bull Trout/Dolly Varden	Healthy		
Coho - SaSI stock not assigned	Unknown	n/a	n/a

Table E-3 Fish status & utilization periodicity for five life cycle stages.



Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table E-4 Fish status/utilization score & bin by stream reach.

Code	Reach Name	Prioritization Score	Normalized Score	Bin
4501	Wenatchee River (Reach 1)	466	0.80	3
4502	Wenatchee River (Reach 2)	578	0.99	3
4503	Wenatchee River (Reach 3)	586	1.00	3
4504	Mission Creek	335	0.57	2
4505	Brender Creek	335	0.57	2
4506	Peshastin Creek	521	0.89	3
4507	Ingalls Creek	541	0.92	3
4508	Derby Canyon	283	0.48	2
4509	Chumstick Creek	335	0.57	2
4510	Eagle Creek	335	0.57	2
4511	Little Chumstick Creek	56	0.10	1
4512	Icicle Creek	558	0.95	3
4513	Chiwaukum Creek	560	0.96	3
4514	Sand Creek	108	0.18	1
4515	Skinney Creek	335	0.57	2
4516	Beaver Creek	335	0.57	2
4517	Chiwawa River	569	0.97	3

Habitat Condition

Three main literature reviews were used as the starting point of habitat scoring within the Wenatchee basin. These consisted of the Wenatchee River Subbasin Plan, the 2001 Limiting Factors Analysis, and the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan.

Habitat condition scores within the Wenatchee basin were scored based on the six habitat attributes in Appendix A. This habitat scoring evaluation varied greatly from downstream tributaries when compared to the upstream or higher elevation area streams. In general, the larger streams rated higher scores of habitat condition and the upper Wenatchee basin high elevation streams with snowpack-based run-off having cooler, cleaner water. Smaller and lower elevation and streams are often over appropriated such as Mission Creek, tributary of the Wenatchee River near Cashmere, Washington. Therefore, the habitat scores calculated out as poor. Higher elevation streams scored higher as they normally had less agriculture land use and higher percentages of canopy cover.

Most evaluated streams rated as ‘fair’ habitat when the scoring was divided into thirds. In fact, 10 of the 17 streams scored fell into the ‘fair’ habitat score tier and only three calculated out as ‘good’ habitat scores, and four scored as ‘poor’ overall habitat conditions.

Most streams, except for three scored ‘fair’-to-’poor’ for floodplain connectivity, which distinguishes more channelized systems. Better scores, mostly in the ‘good’ range, were found for spawning, rearing, and passage conditions. ‘Fair’ to ‘good’ conditions were mainly scored for the other two indicators of off-channel habitat and riparian conditions.

Table E-5 Habitat condition score & bin by stream reach.

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Code	Reach Name	Prioritization Score	Bin
4501	Wenatchee River (Reach 1)	14	2
4502	Wenatchee River (Reach 2)	16	3
4503	Wenatchee River (Reach 3)	15	2
4504	Mission Creek	7	1
4505	Brender Creek	9	1
4506	Peshastin Creek	12	2
4507	Ingalls Creek	13	2
4508	Derby Canyon	9	1
4509	Chumstick Creek	11	2
4510	Eagle Creek	11	2
4511	Little Chumstick Creek	14	2
4512	Icicle Creek	15	2
4513	Chiwaukum Creek	16	3
4514	Sand Creek	8	1
4515	Skinney Creek	11	2
4516	Beaver Creek	15	2
4517	Chiwawa River	21	3

Flow Condition

Snowmelt is a primary source of late summer and fall stream flow in the Wenatchee Watershed. Variability in winter precipitation results in highly variable stream flow, especially in late summer and early fall (July-October). Water demand is highest during the period when stream flows are lowest. In 1983, regulations were established governing how water would be managed on the Wenatchee River, Mission Creek and Icicle Creek. The rule was adopted to protect stream flows, fisheries, and existing water rights. It also closed new allocations of water on Peshastin Creek between June 15 and Oct. 15. In 2007, amendments to that rule revised existing stream flow levels, set aside a reservation of 4 cubic feet per second for future use, and established a maximum amount of water that may be allocated from the Wenatchee River and its tributaries.

The hydrograph for the lower Wenatchee shows increasing flows through the spring, peaking in early June, then falling dramatically through the summer months. Many of Wenatchee’s tributaries show unusual hydrographs, with peaks early in the year dropping to very low flows from May through October (Mission, Peshastin, Chumstick, and Eagle Creeks). Mainstem Wenatchee River flows are typically above the WAC instream flow rules, with September being the most problematic month in drier years. Flows at the Mission and Peshastin Creek control points are below WAC instream flows during average water years in summer and fall months. Average year flows in Icicle Creek are above the WAC instream flow, with August and September being the most likely months for deficits in dry water years.

WRIA 45 is one basin that Ecology manages for instream flow conditions throughout the year (Table E-6). Water right permit holders who are subject to instream flows set in WAC can be regulated – shut off – when actual stream flows fall below the WAC values. WAC Instream flows are measured in the Wenatchee River at Monitor (USGS # 12462500), Peshastin (USGS # 12459000), and Plain (USGS # 12457000), in Mission Creek (ECY 45E070), Peshastin Creek (ECY Gage# 45F070), Icicle Creek (USGS # 12458000), and Nason Creek (not a stream evaluated for CRIA). Six of the 17 CRIA reaches do not have gauges.

Table E-6 Minimum Instream Flows set in Chapter 173-545 WAC

Time Period		Reach 4501 Wenatchee River at Monitor USGS Gage 12462500	Reach 4502 Wenatchee River at Peshastin USGS Gage 12459000	Reach 4503 Wenatchee River at Plain USGS Gage 12457000	Reach 4506 Peshastin Creek at Green Bridge Road ECY Gage 45F070	Reach 4512 Icicle Creek above Snow Creek near Leavenworth USGS Gage 12458000	Nason Creek* near mouth ECY Gage 45J070
Jan	1	1867	1933	550	53	267	120
	15	1867	1933	550	53	267	120
Feb	1	1867	1933	550	53	267	120
	15	2400	2800	550	120	566	160
Mar	1	2400	2800	550	120	518	160
	15	2400	2800	700	120	518	160
Apr	1	2400	2800	910	120	650	160
	15	2400	2800	1150	120	650	160
May	1	2400	2800	1500	120	650	160
	15	2400	2800	2000	120	650	160
Jun	1	2400	2800	2500	120	650	160
	15	1600	1933	2000	110	550	210
Jul	1	1600	1933	1500	110	550	210
	15	1600	1933	1200	110	550	210
Aug	1	1600	1933	880	80	400	180
	15	900	1400	700	80	343	180
Sep	1	900	1311	660	80	275	165
	15	1338	1311	620	80	275	165

Time Period		Reach 4501 Wenatchee River at Monitor USGS Gage 12462500	Reach 4502 Wenatchee River at Peshastin USGS Gage 12459000	Reach 4503 Wenatchee River at Plain USGS Gage 12457000	Reach 4506 Peshastin Creek at Green Bridge Road ECY Gage 45F070	Reach 4512 Icicle Creek above Snow Creek near Leavenworth USGS Gage 12458000	Nason Creek* near mouth ECY Gage 45J070
Oct	1	1723	1932	580	53	267	120
	15	2427	2672	520	53	267	120
Nov	1	2800	2900	550	53	267	120
	15	2800	2900	550	53	267	120
Dec	1	1867	1933	550	53	267	120
	15	1867	1933	550	53	267	120

* Nason Creek is not evaluated for CRIA.

Table E-7 Flow condition score & bin by stream reach

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Code	Reach Name	Prioritization Score	Bin
4501	Wenatchee River (Reach 1)	4	3
4502	Wenatchee River (Reach 2)	3	3
4503	Wenatchee River (Reach 3)	4	3
4504	Mission Creek	27	1
4505	Brender Creek	20	1
4506	Peshastin Creek	9	2
4507	Ingalls Creek	8	2
4508	Derby Canyon	24	1
4509	Chumstick Creek	21	1
4510	Eagle Creek	28	1
4511	Little Chumstick Creek	9	2
4512	Icicle Creek	8	2
4513	Chiwaukum Creek	6	3
4514	Sand Creek	9	2
4515	Skinney Creek	24	1
4516	Beaver Creek	18	2
4517	Chiwawa River	6	3

4. Reach Results

4501 - Wenatchee River (Reach 1):

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

The Wenatchee River (Reach 1) is rated 'high' for fish utilization. The four spring Chinook stocks, Wenatchee Sockeye, and bull trout utilize this reach for rearing and adult migration life cycle stages. In contrast Coho, Wenatchee Summer Chinook and Wenatchee Summer Steelhead use Wenatchee River (Reach 1) for spawning, rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Habitat available for fish in the Wenatchee River (Reach 1) is rated as 'fair.' The majority of this reach is suitable for salmonid spawning but only a moderate portion of the reach is suitable for juvenile rearing. Only 10 – 50 % of the length of this reach has available off-channel habitat and up to 50% of the floodplain connectivity has been lost. In addition, there is a moderate loss of riparian condition with 70 – 80% of native growth forms intact. And finally, fish passage conditions are somewhat impaired during low flows.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:Yes The minimum of monthly mean flows in this reach is 692 cfs in September and the peak is 8,315 cfs in May. Minimum flow is 21 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 9 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. The instream flow rule is higher than Mean Annual Flow in 1 month of the year, on average.

Flow Scoring Detail is provided on Table E-10.

4502 - Wenatchee River (Reach 2)

Fish	Habitat	Flow
3	3	3

Fish Utilization

Wenatchee River (Reach 2) also ranks 'high' for Fish Status/Utilization but the stocks express additional life cycle stages in reach 2 as opposed to reach 1. Wenatchee spring Chinook, in addition to Wenatchee Summer Chinook, Wenatchee Steelhead and Coho spawn, rear, and migrate in this portion of the Wenatchee River. Wenatchee Sockeye and bull trout limit the life cycle stages to rearing and adult migration in this reach.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Wenatchee River (Reach 2) has a 'good' habitat rating. The majority of this reach is suitable for spawning and rearing with minor impediments to salmonid passage at low flows. Although off-channel habitat is limited to 10 – 50% of the reach, only up to 20% of the floodplain has been disconnected from surface flows. The riparian area associated with this reach maintains 70 – 80% intactness of native growth forms and a moderate loss in condition.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:Yes The minimum of monthly mean flows in this reach is 708 cfs in September and the peak is 7,771 cfs in May. Minimum flow is 23 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent less than 1 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component. The instream flow rule is higher than Mean Annual Flow in 1 month of the year, on average.

Flow Scoring Detail is provided on Table E-10.

4503 - Wenatchee River (Reach 3)

Fish	Habitat	Flow
3	2	3

Fish Utilization

Wenatchee River (Reach 3) is the uppermost reach evaluated in the Lower Wenatchee subbasin. Fish Status/Utilization rates 'high' for this reach. Adults of all nine stocks use this reach as a migration corridor. Bull trout is the only stock that does not spawn in this reach. All nine stocks utilize Wenatchee River (Reach 3) for rearing.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

The habitat rating for Wenatchee River (Reach 3) is 'good.' The majority of the reach is suitable for salmonid spawning and rearing with minor impediments to salmonid passage during low flows. Off channel habitat is only available along 10 – 50% of this reach whereas up to 50% of the floodplain connectivity has been lost. Seventy to 80% of the riparian native growth forms remain intact.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:Yes The minimum of monthly mean flows in this reach is 533 cfs in September and the peak is 5,708 cfs in June . Minimum flow is 24 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent less than 1 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component. The instream flow rule is higher than Mean Annual Flow in 1 month of the year, on average.

Flow Scoring Detail is provided on Table E-10.

4504 - Mission Creek

Fish	Habitat	Flow
2	1	1

Fish Utilization

Fish Status/Utilization for Mission Creek, a tributary of the Wenatchee River, rates 'average.' Wenatchee Sockeye stock is not present in this reach whereas the other eight stocks use the creek for juvenile rearing. Wenatchee Summer Steelhead and Coho utilize Mission Creek for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

The habitat rating for Mission Creek is 'poor.' There is little to no off channel habitat, floodplain connectivity has been reduced to less than 50% and less than 70% of available native growth forms remain intact. In addition there are numerous artificial barriers that impede upstream and downstream salmonid migration at a broad range of flows. Mission Creek has a major reduction in suitable spawning habitat whereas only a moderate portion of the stream reach is suitable for salmonid rearing.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 1 cfs in August and the peak is 44 cfs in March . Minimum flow is 4 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversion data used for this evaluation exceed the Mean Annual Flow.

Flow Scoring Detail is provided on Table E-10.

4505 - Brender Creek

Fish	Habitat	Flow
2	1	1

Fish Utilization

Brender Creek is a tributary to Mission Creek and the eight stocks that use Mission Creek are also found in Brender Creek. Wenatchee Summer Steelhead and Coho use this reach for spawning, rearing and adult migration life cycle stages. In contrast Wenatchee Spring Chinook, Wenatchee Summer Chinook, and bull trout utilize Brender Creek for rearing. Wenatchee Sockeye stock is not present in Brender Creek. As a result of the life cycle stages and duration of use expressed above, this reach has an 'average' Fish Status/Utilization rating.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Brender Creek rates 'poor' for salmonid habitat. Up to 50% of the floodplain connectivity has been lost along with 90% of the off channel habitat. The riparian condition has been severely reduced providing inadequate salmonid habitat. A moderate portion of the reach is suitable for salmonid spawning and rearing but numerous artificial barriers and /or riffles impede upstream and/or downstream salmonid migration at a broad range of flows.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 1 cfs in November and the peak is 5 cfs in March . Minimum flow is 49 percent of the average; reaches with August flows between 33% and 66% of average scored 'fair' for this component of the flow element score. The hydrograph for this reach shows two peaks for this reach, in April-May and again in September. This might be linked to irrigation diversions in summer months.

Flow Scoring Detail is provided on Table E-10.

4506 - Peshastin Creek

Fish	Habitat	Flow
3	2	2

Fish Utilization

Fish Status/Utilization for Peshastin Creek is rated as 'high.' This tributary to the Wenatchee River supports the life cycle stages of eight stocks. Wenatchee Sockeye is the only stock not present. Wenatchee Spring Chinook, Wenatchee Summer Steelhead, and Coho express spawning, rearing, and adult migration life cycle stages in this creek, whereas bull trout express rearing and adult migration and Wenatchee Summer Chinook rearing.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Peshastin Creek has 10 – 50% of off channel habitat remaining but there has been a severe reduction in floodplain connectivity and riparian condition. The floodplain connectivity has been reduced to less than 50% remaining and the riparian condition to less than 70% of native growth form intact. In contrast a majority of the reach is suitable for salmonid spawning and rearing but a few artificial barriers and/or riffles exist that reduce upstream and/or downstream salmonid migration at low flows. As such, Peshastin Creek rates 'fair' for salmonid habitat.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:Yes The minimum of monthly mean flows in this reach is 15 cfs in August and the peak is 489 cfs in March . Minimum flow is 9 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 3 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component. The instream flow rule is higher than Mean Annual Flow in 4 months of the year, on average.

Flow Scoring Detail is provided on Table E-10.

4507 - Ingalls Creek

Fish	Habitat	Flow
3	2	2

Fish Utilization

Ingalls Creek, a tributary to Peshastin Creek, is rated 'high' for fish utilization. Fish presence is reduced to seven stocks but those stocks express all three life cycle stages. Wenatchee Sockeye and Wenatchee Summer Chinook are not present.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Ingalls Creek has a 'fair' rating for salmonid habitat. Only minor impediments to upstream and/or downstream salmonid migration at low flows exist in this creek. A moderate portion of this reach is suitable for salmonid spawning and rearing. In contrast there has been a moderate reduction of off channel habitat, floodplain connectivity and riparian condition. This equates to 10 – 50% off channel habitat remaining, a loss of up to 50% of floodplain connectivity and only70 – 80% of native growth forms intact.

Additional habitat information is available on Table E-9.

Flow

Gauge:No Rule:No An NHD+ estimated 53 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow Scoring Detail is provided on Table E-10.

4508 - Derby Canyon

Fish	Habitat	Flow
2	1	1

Fish Utilization

Derby Canyon rates 'low' for fish utilization. This reach is a tributary to the mainstem Wenatchee River but late summer and winter irrigation limits use by salmonids. Bull trout, Coho, Wenatchee Summer Chinook and Wenatchee Spring Chinook stocks only express the juvenile rearing life cycle stage and the amount of time spent rearing may be limited by dewatering. Wenatchee Summer Steelhead is able to spawn, rear, and migrate in Derby Canyon whereas Wenatchee Sockeye is not present.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Numerous artificial barriers and/or riffles exist in Derby Canyon that impede upstream and/or downstream salmonid migration at a broad range of flows. In addition a majority of the reach is unsuitable for salmonid spawning. In contrast, a moderate portion of the stream is suitable for rearing. A moderate reduction in riparian condition and floodplain connectivity has occurred. Riparian condition has been reduced to 70 – 80% of native growth form intactness and floodplain connectivity up to 50% reduction. There is little to no off channel habitat remaining. These habitat conditions lead to a 'poor' salmonid habitat rating.

Additional habitat information is available on Table E-9.

Flow

Gauge:No Rule:No An NHD+ estimated 4 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 6 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component.

Flow Scoring Detail is provided on Table E-10.

4509 - Chumstick Creek

Fish	Habitat	Flow
2	2	1

Fish Utilization

Chumstick Creek is another primary tributary to the mainstem Wenatchee River. Some of the juveniles from Wenatchee Spring Chinook, and Wenatchee Summer Chinook that spawn in the mainstem move into Chumstick Creek to rear. Bull trout also rear in Chumstick Creek but spawning likely occurs in the headwaters outside the Chumstick reach used for this project. Coho and Wenatchee Summer Steelhead are the only two stocks to express all three life cycle stages in this reach. Wenatchee Sockeye stock is not present here. As a result of the limited expression of life cycle stages in this reach, Fish Status/Utilization is rated as 'average.'

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Salmonid habitat in the Chumstick Creek reach is rated as 'fair,' but bordering on 'poor.' Spawning and rearing habitat is suitable along a moderate portion of the reach whereas a few artificial barriers and/or riffles reduce upstream and/or downstream salmonid migration at low flows. The off channel habitat has been reduced to 10 – 50 % of the reach whereas the floodplain connectivity has been reduced up to 50%. Riparian condition has been severely reduced with less than 70% of the native growth form intact.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 3 cfs in October and the peak is 34 cfs in April . Minimum flow is 23 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 31 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow Scoring Detail is provided on Table E-10.

4510 - Eagle Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Eagle Creek is a tributary to Chumstick Creek and similar Fish Status/Utilization carries into the Eagle Creek reach. Wenatchee Spring Chinook, Wenatchee Summer Chinook and bull trout only utilize this reach for rearing where as Eagle Creek is outside Wenatchee Sockeye range. In contrast Coho and Wenatchee Summer Steelhead are able to express all three life cycle stages in this reach. Eagle Creek also rated 'average' for fish utilization.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Eagle Creek salmonid habitat is rated as 'fair,' bordering on 'poor.' The lowest scoring attribute is passage conditions with numerous artificial barriers and/or riffles within the reach that impede upstream and/or downstream migration. A moderated portion of the reach is suitable for salmonid spawning and rearing. Moderate reduction has occurred in off channel habitat, floodplain connectivity, and riparian condition. The reach has off channel habitat that comprises only 10 – 50% of the reach length, up to 50% of floodplain surface water connectivity is lost and 70 – 80% intactness of native growth forms remain.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:No Spotty gauge data make this a very difficult reach to evaluate. Minimum flow in this reach nears 0 in July-October and the peak is 11 cfs in March . Minimum flow is 3 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 64 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow Scoring Detail is provided on Table E-10.

4511 - Little Chumstick Creek

Fish	Habitat	Flow
1	2	2

Fish Utilization

Little Chumstick Creek is a small tributary of Chumstick Creek. Due to reach size, location and/or irrigational dewatering, this reach supports very few stocks and life cycle stages. Because of this, Fish Status/Utilization rates as 'low.' Three stocks utilize this reach for rearing only. Those stocks are bull trout, Coho, and Wenatchee Summer Steelhead. The other six stocks are not present in Little Chumstick Creek.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

The Salmonid habitat rating for Little Chumstick Creek is 'fair.' Salmonid passage is adequate for migration except at extremely low flows but spawning and rearing habitat suitability is limited to a moderate portion of the reach. Riparian conditions consist of moderately high level of woody vegetation and more than 80% of the native growth forms intact. Off channel habitat is limited to 10 – 50% of the reach length whereas floodplain connectivity is limited to less than 50 %.

Additional habitat information is available on Table E-9.

Flow

Gauge:No Rule:No An NHD+ estimated 12 cfs Mean Annual Flow was used to score this reach. Mean August flow estimate is 32.8% of the MAF, which yields a 'poor' score for this attribute. No diversion data are available in this reach. In spite of low flows and high variability, this reach bins "fair" in relation to other reaches in the WRIA.

Flow Scoring Detail is provided on Table E-10.

4512 - Icicle Creek

Fish	Habitat	Flow
3	2	2

Fish Utilization

Fish Status/Utilization for Icicle Creek is rated 'high.' This reach is a tributary to the mainstem Wenatchee River that supports life cycle stages of all nine stocks. Wenatchee Spring Chinook, Wenatchee Summer Chinook, Wenatchee Steelhead, Wenatchee Sockeye and Coho utilize Icicle Creek for spawning, rearing and adult migration. The other stock, bull trout, expresses rearing and adult migration life cycle stages.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Salmonid habitat at Icicle Creek is rated as 'good.' The majority of Icicle Creek is suitable for spawning and rearing with only minor impediments to salmonid passage at low flows. In contrast, the off channel habitat has been reduced to 10 – 50 % of the reach and the floodplain connectivity by up to 50%. Riparian condition has been moderately reduced with 70 - 80% of the native growth forms intact.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:Yes The minimum monthly mean flow in this reach is 143 cfs in September and the peak is 1,579 cfs in May. Minimum flow is 24 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversion data used for this evaluation exceed the Mean Annual Flow. The instream flow rule is higher than minimum Mean Annual Flow in 11 months of the year, but during average flows, instream flow rules are met.

Flow Scoring Detail is provided on Table E-10.

4513 - Chiwaukum Creek

Fish	Habitat	Flow
3	3	3

Fish Utilization

Chiwaukum also has a 'high' Fish Status/Utilization rating. The difference between Chiwaukum Creek and Icicle Creek is that Wenatchee Sockeye stock is not present and bull trout express all three life cycle stages. The other seven stocks also express all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

The overall rating of salmonid habitat for Chiwaukum Creek is ‘good.’ Off channel habitat exists along 50 – 80% of the reach length, and 80% of the surface water connectivity to the floodplain remains. In addition, a majority of the reach is suitable for spawning and rearing. Riparian condition may be one of the week points for salmonid habitat. Woody vegetation is moderately low and 70 – 80% of native growth forms are intact. Another week point may be passage conditions. A few artificial barriers and/or riffles reduce upstream and/or downstream salmonid migration at low flows.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:No The minimum monthly mean flow in this reach is 21 cfs in September and the peak is 281 cfs in June. August flow is 37 percent of the average; reaches with August flows between 33% and 66% of average scored ‘fair’ for this component of the flow element score. No diversion data are available in this reach.

Flow Scoring Detail is provided on Table E-10.

4514 - Sand Creek

Fish	Habitat	Flow
1	1	2

Fish Utilization

Sand creek is a tributary to Mission Creek and rates ‘low’ for fish utilization. Wenatchee Summer Steelhead and bull trout are the only stocks found in Sand Creek. Bull trout utilize this reach for juvenile rearing. In contrast, Wenatchee Summer Steelhead expresses all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Available salmonid habitat in Sand Creek is rated as ‘poor.’ Off channel habitat, floodplain connectivity, spawning suitability, and passage conditions received the lowest marks possible. Sand Creek has little or no off channel habitat with less than 50% of floodplain connectivity remaining. In addition the reach has had a major reduction in suitable spawning habitat and numerous artificial barriers and/or riffles within the reach that impede upstream and/or downstream migration at a broad range of flows. A moderate amount of suitable rearing habitat is available and moderate reduction of riparian condition has occurred.

Additional habitat information is available on Table E-9.

Flow

Gauge:No Rule:No An NHD+ estimated 6 cfs Mean Annual Flow was used to score this reach. Estimated mean August flow is 23% of MAF, yielding a 'poor' score for this attribute. No diversion data are available in this reach.

Flow Scoring Detail is provided on Table E-10.

4515 - Skinney Creek

Fish	Habitat	Flow
2	2	1

Fish Utilization

Skinney Creek, a tributary to the Chiwaukum Creek, has a rating of 'average' for fish utilization. Wenatchee Sockeye is not present in the creek whereas Coho and Wenatchee Summer Steelhead express spawning, rearing and migration behavior. Bull trout Wenatchee Summer Chinook and Wenatchee Spring Chinook use this stream for rearing.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Skinney Creek rates 'fair' for salmonid habitat. The reach has had a moderate reduction in spawning and rearing habitat and a few artificial barriers and/or ripples reduce upstream and/or downstream salmonid migration at low flows. In addition the reach has had a reduction of 20 – 30% of riparian condition and contains 10 – 50% of the off channel habitat along the reach. In contrast the floodplain connectivity has been severely reduced (greater than 50%).

Additional habitat information is available on Table E-9.

Flow

Gauge:No Rule:No An NHD+ estimated 4 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 13 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component. Still, the low overall flow volume tips this reach into the 'poor' bin.

Flow Scoring Detail is provided on Table E-10.

4516 - Beaver Creek

Fish	Habitat	Flow
2	2	2

Fish Utilization

Beaver Creek is a tributary to the mainstem Wenatchee River. This creek is rated as 'average' for fish utilization. Coho and Wenatchee summer steelhead express all three life cycle behaviors, whereas Wenatchee Spring Chinook, bull trout, and Wenatchee Summer Chinook only express juvenile rearing. Wenatchee Sockeye stock is not present in the creek.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Salmonid habitat in Beaver Creek is rated as 'good.' This creek has had a moderately low reduction in riparian condition with 80% or more of the native growth forms intact. The majority of Beaver Creek is suitable for spawning and rearing. In contrast, off channel habitat is limited to 10 – 50% of the length with up to 50% of surface water connectivity lost. A few artificial barriers and/or ripples reduce upstream and/or downstream salmonid migration at low flows.

Additional habitat information is available on Table E-9.

Flow

Gauge:No Rule:No An NHD+ estimated 5 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 12 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component.

Flow Scoring Detail is provided on Table E-10.

4517 - Chiwawa River

Fish	Habitat	Flow
3	3	3

Fish Utilization

Chiwawa River is a tributary to the mainstem Wenatchee River and rates 'high' for fish utilization. Seven stocks use the river for spawning, rearing and adult migration behavior. In contrast bull trout express rearing and adult migration. Wenatchee Sockeye stock is not present in this reach.

Fish Status/Utilization scoring detail is available on Table E-8.

Habitat

Salmonid habitat in Chiwawa River is rated as ‘good.’ It is the only defined reach in the basin to have virtually undisturbed conditions in three categories evaluated in this project. These categories are riparian condition, rearing suitability and passage conditions. The riparian corridor has a good mix of tall and short vegetation. The reach has a good mix of pools and riffles with high numbers of large woody debris. Salmonids are able to migrate up and downstream without impediments. Although spawning suitability, floodplain connectivity and off channel habitat are not pristine, conditions are still good. Off channel habitat exists along 50 – 80% of the reach. Only up to 20% of surface water connection has been lost and a majority of the reach is suitable for spawning.

Additional habitat information is available on Table E-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 142 cfs in September and the peak is 1,689 cfs in June . Minimum flow is 26 percent of the average; reaches with August flows less than 33% of average scored ‘poor’ for this component attribute. Diversions evaluated for this project represent 12 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored ‘fair’ for this scoring component. The reach bins high, or ‘good’ because overall flow volumes are high compared to other reaches in this WRIA.

Flow Scoring Detail is provided on Table E-10.

