

**Fishery Data Series No. 18-07**

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# **Sampling Unmapped Streams for Fish Presence in the Matanuska-Susitna Borough, 2016**

**by**

**Mark Eisenman**

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**December 2018**

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**Alaska Department of Fish and Game**

**Divisions of Sport Fish and Commercial Fisheries**



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Weights and measures (metric)		General		Mathematics, statistics	
centimeter	cm	Alaska Administrative Code		all standard mathematical signs, symbols and abbreviations	
deciliter	dL		AAC		
gram	g	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	H <sub>A</sub>
hectare	ha			base of natural logarithm	<i>e</i>
kilogram	kg			catch per unit effort	CPUE
kilometer	km	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	coefficient of variation	CV
liter	L			common test statistics	(F, t, $\chi^2$ , etc.)
meter	m	at	@	confidence interval	CI
milliliter	mL	compass directions:		correlation coefficient (multiple)	R
millimeter	mm	east	E	correlation coefficient (simple)	r
<b>Weights and measures (English)</b>		north	N	covariance	cov
cubic feet per second	ft <sup>3</sup> /s	south	S	degree (angular)	°
foot	ft	west	W	degrees of freedom	df
gallon	gal	copyright	©	expected value	<i>E</i>
inch	in	corporate suffixes:		greater than	>
mile	mi	Company	Co.	greater than or equal to	≥
nautical mile	nmi	Corporation	Corp.	harvest per unit effort	HPUE
ounce	oz	Incorporated	Inc.	less than	<
pound	lb	Limited	Ltd.	less than or equal to	≤
quart	qt	District of Columbia	D.C.	logarithm (natural)	ln
yard	yd	et alii (and others)	et al.	logarithm (base 10)	log
<b>Time and temperature</b>		et cetera (and so forth)	etc.	logarithm (specify base)	log <sub>2</sub> , etc.
day	d	exempli gratia (for example)	e.g.	minute (angular)	'
degrees Celsius	°C	Federal Information Code	FIC	not significant	NS
degrees Fahrenheit	°F	id est (that is)	i.e.	null hypothesis	H <sub>0</sub>
degrees kelvin	K	latitude or longitude	lat or long	percent	%
hour	h	monetary symbols (U.S.)	\$, ¢	probability	P
minute	min	months (tables and figures): first three letters	Jan, ..., Dec	probability of a type I error (rejection of the null hypothesis when true)	$\alpha$
second	s	registered trademark	®	probability of a type II error (acceptance of the null hypothesis when false)	$\beta$
<b>Physics and chemistry</b>		trademark	™	second (angular)	"
all atomic symbols		United States (adjective)	U.S.	standard deviation	SD
alternating current	AC	United States of America (noun)	USA	standard error	SE
ampere	A	U.S.C.	United States Code	variance	
calorie	cal			population sample	Var var
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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MATANUSKA-SUSITNA BOROUGH, 2016**

by

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# ABSTRACT

Between August 24 and September 30, 2016, the Alaska Department of Fish and Game conducted fish surveys at 104 sites in the Matanuska-Susitna Borough on previously unmapped streams and/or streams with little to no fish information. ADF&G was able to confirm the presence of fish at 64 sites, of which 31 had anadromous fish, and 21 miles of new streams and over 170 acres of new lakes were nominated to the Anadromous Waters Catalog. Sampling information was submitted to the Alaska Freshwater Fish Inventory for inclusion in the project's database and online mapper.

Key words: Matanuska-Susitna Borough, unmapped streams, culverts, distribution, Anadromous Waters Catalog, resident, fish, survey, presence, absence, roads, comprehensive

# INTRODUCTION

In 2011, the Alaska Department of Fish and Game's (ADF&G) Fish Passage Improvement Project concluded a three-year fish passage assessment of Matanuska-Susitna Borough's (MSB) culverts using ADF&G's level one assessment protocols (Eisenman and O'Doherty 2014). The 2011 assessment data and an initial prioritization resulted in the replacement of 10 culverts and improved access to over 30 miles of stream habitat. However, the assessment effort determined that many streams were entirely unmapped and data on stream miles, potential fish habitat, and fish presence was not available. During the fish passage assessments 124 streams (Figure 1) were found to be on unmapped streams; meaning they were not included in the U.S. Geological Survey National Hydrography Dataset (NHD) or shown on topographic maps. Additional analysis of the MSB culvert dataset found that 197 sites had little to no fish information associated with them (Figure 2).

In order to prioritize remaining sites and rank culverts for replacement, ADF&G obtained funding to build an optimization model. This optimization model has been used successfully in other states and countries. It uses replacement cost, fisheries data, available upstream habitat, and other barriers on the system to calculate optimal replacement strategies (O'Hanley et al. 2013). The optimization model will use the new NHD and elevation data created from the 2011 MSB Light Detection and Ranging (LiDAR) and Interferometric Synthetic Aperture Radar (IfSAR) datasets to calculate upstream habitat (Miller et al. 2015; Saint Mary's 2015).

The goal of this project was to address objectives presented in the Mat-Su Basin Salmon Habitat Partnership action plan (Smith and Speed 2013) and include: (1) identifying anadromous fish habitat in the basin, (2) documenting anadromous and nonanadromous species and their respective life stages, (3) reporting habitat and fish species information to the Anadromous Waters Catalog (AWC)<sup>1</sup>, (4) assessing the quality of salmon habitats critical for each life stage (rearing, spawning, and overwintering), (5) locate and map priority riparian habitat for long-term protection and restoration of salmon, and (6) contribute to fish passage restoration by filling in data gaps in ADF&G's culvert replacement optimization model (see Objective 1.1, Strategic Action 1.1.1, and Objectives 1.2, 2.2, and 4.2 in Smith and Speed 2013).

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<sup>1</sup> Information on the Anadromous Waters Catalog can be found at <https://www.adfg.alaska.gov/sf/SARR/AWC/index.cfm?ADFG=main.home>

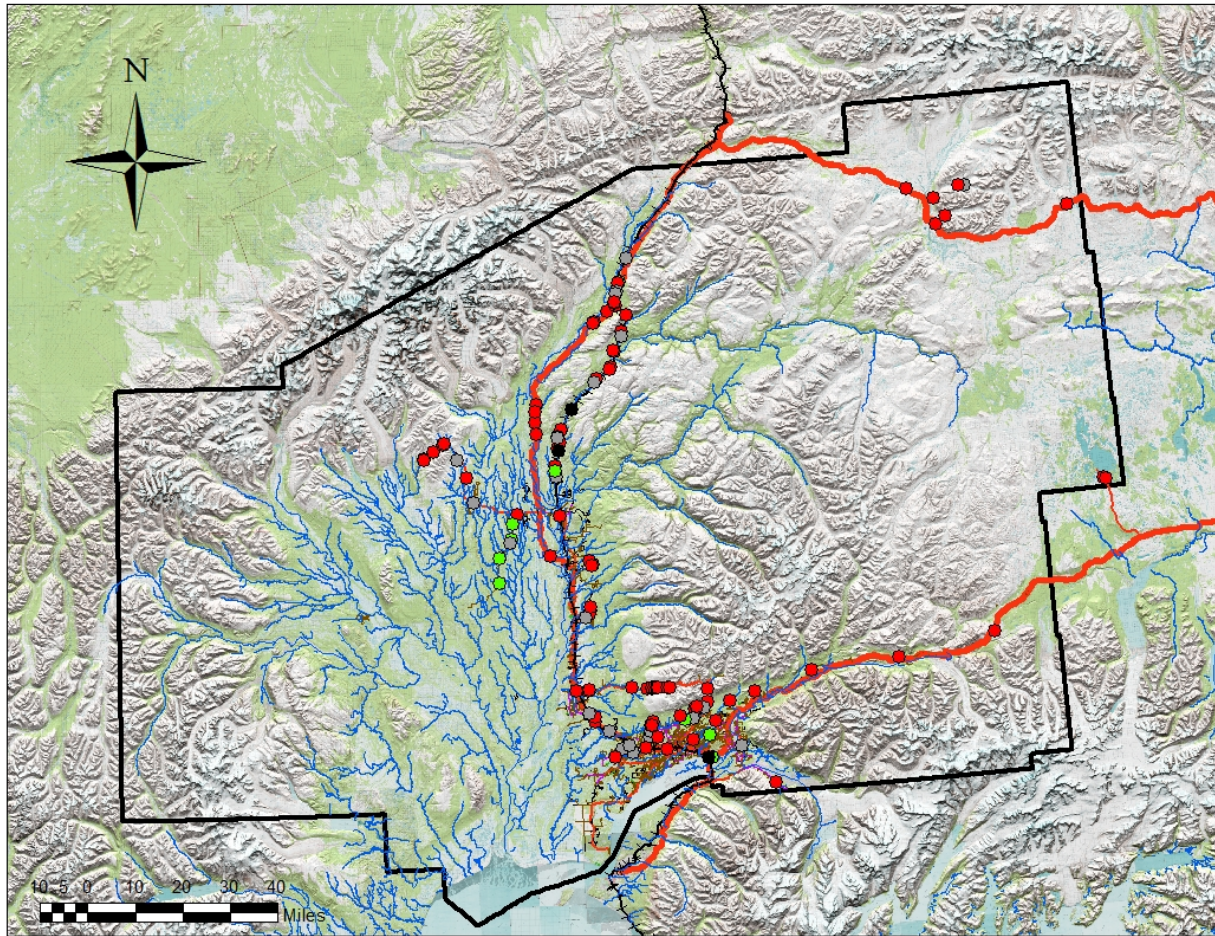


Figure 1.—Matanuska-Susitna Borough culverts located on unmapped streams.

## METHODS

The 2011 prioritization of the MSB's 572 ADF&G assessed culverts found that 124 of those culverts to be on unmapped streams. Thirty-three of those culverts are located on the Alaska Railroad and have been removed from consideration from this project due to accessibility. Of the 91 remaining sites, it was estimated that between 50 to 60 sites were 1) located on unique streams and 2) those streams had the potential of being salmon bearing due to location and stream type. Additionally, 197 culvert sites (including the 91 unmapped sites) within the MSB were found to have little or no fish information associated with the site. These additional 106 sites of interest were plotted with the 91 unmapped sites and were to be sampled if timed allowed (Figure 2). Sites along the Denali Highway and eastern Glenn Highway were not sampled during this project due to their remote locations, limited project time, and these sites were located well upstream of documented anadromy. This project was also unable to access sites at the end of Petersville Road due to high water levels at forded river crossings.

Sampling occurred between August 24 through September 30, 2016. Two years of weekly tagging data in the Montana Creek watershed suggested that August and September are optimal months to attempt sampling for juvenile coho and Chinook salmon in the small unmapped streams that were targeted by this project (O'Doherty *In prep*).



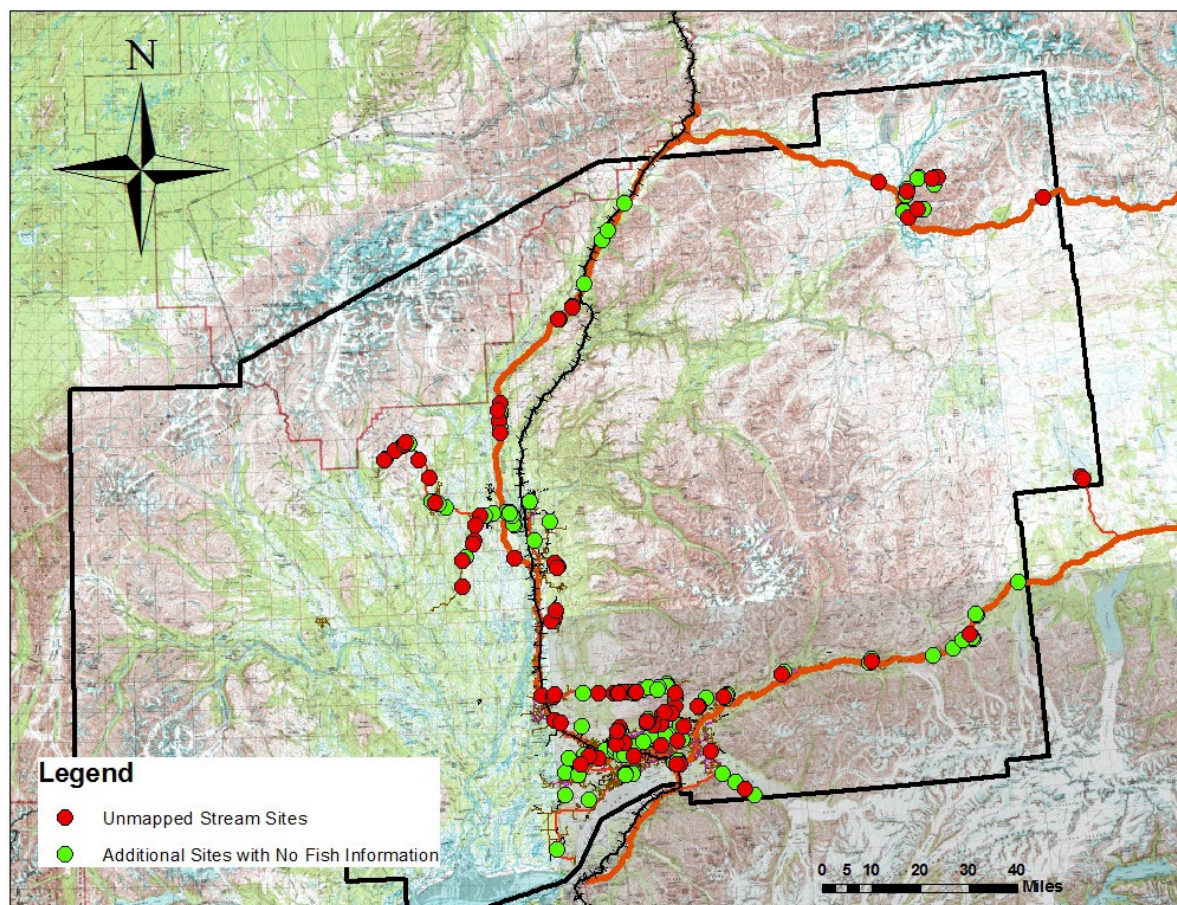


Figure 2.—Unmapped sites and sites with no fish information within the MSB.

## SAMPLING

Sites were accessed at road crossings starting at the upper most crossing if streams had more than one culvert along its course. Small streams with discernable flow were sampled with an LR-24 Smith-Root backpack electrofisher. Two person crews would sample downstream up to the culvert outlet and upstream from the culvert inlet. Sampling reaches were determined by legal accessibility, terrain, foliage, available time at site, and species abundance. Stream conductance was measured using a handheld HANNA conductance meter. The electrofisher voltage set was established using standardized power transfer tables. Streams were fished using smooth DC voltage and adjusted according to fish response. Stream conductance, voltage set on the electrofisher,  $V_S$ , actual voltage delivered by the electrofisher,  $V_A$ , and total time fished were all recorded on project data forms (Appendix C). At sites where salmon were found, efforts were made to capture at least 2 representative fish; the minimum number needed to nominate a water body to the AWC. All accessible stream features (pools, riffles, undercut banks, etc.) were sampled to try to capture fish.

At sites that were ponded or too deep for electrofishing, baited minnow traps were deployed and left to soak from 1 to 24 hours. All fish captured were then examined and identified to species, measured to the nearest millimeter, and photographed.

All fish measurements, total fish encountered, photo descriptions and camera photo numbers, trap locations and soak times, road name, stream name, crossing and extent coordinates, crossing ADF&G Site ID, and any other pertinent site notes were collected on project field forms (Appendix C).

## ANADROMOUS WATERS CATALOG NOMINATIONS

All sites where salmon were captured were nominated to the AWC. During sampling events, the upper most point where salmon were captured was logged on a handheld GPS. This point would be used for the upper bounds of the AWC nomination. Representative photos of all fish captured were taken using a clear fish viewer or measuring board. Additional site photographs showing habitat and current culvert conditions were also taken.

GPS points were taken at the road crossing, upper and lower extents of sampling, and any other points of interest and plotted using ESRI ArcMap GIS. The most current layer of the MSB NHD and culvert location information was used to plot stream course. At sites where lower extents of the stream were already nominated to the AWC or streams that shared a confluence with an AWC cataloged stream and the current hydrography conflicted, a correction nomination to correct stream course was also submitted and verified using the LiDAR imagery (Figures 4–8).

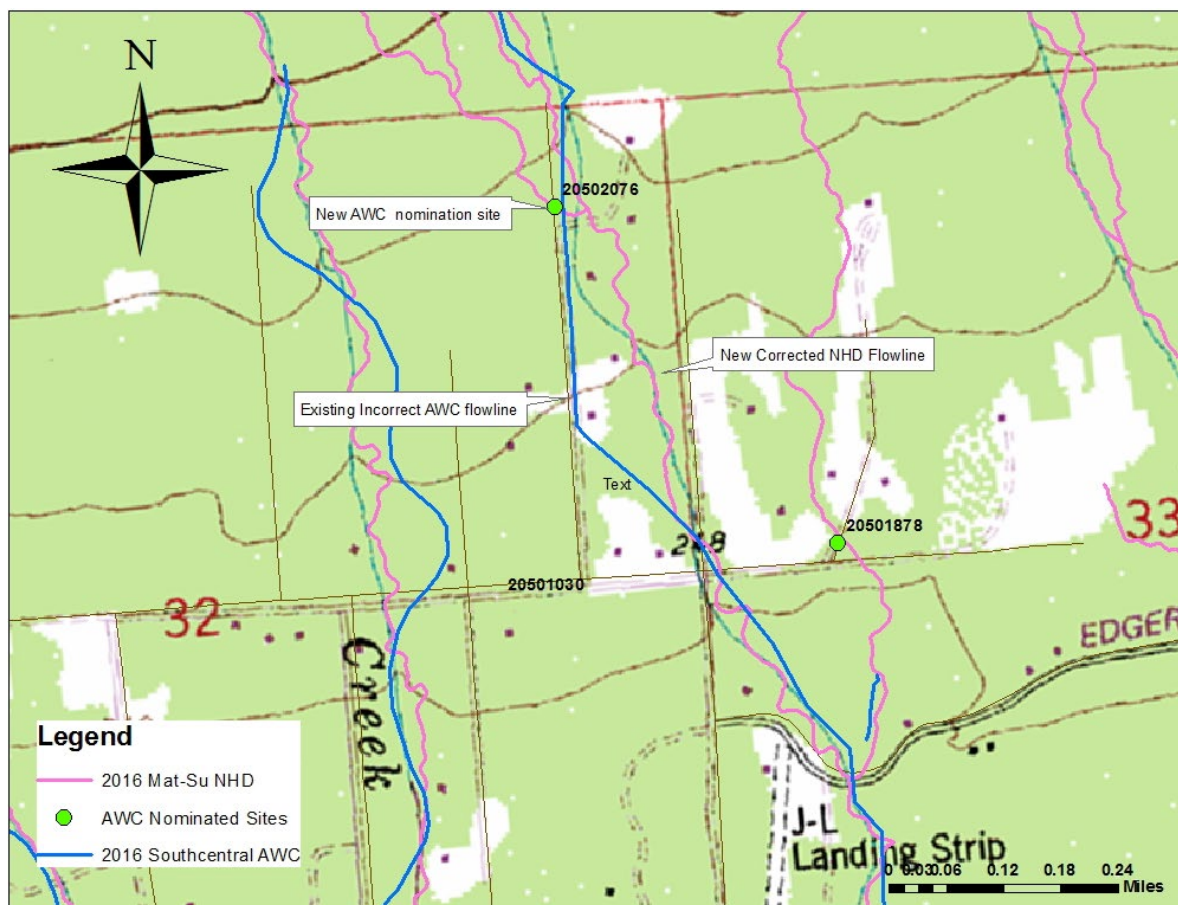


Figure 3.–Map showing an example of an AWC nomination where downstream hydrography was incorrect and conflicted with a new nomination.



