

DIVISION OF MINING, LAND AND WATER  
**WATER RESOURCES SECTION**  
[www.dnr.state.ak.us/mlw/water/index.htm](http://www.dnr.state.ak.us/mlw/water/index.htm)



Anchorage Office 550 West 7 <sup>th</sup> Avenue, Suite 1020 Anchorage, AK 99501-3562 (907) 269-8588 Fax: (907) 269-8947		<b>For ADNR Use Only</b> <b>Date/Time Stamp</b>
<b>For ADNR Use Only</b> <b>LAS #</b>	<b>For ADNR Use Only</b> <b>CID #</b>	<b>For ADNR Use Only</b> <b>Receipt Type</b> <b>WR</b>

## APPLICATION FOR RESERVATION OF WATER

<b>INSTRUCTIONS</b>
<ol style="list-style-type: none"> <li>1. Complete one application per stream segment or water body (incomplete applications will not be accepted).</li> <li>2. Attach legible map(s) indicating all sections from the beginning to the end of stream segment or for all parts of the lake or water body.</li> <li>3. Submit non-refundable fee of \$1,500.</li> <li>4. Attach extra pages for each section, as needed.</li> </ol>

<b>APPLICANT INFORMATION</b>			
_____ Organization Name (if applicable)		_____ Agent or Consultant Name (if applicable)	
_____ Individual Applicant Name (if applicable)		_____ Individual Co-applicant Name (if applicable)	
_____ Mailing Address	_____ City	_____ State	_____ Zip Code
_____ Daytime Phone Number		_____ Alternate Phone Number (optional)	
_____ Fax Number (optional)		_____ E-Mail Address (optional)	

<b>LOCATION OF PROPOSED RESERVATION OF WATER</b>					
<b>Geographic Name of Waterbody</b> _____					
Meridian	Township	Range	Section	Quarter Sections	
				1/4	1/4
				1/4	1/4

Describe the location of the point or points defining the boundary of the proposed reservation of water by river mile index, river mile, geographical or cultural landmark, etc., on the stream or water body.

Attach a US Geological Survey map at 1:63,360 scale, or 1:250,000 scale if 1:63,360 scale is unavailable for the area, clearly identifying the following for the proposed reservation of water:

1. Sections, townships, range and meridians
2. The stream or water body in which the reservation of water is proposed
3. Specific point or points defining the boundary of the proposed reservation of water
4. Permanent, temporary or planned locations of water measurement devices (such as gaging stations, weirs, staff gages)
5. Permanent, temporary or planned bench marks

#### **WATER USE**

Identify the purpose(s) of the proposed reservation of water by checking the appropriate box(es).

- Protection of fish and wildlife habitat, migration, and propagation
- Recreation and park purposes
- Navigation and transportation purposes
- Sanitary and water quality purposes

Describe in detail the purpose(s) of the proposed reservation, including, when appropriate, species and life stage, type of recreation, vehicle, or water quality parameter, or other relevant information.

Is the water currently being used for the purpose(s) applied for?

Yes

No If no, when will use for this purpose begin? Specify approximate date \_\_\_\_\_

#### **WATER QUANTITY**

Water requested to be reserved – **Check one**

- To maintain a specific instream flow rate, measured in cubic feet per second
- To maintain a specific amount of surface water, measured in cubic feet or acre feet
- To maintain a specific surface water elevation, measured in relation to a permanent benchmark

Quantify the specific amount of water requested to be reserved. Identify and quantify, as appropriate, flow rates, quantities, surface water elevations, depths, etc., as they relate to the requested time periods of the year during which the reservation is proposed. Include any flow release schedules from projects upstream of the proposed reservation that would be necessary.

**METHODOLOGY AND MONITORING**

Attach and submit with this application documentation or reports showing facts to support the following:

- (a) The need for the proposed reservation of water, including reasons why the reservation is being requested.
- (b) Identify and describe the methodology, data, and data analysis used to substantiate the need for and the quantity of water requested for the proposed reservation of water, including:
  - 1. Name and description of method used
  - 2. Who conducted the study and analysis
  - 3. Schedule of when data collection and analysis occurred
  - 4. Type(s) of instrument(s) used to collect and analyze data
  - 5. Description of data and how the data were collected, including when applicable, (A) selection of stream reach, study site and transect selection, (B) flow, survey, elevation, and depth measurements, (C) pertinent physical, biological, water chemistry and socio-economic data
  - 6. Description of how data were analyzed, and
  - 7. Maps, photos, aerial photos, calculations, and any other documents supporting this application

If there are provisions for monitoring this proposed reservation of water, include the following:

- (a) Description of monitoring equipment (such as gaging stations, staff gages, weirs)
- (b) Location of monitoring equipment
- (c) Provisions for payment for monitoring
- (d) Reporting system

11 AAC 93.142 sets out the required information on the application for a reservation of water. 11 AAC 93.143 authorizes the commissioner to decide what additional information needed to process an application for a reservation of water. This information is made a part of the state public water records and becomes public information under AS 40.25.110 and 40.25.120. Public information is open to inspection by you or any member of the public. A person who is the subject of the information may challenge its accuracy or completeness under AS 44.99.310, by giving a written description of the challenged information, the changes needed to correct it, and a name and address where the person can be reached. False statements made in an application for a benefit are punishable under AS 11.56.210.

**SIGNATURE**

The information presented in this application is true and correct to the best of my knowledge.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name (please print)

\_\_\_\_\_  
Title (if applicable)

**Fee required by regulation 11 AAC 05.010(a)(8)**

- **\$1,500** for up to 40 hours of staff time

Make checks payable to "Department of Natural Resources."