[Intentionally Blank]

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

5. Scoring Sheets

Table E-8 Fish Scoring Sheet

Code	Reach Name	Reach Score & Bin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4501	Wenatchee River (Reach 1)	466	33	32	36	36	49	48	48	50	33	35	33	33
4502	Wenatchee River (Reach 2)	578	47	46	50	36	49	48	48	64	47	49	47	47
4503	Wenatchee River (Reach 3)	586	48	47	51	36	49	48	48	65	48	50	48	48
4504	Mission Creek	335	29	28	31	31	31	29	26	28	24	26	26	26
4505	Brender Creek	335	29	28	31	31	31	29	26	28	24	26	26	26
4506	Peshastin Creek	521	43	42	45	31	45	46	43	59	41	43	43	40
4507	Ingalls Creek	541	46	44	47	33	47	45	42	58	44	46	46	43
4508	Derby Canyon	283	22	23	29	29	29	29	23	23	19	19	19	19
4509	Chumstick Creek	335	29	28	31	31	31	29	26	28	24	26	26	26
4510	Eagle Creek	335	29	28	31	31	31	29	26	28	24	26	26	26
4511	Little Chumstick Creek	56	3	3	3	8	8	8	8	3	3	3	3	3
4512	Icicle Creek	558	46	45	48	33	46	48	46	63	46	48	46	43
4513	Chiwaukum Creek	560	47	46	49	35	48	46	44	60	46	48	47	44
4514	Sand Creek	108	9	9	12	12	12	12	9	9	6	6	6	6
4515	Skinney Creek	335	29	28	31	31	31	29	26	28	24	26	26	26
4516	Beaver Creek	335	29	28	31	31	31	29	26	28	24	26	26	26
4517	Chiwawa River	569	47	46	49	35	48	46	47	63	46	48	47	47
Monthly Totals			565	551	605	510	616	598	562	685	523	551	541	529

Note: Reach names link to workbook tabs

Table E-7 (continued)

SaSI Stocks in the Wenatchee Basin	SaSI Stock Rating	Weight Factor**
Wenatchee Summer Chinook - 1768	Healthy	1
Chiwawa Spring Chinook - 1776	Depressed	2
Nason Creek Spring Chinook - 1784	Depressed	2
Little Wenatchee Spring Chinook - 1792	Critical	3
White River Spring Chinook - 1800	Critical	3
Wenatchee Summer Steelhead - 6896	Depressed	2
Wenatchee Sockeye - 5800	Healthy	1
Ingalls Creek Bull Trout - 8564	Unknown	2
Icicle Creek Bull Trout - 8576	Unknown	
Chiwaukum Creek Bull Trout - 8588	Unknown	
Chiwawa River Bull Trout - 8600	Unknown	
Chickamin Creek Bull Trout- 8612	Healthy	
Rock Creek Bull Trout - 8624	Healthy	
Phelps Creek Bull Trout - 8636	Healthy	
Nason Creek Bull Trout - 8648	Unknown	
Little Wenatchee River Bull Trout - 8660	Unknown	
White River Bull Trout - 8672	Unknown	
Panther Creek Bull Trout - 8684	Healthy	
Coho- SaSI stock not assigned	Unknown	2

** Weighting Factor Values by SaSI Stock Status:	Weight
Healthy	1
Depressed	2
Unknown	2
Critical	3

Weighting Factor for Federally Listed Species:	ESA Weight Factor
Assign additional weight to stocks that are listed as Threatened or Endangered under the ESA? (yes=1; no=0)	1
Assign additional weight to reaches within Interior Columbia TRT-designated spawning areas (MaSAs or MiSAs)? (yes=1; no=0)	0

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table E-9 Habitat Scoring Sheet

Code	Reach Name	Total Score	Off Channel Habitat (OCHs)	Flood-plain Connec-tivity	Riparian Cond-ition	Spawning Suita-bility	Rearing Suita-bility	Passage Condi-tion
4501	Wenatchee River (Reach 1)	14	2	2	2	3	2	3
4502	Wenatchee River (Reach 2)	16	2	3	2	3	3	3
4503	Wenatchee River (Reach 3)	15	2	2	2	3	3	3
4504	Mission Creek	7	1	1	1	1	2	1
4505	Brender Creek	9	1	2	1	2	2	1
4506	Peshastin Creek	12	2	1	1	3	3	2
4507	Ingalls Creek	13	2	2	2	2	2	3
4508	Derby Canyon	9	1	2	2	1	2	1
4509	Chumstick Creek	11	2	2	1	2	2	2
4510	Eagle Creek	11	2	2	2	2	2	1
4511	Little Chumstick Creek	14	2	2	3	2	2	3
4512	Icicle Creek	15	2	2	2	3	3	3
4513	Chiwaukum Creek	16	3	3	2	3	3	2
4514	Sand Creek	8	1	1	2	1	2	1
4515	Skinney Creek	11	2	1	2	2	2	2
4516	Beaver Creek	15	2	2	3	3	3	2
4517	Chiwawa River	21	3	3	4	3	4	4

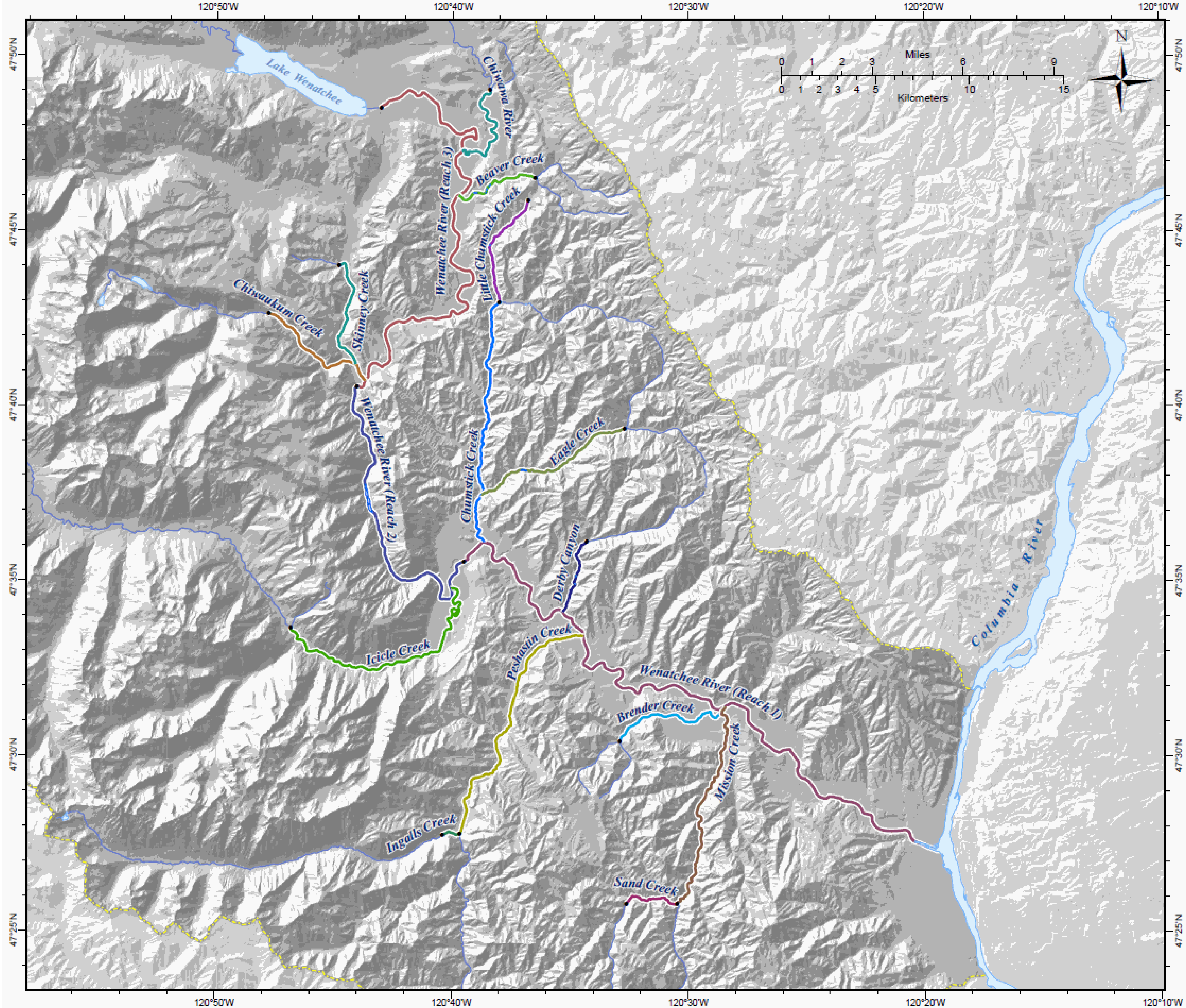
Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table E-10 Flow Scoring Sheet

		GOOD is HIGH	POOR is HIGH; GOOD is LOW >>>>>>>>>>>>>>>>>>>					
				A	B	C	D	E
Code	Reach Name	BIN	Sum scores (A:D) * E	% of Mo Avg Below Rule	Qi Deviation	No. Claims	August Deviation from Mean Annual Flow	Flow Volume Factor
4501	Wenatchee River (Reach 1)	3	4	1	2	3	2	0.5
4502	Wenatchee River (Reach 2)	3	3	1	1	2	2	0.5
4503	Wenatchee River (Reach 3)	3	4	1	1	3	2	0.5
4504	Mission Creek	1	27		3	3	3	3.0
4505	Brender Creek	1	20		1	3	1	4.0
4506	Peshastin Creek	2	9	2	1	3	3	1.0
4507	Ingalls Creek	2	8		0	1	3	2.0
4508	Derby Canyon	1	24		2	1	3	4.0
4509	Chumstick Creek	1	21		3	1	3	3.0
4510	Eagle Creek	1	28		3	1	3	4.0
4511	Little Chumstick Creek	2	9				3	3.0
4512	Icicle Creek	2	8	1	3	2	2	1.0
4513	Chiwaukum Creek	3	6		0	1	2	2.0
4514	Sand Creek	2	9				3	3.0
4515	Skinney Creek	1	24		2	1	3	4.0
4516	Beaver Creek	2	18		2	1	3	3.0
4517	Chiwawa River	3	6		2	2	2	1.0

6. Maps

Figure E-1 Assessed Stream Reaches

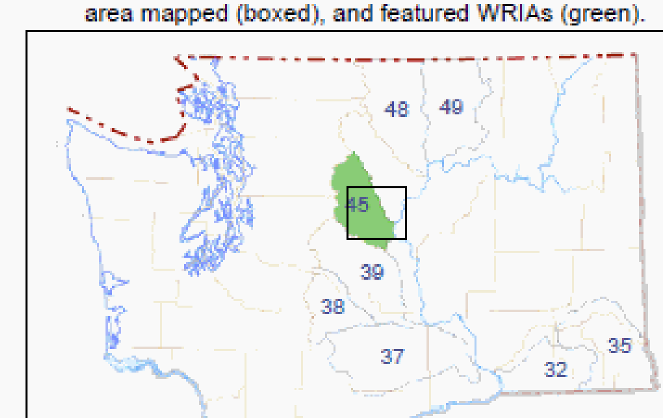


Wenatchee River Basin
WRIA 45
Assessed Stream Reaches
colored for visual reference

• — Assessed Stream Reach upper extents

Continuation of Assessed Streams to Headwaters

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

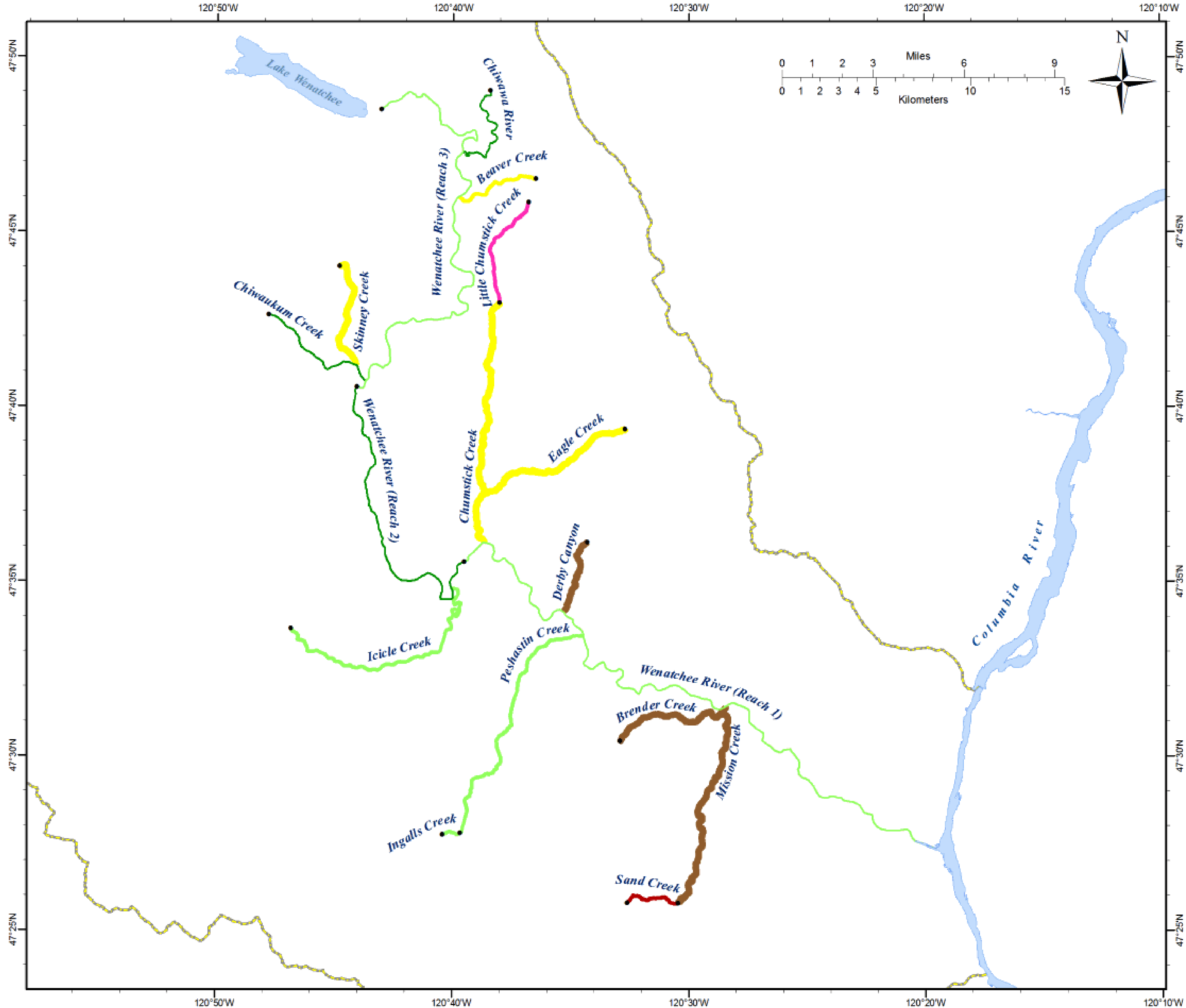


Printed 08/15/2011

WRIA 45 Wenatchee River Basin - Priority Streams

[Intentionally Blank]

Figure E-2 CRIA Scoring
Fish, Habitat, Flow Combined



DEPARTMENT OF ECOLOGY State of Washington

Washington Department of FISH and WILDLIFE

Wenatchee River Basin
WRIA 45
Combined Prioritization Scores for Fish, Habitat, and Flow

Fish Status/Utilization and Habitat Condition scores use this color scheme:

Fish Score
Low | Avg | High

Habitat Score
Good | Fair | Poor

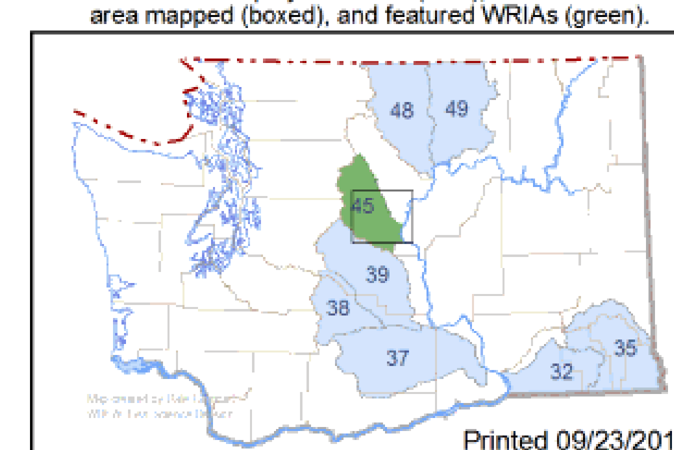
Flow Condition score uses line thickness

Good
Fair
Poor

• — Assessed Stream Reach upper extents

WRIA Boundary

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

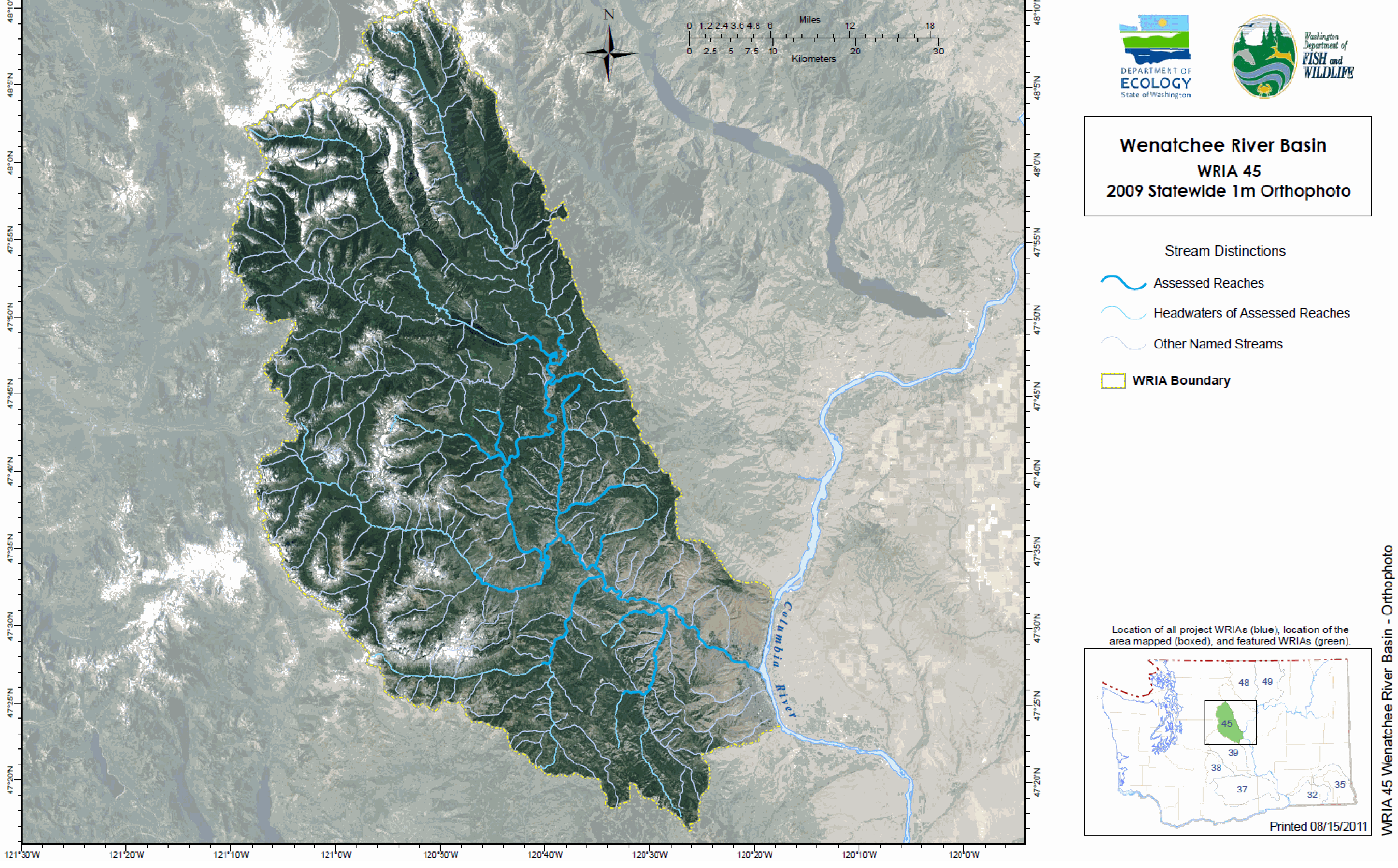


Printed 09/23/2011

WRIA 45 - Wenatchee River Basin - Fish, Habitat, and Flow

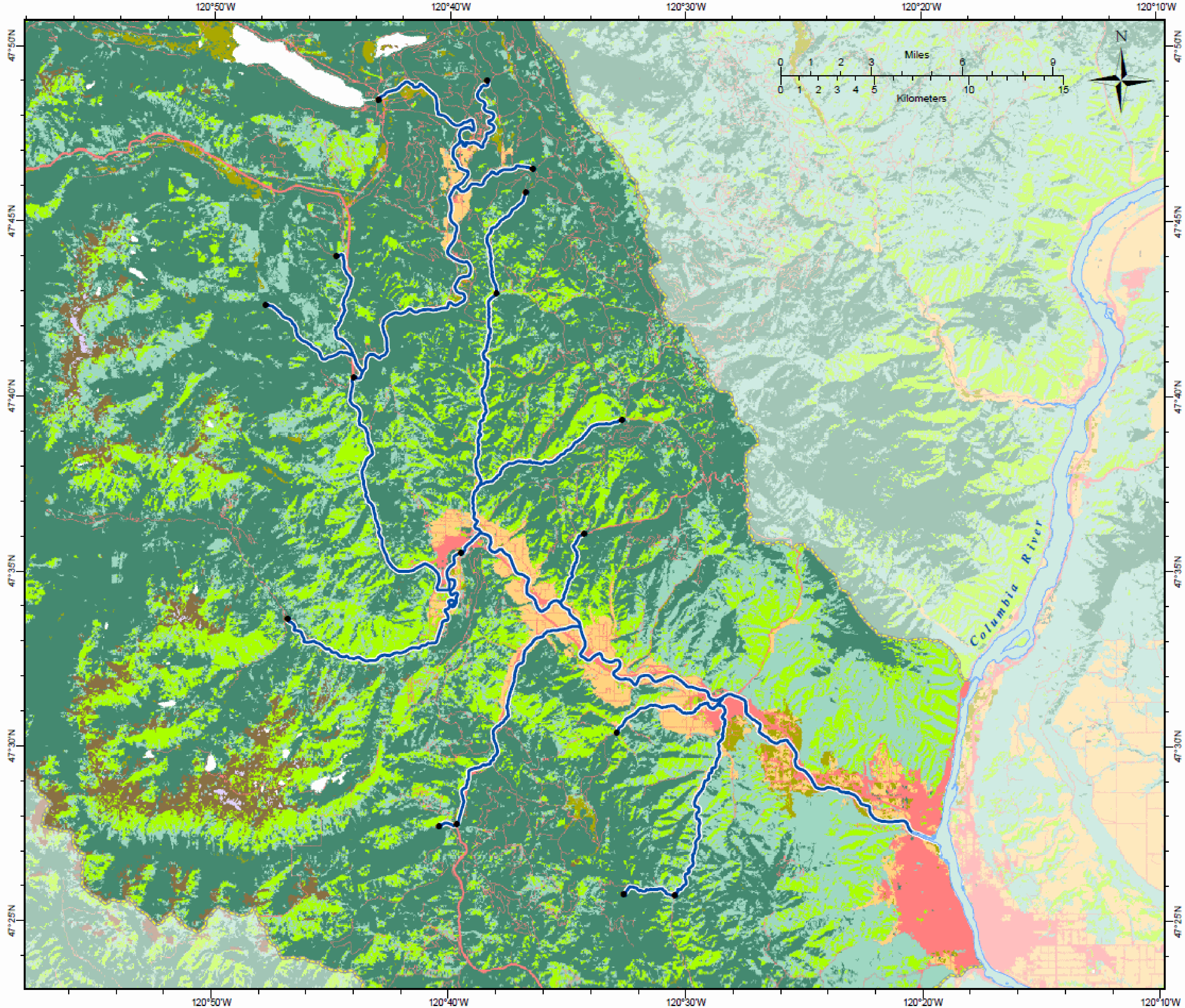
[Intentionally Blank]

Figure E-3 2001 Statewide 1m Orthophoto



[Intentionally Blank]

Figure E-4 2001 National Land Cover Database



Wenatchee River Basin

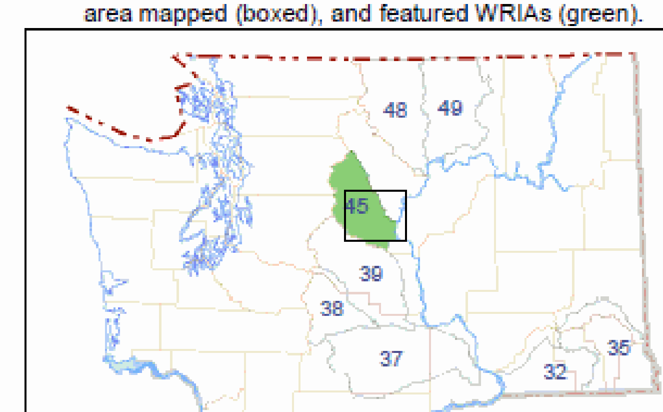
WRIA 45
2001 National Land Cover Database

Land Cover and Use

- Snow and Ice
- Developed
- Barren
- Forest
- Scrub
- Grasslands
- Agriculture
- Riparian

Assessed Stream Reaches with upper extents marked

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).



Printed 08/15/2011

WRIA 45 Wenatchee River Basin - NLCD

[Intentionally Blank]

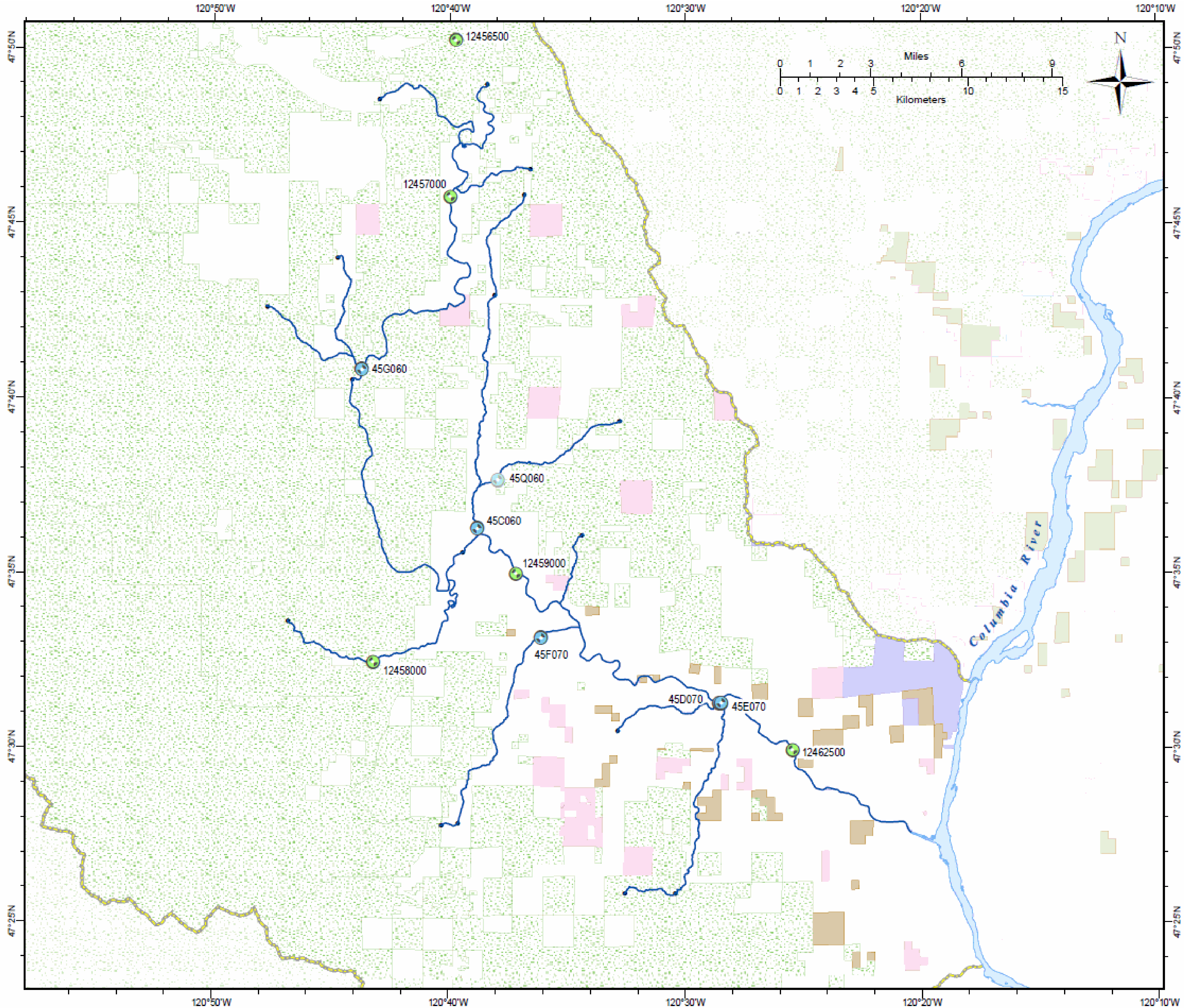


Figure E-5 Stream Gauge Identification and Land Management

DEPARTMENT OF ECOLOGY State of Washington

Washington Department of FISH and WILDLIFE

Wenatchee River Basin

WRIA 45
Stream Gauge Identification and Land Management

Stream Gauges by Agency

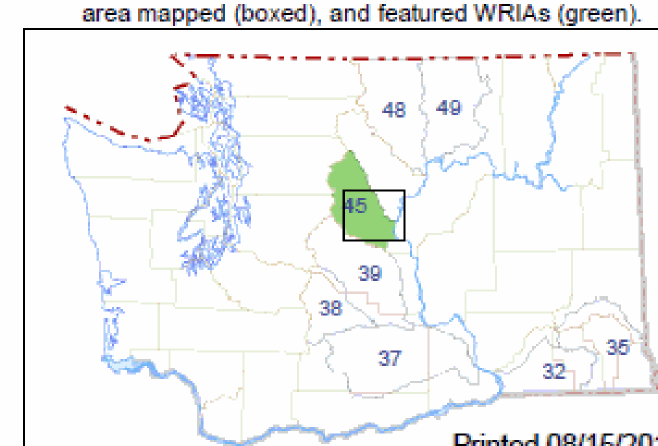
- WA DOE
- WA DOE (limited data)
- USBR
- USGS
- USGS (limited data)

Generalized Land Management

- Tribal
- US Bureau of Land Mgmt.
- US Bureau of Reclamation
- US Forest Service
- WA Dept. Fish & Wildlife
- WA Dept. Natural Resources

Assessed Stream Reaches with upper extents marked

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).



