Q: How were instream flow numbers determined for WRIA 17?

A: It was a collaboration between the state and local Planning Unit. Fish biologists from the state departments of Ecology, and Fish and Wildlife worked together with the WRIA 17 Planning Unit to recommend the instream flow levels to be set in rule. To determine instream flow levels, they used a combination of stream channel studies (Toe-width, Wetted-width, or Physical Habitat Simulation (PHABSIM)models) stream flow measurements where available, and knowledge of what species of fish were present along with their timing and distribution in the stream for spawning, rearing, incubation, and migration.

Protective flow levels for fish vary by season, species, and life stages.

- High winter and spring flows benefit fish out-migration, stream channel maintenance, near-stream wetlands, ground water recharge, and so on.
- Lower flows are usually needed for rearing life stages.
- Intermediate flows are usually better for spawning and incubation.
- Flows that vary too much can leave fish or redds high and dry.
- Flows that are too low prevent up-stream migration of adult fish, cause water temperatures to be to warm which can be deadly for fish, make redds and fry vulnerable to predators such as birds, and reduces or stops transport of food such as drifting insects to rearing fish.

State fish biologists assess a stream's natural hydrology (water movement) and the needs of all species and life stages present at various times of the year. Instream flows need to be protective of fish and prevent future degradation of the fish habitat.

To determine instream flow levels on: **Tarboo, Thorndyke, Salmon, and Snow** Creeks, state biologists and the Planning Unit used:

- Toe-width studies.
- Wetted-width studies.
- PHABSIM study on Snow Creek
- Measured and synthesized stream flows from hydrographs
- Knowledge of fish presence, life stages, timing, and depth, velocity, and substrate preferences to determine fish priority month by month

Month	Tarboo Creek Instream Flow	Thorndyke Creek Instream Flow	Priority Lifestage
January	20 cfs	24 cfs	Coho and chum spawning
February	20 cfs	24 cfs	
March	25 cfs*	45 cfs	Steelhead spawning
April	16 cfs*	45 cfs	
May	8 cfs*	30 cfs	Steelhead egg incubation
June	8 cfs	30 cfs	
July	8 cfs	12 cfs	Steelhead rearing
August	8 cfs	12 cfs	
September	8 cfs	12 cfs	

October	8 cfs	12 cfs	Steelhead rearing
November	20 cfs	24 cfs	Coho and chum spawning
December	20 cfs	24 cfs	
* Tarboo's March, April, and May instream flows were modified down to be closer to the 10% exceedance line on its hydrograph.			

Salmon and Snow creeks vary from the two streams above by having summer chum spawning, and Snow Creek had a more detailed PHABSIM study done in addition to the Toe-width and Wetted-width studies.

Month	**Salmon Creek Instream Flow**	**Snow Creek Instream Flow**	**Priority Lifestage**
January	21 cfs	35 cfs	Snow was coho and chum spawning. Salmon was coho spawning
February	21 cfs	35 cfs	Snow was coho and chum spawning. Salmon was egg incubation and coho spawning
March	40 cfs	50 cfs	Steelhead spawning
April	35 cfs*	50 cfs	Steelhead Spawning
May	26 cfs	50 cfs	Steelhead spawning and Steelhead incubation
June	26 cfs	35 cfs	Steelhead egg incubation
July	9 cfs*	17 cfs*	Steelhead rearing
August	9 cfs	15 cfs*	
September	9 cfs	20 cfs	Summer chum spawning
October	12 cfs*	35 cfs	
November	21 cfs	35 cfs	Fall chum and coho spawning
December	21 cfs	35 cfs	
* Salmon's April, July, and October instream flows were modified down to be closer to the 10% exceedance line on its hydrograph. * Snow's July and August instream flows were modified down to be closer to the 10% exceedance line on its hydrograph.			

To determine instream flow levels on **Chimacum Creek**, state biologists and the Planning Unit used:

- Toe-width study.
- Wetted-width study.
- Measured and synthesized stream flows from a hydrograph
- Knowledge of fish presence ,temperature preference, life stages, timing, and depth, velocity, and substrate preferences to determine fish priority month by month
- A stream temperature model (FLIR)

Month	Chimacum Creek Instream Flow	Priority Lifestage
January	25 cfs	Egg incubation and steelhead and coho spawning
February	25 cfs	
March	46 cfs	Steelhead spawning and rearing and incubation
April	46 cfs	
May	32 cfs	
June	10 cfs	Steelhead rearing and egg incubation
July	10 cfs	Steelhead rearing and egg incubation
August	10 cfs	Steelhead rearing
September	17 cfs*	Summer chum spawning and steelhead rearing
October	20 cfs*	
November	25 cfs	Fall chum and coho spawning
December	25 cfs	
* Chimacum's September and October instream flows were modified down to be closer to the 10% exceedance line on its hydrograph		

