Technical Report No. 15-08

Fish Presence Surveys on Kodiak Island Borough Lands, Kodiak Island Archipelago, 2015

by

William D. Frost

Onion Bay, Raspberry Island

December 2015

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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FISH PRESENCE SURVEYS ON KODIAK ISLAND BOROUGH LANDS, KODIAK ISLAND ARCHIPELAGO, 2015

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, USA

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Finally, I would like to thank Michael J. Daigneault for his guidance and patience during the writing of this document.

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EXECUTIVE SUMMARY

In summer 2015, the Alaska Department of Fish and Game (ADF&G), Division of Habitat, sampled for the presence of anadromous fish on the Kodiak Island archipelago on land owned by the Kodiak Island Borough. 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 50-foot development setback required by Kodiak Island Borough (KIB) code. 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, 15 watersheds were sampled on Kodiak Island and 4 watersheds were sampled on Raspberry Island. Fish presence sampling resulted in 62 nominations to the AWC. As a result of the sampling effort, 19.6 km of new anadromous fish habitat was nominated to the AWC.

The nominations included 7 specified water bodies that support additional life stages of anadromous fish, 7 specified streams whose locations were accurately mapped by Global Positioning System, and 4 new anadromous fish streams. The new streams are located in Onion Bay, Ugak Bay, and Hidden Basin.

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)*, sockeye salmon (*O. nerka*), and rainbow/steelhead trout (*O. mykiss*). Additional species captured or observed were threespine stickleback (*Gasterosteus aculeatus)*, ninespine stickleback (*Pungitius pungitius)*, and sculpin (*Cottus* spp).

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 Kodiak Island Borough (KIB) lands located within the Kodiak Island archipelago and document the presence of anadromous fish in advance of future development. The Kodiak Island archipelago 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). Kodiak Island Borough (KIB) Code 17.50.080(b) requires a 50-foot development setback on all waters listed in the AWC. Forested land located in the KIB may be sold for timber harvest. Many of the streams support anadromous and high value resident fish and require a 100-foot riparian retention area under the Alaska Forest Resources and Practices Act (FRPA; 11 AAC 95.265(4)). 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). A water body that supports anadromous fish but is not listed in the AWC is not afforded any protection under AS 16.05.871.

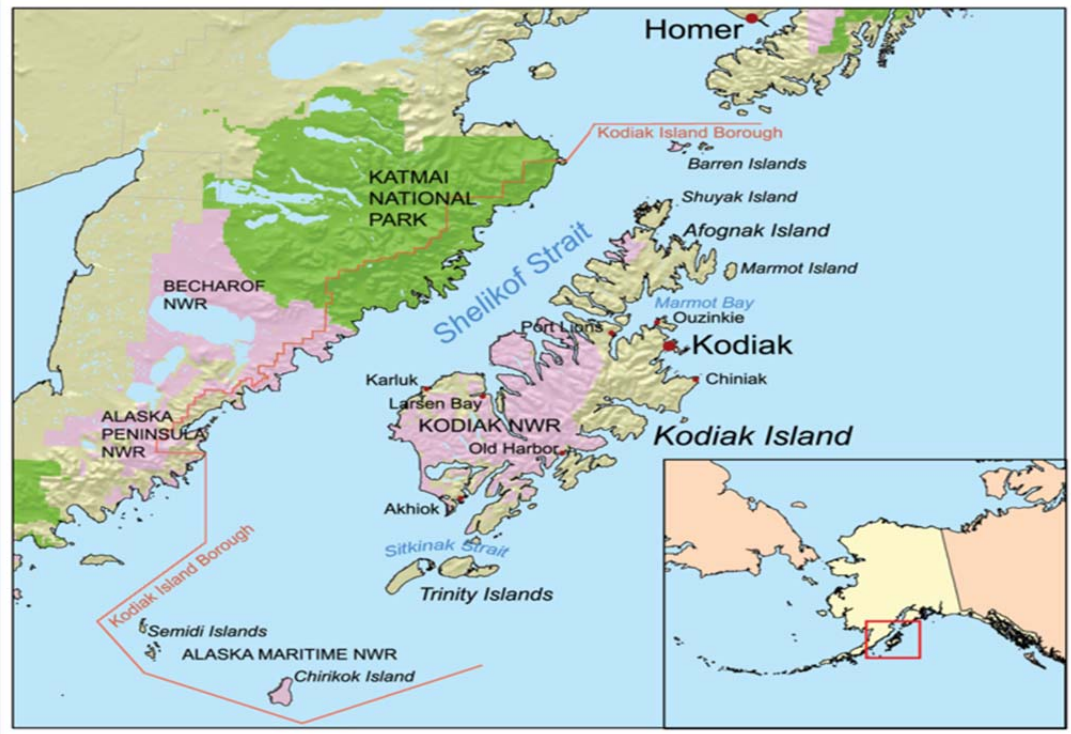

Figure 1.–Kodiak Island archipelago.

ADF&G initiated this project to document anadromous fish presence prior to future land development on Kodiak Island. ADF&G coordinated with KIB to prioritize areas to be sampled and arranged field sampling logistics.

METHODS

ADF&G developed maps using Geographic Information Services (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 the Kodiak Island archipelago in 2015 were small (< 8m wide) first-, second-, and third-order tributaries of known anadromous streams (Strahler 1957). Sampling was prioritized by cross-referencing lands that may be developed with those water bodies likely to support anadromous fish. The length of each reach sampled was measured using the GIS measuring tool or field-verified by Global Positioning System (GPS).

Water bodies were sampled by a team of 1 ADF&G staff and up to 2 KIB employees. 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 2 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, a select number 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 noted.

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).

Criterion	Species requirements (in feet)				
	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 or add barriers to fish passage. 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 location. Nominations were completed according to the ADF&G submission guidelines and requirements (ADF&G 2015).

RESULTS

In 2015, 5 sampling events occurred from May through October. On Kodiak Island, 15 watersheds were sampled during the 2015 season (Appendix A1–A12). On Raspberry Island, 4 watersheds were sampled during the 2015 season (Appendix A13–A17). A total of 65 reaches were sampled with a total length of 29 km (Table 2 and Table 3). The total length of stream documented as containing anadromous fish and nominated to the AWC was 19.6 km (Table 2 and Table 3). The pre-project status of the AWC and AWC nominations resulting from 2015 sampling are graphically shown in Appendix A.

Table 2.–Kodiak Island watersheds sampled in 2015.

Watershed name	AWC number	# Reaches sampled	Total length sampled (meters)	Total new AWC length (meters)
Unnamed (Eagle Harbor)	259-42-10039	15	8,710	8,710
Delta Creek (Ugak Bay)	259-42-10037	3	1,120	880
Janel's Creek (Ugak Bay)		1	1,130	1,130
Unnamed (Ugak Bay)		1	150	0
Unnamed (Hidden Basin)		1	305	250
Unnamed (Hidden Basin)	259-41-10090	1	1,270	0
Unnamed (Hidden Basin)	259-41-10080	2	640	470
Salonie Creek	259-22-10030	12	3,595	2,230
Unnamed (Womens Bay)	259-22-10032	4	860	500
Russian Creek	259-22-10020	5	630	270
Beaver Lake	259-10-10035-0030	4	860	0
Unnamed (Monashka Bay)		1	555	330
Unnamed (Monashka Bay)		1	490	480
Monashka Creek	259-10-10015	3	1,000	900
Virginia Creek	259-10-10015-2001	4	3,785	780
Total		58	25,100	16,930

Table 3.–Raspberry Island watersheds sampled in 2015.

Watershed name	AWC number	# Reaches sampled	Total length sampled (meters)	Total new AWC length (meters)
Unnamed (Onion Bay)		1	90	90
Unnamed (Onion Bay)		1	130	130
Onion Creek	253-31-10010	2	2,445	1,180
Selief Creek	251-10-10010	3	1,300	1,300
Total		7	3,965	2,700

During the 2015 sampling effort, 7 known anadromous streams on Kodiak and Raspberry islands 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 Kodiak and Raspberry Islands corrected in 2015.

Streams Corrected 2015
259-42-10040
259-41-10090
259-22-10030-2013-3007
259-22-10030-2013-3003*
259-22-100020-2006
259-10-10015-2001
253-31-10010

**Note:* Stream No. 259-22-10030-2013-3003 was removed from the AWC because no stream was located.

In 2015, 4 new streams that support anadromous fish were located on Kodiak and Raspberry islands and nominated to the AWC. These 4 streams are located in Ugak Bay, Hidden Basin, and Onion Bay (Appendix A3, Appendix A4, Appendix A13, and Appendix A14).

In 2015, there were 62 nominations submitted to the AWC. Forty-three of the nominations were accepted for inclusion in the 2016 AWC revision; 19 nominations will be reviewed for the 2017 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*), sockeye salmon, and rainbow/steelhead trout (*O. mykiss*). Fork length measurements were taken for a portion of the juvenile salmon and Dolly Varden that were captured (Table 5). Stickleback and sculpin were noted as present but not measured or counted.

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

Month	Length range (mm)			
	Coho	Pink	Sockeye	Dolly Varden
May	45–110 (*n* = 34)	ND	45–75 (*n* = 19)	25-100 (*n* = 21)
July	35–96 (*n* = 47)	ND	ND	45-175 (*n*=19)
August	55–100 (*n* = 45)	ND	ND	30-110 (*n*=10)
September	75-95 (*n*=7)	ND	ND	40-110 (*n*=13)
October	55–129 (*n* = 35)	ND	ND	45-250 (*n*=23)

Note: ND = no data

In 2015, 7 known anadromous water bodies were found to support additional species or life stages (Table 6). The streams were updated in the AWC.

Table 6.–Additional species or life stages located on Kodiak and Raspberry Islands.