## LOCATION OF PROPOSED RESERVATION OF WATER

Meridian	Township	Range	Sections
Copper River	48S	63E	4, 9, 16, 21

Kadashan River is located near the community of Tenakee Springs in Southeast Alaska (Figure 1). This proposed reservation of water applies to stream flows within Reach A, one of five reaches within the Kadashan River watershed for which ADF&G has submitted a reservation of water application. Reach A begins at the downstream end of the Kadashan River at mean lower low water and extends upstream 2.8 miles to the confluence with Tonalite Creek (Figure 2). Stream reach boundaries were selected to ensure fish were present and to minimize the differences in flows (from accretion or reduction) within the reach. Reach boundaries were based on U.S. Geological Survey (U.S. Geological Survey, 1962) topographic maps.

## WATER USE

The primary purpose of this proposed reservation is to protect fish habitat, migration and propagation within the Kadashan River and its watershed. This reach has been specified as important to anadromous fish (under AS 16.05.871) as Anadromous Water Catalog stream number 112-24-10250 by the Alaska Department of Fish and Game (Johnson and Blanche 2011). Coho salmon (*Oncorhynchus kisutch*), chum salmon (*O. keta*), steelhead trout (*O. mykiss*), rainbow trout (*O. mykiss*), pink salmon (*O. gorbuscha*), cutthroat trout (*O. clarki*), and Dolly Varden (*Salvelinus malma*) utilize the Kadashan River for a portion of, or all of their spawning, incubation, rearing, and passage life phases (B. Glynn, Fishery Biologist, Douglas, ADF&G, 2007 personal communication; Figure 3). These species contribute to sport and commercial fisheries in the area and provide recreational opportunities and values as well. Water of sufficient quantity is needed to sustain production of these valuable fisheries.

## WATER QUANTITY

Requested instantaneous flows in cubic feet per second (cfs) to be reserved:

Time Period	Requested Reservation Flows (cfs)
January	54
February	62
March	76
April	180
May	387
June	281
July	111
August	72
September	146
October	323

November	168
December	100

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## METHODOLOGY AND MONITORING

Procedures used to prepare this reservation complied with reservation of water application instructions and requirements established by state law (AS 46.15.145) and regulations (11 AAC 93.141-147), and relevant portions of the "*State of Alaska Instream Flow Handbook*" (DNR 1985).

Requested flows were based primarily on flow duration analyses (Annear et al. 2004) combined with available fish data. Flow duration analyses for specified time periods were used to develop flow requests with seasonal flow variability that mimicked the natural hydrograph of mean daily flows. This approach provided a basis to mimic natural seasonal flows to which fish and other aquatic fauna have adapted to and are dependent upon (Hynes 1970; Estes 1984; Estes and Orsborn 1986; Poff et al. 1997; Richter et al. 1997; Stewardson and Gippel 2003; Annear et al. 2004; Lytle and Poff 2004; Arthington et al. 2006).

### Hydrologic Analyses:

Mean daily flow data for the entire period of record were obtained from United State Geological Survey (USGS) National Water Information System website (<http://waterdata.usgs.gov/nwis>) for the Kadashan River Gage (No. 15107000). This gage is located at latitude 57° 41' 43", longitude 135° 12' 59" near the upstream boundary of reach A (Figure 2) and has a period of record from September 1, 1964 and September 30, 1979. SAS-based applications<sup>1</sup> were used to calculate annual, monthly, mean daily, and flow duration summaries.

### Flow Duration Analyses:

Duration estimates represent the expected frequency of occurrence of mean daily flows within the specified time periods. The durations of daily mean flows were calculated as the percentiles of the empirical distribution of observed values within the specified time periods over the period of record (Table 1). This provided an estimate of the percentage of time a given mean daily flow was equaled or exceeded within the distribution of mean daily flows for each time period analyzed.

### Mean Flow Statistics:

Mean monthly flows were estimated as the mean of monthly mean daily flows for all complete months over the entire period of record (Figure 5 and Table 2). Mean annual flow was estimated as a mean of the annual mean daily flow values for all complete water years of record (Table 3). Mean daily flows are presented in Figure 4 and Table 4.

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<sup>1</sup> Specific product titles described do not constitute product endorsements. Copyright, SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks of trademarks of SAS Institute Inc., Cary, NC, USA.

### Reservation of Water:

Sufficient flows are needed to support riverine habitats used by fish and to provide fluvial processes that maintain these habitats. To maintain seasonal uses of habitats by each life history stage, we recommend maintaining a flow regime that mimics the magnitude and timing of the natural flow regime as discussed above. This approach is necessary to meet the needs of species' life history stages that have coevolved and exhibit biological adaptations to the river's flow regime.

In general, flow requests fell within the 25 to 75% exceedance range for the specified time periods. Flows within the 25 to 75% exceedance range are normal hydrologic conditions and should provide flows and habitat conditions to which fish have adapted. Deviations from these levels subject riverine species to conditions that are increasingly uncommon. Flows outside of this range are defined as dry (75 to 100% exceedance) or wet (0 to 25% exceedance) conditions according to the USGS (2009).

Although important for maintaining fish habitat and overall aquatic and riparian productivity, channel maintenance or other high flows were not specified and requested within this application. Channel maintenance flows are gradually ascending and descending and most effectively meet sediment transport thresholds for the full-range of particle sizes. Evidence suggests that bankfull flow approximates the effective discharge in stable stream channels (Andrews 1980; Leopold 1994; Annear et al. 2004). Other types of periodic high flows are recognized for their importance to habitat maintenance and support of other environmental and biological needs, such as fish migration cues. Collectively, these flows provide the function and structure of river ecosystems (Annear et al. 2004; Schmidt and Potyondy 2004).

Currently, there is no monitoring of streamflow in the Kadashan River watershed.

