ROAD CONDITION SURVEY FOR THE FOREST ROAD SYSTEM IN THE KENAI PENINSULA BOROUGH

PREPARED FOR: The Alaska Sustainable Salmon Fund (AKSSF)

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I. Introduction

This project was designed to assess the condition of the non-federal forest roads in the Kenai Peninsula Borough (KPB), with respect to water quality and fish habitat. The Alaska Department of Natural Resources, Division of Forestry (DOF) inventoried and evaluated the non-federal forest road system in the KPB. The forest roads were located on lands owned and managed by Cook Inlet Regional Corporation, Ninilchik Native Association, Tyonek Native Corporation, Seldovia Native Association, Port Graham Native Corporation, English Bay Corporation, KPB, University of Alaska, Alaska Mental Health Trust and the Alaska Department of Natural Resources. The roads were inventoried by using satellite or low altitude imagery and evaluated on the ground by field surveys. In total, 620 miles were inventoried and 432 miles were inspected on the ground. ATV's, passenger vehicles, well as fixed wing planes and rotor aircraft were used to access the roads. All field surveys were accomplished with the assistance and expertise of the Alaska Department of Fish & Game, Division of Habitat (ADFG).

While on-site, a determination was made as to whether a road system was compliant with the standards of the Alaska Forest Resources and Practices Act (FRPA) (AS 41.17) and whether crossing structures requiring fish passage (bridges, culverts and fords) were compliant with FRPA and Title 16 fishway

requirements (AS 16.05.841). With the collected field information, an ongoing effort is being made to prioritize restoration efforts needed to protect water quality and, salmon habitat, and ensure adequate fish passage.

DOF and ADFG surveyed all crossing structures over anadromous fish streams and crossing structures over most of the tributaries to anadromous streams, with detailed surveys being conducted on crossing structures requiring fish passage. ADFG expertise was utilized to determine the presence or absence of fish in the water bodies, which flowed through culverts. Those structures impeding fish passage were identified for further attention; the substandard culverts are listed in Table 3 and the substandard bridges in Tables 10 and 11. On selected substandard culverts, upstream habitat surveys were performed by DOF and ADFG, with due deference to ADFG for determining how much fish habitat could be opened by structure replacement or repair.

Additionally, this project monitored FRPA compliance related to road construction, maintenance and road closure best management practices (BMP's), with regard to the adjacent fish habitat and water quality.

A concluding goal of this project was to build a GIS dataset for the forest roads within the Kenai Peninsula Borough containing a comprehensive inventory of the forest road system and the associated crossing structures. This involved merging multiple data sources from the KPB and identifying roads, which hadn't been mapped or were depicted incorrectly. Eventually the public will have access to the GIS data through the ADFG Fish Monitor website. DOF will provide the data to all landowners and stakeholders.

II. Scope of Project

This project evaluated all the non-federal forest roads in the KPB, which fall under the applicability of the Forest Resources and Practices Act as well as some roads, which predate FRPA. The project was split into three geographic areas as seen in the figures below; Tyonek, Kenai Peninsula and Seldovia/Port Graham.

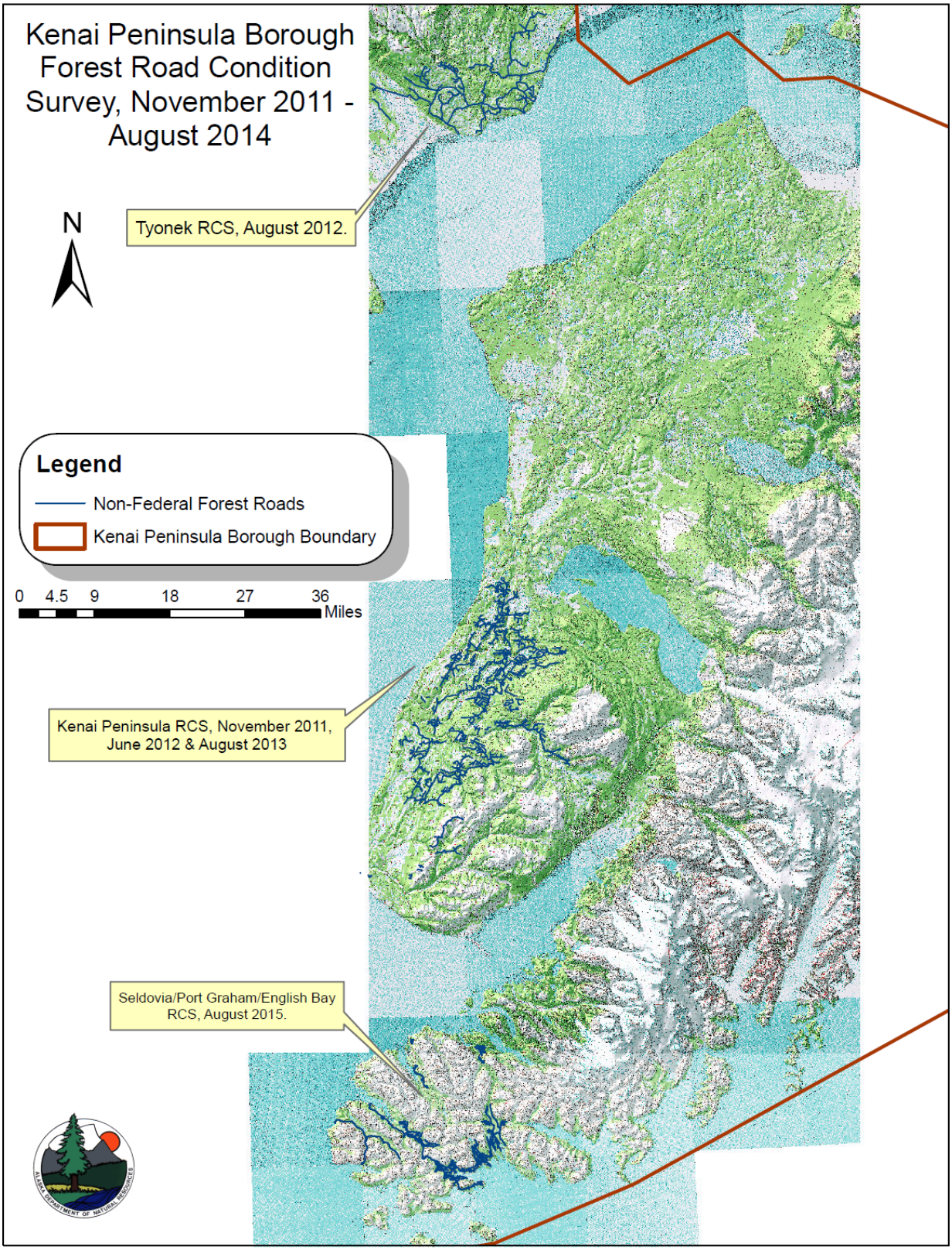

Figure 1. Kenai Peninsula Borough with RCS areas.

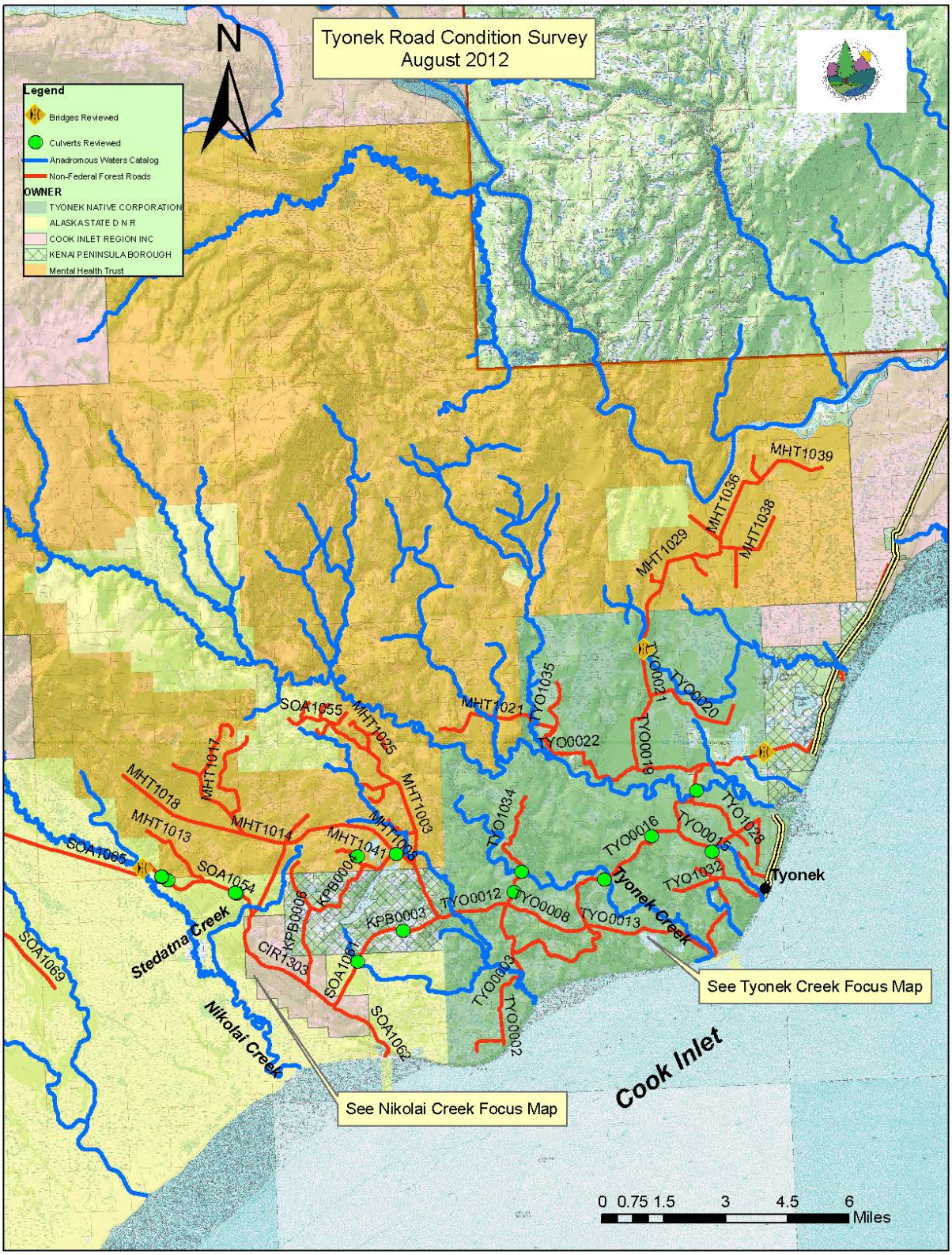

Figure 2. Map of the Tyonek portion of the KPB forest road conditions survey.

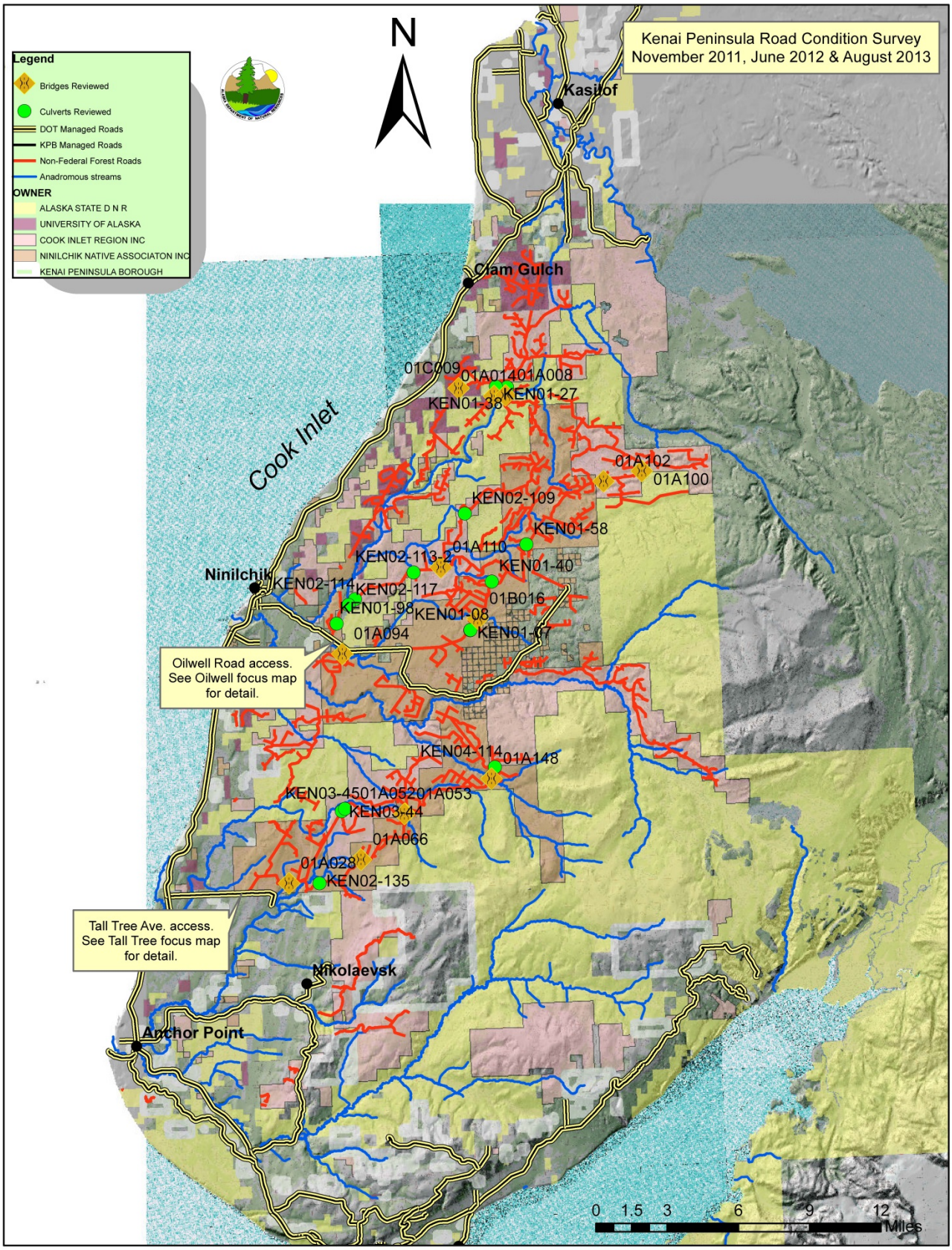

Figure 3. Map of the Central Kenai Peninsula portion of the KPB forest road condition survey.

