

# **Middle Spokane River**

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## **Protecting Recreation and Aesthetic Flows**



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for

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## **Executive summary**

The Washington State Department of Ecology (Ecology) has promulgated an instream flow rule for the Middle Spokane River, from Monroe St. Dam to Nine Mile Reservoir. It protects three flows through the year (1,700 cfs in late fall and winter; 6,500 cfs for 2.5 months in spring; and 850 cfs in summer and early fall).

Ecology acknowledges these flows were primarily based on fish habitat studies. Many public comments on the instream flow rule were sharply critical, requesting higher flows for recreation and aesthetics. Ecology responded that it is not required to conduct recreation and aesthetics studies, and its review of recreation and aesthetic information suggests minimum fish flows will protect them. Several environmental groups asked Confluence Research and Consulting to review recreation and aesthetics information for the Spokane River, consider Ecology's recommendations, and assess the protection of recreation and aesthetic resources. We addressed the following questions.

- What recreation and aesthetic information is available?
- Did Ecology consider available information when adopting their instream flow rule?
- Would other studies better inform decision-making?
- Based on available information, what flow ranges might better protect these resources?
- What other flow protection options should Ecology consider?

### **What recreation and aesthetic information is available?**

Several documents and studies provide information about the Middle Spokane River, how it is used for recreation or as an amenity asset for Spokane, how flows affect recreation or aesthetics, and how Ecology develops instream flows for rivers. Major sources include Avista licensing documents, Ecology's guides to instream flows and 401 water quality certification, a survey of whitewater boaters by American Whitewater, photos of several locations taken at different flows, and fieldwork by Confluence researchers.

### **Did Ecology consider available information when adopting the instream flow rule?**

A review of Ecology's process for considering recreation and aesthetics information suggests the agency believed most recreation and aesthetic information (including public comment and a 2014 American Whitewater boating survey) was "anecdotal," "subjective," or not sufficiently "science-based."

Considerable flow-recreation literature, including Ecology's own guidance manuals, refute Ecology's perspective on the science of recreation flow study methodologies. Studies have been conducted for over twenty-five years, helping to develop defensible minimum flows for recreation and aesthetics in a variety of decision settings. The present report reviews major methods and findings from this literature, and lists specific findings from Middle Spokane information that Ecology has ignored.

### **Would other studies better inform decision-making?**

The 2004 Avista boater study and 2014 AW boater survey used standard methods and reasonable panels of experienced boaters, and can be used to develop flow evaluation curves and specified flows for kayakers and rafters. Taken together, the two studies provide considerable information about

boating evaluations, and are largely consistent with each other in showing preferences for higher flows than those protected by Ecology (particularly summer flows of 850 cfs).

Collective findings from the three flow-aesthetic studies for nearby Upper Spokane Falls suggest that higher flows are generally preferred over lower ones, and flows that cover the bottom of the river channel are a starting point for acceptable evaluations. For the Middle Spokane, matched aesthetic photographs from 37 key observation points (KOPS) taken in 2014 and 2015 at a range of flows provide descriptive information about how conditions change at pool, riffle, and rapid locations. A subset of photos could be systematically evaluated by experts, a panel of recreation users, or a general public sample to provide more quantitative flow preferences.

Ecology's 850 cfs in mid-to late-summer is near historically low flows, and public comments from boaters and other river users appear to show some agreement that the protected flow is below user preferences. Analysis could address these impressions, or otherwise quantify the diversity of opinion.

### **Based on available information, what flow ranges might better protect these resources?**

The present report describes flows that provide for existing boatable, technical, standard, and more challenging boating opportunities, then analyzes how frequently those flows occur in an example year and compares them to Ecology's proposed regime. Ecology's instream flow rule would substantially reduce the number and quality of boating opportunities in a typical recreation season compared to existing hydrology.

Information about general recreation in the Middle Spokane River suggests the river is highly valuable to the Spokane community. Considerable recreation use occurs during lower flow times of the year, when aesthetics are most sensitive to the decreased flows.

Information about aesthetics suggests the Middle Spokane River has many pools and glides that are less sensitive to changes in flows. However, important reaches such as Bowl and Pitcher and Devil's Toenail rapids have falls, rapids, and in-channel geologic features where aesthetics are sensitive to changes in flows. Evaluations of minimal and optimal flows are needed to assess whether Ecology's instream flow rule protects them.

### **What other flow protection options should Ecology consider?**

Ecology's instream flow protection essentially prescribes a three-flow fixed-time claim that protects only the historical dry year hydrograph. If all unprotected water is eventually removed from the river, Ecology's minimal dry year hydrograph will be all that is left, and the recreation and aesthetic benefits of higher and more diverse flows will be lost. The question is, can some other mechanism work better?

The report develops two illustrative flow protection alternatives based on existing recreation and aesthetic information for the Middle Spokane, then compares them to Ecology's three-flow claim. Using an example "typical" year (2014), the analysis shows how Ecology's regime fails to protect recreation opportunities that occur above 6,500, and lacks the diversity to protect other recreation opportunities that occur between 6,500 and 850 cfs. Because it is the same every year, it also misses opportunities to provide better recreation or aesthetic values in wetter years.

A trigger-based claim (with thresholds identified by boating and aesthetic flows) would protect more days of different recreation or aesthetic opportunities when those flows are available (within or across years). It doesn't require predictions about timing of flows, and naturally adjusts to protect more days and flows in wet years and less in dry years.

A percentage-based claim (using the same total amount of water as the trigger-based example) protects more days of different recreation or aesthetic opportunities in years when flows are available, with greater diversity between the threshold flows (just like a natural hydrograph). It doesn't require predictions about timing of flows, and naturally adjusts to protect more days and flows in wet years and less in dry years.

## **Conclusions**

Ecology has the responsibility and ability to assess and protect recreation and aesthetic flows for the Middle Spokane River.

There is considerable existing information that would help Ecology assess recreation and aesthetic flow needs. Documents indicate that Ecology is aware of this literature, but did not integrate the findings into its instream flow rule.

The present report identifies flow-recreation findings from available information, including: 1) a diversity of boating opportunities from about 500 cfs to 15,000 cfs; 2) enhanced general riverside recreation (e.g., camping, hiking, biking, picnicking, and fishing) at a diversity of flows through the season; and 3) low flows that may diminish the quality of those experiences, particularly at rapids, gravel bar, or attractions with in-channel geologic features.

Ecology's fish-based instream flow rule protects only an historical dry year hydrograph. This does not protect the existing diversity of boating experiences, particularly those occurring between 850 and 6,500 cfs in summer/fall or above 6,500 cfs during spring high flows.

Similarly, the 850 cfs minimum flow in summer and fall provides little aesthetic diversity, exposes a low flow "bathtub ring" at scenic locations such as Bowl and Pitcher, and may produce lower aesthetic evaluations than higher flows.

Ecology has not explored alternative ways of protecting a greater diversity of flows, nor taken advantage of variation in hydrology from year to year. Alternative claim structures could protect recreation and aesthetic flows, but Ecology has not considered them.

## Introduction

Washington State's Minimum Flows Act and Water Resources Act allow the State Department of Ecology (Ecology) to "establish minimum water flows or levels for streams . . . for the purposes of protecting fish, game, birds or other wildlife resources, or recreational or aesthetic values of said public waters whenever it appears to be in the public interest to establish the same" (RCW 90.22.010). The law further notes, "the quality of the natural environment shall be protected and, where possible, enhanced . . . with base flows necessary to provide for preservation of wildlife, fish, scenic, aesthetic, and other environmental values, and navigational values" (RCW 90.54.020(3)).

Ecology has promulgated an *instream flow rule* for the Middle Spokane River, from Monroe St. Dam to Nine Mile Reservoir (WAC 173-557). The rule specifies minimum stream flows for specific time periods that will be used to limit future surface and groundwater withdrawals, ensuring sufficient water in the stream to protect the current and future resource values (as listed above).

Ecology (2014 and 2015) adopted the following minimum flows as measured at the Spokane River at Spokane USGS Gage:

- 1,700 cfs from October 1 through March 31
- 6,500 cfs from April 1 to June 15
- 850 cfs from June 16 to September 30

According to Ecology (Beeler, 2015), these flows were calculated based on scientific studies about several resources including fisheries, recreation, and navigation; other information about the river's complex hydrological system (including seasonal weather, groundwater use, and operation of hydropower facilities); and community feedback in September 2014 in response to draft instream flow rules (Ecology, 2015). However, Ecology acknowledges the adopted flows "are primarily based on studies that protect fish habitat, which is a different method than basing a number on historical, seasonal flow" (Beeler, 2015). Ecology also states that it "has chosen not to establish instream flow values based on those recreational needs expressed during the FERC process or any other process including this comment period" (Ecology, 2015, Response to Comments at 8).

Many public comments on the draft instream flow rule were sharply critical, and included requests for higher flows for recreation and aesthetics. In responses, Ecology (2015) claimed that 1) it is not required to conduct recreation and aesthetics studies, and 2) that its review of recreation and aesthetic information (including public and stakeholder comment) suggests Ecology's minimum fish flows will protect those resources. The Center for Environmental Law & Policy (CELP), American Whitewater, and the Sierra Club asked us to review recreation and aesthetics information for the Middle Spokane River, consider Ecology's recommendations, and assess the protection of recreation and aesthetic resources. This report addresses the following questions.

