WHAT DOES THE NOOKSACK INSTREAM FLOW RULE MEAN?[1]

Eric Hirst

January 2018

We need sufficient water in the Nooksack River basin for two key reasons:

- Environmental: to restore and protect salmon, steelhead and trout populations, other species and other values associated with instream flows (e.g., recreation and scenic values).
- People: to support human activities in agriculture, industry, business, and home.

These goals are complicated by several factors:

- The Lummi Nation and Nooksack Indian Tribe have water rights dating to "time immemorial" to support a harvestable surplus of salmon and shellfish. They also have treaty rights dating to 1855 granting them water for use on their reservations. These rights are not yet quantified. This lack of clarity on tribal water rights complicates determination of how much water is available – legally, physically, and environmentally – for out-of-stream human uses.[2]
- The only quantification of instream flow requirements is the Washington State Department of Ecology's (Ecology) 1985 Nooksack Instream Resource Protection Program, which established minimum flows for 30 locations within the Nooksack River basin.[3]
- Although data on human water use exist for all customers of water systems (municipalities, Public Utility District #1, water districts, and water associations), these data are nowhere centralized, organized, analyzed, and made available to the public. In addition, virtually no data exist in the public domain on water use for agricultural irrigation (by far the largest water use in Whatcom County) or for rural homes on permit-exempt wells. Many, if not most, of these agricultural and rural water uses are not metered.
- Because of these data deficiencies, we do not know how much water is used for human out-of-stream purposes, by sector, by function, by time of year, and by location. Nor do we know the trends over time, from year to year and decade to decade.
- Whatever water-supply problems exist today, they are almost certain to get worse as Whatcom County's population continues to grow and the adverse effects of climate change increase. Consistent with local data from the past few decades, climate-induced changes will

[1] I thank Henry Bierlink, Susan Burke, Brad Caldwell, Jay Chennault, Dan Eisses, Jean Melious, and three anonymous reviewers for their very helpful comments on a draft of this paper.

[2] "Dating to a 1908 Supreme Court ruling, courts generally have held that many tribes have a reserved right to water sufficient to fulfill the purpose of their reservations and that this right took effect on the date the reservations were established. This means that, in the context of a state water law system of prior appropriations, which is common in many U.S. western states, many tribes have water rights senior to those of non-Indian users with water rights and access established subsequent to the Indian reservations' creation. Although many Indian tribes hold senior water rights through their reservations, the quantification of these rights is undetermined in many cases." (C. V. Stern, *Indian Water Rights Settlements*, U.S. Congressional Research Service, Nov. 27. 2017.)

[3] Utah State University conducted subsequent studies for the Water Resources Inventory Area 1 (WRIA 1) Planning Unit; see J. Freimund, "Setting and Managing Instream Flows in WRIA 1," 2010 Salmon Summit, Nov. 2010.

continue to reduce summer supply (less glacier mass and snow, lower summer rainfall, lower summer streamflows) and increase summer demand (higher air temperatures and less rainfall).[4]

This paper examines the Ecology rule for the Nooksack basin because of its importance to understanding how much water should be left in the three forks, the tributaries and the mainstem of the Nooksack River; and interpretations of how the rule was set and what it means differ. The importance of this topic is exemplified by the Water Resources Inventory Area (WRIA) 1 Planning Unit effort to review its 2005 Instream Flow Action Plan.[5]

BACKGROUND

Ecology's formal rule is WAC-173-501.[6] Ecology also published a background document, explaining how the rule was developed.[7]

Ecology's rule is intended to (footnote 6):

> retain perennial rivers, streams, and lakes in the Nooksack water resource inventory area with instream flows and levels necessary to provide for preservation of wildlife, fish, scenic, aesthetic, and other environmental values, and navigational values, as well as recreation and water quality.

The rule established minimum flows for 30 reaches within the basin. These minimums are specified for the 1st and 15th of each month, 24 values a year for each reach. Fig. 1, as an example, shows the minimum flow values, in cubic feet per second (cfs), that Ecology set for the mainstem at Ferndale.

