

# KENAI MOUNTAINS TO SEA

**A Land Conservation Strategy  
to Sustain Our Way of Life on the Kenai Peninsula**



**Kachemak Heritage Land Trust  
Audubon Alaska  
Cook Inletkeeper  
Kenai Watershed Forum  
Pacific Coast Joint Venture  
U.S. Fish and Wildlife Service**

**February 2015 (updated Nov 2016)**

---

## EXECUTIVE SUMMARY

The 6 million-acre Kenai Peninsula is a spectacular place to call home. Much of our economy is based on the Kenai's abundant natural resources that support commercial, recreational and subsistence fishing, charter services for hunting and wildlife viewing, tourism and other derivative benefits. However, the downside of this natural bounty is that the Kenai is one of the fastest-growing and most visited areas in Alaska. Although almost three-fourths of the peninsula is managed in three Federal conservation units by the U.S. Forest Service, U.S. Fish and Wildlife Service and National Park Service, road and home building, groundwater withdrawal, logging practices, recreational activities, loss of salmon habitat and increasing human-wildlife conflicts fray at the ecological and cultural integrity of the peninsula. There is a need for a peninsula-wide land conservation strategy to sustain our way of life by promoting natural resource-based community assets. The *Kenai Mountains to Sea* partnership proposes to leverage existing land conservation by focusing on interjurisdictional anadromous stream corridors that pass from the Federal conservation estate through nonfederal lands (including private parcels) to reach the sea. Our goal is to build a broad-based partnership to support and strengthen long-standing and effective private-public partnerships dedicated to voluntarily conserving and enhancing fish and wildlife habitats for the continuing economic, recreational and cultural benefits to residents and visitors of the Kenai Peninsula Borough. Parcel acquisition by land trusts will be one of many tools considered for conservation and development of these corridors. We will also use less-than-fee-simple approaches such as voluntary compliance, perpetual easements, short-term agreements on private parcels as part of publicly-funded restoration projects, and land agreements/ exchanges with tribal and local governments.

Suggested citation: Morton, J.M., D.R. Magness, M. McCarty, D. Wigglesworth, R. Ruffner, M. Bernard, N. Walker, H. Fuller, S. Mauger, B. Bornemann, L. Fuller, M. Smith, and A. Borass. 2015. *Kenai Mountains to Sea: A Land Conservation Strategy to Sustain Our Way of Life on the Kenai Peninsula*. Kachemak Heritage Land Trust, Homer, AK. 82 pp.

# INSIDE

## Executive Summary

## A New Approach to Land Conservation

## The Strategy

## Defining Connectivity

## 20 Corridors to Ensure Mountains to Sea Connectivity into the Future

*Aialik Bay – Bear Glacier to Aialik Bay*

*Beaver Creek – Kenai Lowlands to Kenai Flats*

*Crooked Creek – Caribou Hills to Kasilof River*

*Deep Creek (North Fork) – Caribou Hills to Cook Inlet*

*Fox River – Tustumena country to Kachemak Bay*

*Funny River – Tustumena Benchlands to Kenai River*

*Harding-Gateway – Nunataks to Resurrection Bay*

*Harris Bay – Harding Icefield to Paguna Bay*

*Kasilof River – Andrew Simons Wilderness to the Sea*

*Kenai River – Harding and Sargent Icefields to Cook Inlet*

*Killey River – Harding Icefield to the Kenai River*

*Moose River – Southern Kenai Lowlands to the Kenai River*

*Nuka Bay (3 streams) – Harding Icefield and Wosnesenski-Grewingk Glacier complex to Nuka Bay*

*Otter Creek – Coastal Kenai Lowlands to Cook Inlet*

*Resurrection Creek – Resurrection Pass to Turnagain Arm*

*Resurrection River – Harding Icefield to Resurrection Bay*

*Seven Egg Creek – Northern Kenai Lowlands to Cook Inlet*

*Sheep Creek – Harding Icefield to Kachemak Bay*

*Sixmile Creek – Johnson Pass to Turnagain Arm*

*Swanson River – Interior Kenai Lowlands to Cook Inlet*

## Kenai Decision Support Tool

## Cross-walking Corridors

## A NEW APPROACH TO LAND CONSERVATION

The nearly 6 million-acre Kenai Peninsula in south-central Alaska is widely recognized as a great place to live and visit. George Shiras III, a famous nature photographer for the National Geographic Society, wrote at the turn of the last century that “were all of Alaska erased from the map except the Kenai Peninsula and its immediately adjacent waters, there would yet remain in duplicate that which constitutes the more unique and that which typifies the whole of this wonderful country”.

To protect this exceptional landscape, Congress established predecessors to the current Chugach National Forest in 1907, Kenai National Wildlife Refuge in 1941, and Kenai Fjords National Park in 1978. When the boundaries of the three units were redrawn by the Alaska National Interest Lands Conservation Act in 1980, the 1.7 million acres outside the Federal conservation units were parsed into its current ownership by the State of Alaska, Kenai Peninsula Borough, tribal entities and municipalities, including almost 56,000 parcels in private hands (Table 1).

**Table 1. Ownership and assessed value of the 6 million-acre Kenai Peninsula.**

<b>Ownership</b>	<b>#Parcels</b>	<b>Total Acreage</b>	<b>Assessed Value (2013)</b>
BOROUGH	1,029	62,218	\$ 815,695,700
FEDERAL	530	3,783,844	\$ 1,999,335,800
MUNICIPAL	986	17,686	\$ 433,280,800
NATIVE	1,438	481,687	\$ 356,419,600
NATIVE ALLOTMENT	210	10,810	\$ 25,484,600
PRIVATE	55,844	239,759	\$ 6,601,914,100
STATE	2,296	919,098	\$ 1,047,767,200
<b>Grand Total</b>	<b>62,333</b>	<b>5,515,101</b>	<b>\$ 11,279,897,800</b>

With a population exceeding 56,000 and a growth rate averaging 2.2% per year, 1,000 new residents move to the Kenai Peninsula Borough annually, translating into 1.5 new housing units each day. Road and home building, groundwater withdrawal, logging practices, recreational activities, loss of salmon habitat and increasing human-wildlife conflicts fray at the ecological and cultural integrity of the peninsula.

That almost three quarters of the Kenai Peninsula is protected within three Federal land management units does not accurately reflect the vulnerability of its watersheds to degradation by human activities. Most headwaters on the Kenai Peninsula are within Federally-managed lands – glacial waters originate in the Harding Icefield, Wosnesenski-Grewingk Glacier complex, and the Sargent Icefield; and nonglacial waters originate in the Kenai Lowlands, Tustumena Benchlands, and Caribou Hills. However, the boundary of Federal conservation lands does not extend to the ocean everywhere. In particular, the 175-mile urban interface that extends along the Kenai National Wildlife Refuge from Point Possession in the north to the Fox River Valley in the south ensures that the waters of almost every anadromous stream that originates on the western Kenai Peninsula must pass through a gauntlet of homes, boat launches, eroded banks and urban runoff en route to the sea. The divergence of the Sterling Highway to the south, and the Spur Highway and Kenai North Road Extension to the north, mean that most streams and rivers pass under a high-volume paved road as well. Road crossings and invasive species have found their way into many of the 99 watersheds on the Kenai Peninsula with anadromous streams: 44 have culverts, 26 have reed canary grass, nine have northern pike, and two have Elodea.

The Kenai Peninsula is also warming and drying rapidly in response to contemporary climate change, and its effects do not recognize jurisdictional boundaries. Over the past 50 years, treeline in the Kenai Mountains has risen 50 meters, wetlands in the Kenai Lowlands have decreased 6—11% per decade, the Harding Icefield has shrunk 5% in surface area and 21 meters in elevation, and available water has declined by 55%. Late summer canopy fires in spruce are being replaced by spring fires in bluejoint grasslands, and a 2005 wildfire in mountain hemlock was outside historic fire regimes. These observations support climate-envelope models that forecast continued deforestation of what was Lutz spruce in the southern Kenai Peninsula, and afforestation of alpine tundra in the Kenai Mountains, through at least this century. In addition, summer stream temperatures are reaching sub-lethal levels for salmon in many non-glacial streams, and increased sediment loads in glacial streams are reducing weights of sockeye salmon fry.

The *Kenai Mountains to Sea* partnership seeks to sustain our local natural resource-based economies by minimizing the impacts of a rapidly warming and developing landscape. It is precisely because the Kenai Peninsula is changing so dramatically that this partnership has focused on the role of riparian corridors as enduring components on the landscape that will continue to provide connectivity for salmon, marine-derived nutrients, wildlife movement, and plant dispersal through thick and thin. Stream-based corridors maintain connectivity between the freshwater headwaters high in the Kenai Mountains and Caribou Hills, and their salty mouths in the Cook Inlet and Gulf of Alaska. The *Kenai Mountains to Sea* partnership will work to ensure the maintenance of that connectivity into the future, working with willing landowners, agencies and tribal entities in a non-regulatory context.

## THE STRATEGY

Envision a landscape of connected private and public lands to sustain our way of life on the Kenai Peninsula. Anadromous streams are our target because they have great intrinsic ecological, economic and cultural values. Additionally, streams and their vegetated riparian edge tend to be natural movement corridors for wildlife and dispersal routes for both native and invasive plants. Importantly, stream corridors have more persistence on the landscape than existing vegetation which will change in response to a warming climate, ecological processes, succession and human use. Other things being equal, conserving anadromous riparian corridors is smart — they save salmon; transport marine-derived nutrients; maintain hydrology; provide contiguous and linear green infrastructure for recreation and access, cultural resource protection, plant dispersal and wildlife movement; connect existing protected areas; and, in a world of rapidly changing vegetation due to a warming climate, are a smart bet (Figure 1).

Most anadromous streams on the Kenai Peninsula are completely or partially protected by Kenai National Wildlife Refuge, Chugach National Forest and Kenai Fjords National Park. Of 386 anadromous stream outlets representing 1,800 miles, 212 (55%) are already conserved within Federal lands. However, many of these streams are small glacial, steep-sloped streams representing only 271 miles in total. In contrast, 152 streams (39%) are completely on private lands representing 561 miles. While only 22 outlets are on interjurisdictional streams (*i.e.*, flow from Federal lands through non-federal lands to the sea), these represent 968 miles or 54% of stream miles peninsula-wide. Five of the streams selected are actually tributaries of the Kenai and Kasilof Rivers, but are considered because they are large enough in their own right to be considered landscape features and the two rivers to which they connect are large enough that at least their stream flow (and connectivity to the sea) is not likely to be compromised. Further, the three small interjurisdictional streams flowing into Nuka Bay were treated

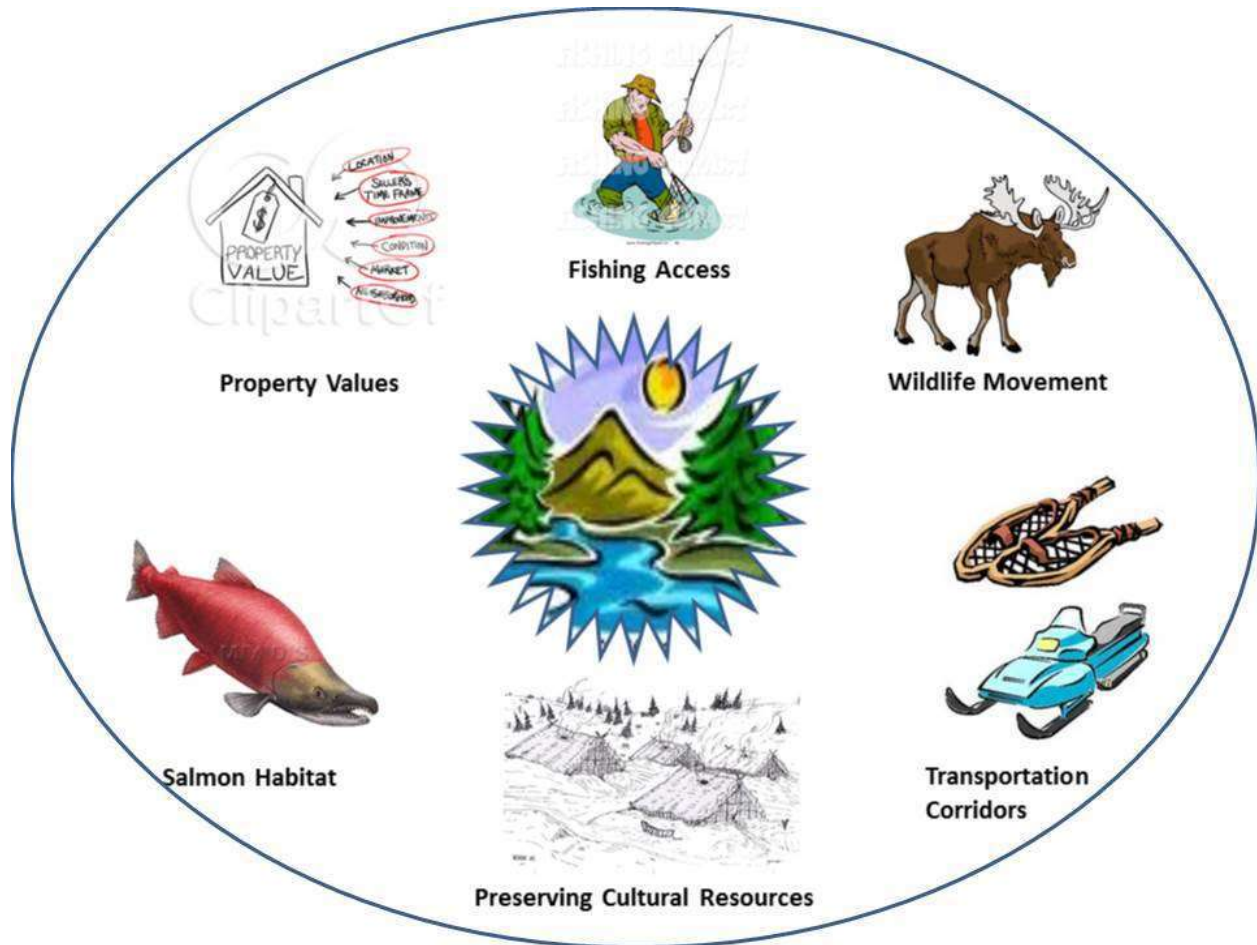


Figure 1. Mountain-to-sea corridors, as contiguous green infrastructure, are a means to promote and sustain natural resource-based community assets that may be different in rural versus urban settings.

as one corridor. The Kenai Mountains to Sea conservation strategy targets these 20 interjurisdictional stream corridors as they are the biggest bang for the buck, leveraging existing but only partial protection within Federal conservation units. These corridors comprise less than 5% of more than 60,000 parcels on the Kenai Peninsula, of which less than 10,700 acres are in private ownership.

Our goal is to build a broad-based partnership to support and strengthen long-standing and effective private-public partnerships dedicated to voluntarily conserving and enhancing fish and wildlife habitats for the continuing economic, recreational, and cultural benefits to residents and visitors of the Kenai Peninsula Borough. Parcel acquisition by land trusts will be one of many tools considered for conservation and development of these corridors. We will also use less-than-fee-simple approaches such as voluntary compliance, perpetual easements, short-term agreements on private parcels as part of publicly-funded restoration projects, and land agreements/ exchanges with tribal and local governments. Using a collective conservation effort, each mile of corridor treated on private land will ultimately leverage 3 miles of anadromous streams on federal lands.

## DEFINING CONNECTIVITY

There is no magic formula for ensuring connectivity. Recommended corridor widths depend, in part, on the design objectives: for which species, for which purpose (migration, movement, seed dispersal, hydrologic function) or perhaps simply as contiguous green infrastructure used for bike and foot trails, or to buffer sounds emanating from the urban interface. There are also site-specific variables that make a hard and fast rule for corridor width unrealistic. For example, streams that have a wetland edge, as many do in the Kenai Lowlands, may need a corridor width that encompasses adjacent forest to ensure its use by some wildlife. Also, it may not be critical to ensure that both sides of a riparian corridor are equally conserved for the purposes of facilitating wildlife movement. Lastly, in an urbanizing landscape that may already be highly fragmented (as on the Kenai River), it may be too expensive and too controversial to realistically consider restoration to a pre-determined buffer.

We find it useful to consider defining (and monitoring) connectivity at three spatial scales:

- 1) The first is at a width to ensure minimum hydrological function (allow for groundwater flow, buffering of surface runoff, minimize bank erosion and maintenance of riparian vegetation). The 50-foot setback for future development on both sides of State-listed anadromous streams, defined by the Kenai Peninsula Borough, is an appropriate metric which can be remotely monitored with high resolution aerial photography.
- 2) 400 meters (1/4 mile) is an appropriate and reasonable width to ensure wildlife movement of even the largest mammals (bears, moose) and seed dispersal. However, unlike the previous metric, 400 meters is inclusive of both banks. For example, this metric would allow 200 m on both sides of the stream or 400 m on one side only (with the 50-foot setback still enacted on both sides), and can be monitored with aerial photography or satellite imagery.
- 3) At its greatest width, a corridor ensures all ecosystem services associated with a riparian corridor are maintained, even subsidizing adjacent agricultural productivity in altered systems. Riparian ecosystems are known to be generally higher in species richness and higher in soil productivity, partly because of the allochthonous energy carried down the river but also, in an anadromous system, because of the marine-derived nutrients carried up rivers by returning salmonids and dispersed away from streams by bears, eagles, and other predators and scavengers as much as 500 meters (i.e., 1 km corridor width). This is an amorphous corridor width, perhaps best determined and monitored by analyzing riparian vegetation uptake of marine-derived nutrients using stable isotopes.

Table 2. Conservation of these 20 anadromous stream corridors, whose headwaters are already protected within Federal conservation units, would ensure that 55% of total stream miles on the Kenai Peninsula reach the sea.

Name	Miles Outside Federal Lands	River Miles Inside Federal Lands	Total River Miles	Anadromous River Miles	Watershed Acres
Aialik Bay (unnamed)	0.4	1.9	2.3	1.0	1,580
Beaver Creek	4.0	17.9	21.8	20.1	39,500
Crooked Creek	16.8	29.2	45.9	31.6	35,141
Deep Creek (North Fork)	34.3	16.7	51.0	34.8	138,528
Fox River	10.3	106.8	117.1	47.5	102,443
Funny River	4.5	62.4	67	17.5	95,012
Harding Gateway (unnamed)	3.8	19.7	23.5	7.1	69,992
Harris Bay (unnamed)	2.0	0.3	2.3	2.1	11,714
Kasilof River	14.0	307.8	321.8	104.9	527,324
Kenai River	48	471.6	519.6	127.8	1,380,758
Killey River	2.7	198.4	201.1	60.5	150,112
Moose River	2.2	135	137.2	65.5	145,750
Nuka Bay (Ferrum Creek)	1.5	3.7	5.2	2.7	9,821
Nuka Bay (unnamed 1)	0.4	8.2	8.7	1.6	30,759
Nuka Bay (unnamed 2)	0.7	6.4	7.1	1.1	
Otter Creek	3.3	4.3	7.6	5.4	26,146
Resurrection Creek	0.5	198	198.5	22.4	108,165
Resurrection River	6.2	145.3	151.5	46	141,729
Seven Egg Creek	4.7	8.1	12.8	6.0	23,300
Sheep Creek	8.2	56.1	64.3	22.2	83,746
Sixmile Creek	10.2	194.6	204.8	40.3	168,512
Swanson River	1.4	106.1	107.5	88.5	182,014



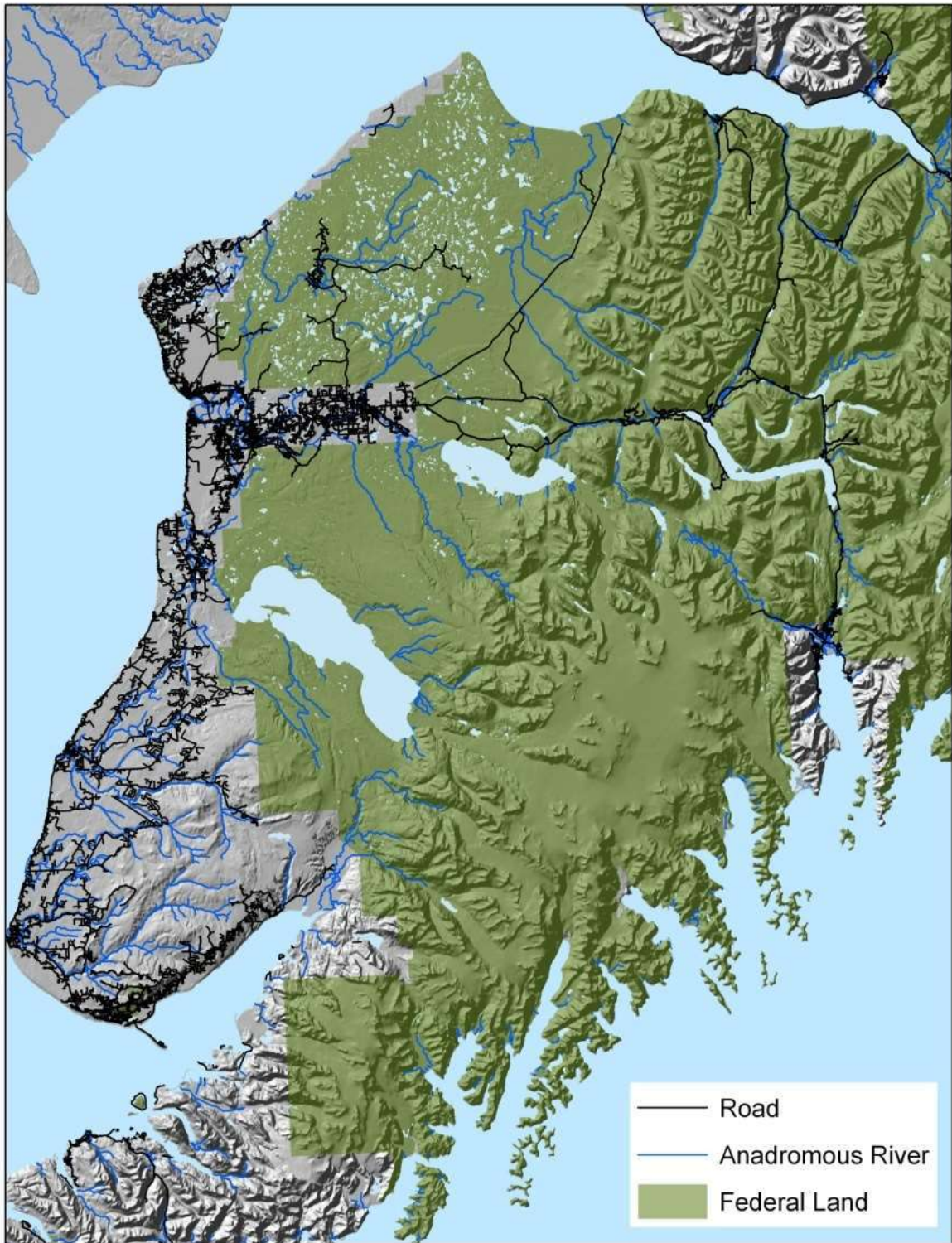


Figure 2. The existing road network puts many glacial and non-glacial anadromous streams on the Kenai Peninsula at risk. Despite the headwater of most streams being protected within three Federal conservation units, many streams must pass through private lands and under roads to reach the sea.