To determine instream flow levels on the **Little Quilcene River**, state biologists and the Planning Unit used:

- Toe-width study.
- Wetted-width study.
- Measured and synthesized stream flows from a hydrograph
- Knowledge of fish presence, life stages, timing, and depth, velocity, and substrate preferences to determine fish priority month by month

Month	Little Quilcene Instream Flow	Priority Lifestage
January	61 cfs	Coho spawning and salmon incubation
February	61 cfs	Steelhead and coho spawning and salmon incubation
March	100 cfs	Steelhead spawning and salmonid incubation
April	100 cfs	Steelhead spawning, rearing, and salmonid incubation
May	92 cfs*	Steelhead spawning, rearing, and incubation
June	66 cfs	Steelhead rearing and incubation
July	66 cfs	
August	27 cfs	Steelhead rearing
September	30 cfs*	Summer chum spawning and salmonid rearing
October	48 cfs*	
November	61 cfs	Fall chum and coho spawning and salmon incubation
December	61 cfs	
* The Little Quilcene River's May, September and October instream flows were modified down to the 10% exceedance line on its hydrograph.		

To determine instream flow levels on the **Big Quilcene River** state biologists and the Planning Unit used:

- A PHABSIM study on the Big Quilcene River
- Measured and synthesized stream flows from hydrographs
- Knowledge of fish presence, life stages, timing, and depth, velocity, and substrate preferences to determine fish priority month by month

Month	Big Quilcene Instream Flow	Priority Lifestage
January	120 cfs	Fall chum and coho spawning, and salmonid incubation
February	120 cfs	Steelhead and coho spawning and salmonid incubation
March	190 cfs	Steelhead spawning and salmonid incubation
April	190 cfs	Steelhead spawning, rearing, and incubation
May	190 cfs	
June	190 cfs	Steelhead rearing and incubation
July	190 cfs	
August	167 cfs*	Steelhead rearing
September	94 cfs*	Summer chum and coho spawning, and salmonid rearing
October	180 cfs	Summer chum, coho, and Chinook spawning and salmonid rearing
November	120 cfs	Fall chum, coho, and Chinook spawning, and salmonid incubation
December	120 cfs	Fall chum and coho spawning, and salmonid incubation
* The Big Quilcene River's August and September instream flows were modified down to the 10% exceedance line on its hydrograph.		

State biologists used the Toe-width method to determine instream flows for all the smaller streams in the Watershed. The Toe-Width Method was developed by the Department of Fisheries (WDF), the Department of Game (WDG), and the U.S. Geological Service (USGS) in the 1970s at the request of the state legislature in response to the need to determine minimum instream flows for fish. The Toe-width is the distance from the toe of one streambank to the toe of the other streambank across the stream channel. This width of the stream is used to derive the flow needed for spawning and rearing salmon and steelhead.

Toe-width measurements gathered by Brad Caldwell of Ecology and WDFW.

Toe Width Flows for WRIA 17, Quilcene

Stream Name	Tributary to	Average Toe Width (in feet)	Toe-Width Flow for Fish Spawning and Rearing (in cfs)				
			Chinook Spawning	*Coho/Chum* Spawning*	*Steelhead Spawning*	*Steelhead Rearing*	*Salmon Rearing*
Chicken Coop (E. Sequim Bay)	Sequim Bay	7.9	17.6	8.2	17.0	3.1	2.7
Dean (Hwy 101)	Sequim Bay	10.0	23.6	11.2	22.4	4.3	3.8
Donovan Creek RM 1.0 (Old Bridge off dirt Rd. 0.4 mi. north of Mcinnis Rd.)	Quilcene Bay	12.8	32.1	15.5	29.8	6.1	5.5
Howe Creek RM 0.4 (@ Lords Lake Rd. crossing)	Little Quilcene River	13.8	35.2	17.1	32.6	6.8	6.1
Jimmy-come lately (Old Blyn Hwy)	Sequim Bay	18.0	49.0	24.3	44.3	9.9	8.9
Johnson (W. Sequim Bay)	Sequim Bay	11.3	27.5	13.2	25.8	5.1	4.6
Leland Creek RM 2.0 (@ Hwy 101 crossing)	Little Quilcene River	22.8	65.7	33.1	58.3	13.9	12.5
Ludlow Creek RM 0.5 (@ Old wooden bridge on Oak Bay Rd.)	Port Ludlow Bay	22.3	63.9	32.1	56.8	13.5	12.1
Marple Creek RM 0.0 ((@ Bee Rd. crossing)	Jackson Cove/Dabob Bay	Dry					
Ripley Creek RM 0.1 (@ Lords Lake Rd. crossing)	Little Quilcene River	Dry					

