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# **Instream Flow Protection in Alaska, 2020-2021**

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Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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<b>Weights and measures (metric)</b>		<b>General</b>		<b>Mathematics, statistics</b>	
centimeter	cm	Alaska Administrative Code	AAC	<i>all standard mathematical signs, symbols and abbreviations</i>	
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	$H_A$
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	$e$
hectare	ha	at	@	catch per unit effort	CPUE
kilogram	kg	compass directions:		coefficient of variation	CV
kilometer	km	east	E	common test statistics	(F, t, $\chi^2$ , etc.)
liter	L	north	N	confidence interval	CI
meter	m	south	S	correlation coefficient (multiple)	R
milliliter	mL	west	W	correlation coefficient (simple)	r
millimeter	mm	copyright	©	covariance	cov
		corporate suffixes:		degree (angular)	$^\circ$
<b>Weights and measures (English)</b>		Company	Co.	degrees of freedom	df
cubic feet per second	ft <sup>3</sup> /s	Corporation	Corp.	expected value	$E$
foot	ft	Incorporated	Inc.	greater than	>
gallon	gal	Limited	Ltd.	greater than or equal to	$\geq$
inch	in	District of Columbia	D.C.	harvest per unit effort	HPUE
mile	mi	et alii (and others)	et al.	less than	<
nautical mile	nmi	et cetera (and so forth)	etc.	less than or equal to	$\leq$
ounce	oz	exempli gratia (for example)	e.g.	logarithm (natural)	ln
pound	lb	Federal Information Code	FIC	logarithm (base 10)	log
quart	qt	id est (that is)	i.e.	logarithm (specify base)	log <sub>2</sub> , etc.
yard	yd	latitude or longitude	lat or long	minute (angular)	'
		monetary symbols (U.S.)	\$, ¢	not significant	NS
<b>Time and temperature</b>		months (tables and figures): first three letters	Jan, ..., Dec	null hypothesis	$H_0$
day	d	registered trademark	®	percent	%
degrees Celsius	°C	trademark	™	probability	P
degrees Fahrenheit	°F	United States (adjective)	U.S.	probability of a type I error (rejection of the null hypothesis when true)	$\alpha$
degrees kelvin	K	United States of America (noun)	USA	probability of a type II error (acceptance of the null hypothesis when false)	$\beta$
hour	h	U.S.C.	United States Code	second (angular)	"
minute	min	U.S. state	use two-letter abbreviations (e.g., AK, WA)	standard deviation	SD
second	s			standard error	SE
<b>Physics and chemistry</b>				variance	
all atomic symbols				population sample	Var
alternating current	AC			sample	var
ampere	A				
calorie	cal				
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity (negative log of)	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

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## ABSTRACT

This report summarizes instream flow protection and related activities of the Alaska Department of Fish and Game's (ADF&G) Instream Flow Program (IFP) during calendar years 2020 and 2021. The status of reservation of water (reservation) applications by other agencies and the public is also presented.

From 2020 to 2021, ADF&G filed 6 reservation applications for river reaches and was granted certificates of reservation for 7 river reaches, providing approximately 19 miles of fish habitat protection. Overall, ADF&G has filed reservation of water applications on 358 river reaches and 7 lakes. Certificates of reservation have been granted to ADF&G for 166 river reaches and 1 lake, and for 1 river and 1 lake under the water export provision, providing fish habitat protection for over 2,600 river miles and 2 lakes.

IFP staff performed 13 hydrologic investigations from 2020 to 2021. Investigations were performed primarily to obtain the necessary data to support reservation of water applications. IFP staff monitored 45 Federal Energy Regulatory Commission hydroelectric and hydrokinetic projects and served as ADF&G's representative for the Alaska Clean Waters Actions program, which funded 11 projects in state fiscal years 2021 to 2023.

Keywords: instream flow, reservation of water, fish habitat protection, Alaska Water Use Act, streamgage, Federal Energy Regulatory Commission, Alaska Clean Water Actions

## INTRODUCTION

The State of Alaska has abundant and diverse sport fisheries that are of considerable importance to anglers and others. To date, 20,503 water bodies in Alaska have been identified as supporting anadromous fish species (J. Giefer, Habitat Biologist, Alaska Department of Fish and Game, March 11, 2022, personal communication).

In 2020, an estimated 311,204 anglers fished 1,566,516 days and caught 2,174,746 fish in rivers and lakes throughout Alaska<sup>1</sup>. The continued production of these fishery resources depends, in part, upon sufficient amounts of good quality water to maintain seasonal fish habitat in rivers and lakes. Fish and other aquatic and terrestrial species have adapted to natural streamflows that provide essential seasonal habitats utilized by the various life stages of each species. Varying seasonal quantities of flowing waters and lake elevations are needed by fish using freshwater and estuarine habitats for migration, spawning, incubation, and rearing (Hynes 1970; Estes 1984; Hill et al. 1991; Poff et al. 1997; Bovee et al. 1998; Annear et al. 2004).

The Fish and Game Act requires the Alaska Department of Fish and Game (ADF&G) to “manage, protect, maintain, improve, and extend the fish, game and aquatic plant resources of the state in the interest of the economy and general well-being of the state” (AS 16.05.020). The act also enables ADF&G to use a variety of legal, regulatory, and administrative options to quantify and acquire water rights within lotic<sup>2</sup> and lentic<sup>3</sup> water bodies to sustain fish and wildlife resources (AS 16.05.050). Fish habitat permits (AS 16.05.841 and .871), issued by ADF&G's Habitat Section, are one of the tools that can be used to maintain sufficient amounts of water to protect fish habitat in lotic and lentic fish-bearing systems. For decisions that have the potential to impact a fish-bearing water body, ADF&G and the Alaska Department of Natural Resources (DNR) have

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<sup>1</sup> Alaska Sport Fishing Survey database [Internet]. 1996– . Anchorage, Alaska: Alaska Department of Fish and Game, Division of Sport Fish, cited March 14, 2022. Available from: <http://www.adfg.alaska.gov/sf/sportfishingsurvey/>.

<sup>2</sup> *Lotic* refers to flowing waters such as rivers and streams.

<sup>3</sup> *Lentic* refers to still waters such as lakes and ponds.

agreed to coordinate water right and fish habitat permits to ensure permit conditions are consistent.<sup>4</sup>

In 1980, Alaska's water law was amended to allow protection of instream flows in rivers and water levels in lakes, commonly referred to as Alaska's instream flow law. Alaska's water law treats the term *instream flow* more broadly than most states' jurisdictions do because the term may be used to refer to the rate or volume of flow in a river, the volume of water in a lake, or a related physical attribute such as water depth for identified resources and values. Water rights to retain water in lentic and lotic habitats can be acquired from DNR by a state or federal agency or the public for one or a combination of four purposes:

1. protection of fish and wildlife habitat, migration, and propagation;
2. recreation and park use;
3. navigation and transportation; and
4. sanitation and water quality.

Alaska's water law follows the prior appropriation doctrine, which assigns seniority of water rights in the order they are filed (Alaska Constitution, Article VIII, Section 13). Under Alaska's water law, an appropriation to retain water within a water body for any of these purposes may also be defined as a reservation of water (reservation, AS 46.15.145). The term *reservation* is often used to differentiate between retaining water within a lotic or lentic water body versus out-of-stream withdrawals. It is important to note that passage of the instream flow law expanded the meaning of appropriation in Alaska to represent all water right uses, including retention of water in lotic and lentic water bodies. However, an appropriation is still more commonly associated with out-of-stream and diversionary uses/water rights. Further information related to Alaska's instream flow law can be found in Curran and Dwight (1979), White (1982), Anderson (1991), Harle and Estes (1993), Spence (1995), and Burkardt (2000).

ADF&G created an Instream Flow Program (IFP) within the Division of Sport Fish (SF) to acquire reservations of water in priority fish-bearing water bodies. Over time, duties were expanded to address other instream flow related issues such as hydroelectric project licensing under the Federal Energy Regulatory Commission (FERC) and representation in the Alaska Clean Water Actions (ACWA) program. IFP staff also developed the capacity to collect hydrologic data to support reservation applications. This report summarizes ADF&G's Instream Flow Program activities from 2020 to 2021.

## **RESERVATIONS OF WATER**

To file for a reservation of water, an application must be completed, signed, and submitted to DNR with the appropriate application fee. Applications are prepared to comply with requirements established by state law (AS 46.15.145), state regulations (11 AAC 93.141-147), reservation of water application form instructions, and the *State of Alaska Instream Flow Handbook* (DNR 1985) when applicable. An applicant can apply for a reservation to secure their interest and obtain a priority date, and they will then have up to three years to collect any additional data; a 2-year extension can be obtained with approval from DNR (11 AAC 93.142 (4)). The following is an overview of the reservation process followed by ADF&G.

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<sup>4</sup> Memorandum from F. Rue, ADF&G Director of Habitat Section to G. Gustafon, DNR Director of Division of Land and Water Management, August 10, 1989, reaffirmed by ADF&G and DNR on December 16, 2009.

## **Prioritization of Candidate Sites for Reservations**

In the past, IFP staff relied upon regional work plans to identify candidate sites for reservations (Klein 2011). Recently, staff have exhausted the available U.S. Geological Survey (USGS) streamgage data for high priority sites contained within these work plans. This has led to IFP staff collecting hydrologic data to support reservation applications. Data collection is costly and resource intensive, so an updated prioritization model was needed to identify high-priority locations for instream flow protection.

IFP staff developed a model that uses a geographic information system (GIS)-based Multi-Criteria Decision Analysis to identify high-priority watersheds throughout the state. Watersheds were prioritized at the HUC10 level, delineating Alaska into 2,448 watershed units. Each watershed received a score based on available fish resource and environmental stressor data (Table 1). The highest-priority watersheds were located in highly productive salmon systems and areas with popular sport fisheries, especially within Southeast, Southcentral, and Southwest Alaska (Figure 1). A review of the 100 highest-priority watersheds in the model indicates substantial progress has already been made filing reservations on high-priority water bodies. IFP staff have worked in 72 of the top 100 watersheds. This updated model will help focus staff resources on high-priority water bodies that provide important fish habitat. A project report describing model development and results is currently being prepared.

Selection of final candidate sites will primarily be based on results of the prioritization model, amount of existing hydrologic records, importance of a water body to fishery resources, likelihood for water use conflicts, and the availability of other mechanisms<sup>5</sup> to provide instream flow protection.

## **Data Compilation, Collection, and Analysis**

A reservation application needs to include information that substantiates the amount of streamflow or level of water being requested for the selected purpose(s). Applications prepared by ADF&G include biological and hydrologic data to support requested streamflows. ADF&G collects and analyzes data according to accepted scientific methods and procedures that would meet evidentiary standards and any challenges<sup>6</sup> that may be filed.