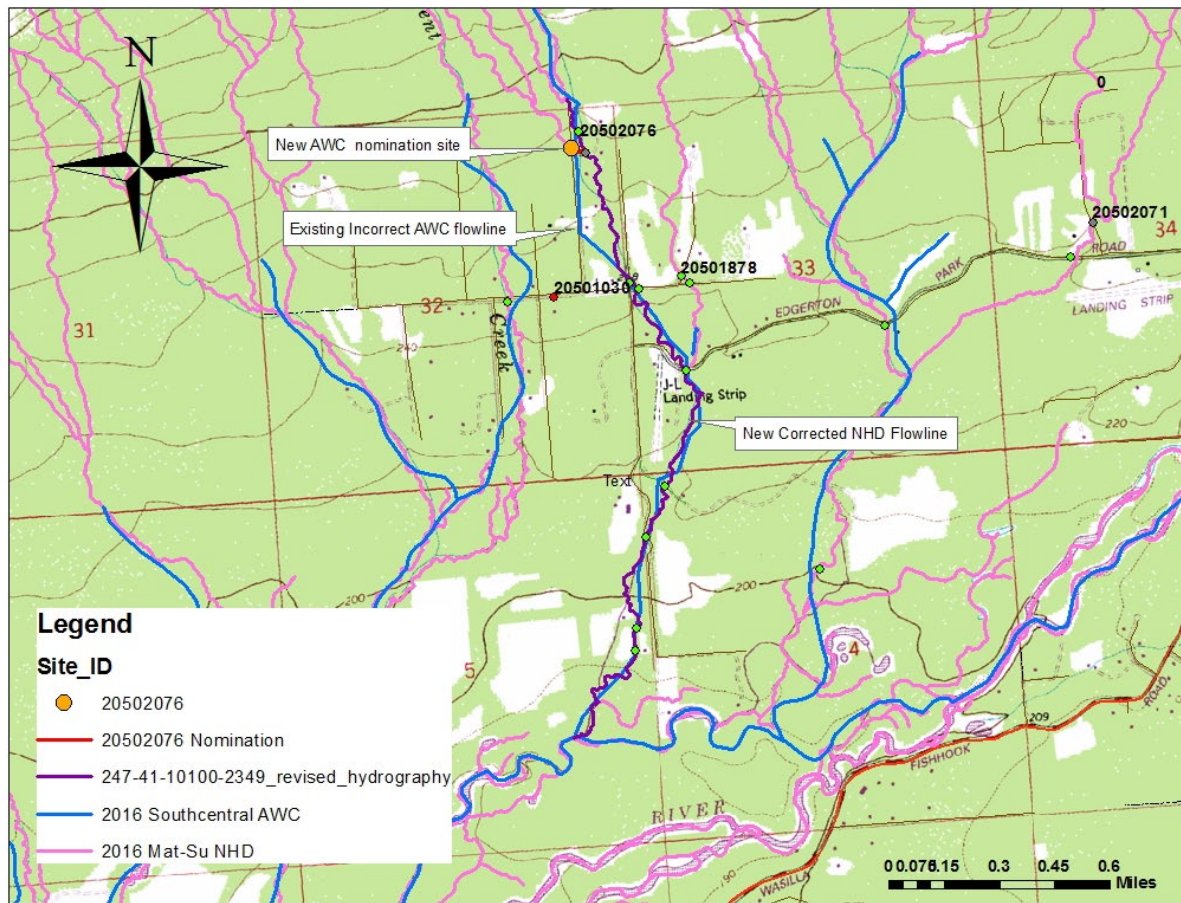


Figure 4.—Map showing revised hydrography of AWC stream #247-41-10100-2349.

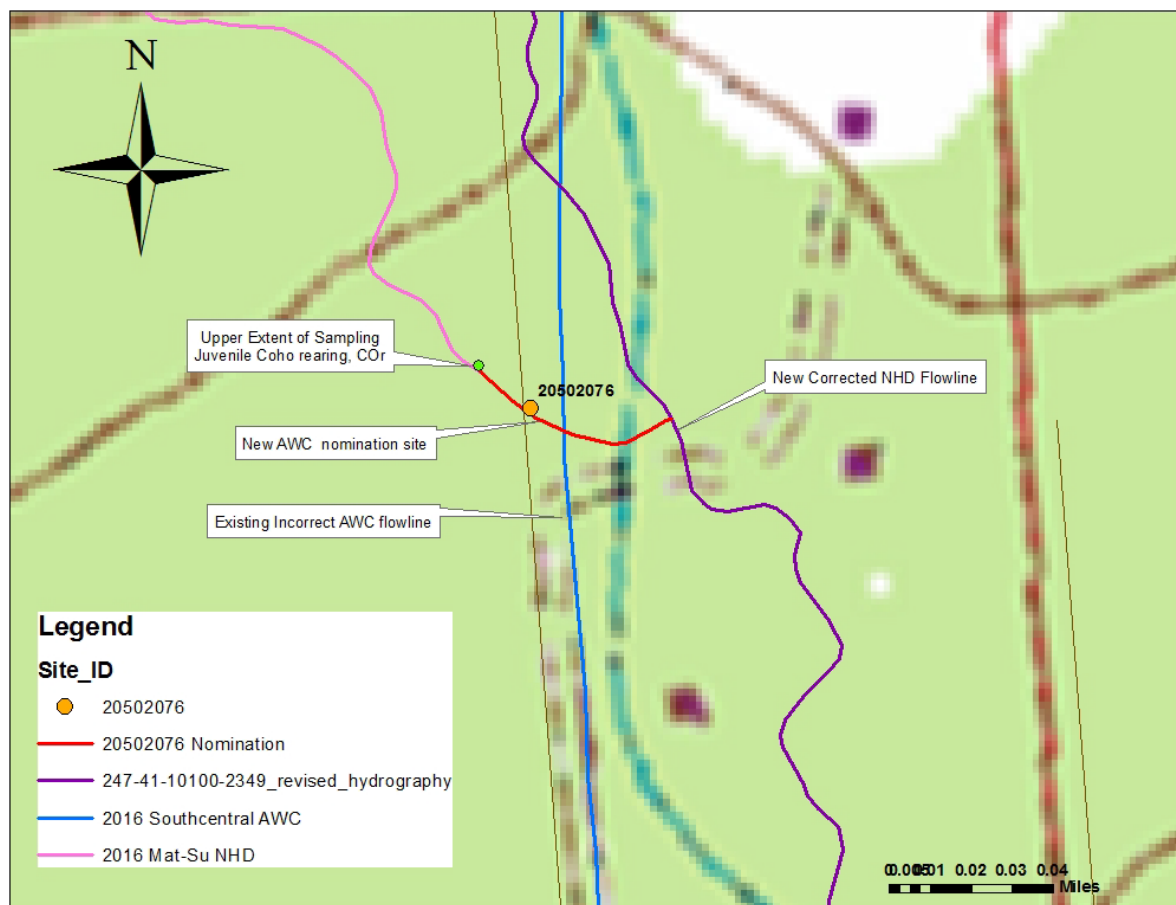


Figure 5.—Map showing an example of an AWC nomination map with a downstream stream course correction, new addition, existing incorrect AWC flowline, upper extent of sampling and species found, and flowline of new stream addition.



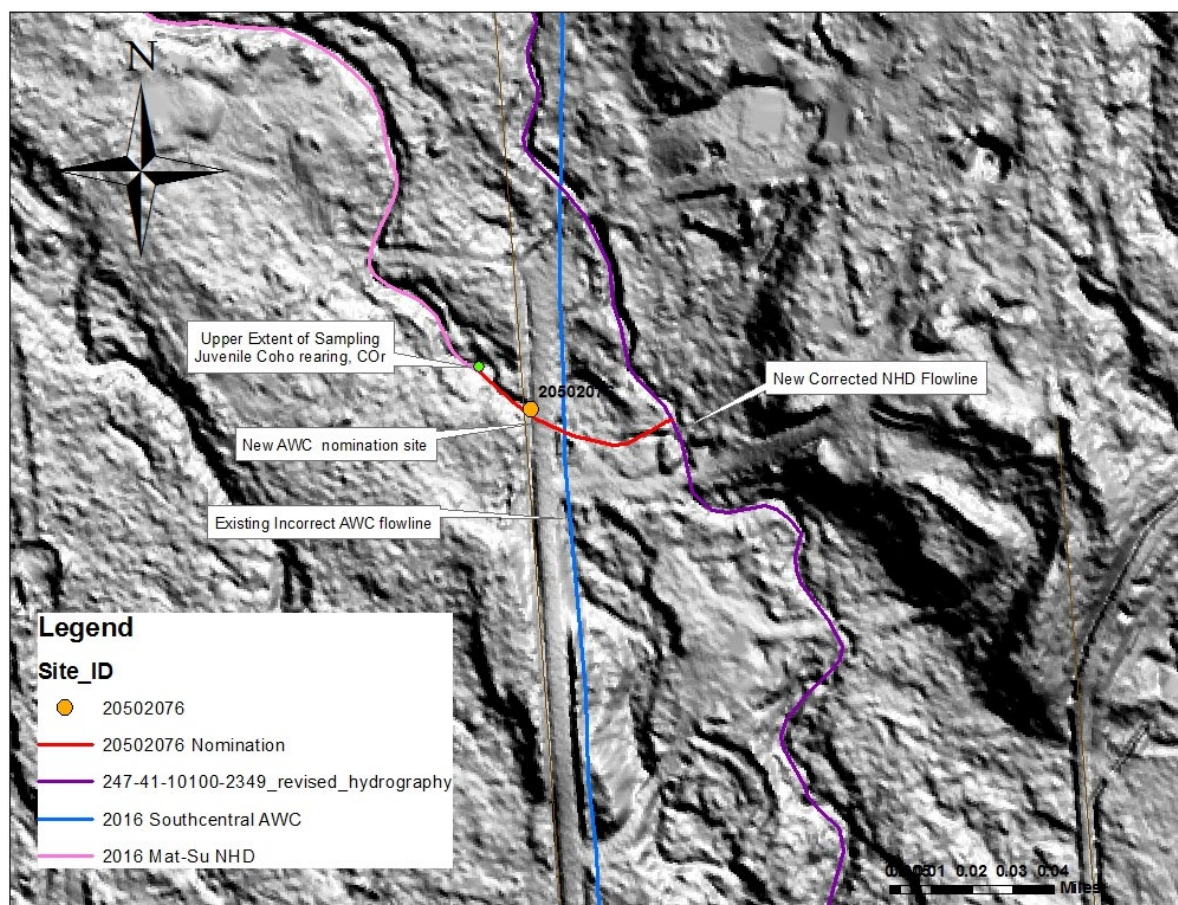


Figure 6.—Map showing an example AWC nomination map using the 2011 MSB LiDAR bare earth hillshade imagery, highlighting the current incorrect AWC flowline, the nominated corrected flowline, the new stream flowline addition, and upper extent of sampling with fish found.

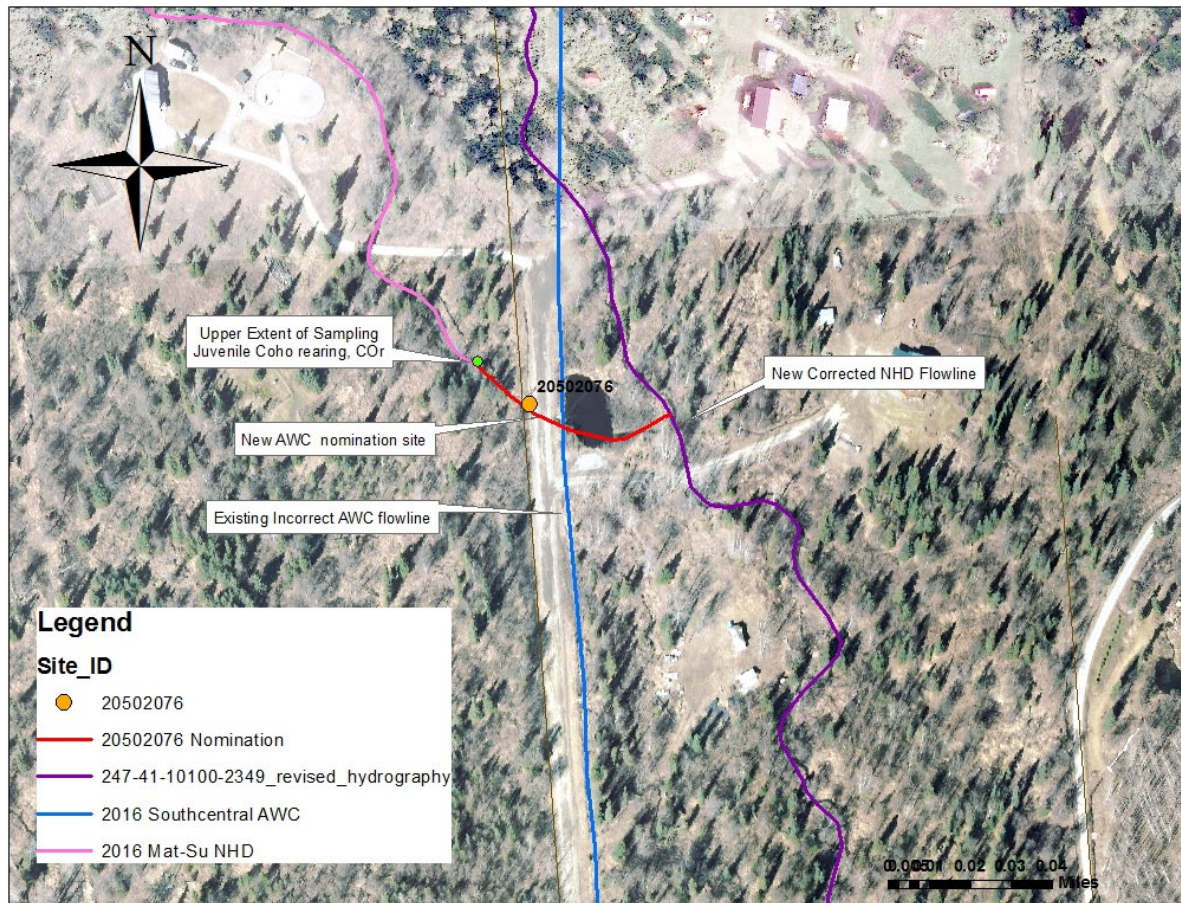


Figure 7.—Map showing an example of an AWC nomination using the 2011 Mat-Su LiDAR ½-foot resolution imagery highlighting the current incorrect AWC flowline, the nominated updated flowline, the new creek addition flowline and the upper extent of sampling with fish found.

## RESULTS

Between August 24 through September 30, 2016, ADF&G personnel sampled 104 sites throughout the MSB. Forty-five unmapped sites were sampled with an additional 59 additional sites of interest (Figures 8 and 9). Fish were captured at 64 sites; 25 from unmapped streams. Salmon were captured at 31 sites; 14 from unmapped streams (Figure 10, Table 1). The project was also able to remove 11 sites from the Fish Passage Assessment Inventory. Sites were visited and evaluated and found to not have any upstream fish habitat.

In total, 21.39 miles (34.42 km) of stream habitat and 134.16 acres of lake habitat were nominated to the AWC (Figures 10–12, Tables 1 and 2).



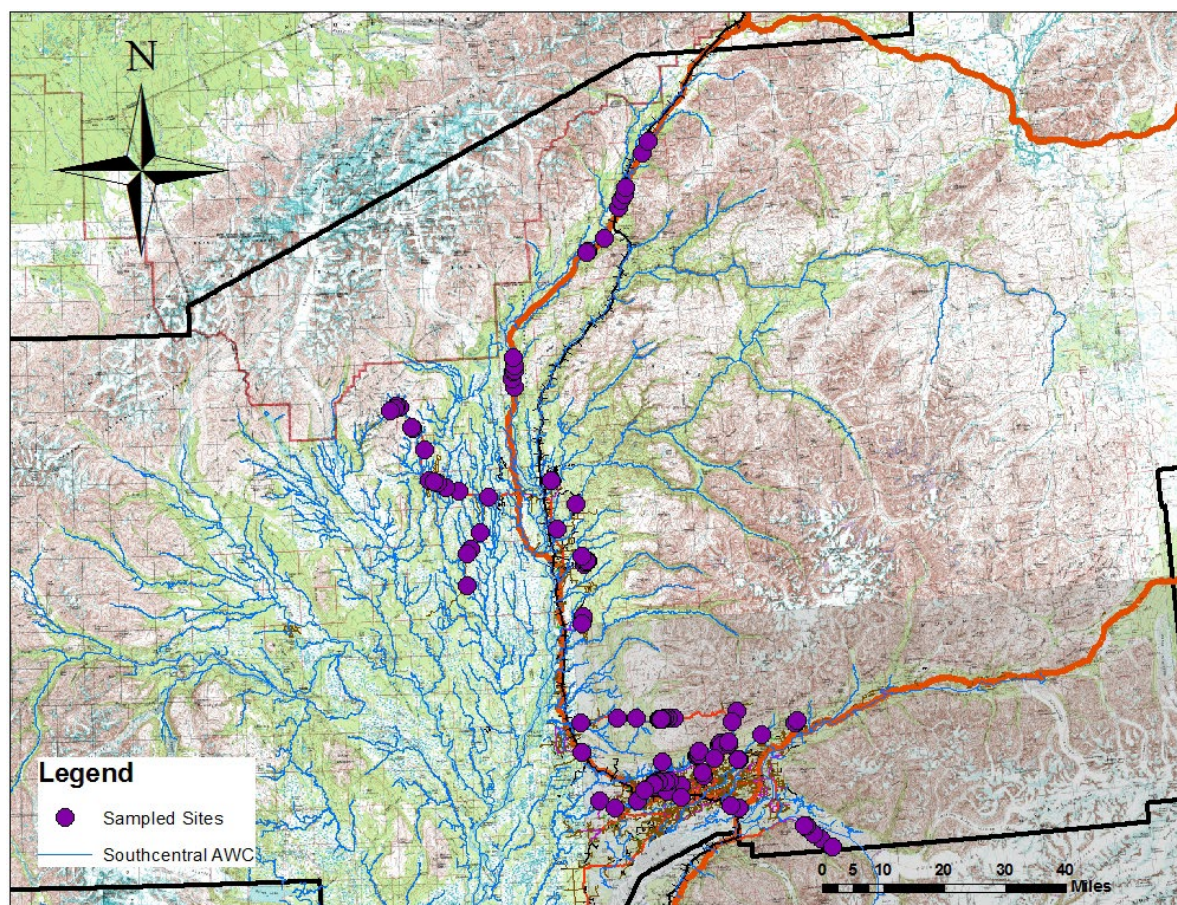


Figure 8.—Map showing the location of all sites sampled during the project.



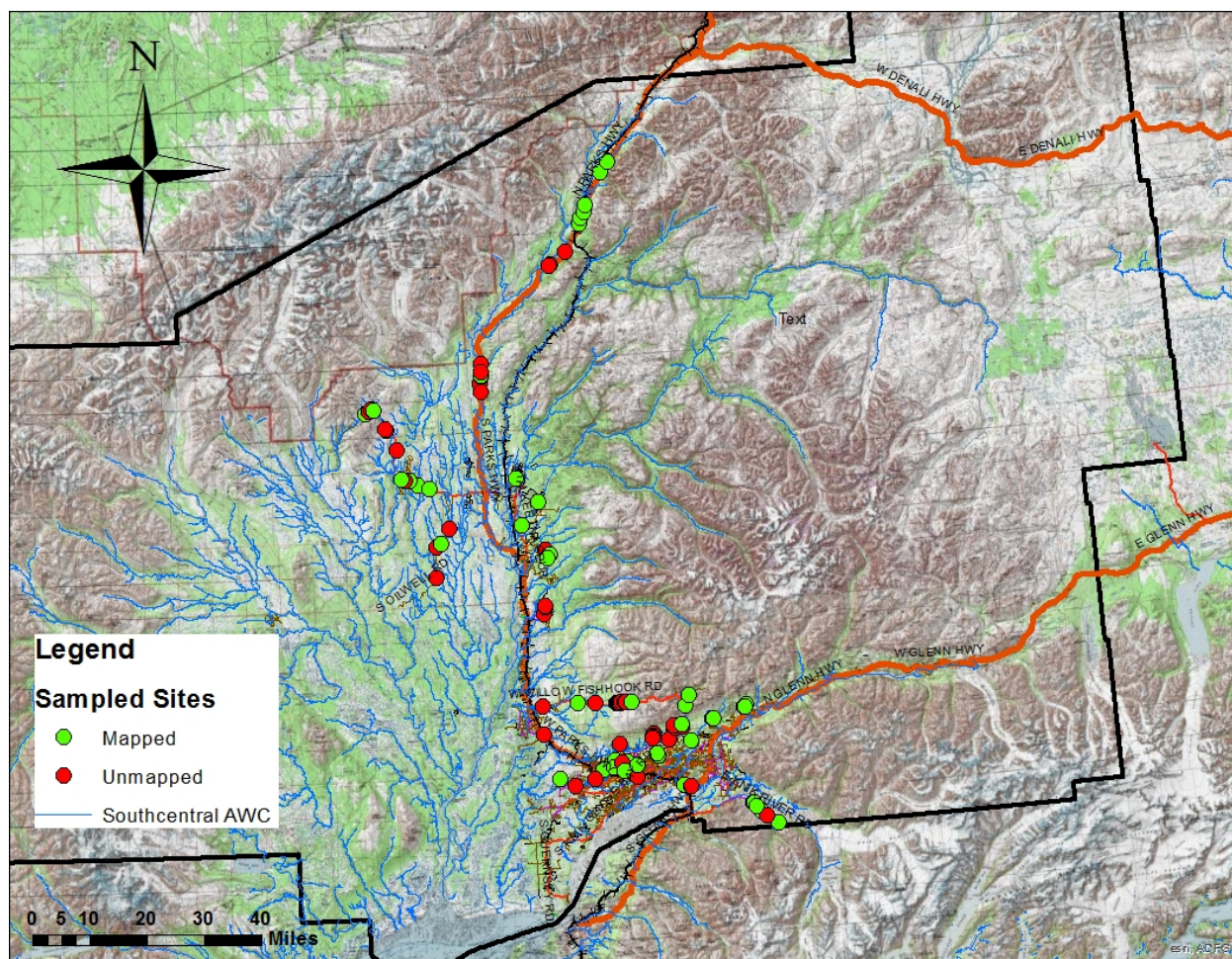


Figure 9.—Map showing the location of sites sampled and if they were previously mapped or unmapped.