Kodiak stream no.	Species added	Life stage added
259-42-10039	Sockeye, Coho salmon	Rearing/spawning
259-42-10037	Coho salmon	Rearing
259-41-10080	Coho salmon	Rearing
259-22-10030	Coho salmon/Dolly Varden	Rearing/spawning
259-10-10015-2001	Coho salmon	Rearing
251-10-10010	Coho salmon	Rearing
253-31-10010	Dolly Varden	

DISCUSSION

Sampling conducted in 2015 on Kodiak and Raspberry Islands 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 2015 nomination deadline have been accepted, approved, and scheduled for inclusion in the 2016 AWC revision. Nineteen nominations submitted after the 2015 deadline will be reviewed by the ADF&G and, if accepted, included in the 2017 AWC revision.

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. This project resulted in the addition of 19.6 km of new anadromous fish habitat to the AWC, plus the addition of species and life stages to listed water bodies. Inclusion in the AWC also results in a 50-foot development setback under KIB code (17.50.080(b)).

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 material 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 temperature 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 KIB and ADF&G. The KIB 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 KIB zoning requirements.

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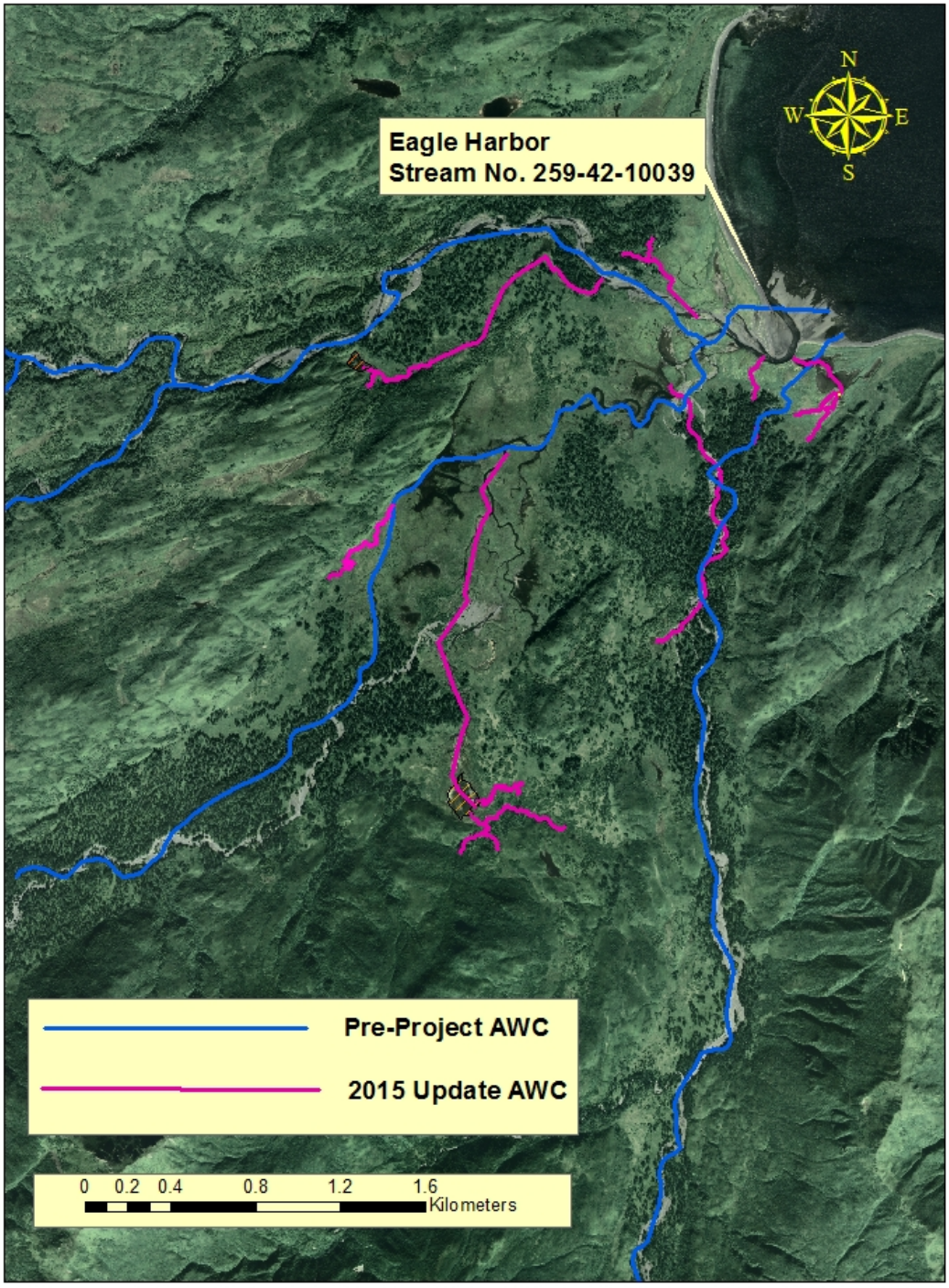
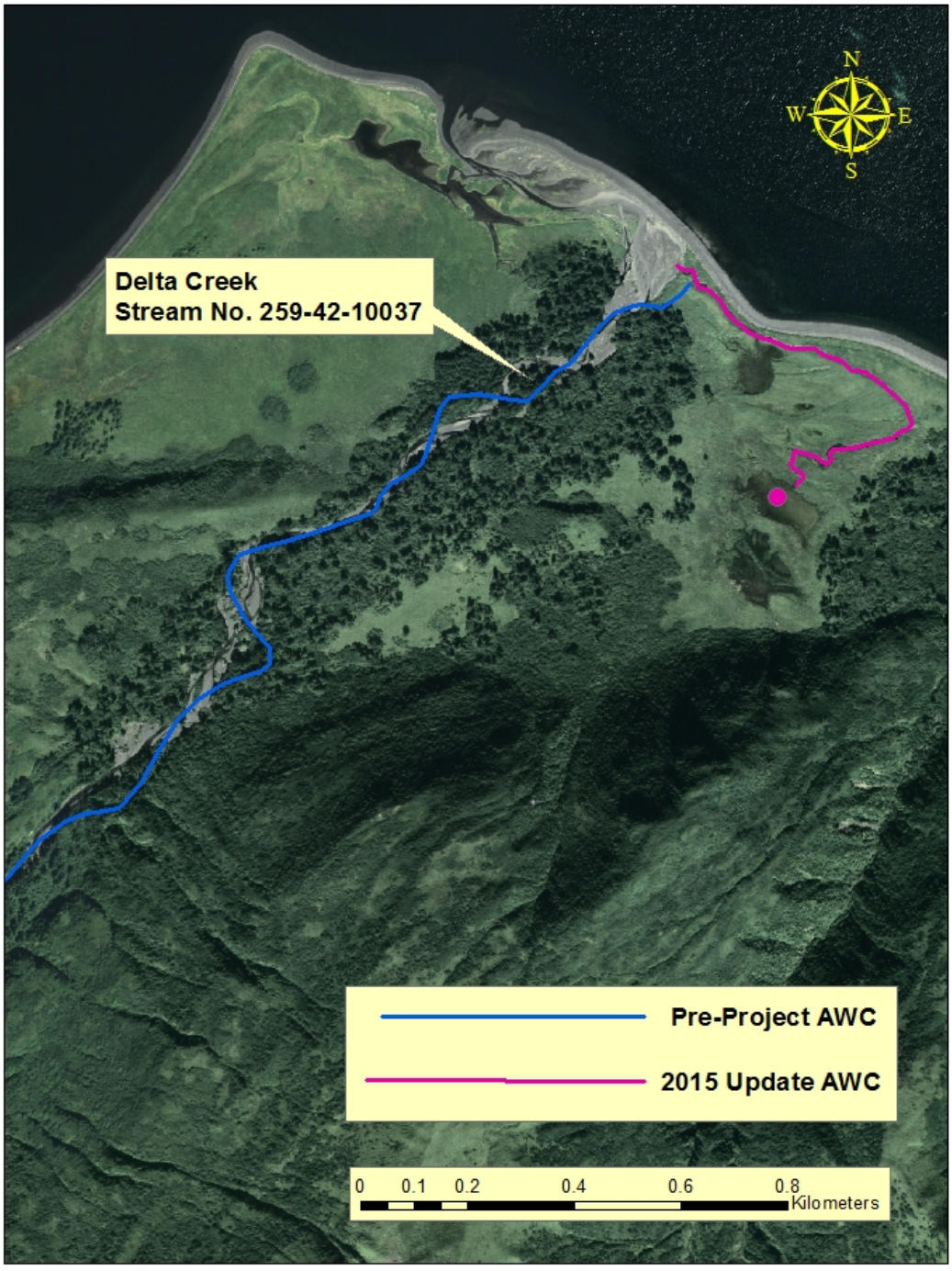
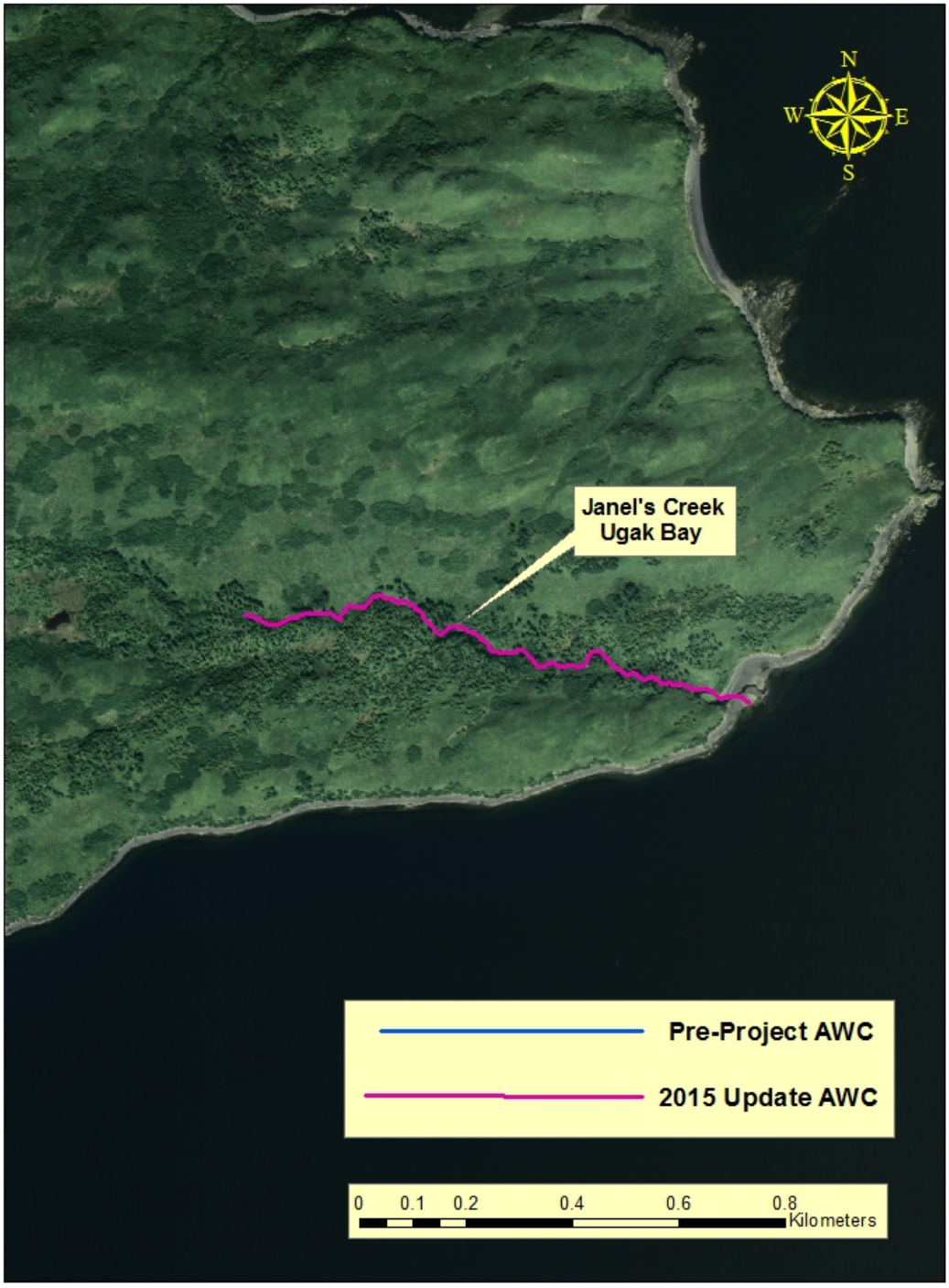
APPENDIX A:
STATUS OF SURVEYED REACHES