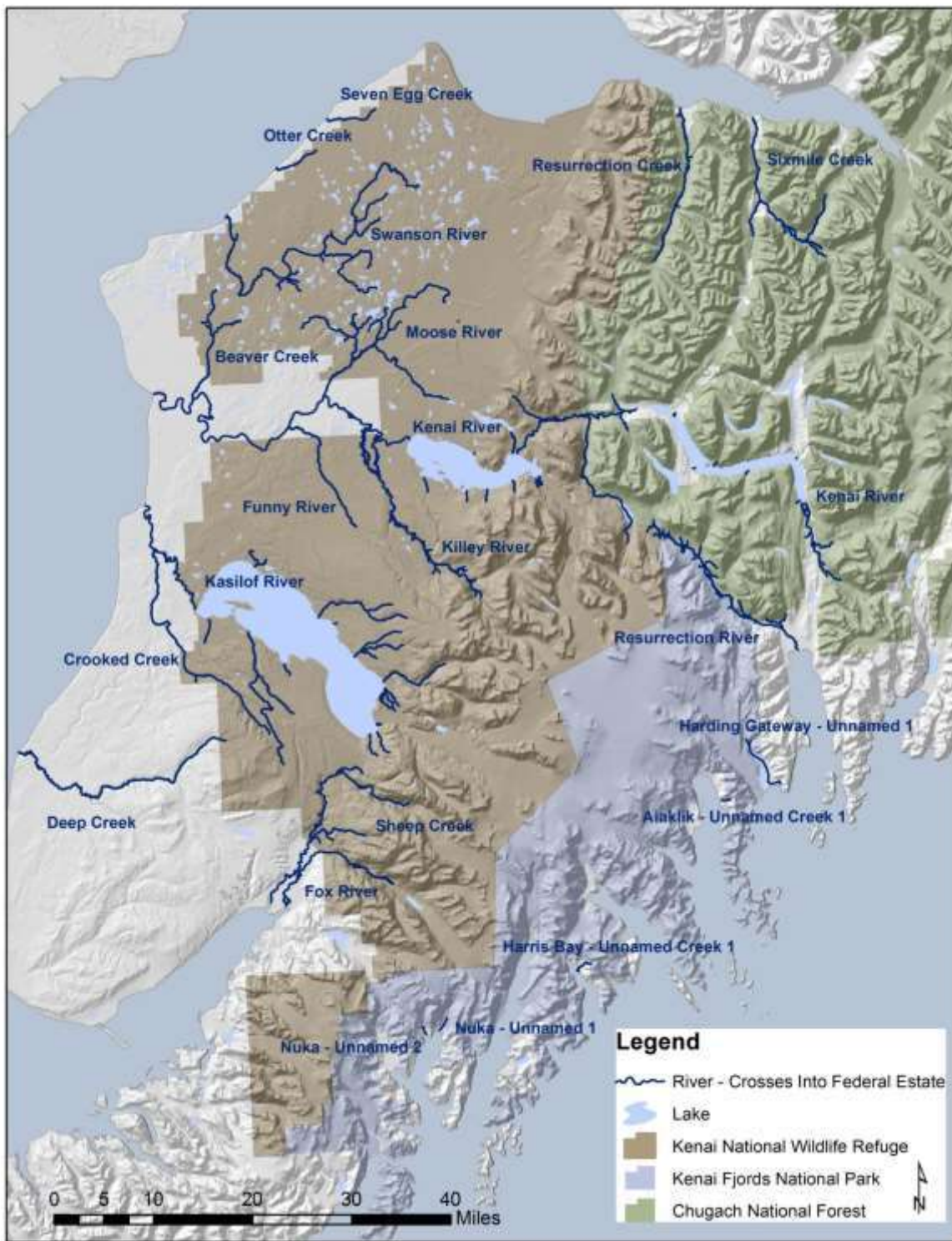


Figure 3. Of 206 named anadromous streams on the Kenai Peninsula, 141 are completely, and 20 are partially, within the three Federal conservation units. Only 45 anadromous streams flow completely outside Federal lands.

**TWENTY CORRIDORS TO ENSURE  
MOUNTAINS TO SEA CONNECTIVITY  
INTO THE FUTURE**



## Aialik Bay (unnamed stream)

### Assets

This unnamed stream drains a 1,580-acre watershed, flowing south and west for 2.3 miles from its headwaters in Kenai Fjords National Park to its mouth on the western side of Aialik Bay. Its waters are likely glacial, although it appears to originate in mostly remnant snow fields on the high (>3000' high) ridge between Bear and Aialik Glaciers, both of which are receding, tidewater glaciers. The lower 1 mile of this stream is listed by the State as supporting chum and pink salmon populations. Aialak Bay is the site of a historic Alutiiq house, indicative of Alutiiq and Russian trade.

### Vulnerabilities

The lower 0.4 miles of this stream flows out of the Kenai Fjords National Park, through one parcel owned by the Port Graham Corporation. This single parcel totals 2,242 acres and is assessed at \$1,408,000 with no improvements.

### Unique Opportunities for Conservation

Most of Aialik Bay is surrounded by Kenai Fjords National Parks. Within the bay, there are several island rookeries managed by Alaska Maritime National Wildlife Refuge. There is an opportunity here to work with the Port Graham Corporation to ensure that the lower stream and its mouth are not developed.



Figure 4. Looking eastward up the watershed of the unnamed stream into Kenai Fjords National Park. In the foreground is Aialik Bay. In the background is Resurrection Bay on the right and the glacial lake formed by meltwater from Bear Glacier on the left.



Figure 5. This 2.3-mile unnamed glacial stream flows from Kenai Fjords National Park to Aialik Bay, and supports pink and chum salmon.



Figure 6. The lower 0.4 miles of the stream flows through a single parcel owned by the Port Graham Corporation.

## Beaver Creek

### Assets

The nonglacial 21.8-mile Beaver Creek drains a 39,500 acre watershed in the Kenai Lowlands, of which 9,072 acres are wetlands. The western branch originates in Ootka and Ermine Lakes and the eastern branch in Beaver Lake; both flow southwards for about 18 miles through a mosaic of spruce-hardwood forest and extensive peatlands in Kenai National Wildlife Refuge. The lower 4 miles are outside Federal lands, eventually flowing into the Kenai River at RM 10.4. Almost 18 miles of Beaver Creek is designated a State-listed anadromous stream with sockeye salmon and Dolly Varden, and habitats for spawning coho and king salmon. Beaver Creek is well known as a travel corridor for brown bears and the Kenai Lowland caribou herd; the latter, in particular, use it to reach calving grounds on the Kenai Flats and near the Kenai Airport. The mouth of Beaver Creek has extensive Dena'ina houses and, in fact, the creek is part of the winter trail from Kenai to Gene Lake in the Swanson River watershed.

### Vulnerabilities

Although much of Beaver Creek is within the Kenai National Wildlife Refuge, there are several transportation and utility right-of-ways that cross it. The east-west pipeline between the Swanson River Field and community of Nikiski passes through the northern extreme of the watershed. Marathon Road, which carries industrial traffic from the City of Kenai to the Beaver Creek Unit (leased within the Kenai National Wildlife Refuge), crosses at least three tributaries of Beaver Creek. The Nikiski Emergency Escape Route transects from northwest to southeast across the middle section of Beaver Creek. Outside of the Kenai National Wildlife Refuge, Beaver Creek flows under the Kenai Spur Highway (just below the Snowshoe Gun Club shooting range) and between two subdivisions as it approaches a braided delta on the north bank of the Kenai River. Many houses on the south side of Beaver Loop Road maintain private boat access to lower Beaver Creek. In summer 2014, the Kenai Watershed Forum replaced a culvert on Beaver Loop Road through which a small tributary of Beaver Creek flows that supports sockeye and coho salmon. Reed canarygrass is also well established in lower Beaver Creek.

Land values exceed \$68 million because of the high cost of the Kenai River parcels. Parcels that have Beaver Creek running through them total \$3.5 million. The parcels beyond Beaver Creek include the high value parcels where Beaver Creek flows into the Kenai River. Improvement values for all parcels are \$30,145,400 with \$19.25 million in improvements on Kenai River parcels, \$8.7 million mostly for the confluence parcels, and \$2.2 million on parcels on Beaver Creek.

### Unique Opportunities for Conservation

The undeveloped riparian corridor along Beaver Creek is already an important migration corridor for the Kenai Lowland caribou herd. As these animals navigate domestic dogs and vehicles to reach their calving grounds, they tend to move along the interface between the Kenai National Wildlife Refuge and the surrounding urbanizing landscape. Beaver Creek is the last contiguous green belt north of the Kenai River leading into the Kenai Flats (see more discussion under Kenai River).

North of the Kenai Spur Highway, Beaver Creek flows through six private parcels (valued at \$331,400). South of the Kenai Spur Highway, most of the surrounding landscape is already too parcelized to consider restoring a wider corridor. Fortunately, the east side of Beaver Creek as it approaches the Kenai River is primarily municipal and State lands, with only three private parcels (valued at \$401,900). There may be opportunities to protect and restore historic Dena'ina homes. There is a clear opportunity to apply multiple conservation tools to ensure conservation of a wide buffer along at least one side of

Beaver Creek between the boundary of the Kenai National Wildlife Refuge and the Kenai River, including replacement of the culvert under the Kenai Spur Highway with a bridge high enough to allow wildlife passage.

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
MUNICIPAL	34	1,922	1.2	\$ 7,632,000
PRIVATE	191	978	1.9	\$ 55,128,900
STATE	12	1,614	0.2	\$ 5,360,600
<b>Grand Total</b>	<b>237</b>	<b>4,514</b>	<b>3.3</b>	<b>\$ 68,121,500</b>
<b>Parcels on Creek</b>				
MUNICIPAL	6	160	1.2	\$ 135,800
PRIVATE	20	342	1.9	\$ 3,314,400
STATE	2	34	0.2	\$ 72,400
	<b>28</b>	<b>536</b>	<b>3.3</b>	<b>\$ 3,522,600</b>
<b>Parcels Beyond Creek</b>				
MUNICIPAL	3	13	0	\$ 1,356,100
PRIVATE	44	139.72	0	\$ 11,820,600
STATE	1	93.13	0	\$ 144,800
	<b>48</b>	<b>246</b>	<b>0</b>	<b>\$ 13,321,500</b>
<b>Parcels on Kenai River</b>				
MUNICIPAL	25	1,749	0	\$ 6,140,100
PRIVATE	127	497	0	\$ 39,993,900
STATE	9	1,486	0	\$ 5,143,400
	<b>161</b>	<b>3,732</b>	<b>0</b>	<b>\$ 51,277,400</b>





Figure 8. Looking southward down Beaver Creek as it passes under the Kenai Spur Highway and between two subdivisions enroute to the Kenai River. This is a major migration corridor for the Kenai Lowland caribou herd.



Figure 7. Looking northward up Beaver Creek towards commercial oil and gas leases within the Kenai National Wildlife Refuge. The Snowshoe Gun Club firing range is in the foreground on the left.



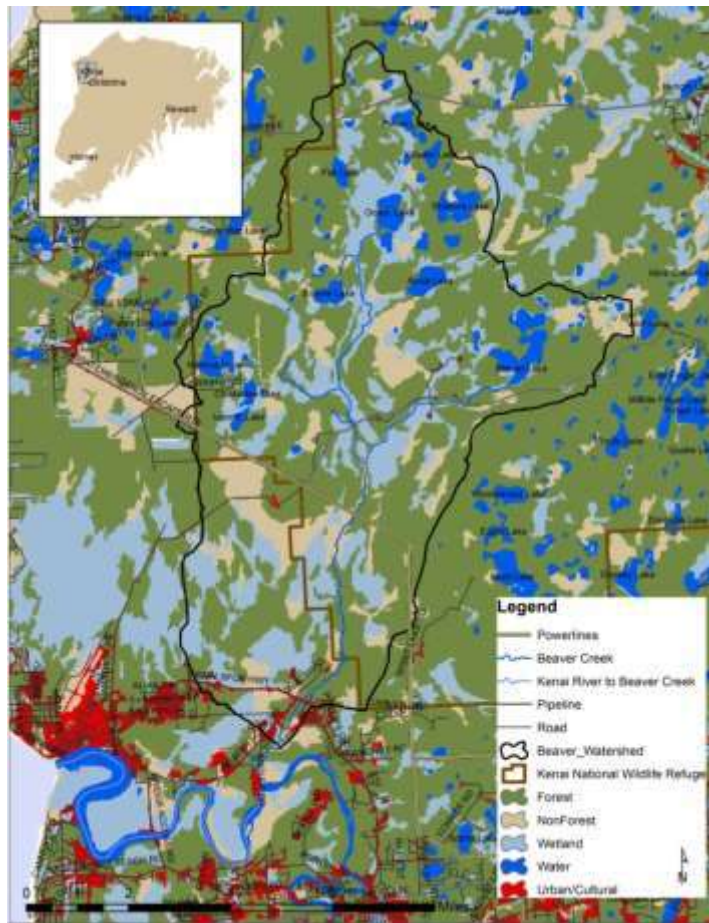


Figure 10. The nonglacial 21.8-mile Beaver Creek drains a 39,500 acre watershed in the Kenai Lowlands, of which 9,072 acres are wetlands.

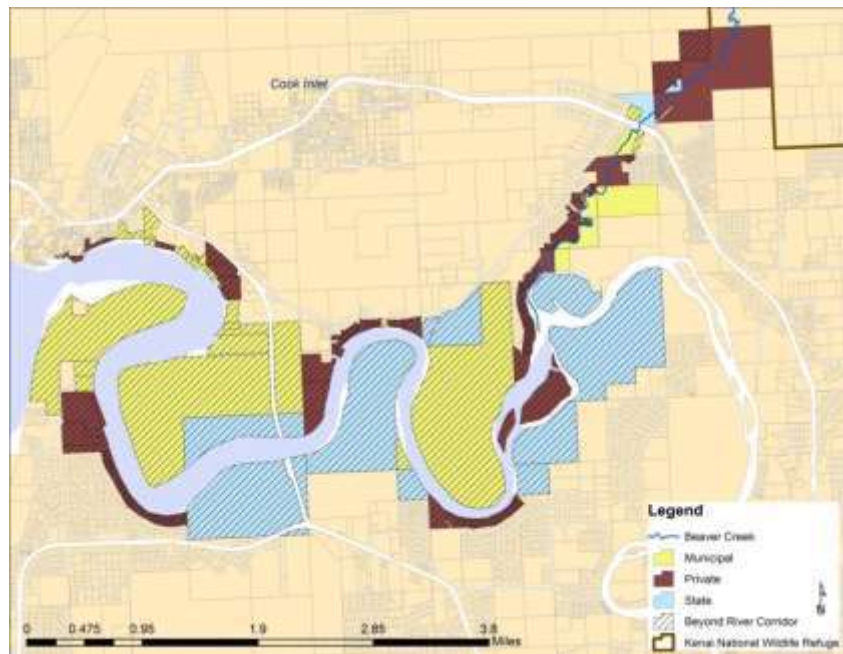


Figure 9. Potential development of nine private parcels on the east side of Beaver Creek make this wildlife movement corridor between the Kenai National Wildlife Refuge and the Kenai Flats vulnerable.

## Crooked Creek

### Assets

Crooked Creek is a 46 mile-long nonglacial stream that flows northwest from about 1,500' elevation in the northern Caribou Hills to RM 6.5 of the Kasilof River. The upper 29 miles are within Congressionally-designated Wilderness of the Kenai National Wildlife Refuge. The lower 31.6 miles are designated as a State-listed anadromous stream with steelhead, Dolly Varden, pink salmon, and Pacific lamprey, and spawning coho, king, and sockeye salmon. Crooked Creek supports the majority of king salmon production in the Kasilof River watershed due to the Crooked Creek Hatchery operated by the Alaska Department of Fish & Game. The steelhead fishery was also once enhanced by the Alaska Department of Fish & Game but that program was discontinued in 1992. The Crooked Creek watershed is 35,141 acres and much of the lower 16.8 miles that is outside the Federal conservation unit is surrounded by riparian wetlands. The stream flows through Johnson Lake State Recreation Site, popular for camping by both residents and tourists, and the mouth is protected within Crooked Creek State Recreation Area, a recreational area with high visitation during the angling season. One of the largest historic site complexes on the Kenai Peninsula occurs in the Crooked Creek-Coal Creek area of the Kasilof River, with at least 50 houses of both the Riverine (1000 BC to AD 1000) and Dena'ina (post AD 1000); many of these are on private properties.

### Vulnerabilities

The lands adjacent to lower Crooked Creek are highly parcelized, with 59 privately-held lots in at least three distinct subdivisions: at the end of Crooked Creek Road (off Tustumena Lake Road), near the intersection of Cohoe Loop Road and the Sterling Highway (adjacent to Johnson Lake State Recreation Site), and near the mouth between two parcels that form Crooked Creek State Recreation Area. Crooked Creek crosses at least four roads used to access these subdivisions, as well as the Sterling Highway at MP 110.5. There are \$15,709,500 in improvements on the Kasilof and Crooked Creek parcels. About \$9.5 million are on Kasilof parcels and \$6 million on Crooked Creek parcels. 3,200 acres are wetlands.

### Unique Opportunities for Conservation

Most of the surrounding landscape on the lower Crooked Creek is already too parcelized to consider restoring a wider corridor through fee-simple land acquisition. However, as many of the parcels are undeveloped, there are still opportunities to entice conservation through long-term leases, programs such as the Partners for Fish and Wildlife, and through dedicated outreach to seek voluntary compliance. The Kenai Watershed Forum has identified the two culverts at MP 110.5 of the Sterling Highway as a high priority for replacement as they are currently undersized and perched such that the movement of almost all juvenile salmon is likely inhibited; there is an opportunity here to ensure that the replacement culvert (or perhaps a bridge) design considers wildlife movement and not just stream passage.

The middle Crooked Creek from where it leaves the Kenai National Wildlife Refuge to the first subdivision at the end of Crooked Creek Road is currently owned as nine large parcels primarily by the Alaska Department of Natural Resource, but also the University of Alaska and Cook Inlet Region, Inc. There are clearly opportunities for land acquisition, but also for conservation easements along the river corridor. An additional conservation strategy is to ensure connectivity between the mouth of Crooked Creek and the southernmost boundary of the Refuge along its southern bank. This would ensure that wildlife, particularly bears, following either river corridor have an exit strategy.

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
BOROUGH	5	138	0	\$ 247,500
FEDERAL	1	55	0	\$ 400,000
NATIVE	5	5,812	3	\$ 2,293,200
PRIVATE	175	1,192	3.8	\$ 26,892,700
STATE	45	9,949	10.1	\$ 7,559,800
<b>Grand Total</b>	<b>231</b>	<b>17,146</b>	<b>16.5</b>	<b>\$ 37,393,200</b>
<b>Parcels on Creek</b>				
NATIVE	3	4,418	2.6	\$ 1,815,400
PRIVATE	59	338	3.8	\$ 5,308,800
STATE	14	8,417	10.1	\$ 3,597,200
	<b>76</b>	<b>13,173</b>	<b>16.5</b>	<b>\$ 10,721,400</b>
<b>Parcels Beyond Creek</b>				
NATIVE	2	1394.21	0	477800
PRIVATE	32	103.03	0	2661400
STATE	3	343.66	0	\$ 319,700
	<b>37</b>	<b>1840.9</b>	<b>0</b>	<b>\$ 3,458,900</b>
<b>Parcels on Kasilof River</b>				
BOROUGH	5	138	0	\$ 247,500
FEDERAL	1	55	0	\$ 400,000
PRIVATE	84	751	0	\$ 18,922,500
STATE	28	1,188	0	\$ 3,642,900
	<b>118</b>	<b>2,132</b>	<b>0</b>	<b>\$ 23,212,900</b>



Figure 11. The upper 29 miles of the 46-mile Crooked Creek are within Kenai National Wildlife Refuge.