### ***Biological Data***

A variety of sources were used to obtain information needed to document fish use in the selected water body. This information typically included fish distribution and periodicity<sup>7</sup> data that were summarized from ADF&G biologists, scientific literature, and the ADF&G Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes (also known as the Anadromous Waters Catalog).<sup>8</sup>

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<sup>5</sup> Other mechanisms may include fish habitat permits, water right permits, Clean Water Act permits (Section 401 Water Quality Certification, Section 402 National Pollution Discharge Elimination System, and Section 404 Dredge and Fill permits), Federal Power Act, and permits from land management agencies.

<sup>6</sup> Challenges may be filed by an aggrieved party to contest the validity of the data set, analyses, and rationale for the requested amount of water the department considers necessary.

<sup>7</sup> Seasonal use of habitat by species and life stage for passage, spawning, incubation, and rearing.

<sup>8</sup> See <https://www.adfg.alaska.gov/sf/SARR/AWC/index.cfm?ADFG=main.home>.

## ***Hydrologic Data***

DNR recommends a minimum of 5 years of continuous streamflow or lake level data to support water rights decisions, including reservation applications (Gary Prokosch, Chief Water Resources Section, DNR, April 26, 2005, personal communication). This 5-year recommendation is intended to reduce potential bias that may be associated with intra- and interannual hydrologic variability.

When available, USGS streamflow data were used to describe seasonal and long-term streamflow characteristics and quantify instream flow needs. When hydrologic data were limited or not available, IFP staff collected streamflow data in accordance with USGS standards (Rantz et al. 1982; Klein 2013). Streamflow records were computed using the Water Information System Kisters Incorporated (WISKI) hydrologic data management software after they were proofed for errors and transformed into a WISKI-compliant format. WISKI is a Windows-based professional time series hydrologic management system that meets USGS standards for data computation. Where less than 5 years of data were available, simple linear regression was used to extend the streamflow record if a suitable, long-term streamgage was available (Klein 2013). Streamflow records were analyzed using SAS statistical software.

## ***Instream Flow Analysis***

Under Alaska law, applicants are not required to use a specific method for quantifying instream flow needs (11 AAC 93.142; DNR 1985). The burden is on the applicant to choose and defend the approach used.

ADF&G used hydrologic-based approaches combined with fish use information to quantify instream flow needs for fish. These included analyses based on historic streamflow data (Annear et al. 2004) and a variation of the Tennant Method (Tennant 1976; Estes 1998) to account for local hydrologic and biological conditions. ADF&G recommended streamflow regimes similar to the magnitude and timing of the natural streamflows to maintain seasonal use of fish habitat.

Hydrologic characteristics of a river were used as the primary basis to delineate reaches. This information came from various sources, including USGS topographic maps, ADF&G Anadromous Waters Catalog, ADF&G Freshwater Fish Inventory<sup>9</sup>, and USGS National Hydrography Database<sup>10</sup>. Reach boundaries were selected to minimize differences in streamflow; major tributaries upstream and downstream of the streamgage site were generally selected as reach boundaries.

## **Adjudication**

Adjudication is the legal process of determining the validity and amount of a water right and includes the settlement of conflicting claims among competing appropriators of record (11 AAC 93.970(1)). During adjudication, DNR provides a 15-day public notice of the proposed reservation. If no further administrative actions are needed after all public comments are reviewed, DNR prepares a “Findings of Facts, Conclusions of Law and Decision” document that describes the information and rationale used for the decision and will issue a Certificate of Reservation. The certificate is recorded in the State Recorder’s Office and includes a description of the water right, any conditions placed on it, and the priority date that establishes the seniority of the water right.

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<sup>9</sup> See <http://www.adfg.alaska.gov/index.cfm?adfg=ffinventory.main>

<sup>10</sup> See <http://nhd.usgs.gov/data.html>

An appeal may be filed to the DNR Commissioner by any party who has standing, with an option to seek further remedy through Alaska’s court system.

In 2002, a Memorandum of Understanding was signed between DNR and ADF&G to address the increasing backlog of reservation applications and to improve the efficiency of the overall process. Part of the agreement was for ADF&G to partially fund a position at DNR to adjudicate applications. However, due to budget cutbacks this funding was eliminated, which means ADF&G is now required to pay reservation application filing fees. Other provisions of the agreement remain in effect.

DNR has recently begun conducting 10-year reviews of granted reservations as per AS 46.15.145(f). These reviews follow the same process as described above to determine whether the purpose for the reservation and the findings still apply.

## **ACTIVITIES**

### **RESERVATIONS OF WATER**

From 2020 to 2021, ADF&G filed six reservation applications (Table 2; Figures 2 and 3). ADF&G received 7 certificates of reservation, which provided instream flow protection for approximately 19 river miles of fish habitat (Table 3; Figures 4 and 5).

DNR also initiated 10-year reviews on reservations granted, beginning with the oldest certificates. DNR completed 6 reviews from 2020 to 2021 for the following water bodies: Terror River, Little Survival Creek, Little Rabbit Creek, Rabbit Creek, Willow Creek, Indian River, and Cottonwood Creek.

### **HYDROLOGIC INVESTIGATIONS**

Hydrologic investigations were performed on 13 projects by IFP staff in 2020 and 2021. The primary objective was to obtain sufficient streamflow data to support reservation of water applications. Investigations are summarized below and shown in Figures 6 and 7.<sup>11</sup>

#### ***Nushagak River Watershed Streamgaging Network***

The Nushagak River watershed is located in Southwest Alaska. The hub community for the region is Dillingham, located at the mouth of the Nushagak River. Tributaries that flow into the Nushagak River near the village of Ekwook (upstream from Dillingham between river mile 50 and 120) were selected for this hydrologic investigation (Figure 6). To collect the hydrologic data necessary for reservation applications, a streamgaging network was established across 7 sub-watersheds that flow into the Nushagak River (Klein 2013).

For this project, ADF&G contracted the USGS to establish an index streamgaging station on the mainstem of the Kokwok River (USGS #15302812) in October 2016. In addition, 9 discharge measurement (DM) stations were also established, 4 operated by ADF&G and 5 operated by USGS.

DM data were collected at Klutuk, Lower Klutuk, Koklong, and Koggiling Creeks. All but Koggiling Creek have a robust correlation with the Kokwok River streamgaging station. Reservation applications will be filed on the 3 remaining sites.

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<sup>11</sup> For more information on any of these projects, see ADF&G’s e-library (<http://www.adfg.alaska.gov/sf/publications/>) for copies of operational plans and/or Fishery Data Series reports.

Data collection is nearly finished at the DM stations operated by the USGS. Data collection is complete on the Kokwok River unnamed tributary, and mainstem Iowithla River and adjacent unnamed tributary. Of these sites, all but the unnamed Iowithla River tributary have a robust correlation with the Kokwok River streamgage.

One more season of data collection remains for Napotoli Creek and an adjacent unnamed tributary. After 5 discharge measurements, both of these sites correlated strongly with the Kokwok River streamgage.

The Kokwok River index streamgage has operated for 5 full water-years and will continue to operate through at least September 2022 to allow for final data collection at the Napotoli Creek DM sites.

Collectively, these waterways provide more than 130 miles of anadromous waters and support populations of Chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), sockeye (*O. nerka*), chum (*O. keta*), and pink (*O. gorbuscha*) salmon, as well as Arctic char (*Salvelinus alpinus*).

### ***Petersville Road Streamgage Network***

The Susitna River watershed is located approximately 25 miles northwest of Anchorage across Cook Inlet in Southcentral Alaska. For this project, tributaries that are accessible via Petersville Road on the west side of the Susitna River watershed were selected. An index streamgage has been operated by USGS on Kroto Creek (USGS #15294080) since May 2017.

ADF&G measured streamflow at 11 DM stations on tributaries to the Susitna River: Martin Creek, Peters Creek, Kenny Creek, Twentymile Creek, upper Kroto Creek, Seventeenmile Creek, Gate Creek, East Fork Ninemile Creek, West Fork Ninemile Creek, Cottonwood Creek, and Whistling Lake tributary/Twin Creek (Figure 6). Collectively, these creeks provide approximately 200 miles of anadromous waters that support populations of Chinook, coho, sockeye, chum, and pink salmon.

Field work was mostly completed by the end of 2019. During the 2020 and 2021 field seasons, ADF&G collected 1 to 3 instantaneous discharge measurements at 6 of the DM stations to complete data collection at all stations except Martin Creek. DM station streamflows correlated strongly to the Kroto Creek streamgage for 9 of the 11 Susitna River tributaries. It is anticipated that reservation applications will be filed for these 9 sites in 2022.

### ***Glenn Highway Streamgage Network***

The Matanuska River watershed is located approximately 50 miles northeast of Anchorage in Southcentral Alaska (Figure 6). A streamgage has been continuously operated by USGS on Moose Creek (USGS #15283700) a tributary to the Matanuska River since September 21, 2007. In early 2017, two DM stations were established by ADF&G on nearby tributaries to the Matanuska River that were expected to correlate with the Moose Creek streamgage: Granite Creek and Kings River. These two tributaries provide approximately 20 miles of anadromous waters that support populations of Chinook, coho, and chum salmon.

In 2020, ADF&G completed this project. Streamflows at both Granite Creek and Kings River sites correlated strongly with the USGS Moose Creek streamgage. Reservation applications for Kings River were submitted to DNR in 2019, and the application for Granite Creek was submitted in 2020.

### ***Little Susitna River near Houston***

The Little Susitna River is located approximately 30 miles north of Anchorage in the Matanuska Valley (Figure 6). The river has approximately 90 miles of anadromous waters and supports populations of Chinook, coho, pink, chum, and sockeye salmon; rainbow trout (*O. mykiss*); Dolly Varden (*Salvelinus alpinus*); and Arctic grayling (*Thymallus arcticus*).

The Little Susitna River drains out of the Talkeetna Mountains and flows about 100 miles from its headwaters to its outlet in Upper Cook Inlet. The watershed has a drainage area of approximately 350 mi<sup>2</sup>. DNR has issued instream flow reservations to ADF&G for the middle and upper portions of the river; these reservations cover 40 miles from the upstream limit of anadromous use down to the Parks Highway bridge.

ADF&G installed streamgage #14901 on the Little Susitna River at the Parks Highway bridge in 2017. This streamgage operated until October 14, 2020. Site visits were made to the streamgage 8 times during 2020 to download transducer data, take discharge measurements, survey the water surface elevation, and perform routine streamgage maintenance. It is anticipated that a reservation application for the lower portion of the river (downstream from the Parks Highway bridge) will be filed with DNR in 2022.

### ***Lower Kenai Peninsula Streamgage Network***

Stariski Creek and Anchor River are located near Anchor Point on lower Kenai Peninsula, approximately 15 miles north of Homer (Figure 6). Stariski Creek flows approximately 25 miles from its headwaters in the Caribou Hills to its mouth in Cook Inlet with a 50 mi<sup>2</sup> watershed of primarily lowlands. The Anchor River flows over 45 miles from the Caribou Hills to Cook Inlet; it has a watershed of approximately 225 mi<sup>2</sup> composed of both lowlands and more rugged terrain with elevations over 2000 ft.