Printed 08/15/2011

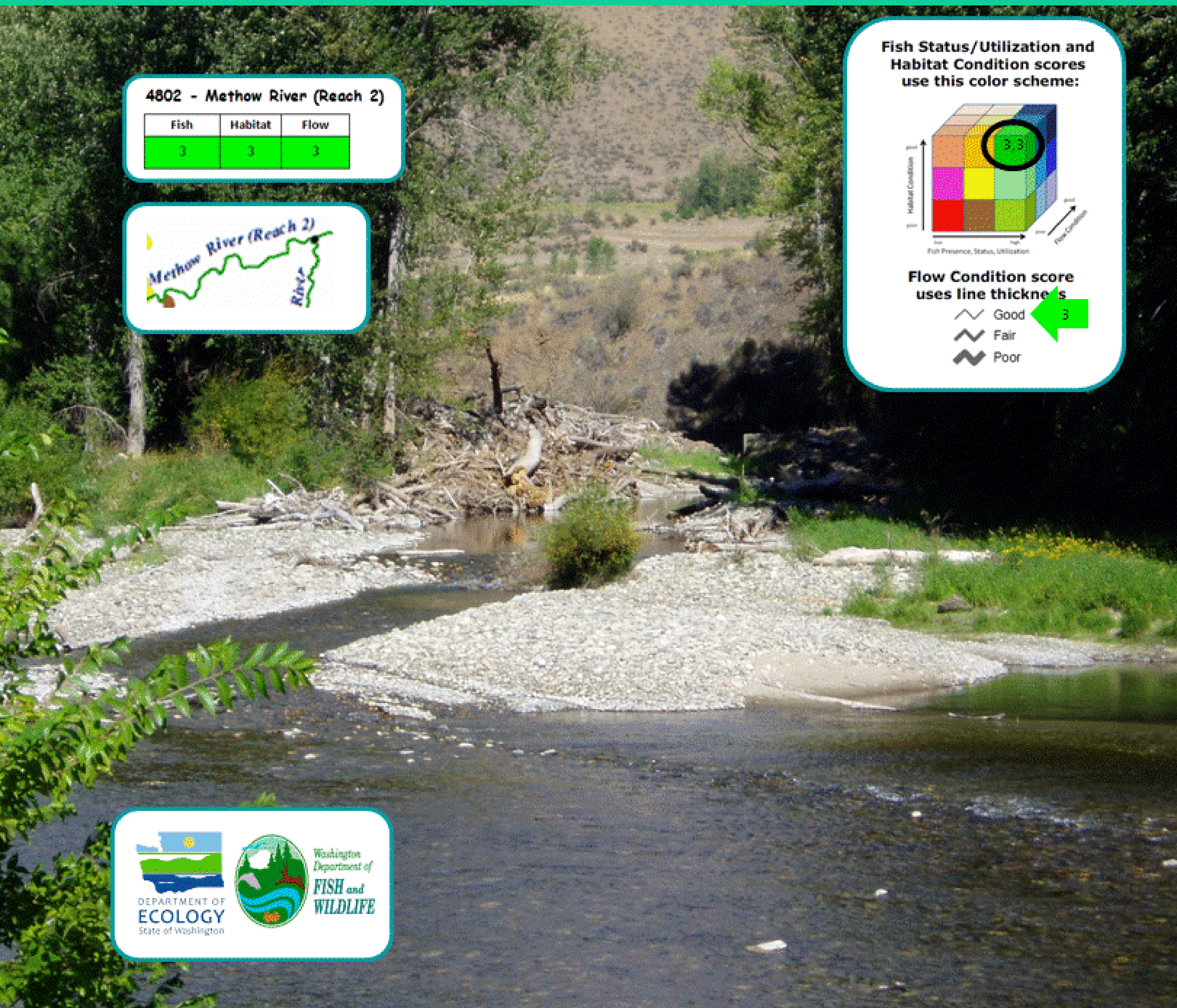
WRIA 45 Wenatchee River Basin - Gauges, Lands

Columbia River Instream Atlas Project

Washington Department of Fish and Wildlife

Final Report – APPENDIX F

WRIA 48 METHOW



Ecology Contract C1000090 - WDFW Contract 09-1471

Ecology Publication Number: 11-12-015

September 2011

Columbia River Instream Atlas Project - Final Report Appendix F –WRIA 48 Methow

September 23, 2011

Washington Department of Fish and Wildlife CRIA Team:

Teresa Scott (Habitat Water Resources Policy Coordinator)
Jonathan Kohr (Habitat Water Science Team)
Dayv Lowry (Fish Science; Habitat Science)
Andrew Weiss (Fish Science)
Aaron Bosworth (King County District Fish Biologist)
Jim Cummins (Yakima District Fish Biologist)
Dale Gombert (Fish Science)
Paul La Riviere (Habitat Water Science Team)
Peggy Miller (Habitat Major Projects)
Brianna Murphy (Fish Science)

Funding provided by Ecology Office of Columbia River as part of the 2011 Columbia Basin Long-term Water Supply and Demand Forecast

Ecology Contract C1000090

WDFW Contract 09-1471

Ecology Publication Number: 11-12-015

If you need this document in a format for the visually impaired, call the Office of Columbia River at (509) 575-2490. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

Cover Photo: Jonathan Kohr

Columbia River Instream Atlas Project

Final Report

Appendix F - WRIA 48 - Methow

September 23, 2011

Table of Contents

Tables

Figures

1. Description

The Methow River Basin (WRIA 48) is located in Okanogan County in north central Washington. The Methow River occupies a deep valley draining the eastern slope of the north Cascade Mountains and forms an important tributary to the Columbia River. The Methow basin consists of about 1,167,764 acres. About 89% of the basin is in public ownership. The remaining 11% is privately owned and is primarily within the valley bottoms. The subbasin consists of ten primary watersheds: Early Winters Creek, Upper Methow, Lost, Middle Methow, Chewuch, Twisp, Beaver Creek, Gold

Creek, Libby Creek, and the Lower Methow Rivers. Spring Chinook, steelhead, and bull trout spawn and rear in the Methow basin[1].

2. Reach Definitions

Many of the Methow stream reaches evaluated for this project extended into Forest Service (USFS) lands where there are no possibilities for water acquisition. In these cases, the beginning of the USFS property would demarcate the upper boundary of the reach. Other stream reaches, as in other watersheds, extend upstream to a major contributor of water, where there are few to no other diversions upstream, or where habitat changes enough to start a new reach. There were only thirteen reaches evaluated for the 2002 water acquisition priorities whereas this new assessment contains thirty-five. In some streams there are very few diversions with low potential for any flow augmentation. But in review of water rights, there still remained that potential, with small volumes of water rights, to augment flows. And the potential to increase habitat with small amounts of water into a smaller system can prove beneficial in restoration and recovery efforts within the Columbia River and its tributaries.

Table F-1 Reach Definitions

Stream Name	Code	Stream Reach Description
Methow River (Reach 1)	4801	Mouth to Twisp River
Methow River (Reach 2)	4802	Twisp River to Chewuch River
Methow River (Reach 3)	4803	Chewuch River to Early Winters Creek
Squaw Creek	4804	Mouth to Squaw Creek Road crossing
French Creek	4805	Mouth to DNR boundary
Petes Creek	4806	Mouth to Highway 123
McFarland Creek	4807	Mouth to 2nd McFarland Road Crossing
Cow Creek	4808	Mouth to road crossing at 120°03’10.24”, 48°11’40.18”
Libby Creek	4809	Mouth to uppermost extent of USFS boundary
Texas Creek	4810	Mouth to North Fork Texas Creek
Puckett Creek	4811	Mouth to Biggers Road
Leecher Canyon	4812	Mouth to USFS boundary
Benson Creek	4813	Mouth to USFS boundary
Alder Creek	4814	Mouth to USFS boundary
Beaver Creek (Reach 1)	4815	Mouth to Frazer Creek
Beaver Creek (Reach 2)	4816	Frazer Creek to South Fork Beaver Creek
Black Canyon Creek	4817	Mouth to USFS boundary
Booth Canyon Creek	4818	Mouth to Booth Canyon Creek forks

1 Adapted from Northwest Power and Conservation Council 2005b; Upper Columbia Salmon Recovery Board 2007

Stream Name	Code	Stream Reach Description
Frazer Creek	4819	Mouth to USFS boundary
Twisp River	4820	Mouth to Buttermilk Creek
Poorman Creek	4821	Mouth to USFS boundary
Little Bridge Creek	4822	Mouth to upper diversion
Buttermilk Creek	4823	Mouth to Buttermilk Creek forks
Thompson Creek	4824	Mouth to USFS boundary
Bear Creek	4825	Mouth to USFS boundary
Chewuch River	4826	Mouth to USGS gauge 12447600
Cub Creek	4827	Mouth to USFS boundary
Ramsey Creek	4828	Mouth to road crossing at USFS boundary
Little Boulder Creek	4829	Mouth to USFS boundary
Wolf Creek	4830	Mouth to diversion dam
Little Falls Creek	4831	Mouth to South Fork Little Falls Creek
Fawn Creek	4832	Mouth to USFS boundary
Goat Creek	4833	Mouth to Goat Cr Road (AKA FR 52)
Gold Creek	4834	Mouth to South Fork Gold Creek
Early Winters Creek	4835	Mouth to Early Winters Diversion

3. WRIA Results

Fish Status and Utilization

Components of the Fish Status / Utilization score and ranking are SaSI status, ESA status, fish diversity, and time spent in the reach for spawning/incubation, rearing/smolt migration and adult migration. TRT designation was not considered in this rating but is available on the spreadsheets for inclusion in future evaluations.

Eight stocks are found in the Methow Basin: Twisp, Methow, Lost River, and Chewuch Spring Chinook; Methow Summer Chinook; Methow Summer Steelhead; Bull Trout; and reintroduced coho. For this analysis bull trout are evaluated as one stock even though they are separated under SaSI (see Appendix A for additional information). Of the aforementioned stocks, the four spring Chinook stocks are classified as endangered under the ESA and critical by SaSI. In contrast the summer Chinook stock does not warrant listing by the ESA and is considered healthy by SaSI standards. Summer steelhead and bull trout are listed as threatened under ESA. Summer steelhead and all but one bull trout stock status are classified as unknown by SaSI. The exception to this is one healthy stock of bull trout.

An endemic coho stock was extirpated from the Methow River Basin in the early 1900's by the construction of Pateros Dam, overharvesting and irrigation practices. The federal ESA and Washington State SaSI do not recognize or address extinct or extirpated species. The present coho stock is a reintroduced hatchery stock associated with efforts by the Yakama Nation to bring coho back to the Methow River Basin. Therefore the stock ESA or SaSI status is not available for this evaluation but an unknown status will be used in place of the SaSI rating.

The weighting factor (ESA and SaSI) for the each stock will remain the same within the basin whereas the life cycle stages and duration will change depending on the stream reach. Stock SaSi status, and ESA listing will not be repeated for each stream reach.

Table F-2 SaSI Stock Name, Status, ESA Listing Unit, & Listing Status

SaSI Stock name	SaSI Status	ESA Unit Name	ESA Listing Status
Methow Summer Chinook	Healthy	Upper Columbia River Summer and Fall Run Chinook	Not Warranted
Methow Spring Chinook	Critical	Upper Columbia River Spring Run Chinook	Endangered
Twisp Spring Chinook	Critical		
Chewuch Spring Chinook	Critical		
Lost River Spring Chinook	Critical		
Methow Summer Steelhead	Unknown	Upper Columbia Steelhead	Endangered
West Fork Methow Bull Trout/Dolly Varden	Unknown	Upper Columbia River Bull Trout	Threatened
Gold Creek (Methow) Bull Trout/Dolly Varden	Unknown		
Beaver Ck Bull Trout/Dolly Varden	Unknown		
Twisp Bull Trout/Dolly Varden	Unknown		
West Fork Buttermilk Ck Bull Trout/Dolly Varden	Unknown		
East Fork Buttermilk Ck Bull Trout/Dolly Varden	Unknown		
Lost River Bull Trout	Healthy		
First Hidden Lake Bull Trout/Dolly Varden	Unknown		
Middle Hidden Lake Bull Trout/Dolly Varden	Unknown		
Monument Creek Bull Trout/Dolly Varden	Unknown		
Reynolds Creek Bull Trout/Dolly Varden	Unknown		
Cougar Lake Bull Trout/Dolly Varden	Unknown		
Lake Creek Bull Trout/Dolly Varden	Unknown		
Wolf Creek Bull Trout/Dolly Varden	Unknown		
Goat Creek Bull Trout	Unknown		
Early Winters Creek Bull Trout	Unknown		
Cedar Creek Bull Trout/Dolly Varden	Unknown		
Coho - SaSI stock not assigned	Unknown	n/a	n/a

Table F-3 Fish status & utilization periodicity for five life stages

Fish Species - SaSI Stock	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Methow Summer Chinook (ESA Not Warrantedl; 1 Healthy SaSI stock)	Adult In-Migration												
	Spawning												
	g Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Methow Spring Chinook (ESA Endangered; 4 Critical SaSI stocks)	Adult In-Migration												
	Spawning												
	g Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Methow Summer Steelhead (ESA Threatened; 1 Unknown SaSI stock)	Adult In-Migration												
	Spawning												
	g Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Methow Coho (No ESA stock; No SaSI stock; Reintroduced)	Adult In-Migration												
	Spawning												
	g Incubation & Fry Emergence												
	Rearing												
	Juvenile Out-Migration												

Fish Species - SaSI Stock	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Methow Bull Trout (ESA Threatened; 17 SaSI stocks of Unknown to Critical status)	Spawning												
	g Incubation & Fry Emergence												
		0											
	Rearing												

Note: Stock presence varies by stream reach

= No Use
= Some activity or use occurring
= Peak activity

Table F-4 Fish status/utilization score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Normalized Score	Bin	Bin Equivalent
4801	Methow River (Reach 1)	515	0.93	3	High
4802	Methow River (Reach 2)	551	1.00	3	High
4803	Methow River (Reach 3)	455	0.83	3	High
4804	Squaw Creek	295	0.54	2	Average
4805	French Creek	295	0.54	2	Average
4806	Petes Creek	295	0.54	2	Average
4807	McFarland Creek	295	0.54	2	Average
4808	Cow Creek	295	0.54	2	Average
4809	Libby Creek	325	0.59	2	Average
4810	Texas Creek	295	0.54	2	Average
4811	Puckett Creek	295	0.54	2	Average
4812	Leecher Canyon	295	0.54	2	Average
4813	Benson Creek	295	0.54	2	Average
4814	Alder Creek	295	0.54	2	Average
4815	Beaver Creek (Reach 1)	370	0.67	3	High
4816	Beaver Creek (Reach 2)	171	0.31	1	Low
4817	Black Canyon Creek	325	0.59	2	Average
4818	Booth Canyon Creek	295	0.54	2	Average
4819	Frazer Creek	126	0.23	1	Low
4820	Twisp River	442	0.80	3	High
4821	Poorman Creek	150	0.27	1	Low
4822	Little Bridge Creek	150	0.27	1	Low
4823	Buttermilk Creek	231	0.42	2	Average
4824	Thompson Creek	247	0.45	2	Average
4825	Bear Creek	247	0.45	2	Average
4826	Chewuch River	394	0.72	3	High
4827	Cub Creek	171	0.31	1	Low
4828	Ramsey Creek	144	0.26	1	Low
4829	Little Boulder Creek	229	0.42	2	Average
4830	Wolf Creek	337	0.61	2	Average
4831	Little Falls Creek	229	0.42	2	Average
4832	Fawn Creek	229	0.42	2	Average
4833	Goat Creek	250	0.45	2	Average
4834	Gold Creek	406	0.74	3	High
4835	Early Winters Creek	337	0.61	2	Average

Habitat Condition

Overall the Methow subbasin is a considerably healthy system. Many of its tributaries extend into Forest Service boundaries and for the most part the basin hasn't been inundated with sprawl and urban development. Creeks in the lower part of the Methow River system tend to have less water and in many cases be intermittent throughout the year, especially south-facing creeks downstream of the Chewuch River confluence. Habitat is exceptional in the upper extents of many of the creeks that are on USFS property and the focus of water acquisition may be on passage and the amount of water needed to aid fish to migrate upstream into their natal spawning grounds. That should not exclude the need for juvenile rearing needs in the small streams that do not naturally go dry during low flow periods.

The mainstem Methow River dries up in portions of the upper reach between Robinson Creek (RM 74.6) and the Weeman Bridge (RM 59.7) and this phenomenon has been documented as far back as 1898 (Gorman 1899). Therefore it is unlikely that there is enough water for acquisition to "water-up" that section of the Methow.

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table F-5 Habitat condition score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Bin
4801	Methow River (Reach 1)	15	3
4802	Methow River (Reach 2)	14	2
4803	Methow River (Reach 3)	19	3
4804	Squaw Creek	6	1
4805	French Creek	6	1
4806	Petes Creek	6	1
4807	McFarland Creek	6	1
4808	Cow Creek	6	1
4809	Libby Creek	13	2
4810	Texas Creek	6	1
4811	Puckett Creek	6	1
4812	Leecher Canyon	6	1
4813	Benson Creek	6	1
4814	Alder Creek	6	1
4815	Beaver Creek (Reach 1)	11	2
4816	Beaver Creek (Reach 2)	14	2
4817	Black Canyon Creek	8	1
4818	Booth Canyon Creek	6	1
4819	Frazer Creek	11	2
4820	Twisp River	15	3

Reach Code	Reach Name	Prioritization Score	Bin
4821	Poorman Creek	13	1
4822	Little Bridge Creek	15	3
4823	Buttermilk Creek	15	3
4824	Thompson Creek	6	1
4825	Bear Creek	8	1
4826	Chewuch River	18	3
4827	Cub Creek	13	2
4828	Ramsey Creek	6	1
4829	Little Boulder Creek	10	2
4830	Wolf Creek	16	3
4831	Little Falls Creek	6	1
4832	Fawn Creek	6	1
4833	Goat Creek	11	2
4834	Gold Creek	13	2
4835	Early Winters Creek	13	2

Flow Condition

Water supply has been paramount to this basin since European settlement began in the late 1800s. Since the late 1980s, the Methow Basin has been involved in a variety of water planning efforts and studies. In addition to planning efforts and technical studies, the basin has also been at the center of several controversial projects, court decisions, and enforcement actions related to Endangered Species Act and state water resources. These have created an intense awareness of water-related issues in the basin.

In 1976, Ecology adopted chapter 173-548 Washington Administrative Code (WAC), which establishes instream flows for seven sub-basins: the Lower Methow, Middle Methow, Upper Methow, Methow Headwaters, Early Winters Creek, Chewuch River and Twisp River. The Rule designates control station locations near the lowest point of each sub-basin to be used for monitoring flows. Streamflow gages operated by the United States Geological Survey (USGS) and having various periods of record are present at or near these locations. All water rights established after the December 28, 1976 rule implementation are subject to flows established in the Rule, except that a reservation of surface water for single domestic and stock watering uses equal to 2 cubic feet per second (cfs) was set aside in each of the seven Methow River reaches to meet future needs. Rights to groundwater developed after 1976 are subject to the instream flow rule if it is determined that groundwater withdrawals will affect surface waters.

Several salmon recovery efforts are worth noting because they depend in part on water use management actions. The Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan was completed by the Upper Columbia Salmon Recovery Board (UCSRB) in August 2007. The recovery plan also addresses bull trout and contains over 300 recommended recovery actions for harvest, hatchery, hydropower, and habitat sectors that affect populations of these fish in the Upper Columbia Basin. Salmonid populations in the Methow River are an integral part of this recovery plan.

Also, United States Bureau of Reclamation and Bonneville Power Administration are actively engaged in WRIA 48 providing funding and technical support for restoration actions involving fish screening, passage barrier removal, habitat and riparian area restoration, and stream flow restoration. [2]

In 2009, the UCSRB's Regional Technical Team published a list of priorities for implementing habitat actions in Upper Columbia River subbasins. Stream flow enhancement is identified as a priority for the lower Twisp, lower Chewuch, and Beaver Creek reaches. [3]

Only nine of thirty-five reaches evaluated for this project had appropriate gauge data. Five of the seven instream flow rules are associated with reaches analyzed (Table F-6). Two gauged control points occur in the mainstem upstream from the reaches we analyzed.

Table F-6 Minimum Instream Flow set in Chapter 173-548 WAC

		Reach 4801 Lower Methow Nr Pateros 12449950	Reach 4802 Middle Methow Nr Twisp 12449500	Reach 4820 Twisp R 12447500	Reach 4826 Chewuch R 12448998	Reach 4835 Early Winters Ck
Jan	1	350	260	34	56	10
	15	350	260	34	56	10
Feb	1	350	260	34	56	10
	15	350	260	34	56	10
Mar	1	350	260	34	56	10
	15	350	260	34	56	10
Apr	1	590	430	60	90	14
	15	860	650	100	140	23
May	1	1,300	1,000	170	215	32
	15	1,940	1,500	300	290	108
Jun	1	2,220	1,500	440	320	290
	15	2,220	1,500	440	320	290
Jul	1	2,150	1,500	390	292	125

2 Adapted from Methow Basin (WRIA 48) Watershed Plan, Methow Basin Planning Unit, 2005; and Final Detailed Implementation Plan - Methow River Basin (WRIA 48), Methow Watershed Council, 2009.

3 RTT, 13 March 2009.

		Reach 4801 Lower Methow Nr Pateros	Reach 4802 Middle Methow Nr Twisp	Reach 4820 Twisp R	Reach 4826 Chewuch R	Reach 4835 Early Winters Ck
	15	800	500	130	110	45
Aug	1	480	325	58	70	20
	15	300	220	27	47	8
Sep	1	300	220	27	47	8
	15	300	220	27	47	8
Oct	1	360	260	35	56	11
	15	425	320	45	68	15
Nov	1	425	320	45	68	15
	15	425	320	45	68	15
Dec	1	390	290	39	62	12
	15	350	260	34	56	10

Note: Rules for two reaches not evaluated for this project are not included on this table.

Table F-7 Flow condition score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Bin
4801	Methow River (Reach 1)	4	3
4802	Methow River (Reach 2)	4	3
4803	Methow River (Reach 3)	3	3
4804	Squaw Creek	28	1
4805	French Creek	32	1
4806	Petes Creek	20	2
4807	McFarland Creek	24	1
4808	Cow Creek	20	2
4809	Libby Creek	21	1
4810	Texas Creek	16	2
4811	Puckett Creek	16	2
4812	Leecher Canyon	28	1
4813	Benson Creek	16	2
4814	Alder Creek	28	1
4815	Beaver Creek (Reach 1)	18	2
4816	Beaver Creek (Reach 2)	21	1
4817	Black Canyon Creek	18	2
4818	Booth Canyon Creek	20	2
4819	Frazer Creek	24	1

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Reach Code	Reach Name	Prioritization Score	Bin
4820	Twisp River	10	3
4821	Poorman Creek	28	1
4822	Little Bridge Creek	18	2
4823	Buttermilk Creek	15	3
4824	Thompson Creek	32	1
4825	Bear Creek	28	1
4826	Chewuch River	8	3
4827	Cub Creek	12	3
4828	Ramsey Creek	16	2
4829	Little Boulder Creek	20	2
4830	Wolf Creek	21	1
4831	Little Falls Creek	12	3
4832	Fawn Creek	28	1
4833	Goat Creek	9	3
4834	Gold Creek	16	2
4835	Early Winters Creek	7	3

4. Reach Results

4801 - Methow River (Reach 1)

Fish	Habitat	Flow
3	3	3

Fish Status/Utilization

The four spring Chinook stocks and fluvial bull trout do not spawn in Methow River (Reach 1) but do utilize the reach for juvenile rearing and migration as well as adult migration life cycle sstages. In contrast summer Chinook, coho, and summer steelhead utilize the reach for spawing, juvenile rearing and migration and adult migration life cycle stages. All eight stocks are found in Methow River (Reach 1) at some point in their life cycle, so this reach has a high Fish Status / Utilization score.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

The lower Methow River is documented as having minimal amounts of off-channel rearing and is mainly a migration corridor for up-and-downstream migrating salmonids. The Limiting Factors Analysis (LFA) rated the lower reach as having good passage and having data gaps for floodplain connectivity and riparian conditions. As this reach is mostly used as a migration corridor for migrating fish, it was given a 'fair' to 'good' score for most habitat attributes, but achieved a 'good' overall habitat score in spite of documented conditions of degraded floodplain and riparian areas due to roads and agriculture.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:Yes Rule:Yes Comments: The minimum of monthly mean flows in this reach is 375 cfs in September and the peak is 5,340 cfs in June . Minimum flow is 24 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 6 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'poor' for this scoring component. The instream flow rule is higher than Mean Annual Flow in 1 month of the year, on average.

Flow scoring detail is available on Table F-10.

4802 - Methow River (Reach 2)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

Methow River (Reach 2) also has a 'high' Fish Status / Utilization score. Like Methow River (Reach 1) all eight stocks utilize this reach at some point in their life cycle but some stocks have increased the time and life cycle use in Methow River (Reach2). Methow Spring Chinook utilize this reach for all three life cycle categories where as the other three spring Chinook stocks and bull trout are limited to juvenile rearing and migration and adult migration life cycle stages. Summer Chinook, coho, and summer steelhead also utilize the reach for spawning, juvenile rearing and migration and adult migration life cycle stages.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Habitat conditions within reach two are similar to reach 4801 as it used by salmonids primarily as a migration corridor to access upstream reaches and tributaries. The LFA rated the floodplain connectivity and riparian conditions as 'poor,' which created an overall habitat score lower than that of reach 4801. But it was still rated good enough to make the upper tier score as conditions for spawning, rearing, and passage combined were better than average.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:Yes Rule:Yes Comments: The minimum of monthly mean flows in this reach is 297 cfs in September and the peak is 5,087 cfs in June . Minimum flow is 21 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 14 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component. Average flows are not less than the instream flow rule in any month.

Flow scoring detail is available on Table F-10.

4803 - Methow River (Reach 3)

Fish	Habitat	Flow
3	3	3

Fish Status/Utilization

Methow River (Reach 3) also scores 'high' for Fish Status / Utilization. Where all eight stocks utilize Methow River reaches 4801 and 4802, Twisp Spring Chinook do not use this reach and Chewuch Spring Chinook use is limited to juvenile rearing. Methow Spring Chinook, Methow Summer Chinook, summer steelhead and coho continue to utilize this reach for all three life cycle categories. In additon bull trout and Lost River Spring Chinook continue to rear and migrate (juvenile and adult) in this reach.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Among the three Methow River reaches, reach 4803 scored the highest for habitat condition. Much of it is still considered a good migration corridor for migrating fish, and LFA scores and local biologists also ranked spawning and rearing conditions as good and all other habitat attributes as fair. This reach is the farthest upstream of the three reaches and is known for its numerous salmonid spawning areas (Denny Snyder, Bioanalysts, personal communication).

Habitat scoring detail is available on Table F-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 257 cfs in September and the peak is 4,377 cfs in May. Minimum flow is 21 percent of the average. Diversions evaluated for this project represent 3 percent of the Mean Annual Flow.

Flow scoring detail is available on Table F-10.

4804 - Squaw Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Squaw Creek is scored as 'average' for Fish Status / Utilization. All eight stocks utilize this reach for rearing and juvenile movement. Adult migration and spawning life cycle stages do not occur in Squaw Creek.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Habitat conditions in Squaw Creek were rated ‘poor’ by the two fish biologists interviewed for this project. The biggest issue is the lack of flow throughout the low flow period causing lack of riparian growth and sinuosity of the stream; it is highly channelized through the lower reach. Substrate was considered poor for spawning and lack of pools yielded ‘poor’ rearing scores.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 27 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored ‘poor’ for this scoring component.

Flow scoring detail is available on Table F-10.

4805 - French Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

The Fish Status / Utilization and score in French Creek are the same as for Squaw Creek. All eight stocks use the reach for juvenile rearing and movement throughout the year.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

French Creek was not assessed in the 2000 LFA but in speaking with local biologists, it is much the same as Squaw Creek in size and condition. It is a low elevation, south facing stream and is so small in size and capacity that access and spawning and rearing conditions are mostly non-existent.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 4 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 17 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored ‘poor’ for this scoring component.

Flow scoring detail is available on Table F-10.

4806 - Petes Creek

Fish	Habitat	Flow
2	1	2

Fish Status/Utilization

Petes Creek is a primary tributary to the Methow River mainstem and all eight stocks utilize this reach for juvenile rearing. The 'average' score reflects the lack of spawning and adult migration in the reach.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Petes, or Pete Creek (as stated in the LFA report) documents spring Chinook rearing in the lower reaches but was still collectively rated as 'poor' for all habitat parameters evaluated. It is again a small system with limited data found for documentation of habitat conditions.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 0.3 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach. Although there are water right claims in this reach, lack of diversion in the records examined boosted this reach's score to 'fair.'