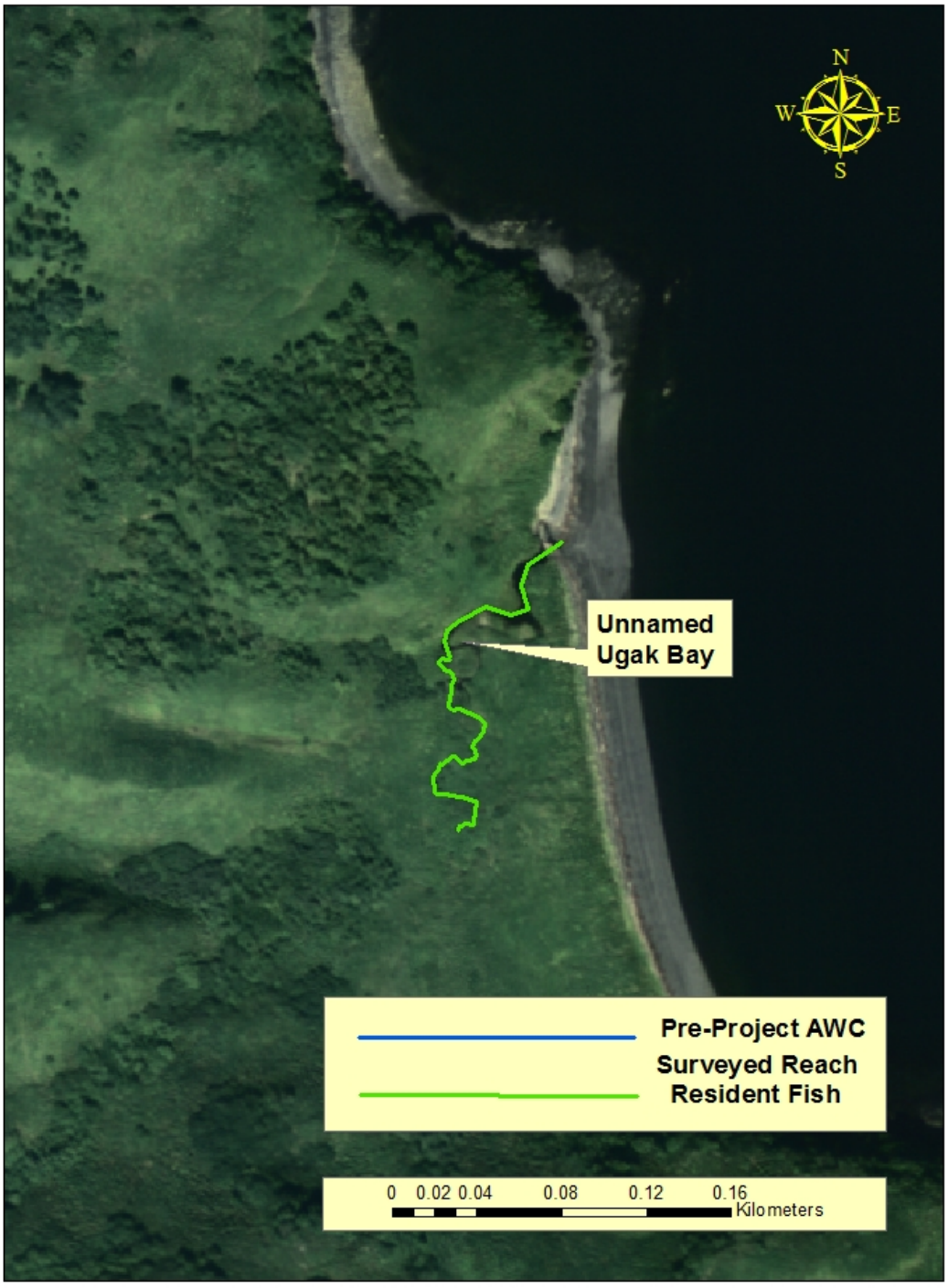
Appendix A1.–Status of surveyed reaches within Stream No. 259-42-10039, Kodiak Island.



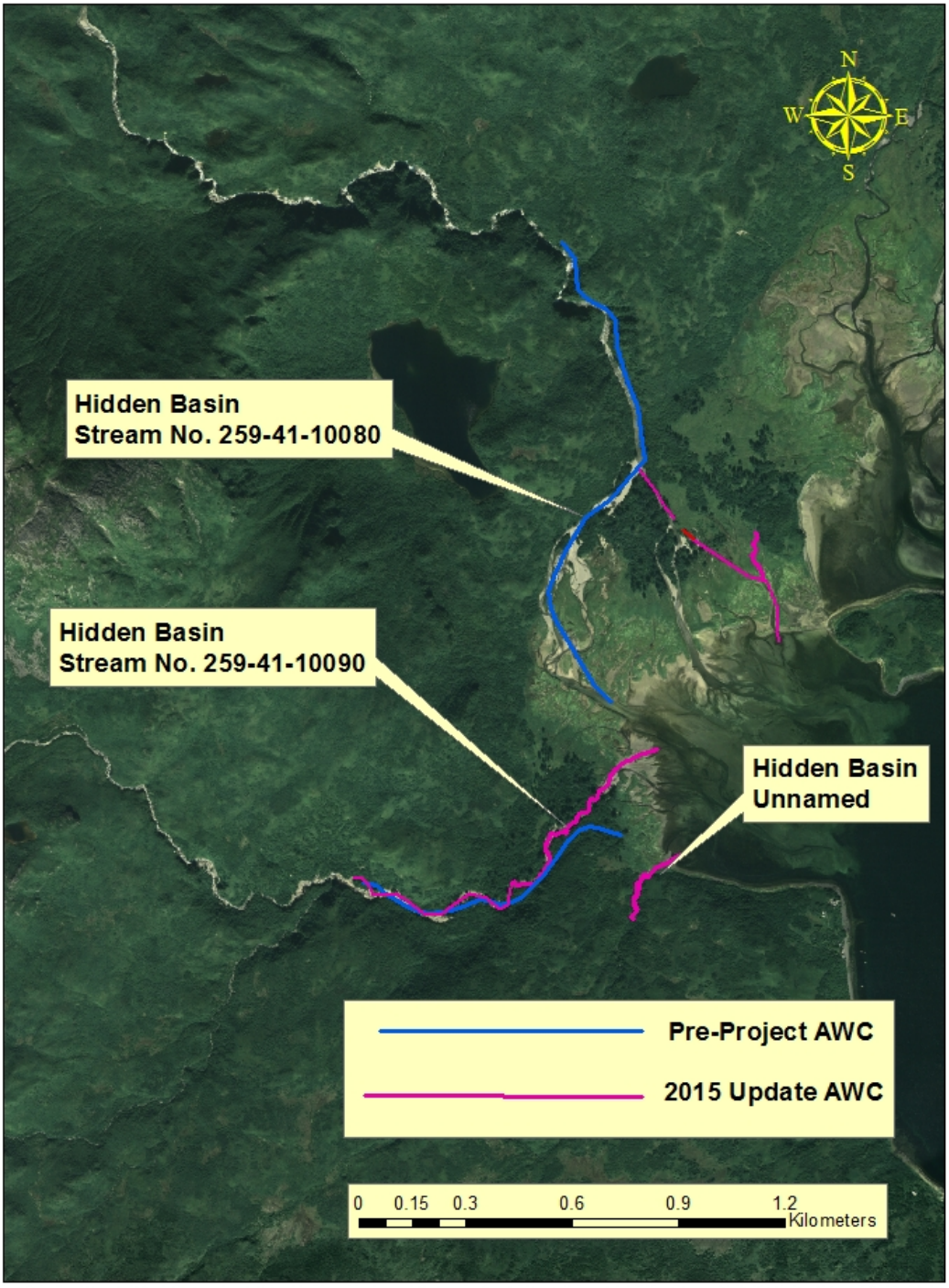
Appendix A2.–Status of surveyed reach within Stream No. 259-42-10037, Kodiak Island.