In 2011, ADF&G filed a reservation of water application on Stariski Creek; however, this application was lacking some hydrologic data for the winter months. To fill this data gap, ADF&G streamgage #11601 was re-established on Stariski Creek in July 2018. This streamgage operated until October 29, 2020, and served as an index streamgage for additional DM stations. Site visits were made to the streamgage 7 times during 2020 to download transducer data, take discharge measurements, and perform routine streamgage maintenance. The data collected will allow for the adjudication of the previously filed application.

In addition to the streamgage, ADF&G established 6 DM stations in the lower Kenai Peninsula area: Stariski Creek at Sergeant Avenue (8.5 miles upstream from the streamgage), Two Moose Creek, Anchor River, 2 locations on the North Fork Anchor River, and an unnamed tributary to Chakok River. These water bodies provide habitat for Chinook, coho, sockeye, chum, and pink salmon. Collectively, discharge measurements at these locations could lead to instream flow reservations on up to 64 miles of fish habitat.

During the 2020 field season, ADF&G completed data collection at 5 of the 6 DM stations. It is anticipated that reservation of water applications will be filed for these sites in 2022.

### ***Nome Area Streamgage Network***

The USGS operated a streamgage (USGS #15621000) on the Snake River near Nome from 1965 to 1991. This project uses that long-term data series to characterize flows of other rivers that flow out of the Kigluaik Mountains in the Nome area (Figure 6). In 2020, USGS reinstalled the

streamgage on the Snake River, and ADF&G established DM stations on 5 nearby rivers flowing into Norton Sound: Sinuk River, Cripple River, Penny River, Anvil Creek, and Nome River. Together these rivers provide over 120 miles of fish habitat that support populations of Chinook, coho, chum, sockeye, and pink salmon.

During the 2020 and 2021 field season, ADF&G collected 7 discharge measurements at each DM station (2 in 2020 and 5 in 2021). Data collection will continue until a minimum of 10 measurements are collected at each location. It is anticipated reservation of water applications will be filed for these sites in 2023 or 2024.

### ***Quartz Creek Streamgage Network***

The Quartz Creek watershed is located near Cooper Landing on the central Kenai Peninsula and lies within the boundaries of Chugach National Forest (Figure 6). The watershed drains an area of approximately 50 mi<sup>2</sup> and contains over 23 miles of anadromous fish habitat. The Quartz Creek drainage, which is part of the Kenai River watershed, provides productive spawning and rearing habitat for Pacific salmon and is a popular sport fishing destination for fly anglers. Additionally, Tern Lake, a marshy lake in the watershed that is located at the intersection of 2 main highways, offers excellent nature viewing opportunities that attract tourists and locals.

Notable fish species in this watershed include Chinook, coho, sockeye, chum, and pink salmon, as well as rainbow trout, Dolly Varden, and whitefish (*Coregonus sp.*). The U.S. Fish and Wildlife Service operated a weir near the mouth of Quartz Creek during the years 2013–2015 (Gates and Boersma 2014a, 2014b, 2016). The weir was only operational during a 2- to 3-month period in the early summer because the primary goal was enumerating Chinook salmon from the early-run Kenai River population. During those 3 years, a total of 1,053 Chinook salmon, 111,458 sockeye salmon, 536 pink salmon, 217 coho salmon, 6 chum salmon, 19,327 Dolly Varden, 1,074 rainbow trout, 22 Arctic grayling, and 362 round whitefish (*Prosopium cylindraceum*) passed by the weir.

During the summer of 2018, ADF&G established the Quartz Creek streamgage network consisting of 2 index streamgages and 6 DM stations. The streamgages are located on Quartz Creek (ADF&G #15301) and at the outlet of Tern Lake, which flows into Daves Creek (ADF&G #15201). There are 2 additional DM stations on Quartz Creek, and 4 stations are located on tributaries to Quartz Creek (Johns Creek, Summit Creek, Dry Creek, and an unnamed tributary).

Since the establishment of the streamgage network, ADF&G has completed 35 site visits to the Tern Lake/Daves Creek streamgage and 32 visits to the Quartz Creek streamgage to download transducer data, take discharge measurements, and perform routine streamgage maintenance. An additional 46 discharge measurements were performed between the 6 DM stations. Spawning salmon were observed at 2 previously undocumented locations and have been added to the Anadromous Waters Catalog. The 2 streamgages will continue to operate until at least October 2023. It is anticipated that preliminary reservation of water applications will be filed on 4 of the study rivers in 2022.

### ***Aniak River Streamgage Network***

In 2019, a hydrologic investigation was initiated on the Aniak River with funding support from the Alaska Sustainable Salmon Fund. The Aniak River watershed is located near the city of Aniak in the Yukon-Kuskokwim Delta, approximately 100 miles northeast of Bethel (Figure 6). The Aniak River flows north approximately 95 miles from its headwaters draining the Kilbuck and Kuskokwim Mountains through lowlands and tundra to its mouth with the Kuskokwim River,

1 mile upstream from the community of Aniak. The Aniak River watershed supports all 5 species of Pacific salmon and resident species including rainbow trout, Dolly Varden, northern pike (*Esox Lucius*), Arctic grayling, burbot (*Lota lota*), sheefish (*Stenodus leucichthys*), lake trout (*Salvelinus namaycush*), whitefish, longnose suckers (*Catostomus catostomus*), blackfish (*Dallia pectoralis*), and slimy sculpin (*Cottus cognatus*; Lafferty and Bingham 2002).

IFP staff installed an index streamgage on the Aniak River (ADF&G #15801) in June 2019 and have since visited the streamgage 16 times to download transducer data, collect discharge measurements, survey water surface elevation, and perform routine streamgage maintenance. This included 2 winter visits during which under-ice streamflow was measured.

In addition to the streamgage, ADF&G established 5 DM stations within the Aniak River watershed: Doestock Creek, Buckstock River, Salmon River, Kipchuk River, and upper Aniak River. Two additional DM stations were established in coordination with the USGS on the Holitna and Stony Rivers, which flow into the mainstem Kuskokwim River upriver from Aniak. Data collection efforts are shared between both agencies.

After 4 to 8 visits to each DM station within the Aniak River watershed, all sites have a strong correlation to the Aniak River streamgage except Doestock Creek. After 6 to 7 discharge measurements, preliminary data analysis indicates the Holitna and Stony Rivers correlate with the USGS operated streamgage at Crooked Creek (USGS #15304010).

A reservation was filed for approximately 31.4 miles of the mainstem of the Aniak River in November 2021 based on 2 years of streamgage data and will be updated once 5 years of data collection is complete.

Data collection is anticipated to continue through 2024. The project will protect over 200 miles of fish habitat.

### ***Davies Creek near Juneau***

Davies Creek, a tributary to Cowee Creek, is located 40 miles northwest of Juneau in Southeast Alaska (Figure 7). From its headwaters, Cowee Creek flows northwest 8 miles to Berners Bay. South Fork Cowee Creek and Davies Creek enter the mainstem from the south and north, respectively. Land ownership within the drainage is fragmented between U.S. Forest Service (USFS), state, private, and Goldbelt Native Corporation. The USFS manages 88% of the land within the watershed as the Heen Latinee Experimental Forest (HLEF; USFS 2009). The HLEF is located mostly in the upper portions of the watershed, whereas the lower portion of the watershed is managed by the State of Alaska as Point Bridget State Park. A popular public use cabin named Cowee Meadow is located within the park and is accessible from the Glacier Highway by a 2.5-mile trail. Cowee and Davies Creeks support populations of coho, pink, and chum salmon; steelhead trout; cutthroat trout; and Dolly Varden char.

The USGS operated a streamgage (USGS #15054990) at Davies Creek for 3 years from October 1, 1969, to September 29, 1972. ADF&G staff installed a new streamgage (ADF&G #11404) at Davies Creek on September 21, 2018, approximately 0.5 river miles upstream of the former USGS streamgage. This new streamgage will operate until October 1, 2023, and collect an additional 5 years of streamflow data on Davies Creek. Discharge measurements are also being collected concurrently on Cowee Creek upstream of Davies Creek (DM station #11403).

The 3 years of streamflow data from the USGS gage and 5 years of new data will be combined to create an 8-year period of record for Davies Creek. Since the streamgage was installed in 2018, 13

discharge measurements have been collected concurrently at each station. Following the completion of data collection in 2023, the streamflow data will be analyzed, and 2 reservation applications will be filed with DNR.

### ***Eva Creek near Sitka***

Eva Creek near Sitka drains out of Lake Eva and flows approximately 0.7 river miles in an easterly direction before entering Hanus Bay (Figure 7). An inlet stream, also referred to as Eva Creek, enters on the west end of Lake Eva, and 2 smaller unnamed inlet tributaries enter the lake on the north side. The watershed has a drainage area of approximately 20 mi<sup>2</sup>. A well-maintained trail on the south side of Eva Creek extends from Hanus Bay to the outlet of Eva Lake.

The Eva Creek watershed supports populations of coho, pink, chum, and sockeye salmon; steelhead; cutthroat trout; and Dolly Varden char. ADF&G operated a fish weir on Eva Creek in the springs and summers of 1963, 1964 and 1995. During the operation of the weir from April 14 to July 31, 1995, a total of 7,605 sockeye salmon, 117,821 Dolly Varden char, 2,535 cutthroat trout, 347 chum salmon, 173 pink salmon, 2 rainbow trout, and 17 steelhead trout were counted (Yanusz 1996). ADF&G has also conducted pink salmon counts on Eva Creek using aerial and foot surveys.

Eva Creek, downstream of Lake Eva, has historically been important to fish, wildlife, and people. Large migrations of sockeye, coho, and pink salmon have provided important subsistence harvests. Sport fishing within the Eva Creek watershed increased after the Eva Creek trail was constructed in 1924. Since 1980, approximately 3 floatplane flights per week drop off and pick up visitors at the Eva Lake USFS public use cabin. This cabin is rented nearly every day between June and October (Van Dyke 2003). In recent years, the Eva Creek watershed and trail have become a popular destination for passengers aboard small cruise ships. Hanus Bay provides a secure anchorage for the small cruise ships, and Eva Creek, Lake Eva, and the trail provide passengers ample opportunity to view spawning salmon, wildlife, and Southeast Alaska scenery. Approximately 2,000 people visit Eva Creek during the spring and summer months (Van Dyke 2003).

ADF&G installed streamgage #13901 at the Lake Eva outlet on August 16, 2016. Site visits were made to the streamgage 10 times during 2020 and 2021 to download transducer data, take discharge measurements, and perform routine streamgage maintenance. This streamgage was in operation until decommissioned on October 7, 2021.

A reservation of water application will be finalized at the completion of streamflow records computation, to protect 0.7 miles of Eva Creek from the mouth upstream to Lake Eva.