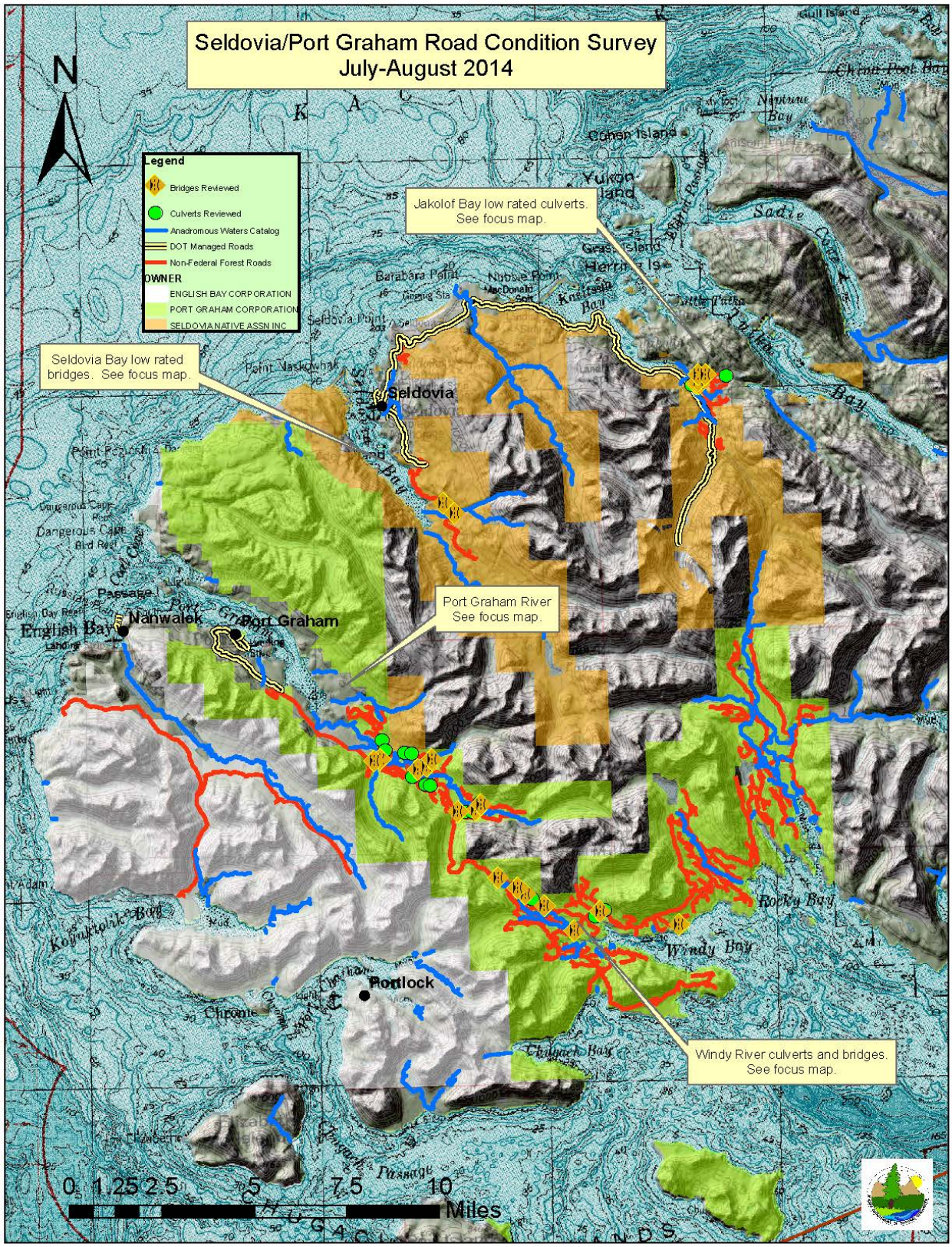

Figure 4. Map of the Seldovia and Port Graham portion of the KPB forest road condition survey.

Road Systems Evaluated and Surveyed

Table 1. Roads Evaluated and Surveyed.

Landowner	RCS Mileage	Unsurveyed mileage	Total mileage including winter trails	Total FRPA road miles (winter trail not included)	Comments
State of Alaska (Peninsula)	9.19	20.38	29.57	9.19	
Univerisity of Alaska (Peninsula)	14.27	0.00	14.27	14.27	
Mental Health Trust (Tyonek)	5.80	38.70	44.50	44.50	Unsurveyed due to inaccessibility
Kenai Peninsula Borough	7.33	13.16	20.49	7.33	
Cook Inlet Region (Peninsula)	75.20	84.20	159.40	75.20	
English Bay Corp	30.57	0.28	30.85	30.85	
Ninilchik Native Association	80.99	6.30	87.29	80.99	
Port Graham Corp.	121.17	119.93	241.10	241.10	Unsurveyed due to inaccessibility
Seldovia Native Assoc.	28.91	0.00	28.91	28.91	
Tyonek Native Corp.	48.10	14.23	62.33	62.33	
Cook Inlet Region (Tyonek)	0.00	5.20	5.20	5.20	Formerly SOA roads.
State of Alaska (Tyonek)	10.71	9.39	20.10	20.10	Unsurveyed due to inaccessibility
Bureau of Indian Affairs (Port Graham)	0.00	12.12	12.12	0.00	FRPA is not applicable to BIA.
Unknown or private individuals	0.00	9.29	9.29	0.00	Unsure of FRPA applicability.
	432.24	**333.18**	**765.42**	**619.97**	

FRPA Regions

The Tyonek and Kenai Peninsula forest road systems fall under the FRPA Region II statutes and regulations. Seldovia/Port Graham area forest road systems are encompassed by FRPA Region I statutes and regulations. Figure 5 identifies the statewide delineation of the three FRPA regions.

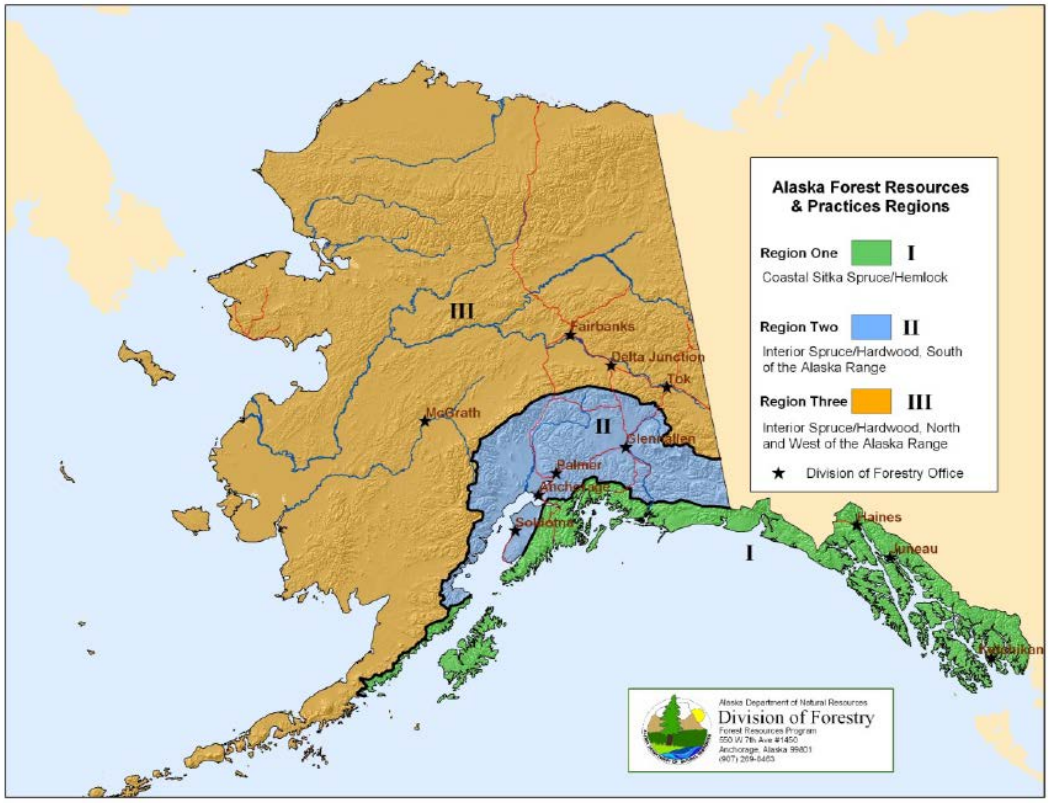

Figure 5. Alaska's Forest Resources & Practices Regions.

III. Field Survey Methodology

Using "Mapping Grade" (see XIV Appendix for Mapping Grade, AKA Resource Grade, Global Positioning Systems descriptions) Garmin GPS units, we took waypoints at all crossing structures, absent structures, removed structures and features affecting the road surface or water quality. If a culvert was used to cross a defined stream channel, then the culvert was scored on each of the FRPA culvert BMP's using a rating system of 1 to 4, where 4 is fully implemented and 1 is not implemented. Similarly, bridges were measured and evaluated for the BMP's related to bridges on the 1-4 scale. Road segments were evaluated on the road construction and road maintenance FRPA BMP's, also on the 1-4 scale.

The field surveys consisted of driving or walking the surveyed road systems and collecting the following data:

1. GPS Tracks of all roads surveyed, to later be added to the GIS database for forest roads.

2. GPS Waypoints identifying crossing structures (bridges, culverts and fords) and non-crossing feature types such as missing structures, road washouts, surface erosion and any feature impacting the condition of the road surface related to fish habitat and water quality.

3. If a culvert crossed a water body that exhibited the characteristics to support fish and was not identified in the Anadromous Waters Catalog (AWC), the biologist would set fish traps or use an electrofisher to determine the presence or absence of fish. Sampling was taken at upstream and downstream locations.

4. If it was determined that a culvert must support the passage of anadromous or resident fish, then more detailed culvert measurements were taken. Using a hand level and stadia rod, crew members recorded the length, diameter, gradient, perch height, blockage, pool depth, tailcrest and average bed width of the stream. Following the measurements, a rating was determined by DOF and ADFG on the condition of the culvert and its ability to pass fish. The measurements and condition ratings were concluded with the evaluation of each culvert related FRPA BMP (see Tables 5, 6 and 7).

5. If a culvert crossed a defined channel but was not required to pass fish, only the FRPA BMP ratings for culverts were recorded.

6. For water bodies crossed by bridges we measured the length of the bridge, type of bridge and structure material. That was followed by rating the bridge on each bridge related FRPA BMP (Tables 8, 9, 10 and 11). Fish trapping or use of the electrofisher was not done at the bridge sites, as the stream classification was already known in most cases. Over 90% of the forest road bridges surveyed crossed anadromous or resident fish streams.

7. Photos were taken at the entrance point and exit point of each culvert requiring fish passage. Multiple photos were taken at each bridge site.

8. Following the review of a road segment's crossing structures, we then rated the road in its entirety on the FRPA BMP's related to road construction and maintenance.

9. DOF evaluated each road segment on the one BMP related to reforestation (11 AAC 95.375). An ocular estimate was made as to whether harvested area met the Region I or Region 2 requirements. The results of the ratings won't be included in this report, since the focus is fish passage and water quality. The results should be available in mid-summer 2015 from DOF.

Upon returning to the office, the following tasks were completed:

1. GIS refinement of the road feature class based on GPS locations and development of RCS Geodatabase and associated attribute tables for the crossing structure feature points and their associated BMP ratings.

2. All field data was transferred from field cards to the Alaska Department of Fish and Game's Fish Resource Monitor website, where it can be analyzed and managed by DNR and Habitat staff and eventually viewed online by stakeholders. Some of the project area and structures are currently visible, but by September 2015, all roads and crossings will be viewable here: http://extra.sf.adfg.state.ak.us/FishResourceMonitor/?mode=culv

3. Update of the Anadromous Waters Catalog (AWC) by the habitat biologist for new nominations of stream reaches identified in the surveys.

IV. Culverts Requiring Fish Passage

Over the entirety of the forest road system the survey determined that 48 culverts were required to pass fish. Each culvert was evaluated on the following:

1. **Fish Passage Rating**. This is a 1-4 (4 as High) rating to determine the effectiveness, functionality and the ability of the culvert to pass fish. This is a subjective rating determined

by DOF and ADFG and based on how well the structure complies with the BMP's and the overall condition of the culvert.

   a. **Rating of 1.** Non-functioning culvert with multiple issues affecting fish passage. This rating does not meet FRPA standards for adequate protection of fish habitat or passage of fish.
   b. **Rating of 2.** Multiple issues affecting fish passage such as gradient, plugging, perch height, sizing (length or diameter) or culvert condition. This rating does not meet FRPA standards for adequate protection of fish habitat or passage of fish.
   c. **Rating of 3.** A single issue affecting fish passage such as gradient, plugging, perch height, sizing (length or diameter) or condition.
   d. **Rating of 4.** A fully functional culvert.

2. **Culvert Category.** The 48 fish culverts fall into one of three categories; A, B or C:
   a. **Category A.** Culverts with acceptable ratings. No remediation required.
   b. **Category B.** Low-rated culverts installed prior to FRPA adoption February 18, 1981.
   c. **Category C.** Low-rated culverts installed in or after the current FRPA regulations, adopted June 10, 1993.
3. **Culvert BMP rating**. All culverts on defined channels regardless of the need to pass fish were rated on seven BMP's, each of which utilize the 1 -4 rating system. The rated culverts of this survey are discussed in section VII. The DOF publication titled ***Implementing Best Management Practices for Timber Harvest Operations*** was used as the field guideline to derive the rating. The following rating list is a generalization of the guidelines:
   a. **Rating of 1**. No attempt to implement or maintain effectiveness.
   b. **Rating of 2**. BMP was somewhat implemented and/or maintained.
   c. **Rating of 3**. A single issue may reduce full effectiveness.
   d. **Rating of 4**. BMP was fully implemented.

There is some correlation with the ADFG culvert rating system, although both systems were designed independent of each other. A Red culvert, in many cases, would equate to a DOF rating of 1. A Grey culvert will usually be equivalent to a rating of 2 or 3. A Green culvert would in most cases equate to a rating of 4. On these surveys, DOF and ADFG had mutual consensus on each culvert rating.

The 48 culverts fall into three categories, depending on their rating and the date of road construction. All of the low-rated culverts were installed either prior to the 1981 FRPA regulations or after the 1993 regulations; there were none in the interim period.

Table 4 references every culvert surveyed which fish passage is required. The comment section describes either the current condition and/or action needed. Those structures highlighted in yellow are undergoing current activities to enhance their ability to meet FRPA BMP's and Title 16 standards for fish passage.

Table 2. Acronyms used in Table 3.

Field crew (First two letters are the intitials of the DOF observer and second two letters are the intitials of the ADFG observer).	Land Owners/Conservation Districts	Fish related (from ADFG)
JN = Joel Nudelman	SOA = State of Alaska	A = Anadromous fish found
RJ = Roy Josephson	CIRI = Cook Inlet Regional Corporation	R = Resident fish found
HR = Hans Rinke	NIN = Ninilchik Native Association	AWC = Anadromous Waters Catalog
PB = Patricia Berkahn	PGC = Port Graham Corporation	DV = Dolly varden
VL = Virginia Litchfield	SNA = Seldovia Native Association	CT = Cut throat trout
WF = Will Frost	TYO = Tyonek Native Association	SC = Sculpin
JW = John Winters	BIA = Bureau of Indian Affairs	SH = Steelhead
	ENG = English Bay Corporation	CH = Chum salmon
	MHT = Mental Health Trust	CO = Coho salmon
	TTCD = Tyonek Tribal Conservation District	S = Sockeye salmon
		K = King salmon
		P = Pink salmon

Culverts highlighted in yellow: efforts are underway to enhance their ability to meet the BMPs.
Culverts highlighted in green: remediation has already been completed.

Table 3. Fish culvert inventory.

