

# Securing Instream Flow on Stariski Creek

FY 2010

Annual Water Quantity Report



Prepared for:  
Alaska Sustainable Salmon Fund

by

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## Introduction

Kenai Peninsula's coastal watersheds in South-central Alaska are under new development pressures with increased road building, housing developments, and gravel mining. These activities may change the natural hydrograph of these systems as well as affect stream water quality. In addition, a Spruce Bark Beetle epidemic has impacted more than 2 million acres of Kenai Peninsula's forests. Increased water yields due to reduced transpiration from tree mortality accompanied by accelerated logging pose additional threats to these watersheds. Climate change also threatens to alter Kenai Peninsula watersheds by affecting flooding frequencies, precipitation levels, surface and ground water volumes, and other hydrologic characteristics. Major flooding in the fall of 2002 and low instream flows in the summer of 2004 have highlighted the need to understand the habitat requirements in relation to seasonal and long-term hydrologic characteristics of these waterbodies in regards to their Chinook, coho, and pink salmon, Dolly Varden char, steelhead and rainbow trout populations.

Sufficient water quantity in freshwater habitats is essential for sustaining healthy salmon production. Decision-makers cannot manage streams effectively without the historical flow and water volume information needed to predict seasonal water availability and characteristics. At the most fundamental level, this information is required to determine water availability and needs for protection of fish and wildlife habitat, migration, and propagation under Alaska law, specifically the Water Use Act (AS 46.15.).

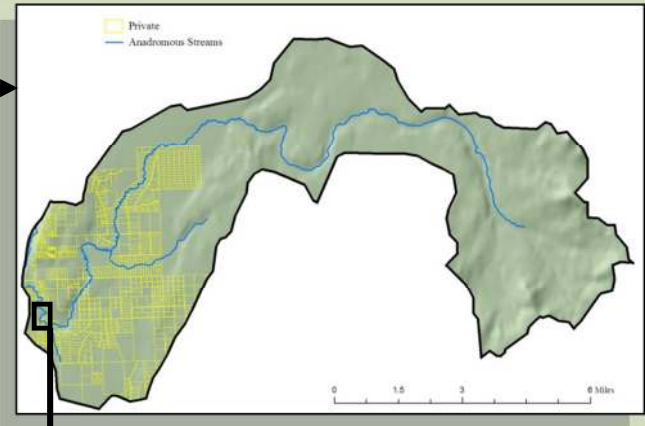
To date, however, limited hydrologic data exist throughout the state, including on the lower Kenai Peninsula. These data gaps hinder the precision and accuracy of flow and stage estimates required for research and management decisions related to fish and water management and planning. Collecting stream water level data from stage gages in conjunction with regular instream discharge measurements allows for a correlation between water level and discharge. As a result, continuous stage data provide the information necessary to construct a hydrograph and calculate mean annual and monthly flows. These calculations are critically important for quantifying flow requirements for the various salmonid life stages, and for securing instream flow reservations for fish.

To reserve water, an application containing supporting data and analyses that substantiate the need for the amount of water being requested must be submitted to the Alaska Department of Natural Resources (DNR) for adjudication (the administrative determination of the validity and amount of a water right, including the settlement of conflicting claims among competing appropriators). Typically a minimum of five years of hydrologic data are necessary to describe the natural variation in hydrologic pattern for a specific stream system. Because Alaska water rights are based on a prior appropriation principle, it is imperative to prioritize completing datasets to accomplish the goal of securing water rights on priority salmon streams.

# Stariski Creek



Stariski Creek watershed drains 52 square miles on the lower Kenai Peninsula in Southcentral Alaska.