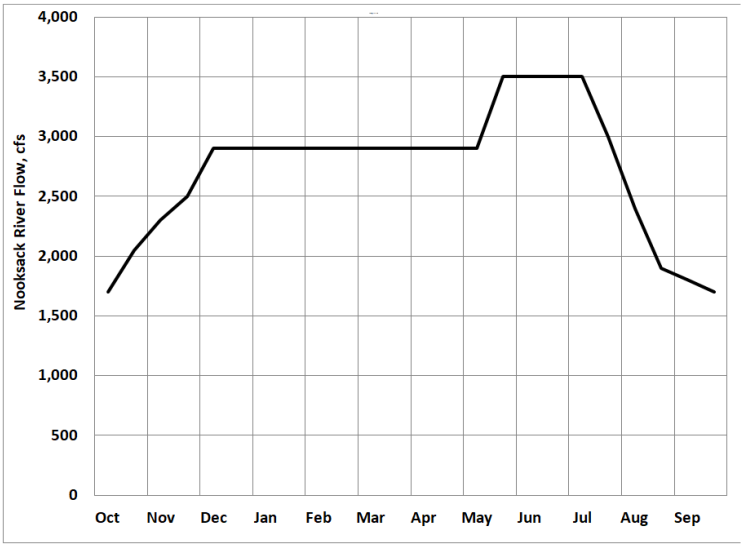

Fig. 1. Ecology's minimum instream flow rule for Nooksack River at Ferndale.

In addition, the Ecology rule closed 27 of the 30 reaches. That

[4] E. Hirst, *Future Prospects for Whatcom County Water Supply,* Feb. 2017.

[5] WRIA 1 Planning Unit, *Work Plan Iteration 2015-1*, included with the Nov. 2017 meeting packet, referring to the Feb. 2005 *Draft Instream Flow Action Plan*.

[6] Washington State Dept. of Ecology, *Instream Resources Protection Program—Nooksack Water Resource Inventory Area (WRIA) 1*, Chapter 173-501 WAC, June 9, 1988.

[7] Washington State Dept. of Ecology, *Nooksack Instream Resource Protection Program (Water Resource Inventory Area 1)*, Nov. 1985. The rule was completed in late 1985 and went into effect in early 1986. The rule was amended in 1988.

is, Ecology prohibited itself from issuing new water rights in these basins, either for annual or seasonal use. Ecology's rule, however, did not affect permit-exempt wells.

BASIS FOR RULE

The 1985 Ecology report (footnote 7) includes a section on Flow Recommendations, which states:

> Information and recommendations regarding the flow needs of fish were provided by WDF [WA Dept. of Fish], WDG [WA Dept. of Game], the Lummi Tribe and the Nooksack Tribe. WDG and WDF obtained channel width measurements for most of the streams supporting anadromous fish in WRIA 1. These measurements were used by WDG and WDF to derive recommended instream flows for salmon and steelhead using the "USGS" method, (toe-width) an instream flow technique developed cooperatively by WDF, WDG, and the U.S. Geological Survey. This method uses standard regression equations developed from data collected at sample sites on numerous western Washington streams to derive preferred rearing and spawning flows. …
>
> Because of the importance of habitat and water quantity, and the greater reliability of the methodology, instream flow incremental method studies were undertaken on several streams. The instream flow incremental method (IFIM) was developed by the Cooperative Instream Flow Service Group of the U.S. Fish and Wildlife Service. This technique involves the correlation of discharge, stage, velocity, and depth measurements over a range of flows to develop a hydraulic model of behavior of these parameters with changes in flow through typical channel sections. The distribution of substrate types and sizes is included in the model. Velocity, depth, and substrate preference criteria are specified for various fish species and life stages of interest. These criteria are interfaced by computer with the hydraulic model to derive weighted usable channel area for various levels of discharge for each fish species and lifestage. Graphs of weighted usable area versus discharge can be created for each species/lifestage and used to evaluate instream flow requirements for fish. IFIM studies were conducted for the North, Middle, and South Forks of the Nooksack River, and Kendall, Silver, Terrell and Maple Creeks.