Figure 12. Lands adjacent to middle Crooked Creek (outside Federal lands) are owned by Alaska DNR, the University of Alaska and CIRI. The landscape surrounding the lower Crooked Creek is highly parceled with at least three subdivisions interspersed around two State recreation areas.





Figure 13. Looking northwest down Crooked Creek towards its confluence with the Kasilof River. In the far left background are the Kasilof Flats.

## Deep Creek – North Fork

### Assets

The 51-mile nonglacial North Fork of Deep Creek drains the western side of the Caribou Hills, with the North Fork extending into Ptarmigan Head and the main fork extending into Boxcar Hills. Almost 17 miles lies in Congressionally-designated Wilderness within the Kenai National Wildlife Refuge, of which only about 0.6 miles is known to support anadromous fish. Outside the refuge boundaries, Deep Creek flows for 34 miles to Cape Ninilchik on the Cook Inlet, all of which is designated as State-listed anadromous stream, supporting steelhead, Dolly Varden, and spawning habitats for pink, coho and king salmon. The mouth of Deep Creek is protected within the Deep Creek State Recreation Area, where a public boat launch and tractor launch are widely used by recreational, commercial, and charter anglers. The Deep Creek watershed is 138,528 acres, of which 13,967 acres are wetlands.

### Vulnerabilities

Outside the Kenai National Wildlife Refuge, both the North and South Forks of Deep Creek and the middle main trunk are owned by the Alaska Department of Natural Resources, Cook Inlet Regional, Inc., and the Ninilchik Native Association, Inc. Only on the lower Deep Creek, just above its confluence with Clam Creek, does the adjacent landscape become subdivided into 36 private lots with \$3 million in improvements. The Alaska State Parks and Kenai Peninsula Borough own several large parcels on the lower Deep Creek.

### Unique Opportunities for Conservation

The landscape corridor formed by Deep Creek and its North Fork is still mostly undeveloped, with improvements restricted to the 36 parcels on the lower stream, primarily between the Sterling Highway and Clam Creek. Above Clam Creek, all the way to the boundary of the Kenai National Wildlife Refuge, either the State or Native associations are the only landowners. There is a very real opportunity to conserve a landscape-scale corridor from mountain to sea using multiple conservation tools.

However, in the aftermath of the spruce bark beetle outbreak during the 1990s, much of what was formerly Lutz spruce forest is now grasslands composed of *Calamagrostis canadensis*. Much of the area immediately north of Deep Creek and the North Fork has now been subdivided with a gridded dirt road system in place, and vehicular access from the Sterling Highway provided by Oil Well Road. It is clear that the opportunity to ensure a contiguous corridor is ephemeral, with more cabins being added every year to this area, and increasing pressure to access Deep Creek at multiple points by ATV.

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
BOROUGH	1	40	0	\$ 130,900
NATIVE	38	23,621	23	\$ 8,314,900
PRIVATE	43	655	2.3	\$ 4,432,700
STATE	13	34,881	7.8	\$ 11,140,900
<b>Grand Total</b>	<b>95</b>	<b>59,197</b>	<b>32.7</b>	<b>\$ 24,019,400</b>
<b>Parcels on Creek</b>				
BOROUGH	1	40	0.1	\$ 130,900
NATIVE	22	22,511	22.5	\$ 7,335,600
PRIVATE	36	602	2.3	\$ 4,220,300
STATE	12	32,961	7.8	\$ 10,660,900
	<b>71</b>	<b>56,114</b>	<b>32.7</b>	<b>\$ 22,347,700</b>
<b>Parcels Beyond Creek</b>				
NATIVE	16	1,110	0	\$ 979,300
PRIVATE	7	53	0	\$ 212,400
STATE	1	1,920	0	\$ 480,000
	<b>24</b>	<b>3,083</b>	<b>0</b>	<b>\$ 1,671,700</b>

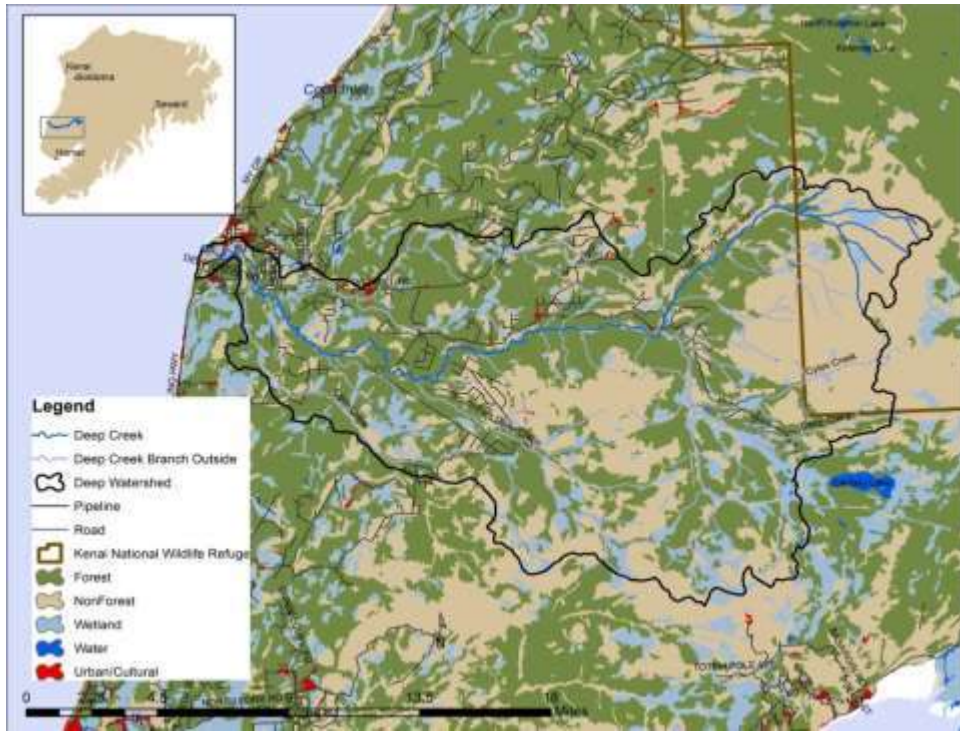


Figure 15. The 51-mile Deep Creek and its North Fork drain a 138,528-acre watershed that extends into Caribou Hills.

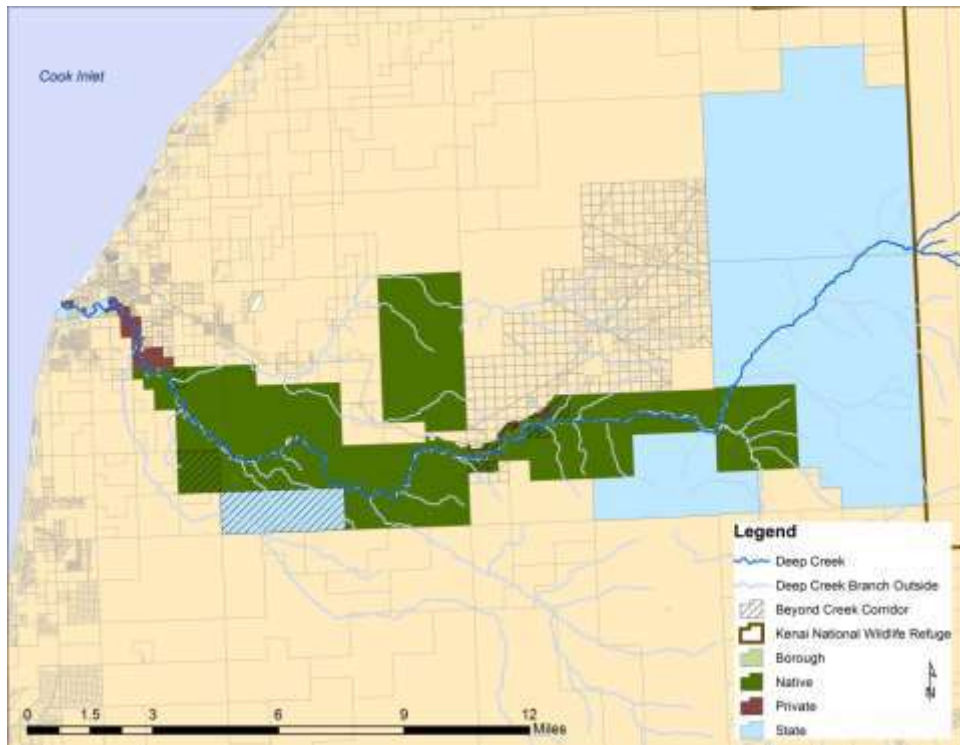


Figure 14. The middle Deep Creek, outside the Kenai National Wildlife Refuge is owned by either the State or tribal organizations. Only lower Deep Creek has been subdivided into private parcels.





Figure 16. Looking eastward up the North Fork of Deep Creek towards the Caribou Hills and Congressionally-designated Wilderness. Oilwell Road in the background roughly parallels Deep Creek, allowing motorized access to a mostly deforested landscape that is rapidly being subdivided and developed.

## **Fox River and Sheep Creek**

### Assets

The Fox River and Sheep Creek parallel each other through most of the Fox River flats, sometimes with braiding side channels that appear to mix water before draining into the head of Kachemak Bay. Consequently, both stream corridors are included here although they connect different valleys and glaciers of the Kenai Mountains to Kachemak Bay. Within the Kenai National Wildlife Refuge, both stream corridors are within Congressionally-designated Wilderness. Both are both spectacular glacial valleys, providing habitats for mountain goats, Dall sheep, the Fox River caribou herd, and brown bears.

The 117-mile Fox River originates from Chernof Glacier in the Harding Icefield, flowing southwards between the Caribou Hills and the Kenai Mountains. It drains a 102,443-acre watershed, of which 5,003 acres are wetlands. Hooligan, Dolly Varden and chum, coho, sockeye and pink salmon are found in the 47.5 miles of State-listed anadromous waters in the lower reach of Fox River. The lower 10 miles are outside the Kenai National Wildlife Refuge, flowing primarily through State lands until it reaches the sea.

The 65-mile Sheep Creek originates from the Dinglestadt Glacier that straddles the boundary between Kenai National Wildlife Refuge and Kenai Fjords National Park. Sheep Creek drains an 83,746-acre watershed, of which 912 acres are wetlands. Coho and pink salmon, and Dolly Varden are found in the 24 miles of State-listed anadromous waters in the lower reach of Sheep Creek. The lower 8 miles are outside the Kenai National Wildlife Refuge, flowing primarily through State lands until it reaches the sea.

### Vulnerabilities

The Fox River and Sheep Creek are truly spectacular glacial valleys that are still remarkably pristine. The area outside the Kenai National Wildlife Refuge is primarily the Fox River Flats, the estuary that forms the head of Kachemak Bay. Although the two parcels that make up the Fox River Flats are State lands, they are managed by the Alaska Department of Natural Resources as leased range lands for free-ranging horses and cattle; both grazers have degraded estuarine habitat. Additionally, one private parcel does intersect the Fox River. Lastly, a transmission line right-of-way that runs from Bradley Lake across both rivers and towards the Homer Benchlands near Caribou Lake is used by snowmachines in winter and, to a lesser extent, by ATVs in summer to access the Fox River valley.

### Unique Opportunities for Conservation

There are no improvements on the three parcels (2 State, 1 private) that intersect the two stream corridors. There is only \$74,800 in improvements on the private lands that are beyond the creek corridors. There is a real opportunity to establish a contiguous landscape corridor from Congressionally-designated Wilderness in the Kenai Mountains to Kachemak Bay with a combination of fee-simple acquisition and a negotiated conservation easement (i.e., to fence out cattle and horse) on at least Sheep Creek, if not both rivers.

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
PRIVATE	16	1,112	0.1	\$ 528,200
STATE	12	19,703	19.9	\$ 5,961,600
<b>Grand Total</b>	<b>28</b>	<b>20,816</b>		<b>\$ 6,489,800</b>
<b>Parcels on Creek</b>				
PRIVATE	1	80	0.1	\$ 34,700
STATE	2	18,670	19.9	\$ 5,601,000
	<b>3</b>	<b>18,750</b>	<b>20.0</b>	<b>\$ 5,635,700</b>
<b>Parcels Beyond Creek</b>				
PRIVATE	15	1,032	0	\$ 493,500
STATE	10	1,033	0	\$ 360,600
	<b>25</b>	<b>2,066</b>	<b>0</b>	<b>\$ 854,100</b>

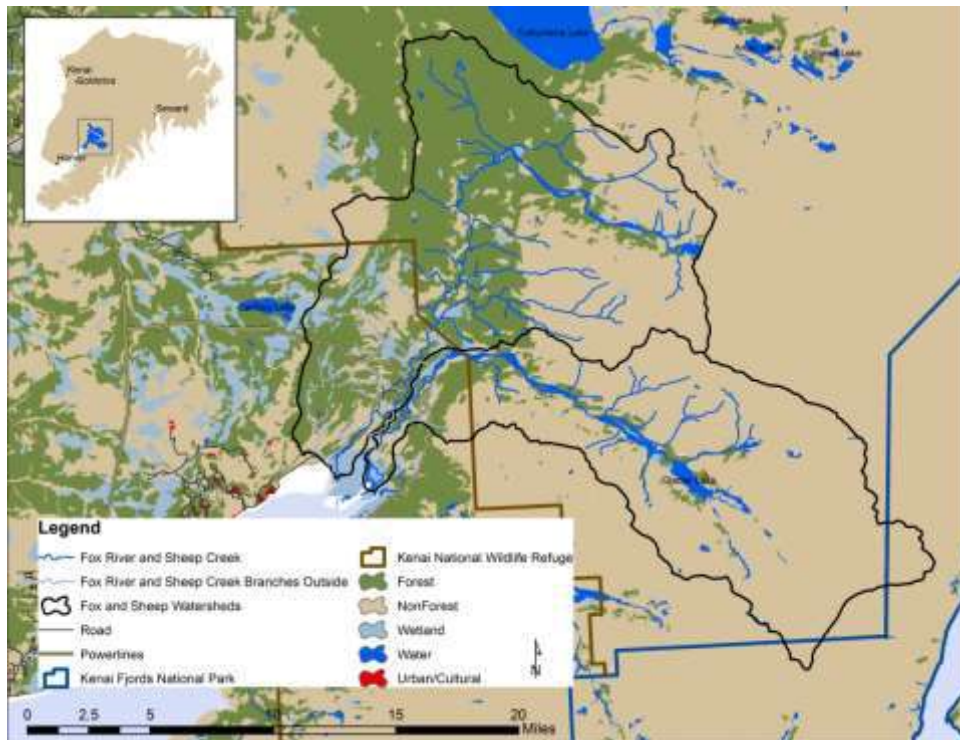


Figure 17. Fox River and Sheep Creek drain an enormous watershed within Congressionally-designated Wilderness, reaching from high in the Harding Icefield to Kachemak Bay.

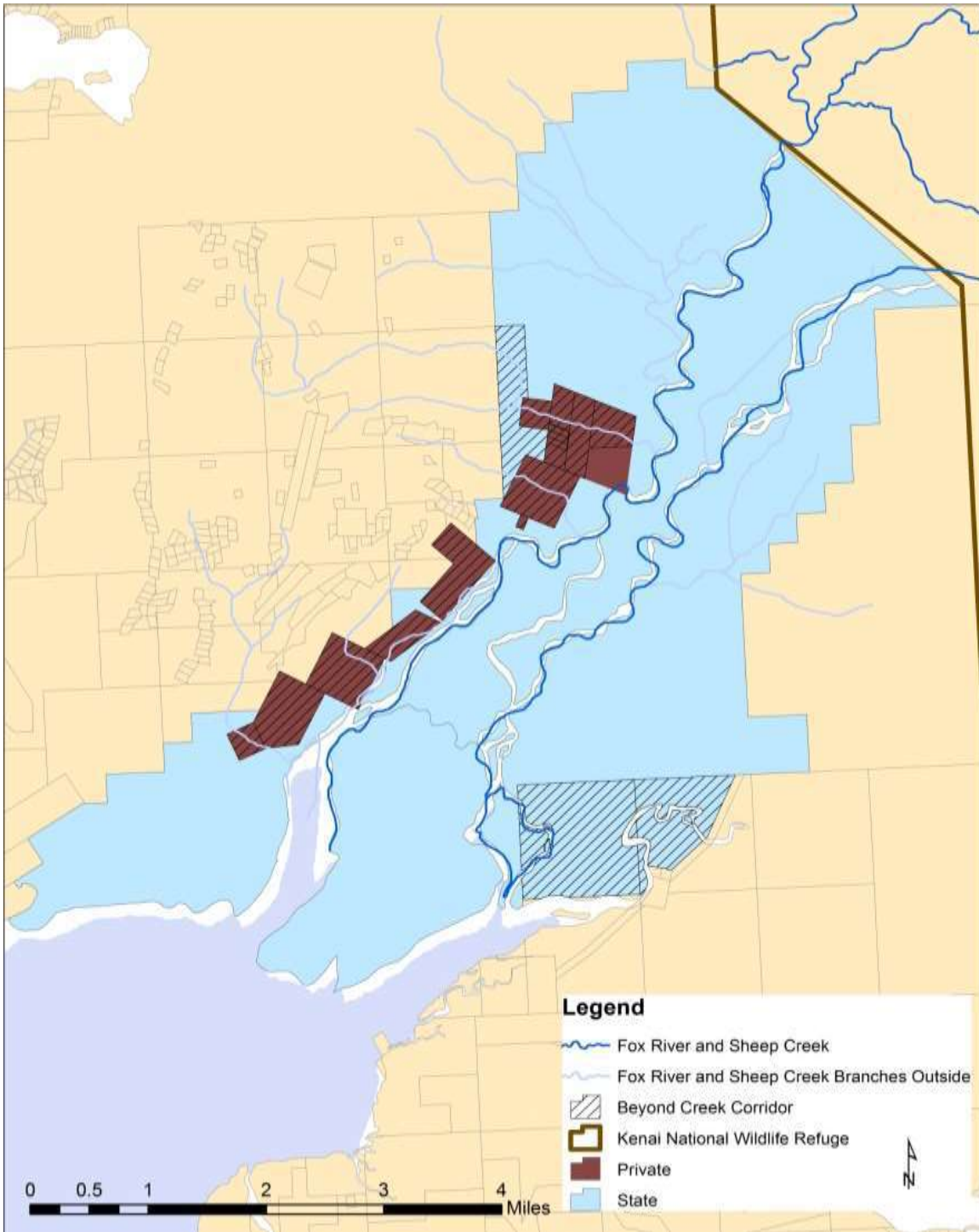


Figure 18. Both Fox River and Sheep Creek flow through the Fox River Flats after leaving the Kenai National Wildlife Refuge. Almost all of the Kenai Flats is contained in two parcels that are leased by Alaska Department of Natural Resources for horse and cattle range.





Figure 19. The Fox River originates from Chernof Glacier, flowing southwards between the Caribou Hills and the Kenai Mountains. Both Fox River and and Sheep Creek braid through the Fox River Flats (shown here), headwaters of Kachemak Bay and outside the boundaries of Kenai National Wildlife Refuge.



Figure 20. Sheep Creek originates from Dinglestadt Glacier that straddles the boundary between Kenai National Wildlife Refuge and Kenai Fjords National Park.

## **Funny River**

### Assets

The Funny River is a major tributary of the Kenai River. Its watershed is 95,012 acres, of which 6,448 acres are wetlands. From its nonglacial origins high in the Tustumena benchlands, the Funny River flows northwest for 67 miles through alpine tundra, white spruce, and then black spruce forest before joining the Kenai River at RM 31. All but the last 4.5 miles are within Congressionally-designated Wilderness of the Kenai National Wildlife Refuge. The lower 17.8 miles are State-listed anadromous waters, with spawning habitats for coho, king, and pink salmon, and steelhead. The historic Funny River Horse Trail roughly parallels the river, used by horse packers and snowmachiners to access the benchlands. At the mouth of Funny River is a complex of historic Dena'ina houses.

### Vulnerabilities

After the Funny River leaves the Kenai National Wildlife Refuge, it meanders past at least two subdivisions within the community of Funny River, flows under Funny River Road, and then past another subdivision at its confluence with the Kenai River. The mouth of the Kenai River is protected by the Funny River State Recreation Site and several lots owned by the Alaska Department of Fish & Game. The Kenai River parcels have \$164 million in improvements. The Funny River parcels have \$778,300 worth of improvements (~ \$460,000 of which are beyond the river corridor).

### Unique Opportunities for Conservation

Much of the lower 4.8 miles outside of the Kenai National Wildlife Refuge, particularly near its mouth, is partially protected by state ownership (Alaska Department of Natural Resources, Alaska Department of Fish & Game). The Cook Inlet Regional, Inc. owns several large parcels that intersect with Funny River. There are only seven privately-held parcels that actually intersect the stream. There is clearly an opportunity here for using a combination of fee simple acquisition, easements, and special state designation to ensure that the Funny River remains a contiguous riparian corridor.

