Gates of the Arctic Hydrology Report

Physical Characteristics Supporting Navigability

The courts and the Department of the Interior have also considered the physical characteristics of the river system in its natural and ordinary condition in their navigability determinations. See, e.g., State of Alaska, 891 F.2d at 1402, 1405; State of Alaska v. United States, 662 F. Supp. at 466-67; Appeal of Doyon, 86 Interior Dec. 692. The physical characteristics of the Kanektok River system compare favorably to the Gulkana, Kandik, and Nation rivers considered in those decisions.

Waters in this section are divided into the following three areas: the Koyukuk River Drainage, the Kobuk River Drainage, and the Noatak River. These are shown in Figure 1.

1. Koyukuk Drainage

a. Basic Characteristics

- **North Fork Koyukuk**
  Location at confluence with Middle Fork Koyukuk River
  Latitude: 67 ° 2’ 45” N
  Longitude: 151° 4’ 38” W
  Basin area: 1676. square miles
  Elevation at source: 4675 feet
  Main channel length: 115.51 miles
  Average channel slope: 33 feet/mile
  Stream order: **4 to 6**
  Channel: braided
  Calculated flows: 1806 to 3185 cfs

- **Upper North Fork Koyukuk** (From the headwaters to Ernie Creek)
  Basin area: 138 square miles
  Stream order: **4** from river mile 106-93
  Channel type: braided
  Calculated flows: 200 to 355 cfs
  John River
  Location at confluence with Koyukuk River
  Latitude: 66 ° 54’ 46” N
  Longitude: 151° 39’ 21” W
  Basin area: 2704 square miles
  Elevation at source: 2050
  Main channel length: 140 miles

Average channel slope: 10 feet/mile
Stream Order: 7

- **John River** (from Anaktuvuk Pass to confluence with the Koyukuk River)
  Location at confluence with Koyukuk River
  Latitude: 66 ° 54' 46" N
  Longitude: 151° 39' 21" W
  Basin area: 2704 square miles
  Elevation at source: 2050
  Main channel length: 140 miles
  Average channel slope: 10 feet/mile
  Stream order: **4 to 7**
  Channel: braided to meandering

- **Upper John River** (From Anaktuvuk Pass to confluence with Hunt Fork John River)
  Basin area: 628 square miles
  Stream order: **4** from river mile 140-123, **5** from river mile 123-101.5
  Channel type: Meandering from headwaters to Confluence with Kollutarak Creek, then it is braided to the confluence with Hunt Fork. Shortly after the confluence the channel is meandering.
  Calculated flows: 520 to 910 cfs

- **Hunt Fork River**
  Location at confluence with John River
  Latitude: 67 ° 46' 45" N
  Longitude: 152° 24' 9" W
  Basin area: 539 square miles
  Elevation at source: 1500 feet
  Main channel length: 13 miles
  Average channel slope: 29 feet/mile
  Stream order: **5**
  Channel type: braided
  Calculated flows: 490 to 885 cfs

- **Alatna River**
  Location at confluence with Koyukuk River
  Latitude: 66 ° 37' 35" N
  Longitude: 152° 37' 35" W
  Basin area: 3494 square miles
  Elevation at source: 4025 feet
  Main channel length: 223 miles

Average channel slope: 16 feet/mile
Stream Order: **4-6**
Channel type: braided to meandering
Calculated flows: 5424 to 10453 cfs

- **Alatna River to confluence with Pingaluk River**
  Basin area: 1,022 square miles
  Channel type: braided
  Stream Order: **4** river mile 221-184, **5** starting at river mile 184
  Calculated flows: 1893 to 3977 cfs

b. Climate

The Koyukuk Drainage is between the Arctic and Continental climate zones.[1] There is one weather station in the Koyukuk Drainage area located 8 miles southwest of the Bettles airport station (USW00026533). A summary from the Bettles weather station is provided in the appendix (Table 1).

c. General Basin Description

The Koyukuk Drainage

The Koyukuk River originates in the Endicott Mountains. The Koyukuk drainage area is approximately 32,000 square miles. It flows west approximately 425 miles to the Chukchi Sea at the Kotzebue Sound. A map of the watershed and the USGS stream gauge is shown in Figure 2. This drainage basin has several headwater tributaries, including the North Fork, Middle Fork, And South Fork of the Koyukuk, the John River, and the Hunt Fork of the John River, and the Alanta River. The tributaries in this application will be discussed in more detail.

North Fork Koyukuk

The headwaters of the North Fork of the Koyukuk River[2] are located in the Endicott Mountains at approximately 4,675 feet above sea level. It flows generally to the south 115 miles to its confluence with the Middle Fork Koyukuk River. Its main tributaries are Ernie Creek, Clear River, the Tinayguk River, and the Glacier River. It drains an area of approximately 1,676 square miles.

John River

[1] Alaska Climate Research Center, *Data – Alaska Climate Research Center*, University of Alaska Fairbanks, accessed August 20, 2026, https://akclimate.org/data/
[2] National Park Service, "North Fork of the Koyukuk River," *Gates of the Arctic National Park & Preserve*, last updated August,13, 2020, accessed August,20, 2026, https://www.nps.gov/gaar/koyukukriver.htm

The headwaters of the John River[3] are on the flank of Soakpak Mountain near Anaktuvuk Pass in the Brooks Range at approximately 2050 feet above sea level. It generally flows to the south-southwest for 140 miles to its confluence with the Koyukuk River. Its main tributaries are the Kollutarak Creek, Hunt Fork, Malamute Fork, Allen River, and Wolverine Creek. It drains an area of approximately 2704 square miles.

Hunt Fork John River

The headwaters of the Hunt Fork of the John River are in the Brooks Range, at the confluence of Loon Creek and Agiak Creek at approximately 1500 feet above sea level. Its main tributaries are Walkaround Creek and Kevuk Creek. It flows to the southeast 13 miles to the confluence with the John River. It drains an area of approximately 539 square miles.

Alatna River

The headwaters of the Alatna River are in the Brooks Range at approximately 4025 feet above sea level. Its main tributaries are Unakserak River, Unakser River, Malamute Fork, and Siruk Creek,. It flows to the southeast 223 miles to the confluence with the Koyukuk River. It drains an area of approximately 3494 square miles.

d. Available Streamflow Data

The Koyukuk had a stream gauge maintained by the United States Fish and Wildlife Service (USFWS) from April 15, 2010 to September 2015. near 0.8 miles below the confluence with the John River (Figure 2). While this gauge is not directly on the John River it is just below the confluence with the John River. The John River visually, from imagery and basin size (the John River drainage area is 2704 square miles and the gauge drainage area is 6850 square miles) account for roughly 40% of the flow at this gauge. A flow duration curve shoe a 50% exceedance at 1029 cfs (Figure 12) and an average daily discharge that peak in May around 32400 cfs and stays around 11500 cfs June-September,(Figure 13), and an average annual average discharge value of 6457 cfs (Table 7).

The Koyukuk had a second stream gauge maintained by the National Weather Service (NWS) at Allakaket from May 1970 until July,2021 (Figure 2). This data was obtained from NOAA but contains only stage heights. These are provided as a stage duration curve (Figure 14).

[3] National Park Service, "John River," *Gates of the Arctic National Park & Preserve*, last updated June 30, 2020, accessed August,20, 2026, https://www.nps.gov/gaar/johnriver.htm

The University of Alaska Fairbanks installed and maintained a stream gauge on the Alatna River below the confluence with the Malemute Fork (Figure 3) from 2012 to 2013 on the Alatna River, they published their data in a report.[4] Their study produced river runoff for 2012 and 2013 (Figure 10). The report also gives estimated peak discharges for the Alatna River (Table 5).

The rest of the rivers in the Koyukuk Basin in this application are ungauged. Values for the flow regression for 2-years and 5-years flows were calculated for all the rivers in this application using the USGS[5] Alaska flow regression equations, using PRISM[6] weather data for mean annual precipitation and basin areas these are shown in Table 4. These values for 2-years and 5-years reflect a bankfull flow. Bankfull stage is a river flow that is a channel forming event. These flows have a reoccurrence interval of 1.5-years but can vary by region.

Annual flow duration[7] gives a refined upper limit of flow (Table 11,12). Equation O-S15 gives year-round flow estimates where 15% of days the mean daily flow is above this value. Equation O- S1 gives year-round flow estimates where 1% of days the mean daily flow is above this value.

North Fork Koyukuk

Values for the flow regression for 2-years and 5-year flows were calculated for the entire North Fork Koyukuk basin as well as the upper North Fork Koyukuk to the confluence with Alinement Creek using the USGS Alaska flow regression equations[8] using PRISM[9] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The entire basin has an annual precipitation value of 15.05 inches per year, a 2-year regression flow of 8077 cfs, and a 5-year regression flow of 11620 cfs. The upper section

[4] D.L. Kane et al., *Environmental Studies of Ambler Transportation Corridor, Alaska: Final Report*, INE/WERC Report 15.14 (Fairbanks, AK: University of Alaska Fairbanks, Water and Environmental Research Center, 2015).
[5] . Janet H. Curran, Nancy A. Barth, Andrea G. Veilleux, and Robert T. Ourso, Estimating Flood Magnitude and Frequency at Gaged and Ungaged Sites on Streams in Alaska and Conterminous Basins in Canada, Based on Data Through Water Year 2012, U.S. Geological Survey Scientific Investigations Report 2016–5024 (Reston, VA: U.S. Geological Survey, 2016), https://pubs.usgs.gov/sir/2016/5024/sir20165024.pdf, 13, 19.
[6] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.
[7] Jeffrey B. Wiley, and Janet H. Curran, Estimating Annual High-Flow Statistics and Monthly and Seasonal Low-Flow Statistics for Ungaged Sites on Streams in Alaska and Conterminous Basins in Canada, U.S. Geological Survey Water-Resources Investigations Report 2003–4114, version 1.10 (Reston, VA: U.S. Geological Survey, 2003), https://pubs.usgs.gov/wri/wri034114/pdf/wri034114_v1.10.pdf, 30.
[8] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[9] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.

has an annual precipitation value of 18.41 inches per year, a 2-year regression flow of 915 cfs, and a 5-year regression flow of 1466 cfs.

Annual flow duration gives a refined upper limit of flow (Table 11).[10] These were calculated for the upper North Fork from the headwaters to the Alinement Creek. Equation O-S15 gives year-round flow estimates where 15% of days, the mean daily flow is above this value. Equation O- S1 gives year-round flow estimates where 1% of days the mean daily flow is above this value. On the upper North Fork, the O-S15 is 355 cfs and the O-S1 is 1357 cfs. The flow on the upper North Fork will statistically be below these flows.

The low duration flows were estimated using USGS monthly low flow statistics (Table 12). These are calculated by month and flow duration.[11] These values from the upper North Fork show that in July, 98% of flow is above 68 cfs and 50% of the time it is above 204 cfs. In August, 98% of flow is above 62 cfs and 50% of flow is above 200 cfs. In September, 98% of flow is above 66 cfs and 50% of flow is above 194 cfs.

John River

Values for the flow regression for 2-years and 5-year flows were calculated for the entire John River basin as well as the upper John River to the confluence with Hunt Fork John River using the USGS Alaska flow regression equations,[12] using PRISM[13] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The entire basin has an annual precipitation value of 13.13 inches per year, a 2-year regression flow of 9736 cfs, and a 5-year regression flow of 13987 cfs. The upper section has an annual precipitation value of 11.94 inches per year, a 2-year regression flow of 2603 cfs, and a 5-year regression flow of 4011 cfs.

Annual flow duration gives a refined upper limit of flow (Table 11).[14] These were calculated for the upper John River from the headwaters to Hunt Fork John River. Equation O-S15 gives year-round flow estimates where 15% of days the mean daily flow is above this value. Equation O- S1 gives year-round flow estimates where 1% of days the mean daily flow is above this value. On the upper John River, the O-S15 is 910 cfs and the O-S1 is 13529 cfs. The flow on the upper John River will statistically be below these flows.

[10] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[11] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[12] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[13] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.
[14] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.

The low duration flows were estimated using USGS monthly low flow statistics (Table 12). These are calculated by month and flow duration.[15] These values from the upper John River show that in July, 98% of flow is above 188 cfs and 50% of the time it is above 527 cfs. In August, 98% of flow is above 175 cfs and 50% of flow is above 520 cfs. In September, 98% of flow is above 186 cfs and 50% of flow is above 509 cfs.

Hunt Fork John River

Values for the flow regression for 2-years and 5-year flows were calculated for Hunt Fork John River basin using the USGS Alaska flow regression equations,[16] using PRISM[17] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The annual precipitation value of 19.483 inches per year, a 2-year regression flow of 3986 cfs, and a 5-year regression flow of 5833 cfs.

Annual flow duration gives a refined upper limit of flow (Table 11).[18] These were calculated for the Hunt Fork John River. Equation O-S15 gives year-round flow estimates where 15% of days the mean daily flow is above this value. Equation O- S1 gives year-round flow estimates where 1% of days the mean daily flow is above this value. On the Hunt Fork John River, the O-S15 is 875 cfs and the O-S1 is 2328 cfs. The flow on the Hunt Fork John River will statistically be below these flows.

The low duration flows were estimated using USGS monthly low flow statistics (Table 12). These are calculated by month and flow duration.[19] These values from the Hunt Fork John River show that in July, 98% of flow is above 176 cfs and 50% of the time it is above 429 cfs. In August, 98% of flow is above 163 cfs and 50% flow is above 487 cfs. In September, 98% of flow is above 174 cfs and 50% of flow is above 478 cfs.

Alatna River

Values for the flow regression for 2-years and 5-year flows were calculated for the entire Alatna River basin as well as the upper Alatna River to the Gaedke Lake using the USGS Alaska flow regression equations,[20] using PRISM[21] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The entire basin has an annual precipitation value of 25.04 inches per year, a 2-year regression flow of 21387 cfs, and a 5-year regression flow of 28636 cfs. The upper section has an annual precipitation

[15] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[16] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[17] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.
[18] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[19] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[20] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[21] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.

value of 30.29 inches per year, a 2-year regression flow of 10045 cfs, and a 5-year regression flow of 13748 cfs.

Annual flow duration gives a refined upper limit of flow (Table 11),[22] These were calculated for the upper Alatna River from the headwaters to Gaedke Lake. Equation O-S15 gives year-round flow estimates where 15% of days the mean daily flow is above this value. Equation O- S1 gives year-round flow estimates where 1% of days the mean daily flow is above this value. On the upper Alatna River, the O-S15 is 3977 cfs and the O-S1 is 9146 cfs. The flow on the upper Alatna River will statistically be below these flows.

The low duration flows were estimated using USGS monthly low flow statistics (Table 12). These are calculated by month and flow duration.[23] These values from the upper Alatna show that in July, 98% of flow is above 753 cfs and 50% of the time it is above 1904 cfs. In August, 98% of flow is above 691 cfs and 50% of flow is above 1881 cfs. In September, 98% of flow is above 776 cfs and 50% of flow is above 1897 cfs.