KENAI PENINSULA BOROUGH FOREST ROAD CONDITION SURVEYS 2011-2014									
Overall condition was rated on a 4-point scale. Culverts rated 1 or 2 do not meet FRPA standards for adequate protection of fish habitat or passage of fish.									
1 = Non-functioning culvert with multiple issues affecting fish passage 2 = Multiple issues affecting fish passage such as, gradient, plugging, perch height, sizing (length or diameter) or condition. 3 = A single issue affecting fish passage such as gradient, plugging, perch height, sizing (length or diameter) or condition. 4 = A fully functional crossing structure.									
Waypoint #	**ADNR/ADFG**	**Survey Date**	**Land Owner**	**Road Segment**	**Longitude**	**Latitude**	**Anadromous /Resident**	**Fish Passage rating**	**Comments**
Category C: Low-rated culverts installed in or after June 10, 1993. Current FRPA regulations and AS 16.05.841 fishway standards apply. The landowner is responsible for remediation to ensure fish passage and either closing the road or maintaining it as an active or inactive road to FRPA standards.									
KEN03-44	JN/PB	6/18/2013	CIRI	1163	-151.575048	59.914084	?	2	No fish found. Trib to AWC just below. Should be resampled.
KEN03-45	JN/PB	6/18/2013	CIRI	1163	-151.5713	59.915321	AWC	2	2" perch is barrier.
KEN01-98	JN/PB	10/16/2013	BIA	NIN 1304	-151.573227	60.027444	A	2	Native allotment inholding on NIN land. Good upstream habitat.
KEN01-07	RJ/VL	10/13/2011	NNA	1207	-151.4105044	60.02049185	A	2	Considerable upstream habitat.
KEN01-08	RJ/VL	10/13/2011	NNA	1207	-151.4103704	60.02057861	A	2	Considerable upstream habitat.
KAC01-155	JW/WF	7/22/2014	PGC	1	-151.556841	59.238529	R	2	Good upstream habitat. Repair will extend fish passage.
KAC01-228	JW/WF	7/23/2014	SNA	14	-151.448509	59.444341	A	2	This will be added to AWC. Pipe is barrier. Should be removed.
KAC01-222	JW/WF	7/23/2014	SNA	12	-151.465057	59.444688	A	1	AWC 50 m. below. Removal reguired.
KAC01-205	JW/WF	7/23/2014	SNA	12	-151.475193	59.441419	AWC	1	Removal or replacement required.
KAC01-249	HR/PB	8/5/2014	PGC (formerly ENG)	1	-151.564124	59.236128	AWC	1	AWC to pipe. Very little upstream habitat.
KAC01-255	HR/PB	8/5/2014	PGC (formerly ENG)	53	-151.611755	59.243944	R	2	1.6' perch may be barrier.
KAC01-282	HR/PB	8/5/2014	PGC	112	-151.66082	59.278536	R	2	1' perch may be barrier.
KAC01-315	HR/PB	8/5/2014	PGC	1	-151.690562	59.28988	A	2	AWC just below, with no barrier to perched culvert.
KAC01-318	HR/PB	8/6/2014	PGC	1	-151.700428	59.292924	R	2	Stream gradient goes to 11% just above pipe. Not a priority.
KAC01-330	HR/PB	8/7/2014	PGC	134	-151.705897	59.302479	AWC	2	AWC to pipe. Poor upstream habitat.
KAC01-341	HR/PB	8/7/2014	PGC	132	-151.72243	59.307672	AWC	2	Twist in pipe. Good upstream habitat. Replacement necessary.
Category B: Low-rated culverts installed prior to adoption February 18, 1981. AS 16.05.841 fishway standards apply. The landowner is responsible for remediation to ensure fish passage. Note: Some of the roads in the Tyonek area may have changed ownership since the culverts were installed.									
TYO01-17	JN/WF	8/20/2012	SOA	1061	-151.4375277	61.04769777	AWC	1	Perched and constricted. Part of SSF grant proposal for replacement.
TYO01-51	JN/WF	8/22/2012	SOA	1063	-151.5728953	61.07861107	A	1	Addition to AWC. Needs upstream habitat survey. Possible removal?
TYO01-52	JN/WF	8/22/2012	SOA	1063	-151.5772223	61.07981513	AWC	1	Future proposal for removal, pending upstream habitat survey.
TYO01-46	JN/WF	8/21/2012	SOA	1054	-151.5232013	61.07317046	AWC	2	Future proposal for removal, pending upstream habitat survey.
TYO01-49	JN/WF	8/22/2012	SOA	1054	-151.5244003	61.07355217	A	2	Addition to AWC. Needs upstream habitat survey. Possible removal?
TYO01-13	JN/WF	8/20/2012	TYO	16	-151.2203289	61.08735088	A	1	Addition to AWC. To be replaced with a bridge in 2014 (C.Doig)
TYO01-33	JN/WF	8/21/2012	TYO	9	-151.3221695	61.06990923	R	2	Working on funding source (C. Doig)
TYO01-19	JN/WF	8/20/2012	KPB	3	-151.4036008	61.05787835	R	2	Constricted. Large amount of debris pulled from inlet.
TYO01-27	JN/WF	8/20/2012	MHT	3	-151.4065535	61.08488006	R	2	Constricted. High value resident fish.
TYO01-30	JN/WF	8/20/2012	MHT	1041	-151.4344656	61.08451839	A	2	Constricted. Addition to AWC.
Category A: Culverts with acceptable ratings. No remediation required.									
KEN02-109	JN/VL	7/17/2012	CIRI	1094	-151.411875	60.091091	AWC	3	
KEN01-38	JN/PB	10/12/2011	CIRI	1043	-151.3538286	60.16664827	AWC	4	
KEN02-114	JN/GL	7/18/2012	CIRI	1090	-151.54946	60.041788	AWC	4	
KEN01-40	RJ/VL	10/14/2011	NNA	1245	-151.3818779	60.04940808	AWC	3	Previously rated 2 but replaced by NNA in 2012 with larger structure.
KEN01-58	RJ/VL	10/14/2011	NNA	1232	-151.3379041	60.07105552	AWC	3	
KEN02-135	JN/VL	7/18/2012	NNA	1209	-151.605381	59.870901	AWC	3	
KEN04-114	JN/PB	10/16/2013	NNA	1247	-151.3871072	59.93711597	AWC	4	Formerly KEN01-50, rated 2. Replaced by NNA in 2013.
TYO01-03	JN/WF	8/20/2012	TYO	17	-151.1864517	61.10265775	A	3	Addition to AWC.
TYO01-41	JN/WF	8/21/2012	TYO	11	-151.3158753	61.07676127	AWC	4	
TYO01-36	JN/WF	8/21/2012	TYO	11	-151.3158991	61.07680779	AWC	4	
KEN01-27	JN/PB	10/12/2011	SOA	1015	-151.36751	60.16716678	A	3	Addition to AWC.
TYO01-53	JN/WF	8/22/2012	SOA	1063	-151.5773004	61.07993164	AWC	4	
KAC01-283	HR/PB	8/5/2014	PGC	112	-151.655416	59.278545	R	4	Stream simulation pipe arch.
KAC01-288	HR/PB	8/6/2014	PGC	153	-151.649506	59.281983	R	3	
KAC01-314	HR/PB	8/5/2014	PGC	1	-151.687033	59.289429	R	4	Only DV found but stream is in AWC just below crossing.
KAC01-332	HR/PB	8/7/2014	PGC	134	-151.700277	59.302106	A	4	Addition to AWC.
KAC01-337	HR/PB	8/7/2014	PGC	132	-151.720449	59.303593	AWC	4	AWC up to pipe. CO found above, so additional reach will be added.
KEN02-117	HR/PB	10/14/2014	CIRI	1090	-151.557851	60.03853	A	4	Previously rated 1. Replaced by CIRI in July 2014
KEN02-113-1	HR/PB	10/14/2014	CIRI	1090	-151.476982	60.05674	AWC	4	Previously rated 1. Replaced by CIRI in July 2014
KEN02-113-2	HR/PB	10/14/2014	CIRI	1090	-151.476982	60.05674	AWC	4	Relief pipe for WP 113-1. Remediation complete.
TYO01-05	JN/WF	8/20/2012	TYO	15	-151.1768831	61.08111978	AWC	4	Formerly rated 1. This culvert was replaced by a larger culvert in 2012 by TYO and TTCD. Replacement opens 1.4 miles (TTCD)
TYO01-11	JN/WF	8/20/2012	TYO	6	-151.256	61.073	AWC	4	Formerly rated 1. A 17' pipe arch installed in 2014 by TYO and the TTCD. This replaces an undersized culvert. Replacement opens 7.4 miles of habitat (TTCD)

Category C: Low-rated culverts installed after June 10, 1993

This category includes 15 culverts on Native corporation lands in the KPB. The landowners must comply with the current FRPA regulations and the Title 16 fishway requirements. On active and inactive roads, landowners must maintain the roads to assure water flow and fish passage and prevent erosion (11 AAC 95.315 (a) and (b)). Alternatively, a landowner may close a road by stabilizing it and removing culverts, bridges and fill (11 AAC 95.320). DOF and ADFG have conducting upstream habitat surveys on most of these low-rated culverts to determine how much fish habitat would become available by repairing, replacing or removing the culverts. This information has and will continue to assist in the prioritization of remediation efforts.

A 16th low-rated culvert is on a Native allotment administered by the BIA. The allottee is not subject to the FRPA regulations, but is subject to Title 16 fishway requirements.

Five additional low-rated culverts were in this category; however they have since been replaced and are now in Category A, all with current ratings of 4.

Category B: Low-rated culverts installed prior to February 18, 1981

This category includes 10 culverts on State, KPB, MHT, and Native Corporation land all in the Tyonek area. The landowners are responsible for complying with fishway requirements under AS 16.05.841, but not FRPA regulations, because they were built before regulations were adopted. Some roads in the Tyonek area may have changed ownership since the culverts were installed. DOF is currently reviewing the history to determine the current responsibility for roads in the Tyonek area.

Seven Category B culverts (see highlighted comments in Table 3) are currently involved in planned replacements or are part of grant applications for removal or replacement. The four structures on roads SOA 1063 and 1054 are all in need of upstream habitat surveys. DOF and Habitat are currently seeking funding to do that work. Following the upstream habitat determination, a prescription would be written recommending to 1. Leave existing culvert(s) in place or wait until removal is needed for other reasons, 2. Remove culvert(s) and reestablish natural drainage, or 3. Replace the culvert with a structure that will allow fish passage.

Originally Category B had 12 culverts, but two on Native corporation land have been replaced by larger structures. Those two structures formerly had a rating of 1 but are now rated 4 and are in Category A.

Category A: High-rated culverts

This category includes 22 culverts on State and private forest roads throughout the KPB. No remediation is needed for these culverts. Seven culverts formerly in Category B and C are now in Category A. Landowners will be responsible for ensuring the structure's ability to continue meeting the fish passage requirements under FRPA and Title 16.

V. Culvert Fish Passage Rating Breakdown

Table 4 examines the 1 – 4 rating breakdown by the three surveyed geographic areas, then further by stream classification and land ownership.

Table 4. Fish passage rating breakdown.

	Tyonek RCS - FRPA Region II	Kenai Peninsula - FRPA Region II	Seldovia-Pt. Graham-English Bay - FRPA Region I	Culvert total by rating	Rating Percentage	
RATINGS:						
Total # fish culverts with a rating of 4:	5	6	4	15	31%	
Total # fish culverts with a rating of 3:	1	5	1	7	15%	
Total # fish culverts with a rating of 2:	6	5	8	19	40%	
Total # fish culverts with a rating of 1:	4	0	3	7	15%	
	16	**16**	**16**	**48**	**100%**	**Total Culverts Surveyed**
Total number of culverts found on Resident Fish Streams:	3	0	9		25%	
Total number of culverts found on Anadromous Fish Streams:	13	15	7		73%	
Total number of culverts found where fish habitat is unkown:	0	1	0		2%	
	16	**16**	**16**			**Total Culverts Surveyed**
Number of fish culverts surveyed on Private land:	37					
Number of fish culverts surveyed on State land:	7					
Number of fish culverts surveyed on Mental Health Trust land:	2					
Number of fish culverts surveyed on Municipal land:	1					
Number of fish culverts surveyed on University land:	0					
Number of fish culverts surveyed on Native allotment land:	1					
	48					

VI. Fish Culvert Remediation and Follow up

DOF will work cooperatively with other forest landowners to identify funding sources for remediation. Potential funding sources include the US Fish and Wildlife Service fish passage program, Natural Resources Conservation Services (NRCS) matching grants through the Environmental Quality Improvement Program, and the Alaska Sustainable Salmon Fund administered by ADFG.

Fish Culverts Needing Attention – Tyonek

To date, two culverts have come off the Category B list and are now in Category A, meeting full FRPA and Title 16 compliance. One more in Category B is the process of being replaced by a bridge and a funding source is being sought after for a fourth culvert on Category B. All four culverts are on land owned by Tyonek Native Association. The Tyonek Conservation District and Tyonek Native Association have taken a proactive approach in evaluating the need to remove and replace these four culverts as well as secure funding.

On the State road segments, DOF has applied for funding through the Sustainable Salmon Fund to replace one culvert (road SOA 1061) and evaluate the upstream habitat and possible removal of three others (roads SOA1063 & SOA1054). These culverts are highlighted in yellow on Table 3. In December 2014, DOF received notice that the grant application was not funded, partly due to a concern of northern pike migrating into this waterway system. DOF will be working with ADFG to determine the extent of the risk posed by Pike and how to mitigate that. DOF will continue to seek funding to repair the low-rated fish culverts and will work closely with ADFG and the Tyonek Conservation District to ensure that replacement will be beneficial.

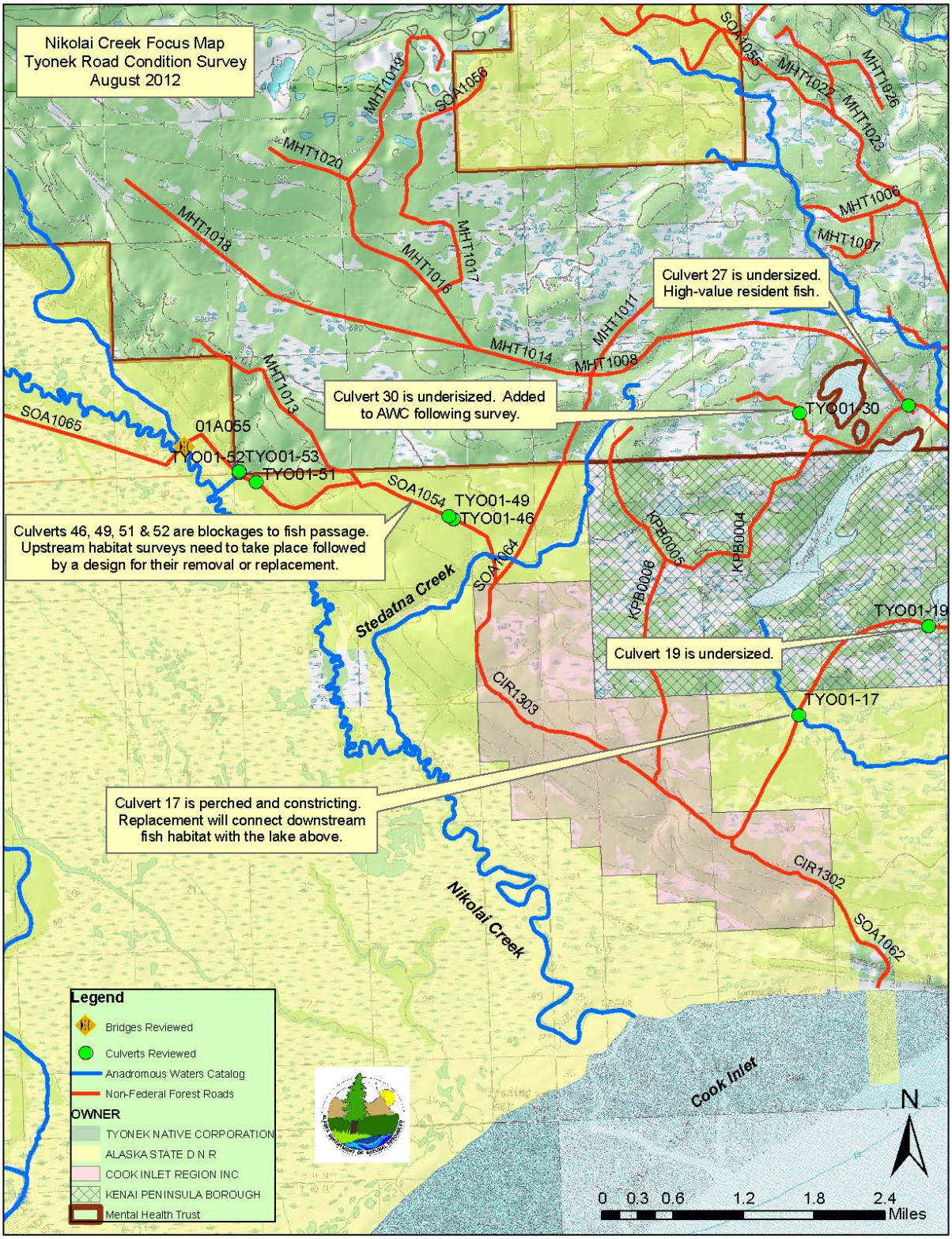

Figure 6. Map showing fish culverts in need of attention.