### REFERENCES

- Alaska Administrative Code Chapter 11 Section 93.141-147.
- Alaska Department of Natural Resources (DNR). 1985. State of Alaska instream flow handbook. DNR. Anchorage, Alaska.
- Andrews, E.D. 1980. Effective and bankfull discharges of streams in the Yampa River basin, Colorado and Wyoming. *Journal of Hydrology* 46:311-330.
- Annear, T., I. Chisholm, H. Beecher, A. Locke, and 12 other authors. 2004. Instream flows for riverine resource stewardship, revised edition. Instream Flow Council. Cheyenne, WY.
- Arthington, A.H., S.E. Bunn, N.L. Poff, and R.J. Naiman. 2006. The challenge of providing environmental flow rules to sustain river ecosystems. *Ecological Applications* 16 :1311-1318.

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- Schmidt, L. and J. Potyondy (2004). *Quantifying Channel Maintenance Instream Flows: An Approach for Gravel-bed Streams in the Western United States*. Fort Collins, CO, U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 33 pages.
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- U.S. Geological Survey. 1962. USGS Sitka Quadrangle (C-4), Alaska, 1:63,360 Topographic Map, Copper River Meridian.
- U.S. Geological Survey. 2009. <http://waterwatch.usgs.gov/ptile.html>.

Figure 1. Area map of Kadashan River near Tenakee Springs, Southeast Alaska.

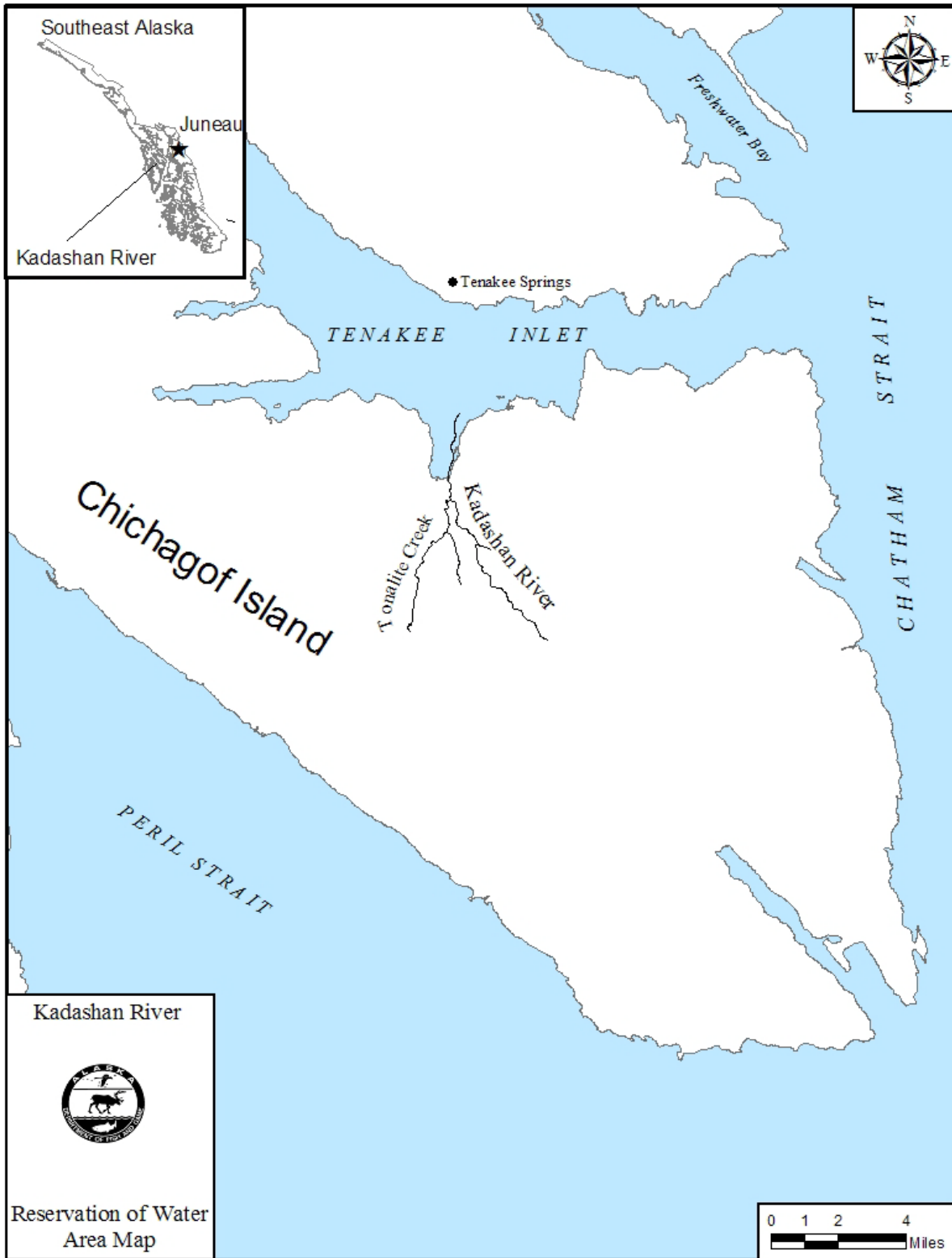


Figure 2. Reservation reach boundaries and location of USGS gages, Kadashan River near Tenakee Springs, Southeast Alaska.