## Questions

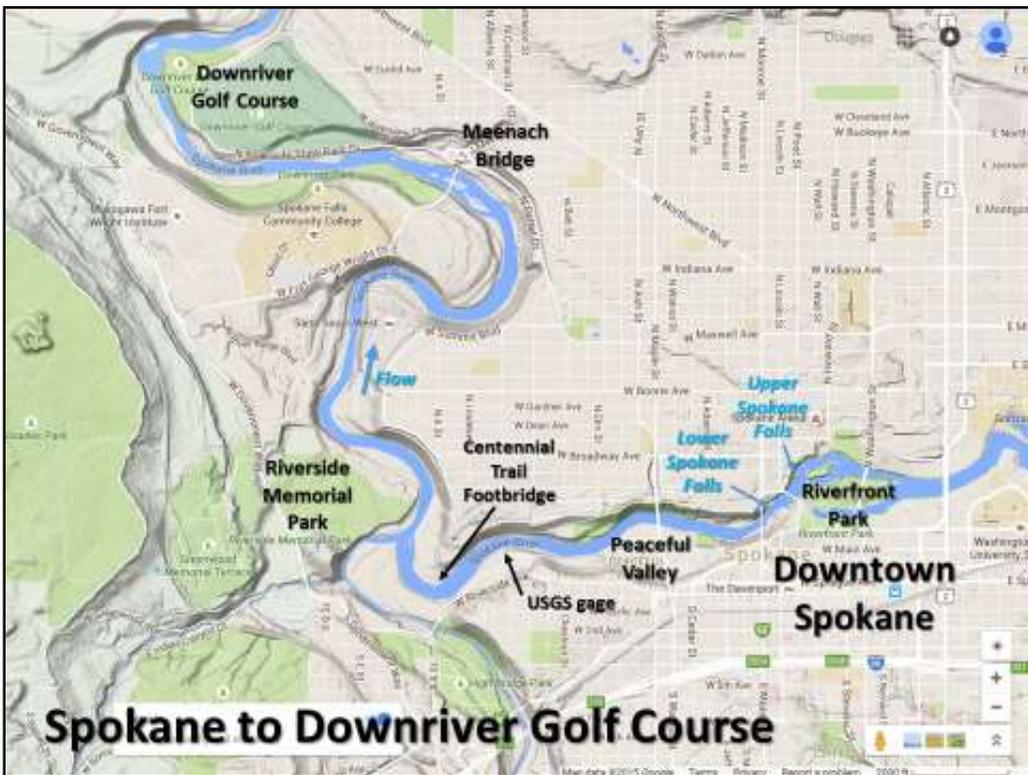
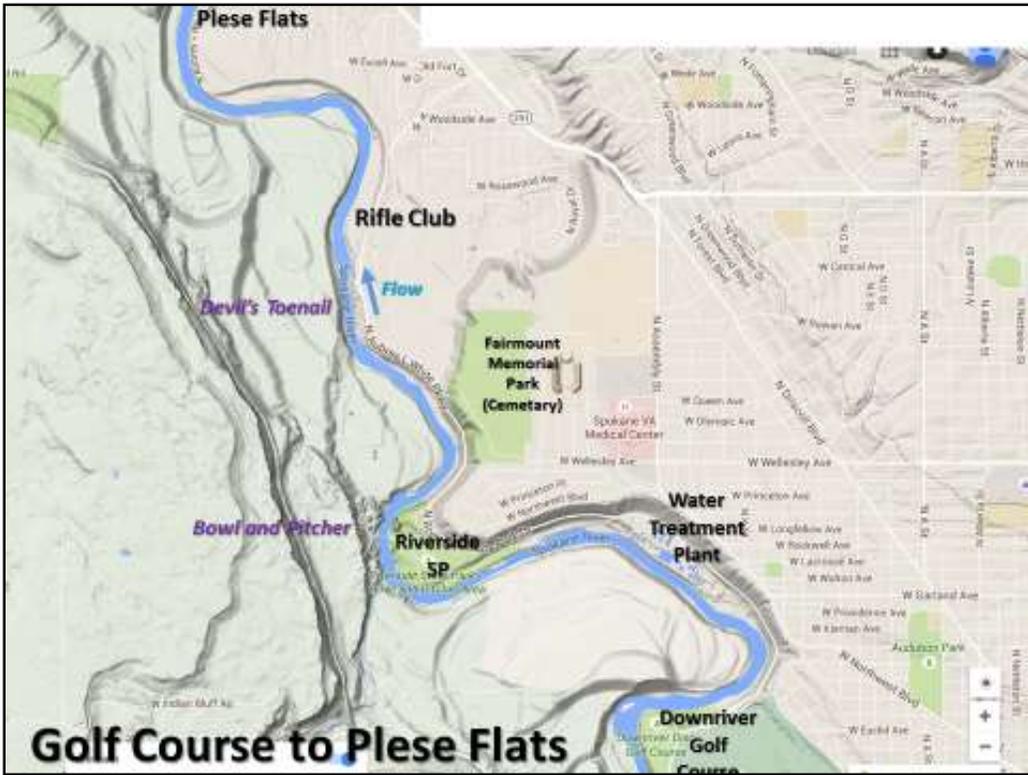
- What recreation and aesthetic information is available?
- Did Ecology consider available information when adopting their instream flow rule?
- Would other studies better inform decision-making?

- Based on available information, what flow ranges might better protect recreation and aesthetic resources?
- What other flow protection options should Ecology consider?

## Study area

The study area for this report is between Middle Spokane Falls and the start of Nine Mile Falls Reservoir near Plese Flats day use area. It is shown below in one overview and two more-detailed maps (the downstream map is placed above the upstream map because the river flows north).





## What recreation and aesthetic information is available?

Several documents and studies provide information about the Middle Spokane River, how it is used for recreation or as an amenity asset for the city, and how flows affect recreation or aesthetics. Information about Washington's instream flow protection process is also relevant.

### General background

It is difficult to separate the history of Spokane from the history of development and use along the river. The city grew from a settlement on its banks, dependent on the river's fish resources, hydroelectric power, and recreation and scenic quality. Documents that provide context for the city's growth and its relationship with the river include:

- The Olmstead Report (1913) by two nationally renowned landscape architects identified values associated with four potential parks along the river, including a Gorge Park that would encompass the falls and Lower River.
- J. William Young's "The Fair and the Falls" (1996) chronicled Spokane's growth along the river. This included a large industrial area which was eventually transformed into a park and exhibit area for the 1974 World's Fair, with pioneering environmental themes.
- David Stratton's "Spokane and the Inland Empire: An Interior Pacific Northwest Anthology" (2005) reviews the city's history to present times, including riverside park development.
- The city's Riverfront Park Master Plan (2014) is the most recent conceptual plan for the downtown river area, mostly focused on facilities development of Riverfront Park (upstream of and adjacent to the Upper Falls). It includes information about a 2012 survey of visitors, park visitation, and economic impacts of park use.

### Spokane Hydroelectric Project licensing

Avista operates several hydroelectric projects on the river that received a new license from FERC in 2009. As part of the relicensing process the utility conducted studies of several resources, including aesthetics of flows in Upper Spokane Falls, whitewater boating, and general recreation. Avista has also conducted post-licensing recreation monitoring at Project-related facilities. Documents reviewed for this report include:

- Whitewater paddling instream flow assessment study report (Louis Berger Group, 2004a). This study was developed through a Recreation, Land Use, and Aesthetics Work Group that included the utility, its consultants, agencies, and stakeholders. The study reviewed whitewater boating on the upper and lower rivers, river access, and Project impacts on boating. Primary data included an on-river controlled flow assessment with boater evaluations of three flows on the Lower River (1,335 cfs; 2,558 cfs, and 3,701 cfs).
- Recreation facility inventory and user survey report (Louis Berger Group, 2004b); the survey included 395 visitors from Spokane River/Nine Mile Reservoir sites.

- Aesthetics study report (Louis Berger Group, 2003). This report assessed flows over Post Falls and Upper Spokane Falls using focus groups who reviewed videotape of the features at different flows. It also includes viewing experiences and preferred viewing times at the two falls.
- Review of waterfall aesthetics issues (Whittaker and Shelby, 2007). This report reviewed the Berger 2003 study, critiquing methods, suggesting alternative findings, and reviewing how information was used by FERC in the relicensing draft Environmental Impact Statement.
- Aesthetic spill pilot test report (CH2MHill, 2010). A settlement regarding aesthetic flows for Upper Spokane Falls (between Avista and environmental stakeholders) led to a collaborative study of flows and channel modifications. This included surveys of a panel of stakeholders and resulted in revised minimum flows and permanent channel modifications.

### **Existing information from Ecology**

- Ecology summarized its basis for the preliminary instream flow rule in a 2015 report (Ecology 2015 a). This included a summary of fish habitat studies, and a “preliminary cost-benefit and least burdensome alternative analysis.” Public comment was invited.
- A second and more comprehensive report (275 pages entitled a “Concise Explanatory Statement”) documented public and stakeholder comments on the preliminary instream flow rule, along with Ecology’s responses (2015b). This provides the most extensive explanations for Ecology’s decisions (discussed below).
- Ecology has also developed a guide (Ecology, 2003) which reviews terminology, statutory framework, concepts and methods, and the agency’s process for setting instream flows. Sections include resolving conflicts between competing instream flow values, ensuring that recommendations are “biologically defensible and hydrologically achievable,” managing uncertainty, and developing watershed plans to address instream and out-of-stream needs.
- Ecology further addressed flows for recreation and aesthetics in a “guidance manual” (Ecology 2005) for 401 Water Quality Certifications for existing hydropower dams. This document recognizes review papers from the recreation-flow literature, lists potential impacts from hydropower projects that include flow reductions, describes a framework for conducting recreation flow studies, and points out the utility of user-based surveys (Ecology 2005).

### **Supplemental information from stakeholders**

Comments from stakeholders and the public provide additional information about recreation and aesthetics on the river, in some cases documenting resources and providing boater evaluations of flows using well-established study methods.

- CELP aesthetics atlas (2014). The Center for Environmental Law and Policy (CELP) established 37 key observation points (KOPs) along the river and took matching photographs at five flows in 2014 (1,000 cfs; 1,450 cfs; 2,000 cfs; 2,500 cfs, and 2,750 cfs). In 2015, CELP photographed a subset of

KOPs at about 750 cfs; 990 cfs; and 4,200 cfs. The photographs document pool, riffle, and rapid reaches at a range of flows.

- American Whitewater (2014) conducted an online survey of boaters familiar with the Middle Spokane River in 2014, asking about their experience, type of craft, and flow preferences. A total of 42 kayakers and 14 rafters (n=56) provided evaluations of flows from 500 to 15,000 cfs on a 7-point acceptability scale.