★  
**Stream Gage Site**  
  
N 59° 51.010'  
W 151° 47.344'  
  
Upstream of  
Sterling Highway  
bridge



## Stariski Creek

Stariski Creek on the lower Kenai Peninsula was nominated in 2006 by Region 2 Sport Fish Division as a high priority stream warranting a reservation of water. Stariski Creek supports small to moderate runs of Chinook, coho, and steelhead. Cook Inletkeeper, in partnership with the Homer Soil and Water Conservation District, has collected water quality and habitat data in this watershed since 1998; however, hydrologic data have been limited to periodic discharge measurements. In 2006, staff from the Statewide Aquatic Resources Coordination Unit (SARCU) of the Alaska Department of Fish and Game (ADF&G) installed a stage gage on Stariski Creek. In 2006 and 2007, in cooperation with SARCU staff, Cook Inletkeeper conducted surveys to confirm reference elevations and collected regular instream discharge measurements during summer months. SARCU staff provided survey and gage station training to Cook Inletkeeper staff, who provided field work as an in-kind service. With three years of funding (FY2009-2011) through the Alaska Sustainable Salmon Fund, Cook Inletkeeper and ADF&G can complete the 5-year dataset needed to secure an instream flow reservation on Stariski Creek.

## Overall Project Goals

In cooperation with ADF&G, Cook Inletkeeper will maintain a stream gage and measure flow on Stariski Creek to provide the necessary data to protect instream flows for salmon habitat. The objectives for this project are to: 1) establish and maintain a year-round stage gage on the lower reach of Stariski Creek; 2) develop a discharge relationship to stage; 3) describe seasonal and long-term flow characteristics required for life stages of salmon; and 4) secure a reservation of water for the protection of fish on Stariski Creek through the Alaska Department of Natural Resources.

## Methodology

Gage installation and data collection techniques follow USGS-WRD standards and protocols. USGS-WRD is the federal agency tasked with our nation's surface water data collection and has established legally defensible standards for quality data collection. General data collection protocols adhered to in this project are also described in the operational plan for ADF&G's Statewide Aquatic Resources Coordination Unit (SARCU). Responsibility for field data collection has been divided among Cook Inletkeeper's Science Director who is qualified to conduct this work according to USGS standards, and ADF&G SARCU personnel.

Stream gauging involves the collection of three main data sets: 1) stream stage usually obtained using survey leveling techniques, and expressed as height or elevation of surface water relative to a nearby benchmark; 2) instantaneous flow or discharge, which is usually measured over a range of flows or stage several times per year; 3) a "continuous" data set that is achieved by using a submersible pressure sensor and data logger to automatically measure and record (usually at 15 minute intervals) water depth which can be calibrated to the stage or surface water elevation data. Stream flow, expressed in terms of volume of water per unit of time is calculated by determining the relationship between surveyed stage and discharge known as a rating curve or rating. This stage-discharge

relationship is a power function, therefore a log-log transformation of the data and linear regression is used to solve for the stage-discharge parameters.

### FY 2010 Progress

From July 2009 - October, 2010, Cook Inletkeeper measured discharge eleven times, including two winter (ice-mode) readings, recorded staff plate readings ten times and conducted ten surveys for quality assurance. On April 23, 2010 the staff plate was removed due to damage from ice flows. A new staff plate was installed on May 21, 2010. Discharge, stream gage, staff plate, and survey data were sent to SARCU staff regularly. Using Kister's WISKI software, SARCU staff developed a rating curve to generate a hydrograph for Stariski Creek and calculated mean monthly and daily flows (see Tables 1 and 2 for provisional data).

On June 16, 2010, Terry Schwarz, hydrologist with the Alaska Department of Natural Resources (ADNR) joined Cook Inletkeeper staff in the field to provide advice on an appropriate reach break for the upcoming Reservation of Water application for Stariski Creek. We visited the stream gage and the bridge crossing on Tall Tree Road and took discharge measurements at both sites to compare flow characteristics. Based on this field visit, ADNR recommended that Cook Inletkeeper take a series of concurrent measurements at both sites to create a discharge relationship at the sites. A total of 4 concurrent measurements have been made thus far.