Table 1.—Summary of sites sampled and AWC nominations during the project.

Sampling Summary	
Sites sampled	104
Number of unmapped sites samples	45
Number of sites with fish (anadromous and resident)	64
Number of sites with coho or Chinook salmon	31
Number of unmapped sites with fish	25
Number of unmapped sites with coho or Chinook salmon	14
Number of new stream miles nominated to the AWC	21.39
Number of new stream miles nominated from unmapped streams	11.34
Number of new lake acres nominated to AWC	171.25
Number of new lake acres nominated to AWC from unmapped streams	134.16



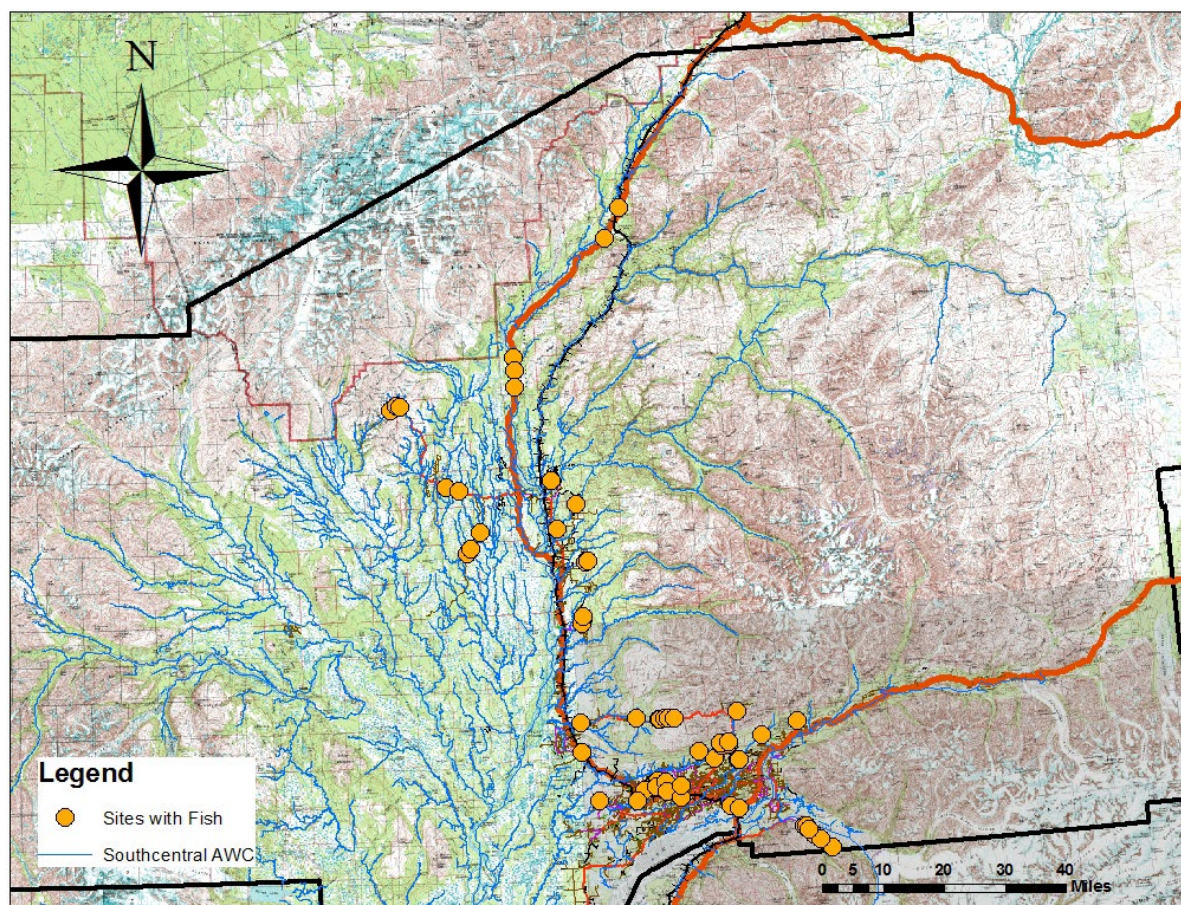


Figure 10.—Map showing all sites where fish were captured.



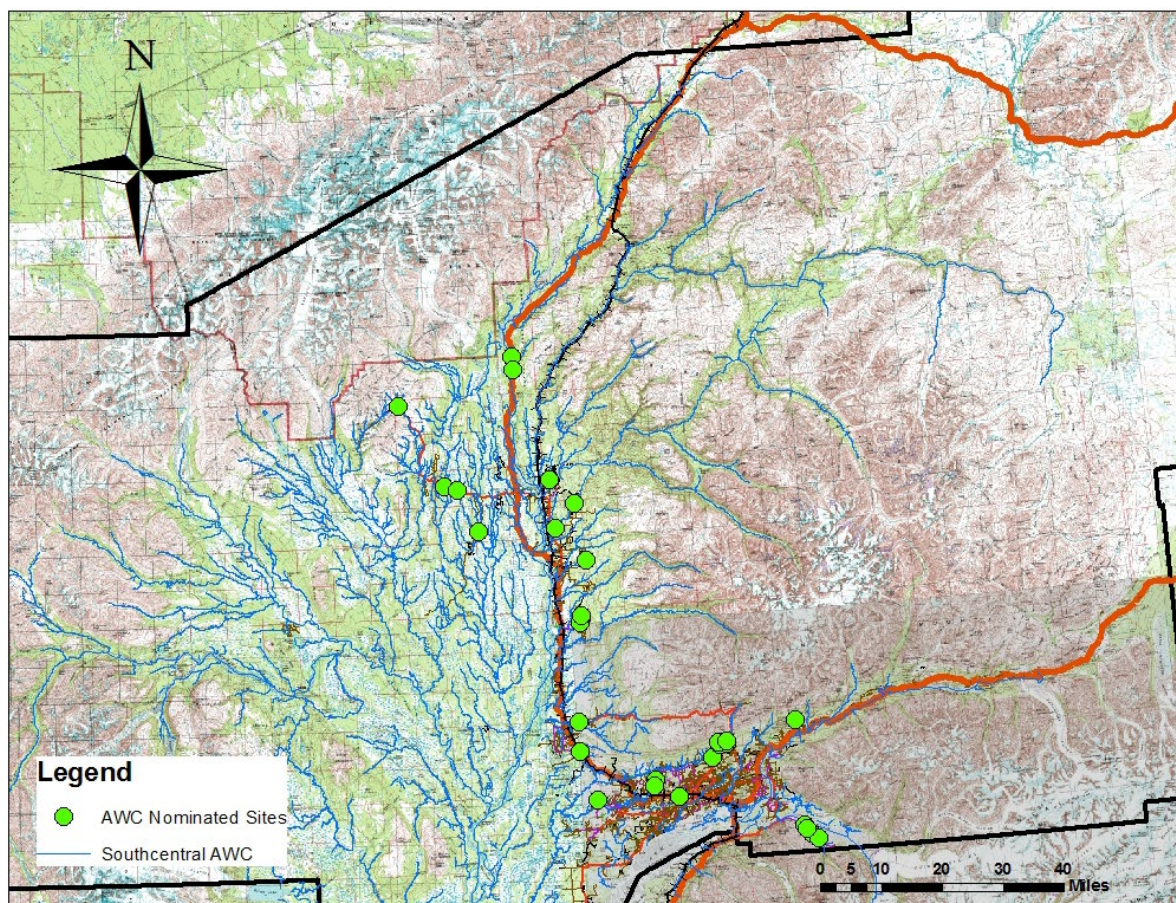


Figure 11.—Map showing the locations of sites where coho and Chinook salmon were captured and nominated to the AWC.



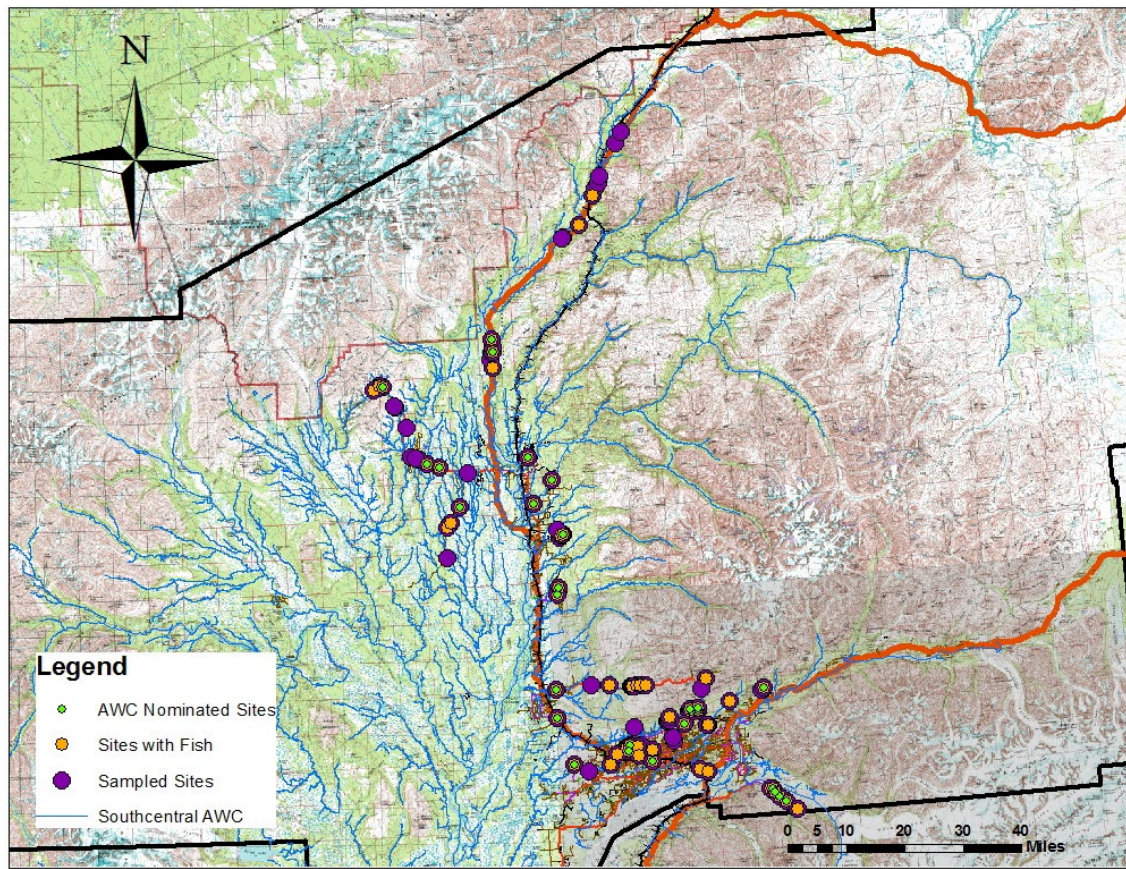


Figure 12.—Map showing the locations of all sites sampled, sites where fish were found, and sites where coho or Chinook salmon were found and nominated to the AWC.

Table 2.—Fish captured at sites in the MSB during the project.

Fish Captured	Number of Sites	% of Sites Sampled
Coho salmon	30	28.85%
Dolly Varden	24	23.08%
Threespine stickleback	15	14.42%
Sculpin (unidentified)	11	10.58%
Rainbow trout	7	6.73%
Chinook salmon	3	2.88%
Ninespine stickleback	3	2.88%
Blackfish	3	2.88%
Sockeye salmon	1	0.96%
Lamprey	1	0.96%
Pike	1	0.96%
Burbot	1	0.96%
Grayling	1	0.96%
Total sites sampled	104	

## DISCUSSION

Fish passage assessments conducted in the MSB indicated that fish passage is widely impacted throughout the borough (O'Doherty *In prep*). ADF&G's initial prioritization model and subsequent optimization model, currently being developed, attempt to provide a borough-wide tool for identifying sites that would produce the most ecological value upon replacement for fish passage. Filling in data gaps is essential for improving the accuracy and integrity of the optimization model.

The project was able to sample 104 sites in only 20 sample days, and established fish presence at 64 sites (62%), with coho and/or Chinook salmon found at 31 sites (30%). The project demonstrated that fish presence could be established relatively easily and quickly using minimal resources and only one sampling event (i.e., electrofishing or trapping). Additionally, it should be pointed out that one sampling event does not preclude a site from bearing fish if no fish were found. Due to timing, water clarity, temperature, and survey methods, one sampling event may fail to capture any fish data or all species present for a water body.

Establishing a water body as fish bearing and/or anadromous warrants protections under the Fishway Act (AS 16.05.841), and the Anadromous Fish Act (AS 16.05.871). It can also provide some riparian protections under the Alaska Forest Resources and Practices Act (FRPA) (AS 41.17; SOA DNR 2013) and the Matanuska-Susitna Borough Code Ordinance 17.55.030 (MSB 2016). Protecting these small and medium sized creeks is important for juvenile salmonids that will utilize nonnatal streams for rearing for up to two years (Kahler and Quinn 1998). In addition, many of the small streams in Southcentral Alaska have resident populations of Dolly Varden char and rainbow trout and it has been observed that these fish utilize the entire length of usable habitat in their streams when flows allow. Providing road crossings that maintain favorable flow conditions are critical for maintaining habitat connectivity (Bryant et.al. 2009).

The project made 31 nominations to the AWC, including over 21 miles of new habitat and 171 acres of new lakes. Sampling information for all 104 sites was submitted to the Alaska Freshwater Fish Inventory project for inclusion in their database and online mapper. Sampling events that produced no fish were also included in the submission and can be important information for regional managers, biologists, and other agency staff wanting to know if an area or waterbody has been sampled for fish presence. It is not unusual for unsuccessful sampling events to go unreported and that information is then lost.

Using the 2011 Mat-Su LiDAR imagery and updated NHD for AWC nominations allowed for correction nominations to be made where stream courses were found to be erroneous. Correction nominations were submitted with new nominations where current hydrography of an existing AWC mapped stream conflicted with the new water body nomination at the confluence. Updating stream courses allowed for stream sinuosity to be captured and increased total AWC stream miles. However increased AWC miles are not reflected in project nomination totals since those streams were already cataloged.

## RECOMMENDATIONS

This project was designed to rapidly sample fish passage sites on previously unmapped streams and streams with no fish sampling information to establish fish presence. All streams where anadromous fish (salmon) were captured were nominated to the AWC, but only up to the upper



most point of sampling where fish were captured due to the limited time at the site. Indeed, many anadromous extents cataloged in the AWC are only the upper extent of sampling and not the full extent of anadromous habitat present in a given stream (Johnson 2016).

This project only dealt with filling in data gaps pertaining to fish presence and usage. The optimization model will rely on the new updated NHD flowlines and elevation data created from the 2011 Mat-Su LiDAR data to estimate potential upstream habitat (Saint Mary's 2015, Miller et al. 2015). This data will allow for calculating potential upstream miles above a barrier to a predetermined sustained stream slope. However, while using the updated NHD flowlines in making AWC nominations, it was noted that there are still areas that need to be adjusted to actual stream courses.

It is recommended that any future investigations allow more time for comprehensive sampling on streams where above-average habitat exists, and upstream fish habitat can be documented to its upper extent. It is also recommended that future investigations consider sampling sites more than once and at different times of the year, especially on sites with above-average habitat.

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## **APPENDIX A: SITE SAMPLING SUMMARY**

Appendix A.—Site sampling summary.

Site ID <sup>a</sup>	Road Name <sup>b</sup>	Stream Name <sup>c</sup>	Latitude	Longitude	Culvert Rating <sup>a</sup>	Date Sampled	Fish Captured <sup>d</sup>	Unmapped?	Nominated to AWC?	Miles Nominated	Lake Acres Nominated
20400592	Jonesville Mine Rd	Eska Cr	61.73873	-148.90591	Green	9/27/16	Coho	No	Yes	1.06	
20400593	Slipper Lake Campground	Slipper Lk Outlet	61.73296	-148.91884	Red	9/27/16	None	No	no		
20400594	Jonesville Mine Rd	Slipper Lk Outlet	61.73315	-148.91489	Red	9/27/16	None	No	no		
20400596	Knik River Rd	Knik R. UT	61.48971	-148.91248	Red	9/15/16	DV	No	No		
20400597	Knik River Rd	Knik R. UT	61.48851	-148.90306	Red	9/15/16	coho, DV, sockeye, Sc	No	Yes	0.21	
20400599	Knik River Rd	Knik R. UT	61.46885	-148.86882	Red	9/15/16	coho	No	Yes	0.2	
20401043	Black Bear Dr	Little Meadow Cr UT	61.62419	-149.39442	Red	9/26/16	None	No	no		
20401044	Ridgeview Dr	Little Meadow Cr UT	61.63208	-149.40013	Red	9/26/16	None	No	no		
20401169	Buffalo Mine Rd	Moose Cr UT	61.71012	-149.09189	Red	9/6/16	DV	No	no		
20401171	Buffalo Mine Rd	Premiere Cr	61.71053	-149.09009	Red	9/6/16	DV	No	no		
20401191	Knik River Rd	Hunter Cr UT	61.43461	-148.78171	Red	9/15/16	DV	No	no		
20401202	Nelson Rd	Wasilla Cr UT	61.54816	-149.26788	Green	9/19/16	coho, Bf	No	Yes	0.58	
20401234	Private Drive off Knik River Rd	Knik R. UT	61.45517	-148.83777	Red	9/15/16	coho, DV	Yes	Yes	1.24	12.60
20401314	Old Matanuska Rd	Rabbit Slough UT	61.54255	-149.23116	Gray	9/19/16	Bf	Yes	no		
20401341	Fauk Rd	Wasilla Cr UT	61.65721	-149.21643	Red	9/28/16	3St, Sc	No	no		

-continued-

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19	Site ID <sup>a</sup>	Road Name <sup>b</sup>	Stream Name <sup>c</sup>	Latitude	Longitude	Culvert Rating <sup>a</sup>	Date Sampled	Fish Captured <sup>d</sup>	Unmapped?	Nominated to AWC?	Miles Nominated	Lake Acres Nominated
	20401342	N Bush Rd	Wasilla Cr UT	61.65707	-149.21487	Red	9/28/16	3St, Sc	No	no		
	20501030	Edgerton Parks Rd	Little Susitna UT	61.69328	-149.306	Red	8/26/16	None	Yes	No		
	20501037	N Welsh Way	Little Susitna side channel	61.66383	-149.33513	Gray	8/31/16	coho, Chinook	Yes	Yes	1.35	
	20501048	Dan Joe St	Little Susitna UT	61.66217	-149.59419	Red	9/27/16	None	Yes	no		
	20501052	W Dean Dr	Little Meadow Cr UT	61.61342	-149.64658	Green	9/1/16	3St	No	no		
	20501054	Meadow Lakes Lp Rd	Outlet to Scott Lk	61.61227	-149.64647	Green	9/1/16	3St	No	no		
	20501055	N Meadow Lakes Dr	Seymore Lk Outlet	61.59758	-149.67757	Red	9/1/16	RBT, 9St	No	no		
	20501056	Skyview Dr	Lalen Lk Outlet	61.59937	-149.69269	Green	9/1/16	RBT, 3St	No	no		
	20501062	Pittman Rd	Unnamed	61.6165	-149.61978	Red	9/1/16	None	No	no		
	20501067	Pittman Rd	Cloud Lk Inlet	61.62028	-149.62364	Red	9/28/16	coho	No	Yes	0.38	
	20501071	Pittman Rd	Little Meadow Cr UT	61.60427	-149.63208	Red	9/28/16	coho, 3St, 9St	No	Yes	1.036	5.15
	20501074	Beverly Lake Rd	UT to Beverly Lk	61.61636	-149.5667	Red	9/1/16	None	Yes	No		
	20501075	Beverly Lake Rd	UT to Beverly Lk	61.61628	-149.56517	Red	9/1/16	None	No	No		