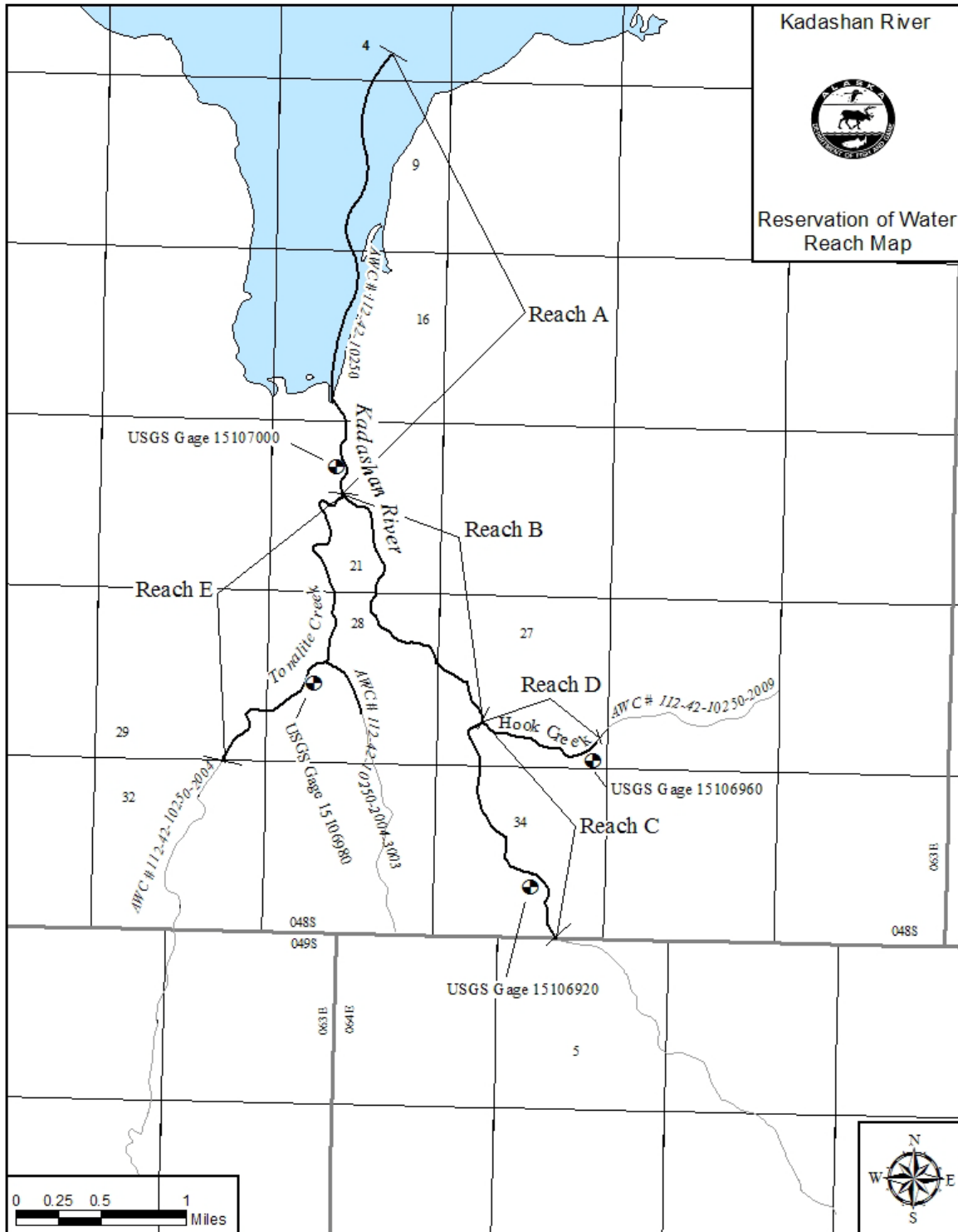


Figure 3. Fish species periodicity chart for Kadashan River near Tenakee Springs, Alaska.

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

Based upon 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  
 \* DV and CT smolt defined as those fish undergoing initial emigration

Figure 3. continued.

<b>Steelhead Trout</b>												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Smolt Passage				XX	XXXX	XXXX						
Adult Passage				XXXX	XXXX	XXXX	XX					
Spawning				XX	XXXX	XXXX						
Incubation				XX	XXXX	XXXX	XXXX	XXXX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
<b>Rainbow Trout</b>												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Resident Adult Passage			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX		
Spawning			X	XXXX	XXXX	XXXX						
Incubation			X	XXXX	XXXX	XXXX	XXXX	XXXX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
<b>Cutthroat Trout</b>												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Smolt Passage*			XXXX	XXXX	XXXX							
Adult Passage			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	
Spawning				XXX	XXXX	XX						
Incubation				XXX	XXXX	XXXX	XXXX	XX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Based upon 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												
* DV and CT smolt defined as those fish undergoing initial emigration												

Figure 4. Annual hydrograph of mean daily flows (cfs) for Kadashan Reservation Reach A. Based on complete water years of record for USGS Gaging Station 15107000 (October 1, 1964 to September 30, 1979).