Flow scoring detail is available on Table F-10.

4807 - McFarland Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Like other primary tributaries to the Methow River mainstem, McFarland Creek is only utilized for juvenile rearing. Spawning and adult migration typically occur in the mainstem of the Methow River. All eight stocks rear in this reach.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

As with other of the small, low flowing streams that flow into the Methow Valley floor, McFarland Creek was not evaluated in the 2000 LFA. It was discussed among local biologists that the stream scores 'low' in all six habitat categories. Size, lack of flow, and poor overall conditions within the lower Methow floodplain ranked it 'low' for habitat condition.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. Diversion data used for this evaluation exceed the Mean Annual Flow, tipping this reach over into the 'poor' scoring bin.

Flow scoring detail is available on Table F-10.

4808 - Cow Creek

Fish	Habitat	Flow
2	1	2

Fish Status/Utilization

Cow Creek is another primary tributary to the mainstem Methow River. All eight stocks, except Methow Summer Chinook, rear year round in this reach. Summer Chinook rear seven months of the year in Cow Creek.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Cow Creek is not mentioned in the LFA and was given 'low' scores for all habitat categories. It is small, far downstream in the Methow Valley, high gradient, channelized, larger substrate, and lacks pool habitat.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 1.4 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table F-10.

4809 - Libby Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Although Libby Creek is a primary tributary to the mainstem Methow River, only seven stocks limit the use of this reach to juvenile rearing. The exception is Methow Summer Steelhead, which utilize the reach for spawning, juvenile migration and rearing, and adult rearing. Even with this increase of fish use, Libby Creek fish utilization is considered 'average.'

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

From reviews of the LFA and the Upper Columbia Recovery Plan, Libby Creek contains 'fair' portions of spawning and rearing, along with 'fair' to 'poor' riparian conditions. Low efforts of habitat restoration in the creek and poor visual conditions of riparian growth due to cattle intrusion rate this reach as 'fair' overall. Forest Service biologists suggest that conditions are better than past reviews and off-channel habitat and floodplain connectivity are 'fair.'

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 18 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 83 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table F-10.

4810 - Texas Creek

Fish	Habitat	Flow
2	1	2

Fish Status/Utilization

Like Petes, Cow, French and McFarland Creeks, Texas Creek supports juvenile rearing for all eight stocks. The life cycle stages of spawning and adult migration do not occur in this reach.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

This creek is similar to other creeks on the north-slope of the lower reach of the Methow Valley floor having poor conditions due to slope, channelization, larger substrate, low pool frequency, and poor riparian growth.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 1.2 cfs Mean Annual Flow was used to score this reach. Some claims, but no diversion data, boost this reach's score to 'fair.'

Flow scoring detail is available on Table F-10.

4811 - Puckett Creek

Fish	Habitat	Flow
2	1	2

Fish Status/Utilization

Fish Status / Utilization for Puckett Creek is 'average.' Only juvenile rearing by all eight stocks occurs here. Spawning and adult migration occurs in the mainstem, but juveniles move into Puckett Creek to forage.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Puckett Creek is a very small creek with a short reach, and receiving no review within the LFA. Upon speaking with other fish biologists in the area, it was concluded that the overall habitat conditions were rated 'poor.'

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 0.2 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach.

Flow scoring detail is available on Table F-10.

4812 - Leecher Canyon

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Fish Status / Utilization in Leecher Creek is ‘average.’ All eight stocks, except Methow Summer Chinook, rear year round in this reach. Summer Chinook rear seven months of the year in Leecher Creek. Spawning and adult migration do not occur in this reach.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Leecher Canyon Creek represents another small system not mentioned in the LFA and was considered poor habitat conditions due to conditions similar to other low lying streams within the Methow watershed.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 0.2 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 29 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored ‘poor’ for this scoring component.

Flow scoring detail is available on Table F-10.

4813 - Benson Creek

Fish	Habitat	Flow
2	1	2

Fish Status/Utilization

Benson Creek also rates ‘average’ for Fish Status / Utilization and is limited to juvenile rearing by all eight stocks.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

With lower elevation and flow, Benson Creek ranked as poor habitat conditions for all six parameters. Benson Creek is mentioned and reviewed in the 2000 LFA but has indications of “data gaps” for all habitat conditions reviewed. Local fish biologists suggest that it is in poor condition for all evaluated habitat parameters.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 4 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 2 percent of the Mean Annual Flow; reaches with diversions less than 5% of MAF rated 'good' for this attribute.

Flow scoring detail is available on Table F-10.

4814 - Alder Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Fish Status / Utilization for Alder Creek is the same as for the majority of other primary tributaries to the Methow River mainstem. All eight stocks utilize this reach for only juvenile rearing.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Alder Creek was assessed in the LFA and indicates poor conditions for five of the six habitat parameters; LFA notes a data gap for rearing, or pool content. It was concluded with area fish biologists that Alder Creek is degraded and in poor overall habitat condition.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 0.9 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 43 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table F-10.

4815 - Beaver Creek (Reach 1)

Fish	Habitat	Flow
3	2	2

Fish Status/Utilization

Beaver Creek (Reach 1) rates 'high' for Fish Status / Utilization. Like other primary tributaries, the four stocks of spring Chinook and one summer Chinook stock only utilized this reach for juvenile rearing. The other three stocks utilize Beaver Creek (Reach 1) for other life cycle stages. Coho and Methow Summer Steelhead utilize the reach for all three life cycle stages where as adult bull trout are known to migrate through this reach but do not spawn here. Juvenile bull trout will move into this reach to forage.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Within the LFA, the habitat conditions rated 'poor.' But recent passage improvements and water acquisitions have created better habitat within the lower Beaver Creek subbasin. Confirmations from local fish biologists conclude that the lower reach is 'fair' habitat for four of the six parameters. Low scores were still given for passage and floodplain connectivity, and 'fair' for riparian condition which could change with future flow and stream restoration efforts.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:Yes Rule:No Comments: An NHD+ estimated 26 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 57 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. Overall flow volume (relative to other reaches in this WRIA) boosted this reach to 'fair' status.

Flow scoring detail is available on Table F-10.

4816 - Beaver Creek (Reach 2)

Fish	Habitat	Flow
1	2	1

Fish Status/Utilization

Fish Status / Utilization in Beaver Creek (Reach 2) is significantly different than Beaver Creek (Reach 1). At this point in the creek, out of the four spring Chinook stocks only Lost River Spring Chinook are utilizing the reach and only for juvenile rearing. It is unlikely the other three stocks migrate this far upstream to rear. Two other stocks, Methow Summer Chinook and coho, do not utilize this reach. In contrast bull trout utilize the reach for adult migration and juvenile rearing and Methow Summer Steelhead for all three life cycle stages. The reduction in utilization by the three spring Chinook stocks is enough to reduce the Fish Status / Utilization rating to 'low.'

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

The upper reach of the Beaver Creek watershed rated 'fair' in all habitat categories except spawning and rearing conditions, where scores of 'good' were recorded. The upper reach still has some low flow and passage problems as documented in the Upper Columbia Salmon and Steelhead Recovery Plan. When "binning" for habitat condition, this reach scored at the low end of the "good" score compared with other reaches within the Methow subbasin.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 7 cfs in October-February and the peak is 82 cfs in June . Minimum flow is 32 percent of the average. Diversions evaluated for this project represent 67 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table F-10.

4817 - Black Canyon Creek

Fish	Habitat	Flow
2	1	2

Fish Status/Utilization

Fish Status / Utilization for Black Canyon Creek rates 'average.' Seven stocks utilize this reach for juvenile rearing only. The exception is Methow Summer Steelhead which spawn, migrate and rear in this reach.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Within the Black Canyon watershed there are some steelhead spawning and therefore the rating of substrate was considered 'fair.' Rearing is also rated as 'fair' within the LFA and among area fish biologists. All other habitat parameters either had data gaps or were rated as 'poor,' yielding the overall score of 'fair' for this creek.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 6 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 42 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table F-10.

4818 - Booth Canyon Creek

Fish	Habitat	Flow
2	1	2

Fish Status/Utilization

Like the majority of other primary tributaries to the mainstem, Fish Status / Utilization in Booth Canyon Creek in limited to juvenile rearing. Seven out of eight stocks rear in this reach year round. Methow Summer Chinook use booth Canyon Creek seven out of 12 months of the year.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Booth Canyon Creek scored 'low' for all six habitat parameters, likely due to lower elevation and flow as in other area streams. Area fish biologists concurred with the low habitat scores.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 2 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'fair' for this scoring component.

Flow scoring detail is available on Table F-10.

4819 - Frazer Creek

Fish	Habitat	Flow
1	2	1

Fish Status/Utilization

Frazer Creek, a tributary to Beaver Creek, has 'low' Fish Status / Utilization. Only Methow Summer Steelhead, bull trout and coho utilize this reach. Coho and bull trout rear only where as summer steelhead spawn, rear and migrate within the reach.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

The 2000 LFA report indicates poor conditions for floodplain connectivity, riparian conditions, and passage. Upon review with area fish biologists, it was concluded that riparian conditions and passage should be ranked as 'fair,' giving Frazer Creek an overall score within the 'fair' bin. Spawning and rearing conditions were considered 'fair' and 'good,' respectively.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 3 cfs Mean Annual Flow was used to score this reach. Diversion data used for this evaluation exceed the Mean Annual Flow.

Flow scoring detail is available on Table F-10.

4820 - Twisp River

Fish	Habitat	Flow
3	3	3

Fish Status/Utilization

The Twisp River has a high rating for Fish Status / Utilization rating. All eight stocks utilize this reach for at least juvenile rearing. In addition to rearing, bull trout adults migrate through this reach of the Twisp River. Twisp Spring Chinook and Methow Summer Steelhead utilize this reach for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

The LFA rated the lower Twisp River as having poor floodplain connectivity and riparian conditions. This was discussed with colleagues and changed to indicate 'fair' conditions for both. Off-channel habitat was rated as 'fair' by area fish biologists. Spawning, rearing, and passage conditions were given a 'good' score, leading to an overall bin score of 'good' for the Twisp River.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:Yes Rule:Yes Comments: The minimum of monthly mean flows in this reach is 37 cfs in September and the peak is 954 cfs in June . Minimum flow is 14 percent of the average. Diversions evaluated for this project represent 31 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. The instream flow rule is higher than Mean Annual

Flow in only 1 month of the year, on average. Overall flow volume boosted the Twisp River's score to 'good.'

Flow scoring detail is available on Table F-10.

4821 - Poorman Creek

Fish	Habitat	Flow
1	2	1

Fish Status/Utilization

Poorman Creek is a tributary to the Twisp River but does not have the same Fish Status / Utilization as the Twisp. Fish Status / Utilization for Poorman Creek is 'low.' Only three out of the eight stocks found in the basin utilize Poorman Creek. Methow Summer Steelhead spawn, rear, and migrate in this reach where as bull trout and Twisp spring Chinook only rear in the reach.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

The Upper Columbia Salmon and Steelhead Plan documents that a few steelhead spawn in Poorman Creek so that habitat parameter was given a 'fair' score. Floodplain connectivity and passage also received 'fair' scores from the LFA report. Riparian conditions and rearing were scored as 'good' after area discussions with WDFW and USFS biologists. Unfortunately, off-channel habitat conditions were considered 'poor' condition, giving the overall bin score of 'fair.'

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 48 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table F-10.

4822 - Little Bridge Creek

Fish	Habitat	Flow
1	3	2

Fish Status/Utilization

Little Bridge Creek is also a tributary to the Twisp River. Like Poorman Creek, Little Bridge Creek has a 'low' Fish Status / Utilization rating. Three stocks, Methow Summer Steelhead, Twisp spring Chinook and bull trout, out of eight stocks are found in Little Bridge Creek. Juvenile bull trout and Twisp Spring Chinook rear in this reach. In contrast Methow Summer Steelhead spawn, rear and migrate within the reach.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Floodplain connectivity, riparian conditions, and passage were rated as 'poor' within the LFA but were discussed and scored higher. Passage was scored higher due to correction of a large culvert near the mouth that had been considered a partial barrier to migrating salmonids. Riparian, rearing, and passage conditions were all ranked as 'good' during recent discussions and direct site observations. Spawning conditions were ranked as 'fair' considering the entire reach gradient with large boulder-type substrate, and the documentation of steelhead in the UCSSRP.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 11 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 16 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table F-10.

4823 - Buttermilk Creek

Fish	Habitat	Flow
2	3	3

Fish Status/Utilization

Fish Status / Utilization in Buttermilk Creek, a tributary of the Twisp River, is 'average.' As with other Twisp River tributaries only three stocks utilize Buttermilk Creek. The difference between Fish Status / Utilization in Little Bridge Creek and Buttermilk Creek is that Twisp Spring Chinook and Methow Summer steelhead spawn, rear and migrate in Buttermilk Creek. Bull trout use this reach for rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

The 2000 LFA reports good conditions for floodplain connectivity and passage. Personal observations and local biologists concur with those scores and indicate that riparian and rearing conditions should be scored higher than that of the LFA, at 'good.' Off-channel habitat gets the only 'poor' score due to steep gradient and channelization. The spawning of a few steelhead has been documented in the UCSSRP, giving a 'fair' score.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 46 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 2 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table F-10.

4824 - Thompson Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Thompson Creek is a tributary of the Methow River and has an 'average' rating for Fish Status / Utilization. Seven out of eight stocks use this reach for only juvenile rearing and Twisp Spring Chinook not at all.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Thompson Creek is another small stream that has very little documentation but was rated an overall habitat score of 'poor' for each parameter. No documentation of spawning conditions was collected. Area biologists had little information but agreed that overall habitat rating should score 'poor.'

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 0.3 cfs Mean Annual Flow was used to score this reach. Diversion data used for this evaluation greatly exceed this estimate.

Flow scoring detail is available on Table F-10.

4825 - Bear Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Bear Creek another primary tributary to the Methow River has similar Fish Status / Utilization to Thompson Creek. Both have an 'average' Fish Status / Utilization rating and both support juvenile rearing for seven stocks. Twisp Spring Chinook is not found in Bear Creek.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

The LFA indicates that the conversion of floodplain to agriculture, residential, and grazing use have negatively impacted floodplain functions. We conclude through direct observation that riparian and rearing conditions should be ranked as 'fair.' As this creek flows into a diversion channel and does not freely flow into the mainstem Methow, it should be scored accordingly. Some riparian restoration and flow augmentation efforts give this creek a 'fair' score within the habitat binning.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 3 cfs Mean Annual Flow was used to score this reach. Diversion data used for this evaluation exceed the Mean Annual Flow estimate.

Flow scoring detail is available on Table F-10.

4826 - Chewuch River

Fish	Habitat	Flow
3	3	3

Fish Status/Utilization

The Chewuch River has a 'high' Fish Status / Utilization rating. The reach supports life cycle stages of seven Methow Basin stocks. The exception is Twisp Spring Chinook. The river supports all three lifecycle stages for Chewuch Spring Chinook, and Methow Summer Steelhead. Bull trout rear and migrate through the reach where as only juvenile rearing is present for Coho, Methow Summer Chinook, Lost River Spring Chinook and Methow spring Chinook.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

The 2000 LFA report suggests a 'fair' condition for off-channel habitat due to road densities exceeding 3.5 miles/square mile along most of the Chewuch River corridor from RM 0.0 to RM 8.0. Area fish biologists agreed the score should be brought up to a 'good' condition status. For floodplain connectivity, the LFA ranks a 'fair' due to the lower 19.5 miles having low LWD levels, a reduced amount of adequate side channel habitat, accelerated bank erosion, and high sediment levels. Again, area biologists agreed that a score of 'good' should be given to that reach. The LFA also reported only 'fair' passage where the new score was considered as 'good' with recent flow augmentation agreements and partial barrier corrections at the Chewuch diversion site. Spawning is well documented in the LFA and UCSSRP and from personal observations. Overall the Chewuch scored a 'good,' bordering on excellent habitat score.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:Yes Rule:No Comments: The minimum of monthly mean flows in this reach is 77 cfs in September and the peak is 1,621 cfs in May. Minimum flow is 19 percent of the average. Diversions evaluated for this project represent 3 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component. 'Good' status also reflects the higher flow volume relative to other reaches in this WRIA.

Flow scoring detail is available on Table F-10.

4827 - Cub Creek

Fish	Habitat	Flow
1	2	3

Fish Status/Utilization

Cub Creek, which is a tributary to Chewuch River, rates 'low' for Fish Status / Utilization. This 'low' rating is based on only three out of the eight stocks present in the creek and of those minimal life cycle stages are expressed. Chewuch Spring Chinook and bull trout utilize the creek for juvenile rearing, whereas Methow Summer Steelhead use the creek for spawning, rearing and adult migration.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Off-channel, floodplain, and riparian conditions were all scored 'poor' during the initial review from research and reference documents. After meetings with local biologists from WDFW and USFS, scores were changed to 'fair' or 'good' in Cub Creek.

There were also discussions of a small natural barrier near the mouth that reduced the passage score to 'fair.' Overall the creek was given a habitat score of 'fair.'

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 7 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach. Although flows are low, the 'good' status score reflects the higher flow volume relative to many other reaches in this WRIA.

Flow scoring detail is available on Table F-10.

4828 - Ramsey Creek

Fish	Habitat	Flow
1	1	2

Fish Status/Utilization

Ramsey Creek is also a tributary of Chewuch River that has a 'low' Fish Status / Utilization score. Ramsey Creek differs from Cub Creek in that four stocks; Chewuch Spring Chinook, Methow Summer Steelhead, bull trout and coho are present in the creek and juvenile rearing is the only life cycle stages expressed.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Ramsey Creek, like other area creeks, is small and documented in the LFA as being confined to a ditch. The alluvial fan for this creek has been under cultivation for over 75 years and the entire stream margin along the fan is rip-rapped. There is very little documentation available evaluate all habitat attributes; given its small size and channelized reach, the overall score was given a 'poor.'

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 1.3 cfs Mean Annual Flow was used to score this reach. Some water right claims, but no diversion volume, tipped this reach from 'poor' to 'fair' condition.

Flow scoring detail is available on Table F-10.

4829 - Little Boulder Creek

Fish	Habitat	Flow
2	2	2

Fish Status/Utilization

Five out of eight stocks are present in Little Boulder Creek. What limits this creek to 'average' Fish Status / Utilization is the expression of life cycle stages. Methow Summer Steelhead is the only stock that spawns, rears and uses Little Boulder Creek for adult migration. The others; bull trout, coho, Methow Summer Chinook, Lost River Spring Chinook and Methow Spring Chinook utilize the reach for juvenile rearing.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

After discussions with a USFS biologist to review the 'poor' status given in the LFA report, it was determined that passage should be rated as 'fair.' Other parameters were agreed on through the LFA reports such as 'poor' floodplain connectivity and 'fair' riparian conditions. Spawning and rearing conditions were also considered 'fair.' The creek was ranked as 'fair' overall for habitat condition.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 3 cfs Mean Annual Flow was used to score this reach. No diversion volumes were identified in this reach.

Flow scoring detail is available on Table F-10.

4830 - Wolf Creek

Fish	Habitat	Flow
2	3	1

Fish Status/Utilization

Wolf Creek, a tributary to the Methow mainstem, also rates 'average' for Fish Status / Utilization. Three stocks, Methow Spring Chinook, bull trout and Methow Summer Steelhead use the creek for all three life cycle stages. In contrast, Lost River Spring Chinook, Methow Summer Chinook, and coho utilize the reach for juvenile rearing.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

The LFA indicates that Wolf Creek is a spawning and rearing stream for fluvial bull trout, summer steelhead, and spring Chinook, ranking it as 'good' for spawning and rearing habitat conditions. Floodplain connectivity and riparian conditions were rated as 'fair' in the LFA. Biologists we consulted conclude that floodplain connectivity hasn't changed much, but that riparian conditions are better now and should be raised to a 'good' score. Overall this reach scored 'good.'

Habitat scoring detail is available on Table F-9.

Flow

Gauge:Yes Rule:No Comments: Diversion data used for this evaluation equal or exceed the Mean Annual Flow.

Flow scoring detail is available on Table F-10.

4831 - Little Falls Creek

Fish	Habitat	Flow
2	1	3

Fish Status/Utilization

Little Boulder Creek and Little Falls Creek have many similar Fish Status / Utilization activities, both rate 'average' for fish use. In addition, Methow Summer Steelhead utilize the reach for all three life cycle stages. Juvenile rearing is the only trait expressed by coho, bull trout, Methow Summer Chinook, Methow Spring Chinook and Lost River Spring Chinook.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Little Falls Creek is another small stream that has very little documentation but was rated an overall habitat score of 'poor' for each parameter. No documentation of spawning conditions was found. This creek receives only passing reference in the LFA. Area biologists had little information but agreed that overall habitat rating should score 'poor.'

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 3 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach, which is undoubtedly the reason this reach appears to have 'good' flow condition.

Flow scoring detail is available on Table F-10.

4832 - Fawn Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Fawn Creek is like Little Boulder Creek and Little Falls Creek in that juvenile rearing is the only trait expressed by coho, bull trout, Methow Summer Chinook, Methow Spring Chinook and Lost River Spring Chinook, where as Methow Summer Steelhead express all three life cycle stages. As a result this creek also rates 'average' for fish use.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Fawn Creek is another small stream that has very little documentation but was rated an overall habitat score of 'poor' for each parameter. There is discussion of the need for LWD and a lower reach diversion within the creek. Fawn Creek, which is not known to support salmonids, has an irrigation withdrawal at the mouth of the Creek for group domestic use in the Edelweiss subdivision. Area biologists had little information but agreed that overall habitat rating should score low.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 3 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 17 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component.

Flow scoring detail is available on Table F-10.

4833 - Goat Creek

Fish	Habitat	Flow
2	2	3

Fish Status/Utilization

Goat Creek also rates 'average' for Fish Status / Utilization. The same stocks are present in Goat Creek as Fawn Creek. The slight difference between the two creeks is that bull trout express juvenile and adult migration and juvenile rearing rather than just juvenile rearing and migration. Coho, Methow Summer Chinook, Methow Spring Chinook and Lost River Spring Chinook utilize the creek for juvenile rearing and migration and Methow Summer Steelhead for all three life cycle stages.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

For Goat Creek habitat scoring, initial review found that floodplain connectivity and riparian conditions were rated as ‘poor.’ Review and discussion with USFS fish biologists found that the riparian conditions are better now and should be given a ‘good’ score. All other parameters were scored as ‘fair,’ reflecting the overall habitat score of ‘fair.’

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 20 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach. The relatively high flow volume in comparison to other reaches in this WRIA tipped the overall score for this reach to ‘good.’

Flow scoring detail is available on Table F-10.

4834 - Gold Creek

Fish	Habitat	Flow
3	2	2

Fish Status/Utilization

The ‘high’ Fish Status / Utilization rating for Gold Creek is attributed to the number of stocks present in the stream (all eight) and the number of life cycle stages they express. Methow Spring Chinook and Methow Summer Steelhead express all three traits; bull trout express adult and juvenile migration and juvenile rearing; and Twisp Spring Chinook, Lost River Spring Chinook, Chewuch Spring Chinook, Methow Summer Chinook and coho juveniles rear in the creek.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

Off channel and passage scores were originally indicated as ‘poor’ from literature review. Meetings with WDFW and USFS area fish biologists determined that these two parameters should be boosted to ‘fair’ now. All other parameters were scored ‘fair’ except for rearing which was scored ‘good.’

Habitat scoring detail is available on Table F-9.

Flow

Gauge:No Rule:No Comments: An NHD+ estimated 70 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 16 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. These results combine to achieve a 'fair' score overall.

Flow scoring detail is available on Table F-10.

4835 - Early Winters Creek

Fish	Habitat	Flow
2	2	3

Fish Status/Utilization

Fish presence drops to six stocks in Early Winter Creek but still maintains a 'average' Fish Status / Utilization rating. Bull trout, Methow Summer Steelhead and Methow Spring Chinook utilize this creek for all three life cycle stages. In contrast Lost River Spring Chinook, Methow Summer Chinook and coho utilize the stream for juvenile rearing.

Fish Status/Utilization scoring detail is available on Table F-8.

Habitat

The LFA states that the construction of State Highway 20, recreational use, irrigation withdrawal, diking, and residential development have had significant impacts in the lower 1.5 miles of Early Winters Creek. The off-channel habitat score was set at 'fair' after discussions with area biologist and direct personal observations. The lower 0.5 mile of Early Winters Creek has been rip-rapped and diked. From RM 0.0 – 1.9 the channel is incising as a result of rip-rapping and diking in the lower reach, leading to an increased stream gradient, the loss of pool habitat, increased stream velocities in riffle-run habitat, and the loss of spawning gravels. Rearing and passage were ranked as 'good' but overall the habitat conditions fall within the 'fair' bin.

Habitat scoring detail is available on Table F-9.

Flow

Gauge:Yes Rule:No Comments: The minimum monthly mean flow in this reach is 18 cfs in January and the peak is 535 cfs in June. Minimum flow is 15 percent of the average. Diversions evaluated for this project represent 3 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component. These results combined with high flow volume yield a 'good' score for this creek.

Flow scoring detail is available on Table F-10.