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Site ID <sup>a</sup>	Road Name <sup>b</sup>	Stream Name <sup>c</sup>	Latitude	Longitude	Culvert Rating <sup>a</sup>	Date Sampled	Fish Captured <sup>d</sup>	Unmapped?	Nominated to AWC?	Miles Nominated	Lake Acres Nominated
20501076	N. Kalmbach Lake Dr	Beverly Lk Outlet	61.6148	-149.58762	Gray	9/1/16	RBT, Sc		no		
20501090	Little Meadow Creek Rd	Meadow Cr UT	61.57545	-149.73589	Gray	9/14/16	3St	Yes	No		
20501120	Lakes Blvd	Unnamed	61.56306	-149.848333	Red	9/14/16	none	Yes	No		
20501147	Moose Meadows Rd	Little Susitna UT	61.68274	-149.40868	Red	8/31/16	DV		no		
20501149	Moose Meadows Rd	Little Susitna UT	61.67528	-149.41333	Red	8/31/16	None	Yes	no		
20501150	Moose Meadows Rd	Little Susitna UT	61.67335	-149.41812	Red	8/31/16	None	Yes	no		
20501151	Moose Meadows Rd	Little Susitna UT	61.6715	-149.4211	Green	8/31/16	None		no		
20501181	Creekside Dr	Willow Cr UT	61.76626	-149.99547	Red	9/16/16	coho, Bf	Yes	Yes	1.34	
20501188	Karsten Dr	Little Meadow Cr UT	61.59404	-149.58229	Red	9/26/16	3St	no	no		
20501189	Kime Lane Dr	Kime Lk outlet	61.69679	-149.99666	Green	9/30/16	coho, 9St	Yes	Yes	0.08	3.43
20501197	S. Clapp Rd	Lucille Cr UT	61.57665	-149.51175	Red	9/26/16	coho, 3St	Yes	Yes	0.25	6.9
20501207	Palmer Fishhook Rd	Little Susitna UT	61.74697	-149.23235	Red	9/28/16	None	no	no		
20501239	Willow Fishhook Rd	Willow Cr UT	61.77191	-149.80685	Red	9/16/16	None	no	No		

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Site ID <sup>a</sup>	Road Name <sup>b</sup>	Stream Name <sup>c</sup>	Latitude	Longitude	Culvert Rating <sup>a</sup>	Date Sampled	Fish Captured <sup>d</sup>	Unmapped?	Nominated to AWC?	Miles Nominated	Lake Acres Nominated
20501240	Willow Fishhook Rd	Willow Cr UT	61.76905	-149.71297	Red	9/16/16	burbot	Yes	No		
20501242	Willow Fishhook Rd	Willow Cr UT	61.76458	-149.59807	Green	9/16/16	DV	No	No		
20501243	Willow Fishhook Rd	Willow Cr UT	61.7638	-149.59566	Green	9/20/16	None	No	No		
20501243	Willow Fishhook Rd	Willow Cr UT	61.76376	-149.59549	Green	9/16/16	DV	No	No		
20501244	Willow Fishhook Rd	Willow Cr UT	61.76426	-149.58827	Red	9/16/16	None	No	No		
20501245	Willow Fishhook Rd	Willow Cr UT	61.76447	-149.58237	Red	9/20/16	None	Yes	no		
20501246	Driveway off Willow Fishhook Rd	Willow Cr UT	61.76442	-149.58153	Red	9/20/16	None	Yes	no		
20501247	Willow Fishhook Rd	Willow Cr UT	61.76535	-149.57167	Red	9/20/16	DV, Sc	Yes	no		
20501248	Willow Fishhook Rd	Willow Cr UT	61.76532	-149.55518	Red	9/20/16	None	Yes	no		
20501249	Willow Fishhook Rd	Willow Cr UT	61.76478	-149.54999	Red	9/20/16	DV, Sc	Yes	no		
20501250	Willow Fishhook Rd	Francie Cr	61.76477	-149.52066	Red	9/20/16	DV	No	no		
20501376	Parks Hwy	Chulitna R. UT	63.1026	-149.49289	Red	9/21/16	None	No	No		
20501380	Parks Hwy	Chulitna R. UT	62.87797	-149.80511	Red	9/9/16	None	Yes	no		
20501382	Parks Hwy	Chulitna R. UT	62.87653	-149.814417	Red	9/9/16	None	Yes	no		

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Site ID <sup>a</sup>	Road Name <sup>b</sup>	Stream Name <sup>c</sup>	Latitude	Longitude	Culvert Rating <sup>a</sup>	Date Sampled	Fish Captured <sup>d</sup>	Unmapped?	Nominated to AWC?	Miles Nominated	Lake Acres Nominated
20501384	Parks Hwy	Pass Cr UT	62.90757	-149.71889	Red	9/9/16	Sc	Yes	no		
20501386	Parks Hwy	Chulitna R. UT	62.63919	-150.22348	Red	9/22/16	coho	Yes	Yes	0.48	
20501389	Parks Hwy	Chulitna R. UT	62.58784	-150.23601	Red	9/22/16	None	Yes	No		
20501390	Parks Hwy	Chulitna R. UT	62.60516	-150.22711	Red	9/22/16	None	No	No		
20501391	Parks Hwy	Chulitna R. UT	62.60845	-150.22301	Red	9/22/16	coho, DV	No	Yes	0.1077	
20501396	Petersville Rd	Ninemile Cr UT	62.31191	-149.39220	Red	9/9/16	Coho	Yes	Yes	1.11	
20501405	Oilwell Rd	Moose Cr UT	62.2285	-150.44531	Gray	9/7/16	coho	Yes	Yes	0.31	
20501447	S Horseshoe Lake Rd	Inlet to Horseshoe Lk	61.58142	-149.92383	Green	9/14/16	coho, 3St	No	Yes	0.14	
20501449	Church Rd	Little Meadow Cr UT	61.60449	-149.51121	Red	9/26/16	3St	No	No		
20501460	Barge Dr	Question Cr UT	62.22783	-150.05174	Red	9/30/16	coho, 3St	No	Yes	0.192	
20501461	E. Caswell Lakes Rd	Caswell Cr UT	62.00056	-149.9563	Red	8/24/16	coho, RBT, 3St, lamprey	Yes	Yes		
20501467	Makuskin Rd	Buddy Cr UT	62.14694	-149.91324	Red	9/13/16	RBT, Sc	Yes	No		
20501468	Malsapina Lp Rd	Buddy Cr UT	62.16045	-149.93326	Red	9/13/16	None	Yes	No		

-continued-



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Site ID <sup>a</sup>	Road Name <sup>b</sup>	Stream Name <sup>c</sup>	Latitude	Longitude	Culvert Rating <sup>a</sup>	Date Sampled	Fish Captured <sup>d</sup>	Unmapped?	Nominated to AWC?	Miles Nominated	Lake Acres Nominated
20501469	Malsapina Lp Rd	Buddy Cr UT	62.14458	-149.92055	Red	9/13/16	RBT, DV, Sc	Yes	No		
20501470	Mastodon Rd	Birch Cr UT	62.2827	-149.95087	Gray	9/30/16	Coho	No	Yes	0.05	
20501472	Oilwell Rd	Kroto Cr UT	62.10636	-150.52545	Green	9/7/16	None	Yes	no		
20501473	Oilwell Rd	Kroto Cr UT	62.18155	-150.51698	Green	9/7/16	NP	Yes	no		
20501474	Oilwell Rd	Moose Cr UT	62.19147	-150.49477	Green	9/7/16	grayling	No	no		
20501491	Petersville Rd	Peters Cr UT	62.48354	-150.76303	Red	9/8/16	None	Yes	no		
20501463	Cummings Rd	Talkeetna R. UT	62.34389	-150.06601	Red	9/30/16	coho, Sc	No	Yes	1.83	
20501495	Petersville Rd	Long Cr UT	62.52882	-150.87039	Green	9/8/16	DV	No	no		
20501496	Petersville Rd	UT	62.53283	-150.84966	Red	9/8/16	None	Yes	no		
20501497	Petersville Rd	Peters Cr UT	62.53711	-150.84123	Red	9/8/16	DV	Yes	no		
20501498	Petersville Rd	Peters Cr UT	62.53498	-150.82373	Red	9/8/16	coho, DV, Sc	No	Yes	0.25	
20501500	Petersville Rd	Peters Cr UT	62.48619	-150.76566	Gray	9/8/16	None	Yes	no		
20501503	Petersville Rd	Deep Cr UT	62.43077	-150.70657	Red	9/8/16	None	Yes	no		
20501505	Petersville Rd	Kroto Cr UT	62.341	-150.60594	Green	9/8/16	coho	No	Yes	0.93	

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Site ID <sup>a</sup>	Road Name <sup>b</sup>	Stream Name <sup>c</sup>	Latitude	Longitude	Culvert Rating <sup>a</sup>	Date Sampled	Fish Captured <sup>d</sup>	Unmapped?	Nominated to AWC?	Miles Nominated	Lake Acres Nominated
20501506	Petersville Rd	Kroto Cr UT	62.35293	-150.64851	Green	9/8/16	None	No	no		
20501508	Petersville Rd	Twenty Mile Cr UT	62.35531	-150.66957	Gray	9/8/16	None	Yes	no		
20501509	Petersville Rd	Jake Lk Inlet	62.35921	-150.69237	Green	9/8/16	None	No	no		
20501514	Shaman Rd	Caswell Cr UT	62.01786	-149.94838	Red	8/24/16	Chinook, RBT	Yes	Yes	3.47	111.23
20501515	Shaman Rd	Caswell Cr UT	62.01839	-149.94705	Red	8/24/16	coho, Chinook	Yes	Yes	0.31	
20501851	Parks Hwy	Chulitna R. UT	63.12755	-149.45367	Red	9/21/16	None	No	No		
20501878	Runyon Cir	Little Susitna UT	61.6937	-149.29533	Green	8/26/16	coho, DV	Yes	Yes	0.17	
20502071	N Solid Rock Cir	Little Susitna UT	61.69474	-149.26094	Gray	8/26/16	coho	Yes	Yes	1.18	
20502076	N. Waldo Reed Dr	Little Susitna UT	61.69907	-149.30363	Red	8/26/16	coho, DV	Yes	Yes	0.05	
20502147	Parks Hwy	Chulitna R. UT	62.56874	-150.23154	Red	9/22/16	DV	Yes	No		
20502148	Parks Hwy	Chulitna R. UT	62.61769	-150.22403	Red	9/22/16	None	Yes	No		
MP 171	Parks Hwy	Granite Cr UT	61.97762	-149.63165		9/21/16	DV	no	No		
MP 172.3	Parks Hwy	Chulitna R. UT	62.99222	-149.62086		9/21/16	None	no	No		
MP 173.4	Parks Hwy	Chulitna R. UT	63.00596	-149.60086		9/21/16	None	no	No		

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Site ID <sup>a</sup>	Road Name <sup>b</sup>	Stream Name <sup>c</sup>	Latitude	Longitude	Culvert Rating <sup>a</sup>	Date Sampled	Fish Captured <sup>d</sup>	Unmapped?	Nominated to AWC?	Miles Nominated	Lake Acres Nominated
MP 174.8	Parks Hwy	Chulitna R. UT	63.02375	-149.58942		9/21/16	None	no	No		
	Petersville Rd	Gate Lk	62.3307	-150.54262		9/22/16	coho, 3St	no	Yes	0.15	15.29
	Mastodon Rd	Birch Cr	62.28308	-149.95232		9/30/16	coho, 3St	no	Yes		16.65
	Southfork Rd	Upper Buddy Cr	62.14877	-149.90802		9/30/16	coho	no	Yes	2.4	
MP 13	Palmer Fishhook Rd	Little Susitna UT	61.77154	-149.20955		9/28/16	DV	no	no		
	N Solid Rock Cir	Little Susitna UT	61.69984	-149.25978		8/26/16	coho, DV	no	Yes	0.02	
	Knik River Rd	Knik R. UT	61.47998	-148.88979	Red	9/15/16	coho, DV	no	Yes	0.51	
	Montana Creek Rd	Buddy Cr UT	62.13969	-149.92369		9/13/16	None	no	No		

<sup>a</sup> Site ID and Culvert Rating are ADF&G designations. MP locations listed under Site ID indicate Alaska Department of Transportation Milepost markers.

<sup>b</sup> Road Name abbreviations: Blvd = Boulevard, Cir = Circle, Dr = Drive, Hwy = Highway, Lp = Loop, Rd = Road and St = Street.

<sup>c</sup> Stream Name abbreviations: Cr = Creek, Lk = Lake, R. = River, and UT = unnamed tributary.

<sup>d</sup> Fish Captured abbreviations: Bf = blackfish, coho = coho salmon, Chinook = Chinook salmon, DV = Dolly Varden char, NP = northern pike, RBT = rainbow trout, Sc = unidentified sculpin, 3St = threespine stickleback, and 9St = ninespine stickleback.



## **APPENDIX B: ANADROMOUS WATERS NOMINATIONS**

Appendix B.—Anadromous waters nominations.

Site 20501396

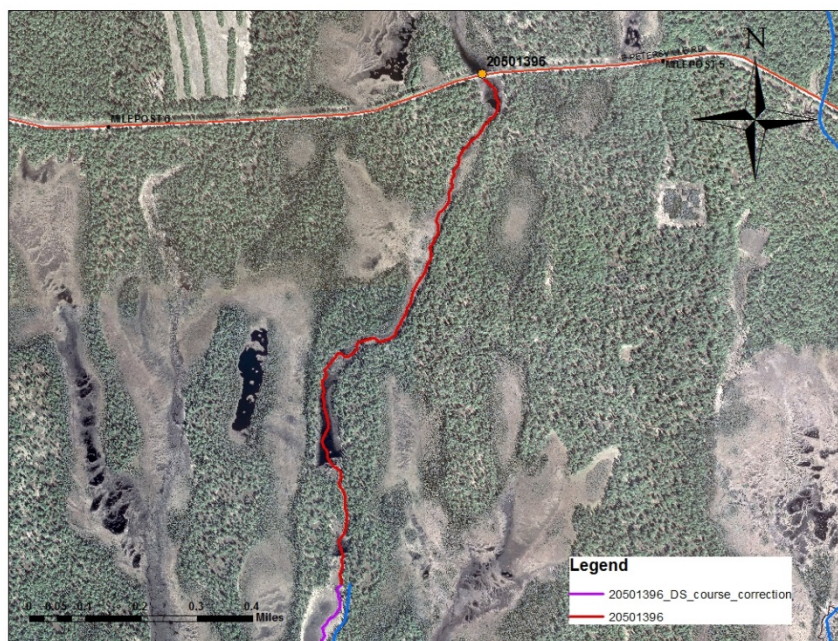
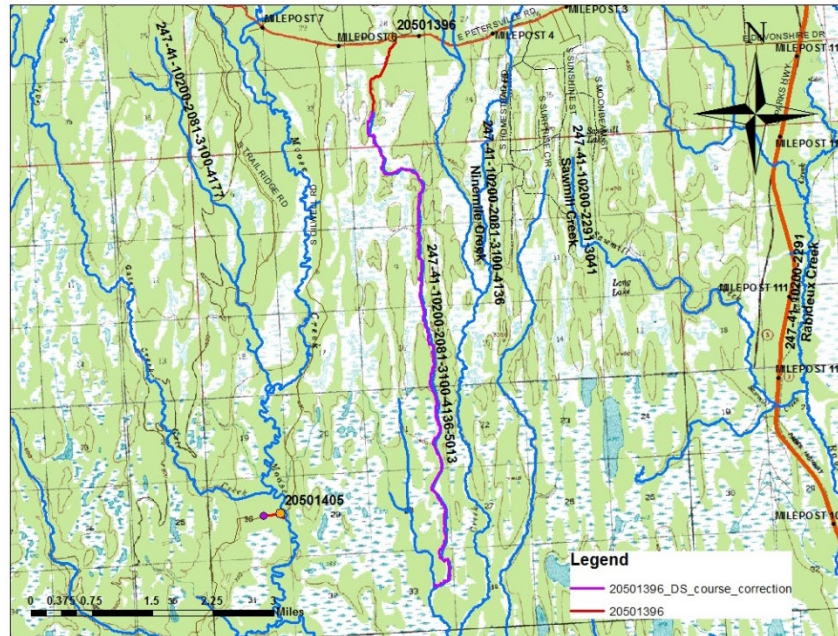
Road: Petersville Road

Stream Name: Unnamed tributary to Moose Creek

Nomination Type: **Addition:** extend anadromy up to road crossing for AWC stream #247-47-10200-2081-3100-4136-5013 with coho salmon rearing. **Correction:** Correct downstream stream course using new NHD to confluence with next stream.

Total new distance nominated: 1.11 miles

Fish found at site: coho salmon





Site 20501067

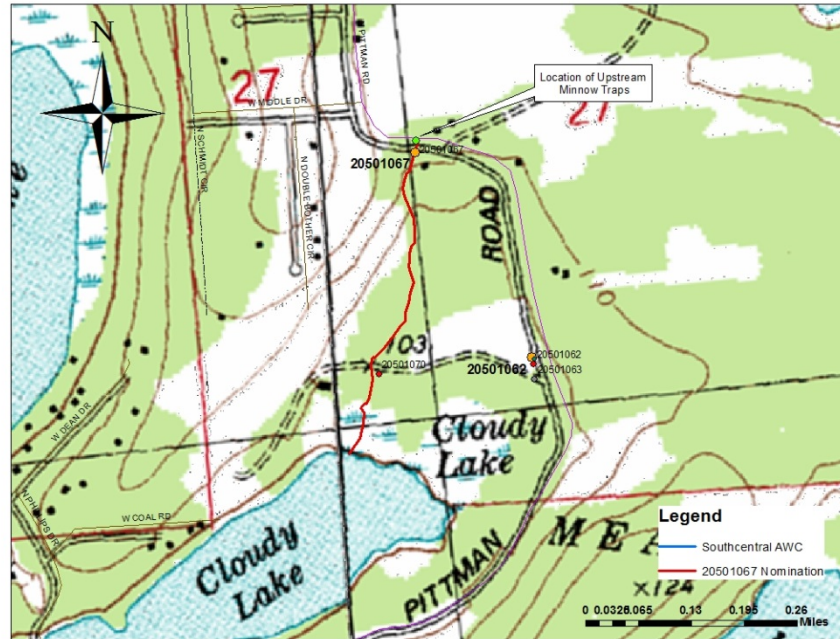
Road name: Pittman Road

Stream name: Cloudy Lake Inlet

Nomination type: **Addition:** Add tributary to Cloudy Lake AWC #247-50-10330-2050-3050-4027-0055, with coho salmon rearing.