2. Kobuk River Drainage

a. Basic Characteristics

- **Kobuk River**
  Location at the mouth where it enters Kotzebue Sound
  Latitude: 66.6687346
  Longitude: 161.8102047
  Basin area: 33288 square miles
  Elevation at source: 4975 feet
  Main channel length: 399 miles
  Average channel slope: 12.5
  Channel type: single channel meandering river
  Stream Order: **4 to 7**

- **Upper Kobuk to Walker Lake**
  Basin area: 199 square miles
  Channel type: single channel meandering river
  Stream Order: **4** from river mile 326-310 and **5** from river mile 310-301
  Calculated flows: 268-549 cfs

- **Walker Lake**
  Latitude: 67.1153518 N

[22] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[23] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.

Longitude: 154.3347046 W
Elevation: 700
Surface Area: 9140 acers

- **Walker Lake Outlet**
  Location at the confluence with the Kobuk River
  Latitude: 67.0252637
  Longitude: 154.3524497
  Basin area: 205 square miles
  Elevation at source: 700 feet
  Main channel length: 4 Miles
  Average channel slope: 12.5
  Channel type: single channel
  Stream Order: **4**

- **Kichaiakaka Creek**
  Location at the confluence with the Kobuk River
  Latitude: 67.0623352
  Longitude: 154.1649932
  Basin area: 85 square miles
  Elevation at source:1500 feet
  Main channel length: 17 miles
  Average channel slope: 46
  Channel type: meandering
  Stream Order: **3** from river mile 10-2 and **4** from river mile 2-0

- **Nutuvukti Lake**
  Latitude: 66.9789190 N
  Longitude: 154.6969146 W
  Elevation: 650 feet
  Surface Area: 3780 acres

- **Reed River**
  Location at confluence with the Kobuk River
  Latitude: 66.8172464
  Longitude: 154.9663543
  Basin area: 366 square miles
  Elevation at source: 3775 feet
  Main channel length: 68 miles
  Average channel slope: 48

Channel type: meandering
Stream Order: **3** from river mile 57-53 and **4** from river mile 53-0

- **Beaver Creek**
  Location at the confluence with the Kobuk River
  Latitude: 66.8065323 N
  Longitude: 155.0558261 W
  Basin area: 294 square miles
  Elevation at source: 2975 feet
  Main channel length: 77 miles
  Average channel slope: 33
  Channel type: meandering
  Stream Order: **4** from river mile 66-31 and **5** from river mile 31-0

  Lake Minakokosa
  Latitude: 66.9284908 N
  Longitude: 115.0252957 W
  Elevation: 500 feet
  Surface area: 780 acres

- **Outlet of Lake Minakokosa**
  Location at confluence with the Beaver Creek
  Latitude: 66.9041482 N
  Longitude: 155.0162453 W
  Basin area: 36 square miles
  Elevation at source: 500 feet
  Main channel length: 1370 feet
  Channel type: single channel
  Stream Order: **4**

- **Narvak Lake**
  Latitude: 66.9338272 N
  Longitude: 155.6289103 W
  Elevation: 550 Feet
  Surface Area: 2130 acers

- **Lake Selby**
  Latitude: 66.8720025 N
  Longitude: 155.6798180 W
  Elevation: 525 feet

Surface area: 2460 acres

- **Selby River**
  Location at confluence with the Kobuk River
  Latitude: 66.7889355 N
  Longitude: 156.1908106 W
  Basin area: 164 square miles
  Elevation at source:1850 feet
  Main channel length: 30 miles
  Average channel slope: 33 feet/Mile
  Channel type: meandering
  Stream Order: **4** from river mile 9.5-5 and **5** from river mile 5-0

b. Climate

The Kobuk Drainage is between the Arctic and Continental climate zones. The closest weather stations to the Kobuk Drainage are the Bettles (USW00026533) weather station (Table 1, Figure 2) and the Kotzebue 25 N station (USC00505051) and the Kotzebue Station (USW00026616). A summary of the Kotzebue weather stations is provided below (Table 2 & Table 3, Figure 9).

c. General Basin Description

The Kobuk Drainage

The headwaters of the Kobuk are in the Endicott Mountains at approximately 4975 feet above sea level. The Kobuk drainage drains an area of 33288 square miles. It flows west approximately 399 miles to the Chukchi Sea at the Kotzebue Sound. A map of the watershed and the USGS stream gauge is shown in Figures 4, 5, and 6. This drainage basin has several headwater Reed River, Beaver Creek, Mauneluk River, Kogoluktuk River, Shungnak River, Ambler River, Akillik River, Tutuksuk River, Salmon River, Squirrel River, Kallarichuk River, Kaligurichearк River, Adillik River, Pah River, Pick River, and Niaktuvik Creek. The tributaries in this application will be discussed in more detail.

Walker Lake and Walker Lake Outlet

Walker Lake is a glacial lake located in the Brooks Range.[24, 25] It has a surface area of approximately 9140 acres. It is approximately 700 feet above sea level. Its main tributary

[24] National Park Service, "Walker Lake," Gates of the Arctic National Park & Preserve, last modified December 1, 2021, accessed August 20, 2026, https://www.nps.gov/gaar/learn/nature/walker-lake.htm.
[25] National Park Service, "Walker Lake," U.S. National Park Service, last updated January 14, 2021, accessed August 20, 2026, https://www.nps.gov/places/walker-lake.htm.

is Kaluluktok Creek. The Walker Lake basin drains an area of 205 square miles. Its outlet flows south 4 miles to its confluence with the Kobuk River.

Kichaiakaka Creek

The headwaters of Kichaiakaka Creek are in the Brooks Range just north of the Helpmejack Hills at approximately 1500 feet above sea level. The Kichaiakaka Creek drains an area of 85 square miles. It flows south-southeast 14 miles to the confluence with the Kobuk River.

Nutuvukti Lake

Nutuvukti Lake is a glacial lake located in the Brooks Range.[26] It has a surface area of approximately 3780 acres. It is approximately 650 feet above sea level. Its main tributary is Selby River and its outlet flows into Selby Lake.

Reed River

The headwaters of Reed River are in the Brooks Range at approximately 3775 feet above sea level. Its main tributary is Inyullak Creek. The Reed River drains an area of 366 square miles. It flows south 68 miles to the confluence with the Kobuk River.

Beaver Creek

The headwaters of Beaver Creek are in the Brooks Range at approximately 2975 feet above sea level. Its main tributary is the outlet of Lake Minakokosa. Beaver Creek drains an area of 294 square miles. It flows south 77 miles to the confluence with the Kobuk River.

Lake Minakokosa and its outlet

Lake Minakokosa is a glacial lake located in the Brooks Range. It has a surface area of approximately 780 acres. It is approximately 500 feet above sea level. Its main tributary is an unnamed stream. The Minakokosa Lake Basin drains an area of 36 square miles. Its outlet flow south 1370 feet to its confluence with Beaver Creek.

Narvak Lake

Narvak Lake is a glacial lake located in the Brooks Range. It has a surface area of approximately 2130 acres. It is approximately 550 feet above sea level.

Selby Lake

Selby Lake is a glacial lake located in the Brooks Range. It has a surface area of approximately 2460 acres. It is approximately 525 feet above sea level. Its main tributary is

[26] National Park Service, "Nutuvukti Lake and Fen," Gates of the Arctic National Park & Preserve, last modified December 21, 2023, accessed August 20, 2026, https://www.nps.gov/articles/000/nutuvkti-lake.htm.

Selby River and after Selby Lake Selby River flows 9.5 miles to its confluence with the Kobuk River.

Selby River

The headwaters of Selby River are in the Brooks Range on the flanks of the Angayucham Mountains at approximately 1850 feet above sea level. It flows through Lake Navuk and Lake Selby. Its main tributary is Angayukachak Creek. Selby River drains an area of 164 square miles. It flows south 30 miles to the confluence with the Kobuk River.

Ambler River

The headwaters of Ambler River are in the Brooks Range at approximately 3100 feet above sea level. Its main tributaries are Ulaneak Creek, Kalurivik Creek, and the Redstone River. The Ambler River drains an area of 1082 square miles. It flows south 84 miles to the confluence with the Kobuk River.

c. Available Streamflow Data

The University of Alaska Fairbanks installed and maintained a stream gauge from 2012 to 2013 on the Reed River (Figure 4). Their study produced discharge graphs for 2013 and 2014 (Figure 11). The report also gives estimated peak runnoff for the Reed River (Table 6).

There are several gauges on the Kobuk river, from upstream to downstream they are Kobuk River at Kobuk, Kobuk River at Ambler, Kobuk River at Kanina, and Kobuk River at Kaina.

The Kobuk River at Kobuk stream gauge was maintained by the NWS from August 1952 until July 2010 (Figure 5). This data was obtained from NOAA but contains only stage heights. These are provided as a stage duration curve (Figure 15).

The Kobuk River at Ambler stream gauge is maintained by the USGS from July1965 to Present (Figure 5). This station is located at the confluence of the Ambler River with the Kobuk River. It has a drainage area of 6420 square miles, the Ambler River accounts for 1082 square miles of that drainage area. A flow duration curve for the entire record shows 50% exceedance being 3400 cfs (Figure 16) the average daily discharges peak in May at 40554 cfs and it stays around 14871 June through September (Figure 17), and an annual average discharge values 9488 cfs (Table 8).

The Kobuk River at Kanina stream gauge is maintained by the USGS from September 1976 to Present (Figure 5 & 6). It has a drainage area of 9480 square miles. A flow duration curve for the entire record shows a 50% exceedance is 6200 cfs (Figure 18) and the average daily discharge peak in May around 62198 cfs and stay at about 26648 cfs

June through September (Figure 19), and annual average discharge value is 15792 cfs (Table 9).

The rest of the rivers in the Koyukuk Basin in this application are ungauged. Values for the flow regression for 2-years and 5-years flows were calculated for all the rivers in this application using the USGS Alaska flow regression equations, using PRISM weather data for mean annual precipitation and basin areas these are shown in Table 4. These values at 2-years and 5-years reflect a bankfull flow.

Kobuk

Values for the flow regression for 2-years and 5-year flows were calculated for the entire Kobuk basin as well as the upper Kobuk River to the confluence at Kichaiakaka Creek using the USGS Alaska flow regression equations, [27] using PRISM [28] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The entire basin has an annual precipitation value of 17.33 inches per year, a 2-year regression flow of 47584 cfs, and a 5-year regression flow of 62253 cfs. The upper section has an annual precipitation value of 26.97 inches per year, a 2-year regression flow of 2212 cfs, and a 5-year regression flow of 3294 cfs.

Annual flow duration gives a refined upper limit of flow (Table 11). [29] These were calculated for the upper Kobuk River from the headwaters to the confluence with the outlet of Walker Lake. Equation O-S15 gives year-round flow estimates where 15% of days the mean daily flow is above this value. Equation O- S1 gives year-round flow estimates where 1% of days the mean daily flow is above this value. On the upper Noatak River the O-S15 is 549 cfs and the O-S1 is 1675 cfs. The flow on the upper Kobuk will statistically be below these flows.

The low duration flows were estimated using USGS monthly low flow statistics (Table 12). These are calculated by month and flow duration. [30] These values from the upper Kobuk River show that in July, 98% of flow is above 94 cfs and 50% of the time it is above 272 cfs. In August, 98% of flow is above 82 cfs and 50% of flow is above 267 cfs. In September, 98% of flow is above 92 cfs and 50% flow is above 263 cfs.

Walker Lake Outlet

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[27] Janet H. Curran et al., Estimating Flood Magnitude and Frequency at Gaged and Ungaged Sites on Streams in Alaska and Conterminous Basins in Canada, Based on Data through Water Year 2012, U.S. Geological Survey Scientific Investigations Report 2016–5024 (Reston, VA: U.S. Geological Survey, 2016), https://doi.org/10.3133/sir20165024.

[28] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.

[29] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.

[30] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.

Values for the flow regression for 2-years and 5-year flows were calculated for Walker Lake outlet using the USGS Alaska flow regression equations,[31] using PRISM[32] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The basin has an annual precipitation value of 27.23 inches per year, a 2-year regression flow of 2385 cfs, and a 5-year regression flow of 3522 cfs.

Kichaiakaka Creek

Values for the flow regression for 2-years and 5-year flows were calculated for Kichaiakaka Creek using the USGS Alaska flow regression equations,[33] using PRISM[34] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The basin has an annual precipitation value of 16.5 inches per year, a 2-year regression flow of 682 cfs, and a 5-year regression flow of 1102 cfs.

Reed River

Values for the flow regression for 2-years and 5-year flows were calculated for Reed River using the USGS Alaska flow regression equations,[35] using PRISM[36] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The basin has an annual precipitation value of 19.59 inches per year, a 2-year regression flow of 2754 cfs, and a 5-year regression flow of 4114 cfs.

Beaver Creek

Values for the flow regression for 2-years and 5-year flows were calculated for Beaver Creek using the USGS Alaska flow regression equations,[37] using PRISM[38] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The basin has an annual precipitation value of 21.02 inches per year, a 2-year regression flow of 2464 cfs, and a 5-year regression flow of 3686 cfs.

Selby River

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[31] Janet H. Curran et al., Estimating Flood Magnitude and Frequency at Gaged and Ungaged Sites on Streams in Alaska and Conterminous Basins in Canada, Based on Data through Water Year 2012, U.S. Geological Survey Scientific Investigations Report 2016–5024 (Reston, VA: U.S. Geological Survey, 2016), https://doi.org/10.3133/sir20165024.
[32] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.
[33] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[34] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.
[35] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[36] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.
[37] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.
[38] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.

Values for the flow regression for 2-years and 5-year flows were calculated for Selby River using the USGS Alaska flow regression equations,[39] using PRISM[40] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The basin has an annual precipitation value of 25.59 inches per year, a 2-year regression flow of 1850 cfs, and a 5-year regression flow of 2776 cfs.

Ambler River

Values for the flow regression for 2-years and 5-year flows were calculated for the entire Ambler basin as well as the upper Ambler River to the limit of interest using the USGS Alaska flow regression equations,[41] using PRISM[42] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The entire basin has an annual precipitation value of 22.82 inches per year, a 2-year regression flow of 7975 cfs, and a 5-year regression flow of 11210 cfs. The upper section has an annual precipitation value of 28.26 inches per year, a 2-year regression flow of 1605 cfs, and a 5-year regression flow of 2413 cfs.

Annual flow duration gives a refined upper limit of flow (Table 11).[43] These were calculated for the upper Ambler River from the headwaters to the limit of interest. Equation O-S15 gives year-round flow estimates where 15% of days the mean daily flow is above this value. Equation O-S1 gives year-round flow estimates where 1% of days the mean daily flow is above this value. On the upper Ambler River the O-S15 is 388 cfs and the O-S1 is 1205 cfs. The flow on the upper Ambler will statistically be below these flows.

The low duration flows were estimated using USGS monthly low flow statistics (Table 12). These are calculated by month and flow duration.[44] These values from the upper Ambler River show that in July, 98% of flow is above 64 cfs and 50% of the time it is above 190 cfs. In August, 98% of flow is above 55 cfs and 50% of flow is above 185 cfs. In September, 98% of flow is above 62 cfs and 50% of flow is above 181 cfs.

3. Noatak River:

a. Basic characteristics

- **Noatak River**

[39] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13. https://doi.org/10.3133/sir20165024.

[40] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.

[41] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.

[42] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.

[43] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.

[44] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.