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
BOROUGH	10	185	0	\$ 5,686,700
FEDERAL	1	26	0	\$ 893,900
MUNICIPAL	42	2,073	0	\$ 20,764,200
NATIVE	11	2,241	1.8	\$ 6,199,900
NATIVE ALLOTMENT	2	71	0.0	\$ 1,929,800
PRIVATE	878	2,219	2.1	\$ 282,273,500
STATE	64	3,046	0.6	\$ 61,038,100
<b>Grand Total</b>	<b>1008</b>	<b>9,860</b>	<b>4.5</b>	<b>\$ 378,786,100</b>
<b>Parcels on Creek</b>				
NATIVE	4	1,600	1.8	\$ 742,500
PRIVATE	7	470	2.1	\$ 775,700
STATE	5	51	0.6	\$ 459,200
	<b>16</b>	<b>2,120</b>	<b>4.5</b>	<b>\$ 1,977,400</b>
<b>Parcels Beyond Funny River</b>				
NATIVE	1	124	0	\$ 112,900
PRIVATE	11	15	0	\$ 811,100
	<b>12</b>	<b>139</b>	<b>0</b>	<b>\$ 924,000</b>
<b>Parcels on Kenai River</b>				
BOROUGH	10	185	0	\$ 5,686,700
FEDERAL	1	26	0	\$ 893,900
MUNICIPAL	42	2,073	0	\$ 20,764,200
NATIVE	6	517	0	\$ 5,344,500
NATIVE ALLOTMENT	2	71	0	\$ 1,929,800
PRIVATE	860	1,734	0	\$ 280,686,700
STATE	59	2,996	0	\$ 60,578,900
	<b>980</b>	<b>7,601</b>	<b>0</b>	<b>\$ 375,884,700</b>

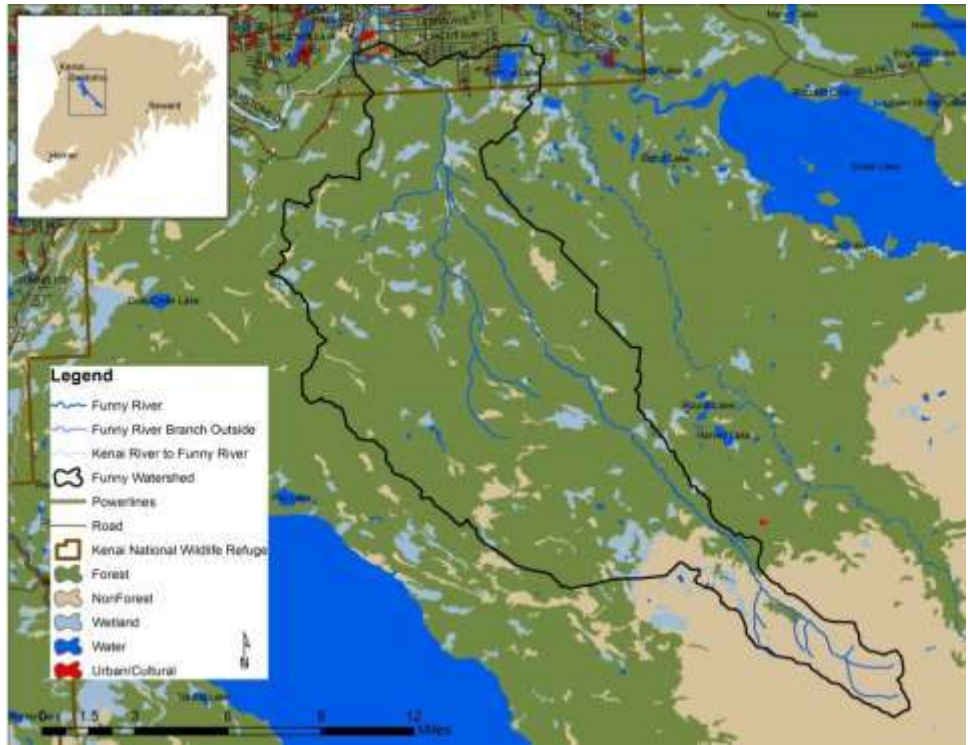


Figure 22. The 67-mile Funny River drains a 95,012-acre watershed, of which 6,448 acres are wetlands.

S

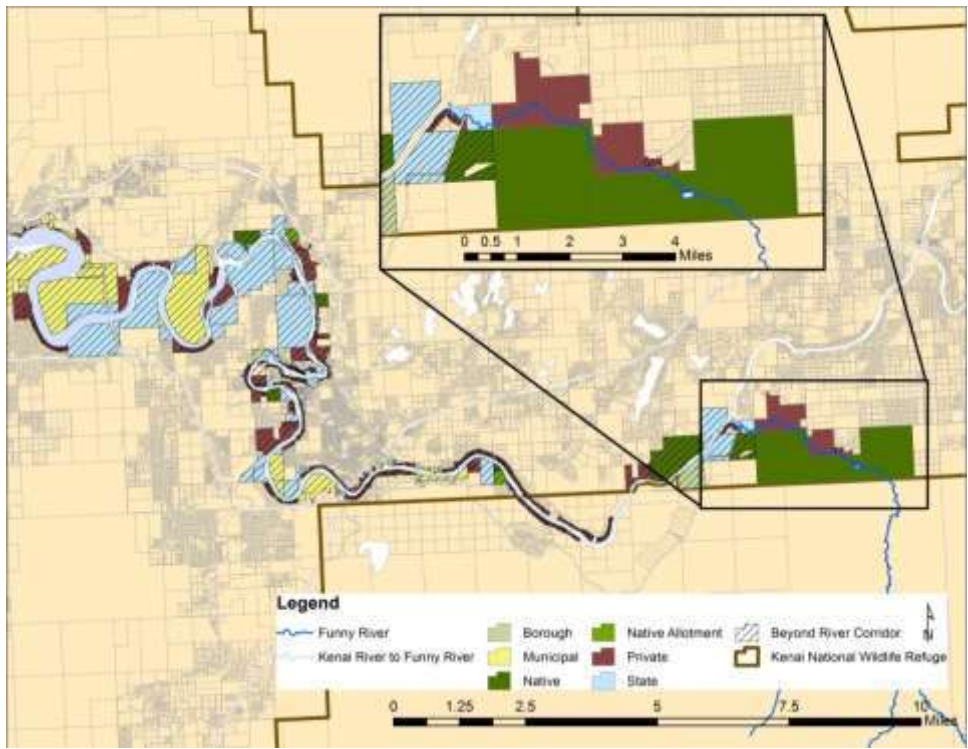


Figure 21. Of the 4.8 miles of the Funny River that flows outside the Kenai National Wildlife Refuge, only seven parcels are privately owned with other parcels owned by the State of Alaska and Alaska Native Corporations.





Figure 23. Looking northwestward down the Funny River towards its confluence with the Kenai River. Except for the last 4.8 miles near its mouth, all of the nonglacial Funny River is within the Kenai National Wildlife Refuge where it originates on the Tustumena Bench.

## Harding-Gateway – unnamed creek

### Assets

This unnamed creek (hereafter called Bear Glacier Creek) that flows mostly south along the eastern edge of Bear Glacier is 23.5 miles long. Most of the creek and its branches are within Kenai Fjords National Park (20 miles); only the lower 4 miles flow outside Federal lands enroute to Resurrection Bay. This stream drains the 69,992-acre Harding-Gateway watershed, of which 50% is ice (Bear Glacier) and 1,743 acres are wetlands. The lower 7 miles are State-listed anadromous waters that provide habitat for spawning sockeye salmon.

### Vulnerabilities

Two state-owned parcels contain the lower 4 miles of Bear Glacier Creek outside the Federal conservation unit, both managed by the Alaska Department of Natural Resources. The two parcels total 17,160 acres and are assessed at \$10,776,400 with no improvements.

### Unique Opportunities for Conservation

Bear Glacier Creek is one of the longer streams to flow out of the Harding Icefield on the eastern side of the Harding Icefield. There is clearly an opportunity to ensure a contiguous corridor from remote nunataks high in the Kenai Mountains to the gravel beaches of Resurrection Bay by seeking special conservation designation by, or conservation easement with, the State.



Figure 24. After leaving Kenai Fjords National Park, Bear Glacier Creek flows for 4 miles through two State-owned parcels before reaching Resurrection Bay.

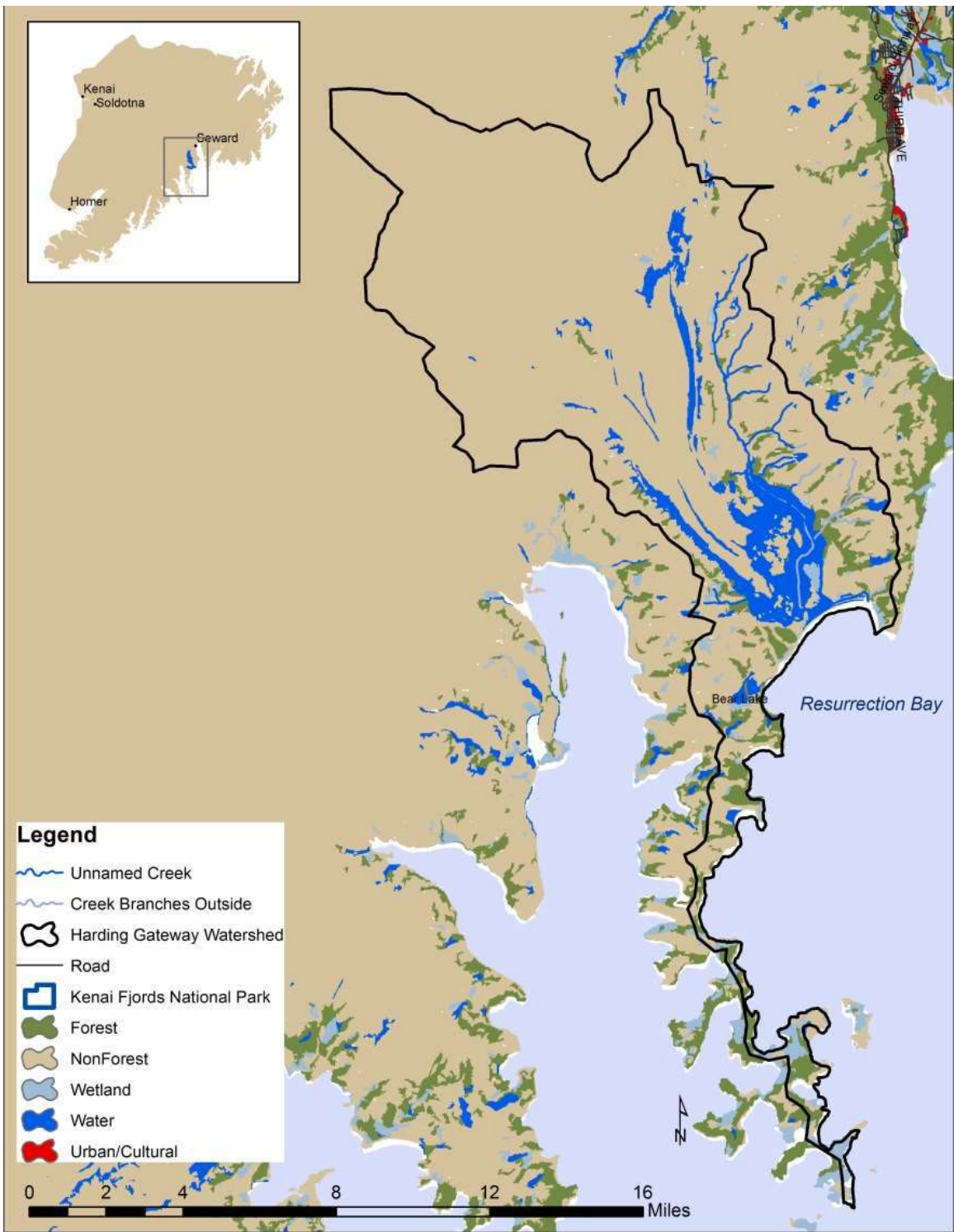


Figure 25. Half of the 70,000-acre watershed drained by this unnamed creek is the ice of Bear Glacier, part of the Harding Icefield. Most of the watershed is within Kenai Fjords National Park.



## Harris Bay

### Assets

This unnamed stream (hereafter named Paguna Creek) drains an 11,714-acre watershed, flowing southerly for 2.3 miles from Kenai Fjords National Park to the northeastern shore of the Paguna Arm of Two Arm Bay. Originating in remnant ice and snow fields at the 1500' elevation in coastal mountains, it drops quickly to a relatively large, sparsely forested alluvial plain. The lower 2.1 miles are listed by the Alaska Department of Fish & Game as providing habitat for spawning pink salmon.

### Vulnerabilities

The lower 2 miles of Paguna Creek flow through one 2,090-acre parcel, owned by the Port Graham Corporation. The value of this parcel is \$3,135,000 with no improvements.

### Unique Opportunities for Conservation

The valley formed by the braided Paguna Creek is already forested and likely to become more so as forecasted in climate envelope models, creating a forested corridor that reaches from the coast to high in the 4,700-foot coastal mountains that form a small peninsula between Paguna Arm and Northwestern Fjord. A negotiated conservation easement with, or designation by, the Port Graham Corporation would ensure that this stream corridor remains a contiguous landscape feature



Figure 26. Paguna Creek flows for more than 2 miles from high in the mountains between Paguna Arm of Two Arm Bay (foreground) and Northwestern Fjord.

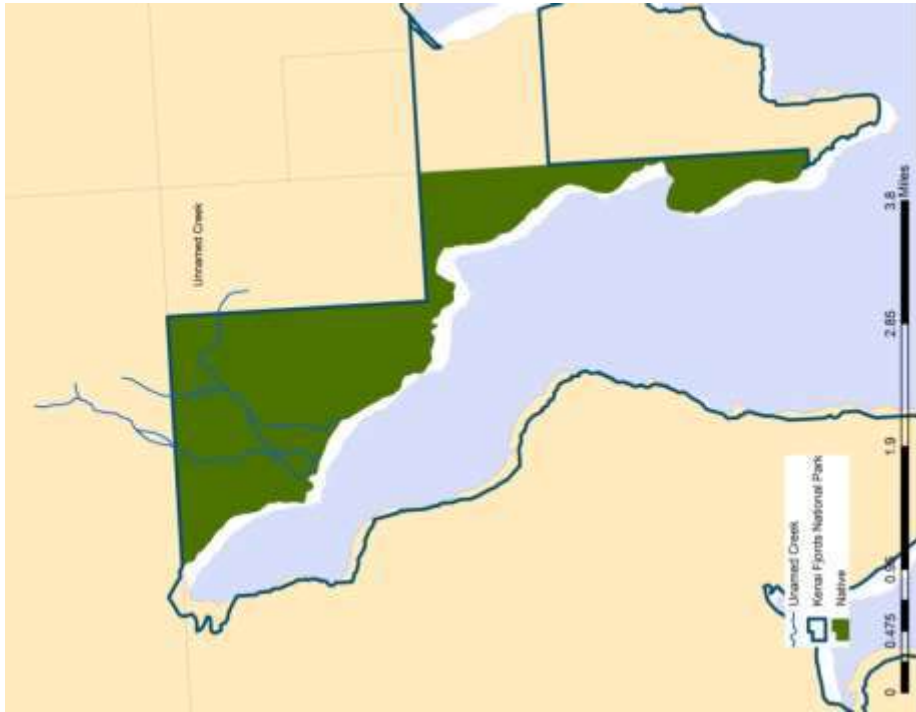


Figure 27. The lower 2.1 miles of this creek flow through a large parcel owned by an Alaska Native Corporation before reaching the sea.

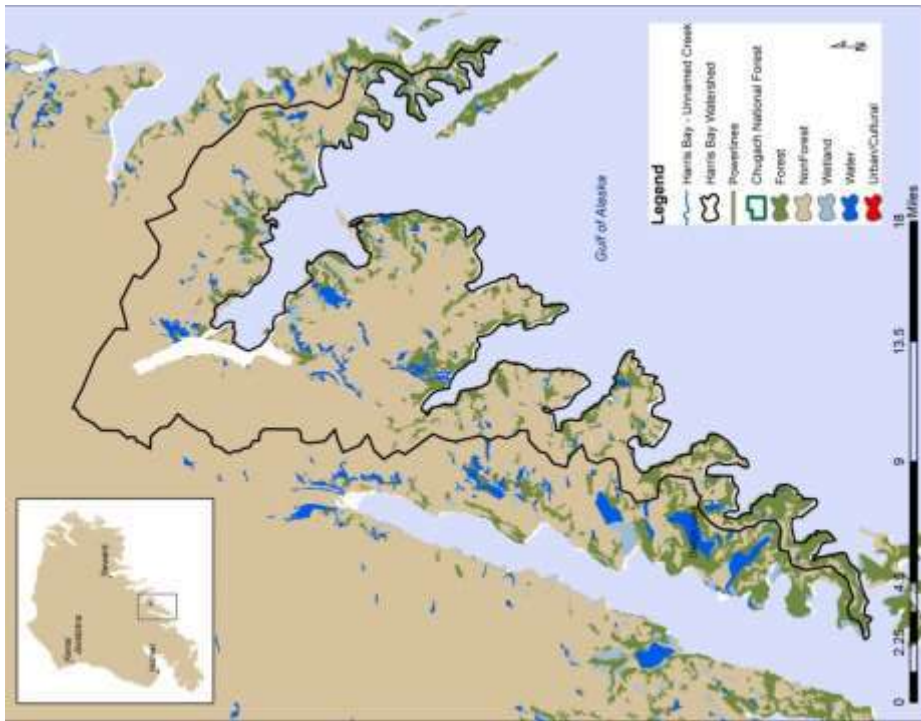


Figure 28. This unnamed stream flows for 2.3 miles from remnant ice and snow fields high in Kenai Fjords National Park to Paguna Arm.

## Kasilof River

### Assets

The 323-mile Kasilof River is perhaps the second most significant river on the Kenai Peninsula, connecting the coast with the 73,432-acre Tustumena Lake, the largest lake on the peninsula with nine anadromous glacial and nonglacial tributary streams, and to Tustumena Glacier and the Harding Icefield high in the Kenai Mountains. The lake itself is in the Andrew Simons unit of Kenai Wilderness in the heart of the Kenai National Wildlife Refuge. Boat access to Tustumena Lake is provided by a public boat launch on the main branch of the Kasilof River, two miles downstream from the outlet.

The Kasilof River basin includes 10 watersheds totaling 527,324 acres (Table 3), of which 23,692 acres are wetlands and 101,820 acres are part of the Harding Icefield. The Kasilof River system includes three large lakes in addition to Tustumena: North Kolomin Lake (52 acres), Green Lake (170 acres) and Arctic lake (362 acres). There are 105 miles of stream designated as anadromous water by the Alaska Department of Fish and Game and includes habitats for spawning king and pink salmon, silver and sockeye salmon, Dolly Varden, Pacific lamprey, and steelhead.

Table 3. In addition to the Kasilof River, there are nine other named anadromous stream subwatersheds that flow into the Kasilof River system.

Name	Acres
Bear Creek	23,623
Crooked Creek	35,141
Crystal Creek	7,532
Fox Creek 1	26,022
Glacier Creek	145,099
Indian Creek	47,634
Kasilof River	141,617
Moose Creek 2	24,446
Nikolai Creek	37,190
Shantalik Creek	39,021

Enroute to the Cook Inlet, The Kasilof River flows past the Kasilof River State Recreation Area and the Crooked Creek State Recreation Area, ultimately forming the Kenai Flats, much of which is managed as the Kasilof River Special Use Area by the Alaska Department of Natural Resources. It is an important estuary used by Alaska residents for personal-use dipnet and gillnet fishing, commercial setnetting, and foraging by beluga whales and migrating shorebirds. A fish processing facility and associated small boat harbor is on the north bank, accessed from the Kasilof Beach Road; a second processor is further upstream, accessed from Skein Avenue.

### Vulnerabilities

Only the lower 14 miles of the 18 miles that form the main trunk of the Kasilof River are outside the Federal conservation unit. Flowing northeasterly from its outlet on Tustumena Lake, it passes subdivisions on both banks, generally associated with the community of Kasilof, before passing under a high bridge at MP 109.5 of the Sterling Highway. From there, the Kasilof River flows between two major paved thoroughfares, Cohoe Loop Road and Kalifornsky Beach Road, enroute to the sea. These two roads are used to access several subdivisions on both banks before entering the Kasilof River Special Use Area. There are \$17 million in improvements on the Kasilof parcels.

### Unique Opportunities for Conservation

The Kasilof River complex is a spectacularly varying landscape, with 308 river miles protected within Kenai National Wildlife Refuge. The Kasilof River is conventionally viewed as the portion of the river that flows for 18 miles from the outlet of Tustumena Lake to its mouth in Cook Inlet. For this analysis, the upper watershed was embraced as to not would be akin to considering the upper Kenai River as separate from the middle and lower Kenai River because it flows through Skilak Lake.

Only a very small portion of the overall Kasilof River corridor has been subdivided into 162 privately-held parcels, but these are valued at over \$36 million already, making fee-simple acquisition unrealistic as a primary tool for ensuring a contiguous landscape corridor from the Kenai Mountains to the Cook Inlet. However, there are significant acreages in a few parcels held by the University of Alaska, Alaska Department of Natural Resources, Kenai Peninsula Borough, Bureau of Land Management, and the Cook Inlet Regional, Inc. This is a corridor that will require multiple conservation mechanisms, but the opportunity is ripe as this is a significant and still largely intact system.

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
BOROUGH	6	154		\$ 548,300
FEDERAL	1	55		\$ 400,000
NATIVE	2	3,468		\$ 1,816,400
PRIVATE	172	1,433		\$ 37,288,100
STATE	38	2,133		\$ 7,975,100
<b>Grand Total</b>	<b>219</b>	<b>7,243</b>		<b>\$ 48,027,900</b>
<b>Parcels on Creek</b>				
BOROUGH	4	83		\$ 472,100
FEDERAL	1	55		\$ 400,000
NATIVE	2	3,468		\$ 1,816,400
PRIVATE	162	1,238		\$ 36,464,000
STATE	37	2,098		\$ 7,755,100
	<b>206</b>	<b>6,942</b>		<b>\$ 46,907,600</b>
<b>Parcels Beyond Creek</b>				
BOROUGH	2	71		\$ 76,200
PRIVATE	10	195		\$ 824,100
STATE	1	34		\$ 220,000
	<b>13</b>	<b>301</b>		<b>\$ 1,120,300</b>





Figure 30. Only 14 miles of the lower 18 miles of the Kasilof River that flow from Tustumena Lake to the Cook Inlet is outside the Kenai National Wildlife Refuge.