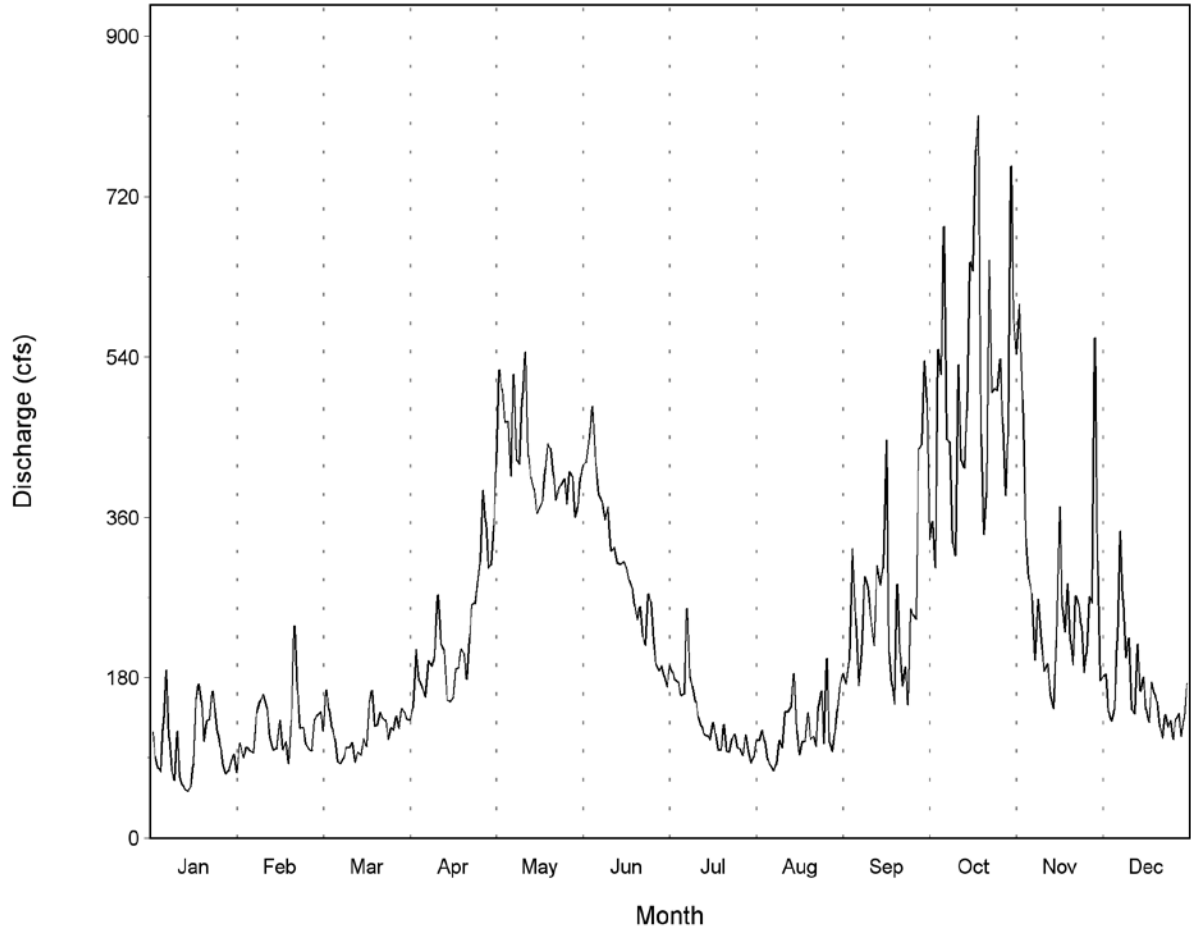
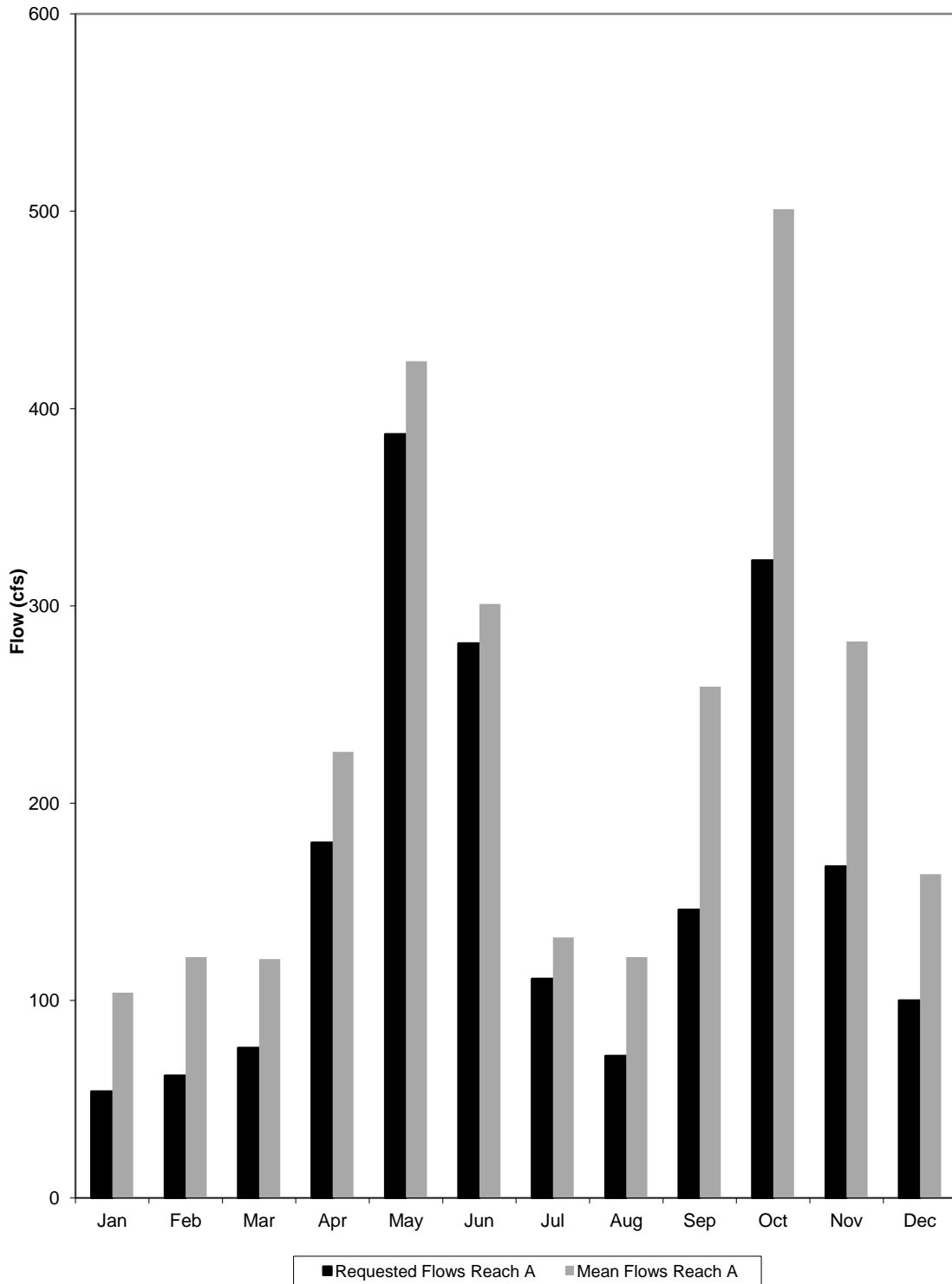


Figure 5. Mean monthly flows and reservation requests for Kadashan Reservation Reach A. Based on complete months of record for USGS Gaging Station 15107000 (September 1, 1964 to September 30, 1979).