Location at the mouth where it enters Kotzebue Sound
Latitude: 66.9813987 N
Longitude: 162.5053456 W
Basin area: 13393 square miles
Elevation at source: 4025 feet
Main channel length: 453 miles
Average channel slope: 9 feet/mile
Channel type: braided mile 447-431 and meandering 431-0
Stream Order: **4-7**

- **Upper Noatak to Portage Creek**
  Basin area: 350 square miles
  Channel type: braided to meandering
  Stream order: **4** from river mile 447-428
  Calculated flows: 717 to 1593 cfs

- **Unnamed Lake -K26N15E, Section 11 & 12**
  Latitude: 67.6687746 N
  Longitude: 155.4184412 W
  Elevation: 1800 feet
  Surface area: 190 acres

- **Unnamed Lake -K25N16E, Section 1 & 2**
  Latitude: 67.5990144 N
  Longitude: 155.2199869 W
  Elevation:1850 feet
  Surface area: 12 acres

b. Climate

The Noatak Drainage is in the Arctic and Continental climate zones.[45] The closest weather stations to the Noatak Drainage are the Kotzebue 25 N station (USC00505051) and the Kotzebue Station (USW00026616). A summary from both weather stations is provided below (Table 2 & Table 3).

c. General Basin Description

[45] Alaska Climate Research Center, Data – Alaska Climate Research Center, University of Alaska Fairbanks, accessed August 20, 2026, https://akclimate.org/data/

The headwaters of the Noatak are on the north side flank of Mount Igipak, in the Brooks Range at approximately 4025 feet above sea level. The Noatak drains an area of 13393 square miles. It flows west approximately 453 miles to the Chukchi Sea at the Kotzebue Sound. A map of the watershed and the USGS stream gauge is shown in Figure 4, 5, & 6

Both unnamed lakes in the Noatak drainage are located in the upper Kobuk River drainage. These lakes are oxbow lakes formed from abandoned channels of the Kobuk River. Imagery from 1990 to present in Google Earth[46] shows these lakes retaining the same relative size and shape.

d. Streamflow Data Available

The USGS installed and maintained a gauge (15746000) on the Noatak River from August,1965 to September 1971 (Figure 9). It has a drainage area of 12000 square miles. A flow duration curve for the entire record with 50% of the flow being above 8500 cfs (Figure 20) is provided along with average daily discharges with peak flows in May reaching up to 109800 cfs and staying around 26000 cfs from June to August,(Figure 21), and annual average discharge of 23082 cfs (Table 10).

Values for the flow regression for 2-years and 5-year flows were calculated for the entire Noatak basin as well as the upper Noatak River to Portage creek using the USGS Alaska flow regression equations,[47] using PRISM[48] weather data for mean annual precipitation and basin area. The results are shown in Table 4. The entire basin has an annual precipitation value of 17.90 inches per year, a 2-year regression flow of 50916 cfs, and a 5-year regression flow of 66268 cfs. The upper section has an annual precipitation value of 34.41 inches per year, a 2-year regression flow of 4461 cfs, and a 5-year regression flow of 6578 cfs. These values for 2-years and 5-years reflect a bankfull flow. Bankfull stage is a river flow that is a channel forming event. Bankfull flows have a reoccurrence interval of 1.5-years but can vary by region.

Annual flow duration gives a refined upper limit of flow (Table 11).[49] These were calculated for the upper Noatak River from the headwaters to Portage creek. Equation O-S15 gives year-round flow estimates where 15% of days the mean daily flow is above this value. Equation O- S1 gives year-round flow estimates where 1% of days the mean daily

[46] Google Earth, *Kobuk River Area, Alaska*, accessed August 20, 2026, https://earth.google.com/web/
[47] Janet H. Curran et al., Estimating Flood Magnitude and Frequency at Gaged and Ungaged Sites on Streams in Alaska and Conterminous Basins in Canada, Based on Data through Water Year 2012, U.S. Geological Survey Scientific Investigations Report 2016–5024 (Reston, VA: U.S. Geological Survey, 2016), https://doi.org/10.3133/sir20165024.
[48] PRISM Climate Group, PRISM Group at Oregon State University, Oregon State University, accessed August 20, 2026, https://www.prism.oregonstate.edu/.
[49] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.

flow is above this value. On the upper Noatak River the O-S15 is 1593 cfs and the O-S1 is 3838 cfs. The flow on the upper Noatak will statistically be below these flows.

The low duration flows were estimated using USGS monthly low flow statistics (Table 12). These are calculated by month and flow duration.[50] These values from the upper Noatak River show that in July 98% of flow is above 272 cfs and 50% of the time it is above 731 cfs. In August 98% of flow is above 238 cfs and 50% of flow is above 710 cfs. In September 98% of flow is above 270 cfs and 50% of flow is above 711 cfs.

[50] Curran, et al, *Estimating Flood Magnitude and Frequency*, 2016, 13.

Appendix

Tables and Figures

Table 1: Bettles weather station summary, period of record: 5/1/1951 -8/10/2026

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Mean Maximum Temp (â„‰)	54.2	2.7	15.2	33.4	54.1	68.6	69.6	62.5	49.1	26.7	6.8	-0.6
Monthly Total Precipitation (in)	0.8	0.8	0.6	0.6	0.7	1.5	2.1	2.6	2.0	1.2	1.0	1.0
Monthly Average Mean Temp (deg F)	-11.6	-6.8	3.0	22.2	43.9	57.8	59.3	52.9	40.8	20.0	-0.3	-8.3
Monthly Mean Minimum Temp (â„‰)	-19.6	-16.4	-9.3	10.9	33.8	46.9	49.0	43.4	32.4	13.3	-7.4	-16.1
Monthly Total Snowfall (in)	12.6	12.1	9.8	6.6	1.6	0.0	0.0	0.0	2.9	12.1	15.3	16.5

Table 2: Kotzebue weather station summary, period of record: 5/1/1940 -8/10/2026

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Mean Maximum Temp (â„‰)	0.9	2.9	8.8	24.5	46.1	63.2	66.9	59.1	46.3	25.8	9.4	6.5
Monthly Total Precipitation (in)	0.7	0.8	0.8	0.6	0.4	0.5	2.0	3.0	2.5	2.1	1.0	1.0
Monthly Average Mean TempF (degF)	-7.7	-6.1	-2.0	13.7	36.0	51.2	56.0	49.7	37.9	18.7	1.6	-2.6
Monthly Mean Minimum Temp (â„‰)	-16.4	-14.9	-13.0	2.9	25.9	39.2	45.2	40.4	29.5	11.5	-6.0	-11.6
Monthly Total Snowfall (in)	7.0	7.8	7.5	4.0	0.8	0.0	0.0	0.0	1.0	8.6	9.6	11.9

Table 3: Kotzebue 25 N weather station summary, period of record: 11/1/1982-8/28/1995

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Mean Maximum Temp (â„‰)	6.0	4.4	4.9	8.7	22.2	38.3	51.0	59.3	56.4	46.8	29.4	14.4
Monthly Total Precipitation (in)	0.6	0.5	0.5	0.4	0.4	0.4	0.6	1.6	2.2	1.5	0.9	0.6
Monthly Average Mean Temperature (degF)	-0.3	-2.2	-2.4	0.6	13.7	31.8	45.1	54.1	51.7	42.0	24.9	9.0
Monthly Mean Minimum Temp (â„‰)	-6.7	-8.8	-9.6	-7.6	5.2	25.3	39.1	48.9	46.9	37.2	20.4	3.6
Monthly Total Snowfall (in)	9.2	7.8	8.3	6.3	5.0	2.0	0.2	0.0	0.0	1.3	6.2	9.1

Table 4: Flow regression for 2-years and 5-years using USGS flow regression equations.

River Name	Area Square Mile	Average Precipitation in Inches	Reg2YR (cfs)	Reg5YR (cfs)
Reed River	366	19.59	2754	4114
Beaver Creek	294	21.02	2464	3686
Selby River	164	25.59	1850	2776
Walker Outlet	206	27.23	2385	3522
Ambler River	1083	22.82	7974	11210
Ambler to NPS boundary	132	28.26	1605	2413
Kichaiakaka Creek	85	16.50	682	1102
Kobuk River	12853	17.33	47584	62253
Upper Kobuk	199	26.97	2212	3294
Alatna River	3494	22.99	21387	28636
Alatna to Gaedke Lake	1022	30.29	10045	13748
North Fork Koyukuk	1831	15.05	8077	11620
Upper NF to Alinement Creek	138	19	915	1466
John River	7006	13.13	9736	13987
Upper John River	627	11.94	2603	4011
Hunt Fork of John River	539	20.50	3986	5833
Noatak River	13394	17.90	50916	66268
Upper Noatak to Portage Creek	350	34.41	4461	6578

Table 5: Estimated peak spring breakup and summer water level events for the Alatna River (from Kane et al.).

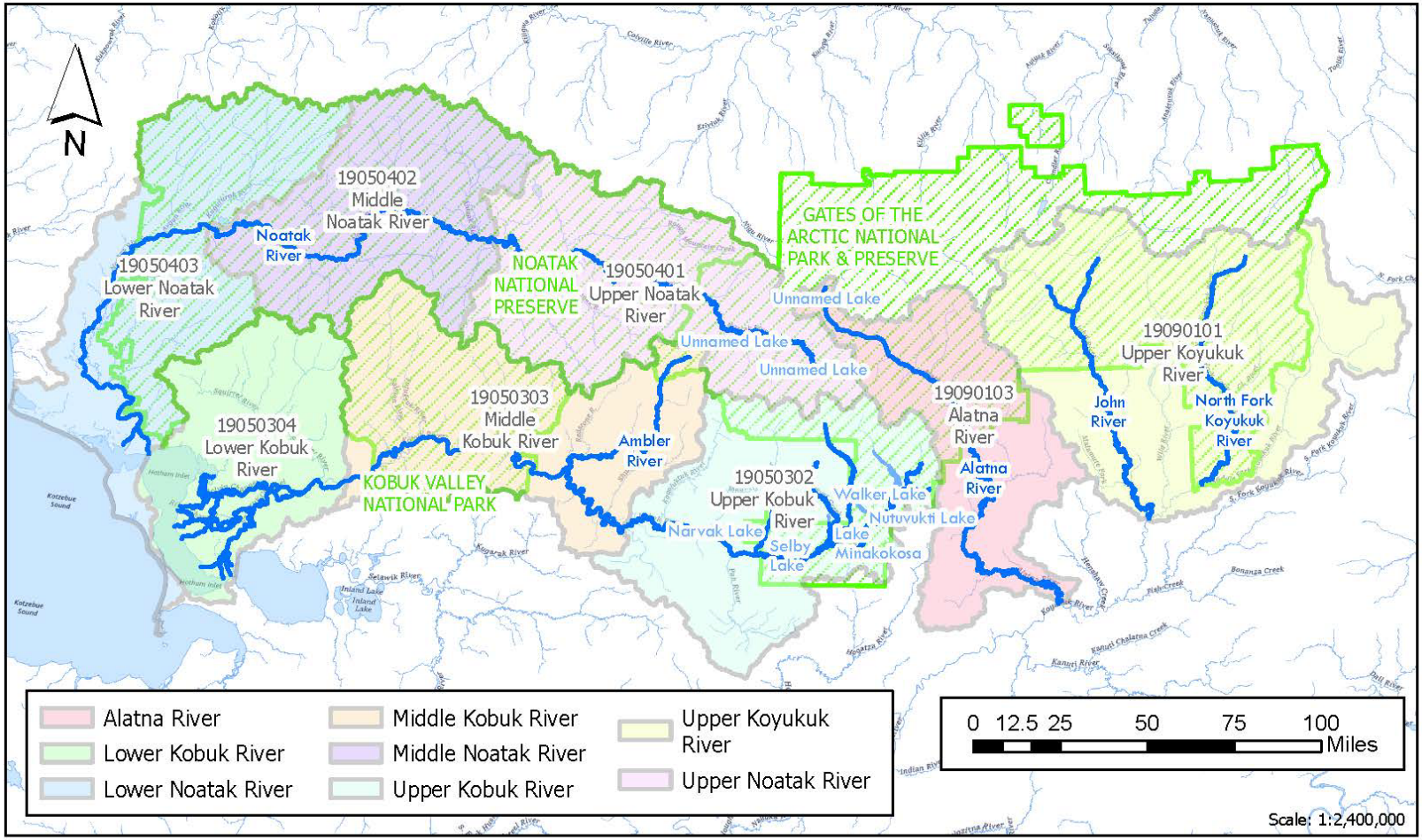
Date	Peak Runoff (m^3/s)	Peak Runoff (ft^3/s)
Summer: August 31, 2012	680	24,000
Spring: ~May 29, 2013	760+	26,850+
Summer: June 5, 2013	375	13,240
Spring: June 1, 2014	735	26,000
Summer: June 10, 2014	480	16,910

Table 6: Estimated peak runoff dates for the Reed River. Due to lack of rating measurements at high stage and high uncertainty in the rating cure, peak runoff is very uncertain for these events (from Kane et al.).

Date	Peak Runoff (m^3/s)	Peak Runoff (ft^3/s)
Summer: August 31, 2012	300G >e	10600>e
Spring: May 28, 29, or 30, 2013[1]	n/a	n/a
Summer: June 4, 2013	144	5085
Spring: June 1, 2014	200e	7060
Summer: July 14, 2014	220e	7770

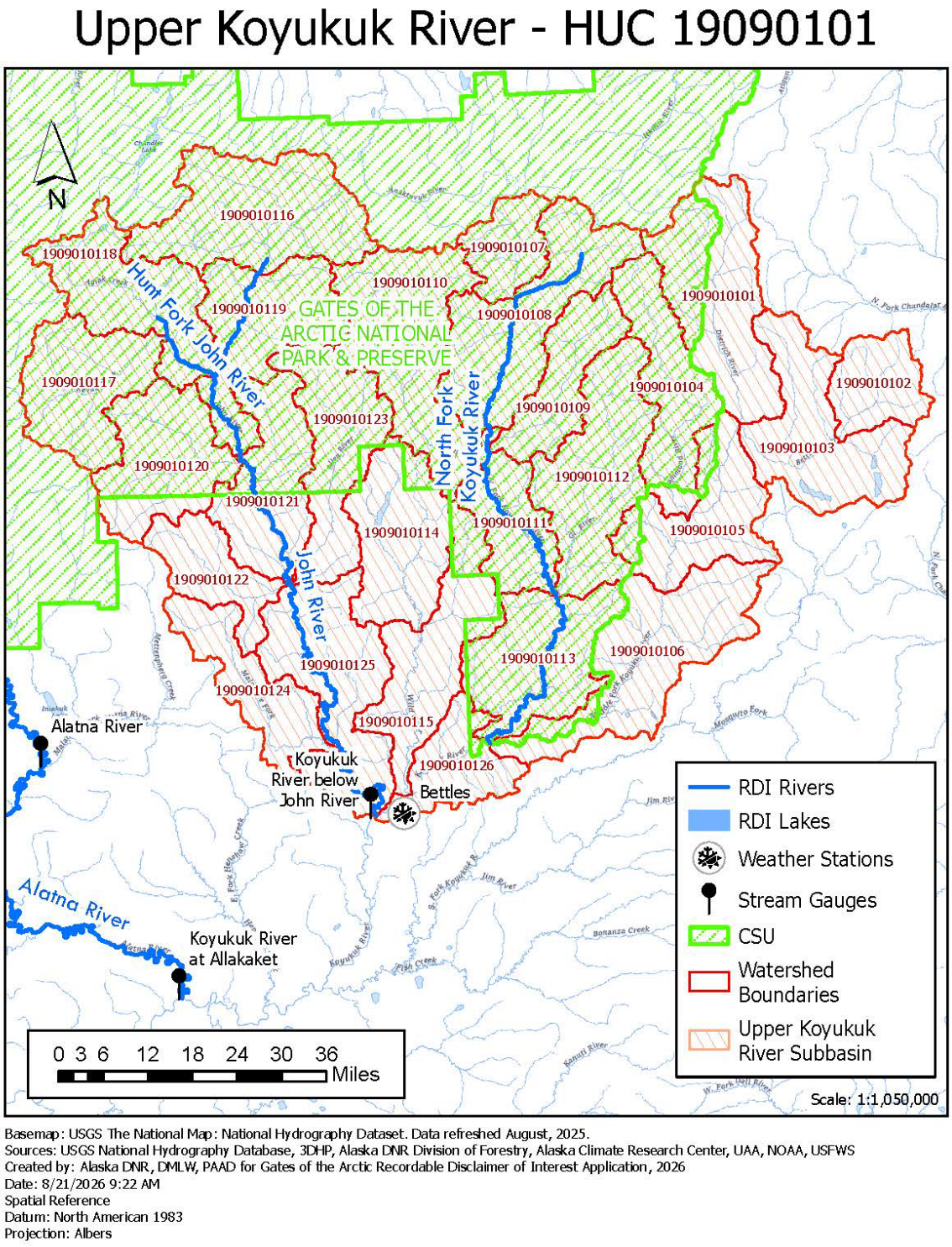
[1] Exact date of maximum spring flow unknown due to poor pressure transducer data, lack of measurements, and ice-affected conditions.
e: Estimate based on rating curve extrapolation; very high uncertainty.