### ***Freshwater Creek near Hoonah***

Freshwater Creek, Kennel Creek, and Pavlof River are adjacent watersheds that are located in the northeast portion of Chichagof Island, within the coastal rainforest of Southeast Alaska. All three watersheds drain into Freshwater Bay, approximately 14 miles southeast of Hoonah (Figure 7).

Freshwater Creek flows out of the mountains in a generally easterly direction for approximately 10 miles before emptying into Freshwater Bay. Many tributaries flow into Freshwater Creek along its route to saltwater, including the North Fork Freshwater Creek at river mile (RM) 1.2, and an unnamed tributary at RM 2.55. USFS Road 8508 travels out of Hoonah roughly parallel to the upper reaches of the North Fork Freshwater Creek and crosses Freshwater Creek at RM 2.5. A system

of other seasonally maintained roads provide access to the Freshwater Creek tributaries and nearby Kennel Creek and Pavlof River.

Freshwater Creek, Kennel Creek, and Pavlof River support populations of coho, pink, and chum salmon, cutthroat trout, and Dolly Varden char. In addition, Freshwater Creek supports a population of steelhead trout and Pavlof River supports a population of sockeye salmon. Combined, the 3 watersheds provide more than 37 river miles of anadromous fish habitat.

ADF&G has operated streamgage #14801 on Freshwater Creek since September 21, 2017. Site visits were made to the streamgage nine times during 2020 and 2021 to download transducer data, take discharge measurements, and perform routine streamgage maintenance.

In 2017, DM stations were established on North Fork Freshwater Creek, Kennel Creek, Pavlof River, and on Freshwater Creek above Streamgage #14801. During 2020 and 2021, one to three discharge measurements were collected at each DM station.

Streamgage #14801 and all the DM stations will remain in operation until October 2022. Reservation of water applications will be finalized at the completion of data collection, to protect over 9 miles of Freshwater Creek from the mouth upstream. If the correlations between Streamgage #14801 and the DM stations remain robust, reservation of water applications will be completed for these stream reaches.

### ***Luck and Control Creeks on Prince of Wales Island***

Luck Creek and Control Creek are part of the Central Prince of Wales (POW) Island streamgage network in Southeast Alaska (Figure 7). Nearby communities include Coffman Cove to the northeast, Thorne Bay to the southeast, Klawock to the southwest, and Naukauti to the northwest.

Luck Creek flows approximately 7 river miles in a northeasterly direction from its headwaters in the central POW mountains before emptying into Luck Lake. The outlet of Luck Lake is named Eagle Creek and flows 1.7 miles before emptying into Clarence Strait. Luck Creek, Luck Lake, and Eagle Creek support populations of coho, sockeye, chum, and pink salmon; cutthroat and steelhead trout; and Dolly Varden char. Most of the Luck Creek watershed is composed of high gradient terrain and mountain peaks exceeding elevations of 2,500 ft. Streamgage and DM stations within this watershed are located within medium floodplain channels with gravel and cobble substrate and bankfull widths of approximately 40–100 ft.

Control Creek is 15 miles southwest of Luck Lake and flows approximately 3.5 river miles in a northeasterly direction out of Control Lake to its confluence with an unnamed tributary. Control Creek supports populations of coho salmon, sockeye salmon, and Dolly Varden char. Most of the Control Creek watershed is composed of low-gradient muskegs, lakes, and ponds. The streamgage and DM stations within this watershed are located within medium floodplain channels with gravel and cobble substrate and a bankfull width of approximately 100 feet. Control Creek offers angling opportunity as well as great recreational opportunity. A public use cabin is located upstream on Control Lake, and a campground and hiking trail system are located downstream on Balls Lake.

ADF&G installed streamgage #15401 on Luck Creek and streamgage #15701 on Control Creek on August 29, 2018. During 2020 and 2021, 6 site visits were made to the Luck Creek streamgage and 8 site visits were made to the Control Creek streamgage to download transducer data, take discharge measurements, and perform routine streamgage maintenance.

DM stations were also established in 2018 on the west fork of Luck Creek, Eagle Creek, Ratz Creek, and Logjam Creek. During 2020 and 2021, 3 or 4 discharge measurements were collected at each DM station.

Streamgages #15401 and #15701 and all DM stations will remain in operation until October 2023. Reservation of water applications will be finalized at the completion of data collection to protect 4.5 miles of Luck Creek and 1.2 miles of Control Creek. If robust correlations are found between the streamgage and the discharge stations, reservations will be completed for the stream reaches with DM stations.

## **FERC HYDROELECTRIC PROJECT LICENSING**

The Federal Energy Regulatory Commission (FERC) administers the Federal Power Act (FPA), which governs the regulation of hydroelectric projects in the United States, among other duties. FERC issues licenses that specify how projects will be constructed and operated, including any protection, mitigation, and enhancement requirements. FERC licenses specify how streamflows will be allocated between energy generation and other beneficial uses recognized by the FPA and other applicable laws (Roos-Collins and Gantenbein 2005). The FPA affords considerable weight and due deference to ADF&G as the state’s fish and wildlife agency. If FERC does not accept all of ADF&G’s recommendations, they must attempt to resolve any such inconsistency, giving due weight to the department’s authority and expertise. Each project is unique, requiring reviews and analyses specific to affected resources.

Prior to 1998, ADF&G’s review of FERC hydroelectric projects was handled on a regional basis. To provide better consistency and interdepartmental coordination, a position was created within the IFP to oversee statewide coordination efforts for all FERC jurisdictional projects and to ensure all legal and administrative requirements are met in a timely manner. Non-FERC hydroelectric projects are reviewed by ADF&G Habitat Section staff.

Under the FERC process, applicants obtain a preliminary permit that gives them the exclusive right to study the project’s feasibility. ADF&G plays an important role in assisting the applicant to obtain fish and wildlife information needed for project review. If an applicant is interested in pursuing the project, a license application is submitted before the end of the Preliminary Permit term. From 2020 to 2021, IFP staff monitored 45 FERC hydroelectric and hydrokinetic projects (Table 4).

## **ALASKA CLEAN WATER ACTIONS**

Alaska contains more than 40% of the nation’s surface water resources<sup>12</sup>. The majority of these water bodies are considered pristine, although with over 3 million lakes and more than 12,000 rivers, it is impossible to assess them all. Still, Alaska is bound by national laws and policies, such as the Clean Water Act, and is required to assess and report on the status of the state’s waters. To aid in this endeavor, the Alaska Clean Water Actions (ACWA) program was created through Alaska Administrative Order 200 and brings together the 3 state resource agencies—Alaska Department of Environmental Conservation (DEC), ADF&G, and DNR—to characterize Alaska’s waters in a holistic manner that includes the sharing of relevant data and expertise. Each agency is

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<sup>12</sup> <https://dnr.alaska.gov/mlw/water/> accessed April 5, 2022.

responsible for collecting and assessing water body information related to its expertise: ADF&G assesses aquatic habitat, DEC assesses water quality, and DNR assesses water quantity.

The ACWA team maintains an interagency database of water bodies throughout the state, which are ranked based on current water quality, water quantity, and aquatic habitat information. In 2021, the database was updated and improved through the creation of a GIS-based watershed prioritization model. This model helps to identify high-priority water bodies that may be eligible for project funding through the ACWA grant solicitation process. ACWA grants are awarded every 2 years for projects that cover a 2-year period. Eligible projects are those that restore, protect, or conserve water quality, water quantity, and aquatic habitat on prioritized waters.

During the last grant cycle, ACWA awarded \$470,000 in grants to 11 projects throughout the state, which included \$419,000 in matching contributions (Table 5). These projects are funded from March 2021 through February 2023. Funding sources for ACWA grants included Environmental Protection Agency Clean Water Act Section 319 funding (nonpoint source management) and DEC Clean Vessels and Beaches Environmental Assessment and Coastal Health Act funding.

ADF&G in cooperation with DEC and Kenai Watershed Forum (KWF), established an information booth on Kenai's North Beach to help educate dipnetters about beach health and fishing regulations during the personal use fishery on the Kenai River. This booth continues to operate annually in July, with the majority of booth staff composed of volunteers from KWF's Stream Watch program. Visitors to the booth have access to information on proper disposal of fish waste, fishing regulations, fish identification, tides, weather, and up-to-date fish counts and commercial openers. In 2020, the booth operated on 9 days throughout the fishery (July 10-31), with an average of 43 visitor interactions per 4-hour shift. In 2021, the booth operated on 16 days during the fishery, with an average of 60 visitor interactions per 4-hour shift. The information booth has been successful at engaging a wider audience of dipnetters, establishing an agency presence on the North Beach, and developing educational materials and signage.

## **DISCUSSION**

### **RESERVATIONS**

From 2020 to 2021, ADF&G filed 6 reservations and was granted 7 certificates, providing approximately 19 miles of fish habitat protection. DNR initiated and completed 10-year reviews on 6 reservation certificates.

To date, ADF&G has filed reservation applications on 358 river systems and 7 lakes. Certificates of reservation have been granted to ADF&G for 166 river reaches and 1 lake, and for 1 river and 1 lake under the water export provision<sup>13</sup> (Table 6). Overall, ADF&G has protected over 2,600 miles of streams and 2 lakes.

There are various reasons for the decline in reservations filed and granted in last few years. For one, a lack of available streamflow and lake data has led to more staff time and resources being allocated towards hydrologic data collection in order to obtain the necessary data to file reservations. Operating a streamgage is typically a 5-year commitment, unless there is already a short-term record and a suitable, concurrently operating USGS streamgage nearby that can be used

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<sup>13</sup> Water exported from 1 of the 6 defined hydrologic units requires a mandatory reservation to protect fish resources (AS 46.15.035).

to extend the hydrologic record. Additionally, the ongoing pandemic, budget cuts, and 10-year reviews have further limited IFP staff ability to file and adjudicate reservations.

To optimize staff time and resources for hydrologic data collection, IFP staff typically use a streamgaging network approach. This approach uses an index streamgauge (either USGS or ADF&G) and semi-permanent DM stations to extend streamgauge records on semi-permanent stations. In remote areas of the state, IFP staff rely on grants and cooperators to assist with projects. These collaborations, based on shared strategic priorities, help with funding and project logistics.

## **HYDROLOGIC DATA NEEDS**

The primary purpose for the hydrological investigations is to obtain the necessary data to support reservation applications. Investigations are based out of ADF&G's Anchorage and Douglas offices.

The paucity of hydrologic data throughout most of Alaska limits ADF&G's ability to acquire reservations of water (Brabets 1996; Estes 1998). Although Alaska has approximately 40 percent of the nation's surface water resources, only 111 streamgages were operating in Alaska in 2021.<sup>14</sup> This represents approximately one streamgauge site per 5,500 mi<sup>2</sup>, which contrasts significantly with the western United States where there is approximately one streamgauge per 400 mi<sup>2</sup>.