Figure 29. The Kasilof River effectively includes the glacially-fed Tustumena Lake, at 73,000 acres the largest lake on the Kenai Peninsula and eighth largest in Alaska. This system includes nine other State-listed anadromous streams.





Figure 31. Looking westward towards Kasilof Flats at the mouth of the Kasilof River. This estuary is managed by the Alaska Department of Natural Resources as the Kasilof River Special Use Area.

## Kenai River

### Assets

The Kenai River is the gem of the Kenai Peninsula, flowing for 125 miles through, and helping to sustain, the communities of Cooper Landing, Sterling, Funny River, Soldotna and Kenai. The Kenai River watershed has 520 river miles of tributaries and 29 distinct watersheds that encompass 1,380,758 acres of vegetation components from both the boreal and coastal rainforest biomes, including 74,242 acres of wetlands. There are 128 miles of State-listed anadromous waters, providing spawning habitats for all five salmon species, Dolly Varden, lamprey, Pacific lamprey and hooligan. The Kenai River has extensive site locations of two pre-contact Alaska Native cultures, the Riverine Tradition and the pre-contact Dena'ina. The cultural change from Riverine to Dena'ina is one of the most distinct archaeological breaks in Alaska and may be due to events triggered by the Medieval Warm Period around A.D. 1000. The Kenaitze Dena'ina continues to recognize spiritual connections to the Kahtnu or Kenai River.

The Kenai River originates in the Sargent Icefield in Chugach National Forest. Glacial meltwater forms the Snow River that flows for 28 miles to the 23-mile-long Kenai Lake. Here at the outlet of Kenai Lake, at Cooper Landing, begins what is known as the "Upper River" which flows past its confluence with the Russian River and the boundary of the Kenai National Wildlife Refuge, extending for 12 miles to the Kenai Canyon, a 2-mile section that includes Class I-III rapids, and then into the 14-mile-long Skilak Lake that receives input from Skilak Glacier, part of the Harding Icefield. The "Mid-River" begins at Skilak Lake's outlet, where it flows for 19.5 miles to Soldotna where the Sterling Highway crosses above the Kenai River. The Killey, Moose and Funny Rivers flow into this middle section of the Kenai River. Below the bridge begins the 21-mile-long "Lower River" where the river begins to meander before draining into the Cook Inlet. The lower 12 miles of the Kenai River are tidally-influenced, with its mouth forming the Kenai Flats, the second largest estuary on the Kenai Peninsula. This tidal area is used for foraging by beluga whales, as a haul-out for harbor seals, for roosting by gulls, and by migrating waterfowl and shorebirds.

Most of the headwaters of the Kenai River down to its confluence with the Russian River are within Chugach National Forest. From the Russian River downstream to its confluence with the Killey River are within Kenai National Wildlife Refuge. However, because there are multiple jurisdictions involving Federal, State, and municipal governments, the Kenai River corridor is managed in an interagency forum as the Kenai River Special Management Area (KRSMA). Within the KRSMA, there are multiple recreational public use areas. Chugach National Forest manages the Primrose, Ptarmigan Creek, Trail River, Quart Creek, Cooper Creek, and Russian River campgrounds. Kenai National Wildlife Refuge manages Sportsman's Landing/Russian River Ferry, Jim's Landing, and the Upper and Lower Skilak Campgrounds. Alaska State Parks manages the Bing's Landing, Isaac Walton, Funny River and Ciechanski State Recreation Sites, Morgan's Landing, Slikok Creek and Big Eddy State Recreation Areas, and the boat launches at the Pillars and Eagle Rock. The City of Soldotna manages Swiftwater and Centennial Parks. The City of Kenai manages Cunningham Park and a public boat launch near the mouth of the Kenai River.

### Vulnerabilities

The main trunk of the Kenai River, particularly downstream from its confluence with the Killey River, is a highly developed shoreline with over 1,800 private parcels assessed at more than \$500 million, with almost \$300 million in improvements. Over 17,700 people live in the five communities perched on the Kenai River, and both the Seward and Sterling Highways parallel the river for many miles, crossing the

river at Cooper Landing, Schooner Bend, Soldotna and Kenai. There are many threats to the integrity of the Kenai River including toxic spills, surface run-off, bank erosion, riparian habitat loss, contamination from leachate, multiple vectors for invasive species, and overfishing. Although the KRSMA partners, municipalities and local NGOs do a good job working to ensure that the river maintains high water quality, minimal bank erosion, and regulated boating and angling, it no longer makes sense to consider the Kenai River, particular on the 48 miles outside of Federal lands, a landscape corridor for wildlife movement and plant dispersal. It is too fragmented, and human-wildlife conflicts arise such as killings of bears in defense of life or property and moose-vehicle collisions, as well as the continuing introduction of exotic and invasive species.

Owner Type	Number of Parcels	Acres	Assessed Value
<b>ALL Parcels</b>			
BOROUGH	16	932	\$ 8,427,600
FEDERAL	4	284	\$ 8,247,400
MUNICIPAL	42	2,073	\$ 20,764,200
NATIVE	48	2,637	\$ 23,526,600
NATIVE ALLOTMENT	2	71	\$ 1,929,800
PRIVATE	1830	3,276	\$ 549,344,300
STATE	171	11,752	\$ 123,713,200
<b>Grand Total</b>	<b>2113</b>	<b>21,024</b>	<b>\$ 735,953,100</b>

An urbanizing landscape downstream from the Kenai National Wildlife Refuge and high traffic volume along the Sterling Highway are making this riparian corridor, in fact, a barrier to north-south wildlife movement. The total linear distance from the mouth of the Kenai River to the Seward Highway (along the eastern most edge of Kenai Lake) is 65 miles. After eliminating Kenai Lake and Skilak Lake as natural barriers to wildlife movement, the remaining potential segment for north-south movement is 35 miles. However, the continuing urbanization in the Kenai-Soldotna-Sterling area and in Cooper Landing has severely bottlenecked passage for landscape-level wildlife movement. Only two landscape corridors remain that allow unrestricted (except for the highway) wildlife movement between the northern and southern parts of the Refuge: a 3.5-mile wide segment immediately west of the mouth of Skilak Lake and a 4-mile wide segment from the headwaters of Skilak Lake to the Russian River. These two corridors combined represent < 20% of the area once available naturally.

#### Unique Opportunities for Conservation

The Kenai River itself is too complex and far too expensive to reasonably consider restoring a terrestrial component to make it a true landscape corridor. However, it is critical that all efforts be made to keep the river itself a conduit for anadromous fish returning from the sea. Protecting and restoring bank, annual tweaking of boating and fishing regulations, treating and regulating municipal waste water treatment and urban run-off, and responding to catastrophic toxic spills will continue to be a part of conserving the Kenai River.

Perhaps more attention should be given to conserving the integrity of the mouth of the Kenai River including the Kenai Flats. Most of the Kenai Flats downstream of Bridge Access Road is owned by the

City of Kenai; upstream of the road is primarily owned by the Alaska Department of Natural Resources, City of Kenai and Kachemak Heritage Land Trust. There are still opportunities for fee-simple acquisition of, and conservation easements on, private parcels as far upstream as Beaver Creek. Importantly, which commercial and recreational activities are deemed allowable at and near the mouth of the Kenai River bears close scrutiny as this truly is the mouth that feeds the central Kenai Peninsula.

Even as the Kenai River from its mouth to the Killey River, and in Cooper Landing area downstream from Kenai Lake, become urban barriers to wildlife movement, there are still opportunities for a few contiguous north-south green belts and highway mitigation for wildlife movement. The east bank of Beaver Creek is one potential landscape corridor to allow the Kenai Lowland caribou herd continued access from the north to the Kenai Flats. Slikok Creek is another potential landscape corridor to allow movement from the south, but the Kenai River is already too parcelized downstream from the mouth of Slikok Creek to allow safe passage for caribou. However, it is still possible that a focused effort could conserve a corridor that passes from Skikok Creek north of Echo Lake through several large parcels owned by the Kenai Peninsula Borough, Cook Inlet Region, Inc., and Salamatof Native Association, Inc., to allow access to Kenai Flats. This would create a contiguous albeit circuitous greenbelt through the Kenai Flats that would connect Kenai National Wildlife Refuge on the north side of the Kenai Spur Highway with Refuge lands south of Soldotna.

Similarly, there are opportunities in the Cooper Landing Area to use multiple tools to secure safe passage for bears, moose and other wildlife through a landscape that is likely to be further subdivided and developed in the near future, particularly if the Cooper Landing Bypass becomes a reality. A focused effort could ensure that Chugach National Forest on the south side and north side of Cooper Landing remain connected by conserving lands along Cooper and Juneau Creeks with appropriate highway mitigation.





Figure 32. Looking down the upper Kenai River as it flows through the Kenai National Wildlife Refuge towards Skilak Lake. Congressionally-designated Wilderness is on the left.



Figure 33. The Sterling Highway passes through the City of Soldotna and crosses the Kenai River at RM 21, one of four bridges that span the river.





Figure 34. Looking westward over the Kenai Flats at the mouth of the Kenai River. Beluga whale, harbor seals and sea lions feed in the lower river, the Kenai Lowland caribou herd calves here, and waterfowl and shorebirds stopover here during migrations. Bridge Access Road, the old fish cannery, and the City of Kenai (on the bluffs) are in the near background. The Alaska Range and Cook Inlet are in the far background.

---

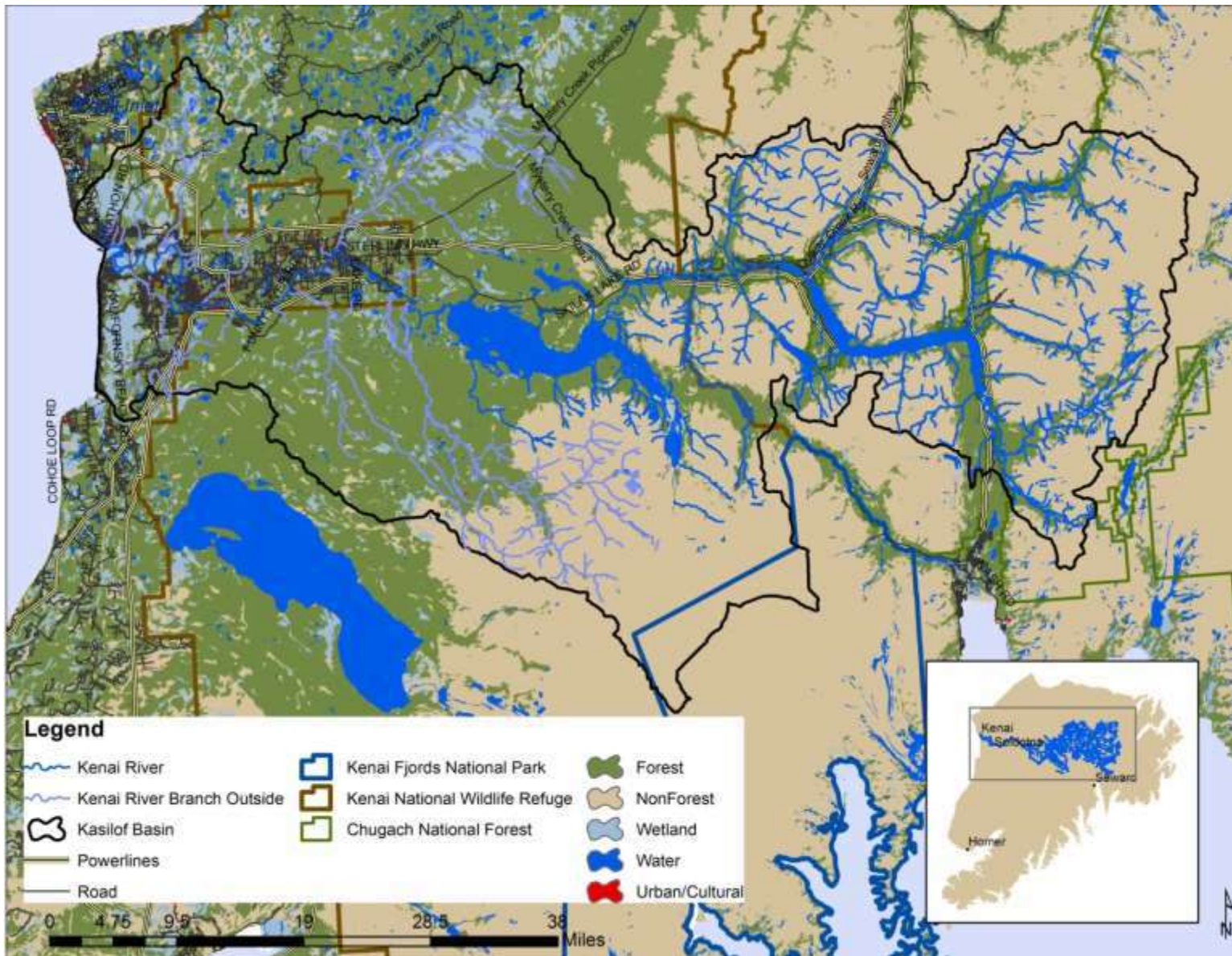


Figure 35. The 1,380,758-acre Kenai River watershed includes 29 distinct watersheds formed by its tributaries, and reaches into both the Harding and Sargent Icefields.



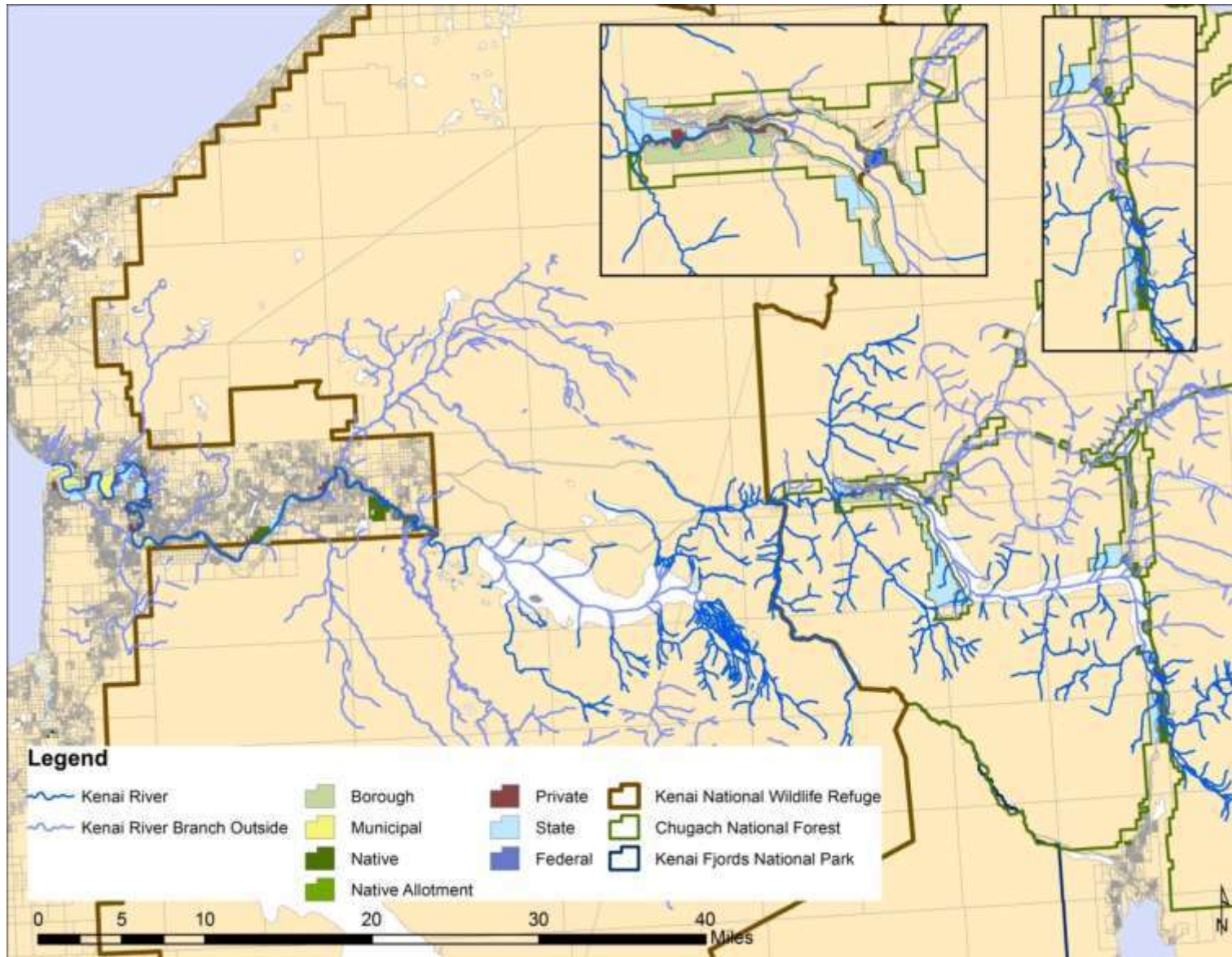


Figure 36. Almost 50 miles of the Kenai River are outside Federal lands, most of which occurs downstream from its confluence with the Killey River.

## **Killey River**

### Assets

The Killey River is a significant tributary of the Kenai River, flowing for 201 miles from the Killey Glacier in the Harding Icefield northwest across the Tustumena Benchlands. Harvey Lake (132 acres), Twin Lakes (256 acres) and Iceberg Lake (274 acres) contribute to the system, of which all but 2.7 miles are inside the Kenai National Wildlife Refuge and Congressionally-designated Wilderness. The Killey watershed is 150,112 acres, of which 2,355 acres are wetlands and 24,672 are ice. There are 61 miles of State-listed anadromous stream with Dolly Varden and Pacific lamprey, and spawning populations of coho, king and pink salmon. The Tustumena Benchlands is the core breeding area for Kenai brown bears as well as the Killey caribou herd. In addition to a large number of Riverine sites, the Killey River is the location of Stepanka's Village, one of the largest historic Dena'ina villages on the Kenai drainage.

### Vulnerabilities

Within the lower 2.7 miles of the Killey River that are outside the Kenai National Wildlife Refuge, there are 15 parcels, of which only 1 is State owned. The entire mouth of the Killey River, where it flows into the Kenai River at RM 44.7, is owned by the Cook Inlet Region, Inc. Across the Kenai River from its confluence with the Killey River is the Kenai Keys subdivision. The Killey River has ~ \$55,000 of improvements on the parcels worth \$2,368,000. The Kenai River parcels have ~ \$255 million in improvements.

### Unique Opportunities for Conservation

The good news is that in addition to two parcels owned by the Cook Inlet Region, Inc., and one parcel owned by the Alaska Mental Health Trust Authority, The Nature Conservancy owns all other parcels adjacent to the Killey River except one 10-acre parcel. There is a real opportunity to continue to leverage the previous fee-simple acquisition by The Nature Conservancy, seeking ways to finish conserving the riparian corridor on the last three remaining parcels on the Killey River.

---

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
PRIVATE	1664	2,978	1	\$ 485,996,500
NATIVE	24	2,013	1	\$ 18,732,700
STATE	99	3,564	0	\$ 75,840,900
MUNICIPAL	42	2,073	0.0	\$ 20,764,200
NATIVE ALLOTMENT	2	71	0.0	\$ 1,929,800
FEDERAL	1	26	0.0	\$ 893,900
BOROUGH	14	214	0.0	\$ 6,943,700
<b>Grand Total</b>	<b>1846</b>	<b>10,938</b>	<b>2.7</b>	<b>\$ 611,101,700</b>
<b>Parcels on Creek</b>				
PRIVATE	12	111	1.0	\$ 348,400
NATIVE	2	566	1.5	\$ 1,727,400
STATE	1	160	0.2	\$ 105,900
	<b>15</b>	<b>837</b>	<b>2.7</b>	<b>\$ 2,181,700</b>
<b>Parcels Beyond Killey River</b>				
PRIVATE	11	48	0	\$ 242,300
	<b>11</b>	<b>48</b>	<b>0</b>	<b>\$ 242,300</b>
<b>Parcels on Kenai River</b>				
PRIVATE	1641	2,819	0	\$ 485,405,800
NATIVE	22	1,447	0	\$ 17,005,300
STATE	98	3,404	0	\$ 75,735,000
MUNICIPAL	42	2,073	0	\$ 20,764,200
NATIVE ALLOTMENT	2	71	0	\$ 1,929,800
FEDERAL	1	26	0	\$ 893,900
BOROUGH	14	214	0	\$ 6,943,700
	<b>1820</b>	<b>10,053</b>	<b>0</b>	<b>\$ 608,677,700</b>





Figure 38. The Killey River is a major tributary of the Kenai River, draining a 150,112-acre watershed with 201 miles of stream, 60.5 of which have been designated as anadromous by the State of Alaska.

