Technical Report No. 17-05

Fish Presence Surveys in Proposed Timber Harvest Areas, Afognak Island, 2015 and 2016

by

William D. Frost

Marka Bay, Afognak Island

January 2017

Alaska Department of Fish and Game **Division of Habitat**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
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

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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by

William D. Frost
Alaska Department of Fish and Game, Division of Habitat, Anchorage

Alaska Department of Fish and Game
Division of Habitat
333 Raspberry Road, Anchorage, Alaska, 99518-1565

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William D. Frost,
Alaska Department of Fish and Game, Division of Habitat,
333 Raspberry Road, Anchorage Alaska 99518 USA

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EXECUTIVE SUMMARY

In summer of 2015 and 2016, the Alaska Department of Fish and Game (ADF&G), Division of Habitat, sampled for the presence of anadromous fish on Afognak Island on land owned by Afognak Native Corporation, Natives of Kodiak Incorporated, Ouzinkie Native Corporation, and Koniag Native Corporation. The information gathered was used to submit nominations for inclusion in the ADF&G *Catalog of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* and its companion Atlas (AWC).

Inclusion in the AWC will help to conserve salmon habitat by providing the 66-foot riparian retention area protection required under the Alaska Forest Resources and Practices Act. A water body listed in the AWC is also afforded protection under Alaska Statute 16.05.871.

Water bodies were sampled using a backpack electrofisher or baited minnow traps to target juvenile fish. Sampling was terminated at barriers to fish passage when such barriers were present. Absent a barrier, the sampling team determined the most appropriate location to terminate sampling based on an assessment of available habitat, stream gradient, and a failure to capture fish at a given sampling location. Adult salmonids observed were counted and their spawning activity noted.

During the 2015 season, 18 watersheds were sampled on Afognak Island. During the 2016 season, 13 watersheds were sampled on Afognak Island. Fish presence sampling resulted in 114 nominations to the AWC: 54 in 2015 and 60 in 2016. As a result of the sampling effort, 41.3 km of new anadromous fish habitat was nominated for inclusion in the AWC.

The nominations include 18 specified water bodies that support additional life stages of anadromous fish, 25 specified streams whose locations were accurately mapped by Global Positioning System, and 4 new anadromous fish streams. The new streams are located in Kazakof Bay and Delphin Bay.

Adult and juvenile coho salmon (*Oncorhynchus kisutch)* and Dolly Varden (*Salvelinus malma)* were the most common salmonid species captured or observed. Other adult and juvenile salmonid species captured or observed were pink salmon (*O. gorbuscha)* and rainbow/steelhead trout (*O. mykiss)*. Additional species captured or observed were threespine stickleback (*Gasterosteus aculeatus)*, ninespine stickleback (*Pungitius pungitius)*, and sculpin (*Cottus* spp.).

The two year project was a successful collaboration effort between the ADF&G and the timber industry. Fish and fish habitat benefited from the additional riparian retention areas, and the land owners and operators benefited by having better information to develop their future timber harvest plans.

INTRODUCTION

The mission of the Alaska Department of Fish and Game (ADF&G) is to protect, maintain, and improve the fish, game, and aquatic plant resources of the state, and manage their use and development in the best interest of the economy and the well-being of the people of the state, consistent with the sustained yield principal. The mission of ADF&G Division of Habitat is to protect Alaska's valuable fish and wildlife resources and their habitats as Alaska's population and economy continue to expand.

In the winter of 2015, a 2-year grant was secured through the Alaska Sustainable Salmon Fund (AKSSF) for ADF&G to sample streams and lakes on Afognak Island and document the presence of anadromous fish in advance of timber harvest activity. Afognak Island is located about 390 km southwest of Anchorage, Alaska (Figure 1). The information gathered will be used to submit nominations for inclusion in the *Catalog of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes* and its companion Atlas (AWC; ADF&G 2015). Inclusion in the AWC will conserve salmon habitat by providing the 66-foot riparian retention area required under the Alaska Forest Resources and Practices Act (FRPA); under Alaska Administrative Code (11 AAC 95.265(1)). A specified water body listed in the AWC is also afforded protection under State law at Alaska Statute (AS) 16.05.871 (ADF&G 2014–2015).

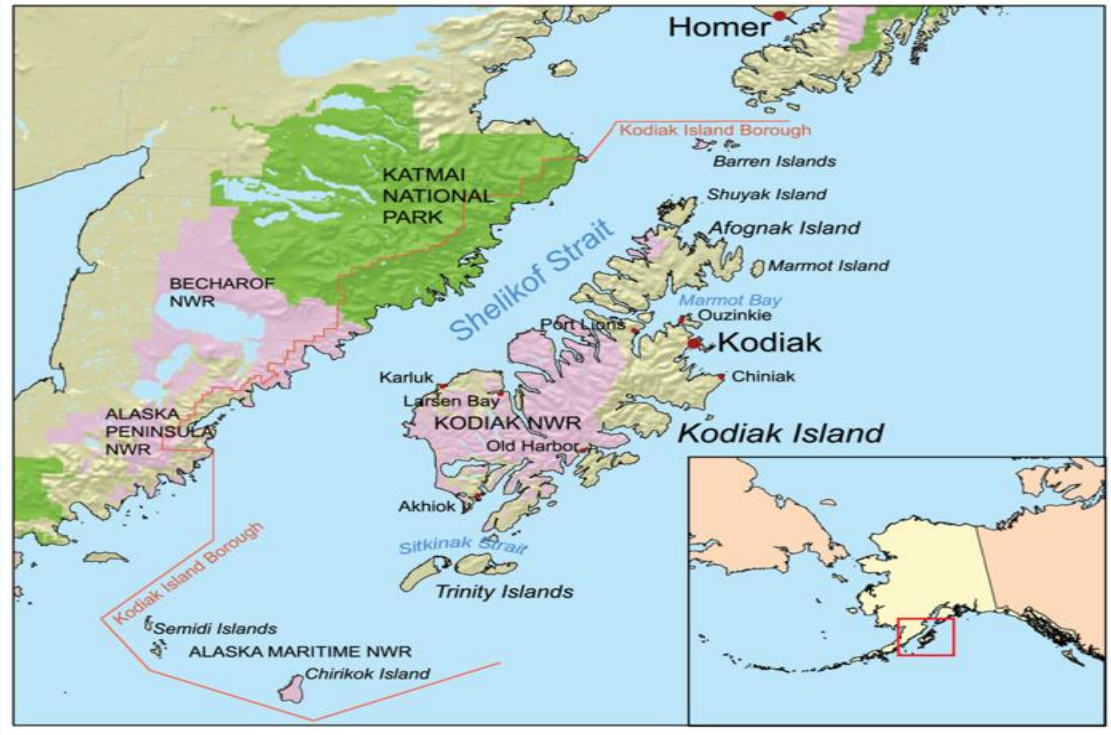

Figure 1.–Afognak and Kodiak Islands.

ADF&G initiated this project to document anadromous fish presence prior to timber harvest occurring on Afognak Island. ADF&G coordinated with two land managers in the region: Afognak Native Corporation and Koncor Forest Products. The coordination included a review of upcoming timber harvest activities, prioritization of areas to be sampled, and field sampling logistics.

METHODS

ADF&G developed maps using geographic information system (GIS) mapping software to assist with locating streams in the project area. The maps were produced by using georeferenced satellite imagery with the AWC data layer. Most streams sampled on Afognak Island in 2015 and 2016 were small (< 8 m wide) first-, second-, and third-order tributaries of known anadromous streams (Strahler 1957). Sampling was prioritized by cross-referencing upcoming timber harvest activities with those water bodies likely to support anadromous fish. The length of each reach sampled was measured using the GIS measuring tool and field verified by a handheld Global Positioning System (GPS) unit.

Water bodies were sampled by a team of two ADF&G staff. Sampling was conducted using a Smith-Root LR-25 backpack electrofisher. Output voltage was adjusted to the minimum level necessary to achieve taxis (forced swimming), and continuous DC was used to minimize fish injury (NMFS 2000). A single electrofishing pass at each sample reach was completed, starting at the downstream end and working upstream.

Lakes and ponds were sampled using Gee-type minnow traps baited with betadine-treated salmon eggs. Traps soaked for a minimum of two hours. Trap size selected for smaller fish, but this outcome was considered adequate as an indicator of the presence of fish species (Bloom 1976). However, it is noted that juvenile sockeye salmon (*Oncorhynchus nerka*) may be missed by minnow trapping, potentially causing underestimation of sockeye distribution because of this species' tendency toward a planktivorous diet (Burgner 1991).

Captured juvenile salmon and Dolly Varden (*Salvelinus malma)* were identified to species and counted. Because of time constraints, only a select number of fish captured were measured to the nearest mm in fork length (FL). Threespine stickleback (*Gasterosteus aculeatus*), ninespine stickleback (*Pungitius pungitius*), and sculpin (*Cottus* spp.) were noted as present but not measured or counted. All fish were released into a slack-water area at the point of capture. Adult salmonids observed were counted, and spawning activity was recorded using GPS.

We used existing FRPA criteria (Table 1; FRPA 2013) and professional judgment to determine the upper extent of the water body to be sampled. Absent a barrier, the sampling team determined the most appropriate location to terminate sampling, based on an assessment of available habitat, stream gradient, and a failure to capture fish at a given sampling location.

Table 1.–Anadromous Fish Blockage (11 AAC 95.265(g) Table A).

Species requirements (in feet)					
Criterion	Coho	Steelhead	Sockeye	Chinook	Pink/Chum
Maximum fall height: a blockage may be presumed if fall height in feet exceeds:	11	13	10	11	a) 4 with deep jump pool b) 3 without pool
Pool depth: a blockage may be presumed if the unobstructed water column depth in feet within the pool is less than:	1.25 x jump height, except that no minimum pool depth exists for falls as follows: a) less than 4 in the case of coho and steelhead; and b) less than 2 in the case of other anadromous fish species.				
Steep channel: a blockage may be presumed at the upper end of the reach if channel steepness in feet is equal to or greater than the following without resting places for fish:	• 225 at 12% gradient • 100 at 16% gradient • 50 at 20% gradient • 25 at 24% gradient			100 at 9% gradient	

A hand-held Garmin GPS unit was used to record the geographic information to verify or correct the actual location of water bodies, add barriers to fish passage, and note locations of captured salmonids. Number and length of fish captured or observed were recorded with the GPS device to allow for georeferencing. These data were used to submit nominations to the AWC. Nominations included new water bodies, upstream extensions of existing anadromous waters, addition of species or life stages, and corrections of water body locations. Nominations were completed according to the ADF&G submission guidelines and requirements (ADF&G 2015).

RESULTS

In 2015 and 2016, monthly sampling events occurred on Afognak Island from May through October. A total of 136 reaches were sampled with a total length of 57.2 km (Table 2 and Table 3; Appendix A1 through A25). The total length of streams documented as containing anadromous fish and nominated to the AWC was 41.3 km (Table 2 and Table 3). The pre-project AWC status of the surveyed streams and AWC nominations resulting from 2015 and 2016 sampling are graphically shown in Appendix A.

Table 2.–Afognak Island watersheds sampled in 2015.

Watershed name	AWC number	# Reaches sampled	Total length sampled (meters)	Total new AWC length (meters)
McDonald Creek	252-31-10080	7	3,000	700
Big Kitoi Lake		2	600	0
Little Afognak River	252-32-10010	1	100	0
Unnamed (Mary Anderson Bay)	252-32-10008	1	560	0
Unnamed (Kazakok Bay)		1	150	150
Unnamed (Kazakof Bay)		1	150	150
Unnamed (Kazakof Bay)		1	1,435	1,085
Unnamed (Kazakof Bay)	252-33-10025	1	500	0
Unnamed (Kazakof Bay	252-33-10024	1	200	0
Unnamed (Discoverer Bay)	251-82-10057	1	290	290
Unnamed (Discoverer Bay)	251-82-10052	10	4,260	1,850
Unnamed (Discoverer Bay)	251-82-10053	1	210	0
Portage Creek	251-82-10050	19	5,910	3,255
Otter Creek	251-82-10045	3	375	190
Unnamed (Delphin Bay)	251-82-10036	2	1,150	1,150
Unnamed (Delphin Bay)		1	255	255
Paramanof River	251-40-10030	7	3,710	3,710
Unnamed (Marka Lake)	252-34-10005-2081	4	1,090	370
Total		64	23,915	13,155

Table 3.–Afognak Island watersheds sampled in 2016.

Watershed name	AWC number	# Reaches sampled	Total length sampled (meters)	Total new AWC length (meters)
Waskanareska Creek	251-10-10020	7	2,980	2,980
Unnamed (Raspberry Strait)		1	1,508	0
Paramanof River	251-40-10030	18	10,570	9,115
Unnamed (Kazakok Bay)	252-33-10020-2005	1	340	340
Unnamed (Kazakok Bay)	252-33-10003	5	2,353	2,265
Unnamed (Kazakof Bay)	252-33-10005	1	2,195	2,195
NE Danger Creek	252-33-10010	2	430	430
Portage Creek	251-82-10050	11	4,000	4,000
Unnamed (Portage Bay)	251-82-10052	1	100	100
Unnamed (Pauls & Laura Lakes)	251-82-10080	24	6,290	4,182
Unnamed Lake (Izhut Bay)		1	20	0
Little Afognak River	252-32-10010	3	2,110	2,110
Unnamed (Duck Bay)	252-32-10050	2	440	440
Total		77	33,336	28,157

During the 2015 and 2016 sampling effort, 25 known anadromous streams on Afognak Island were determined by GPS to be mapped in the wrong location. The stream mapping has been revised and corrections were submitted to the AWC (Table 4).

Table 4.–Anadromous streams on Afognak Island corrected in 2015 and 2016.

Streams Corrected 2015	Streams Corrected 2016
252-32-10008*	252-32-10050
252-32-10080	251-82-10080-2032
252-33-10025*	251-82-10080-2040
251-82-10052	251-82-10080-2040-3011
251-82-10053*	251-82-10080-2048
251-82-10045	251-82-10080-2050
251-82-10045-2009	251-82-10080-2060
251-82-10036	251-82-10080-2068
251-40-10030	251-82-10050-2020
251-40-10030-2040	252-33-10003
252-34-10005-2081	252-33-10003-2004
252-34-10005-2083	251-10-10020
	252-32-10010

*Note: Stream Nos. 252-32-10008, 251-82-10053, and 252-33-10025 were revised because of a barrier blocking fish passage.