People hold different opinions on how the rule was set. Some believe that the rule is based on the ecological science prevalent in the early 1980s. Others claim that Ecology set the levels to approximate the 50% exceedance level (median flow) in each reach.[8] To support that claim, they note that the Ecology flow levels approximate median flows. Fig. 2 shows, for the Nooksack River at Ferndale, that the levels set in the rule match closely with the 50% exceedance levels, especially for July through October. (These results are based on daily data from USGS.)

[8] As examples, Dan Eisses (General Manager, Birch Bay Water & Sewer District) and Robert Carmichael (Attorney with Carmichael Clark, P.S.)

The Ecology rule itself includes no references to "exceedance" values. It does however contain many references to "minimum" flows. As examples, the rule mentions "minimum water flows" (p 1), "minimum flow" (5), and "minimum instream flow" (6). Ecology's 1985 supporting study also does not mention "exceedance." However, this report also contains many statements that refer to "minimum" flows.

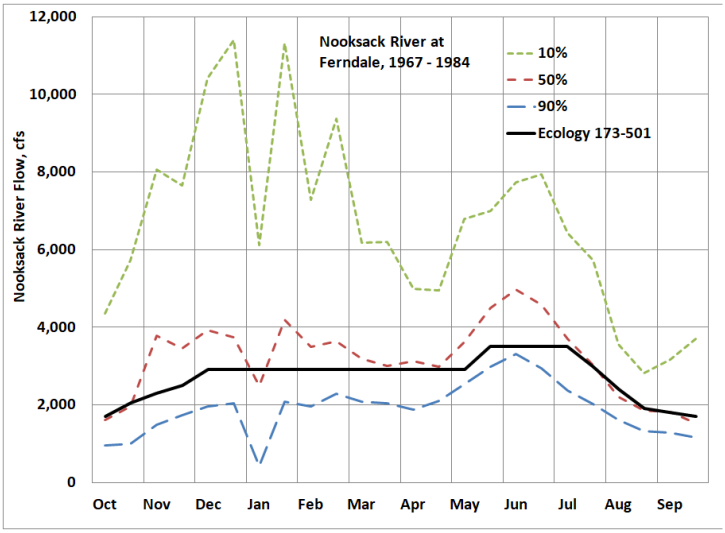

Fig. 2. Nooksack River flows at Ferndale, 1967 – 1984 and Ecology's instream flow rule.

In practice, Ecology's instream rule reflects a combination of science and negotiation:

> Debate begins when one tries to determine the actual amount of flow necessary to accomplish these purposes. The referenced USGS preferred stream discharges document makes one set of recommendations. The base flow analysis described in Appendix IV [Program Overview] may result in another. There will be considerable debate among competing water users concerning some streams and tributaries. Since determination of the smallest amount of water necessary for fish is not an exact science, a strong argument can be made for setting the instream flow high enough to include a substantial margin for error. If the flows are set too low and water is appropriated to that level, the water cannot be easily retrieved.[9]

WHAT DOES THE RULE MEAN

Regardless of the scientific and/or statistical basis for Ecology's rule, it is important to ask what it means. What actions follow from failure to meet these minimum flows?

Although often referred to as *minimum* flows, the rule in no way restricts holders of senior water rights from using water when streamflows fall below the Ecology levels. That is, these instream flow levels are water rights, just like any other, which means they have a priority date, 1985 in this case. Thus, when flows drop below the minimums, Ecology or a senior rights holder could require those holding junior rights (i.e., issued after 1985) to reduce or eliminate their water use.

Thus, the rule does not limit water use for senior water rights, nor does it trigger any remedial actions to bring flows up to their administratively determined minimum levels. That is, the rule

[9] Ecology, *Final Environmental Impact Statement, Western Washington Instream Resources Protection Program*, June 1979.

does not require any entity to take actions to leave or put more water into creeks and the Nooksack River to increase streamflows. The only effect of the rule is to prohibit or limit future, more junior water rights.