ATTACHMENT A. KADASHAN RIVER REACH A RESERVATION OF WATER APPLICATION.

Page 11

Table 1. Monthly exceedance flows (cfs) for Kadashan Reservation Reach A. Based on complete months of record for USGS Gaging Station 15107000 (September 1, 1964 to September 30, 1979).

% Time exceeded	January	February	March	April	May	June	July	August	September	October	November	December
0	1,600	2,000	895	1,000	1,500	1,170	1,420	1,500	2,920	4,490	3,120	1,500
5	320	438	375	538	849	649	293	396	859	1,520	826	500
10	200	264	249	421	700	532	249	256	598	1,070	594	366
15	170	198	198	352	610	452	209	204	437	830	475	290
20	130	160	160	326	539	415	182	167	352	723	366	225
25	110	130	140	296	495	380	168	146	284	600	304	200
30	95	110	124	276	458	362	150	122	236	508	272	172
35	80	91	111	240	440	340	138	103	210	447	230	150
40	71	80	100	215	422	319	129	90	188	400	200	135
45	62	70	89	199	400	296	117	80	165	362	181	120
50	54	62	76	180	387	281	111	72	146	323	168	100
55	48	59	66	169	365	260	98	66	126	295	150	90
60	40	54	60	150	341	243	87	60	107	267	136	80
65	35	48	55	140	315	216	78	55	98	239	122	70
70	33	42	50	130	298	190	71	49	85	207	111	62
75	30	33	46	116	271	170	65	42	74	183	95	56
80	26	28	43	106	257	147	57	38	67	158	81	50
85	22	26	37	96	233	120	53	35	58	131	70	45
90	20	25	33	82	213	98	49	31	49	102	60	37
95	18	16	28	66	195	81	42	28	36	80	44	29
100	14	14	22	28	132	53	28	23	21	49	28	19
Mean	104	122	121	226	424	301	132	122	259	501	282	164

Table 2. Monthly flow summaries (cfs) for Kadashan Reservation Reach A. Based on complete months of record for USGS Gaging Station 15107000 (September 1, 1964 to September 30, 1979).

Month	# of Months	Minimum monthly flow (cfs)	Mean monthly flow (cfs)	Maximum monthly flow (cfs)
January	15	20	104	256
February	15	22	122	363
March	15	37	121	267
April	15	101	226	374
May	15	224	424	671
June	15	117	301	487
July	15	48	132	214
August	15	38	122	231
September	16	69	259	522
October	15	189	501	959
November	15	58	282	516
December	15	34	164	274

Table 3. Annual flow summaries (cfs) for Kadashan Reservation Reach A. Based on complete water years of record for USGS Gaging Station 15107000 (October 1, 1964 to September 30, 1979).

Water year	Number of days of record	QAA (cfs)
1965	365	218
1966	365	229
1967	365	245
1968	366	226
1969	365	198
1970	365	253
1971	365	225
1972	366	252
1973	365	254
1974	365	186
1975	365	293
1976	366	223
1977	365	247
1978	365	173
1979	365	243
Mean for period of record	5,478	231

Table 4. Daily flow summaries (cfs) for Kadashan Reservation Reach A. Based on complete water years of record for USGS Gaging Station 15107000 (October 1, 1964 to September 30, 1979).

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
1	January 1	15	32	119	300
2	January 2	15	32	90	200
3	January 3	15	26	79	160
4	January 4	15	25	75	200
5	January 5	15	23	129	707
6	January 6	15	20	189	1,200
7	January 7	15	19	112	600
8	January 8	15	17	76	300
9	January 9	15	16	65	200
10	January 10	15	15	120	1,030
11	January 11	15	15	68	327
12	January 12	15	15	59	202
13	January 13	15	16	55	156
14	January 14	15	17	53	137
15	January 15	15	16	58	129
16	January 16	15	16	83	250
17	January 17	15	15	156	1,000
18	January 18	15	15	172	1,600
19	January 19	15	15	152	1,300
20	January 20	15	18	109	700
21	January 21	15	20	132	800
22	January 22	15	19	133	550
23	January 23	15	18	164	900
24	January 24	15	17	144	500
25	January 25	15	16	118	460
26	January 26	15	16	102	320
27	January 27	15	15	80	200
28	January 28	15	15	72	195
29	January 29	15	14	75	200
30	January 30	15	14	87	250
31	January 31	15	14	94	389

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Table 4. Page 2 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
32	February 1	15	14	74	250
33	February 2	15	15	107	666
34	February 3	15	15	90	394
35	February 4	15	16	102	433
36	February 5	15	15	99	497
37	February 6	15	15	96	412
38	February 7	15	15	141	551
39	February 8	15	15	153	800
40	February 9	15	16	161	600
41	February 10	15	16	147	700
42	February 11	15	16	112	400
43	February 12	15	16	99	280
44	February 13	15	15	101	516
45	February 14	15	15	132	882
46	February 15	15	15	99	438
47	February 16	15	16	108	386
48	February 17	15	16	84	260
49	February 18	15	15	132	761
50	February 19	15	15	238	2,000
51	February 20	15	15	166	1,000
52	February 21	15	15	123	470
53	February 22	15	16	124	530
54	February 23	15	19	106	290
55	February 24	15	25	100	350
56	February 25	15	25	99	250
57	February 26	15	25	133	800
58	February 27	15	25	138	1,000
59	February 28 OR 29	18	25	141	800