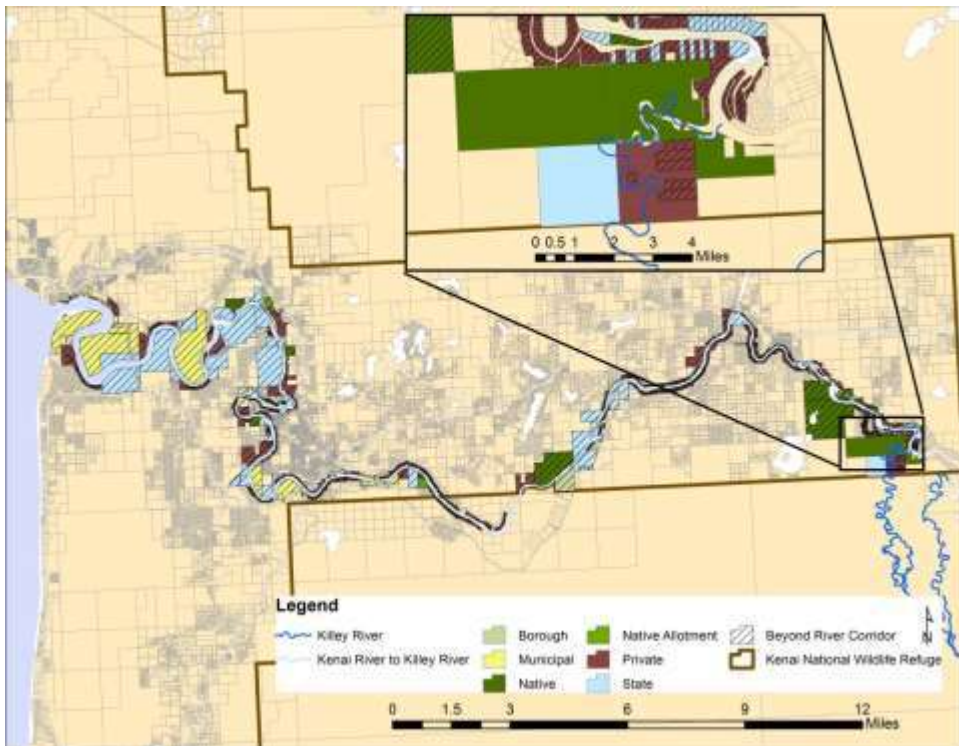


Figure 37. Fifteen parcels comprise the lower 2.7 miles of the lower Killey River that are outside the Kenai National Wildlife Refuge, of which all but 3 parcels have been purchased by The Nature Conservancy.



Figure 39. Looking northward towards the confluence of the glacially-fed Killey River with the Kenai River. In the foreground are the remains of a black spruce forest burned by the 2014 Funny River Fire. In the background is the Kenai Keys subdivision on the far bank of the Kenai River.

## Moose River

### Assets

The Moose River is a major nonglacial, meandering water course that drains the Kenai Lowlands including the Swan Lake Wilderness Canoe System in the Kenai National Wildlife Refuge. The Moose River system includes 137 miles of stream and includes 18 named lakes totaling 4,227 acres, all within the Refuge except the lower 2.2 miles. The Moose River watershed comprises 145,750 acres, of which 18,995 acres are wetlands.

More than 65 miles of State-listed anadromous streams include spawning habitat for coho, king, and Pacific lampreys, as well as populations of pink and sockeye salmon. Many of the lakes are part of the core breeding habitat for trumpeter swans. The Kenai lowland caribou herd winters in the black spruce forest-muskeg complex along the East Fork of the Moose River. The Kenai Lowlands is generally known to be an important calving area for moose and the area north of Skilak as an important wintering area for moose. The East Fork of the Moose River provides a northeast-to-southwest landscape corridor for large mammal movement from the Kenai Lowlands to Watson Lake to Hidden Lake, and then to Skilak Lake.

### Vulnerabilities

Only 2.2 miles of the lower Moose River are outside the Kenai National Wildlife Refuge. However, enroute to its confluence with RM 38.9 of the Kenai River, it runs a gauntlet of partially developed private parcels on both banks with \$9 million in improvements on 64 parcels. This area of the river widens into a shallow, narrow lake that is known as a wintering and staging area for trumpeter swans and other waterfowl. The river flows under a bridge on the Sterling Highway, and then flows between a commercial fish camp and the Izaak Walton State Recreation Site at its confluence with the Kenai River. The improved value of all 1,308 parcels on the Kenai River is about 56% of the total \$478 million.

### Unique Opportunities for Conservation

The lower Moose River outside the Kenai National Wildlife Refuge is already so parcelized and developed that a conservation strategy based on fee-simple acquisition seems unreasonable. In addition, most of the parcels are privately owned. Instead, voluntary and purchased easements, both short- and long-term, will likely be the tools to ensure a contiguous landscape corridor to the Kenai River. A small culvert under the Sterling Highway, through which The East Fork of the Moose River currently flows, is scheduled to be replaced by a 140' bridge in 2016 that is being designed to allow for passage of moose and caribou.

Name	Acres
Kelly Lake	147
Rock Lake	350
Little Mink Lake	70
Loon Lake	602
Bear Lake	52
Meadow Lake	88
Moosehorn Lake	289
Camp Island Lake	423
Clam Lake	345
Grebe Lake	366
Swan Lake	826
Weasel Lake	117
Afonasi Lake	105
Watson Lake	60
Mosquito Lake	70
Silver Lake	138
Equmen Lake	108
Petersen Lake	91

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
BOROUGH	13	213	0	\$ 6,902,600
MUNICIPAL	42	2,073	0	\$ 20,764,200
NATIVE	8	602	0	\$ 5,808,300
NATIVE ALLOTMENT	2	71	0.3	\$ 1,929,800
PRIVATE	1255	2,544	1.8	\$ 390,678,100
STATE	67	3,288	0.1	\$ 67,709,900
<b>Grand Total</b>	<b>1387</b>	<b>8,792</b>	<b>2.2</b>	<b>\$ 493,792,900</b>
<b>Parcels on Creek</b>				
NATIVE	2	86	0.3	\$ 463,800
PRIVATE	64	303	1.8	\$ 14,993,400
STATE	1	5	0.1	\$ 437,400
	<b>67</b>	<b>394</b>	<b>2.2</b>	<b>\$ 15,894,600</b>
<b>Parcels Beyond Creek</b>				
PRIVATE	12	0.48	0	\$ 193,900
<b>Parcels on Kenai River</b>				
BOROUGH	13	213	0	\$ 6,902,600
MUNICIPAL	42	2,073	0	\$ 20,764,200
NATIVE	6	517	0	\$ 5,344,500
NATIVE ALLOTMENT	2	71	0	\$ 1,929,800
PRIVATE	1,179	2,241	0	\$ 375,490,800
STATE	66	3,283	0	\$ 67,272,500
	<b>1308</b>	<b>8,398</b>	<b>0</b>	<b>\$ 477,704,400</b>



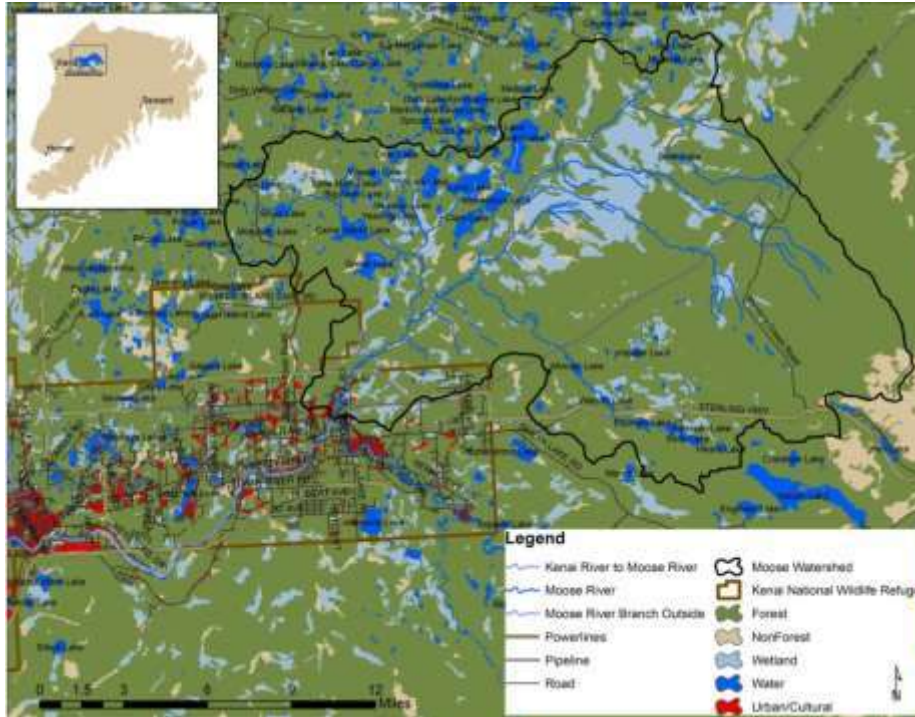


Figure 41. The Moose River watershed is 145,750 acres, of which 18,995 acres are wetlands. It spans both sides of the Sterling Highway and includes the community of Sterling and both Wilderness and non-Wilderness within the Kenai National Wildlife Refuge.

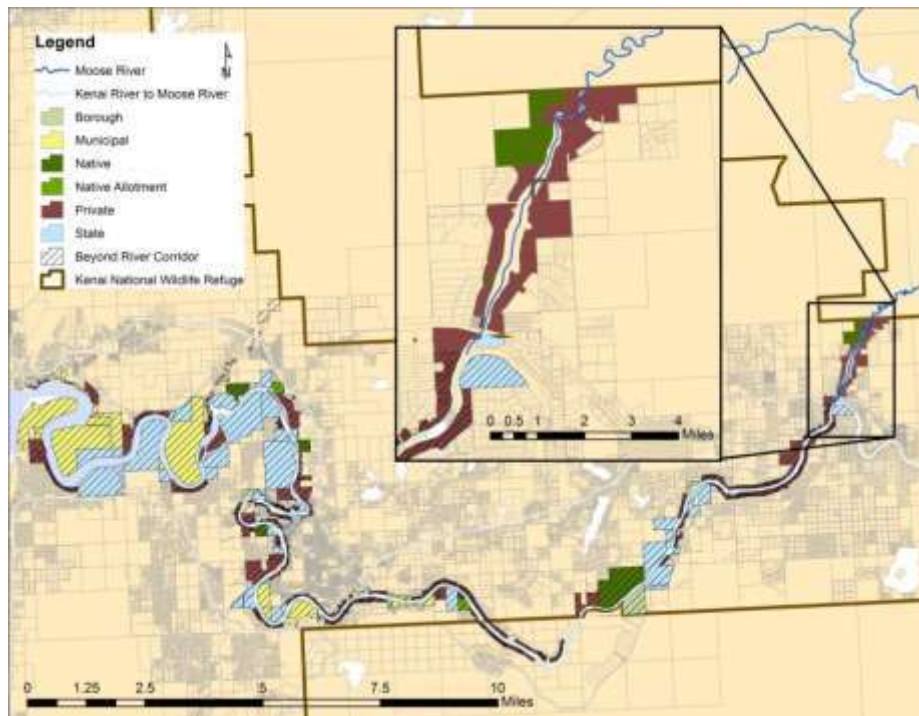


Figure 40. Only 2.2 miles of the Moose River are outside the Kenai National Wildlife Refuge as it approaches its confluence with the Kenai River. Both banks are already parceled and developed, making fee-simple acquisition an unlikely tool for conservation of this corridor.





Figure 42. Looking southward down the nonglacial Moose River as it flows out of the Kenai National Wildlife Refuge towards its confluence with the Kenai River in the community of Sterling. The small lake in the foreground is a staging area for Trumpeter Swans and other waterfowl. The river is part of the Swan Lake National Recreation Canoe Trail within Congressionally-designated Wilderness.

## **Nuka Bay**

### Assets

There are three anadromous, glacial streams that originate in Federal land administered by Kenai Fjords National Park, and pass through parcels owned by an Alaska Native Corporation before emptying into Nuka Bay. Ferrum Creek drains a 9,821-acre watershed and two unnamed creeks drain a 30,759-acre watershed. Nuka Bay itself has rich archaeological sites connected to the Alutiiq marine mammal hunters; however, many of these site are now underwater due to land subsidence after the 1964 Earthquake.

The 5.2-mile Ferrum Creek originates high in Yalik Glacier, part of the Wosnesenski-Grewingk Glacier complex, flowing through Kenai Fjords National Park, and then through 1.5 miles of lands owned by English Bay Corporation before draining into Beauty Bay, an embayment within Nuka Bay. Ferrum Creek provides 2.7 miles of habitat for spawning pink salmon.

The two unnamed anadromous creeks originate within Kenai Fjords National Park on the southern end of the Harding Icefield, eventually flowing for less than a mile through a parcel owned by the English Bay Corporation before draining into the North Arm of Nuka Bay. Unnamed Creek #1 is 8.7 miles, of which 1.6 miles provide habitat for spawning pink salmon; only the lower 0.5 miles are outside Federal lands. The waters of Unnamed Creek #2 originate from Split Glacier and flow for 7.1 miles, of which 1.1 miles provide habitat for spawning pink salmon; only the lower 0.7 miles are outside Federal lands.

### Vulnerabilities

The private lands for all three creeks occur on two parcels owned by the English Bay Corporation. These two parcels total 4,068 acres and are valued at about \$3 million with no improvements.

### Unique Opportunities for Conservation

With only one Alaska Native Corporation to negotiate a conservation agreement, easement, purchase or land exchange, there is an opportunity to protect three anadromous stream corridors that provide connectivity from the sea to two different ice fields, the Harding and the the Wosnesenski-Grewingk Glacier complex. This potential connectivity between the two icefields will become more critical in the future as the two ice bodies recede away from each other and from the coast.

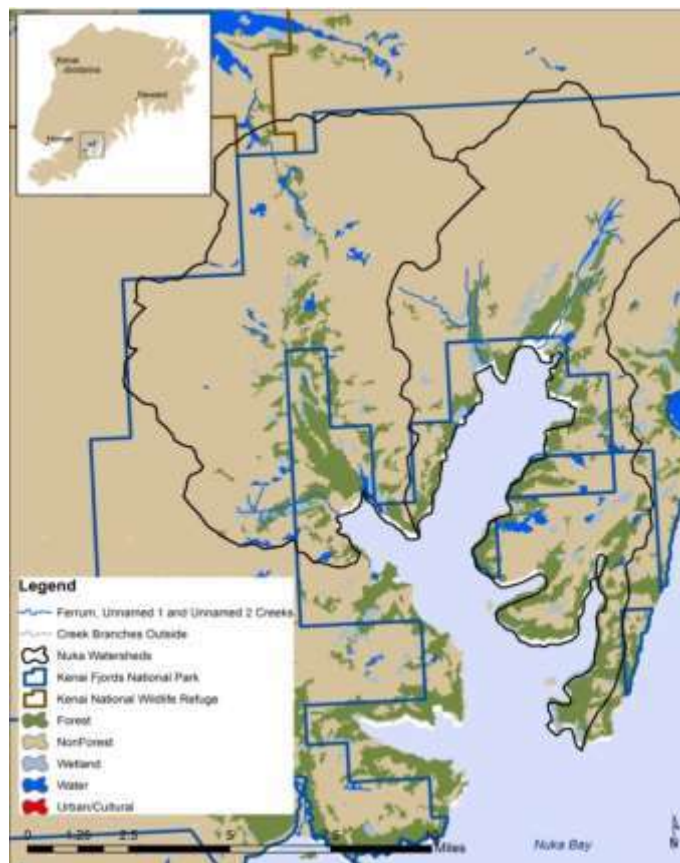


Figure 43. Ferrum Creek and two other unnamed anadromous streams flow from the Wosnesenski-Grewingk Glacier complex and the Harding Icefield, respectively, to embayments within Nuka Bay.



Figure 44. These three streams flow from Kenai Fjords National Park through two parcels owned by the English Bay Corporation to reach the sea.



Figure 45. Looking westward up the 5.2 mile long Ferrum Creek towards the Kenai Fjords National Park. In the left foreground is Beauty Bay. The lower 2.7 miles is habitat for spawning pink salmon.



## Otter Creek

### Assets

Otter Creek is a nonglacial, low-gradient stream that originates in the Kenai Lowlands and flows southwesterly for 7.6 miles to the Cook Inlet. The upper 4.3 miles are inside the Kenai National Wildlife Refuge and the lower 3.3 miles flows through the Gray Cliffs subdivision. A second branch of Otter Creek adds another 2.5 miles. The lower 5.4 miles are listed by the State as anadromous stream with populations of Dolly Varden and spawning coho salmon. The entire watershed is 26,146 acres, of which 5,373 acres are wetlands.

### Vulnerabilities

The mouth of Otter Creek is partially protected by two parcels owned by the Kenai Peninsula Borough. However, 1 private parcel at the mouth and more than 30 private parcels elsewhere in the Grey Cliffs subdivision that intersect with Otter Creek makes this a corridor at risk for degradation. Landowners currently reach this subdivision via the Pipeline Access 4WD Trail from Captain Cook State Park, which crosses over Otter Creek. In addition, the lands within the Kenai National Wildlife Refuge are 22G lands on which the subsurface rights are owned Tyonek Native Corporation. When all private parcels are considered (n=42), 13 have improvements valued at \$92,800.

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
BOROUGH	9	103	0.6	\$ 106,800
NATIVE	2	21,738	4.3	\$ 8,695,200
PRIVATE	42	439	2.6	\$ 444,200
<b>Grand Total</b>	<b>53</b>	<b>22,280</b>	<b>7.5</b>	<b>\$ 9,246,200</b>
<b>Parcels on Creek</b>				
BOROUGH	8	100	0.6	\$ 101,900
PRIVATE	31	348	2.6	\$ 349,900
NATIVE	2	21,738	4.3	\$ 8,695,200
<b>Grand Total</b>	<b>41</b>	<b>22,186</b>	<b>7.5</b>	<b>\$ 9,147,000</b>
<b>Parcels Beyond Creek</b>				
BOROUGH	1	4	0	\$ 4,900
PRIVATE	11	90.45	0	\$ 94,300
<b>Grand Total</b>	<b>12</b>	<b>94.05</b>	<b>0</b>	<b>\$ 99,200</b>

### Unique Opportunities for Conservation

Otter Creek is not a particularly high value landscape corridor as it is always less than 3 miles from the Cook Inlet coastline. On the other hand, to enable oil and gas development of 22G lands on Kenai National Wildlife Refuge, the Apache Corporation is planning on building a road from the end of the North Road Extension (at Captain Cook State Park) for 7.5 miles into the Gray Cliffs subdivision. It is reasonable to assume that traffic volumes will greatly increase to the Otter Creek area as well as new construction in the subdivision. The opportunity to ensure that this stream remains a viable landscape corridor through fee simple acquisition and easements is probably time limited.

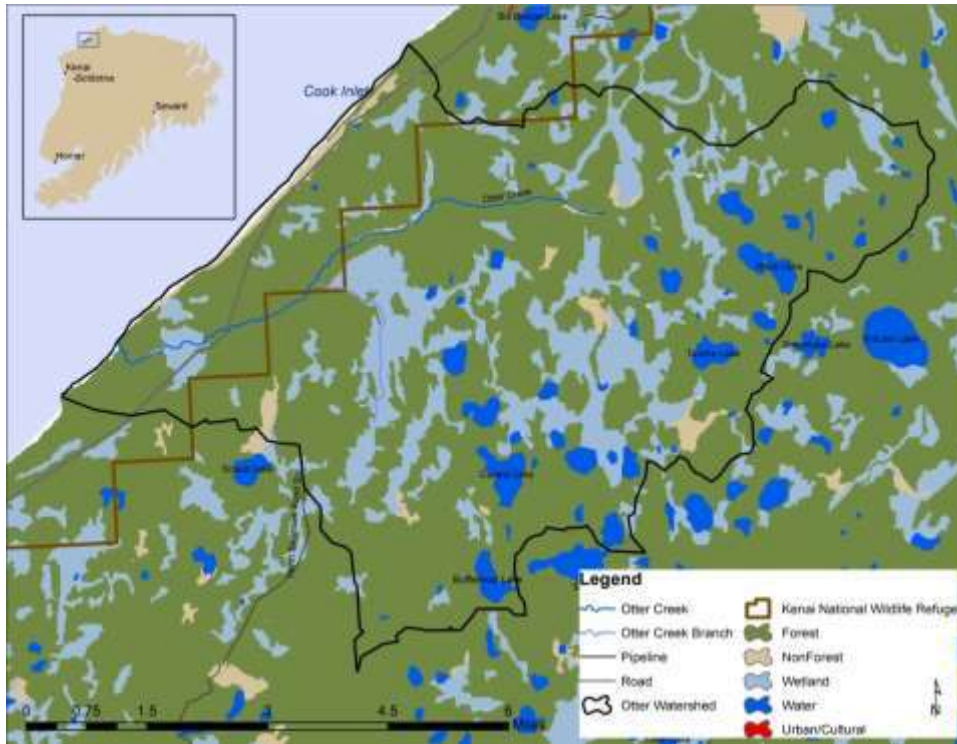


Figure 47. Otter Creek drains a 26,000 acre watershed in the Kenai Lowlands near the Cook Inlet coast.



Figure 46. The lower 3.3 miles of Otter Creek lie within the Gray Cliffs subdivision with over 30 parcels that intersect the river corridor. The subdivision is currently accessed by ATV or snowmachine along a right-of-way, but plans are currently underway to build a road there.



Figure 48. The nonglacial Otter Creek drains the northern Kenai Lowlands within the Kenai National Wildlife Refuge before passing across a public right-of-way currently used for ATV access to a small subdivision at the creek's mouth. The upper watershed is part of the Dave Spencer Wilderness Unit.