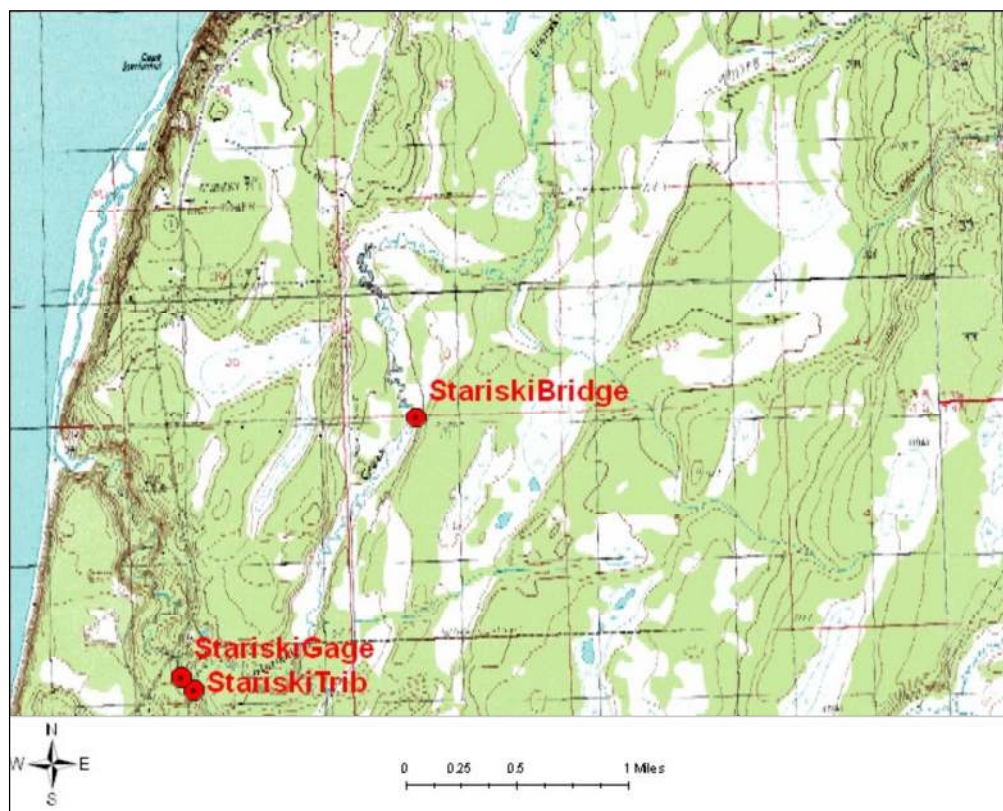


Figure 1. Lower Stariski Creek map with sites visited during the 6/16/2010 field visit.

Cook Inletkeeper worked with the Division of Sport Fish (Homer Office) to develop a fish periodicity table based on historical data collection and existing escapement projects on nearby salmon streams (Table 3). This information will be used along with hydrologic data to determine flow characteristics required for all life stages of relevant salmon species.

### Future Plans

Cook Inletkeeper will continue to maintain the stream gage through June 2011. SARCU staff will continue to provide technical services to generate annual, monthly and daily statistics and provide seasonal and long-term flow characteristics required for life stages of salmon to be included in the reservation of water.

### Benefits to Salmon/Salmon Fisheries/Salmon Fishers/Communities

Fish habitat and fish have needs for particular flows for their various life history stages and habitat types. Seasonal out-of-stream uses of water might alter the duration and magnitude of seasonal flows the fish depend on if the use is significant enough. Impoundments (dams), on the other hand, typically alter all parameters, but most importantly the timing of flows caused by economically-driven release schedules. Likewise, the formation and maintenance of specific habitat features, substrate, woody debris, pools, riffles, etc. depend on various features of natural flow regime that can be described and evaluated using the aforementioned flow metrics.

Continuous stage and flow data are essential for scientists and managers to make biologically sound water quantity and quality decisions relating to development practices that have the potential to impact water resources, fish populations, fish habitat and natural resource stewardship. As a result, this project will provide two discrete benefits. First, it will provide concrete data to assist fisheries and other resource managers with permitting, allocation and related decisions in the Stariski Creek watershed. Second, this project will allow scientists, natural resource specialists, engineers, and others to improve models to predict flow availability and characteristics in un-gauged systems or portions of waterways with limited hydrologic information in Southcentral Alaska.