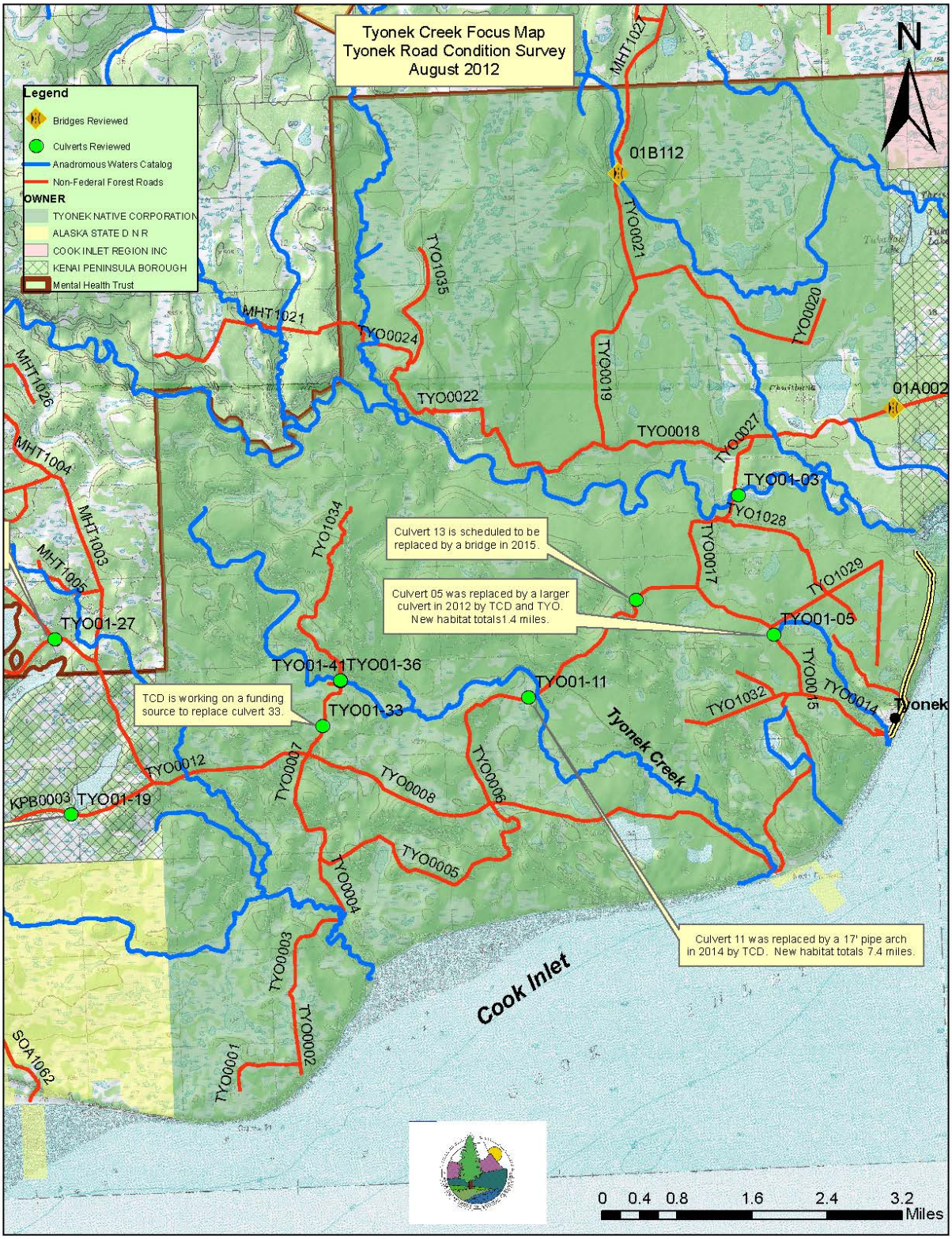

Figure 7. Map showing fish culverts in need of attention and projects accomplished in the vicinity of Tyonek creek. All culvert replacements projects have been developed and administered by the Tyonek Tribal Conservation District and Tyonek Native Association.

Fish Culverts Needing Attention – Kenai Peninsula

Since this survey began in 2011, four low rated culverts have been replaced by their landowners. They were originally in the Category C list (previously rated 1 and 2) and are now in the Category A, all with an updated rating of 4. The four culverts are highlighted in yellow on Table 3. CIRI replaced two of those culverts (road CIR1090) and added an additional relief culvert to one of them. NNA replaced the remaining two (roads NNA1245 and NNA1247).

Two additional low-rated culverts remain on both the CIRI and NNA road systems. There's an additional low-rated culvert on a Native allotment, which is an inholding of NNI. DOF will work with the landowners to seek funding sources for their replacement.

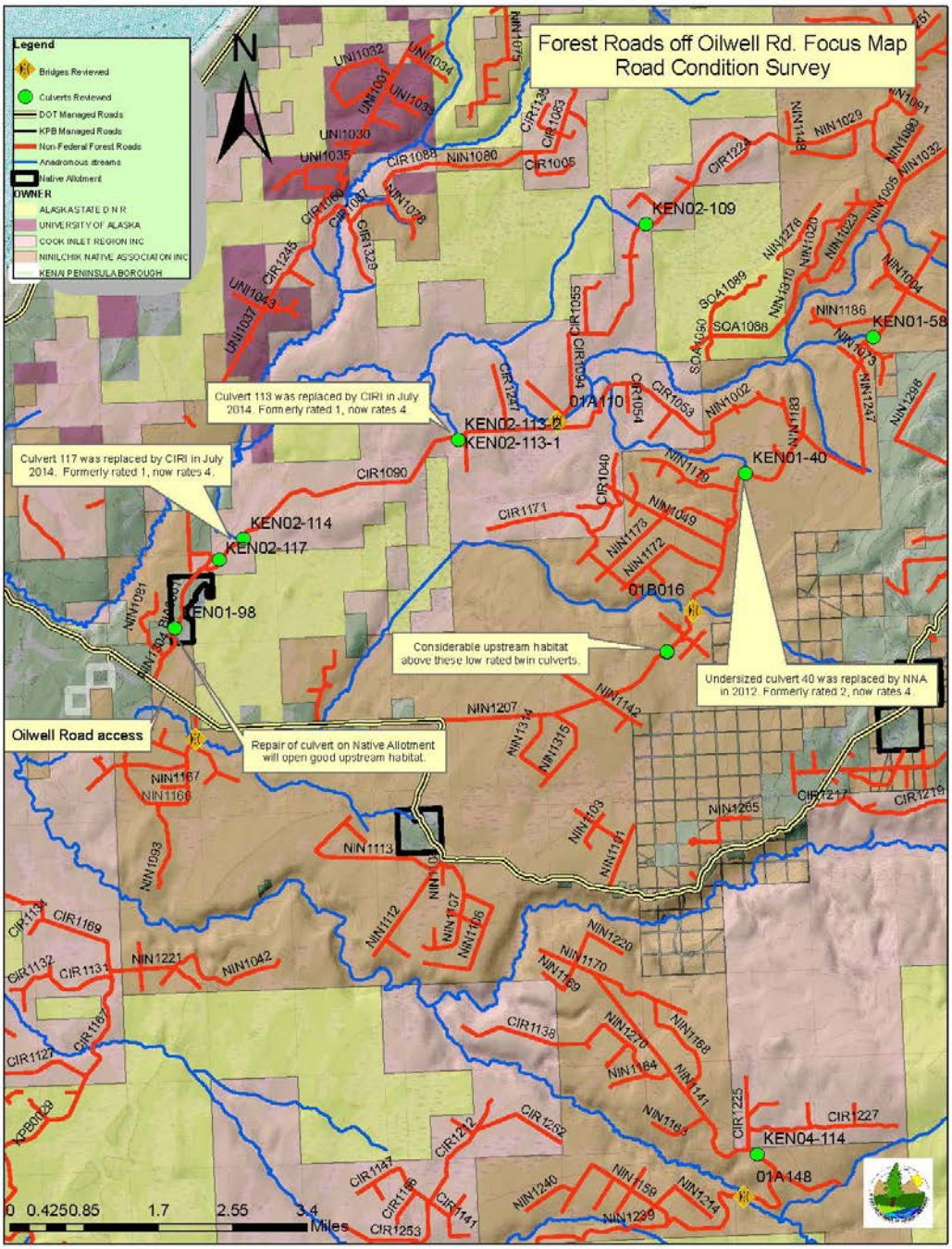

Figure 8. Map showing low-rated fish culverts and replaced culverts by CIRI and NNA.

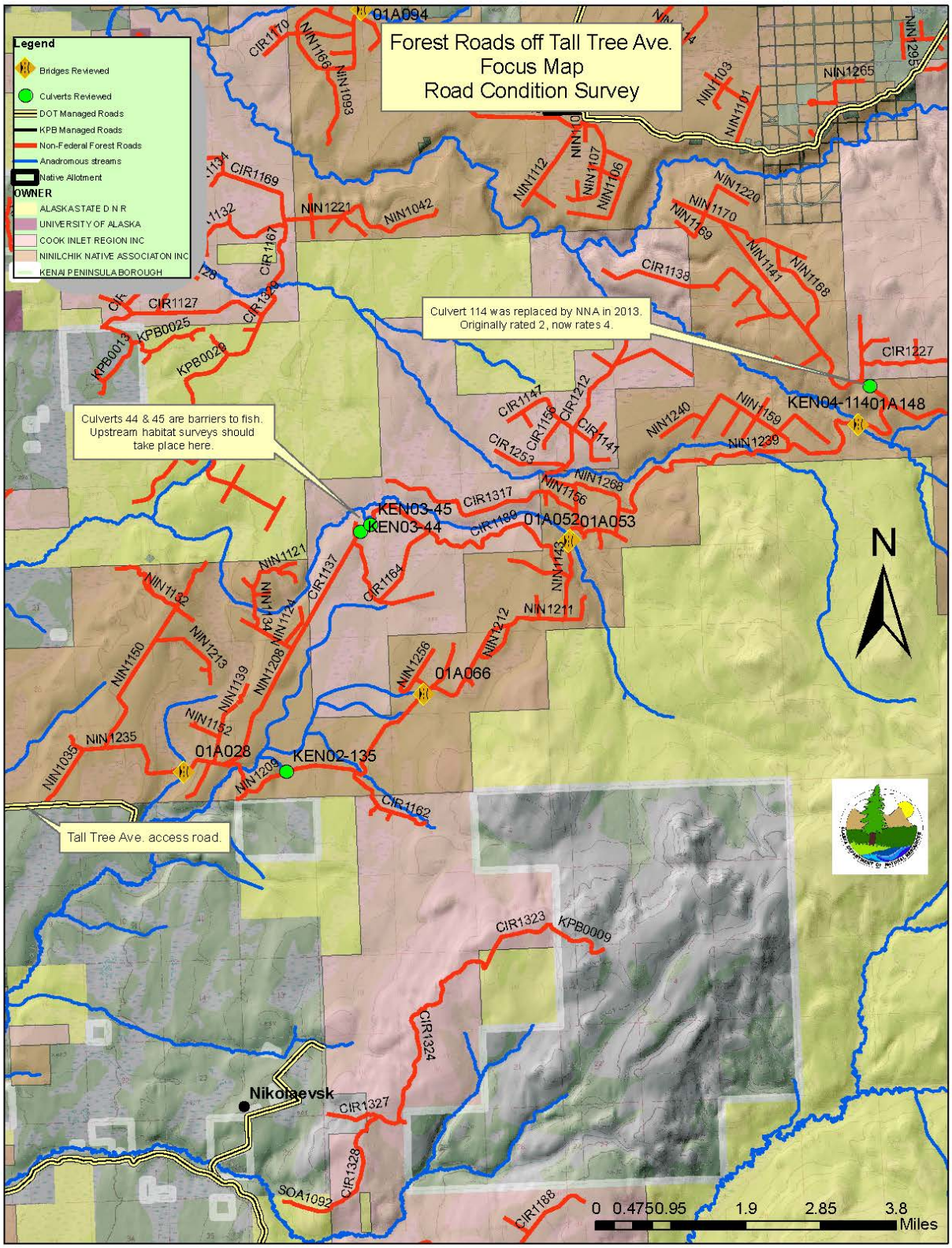

Figure 9. Map showing low-rated fish culverts and a replaced culverts by NNA.

Fish Culverts Needing Attention – Seldovia/Port Graham

There are three low-rated culverts in close proximity of each other in the Seldovia area. They're all in the Jakolof watershed and need to be replaced. The most problematic culvert was a 7-foot diameter pipe located in Jakolof Creek (see culvert KAC01-205 on Table 3). George Oliveira, Alaska Department of Transportation, Seldovia, explained that stream bed-load has aggraded above the culvert causing flooding and damage of the adjacent State highway. All three culverts are out of compliance with FRPA and Title 16, but the one on Jakolof Creek is causing the most visible damage and affects other public resources besides fish. DOF will work with Habitat and the landowners to rectify the problem. The landowners are aware of the problem.