5. Scoring Sheets

Table F-8 Fish Scoring Sheet

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Code	Reach Name	Reach Score & Bin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4801	Methow River (Reach 2)	551	37	38	41	37	52	47	52	55	57	56	40	39
4802	Methow River (Reach 1)	515	33	34	37	37	52	47	48	51	53	52	36	35
4803	Methow River (Reach 3)	455	33	34	37	33	40	35	40	43	45	44	36	35
4804	Squaw Creek	295	24	25	25	25	25	25	25	25	24	24	24	24
4805	French Creek	295	24	25	25	25	25	25	25	25	24	24	24	24
4806	Petes Creek	295	24	25	25	25	25	25	25	25	24	24	24	24
4807	McFarland Creek	295	24	25	25	25	25	25	25	25	24	24	24	24
4808	Cow Creek	295	24	25	25	25	25	25	25	25	24	24	24	24
4809	Libby Creek	325	24	25	31	31	31	28	28	28	27	24	24	24
4810	Texas Creek	295	24	25	25	25	25	25	25	25	24	24	24	24
4811	Puckett Creek	295	24	25	25	25	25	25	25	25	24	24	24	24
4812	Leecher Canyon	295	24	25	25	25	25	25	25	25	24	24	24	24
4813	Benson Creek	295	24	25	25	25	25	25	25	25	24	24	24	24
4814	Alder Creek	295	24	25	25	25	25	25	25	25	24	24	24	24
4815	Beaver Creek (Reach 1)	370	26	27	33	33	36	31	31	31	32	31	31	28
4816	Beaver Creek (Reach 2)	171	10	10	16	16	19	16	16	16	16	13	13	10
4817	Black Canyon Creek	325	24	25	31	31	31	28	28	28	27	24	24	24
4818	Booth Canyon Creek	295	24	25	25	25	25	25	25	25	24	24	24	24
4819	Frazer Creek	126	8	8	14	14	14	11	11	11	11	8	8	8
4820	Twisp River	442	34	35	38	34	38	35	39	42	41	38	34	34
4821	Poorman Creek	150	10	10	16	16	16	13	13	13	13	10	10	10

Code	Reach Name	Reach Score & Bin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4822	Little Bridge Creek	150	10	10	16	16	16	13	13	13	13	10	10	10
4823	Buttermilk Creek	231	14	14	20	16	23	20	24	24	24	21	17	14
4824	Thompson Creek	247	20	21	21	21	21	21	21	21	20	20	20	20
4825	Bear Creek	247	20	21	21	21	21	21	21	21	20	20	20	20
4826	Chewuch River	394	30	31	34	30	34	31	35	38	37	34	30	30
4827	Cub Creek	171	13	13	16	16	16	13	13	16	16	13	13	13
4828	Ramsey Creek	144	12	12	12	12	12	12	12	12	12	12	12	12
4829	Little Boulder Creek	229	16	17	23	23	23	20	20	20	19	16	16	16
4830	Wolf Creek	337	23	24	30	26	33	27	31	31	33	30	26	23
4831	Little Falls Creek	229	16	17	23	23	23	20	20	20	19	16	16	16
4832	Fawn Creek	229	16	17	23	23	23	20	20	20	19	16	16	16
4833	Goat Creek	250	16	17	23	23	26	23	23	23	22	19	19	16
4834	Gold Creek	406	28	29	35	31	38	35	39	39	38	35	31	28
4835	Early Winters Creek	337	23	24	30	26	33	27	31	31	33	30	26	23
		Monthly Totals	760	788	896	864	946	869	904	922	911	856	792	768

Note: Reach names link to workbook tabs

Table F-8 Fish Scoring Sheet - continued

SaSI Stocks in the Methow Basin	SaSI Stock Rating	SaSI Weight Factor
Twisp Spring Chinook- 1840	Critical	3
Methow Spring Chinook- 1824	Critical	3
Lost River Spring Chinook- 1848	Critical	3
Chewuch Spring Chinook- 1844	Critical	3
Methow Summer Chinook- 1832	Healthy	1
Methow Summer Steelhead- 6912	Unknown	2
Coho - SaSI stock not assigned	Unknown	2
Bull Trout - Wolf Creek- 8876	Unknown	2
Bull Trout - West Fork Methow- 8720	Unknown	2
Bull Trout - WF Buttermilk Creek- 8768	Depressed	
Bull Trout - Beaver Creek- 8744	Healthy	
Bull Trout - Cedar Creek- 8912	Depressed	
Bull Trout - Cougar Lake- 8852	Unknown	

SaSI Stocks in the Methow Basin	SaSI Stock Rating	SaSI Weight Factor
Bull Trout - Early Winters- 8890	Critical	2
Bull Trout - EF Buttermilk Creek- 8780	Critical	
Bull Trout - First Hidden Lake- 8804	Depressed	
Bull Trout - Goat Creek- 8888	Depressed	
Bull Trout - Gold Creek- 8732	Critical	
Bull Trout - Lake Creek- 8864	Depressed	
Bull Trout - Lost River- 8792	Critical	
Bull Trout - Middle Hidden Lake- 8816	Unknown	
Bull Trout - Monument Creek- 8828	Critical	
Bull Trout - Reynolds Creek- 8840	Critical	
Bull Trout - Twisp- 8756	Critical	

** Weighting Factor Values by SaSI Stock Status:	Weight
Healthy	1
Depressed	2
Unknown	2
Critical	3

Weighting Factor for Federally Listed Species:	ESA Weight Factor
Assign additional weight to stocks that are listed as Threatened or Endangered under the ESA? (yes=1; no=0)	1
Assign additional weight to reaches within Interior Columbia TRT-designated spawning areas (MaSAs or MiSAs)? (yes=1; no=0)	0

[intentionally blank]

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table F-9 Habitat Scoring Sheet

Code	Reach Name	Total Score	Off Channel Habitat (OCHs)	Flood-plain Connec-tivity	Riparian Cond-ition	Spawning Suita-bility	Rearing Suita-bility	Passage Condi-tion
4801	Methow River (Reach 1)	15	2	2	2	3	3	3
4802	Methow River (Reach 2)	14	2	2	2	2	3	3
4803	Methow River (Reach 3)	19	3	3	3	3	4	3
4804	Squaw Creek	6	1	1	1	1	1	1
4805	French Creek	6	1	1	1	1	1	1
4806	Petes Creek	6	1	1	1	1	1	1
4807	McFarland Creek	6	1	1	1	1	1	1
4808	Cow Creek	6	1	1	1	1	1	1
4809	Libby Creek	13	2	2	2	2	3	2
4810	Texas Creek	6	1	1	1	1	1	1
4811	Puckett Creek	6	1	1	1	1	1	1
4812	Leecher Canyon	6	1	1	1	1	1	1
4813	Benson Creek	6	1	1	1	1	1	1
4814	Alder Creek	6	1	1	1	1	1	1
4815	Beaver Creek (Reach 1)	11	1	1	2	2	2	3
4816	Beaver Creek (Reach 2)	14	2	2	2	3	3	2
4817	Black Canyon Creek	8	1	1	2	2	1	1
4818	Booth Canyon Creek	6	1	1	1	1	1	1
4819	Frazer Creek	11	1	1	2	2	3	2
4820	Twisp River	15	2	2	2	3	3	3
4821	Poorman Creek	13	1	2	3	2	3	2
4822	Little Bridge Creek	15	2	2	3	2	3	3
4823	Buttermilk Creek	15	1	3	3	2	3	3
4824	Thompson Creek	6	1	1	1	1	1	1
4825	Bear Creek	8	1	1	2	1	2	1
4826	Chewuch River	18	3	3	3	3	3	3
4827	Cub Creek	13	2	3	2	2	2	2
4828	Ramsey Creek	6	1	1	1	1	1	1
4829	Little Boulder Creek	10	1	1	2	2	2	2
4830	Wolf Creek	16	2	2	3	3	3	3

Code	Reach Name	Total Score	Off Channel Habitat (OCHs)	Flood-plain Connec-tivity	Riparian Cond-ition	Spawning Suita-bility	Rearing Suita-bility	Passage Condi-tion
4831	Little Falls Creek	6	1	1	1	1	1	1
4832	Fawn Creek	6	1	1	1	1	1	1
4833	Goat Creek	11	2	1	2	2	2	2
4834	Gold Creek	13	2	2	2	2	3	2
4835	Early Winters Creek	13	2	1	2	2	3	3

Color / Bin Score

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

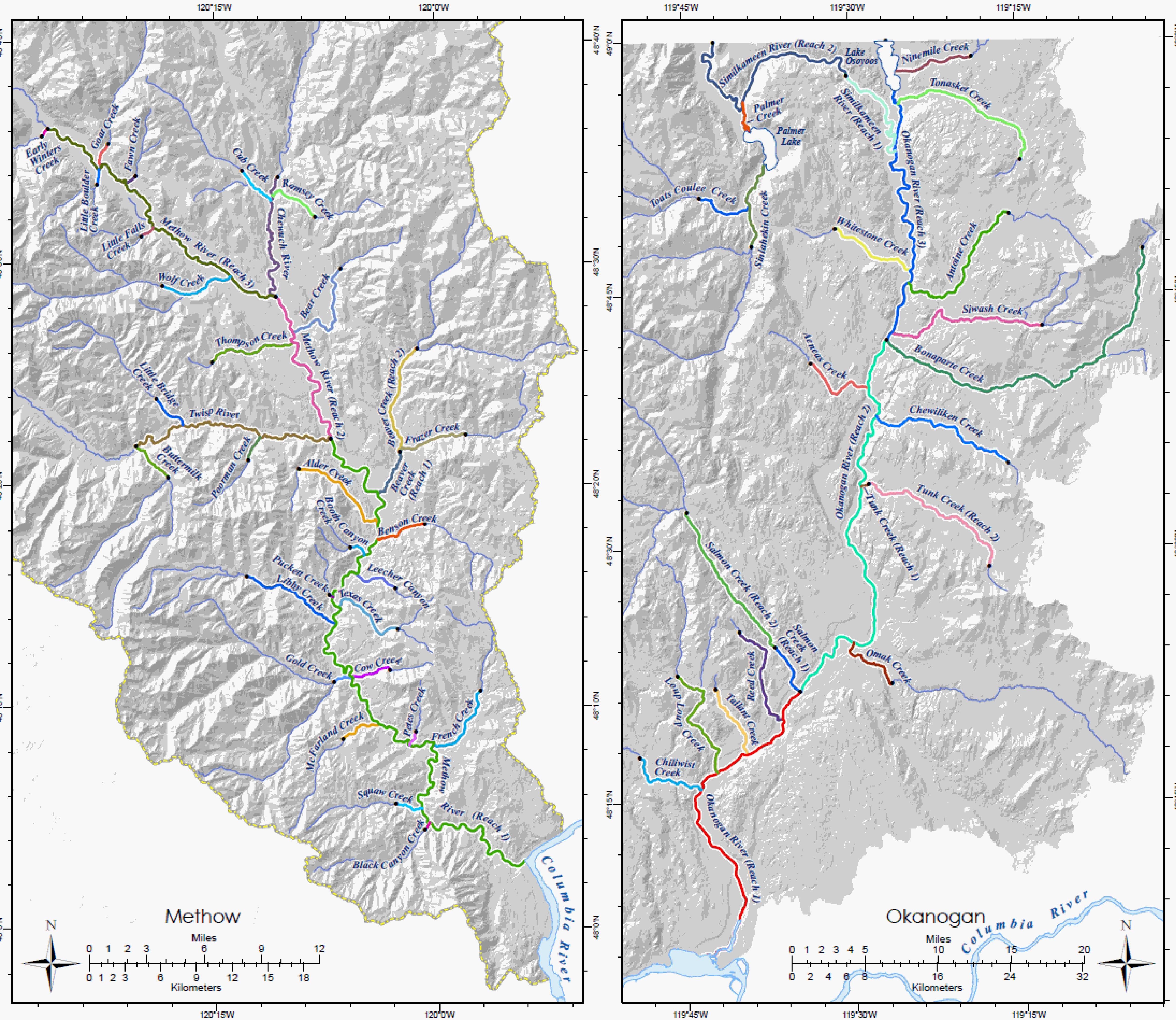
Table F-10 Flow Scoring Sheet

		GOOD IS HIGH	POOR IS HIGH, GOOD IS LOW >>>>>>>>>>>>>>>>>>>					
				A	B	C	D	E
Reach Code	Reach Name	Bin	Sum scores (A:D) * E	% of Mo Avg Below Rule	Qi Deviation	No. Claims	August Deviation from Mean Annual Flow	Flow Volume Factor
4801	Methow River (Reach 1)	3	4	1	2	3	2	0.5
4802	Methow River (Reach 2)	3	4	1	2	2	2	0.5
4803	Methow River (Reach 3)	3	3		1	3	2	0.5
4804	Squaw Creek	1	28		3	2	2	4.0
4805	French Creek	1	32		3	3	2	4.0
4806	Petes Creek	2	20		0	2	3	4.0
4807	McFarland Creek	1	24		3	1	2	4.0
4808	Cow Creek	2	20		0	2	3	4.0
4809	Libby Creek	1	21		3	2	2	3.0
4810	Texas Creek	2	16		0	2	2	4.0
4811	Puckett Creek	2	16		0	1	3	4.0
4812	Leecher Canyon	1	28		3	1	3	4.0
4813	Benson Creek	2	16		1	1	2	4.0
4814	Alder Creek	1	28		3	2	2	4.0
4815	Beaver Creek (Reach 1)	2	18		3	1	2	3.0
4816	Beaver Creek (Reach 2)	1	21		3	2	2	3.0
4817	Black Canyon Creek	2	18		3	1	2	3.0
4818	Booth Canyon Creek	2	20		1	1	3	4.0
4819	Frazer Creek	1	24		3	1	2	4.0
4820	Twisp River	3	10	1	3	3	3	1.0
4821	Poorman Creek	1	28		3	2	2	4.0
4822	Little Bridge Creek	2	18		3	1	2	3.0
4823	Buttermilk Creek	3	15		1	2	2	3.0
4824	Thompson Creek	1	32		3	2	3	4.0
4825	Bear Creek	1	28		3	2	2	4.0
4826	Chewuch River	3	8	1	1	3	3	1.0
4827	Cub Creek	3	12		0	2	2	3.0
4828	Ramsey Creek	2	16		0	2	2	4.0
4829	Little Boulder Creek	2	20		1	2	2	4.0
4830	Wolf Creek	1	21		3	2	2	3.0
4831	Little Falls Creek	3	12				3	4.0

Reach Code	Reach Name	GOOD IS HIGH Bin	POOR IS HIGH, GOOD IS LOW >>>>>>>>>>>>>>>>>>>> Sum scores (A:D) * E	A % of Mo Avg Below Rule	B Qi Deviat ion	C No. Claims	D August Deviation from Mean Annual Flow	E Flow Volume Factor
4832	Fawn Creek	1	28		3	1	3	4.0
4833	Goat Creek	3	9		0	1	2	3.0
4834	Gold Creek	2	16		3	3	2	2.0
4835	Early Winters Creek	3	7	1	1	3	2	1.0

6. Maps

Figure F-1Assessed Stream Reaches



DEPARTMENT OF ECOLOGY State of Washington

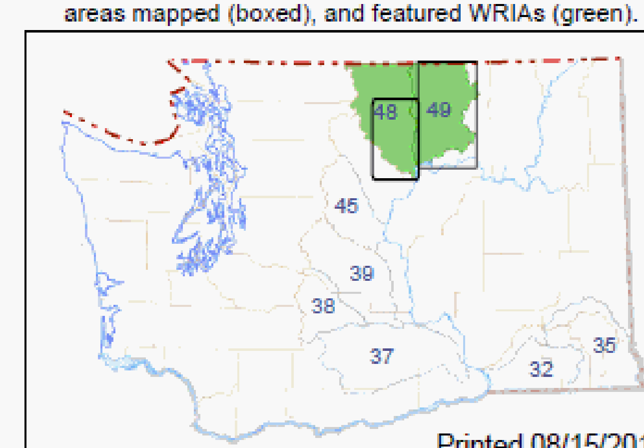
Washington Department of FISH and WILDLIFE

Methow and Okanogan River Basins
WRIAs 48 and 49
Assessed Stream Reaches colored for visual reference

• – Assessed Stream Reach upper extents

Continuation of Assessed Streams to Headwaters

Location of all project WRIAs (blue), location of the areas mapped (boxed), and featured WRIAs (green).

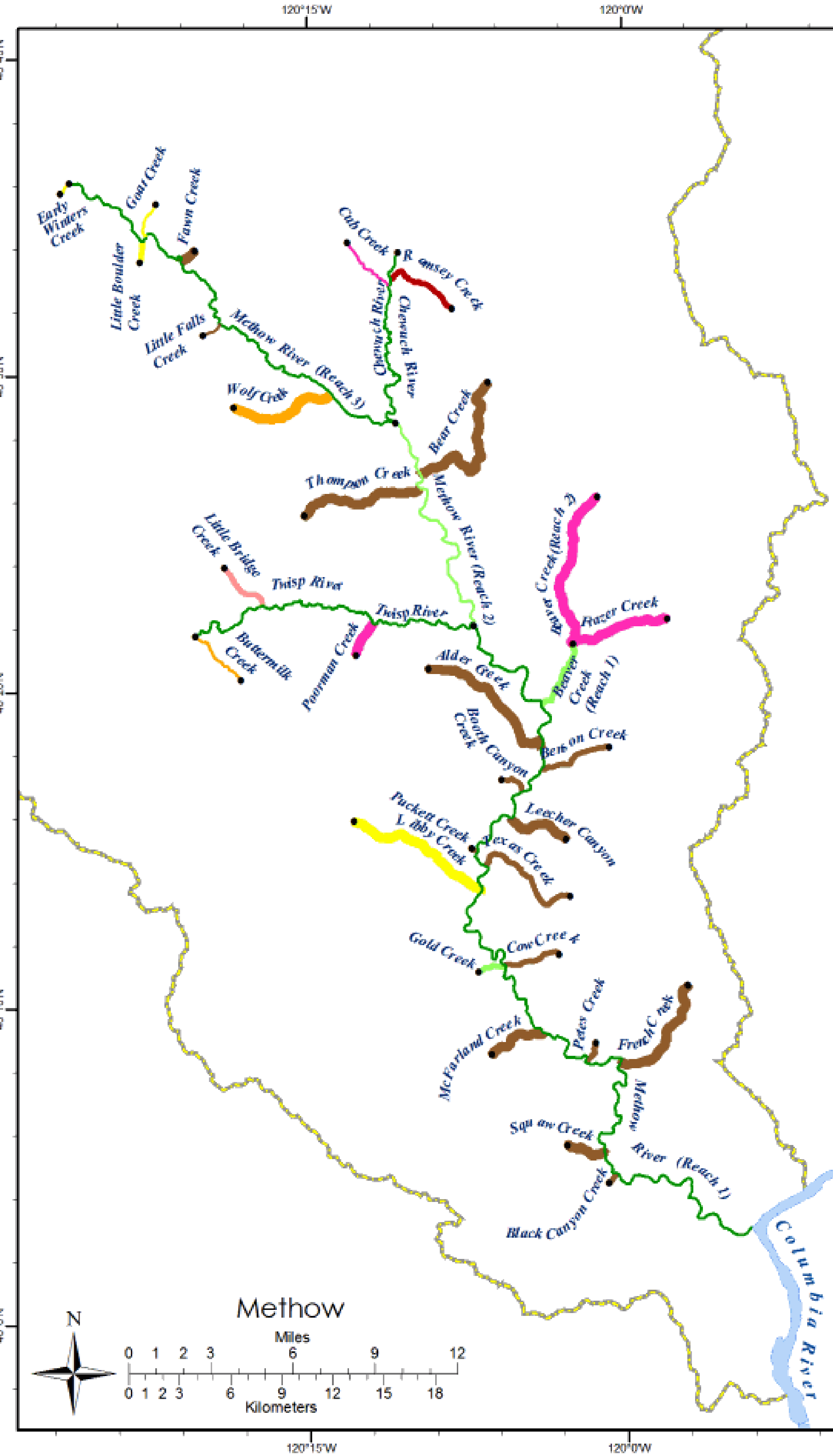


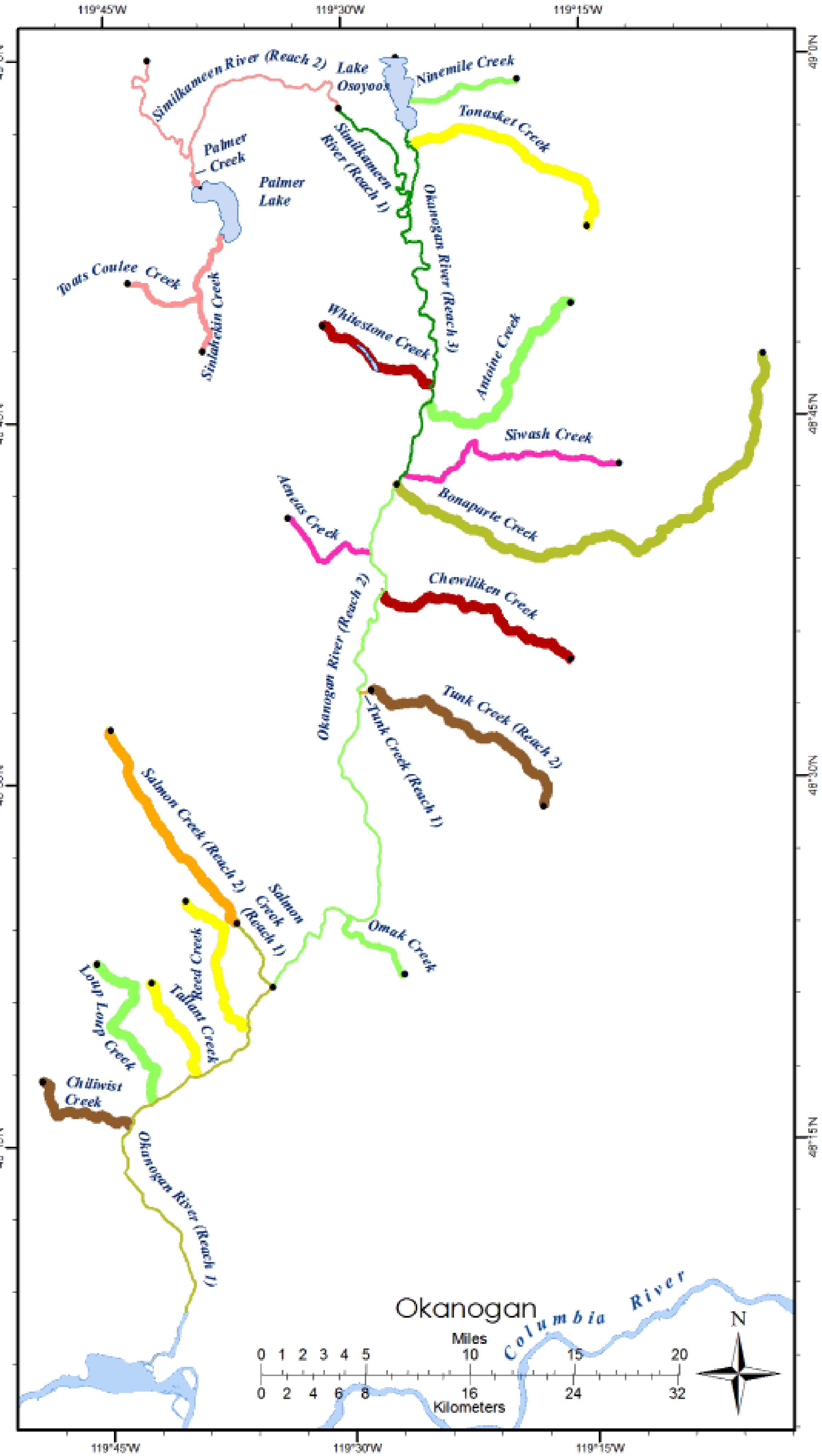
Printed 08/15/2011

WRIAs 48 and 49 - Methow and Okanogan River Basins - Priority Streams

[Intentionally Blank]

Figure F-2 Combined Prioritization Scores Fish, Habitat, & Flow





DEPARTMENT OF ECOLOGY State of Washington

Washington Department of FISH and WILDLIFE

Methow and Okanogan River Basins
WRIAs 48 and 49
Combined Prioritization Scores for Fish, Habitat, and Flow

Scores for Fish Status and Utilization and Current Habitat Condition are visually represented using the following color scheme:

Fish Score

Low | Med | High

Habitat Score

Good | Fair | Poor

Line thicknesses represent Flow Condition

Good

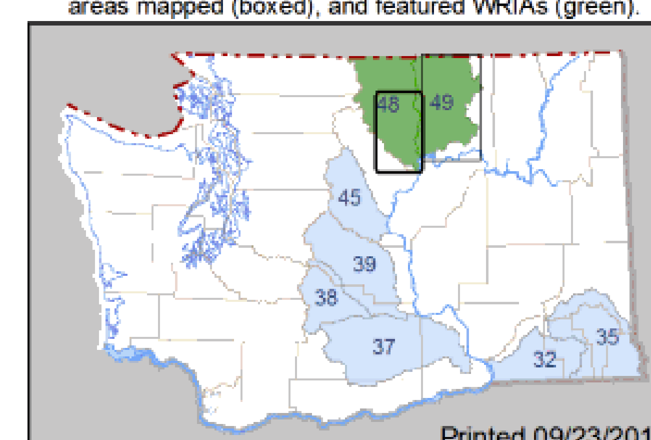
Fair

Poor

• — Assessed Stream Reach upper extents

WRIA Boundary

Location of all project WRIAs (blue), location of the areas mapped (boxed), and featured WRIAs (green).

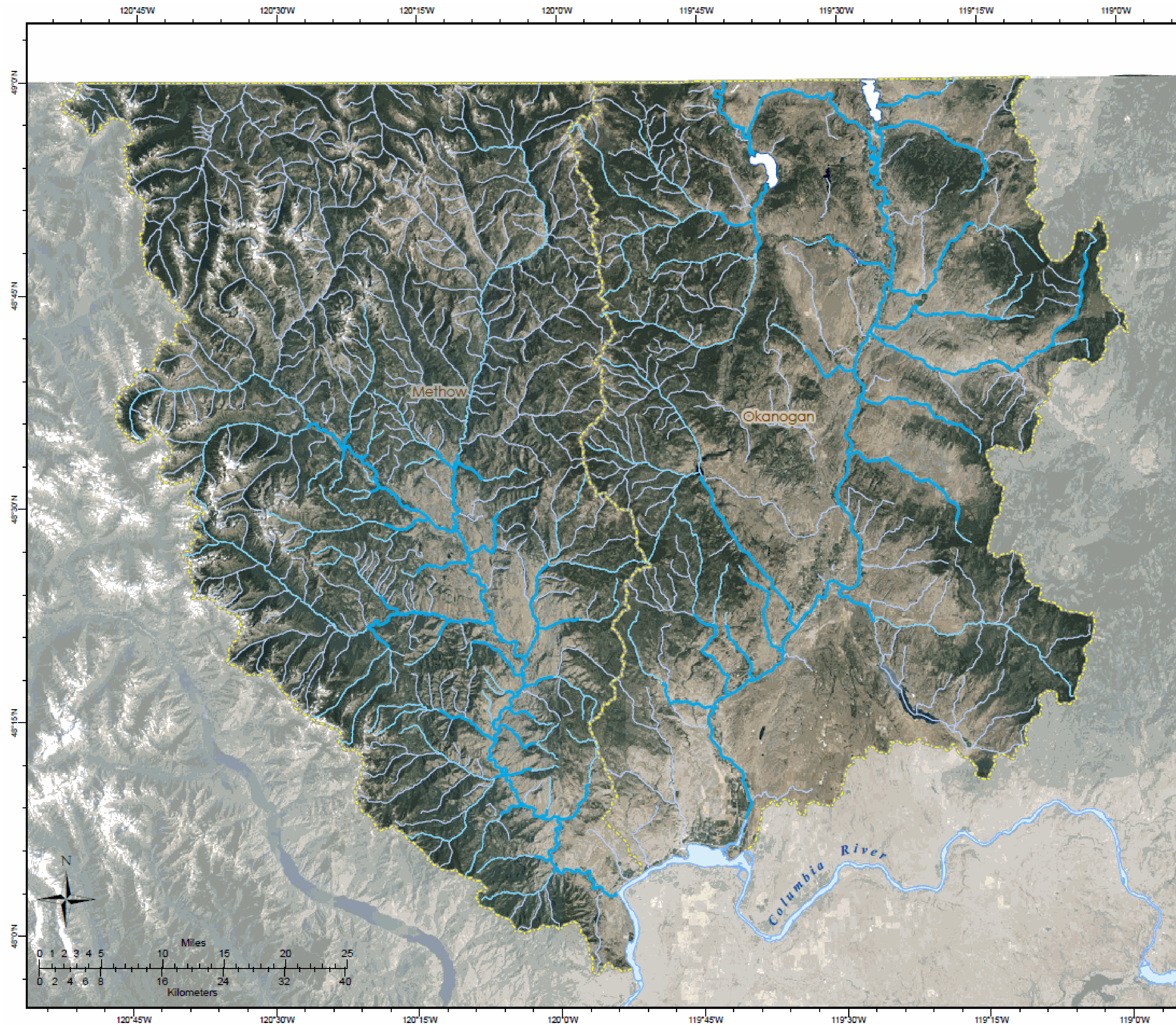


Printed 09/23/2011

WRIAs 48 and 49 - Methow and Okanogan River Basins - Fish, Habitat, and Flow

[Intentionally Blank]

Figure F-32001 Statewide 1m Orthophoto

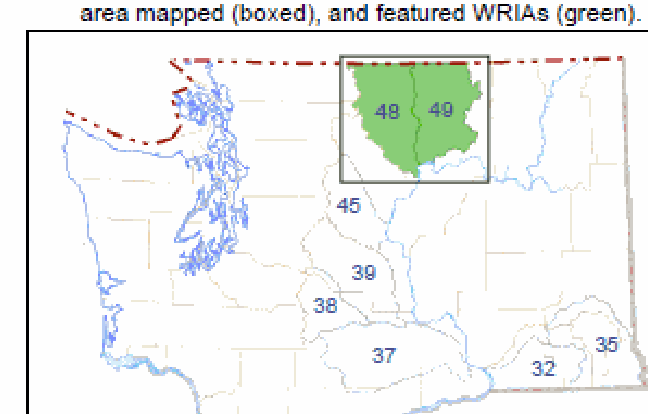


Methow and Okanogan River Basins
WRIAs 48 and 49
2009 Statewide 1m Orthophoto

Stream Distinctions

- Assessed Reaches
- Headwaters of Assessed Reaches
- Other Named Streams
- **WRIA Boundary**