Total new distance nominated: 0.38 miles

Fish found at site: coho salmon



## Site 20502076

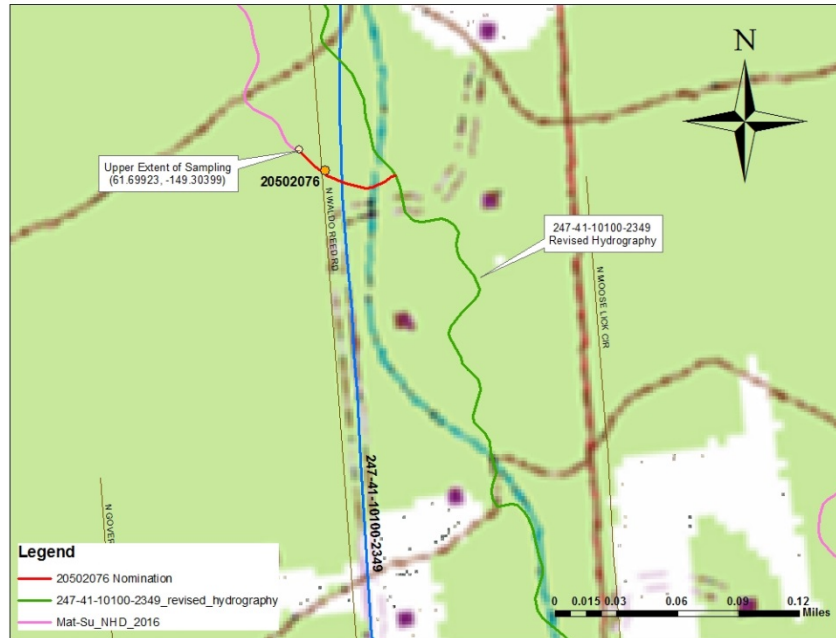
Road name: North Waldo Reed Road

Stream name: unnamed tributary to AWC Stream #247-41-10100-2349, Unnamed Tributary to Little Susitna River

Nomination type: **Addition:** add tributary to AWC stream #247-41-10100-2349 with coho salmon rearing. **Correction:** corrected stream course for AWC stream #247-41-10100-2349 to confluence with Little Susitna River.

Total new distance nominated: 0.05 miles

Fish found at site: coho salmon, Dolly Varden char





Site 20501460

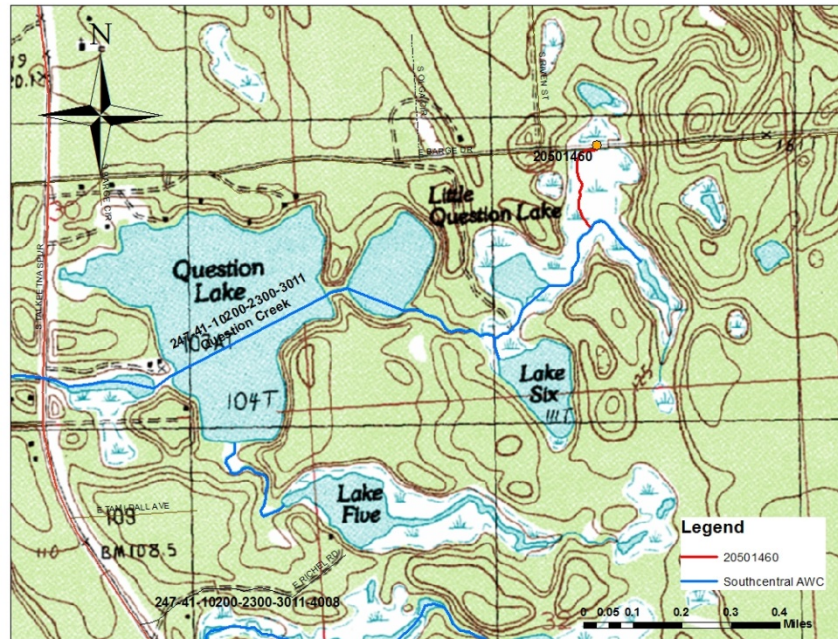
Road name: Barge Drive

Stream name: unnamed tributary to Question Creek, AWC #247-41-10200-2300-3011.

Nomination type: **Addition:** add tributary to Question Creek, AWC #247-41-10200-2300-3011, with coho salmon rearing.

Total new distance nominated: 0.20 miles

Fish found at site: coho salmon, threespine stickleback





Site 20501189

Road name: Kime Lane Drive

Stream name: Kime Lake outlet, tributary to Nancy Lake AWC#247-41-10100-2231-0010.

Nomination type: **Addition:** add Kime Lake and Kime Lake outlet as a tributary to the Nancy Lake drainage with coho salmon rearing.

Total new distance nominated: 0.08 miles and 3.43 acres

Fish captured at site: coho salmon, ninespine stickleback



Site 20501197

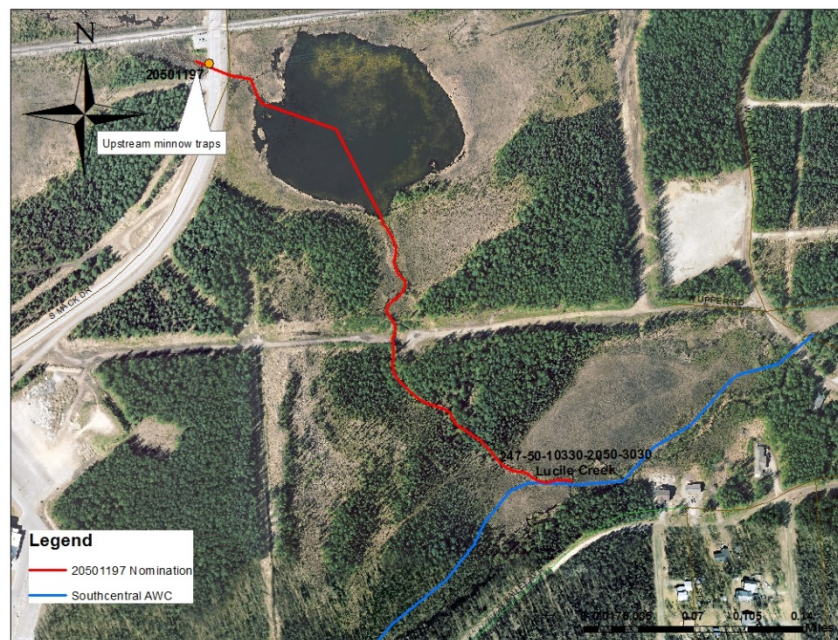
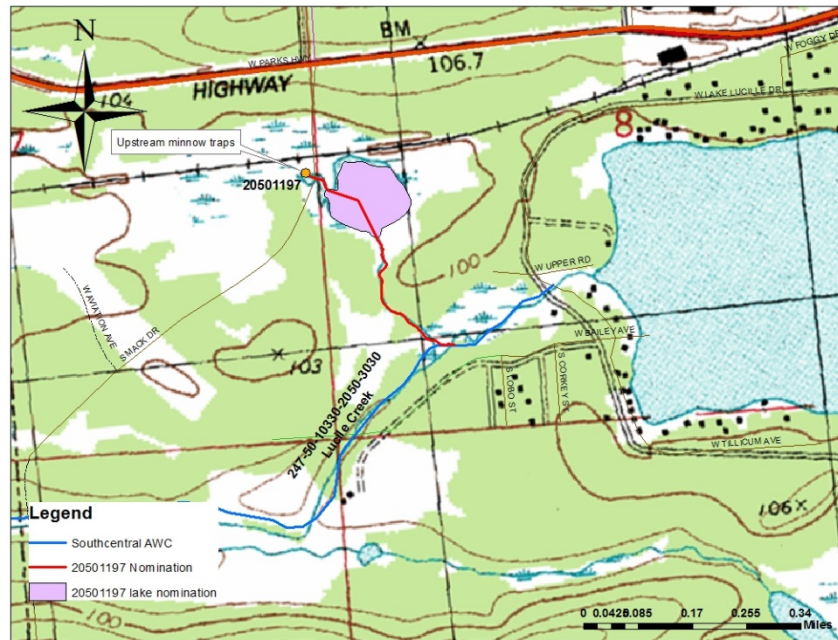
Road name: South Clapp Street

Stream name: unnamed tributary to Lucille Creek, AWC#247-50-10330-2050-3030.

Nomination type: **Addition**: add tributary and downstream pond, with coho salmon rearing.

Total new distance nominated: 0.25 miles, 6.9 acres

Fish found at site: coho salmon, threespine stickleback





Site 20400592

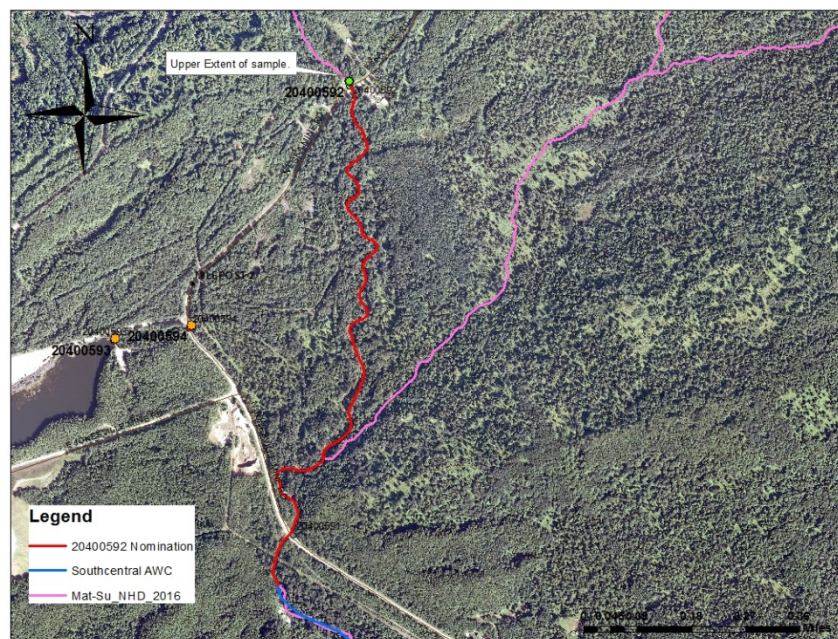
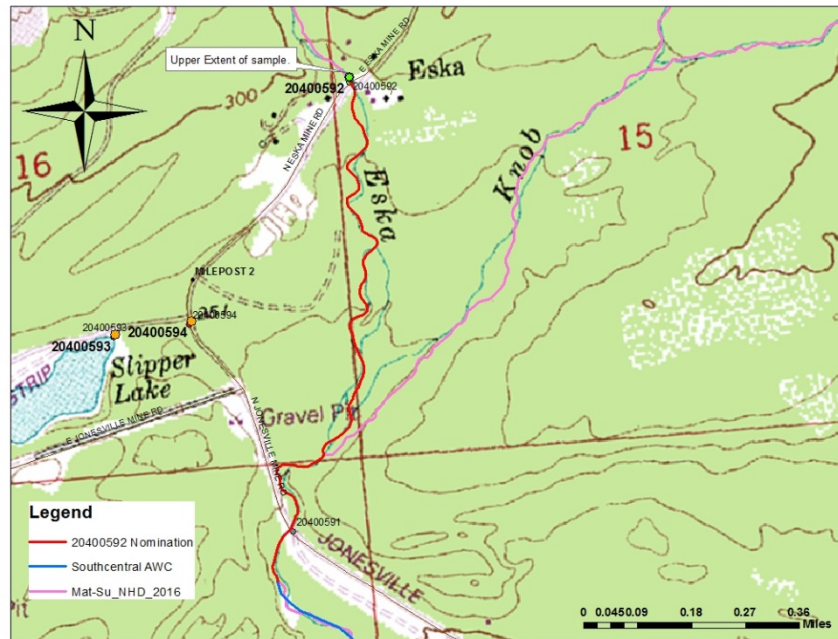
Road name: Eska Mine Road

Creek name: Eska Creek, AWC #247-50-10220-2095

Nomination type: **Addition:** extend anadromy up to upper most sample point for coho salmon spawning.

Total new distance added: 1.06 miles

Fish found at site: adult coho salmon





Site 20501071

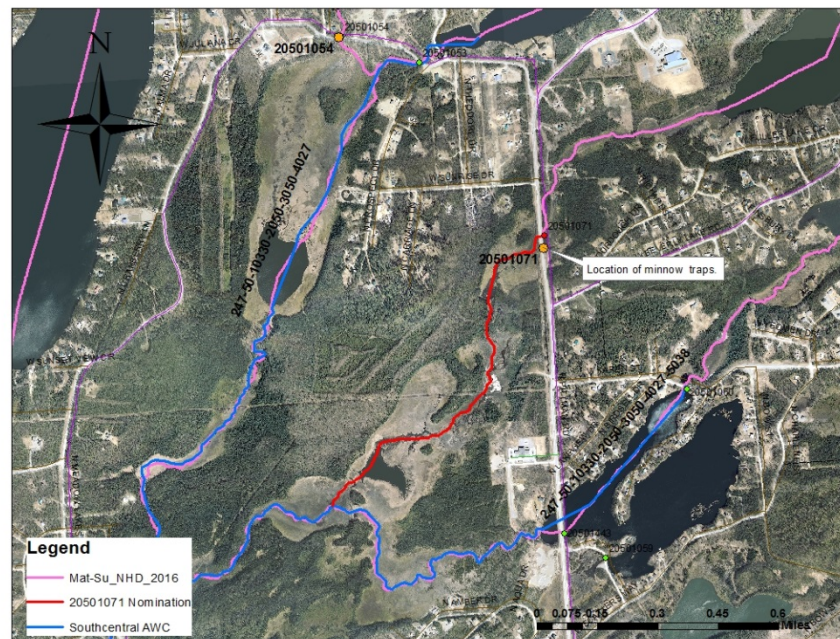
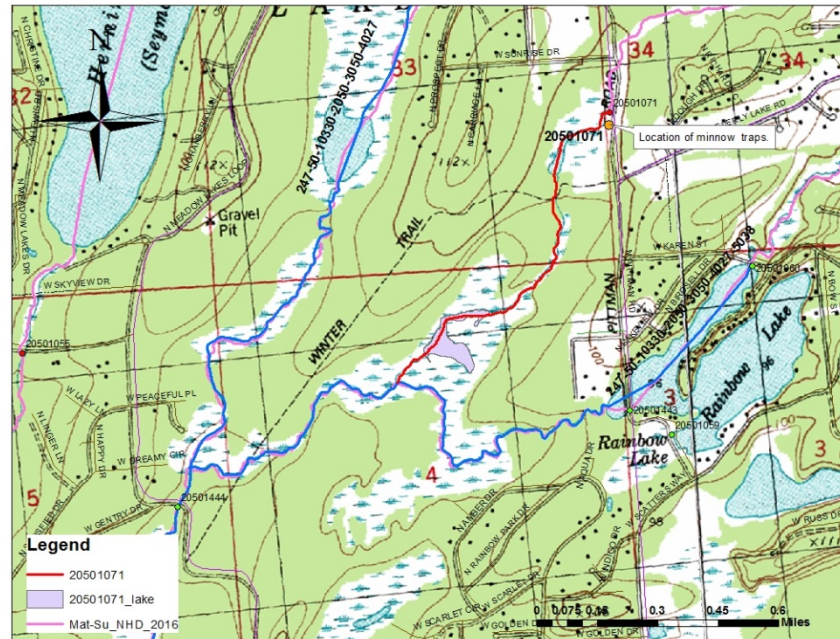
Road name: Pittman Road

Stream name: unnamed tributary to AWC stream #247-50-10330-2050-3050-4027-5038.

Nomination type: **Addition:** add tributary to AWC stream #247-50-10330-2050-3050-4027-5038 and downstream pond, with coho salmon rearing.

Total new distance nominated: 1.04 miles, 5.15 acres

Fish found at site: coho salmon, threespine sticklebacks, ninespine sticklebacks





Site 20501463

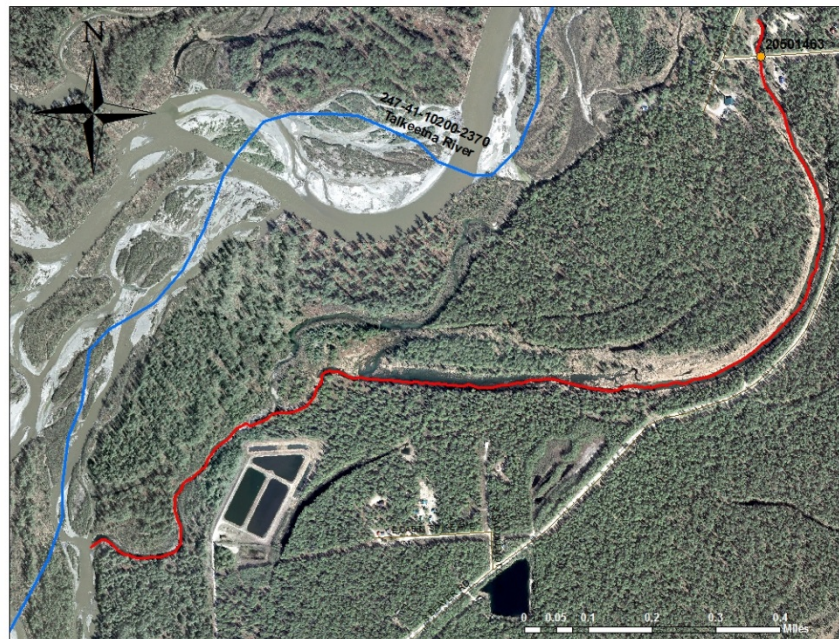
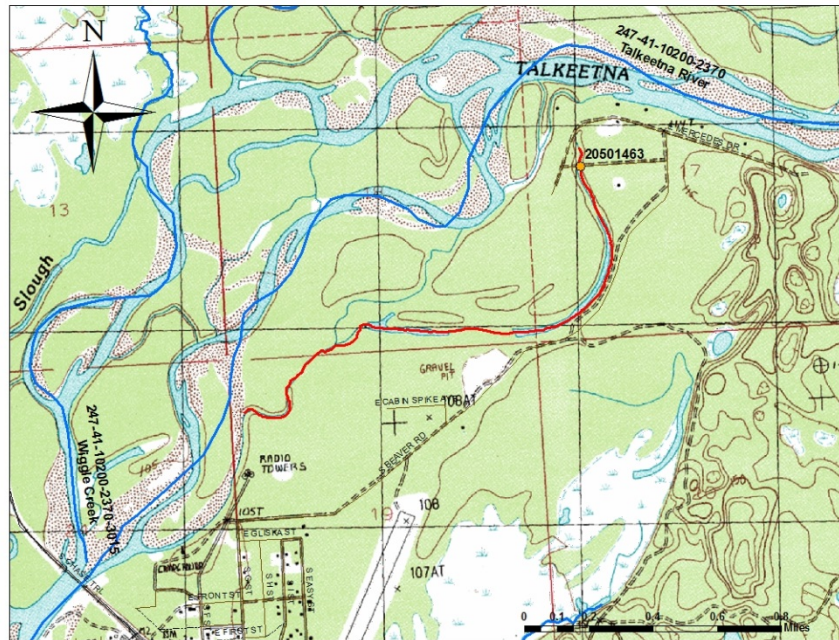
Road name: Cummings Road

Stream name: unnamed tributary to Talkeetna River, AWC #247-41-10200-2370

Nomination type: **Addition:** add tributary to Talkeetna River, AWC #247-41-10200-2370 and upstream source pond for coho salmon rearing.