-continued-

Table 4. Page 3 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
60	March 1	15	25	120	600
61	March 2	15	25	166	895
62	March 3	15	25	144	700
63	March 4	15	27	123	600
64	March 5	15	27	111	700
65	March 6	15	25	86	394
66	March 7	15	24	84	263
67	March 8	15	25	89	212
68	March 9	15	28	101	278
69	March 10	15	29	102	387
70	March 11	15	26	107	442
71	March 12	15	24	86	190
72	March 13	15	23	96	350
73	March 14	15	22	94	300
74	March 15	15	22	111	450
75	March 16	15	22	103	268
76	March 17	15	22	152	838
77	March 18	15	24	166	813
78	March 19	15	27	126	409
79	March 20	15	31	127	454
80	March 21	15	31	141	618
81	March 22	15	32	134	341
82	March 23	15	33	132	405
83	March 24	15	32	111	287
84	March 25	15	30	124	350
85	March 26	15	27	121	296
86	March 27	15	25	137	623
87	March 28	15	25	123	304
88	March 29	15	25	145	640
89	March 30	15	25	141	600
90	March 31	15	25	133	460

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Table 4. Page 4 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
91	April 1	15	28	133	460
92	April 2	15	32	147	400
93	April 3	15	35	211	757
94	April 4	15	40	177	479
95	April 5	15	45	168	506
96	April 6	15	45	159	389
97	April 7	15	47	199	730
98	April 8	15	50	193	383
99	April 9	15	55	205	533
100	April 10	15	65	273	1,000
101	April 11	15	75	217	584
102	April 12	15	65	211	872
103	April 13	15	95	155	283
104	April 14	15	84	153	337
105	April 15	15	78	158	360
106	April 16	15	70	190	577
107	April 17	15	73	192	479
108	April 18	15	80	212	488
109	April 19	15	100	207	410
110	April 20	15	100	179	301
111	April 21	15	70	225	712
112	April 22	15	70	262	618
113	April 23	15	90	264	477
114	April 24	15	110	286	741
115	April 25	15	130	311	581
116	April 26	15	120	390	950
117	April 27	15	100	355	629
118	April 28	15	130	303	503
119	April 29	15	150	307	662
120	April 30	15	160	350	822

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Table 4. Page 5 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
121	May 1	15	166	420	1,080
122	May 2	15	200	525	998
123	May 3	15	150	503	1,300
124	May 4	15	178	467	1,300
125	May 5	15	170	468	860
126	May 6	15	196	407	712
127	May 7	15	212	520	1,330
128	May 8	15	224	424	920
129	May 9	15	183	420	938
130	May 10	15	147	493	1,170
131	May 11	15	136	545	1,260
132	May 12	15	132	429	740
133	May 13	15	143	404	624
134	May 14	15	185	391	646
135	May 15	15	198	364	720
136	May 16	15	185	371	682
137	May 17	15	183	379	700
138	May 18	15	270	414	800
139	May 19	15	245	442	1,500
140	May 20	15	242	437	1,400
141	May 21	15	158	407	800
142	May 22	15	158	380	577
143	May 23	15	160	393	849
144	May 24	15	195	397	841
145	May 25	15	198	403	662
146	May 26	15	181	375	600
147	May 27	15	192	411	820
148	May 28	15	210	406	780
149	May 29	15	200	361	780
150	May 30	15	194	372	1,100
151	May 31	15	178	404	750

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Table 4. Page 6 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
152	June 1	15	186	419	772
153	June 2	15	241	422	580
154	June 3	15	254	450	978
155	June 4	15	213	484	1,170
156	June 5	15	176	421	781
157	June 6	15	170	385	818
158	June 7	15	158	379	807
159	June 8	15	141	358	745
160	June 9	15	126	371	745
161	June 10	15	115	322	630
162	June 11	15	115	326	666
163	June 12	15	103	308	618
164	June 13	15	101	307	656
165	June 14	15	92	310	644
166	June 15	15	85	303	773
167	June 16	15	80	289	513
168	June 17	15	83	282	513
169	June 18	15	98	261	501
170	June 19	15	94	245	418
171	June 20	15	96	260	835
172	June 21	15	81	226	422
173	June 22	15	71	217	370
174	June 23	15	65	274	766
175	June 24	15	68	265	635
176	June 25	15	65	221	434
177	June 26	15	72	194	346
178	June 27	15	65	188	372
179	June 28	15	67	193	338
180	June 29	15	60	181	351
181	June 30	15	53	170	340

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Table 4. Page 7 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
182	July 1	15	50	193	508
183	July 2	15	43	186	591
184	July 3	15	42	178	422
185	July 4	15	39	175	379
186	July 5	15	37	160	362
187	July 6	15	37	162	341
188	July 7	15	42	257	1,420
189	July 8	15	54	181	603
190	July 9	15	52	169	396
191	July 10	15	52	153	310
192	July 11	15	50	135	233
193	July 12	15	46	126	252
194	July 13	15	44	117	228
195	July 14	15	43	115	209
196	July 15	15	39	111	175
197	July 16	15	36	129	386
198	July 17	15	36	116	203
199	July 18	15	34	99	191
200	July 19	15	33	99	223
201	July 20	15	32	127	636
202	July 21	15	31	98	295
203	July 22	15	31	97	221
204	July 23	15	30	111	252
205	July 24	15	30	117	287
206	July 25	15	28	101	252
207	July 26	15	30	100	394
208	July 27	15	42	93	215
209	July 28	15	48	116	300
210	July 29	15	44	97	220
211	July 30	15	42	85	181
212	July 31	15	40	91	215