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

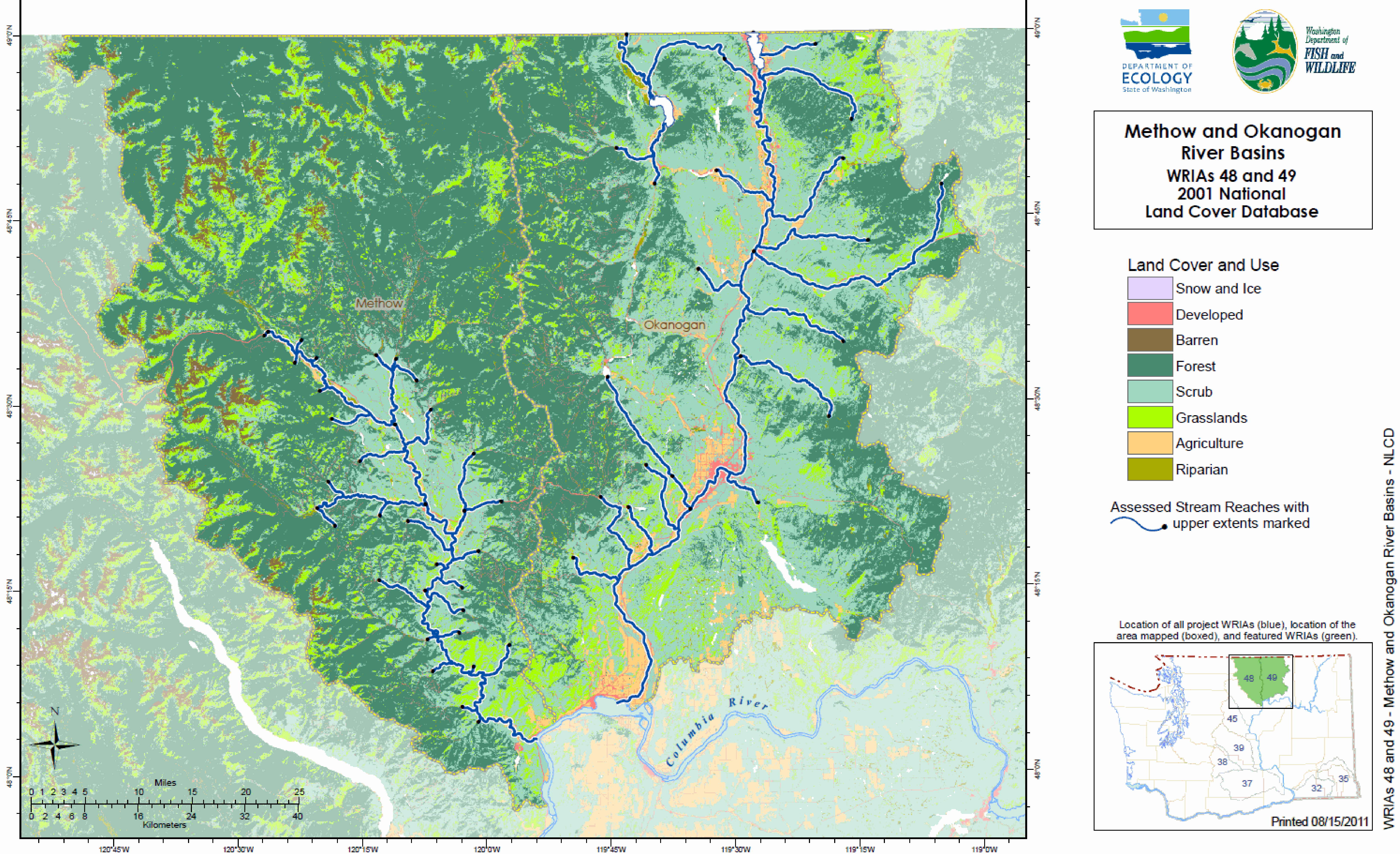


Printed 08/15/2011

WRIAs 48 and 49 - Methow and Okanogan River Basins - Orthophoto

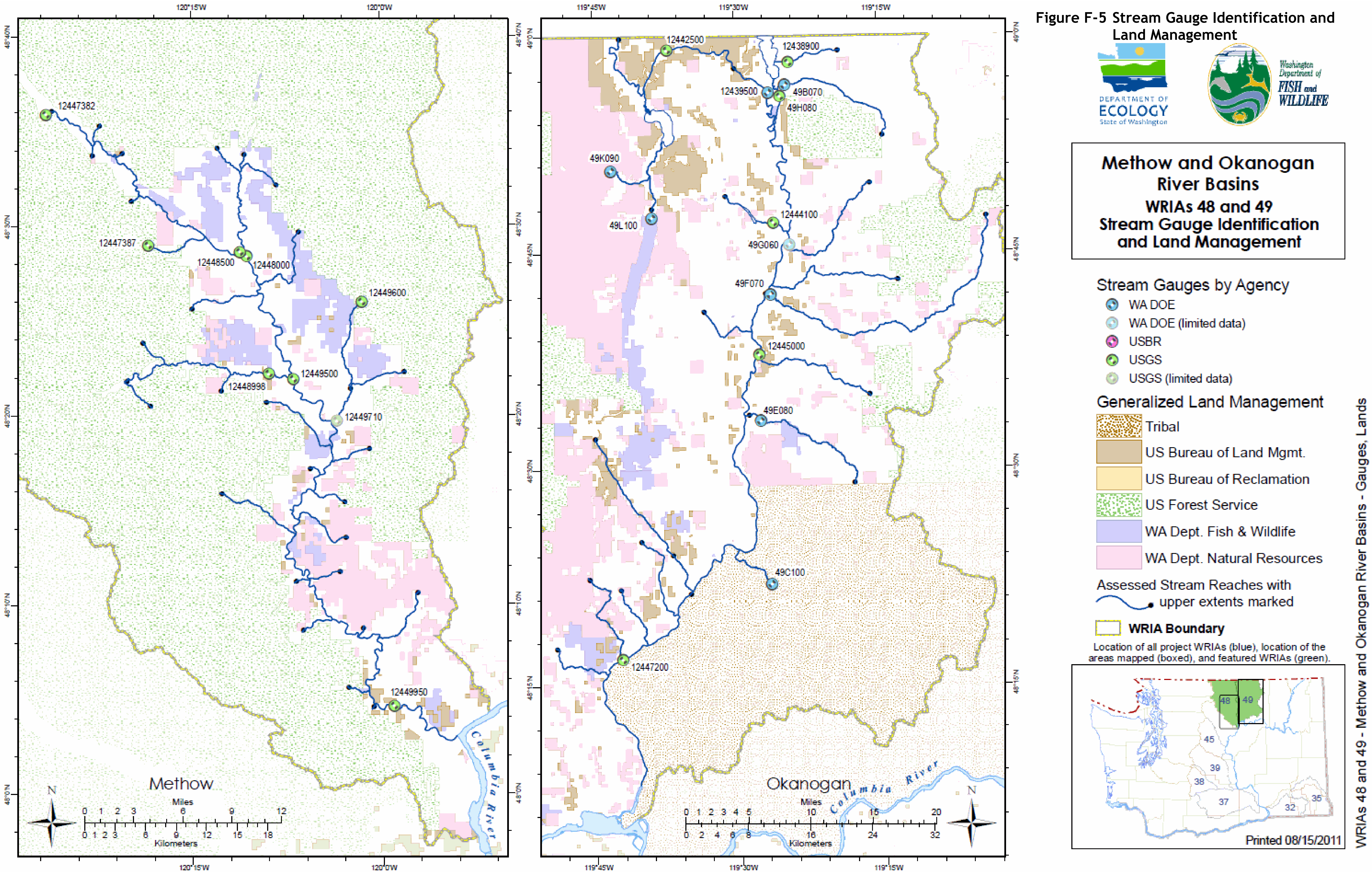
[Intentionally Blank]

Figure F-4 2001 National Land Cover Database



[Intentionally Blank]

Figure F-5 Stream Gauge Identification and Land Management

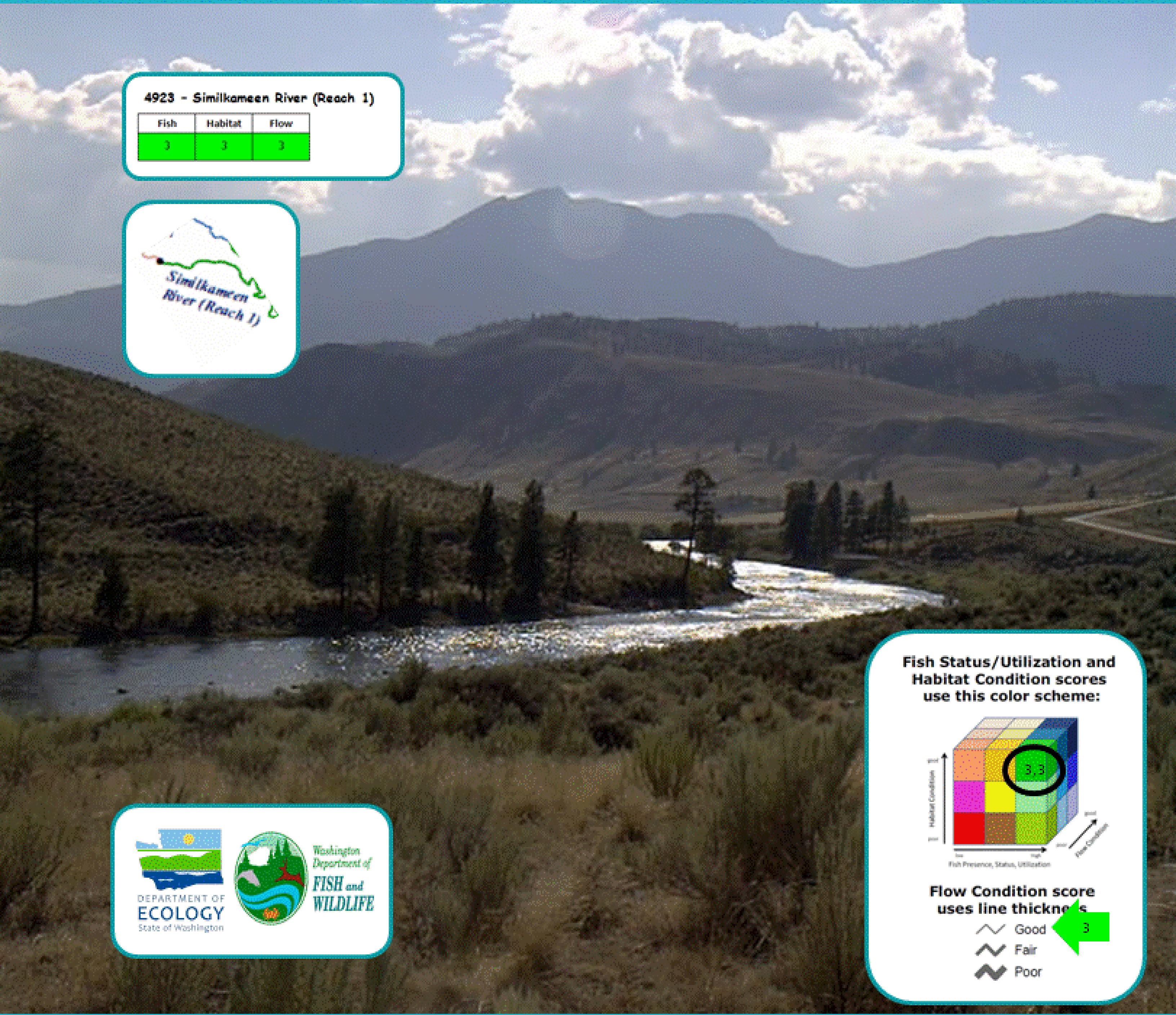


Columbia River Instream Atlas Project

Washington Department of Fish and Wildlife

Final Report – APPENDIX G

WRIA 49 OKANOGAN



Ecology Contract C1000090 - WDFW Contract 09-1471

Ecology Publication Number: 11-12-015

September 2011

Columbia River Instream Atlas Project - Final Report Appendix G –WRIA 49 Okanogan

September 23, 2011

Washington Department of Fish and Wildlife CRIA Team:

Teresa Scott (Habitat Water Resources Policy Coordinator)
Jonathan Kohr (Habitat Water Science Team)
Dayv Lowry (Fish Science; Habitat Science)
Andrew Weiss (Fish Science)
Aaron Bosworth (King County District Fish Biologist)
Jim Cummins (Yakima District Fish Biologist)
Dale Gombert (Fish Science)
Paul La Riviere (Habitat Water Science Team)
Peggy Miller (Habitat Major Projects)
Brianna Murphy (Fish Science)

Funding provided by Ecology Office of Columbia River as part of the 2011 Columbia Basin Long-term Water Supply and Demand Forecast

Ecology Contract C1000090

WDFW Contract 09-1471

Ecology Publication Number: 11-12-015

If you need this document in a format for the visually impaired, call the Office of Columbia River at (509) 575-2490. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

Cover Photo: (Brad Caldwell, Chris Maynard, Hal Beecher, Patrick Verhey)

Columbia River Instream Atlas Project

Final Report

Appendix G - WRIA 49 - Okanogan

September 23, 2011

Table of Contents

Tables

Figures

1. Description[1]

The Okanogan River is the third largest of the Columbia River tributaries. The Okanogan originates in British Columbia and flows through Okanogan, Skaha, Vaseaux, and Osoyoos lakes before crossing into the State of Washington. Within Washington, the Okanogan watershed encompasses about 2,600 square miles (1.65 million acres), which represents 26% of the total watershed for this basin. The Okanogan River is considered

1 Adapted from Okanogan Watershed Plan, Okanogan Watershed Planning Unit, 2009; Northwest Power and Conservation Council 2005c; and Upper Columbia Salmon Recovery Board 2007

the northernmost geologic dividing line between the Cascade and Rocky Mountain Ranges. Within Washington State, the Okanogan runs primarily north to south approximately 79 miles from Lake Osoyoos to its confluence with the Columbia River between Wells Dam and Chief Joseph Dam at Columbia River mile 533.5.

The Similkameen River, located primarily in Canada, contributes 75% of the flow to the Okanogan River. There are numerous important tributaries that drain directly into the Okanogan River. Some of the more significant and larger tributaries draining from the west are Johnson, Salmon, Loup Loup, and Chiliwist Creeks. Dams impound Salmon Creek in Conconully Lake and Conconully Reservoir for irrigation. Important tributaries from the east include Tonasket, Antoine, Siwash, Bonaparte, Tunk, Omak, and Nine Mile Creeks.

2. Reach Definitions

Within WRIA 49 reaches were mainly defined using uppermost diversions, but there were a variety of reach differences within the Okanogan watershed. Many of the streams contained natural barriers to migrating salmonids. In these cases, reaches were separated into two reaches, or ended at those points. Some streams upper reach extents would end at a reservoir or lake such as Bonaparte, Spectacle, or Osoyoos Lakes. As with other stream reach lengths in other WRIA's, upper extents would conclude at national borders, tribal lands, or USFS boundaries. Other stream reaches would end at dams such as Fanchers and Conconully dams, while others would end with landmarks such as road crossings or stream gages nearest to the uppermost water withdrawal diversion points.

Reach 4911 is Palmer Lake, which was not evaluated for this project.

Table G-1 Reach Definitions

Stream Name	Code	Stream Reach Description
Okanogan River (Reach 1)	4901	Mouth to Salmon Creek
Okanogan River (Reach 2)	4902	Salmon Creek to Bonaparte Creek
Okanogan River (Reach 3)	4903	Bonaparte Creek to Canada border
Tonasket Creek	4904	Mouth to USFS boundary
Bonaparte Creek	4905	Mouth to Bonaparte Lake
Loup Loup Creek	4906	Mouth to Helensdale ID weir
Ninemile Creek	4907	Mouth to diversion at 119°18'52.096"W, 48°59'02.9"N
Aeneas Creek	4908	Mouth to North Lamanasky Road
Omak Creek	4909	Mouth to USGS gauging station 12445900
Palmer Creek	4910	Mouth to Palmer Lake - conduit for Sinlahekin River
Antoine Creek	4912	Mouth to Fanchers Dam
Siwash Creek	4913	Mouth to South and Middle Forks Siwash Creek
Tunk Creek (Reach 1)	4914	Mouth to Natural Barrier at 119°28'32.9"W 48°33'48.5"N
Tunk Creek (Reach 2)	4915	Natural Barrier to Colville Indian Reservation
Salmon Creek (Reach 1)	4916	Mouth to OID diversion dam

Stream Name	Code	Stream Reach Description
Salmon Creek (Reach 2)	4917	OID diversion dam to Conconully Reservoir
Chiliwist Creek	4918	Mouth to Chiliwist Road
Tallant Creek	4919	Mouth to northernmost crossing of SR 20
Reed Creek	4920	Mouth to road crossing above Reed Pond
Whitestone Creek	4921	Mouth to mouth of Spectacle Lake
Chewiliken Creek	4922	Mouth to USFS boundary
Similkameen River (Reach 1)	4923	Mouth to Enloe Dam
Similkameen River (Reach 2)	4924	Enloe Dam to Canada border
Toats Coulee	4925	Mouth to DNR boundary
Sinlahekin Creek	4926	Palmer Lake (inclusive) to Cecile Creek

3. WRIA Results

Fish Status and Utilization

Components of the fish status/utilization score and ranking are SaSI status, ESA status, fish diversity, and time spent in the reach for spawning/incubation, rearing/smolt migration and adult migration. TRT designation was not considered in this rating but is available on the spreadsheets for inclusion in future evaluations.

Three SaSI stocks are found in the Okanogan River Basin, Okanogan Summer Chinook, Okanogan Summer Steelhead and Okanogan Sockeye. They are rated as healthy, unknown, and depressed respectively. As for ESA status Okanogan summer steelhead are ESA listed as threatened whereas Okanogan summer Chinook and Okanogan sockeye are not listed under ESA.

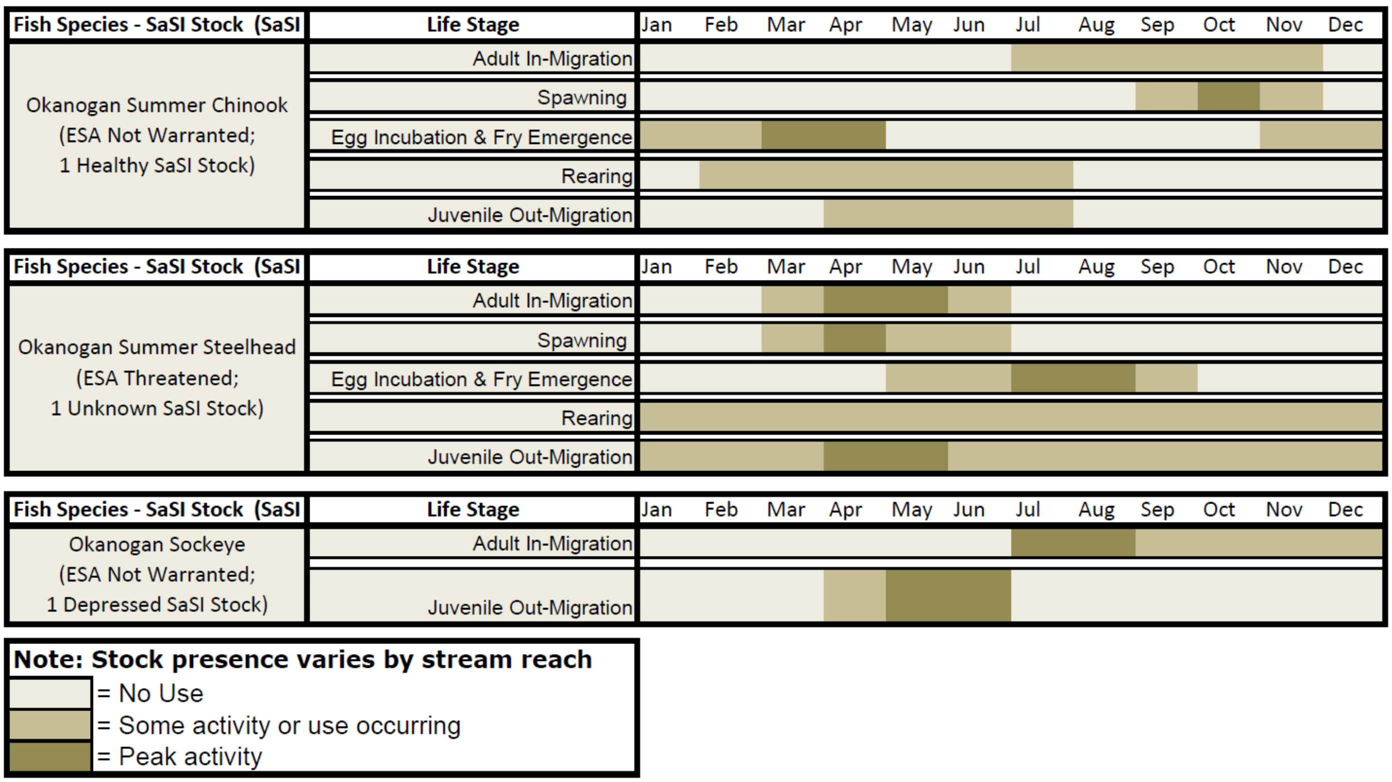
Spring Chinook in the Okanogan River Basin are not considered in this project. Spring Chinook are considered extirpated from the Okanogan watershed (Salmon and Steelhead Habitat Limiting Factors Assessment Watershed Resource Inventory 49: Okanogan Watershed, Entrix 2004; Columbia River Hatchery Reform Project, Okanogan Spring Chinook Population Project, 2009). Limited efforts have been made in some years to re-introduce this stock using Carson Broodstock from the Winthrop hatchery. Residual individuals of spring Chinook return to the Okanogan, and some have been observed spawning in Omak Creek. However, a full re-introduction program has not been implemented, the number of returning fish is small (e.g., 17 fish), and their distribution is not well documented. This population is not recognized by the ESA or by SaSI, and will not be considered here. This stock can be included in following iterations of the atlas as information becomes available.

The components of the fish status/utilization score, SaSi status, and ESA listing will remain the same throughout the Okanogan Basin and will not be repeated for each stream designation.

Table G-2 SaSI Stock Name, Status, ESA Listing Unit, & Listing Status

SaSI Stock name	SaSI Status	ESA Unit Name	ESA Listing Status
Okanogan Summer Chinook	Healthy	Upper Columbia River Summer and Fall Run Chinook	Not Warranted
Okanogan Sockeye	Depressed	Okanogan River Sockeye	Not Warranted
Okanogan Summer Steelhead	Unknown	Upper Columbia Steelhead	Endangered

Table G-3 Fish status & utilization periodicity for five life stages



Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table G-4 Fish status/utilization score & bin by stream reach

Reach Code	Reach Name	Prioritization Score	Normalized Score	Bin
4901	Okanogan River (Reach 1)	106	1.00	3
4902	Okanogan River (Reach 2)	106	1.00	3
4903	Okanogan River (Reach 3)	106	1.00	3
4904	Tonasket Creek	57	0.54	2
4905	Bonaparte Creek	75	0.71	3
4906	Loup Loup Creek	75	0.71	3
4907	Ninemile Creek	75	0.71	3
4908	Aeneas Creek	12	0.11	1
4909	Omak Creek	75	0.71	3
4910	Palmer Creek	0	0.00	1
4912	Antoine Creek	75	0.71	3
4913	Siwash Creek	12	0.11	1
4914	Tunk Creek (Reach 1)	54	0.51	2
4915	Tunk Creek (Reach 2)	48	0.45	2
4916	Salmon Creek (Reach 1)	75	0.71	3
4917	Salmon Creek (Reach 2)	69	0.65	2
4918	Chiliwist Creek	42	0.40	2
4919	Tallant Creek	42	0.40	2
4920	Reed Creek	42	0.40	2
4921	Whitestone Creek	15	0.14	1
4922	Chewiliken Creek	12	0.11	1
4923	Similkameen River (Reach 1)	88	0.83	3
4924	Similkameen River (Reach 2)	0	0.00	1
4925	Toats Coulee Creek	0	0.00	1
4926	Sinlahekin Creek	0	0.00	1

Habitat Condition

Information on fish habitat conditions in the Okanogan watershed was gleaned from literature review such as the 2004 Limiting Factors Analysis (LFA), personal communications with area biologists during meetings in Twisp in 2010, and direct personal observation documented during the 2003 "Okanogan River Tributary Fish Passage And Diversion Screening Prioritization Inventory" survey work. Sub-basin habitat conditions were rated as 'Excellent,' 'Good,' 'Fair,' or 'Poor' based on CRIA habitat criteria. Most streams reviewed had low summer flows and dry land shrub-steppe riparian conditions. The climatic conditions of the Okanogan naturally restrict salmonid habitat use by imposing thermal and flow barriers that can affect the overall production in the watershed. In some portions of the Okanogan watershed, human alterations to the landscape have exacerbated the naturally limiting conditions by further reducing habitat quality and quantity available for salmonid life history needs. These alterations have primarily occurred in the lower gradient, lower reaches of subwatersheds. Low amounts of LWD loading and habitat impacts are mostly the result of past timber harvest operations, road building and placement, and grazing. In the end, a limited amount of documented stream data was available, which supports the assertion made in the 2004 LFA that a quantitative reach-by-reach assessment of habitat conditions in most of the Okanogan basin is needed.

Table G-5 Habitat condition score & bin by stream reach

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Reach Code	Reach Name	Prioritization Score	Bin
4901	Okanogan River (Reach 1)	9	1
4902	Okanogan River (Reach 2)	11	2
4903	Okanogan River (Reach 3)	13	3
4904	Tonasket Creek	10	2
4905	Bonaparte Creek	9	1
4906	Loup Loup Creek	11	2
4907	Ninemile Creek	11	2
4908	Aeneas Creek	11	2
4909	Omak Creek	12	2
4910	Palmer Creek	13	3
4912	Antoine Creek	10	2
4913	Siwash Creek	10	2
4914	Tunk Creek (Reach 1)	13	3
4915	Tunk Creek (Reach 2)	8	1
4916	Salmon Creek (Reach 1)	8	1
4917	Salmon Creek (Reach 2)	14	3
4918	Chiliwist Creek	8	1
4919	Tallant Creek	12	2

Reach Code	Reach Name	Prioritization Score	Bin
4920	Reed Creek	12	2
4921	Whitestone Creek	8	1
4922	Chewiliken Creek	6	1
4923	Similkameen River (Reach 1)	15	3
4924	Similkameen River (Reach 2)	13	3
4925	Toats Coulee Creek	14	3
4926	Sinlahekin Creek	13	3

Flow Condition

The hydrology of the Okanogan River Watershed is characterized by high springtime run-off due to spring rains and melting snowpack, with low summer and early fall flows due to nearly absent precipitation and diminishing snowpack. Irrigation diversions also reduce summer flows. Hydrology may be altered from historical patterns, increasing peak flows and changing overall water yield and timing of runoff. Landscape changes such as timber harvest and road construction can cause dramatic changes in certain portions of a drainage, such as in small headwater subbasins with southerly aspects.

WRIA 49 is comprised of numerous drainage basins. The Similkameen River is considered a major tributary to the Okanogan River. Its flow is, on average, actually more than 4 times the flow of the Okanogan where the two rivers join south of Oroville. About 90 percent of the Similkameen River drainage is from Canada; only 10 percent of the drainage is within Washington from Sinlahekin Creek and its primary tributary, Toats Coulee Creek, as well as from other streams (Paysaten and Ashnola). Sinlahekin Creek drains into Palmer Lake, which empties into the Similkameen River through Palmer Creek. There are numerous other important tributaries that drain directly into the Okanogan River and some of the more significant and larger ones draining from the west are Johnson, Salmon, Loup Loup, and Chiliwist Creeks. Dams impound Salmon Creek in Conconully Lake and Conconully Reservoir for irrigation. Important tributaries from the east include Tonasket, Antoine, Siwash, Bonaparte, Tunk, and Omak Creeks.

There are several data sets with long-term continuous records, short-term continuous records, individual point data from throughout the year, or only very short-term seasonal data regarding flow that are available from various entities (Ecology, Okanogan Conservation District, Colville Confederated Tribes, Reclamation, and USGS). For those tributary streams for which data are available, the estimated mean annual flows per square mile are highest in the Sinlahekin Creek (~448 ac-ft/sq mi), Similkameen River (~433 to 478 ac-ft/sq mi), and North Fork Salmon Creek (~460 to 491 ac-ft/sq mi). Mean annual flows are lowest in Bonaparte Creek (~21 to 37 ac-ft/sq mi) and Tunk Creek (~21 to 52 ac-ft/sq mi). Peak discharges typically occur during the 4-month period from April through July, reflecting primarily snowmelt or rain-on-snow events, when streams contribute about 70-80 percent of their average annual discharge. Low flows generally occur from August (Johnson Creek) to October (Okanogan River) depending on the stream, but prior to the beginning of autumn rainy periods. In some cases, the streamflow hydrographs are influenced by upstream diversions or regulation (e.g., Whitestone Creek). Some smaller streams freeze up during winter and have no flow until the spring thaw.[2]

Of the twenty-five stream reaches evaluated for this project, fourteen have gauges with data sufficient for analysis, and four reaches have minimum instream flow rules set by Ecology. Instream flows were set on the main stem Okanogan River in 1976 (Chapter 173-549 WAC) (Table G-6).

The Upper Columbia Salmon Recovery Board's Regional Technical Team identified Bonaparte, Loup Loup, and Antoine Creeks as specifically needing instream flow enhancement, in addition to a general need for strategic acquisition of water for instream benefits throughout the Okanogan basin.[3]

Table G-6 Minimum Instream Flows set in Chapter 173-549 WAC

Time period		Reach 4901 Okanogan River at Malott USGS 12447200	Reach 4902 Okanogan River near Tonasket USGS 12445000	Reach 4903 Okanogan River at Oroville USGS 12439500	Reach 4924 Similkameen River near Nighthawk USGS 12442500
Jan	1	860	800	320	400
	15	830	800	320	400
Feb	1	820	800	320	400
	15	850	800	320	400
Mar	1	880	800	320	425
	15	900	800	320	450
Apr	1	925	910	330	510
	15	1,100	1,070	340	640
May	1	1,750	1,200	350	1,100
	15	3,800	3,800	500	3,400
Jun	1	3,800	3,800	500	3,400
	15	3,800	3,800	500	3,400
Jul	1	2,100	2,150	420	1,900
	15	1,200	1,200	350	1,070
Aug	1	800	840	320	690
	15	600	600	300	440
Sept	1	620	600	300	400
	15	700	600	300	400
Oct	1	750	730	330	450

[2] Adapted from Okanogan Watershed Plan, Okanogan Watershed Planning Unit, 2009.

[3] RTT Summary of Priority Reaches and Actions, UCSRB RTT, 2009.