## **Did Ecology consider available information when adopting the instream flow rule?**

Ecology has claimed it is not required to protect recreation and aesthetic resources on the Middle Spokane River. But the agency has at the same time claimed it reviewed information about recreation and aesthetic flows, and that the agency's instream flow rule will protect those values. Ecology's "Concise Explanatory Statement" (Ecology, 2015) summarized many of these positions on aesthetic and recreation flows, identified below by topic.

### **Ecology claims flows for recreation and aesthetic values are discretionary:**

*RCW 90.03.247 grants the Department of Ecology exclusive authority to establish minimum flows. Minimum flows are established "for the purposes of protecting fish, game, birds or other wildlife resources, or recreational or aesthetic values" (RCW 90.22.010, emphasis added). Under 90.22 Ecology is not required to establish minimum flows for fish and recreational values or aesthetic values. The department has some discretion and leeway in the process.*

*RCW 90.54.020(3)(a) says "streams of the state shall be retained with base flows necessary to provide for preservation of wildlife, fish, scenic, aesthetic and other environmental values, and navigational values.... Withdrawals of water which would conflict therewith shall be authorized only in those situations where it is clear that overriding considerations of the public interest will be served." This doesn't mandate that minimum flows must be set for navigational flows or aesthetic values, it states that base flows necessary for preservation of these values be retained. In addition, new withdrawals shouldn't conflict with these values unless there is some clear overriding public interest at stake.*

### **Ecology claims an instream flow rule could not control recreational flow releases from Avista's hydroelectric project, which was licensed in 2010.**

*Flows that serve the recreational community occur every year in the Spokane River. What varies from year-to-year is the timing and duration of those recreational flows. The instream flow rule does not control the hydrograph of the river. It does not require or control the release of water from storage. It is simply a tool used to notify junior water users when they have to turn off their use to protect the senior, instream flow. To change the actual flow in the river to better suit a particular recreational use, one would need to seek changes in Avista's FERC license, which does have control over water storage and ramping rates and the shape of the hydrograph (for parts of the year at least). The FERC licenses for Avista's dams were last re-issued in 2009.*

### **Ecology claims it reviewed recreation flow needs during its instream flow rule process, including a review of Avisita licensing studies and other watershed planning.**

*Ecology considered the recreational, aesthetic, and navigational values arguments for protecting the Spokane River at multiple stages throughout the*

*process which culminates in establishing these instream flows for the river. The subject was addressed in detail during Avista's FERC relicensing process for their Spokane hydroelectric facilities. The subject was addressed during the Watershed Planning process in all Spokane WRAs. The subject was addressed during the comment period on the preliminary draft of this rule. And again, the subject came up during this comment period before final rule adoption. The department has read the Whitewater Paddling Study conducted under the FERC process, and listened to many river users. Ecology has reviewed the anecdotal observations, opinions, and photos submitted by whitewater enthusiasts and others.*

**Ecology claims instream flow rules should protect the lowest flow capable of protecting instream values, which is native fish populations, not recreation or aesthetics.**

*The department has chosen not to establish instream flow values based on those recreational needs expressed during the FERC process or any other process including this comment period. The department regards the minimum permissible flow consistent with legislative intent as the lowest flow capable of protecting and preserving instream values, in this case native fish populations. Four independent scientific instream flow studies were conducted on the Spokane River to develop habitat curves that Ecology and the State Caucus used to derive its recommended instream flows. The method employed by Ecology and the Department of Fish and Wildlife to establish instream flows was affirmed by the State Supreme Court in: Supreme Court of Washington, En Banc.; State of Washington, Department of Ecology, Department of Fisheries and Department of Wildlife, Respondents, v. PUD No. 1 of Jefferson County and City of Tacoma, Department of Public Utilities, Appellants. No. 58272-6. April 1, 1993.*

**Ecology considered recreation flow needs based on licensing studies, but rejected them as a basis for setting flows.**

*The department considered the recreational, aesthetic, and navigational values arguments for protecting the Spokane River at multiple stages throughout the process which concludes in establishing these instream flows for the river. The subject, as you indicate, was addressed in detail during Avista's FERC relicensing process for their Spokane hydroelectric facilities (Berger, 2004). Ecology has read the Whitewater Paddling Study conducted under the FERC process, listened to many river users, and reviewed the anecdotal observations, opinions, and photos submitted by whitewater enthusiasts and others.*

*The department has chosen not to establish instream flow values based solely on those recreational needs expressed during the FERC process and other processes. Choosing not to solely use recreational flow criteria to establish flows in an instream flow rule is different than not considering them. They were considered by the department and rejected as the primary basis for establishing instream flows. Ecology chose to use science-based fish studies to develop the instream flow values for the rule when the Watershed Planning unit failed to reach consensus about instream flow values during their process (RCW 90.82.080(5)).*

*The department regards the minimum permissible flow consistent with legislative intent as the lowest flow capable of protecting and preserving instream values, in this case native fish populations.*

**Ecology considers aesthetic flow evaluations too subjective and insufficiently science-based, while suggesting fish flows would protect aesthetic values.**

*Ecology agrees the river is valuable. See response to Comment 1. Aesthetic appeal is among the most subjective of criteria, and a wide range of flows are seen as scenic to various people. Ecology believes this flow rule, based as it is on four independent fish habitat studies is science based, and preserves and protects the aesthetic values of the river.*

**Ecology suggests flow needs for recreation and aesthetics are diverse, requiring a range of flows about which there is no consensus, which contrasts with flows for fish.**

*[After summarizing key points from the Avista paddling study, Ecology noted it] analyzed the opinions of approximately 30 individuals. The 30 individuals queried produced a range of opinions regarding flows. In all cases, the report acknowledges the dependence of flows for whitewater use on releases from Post Falls Dam, regulated under the FERC license [which generally controls flow inputs from Lake Coeur d'Alene into the Upper and Middle Spokane River].*

*The whitewater community is one of many uses of the Spokane River. Among its members, a significant range of needs and desires are expressed. For other uses and for aesthetics, we anticipate a range of flows in the river to be representative of the needs and desires of those sampled and the entire population. No primacy among these uses exists in statute.*

*In contrast, the instream flows are flows protective of fish resources. They are thorough and science based. They firmly describe the needs of this public resource. Those needs are more tied to water use at all life stages than are those for the range and magnitude of opinions on recreational needs. While the instream flow levels are based on fish studies, they also ensure flow in the river for preservation of other instream values.*

**Ecology asserts instream flows that protect native fish will also preserve wildlife, scenic, aesthetic, recreation, and other environmental values in the Spokane River.**

*Choosing to not use sole recreational flow criteria to establish flows in an instream flow rule is different than not considering them. They were considered by the department and rejected as the primary basis for establishing instream flows. Ecology chose to use science-based fish studies to develop the instream flow values for the rule when the Watershed Planning unit failed to reach consensus about instream flow values during their process (RCW 90.82.080(5)). While they are based on fish habitat studies, the*

*instream flow levels established in this rule will preserve wildlife, scenic, aesthetic, and other environmental values in the Spokane River, in accordance with RCW 90.54.020. Since the Legislature first adopted RCW 90.22 in 1969, Ecology has adopted numerous instream flow rules throughout the state. Fish based studies serve as the backbone of minimum instream flow rule values that have been adopted in the respective rules. Methodologies have changed over the decades and exceptions undoubtedly exist, but Ecology has confidence in its approach and has case law to validate its direction.*

**Ecology claims instream flow rules are minimum standards, and do not preclude increased flow protection or “managing up” in the future:**

*It is our opinion these flows are the best flows available to protect instream resources of the Spokane River. They represent minimum flows necessary for stream health and ecological function.*

*They are not standards to which the state intends to “manage down.” They are minimum standards the community can use from which to “manage up.” Henceforth, the community has a yardstick with which to measure proposals for water management: proposed new uses of water, conservation actions, etc. Increased flows are not prohibited by this rule.*

**Conclusions about Ecology’s Perspective toward Recreation and Aesthetic Flows**

Without offering comment on the legality of Ecology’s positions, they clearly indicate the agency’s position on recreation and aesthetic information and related flows.

- Ecology considers the recreation and aesthetic information it reviewed to be “anecdotal,” “subjective,” or not “science-based” (the claim they consistently make for fish information).
- When Ecology considered boating needs, they relied primarily on the 2007 Avista study (and disparaged it for its sample size). There is no indication they analyzed the more recent American Whitewater boating study conducted and provided to Ecology in 2014. There is a reference to Watershed Planning recreation studies, but no such studies were conducted.
- Ecology suggests they considered public comment that included flow recommendations from whitewater and fishing guides, but characterized these as unimportant by noting the range of suggestions or by labeling them anecdotal. The agency made no attempt to analyze anecdotes, solicit evaluations from a larger sample in a more systematic way, or critique the existing study from a scientific standpoint. Ecology simply asserted they read the reports and comments, and then disregarded them when setting the instream flow rule.
- Similarly, Ecology appears to consider public comment recommendations too wide-ranging and anecdotal. We see no effort to analyze these recommendations or solicit them in a more systematic way.
- In summary, there is little evidence that Ecology carefully reviewed the information. If they did, the final instream flow rule does not reflect what the information shows.

## Would other studies better inform decision-making?

Considerable literature, including Ecology's own guidance manuals, refute Ecology's perspective on the science of recreation flow study methodologies. Studies of flows for recreation/aesthetics have been conducted for over twenty-five years on hundreds of rivers in several different decision settings (including dam licensing, 401 water quality certification hearings, federal dam operations management, state and federal water rights adjudications, and navigability adjudications).