SEASONAL RESULTS

For those concerned most about environmental quality in general (and salmon in particular), the key concern is very low flows during the summer months. These low flows mean higher water temperatures, less dissolved oxygen, higher concentrations of pollutants, and less available habitat – all bad for salmon and other fish.

To continue with the Ferndale example, Fig. 3 shows the percentage of days by month, over the past 30 years (since the rule was established) that Ecology's rule was not met. July through October stand out – flows fall below the levels set by Ecology much more than 50% of the time.

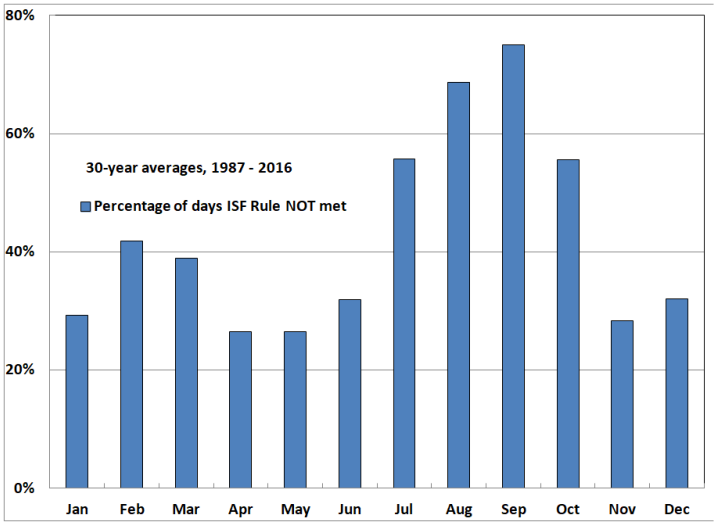

Fig. 3. Percentage of days Ecology's rule is not meet by month at Ferndale.

The situation is actually worse than depicted in Fig. 3. Fish health depends not just on the fact that Ecology's rule is not met but especially on the extent of the deficit, as shown in Fig. 4. If the rule calls for 2,400 cfs (August 1 level) and the actual flow is 2,399 cfs the 1 cfs deficit likely has little effect on fish health. However, if the actual flow is only 1,800 cfs, the 600 cfs deficit is likely to strongly and negatively affect fish. In practice, the deficit is substantial, especially during the summer months. October stands out with an average deficit of 40%, equivalent to 800 cfs.

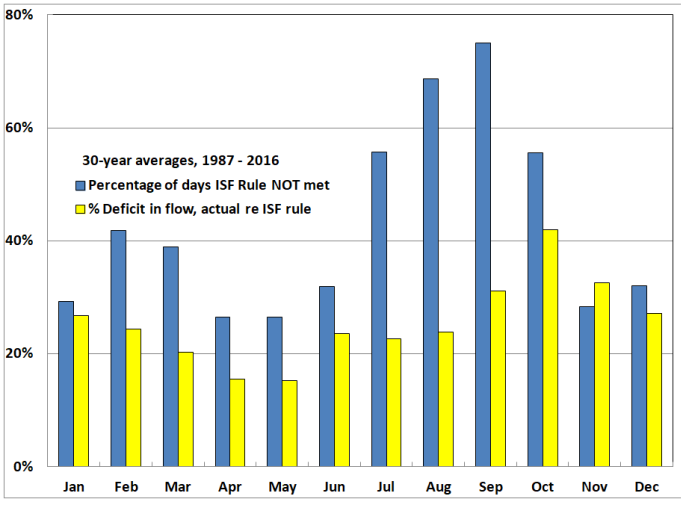

Fig. 4. Percentage of days Ecology's rule is not met (left bars) and the percent deficit relative to the levels set in the rule (right bars).