Baseline hydrologic data are needed by water resource agencies and water users for planning and management. Accurate estimates of available streamflows and lake elevations are needed for project designs, management of water rights, and environmental analyses. Obtaining these data can be difficult and expensive because of challenges that include Alaska's limited road systems, extreme weather conditions, and the loss of equipment to bears and other wildlife.

Without baseline hydrologic data, models must be used to estimate seasonal and long-term streamflow characteristics. On streams with limited or no streamflow data, using hydrologic models to predict long-term or seasonal flow characteristics is difficult and often produces estimates with high uncertainty. Furthermore, it is more time-consuming to estimate streamflow characteristics for streams with limited or no data than it is to summarize data for a stream with an adequate hydrologic record.

To address the need for streamflow and lake data, IFP staff use 3 approaches. First, more staff resources are dedicated to hydrologic investigations to collect the streamflow and lake data. Second, partnerships and funding opportunities are explored to leverage our resources and increase hydrologic data collection. Finally, funding for streamgaging efforts are commonly leveraged with USGS to maximize the amount of streamflow data collected. Altogether, these efforts have enabled IFP staff to meet program objectives and provide instream flow protection for Alaska's fish and wildlife resources.

## **FERC HYDROELECTRIC LICENSING ACTIVITIES**

In a 2019 FERC-issued project license for the Grant Lake Hydroelectric Project, Commission staff ruled that no post-construction fish population monitoring was required, despite the fact that both the project applicant and the resource agencies proposed post-operation fish monitoring for the project. The reasons provided for FERC's decision were that "The proposed fishery monitoring efforts [did] not provide direct benefits to the fishery, and it [was] not clear how the proposed fish

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<sup>14</sup> <https://waterdata.usgs.gov/ak/nwis/sw> accessed December 30, 2021.

monitoring would inform project-related matters” (FERC 2019). In the past, monitoring of fish populations after a hydropower project becomes operational has been an important action to verify the effectiveness of environmental measures adopted to protect fish. Monitoring allows ADF&G to fulfill part of its mission to protect and maintain the fish resources of the state. With the decision in the FEIS for the Grant Lake Project, FERC appears to be setting a precedent that will limit the possibilities of fish population monitoring during the operational phase of hydropower projects.

## **RECOMMENDATIONS**

More hydrologic information on seasonal and long-term streamflows are needed throughout Alaska. Ideally, more streamgages should be installed, but also new technologies should be explored, such as models that use existing streamflow/environmental data, remote sensing techniques, and satellite imagery.

The relationship between instream flows and fish productivity needs to be more intensively researched. Ideally, investigations should be conducted over multiple life cycles and in areas not significantly influenced by human activities. Naturally occurring fish populations and the amount of available versus utilized habitat should be monitored to better understand fish habitat preferences. Research is needed on key environmental parameters (e.g., relation of upwelling/downwelling to spawning fish, effects of water temperature variability on fish activity and development, influence and effects of turbidity on aquatic organisms) and the interrelationship of environmental parameters to productivity.

Out-of-stream appropriations should be reviewed by DNR once every 10 years, similar to reservations of water. This would allow DNR to better manage Alaska’s water resources and minimize or avoid water use conflicts.

Instream flow education, training, and outreach should be strengthened within the department and interested stakeholders. A fundamental goal commonly identified by instream flow practitioners is to achieve public recognition of the importance of maintaining instream flows and lake levels to sustain healthy fish populations. A key step toward achieving this goal is comprehensive outreach and incorporation of instream flow concepts and activities into education programs and school systems.

Dedicated funding to the ACWA grant pool is needed to continue to address stewardship of Alaska’s water bodies. Information about aquatic habitat issues is also needed to improve the ACWA database. Information can range from fish habitat concerns to documented habitat degradation and can include field data, reports, or photographs.

Overall, the objective is to sustain a balance between water uses and sufficient instream flows so that economic vitality, fish and wildlife, and environmental health, safety, and welfare can be achieved and maintained for future generations. A healthy ecosystem is the best way to prevent further erosion of our natural biodiversity and prevent the need for potential Endangered Species Act listings (Spain 2022). The experience of other states has shown that it is imminently prudent to protect instream flows as early as possible; otherwise, opportunities for protection can become very difficult, costly, and contentious.

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## **TABLES AND FIGURES**

Table 1.–Six criterion used to rank each watershed in the statewide prioritization model.

<b>Model Criterion</b>	
<i>Fish Resources</i>	AWC Stream Miles
	Number of Salmon Species
	Number of Angler Days
<i>Environmental Stressors</i>	Population
	Roads
	Lower Land Protection Status

Table 2.—Summary of ADF&G reservation of water applications filed in 2020 to 2021 in Alaska.

Name	DNR LAS No. <sup>a</sup>	Priority date
Salmon River near Gustavus	33347	6/30/2020
Chandalar River	33351	6/30/2020
Government Creek Reach A	33352	6/30/2020
Granite Creek near Palmer	33353	6/30/2020
McGinnis Creek near Juneau	33354	6/30/2020
Aniak River	33894	11/29/2021

*Note:* See Figures 2 and 3 for site locations.

<sup>a</sup> The Land Administration System (LAS) is managed by the Alaska Department of Natural Resources (DNR) to provide case file summaries and abstracts of information depicted on the State Status Plat.

Table 3.–Summary of ADF&G Certificates of Reservation granted in 2020 to 2021 in Alaska.

Name	DNR LAS No. <sup>a</sup>	Priority date	Granted date	Miles of fish Habitat protected
Kadashan River Reach A	28372	1/6/2012	9/24/2020	2.2
Kadashan River Reach B	28373	1/6/2012	9/24/2020	1.8
Kadashan River Reach C	28374	1/6/2012	9/24/2020	1.6
Hook Creek	28375	1/6/2012	9/24/2020	1.0
Tonalite Creek	28376	1/6/2012	9/24/2020	2.4
Trail River	29149	5/22/2013	5/28/2021	2.0
Little Willow Creek	30818	2/18/2016	5/28/2021	8.0
			Total	19.0

*Note:* See Figures 4 and 5 for site locations.

<sup>a</sup> The Land Administration System (LAS) is managed by the Alaska Department of Natural Resources (DNR) to provide case file summaries and abstracts of information depicted on the State Status Plat.

Table 4.–Summary of FERC hydroelectric and hydrokinetic projects in Alaska monitored by ADF&G in 2020 to 2021.

Project	FERC No.	Capacity (kW) <sup>a</sup>	Status
Southeast			
Annex Creek	2307	3,600	Licensed hydroelectric
Armstrong – Keta	8875	80	License exemption
Beaver Falls	1922	7,100	Licensed hydroelectric
Black Bear	10440	4,500	Licensed hydroelectric
Blind Slough/Crystal Lake	201	2,000	Licensed hydroelectric
Blue Lake	2230	16,900	Licensed hydroelectric
Burnett River Hatchery	10773	80	Licensed hydroelectric
Crooked Creek/Jim’s Lake Elfin Cove	14514	160	Proposed hydroelectric
Dewey Lakes	1051	943	Licensed hydroelectric
Falls Creek	11659	800	Licensed hydroelectric
Gartina Falls	14066	450	Licensed hydroelectric
Goat Lake	11077	4,000	Licensed hydroelectric
Green Lake	2818	18,540	Licensed hydroelectric
Hidden Falls	14785	330	Conduit exemption
Jetty Lake	3017	249	Licensed hydroelectric
Kasidaya	11588	3,000	Licensed hydroelectric
Ketchikan Lakes	420	4,200	Licensed hydroelectric
Kootznahoo Inlet Tidal Energy	15110	300	Proposed hydrokinetic
Lake Dorothy	12379	14,300	Licensed hydroelectric
Mahoney Lake	11393	9,600	Under FERC stay
Pelican	10198	700	Licensed hydroelectric
Hiilangaay (Reynolds Creek)	11480	5,000	Licensed hydroelectric
Salmon Creek	2307	6,700	Licensed hydroelectric
South Kupreanof Micro-Hydro	14862	1.5	Proposed hydroelectric
Swan Lake	2911	22,000	Licensed hydroelectric
Sweetheart Lake	13563	20,000	Licensed hydroelectric
Tyee	3015	20,000	Licensed hydroelectric
Whitman Lake	11841	4,600	Licensed hydroelectric
Wolf Creek Boatworks	14845	300	Proposed hydroelectric

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Table 4.–Page 2 of 2.

Project	FERC No.	Capacity (kW) <sup>a</sup>	Status
Southcentral			
Allison Lake	13124	6,500	Licensed hydroelectric
Bradley Lake	8221	119,700	Licensed hydroelectric
Chignik	620	60	Licensed hydroelectric
Cooper Lake	2170	19,380	Licensed hydroelectric
Dry Spruce	1432	75	Licensed surrendered in 2020
East Foreland Tidal Energy	15116	5,000	Proposed hydrokinetic
Grant Lake	13212	5,000	Licensed hydroelectric
Humpback Creek	8889	1,250	Licensed hydroelectric
Kvichak River-Igiugig	13511	4,000	Hydrokinetic pilot license
Nuyakuk River	14873	10,000	Proposed hydroelectric
Old Harbor	13272	262	Licensed hydroelectric
Power Creek	11243	6,000	Licensed hydroelectric
Solomon Gulch	2742	12,000	Licensed hydroelectric
Susitna-Watana	14241	600,000	Under FERC abeyance
Terror Lake	2743	36,000	Licensed hydroelectric
Turnagain Arm Tidal Water	15109	2,420,000	Proposed hydrokinetic

<sup>a</sup> kilowatts

Table 5.–Summary of Alaska Clean Water Actions grants awarded for the 2021 to 2023 grant cycle.

Project Name	Location	Group
Jordan Creek Restoration and Implementation of Best Management Practices	Juneau	Southeast Alaska Watershed Coalition
Playground Creek Rain Garden	Wrangell	Southeast Alaska Watershed Coalition
Hoonah Marine Beach Monitoring	Hoonah	Southeast Alaska Watershed Coalition
Ketchikan Beaches Monitoring	Ketchikan	Southeast Alaska Watershed Coalition
Lake Lucile Bioretention Installation at Burchell High School and Outreach on Understanding Stormwater Runoff Impacts to Lake Lucile	Wasilla	Sustainable Design Group
Willow and Walkways – Anchor River Restoration	Anchor Point	Homer Soil and Water Conservation District
Salcha River Baseline Water Quality Monitoring	Fairbanks	University of Alaska Fairbanks
Chena River Water Quality Monitoring	Fairbanks	Tanana Valley Watershed Association
No Litter Yes Healthy Slough – Noyes Slough Outreach	Fairbanks	Catalyst Alaska
Clearer Creeks in the Interior – Placer Mining Outreach & Watershed Planning	Fairbanks	Catalyst Alaska
Lacey Street Rehabilitation Planning and Outreach	Fairbanks	Catalyst Alaska

Table 6.–Summary of all reservation of water applications filed and granted in Alaska as of December 2021.