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Table 4. Page 8 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
213	August 1	15	36	111	367
214	August 2	15	35	110	449
215	August 3	15	33	121	612
216	August 4	15	32	108	447
217	August 5	15	30	88	326
218	August 6	15	28	81	323
219	August 7	15	28	76	194
220	August 8	15	29	83	204
221	August 9	15	28	109	378
222	August 10	15	28	102	242
223	August 11	15	27	142	644
224	August 12	15	25	142	629
225	August 13	15	24	148	648
226	August 14	15	23	184	821
227	August 15	15	23	120	429
228	August 16	15	23	94	241
229	August 17	15	26	109	354
230	August 18	15	26	109	534
231	August 19	15	24	140	466
232	August 20	15	24	111	350
233	August 21	15	28	114	400
234	August 22	15	28	103	300
235	August 23	15	27	148	637
236	August 24	15	26	165	688
237	August 25	15	27	107	250
238	August 26	15	27	201	1,500
239	August 27	15	30	107	396
240	August 28	15	28	97	323
241	August 29	15	28	118	432
242	August 30	15	42	145	773
243	August 31	15	39	174	700

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Table 4. Page 9 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
244	September 1	15	36	184	643
245	September 2	15	33	173	700
246	September 3	15	31	200	800
247	September 4	15	29	325	2,270
248	September 5	15	30	246	860
249	September 6	15	29	171	524
250	September 7	15	27	208	780
251	September 8	15	27	294	1,410
252	September 9	15	24	282	858
253	September 10	15	21	245	848
254	September 11	15	21	217	947
255	September 12	15	30	305	1,560
256	September 13	15	40	285	806
257	September 14	15	44	304	1,130
258	September 15	15	42	446	2,300
259	September 16	15	42	208	414
260	September 17	15	44	172	295
261	September 18	15	47	150	358
262	September 19	15	49	285	1,000
263	September 20	15	34	208	694
264	September 21	15	50	171	714
265	September 22	15	58	192	982
266	September 23	15	53	150	500
267	September 24	15	46	257	1,840
268	September 25	15	44	250	1,220
269	September 26	15	42	246	827
270	September 27	15	40	437	2,120
271	September 28	15	35	442	2,290
272	September 29	15	60	536	2,920
273	September 30	15	77	489	1,660

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Table 4. Page 10 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
274	October 1	15	67	335	1,260
275	October 2	15	84	355	1,520
276	October 3	15	78	304	674
277	October 4	15	64	548	2,500
278	October 5	15	55	520	3,280
279	October 6	15	49	686	3,260
280	October 7	15	60	447	1,760
281	October 8	15	80	444	1,870
282	October 9	15	77	331	1,020
283	October 10	15	87	318	853
284	October 11	15	82	531	1,190
285	October 12	15	83	423	982
286	October 13	15	76	415	1,400
287	October 14	15	76	481	1,890
288	October 15	15	72	647	1,960
289	October 16	15	71	637	2,080
290	October 17	15	64	772	2,820
291	October 18	15	64	810	3,570
292	October 19	15	80	453	1,020
293	October 20	15	98	341	1,000
294	October 21	15	96	388	1,240
295	October 22	15	85	648	2,370
296	October 23	15	71	500	1,840
297	October 24	15	65	504	1,660
298	October 25	15	62	503	2,800
299	October 26	15	53	537	2,920
300	October 27	15	50	464	1,120
301	October 28	15	50	385	850
302	October 29	15	90	452	1,120
303	October 30	15	134	754	4,490
304	October 31	15	159	582	1,890

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Table 4. Page 11 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
305	November 1	15	113	544	1,860
306	November 2	15	145	599	1,940
307	November 3	15	111	492	1,840
308	November 4	15	89	342	1,430
309	November 5	15	78	291	826
310	November 6	15	70	274	688
311	November 7	15	60	200	463
312	November 8	15	50	268	1,420
313	November 9	15	50	221	548
314	November 10	15	45	188	500
315	November 11	15	45	195	380
316	November 12	15	45	161	300
317	November 13	15	40	145	290
318	November 14	15	40	222	732
319	November 15	15	35	371	1,810
320	November 16	15	35	259	800
321	November 17	15	35	232	850
322	November 18	15	35	285	2,100
323	November 19	15	30	221	1,000
324	November 20	15	28	195	700
325	November 21	15	30	272	1,260
326	November 22	15	30	263	845
327	November 23	15	35	239	1,000
328	November 24	15	40	186	500
329	November 25	15	40	208	782
330	November 26	15	34	271	716
331	November 27	15	33	264	1,500
332	November 28	15	31	561	3,120
333	November 29	15	28	311	1,500
334	November 30	15	31	177	600

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Table 4. Page 12 of 12.

Julian Day	Day of Year	# of days of record	Minimum-mean daily flow (cfs)	Mean-mean daily flow (cfs)	Maximum-mean daily flow (cfs)
335	December 1	15	30	181	646
336	December 2	15	29	183	690
337	December 3	15	29	141	485
338	December 4	15	37	132	500
339	December 5	15	30	145	400
340	December 6	15	28	221	1,000
341	December 7	15	25	345	1,500
342	December 8	15	25	267	900
343	December 9	15	30	203	507
344	December 10	15	29	224	836
345	December 11	15	27	144	372
346	December 12	15	26	140	483
347	December 13	15	25	218	1,210
348	December 14	15	24	165	553
349	December 15	15	23	180	700
350	December 16	15	24	144	522
351	December 17	15	28	130	336
352	December 18	15	33	174	1,100
353	December 19	15	29	162	600
354	December 20	15	26	153	366
355	December 21	15	23	125	329
356	December 22	15	22	112	381
357	December 23	15	19	138	700
358	December 24	15	19	125	500
359	December 25	15	20	132	410
360	December 26	15	22	111	230
361	December 27	15	28	134	440
362	December 28	15	40	140	350
363	December 29	15	38	115	300
364	December 30	15	37	135	500
365	December 31	15	32	173	600