OTHER LOCATIONS

So far, the data presented are all for the mainstem Nooksack River at Ferndale. Is the situation different on the three forks and on the tributaries? Unfortunately, sufficient long-term data on streamflows are not available for enough locations to provide a comprehensive answer to that question.[10]

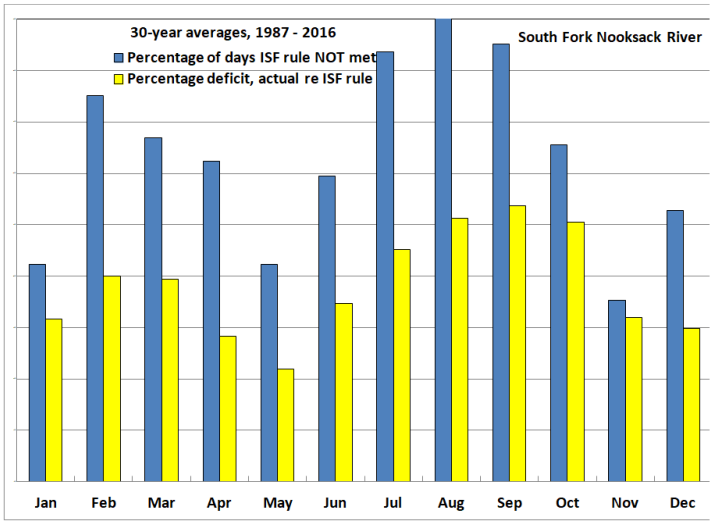

Fig. 5. Percentage of days Ecology's rule is not met and the percent deficit relative to the levels set in the rule for the South Fork.

I examined data from the South Fork and Fishtrap Creek to provide a partial picture at other locations. Figure 5, analogous to Fig. 4, shows results for the South Fork.

Interpreting South Fork data is complicated for three reasons:

- Data through September 2008 are from a gauge at Wickersham; subsequent data are from a gauge at Saxon almost two miles away.
- Both gauges are eight to ten miles upstream from the point at which Ecology set its minimum flows.
- Data for January through May and for November and December exist only from 1996 on.

As a consequence, we should view South Fork results qualitatively, not quantitatively (which is why there are no numbers on the y axis of Fig. 5). These results are similar to those for the mainstem at Ferndale.

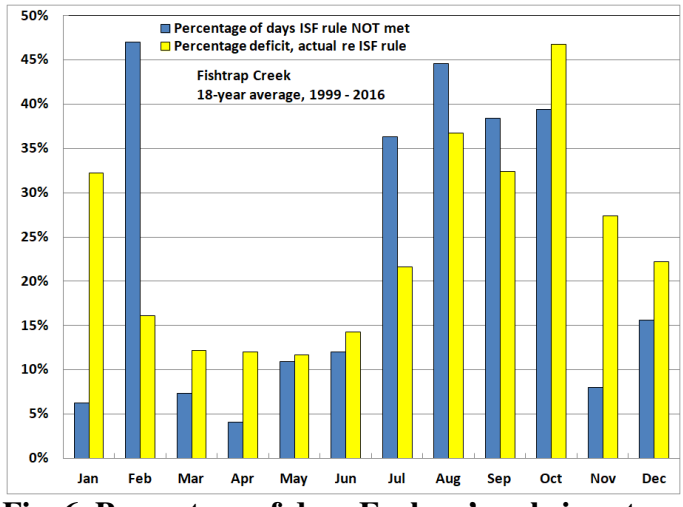

Fig. 6. Percentage of days Ecology's rule is not met and the percent deficit relative to the levels set in the rule for Fishtrap Creek.

Data for Fishtrap Creek are available only from 1999, 16 years instead of the 30 years available for the mainstem and for the South Fork (Fig. 6). As with the other two locations, performance is lowest during the summer months (except for January and February). On the days that flows are below those called for in the rule, the deficit is, once again, substantial.

[10] RH2 Engineering, *Whatcom County Streamflow Analysis*, prepared for PUD #1 of Whatcom County, Dec. 2016.

To more easily compare results across the three locations, I created a Streamflow Sensitivity Index. The index is the product of the percentage of days with flows below the levels in Ecology's rule multiplied by the percentage deficit on those days.[11] Thus, higher numbers mean greater effects on fish. Clearly the summer and early fall are the most critical times (July through October); Fig. 7.