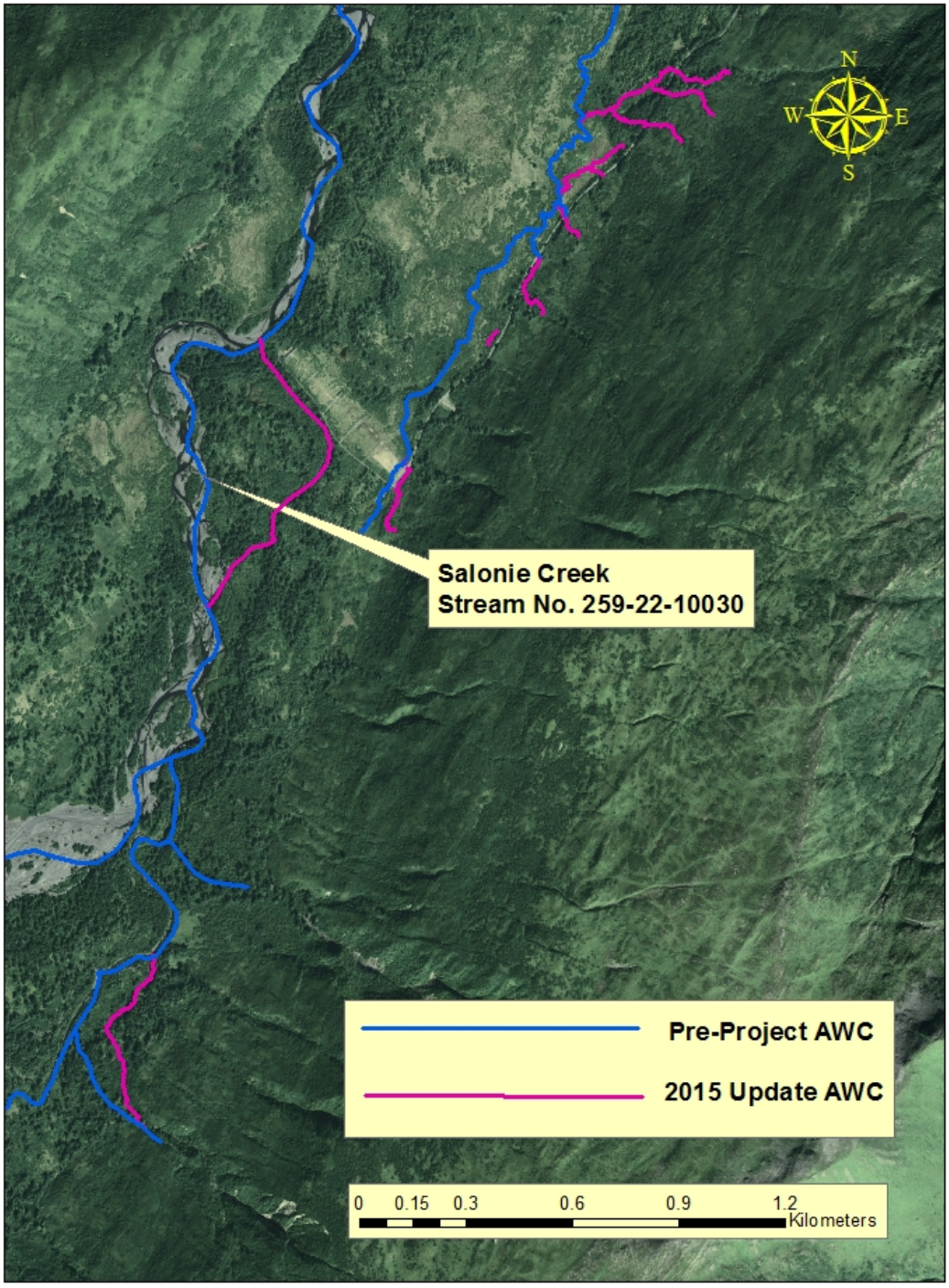
Appendix A3.–Status of surveyed reach within Janel's Creek, Kodiak Island.



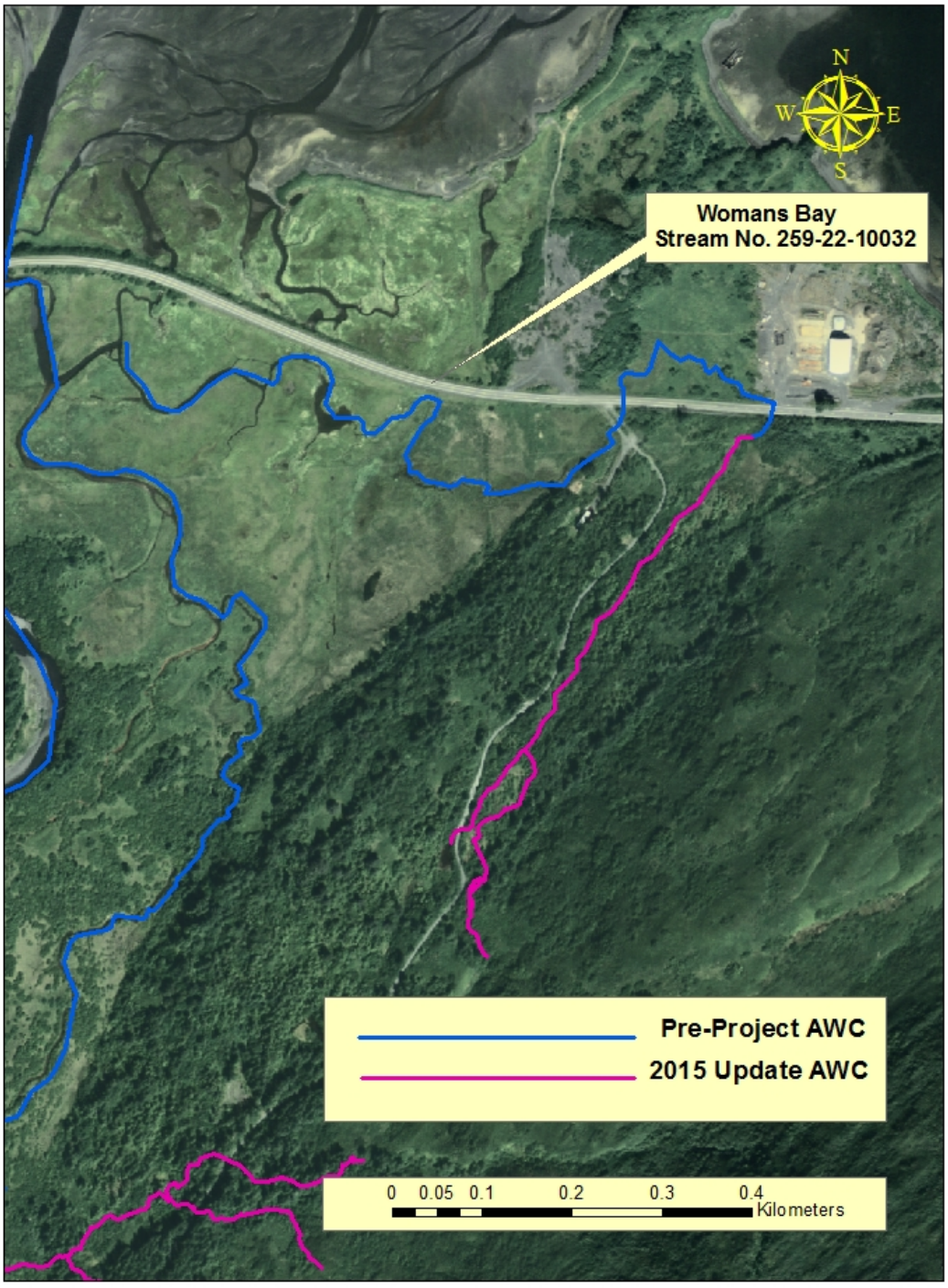
Appendix A4.– Status of surveyed reach within an unnamed stream, Ugak Bay.