In its guide to setting instream flows, Ecology (2003, p.17) recognized other methods targeting other resources:

*Currently, fish habitat is the instream value that is most commonly quantified, and knowledge in this area continues to be refined as scientific methods improve. However, there are also tools available for evaluating instream values other than fish. Whittaker et al (1993) evaluated the relationship between stream flows and recreational values, concluding that one of the most effective methods for evaluating flows for recreation is user survey-based methods. In one such survey-based study, Brown and Daniel (1991) investigated the relationship of flow levels to the public perception of scenic quality along the Cache La Poudre River in northern Colorado, a "wild and scenic river." They concluded that positive reactions to scenic beauty increased as flows got higher to a point, but then decreased with further flow increases.*

Similarly, Ecology's guide to establishing 401 Water Quality standards in hydropower licensing specifically recognized an early flow-recreation review paper (Shelby et al., 1992) that showed the importance of developing flow evaluation or suitability curves, as well as a guide to flow-recreation methods (Whittaker et al, 1993). In particular, Ecology recognizes that "a user-based survey provides an excellent means to get qualitative responses from the user community regarding river conditions...and offers the opportunity to query users about other aspects of the recreational opportunity in addition to instream flow" (Ecology 2005, p. 54). Paraphrasing Whittaker et al. (1993), the guide also describes potential outcomes of a comprehensive recreation-flow study process, including:

- *Describe the resource.*
- *Determine which resource attributes are important to each subcategory of recreation use.*
- *Describe the hydrology—proposed, existing, and pre-project.*
- *Describe the relationship between flows and physical conditions in the project setting.*
- *Evaluate flow needs for specific opportunities (e.g., boating type, skill level).*
- *Integrate flow needs for various opportunities.*
- *Develop strategies to protect/provide flows.*

Ecology worked with this literature while developing a 401 Water Quality Certification for a proposed hydroelectric project on the Similkameen River in north-central Washington in 2013, as well as other FERC projects with flow-aesthetic issues such as Snoqualmie Falls, Upper Spokane Falls, and Sunset Falls. In the Similkameen River case (PCHB No 12-082, 2013), there was extensive testimony about recreation and aesthetic study methods, and whether they were adequately applied by Ecology to establish minimum aesthetic flows over the dam and a downstream waterfall. The PCHB ruled that aesthetic study options were available, had not been conducted, and were required as a condition to the 401 Certification.

It is beyond the scope of this report to provide an extensive review of the scientific literature on flow-recreation or flow-aesthetic studies, but we have collected summary points and their implications for the Middle Spokane River.

- Flow-recreation studies explore how flows affect the quality of recreation experiences. This is a branch within the larger field of recreation management research, which examines the use of parks and related settings as well as the characteristics, evaluations, and behavior of people who visit them (Manning, 2011).
- Biophysical, social, facility, and managerial conditions affect the quality of recreation experiences. Recreation management works with these “recreation habitats” to create opportunities for people to have high quality experiences.
- Considerable work in this field has focused on how the type and amount of recreation use affects social conditions (crowding, carrying capacity, and conflict), and much of that work is based on well-developed and well-accepted social research on values, attitudes, and norms (Manning, 2011; Shelby et al, 1996; Vaske, 2008). In general, these studies develop descriptive information about use, management, and conditions.
- Applied to flow-recreation issues, the descriptive component focuses on how management actions affect conditions (e.g., how a diversion may change flows in a river) and related attributes (e.g., how different flows affect channel depths, widths, or whitewater). The evaluative component focuses on which conditions or attributes matter most.
- This often involves field work, focus groups, or survey research, where individual evaluations are analyzed quantitatively. Statistics can be used to describe optimal or marginal conditions, levels of agreement, etc.
- Early work on flows and recreation focused on identifying improved dam releases in Grand Canyon (Shelby et al., 1992) and protecting flows for recreation through water rights on several rivers in Alaska (Van Haveren et al., 1987), Arizona (Jackson et al., 1987), and Colorado (Vandas et al., 1990).
- Flow-recreation concepts, methods, and findings were the focus of national conferences in Oregon (Whittaker 1991), South Carolina (1992), and San Francisco (1993). Review articles summarizing the literature (Brown, et al., 1992; Shelby et al., 1992) and developing methods and concepts (Whittaker et al., 1993) appeared about the same time.
- Whittaker et al. (1993) developed a conceptual model, reviewed the advantages, disadvantages, and keys to success for specific flow-recreation methods, and reviewed common findings. Many studies using these increasingly standardized methods were conducted throughout the 1990s, particularly in FERC licensing settings. A peer-reviewed paper (Whittaker and Shelby, 2002) summarized the approach, provided a list of studies, and shared common findings as the field moved into maturity.
- Whittaker, Shelby, and Gangemi (2005) updated the Whittaker et al. (1993) guide to concepts and methods with greater attention to agency and stakeholder responsibilities during studies, and differing types of studies depending on the decision setting and need for precision. In general, desktop analyses based on literature reviews, hydrology analyses, and interviews are useful for developing rough estimates of flow needs. More precise estimates (needed for most decision settings) require field work, more extensive interviews, and systematic evaluations by panels or samples of recreation users (sometimes in controlled flow studies).

- Many flow-recreation studies have focused on boating. Whitewater boaters are particularly sensitive to flow, which is often a key determinant in whether people can take a trip, what level of challenge it will provide, and the type of equipment needed (Whittaker and Shelby, 2002; Jackson et al., 1987).
- Several methodological issues are involved in conducting effective survey-based evaluations of flows for recreation, including:
  - Single flow vs. flow comparison surveys (Whittaker and Shelby, 2002).
  - Conducting surveys through a season vs. a targeted flow range (Whittaker and Shelby, 2002).
  - Considering a controlled flow assessment, where exact flows are provided in a short period to facilitate comparisons (Shelby, Whittaker, & Roppe, 1998).
  - Choosing question formats (more general evaluations of a range of flows for a flow evaluation curve, specified flows for important features) (Shelby and Whittaker, 1995).
  - Choosing panels or samples of recreation users (Whittaker et al., 2005).
- Common findings from flow-recreation studies include:
  - Relationships between flow and recreation quality tend to be curvilinear, and flows for recreation may have several values (Brown et al., 1992; Whittaker and Shelby, 2002).
  - In studies of flow needs for boating, evaluations commonly show differences for different craft (e.g. rafts and kayaks, non-motorized and motorized craft).
  - In many cases, different flows provide opportunities for different skill levels.
  - Different recreation opportunities often occur at different flow levels; in a varied flow regime, these opportunities occur in different “niches” in the hydrograph (Shelby et al., 1997).
- Flow-aesthetic research uses techniques similar to those for flow-recreation studies, but often includes evaluations of photographic media (photos or video). Many studies have addressed the aesthetics of flows in waterfalls or similar features (e.g., Spokane Falls, Snoqualmie Falls, Similkameen Falls in Washington). Others have addressed riverscapes without such dominant visual features (e.g., Virgin River in Arizona/Utah, Poudre River in Colorado, Shepaug River in Connecticut).
- In many river settings, flows that cover the bottom of the channel are often sufficient to produce acceptable aesthetic evaluations, and higher flows produce only marginally improved evaluations (Whittaker and Shelby, 2002). However, in other settings, particularly those with waterfalls, higher flows may be evaluated more positively than lower and moderate flows (Hudson, 2002).
- While angling, swimming, hiking, or the aesthetics associated with general riverside recreation are also influenced by flows, these activities are sometimes “flow-enhanced” rather than “flow-dependent” (Shelby, Brown, & Taylor, 1992).
- The National Park Service (NPS) has funded Whittaker and Shelby to develop a guide to concepts and methods for conducting flow-aesthetic studies, with a draft expected in 2016. Issues include:
  - Choosing key observation points (KOPs) for assessing aesthetics.
  - Choosing evaluators: Expert judgments vs. panels/samples of recreation users or the general public.

- Simulating photos or video for flows that have not been photographed or may not occur naturally until a project is built.
- Differences between flow-aesthetic evaluations and traditional Visual Resource Management techniques.
- In conclusion, fish biologists often assess the suitability of different depths and velocities (sometimes based on regional rather than local curves), then model stream hydraulics at a sample of sites on the study river to determine which flows provide more or less habitat. However, biologists would probably avoid this complex process if it were possible to ask fish to evaluate flows directly. Recreation flow studies ask standardized direct questions that allow people who use the river to evaluate flows, or to specify flows that provide specific attributes or opportunities.

### **Specific information Ecology should have considered**

It appears that Ecology's instream flow decisions for the Middle Spokane are not informed by this literature, nor have they considered existing information within this context. More specifically, Ecology does not recognize:

- The 2004 Avista boater study used standardized flow-recreation methods and question formats during a controlled flow study, and included questions about diversity of flows through the year.
- The 2014 AW boater study conducted a flow comparison survey among a reasonable panel of experienced boaters, used standard question formats, and can be used to develop flow evaluation curves and specified flows for kayakers and rafters.
- Taken together, the two studies provide considerable information about boating evaluations, and are largely consistent with each other in showing preferences for higher flows (see more detailed discussion below). This provides scientific rigor similar to fish habitat weighted usable area curves, allowing integration of results for recreation and fish resources.
- Collective findings from the three flow-aesthetic studies for Upper Spokane Falls suggest that higher flows are generally preferred over lower ones, and flows that cover the bottom of the river channel are a starting point for acceptable evaluations.
- Matched aesthetic photographs from 37 KOPs at a range of flows provide descriptive information about how conditions change at pool, riffle, and rapid locations. A subset of photos could be systematically evaluated by 1) experts, 2) a panel of recreation users, 3) stakeholders, or 4) a general public sample to provide quantitative flow preferences.
- Ecology's 850 cfs in mid-to late-summer is near historically low flows, and public comments from boaters and other river users appear to show some agreement that the protected flow is below user preferences. Analysis could address these impressions, or otherwise quantify the diversity of opinion.
- ***Without recognizing findings from existing studies, or conducting additional analyses, it is unclear how Ecology can assure their fish-based instream flows adequately protect recreation and aesthetic values.***

## What flow ranges would protect recreation and aesthetic resources?

In this section we briefly summarize findings from existing information, public comments, and our own fieldwork, and compare that to Ecology's three-flow instream flow protection regime.

### Boating

Boating information comes from four sources, the 2004 Avista boating study, the 2014 American Whitewater boating survey, fieldwork conducted for this report in July 2014, and interviews with outfitters or other experienced boaters.