Organization/Private Individual	Filed		Granted	
	Rivers	Lakes	Rivers	Lakes
ADF&G	358	7	166	1
U.S. Fish and Wildlife Service	61	140	1	
Bureau of Land Management	22		1	
Trout Unlimited	11			
Curyung Tribal Council–Trout Unlimited	11			
U.S. Forest Service	4			
Chuitna Citizens Coalition	3			
Eklutna Native Village	3	1		
Southwest Alaska Salmon Habitat Partnership–ADF&G	3			
The Nature Conservancy–ADF&G	1			
Arctic Unit of the Alaska Chapter of the American Fisheries Society–ADF&G	1			
Trout Unlimited–ADF&G	1			
Cook Inletkeeper–ADF&G	1			
Cheesh-na Tribal Council	1			
Chickaloon Native Village	1			
Bristol Bay Heritage Land Trust-New Koliganek Village Council	1			
Willie Dixon	1			
Kenai Watershed Forum	1			
Copper River Watershed Council		1		
ADF&G (per Water Export Provision <sup>a</sup> )			1	1
DNR (per Water Export Provision)			2	2

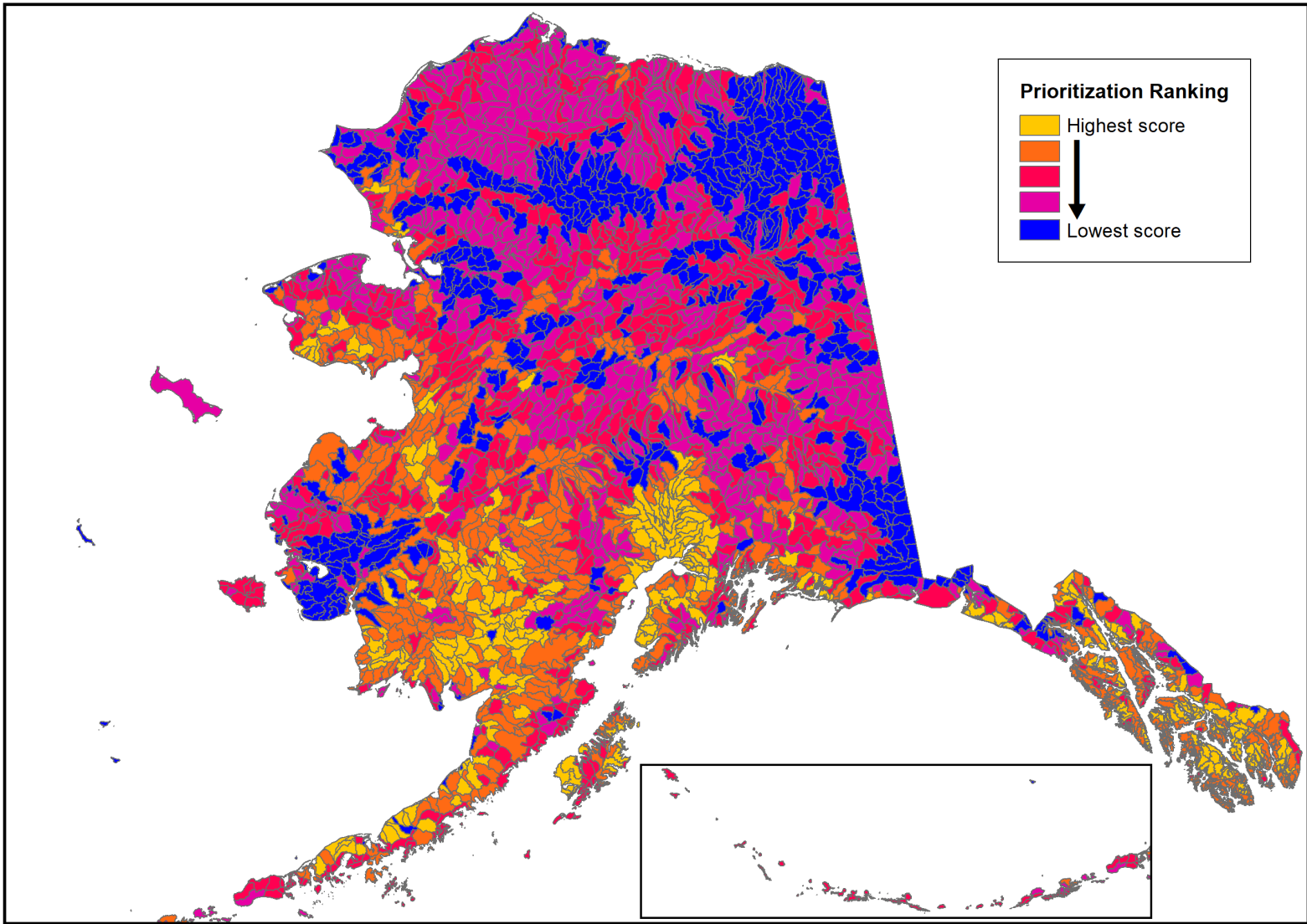


Figure 1.—Map of Alaska showing the statewide prioritization model results of highest- to lowest-priority watersheds.

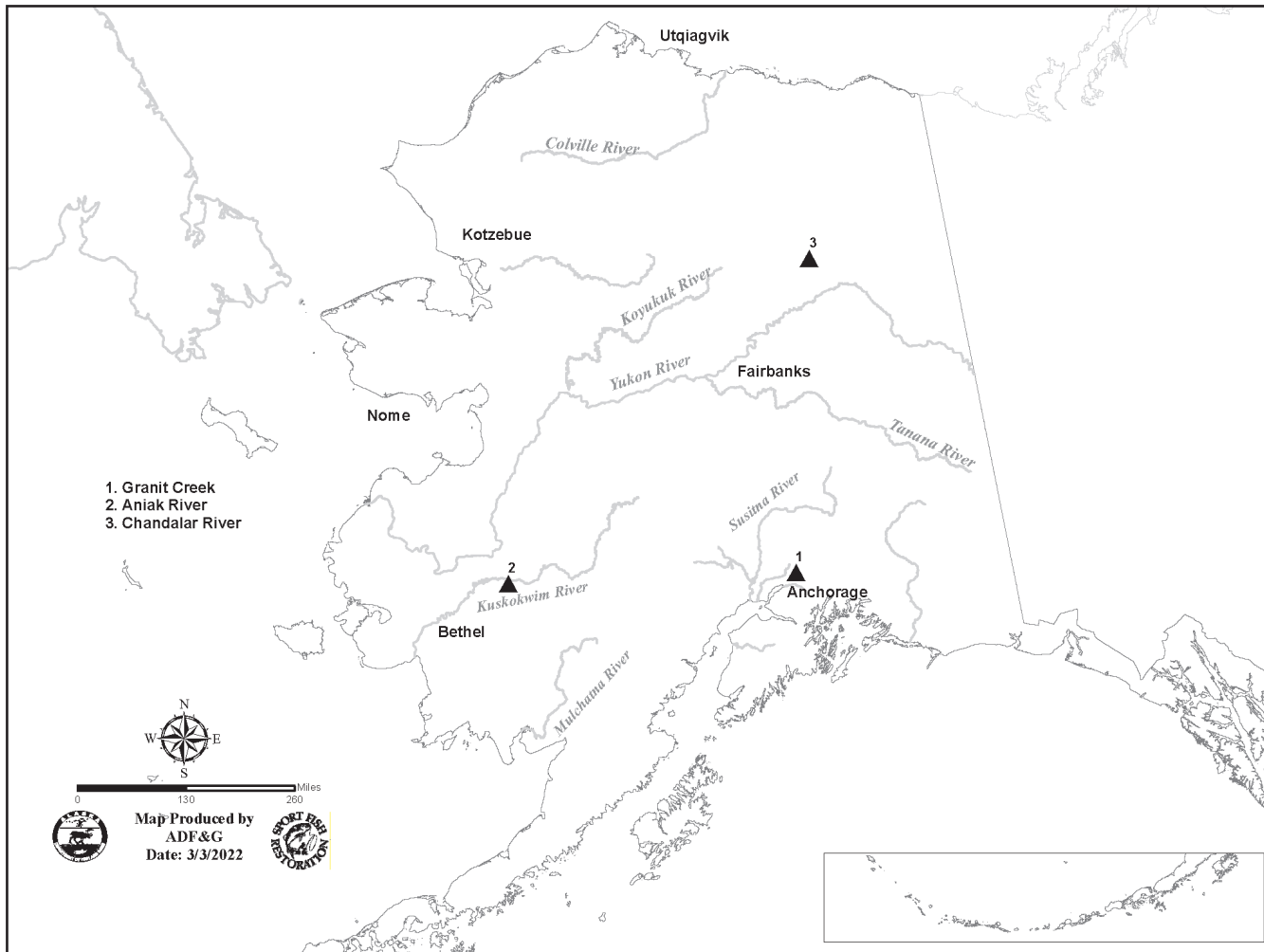


Figure 2.—Location of ADF&G reservation of water applications filed from 2020 to 2021 in Alaska, except Southeast.