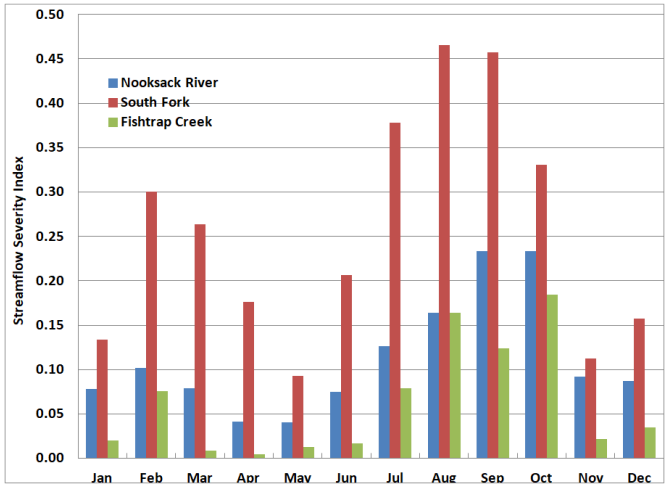

Fig. 7. Streamflow sensitivity index for Nooksack River, South Fork, and Fishtrap Creek.

IMPLICATIONS

Here is my sense of what this discussion and data mean (based also on many prior studies):

- Salmon populations have declined dramatically over the past several decades.
- We have a major responsibility to reverse these trends to restore healthy salmon (and other wildlife) populations.
- Salmon-recovery efforts encompass a broad range of activities, including habitat restoration and protection, higher water quality, improved floodplain and land-use management, and better management of fishing. One element of such a program is improved management of human use of both ground and surface water to increase instream flows, especially during the summer. Indeed, streamflows interact with the other factors affecting salmon health; e.g., low streamflows lead to high water temperatures, low dissolved oxygen levels, less access to and extent of habitat, and increased concentrations of pollutants.
- The streamflows set by Ecology in its 1985 Nooksack Instream Resource Protection Program are not being met during the critical summer months when flows are low and human use of water is high. Whether low summer flows is a serious problem or an artifact of how the numbers were developed is subject to debate.

In my vision of an ideal world, the U.S Dept. of the Interior would, at long last, respond positively to the 2011 requests from the Lummi Nation and Nooksack Indian Tribe to quantify tribal treaty rights.[12] Such a process would involve reviewing, validating and perhaps updating prior scientific studies on fish habitat and instream flows to determine how much water fish need

[11] Neither the percentage of days nor the percentage deficit alone is sufficient to determine adverse effects on fish. If the deficit (in cfs) is very small and the number of days of deficit is high, the effect on fish health may be much less than fewer deficit days with larger cfs deficits. This new index captures and combines both effects.

[12] Lummi Indian Business Council, "Litigation Request to Protect Lummi Nation Treaty and Fishing Rights," letter to U.S. Dept. of the Interior, June 6, 2011.

by location, time of year, lifecycle stage, and type of fish. These studies would then form the basis for negotiations among the tribes and other water users to determine an appropriate balance between the flow rates that are optimal for fish and other wildlife and what farmers and others need to maintain their livelihoods and lifestyles.

If federal leadership/participation does not occur, an alternative would be for Ecology to conduct the studies and negotiations suggested in the prior paragraph. That is, Ecology would revisit and revise its 1985 Nooksack Instream Resource Protection Program. The major problem with this approach is that any changes in the rule would have a priority date of, say, 2019 or 2020, which would have virtually no effect on actual streamflows.

Overall, the current water supply/demand situation is confused. We face too many unknowns that hamper resolution of the situation:

- How much water fish and other wildlife need in the creeks and Nooksack River,
- How much water the tribes are entitled to, and
- How much water farmers need for irrigation.

Absent more and better information on these issues, it remains difficult to resolve our growing water/supply balance issues. My sense is we need to leave more water instream and reduce out-of-stream water use during the summers. The best way to reduce summer water use without adversely affecting society is to improve the efficiency of agricultural irrigation, primarily through automated irrigation scheduling. And we should actively search for and develop new environmentally benign supplies, perhaps including water from the deep wells now being tested by the Birch Bay Water & Sewer District.