Total new distance nominated: 1.83 miles, 0.43 acres

Fish found at site: coho salmon, unidentified sculpin





Site 20401234

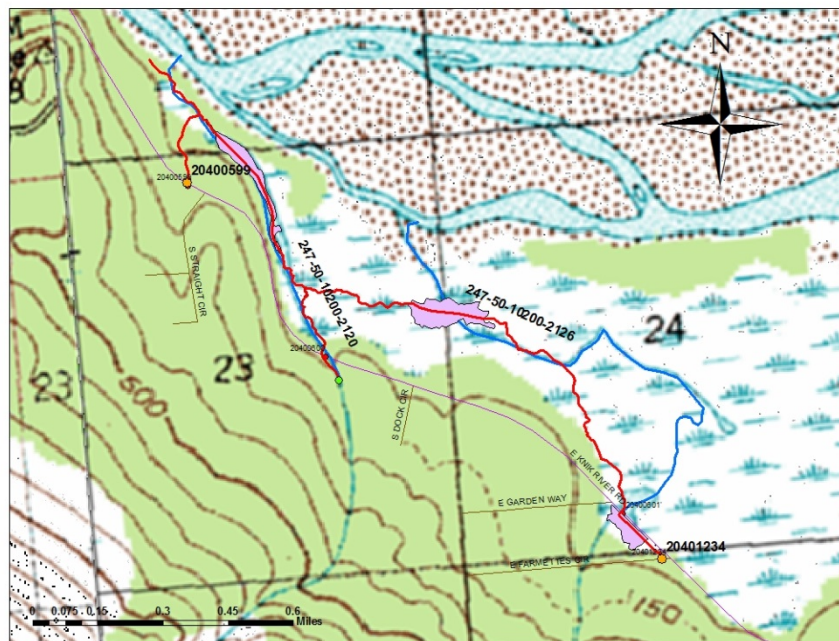
Road name: driveway off Knik River Road

Stream name: unnamed tributary to Knik River AWC #247-50-10200

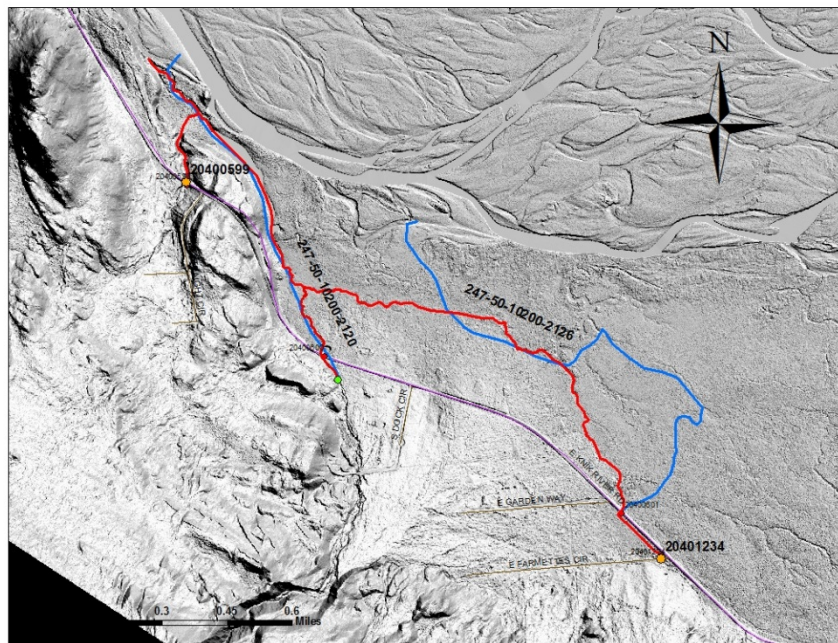
Nomination type: **Addition:** add upstream pond and stream above downstream culvert on Knik River Road #20400601. **Addition:** add 3 pond polygons along downstream course of 247-50-10200-2120 and new additions. **Deletion:** remove stream AWC #247-50-10200-2126 and redraw hydrography as the mainstem of AWC stream #247-50-10200-2120. **Correction:** redraw hydrography of AWC #247-50-10200-2120 showing correct stream course up to culvert 20400601 on Knik River road. **Correction:** redraw the upstream portion of #247-50-10200-2120 that flows through culvert #20400600 as a tributary to stream #247-50-10200-2120.

Total new distance nominated: 1.24 miles (includes downstream correction to known anadromy), 12.6 acres

Fish found at site: coho salmon, Dolly Varden char



Site 20401234 (continued)





Site 20501447

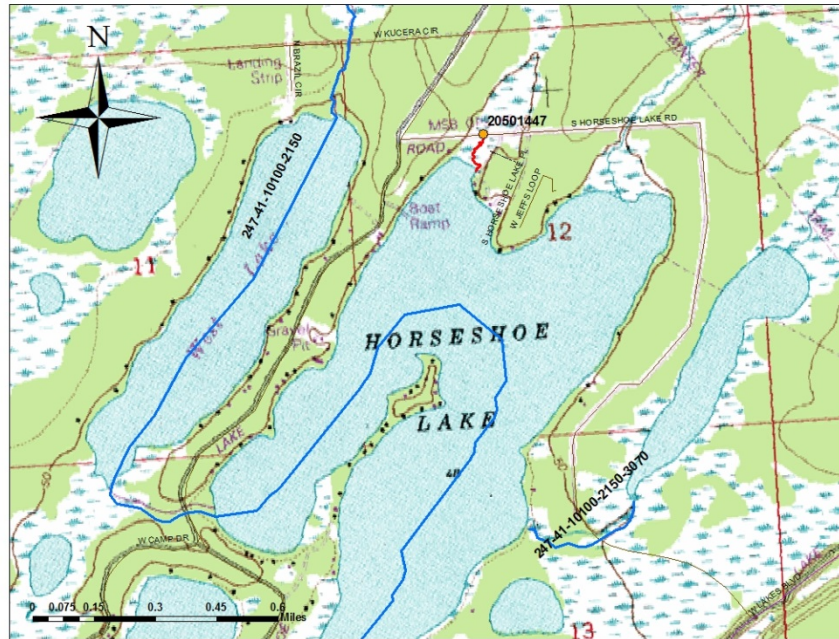
Road name: South Horseshoe Lake Road

Stream name: unnamed tributary to Horseshoe Lake, AWC #247-41-10100-2150-0020

Nomination type: **Addition**: add tributary to Horseshoe Lake, AWC #247-41-10100-2150-0020, with coho salmon rearing.

Total new distance nominated: 0.14 miles

Fish found at site: coho salmon, threespine stickleback





Site 20501037

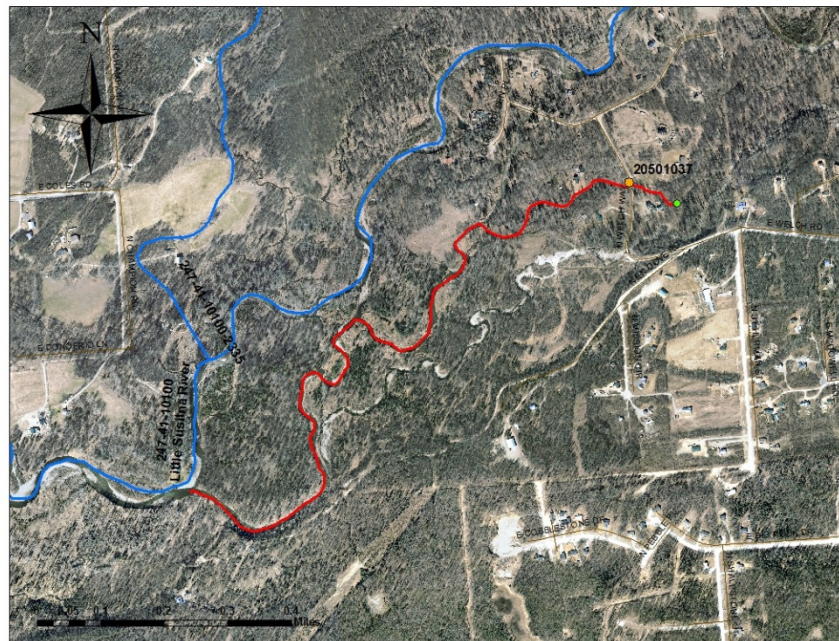
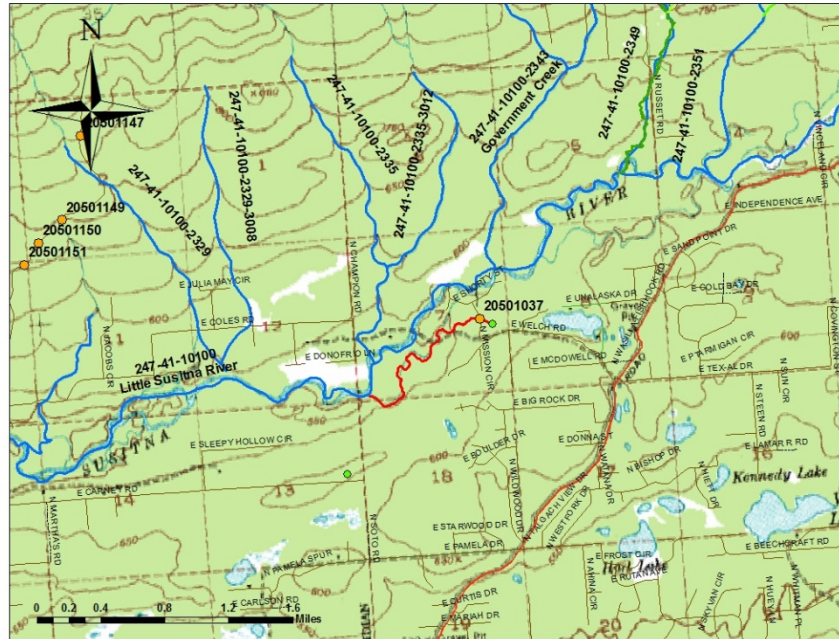
Road name: North Welsh Way

Stream name: Little Susitna side channel

Nomination type: **Addition**: add channel to AWC with coho and Chinook salmon rearing.

Total new distance nominated: 1.35 miles

Fish found at site: coho salmon, Chinook salmon, unidentified sculpin





Site 20501181

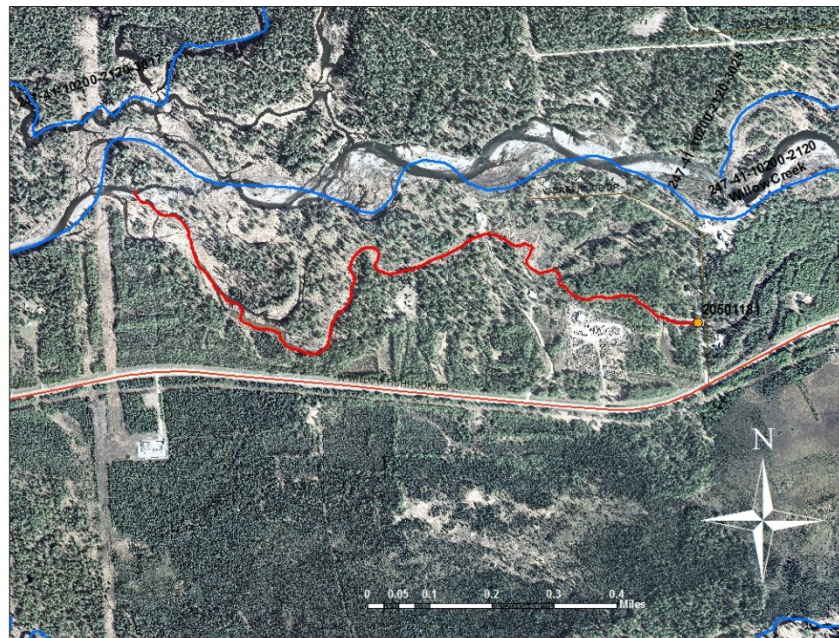
Road name: Creekside Drive

Stream name: unnamed tributary to Willow Creek, AWC # 247-41-10200-2120

Nomination type: **Addition**: add tributary up to culvert crossing on Creekside Drive for Chinook salmon rearing.

Total new distance nominated: 1.34 miles

Fish found at site: Chinook salmon, blackfish



Site 20501878

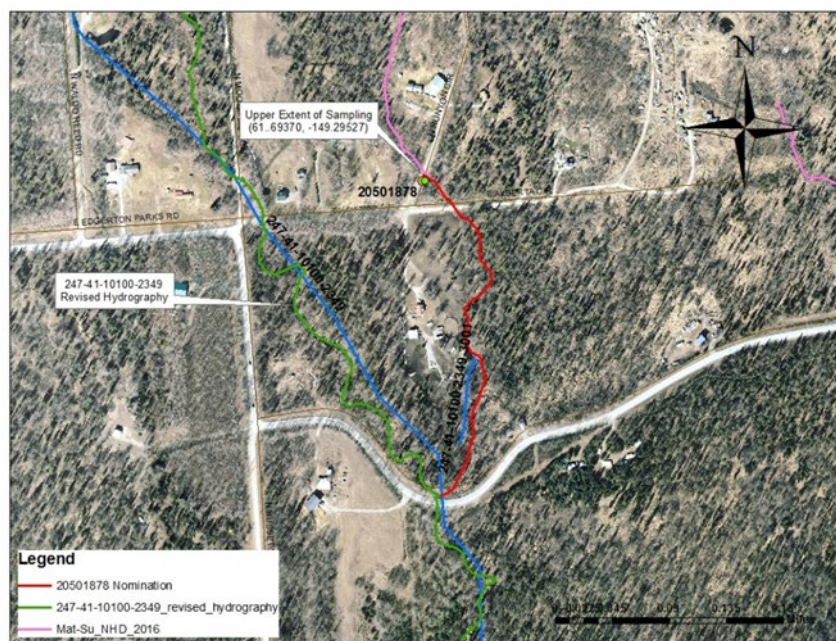
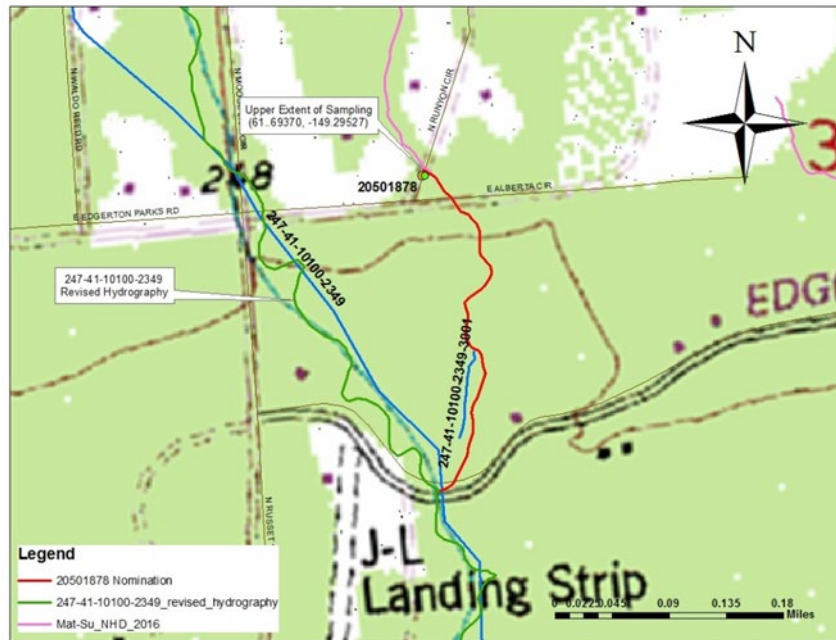
Road name: Runyon Circle

Stream name: unnamed tributary to Little Susitna, downstream AWC #247-41-10100-2349-3001, tributary to unnamed stream AWC #247-41-10100-2349

Nomination type: **Addition:** extend anadromy for coho salmon rearing up to road crossing. **Correction:** revise downstream hydrography on cataloged portion of stream to connect to revised hydrography of AWC #247-41-10100-2349.

Total new distance nominated: 0.17 miles

Fish found at site: coho salmon, Dolly Varden char





Site 20400597

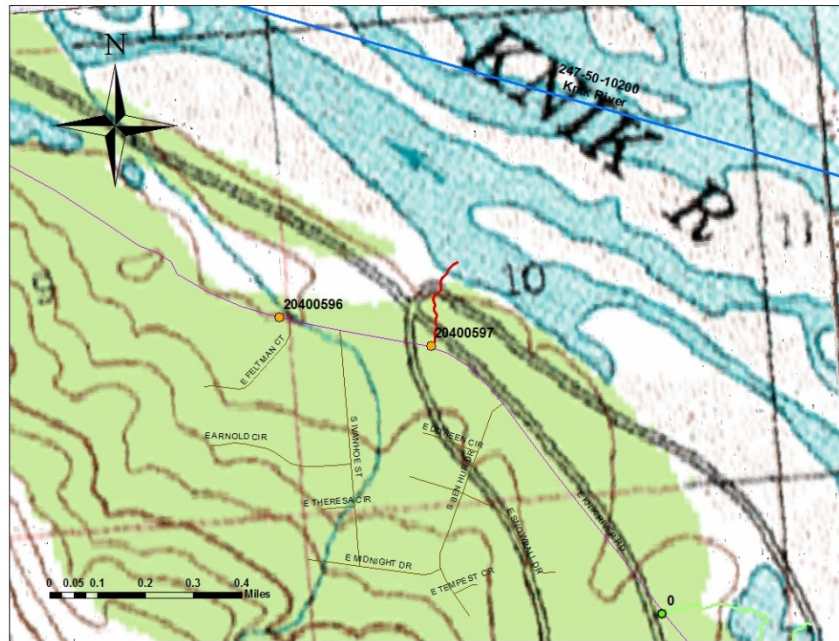
Road name: Knik River Road

Stream name: unnamed tributary to Knik River, AWC # 247-50-10200

Nomination type: **Addition:** add tributary with coho salmon rearing.

Total new distance added: 0.21 miles

Fish found at site: coho salmon, sockeye salmon, Dolly Varden char, unidentified sculpin



Site 20400599

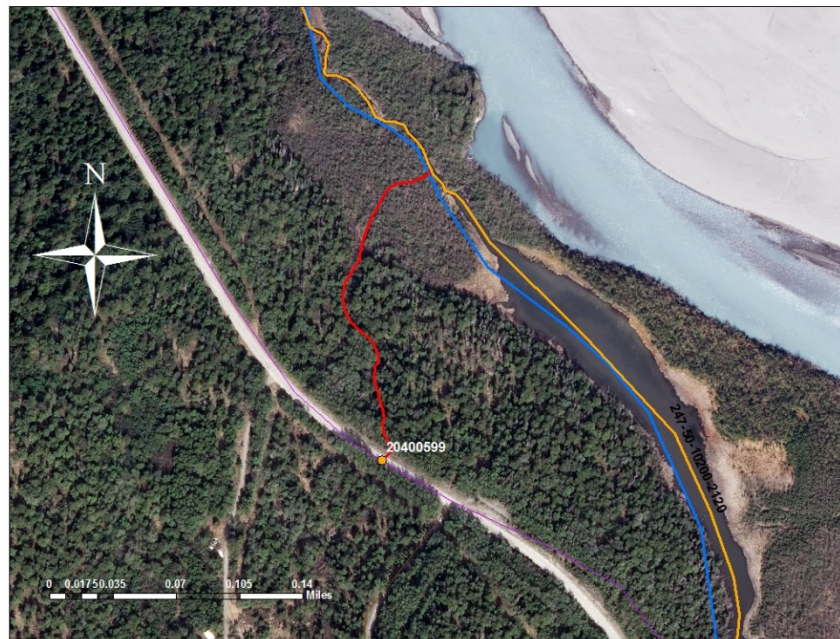
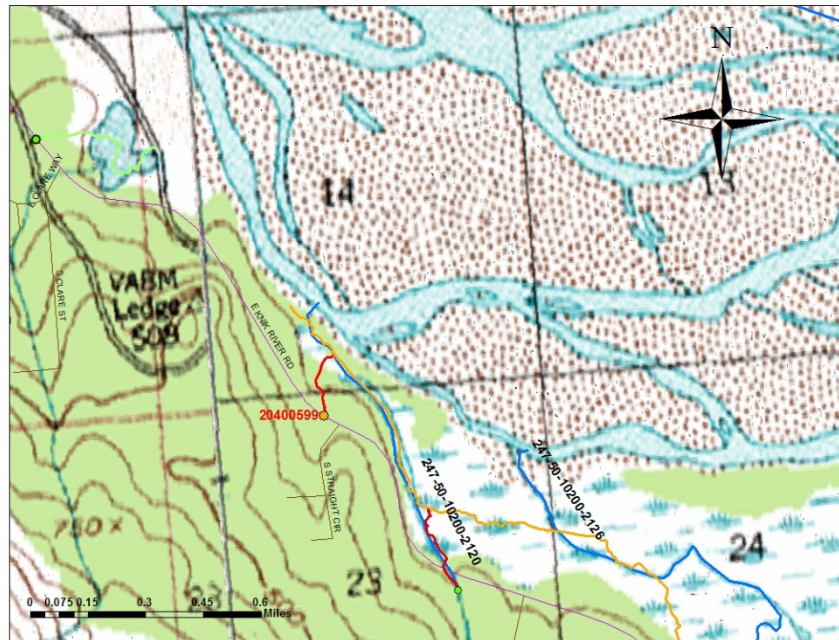
Road name: Knik River Road

Stream name: unnamed tributary to an unnamed tributary to Knik River, AWC #247-50-10200-2120

Nomination type: **Addition:** add tributary.