In 2015, 4 new streams that support anadromous fish were located on Afognak Island and nominated to the AWC. These 4 streams are located in Kazakof Bay and Delphin Bay (Appendix A3, Appendix A4, and Appendix A12).

In 2015 and 2016, there were 114 nominations submitted to the AWC: 54 in 2015 and 60 in 2016. All of the nominations were accepted for inclusion into the 2017 AWC update, except for 7 that are currently being reviewed for the 2018 AWC revision. Juvenile and adult coho salmon (*O. kisutch*) and Dolly Varden were the most common salmonid species captured or observed. Other adult and juvenile salmonid species captured or observed were pink salmon (*O. gorbuscha*) and rainbow/steelhead trout (*O. mykiss*). Length measurements were taken for a portion of the juvenile salmon and Dolly Varden that were captured (Table 5 and Table 6). Stickleback and sculpin were noted as present but not measured or counted.

Table 5.–2015 Afognak Island fork length measurements, by month and species.

	Length range (mm)	
Month	Coho Salmon	Dolly Varden
May	45–70 (n = 23)	40–120 (n = 29)
June	45–85 (n = 41)	45–120 (n = 13)
July	75–95 (n = 23)	35–195 (n = 41)
August	65–110 (n = 7)	45–60 (n = 9)
September	55–110 (n = 23)	55–140 (n = 20)
October	45–90 (n = 10)	35–110 (n = 24)

Table 6.–2016 Afognak Island fork length measurements, by month and species.

	Length range (mm)	
Month	Coho Salmon	Dolly Varden
May	40–120 (*n* = 25)	35–110 (*n* = 35)
June	40–60 (*n* = 14)	55–70 (*n* = 7)
July	50–120 (*n* = 15)	40–130 (*n* = 48)
August	50–90 (*n* = 28)	45–100 (*n* = 15)
September	45–110 (*n* = 75)	50–150 (*n* = 30)
October	55–115 (*n* = 26)	40–45 (*n* = 11)

In 2015 and 2016, 18 known anadromous water bodies were found to support additional species or life stages (Table 7). The streams were updated in the AWC.

Table 7.–Additional species or life stages located on Afognak Island.

Afognak stream no.	Species added	Life stage added
252-32-10008	Pink salmon	Rearing
251-82-10052	Coho salmon	Rearing
251-10-10020	Coho salmon	Rearing
252-34-10005-2081	Coho salmon	
252-34-10005-2083	Dolly Varden	Spawning
251-40-10030	Dolly Varden	
251-40-10030-2031	Coho salmon	Rearing
251-40-10030-2040	Dolly Varden	
251-82-10050	Coho salmon	Rearing
251-82-10050-2020	Sockeye salmon	Spawning
251-82-10050-2033	Coho salmon	Rearing
251-82-10057-2009	Coho salmon	Rearing
251-82-10045	Coho salmon	Rearing
251-82-10036	Coho salmon	Rearing
252-33-10025	Pink salmon	Spawning
252-33-10003	Coho salmon	Rearing
252-33-10005	Coho Salmon	Rearing
	Dolly Varden	
252-33-10010	Coho salmon	Rearing

DISCUSSION

Sampling conducted in 2015 and 2016 on Afognak Island identified new anadromous water bodies, extended existing anadromous waters, added species or life stages to existing anadromous waters, and corrected existing anadromous water body locations. Nominations were completed according to ADF&G submission guidelines and requirements. All nominations submitted prior to the 2016 nomination deadline have been accepted, approved, and scheduled for inclusion in the 2017 AWC revision. Seven nominations submitted after the 2017 deadline will be reviewed by the ADF&G and, if accepted, included in the 2018 AWC revision. These two sampling years resulted in the addition of 41.3 km of new anadromous fish habitat to the AWC, plus the addition of species and life stages.

Inclusion in the AWC affords the water body protection under AS 16.05.871 by requiring notification and ADF&G approval for proposed activities below ordinary high water, in order to provide proper protection of fish and game. Inclusion in the AWC also results in a 66-foot riparian retention area regulated by FRPA under 11 AAC 95.265. Streams that were sampled on Afognak Island in 2015 and 2016 that did not result in the capture or observation of anadromous fish but flowed into a specified water body were voluntarily given a 66-foot riparian retention area by the landowner up to the point where a physical blockage was determined by FRPA criteria. Thus, this project resulted in additional protection for more water bodies than just the 41.3 km being added to the AWC.

Riparian habitat provides streambank stability, filters pollutants, and maintains water quality for fish and wildlife habitat. To function properly, buffers must have an effective vegetative cover and sufficient width and continuity along the stream. Vegetative cover filters sediment and pollutants, reducing the amount of materials that may enter a stream. The rate of surface erosion is closely correlated with vegetative cover on the soil surface, such as plant litter. Litter and the stems of vegetation reduce the downslope movement of surface soils. Accelerated surface erosion occurs when these barriers are removed (Strahler et al. 1971).

Riparian vegetation provides shade to help maintain air and water temperatures and prevent excessive algal blooms. Reduced shade leads to increased water temperatures. Increased water temperatures can obstruct adult migration and limit spawning success, trigger early juvenile outmigration resulting in decreased survival rates, change juvenile sheltering behavior, reduce disease resistance, and increase metabolic requirements (Taylor 1988). Riparian vegetation also provides allochthonous input to the base of the food web, terrestrial insects for fish consumption, and cover for aquatic vertebrates.

This project has been a successful example of collaboration between the timber industry and ADF&G. By sampling in advance of timber harvest operations, ADF&G has provided the operators with information for planning the layout of proposed timber harvest units. Additionally, the operators and land owners support of this project has been invaluable to identifying and prioritizing waters to sample, which has resulted in aquatic habitat protections required by ADF&G statutes and FRPA requirements.

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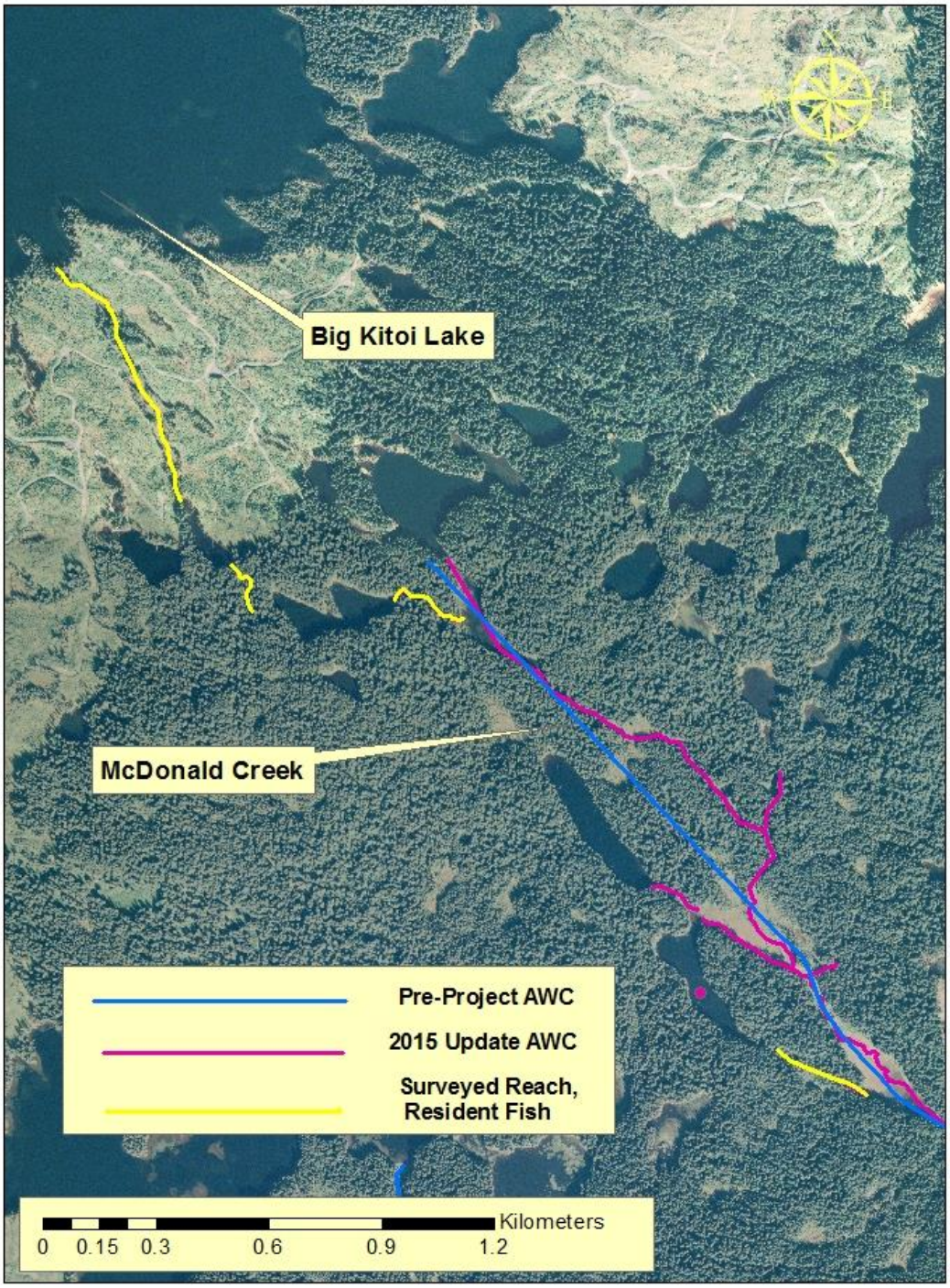
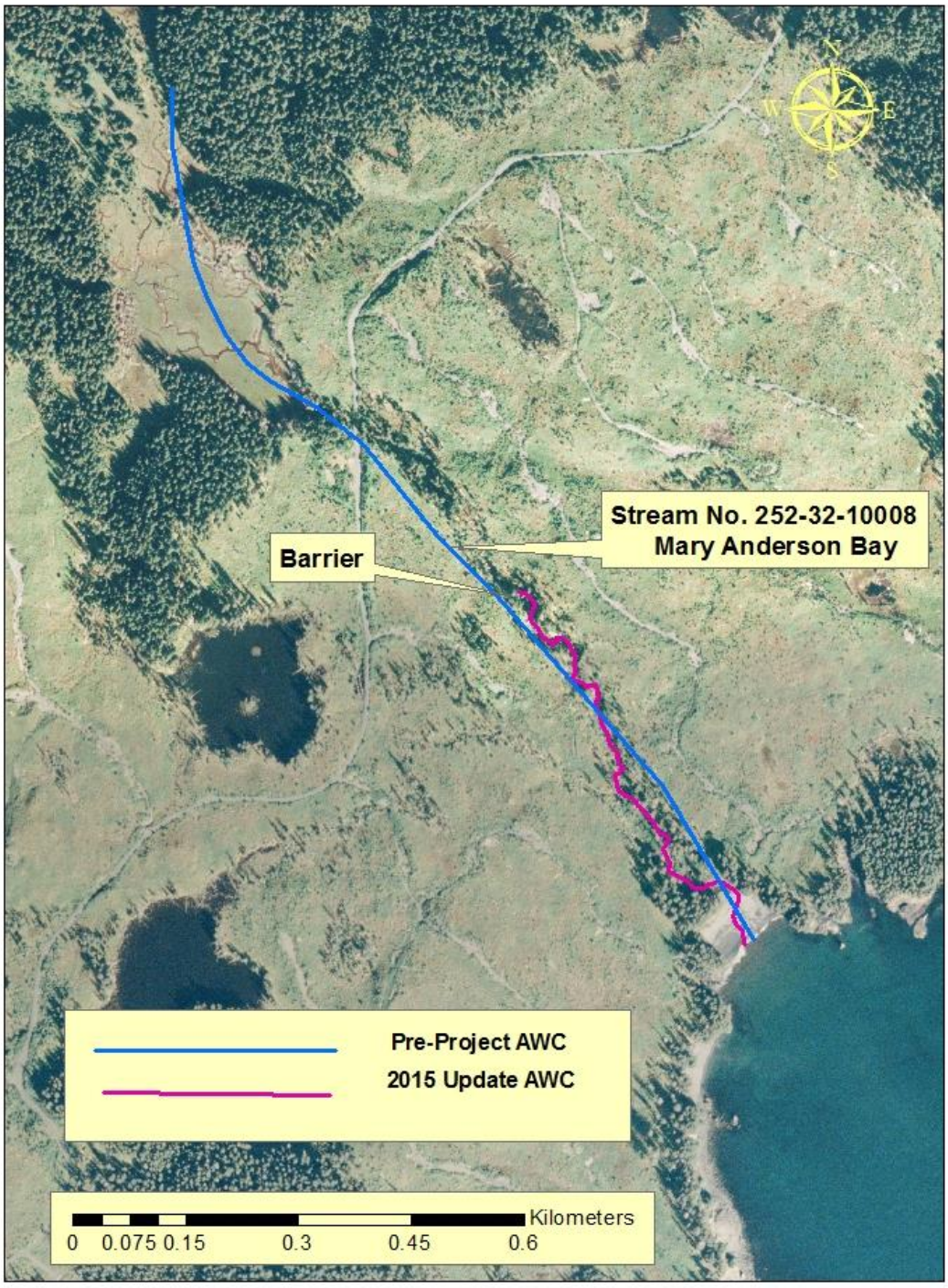
APPENDIX A:
STATUS OF SURVEYED REACHES