RDI Application Area Subbasins



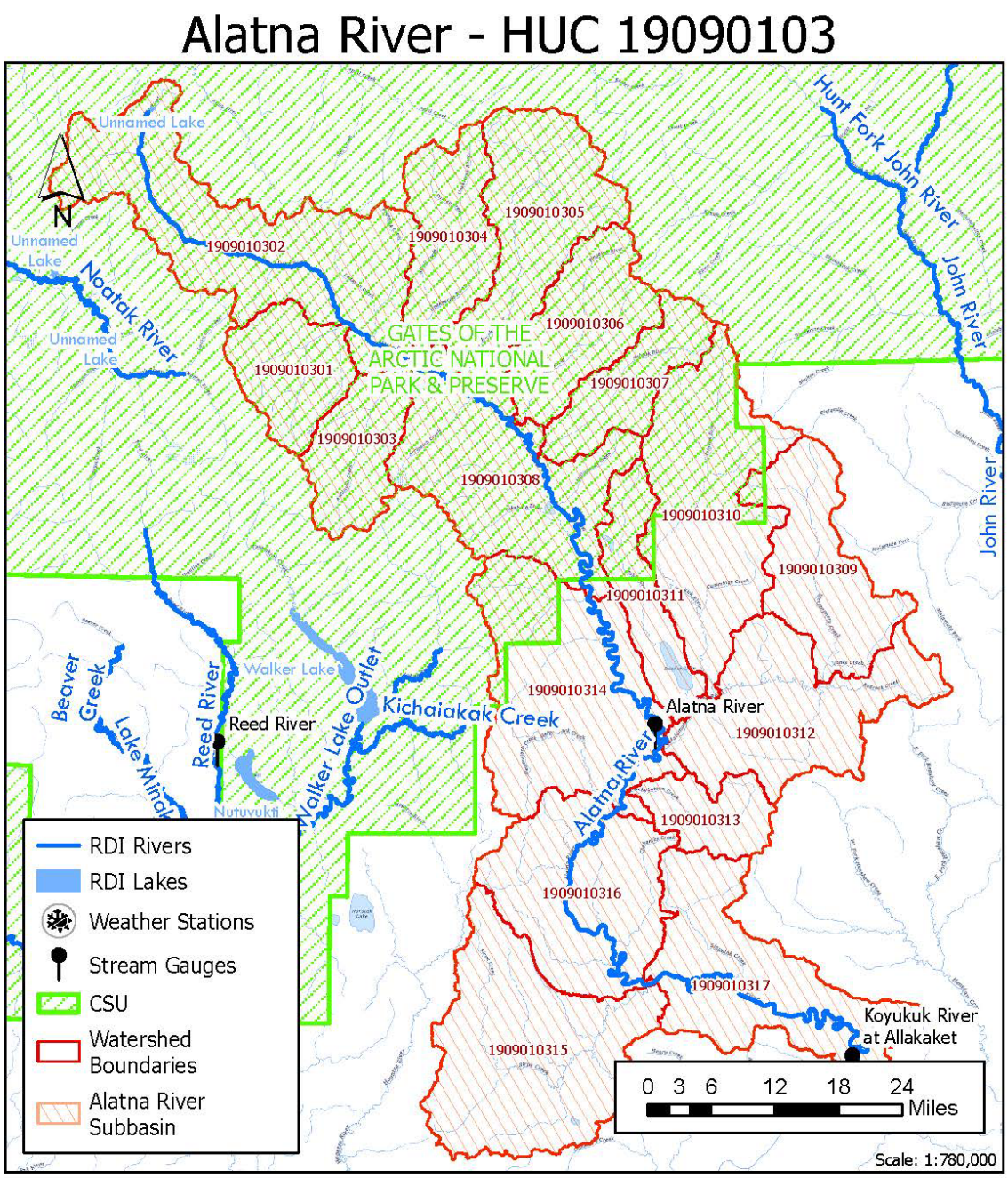
Basemap: USGS The National Map: National Hydrography Dataset. Data refreshed August, 2025.
Sources: USGS National Hydrography Database, 3DHP, Alaska DNR Division of Forestry, Alaska Climate Research Center, UAA, NOAA, USFWS
Created by: Alaska DNR, DMLW, PAAD for Gates of the Arctic Recordable Disclaimer of Interest Application, 2026
Date: 8/20/2026 11:03 AM
Spatial Reference
Datum: North American 1983
Projection: Albers

Figure 1: RDI Application Area Hydrologic Subbasin Map.



Basemap: USGS The National Map: National Hydrography Dataset. Data refreshed August, 2025.
Sources: USGS National Hydrography Database, 3DHP, Alaska DNR Division of Forestry, Alaska Climate Research Center, UAA, NOAA, USFWS
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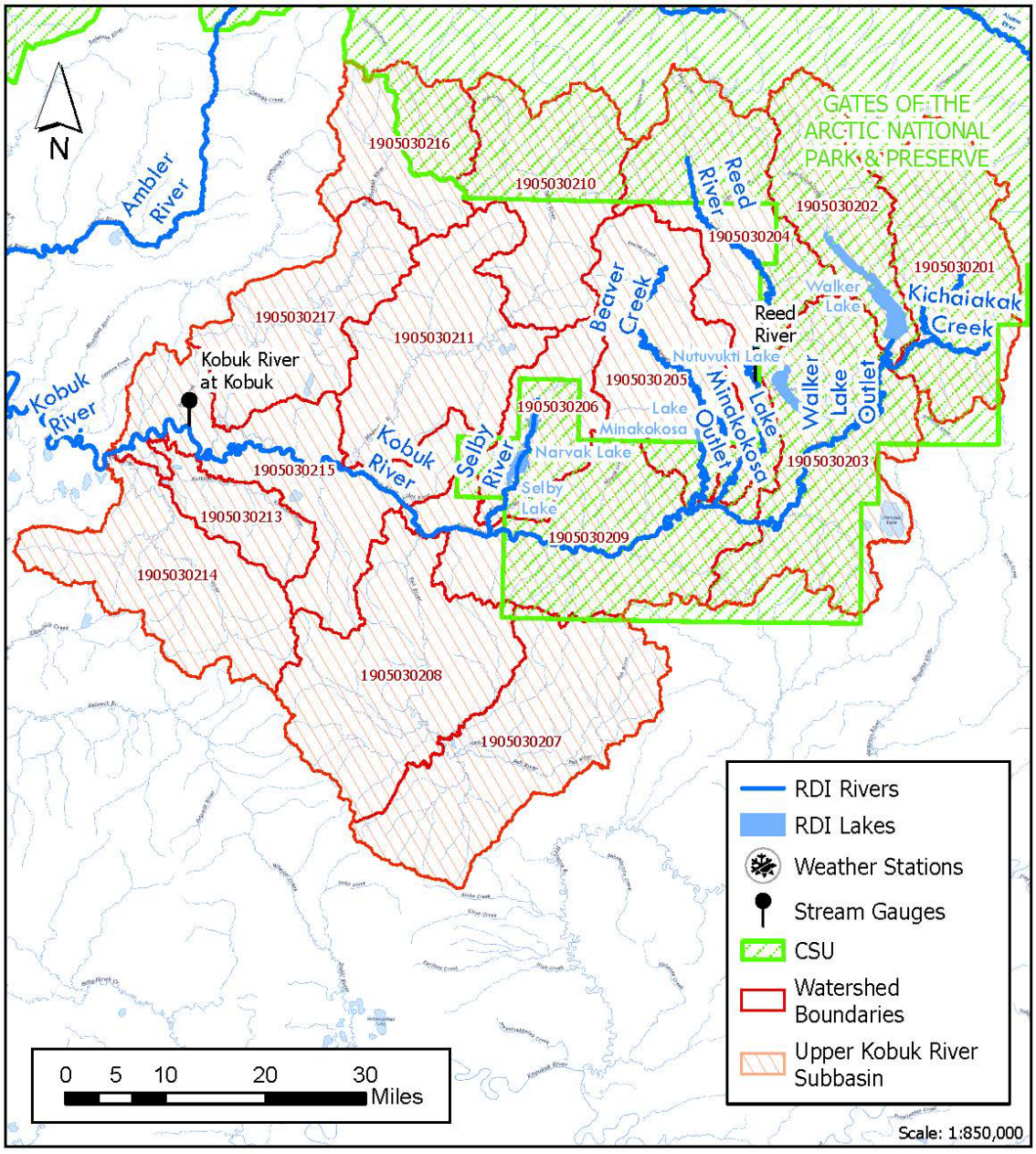
Figure 2: Upper Koyukuk River HUC 10 basins.



Basemap: USGS The National Map: National Hydrography Dataset. Data refreshed August, 2025.
Sources: USGS National Hydrography Database, 3DHP, Alaska DNR Division of Forestry, Alaska Climate Research Center, UAA, NOAA, USFWS
Created by: Alaska DNR, DMLW, PAAD for Gates of the Arctic Recordable Disclaimer of Interest Application, 2026
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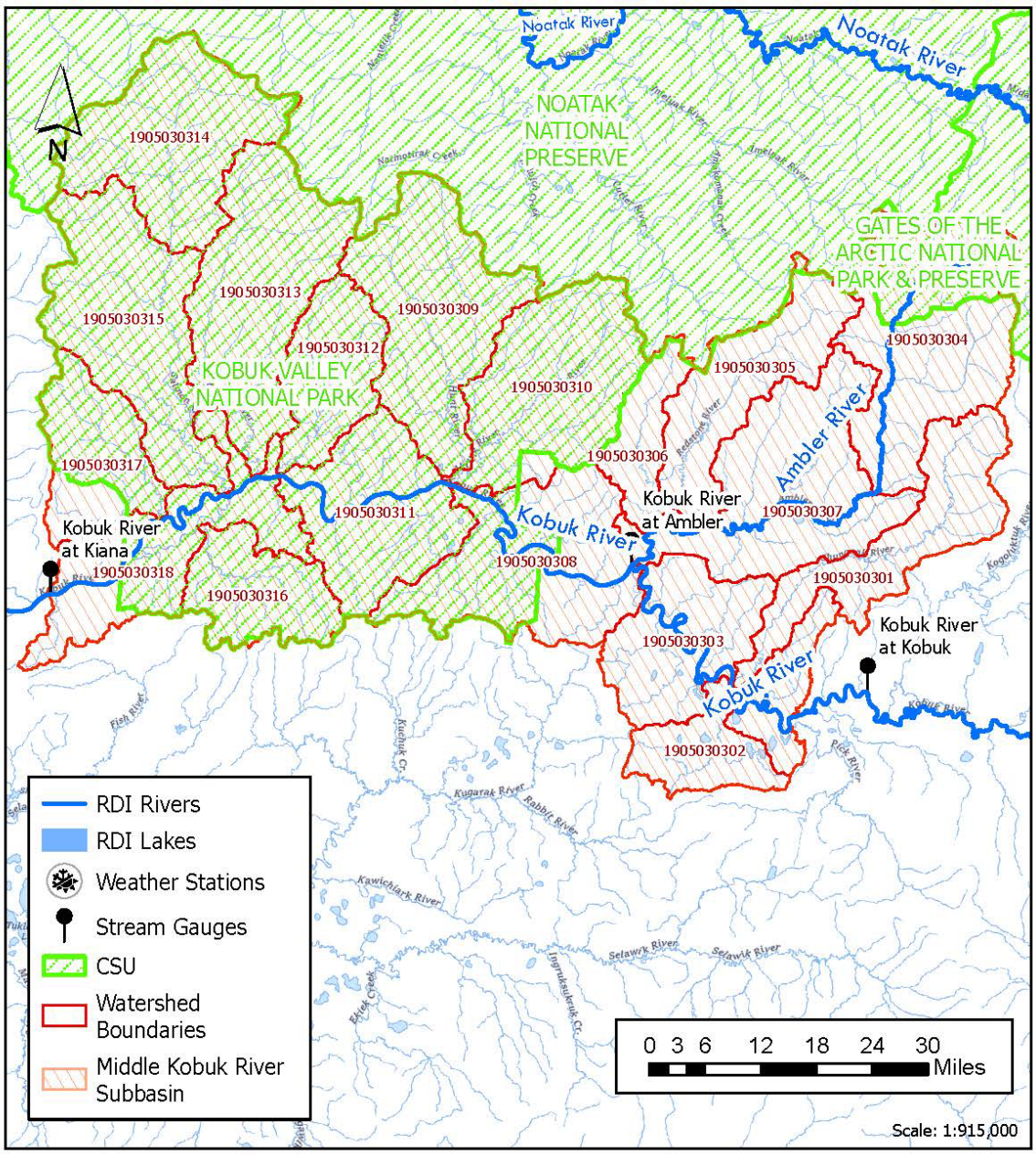
Figure 3: Alatna River HUC 10 basins.