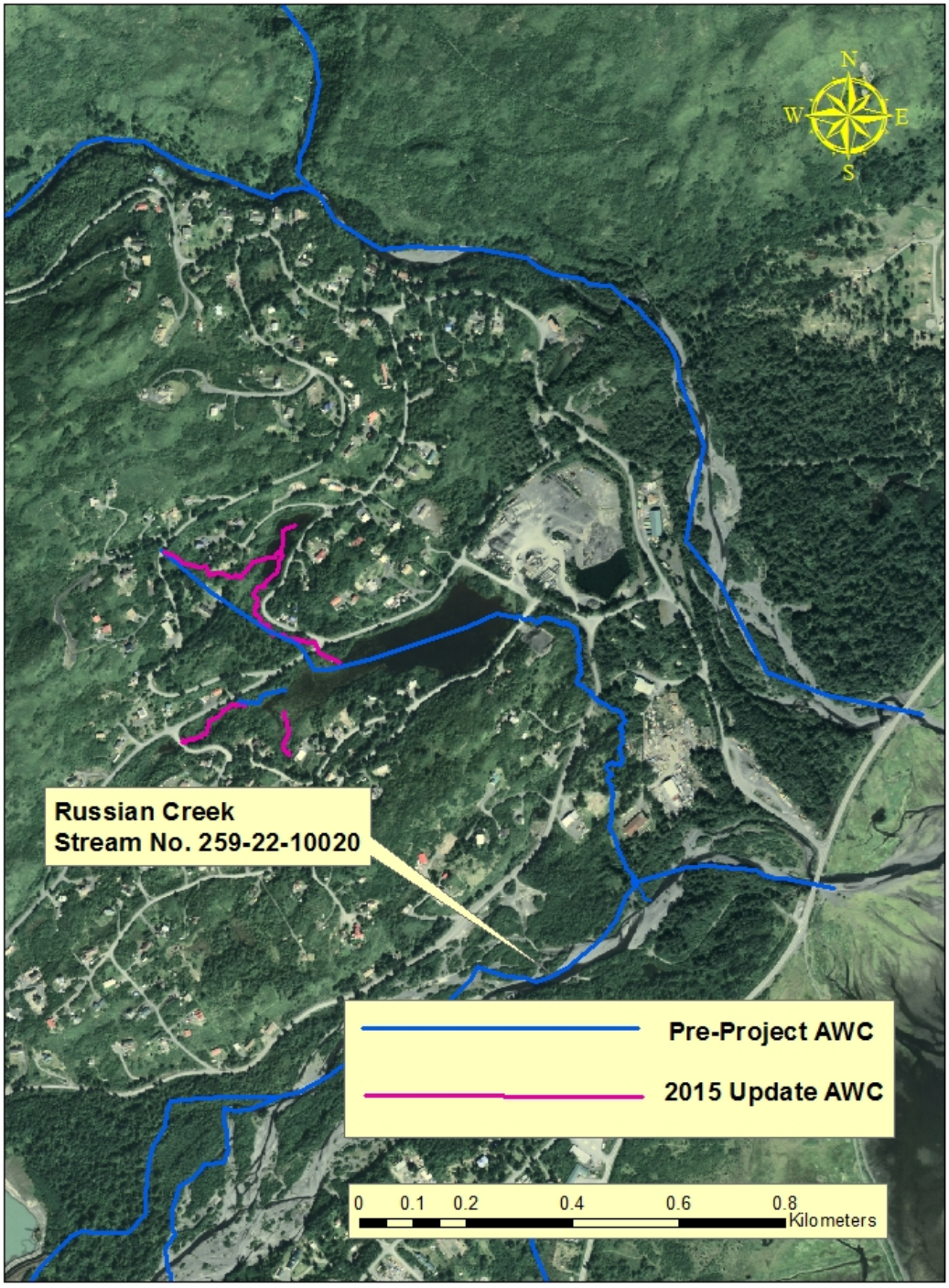
Appendix A5.–Status of surveyed reaches within Stream Nos. 259-41-10080, 259-41-10090, and an unnamed stream, Kodiak Island.



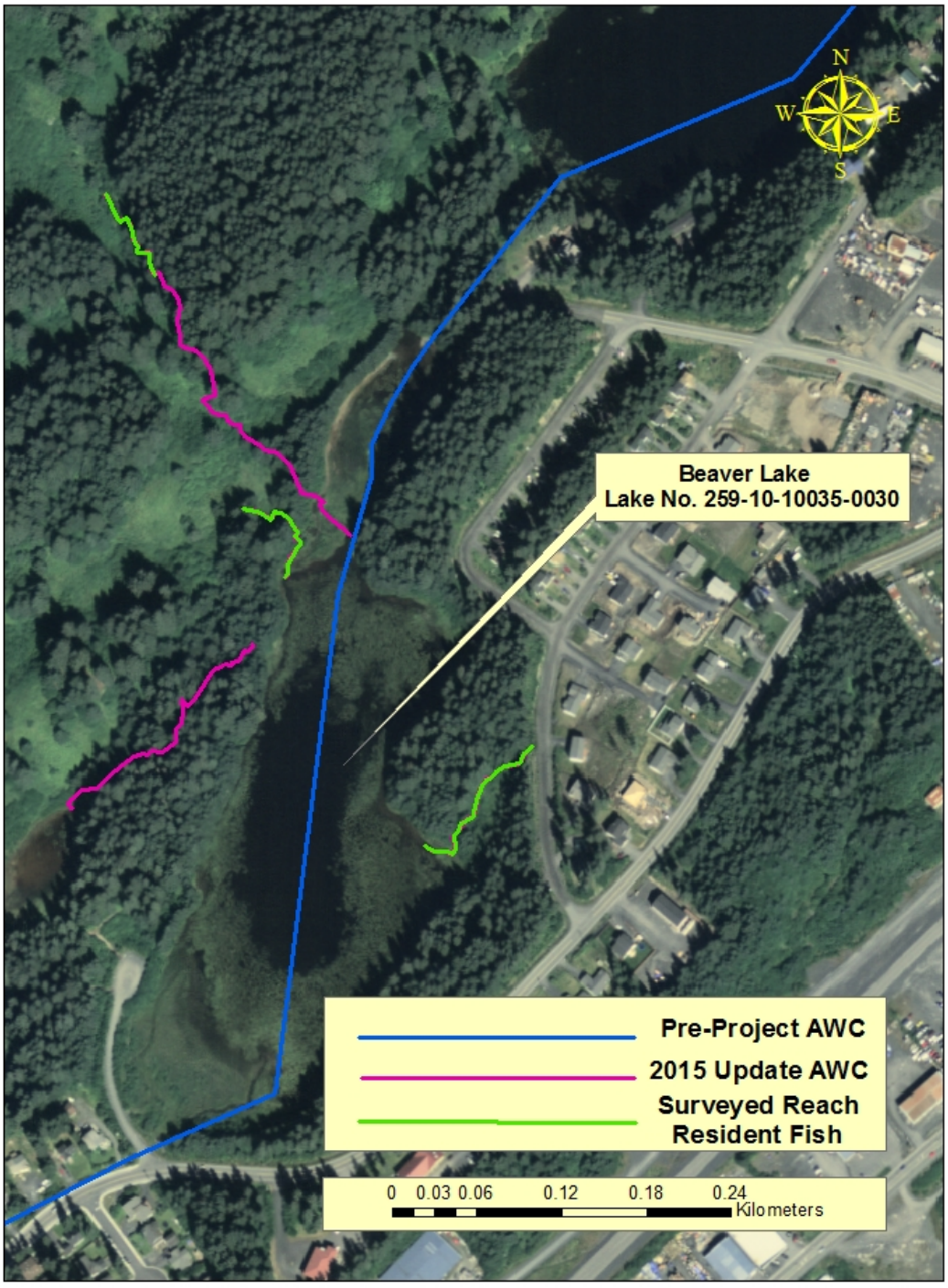
Appendix A6.–Status of surveyed reaches within Salonie Creek, Kodiak Island.



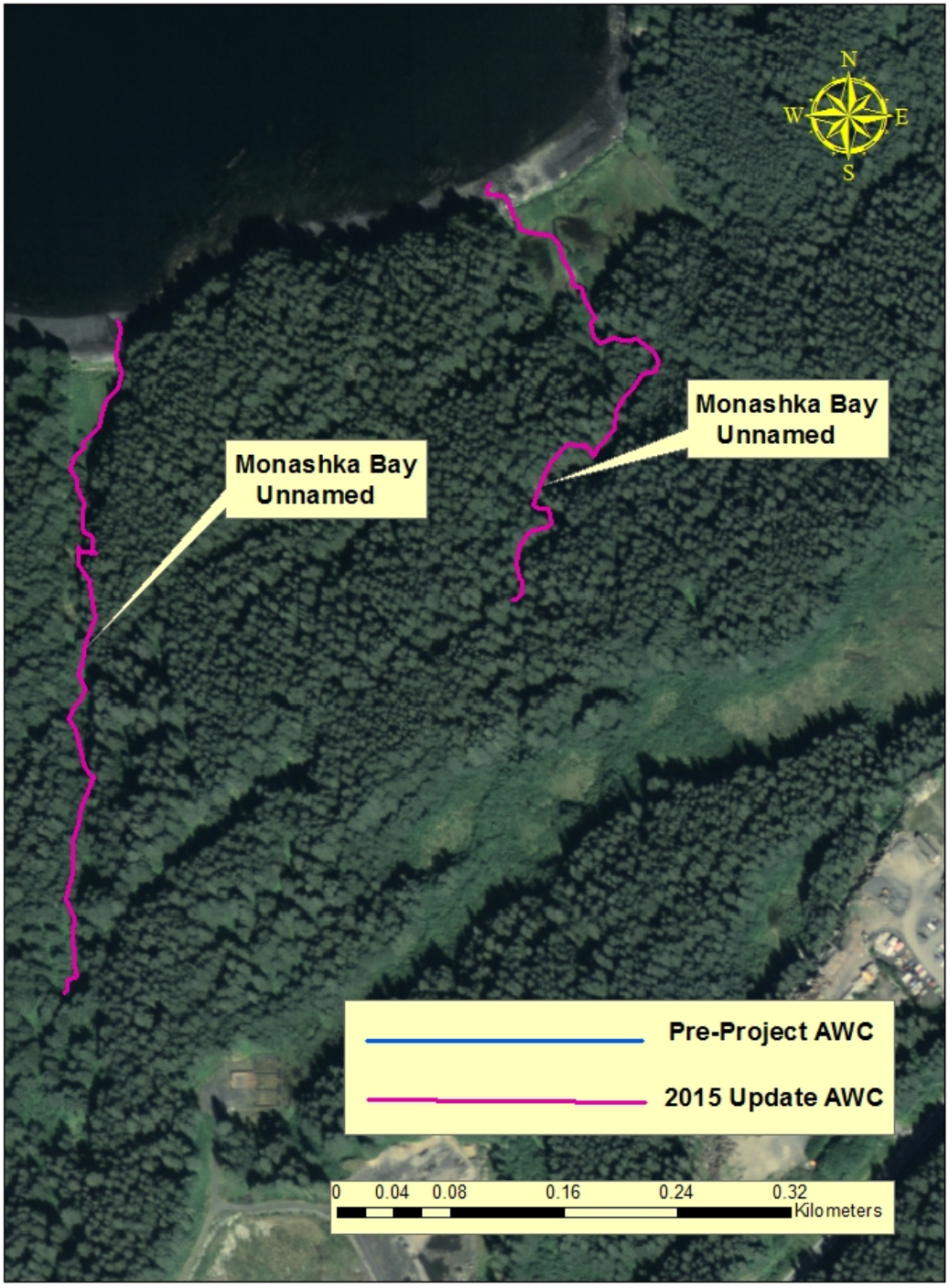
Appendix A7.–Status of surveyed reaches within Stream No. 259-22-10032, Kodiak Island.