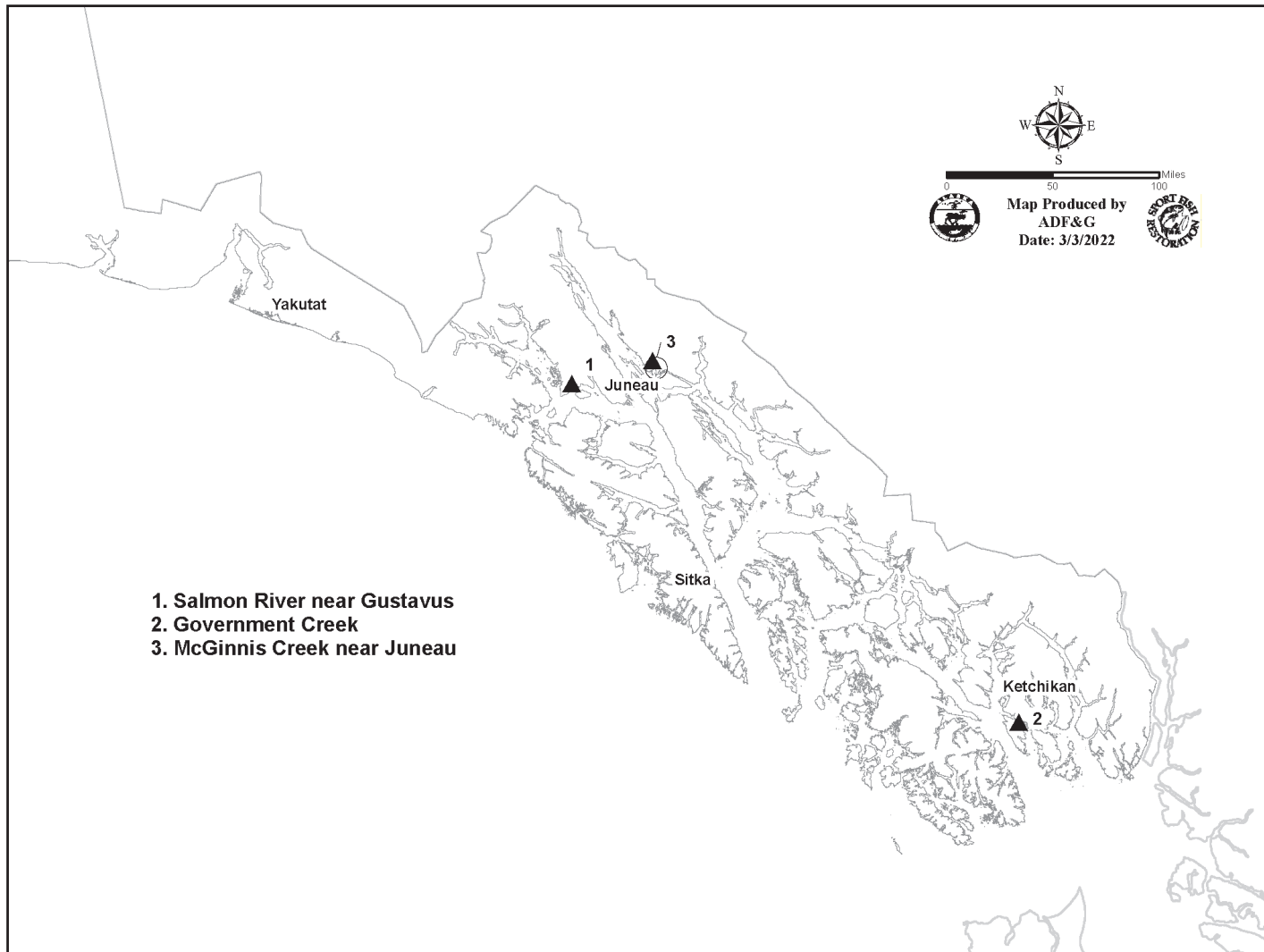


Figure 3.—Location of ADF&G reservation of water applications filed from 2020 to 2021 in Southeast Alaska.

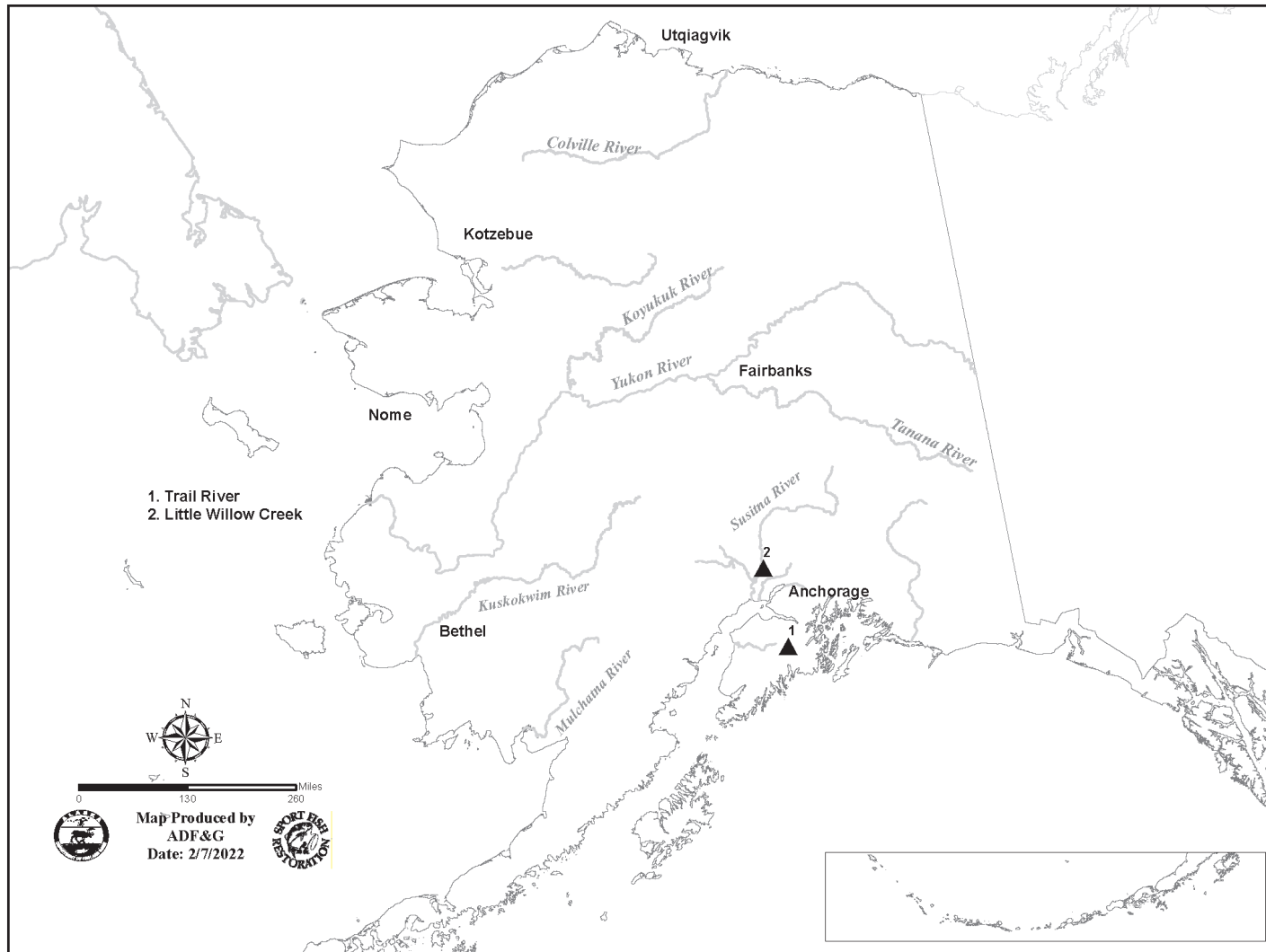


Figure 4.—Location of ADF&G certificates of reservation granted from 2020 to 2021 in Alaska, except Southeast.

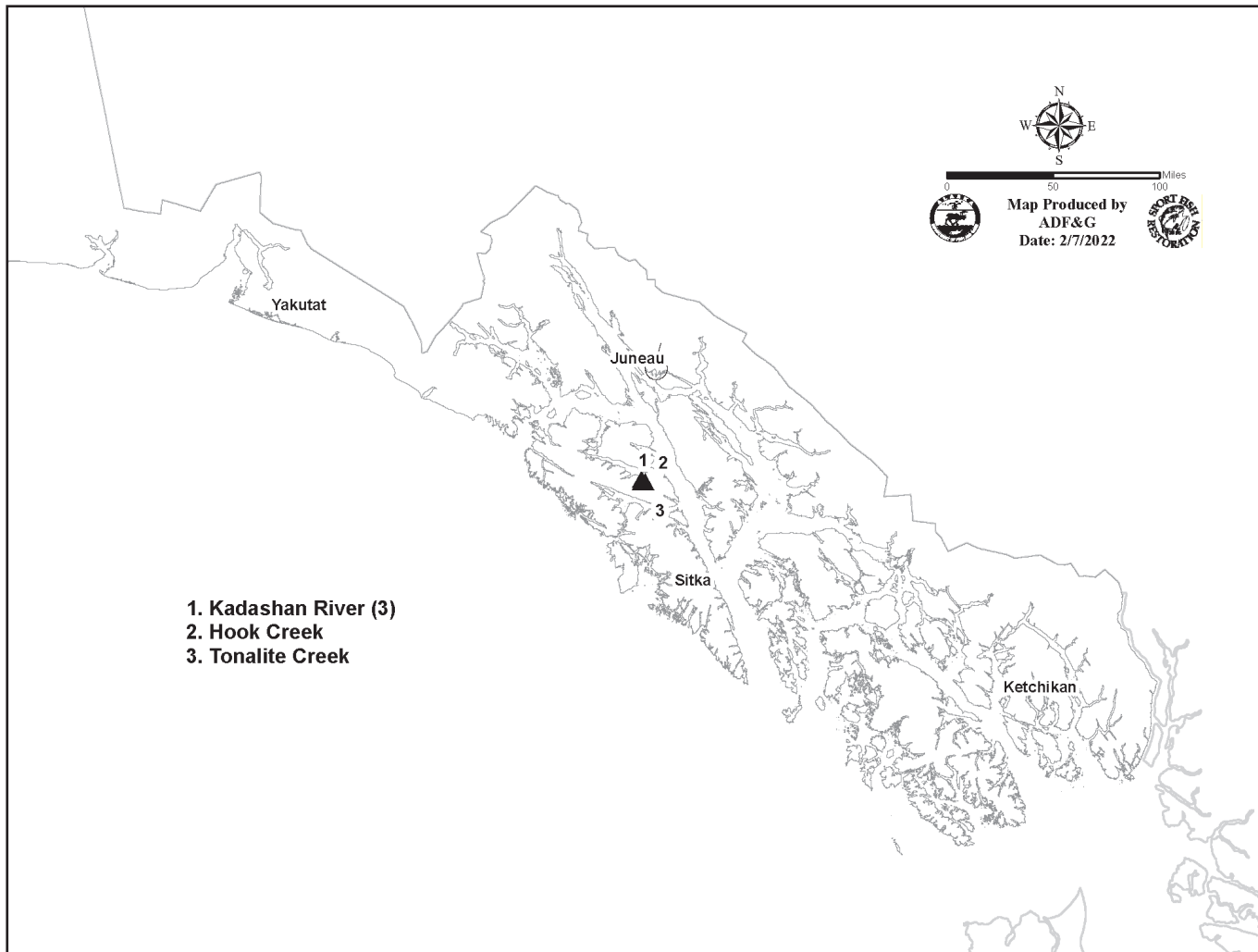


Figure 5.—Location of ADF&G certificates of reservation granted from 2020 to 2021 in Southeast Alaska. Parentheses indicate the number of certificates granted.