Avista examined three flows during its **2004 controlled flow study** (about 1,400 cfs, 2,600 cfs, and 3,700 cfs). Findings suggest:

- Several whitewater boating characteristics (availability of whitewater play areas, powerful hydraulics, and overall whitewater challenge) were rated unacceptable or marginal at the two lower flows, but received substantially higher ratings at the highest flow.
- In contrast, technical boating was rated lower at the highest flow, but was acceptable at all three flows.
- Boatability, rate of travel, and length of trip improved with higher flows, but were acceptable at all three flows.
- Overall ratings indicate 1,300 cfs was marginally acceptable, while 2,600 and 3,700 cfs were acceptable but not optimal.
- When asked to identify a minimum flow, the median response was 1,500 cfs.
- When asked to identify an optimal flow, the median response was 4,000 cfs. But 2,500, 3,000, 4,000, and 5,000 cfs had 16% each, and 27% identified flows between 6,000 and 12,000 cfs. The study concluded that an optimum range might begin between 2,600 and 3,700 cfs (the two higher flows in the study), but would extend through the hydraulic capacity of the project.
- About 65% reported that it was "very" or "extremely" important to provide multiple flows in the river "to provide multiple experiences" (only 5% reported this was not important). Similarly, 70% reported it was "very" or "extremely" important to provide multiple flows in the river "for different skill levels and water craft."
- The study presumably could provide more detailed findings for boaters with different craft or different skill levels, but those generally were not reported.

American Whitewater's **2014 follow-up boater survey** provides additional (and largely concurring) information:

- Boaters were asked specified flow questions for several commonly-examined types of trips (Table 1).
  - Lowest flow to navigate the river.
  - Lowest flow that provides an acceptable recreational boating experience.
  - Optimal flow for a technical boating experience. (This refers to lower-flow trips with more boatability problems, limited route options, and less powerful hydraulics that require more precise maneuvering and often smaller/lighter craft than standard trips.)

- Optimal flow for a standard boating experience. (This refers to medium flow trips that have few boatability problems, more route options, and typical whitewater difficulty levels for which the river is known).
- Optimal flow for increased whitewater challenge. (This refers to higher flow trips with stronger hydraulics and larger waves than standard trips, often with increased whitewater difficulty).

**Table 1.** Specified flows (medians) for different types of trips (American Whitewater survey, 2014).

Type of opportunity	Kayakers	Rafters
Lowest flow to navigate river	1,000	1,900
Lowest flow that provides acceptable experience	1,500	2,000
Optimal flow for a technical experience	1,200	2,000
Optimal flow for a standard experience	3,500	5,000
Optimal flow for a more challenging experience	15,000	15,000

- Specified flow results show:
  - Several different types of opportunities are available from about 1,000 through at least 15,000 cfs.
  - The lowest flows to navigate the river (as low as 500 cfs in some small craft) do not provide acceptable quality whitewater experiences, and optimal experiences require higher flows.
  - Similar to many previous studies, boaters distinguished between flows for technical, standard and more challenging experiences (as described above).
  - Differences between kayaks and rafts were greater for technical and standard experiences than more challenging experiences.
- Boaters also provided overall evaluations for a full range of flows. Figure 1 shows average ratings on a 7-point acceptability scale for rafters and kayakers.
  - For kayakers, ratings are clearly unacceptable at 500 cfs, but improve with increasing flow, crossing the marginal line about 1,100 cfs. Ratings become near-optimal about 3,000 cfs, and remain high through 15,000 cfs.
  - For rafters, ratings start lower and improve at a slower rate. Ratings cross the marginal line about 2,100 cfs and become near-optimal about 4,800 cfs, with a more distinct optimum point around 7,500 cfs.
- Comments from survey respondents note that the two Class III rapids become easier for less skilled boaters at moderately high flows, while skilled boaters appreciate technical lines (the precise routes

they must take through rapids) at low flows and big hydraulics at higher flows (that provide power in the chutes, waves, and holes in rapids). A few larger play waves (hydraulic features that boaters can surf or use for other whitewater maneuvers, sometimes with “eddy service” allowing a return to the wave).

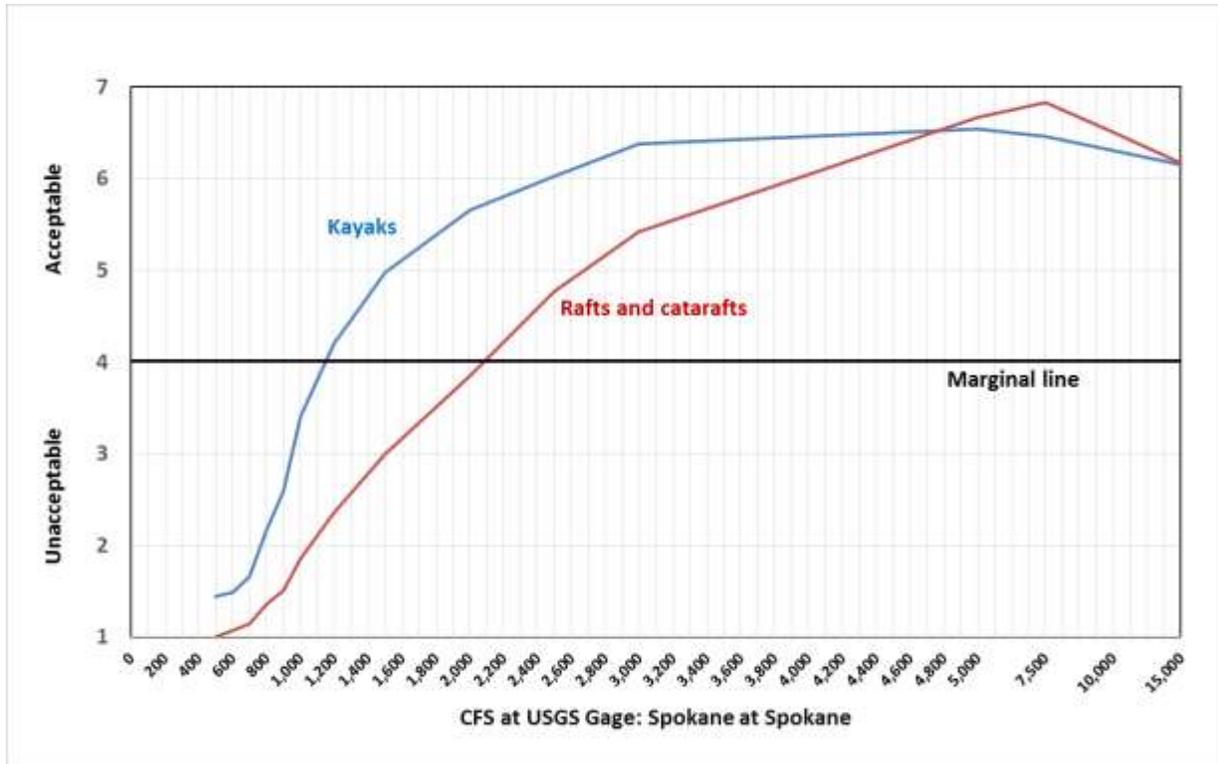


Figure 1. Flow preference curves for kayakers and rafters (American Whitewater survey, 2014).

**Fieldwork conducted for this report in July 2015** provided additional information about boating and other recreation uses at lower flows. Notes are provided below.

- Fieldwork was conducted by Bo Shelby (in an 8.5 foot long by 27 inches wide hard shell kayak), Doug Whittaker (in a 12 foot long x 6 foot wide cataraft), accompanied by Andrea Rodgers (CELP lawyer, in a 10 foot long x 2.5 foot wide inflatable kayak)
- Whittaker and Shelby boated from Peaceful Valley (W. Water Ave) to Plese Flats on both days. Andrea Rodgers boated from Peaceful Valley to a takeout just downstream of the water treatment plant (upstream of the two Class III rapids) on both days.
- Flows at Post Falls (the outflow from Lake Coeur d’Alene) were stable at 500 cfs on both days. We assume that accretion from springs and return flow from irrigation/municipal sources caused rising flows at the downstream USGS Spokane gage from 760 to 790 cfs during boating on Fri Jul 24 and fluctuating flows between 710 and 770 cfs during boating on Sat Jul 25.
- There was higher recreation use on Fri Jul 24, which had warm, clear summer weather. Overcast skies and cooler temperatures occurred on Sat Jul 25, with noticeably lower on-river use. The only water craft observed were two groups of tubers (who put in at the Centennial Trail footbridge and took out at Meenach Bridge).

- The kayak had no boatability problems on either day, with clear lines through both major rapids and several low flow riffles.
- On Jul 24, the cataraft had 5 hits (contact that did not slow the boat) and 2 stops (contact with the channel that stopped the boat). The stops were in the split channel just upstream of the Centennial Trail (Sandifur) Footbridge (a channel-wide riffle); the hits were in smaller riffles along the rest of the segment.
- On Jul 25, the cataraft had 4 hits and 1 stop (in the alternative channel above the footbridge).
- The shallowest riffle on the river is a long diagonal bar about a quarter mile upstream of Meenach Bridge, but it had a few slots among the boulders. Some tubers became stopped on these rocks and at least one had to stand and carry his tube over it.
- Bowl and Pitcher rapid (a longer Class III) had an S-turn line on both days that was boatable for both craft. Wider and longer commercial rafts would probably have hits and stops in some of these narrow slots, possibly with one or more boat drags (where boaters get out of the boat to move it off the obstacle). There was little power in the hydraulics with the exception of the small drop just upstream of the Bowl. Some of the small channels below the rapid (adjacent to the Pitcher) were probably too narrow for larger commercial rafts.
- Devils Toenail rapid (a shorter Class III) had no obvious line on river right and a narrow slot in the last steep drop on river left. The cataraft was portaged / lined over the last part of this rapid on the first day, but ran it on the second. Below the main drop, a narrow slot required the cataraft to be lifted on edge (both days). A commercial raft would have more difficulty at this location at this flow.

**Interviews with boating outfitters** (Jon Wilmot and Peter Grubb) provided additional information. They offer trips in 14 and 16 foot rafts, usually with 6 to 7 passengers plus a guide. They require flows over 2,000 cfs to run longer (7 mile) whitewater trips that include Bowl and Pitcher and Devil's Toenail, the Class III rapids which are major attractions. At lower flows, they can offer only shorter (3.5 mile) flatwater scenic trips from Peaceful Valley to Meenach Bridge; one outfitter also offers flatwater inflatable kayak trips, but recommends flows above 1,000 cfs.