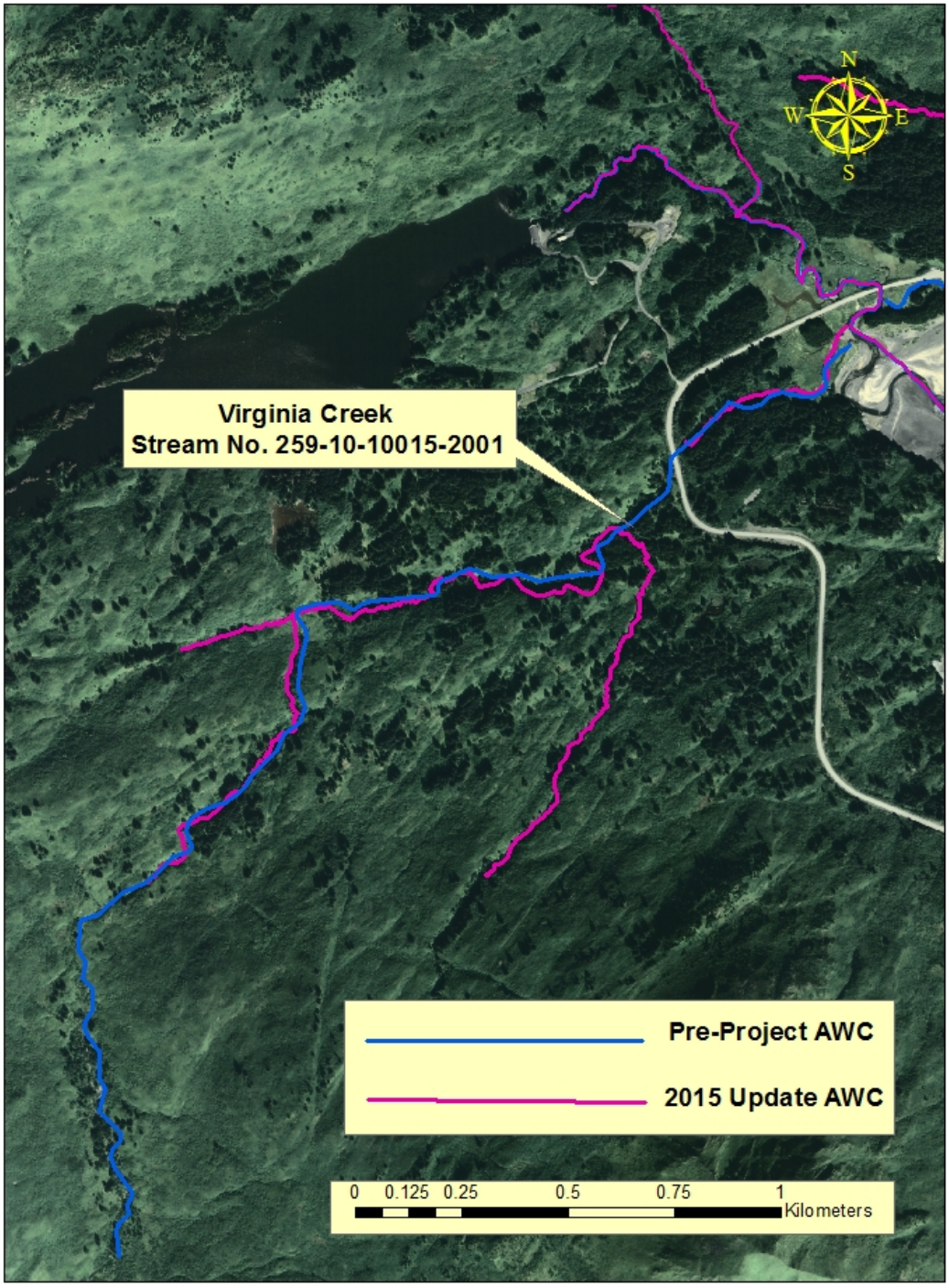
Appendix A8.–Status of surveyed reaches within Russian Creek, Kodiak Island.



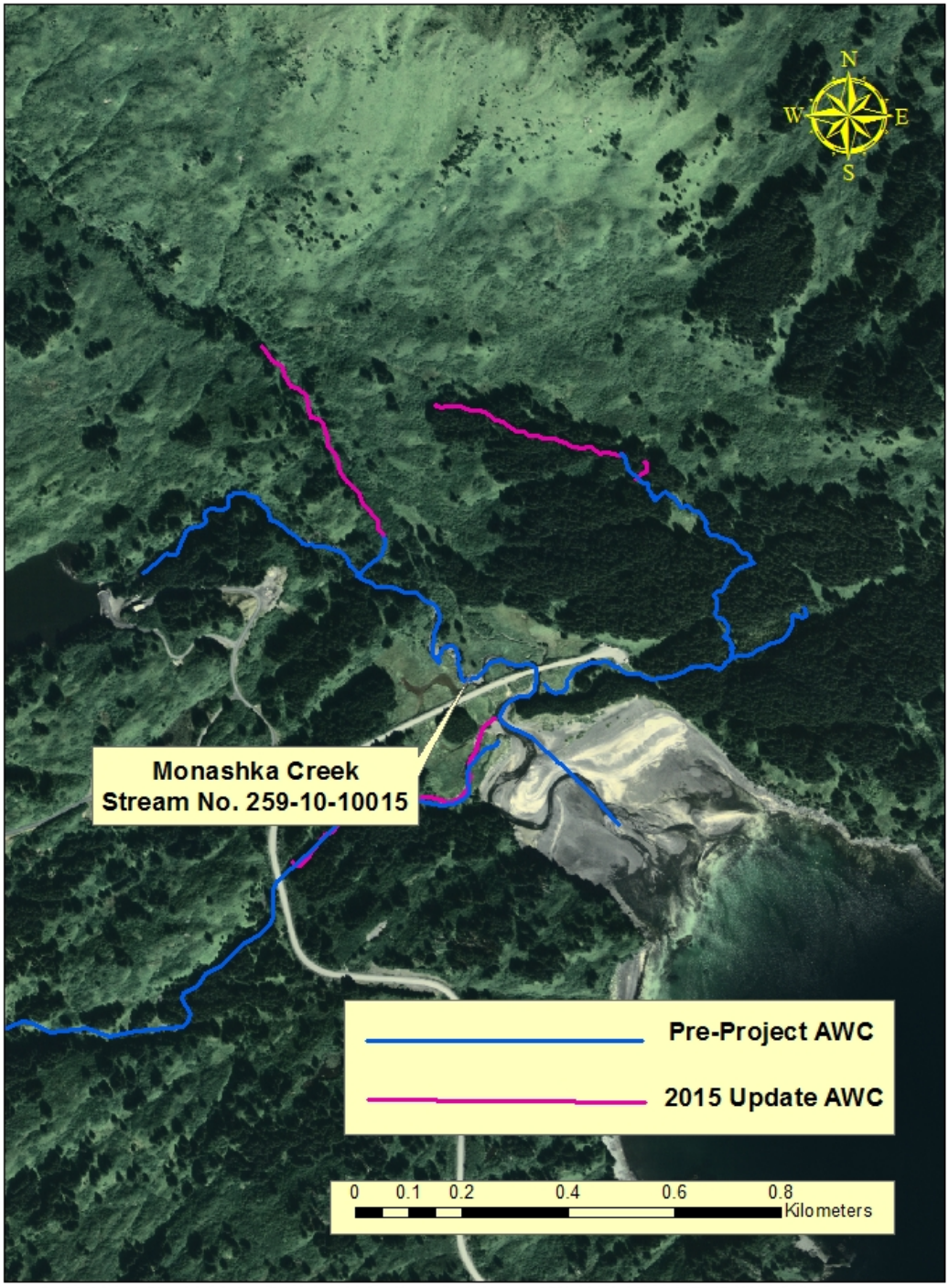
Appendix A9.–Status of surveyed reaches within Beaver Lake, Kodiak Island.