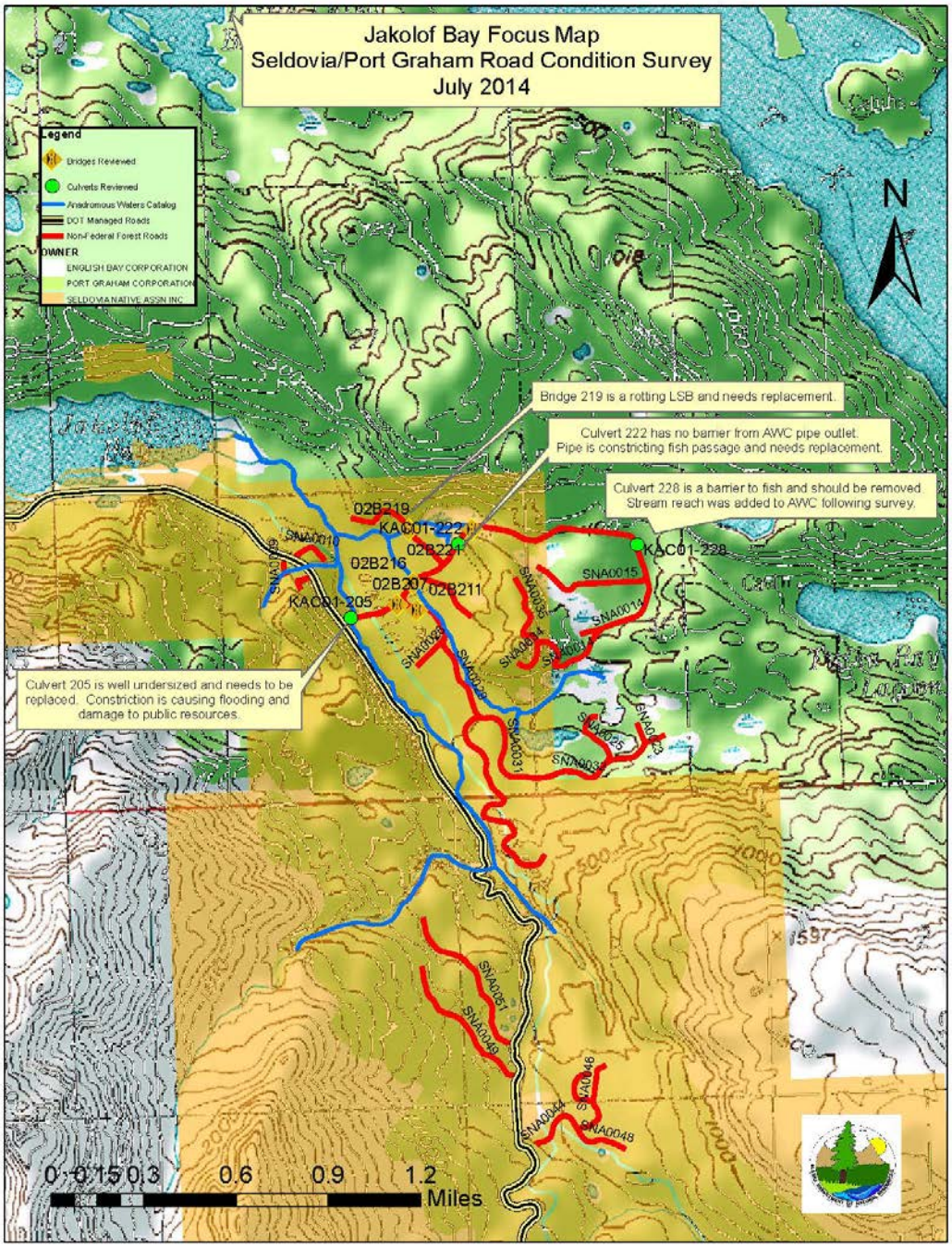

Figure 10. Map showing low-rated fish culverts and a bridge needing replacement.

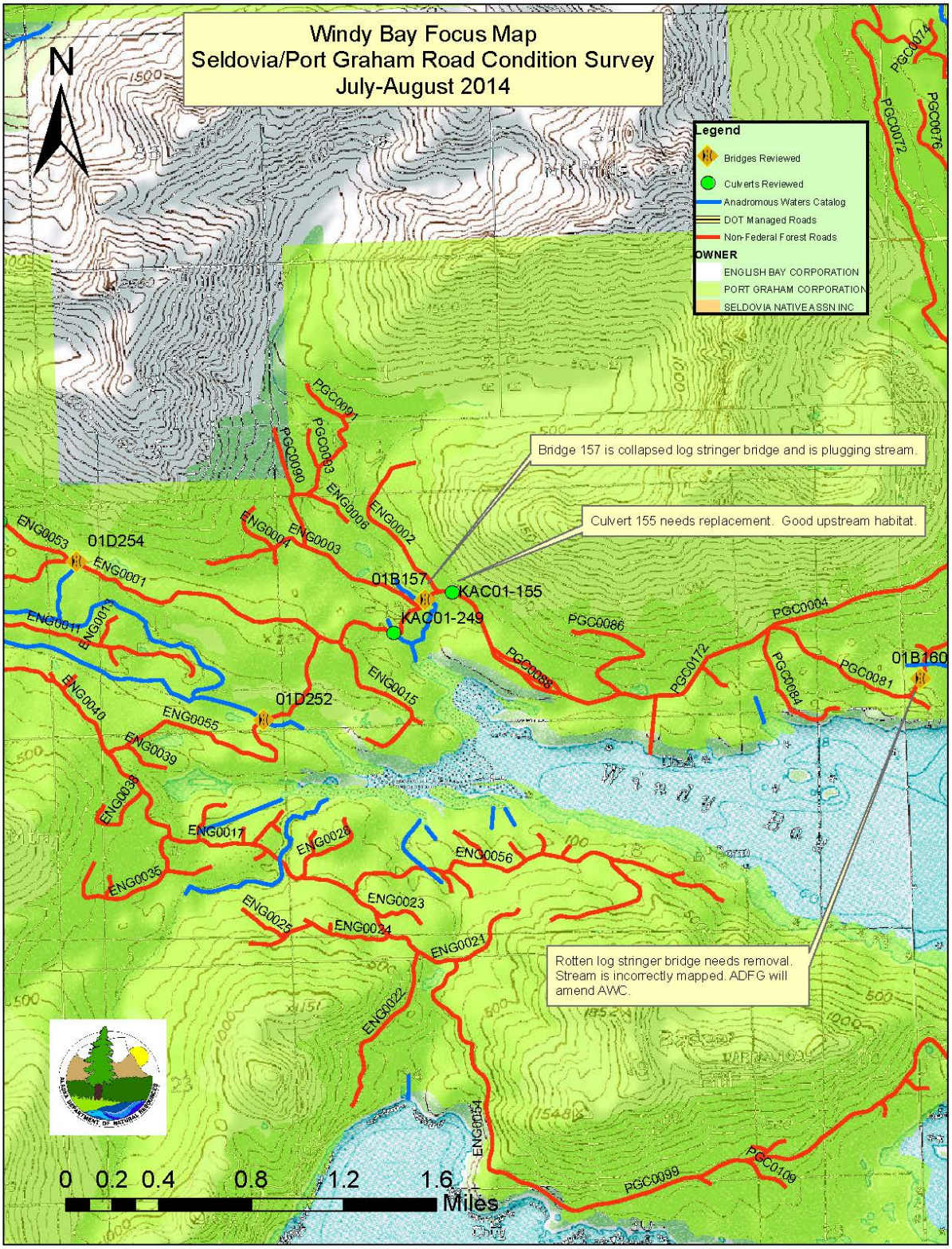

Figure 11. Map showing a low rated culvert and two bridges needing replacement or removal.

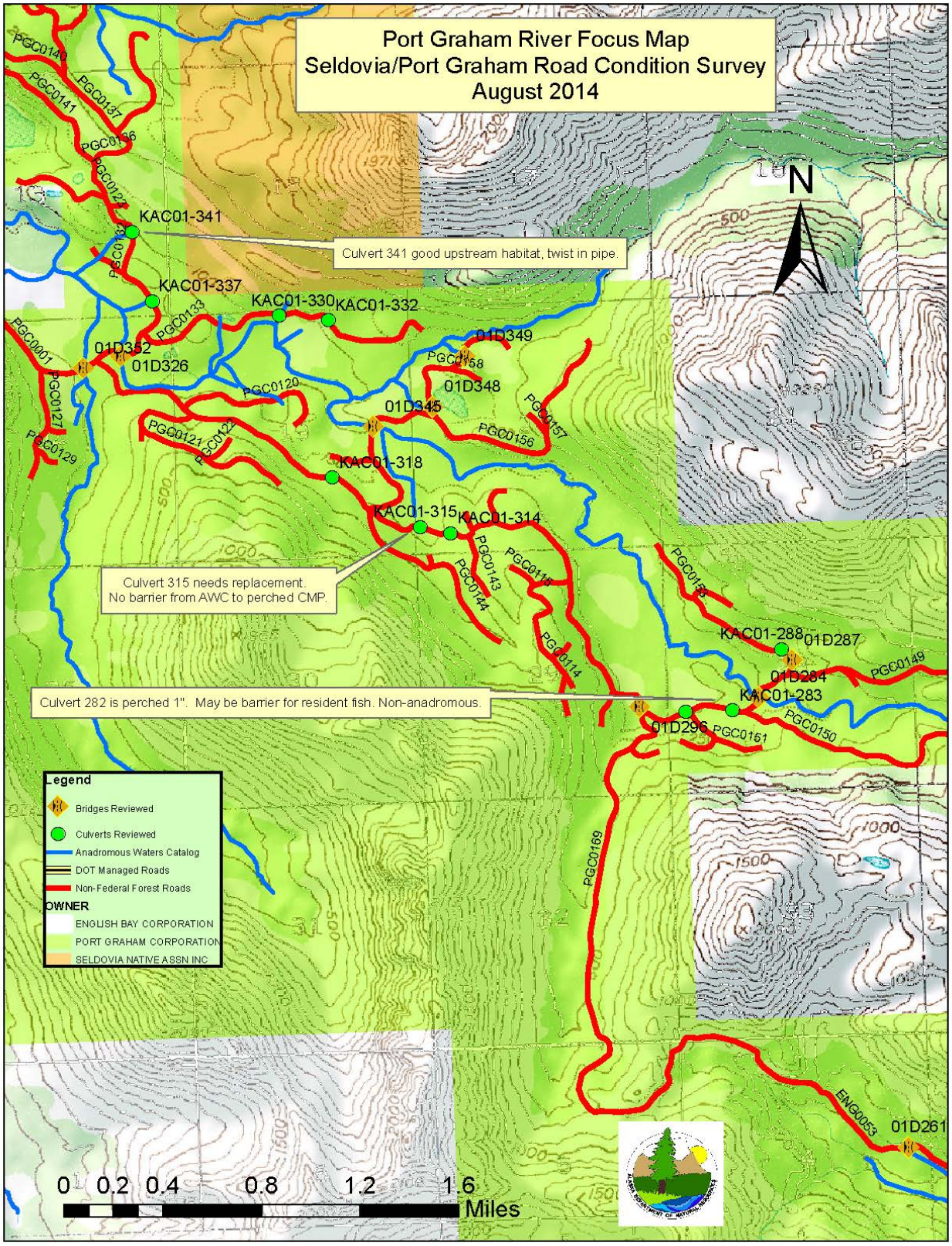

Figure 12. Map showing a low rated culverts in the Port Graham watershed.

VII. Culvert BMP ratings on all culverts with defined channels

A waypoint was given to every culvert on the forest road system surveyed under the RCS. If the pipe was considered to be a cross drain, used only to move water from one side of the road to the other, then nothing more was done. If the culvert was installed as a crossing structure for a channelized stream, then we evaluated the culvert on seven BMP's. The culvert BMP's can be seen in Tables 5 – 7. Each of the three culvert BMP tables below represent one of the three geographic areas surveyed; Tyonek, Kenai Peninsula and Seldovia/Port Graham.

There is no differentiation between fish culverts and non-fish culverts on the BMP ratings. The tables below include both classes of culverts, but not cross drains. One BMP evaluated pertains only to fish culverts and the remaining six BMP's apply to both. As the culvert's ability to pass fish was evaluated in the fish culvert section of this report, it did not seem necessary to separate those culverts from the non-fish culverts in this section.

The evaluations have been stratified by owner type. In other surveys we've also stratified by road activity (Active, Inactive and Closed), however on the KPB RCS only Inactive and Closed roads were surveyed. All of the roads classed as Closed on this survey were void of culverts, as they had all been removed.

Culvert BMP's for Tyonek

Table 5. Culverts and their BMP ratings reviewed on the Tyonek survey.

CULVERT BMP RATINGS - TYONEK PORTION OF THE RCS (AUGUST 2012)

Each BMP was rated on a 4-point scale. BMP's rated 1 = No attempt to implement or maintain effectiveness

2 = BMP was somewhat implemented and/or maintained 3 = A single issue issue may affect full effectiveness 4 = BMP was fully implemented NA = BMP was not applicable

Owner Type	Road Activity	Regulation/BMP	# Occurrences Ratings = 1	# Occurrences Ratings = 2	# Occurrences Ratings = 3	# Occurrences Ratings = 4	# Occurrences Ratings = NA	BMP Rating Total
MHTrust	Inactive	95.305a3 Culvert not perched on fish bearing waters	0	0	0	2	0	2
MHTrust	Inactive	95.305a4 Culvert terminates on material not readily erodible	0	0	1	1	0	2
MHTrust	Inactive	95.305a7 Culvert clear of mobile slash	0	0	0	2	0	2
MHTrust	Inactive	95.305a8 Adequate and apropriate catch basins and headwalls	0	0	0	1	1	2
MHTrust	Inactive	95.305a9 Culvert is proper length to prevent blocking	0	0	0	2	0	2
MHTrust	Inactive	95.305a1 Culvert size capable of passing 25 year flood	0	1	1	0	0	2
MHTrust	Inactive	95.305a3 Culvert entrance/exit match natural stream channel	0	1	1	0	0	2
MHTrust	Inactive	Total culverts per rating value	0	2	3	8	1	14
Municipality	Inactive	95.305a3 Culvert not perched on fish bearing waters	0	0	0	1	0	1
Municipality	Inactive	95.305a4 Culvert terminates on material not readily erodible	0	0	0	1	0	1
Municipality	Inactive	95.305a7 Culvert clear of mobile slash	0	1	0	0	0	1
Municipality	Inactive	95.305a8 Adequate and apropriate catch basins and headwalls	0	0	0	0	1	1
Municipality	Inactive	95.305a9 Culvert is proper length to prevent blocking	0	1	0	0	0	1
Municipality	Inactive	95.305a1 Culvert size capable of passing 25 year flood	1	0	0	0	0	1
Municipality	Inactive	95.305a3 Culvert entrance/exit match natural stream channel	0	1	0	0	0	1
Municipality	Inactive	Total culverts per rating value	1	3	0	2	1	7
Native Corp	Inactive	95.305a3 Culvert not perched on fish bearing waters	2	0	1	4	12	20
Native Corp	Inactive	95.305a4 Culvert terminates on material not readily erodible	2	1	3	14	0	20
Native Corp	Inactive	95.305a7 Culvert clear of mobile slash	0	1	1	17	1	20
Native Corp	Inactive	95.305a8 Adequate and apropriate catch basins and headwalls	1	2	4	2	11	20
Native Corp	Inactive	95.305a9 Culvert is proper length to prevent blocking	1	2	4	13	0	20
Native Corp	Inactive	95.305a1 Culvert size capable of passing 25 year flood	4	4	5	7	0	20
Native Corp	Inactive	95.305a3 Culvert entrance/exit match natural stream channel	4	2	3	6	5	20
Native Corp	Inactive	Total culverts per rating value	14	13	21	63	29	140
State	Inactive	95.305a3 Culvert not perched on fish bearing waters	3	0	0	3	1	7
State	Inactive	95.305a4 Culvert terminates on material not readily erodible	1	1	1	4	0	7
State	Inactive	95.305a7 Culvert clear of mobile slash	0	1	0	6	0	7
State	Inactive	95.305a8 Adequate and apropriate catch basins and headwalls	0	1	0	2	4	7
State	Inactive	95.305a9 Culvert is proper length to prevent blocking	0	0	1	5	1	7
State	Inactive	95.305a1 Culvert size capable of passing 25 year flood	3	2	2	0	0	7
State	Inactive	95.305a3 Culvert entrance/exit match natural stream channel	2	1	3	1	0	7
State	Inactive	Total culverts per rating value	9	6	7	21	6	49

The Tyonek road system was initially constructed to facilitate timber harvest efforts in the late 70's, which pre-dates the adoption of FRPA in 1981. Much of the road system is still in use, but no longer to access forest products. While we performed the survey, there was a fair amount of commercial as well as local traffic. There was active oil, gas, and coal exploratory work utilizing the road system as well as an environmental cleanup project taking place. Some of the original forest road system has since been converted to local arterials through residential areas, so those were not included in the survey.