Table 1. Mean daily discharge values (cfs) for Stariski Creek, water year 2009.

-----PROVISIONAL-----

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	50	193e	66e	38e	36e	34e	32e	31e	62	35	34	27
2	47	186e	64e	38e	36e	34e	32e	31e	53	32	29	33
3	45	180e	62e	38e	36e	34e	32e	31e	47	30	26	41
4	44	173e	60e	38e	36e	34e	32e	31e	44	28	28	34
5	46	167e	58e	38e	36e	34e	32e	31e	49	26	40	30
6	50	162e	56e	38e	36e	34e	32e	30e	44	24	37	28
7	51	156e	54e	38e	36e	34e	32e	30e	39	23	31	27
8	53	151e	52e	38e	36e	34e	32e	30e	36	22	28	27
9	51	145e	50e	38e	36e	34e	32e	30e	34	21	26	28
10	179	140e	48e	37e	35e	34e	32e	30e	32	20	24	28
11	200e	135e	47e	37e	35e	34e	32e	30e	32	20	23	37
12	207	131e	45e	37e	35e	34e	32e	30e	32	20	22	38
13	173	126e	43e	37e	35e	34e	32e	30e	32	20	22	34
14	112	122e	42e	37e	35e	34e	32e	30e	30	20	27	32
15	113	117e	40e	37e	35e	33e	32e	30e	29	19	56	29
16	109	113e	39e	37e	35e	33e	32e	30e	29	19	55	27
17	85	109e	39e	37e	35e	33e	32e	30e	29	19	43	26
18	70	105e	39e	37e	35e	33e	32e	30e	30	20	36	26
19	63	102e	39e	37e	35e	33e	31e	30e	35	25	31	26
20	57	98e	39e	37e	35e	33e	31e	30e	32	32	28	25
21	54	95e	39e	37e	35e	33e	31e	30	34	39	26	24
22	52	92e	39e	37e	35e	33e	31e	32	37	35	24	24
23	45	88e	39e	37e	35e	33e	31e	34	58	31	25	25
24	41	85e	39e	37e	35e	33e	31e	32	50	28	33	25
25	54	82e	38e	36e	34e	33e	31e	31	53	27	35	31
26	86	79e	38e	36e	34e	33e	31e	29	71	28	32	35
27	174	77e	38e	36e	34e	33e	31e	29	77	27	31	31
28	273	74e	38e	36e	34e	33e	31e	48	59	27	31	32
29	270e	71e	38e	36e	---	33e	31e	85	45	30	33	31
30	240e	69e	38e	36e	---	33e	31e	61	39	29	32	41
31	200e	---	38e	36e	---	33e	---	62	---	37	28	---
TOTAL	3294	3623	1404	1149	985	1037	948	1078	1273	813	976	902
MEAN	106.2	120.8	45.3	37.1	35.2	33.4	31.7	34.8	42.4	26.2	31.5	30
MAX	273	193	66	38	36	34	32	85	77	39	56	41
MIN	41	69	38	36	34	33	31	29	29	19	22	24



Table 2. Mean daily discharge values (cfs) for Stariski Creek, water year 2010.