Spencer Creek RM 0.0 (@ Bee Rd. crossing, west side of road--no tidal influence)	Jackson Cove/Dabob Bay	11.4	27.8	13.3	26.1	5.2	4.6
Piddling Creek # 17.0200 RM 0.2 (@ Oak Bay Rd. crossing)	Mats Mats Bay	6	12.5	5.8	12.4	2.1	1.8

Quilcene Snow Planning Area (selected WRIA 17 streams)
Recommendations for Instream Flow Levels by WRIA 18 Planning Unit

Stream		Toe-Width (in feet) & location	Spawning and Rearing flows (cfs)	Instream Flow Recommendations by Month (cfs) Numbers indicate recommended flow for the month.											
				J	F	M	A	M	J	J	A	S	O	N	D
Chicken Coop	Cutthroat	7.9 @ E. Sequim Bay Rd.	Steel rear 3	8	3	3	3	3	3	3	3	3	8	8	8
Dean	Cutthroat Coho	10 @ Hwy. 101	Coho spawn 11 Steel rear 4	11	7	7	7	4	4	4	4	4	4	11	11
Jimmycomelately	Coho Steelhead Cutthroat Summer chum	18 @ Old Blyn Hwy.	Coho spawn 24 Steel spawn 44 Chum spawn 49 Steel rear 10	24	16	44	44	30	30	10	10	24	24	24	24
Johnson	Coho Steelhead Cutthroat Chum	11.3 @ W. Sequim Bay Rd.	Coho spawn 13 Steel spawn 26 Chum spawn 27 Steel rear 5	13	8	26	26	17	17	5	5	5	5	13	13

Proposed instream flows using toe-width measurements were determined at a meeting on 11-17-1997 with Hal Beecher (WDFW) and Brad Caldwell (Ecology).
Fish species utilization was determined at a meeting on 9-11-1997 with local biologists Tim Rymer and Ginna Correa (WDFW) and Mike Reed (Jamestown S'Klallam Tribe).

Quilcene Snow Planning Area (selected WRIA 17 streams)
Instream Flow determinations made by Ecology and WDFW

Stream		Toe-Width (feet) & location	Spawning and Rearing flows (cfs)	Instream Flow by Month (cfs) Numbers indicate recommended flow for the month.											
				J	F	M	A	M	J	J	A	S	O	N	D
Ludlow RM .5 @ Schmuck Rd.	Coho Steelhead Cutthroat Chum	22.3	Coho spawn 32.1 Steel spawn 56.8 Chum spawn 32.1 Steel rear 13.5	32	20	57	57	38	38	14	14	32	32	32	32
Piddling RM .2 @ Oak Bay Rd.	Coho Cutthroat Chum	6	Coho spawn 5.8 Steel spawn 12.4 Chum spawn 5.8 Steel rear 2.1	6	4	12	12	8	8	2	2	6	6	6	6
Donovan RM 1.0 @ Bridge off dirt Rd. .4 mi. north of McInnis Rd.	Coho Steelhead Cutthroat Chum	12.8	Coho spawn 15.5 Steel spawn 29.8 Chum spawn 15.5 Steel rear 6.1	15	10	30	30	20	20	6	6	15	15	15	15
Spencer RM 0.0 @ Bee Rd.	Coho Steelhead Cutthroat Chum	11.4	Coho spawn 13.3 Steel spawn 26.1 Chum spawn 13.3 Steel rear 5.2	13	9	26	26	17	17	5	5	13	13	13	13
Howe @ W. Sequim Bay Rd.	Coho Steelhead Cutthroat	13.8	Coho spawn 17.1 Steel spawn 32.6 Chum spawn 17.1 Steel rear 6.8	17	11	33	33	22	22	7	7	17	17	17	17
Leland RM .2.0 @ Hwy 101	Coho Steelhead Cutthroat Chum	22.8	Coho spawn 33.1 Steel spawn 58.3 Chum spawn 33.1 Steel rear 13.9	33	22	58	58	38	38	14	14	33	33	33	33

Not enough information on Ripley and Marple Creeks, as they were dry when measured 9/9/99. Proposed instream flows using toe-width measurements were determined at a meeting on 3-7-2005 between Brad Caldwell (Ecology) and Terra Hegy (WDFW). All proposed to be closed all year.