Time period	Reach 4901 Okanogan River at Malott USGS 12447200	Reach 4902 Okanogan River near Tonasket USGS 12445000	Reach 4903 Okanogan River at Oroville USGS 12439500	Reach 4924 Similkameen River near Nighthawk USGS 12442500
15	960	900	370	500
Nov 1	950	900	370	500
15	950	900	320	500
Dec 1	930	900	320	500
15	900	850	320	450

Table G-7 Flow condition score & bin by stream reach

Reach Codes	Reach Name	Prioritization Score	Bin
4901	Okanogan River (Reach 1)	4	3
4902	Okanogan River (Reach 2)	4	3
4903	Okanogan River (Reach 3)	10	3
4904	Tonasket Creek	32	1
4905	Bonaparte Creek	36	1
4906	Loup Loup Creek	27	1
4907	Ninemile Creek	20	2
4908	Aeneas Creek	20	2
4909	Omak Creek	21	2
4910	Palmer Creek	6	3
4912	Antoine Creek	32	1
4913	Siwash Creek	20	2
4914	Tunk Creek (Reach 1)	12	3
4915	Tunk Creek (Reach 2)	32	1
4916	Salmon Creek (Reach 1)	15	3
4917	Salmon Creek (Reach 2)	24	1
4918	Chiliwist Creek	36	1
4919	Tallant Creek	24	1
4920	Reed Creek	32	1
4921	Whitestone Creek	24	1
4922	Chewiliken Creek	24	1
4923	Similkameen River (Reach 1)	3	3
4924	Similkameen River (Reach 2)	4	3
4925	Toats Coulee Creek	18	2
4926	Sinlahekin Creek	21	2

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

4. Reach Results

4901 – Okanogan River (Reach 1):

Fish	Habitat	Flow
3	1	3

Fish Status/Utilization

This stream reach is rated high for fish utilization. Okanogan summer Chinook and Okanogan summer steelhead spawn and rear in this reach of the Okanogan River mainstem. In addition it is part of the adult and juvenile migration corridor for Okanogan summer Chinook, Okanogan summer steelhead and Okanogan sockeye. Okanogan River (Reach 1) is not part of an Okanogan summer Chinook, Okanogan summer steelhead or Okanogan sockeye designated Major or Minor Spawning Area. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

The lower Okanogan River reach was given a poor overall habitat condition score, mainly due to the known water quality issues. Ecology's 1998 Section 303(d) list (Impaired and Threatened Waterbodies Requiring Additional Pollution Controls) includes the Okanogan River for "failure to meet water quality standards for temperature, dissolved oxygen, pH, and fecal coliform." Okanogan River water temperatures often exceed lethal tolerance levels for salmonids in the mid to- late summer. These exceedences are partly a result of natural phenomena (low gradient and solar radiation on the upstream lakes), but are exacerbated by sedimentation and summer low flows caused by dam operations and irrigation. High water temperatures in late summer and fall form a thermal barrier, effectively excluding juvenile salmon from rearing in most of the basin, except during the first few weeks after emergence (Chapman et al. 1994a). At times, high water temperatures in the lower Okanogan River have blocked adult anadromous salmonid passage. The most extreme example is in adult sockeye that are sometimes thermally blocked through the lower Okanogan River (downstream of Lake Osoyoos) during late July and early August (Pratt et al. 1991).

The reach is mostly channelized and contains poor floodplain connectivity, few Off-Channel Habitats (OCH) for rearing, and is inundated with warmwater species such as smallmouth bass that prey on outmigrating salmonids. Spawning scored low due to the high sediment levels. This reach is primarily used as a migration corridor, and passage scored a 'good'. Some rearing occurs, providing a 'fair' score for that attribute. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:Yes The minimum of monthly mean flows in this reach is 1,117 cfs in September and the peak is 9,680 cfs in June . Minimum flow is 38 percent of the average. Diversions evaluated for this project represent 4 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component. On average, actual flows exceed minimum instream flow rules in every month. Flow scores are presented on Table G-10.

4902 – Okanogan River (Reach 2)

Fish	Habitat	Flow
3	2	3

Fish Status/Utilization

The Okanogan River (Reach 2) is rated 'high' for fish utilization. As with Okanogan River (Reach1), Okanogan summer Chinook and Okanogan summer steelhead spawn and rear in this reach of the Okanogan River mainstem. In addition it is part of the adult and juvenile migration corridor for Okanogan summer Chinook, Okanogan summer steelhead, and Okanogan sockeye. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

The channelization of reach 2 of the Okanogan River is similar to reach 1 morphologically and rates 'poor' for floodplain connectivity and OCH. Riparian, spawning, and rearing conditions were scored 'fair' after review with local biologists. Passage was rated 'good' with no unnatural barriers; there are possible riffle barriers at lower flow. Overall, habitat conditions are 'fair' at present. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:Yes The minimum of monthly mean flows in this reach is 1,083 cfs in October and the peak is 9,680 cfs in June . Minimum flow is 37 percent of the average. Diversions evaluated for this project represent 8 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component. On average, actual flows exceed minimum instream flow rules in every month. Flow scores are presented on Table G-10.

4903 – Okanogan River (Reach 3)

Fish	Habitat	Flow
3	3	3

Fish Status/Utilization

The fish status/utilization rates 'high' for the Okanogan River Reach 3. Okanogan summer Chinook and Okanogan summer steelhead continue to spawn and rear in this reach of the Okanogan River mainstem. All three species utilize Okanogan River

Reach 3 for adult and juvenile migration. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

Reach 3 contains slightly better salmonid spawning and rearing suitability and was rated 'good' based on discussions of known salmonid use and past site reviews. Riparian score was scored as 'fair' and other scores of floodplain connectivity and OCH's were still considered 'poor,' similar to downstream reach scores. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:Yes The minimum of monthly mean flows in this reach is 453 cfs in January and the peak is 1,125 cfs in May. Minimum flow is 68 percent of the average. Diversions evaluated for this project represent 41 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. The instream flow rule is higher than Mean Annual Flow in 7 months of the year, on average. Reaches with flow rules greater than Mean Annual Flow between 6 and 9 months of the year are considered to be in 'fair' condition. In spite of difficulty meeting the minimum instream flows, average flow volume is large relative to other reaches in this WRIA, and this attribute strongly influences the overall flow condition score. Flow scores are presented on Table G-10.

4904 – Tonasket Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

The Tonasket Creek reach fish status/utilization rates 'average' compared to the mainstem Okanogan reaches. Okanogan summer steelhead is the only stock to spawn, rear, and use this reach as an adult migration corridor. Okanogan summer Chinook juveniles may use Tonasket Creek as a rearing area for a portion of the year. Okanogan sockeye do not utilize this stream reach at all. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

Direct observation reveals very few OCH's within the creek, so this attribute scored 'poor.' Floodplain connectivity and riparian conditions were rated as 'poor' to 'fair' in the 2004 LFA, and we settled on 'fair' scores after consultations with local biologists. Spawning and rearing suitability are 'fair' in the lower reach but there is a natural gradient barrier that drops the passage score to a 'poor' rating. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:No An NHD+ estimated 3 cfs Mean Annual Flow was used to score this reach. Diversion data used for this evaluation exceed the Mean Annual Flow. Flow scores are presented on Table G-10.

4905 – Bonaparte Creek

Fish	Habitat	Flow
3	1	1

Fish Status/Utilization

Fish status/utilization in Bonaparte Creek is high, even though Okanogan sockeye does not utilize this reach and Okanogan summer Chinook use is limited to rearing during a portion of the year. Okanogan summer steelhead use carries most of the rating with yearlong rearing, 7 months of spawning to emergence, and four months of use as an adult migration corridor. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

Habitat conditions were not scored within the LFA for Bonaparte Creek, so our scores are based entirely on direct observation and consultation with local biologists. The creek is mostly channelized and lacks pools and sinuosity, leading to morphological scores of ‘poor.’ Lack of riparian growth due to cultivation at the stream edge, and low utility for spawning and rearing in the lower reach, lead to ‘fair’ scores for these parameters. Since there is a natural barrier at RM 1.0, passage was rated ‘poor.’ Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is less than 1 cfs in August and the peak is 8 cfs in May. Minimum flow is 9 percent of the average. Diversion data used for this evaluation exceed the Mean Annual Flow. Bonaparte is one creek recommended by the RTT for instream flow enhancement. Flow scores are presented on Table G-10.

4906 – Loup Loup Creek

Fish	Habitat	Flow
3	2	1

Fish Status/Utilization

Loup Loup Creek also rates high for fish utilization. Fish status/utilization and timing is the same as for Bonaparte Creek. Okanogan summer Chinook utilize this reach for limited juvenile rearing and Okanogan sockeye not at all. Okanogan summer steelhead use carries most of the rating with yearlong rearing, 7 months of spawning to emergence and four months of use as an adult migration corridor. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

The Loup Loup Creek habitat was evaluated to the upper most diversion weir at RM 10.2. The historic terminus for steelhead fish passage is Loup Loup Falls @ RM 2.04. Therefore, the lower portion was more heavily weighted in scoring determination of the six habitat parameters. Through onsite observations, corroborated through consultations with local biologists, floodplain connectivity and passage is considered 'poor.' Spawning conditions are 'fair' and rearing suitability in the lower reach is limited, but considered good value. The LFA rates floodplain connectivity as 'good,' but we downgraded that score to 'fair' after site review and consultations. Riparian conditions were graded 'fair' in the LFA, and verified by personal site visits. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 8 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 42 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. Loup Loup Creek was specifically identified by the RTT as needing instream flow enhancement. Flow scores are presented on Table G-10.

4907 – Ninemile Creek

Fish	Habitat	Flow
3	2	2

Fish Status/Utilization

Fish status/utilization at Ninemile Creek is the same as Loup Loup and Bonaparte Creeks. The Okanogan summer steelhead carries the 'high' fish status/utilization rating by utilizing this reach for spawning, rearing, and as an adult migration corridor. Okanogan sockeye do not use this reach and Okanogan summer Chinook may utilize it for a limited time for juvenile rearing. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

Ninemile Creek habitat ranked as 'fair' because of passage concerns, poor floodplain connectivity, and degraded off-channel habitat conditions related to agricultural practices, cattle intrusion, and channelizing of the creek. It is ranked as 'good' for both spawning and rearing suitability as confirmed from local biologists' recent steelhead spawning surveys. Riparian conditions are good and bad in places along the creek with an overall reach score of 'fair.' Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is less than 1 cfs from June to December and the peak is 2 cfs in March . Minimum flow is 38 percent of the average. Basically, this creek has very low flows year-round. No diversion data are available in this reach. Flow scores are presented on Table G-10.

4908– Aeneas Creek

Fish	Habitat	Flow
1	2	2

Fish Status/Utilization

Aeneas Creek reach rates 'low' for fish utilization. Fish status/utilization is limited to juvenile use by both Okanogan summer Chinook and Okanogan summer steelhead. During low flow in late summer Aeneas Creek becomes a complete fish passage barrier and is only passable during May through July. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

The reach described and evaluated for Aeneas Creek flows through an area referred to as the "lime belt region." The affect of this lime belt is evident by the accumulation of calcium carbonate along the streambed channel (Entrix, 2003). The majority of the land in the watershed is privately owned and used primarily for farming and ranching, and rural development. These are likely reasons for the average scores (fair) for spawning and rearing conditions and low scores (poor) for OCH and passage conditions. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 0.4 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach. Flow scores are presented on Table G-10.

4909 – Omak Creek

Fish	Habitat	Flow
3	2	2

Fish Status/Utilization

Fish status/utilization in Omak Creek is a repetition of Bonaparte, Loup Loup, and Ninemile Creeks. Okanogan sockeye do not use this reach whereas Okanogan summer Chinook may utilize it for a limited time for juvenile rearing. Okanogan summer steelhead utilize this reach for spawning, rearing and as an adult migration corridor. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

All reviewed habitat parameters scored 'fair' except off-channel habitat, which scored 'poor,' and rearing suitability, which scored 'good.' Mission Falls, located 5.4 miles upstream of the confluence with the Okanogan River, remains an effective barrier to Chinook salmon and a major impediment to summer steelhead. The reach reviewed for the project extended to the USGS gage at RM 5.7. Since this barrier was so far upstream into the reach, overall passage was given a 'fair' score. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 2 cfs in August-September and the peak is 55 cfs in April. Minimum flow is 13 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 4 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component. Flow scores are presented on Table G-10.

4910 – Palmer Creek

Fish	Habitat	Flow
1	3	3

Fish Status/Utilization

Okanogan anadromous salmon stocks do not utilize Palmer Creek because passage in the Similkameen is blocked by Enloe Dam. Palmer Creek is included in this evaluation because there may be potential water sources that would benefit downstream reaches. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

Palmer Creek literature review revealed little to no information on its habitat conditions and therefore we were reliant on consultation with local biologists. The reach was given 'fair' ratings on most habitat attributes, which yield an overall 'good' bin score when compared with other reaches in this WRIA. Additional direct observation is necessary for higher confidence evaluation of this creek. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 62 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach. The relatively good estimated flow volume carried the 'good' bin score for Palmer Creek. Flow scores are presented on Table G-10.

4912 – Antoine Creek

Fish	Habitat	Flow
3	2	1

Fish Status/Utilization

Antoine Creek is another repeat of Bonaparte, Loup Loup, Ninemile, and Omak creeks. Okanogan summer Chinook may use the reach for limited juvenile rearing contrasted by Okanogan summer steelhead, which uses the reach for spawning, rearing and as an adult migration corridor. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

There is a natural barrier found at approximately RM 3 and Fanchers Dam impounds Antoine Creek at River Mile 12; the reservoir covers approximately 20 acres and is used for irrigation. Lands adjacent to Antoine Creek are used primarily for agriculture. Using LFA and past WDFW stream inventory results, we scored Antoine Creek 'fair' for all habitat parameters except for passage and OCH, which are 'poor.' Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:No Minimum flow in this reach between 0 and 1 cfs in July-April, with a peak flow of 4 cfs in May. Minimum flow is 31 percent of the average. This site has been very difficult to monitor over the years. Even though regular discharge measurements are made, a reliable rating curve has been extremely difficult to maintain. One contributing source of difficulty to maintaining a rating curve is large seasonal variability of vegetation growth which creates backwater conditions in the gauge reach. Currently these are the only data available on which to evaluate. Diversion data used for this evaluation equal or exceed the Mean Annual Flow. Antoine Creek was specifically identified by the RTT as needing instream flow enhancement. Flow scores are presented on Table G-10.

4913 – Siwash Creek

Fish	Habitat	Flow
1	2	2

Fish Status/Utilization

Siwash Creek is rated as low for fish utilization. This can be explained by the limited use of the reach by the three stocks. Okanogan sockeye do not utilize the reach and Okanogan summer Chinook and Okanogan summer steelhead only use Siwash Creek for 3 months out of the year as juvenile rearing. During low flow in late summer Siwash Creek becomes a complete fish passage barrier and is only passable during May through July. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

Anadromous fisheries resources are restricted due to an impassible steep gradient reach located approximately 1.4 miles upstream of the confluence with the Okanogan River. Siwash Creek is nearly impounded at RM 3 by a dam on private property. The lands adjacent to the creek are used primarily for agriculture and home sites. Scores were considered ‘fair’ for all but OCH and floodplain connectivity, which both scored ‘poor.’ Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 4 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach. Flow scores are presented on Table G-10.

4914 – Tunk Creek (Reach 1)

Fish	Habitat	Flow
2	3	3

Fish Status/Utilization

Tunk Creek (Reach 1) fish status/utilization by anadromous fish is limited, hence the ‘average’ rating. Okanogan sockeye do not utilize this reach whereas juvenile Okanogan summer Chinook may be found rearing in Tunk Creek Reach 1. Okanogan summer steelhead use this reach March through September for spawning, rearing and as an adult migration corridor. In some years, Okanogan summer steelhead adult migration and spawning is prohibited by low-to-nonexistent flows in summer and fall. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

Lower Tunk Creek Reach 1 consists of only a 0.6 mile reach where a natural falls occurs near the confluence with the Okanogan River. The land adjacent to Tunk Creek is used mainly for agriculture with an apple orchard straddling the right bank. Lower Tunk Creek is considered good habitat for salmonids. Passage to the falls is also considered good, but the adjacent orchard and residential area drives the off-channel habitat and riparian condition scores down to ‘poor’ values. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 3 cfs Mean Annual Flow was used to score this reach. No diversion data are available. It is primarily the degree of impairment in other reaches of this WRIA that drives this average-scoring reach to a ‘good’ flow condition bin. Flow scores are presented on Table G-10.

4915 – Tunk Creek (Reach 2)

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Tunk Creek Reach 2 is also rated as 'average.' Okanogan summer steelhead is the only anadromous stock utilizing this reach. Spawning, rearing and adult migration is limited to March through September. Low flows during adult migration and no water available most summers precludes the use of the stream for spawning and adult migration some years. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

The land adjacent to Tunk Creek is used mainly for rangeland and other agricultural uses, leading to 'poor' scores for habitat functions and values. There is limited rearing potential and 'fair' floodplain connectivity. Much of the middle reach is degraded due to agriculture and livestock intrusion. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 0-1 cfs in July-November and the peak is 11 cfs in May. Minimum flow is 4 percent of the average; reaches with August flows less than 33% of average scored 'poor' for this component of the flow element score. Diversions evaluated for this project represent 38 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. Flow scores are presented on Table G-10.

4916 – Salmon Creek (Reach 1)

Fish	Habitat	Flow
3	1	3

Fish Status/Utilization

Fish status/utilization rating for Salmon Creek (Reach 1) is high. The activities and duration of activities by stocks in this reach is the same as Bonaparte and other creeks in the system. Okanogan summer steelhead rear yearlong in this reach. They also utilize the reach for spawning and as an adult migration corridor. Okanogan summer Chinook utilize the reach for limited juvenile rearing. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

The Okanogan Irrigation District (OID) formerly diverted 100% of Salmon Creek at a diversion dam at RM 4.3, leaving the river downstream of the diversion dam completely dewatered. Water conservation efforts have reduced the diversion so water is retained in the lower reach. The ground porosity consists of larger rocks and boulders through the lower portion and this is considered a passage problem; therefore, the passage score is ‘poor.’ The lower reach habitat is degraded as it flows through the town of Okanogan. Spawning and rearing suitability was scored as ‘fair’ and other habitat parameters scored ‘poor.’ Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 22 cfs Mean Annual Flow was used to score this reach. No diversion data are available in this reach. Relative flow volume elevates the bin score for this reach. Flow scores are presented on Table G-10.

4917 – Salmon Creek (Reach 2)

Fish	Habitat	Flow
2	3	1

Fish Status/Utilization

Fish status/utilization in Salmon Creek (Reach 2) is limited to Okanogan summer steelhead even though the creek is rated as high utilization. Okanogan steelhead are found in this reach year round and all life cycle stages occur in Salmon Creek Reach2 as they do in Salmon Creek Reach 1, yielding a ‘high’ rating in both reaches. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

This upper Salmon Creek reach is evaluated up to Conconully Dam, approximately 15 miles upstream from the mouth. Uses of lands adjacent to the creek include range activities and agriculture, so habitat has been somewhat degraded in the lower part of the reach. Once into the forested portion upstream of the agricultural area, the creek has better-than-average habitat. Direct observation indicates spawning and rearing suitability are ‘good,’ as are passage conditions. Riparian habitat and floodplain conditions were rated as ‘fair,’ because the lower few miles of this reach is in ‘poor’ condition within the agriculture area. Just as many streams are limited in off-channel habitat, Salmon Creek is no exception having ‘poor’ overall score for OCH. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 21 cfs Mean Annual Flow was used to score this reach, and the estimated mean August flow is 30% of MAF. Diversions evaluated for this project represent 6 percent of the Mean Annual Flow, yielding a ‘fair’ score on this attribute. Flow scores are presented on Table G-10.

4918 – Chiliwist Creek

Fish	Habitat	Flow
2	1	1

Fish Status/Utilization

Chiliwist Creek fish status/utilization rating is ‘average.’ This rating is based on juvenile rearing of Okanogan summer Chinook and Okanogan summer steelhead. This creek differs from other creeks in that Okanogan summer steelhead do not use this reach for spawning or as an adult migration. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

The Okanogan Conservation District (OCD) identified a natural barrier they named Chiliwist Falls at RM 0.56. This restricts anadromous access to the lower half mile of the creek and gives this reach a passage score of ‘poor.’ Forestry, livestock grazing and irrigated agriculture are the primary uses of the Chiliwist subwatershed. Riparian conditions and rearing suitability are scored as ‘fair’ from LFA review, peer discussions, and personal observations. The off-channel and floodplain habitat conditions are ‘poor’ and spawning suitability is low. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 2 cfs Mean Annual Flow was used to score this reach. Diversion data used for this exceed the Mean Annual Flow. Flow scores are presented on Table G-10.

4919 – Tallant Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

Tallant Creek fish status/utilization is a repeat of Chiliwist Creek. They both received an ‘averagea rating for fish utilization. Juveniles of both Okanogan summer steelhead and Okanogan summer Chinook stocks rear in this reach. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

Very limited information was found in reviewed literature. More in-depth review is needed for habitat of this creek; scores of 'fair' were given due to lack of information or observations. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 1.1 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent about 9 percent of the Mean Annual Flow; reaches with diversions between 5% and 15% of Mean Annual Flow scored 'fair' for this scoring component. Flow scores are presented on Table G-10.

4920 – Reed Creek

Fish	Habitat	Flow
2	2	1

Fish Status/Utilization

The fish status/utilization rating is also 'average' for Reed Creek. As with Tallant and Chiliwist creeks, juveniles of both Okanogan summer steelhead and Okanogan summer Chinook stocks rear in this reach. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

Similar findings are noted with Reed Creek and some habitat information was discussed with local Okanogan Conservation District biologists. This creek likely needs a further habitat review for more confident scoring. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 0.04 cfs Mean Annual Flow was used to score this reach. Diversion data used for this evaluation exceed the Mean Annual Flow. Flow scores are presented on Table G-10.

4921 – Whitestone Creek

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Okanogan summer Chinook and Okanogan summer steelhead fish status/utilization in Whitestone Creek is limited to 4 months and 3 months of possible juvenile rearing respectively. Channel modifications and high irrigation pressures preclude other life cycle stages. This results in a ‘low’ fish status/utilization rating. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

The Whitestone Creek Watershed encompasses five main bodies of water: Blue Lake, Wanancut Lake, Spectacle Lake, Whitestone Lake, and Stevens Lake (Entrix, 2003). The mainstem is approximately 2.8 miles long with a total of approximately 83.4 miles of stream channel in the subwatershed. Whitestone Creek is a heavily manipulated waterway; the water originates from a westerly stream, Toats Coulee Creek, where it is diverted subsurface for 7 miles until it is pumped into Spectacle Lake. From Spectacle Lake, Whitestone Creek begins and most flow is diverted into an irrigation canal, while some passes through a wetland into Whitestone Lake. From Whitestone Lake the creek gains velocity and empties into the mainstem Okanogan. The reach length under review extends only to the lake egress at approximately RM 6.7. The overall habitat is considered ‘poor’ due to the impacts of agriculture in much of the lower portion. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 2 cfs in October-November and the peak is 4 cfs in July . Minimum flow is 53 percent of the average. Diversion data used for this evaluation exceed the Mean Annual Flow. Flow scores are presented on Table G-10.

4922 – Chewiliken Creek

Fish	Habitat	Flow
1	1	1

Fish Status/Utilization

Chewiliken Creek is a relatively small creek that is dewatered in fall and winter creating a complete fish passage barrier; it is only passable during May through July. As with Whitestone Creek, fish status/utilization in this reach is limited to Okanogan summer Chinook and Okanogan summer steelhead juvenile rearing ,hence the ‘low’ fish status/utilization rating. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

A natural falls exists at approximately RM 1.75, and intermittent flows are also considered as a passage barrier. The creeks overall habitat score is of ‘poor’ function and values for salmonid life or production potential. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:No Rule:No An NHD+ estimated 1.3 cfs Mean Annual Flow was used to score this reach. Diversions evaluated for this project represent 2 percent of the Mean Annual Flow. Flow scores are presented on Table G-10.

4923 – Similkameen River (Reach 1)

Fish	Habitat	Flow
3	3	3

Fish Status/Utilization

Similkameen River Reach 1 has one of the higher fish status/utilization ratings. The high rating is attributed to all three life stages of Okanogan summer Chinook and Okanogan summer steelhead being carried out in this reach. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

The Similkameen River Basin is primarily comprised of forested lands and rangelands. Just as in the Okanogan River Basin, ownership of the Similkameen encompasses public and private lands. There are few-to-no passage problems upstream to Enloe dam, and this reach contains 'good' spawning and rearing suitability. Off-channel, floodplain, and riparian conditions are 'fair' as documented by personal observations and consultations within WDFW. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 443 cfs in September and the peak is 7,521 cfs in May. Minimum flow is 21 percent of the average. Diversions evaluated for this project represent 1 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component. Flow scores are presented on Table G-10.

4924 – Similkameen River (Reach 2)

Fish	Habitat	Flow
1	3	3

Fish Status/Utilization

Similkameen River Reach 1 and Reach 2 are separated by Enloe dam, which completely blocks anadromous fish access to Similkameen River Reach2 and upstream tributaries. This reach was included in the evaluation because addition water savings above the dam may be found and would benefit downstream reaches. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

Passage for the upper Similkameen River is the only habitat score rated as 'poor,' due to the lack of anadromous passage over Enloe Dam. Other than that low score, the five other habitat conditions are ranked as 'fair' to 'good' based on discussions and personal on-site observations. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:Yes The minimum of monthly mean flows in this reach is 586 cfs in September and the peak is 8,515 cfs in June. Minimum flow is 26 percent of the average. Diversions evaluated for this project represent 3 percent of the Mean Annual Flow; reaches with diversions less than 5% of Mean Annual Flow scored 'good' for this scoring component. Flows remain above the minimum instream flow rule every month, on average. Flow scores are presented on Table G-10.

4925 – Toats Coulee Creek

Fish	Habitat	Flow
1	3	2

Fish Status/Utilization

Toats Coulee Creek is also above Enloe dam and has no anadromous usage, but there is a potential of water savings on this reach that may benefit downstream reaches. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

The creek is fully diverted at approximately RM 2.5 upstream from the confluence of Sinlahekin Creek at certain times of the year and therefore rates a 'poor' passage condition score. There is very limited information on this reach in the literature reviewed, and scoring was based on direct observations from past WDFW inventory surveys. The portion upstream of the diversion is less populous and habitat scores are 'fair' to 'good' with more natural surroundings. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 11 cfs in September and the peak is 262 cfs in May. Minimum flow is 17 percent of the average. Gauge data are missing in winter months for this reach. Diversions evaluated for this project represent 43 percent of the Mean Annual Flow; reaches with diversions more than 15% of Mean Annual Flow scored 'poor' for this scoring component. High flow volume in comparison to other WRIA reaches boosts the score to 'fair.' Flow scores are presented on Table G-10.

4926 – Sinlahekin Creek

Fish	Habitat	Flow
1	3	2

Fish Status/Utilization

Sinlahekin Creek is another reach above Enloe dam and does not support anadromous fish. Additional fish biodiversity scoring information is provided on Table G-8.

Habitat

There is limited habitat information available through literature for Sinlahekin Creek. Scoring was determined primarily through observations and assumptions based on location of the creek within a less populous area of the Okanogan watershed. While there are no anadromous fish, passage can be scored based on resident fish needs; passage for resident salmonids in this creek is considered 'good.' All other habitat parameters were scored as 'fair' as there are agriculture uses, lower gradient reaches, and a road nearby that somewhat degrade the habitat. Habitat scoring detail can be found on Table G-9.

Flow

Gauge:Yes Rule:No The minimum of monthly mean flows in this reach is 4 cfs in January and the peak is 15 cfs in May. Minimum flow is 49 percent of the average. Diversion data used for this evaluation exceed the Mean Annual Flow. Flow scores are presented on Table G-10.