-----PROVISIONAL-----

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	47	34e	26e	34e	30e	27e	26	191e	42	31	67	54
2	39	34e	26e	34e	30e	27e	26	185e	41	31	55	43
3	39	34e	27e	34e	30e	27e	26	179e	41	31	48	36
4	40	33e	27e	34e	30e	27	27	173e	49	31	64	34
5	37	33e	27e	34e	30e	27	28	167e	51	32	89	48
6	39	32e	27e	34e	30e	27	27	161e	45	34	75	57
7	55	32e	28e	34e	30e	27	34	155e	41	33	82	55
8	83	32e	28e	34e	30e	27	45	149e	39	35	66	63
9	90	31e	28e	33e	29e	27	39	143e	36	34	62	49
10	85	31e	29e	33e	29e	28	28	137e	35	34	55	41
11	75	31e	29e	33e	29e	28	28	131e	43	33	48	37
12	82	30e	29e	33e	29e	28	33	125e	41	29	42	34
13	69	30e	30e	33e	29e	27	52	119e	35	37	41	32
14	59	29e	30e	33e	29e	27	119	113e	33	70	54	30
15	55	29e	30e	33e	29e	26	71	107e	38	51	52	30
16	51	29e	31e	33e	29e	26	52	101e	63	39	46	29
17	47	28e	31e	32e	28e	26	59	95e	60	33	59	28
18	44	28e	31e	32e	28e	25	121	89e	53	34	58	27
19	41	28e	32e	32e	28e	25	170e	83e	59	45	46	28
20	40	27e	32e	32e	28e	25	220e	77e	65	50	39	27
21	39	27e	32e	32e	28e	25	269	68	54	60	36	27
22	39	26e	33e	32e	28e	25	273	70	45	50	35	26
23	41	26e	33e	32e	28e	24	230	60	40	43	37	26
24	49	26e	33e	32e	28e	24	232e	55	36	39	34	27
25	46	25e	34e	31e	27e	24	226e	56	34	43	31	26
26	44	25e	34e	31e	27e	24	220e	53	36	68	29	26
27	41	25e	34e	31e	27e	24	214e	50	36	147	29	27
28	39	25e	34e	31e	27e	24	208e	48	36	84	29	27
29	35	25e	35e	31e	---	24	203e	45	34	62	30	28
30	35e	26e	35e	31e	---	25	197e	43	33	54	29	33
31	35e	---	35e	31e	---	26	---	43	---	72	34	---
TOTAL	1521	98	680	1021	896	843	3174	3296	1355	1566	1657	1267
MEAN	52.4	24.5	23.4	35.2	32.1	27.2	113.5	106.2	45.1	50.5	53.5	42.2
MAX	92	25	24	42	36	30	281	191	67	157	96	72
MIN	36	24	23	30	28	25	27	45	35	31	34	33

Table 3. Periodicity chart for Stariski Creek (DRAFT).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Chinook Salmon</b>												
Smolt Passage					XX	XXXX	XXXX					
Adult Passage					XX	XXXX	XXXX	XX				
Spawning							XXXX	XXX				
Incubation	XXXX	XXXX	XXXX	XXX			X	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
<b>Coho Salmon</b>												
Smolt Passage					X	XXXX	X					
Adult Passage								XXXX	XXXX	X		
Spawning									XXX	XXX		
Incubation	XXXX	XXXX	XXXX	XXX					X	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
<b>Chum Salmon</b>												
Fry Passage												
Adult Passage								XXX	XXX			
Spawning												
Incubation												
Rearing												
<b>Sockeye Salmon</b>												
Smolt Passage												
Adult Passage							XXXX	XX				
Spawning												
Incubation												
Rearing												
<b>Pink Salmon</b>												
Fry Passage												
Adult Passage							XXXX	XXXX	XXX			
Spawning							X	XXXX	XXXX			
Incubation	XXXX	XXXX	XXXX	XXX					XXXX	XXXX	XXXX	XXXX
Rearing			X	XXXX								
<b>Dolly Varden</b>												
Smolt Passage					XXXX	X						
Adult Passage							XXXX	XXXX	XXXX			
Spawning									XX	XXXX	XXX	
Incubation	XXXX	XXXX	XXXX	X						X	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
<b>Steelhead</b>												
Smolt Passage					XXXX	X						
Adult Passage								XXXX	XXXX	XX		
Spawning				XXXX								
Incubation					XXXX	XXXX	XXXX					
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Footnote: (include in Word Document)

Based on professional judgment of ADF&G biologists

Smolt passage is for juvenile emigration to estuarine/marine environment

Adult passage: for salmon is immigration: for trout, char, and other species, immigration and emigration.

Incubation life phase includes time of egg deposition to fry emergence

? = Data not available or timing is incomplete