### ***Frequency Analysis for Recreation Opportunities***

***Taking all boating information together***, it is possible to describe flow ranges that provide for these existing boating opportunities, and then analyze how frequently those flows occur in an example year. ***That existing flow regime can then be compared to Ecology's proposed regime*** to assess what opportunities are protected. This ***frequency analysis*** is a common approach for assessing impacts of proposed flow regimes in hydropower licensing studies.

- Using 2014 as a recent example year, Table 2 shows the number of days in different flow ranges (which provide different boating opportunities) though a recreation season. This is compared with the number of days that would be provided under Ecology's instream flow rule. Assumptions for the analysis included:
  - The recreation season is from April 1 through October 31 (214 days).
  - Daily flows come from the USGS gage at Spokane.
  - The example year was 2014, which had an annual flow of 6,782 cfs that is similar to the average annual flow over the last 50 years (6,464 cfs, a 4% difference). Using 2014 controls for recent

- water diversions and groundwater development as a variable (they are already part of existing hydrologic conditions).
- All flows not specifically protected under the instream flow rule would be unavailable for recreation.
  - Boating flow ranges defined below were simplified for ease of understanding; they could be further subdivided for different craft.
    - 500 to 999 cfs – Boatable but lower quality opportunities for smaller craft; generally not used by commercial rafts or kayaks downstream of Meenach Bridge.
    - 1,000 to 1,999 cfs – Technical whitewater opportunities for smaller craft
    - 2,000 to 9,999 cfs – Standard whitewater opportunities for all craft
    - Over 10,000 cfs – More challenging whitewater opportunities for all craft
  - Results show that Ecology’s instream flow rule substantially reduces the number and quality of boating opportunities in a typical recreation season.
    - Existing conditions provide 214 days of higher quality boating (flows above 1,000 cfs). Ecology’s rule reduces that by 50% (107 days are at 850 cfs, providing lower quality trips that can only be used by smaller craft).
    - Existing conditions provide 68 days of more challenging boating (over 10,000 cfs) that Ecology’s rule eliminates (the highest protected flow is 6,500 cfs).
    - Existing conditions provide 146 days of technical and standard trips. Ecology’s rule reduces that by 26% to 107 days.

**Table 2.** Frequency analysis for boating opportunities under existing conditions and Ecology’s instream flow rule regime.

Type of opportunity	Flow range	Number of days in 2014 recreation season	
		Under existing conditions	With Ecology’s instream flow rule (all other flows removed)
Low quality for small craft	500 to 999	0	107
Technical for small craft	1,000 to 1,999	83	31
Standard whitewater	2,000 to 9,999	63	76
More challenging whitewater	> 10,000	68	0

**General Recreation**

The value of the Spokane River and its gorge as a recreation site has been evident since the Olmstead brothers report in 1913:

*"Nothing is so firmly impressed on the mind of the visitor to Spokane, as regards its appearance, as the great gorge into which the river falls near the center of the city. It is a tremendous feature of the landscape and one which is rarer in a large city than river, lake, bay or mountain. Any city should prize and preserve its great landscape features, inasmuch as they give it individuality. Chicago has spent millions for its Lake Shore parks. New York has spent more millions on its great Riverside Park and Drive extending for many miles along the Hudson River. Many instances could be enumerated showing that the wisdom of preserving such landscape features has been recognized and acted upon by making them enjoyably accessible by laying out parks and parkways along them."*

Over the years, Spokane has acted upon the Olmstead brothers’ vision of park development and resource protection, with many designations to protect land along the Spokane River. In reviewing this list, it is ironic that recreation and aesthetic flows in the river, the area’s centerpiece, remain unprotected.

- Riverfront Park – 100 acre city park adjacent to the Upper and Middle Spokane Falls, site of the landmark 1974 World’s Fair (with a pioneering environmental theme). Has several developed facilities (e.g., ice rink, gondola, Imax Theatre, carousel, children’s playground) as well as multiple trails, footbridges, and scenic overlooks.
- Glover Field Park – 3 acre city park with a community center and picnicking along the river.
- Peaceful Valley Park – 2 acre city park with picnic tables.
- Peaceful Valley Conservation Land – 11 acres with river frontage and trails, plus undeveloped boating put-in used by some outfitters.

- Hamblen Conservation Area – 63 acre open space park along north bank with trails, overlook, and picnicking.
- High Bridge Park – 200 acre park with river frontage, trails, picnic areas and shelters, and a footbridge across the river for the Centennial Trail. Includes frontage along Latah Creek (a major tributary of the Spokane).
- Palisades Park – 464 acres of conservation land on the canyon rim with trails and views over the river.
- Summit Boulevard – 9 acre roadside parkway with river frontage.
- Elliott Drive – 57 acres of roadside parkway along the canyon rim with trails and overlooks.
- Downriver Golf Course – 18 hole course with views of the river.
- Downriver Park – 95 acres of conservation land along river with natural springs, wildlife.
- Northwest Boulevard – 14 acres of parkway along the river.
- Aubrey L White Parkway / Riverside Drive – 7.5 miles along the north side of the river from Meenach Bridge to 7 Mile Road, a scenic drive that connects several parks and river accesses.
- Riverside State Park – 14,000 acre state park along the Spokane and Little Spokane Rivers. There are separate park units at Bowl and Pitcher, along Nine Mile Reservoir and Deep Creek Canyon, and at the Little Spokane River. The park has over 55 miles of hiking/biking trails, 25 miles of horse trails, three boat ramps, a 32-site developed campground, and several day use and picnic areas. The Bowl and Pitcher unit is particularly river-focused; the campground and picnic area overlook the river, and a trail system accesses several overlooks highlighting the rapids and geologic features at Bowl and Pitcher and Devils Toenail (about a mile downstream).

**Avista's report on general recreation** (Berger, 2004b) estimates 722,269 visits annually in the river corridor from Spokane to Nine Mile Reservoir. Use is evenly distributed (43% off-season vs. 57% in the summer, 55% weekends vs. 45% weekdays). Close proximity to Spokane and its suburbs, easy access via a road along its length, and developed facilities and parking at several locations make this a community and front-country resource.

Avista's survey of visitors to this part of the river reports popular activities as swimming (64%), sightseeing (42%), picnicking (40%), hiking (38%), fishing (30%), nature/wildlife viewing (26%), and boating (16%). The survey focused on evaluations of developed facilities or crowding/capacity issues.

During **2015 fieldwork in July**, recreation users were observed fishing, swimming, picnicking, and hiking/running/ biking along trails. There was considerable sightseeing at Bowl and Pitcher rapids and footbridge, which is adjacent to a campground and day use area. Flows of about 750 to 800 cfs during this fieldwork were at the low end of the historical range.

Taken together, information about general recreation in the Middle Spokane River suggests the following:

- The river is highly valuable to the Spokane community, as demonstrated by land designations, recreation facility development, and numbers of recreation users.

- Considerable recreation use occurs during lower-flow times of the year, when aesthetics are most sensitive to decreased flows (see discussion below).
- Given the extent of land designations, facility development, and recreation use, it makes no sense that the river, the “tremendous feature of the landscape” which “any city should prize and preserve” (Olmstead 1911), does not have sufficiently protected recreation and aesthetic flows.

## Aesthetics

**Studies related to aesthetics of the Upper Falls** provide evaluations of different flows at the low end of the river’s hydrograph (0 to 500 cfs). These studies were conducted as part of FERC relicensing for a hydroelectric diversion capable of removing 500 to 2,500 cfs.

**The initial Upper Falls flow-aesthetic study** (Berger 2003) used a focus group panel to rank video footage of flows at approximately 40, 100, 200, 300, 400, and 500 cfs. Results showed the highest rankings for the highest flows. The study did not investigate flows higher than 500 cfs, even though natural flows under the existing condition reach 20,000 cfs in most years and 30,000 in some years.

After FERC approved the utility’s proposed Upper Falls minimum flows of 200 cfs, litigation by environmental groups led to a second study. The **second Upper Falls flow-aesthetic study** (CH2MHill, 2010) was a cooperative project between the utility, environmental groups, and their consultants. It focused on flows of 300 to 500 cfs, in combination with channel modifications that would distribute water more evenly between the north and south channels, and within each channel get water out of human-made ditches and spread it evenly across the bottom of the natural river. A panel evaluated flows and channel modifications on-site in July 2010, and also evaluated still photos of higher flows taken in spring 2010. Flow releases were controlled from the hydroelectric diversion dam, channel modifications were manipulated with temporary sandbag weirs, and evaluations included quantitative survey data from 10 key observation points (KOPs) along with follow-up focus group discussions. Results showed that 320 cfs flows with channel modifications were aesthetically similar to 500 cfs without modifications, indicating that “covering the bottom of the channel” is an important principle for acceptable aesthetics. Data also showed that 1,000 cfs (the highest flow evaluated) produced even higher quality aesthetics.

The **flow-aesthetics photo data base** has been assembled by CELP and associated volunteers. Using 37 KOPs on the river from 2014 and 2015, photos of different flows were taken systematically from the same locations. Comparing photos shows how flows change the aesthetics of the river. No formal analysis of these matched photos has been conducted, but a review suggests they illustrate the following flow-aesthetic principles.

- Changes in flow are **more noticeable at sites with steeper gradients and boulders**, such as the rapids at Bowl and Pitcher and Devil’s Toenail (see comparisons A and B in linked aesthetics photo gallery)
- Changes in flow are **more noticeable at shallow sites with gravel bars or riffles** than at pools or glides (see comparisons C and D in aesthetics photo gallery).
- Flows that **cover the bottom of the channel** are likely to be rated more acceptable than those which expose channel features or a “bathtub ring” (see photo E in aesthetics photo gallery).

Taken together, information about aesthetics suggests the following:

- Many reaches of the Middle Spokane River have pools and glides without rapids or mid-channel geologic features that are probably less sensitive to changes in flows.
- In contrast, there are important reaches (especially the two Upper Falls, Bowl and Pitcher, and Devil's Toenail) where the aesthetics of falls, rapids, and geologic features are sensitive to changes in flows, and evaluations of minimal and optimal flows are needed to assess whether Ecology's instream flow rule would protect them.
- There may be other riffle/gravel bar locations on the river that are similarly sensitive to flow-related changes because they are heavily used (e.g., the split channel area near the Centennial Trail footbridge).