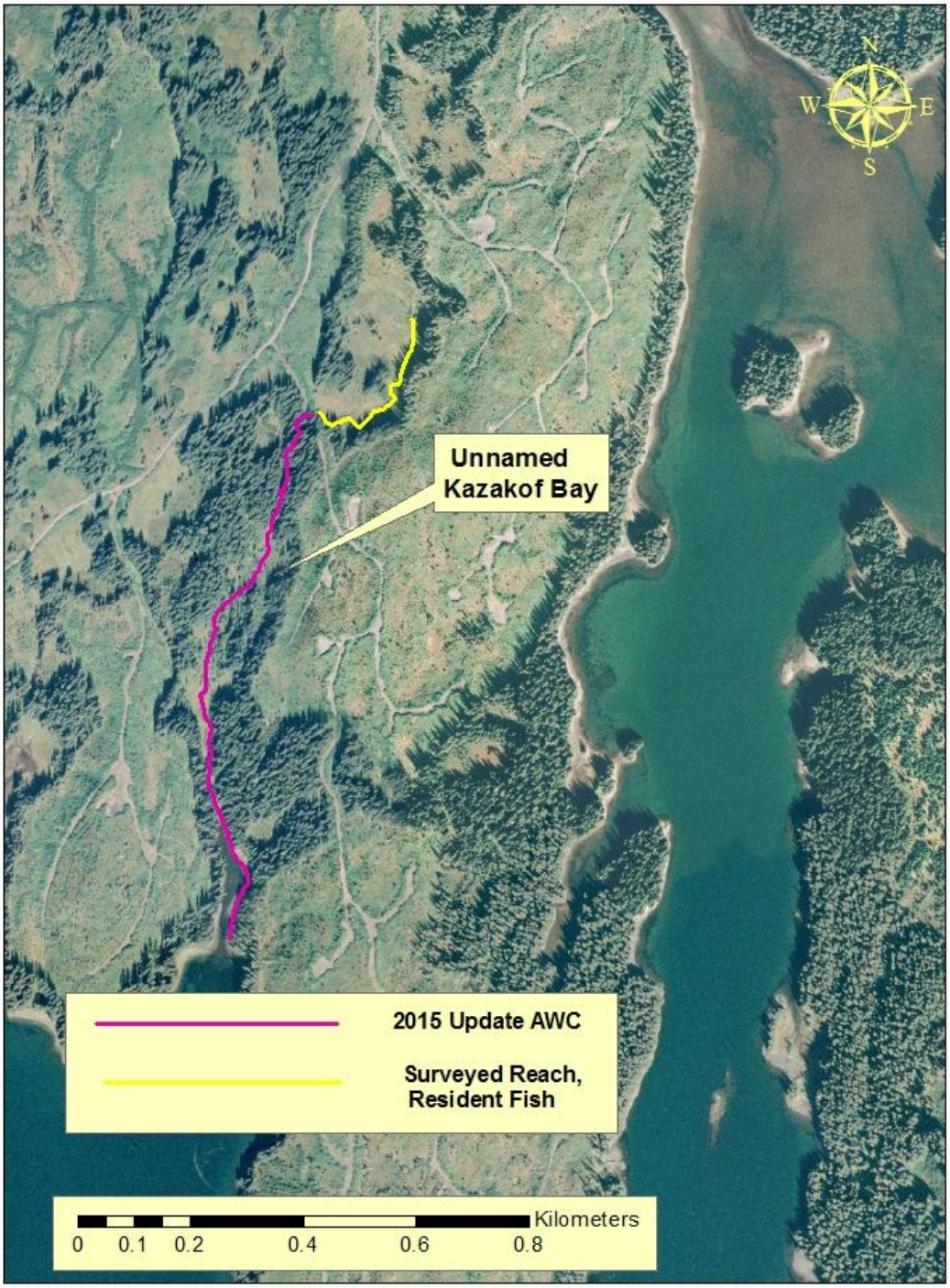


Appendix A1.–Status of surveyed reaches within McDonald Creek, Afognak Island.

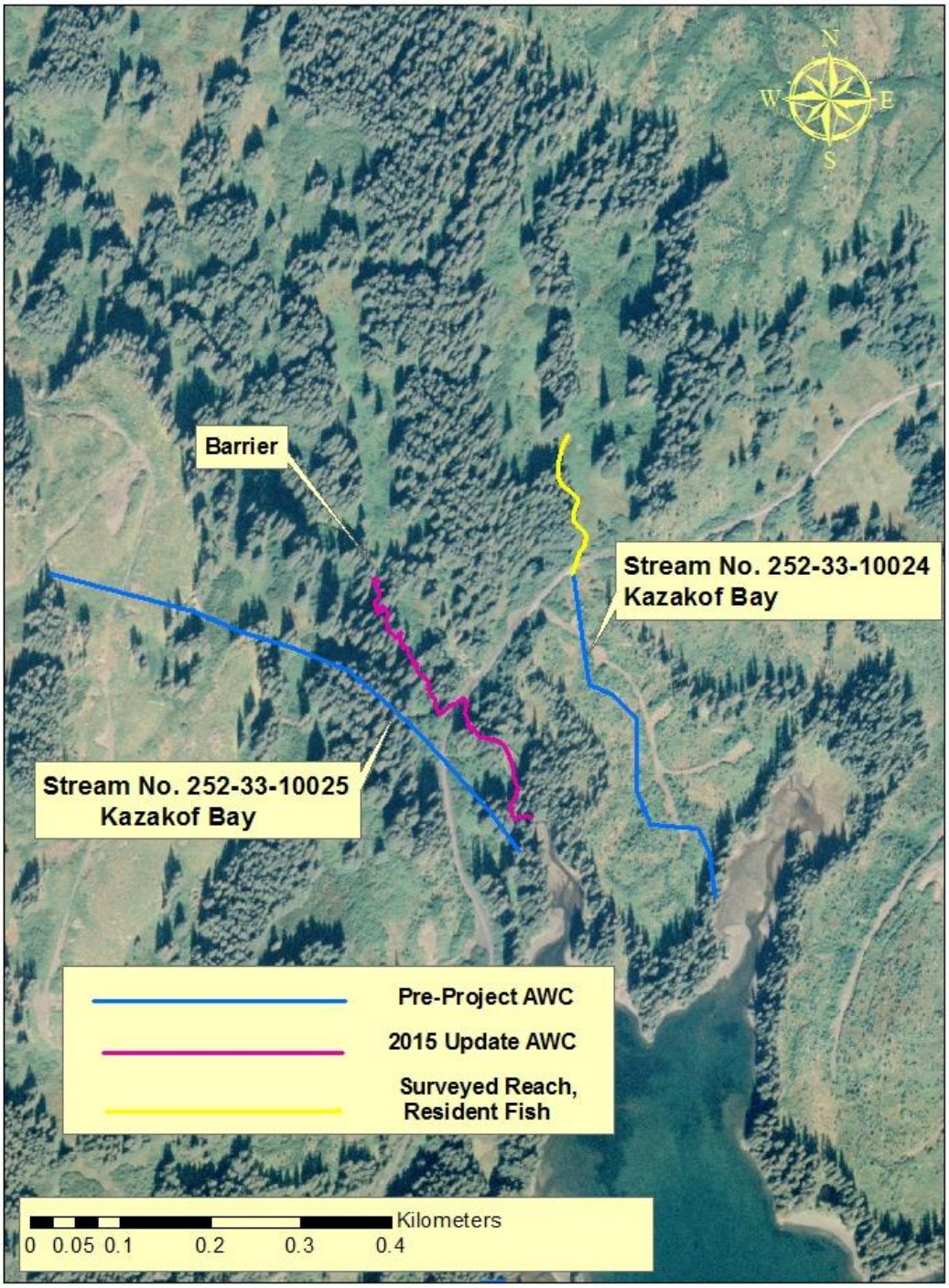


Appendix A2.–Status of surveyed reach within Stream No. 252-32-10008, Afognak Island.

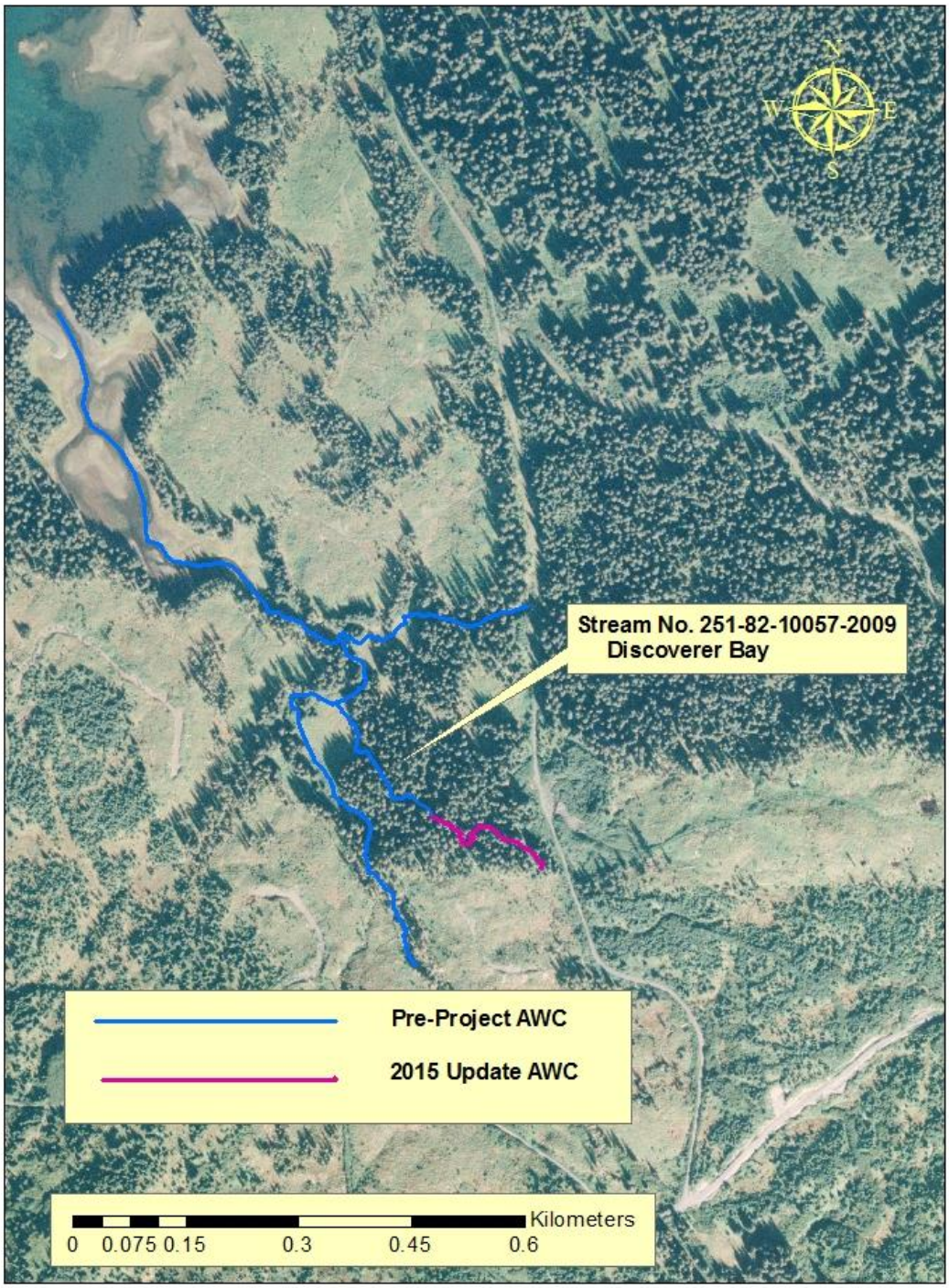
Appendix A3.–Status of surveyed reaches within unnamed streams, Kazakof Bay, Afognak Island.



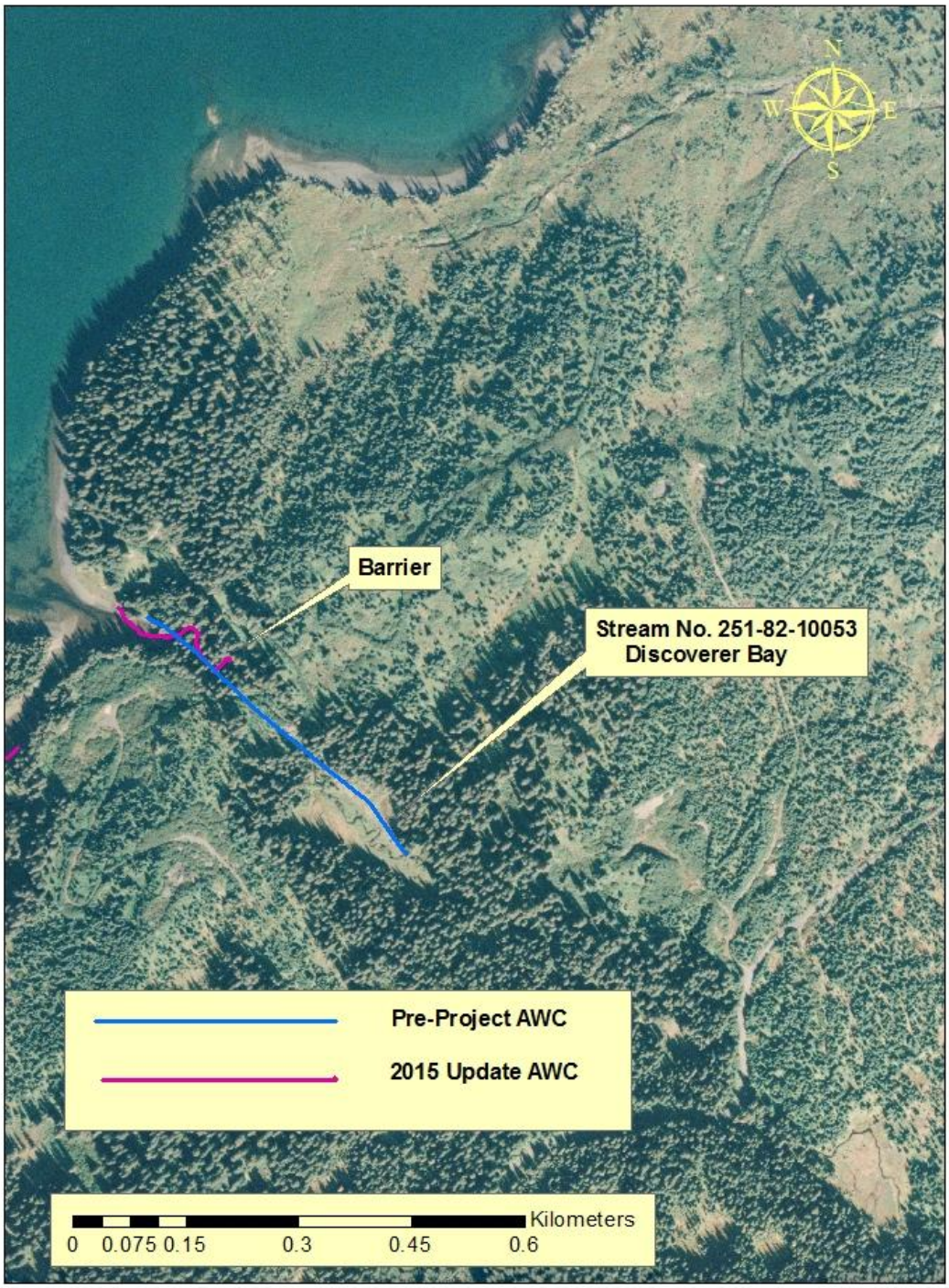
Appendix A4.–Status of surveyed reach within unnamed stream, Kazakof Bay, Afognak Island.