Upper Kobuk River - HUC 19050302



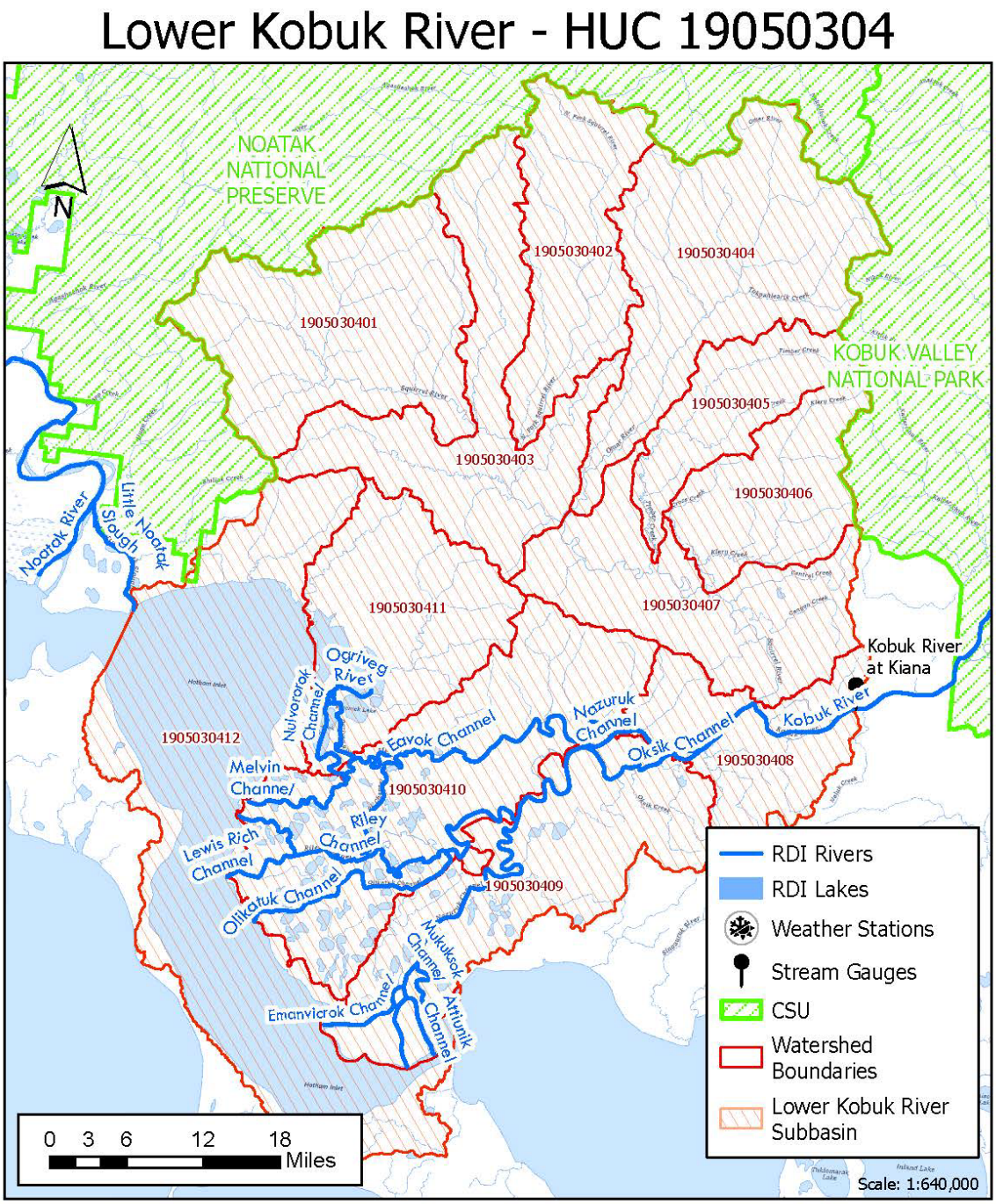
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Sources: USGS National Hydrography Database, 3DHP, Alaska DNR Division of Forestry, Alaska Climate Research Center, UAA, NOAA, USFWS
Created by: Alaska DNR, DMLW, PAAD for Gates of the Arctic Recordable Disclaimer of Interest Application, 2026
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Spatial Reference
Datum: North American 1983
Projection: Albers

Figure 4: Upper Kobuk River HUC 10 basins.



Basemap: USGS The National Map: National Hydrography Dataset. Data refreshed August, 2025.
Sources: USGS National Hydrography Database, 3DHP, Alaska DNR Division of Forestry, Alaska Climate Research Center, UAA, NOAA, USFWS
Created by: Alaska DNR, DMLW, PAAD for Gates of the Arctic Recordable Disclaimer of Interest Application, 2026
Date: 8/20/2026 11:03 AM
Spatial Reference
Datum: North American 1983
Projection: Albers

Figure 5: Middle Kobuk River HUC 10 basins.



Basemap: USGS The National Map: National Hydrography Dataset. Data refreshed August, 2025.
Sources: USGS National Hydrography Database, 3DHP, Alaska DNR Division of Forestry, Alaska Climate Research Center, UAA, NOAA, USFWS
Created by: Alaska DNR, DMLW, PAAD for Gates of the Arctic Recordable Disclaimer of Interest Application, 2026
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Spatial Reference
Datum: North American 1983
Projection: Albers

Figure 6: Lower Kobuk River HUC 10 basins.



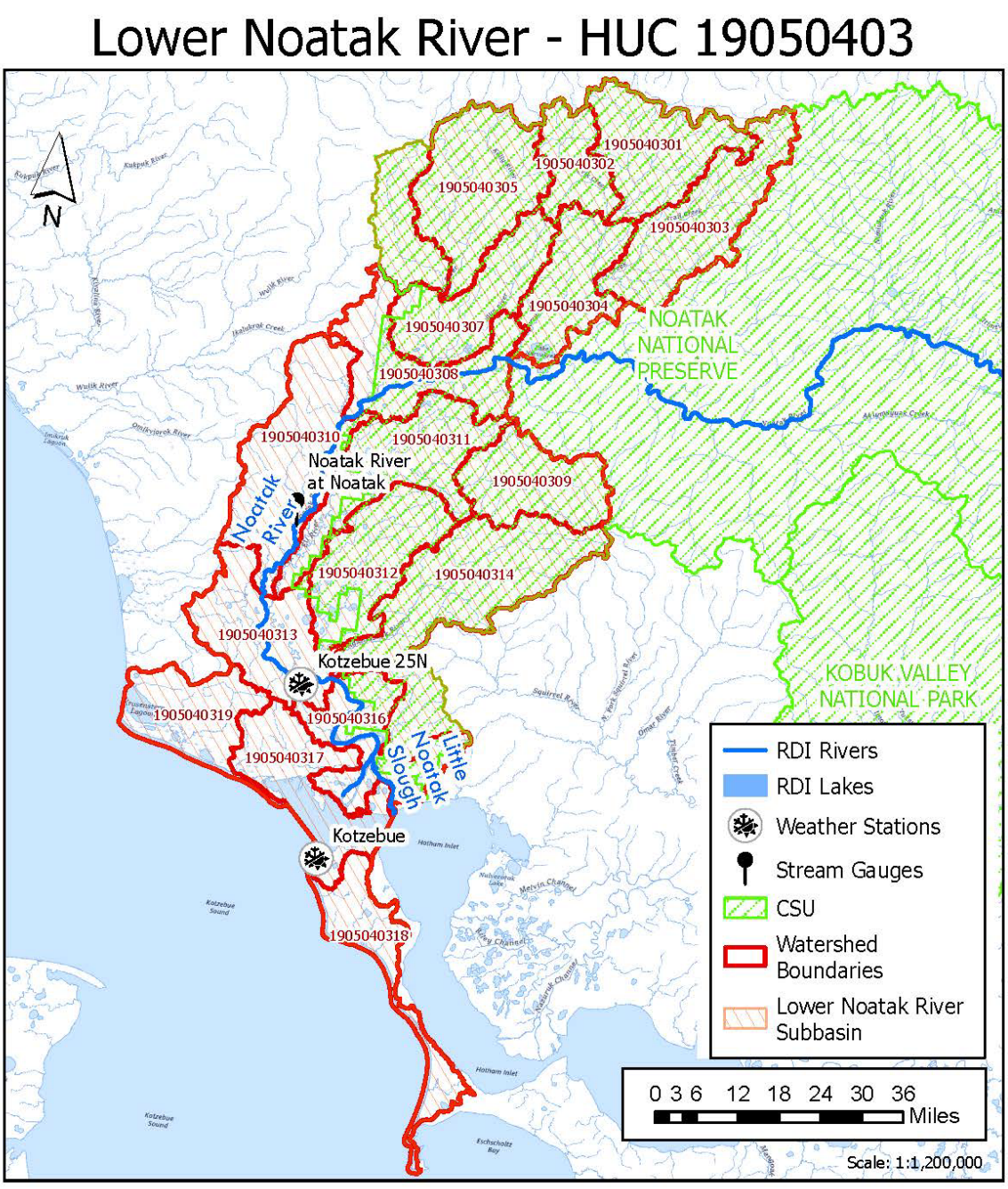
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Sources: USGS National Hydrography Database, 3DHP, Alaska DNR Division of Forestry, Alaska Climate Research Center, UAA, NOAA, USFWS
Created by: Alaska DNR, DMLW, PAAD for Gates of the Arctic Recordable Disclaimer of Interest Application, 2026
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Spatial Reference
Datum: North American 1983
Projection: Albers

Figure 7: Upper Noatak River HUC 10 basins.



Basemap: USGS The National Map: National Hydrography Dataset. Data refreshed August, 2025.
Sources: USGS National Hydrography Database, 3DHP, Alaska DNR Division of Forestry, Alaska Climate Research Center, UAA, NOAA, USFWS
Created by: Alaska DNR, DMLW, PAAD for Gates of the Arctic Recordable Disclaimer of Interest Application, 2026
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Spatial Reference
Datum: North American 1983
Projection: Albers

Figure 8: Middle Noatak River HUC 10 basins.



Basemap: USGS The National Map: National Hydrography Dataset. Data refreshed August, 2025.
Sources: USGS National Hydrography Database, 3DHP, Alaska DNR Division of Forestry, Alaska Climate Research Center, UAA, NOAA, USFWS
Created by: Alaska DNR, DMLW, PAAD for Gates of the Arctic Recordable Disclaimer of Interest Application, 2026
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Projection: Albers

Figure 9: Lower Noatak Ricer HUC 10 basins.

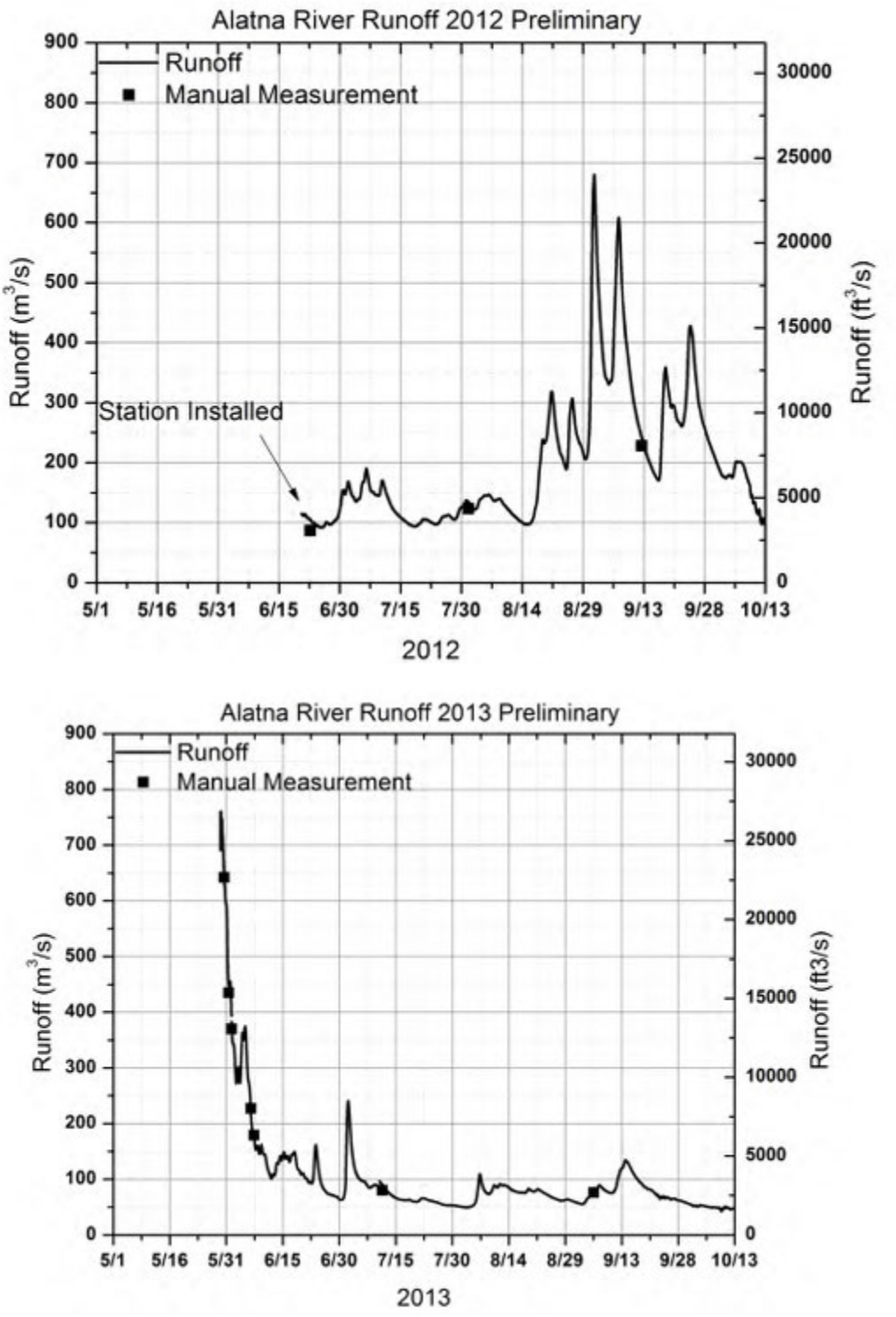


Figure 10: Runoff at the Alatna River Station below the confluence with the Malemute Fork, 2012 and 2013, (from Kane et al.).