## What other flow protection options should Ecology consider?

Ecology claims its instream flow rules are intended to protect important values over time. As discussed in Ecology's guide to setting instream flows (Ecology, 2003):

*RCW 90.22.010 provides for the "protection" of instream resources and RCW 90.54.030(3)(a) provides for the "preservation" of those resources. Although neither statute defines those terms, both terms share the common dictionary definition of "keeping from harm, or injury." In that usage, protection or preservation of fish, wildlife, scenic, recreation, navigation, water quality, and other environmental values requires sufficient flows to maintain those values over the long term.*

Previous sections of this report suggest Ecology's simple three-step instream flow protection regime cannot assure that recreation and aesthetic values will be kept "from harm or injury." Ecology has not reviewed nor clearly defined recreation and aesthetic values, let alone attached specific flows to those values. Existing hydrology, the baseline for defining values, provides a much greater diversity of higher quality resources. Ecology has chosen three different flows to protect fish, but has completely failed to identify flows to protect recreation or aesthetic resources.

In essence, Ecology has prescribed a **three-flow fixed time claim that protects only the historical dry year hydrograph**. If it is prudent to assume that all unprotected water will be removed from the river over the long term, Ecology's dry year hydrograph protected by the instream flow rule will be all that is left, and the recreation and aesthetic benefits of higher and more diverse flows will be lost. If Ecology's fixed time claim is thus inadequate, the question is, **can some other mechanism work better?**

Ecology has often stated its goal of developing instream flow rules that are "biologically defensible and hydrologically achievable" (Ecology, 2003):

*This requires an evaluation of both the current and historic hydrology of the stream, however, it is not narrowly defined by the stream flows found in the stream today, nor by the stream flows that existed prior to development within a watershed. Instead, determining the potential of a stream requires an assessment of how existing and future land use, water use, storage systems (natural and constructed), and other watershed factors, affect the stream's "hydrological potential." This evaluation will indicate the range of potential stream flows that could be achieved in the stream through a variety of*

*water management activities. Within the range of biologically defensible stream flows, the instream flow recommendation should be adjusted in consideration of the hydrological potential of the stream.*

Ecology further notes that protection strategies may need to differ in wet, normal, or dry years, it may be difficult to time higher or lower flows, and hydrologic potential may be different in wetter vs. drier years (Ecology, 2003):

*Given the two management purposes of instream flows, it is also possible for the instream flow recommendation to propose two different flow curves, so that both purposes are addressed – one flow curve related to new water uses from the stream, and a second flow curve related to the stream flow objectives to be achieved in the stream. For example, a higher flow curve related to new water uses could protect the occasional “good water year” needed to preserve a healthy population of fish. This would reduce or remove the availability of new water rights from stream. At the same time, a defensible watershed management program could include a lower flow curve to identify the stream flow objectives to be achieved by a certain future date through implementation of the watershed plan.*

*The use of ranges, frequencies, varying, and/or multiple stream flows, as long as they are applied in a manner that is scientifically defensible, can help reconcile the instream flow recommendation with natural conditions and can provide an effective way to integrate water management objectives in the watershed. However, these features are more difficult to implement than a single flow curve, and will require increased attention to water management in the basin.*

Such strategies are discussed in the literature to protect a greater diversity of flows and associated resources (Whittaker and Shelby, 2000). These strategies include a “fixed-time claim” with more thresholds for different resources, a “trigger-based claim” that is timed to take advantage of flows when they occur, and a “percentage-based claim” that follows the natural hydrograph. Each of these results in a more complex hydrograph that protects a greater diversity of resources, as suggested in the above admonitions from Ecology.

It is beyond the scope of this report to enumerate the advantages, disadvantages, and challenges of different flow protection strategies. However, we have developed two illustrative alternatives based on existing recreation and aesthetic information that apply the different principles to the Middle Spokane.

Using the example of a recent “normal” year (2014, as discussed above), we show 1) Ecology’s simple three-step fixed time claim; 2) a trigger-based claim; and 3) a percentage-based claim. For each, we show how the alternatives might better protect recreation and aesthetic resources while allowing other flows for out-of-stream use.

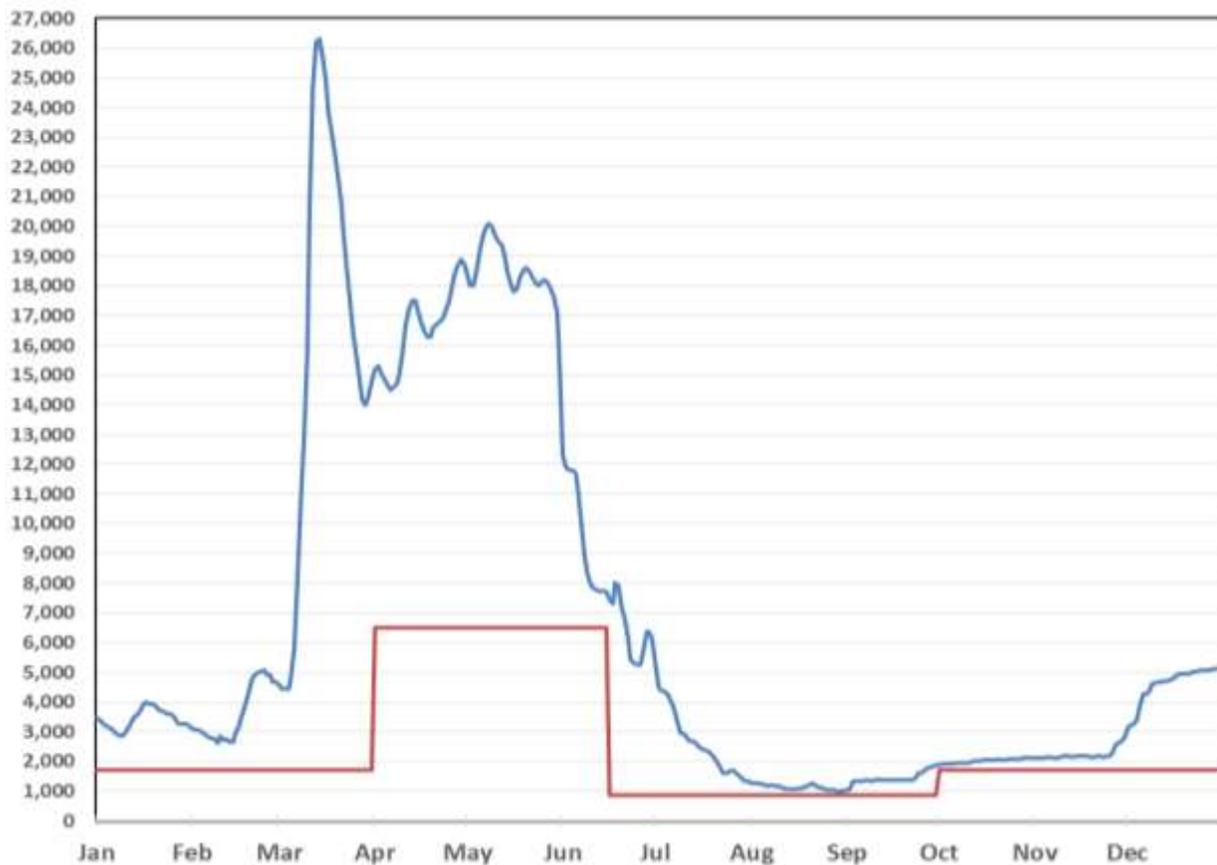
## Ecology's fixed time claim

Figure 2 shows Ecology's three step instream flow rule (with 6,500, 1,700, and 850 cfs) juxtaposed against the 2014 hydrograph. Water above the red line but below the blue line is unprotected and available to new water rights to out-of-stream users, and would eventually be removed from the river.

The primary advantage of such a claim is its simplicity. But it does not protect recreation opportunities that occur above 6,500 cfs, and lacks the diversity to protect other recreation opportunities that occur between 6,500 and 850 cfs. Because it is the same every year, it also misses opportunities to provide better recreation or aesthetic values in wetter years.

Fixed-time claims are most appropriate when a small number of instream resources are protected, with a small number of well-defined flow thresholds that are less diverse than naturally available flows. Fixed time claims are less appropriate for rivers with multiple values, where few thresholds do not provide for diverse resources, or where the timing of natural flows is more variable.

That said, it is possible to use a fixed-time claim to protect a larger number of resource values. Ecology has chosen three flows to protect different fishery values, and it would be possible to add more flows for recreation (such as those listed in the example below).