The survey covered four landowners, however, at the time of construction in the late seventies and early eighties only the State of Alaska was harvesting timber. Later in the late 90's and beginning the new millennium, Tyonek Natives and Mental Health Trust initiated timber sales. While new forest roads were constructed during that time, access to the new areas relied primarily on the road system built for the first entry. All the culverts in this rating were installed on roads constructed prior to the enactment of FRPA.

Most road surfaces were in excellent shape, with regular maintenance taking place. Much of the road system had an adequate number of drainage structures and water moved quickly off the roads after rain events. Some of the lower ratings were related to culvert sizing, where pipes were narrower than bed width. Also, the BMP related to a culvert's ability to withstand a 25 year storm event caused some lower ratings. Additionally some lower ratings were noted on the BMP related to perched culverts on fish bearing waters. The BMP's for culvert perch was discussed in the fish culvert section. The remaining BMP scores showed full implementation or close to full implementation (ratings of 3 or 4). The overall BMP rating average for MHT ownership was 3.46 (out of 4). The average on Municipal roads, which belong to the SOA at the time of construction, was 2.5. The Native corporation road system had an average rating of 3.22 while the SOA's was 3.14.

Figure 13. Twin culverts with a rating of 4, Tyonek.

Culvert BMP's for the Kenai Peninsula

Table 6. Culverts and their BMP ratings reviewed on the Kenai Peninsula survey.

CULVERT BMP RATINGS - KENAI PENINSULA PORTION OF THE RCS (OCTOBER 2011, JULY 2012, JUNE 2013 AND OCTOBER 2013)								
Each BMP was rated on a 4-point scale. BMP's rated 1 = No attempt to implement or maintain effectiveness								
2 = BMP was somewhat implemented and/or maintained 3 = A single issue issue may affect full effectiveness 4 = BMP was fully implemented NA = BMP was not applicable								
Owner Type	Road Activity	Regulation/BMP	# Occurrences Ratings = 1	# Occurrences Ratings = 2	# Occurrences Ratings = 3	# Occurrences Ratings = 4	# Occurrences Ratings = NA	BMP Rating Total
Native Corp	Inactive	95.305a3 Culvert not perched on fish bearing waters	2	3	0	10	30	45
Native Corp	Inactive	95.305a4 Culvert terminates on material not readily erodible	0	1	2	34	8	45
Native Corp	Inactive	95.305a7 Culvert clear of mobile slash	2	0	3	32	8	45
Native Corp	Inactive	95.305a8 Adequate and apropriate catch basins and headwalls	0	1	3	19	22	45
Native Corp	Inactive	95.305a9 Culvert is proper length to prevent blocking	3	0	1	39	2	45
Native Corp	Inactive	95.305a1 Culvert size capable of passing 25 year flood	3	1	6	34	1	45
Native Corp	Inactive	95.305a3 Culvert entrance/exit match natural stream channel	3	2	12	22	6	45
Native Corp	Inactive	Total culverts per rating value	**13**	**8**	**27**	**190**	**77**	**315**
State	Inactive	95.305a3 Culvert not perched on fish bearing waters	0	0	0	1	2	3
State	Inactive	95.305a4 Culvert terminates on material not readily erodible	0	0	0	2	1	3
State	Inactive	95.305a7 Culvert clear of mobile slash	0	0	0	2	1	3
State	Inactive	95.305a8 Adequate and apropriate catch basins and headwalls	0	0	0	0	3	3
State	Inactive	95.305a9 Culvert is proper length to prevent blocking	1	0	0	2	0	3
State	Inactive	95.305a1 Culvert size capable of passing 25 year flood	0	1	1	1	0	3
State	Inactive	95.305a3 Culvert entrance/exit match natural stream channel	0	1	0	2	0	3
State	Inactive	Total culverts per rating value	**1**	**2**	**1**	**10**	**7**	**21**

The Kenai Peninsula forest road system was constructed following the enactment of FRPA in 1981. The survey covered five landowners; State of Alaska, University of Alaska, Kenai Peninsula Borough, Cook Inlet Regional Corporation and Ninilchik Native Association. There were no culverts remaining on the University road system as the roads were closed out in their entirety and are classed as Closed. The Kenai Peninsula Borough road system was classed as Active at the time of survey, since log hauling was occurring to facilitate an active timber sale. The remaining three landowners were grouped in two land owner types; Native Corporation and State. There were many miles of winter trails, which had once been used for hauling logs, among other uses. Those roads were not surveyed. There are few, if any, crossing structures on the winter trails.

Most of the 180 miles of forest road on the main peninsula was in Inactive status, and the culvert ratings are a reflection of their good condition. While there were some roads classed as Closed on all ownership types, only the University of Alaska roads were completely closed out, with all crossing structures pulled. While there were no culverts to rate, it should be noted that the removal of structures was done in accordance with FRPA and that natural drainage was reestablished. The Closed road system was adequately “put to bed”.

Overall we found the culverts to be in good condition on both the State and Native corporation lands. The low ratings noted on the BMP related to culverts that were perched on fish bearing waters; these were discussed earlier. The remaining BMP’s required of culverts were met with a total BMP average of 3.65 (out of 4) for the Native corporation roads and 3.43 for the State road system.

Figure 14. Culvert replacement with relief pipe on NNA1047.

Culvert BMP's for Seldovia/Port Graham

Table 7. Culverts and their BMP ratings reviewed on the Seldovia/Port Graham survey.

CULVERT BMP RATINGS - SELDOVIA/PORT GRAHAM PORTION OF THE RCS (July - August 2014)

Each BMP was rated on a 4-point scale. BMP's rated 1 = No attempt to implement or maintain effectiveness

2 = BMP was somewhat implemented and/or maintained 3 = A single issue issue may affect full effectiveness 4 = BMP was fully implemented NA = BMP was not applicable

Owner Type	Road Activity	Regulation/BMP	# Occurrences Ratings = 1	# Occurrences Ratings = 2	# Occurrences Ratings = 3	# Occurrences Ratings = 4	# Occurrences Ratings = NA	BMP Rating Tota
Native Corp	Inactive	95.305a3 Culvert not perched on fish bearing waters	9	1	2	4	17	33
Native Corp	Inactive	95.305a4 Culvert terminates on material not readily erodible	2	1	6	24	0	33
Native Corp	Inactive	95.305a7 Culvert clear of mobile slash	1	1	11	19	1	33
Native Corp	Inactive	95.305a8 Adequate and apropriate catch basins and headwalls	4	2	9	15	3	33
Native Corp	Inactive	95.305a9 Culvert is proper length to prevent blocking	6	1	4	22	0	33
Native Corp	Inactive	95.305a1 Culvert size capable of passing 25 year flood	5	4	9	15	0	33
Native Corp	Inactive	95.305a3 Culvert entrance/exit match natural stream channel	5	5	15	8	0	33
Native Corp	Inactive	Total culverts per rating value	**32**	**15**	**56**	**107**	**21**	**231**

Most of the Seldovia/Port Graham road system was developed after the enactment of FRPA in 1981, although there was a small portion developed prior to the Act. We found very little road that would be classed as Closed, however quite a network was impassable for motorized vehicles due to slide activity. Structures are still in place, so they would be classed as Inactive.

We worked this road system in three different trips; one week out of Seldovia, a second weeklong trip from Port Graham and a one-day trip from Dogfish Bay near Nanwalek. From the Seldovia side, only about ten miles of forest road is accessible but some of that is gated. We surveyed the gated portion as

well as the open segments in their entirety. Beyond the accessible portion, we travelled by helicopter to strategic points along an extensive road system, which is blocked by slides. We began the survey at a collapsed log stringer bridge on the mainline road, which once connected Seldovia to Port Graham. From this point, it was possible to drive to Port Graham but not Seldovia. We worked our way toward Seldovia from this point and two weeks later, drove to this point from Port Graham, working our way back towards that community.

From the helicopter, we got dropped off at two other strategic locations in the Windy Bay drainage, performing the RCS work within a few miles of the landing zone. The landing zones were selected due to their proximity to fish habitat. There were two other areas that we attempted to land at, however we were unable to due to localized fog on the day that we had the helicopter. Those areas were in the Rocky Bay drainage. We did do an extensive fly over covering the Rocky Bay watershed in its entirety. The road system appeared to be fine from the aircraft; however no collected data became part of this report due to the necessity of being on the ground to adequately evaluate crossing structure condition, BMP compliance and fish passage. I do believe that we recorded an adequate culvert and forest road system sampling in all the other watersheds of the Seldovia, Port Graham and Nanwalek areas.

For the culvert BMP's the overall average rating was 3.1 (out of a possible 4). Without the BMP which applies to perched culverts, discussed on fish streams, the overall rating would've been higher. The low-rated culverts from this survey are discussed in the section above, related to culverts requiring fish passage.

VIII. Bridges

Like the culverts, the bridges were evaluated for all the bridge related BMP's using the 1 through 4 rating system. There are six BMP's in total that apply to bridges including one, which applies to bridges crossing anadromous streams. 36 of 38 bridges evaluated crossed anadromous streams. Unlike the culvert BMP tables, the bridge BMP tables will display every bridge evaluated from all roads surveyed throughout the KPB road system. All bridges highlighted in yellow will need further attention and review. We believe that we surveyed every bridge on the Tyonek and Kenai Peninsula RCS segments. On the Seldovia/Port Graham system, we survey 22 but missed an estimated 4 to 6 in the Rocky Bay drainage due to inaccessibility. We may've missed a couple in the Windy Bay drainage as well. A BMP without a rating indicates that it was not applicable for that structure.

Figure 15. Rating bridge over Lower Ninilchik.

Bridge BMP's for Tyonek

Table 8. Bridges and their BMP ratings reviewed on the Tyonek survey.

BRIDGE INVENTORY AND BMP RATINGS - TYONEK PORTION OF THE RCS (AUGUST 2012)																
Overall condition was rated on a 4-point scale. Bridge BMP rated 1 does not meet compliance standards																
1 = Bridge BMP is out of compliance 2 = Bridge BMP is partially effective, occasional adequate or marginally attempted 3 = Bridge BMP is mostly effective to applied, but not fully 4 = Bridge BMP is in full compliance -1 = Bridge BMP is not applicable																
									95.300a1	95.300a2	95.300a3	95300.a4	95.300a8	95.300d		
Survey Area	survey waypoint	Structure Type	Structure Material	Survey Date	Land Owner	Road Seg-ment	Longitude	Latitude	Instal relief culvert on ap-proaches	One end of log bridge anchored	Earth embank-ment protected from erosion	Curbs and filter fabric installed on rock decked	Minimize disturban ce to bed and bank of stream	Does not encroach on anad-romous stream	AWC #	comments
Tyonek	01A002	Bridge (Modular)	Steel	8/20/2012	Tyonek Native Corp	TYO1025	-151.1354312	61.11504293	4		3		3	3		Chuitna River
Tyonek	01A055	Bridge (Modular)	Steel	8/23/2012	State of Alaska	SOA1063	-151.5907385	61.08326504			3			4	247-10-10200	No decking. Log pilings holding abutments
Tyonek	01B112	Bridge	Wood	8/23/2012	Tyonek Native Corp	TYO0021	-151.220258	61.152867			3		4	4	247-20-10002-2019	16 ft wide inside curbs. Old adjacent culvert left in place 75% plugged. Newer bridge replaced main culvert. Silt fence limiting sedimentation.

Only three bridges were located and surveyed on the Tyonek forest road system. We are unsure if more exist, but if they do, they would be beyond the accessible portion of the local road system and in an area where satellite imagery was unavailable. Every rating was >2, so the bridges are in good condition and no follow up work is required.

Bridge BMP's for the Kenai Peninsula

Table 9. Bridges and their BMP ratings on the Kenai Peninsula survey.

BRIDGE INVENTORY AND BMP RATINGS - KENAI PENINSULA PORTION OF THE RCS (OCTOBER 2011, JULY 2012, JUNE 2013 AND OCTOBER 2013)

Overall condition was rated on a 4-point scale. Bridge BMP rated 1 does not meet compliance standards

1 = Bridge BMP is out of compliance 2 = Bridge BMP is partially effective, occasional adequate or marginally attempted 3 = Bridge BMP is mostly effective to applied, but not fully 4 = Bridge BMP is in full compliance -1 = Bridge BMP is not applicable

									95.300a1	95.300a2	95.300a3	95300.a4	95.300a8	95.300d		
Survey Area	survey waypoint	Structure Type	Structure Material	Survey Date	Land Owner	Road Seg-ment	Longitude	Latitude	Instal relief culvert on ap-proaches	One end of log bridge anchored	Earth embank-ment protected from erosion	Curbs and filter fabric installed on rock decked	Minimize disturban ce to bed and bank of stream	Does not encroach on anad-romous stream	AWC #	comments
Kenai Peninsula	01B016	Bridge (Modular)	Steel	10/12/2011	Ninilchik Native Associati on	NIN1206	-151.4009476	60.02720299			4		4	4	244-20-10100-2019	RRC North Fork/Deep Creek
Kenai Peninsula	01A066	Bridge		10/14/2011	Ninilchik Native Associati on	NIN1209	-151.554067	59.88425625		4	4		4	4	244-10-10010-2011-3031-4038-5033	Drill casing stringers (4); wood deck
Kenai Peninsula	01C009	Bridge (Modular)	Rail Car	10/11/2011	State of Alaska	SOA1040	-151.4135014	60.16714381			4		4			Falls Creek
Kenai Peninsula	01A008	Bridge	Rail Car	10/11/2011	State of Alaska	SOA1027	-151.3562679	60.16169105			4	4	4	4	244-20-10090	Ninilchik River
Kenai Peninsula	01A052	Bridge	Wood	10/13/2011	Ninilchik Native Associati on	NIN1143	-151.4986407	59.91126853		4	4		4	4	244-10-10050	Stariski Creek. Wood deck on steel abutments.
Kenai Peninsula	01A053	Bridge	Wood	10/13/2011	Ninilchik Native Associati on	NIN1143	-151.4990501	59.91095924		4	4		4	4		Adjacent to Stariski; overflow channel. Wood deck on steel abutments.
Kenai Peninsula	01A148	Bridge (Modular)	Steel	7/19/2012	Ninilchik Native Associati on	NIN1271	-151.3916522	59.93025765		4	4	4	4	4		Steel I-beams 64' sitting on a dump-bed abuttment.
Kenai Peninsula	01A100	Bridge (Log stringer)	Wood	7/17/2012	Cook Inlet Regional Corp.	CIR1139	-151.1932699	60.11256823			4					LSB 20" falling apart into stream. Non-anadromous.
Kenai Peninsula	01A102	Bridge	Wood	7/17/2012	Cook Inlet Regional Corp.	CIR1152	-151.240501	60.10716677	4	4	4	4	4	4		Drill tube piping 30' long capped with rotten wood decking. Large hole in center of decking needs replacement.
Kenai Peninsula	01A094	Bridge (Modular)	Rail Car	7/16/2012	Ninilchik Native Associati on	NIN1166	-151.5676218	60.00914938		4	4	4	4	4	244-20-10100-2019	
Kenai Peninsula	01A110	Bridge (Modular)	Steel	7/17/2012	Cook Inlet Regional Corp.	CIR1094	-151.4435833	60.05919219		4	4	4	4	4	244-20-10090-2030	Drill casing abuttments, steel I-beams. Replacement of rotten wood deck was commencing during survey.
Kenai Peninsula	01A028	Bridge	Rail Car	6/18/2013	Ninilchik Native Associati on	NIN1235	-151.642473	59.871651		4	3	3	4	4	244-10-10010-2011-3031	Chikok trib bridge; old railcar; grader damage to sill posts.