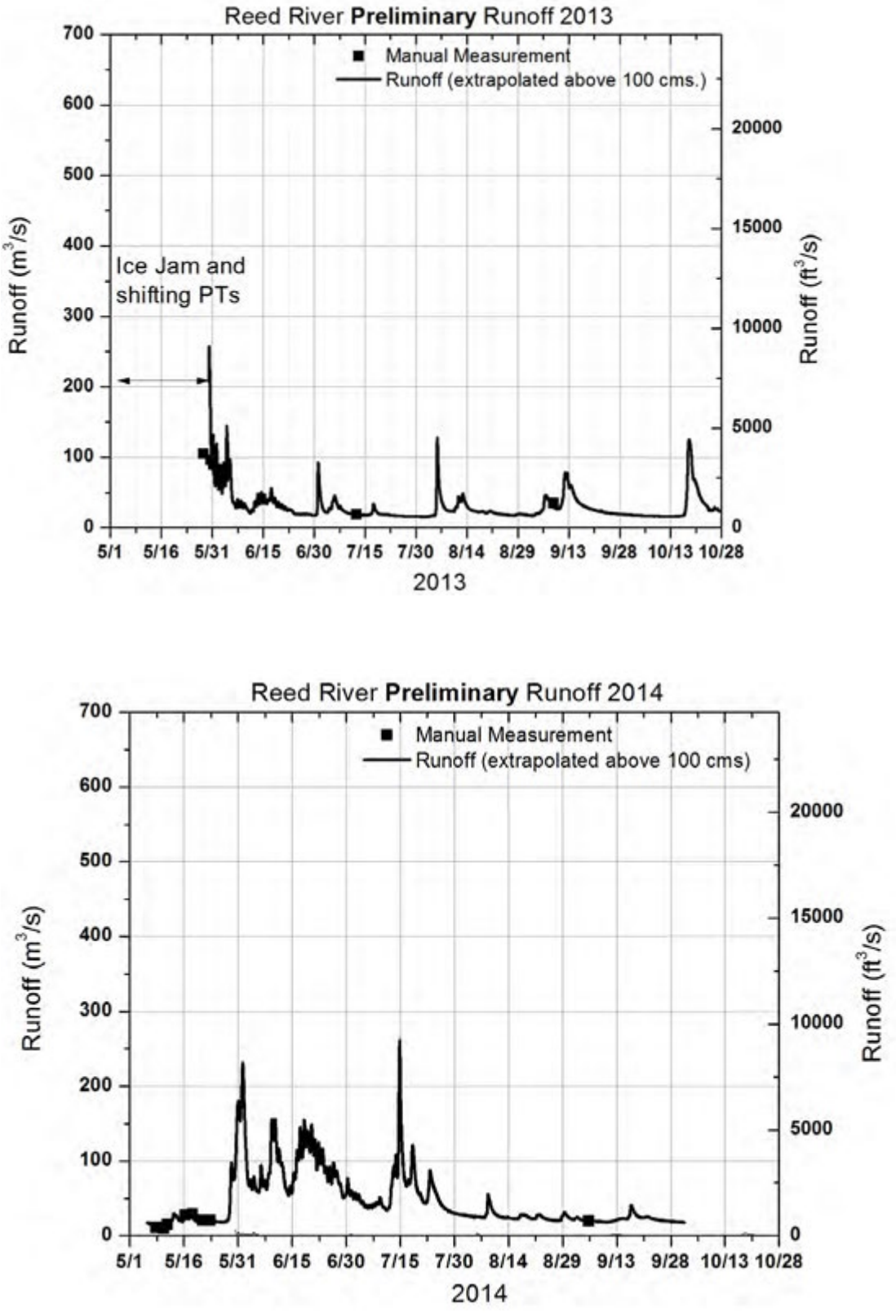


Figure 11: Runoff for the Reed River in 2013 and 2014 (from Kane et al.).

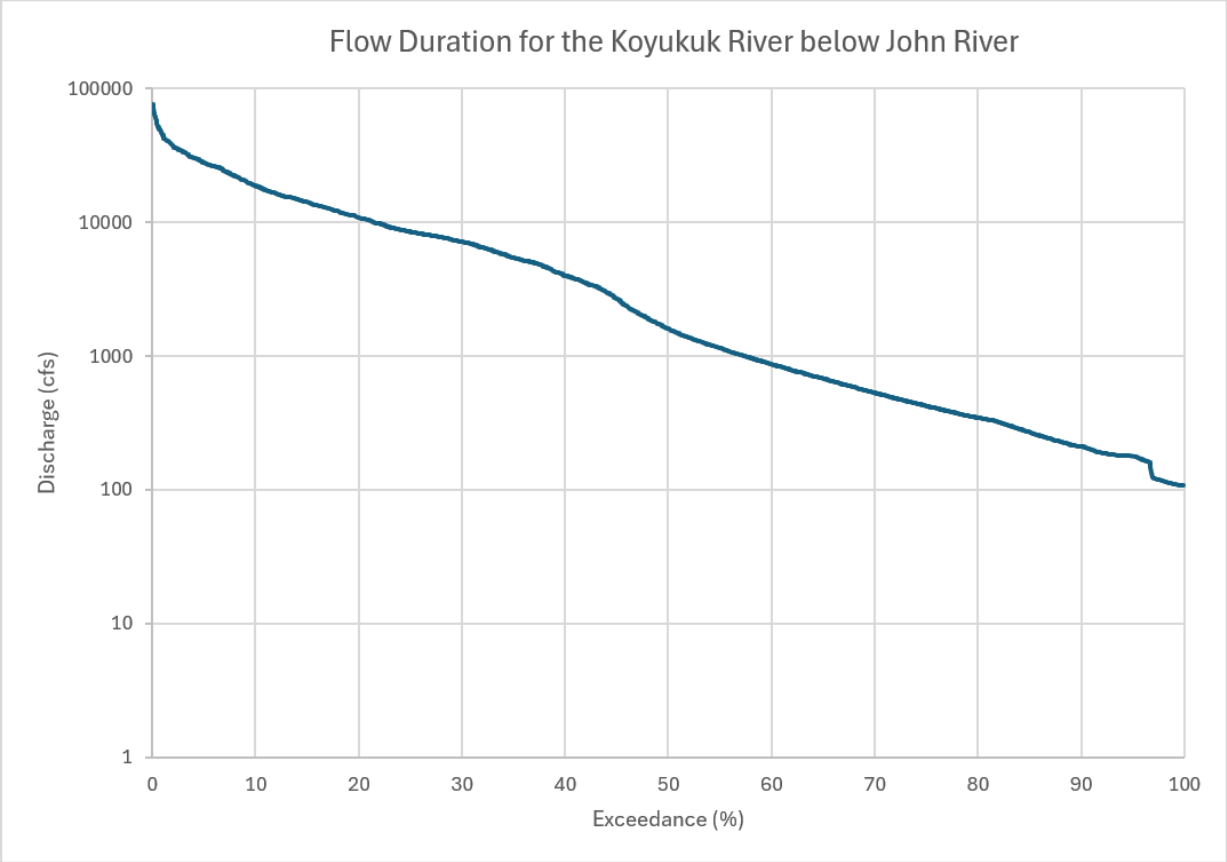


Figure 12: Koyukuk River flow duration curve for the USFWS on the Koyukuk River 0.8 miles below John River (April 2010 to September,2015)

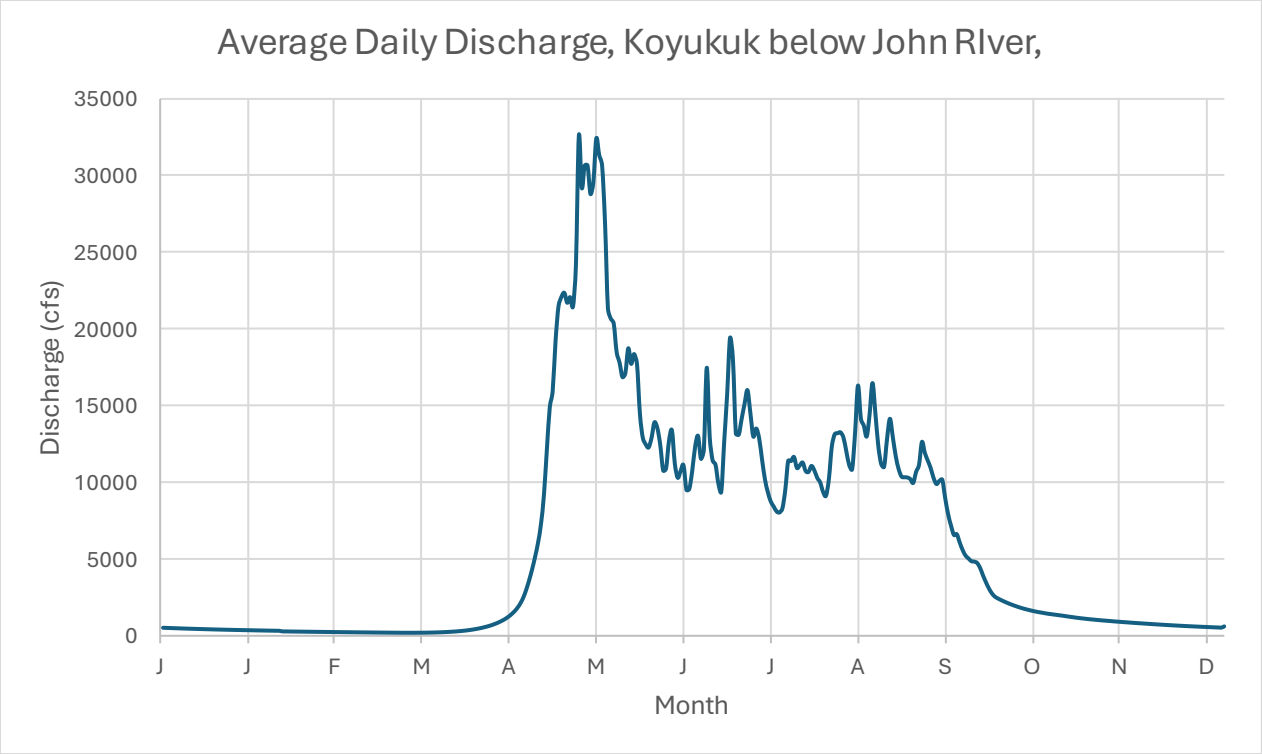


Figure 13: Average daily Discharge from the USFWS gauge on the Koyukuk River 0.8 miles below John River (April 2010 to September,2015)

Table 7: Annual discharge values for the USFWS gauge on the Koyukuk River 0.8 miles below John River.

Year	Discharge (cfs)
2010	6032
2011	5658
2012	8401
2013	3939
2014	8558
2015	6154
Average	6457

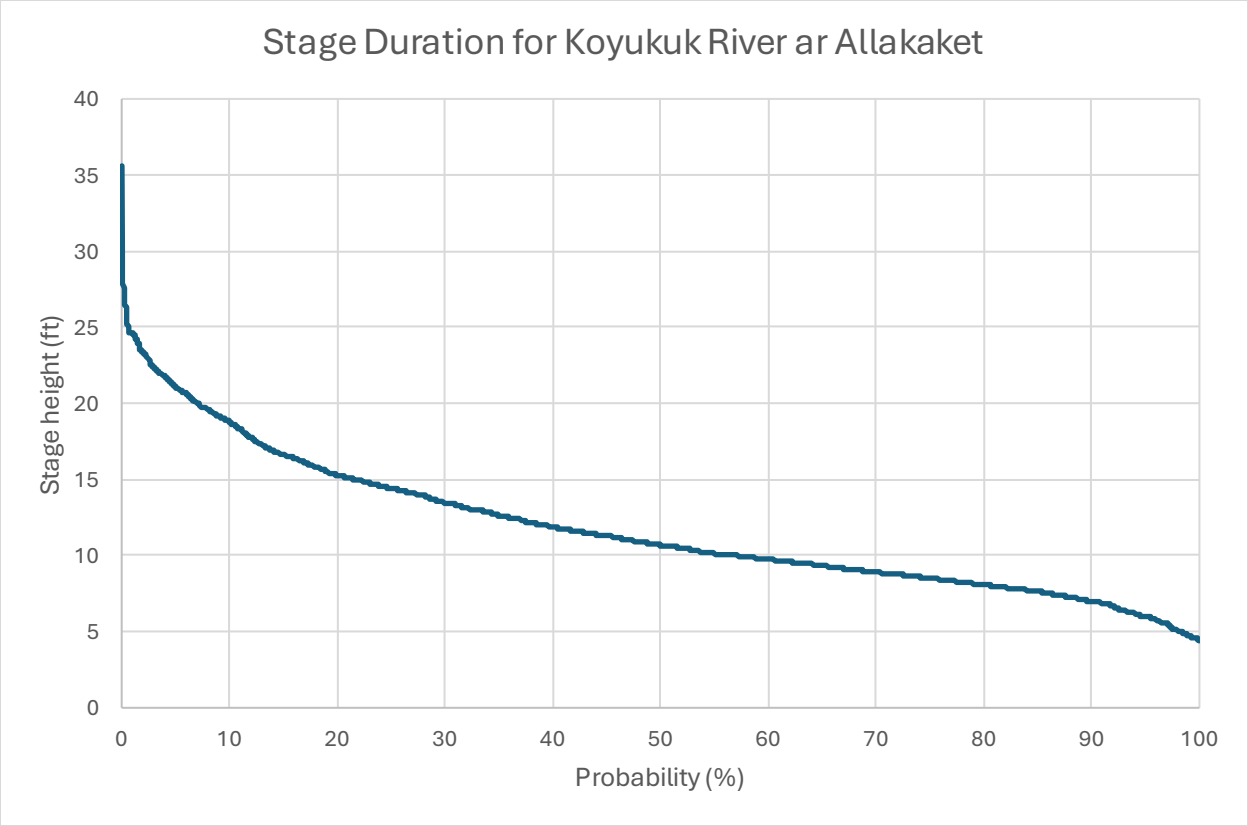


Figure 14: Stage duration curve for the NWS gauge Koyukuk River at Allakaket (from May 1970 to July,2021).

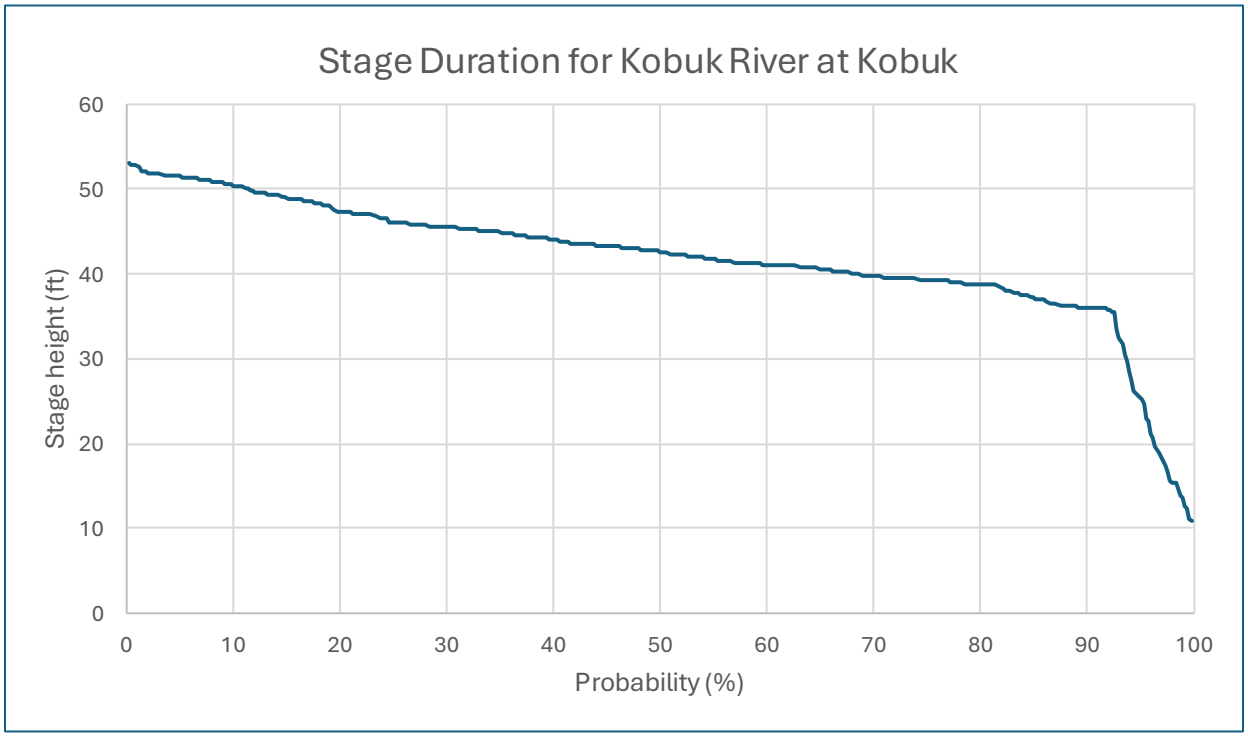


Figure 15 : Stage duration curve for the NWS gauge Kobuk River at Kobuk (from August,1953 to July,2010).