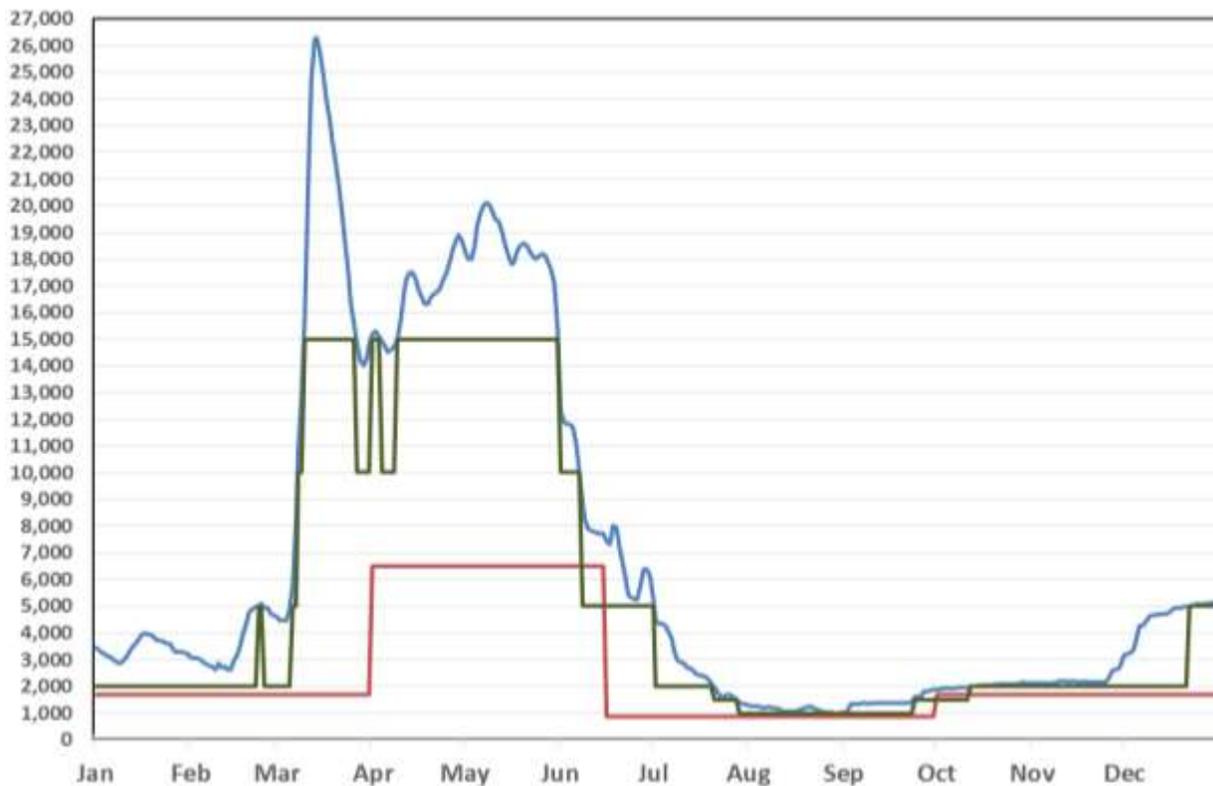
**Figure 2.** Ecology's instream flow rule is a fixed-time claim with three threshold flows (shown with an example year hydrograph, 2014).

### Example trigger-based claim with six threshold recreation/aesthetic flows

Figure 3 illustrates a **trigger-based claim** juxtaposed against Ecology's fixed-time claim and the 2014 actual hydrograph. A trigger-based claim applies whenever the natural regime provides that flow, not just during a specified time period. For example, with triggers at 1,000 and 1,500 cfs, a trigger claim would protect 1,000 cfs whenever available flows are between 1,000 and 1,500 cfs, but if flows exceed 1,500 cfs, that amount is protected. Water available to out-of-stream users is the water above the green line but below the blue line. The difference between the green and red lines is the water that the trigger claim protects beyond Ecology's fixed-time claim.

The six thresholds used in the illustrative trigger claim are based on flow information for boating, and they would provide different opportunities through the existing flow range. Other thresholds based on boating or aesthetic information could be developed if additional studies were conducted.

- 1,000 cfs (minimum acceptable boating flow for small craft)
- 1,500 (optimal technical boating at mid-point of the range)
- 2,000 (start of acceptable standard boating)
- 5,000 (optimal standard boating, mid-point of the range)
- 10,000 (start of acceptable challenging boating)
- 15,000 (optimal challenging boating, mid-point of the range)



**Figure 3.** Example six-threshold trigger claim (in green) vs. Ecology's three-threshold fixed time claim (in red) and an example year (2014) hydrograph (in blue).

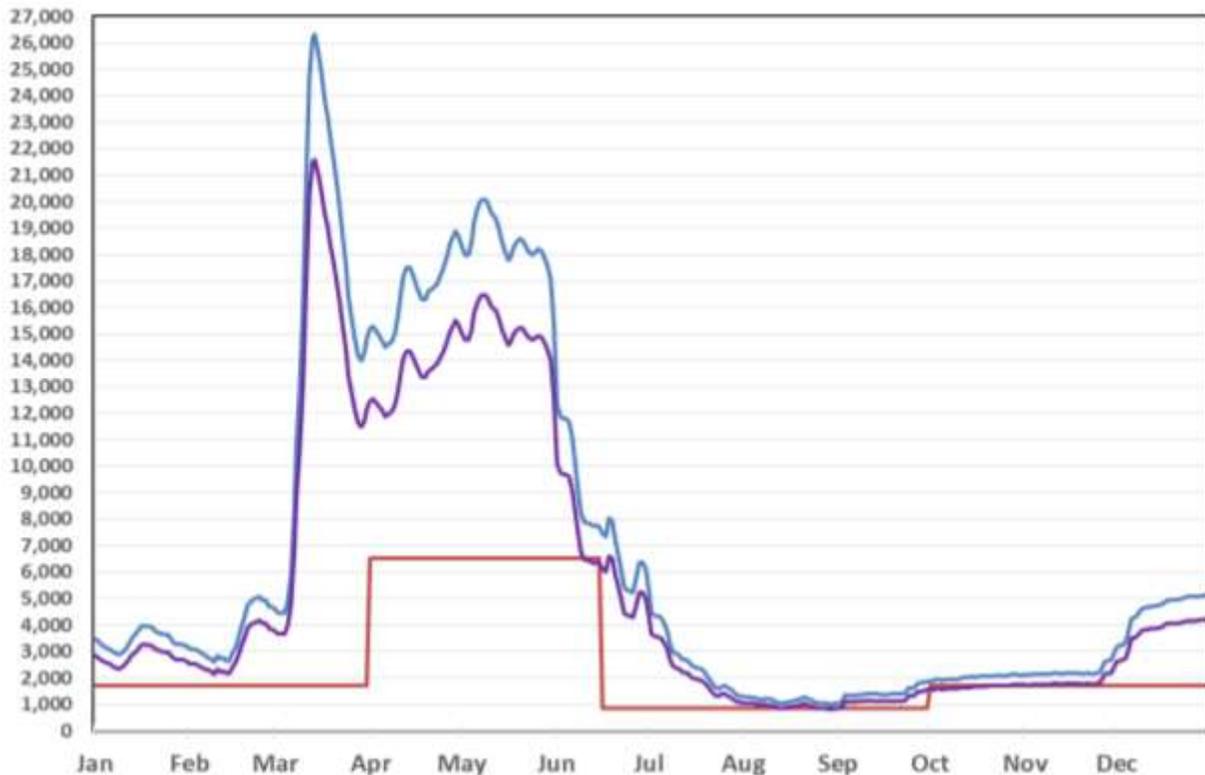
The primary advantage of a trigger claim is the ability to protect more days of different recreation or aesthetic opportunities when those flows are available (within or across years). It doesn't require predictions about timing of flows, and the claim naturally adjusts to protect more days and flows in wet years and less in dry years.

Trigger claims are particularly useful when the goal is to mimic natural variations, taking advantage of flows when they are available to provide resource values. Trigger structures are less appropriate for protecting a larger number of resource values that require a greater diversity or continuum of flows (see percentage-based claims below).

Administering trigger claims is slightly more complicated than fixed time claims. For example, as natural flow availability decreases and approaches a trigger, less out-of-stream water is available. At the trigger no out-of-stream water is available, but when flow decreases below this trigger, requests are based on the next lower trigger, so junior users can resume diversions. Any appropriation system requires such adjustments by junior out-of-stream users when water supply is constrained, but the adjustments are likely to be more frequent with trigger requests.

## Percentage-based claim

Figure X illustrates a **percentage-based claim** juxtaposed against Ecology's fixed time claim and the 2014 actual hydrograph. The claim is based on the same amount of water that would be protected under the above six-threshold trigger claim (82% of the total), but the claim is now expressed as a percentage. Water above the purple line but below the blue line is available to out-of-stream users. The difference between the purple and red lines is water that the percentage claim protects beyond Ecology's fixed-time claim.



**Figure 4.** Example 82% trigger claim (in purple) vs. Ecology's three-threshold fixed time claim (in red) and an example year (2014) hydrograph (in blue).

The primary advantage of a percentage-based claim is the ability to protect more days of different recreation or aesthetic opportunities in years when flows are available, with greater diversity between the threshold flows (just like a natural hydrograph). The claim doesn't require predictions about timing of flows, it naturally adjusts to protect more days and flows in wet years and less in dry years, and a known percentage is always available for out-of-stream uses.

A percentage-based claim is most appropriate on rivers that have a larger number of diverse instream flow resources, that lack substantial human control of flows, and with less-predictable hydrologic variation (within the year or from year-to-year). It is probably less appropriate on rivers with fewer and less diverse instream flow resources, where flows are extensively controlled, and when protection can be achieved with substantially less than natural flows.

This type of flow claim is new and may require some administrative or legal precedent, but protections for instream flows are themselves only a few decades old. Any appropriation system requires adjustments by junior out-of-stream users when water supply is constrained, but a percentage-based system simplifies the number of times that happens compared to trigger claims.

## Conclusions

1. Ecology has the responsibility and ability to assess and protect recreation and aesthetic flows for the Middle Spokane River.
2. There is considerable existing information that would help Ecology assess recreation and aesthetic flow needs. Documents indicate that Ecology is aware of this literature, but did not integrate the findings into its instream flow rule.
3. We have identified some flow-recreation findings from available information:
  - a. There are a diversity of boating opportunities available from about 500 cfs to 15,000 cfs. These provide different types of opportunities in different craft for users with different skill levels.
  - b. Other general riverside recreation (e.g., camping, hiking, biking, picnicking, and fishing) is enhanced by a diversity of flows in the river through the season. Low flows may diminish the quality of those experiences, particularly at rapids (e.g., Bowl and Pitcher, Devil's Toenail) or gravel bar locations.
  - c. Ecology's fish-based instream flow rule protects only an historical dry year hydrograph. This does not protect the existing diversity of boating experiences, particularly those occurring between 850 and 6,500 cfs in summer/fall or above 6,500 cfs during spring high flows.
  - d. Similarly, the 850 cfs minimum flow in summer and fall provides little aesthetic diversity, exposes a low flow "bathtub ring" at scenic locations such as Bowl and Pitcher, and may produce notably lower aesthetic evaluations compared to higher flows.
4. Ecology has not explored alternative ways of protecting a greater diversity of flows, nor taken advantage of variation in hydrology from year to year.
5. Alternative claim structures could protect recreation and aesthetic flows, but Ecology has not considered them.

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