Every bridge we examined was in good shape. Table 9 reflects a 100% of the remaining bridges on the Peninsula forest road system. 96% of all bridge BMP's rated 4. There were no BMPs that rated <3. There were three sites where bridges had been removed and all of those were done very well with slopes pulled back and material away from where stream entry could occur. A few of the wood decked bridges had rotten decking and were in need of replacement; however there is no BMP that addresses that.

No further follow up is needed on the Kenai Peninsula forest road bridges.

Bridge BMP's for Seldovia/Port Graham

Table 10. Bridges and their BMP ratings reviewed on the Seldovia/Port Graham survey (July 2014 portion).

BRIDGE INVENTORY AND BMP RATINGS - SELDOVIA/PORT GRAHAM PORTION OF THE RCS (July 2014)

Overall condition was rated on a 4-point scale. Bridge BMP rated 1 does not meet compliance standards

1 = Bridge BMP is out of compliance 2 = Bridge BMP is partially effective, occasional adequate or marginally attempted 3 = Bridge BMP is mostly effective to applied, but not fully 4 = Bridge BMP is in full compliance

									95.300a1	95.300a2	95.300a3	95300.a4	95.300a8	95.300d		
Survey Area	survey waypoint	Structure Type	Structure Material	Survey Date	Land Owner	Road Seg-ment	Longitude	Latitude	Install relief culvert on ap-proaches	One end of log bridge anchored	Earth embank-ment protected from erosion	Curbs and filter fabric installed on rock decked	Minimize disturbance to bed and bank of stream	Does not encroach on anad-romous stream	AWC #	comments
Seldovia/ Port Graham	01B157	Bridge	Wood	7/22/2014	Port Graham Corp.	ENG0001	-151.560113	59.238158			1		1	1	242-32-10160	Collapsed log stringer bridge, due to rotted stringers, has fallen into the stream. A log jam has developed upstream of the bridge. Many adult humpies were found both above and below the collapsed structure by ADFG, who will require the bridge to be removed.
Seldovia/ Port Graham	01B160	Bridge	Wood	7/22/2014	Port Graham Corp.	PGC0081	-151.499937	59.23211		4	2		2	2		Old log stringer bridge has vegetated and is rotting away. ADFG will require this bridge to be removed. The location of the stream in the AWC is in the wrong location. The correct stream location will be nominated for update in the AWC.
Seldovia/ Port Graham	02B207	Bridge	Wood	7/23/2014	Seldovia Native Association	SNA0012	-151.470828	59.441965			4	4	4	4		Dry channel. New log stringer bridge.
Seldovia/ Port Graham	02B211	Bridge	Wood	7/23/2014	Seldovia Native Association	SNA0027	-151.469045	59.44167		4	4	4	4	4		Log stringer bridge over dry channel.
Seldovia/ Port Graham	02B216	Bridge	Wood	7/23/2014	Seldovia Native Association	SNA0012	-151.469255	59.44293	3	2	4	4	2	2	241-16-10040-2013	Log stringer bridge over dry channel.
Seldovia/ Port Graham	02B219	Bridge	Wood	7/23/2014	Seldovia Native Association	SNA0020	-151.469475	59.445466		3	2	3	2	2	241-16-10040-2013-3009	Log stringer bridge. Juvenile coho observed in the stream channel. This bridge needs to be removed according to ADFG. Bull rail has rolled and stringers are full of conks.
Seldovia/ Port Graham	02B221	Bridge	Wood	7/23/2014	Seldovia Native Association	SNA0012	-151.463653	59.445363		3	3		3	2	241-16-10040-2013-3009	
Seldovia/ Port Graham	03B237	Bridge	Wood	7/24/2014	Seldovia Native Association	SNA0040	-151.669008	59.399168		2	1	1	1	1		Log stringer bridge is failing and in danger of collapsing. Sill log rolled off setting and is not anchored in. Bottom support stringer is split. Not sure if fish are present.
Seldovia/ Port Graham	03B239	Bridge	Wood	7/24/2014	Seldovia Native Association	SNA0040	-151.660783	59.395072		1	1	1	1	1	241-11-10740	This log stringer bridge is failing and in danger of collapsing. ADFG will require this bridge to be removed.

Table 11. Bridges and their BMP ratings reviewed on the Seldovia/Port Graham survey (August 2014 portion).

BRIDGE INVENTORY AND BMP RATINGS - SELDOVIA/PORT GRAHAM PORTION OF THE RCS (August 2014)
Overall condition was rated on a 4-point scale. Bridge BMP rated 1 does not meet compliance standards
1 = Bridge BMP is out of compliance 2 = Bridge BMP is partially effective, occasional adequate or marginally attempted 3 = Bridge BMP is mostly effective to applied, but not fully 4 = Bridge BMP is in full compliance

									95.300a1	95.300a2	95.300a3	95300.a4	95.300a8	95.300d		
Survey Area	survey waypoint	Structure Type	Structure Material	Survey Date	Land Owner	Road Seg-ment	Longitude	Latitude	Install relief culvert on ap-proaches	One end of log bridge anchored	Earth embank-ment protected from erosion	Curbs and filter fabric installed on rock decked	Minimize disturban ce to bed and bank of stream	Does not encroach on anad-romous stream	AWC #	comments
Seldovia/ Port Graham	01D256	Bridge	Log	8/5/2014	English Bay Corp.	ENG0053	-151.61662	59.246108		4	4	2	2	4		Broken log in middle of bridge. Lots of road clearing slash in stream.
Seldovia/ Port Graham	01D259	Bridge	Log	8/5/2014	English Bay Corp.	ENG0053	-151.622375	59.248535		4	1	1	1			Non-anadromous
Seldovia/ Port Graham	01D261	Bridge (Modular)	Structural steel plate	8/5/2014	English Bay Corp.	ENG0053	-151.636955	59.25273		4	4		3	4	242-32-10170	Steel bridge in good condition, over log abutments.
Seldovia/ Port Graham	01D254	Bridge	Log	8/5/2014	Port Graham Corp.	ENG0001	-151.602488	59.241312		4	1	3	2	2	242-32-10170-2024	Log stringer bridge. Rotten stringers. In AWC.
Seldovia/ Port Graham	01D284	Bridge (Modular)	Steel (Bridge)	8/6/2014	Port Graham Corp.	PGC0112	-151.652301	59.279265		4	4	4	4	4	241-20-10550-2024	Big R bridge in good condition. Large root wad stuck underneath structure.
Seldovia/ Port Graham	01D287	Bridge	Log	8/6/2014	Port Graham Corp.	PGC0153	-151.648317	59.281365		4	4	4	4	4		Old log stringer bridge in good shape.
Seldovia/ Port Graham	01D252	Bridge	Rail Car	8/5/2014	English Bay Corp.	ENG0055	-151.580315	59.231061		4	3		2	3	242-32-10170	Rail car bridge over an old log stringer bridge. Railroad ties over railcar over log stringer bridge. Lots of spawners below consisting of pinks and chums. Bridge is rotten but not impeding stream. AWC.
Seldovia/ Port Graham	01D296	Bridge (Modular)	Steel (Bridge)	8/6/2014	Port Graham Corp.	PGC0001	-151.666022	59.278967		4	4		4	4		
Seldovia/ Port Graham	01D326	Bridge (Modular)	Steel (Bridge)	8/7/2014	Port Graham Corp.	PGC0132	-151.724224	59.300476		4	4		4	4	241-20-10550	Big R in good shape.
Seldovia/ Port Graham	01D345	Bridge (Modular)	Structural steel plate	8/7/2014	Port Graham Corp.	PGC0118	-151.695458	59.295842		4	4		4	4	241-20-10550-2024	Big R in good shape.
Seldovia/ Port Graham	01D348	Bridge	Log	8/7/2014	Port Graham Corp.	PGC0158	-151.688553	59.296897		4	4		4	3	241-20-10550-2040	In AWC up to log stringer bridge. Found coho up to pond for addition to AWC. Wood is rotten and brow logs have moved.
Seldovia/ Port Graham	01D349	Bridge	Log	8/7/2014	Port Graham Corp.	PGC0159	-151.684678	59.299767		4	4	4	3	3	241-20-10550-2048	Brow log has been misplaced.
Seldovia/ Port Graham	01D352	Bridge	Steel (Bridge)	8/7/2014	Port Graham Corp.	PGC0001	-151.72855	59.299838	4	4	4		4	4	241-20-10550-2018	Hamiliton bridge in good shape.

During the two weeklong surveys, we examined 22 bridges on the forest road system, 16 of which were in excellent condition and rated well. All of the metal bridges were in good shape. All but one bridge crossed an anadromous stream. One BMP was never applicable on this system: installing relief culverts. This BMP is needed when you want to avoid ditch line water entering a stream. Six bridges, in yellow highlight will need further attention. They are all log stringer bridges, which have rotted out. We've found that the life of a log stringer bridge can vary from location to location. The problem wood structures are estimated to be between 15 and 30 years old.

IX. Bridge Remediation and Follow Up

The six log stringer bridges highlighted in Tables 10 and 11 will need to be pulled apart, with the material moved away from where it could reenter the stream. One structure, 1B157 on a stream 242-32-10160 has fallen into the stream and a log jam has developed upstream of the bridge (see map on Figure 11, photo on Figure 17). About 75 adult pink salmon were observed spawning near the bridge, according to the Habitat biologist.

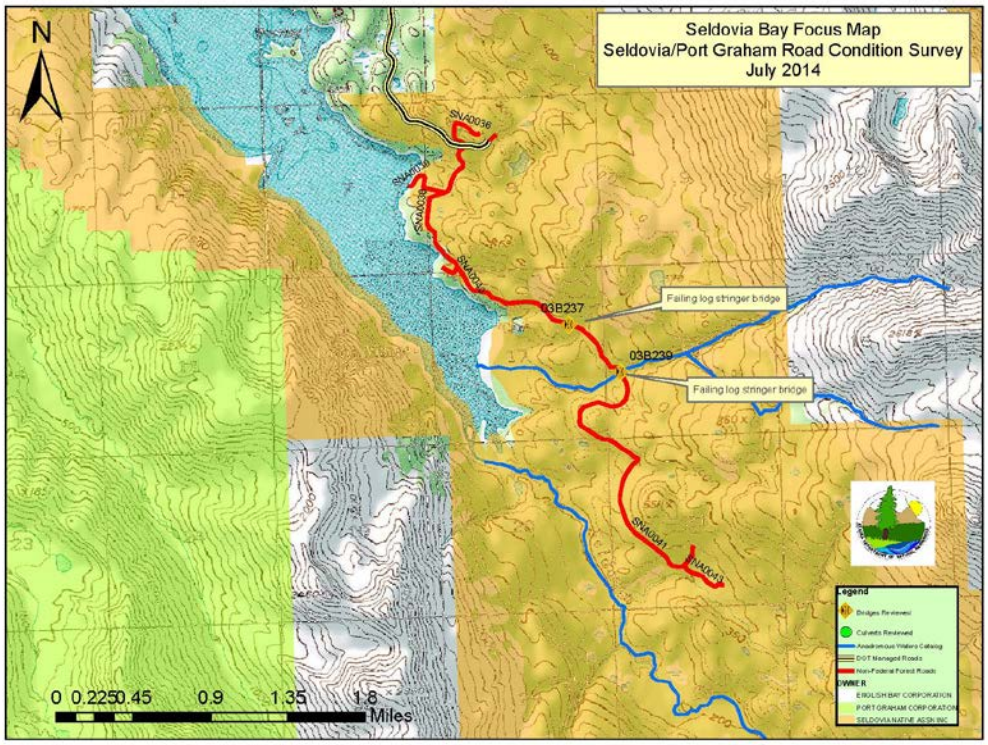

Figure 16. Map showing two failing log stringer bridges needing replacement or removal.

Figure 17. Collapsed log stringer bridge on Stream No. 242-32-10160 (Bridge 157 on Figure 11 map)

Figure 18. Failing log stringer bridge on Stream No. 241-11-10740 (Bridge 219 on Figure 10).

X. GIS Development

RCS GIS Products for the Kenai Peninsula Borough Forest Road System

As a result of this survey, an Esri Geodatabase was developed containing feature classes for the KPB forest road system and crossing structures points. The layout of the geodatabase is as follows:

ForestRds_RCS_KPB_20141231.gdb Forest Roads geodatabase for the KPB forest road system (date will reflect most current version).

1. **NonFed_ForestRds_20141231** Line Feature Class depicting the forest roads in the Kenai Peninsula Borough (see Table 12 for attributes).

2. **Culverts_20141231** Point Feature Class identifying culverts surveyed on the forest road system (see Table 13 for attributes).

3. **Bridges_20141231** Point Feature Class identifying bridges surveyed on the forest road system (see Table 14 for attributes).

Forest Roads GIS Feature Class (NonFed_ForestRds_20141231.shp)

The NonFed_ForestRds GIS feature class houses all the road data that was collected on the KPB RCS. The data structure is identical to the road feature class used by the DOF. This data is a comprehensive forest road inventory for the Kenai Peninsula Borough and is a subset of DOF's statewide forest road dataset.

Table 12. Forest Roads feature class attributes.