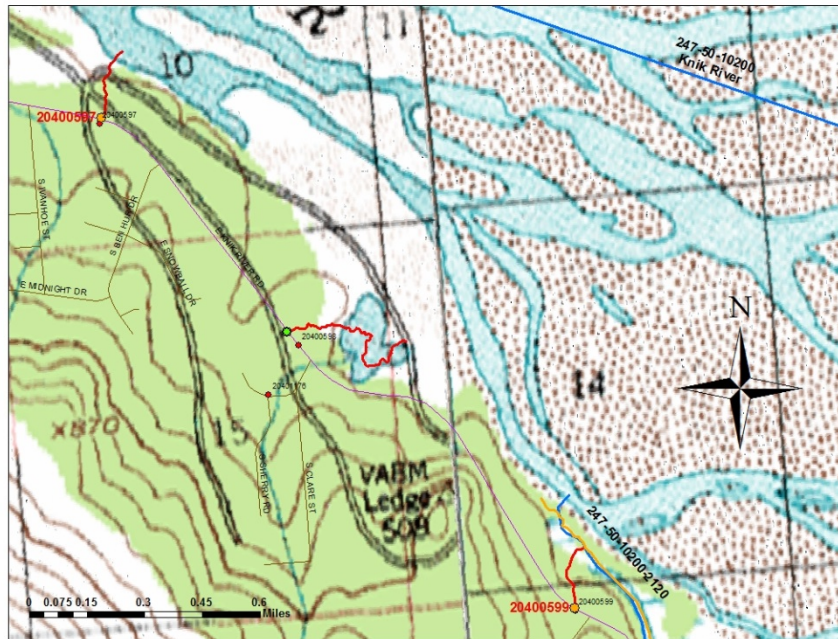
Total new distance nominated: 0.20 miles

Fish found at site: adult coho salmon, Dolly Varden char





Fish found at site: coho salmon, Dolly Varden char



## Road name: Shaman Road

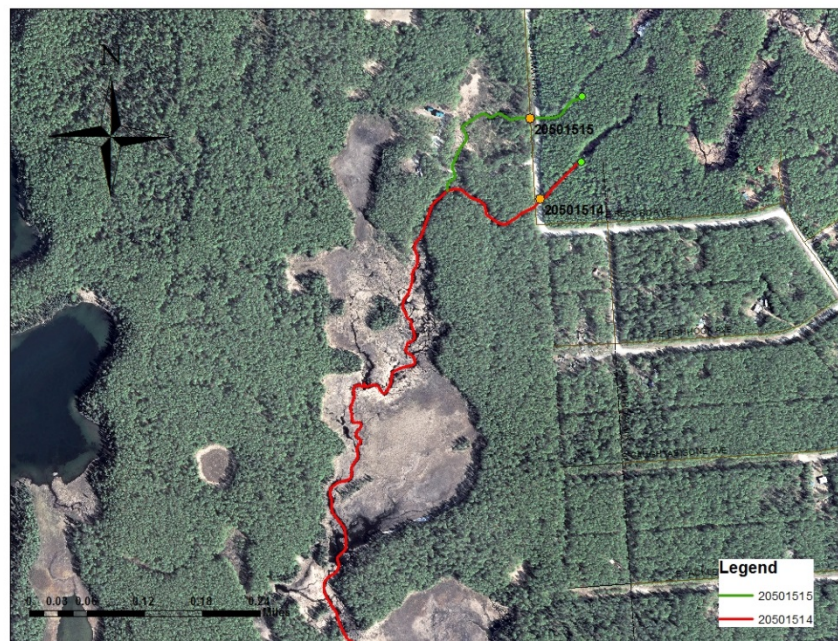
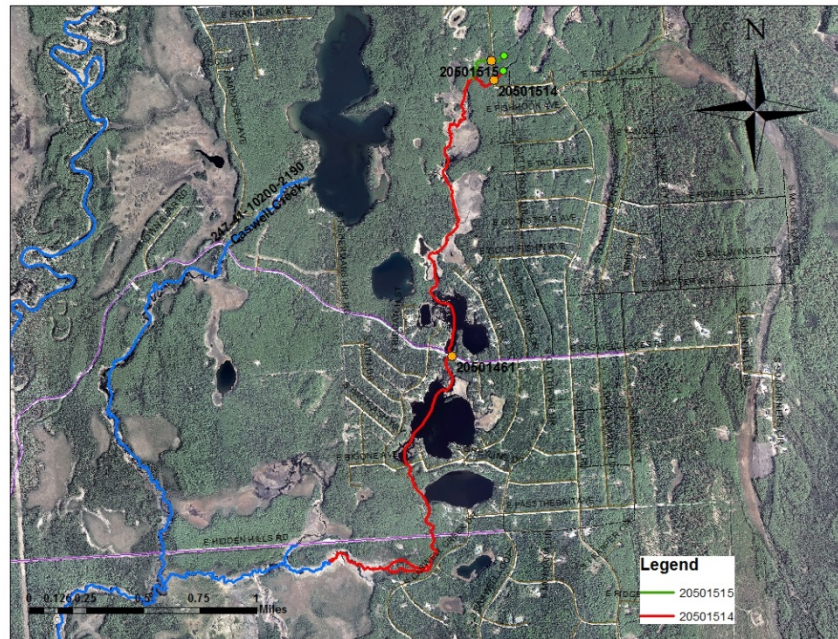
Nomination type: **Addition:** extend anadromy of unnamed AWC stream #247-41-10200-2190-3020 to upper extent of sampling above site 20501514 and added three downstream lakes.

Fish found at site: Chinook salmon, rainbow trout. Site 20501461 was sampled downstream on Caswell Lakes Road and coho salmon, rainbow trout, and threespine sticklebacks were caught. Additionally, site 20501515 which is just north of this site was sample and Chinook and coho salmon were captured.



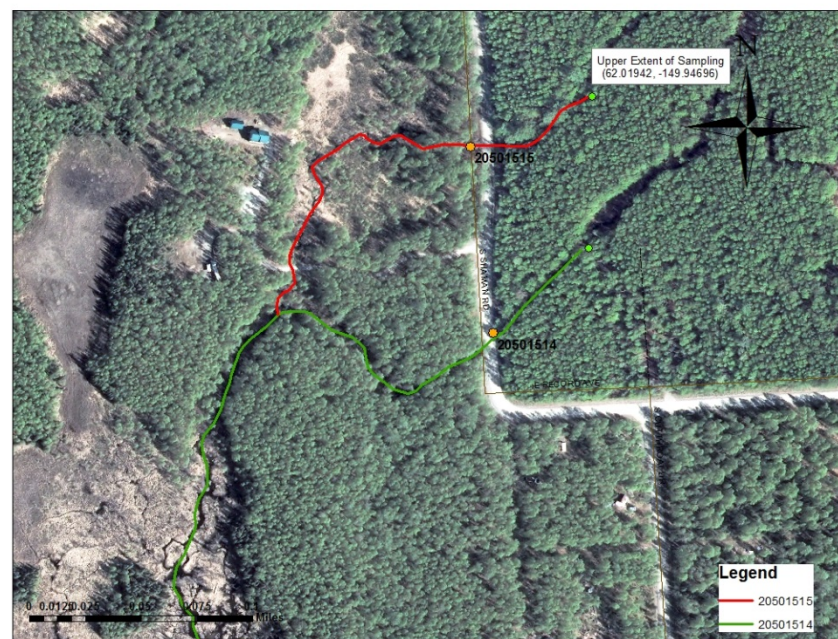
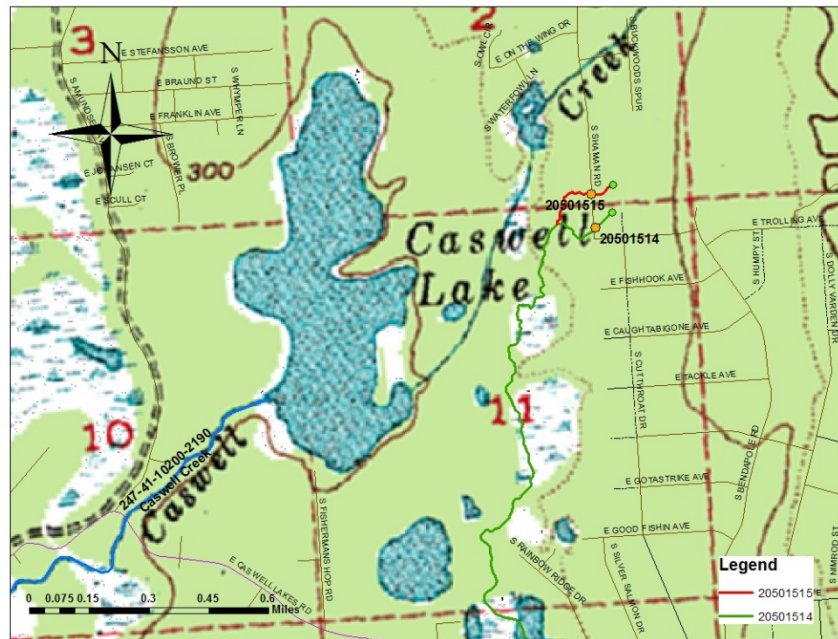


Site 20501514 (continued)





Fish found at site: Chinook salmon, coho salmon



Site 20501505

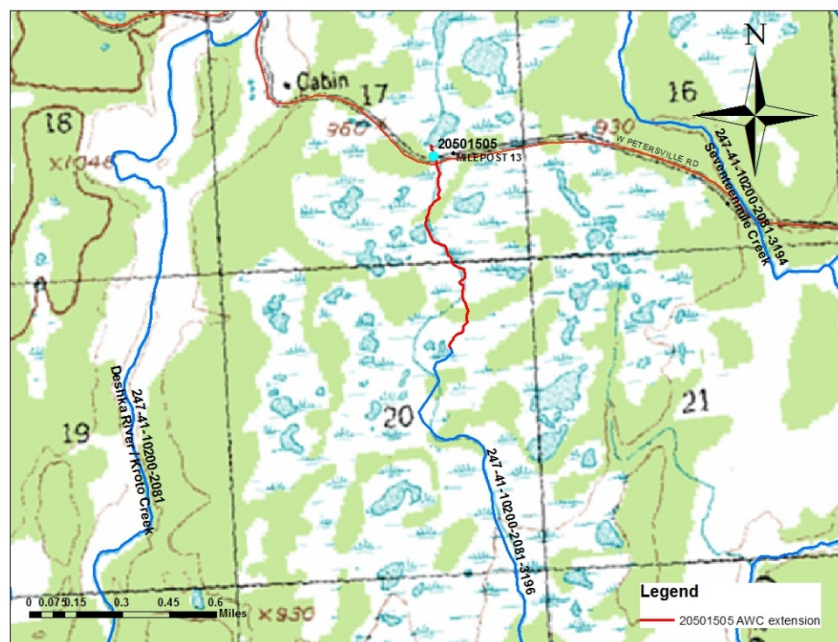
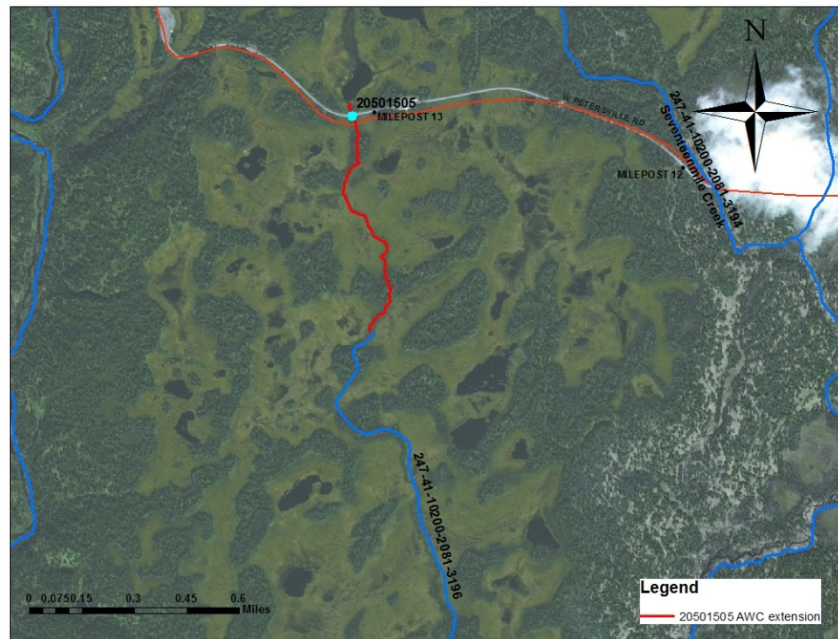
Road name: Petersville Road

Stream name: unnamed tributary to Kroto Creek / Deshka River AWC #247-41-10200-2081, stream is in AWC downstream as AWC# 247-41-10200-2081-3196

Nomination type: **Addition**: extend anadromy of AWC Stream #247-41-10200-2081-3196 to above culvert. Note: site is outside of LiDAR project area.

Total new distance nominated: 0.93 miles

Fish found at site: coho salmon





Site 20501405

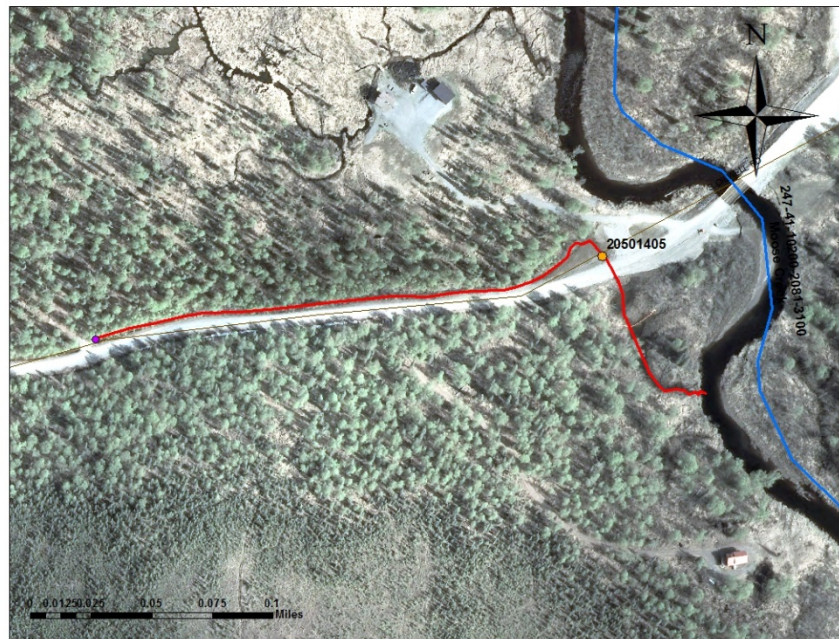
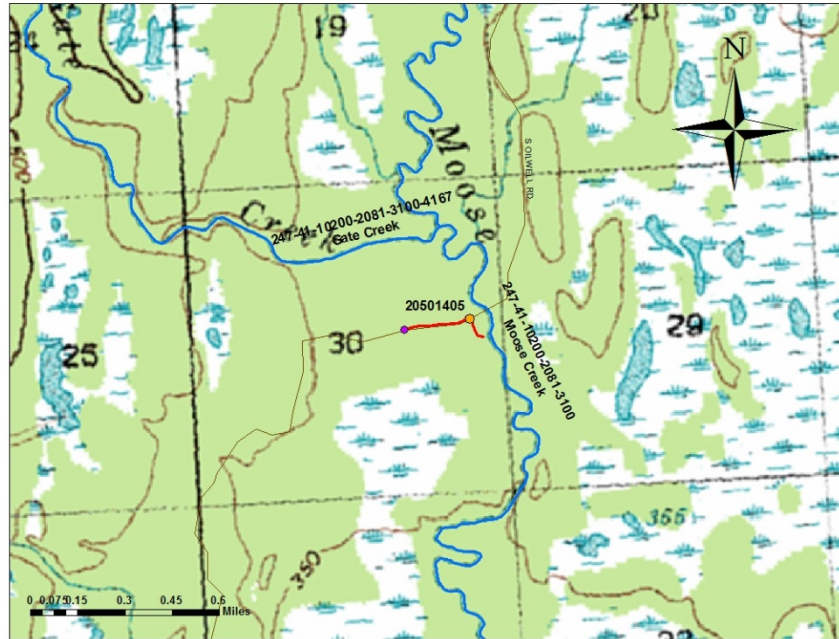
Road name: Oilwell Road

Stream name: unnamed tributary to Moose Creek, AWC #247-41-10200-2081-3100

Nomination type: **Addition:** add tributary with coho salmon rearing.

Total new distance nominated: 0.31 miles

Fish found at site: coho salmon





Site 20501498

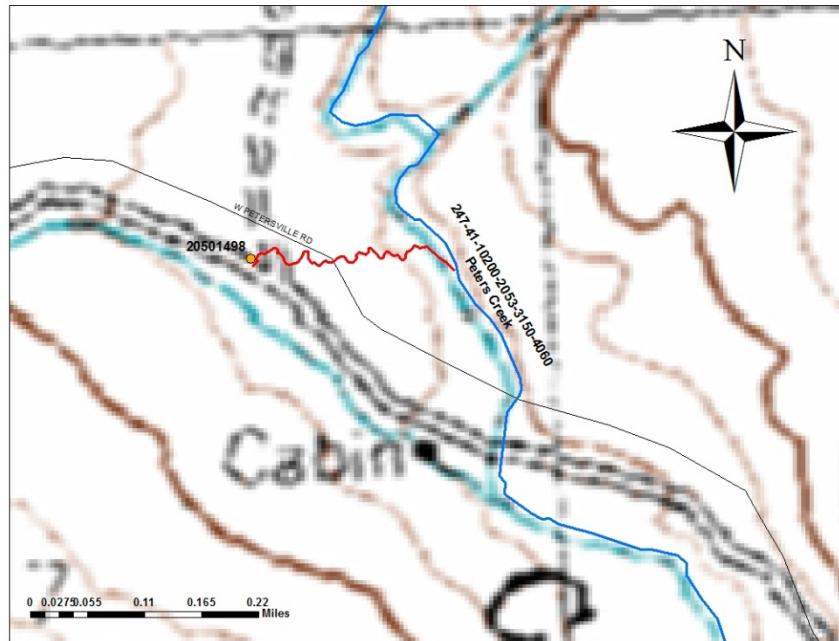
Road name: Petersville Road

Stream name: unnamed tributary to Peters Creek, AWC #247-41-10200-2053-3150-4060

Nomination type: **Addition:** add tributary with coho salmon rearing.

Total new distance nominated: 0.25 miles

Fish found at site: coho salmon, Dolly Varden char, unidentified sculpin



Site 20501391

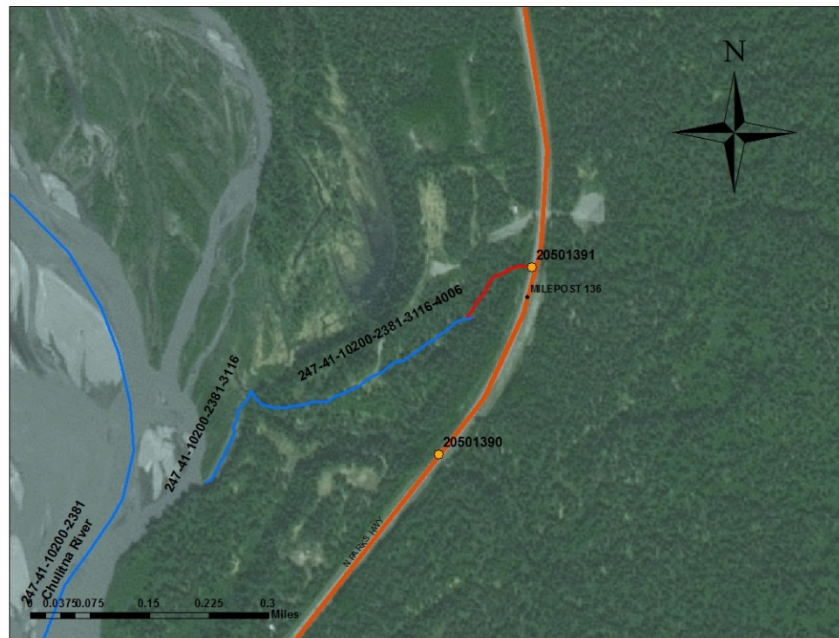
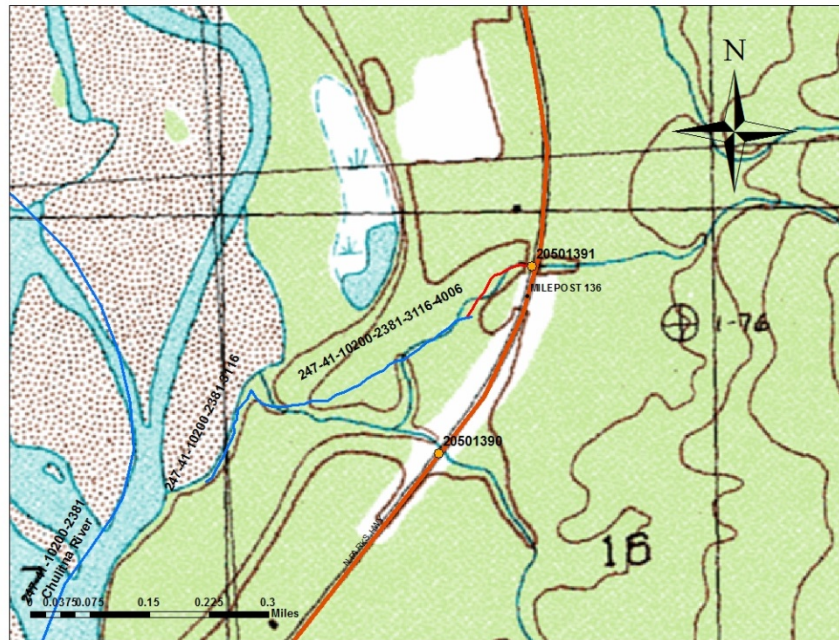
Road name: Parks Highway

Stream name: unnamed tributary to the Chulitna River, AWC #247-41-10200-2381, stream is in AWC downstream as AWC #247-41-10200-2381-3116-4006

Nomination type: **Addition**: extend anadromy up to road crossing for juvenile coho salmon.