## Resurrection Creek

### Assets

Resurrection Creek is a nonglacial stream that originates in the northern Kenai Mountains and flows northward to Turnagain Arm, where it meets the sea at the small community of Hope. The Resurrection Creek system has 198.5 river miles, of which only the last 0.5 miles are outside Chugach National Forest. Its watershed encompasses 108,165 acres of Sitka spruce forest and subalpine shrub, of which 387 acres are wetlands. There are more than 22 miles of State-listed anadromous stream that supports Dolly Varden and spawning habitats for pink, chum, king, and coho salmon. The Kenai Mountain caribou herd moves through the Resurrection Creek valley to reach alpine tundra on adjacent ridges. The Chugach National Forest maintains the Resurrection Pass Trail that parallels Resurrection Creek and several public use cabins.

### Vulnerabilities

Outside Chugach National Forest, Resurrection Creek flows under the paved Hope Highway and through five private parcels and one Federal parcel (administered by the Bureau of Land Management) in Hope before reaching a tidal mud flat in Turnagain Arm. One of the five river front parcels has \$92,300 in improvements.

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
FEDERAL	1	1	0.05	\$ 53,800
PRIVATE	14	103	0.15	\$ 757,900
<b>Grand Total</b>	<b>15</b>	<b>105</b>	<b>0.20</b>	<b>\$ 811,700</b>
<b>Parcels on Creek</b>				
FEDERAL	1	1	0.1	\$ 53,800
PRIVATE	5	91	0.2	\$ 431,600
	<b>6</b>	<b>92</b>	<b>0.2</b>	<b>\$ 485,400</b>
<b>Parcels Beyond Creek</b>				
PRIVATE	9	13	0	\$ 326,300
	<b>9</b>	<b>13</b>	<b>0</b>	<b>\$ 326,300</b>

### Unique Opportunities for Conservation

The Resurrection Creek valley is clearly a large landscape corridor for north-south movement and dispersal in the northern Kenai Mountains, extending from Turnagain Arm to Resurrection Pass and then southwards down Juneau Creek to the Kenai River. Fee simple acquisition and conservation easements are likely appropriate tools for the few private parcels in Hope on which development could threaten the integrity of this anadromous stream and landscape corridor.



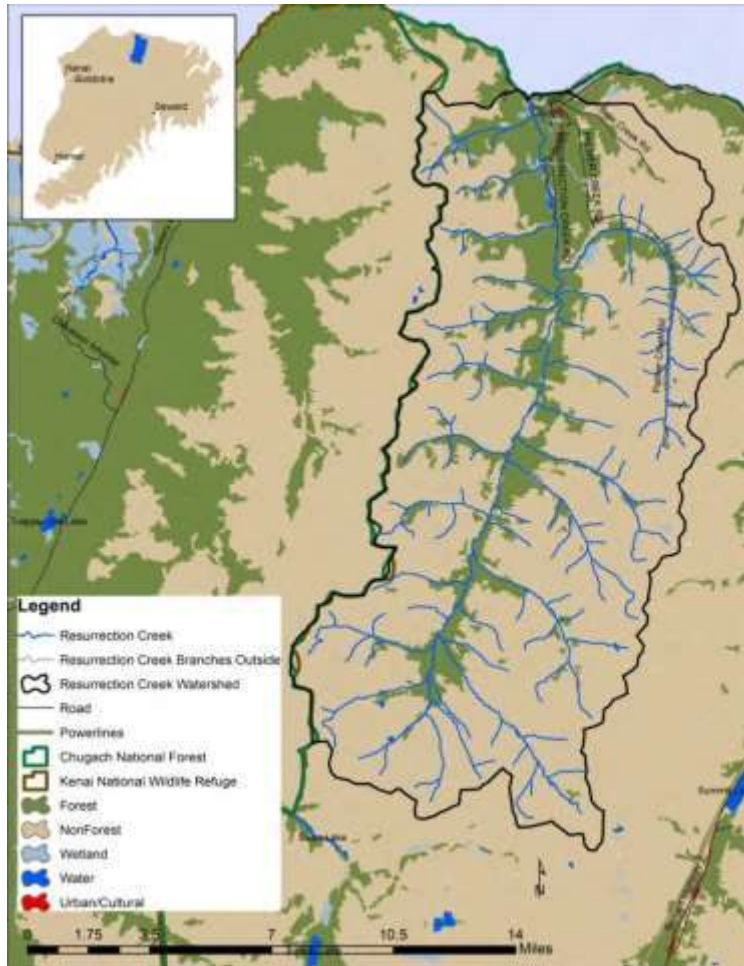


Figure 49. The 108,000-acre Resurrection Creek watershed includes Resurrection Pass high in the Kenai Mountains.



Figure 50. Only the last 0.5 miles of Resurrection Creek are outside Chugach National Forest.



Figure 51. Looking northward down Resurrection Creek towards Turnagain Arm. Only the last 0.5 miles of the stream is outside lands managed by Chugach National Forest.

## Resurrection River

### Assets

The waters of Resurrection River are primarily of nonglacial origin although small, high gradient tributaries drain the northern edge of the Harding Icefield including Exit and Lowell Glaciers. Its jurisdiction is unique on the Kenai Peninsula, with headwaters in all three Federal conservation units. Its main trunk forms the boundary between Chugach National Forest and Kenai National Wildlife Refuge, and between Chugach National Forest and Kenai Fjords National Park. Its watershed is comprised of 141,729 acres of mixed deciduous-Sitka spruce forest, subalpine shrub, alpine tundra and 2,978 acres of wetlands. Including Box Canyon Creek and seven other named tributaries, there are 151.5 river miles conserved within Federal lands; only the lower 6.2 miles that flow into Resurrection Bay on the outskirts of Seward are in other ownership. The lower 46 miles are listed as anadromous by the State and include populations of king, pink, and sockeye salmon, and spawning habitat for coho and chum salmon and hooligan.

### Vulnerabilities

Enroute to the sea, the Resurrection River flows under Exit Glacier Road (Herman Leirer Road), the Seward Highway and the Alaska Railroad tracks. For the first 2 miles or so after leaving Federal lands, it flows between parcels managed by the Alaska Department of Natural Resources and Kenai Peninsula Borough. It is only in the last 3 miles that there are more than 30 privately- and commercially-owned parcels on both banks; intermixed are parcels owned by the Bureau of Indian Affairs and the University of Alaska. Given the ecological and economic significance of this river as the headwaters of Resurrection Bay, it is unsettling that the river's delta is framed by the Seward Airport to the west, a highway and railroad tracks to the north, and subdivisions along Nash Road to the east. Further upstream, there are commercial gravel operations in or adjacent to the braided river channel. There are about \$11.5 million dollars in improvements on the Resurrection River parcels, with another \$9.5 million in improvements of the improvement value is on the private parcels that are not directly on the river bank.

### Unique Opportunities for Conservation

As the largest river system on the eastern Kenai Peninsula, and one that hosts a significant salmon fisheries, forms the primary landscape corridor immediately north of the Harding Icefield, and feeds the headwaters of Resurrection Bay, ensuring the ecological integrity of the Resurrection River should be a priority. There are opportunities to develop agreements or easements with the Alaska Department of Natural Resources, Kenai Peninsula Borough, University of Alaska, and the Bureau of Indian Affairs. The Seward Airport, private subdivisions and various commercial interests will clearly pose challenges for ensuring (and restoring) a conservation corridor, but the very close proximity of sources of potential toxic spills (railroad, highway, airport) demand a focused effort.

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
BOROUGH	3	163.3	0.1	5342000
FEDERAL	1	39	0.1	25600
MUNICIPAL	2	34.86	0	340400
NATIVE ALLOTMENT	1	20	0	82900
PRIVATE	39	423	2.5	\$ 12,609,300
STATE	7	4,648	7.2	\$ 6,682,300
<b>Grand Total</b>	<b>53</b>	<b>5,328</b>	<b>10.2</b>	<b>\$ 25,082,500</b>
<b>Parcels on Creek</b>				
BOROUGH	2	43	0.1	\$ 1,210,200
FEDERAL	1	39	0.1	\$ 25,600
PRIVATE	31	347	2.5	\$ 2,571,500
STATE	5	4,618	7.5	\$ 6,672,700
	<b>39</b>	<b>5,047</b>	<b>10.2</b>	<b>\$ 10,480,000</b>
<b>Parcels Beyond Creek</b>				
BOROUGH	1	120	0	\$ 4,131,800
MUNICIPAL	2	35	0	\$ 340,400
NATIVE ALLOTMENT	1	20	0	\$ 82,900
PRIVATE	8	76	0	\$ 10,037,800
STATE	2	30	0	\$ 9,600
	<b>14</b>	<b>281</b>	<b>0</b>	<b>\$ 14,602,500</b>



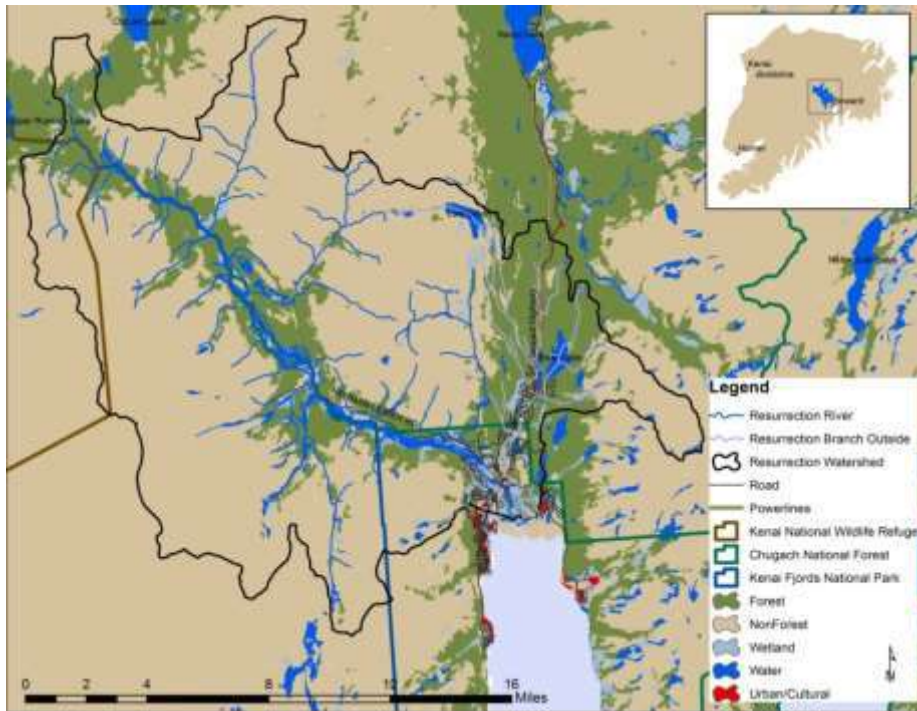


Figure 52. The 141,729-acre Resurrection River watershed is unique in that it encompasses lands from Kenai National Wildlife Refuge, Chugach National Forest, and Kenai Fjords National Park. It forms a small delta at the headwaters of Resurrection Bay near Seward.



Figure 53. The lower 6 miles of the Resurrection River are outside Federal lands and are particularly vulnerable at its mouth where it is framed by the Seward Airport, Seward Highway and Alaska Rail, and subdivisions along Nash Road.



Figure 54. The Resurrection River is the largest river on the eastern Kenai Peninsula and the first landscale-scale corridor immediately north of the Harding Icefield, providing a thoroughfare from the sea to the interior of the Kenai Mountains.

## Seven Egg Creek

### Assets

Seven Egg Creek is a 12.8-mile nonglacial stream that meanders through a flat, forested watershed of 23,300 acres in the Kenai Lowlands, of which 3,184 acres are wetlands. Its headwaters are mapped as Kakoon Lake in the Kenai National Wildlife Refuge, from which it flows north through Kraenberi Lake and then easterly enroute to the Cook Inlet. However, the Neckshorta-Angler lake complex also appears to drain into Kraenberi Lake. Seven Egg Creek provides spawning and rearing habitats for coho salmon.

### Vulnerabilities

Less than five miles of Seven Egg Creek are outside Federal lands in three separate places, bordering Tyonek Native Corporation lands before flowing through the Moose Point subdivision, one of three platted subdivisions along the coast north of Captain Cook State Park. The stream intersects 17 nonfederal parcels covering 3,006 acres with an assessed value of \$1,748,000. The stream crosses the Pipeline Access 4WD Trail 0.5 miles from its mouth. In addition to increasing stream temperatures as a result of a warming climate, long-term threats include continued development of the surrounding subdivision, particularly if the North Kenai Spur Road Extension is completed to Point Possession as planned.

Owner Type	Number Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
BOROUGH	8	1,582	4.1	\$832,100
NATIVE	2	1,280	0.7	\$768,000
PRIVATE	24	527	0.5	\$311,300
<b>Grand Total</b>	<b>34</b>	<b>3,389</b>	<b>5.3</b>	<b>\$1,911,400</b>
<b>Parcels on Creek</b>				
BOROUGH	8	1,581	4.1	\$832,100
NATIVE	2	1,280	0.7	\$768,000
PRIVATE	7	146	0.5	\$148,500
<b>Grand Total</b>	<b>17</b>	<b>3,006</b>	<b>5.3</b>	<b>\$1,748,600</b>
<b>Parcels Beyond Creek</b>				
PRIVATE	17	381	0	\$162,800

### Unique Opportunities for Conservation

There is a real opportunity here to create a wall-to-wall riparian corridor using both fee-simple acquisition for private lands, and partnering or establishing easements with the Kenai Peninsula Borough, which borders much of the stream outside the Refuge, and two large parcels within Refuge boundaries for which the surface patent is owned by Tyonek Native Corporation (ANCSA 22[g] lands). Of 34 parcels that could comprise a potential corridor, only 7 private parcels valued at \$148,500 actually border Seven Egg Creek. Only five parcels are “improved” (\$10,000 - \$76,000) including two private parcels adjoining, and three private parcels that are adjacent, to the creek channel.

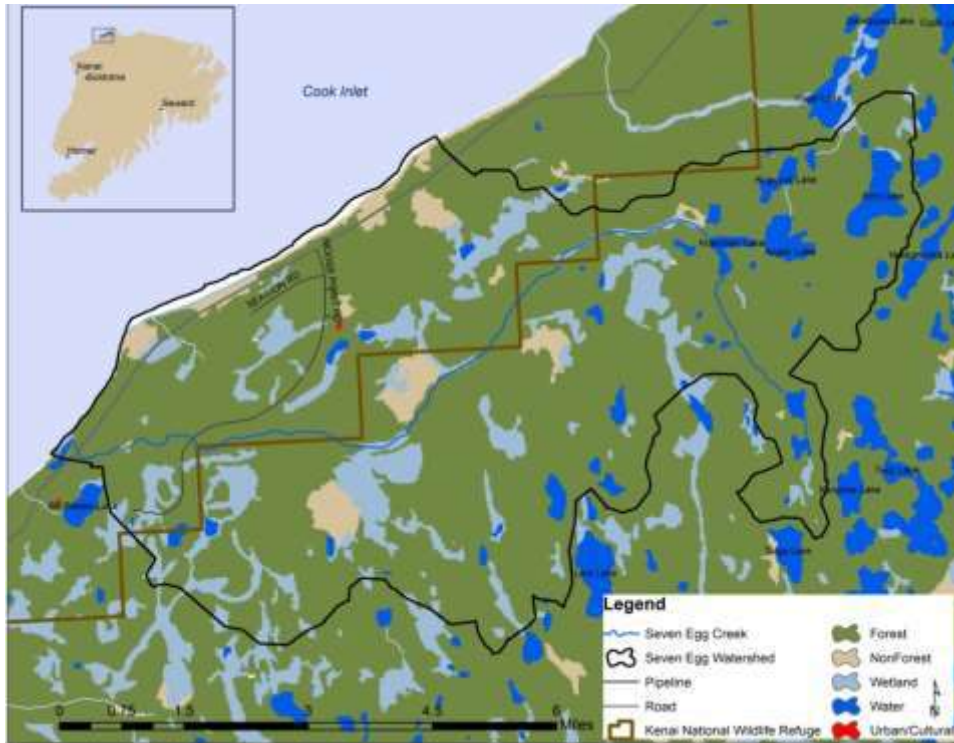


Figure 55. Distribution of 3,184 acres of wetlands within the 23,300-acre Seven Egg Creek watershed.

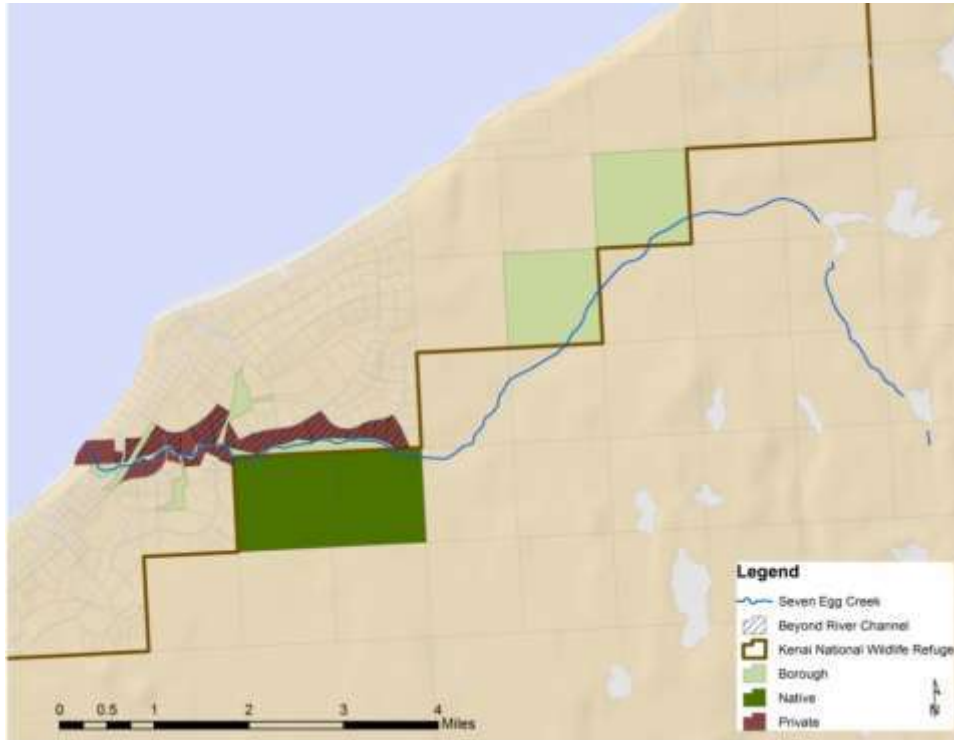


Figure 56. The 12.3-mile Seven Egg Creek flows for 7 miles within the Kenai National Wildlife Refuge before passing through 7 private parcels with a total value of \$148,500. Other lands are owned by the Kenai Peninsula Borough and Native Corporations.





Figure 57. Looking westward down the nonglacial Seven Egg Creek as it flows almost from Chickaloon Flats to the Cook Inlet. Much of the surrounding land is the Dave Spencer Unit of Congressionally-designated Kenai Wilderness.

## Sixmile Creek

### Assets

Sixmile Creek and its tributaries comprise 205 river miles, of which all but 10 miles are within Chugach National Forest. Its two main branches are the East Fork and Canyon Creek that flow together below Moose Mountain near the junction of the Hope and Seward Highways, and continue flowing north through the old mining community of Sunrise before draining into Turnagain Arm. The nonglacial Sixmile Creek watershed is 168,512 acres, of which 941 acres are wetlands. The State has cataloged 40 miles of anadromous streams that include populations of all five salmon species (very unusual for the Kenai Peninsula), including known spawning habitats for chinook and coho salmon. As a high gradient stream, the river is popular for white-water rafting.

### Vulnerabilities

As a landscape corridor for wildlife movement, the integrity of Sixmile Creek is compromised by the adjacency of the Seward and Hope Highways that cross both the East Fork and Canyon Creek. Chugach National Forest maintains a public roadside campground at Granite Creek, a tributary of the East Fork of Sixmile Creek. At the confluence of the East Fork and Canyon Creek is a public roadside rest area and campground, with placer mining activity. A large 2,117-acre parcel owned by the Alaska Department of Natural Resources encompasses this area. The lower 3 miles of Sixmile Creek flow outside the Chugach National Forest before reaching the sea, with more than 20 private parcels spread along a subdivision between the west bank of the stream and the Hope Highway. A total of 11.3 river miles occur on lands outside Chugach National Forest. On all parcels there are \$1,097,000 in improvements. Most of the improvement value is on parcels on the creek; the 4 parcels beyond the creek channel have \$100,000 in improvements.

### Unique Opportunities for Conservation

Despite the presence of the highway system along much of its length, the Sixmile Creek valley is still a viable landscape corridor because it is wide and the road is mostly constrained to the west side of the river. Additionally, the entire east bank of Sixmile creek in Sunrise is comprised of five parcels owned by the same private landowner. There is an opportunity to work with this landowner, the Alaska Department of Natural Resources, and Chugach National Forest to ensure that the east bank of Sixmile Creek (including the East Fork) are conserved as a contiguous corridor from sea to the interior of the northern Kenai Mountains, certainly to Turnagain Pass and perhaps to Johnson Trail Pass if the bridge over East Fork of Sixmile Creek was improved to facilitate wildlife movement (i.e., bridge extended on the bank opposite the cloverleaf-shaped bike trail).