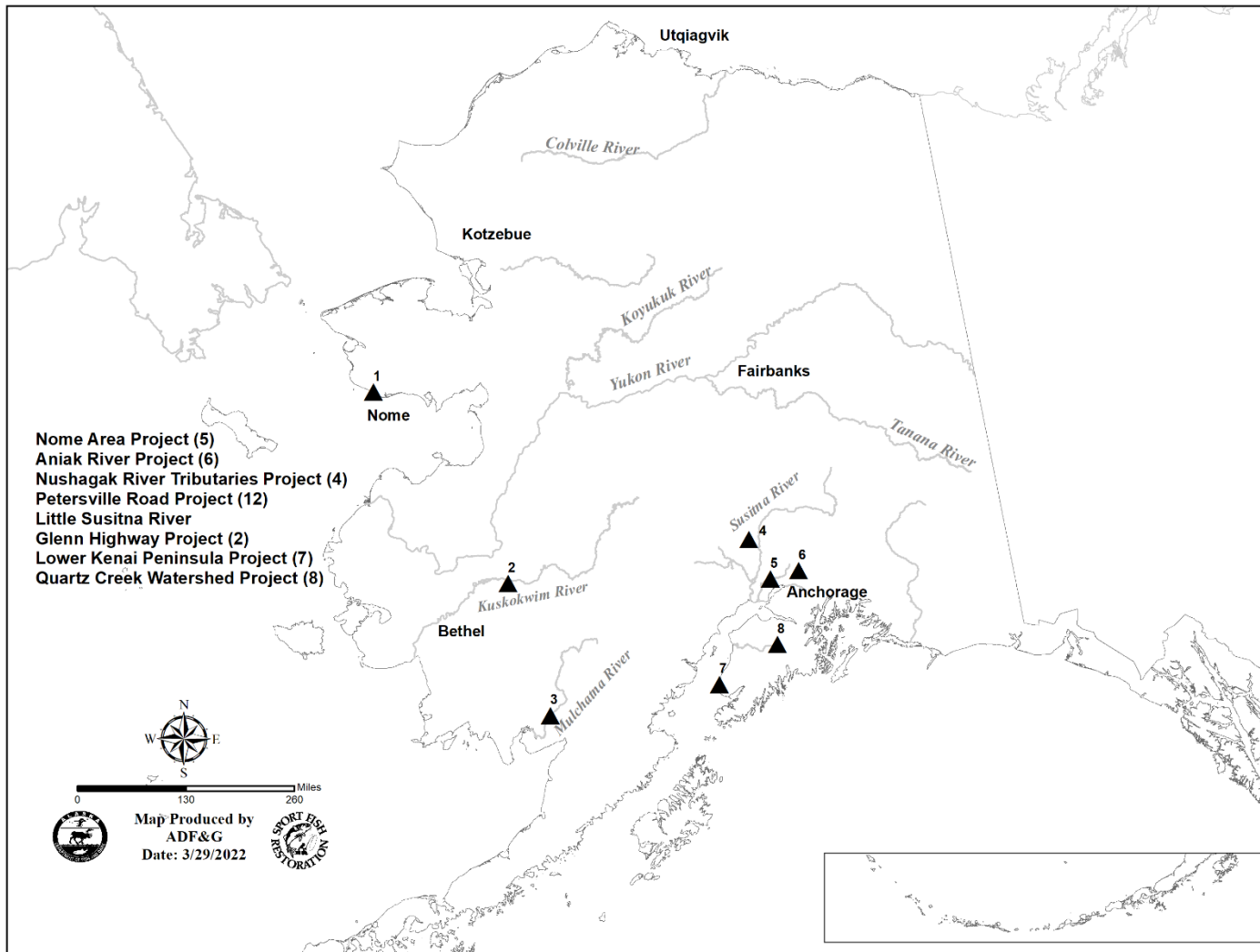


Figure 6.—Location of hydrologic investigations performed during 2020 to 2021 by ADF&G Instream Flow Program staff in Alaska, except Southeast. Parentheses indicate the number of stations monitored.

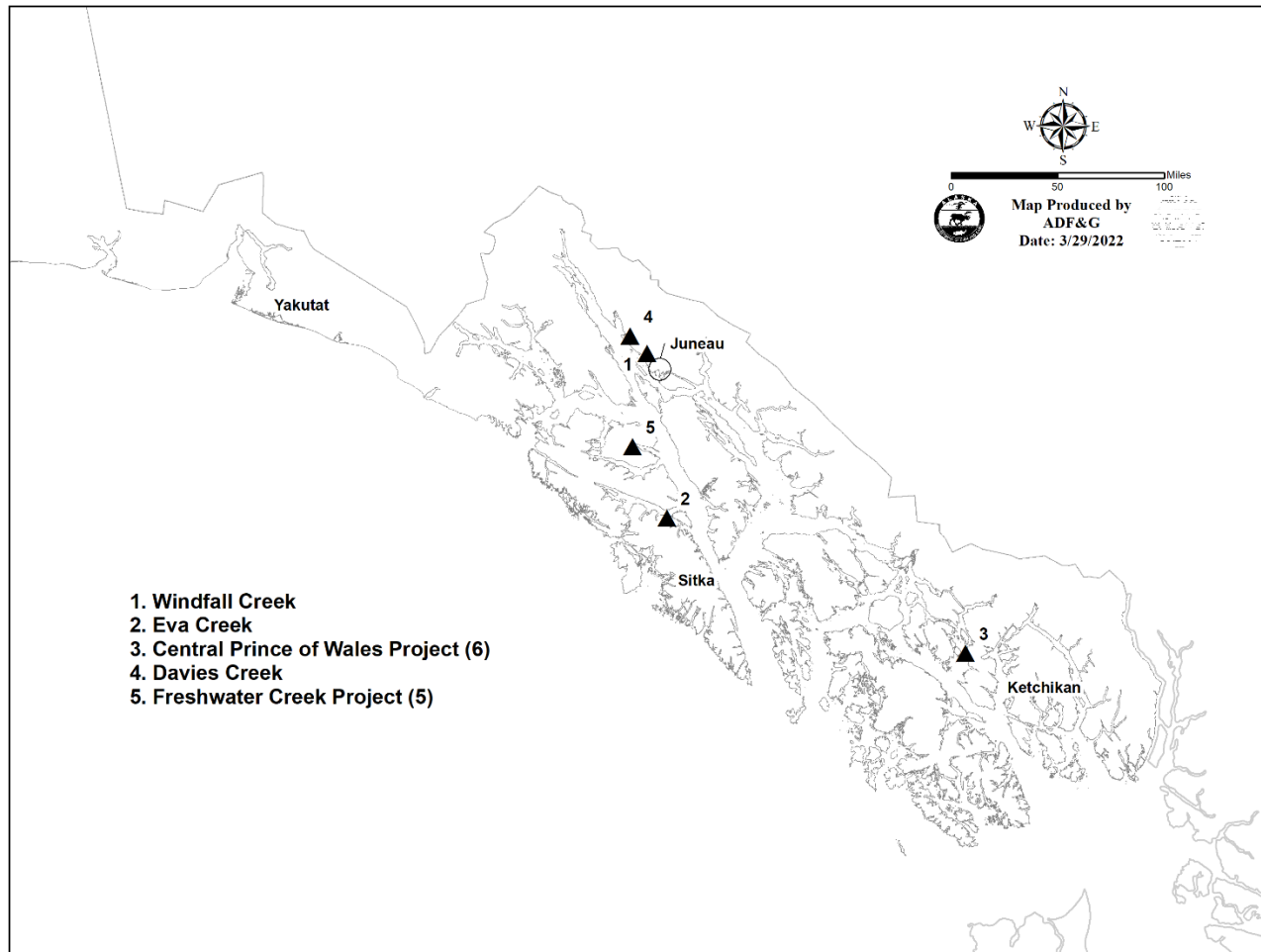


Figure 7.—Location of hydrologic investigations performed during 2020 to 2021 by ADF&G Instream Flow Program staff in Southeast Alaska. Parentheses indicate the number of stations monitored.

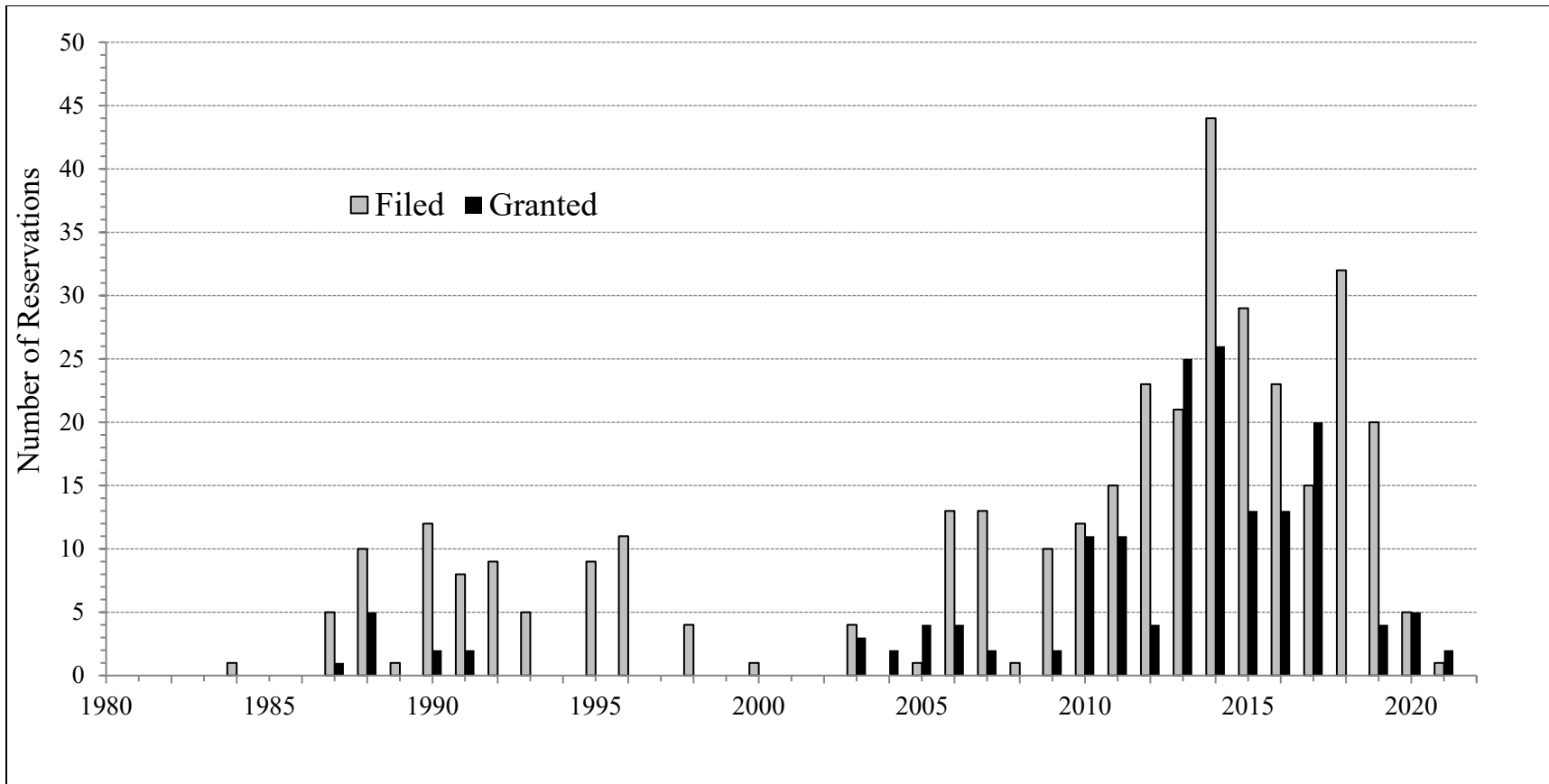


Figure 8.—Number of ADF&G reservations filed and granted from 1980 to 2021 in Alaska.