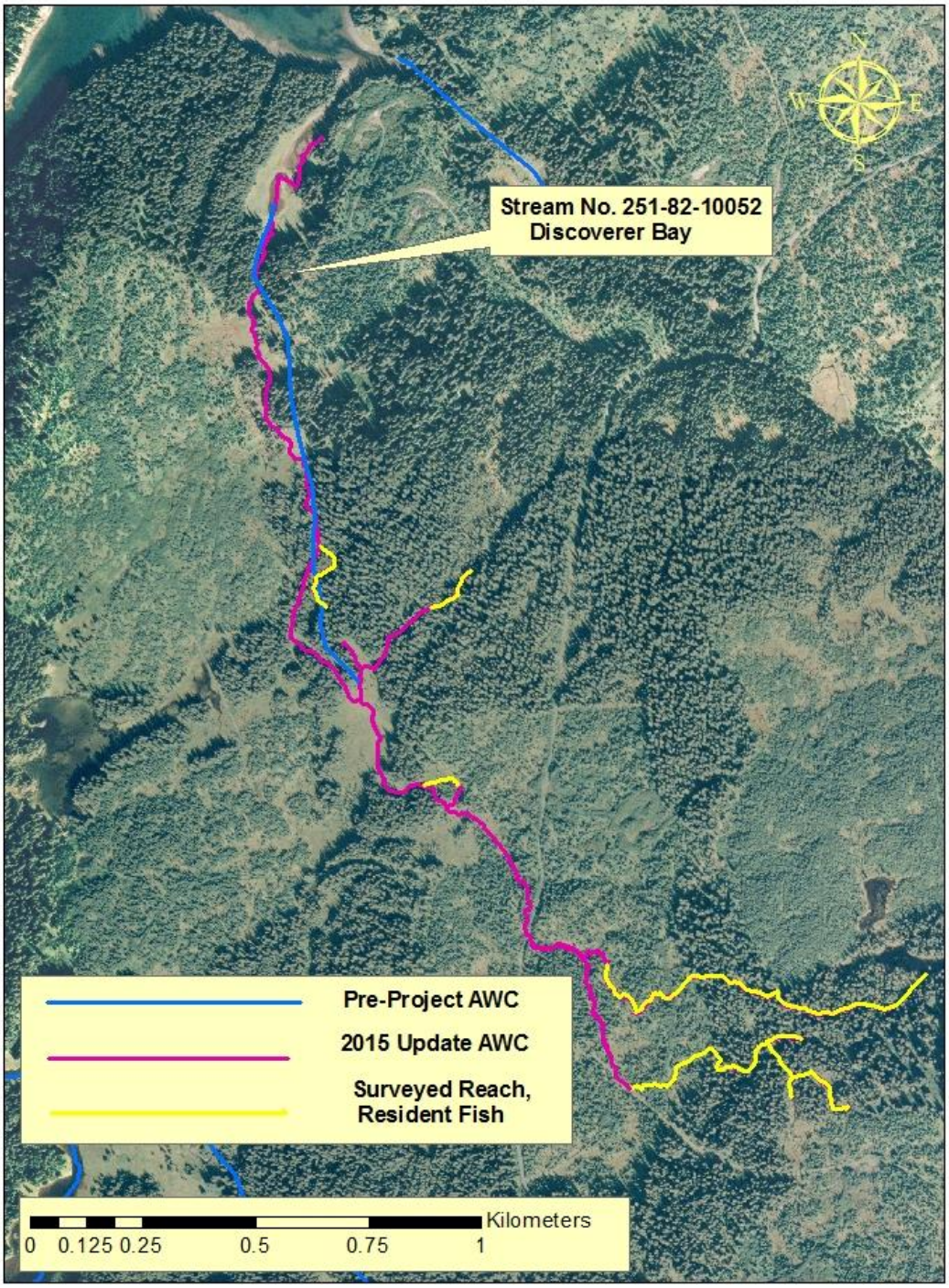
Appendix A5.–Status of surveyed reaches within Stream Nos. 252-33-10024 and 252-33-10025, Afognak Island.



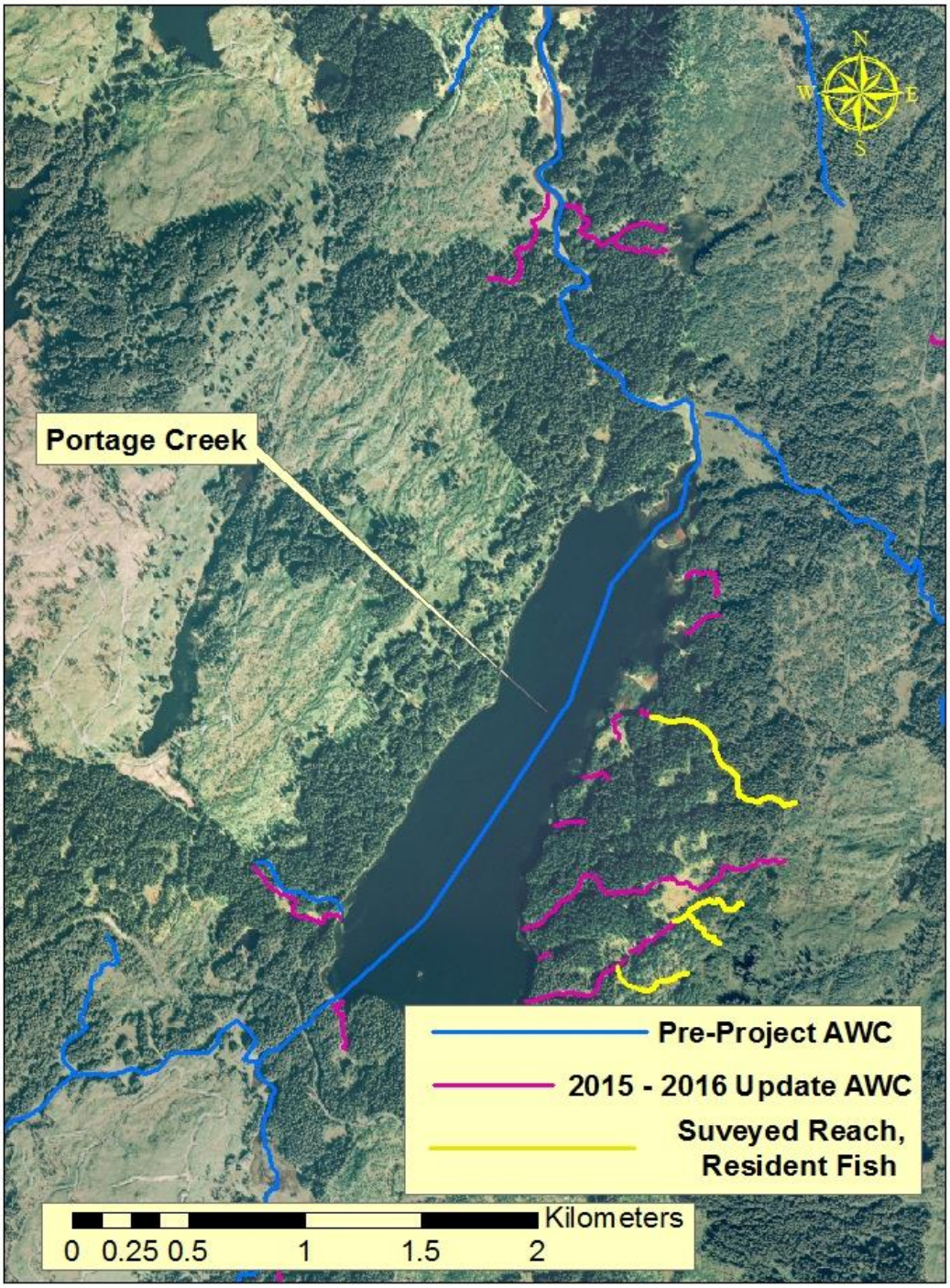
Appendix A6.–Status of surveyed reach within Stream No. 251-82-10057-2009, Afognak Island.



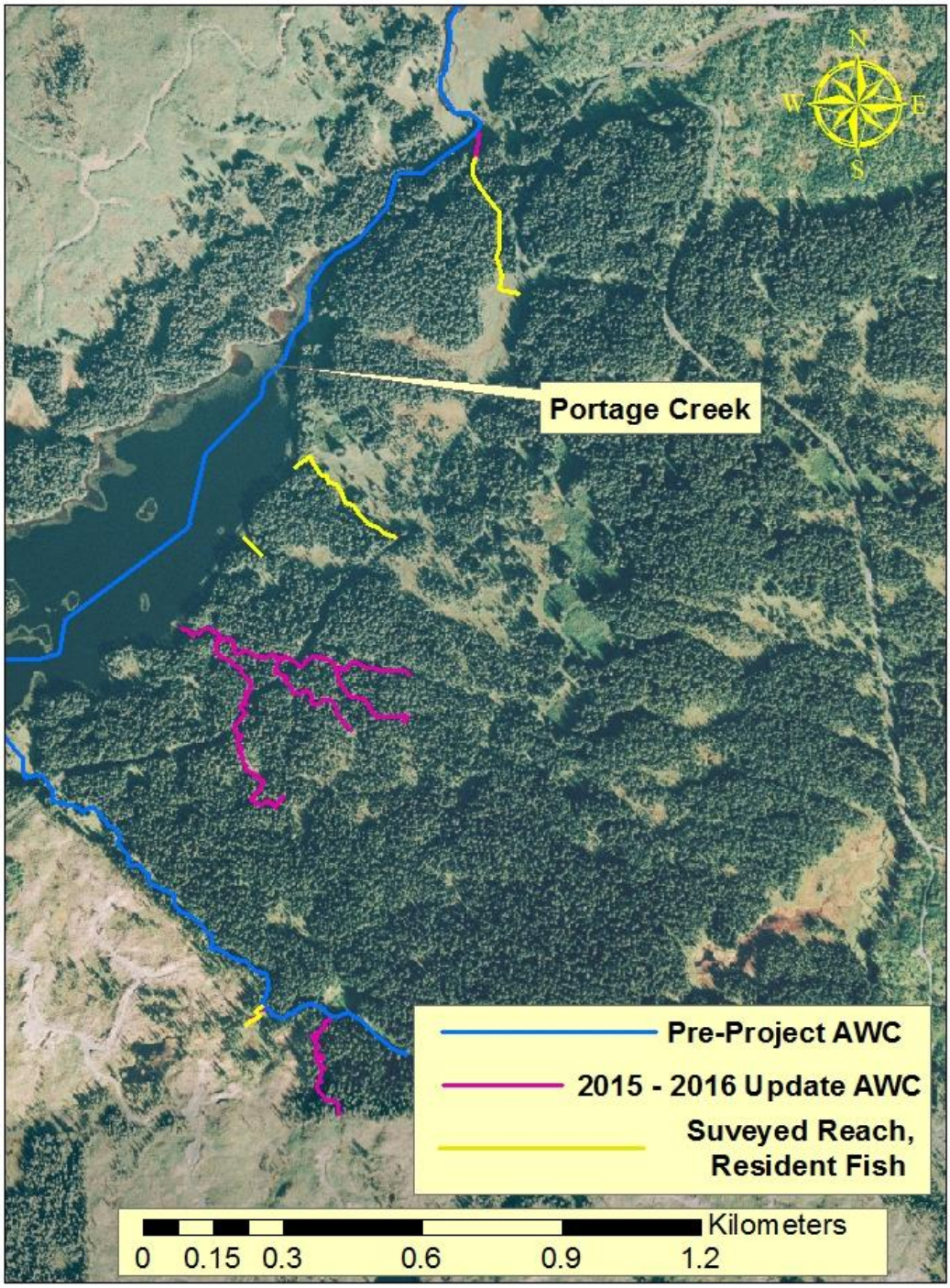
Appendix A7.–Status of surveyed reach within Stream No. 251-82-10053, Afognak Island.