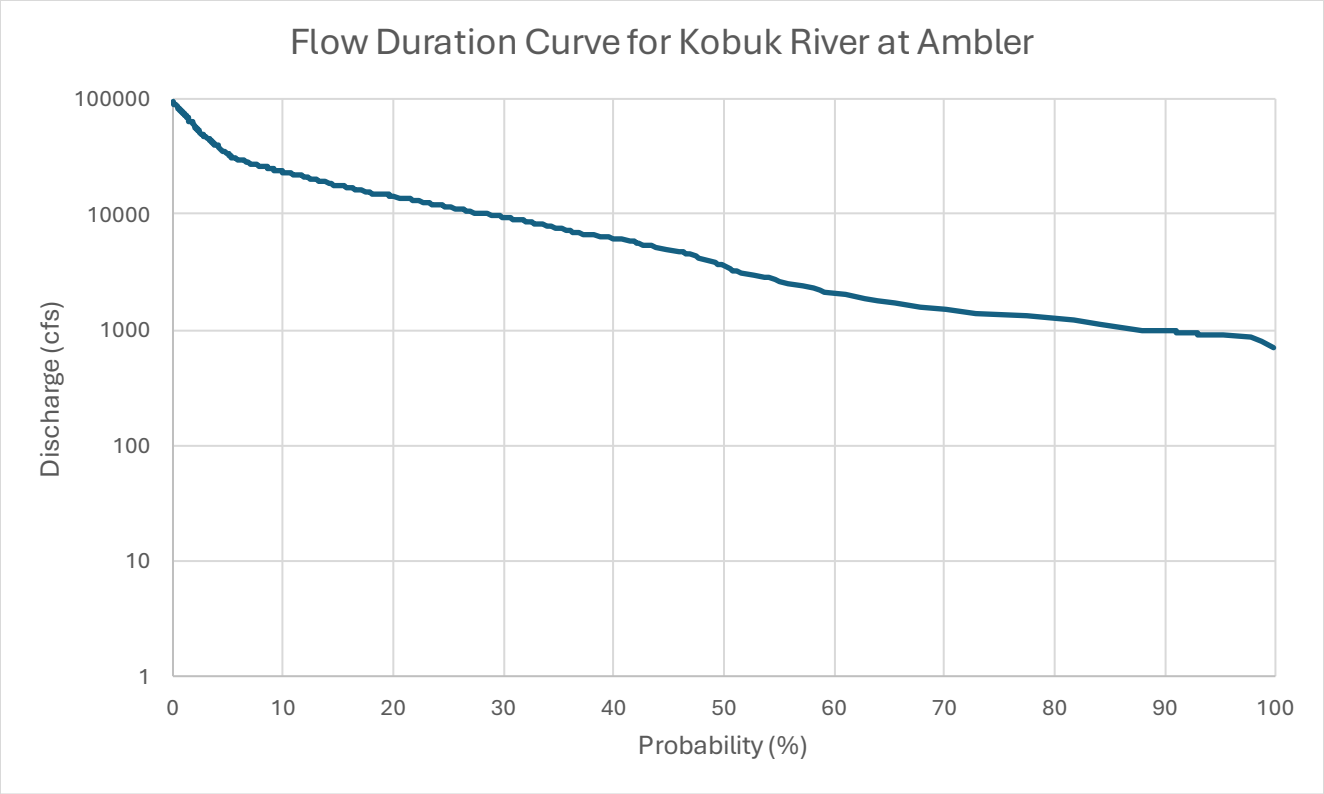


Figure 16: Flow duration curve for the USGS stream gauge at Kobuk River at Ambler (July,1965 to August,2026).

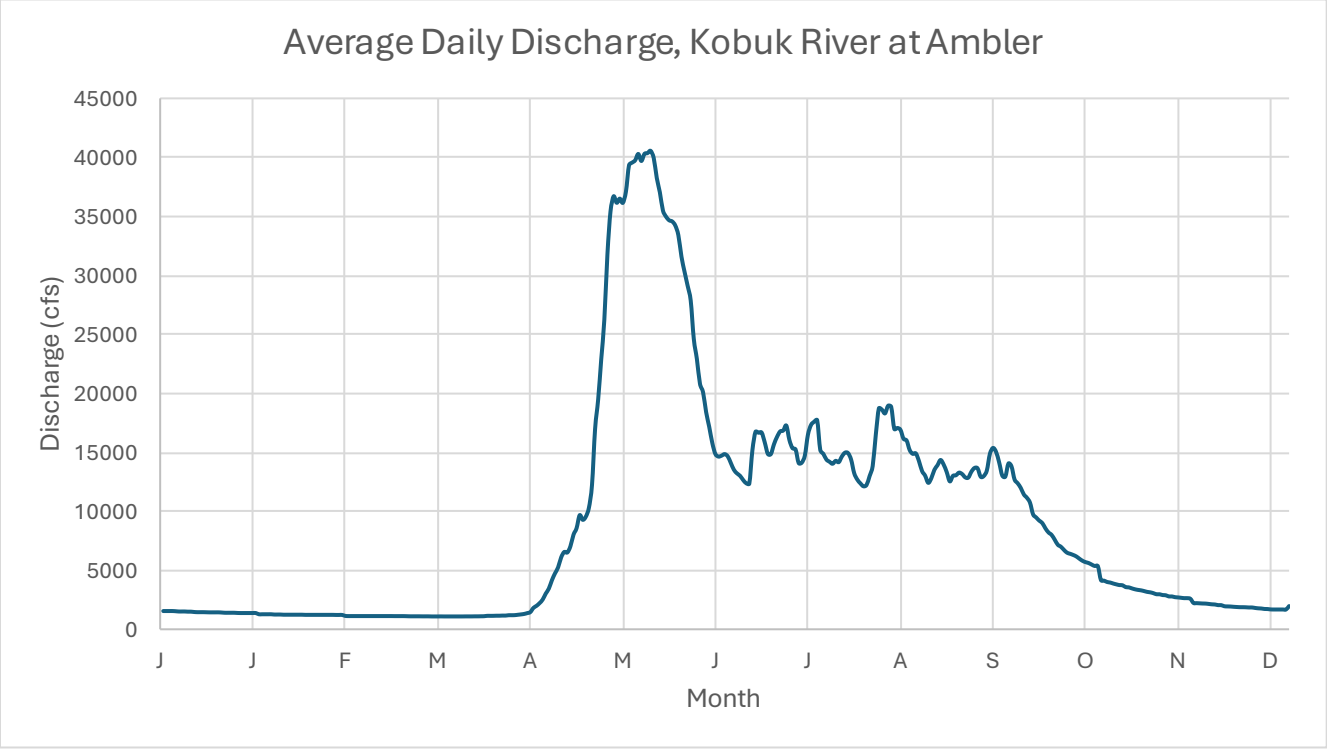


Figure 17: Average daily discharge for the USGS stream gauge at Kobuk River at Ambler (July,1965 to August,2026).

Table 8: Annual discharge values for the USGS stream gauge athe the Kobuk River at Ambler.

Year	Discharge (cfs)
1965	17706
1966	7697
1967	13162
1968	10126
1969	4995
1970	6012
1971	9793
1972	9010
1973	15604
1974	7538
1975	8544
1976	6563
1977	7438
1978	8649
Average	9488

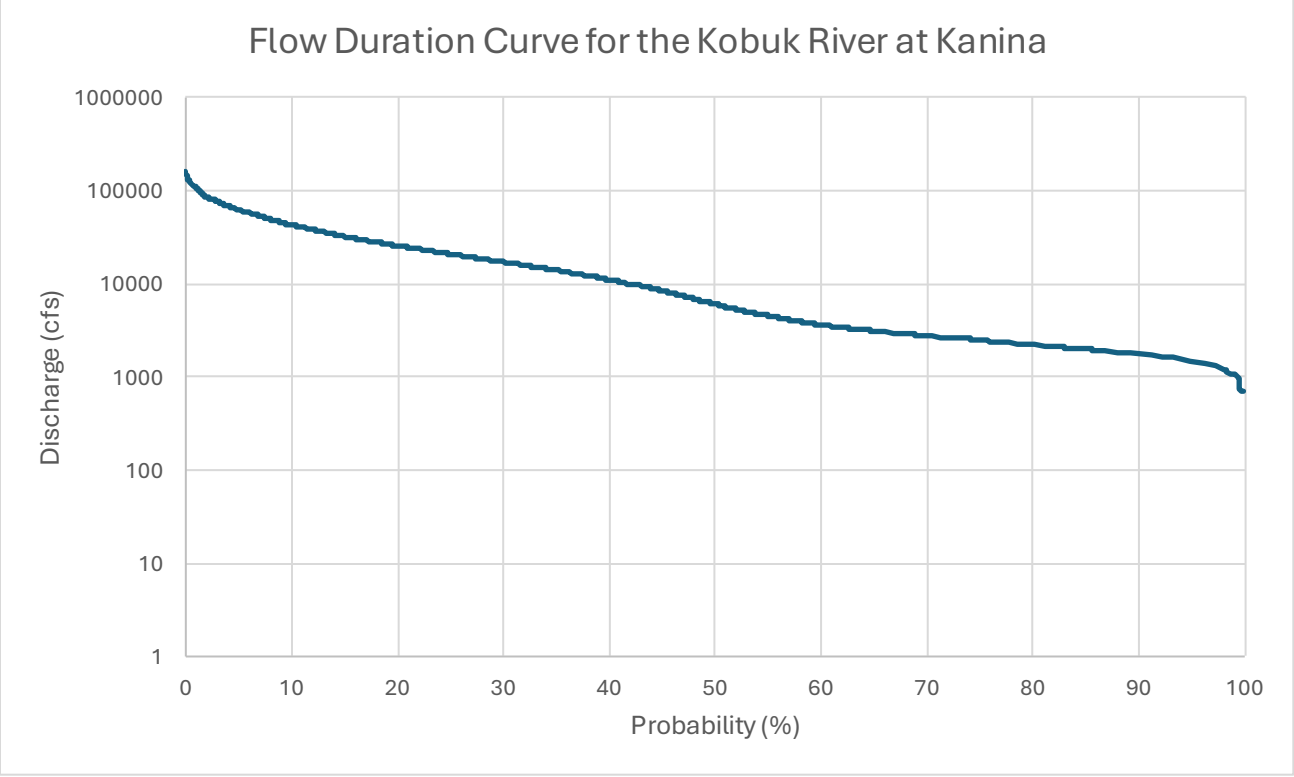


Figure 18: Flow duration curve for the USGS stream gauge at Kobuk River at Kaina (September,1997 to August,2026)

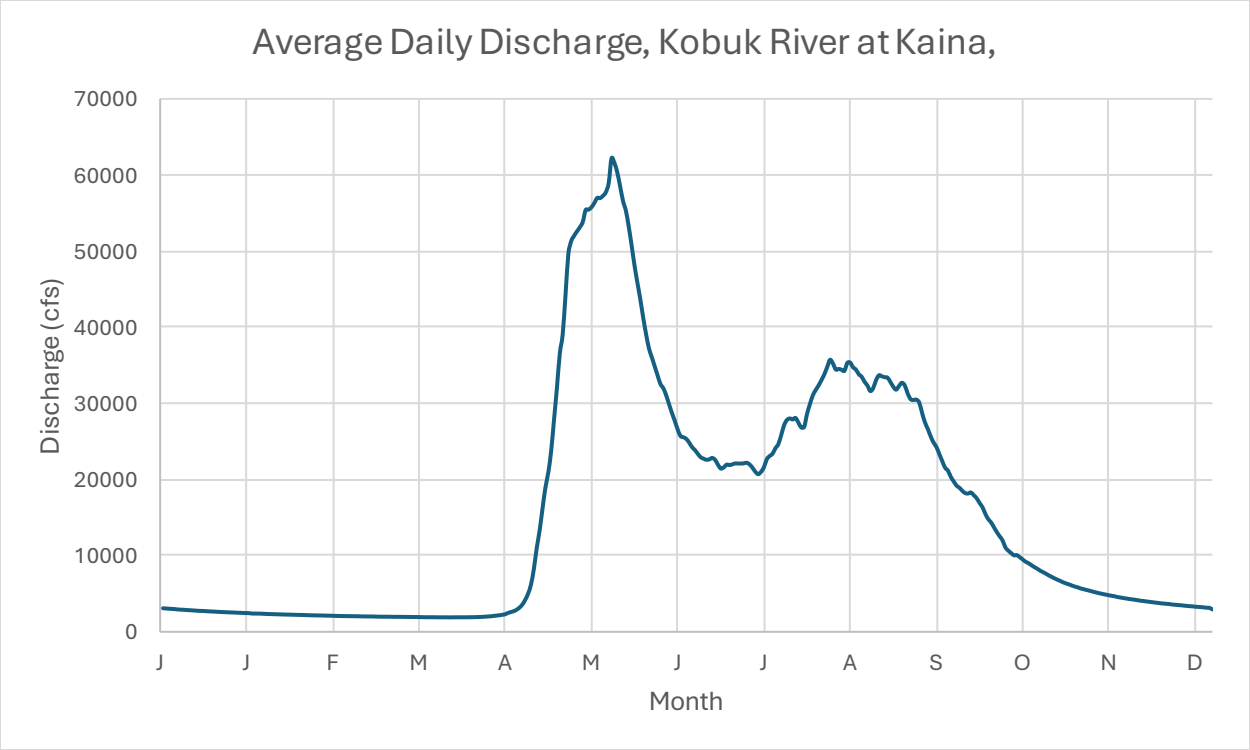


Figure 19: Average Daily discharge for the USGS stream gauge at Kobuk River at Kaina (September,1997 to August,2026).

Table 9: Annual discharge for the USGS stream gauge at the Kobuk River at Kaina. Average flow is 15791.74cfs.