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>ALL Parcels</b>				
BOROUGH	2	342	1.0	\$ 401,600
PRIVATE	26	1,292	3.6	\$ 2,628,100
STATE	8	2,174	6.7	\$ 1,370,400
<b>Grand Total</b>	<b>36</b>	<b>3,807</b>	<b>11.3</b>	<b>\$ 4,400,100</b>
<b>Parcels on Creek</b>				
BOROUGH	1	211	1	222200
PRIVATE	23	1,272	3.6	2400200
STATE	8	2,174	6.7	1370400
	<b>32</b>	<b>3,657</b>	<b>11.3</b>	<b>\$ 3,992,800</b>
<b>Parcels Beyond Creek</b>				
BOROUGH	1	131	0	\$ 179,400
PRIVATE	3	19	0	\$ 227,900
<b>Grand Total</b>	<b>4</b>	<b>150</b>	<b>0</b>	<b>\$ 407,300</b>

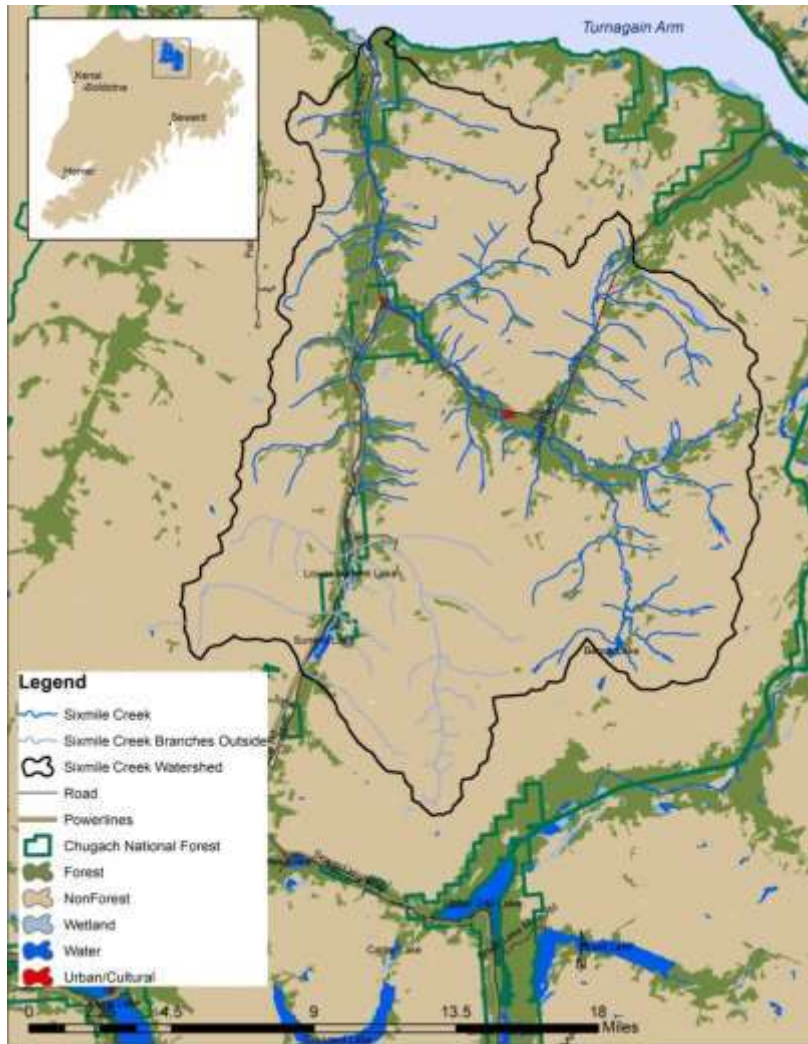


Figure 59. The 168,500-acre Sixmile Creek watershed includes 40 miles of habitats for all five salmon species, unusual for the Kenai Peninsula.

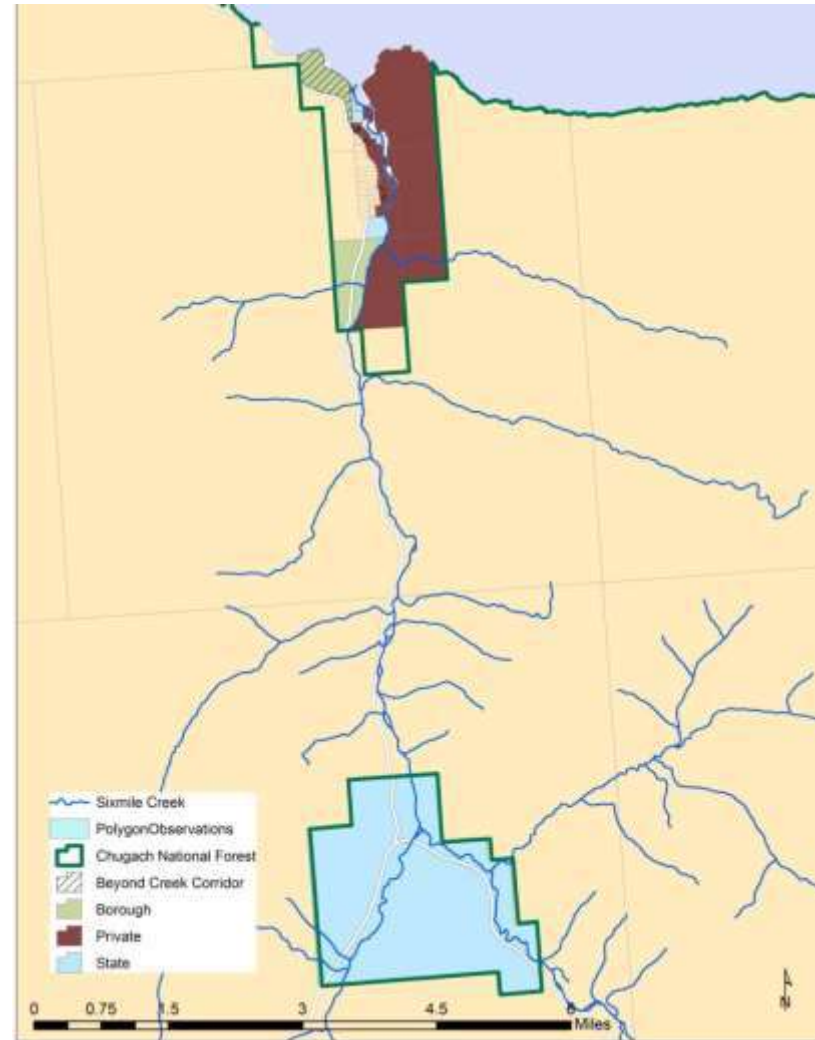


Figure 58. Although the lower 3 miles of Sixmile Creek flow outside Chugach National Forest, there is an opportunity to create a contiguous corridor on the east side of Sixmile Creek from at Turnagain Pass to Turnagain Arm.





Figure 60. Looking northward down Sixmile Creek towards Turnagain Arm. In the foreground is the confluence of the Sterling and Hope Highways.

## Swanson River

### Assets

The Swanson River is “Yaghanenetnu” or the Good Land River, and is thought to be the location of the first Dena’ina migrants to the peninsula. The nonglacial Swanson River flows through the heart of the Kenai Lowlands, originating near Point Possession certainly at Wild Lake and perhaps as far north as Mull Lake. The watershed encompasses over 125 named lakes and 182,014 acres of black and white spruce-mixed deciduous forest, of which 17,034 acres are wetlands including extensive peatlands. With an average gradient of only 4 feet per mile, it meanders towards the southwest across the Kenai Peninsula’s true boreal forest, only bending towards the northwest near Akula Lake before finally draining into the Cook Inlet. Enroute, it flows for 108 miles through the Swanson River National Recreation Canoe Trail, the Dave Spencer Wilderness Unit, the Swanson Oil and Gas Field, and finally the Captain Cook State Park. There are 88.5 miles of State-listed anadromous stream that support Dolly Varden and sockeye salmon, and known spawning habitats for coho and pink salmon. The watershed is known for high moose, black bear and trumpeter swan populations. The mouth of Swanson River is the location of a large Dena’ina site that was abandoned in the early 20<sup>th</sup> century. A number of Dena’ina and non-Dena’ina trapping cabins are along the Swanson River, part of a historic winter trail used to access the Kenai Lowlands.

### Vulnerabilities

Despite a half century of oil and gas exploration and development in this watershed (the 1957 Discovery Well is here), it is still remarkably pristine except of a couple of outstanding anomalies. The 8,000-acre lease currently held by Hilcorp includes over 90 well pads, a compressor plant, a pipeline that flows to Nikiski, and two grated steel bridges (under which the Swanson River flows) that allow industrial vehicles access from the Sterling Highway. Although the mouth of the Swanson River is protected within the Cook Inlet State Park, the river flows under the North Road Extension, which currently terminates at the state park. Apache Corporation is planning to extend this road 7.5 miles further north up the Cook Inlet coast to access subsurface deposits on 22G lands in Kenai National Wildlife Refuge; this will only increase traffic across the Swanson River. The Swanson River has infestations of reed canarygrass at its mouth and in the Swanson oil and gas field. The introduced northern pike was recently eradicated from Stormy Lake, which flows into the Swanson River, but it is still uncertain if a pike population in the Swanson has been established.

Owner Type	Number of Parcels	Acres	Miles of Creek	Assessed Value
<b>Parcels on Creek</b>				
STATE	2	1,288	1.4	\$938,800

### Unique Opportunities for Conservation

Only 1.4 miles of the lower Swanson River is outside the Kenai National Wildlife Refuge. Remarkably, only two state-owned parcels make the outlet vulnerable. The Alaska Department of Fish and Game owns the smaller 6.5 acre parcel north of the mouth and the Alaska Department of Natural Resources owns the larger parcel; neither have improvements. These two parcels also protect two small anadromous branches (1.6 miles). Agreements or easements with these two agencies would help ensure that the Swanson River remain a contiguous landscape corridor.

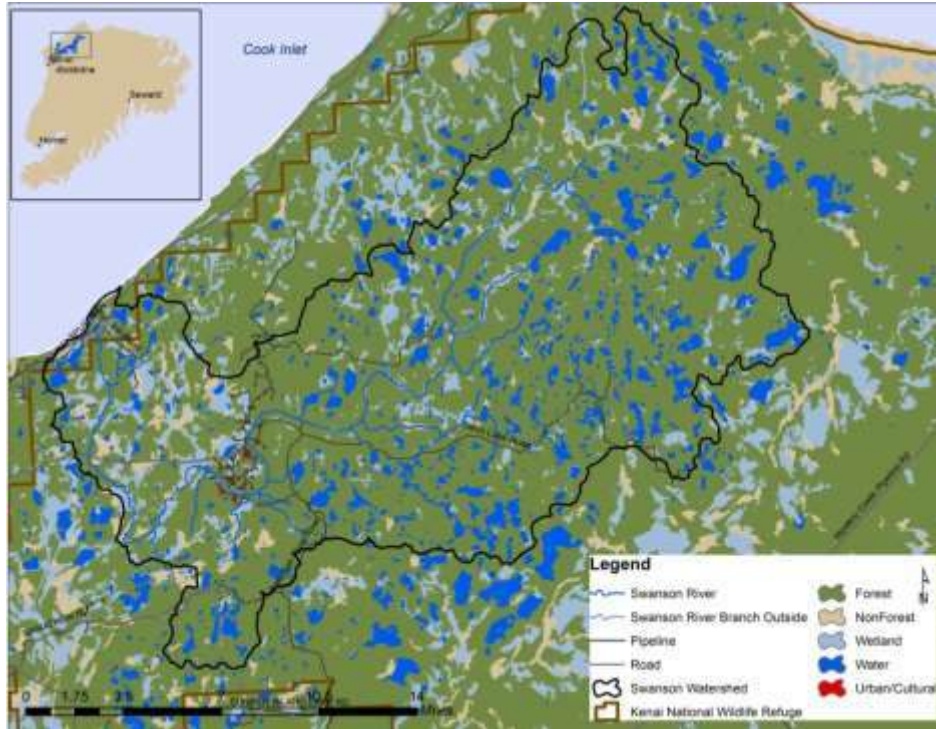


Figure 62. The 182,000-acre Swanson River watershed encompasses 125 named lakes in the Kenai Lowlands.

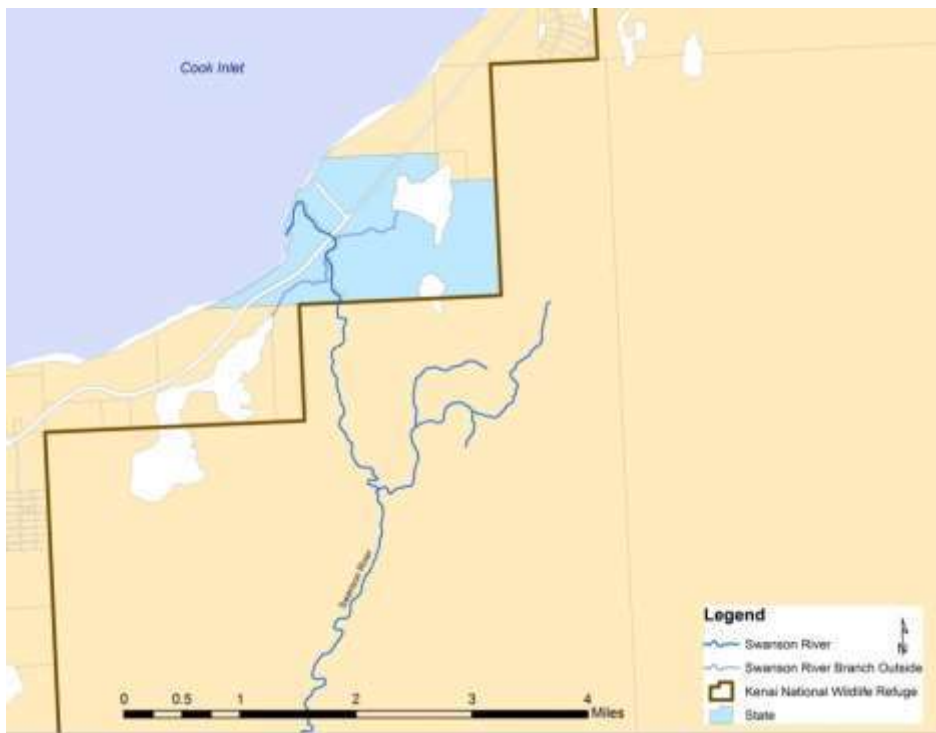


Figure 61. With the exception of 1.4 miles on two State parcels, the rest of the 108-mile Swanson River system is within the Kenai National Wildlife Refuge, much of it part of the Dave Spencer Wilderness Unit.





Figure 63. The 108-mile Swanson River drains a significant portion of the Kenai Lowlands and is part of the Swanson National Recreation Canoe Trail. In the foreground is the Kenai North Road Extension that crosses the river just before it flows into the Cook Inlet.



## KENAI DECISION SUPPORT TOOL

Commonly, conservation organizations and land trusts perform land prioritization analysis to guide their conservation strategies. This often involves the use of a GIS analysis to overlay various resource layers, and rank land units according to their importance based on stakeholder input. Although this approach can be effective, it is typically not very flexible. Organizational priorities change as new grants become available, staff change, or the political context shifts. Furthermore, the results of any prioritization process differ depending on the stakeholders involved or the scale of analysis. Conservation strategies need to be continually updated to account for such changes, which calls for moving beyond a standard GIS to a dynamic decision support tool framework.

With funding from the Alaska Coastal Program, Audubon Alaska created an interactive, online tool for the Kenai Peninsula. Developed in consultation with the Kachemak Heritage Land Trust, Kenai National Wildlife Refuge, other conservation organizations, and the Kenai Peninsula Borough, this tool ensures that the data and decision parameters would be meaningful to local decision-makers. Javascript API with ArcGIS Online was used to create an interface that allows users to dynamically allocate weights to various resource layers, and rapidly identify areas of interest based on different scoring scenarios. This tool allows users to identify priorities at various scales, from watersheds and subwatersheds down to the parcel level, allowing for decisions to be based on ecological and/or administrative boundaries. Data on rivers, wetlands, fish, birds, vegetation, climate change, and development were included, as well as other relevant factors such as parcel size and cost. Users can quickly reassess their land priorities to account for changing circumstances, and experiment with different scenarios.

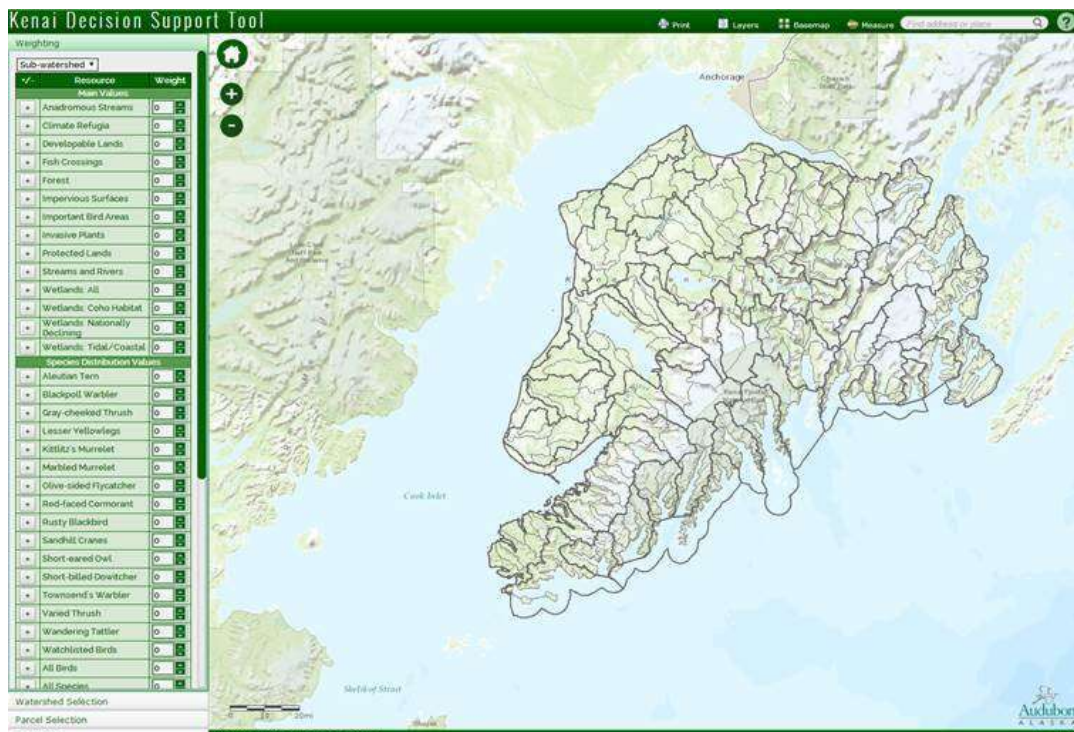


Figure 5. The Kenai Decision Support Tool is an interactive, online tool that helps prioritize parcels, subwatersheds and watersheds for acquisition or less-than-fee-simple conservation approaches to develop contiguous stream-based corridors.

Table 4. Cross-walking names for Mountains to Seas corridors with the Alaska Department of Fish & Game’s Anadromous Waters Catalog, the stream classification used by the Kenai Peninsula Fish Habitat Partnership, and traditional place names used by Alaska native tribes.

<b>Corridors</b>	<b>AWC Stream Code</b>	<b>KPFHP CAP Ref.</b>	<b>Traditional Name</b>
<b>Aialik Bay</b>	232-40-10150	Steep Coastal Streams	
<b>Beaver Creek</b>	244-30-10010-2025	Lowland groundwater/wetland-dominated systems	Hkayitnu
<b>Crooked Creek</b>	244-30-10050-2024	Lowland groundwater/wetland-dominated systems	
<b>Deep Creek (North Fork)</b>	244-20-10100-2045	Lowland groundwater/wetland-dominated systems	
<b>Fox River</b>	241-14-10645	Glacial rivers without lakes	
<b>Funny River</b>	244-30-10010-2050	Glacial rivers without lakes	Ts’ilatnu
<b>Harding – Gateway</b>	231-20-13500	Steep Coastal Streams	
<b>Harris Bay</b>	232-30-10251	Steep Coastal Streams	
<b>Kasilof River</b>	244-30-10050	Glacial rivers with lakes	Ggasilahtnu
<b>Kenai River</b>	244-30-10010	Glacial rivers with lakes	Kahtnu
<b>Killey River</b>	244-30-10010-2076	Glacial rivers with lakes	
<b>Moose River</b>	244-30-10010-2063	Lowland groundwater/wetland-dominated systems	
<b>Nuka Bay Ferrum Creek</b>	<i>232-22-10145</i>	<i>Steep Coastal Streams</i>	
<b>Nuka Bay Creek 1</b>	<i>232-22-10090</i>	<i>Steep Coastal Streams</i>	
<b>Nuka Bay Creek 2</b>	<i>232-22-10082</i>	<i>Steep Coastal Streams</i>	
<b>Otter Creek</b>	247-80-10015	Lowland groundwater/wetland-dominated systems	
<b>Resurrection Creek</b>	247-60-10150	Non-glacial mountain rivers	
<b>Resurrection River</b>	231-30-10080	Non-glacial mountain rivers	
<b>Seven Egg Creek</b>	247-80-10010	Lowland groundwater/wetland-dominated systems	
<b>Sheep Creek</b>	241-14-10630	Glacial rivers without lakes	
<b>Sixmile Creek</b>	247-60-10170	Non-glacial mountain rivers	
<b>Swanson River</b>	247-90-10020	Lowland groundwater/wetland-dominated systems	Yaghanenetnu (Good Land)

Disclaimer: All estimates of parcel values are appraised values from the Kenai Peninsula Borough parcel viewer and are intended for comparative purposes. Information on anadromous fisheries is from the Alaska Department of Fish and Game's Atlas and Catalogue of Waters Important for Spawning, Rearing, or Migration of Anadromous Fish. Spatial data for streams and rivers are from the USGS National Hydrography Dataset.