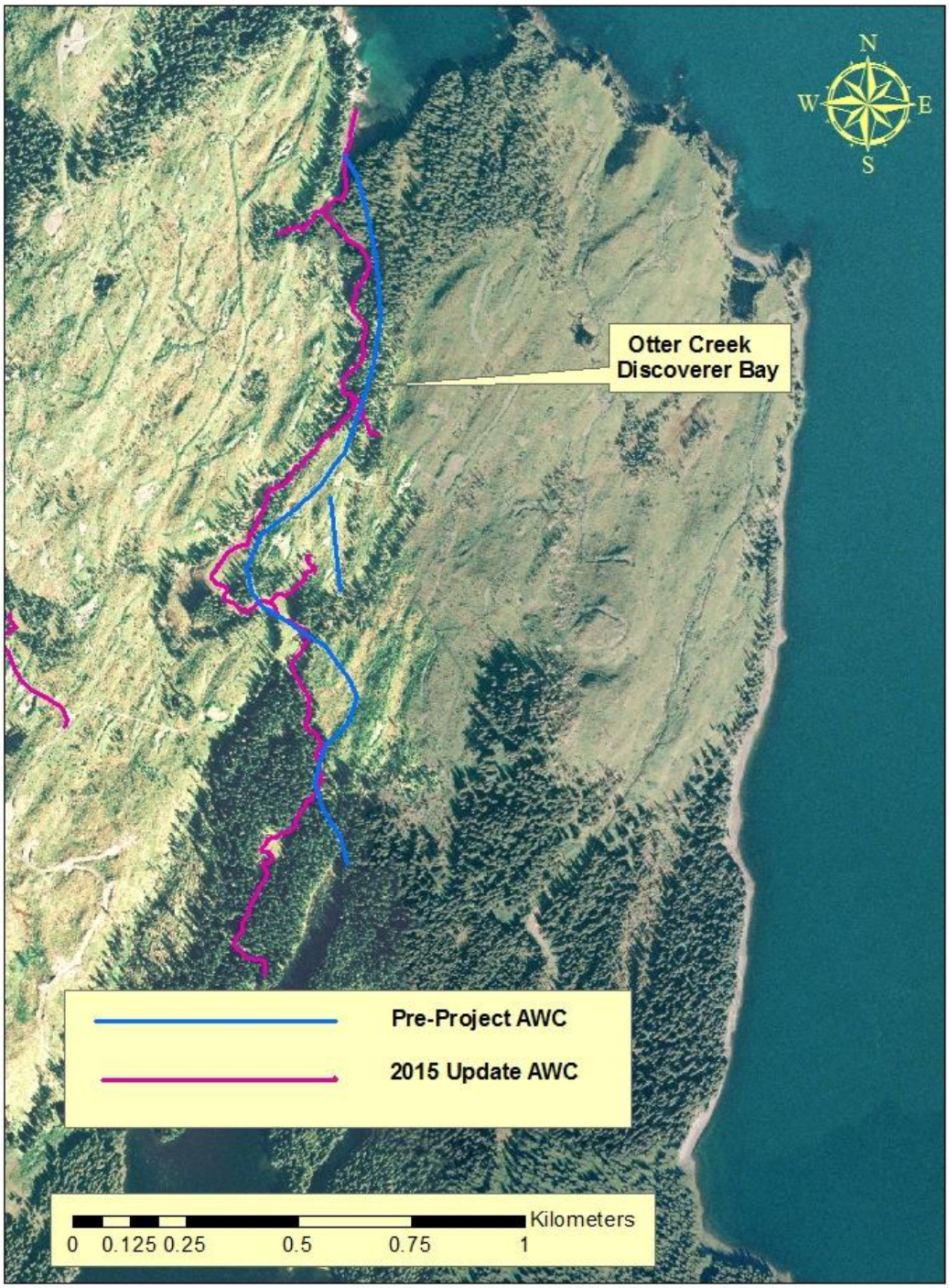
Appendix A8.–Status of surveyed reaches within Stream No. 251-82-10052, Afognak Island.



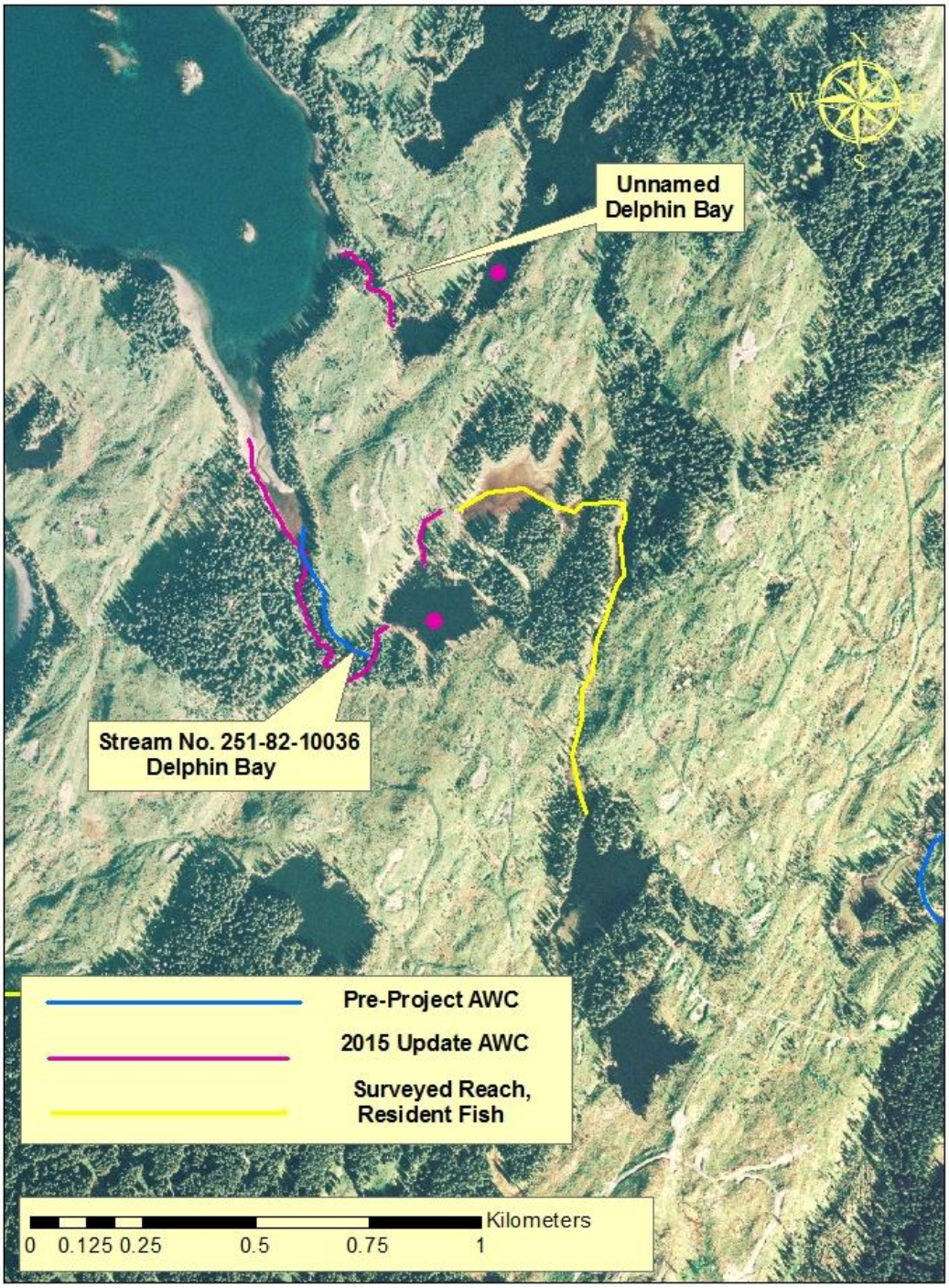
Appendix A9.–Status of surveyed reaches within Portage Creek and Portage Lake, Afognak Island.



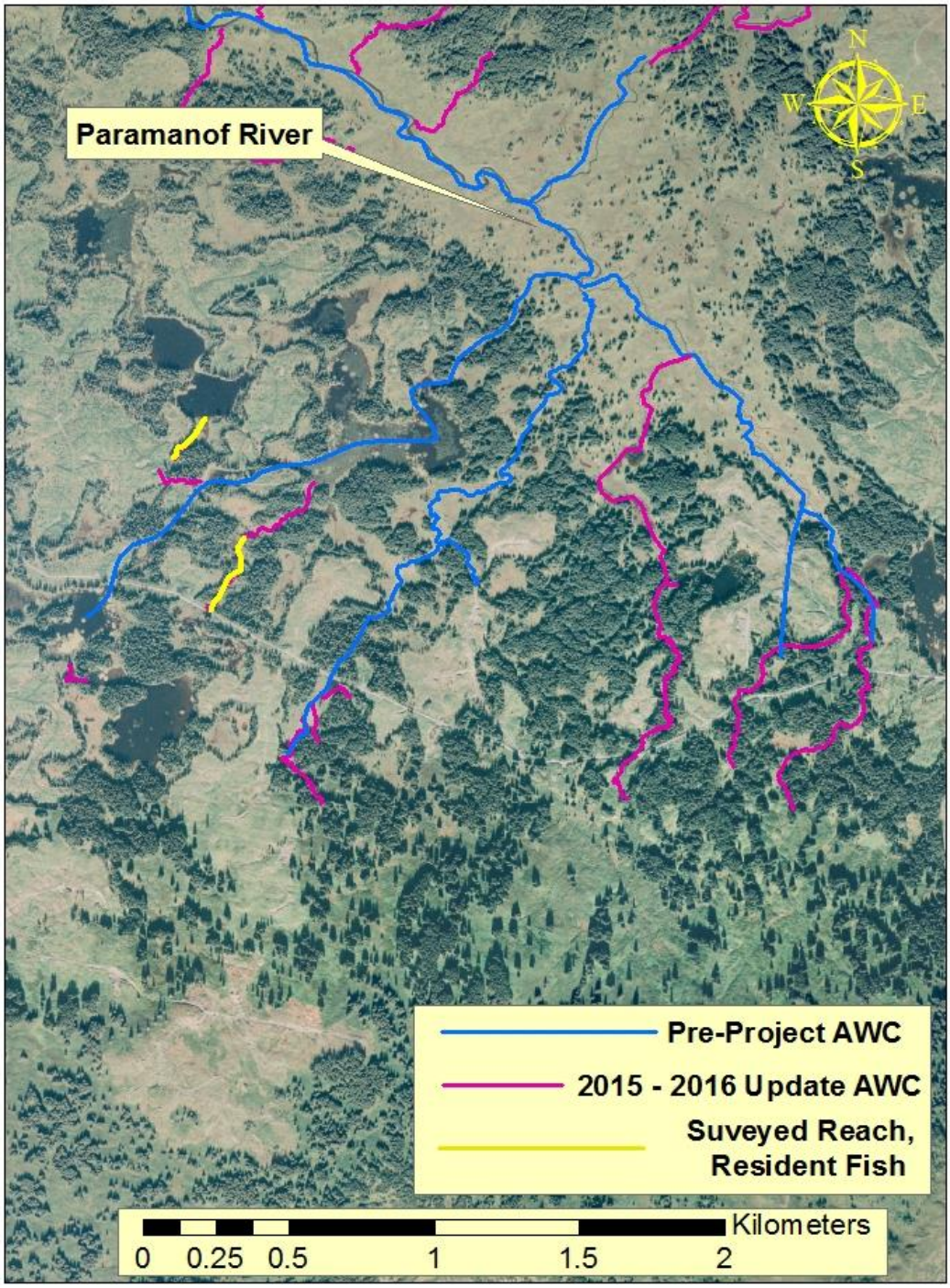
Appendix A10.–Status of surveyed reaches within upper Portage Creek, Afognak Island.



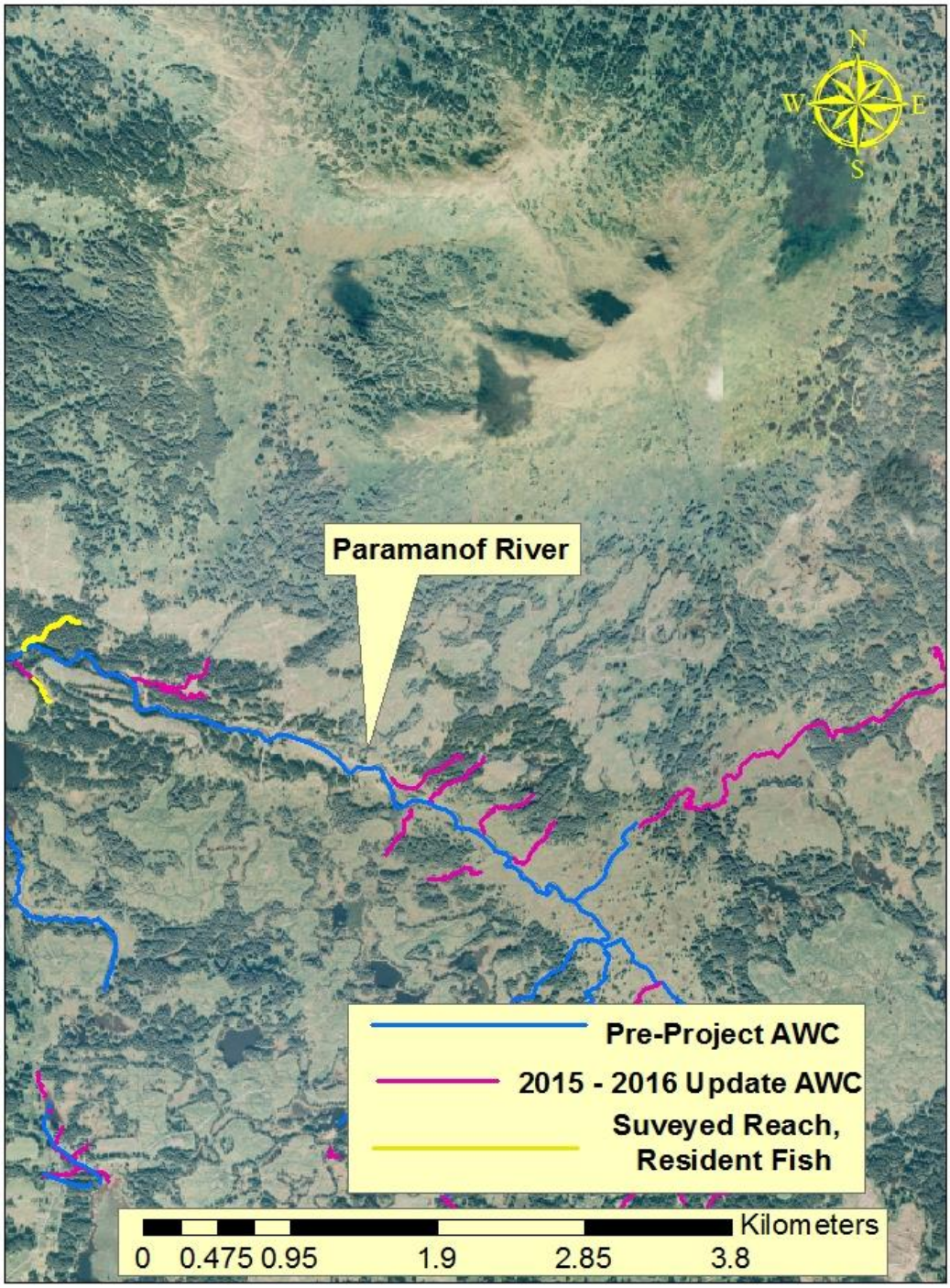
Appendix A11.–Status of surveyed reaches within Otter Creek, Afognak Island.