5. Scoring Sheets

Table G-8 Fish Scoring Sheet

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Code	Reach Name	Reach Score & Bin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4901	Okanogan River (Reach 1)	106	4	5	11	13	12	12	10	9	10	7	7	6
4902	Okanogan River (Reach 2)	106	4	5	11	13	12	12	10	9	10	7	7	6
4903	Okanogan River (Reach 3)	106	4	5	11	13	12	12	10	9	10	7	7	6
4904	Tonasket Creek	57	0	1	10	10	10	10	7	6	3	0	0	0
4905	Bonaparte Creek	75	3	4	10	10	10	10	7	6	6	3	3	3
4906	Loup Loup Creek	75	3	4	10	10	10	10	7	6	6	3	3	3
4907	Ninemile Creek	75	3	4	10	10	10	10	7	6	6	3	3	3
4908	Aeneas Creek	12	0	0	0	0	4	4	4	0	0	0	0	0
4909	Omak Creek	75	3	4	10	10	10	10	7	6	6	3	3	3
4910	Palmer Creek	0	0	0	0	0	0	0	0	0	0	0	0	0
4912	Antoine Creek	75	3	4	10	10	10	10	7	6	6	3	3	3
4913	Siwash Creek	12	0	0	0	0	4	4	4	0	0	0	0	0
4914	Tunk Creek (Reach 1)	54	0	1	10	10	10	10	7	3	3	0	0	0
4915	Tunk Creek (Reach 2)	48	0	0	9	9	9	9	6	3	3	0	0	0
4916	Salmon Creek (Reach 1)	75	3	4	10	10	10	10	7	6	6	3	3	3
4917	Salmon Creek (Reach 2)	69	3	3	9	9	9	9	6	6	6	3	3	3
4918	Chiliwist Creek	42	3	4	4	4	4	4	4	3	3	3	3	3
4919	Tallant Creek	42	3	4	4	4	4	4	4	3	3	3	3	3
4920	Reed Creek	42	3	4	4	4	4	4	4	3	3	3	3	3
4921	Whitestone Creek	15	0	1	1	1	4	4	4	0	0	0	0	0
4922	Chewiliken Creek	12	0	0	0	0	4	4	4	0	0	0	0	0

4923	Similkameen River (Reach 1)	88	4	5	11	11	10	10	8	7	8	5	5	4
4924	Similkameen River (Reach 2)	0	0	0	0	0	0	0	0	0	0	0	0	0
4925	Toats Coulee Creek	0	0	0	0	0	0	0	0	0	0	0	0	0
4926	Sinlahekin Creek	0	0	0	0	0	0	0	0	0	0	0	0	0
		Monthly Totals	46	62	155	161	172	172	134	97	98	56	56	52

Note: Reach names link to workbook tabs

SaSI Stocks in the Yakima Basin	SaSI Stock Rating	Weight Factor**
Okanogan Summer Chinook - 1864	Healthy	1
Okanogan Summer Steelhead - 6920	Unknown	2
Okanogan Sockeye - 5900	Depressed	2

** Weighting Factor Values by SaSI Stock Status:	Weight
Healthy	1
Depressed	2
Unknown	2
Critical	3

Weighting Factor for Federally Listed Species:	ESA Weight Factor
Assign additional weight to stocks that are listed as Threatened or Endangered under the ESA? (yes=1; no=0)	1
Assign additional weight to reaches within Interior Columbia TRT-designated spawning areas (MaSAs or MiSAs)? (yes=1; no=0)	0

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table G-9 Habitat Scoring Sheet

Reach Code	Reach Name	Reach Score & Bin	Off Channel Habitat (OCHs)	Flood-plain Connec-tivity	Riparian Cond-ition	Spawning Suita-bility	Rearing Suita-bility	Passage Condi-tion
4901	Okanogan River (Reach 1)	9	1	1	1	1	2	3
4902	Okanogan River (Reach 2)	11	1	1	2	2	2	3
4903	Okanogan River (Reach 3)	13	1	1	2	3	3	3
4904	Tonasket Creek	10	1	2	2	2	2	1
4905	Bonaparte Creek	9	1	1	2	2	2	1
4906	Loup Loup Creek	11	1	2	2	2	3	1
4907	Ninemile Creek	11	1	1	2	3	3	1
4908	Aeneas Creek	11	1	3	2	2	2	1
4909	Omak Creek	12	1	2	2	2	3	2
4910	Palmer Creek	13	2	2	2	2	3	2
4912	Antoine Creek	10	1	2	2	2	2	1
4913	Siwash Creek	10	1	1	2	2	2	2
4914	Tunk Creek (Reach 1)	13	1	2	1	3	3	3
4915	Tunk Creek (Reach 2)	8	1	2	1	1	2	1
4916	Salmon Creek (Reach 1)	8	1	1	1	2	2	1
4917	Salmon Creek (Reach 2)	14	1	2	2	3	3	3
4918	Chiliwist Creek	8	1	1	2	1	2	1
4919	Tallant Creek	12	2	2	2	2	2	2
4920	Reed Creek	12	2	2	3	1	2	2
4921	Whitestone Creek	8	1	1	2	1	2	1
4922	Chewiliken Creek	6	1	1	1	1	1	1
4923	Similkameen River (Reach 1)	15	2	2	2	3	3	3
4924	Similkameen River (Reach 2)	13	2	2	2	3	3	1
4925	Toats Coulee Creek	14	3	2	3	2	3	1
4926	Sinlahekin Creek	13	2	2	2	2	2	3
			33	41	47	50	59	44

Color / Bin Score
3 = High/Good
2 = Average / Fair
1 = Low / Poor

Table G-10 Flow Scoring Sheet

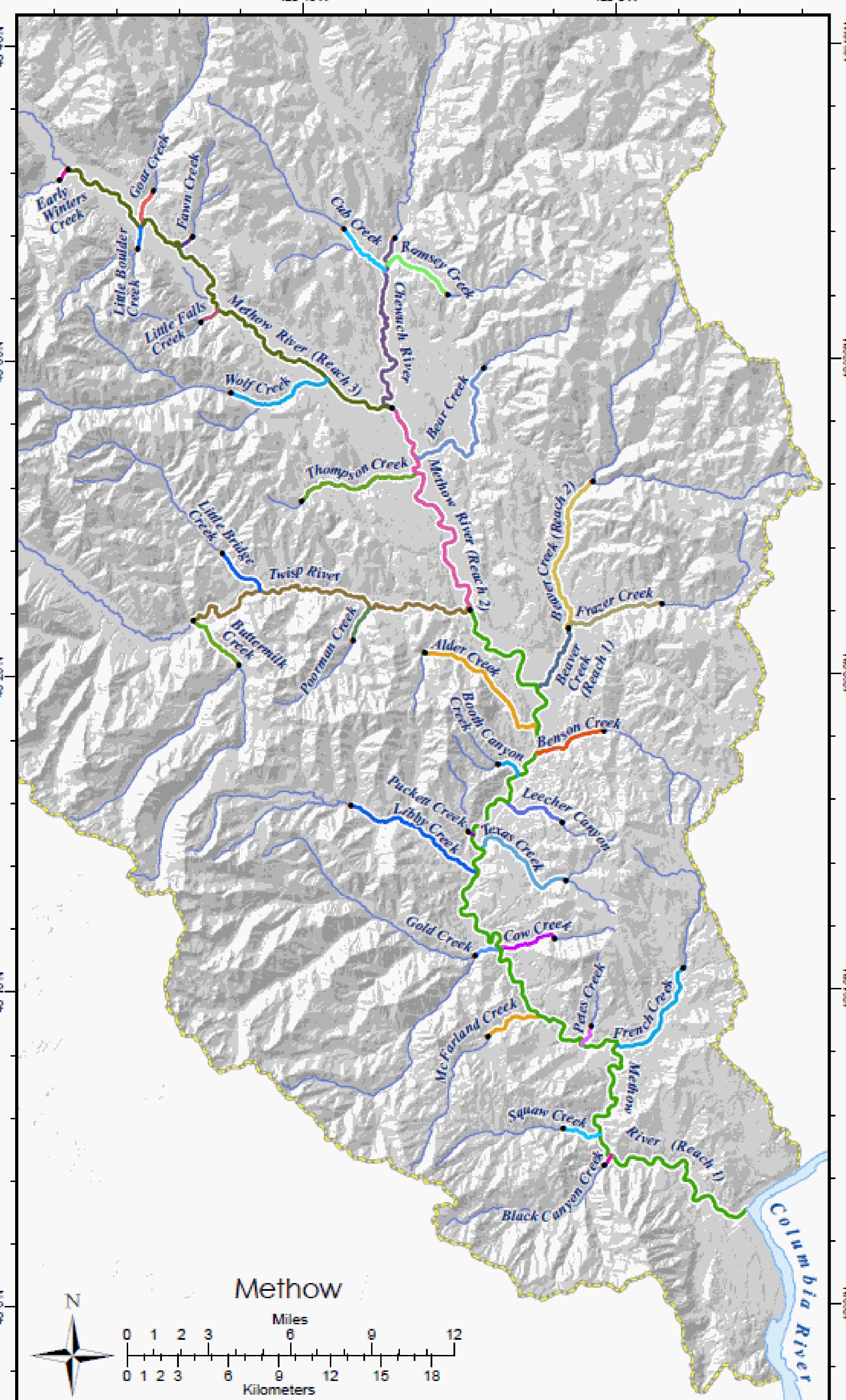
		GOOD IS HIGH	POOR IS HIGH; GOOD IS LOW >>>>>>>>>					
				A	B	C	D	E
Code	Reach Name	BIN	Sum scores (A:D) * E	% of Mo Avg Below Rule	Qi Deviation	No. Claims	August Deviation from Mean Annual Flow	Flow Volume Factor
4901	Okanogan River Reach 1	3	4	1	1	3	2	0.5
4902	Okanogan River Reach 2	3	4	1	2	3	2	0.5
4903	Okanogan River Reach 3	3	10	3	3	3	1	1.0
4904	Tonasket Creek	1	32		3	2	3	4.0
4905	Bonaparte Creek	1	36		3	3	3	4.0
4906	Loup Loup Creek	1	27		3	3	3	3.0
4907	Ninemile Creek	2	20		0	3	2	4.0
4908	Aeneas Creek	2	20		0	2	3	4.0
4909	Omak Creek	2	21		1	3	3	3.0
4910	Palmer Creek	3	6				3	2.0
4912	Antoine Creek	1	32		3	3	2	4.0
4913	Siwash Creek	2	20		0	2	3	4.0
4914	Tunk Creek Reach 1	3	12				3	4.0
4915	Tunk Creek Reach 2	1	32		3	2	3	4.0
4916	Salmon River Reach 1	3	15		0	2	3	3.0
4917	Salmon River Reach 2	1	24		2	3	3	3.0
4918	Chiliwist Creek	1	36		3	3	3	4.0
4919	Tallant Creek	1	24		2	1	3	4.0
4920	Reed Creek	1	32		3	2	3	4.0
4921	Whitestone Creek	1	24		3	2	1	4.0
4922	Chewiliken Creek	1	24		1	2	3	4.0
4923	Similkameen River Reach 1	3	3		1	2	3	0.5
4924	Similkameen River Reach 2	3	4	1	1	3	2	0.5
4925	Toats Coulee	2	18		3	1	2	3.0
4926	Sinlahekin	2	21		3	3	1	3.0

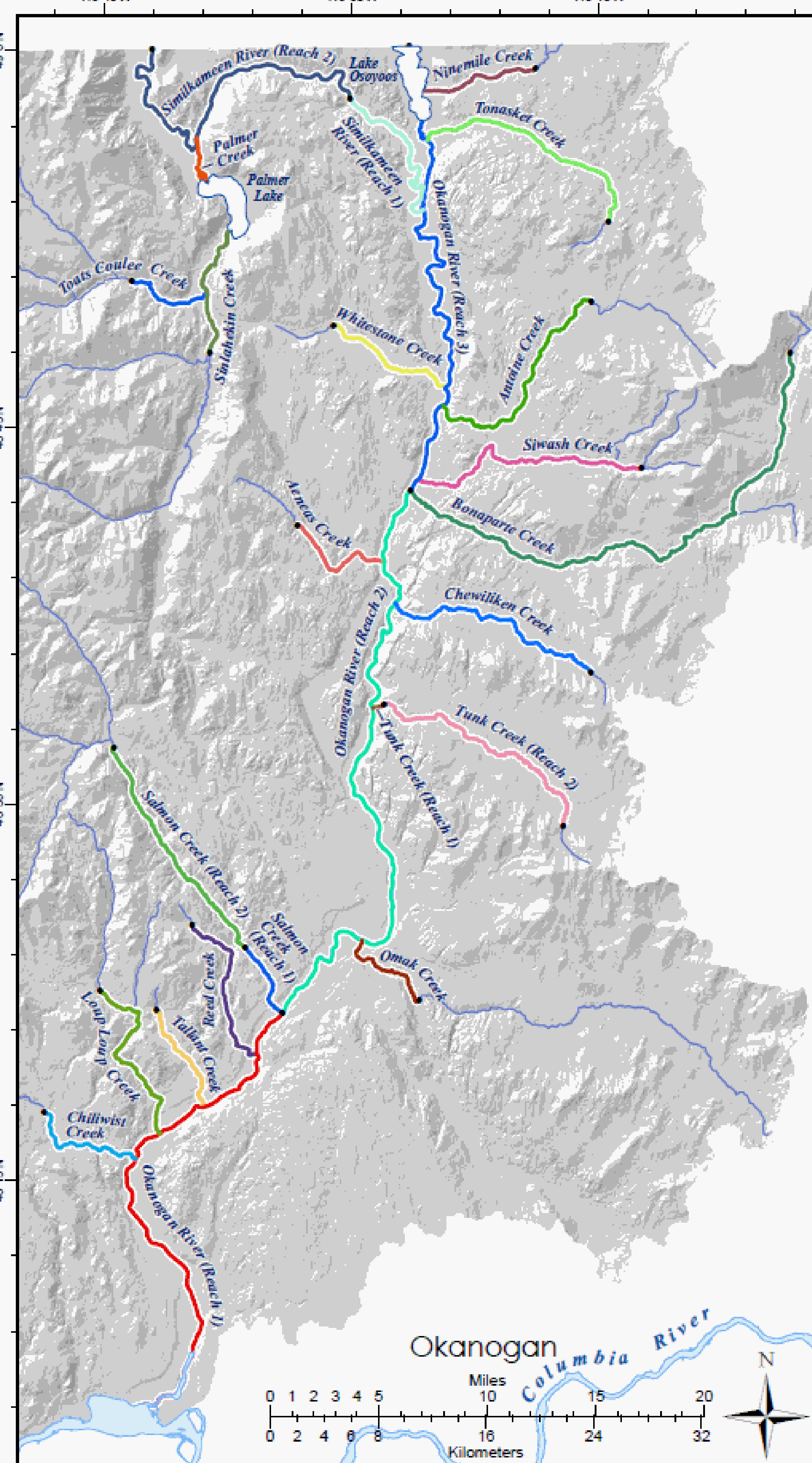
6. Maps

[intentionally blank]

Figure G-1 Assessed Stream Reaches

Methow and Okanogan River Basins
WRIAs 48 and 49
Assessed Stream Reaches colored for visual reference

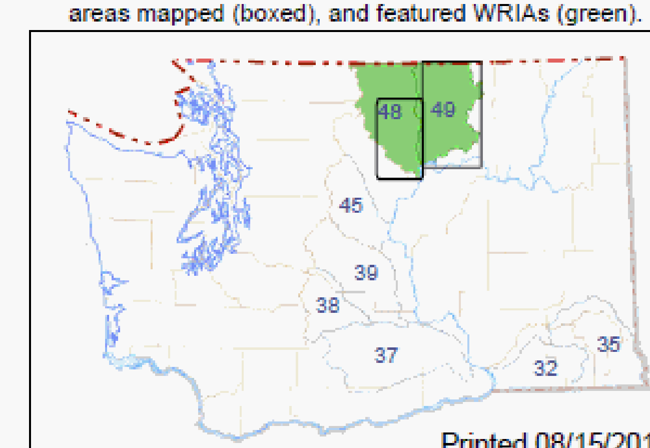




• — Assessed Stream Reach upper extents

Continuation of Assessed Streams to Headwaters

Location of all project WRIAs (blue), location of the areas mapped (boxed), and featured WRIAs (green).



Printed 08/15/2011

WRIAs 48 and 49 - Methow and Okanogan River Basins - Priority Streams

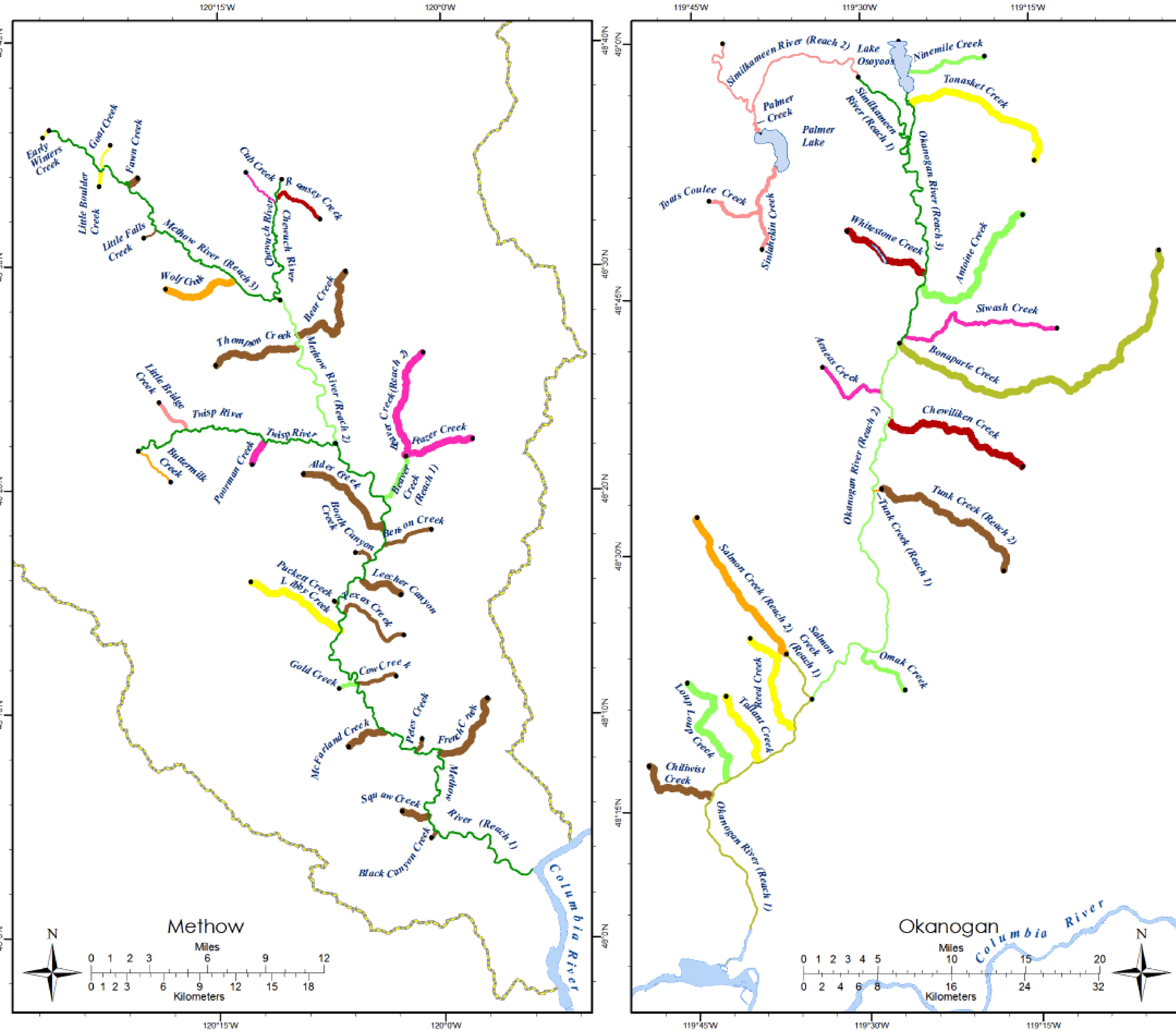
[Intentionally Blank]

Figure G-2 Combined Prioritization Scores
Fish, Habitat, & Flow

DEPARTMENT OF ECOLOGY State of Washington

Washington Department of FISH and WILDLIFE

Methow and Okanogan River Basins
WRIAs 48 and 49
Combined Prioritization Scores for Fish, Habitat, and Flow



Scores for Fish Status and Utilization and Current Habitat Condition are visually represented using the following color scheme:

Fish Score

	Low	Med	High
Habitat Score: Good			
Fair			
Poor			

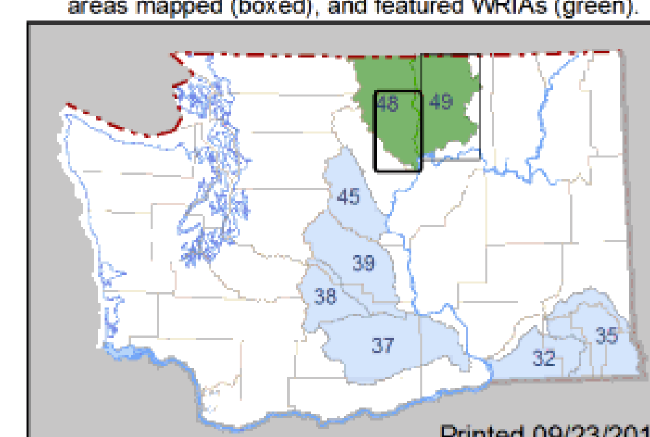
Line thicknesses represent Flow Condition

- Good
- Fair
- Poor

• — Assessed Stream Reach upper extents

WRIA Boundary

Location of all project WRIAs (blue), location of the areas mapped (boxed), and featured WRIAs (green).



Printed 09/23/2011

WRIAs 48 and 49 - Methow and Okanogan River Basins - Fish, Habitat, and Flow

[Intentionally Blank]

Figure G-3 2001 Statewide 1m Orthophoto

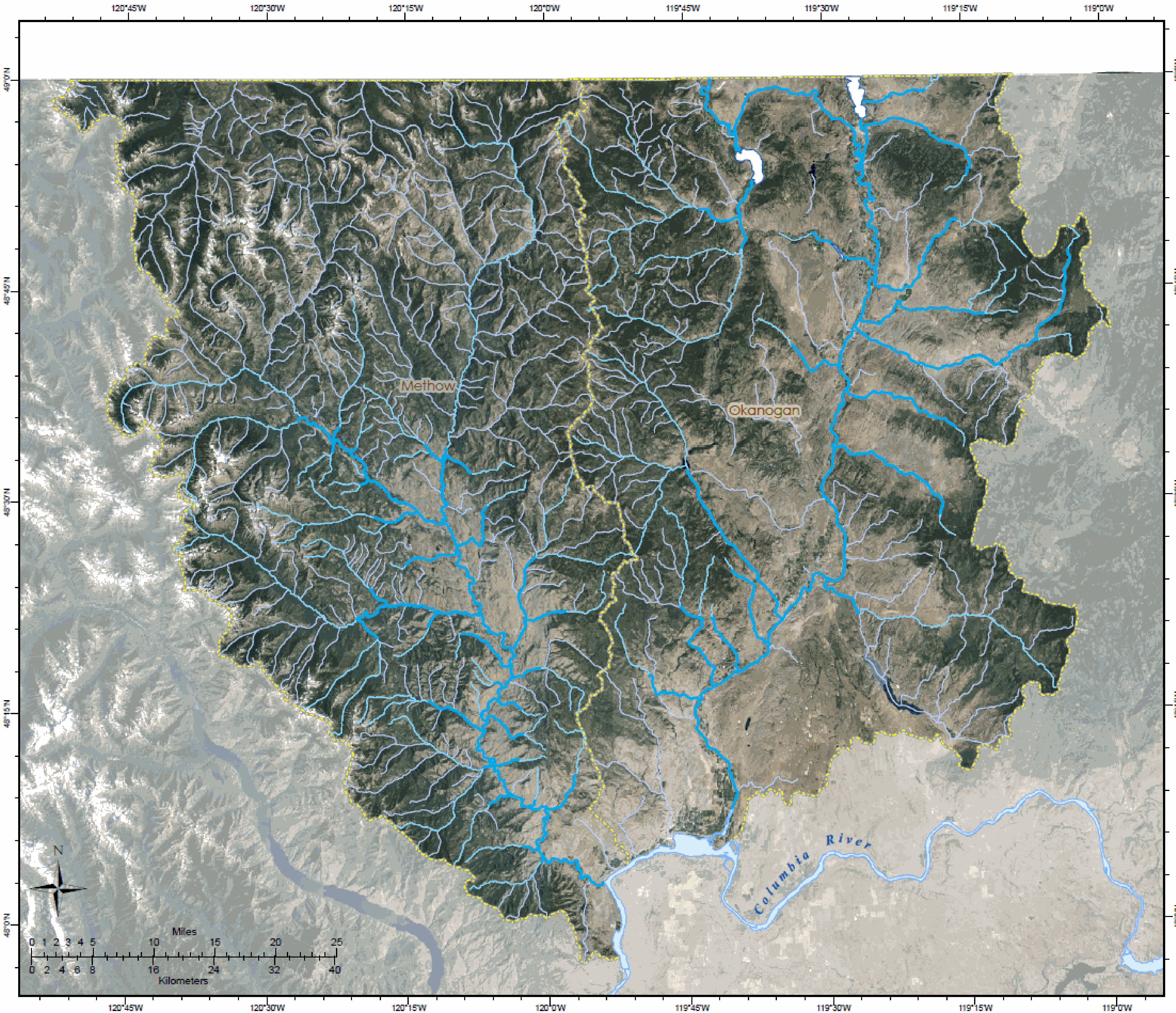
DEPARTMENT OF ECOLOGY State of Washington

Washington Department of FISH and WILDLIFE

Methow and Okanogan River Basins

WRIAs 48 and 49

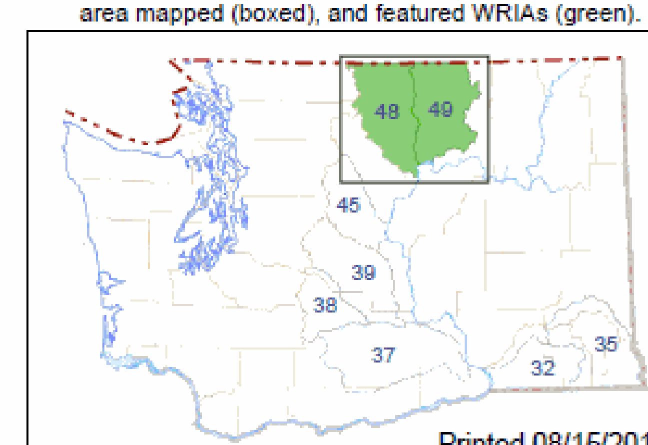
2009 Statewide 1m Orthophoto



Stream Distinctions

- Assessed Reaches
- Headwaters of Assessed Reaches
- Other Named Streams
- **WRIA Boundary**

Location of all project WRIAs (blue), location of the area mapped (boxed), and featured WRIAs (green).

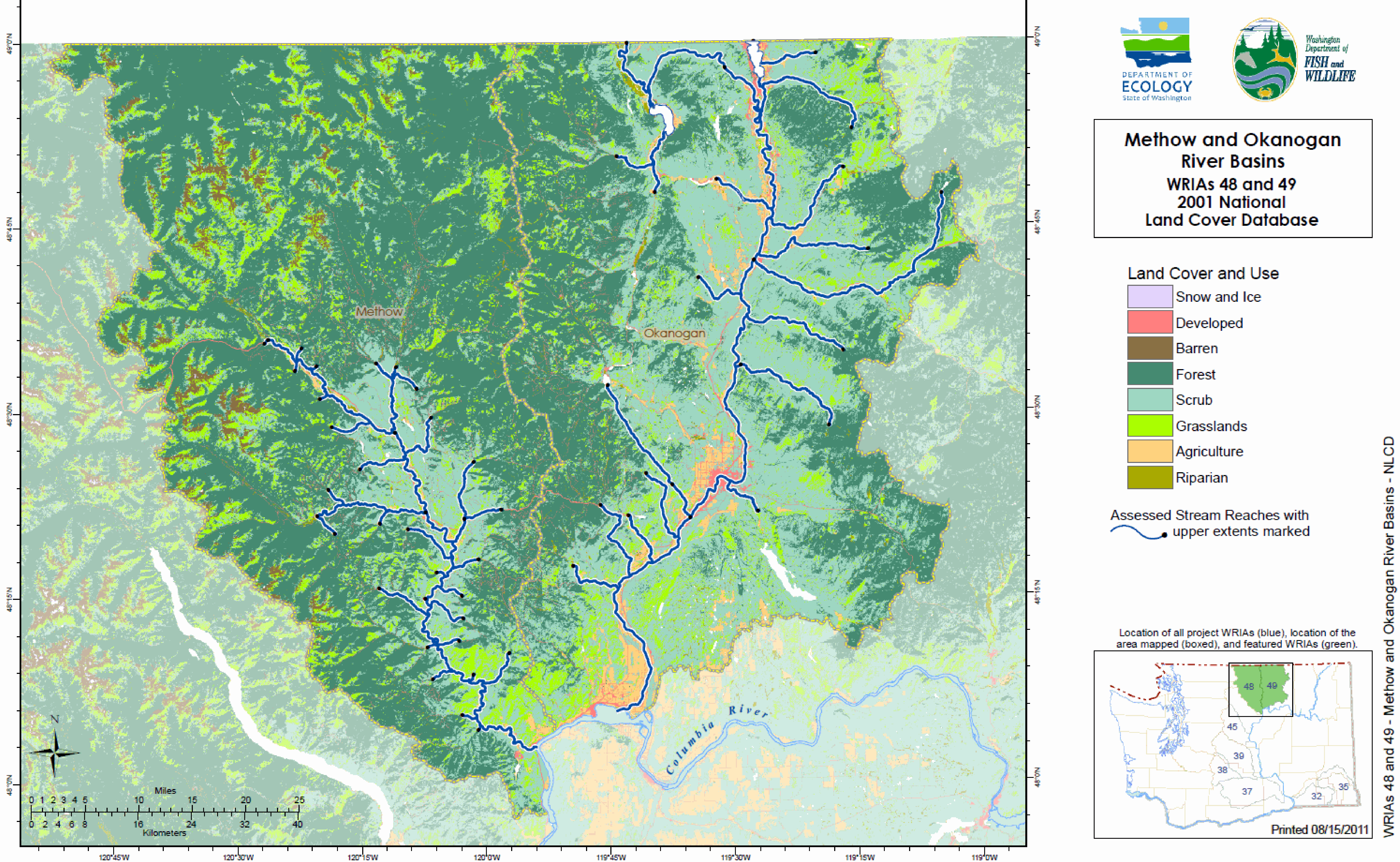


Printed 08/15/2011

WRIAs 48 and 49 - Methow and Okanogan River Basins - Orthophoto

[Intentionally Blank]

Figure G-4 2001 National Land Cover Database



[Intentionally Blank]

Figure G-5 Stream Gauge Identification and Land Management