Year	Discharge (cfs)	Year	Discharge (cfs)	Year	Discharge (cfs)
1976	7518	1993	21904	2010	9724
1977	10220	1994	23156	2011	13313
1978	12513	1995	11363	2012	22806
1979	20319	1996	12549	2013	No Data
1980	17234	1997	11570	2014	16680
1981	13930	1998	21043	2015	13395
1982	19921	1999	11777	2016	14397
1983	12457	2000	13654	2017	16410
1984	12745	2001	16496	2018	18117
1985	17157	2002	13849	2019	22541
1986	16097	2003	22119	2020	18913
1987	10667	2004	No data	2021	18575
1988	14495	2005	No data	2022	17751
1989	23002	2006	No data	2023	25436
1990	12347	2007	6346	2024	20889
1991	15853	2008	12250	2025	21872
1992	11724	2009	14575	2026	10543

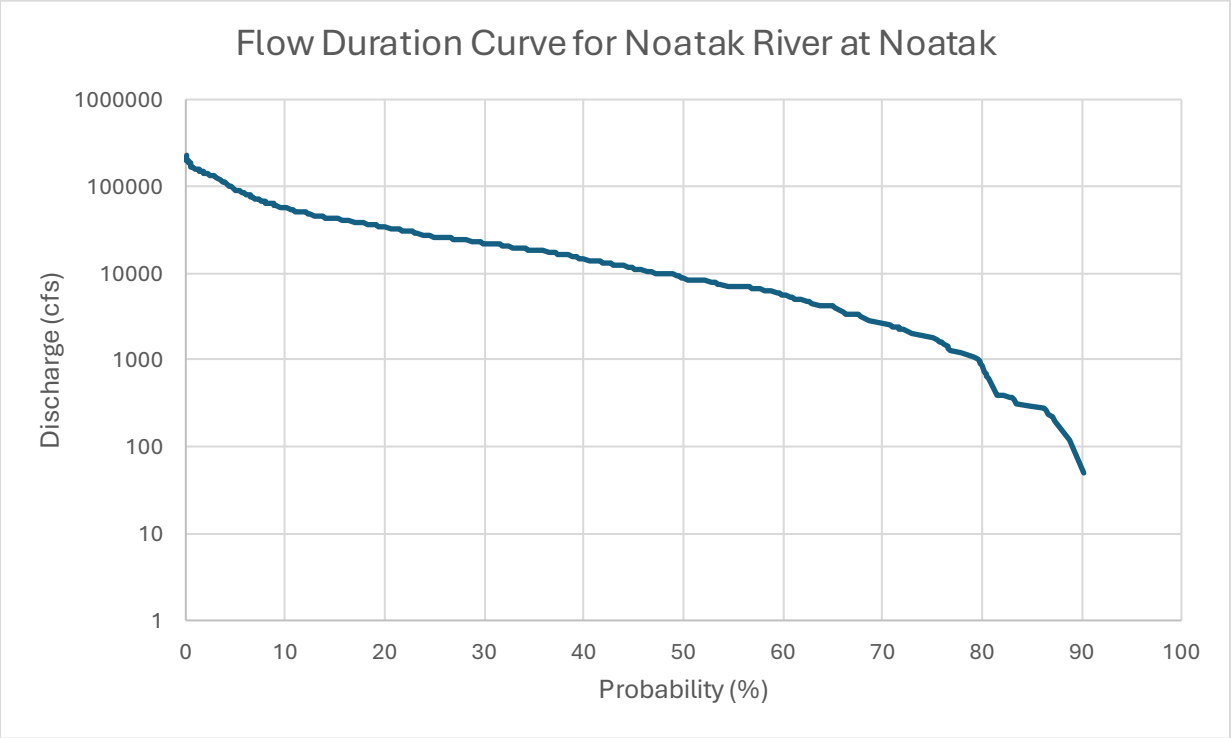


Figure 20: Flow duration curve for the USGS stream gauge at Noatak River at Noatak (August, 1965 to September, 1971).

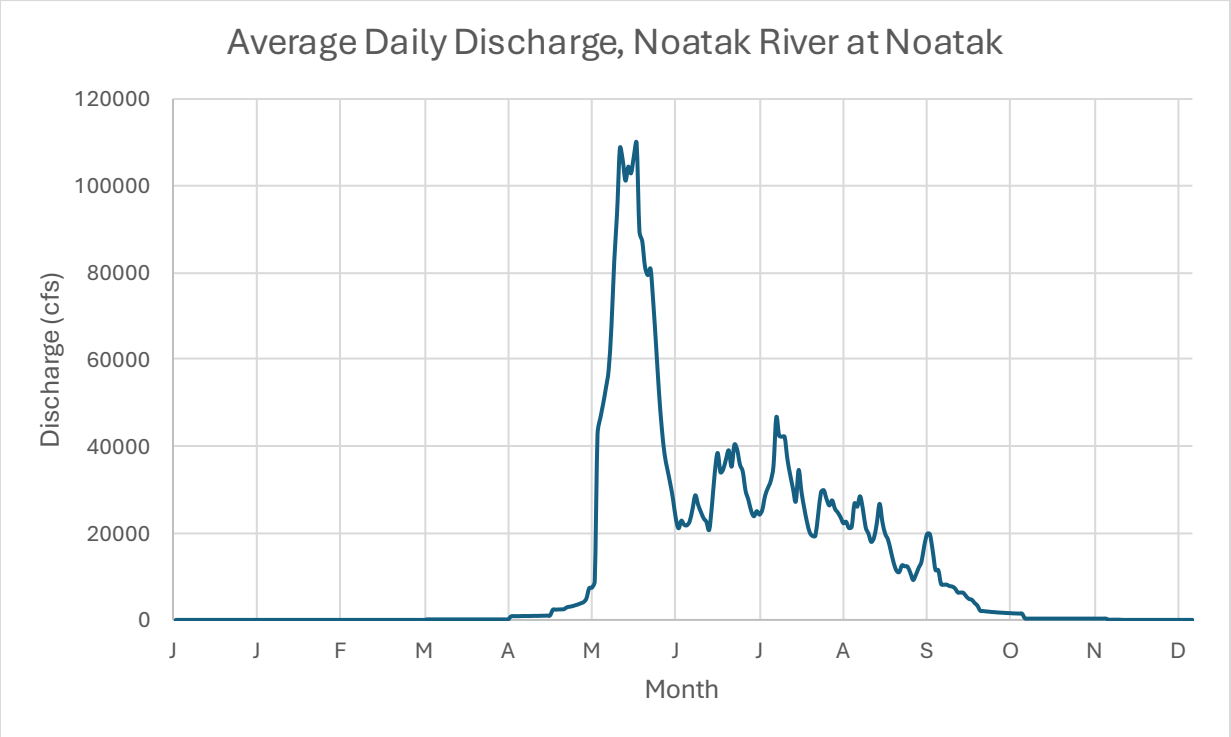


Figure 21: Average daily discharge for the USGS stream gauge at Noatak River at Noatak (August, 1965 to September, 1971).

Table 10: Annual average discharge for the USGS stream gauge at the Noatak River at Noatak.

Year	Discharge (cfs)
1965	19533
1966	11331
1967	35107
1968	25356
1969	31079
1970	10425
1971	28739
Average	23082

Table 11: Daily Mean High Flow Statistics

Watershed	Area (sq mi)	PRISM Avg	% Glaciers	Daily Mean High Flow Statistics by Duration (% Exceedence Probability)										
				O-S15	O-S10	O-S9	O-S8	O-S7	O-S6	O-S5	O-S4	O-S3	O-S2	O-S1
Alatna River - To Limit of Navigability	7.39	26.12	0%	15	21	23	25	27	30	33	38	43	52	70
Alatna River - To Weyahok River	76.99	29.93	0%	241	314	333	356	382	406	445	487	538	617	770
Alatna River - To Gaedeke Lake	1,022.33	30.29	0%	3,977	4,846	5,074	5,320	5,601	5,839	6,262	6,666	7,159	7,875	9,146
Alatna River - To Confluence with Koyukuk	3,499.97	25.04	0%	10,453	12,601	13,187	13,794	14,506	15,106	16,167	17,204	18,469	20,324	23,487
John River - Hunt Fork to Limit of Navigability	194.35	19.21	0%	285	379	406	437	474	511	566	630	711	842	1,095
John River - John River Fork to Limit of Navigability	372.79	18.27	0%	522	688	735	789	853	918	1,013	1,125	1,265	1,489	1,916
John River - Hunt Fork	538.97	19.48	0%	875	1,135	1,208	1,290	1,389	1,485	1,630	1,795	2,002	2,328	2,938
John River - To Confluence with Hunt Fork	625.22	18.26	0%	910	1,184	1,261	1,349	1,454	1,557	1,712	1,890	2,114	2,468	3,133
John River - To Confluence with Koyukuk River	2,705.23	19.36	0%	4,901	6,109	6,449	6,815	7,252	7,658	8,299	8,999	9,862	11,189	13,529
North Fork Koyukuk River - To Limit of Navigability	80.42	19.39	0%	112	153	164	178	194	210	235	263	300	360	478
North Fork Koyukuk River - To Limit of Navigability	80.42	19.39	0%	112	153	164	178	194	210	235	263	300	360	478
North Fork Koyukuk River - To Ernie Creek	257.00	18.41	0%	355	472	505	543	589	635	703	783	883	1,045	1,357
North Fork Koyukuk River - To End of Streamline	1,830.53	19.25	0%	3,185	4,012	4,244	4,499	4,801	5,087	5,532	6,024	6,632	7,576	9,266
Watershed	**Area (sq mi)**	**PRISM Avg**	**% Glaciers**	**Daily Mean High Flow Statistics by Duration (% Exceedence Probability)**										
				O-S15	O-S10	O-S9	O-S8	O-S7	O-S6	O-S5	O-S4	O-S3	O-S2	O-S1
Upper Ambler River - to Upper Limit of RDI Application	39.51	30.17	1.0%	120	158	168	180	194	208	229	252	281	325	412
Upper Ambler River - to limit of Area of Interest	132.46	28.26	1.6%	388	501	532	567	607	645	705	770	849	972	1,205
Watershed	**Area (sq mi)**	**PRISM Avg**	**% Glaciers**	**Daily Mean High Flow Statistics by Duration (% Exceedence Probability)**										
				O-S15	O-S10	O-S9	O-S8	O-S7	O-S6	O-S5	O-S4	O-S3	O-S2	O-S1
Upper Kobuk River - to Upper Limit of RDI Application	144.00	28.25	0.1%	424	547	579	617	661	702	767	836	922	1,054	1,304
Upper Kobuk River - to Walker Lake	198.52	26.97	0.1%	549	706	748	796	852	905	988	1,077	1,187	1,356	1,675
Watershed	**Area (sq mi)**	**PRISM Avg**	**% Glaciers**	**Daily Mean High Flow Statistics by Duration (% Exceedence Probability)**										
				O-S15	O-S10	O-S9	O-S8	O-S7	O-S6	O-S5	O-S4	O-S3	O-S2	O-S1
Upper Noatak River - to Upper Limit of RDI Application	94.50	35.60	1.8%	416	529	558	591	629	663	720	777	847	952	1,151
Upper Noatak River - to Portage	349.68	34.41	3.2%	1,593	1,967	2,063	2,170	2,291	2,395	2,577	2,750	2,963	3,271	3,838

Table 12: Average calculated monthly flow statistics.

Watershed	Low Duration Flows (by Month/%)																							
	JULY98	JULY95	JULY90	JULY85	JULY80	JULY70	JULY60	JULY50	AUG98	AUG95	AUG90	AUG85	AUG80	AUG70	AUG60	AUG50	SEPT98	SEPT95	SEPT90	SEPT85	SEPT80	SEPT70	SEPT60	SEPT50
Alatna River - To Limit of Navigability	2	2	3	4	4	5	6	7	2	2	3	3	4	5	6	7	2	2	3	4	4	5	6	7
Alatna River - To Weyahok River	37	44	53	61	68	84	98	114	31	40	50	58	64	78	93	112	36	43	52	61	68	81	94	109
Alatna River - To Gaedeke Lake	753	865	1027	1150	1255	1495	1680	1904	691	808	979	1091	1183	1377	1601	1881	776	895	1010	1145	1253	1453	1671	1897
Alatna River - To Confluence with Koyukuk	2301	2606	3070	3412	3695	4338	4830	5424	2216	2526	2968	3257	3494	4010	4633	5384	2415	2766	3093	3452	3743	4296	4880	5464
John River - Hunt Fork to Limit of Navigability	53	62	75	87	97	117	138	161	47	60	72	83	91	111	132	158	51	62	77	89	99	117	133	153
John River - John River Fork to Limit of Navigability	104	120	145	167	185	223	260	302	95	119	140	159	175	211	249	297	101	122	150	172	190	223	254	289
John River - Hunt Fork	176	204	244	279	309	371	429	494	163	200	236	267	293	350	411	487	174	208	251	288	316	370	421	478
John River - To Confluence with Hunt Fork	188	218	261	298	330	396	458	527	175	216	252	286	313	374	439	520	186	223	270	309	339	397	450	509
John River - To Confluence with Koyukuk River	1128	1282	1517	1704	1858	2189	2474	2802	1094	1280	1478	1634	1762	2050	2380	2778	1159	1352	1569	1758	1909	2202	2485	2778
North Fork Koyukuk River - To Limit of Navigability	19	23	28	32	37	45	53	63	17	22	27	31	35	43	51	61	18	22	28	33	37	44	51	59
North Fork Koyukuk River - To Limit of Navigability	19	23	28	32	37	45	53	63	17	22	27	31	35	43	51	61	18	22	28	33	37	44	51	59
North Fork Koyukuk River - To Ernie Creek	68	80	96	111	124	150	175	204	62	78	92	106	117	142	168	200	66	80	99	115	126	149	170	194
North Fork Koyukuk River - To End of Streamline	711	812	964	1087	1189	1408	1601	1821	682	808	937	1042	1128	1321	1538	1803	723	849	996	1122	1222	1414	1599	1794
Watershed	**Low Duration Flows (by Month/%)**																							
	JULY98	JULY95	JULY90	JULY85	JULY80	JULY70	JULY60	JULY50	AUG98	AUG95	AUG90	AUG85	AUG80	AUG70	AUG60	AUG50	SEPT98	SEPT95	SEPT90	SEPT85	SEPT80	SEPT70	SEPT60	SEPT50
Upper Ambler River - to Upper Limit of RDI Application	17	21	25	29	33	41	48	56	14	19	24	28	31	38	46	55	16	20	25	29	32	39	45	53
Upper Ambler River - to limit of Area of Interest	64	75	91	104	116	141	164	190	55	69	85	98	109	131	156	185	62	74	88	103	114	135	157	181
Watershed	**Low Duration Flows (by Month/%)**																							
	JULY98	JULY95	JULY90	JULY85	JULY80	JULY70	JULY60	JULY50	AUG98	AUG95	AUG90	AUG85	AUG80	AUG70	AUG60	AUG50	SEPT98	SEPT95	SEPT90	SEPT85	SEPT80	SEPT70	SEPT60	SEPT50
Upper Kobuk River - to Upper Limit of RDI Application	70	82	99	113	126	154	178	206	60	75	93	107	119	143	169	202	68	81	97	113	125	148	172	198
Upper Kobuk River - to Walker Lake	94	110	132	151	168	204	235	272	82	102	125	143	158	190	224	267	92	110	131	152	168	198	229	263
Watershed	**Low Duration Flows (by Month/%)**																							
	JULY98	JULY95	JULY90	JULY85	JULY80	JULY70	JULY60	JULY50	AUG98	AUG95	AUG90	AUG85	AUG80	AUG70	AUG60	AUG50	SEPT98	SEPT95	SEPT90	SEPT85	SEPT80	SEPT70	SEPT60	SEPT50
Upper Noatak River - to Upper Limit of RDI Application	63	74	89	102	114	139	160	186	53	66	83	96	106	128	153	180	61	72	85	99	111	131	153	178
Upper Noatak River - to Portage	272	316	378	426	469	565	640	731	238	286	355	402	439	518	616	710	270	314	360	413	456	533	619	711

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