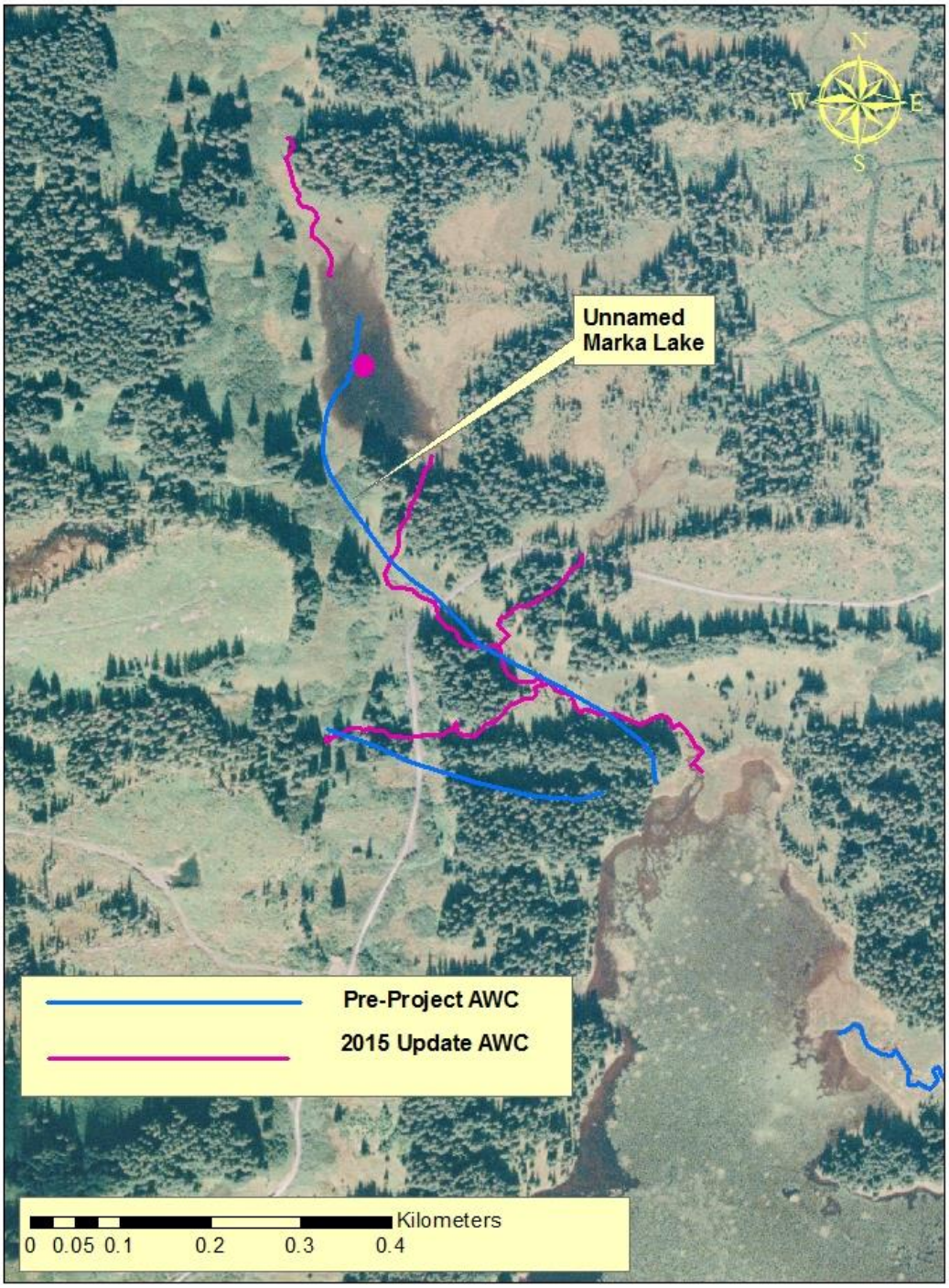
Appendix A12.–Status of surveyed reaches within Stream No. 251-82-10036 and unnamed stream, Delphin Bay, Afognak Island.



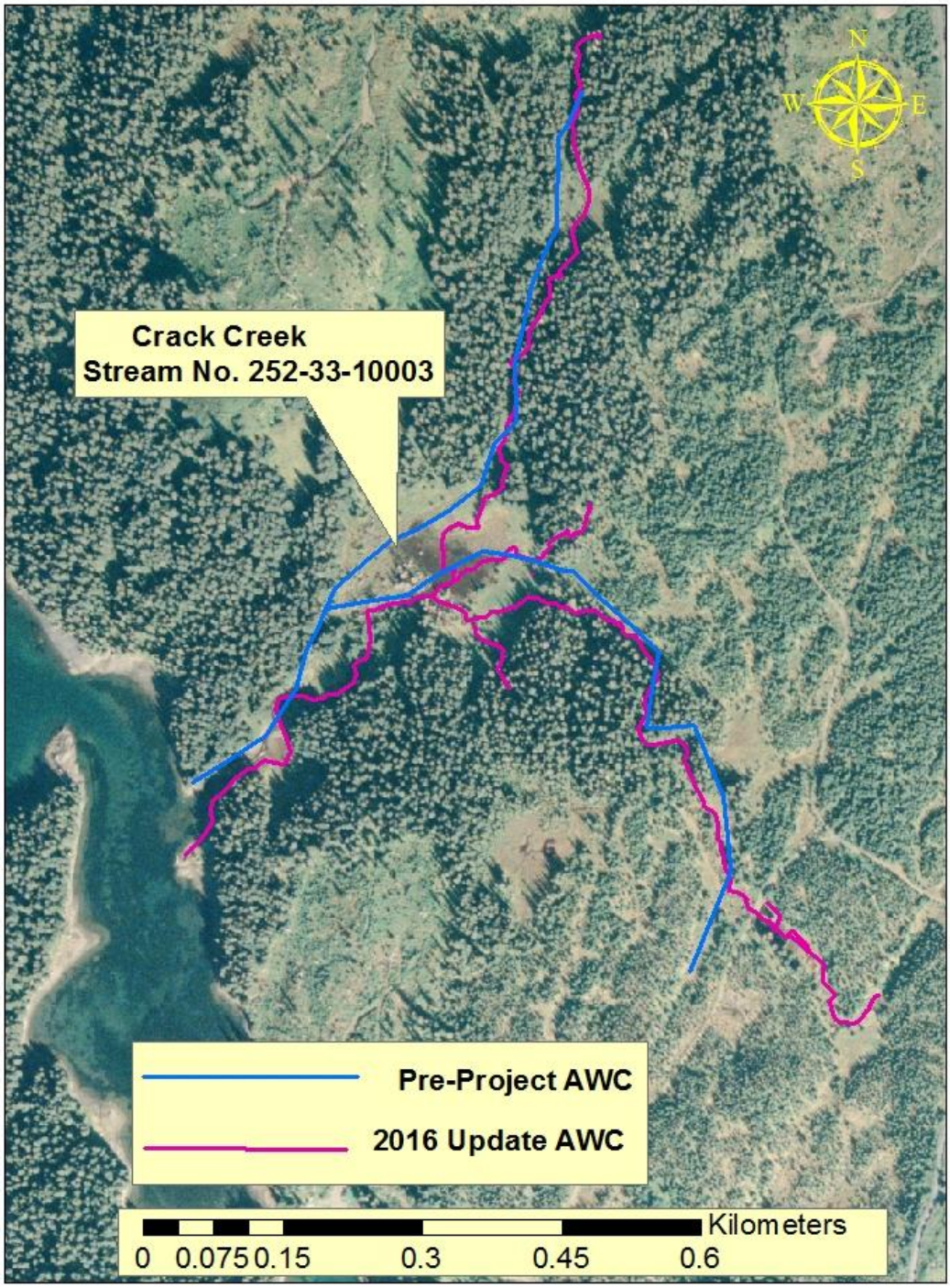
Appendix A13.–Status of surveyed reaches within Paramanof River, Afognak Island.



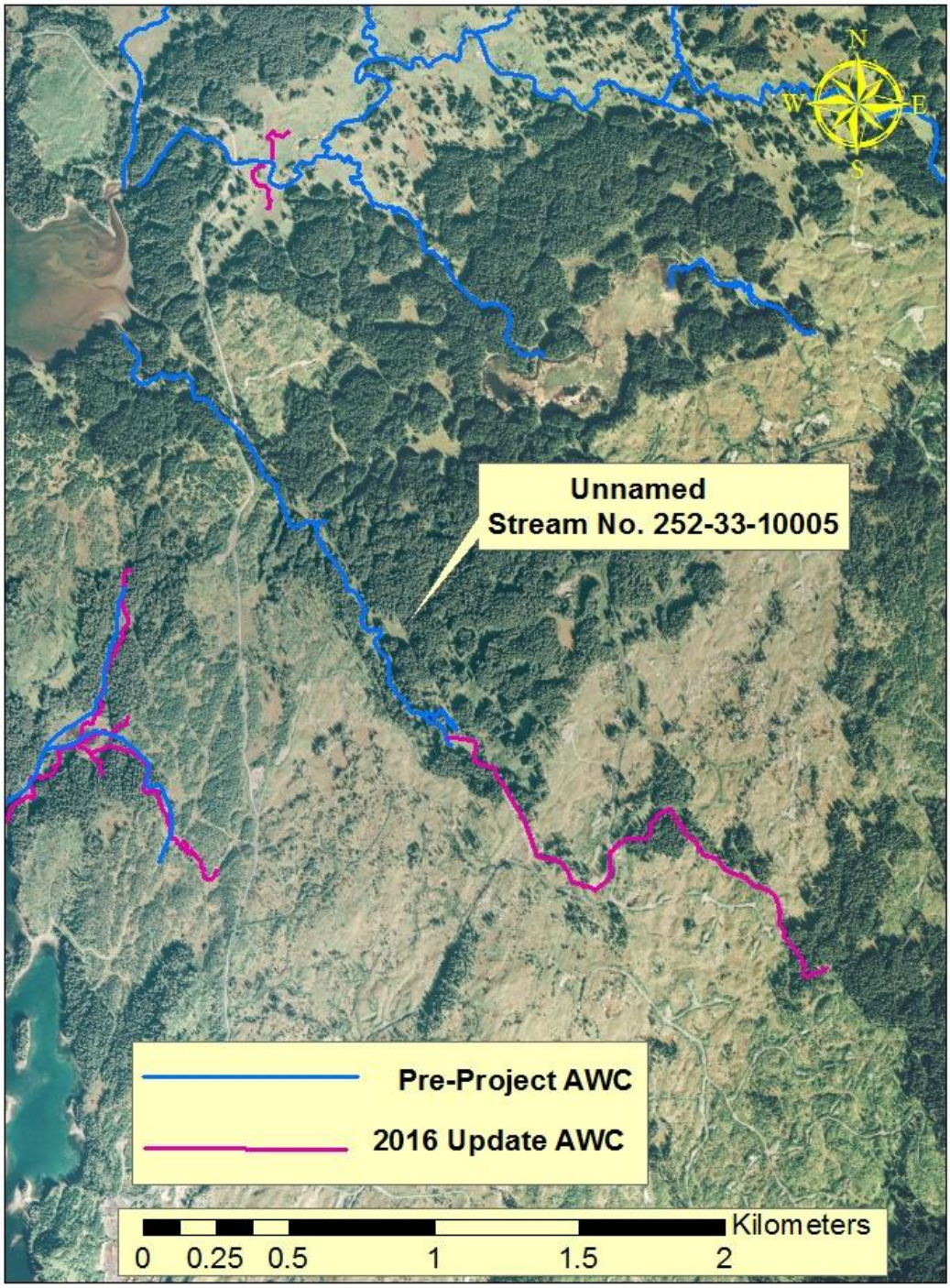
Appendix A14.–Status of surveyed reaches within Paramanof River, Afognak Island.



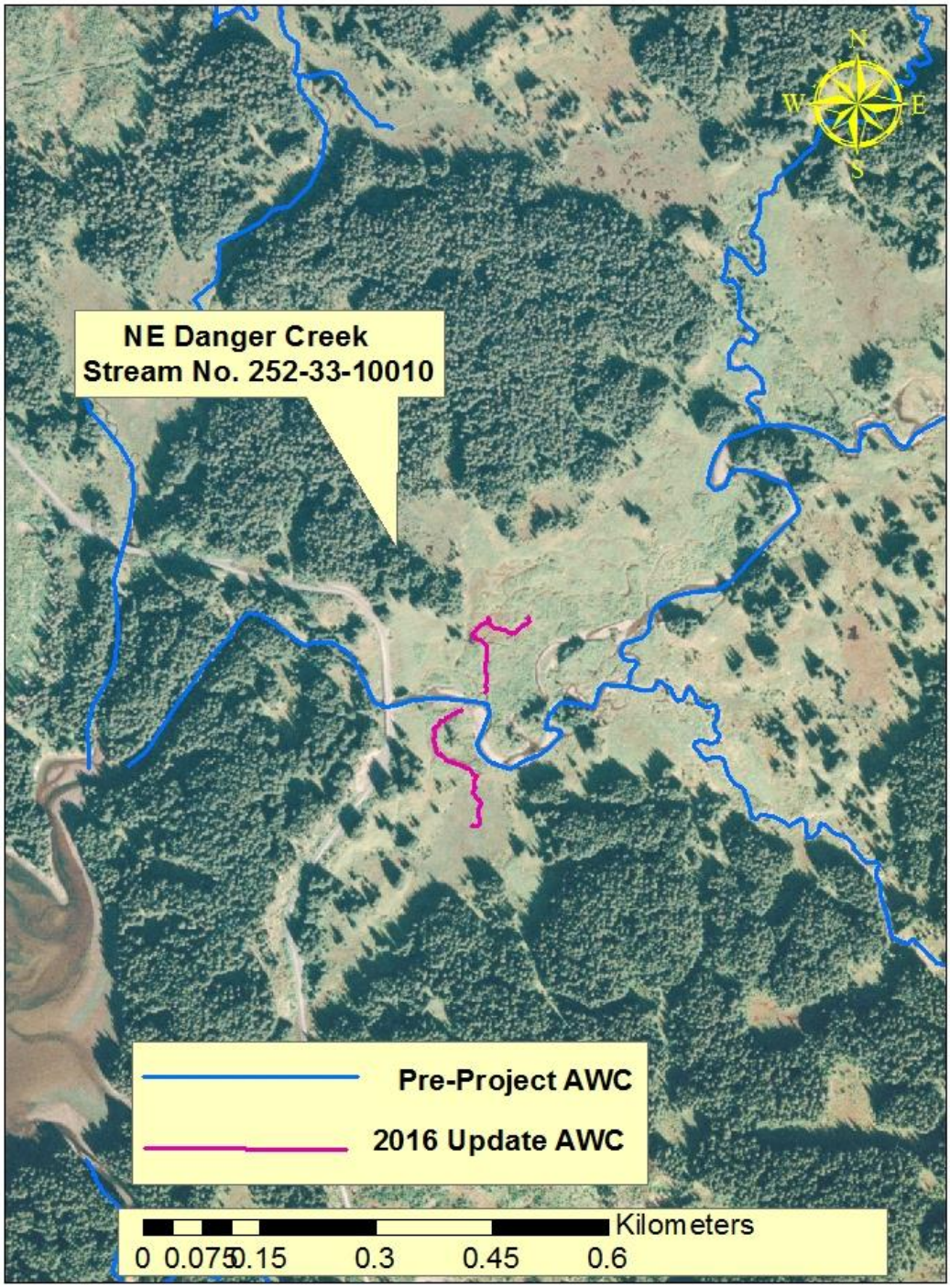
Appendix A15.–Status of surveyed reaches within unnamed tributaries, Marka Lake, Afognak Island.