Attribute Field	Attribute Description	Domain
FID	Computer generated ID number.	
Area	DOF Area office.	SSEA = Southern SE Area Office
		NSEA = Northern SE Area Office
		KKA = Kenai/Kodiak Area Office
		MSA = Mat-Su Area Office
		VCRA = Valdez/Copper River Area Office
		TA = Tok Area Office
		DA = Delta Area Office
		FA = Fairbanks Area Office
		MCG = McGrath or Southwest Area Office
ROAD_NO	Road number if applicable or known.	
SEGMENT	Road segment number if known.	
ROAD_NAME	Road name if known.	
CLASS		Primary = Main arterial road
		Secondary = Secondary arterial connecte to a primary
		Spur = Connected to primary or secondary with dead end
RD_STATUS	Road Status as per FRPA.	Active = Forest road where log hauling is actively occuring
		Inactive = Forest road open to vehicle traffic but log hauling is not currently occuring
		Closed = Forest road now closed to vehicular traffic or crossing structures have been removed.
SEASON		All = All season road
		Summer = Summer use only
		Winter = Winter use, snow machine, snow road or ice road
ROADSEGLEN	Length of road segment in feet.	
FRPA	Does this pass FRPA inspection?	Pass = Yes
		Fail = No
		Unsafe = Use at your own risk
ADOT		Restricted = Restrictions by ADOT in place
		Unrestriced = No restrictions in place
OWN_TYPE	General ownership classification.	Federal
		State
		Private
		Municipal or Borough
		Alaska Native
		Mental Health Trust
		University
MANAGER	Responsible party for road maintenance	AHMT = Alaska Mental Health Trust, UNI = University of AK, USFW = U.S. Fish and Wildlife,
	and safety.	USFS = U.S. Forest Service, BLM = Bureau of Land Management, BIA = Bureau of Indian
		Affairs, NPS = National Park Service, DMLW = DNR-Division of Mining Land and Water,
		DOF = DNR-Division of Forestry, DPOR = DNR-Division of Parks and Outdoor Recreation,
		ADFG = Alaska Dept. of Fish and Game, Boro = Organized borough, Mun = Municipality,
		ADOA = Alaska Dept. of Administration, NV = Native village corporation, NR = Native regional corporation,
		PR = Private owner, DOT = AK Dept. of Transportation
OP_ID	ID number of FRPA forestry operation.	Each operation that's been rated on the ground receives an Operation ID number
		For the list of operation ID numbers, see PrjCode_Owner_Lookup.
MAINLINE	Is this a mainline road?	Y = Yes, N = No
RCSURVEY	Has a Road Condition Survey been performed.	Y = Yes, N = No
COMMENTS		
OWN_SEG_ID	Unique identifier for each road segment.	First three letters determine road ownership followed by a road number
SOURCE	How was this road mapped?	Options include GPS, satellite imagery, historic paper maps, etc..
Accessible	Comment field to describe impediments to accessibility.	
Access_Roa	What road is this road accessible from?	

GIS Feature Classes for culverts and bridges (Culverts_20141230.shp & Bridges_20241230.shp)

The culvert and bridge GIS feature classes were created to identify and manage the structures that were located during the RCS. See the tables below for the GIS attributes.

Table 13. Attribute table for culverts.

Attribute Field	Attribute Description	Units	Domain
projectCode	Every survey is represented by a project code.		
projectID	ID number for the project.		
survey	Waypoint survey ID # for the structure.		
surveyDate	Date of structure field review.	Date	
structureType	See lookup table for Structure Types.		
structureMaterial	See lookup table for Structure materials.		
culvertLength	Length of culvert.	Feet	
intletWidth	Diameter of culvert at inlet.	Feet	
outletWidth	Diameter of culvert at outlet.	Feet	
slopePercent	Gradient of structure.	Percent	
OutfallHeight	Height of culvert perch.	Feet	
forestPracticeCondition	Rating of structure condition and ability to pass fish.	BMP Rating	1-4 (4 is High)
LandOwnerCode	See lookup for land owner codes		
roadNo	Forest road number. First three letters represent landowner.		
AWCstreamNo	Stream # from Anadromous Waters Catalog.		
decDegLat	Latitude	Decimal degrees	
decDegLon	Longitude	Decimal degrees	
CMP25YRCAP	Culvert size capable of passing 25 year flood:	BMP Rating	1-4 (4 is High)
CMPMATCHCH	Culvert entrance and exit match natural course of stream channel:	BMP Rating	1-4 (4 is High)
CMPNOTPERC	Culvert is not perched on fish bearing waters:	BMP Rating	1-4 (4 is High)
CMPTERMNER	Culvert terminates on material not readily erodible:	BMP Rating	1-4 (4 is High)
CMPSLASHCL	Culvert cleared of mobile slash or debris from inlet to 50' upstream:	BMP Rating	1-4 (4 is High)
CMPADQCBAS	Adequate and appropriate catch basins and headwalls:	BMP Rating	1-4 (4 is High)
CMPPROPLEN	Culvert proper length to prevent blocking:	BMP Rating	1-4 (4 is High)
Comments			

Table 14. Attribute table for bridges.

Attribute Field	Attribute Description	Units	Domain
projectCode	Every survey is represented by a project code.		
projectID	ID number for the project.		
survey	Waypoint survey ID # for the structure.		
surveyDate	Date of structure field review.	Date	
structureType	See lookup table for Structure Types.		
structureMaterial	See lookup table for Structure materials.		
bridgeLength	Length of bridge.	Feet	
LandOwnerCode	See lookup for land owner codes		
roadNo	Forest road number. First three letters represent landowner.		
AWCstreamNo	Stream # from Anadromous Waters Catalog.		
decDegLat	Latitude	Decimal degrees	
decDegLon	Longitude	Decimal degrees	
BRGRELIEFD	Install required relief culvert on approaches:	BMP Rating	1-4 (4 is High)
BRGANCHORE	One end of log bridge anchored:	BMP Rating	1-4 (4 is High)
BRGEROSPRT	Earth embankment protected from erosion:	BMP Rating	1-4 (4 is High)
BRGCURBFAB	Curbs and filter fabric installed on rock decked bridge:	BMP Rating	1-4 (4 is High)
BRGMINDIST	Minimize disturbance to bed and bank of stream:	BMP Rating	1-4 (4 is High)
BRGNOENCRO	Does not encroach on anadromous stream:	BMP Rating	1-4 (4 is High)

Highlighted items are ratings which are part of the ADFG Fish Monitor Website. The ratings were collected during the field surveys.

Table 15. Look up table for crossing structure types and materials from Table 12 & 13.

structureMaterialID	structureMaterialCode	structureMaterial
1	SSP	Structural steel plate
2	SAP	Structural aluminum plate
3	CSP	Corrugated steel
4	CAP	Corrugated aluminum
5	WOD	Wood
7	CON	Reinforced concrete
8	CPP	Corrugated plastic
10	NCP	Non-corrugated metal
11	CMP	Corrugated Metal
12	SMP	Strutural Metal Plate
13	UNK	Unknown
14	RL	Rail Car
15	LOG	Log
16	STL	Steel (Bridge)

structureTypeID	structureTypeCode	structureType
1	CIR	Circular pipe
2	OVL	Oval
3	AO	Open-bottom arch
4	AR	Closed-bottom arch
5	BOX	Box culvert
6	PA	Pipe-arch
7	BR	Bridge
9	OT	Other
10	RM	Removed structure
11	FBO	Flat Bottom Oval Pipe
12	BRM	Bridge (Modular)
13	CUL	Culvert (Non-standard)

XI. ADFG Fish Passage Inventory Database

ADFG maintains a culvert and stream survey database that was developed to aid users in accessing culvert information and the AWC through an interactive mapping program. DOF has utilized this system to store and retrieve data and generate reports from the RCS. The system is available online, so users will be able to access the map viewer and navigate the road system, crossing structures and view the

feature attributes. Currently the forest roads are not yet available, although we are working with ADFG to make that available on the public view. The public site can be found here: http://www.adfg.alaska.gov/index.cfm?Habitat=fishpassage.mapping

At the time of this report, the website displays all culverts surveyed by ADFG. By summer 2015 the forest roads, culverts, bridges and their attributes that were surveyed during the RCS will be publicly visible.

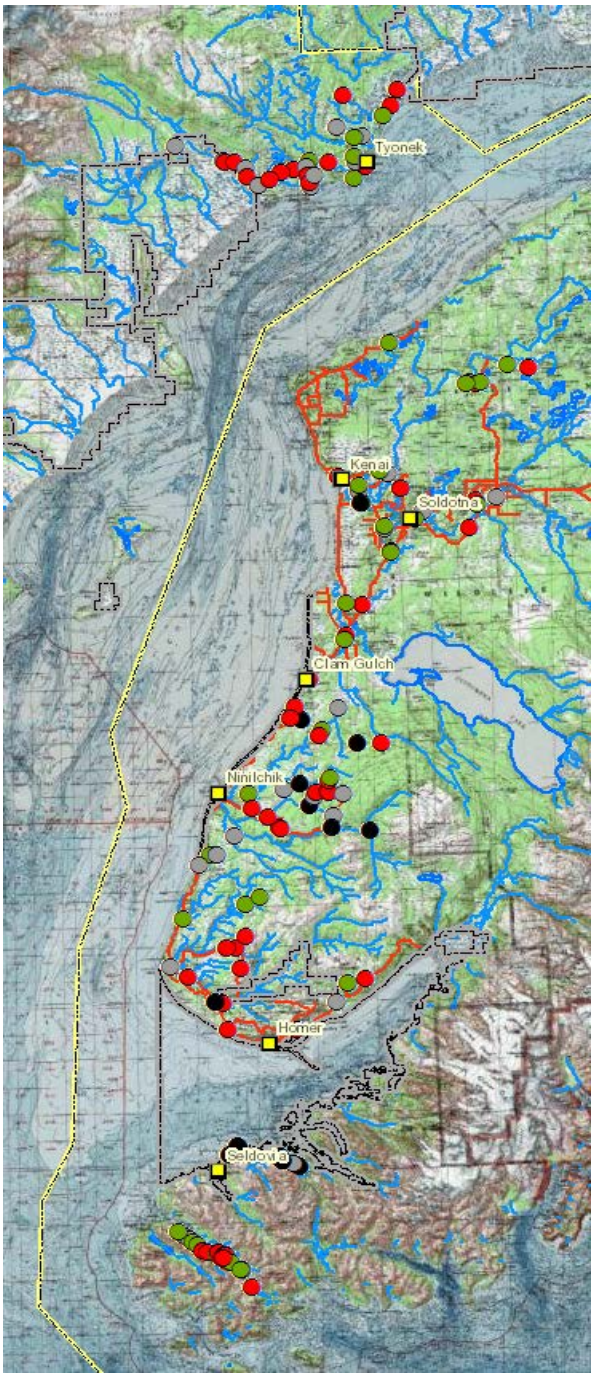

Figure 19. View of culverts and streams from ADFG Fish Resource Monitor website.

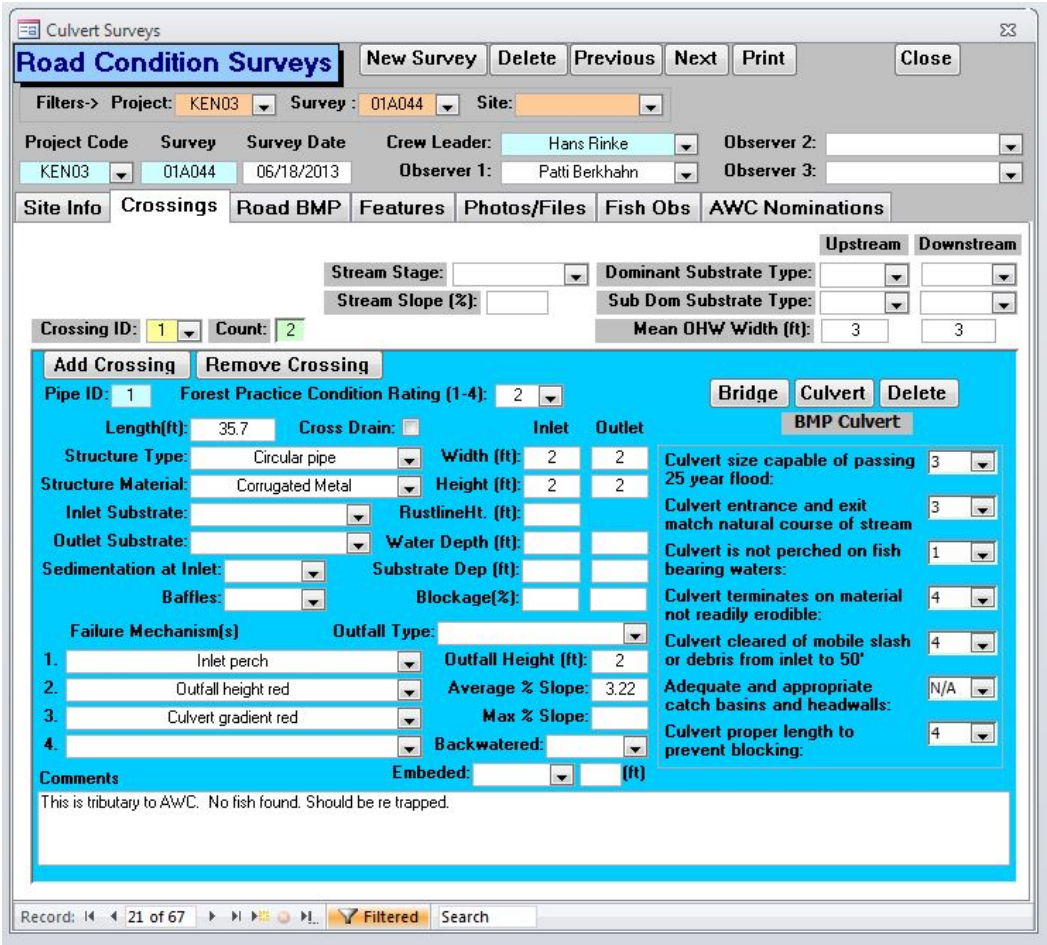

Figure 20. Crossing structure user interface from ADFG Fish Resource Monitor internal site.

XII. Acknowledgements

Field crew

Roy Josephson, Area Forester, Northern Southeast Area, DOF, Co-PI and field leader on Kenai Peninsula; Hans Rinke, Area Forester, Kenai/Kodiak Area, DOF, field leader on Kenai Peninsula and Port Graham surveys; John Winters, Resource Forester, DOF, field leader on Kenai Peninsula, Tyonek and Seldovia surveys; Virginia Litchfield, Habitat Biologist, ADFG, field biologist on Kenai Peninsula surveys; Patricia Berkhahn, Habitat Biologist, ADFG, field biologist on Kenai Peninsula and Port Graham surveys; William Frost, Habitat Biologist, ADFG, field biologist on Tyonek and Seldovia surveys; Jeanette Alas, Habitat Biologist, ADFG, field biologist on Tyonek survey; Gillian O'Doherty, Habitat Biologist, field biologist on Tyonek survey and advisor on culvert measurements, hydraulics, design and database development.

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Corporation and Cook Inlet Regional Corporation. Collectively, the ANSCA Corporation provided a great deal of local knowledge on their road systems and natural resource management history. Additionally they were instrumental in providing logistical suggestions and support.

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XIII. Appendices

Global Positioning System Units

For collections of feature data, stream data and locations of fish trapping, this project utilized "Mapping Grade" commercial GPS units. Only Garmin GPS units were used in these surveys.

The United States Geological Survey describes Mapping Grade as units available from commercial retailers and designed for recreation or general commercial use. The range in price up to $600 and are not designed for precise or extensive mapping and data collection. They are best for navigation to a location in the field or for simple coordinate determination of a point. These Mapping Grade GPS units are able to obtain coordinates with a horizontal (X, Y) accuracy of approximately 3 meters. The elevation (Z) accuracy is quite poor, however the Z value was not needed on these surveys.

Some websites and manufactures refer to Mapping Grade as resource grade. Both references are considered to be more precise than recreation grade (cell phones and low cost commercial brands) and less precise than survey grade, which will usually provide an accuracy of <= 1 meter. For more detail regarding GPS grades and their specifications, refer to the USGS website on GPS; water.usgs.gov/osw/gps/ .