Total new distance nominated: 0.11 miles

Fish found at site: coho salmon, Dolly Varden char





Site 20501386

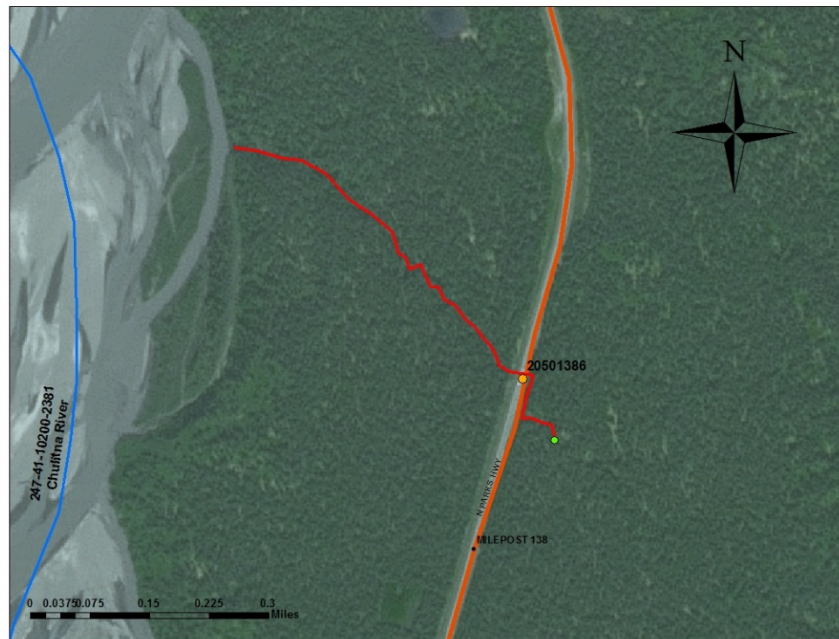
Road name: Parks Highway

Stream name: unnamed tributary to Chulitna River, AWC #247-41-10200-2381

Nomination type: **Addition:** add uncatalogued tributary for juvenile coho rearing.

Total new distance nominated: 0.48 miles

Fish found at site: coho salmon





Site 20502071 and upstream tributary

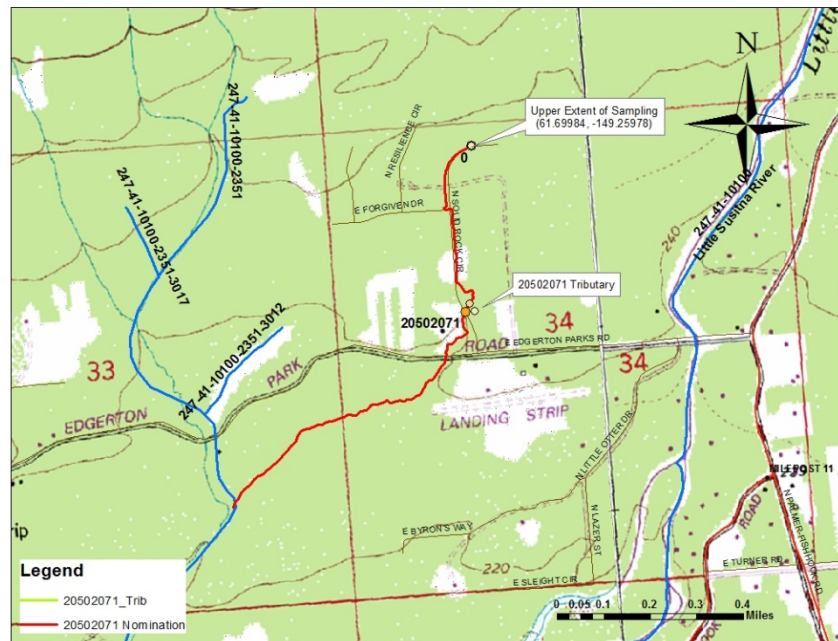
Road name: North Solid Rock Circle

Stream name: unnamed tributary to AWC Stream #247-41-10100-2351

Nomination type: **Addition:** add tributary to AWC stream #247-41-10100-2351 from downstream confluence up through culvert site 20501036 on Edgerton Parks Road, up through culvert site 20502071 on North Solid Rock Circle to upper most point of fish capture and add the tributary to this stream up to the point of the barrier culvert on an abandoned road grade, both for juvenile coho rearing.

Total new distance nominated: 1.18 miles

Fish found at site: coho salmon, Dolly Varden char



Site 20502071 and upstream tributary (continued)





Site 20501470

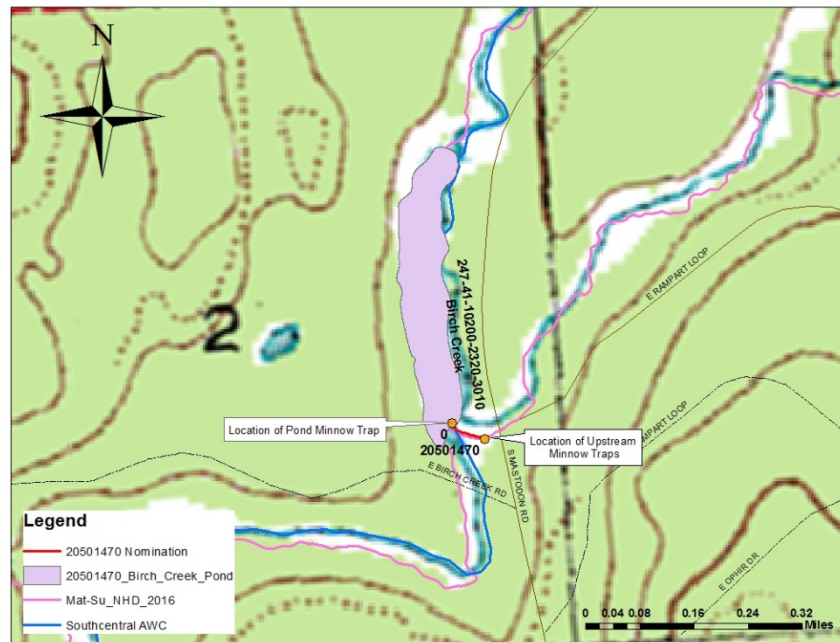
Road name: Mastodon Road

Stream name: unnamed tributary to Birch Creek, AWC # 247-41-10200-2320-3010.

Nomination type: **Addition:** add tributary with rearing coho salmon.

Total new distance nominated: 0.06 miles

Fish found at site: coho salmon





## Site Gate Lake

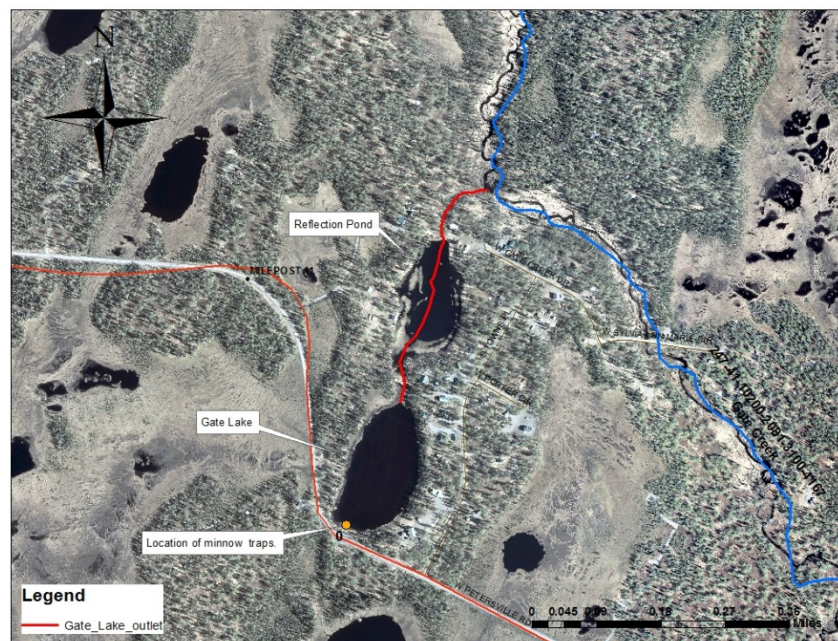
Road name: Petersville Road

Lake name: Gate Lake and Reflection Pond

Nomination type: **Addition:** add Gate Lake, Reflection Pond, and the outlet stream the flows into Gate Creek, AWC # 247-41-10200-2081-3100-4167, for juvenile coho salmon rearing.

Total new distance nominated: 0.15 miles and 15.29 acres

Fish found at site: coho salmon, threespine stickleback (note: Gate Lake is stocked with rainbow trout)



## Site Upper Buddy Creek

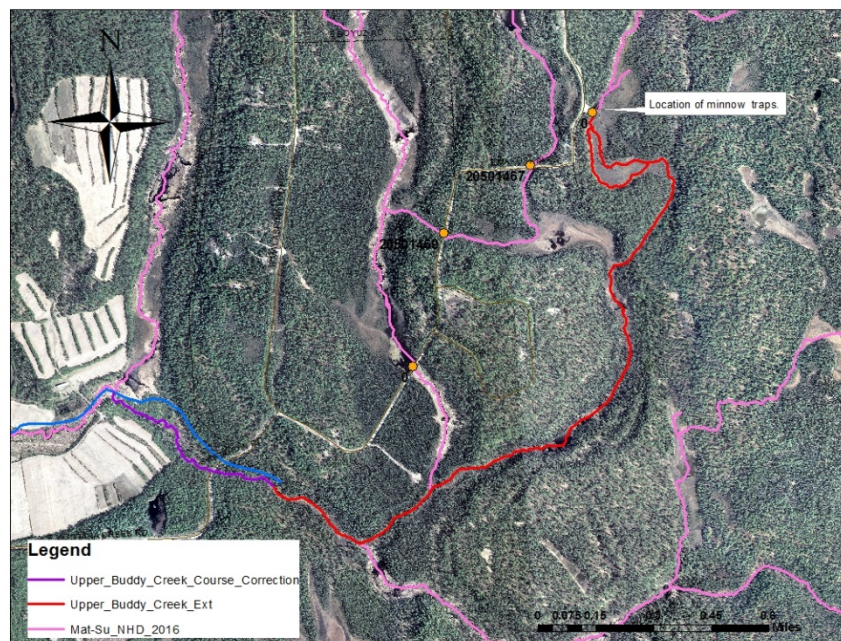
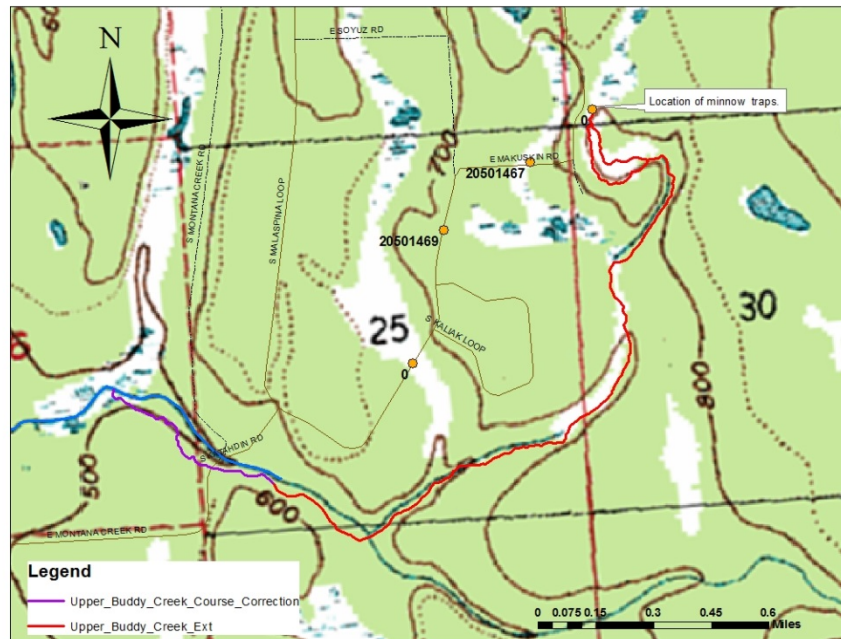
Road name: Southfork Road

Creek name: Buddy Creek, AWC # 247-41-10200-2250-3020

Nomination type: **Addition:** extend anadromy up to upper trapping point off of Southfork Road for juvenile coho salmon rearing. **Correction:** revise downstream hydrography using new NHD lines.

Total new distance nominated: 2.40 miles

Fish found at site: coho salmon





## Site Birch Creek Pond Below 20501470

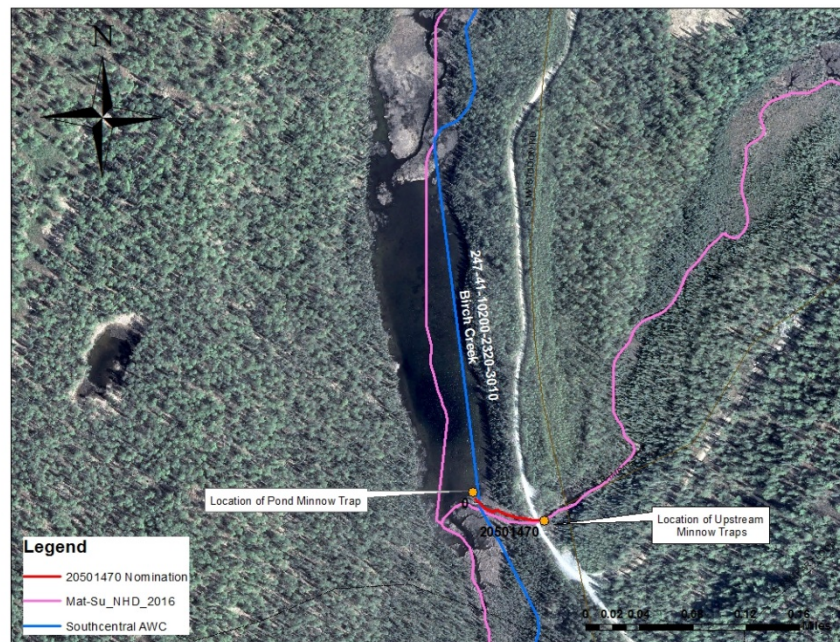
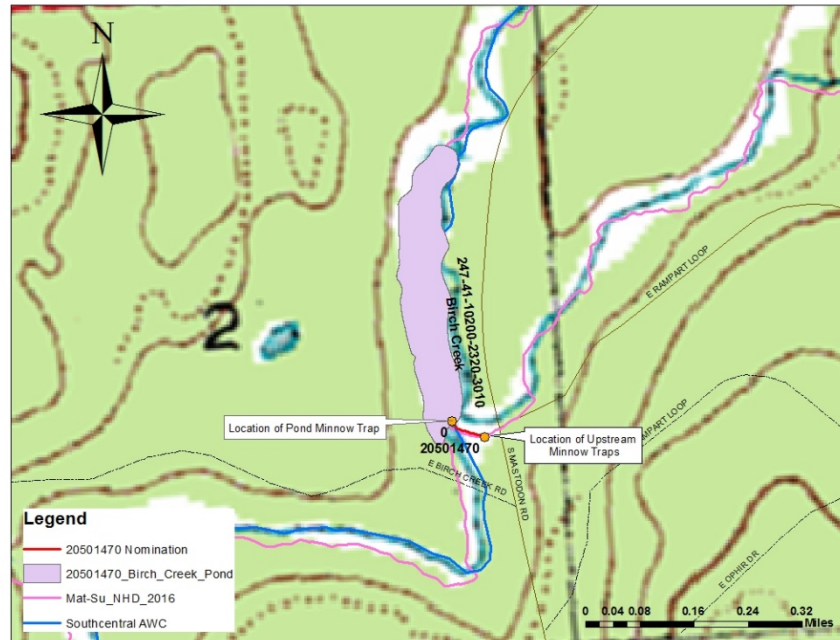
Road: Mastodon Road

Creek: Birch Creek, AWC # 247-41-10200-2320-3010

Nomination type: **Addition:** add pond polygon on Birch Creek stream course.

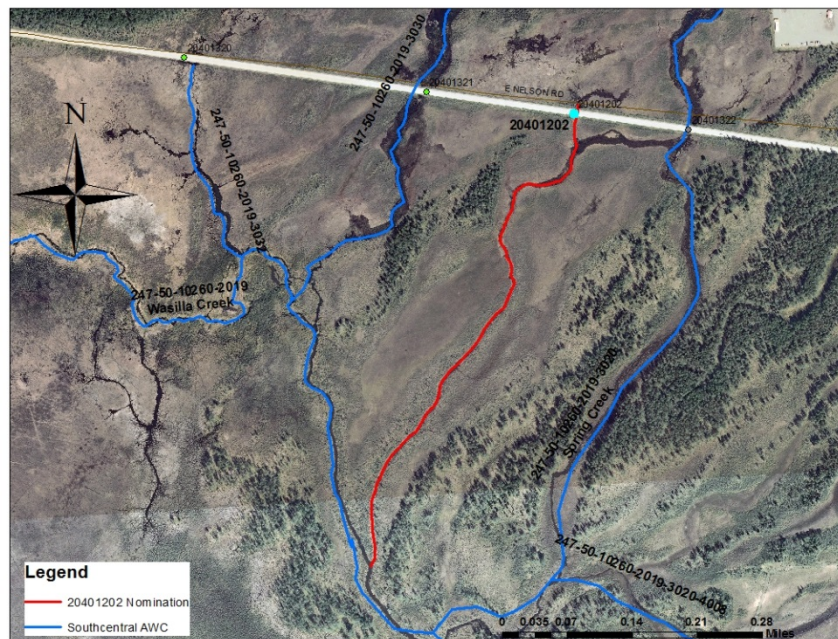
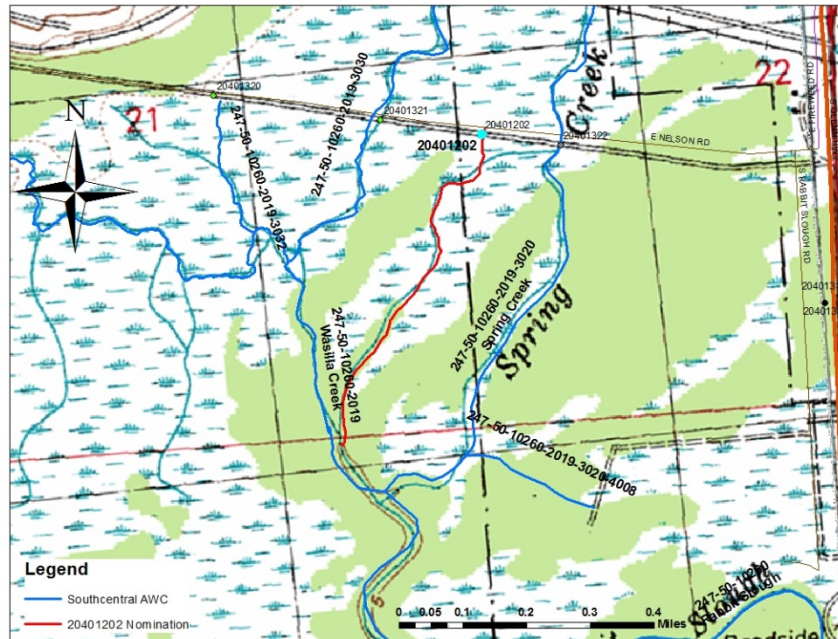
Total new distance nominated: 16 acres

Fish found at site: coho salmon, threespine stickleback





Fish found at site: coho salmon, blackfish



## **APPENDIX C: PROJECT SAMPLING FORM**