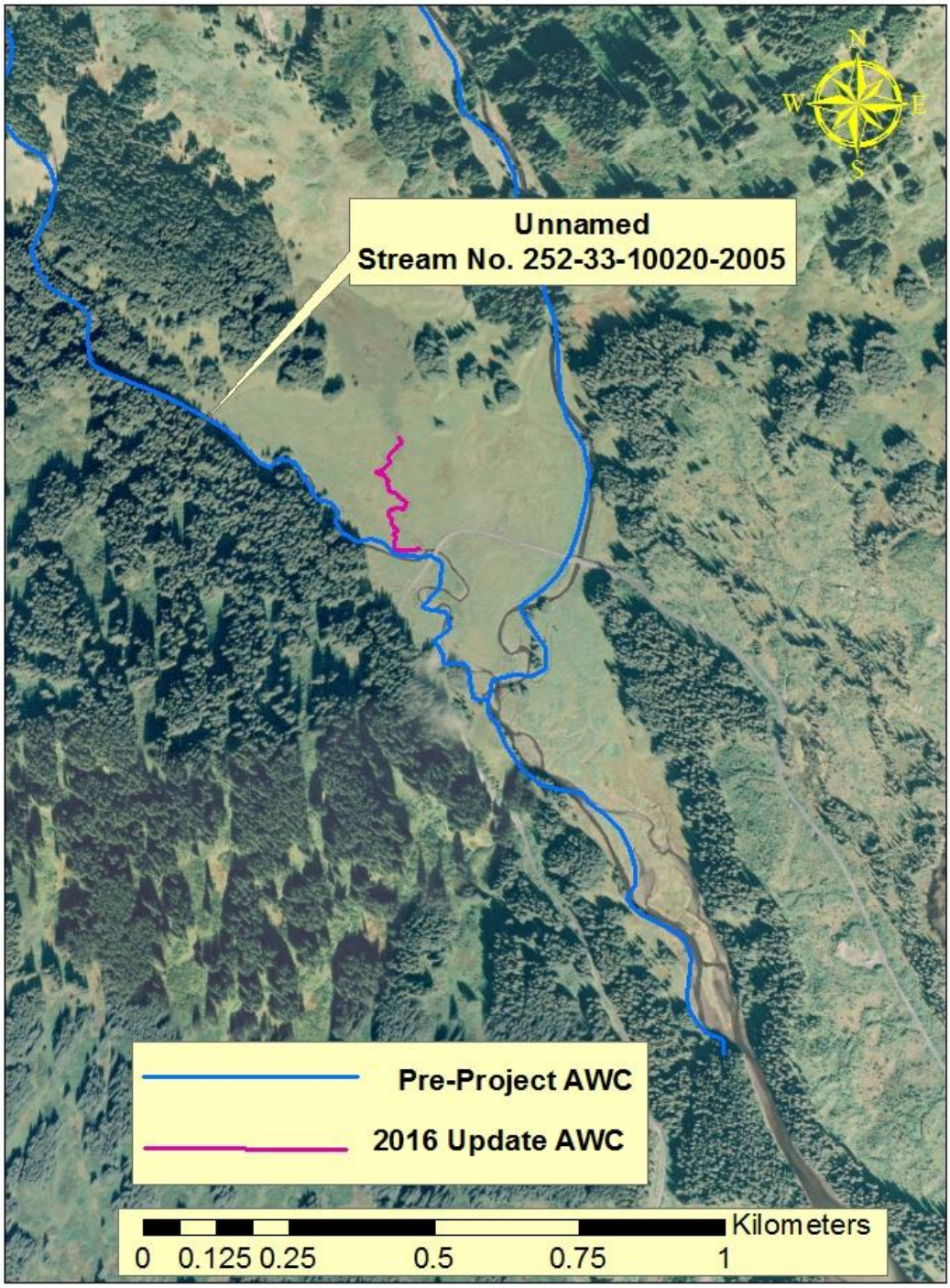
Appendix A16.–Status of surveyed reaches within unnamed tributaries, Crack Creek, Afognak Island.



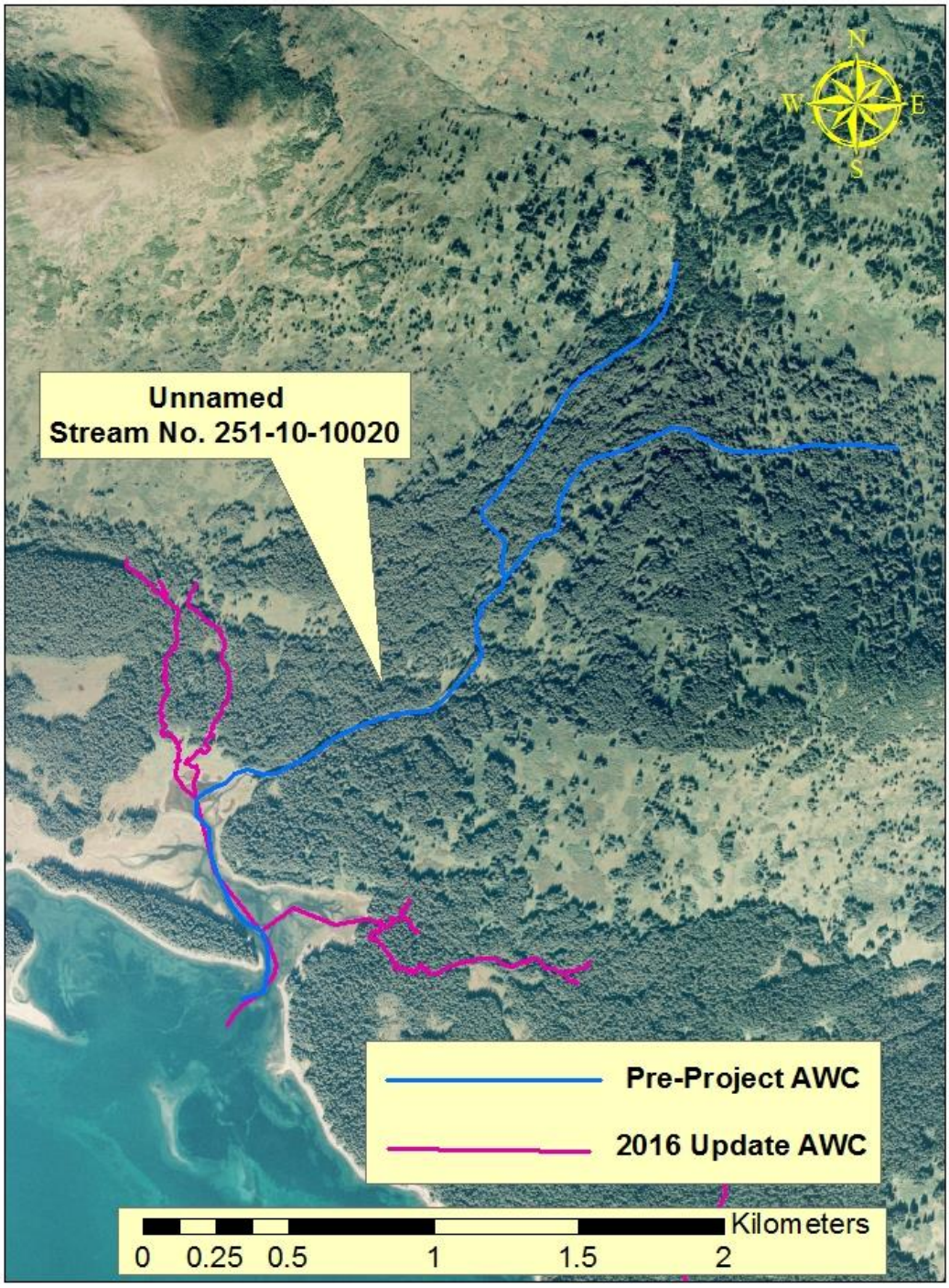
Appendix A17.–Status of surveyed reach within Stream No. 252-33-10005, Afognak Island.



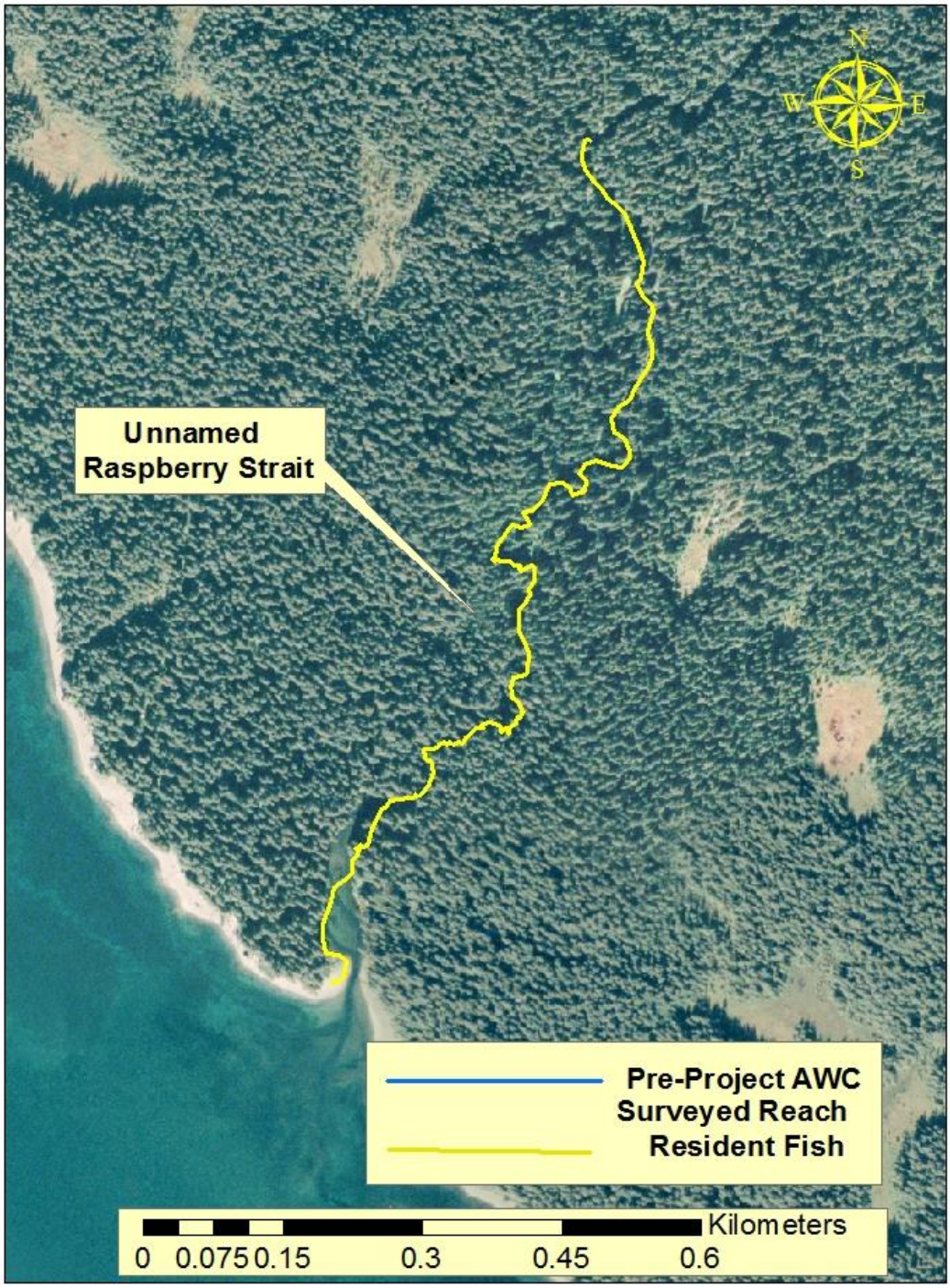
Appendix A18.–Status of surveyed reaches within NE Danger Creek, Afognak Island.