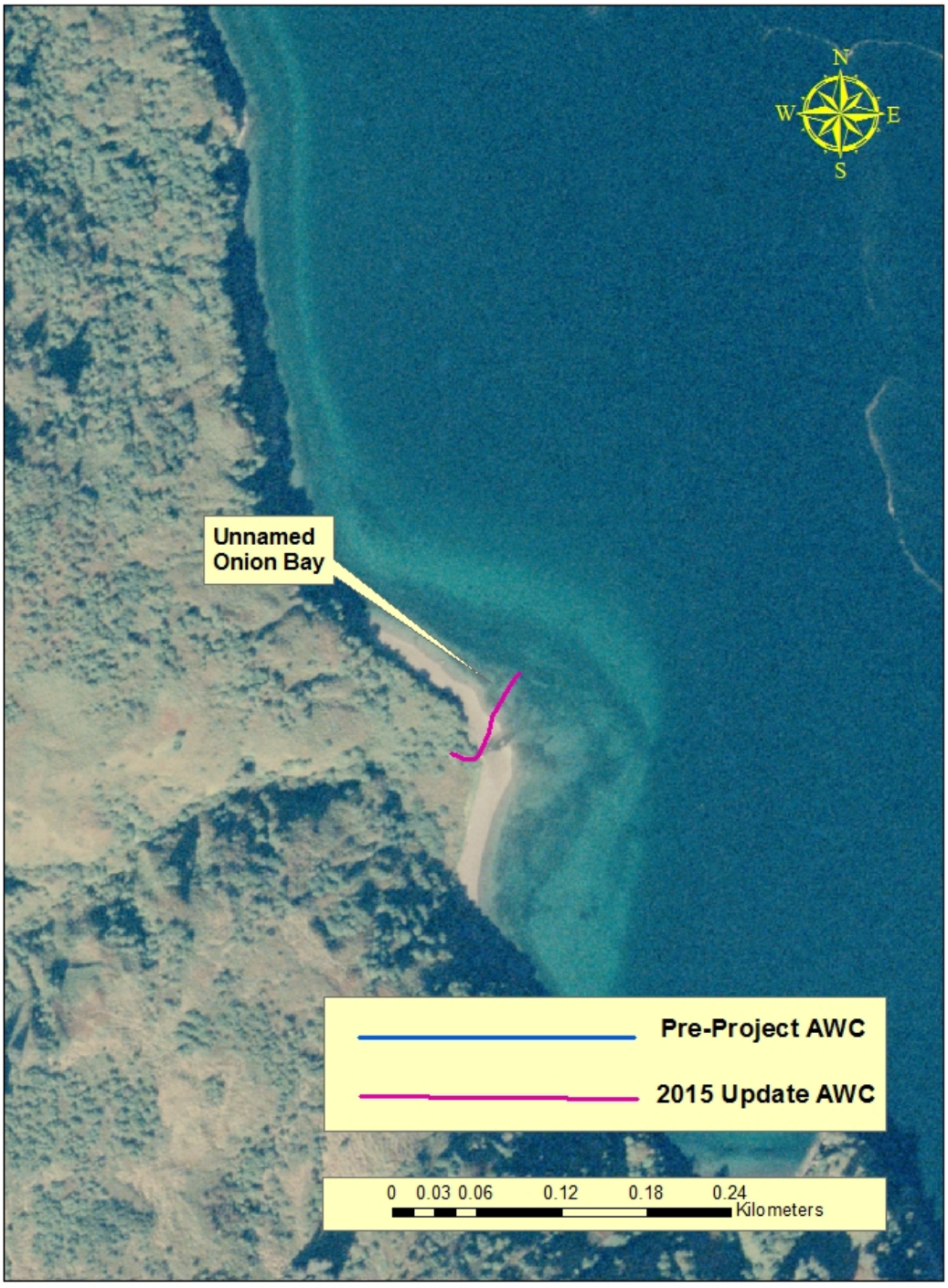
Appendix A10.–Status of surveyed reaches within unnamed streams Monaska Bay, Kodiak Island.



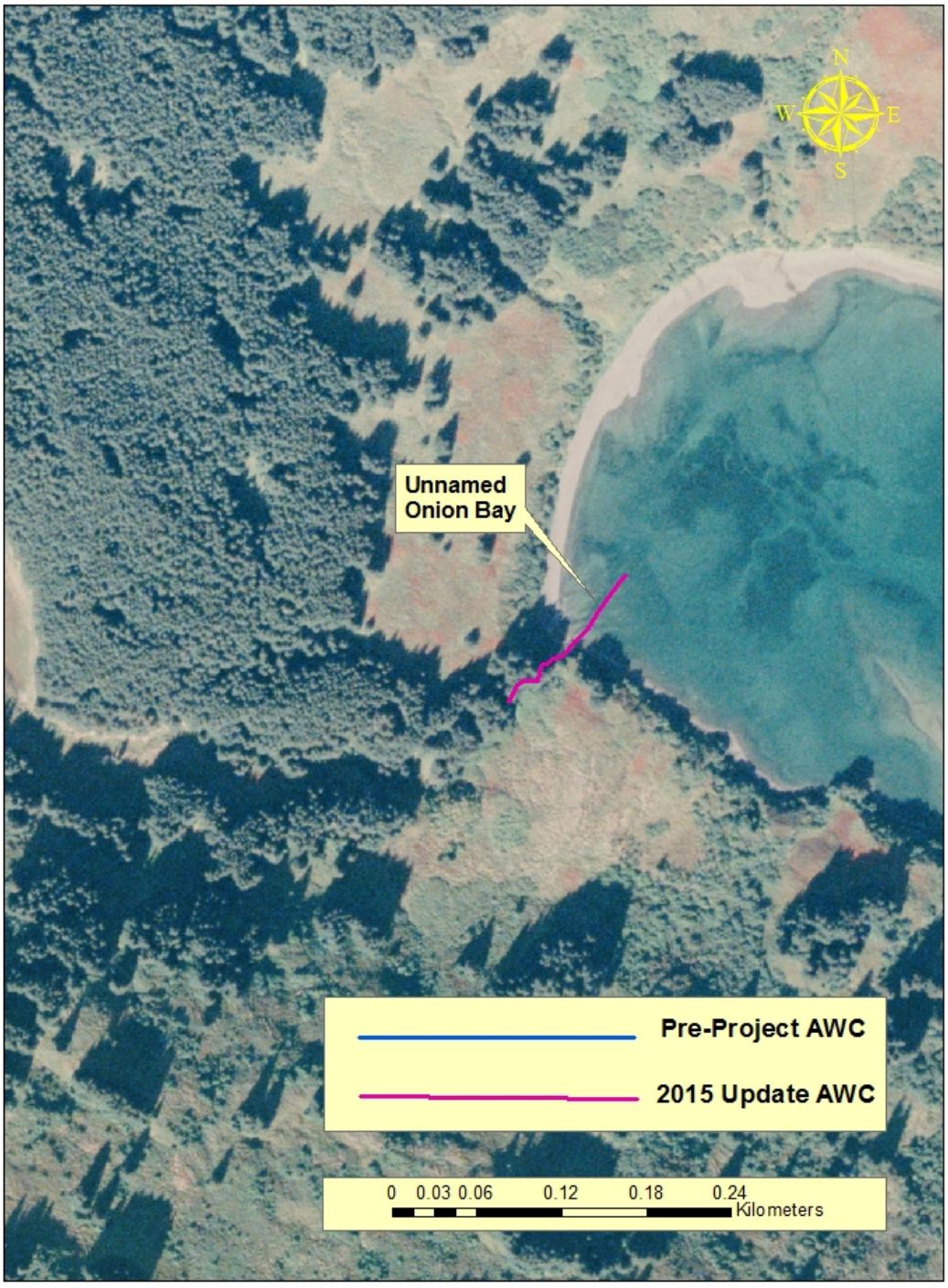
Appendix A11.–Status of surveyed reaches within Virginia Creek, Kodiak Island.



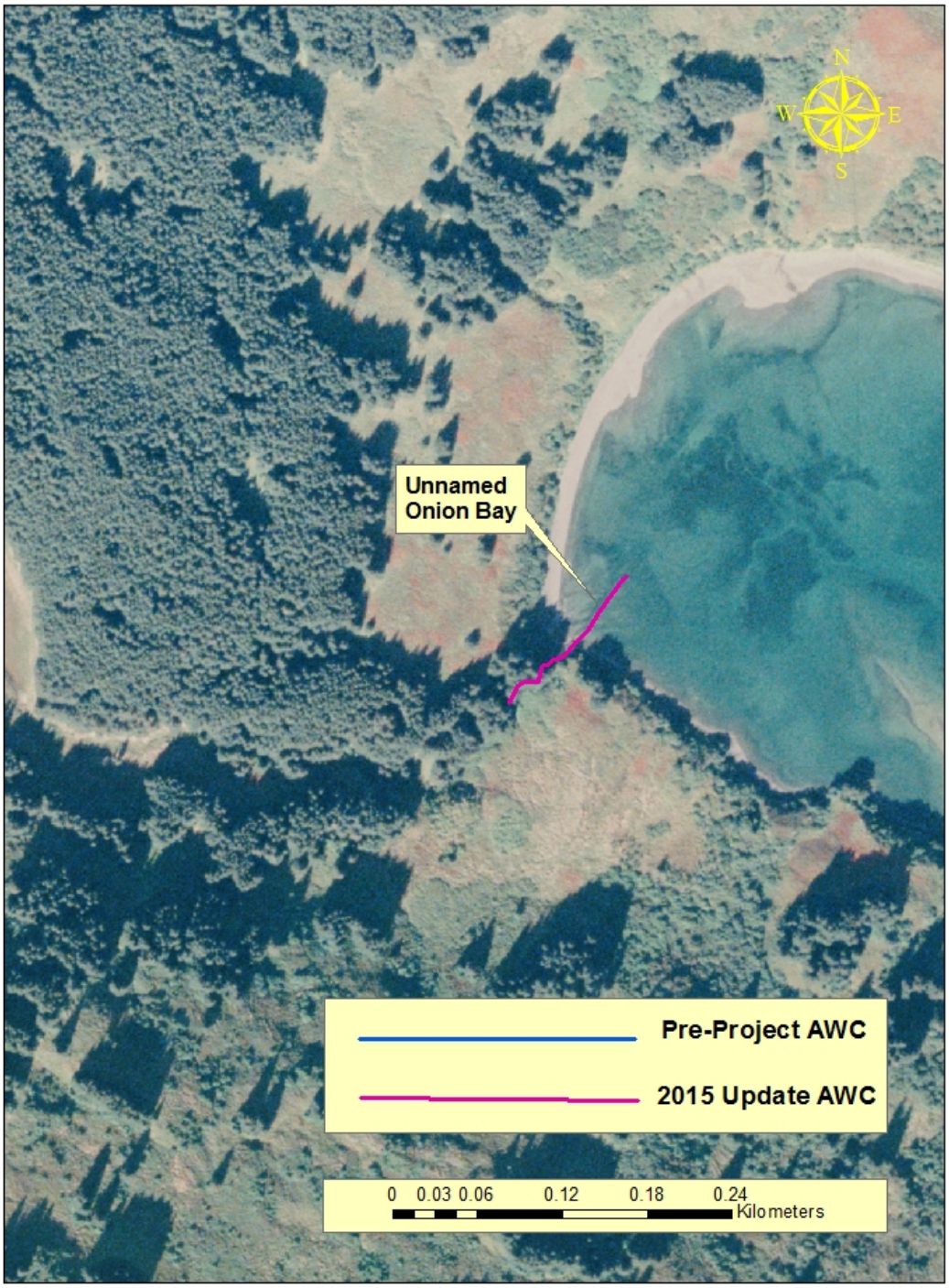
Appendix A12.–Status of surveyed reaches within Monashka Creek, Kodiak Island.