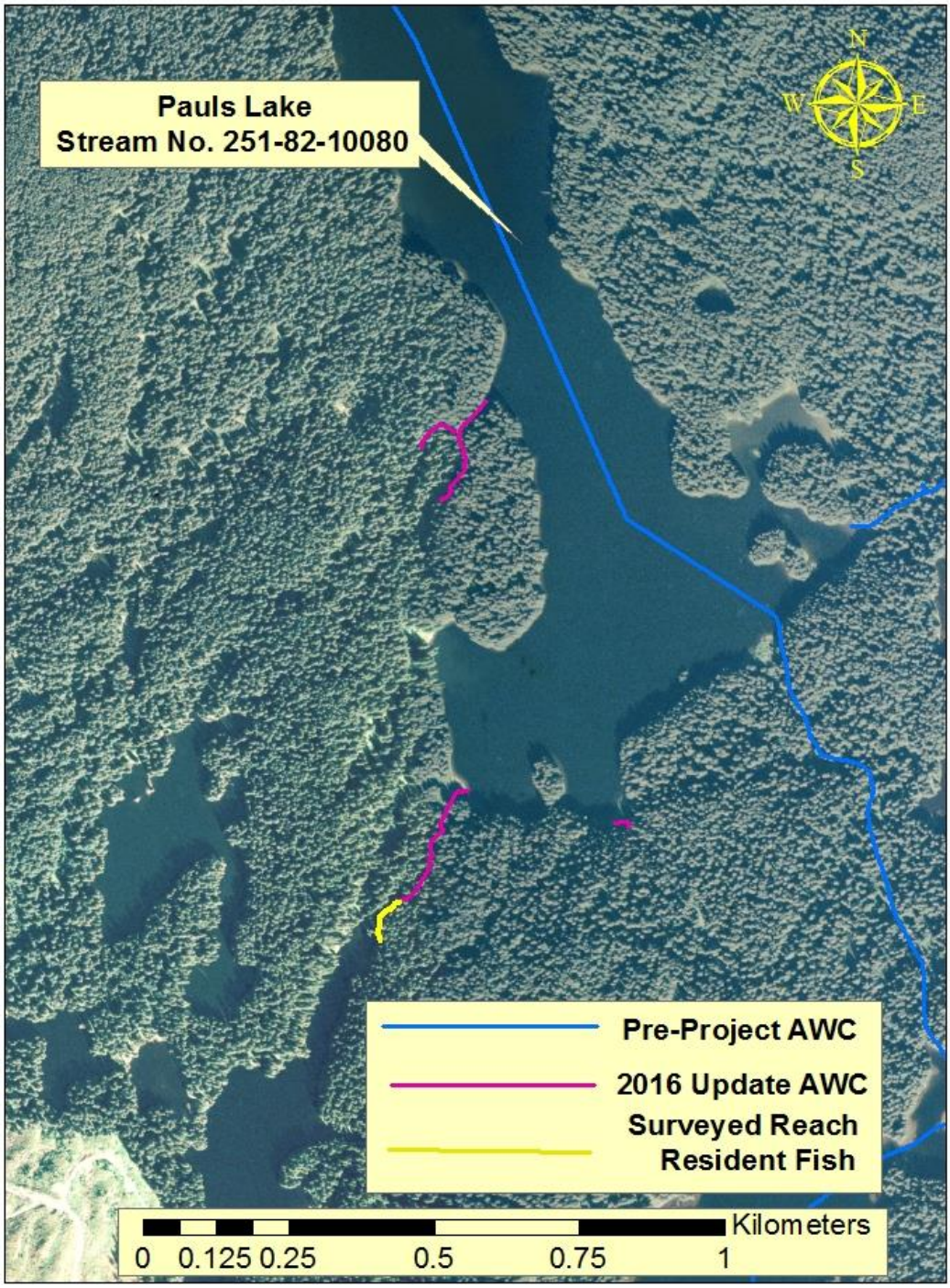
Appendix A19.–Status of surveyed reach within Stream No. 252-33-10020-2005, Afognak Island.



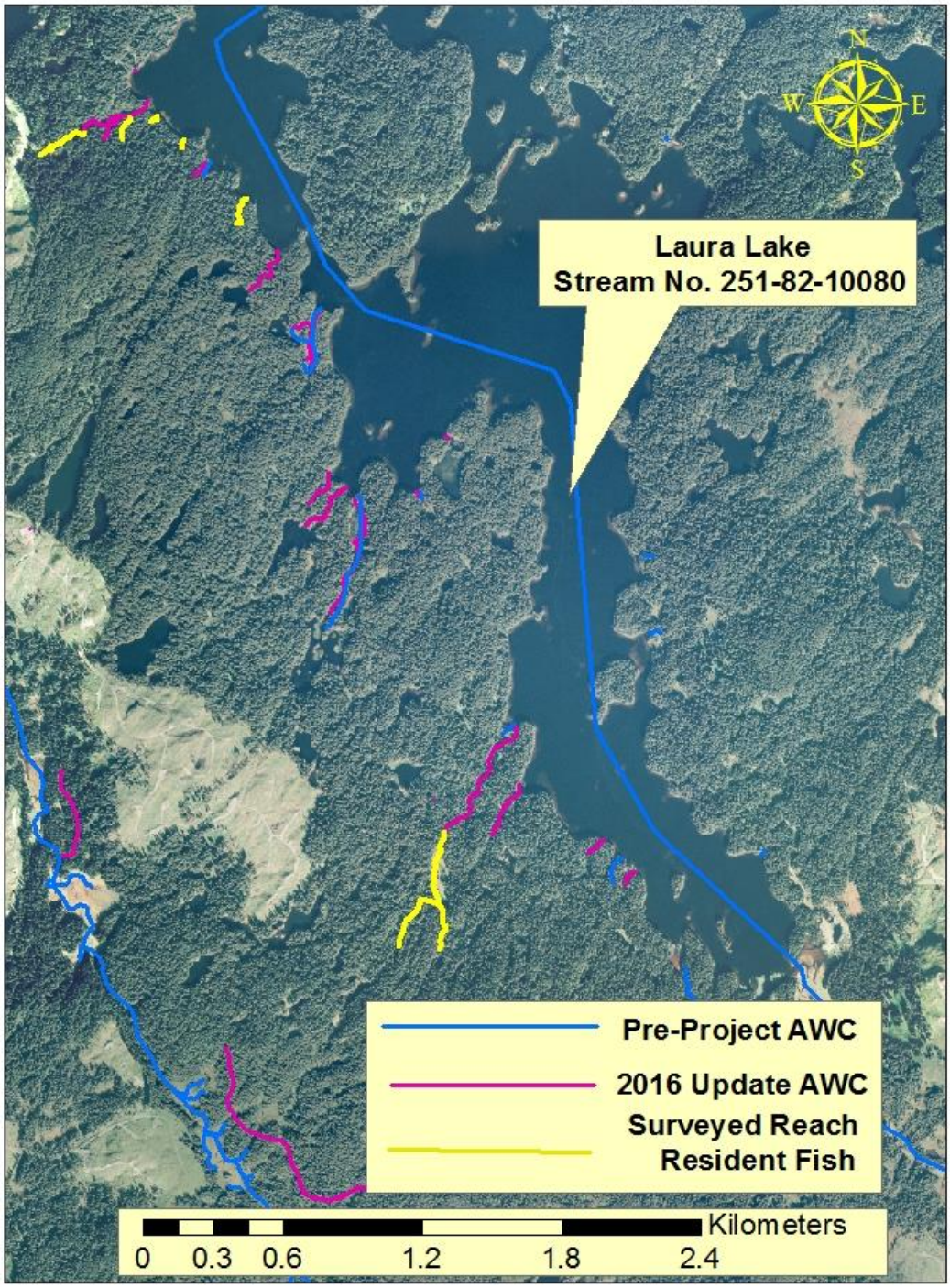
Appendix A20.–Status of surveyed reaches within Stream No. 251-10-10020, Afognak Island.



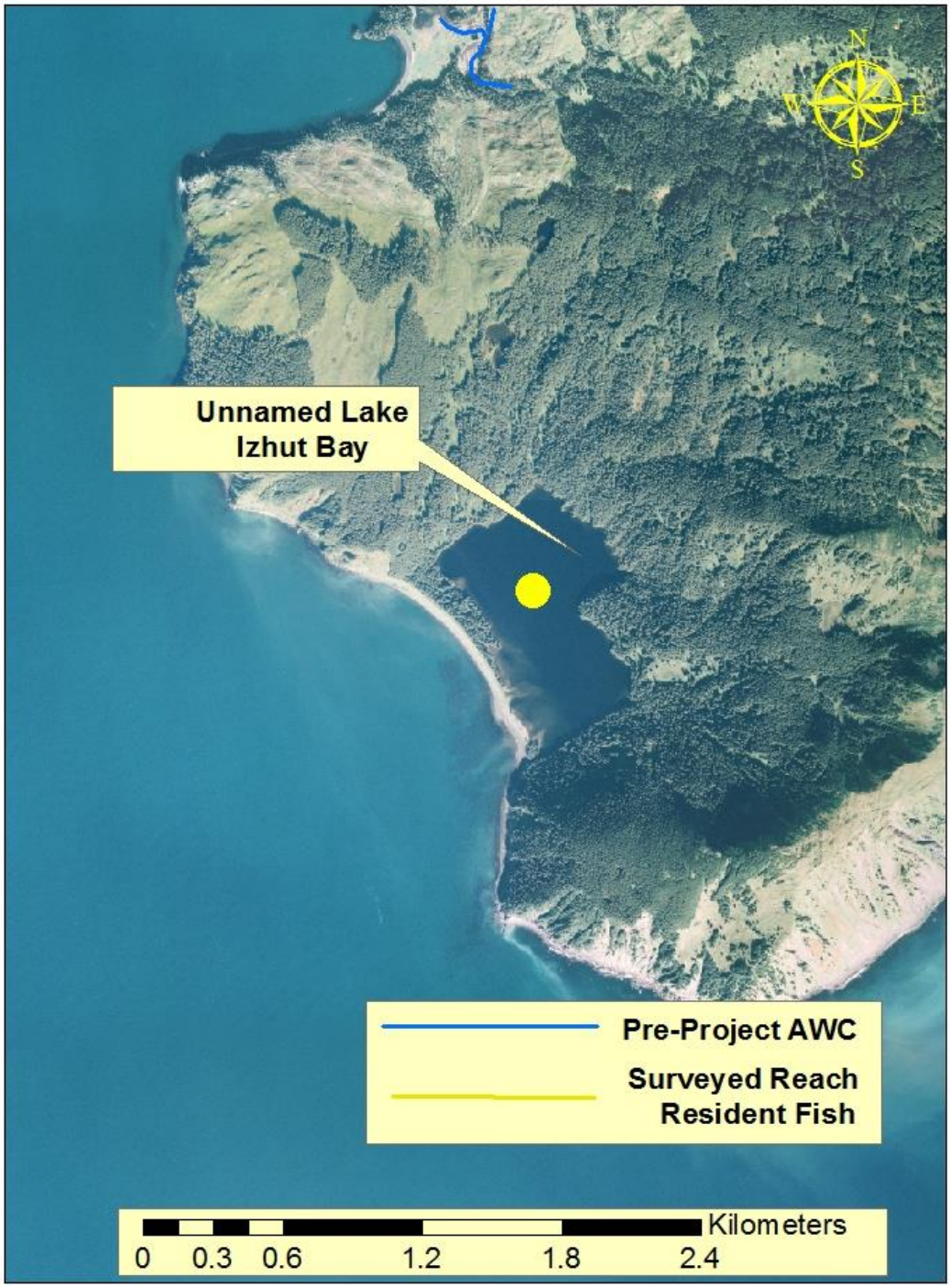
Appendix A21.–Status of surveyed reach within Unnamed Stream, Afognak Island.



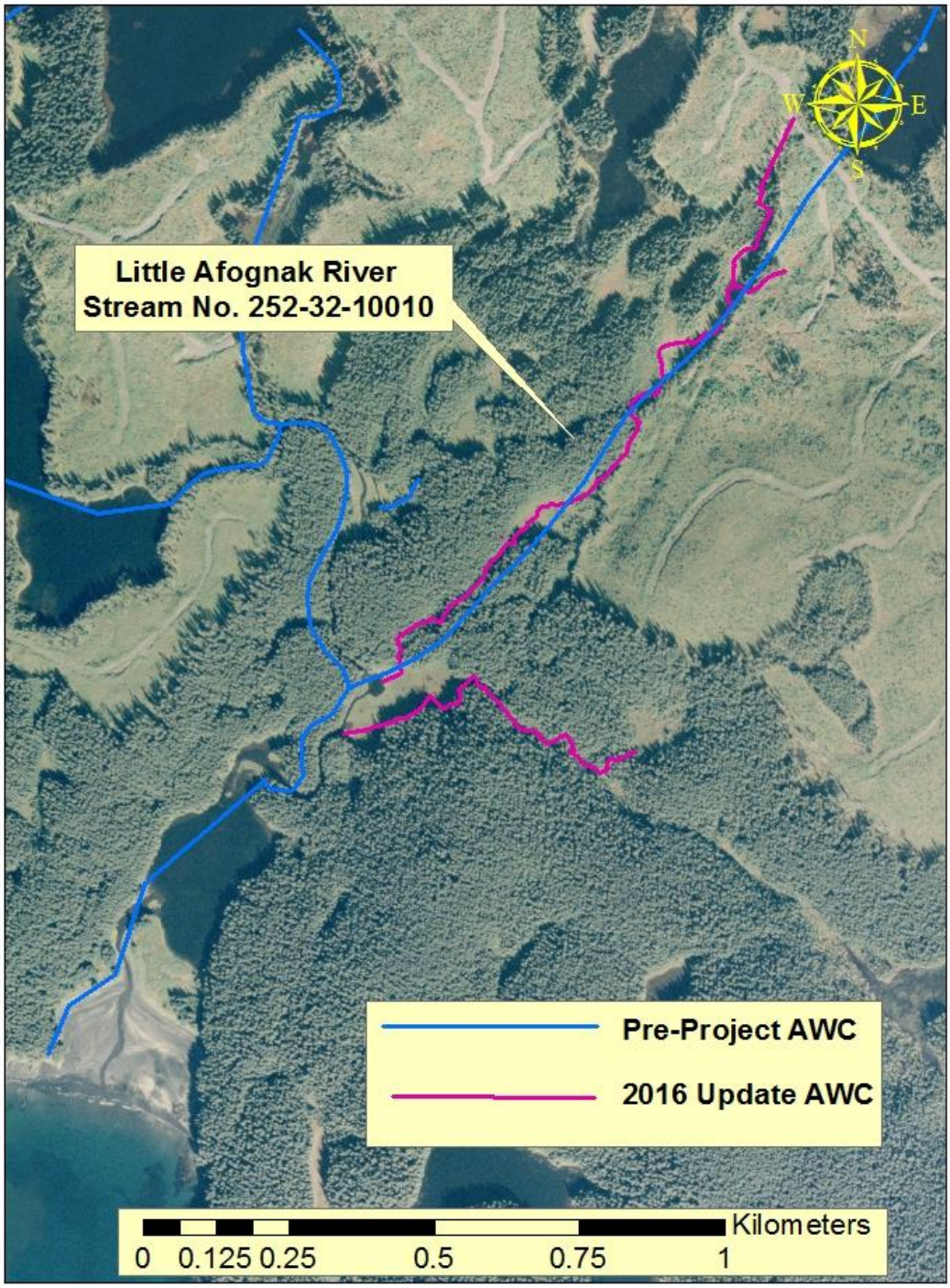
Appendix A22.–Status of surveyed reaches within Pauls Lake, Afognak Island.



Appendix A23.–Status of surveyed reaches within Laura Lake, Afognak Island.



Appendix A24.–Status of surveyed reach within Unnamed Lake, Afognak Island.



Appendix A25.–Status of surveyed reaches within Little Afognak River, Afognak Island.