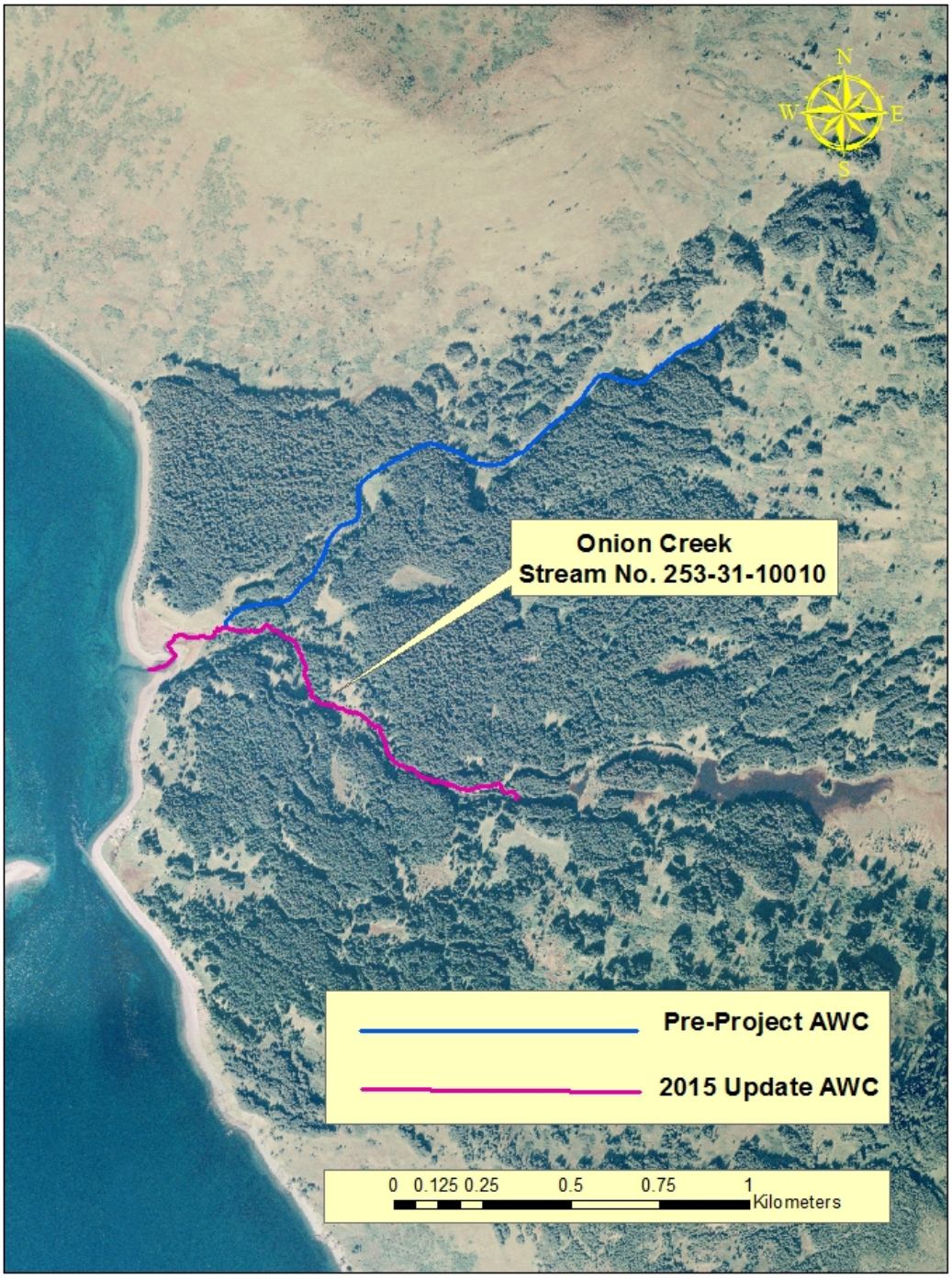
Appendix A13.–Status of surveyed reach within an unnamed stream, Onion Bay, Raspberry Island.



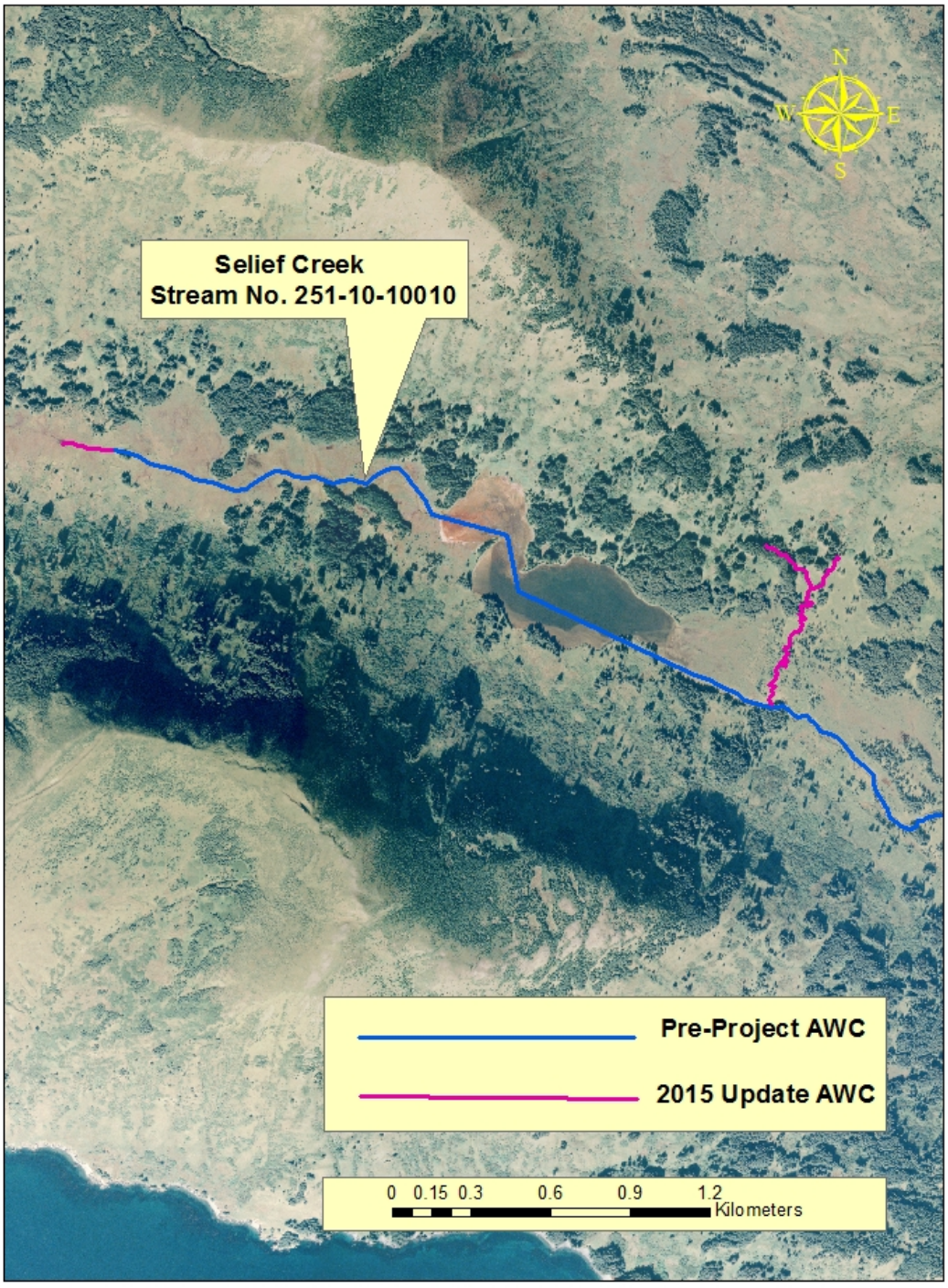
Appendix A14.–Status of surveyed reach within an unnamed stream, Onion Bay, Raspberry Island.



Appendix A15.–Status of surveyed reach within unnamed stream Onion Bay, Raspberry Island.



Appendix A16.–Status of surveyed reach within Onion Creek, Raspberry Island.



Appendix A17.–Status of surveyed reaches within Selief Creek, Raspberry Island.