Table 1: Olympic Peninsula core areas; currently identified local populations; foraging, migration and overwintering habitat; and research needs areas for bull trout. See also Figure 2.

Core Area	**Local Population** *(potential local populations[a] in italic type)*	**Foraging, Migration, Overwintering Habitat[b]**	**Research Needs Area**
Skokomish River, including North and South Forks	North Fork Skokomish River, including Elk and Slate Creeks		
	South Fork Skokomish River, including Church Creek		
	Brown Creek (potential)		
	N/A[c]	Hood Canal and westside tributary estuaries	Hood Canal westside tributaries
		Bell Creek (east of the Dungeness River)	
Dungeness River, including Grey Wolf and upper Dungeness	Middle Dungeness River and tributaries up to rm 24 and including Silver, Gold, and Canyon Creeks		
	Gray Wolf River to confluence with Cameron, Grand, and Cedar Creeks		
	N/A[c]	Morse Creek, Ennis Creek, and Siebert Creek (tributaries to Strait of Juan de Fuca between Dungeness and Elwha Rivers)	
Elwha River	Elwha River and tributaries above 213 meters (700 feet) elevation, including Boulder, Cat, Prescott, Stony, Hayes, Godkin, Buckinghorse, and Delabarre Creeks		
	Little River (potential)		
	N/A[c]	Nearshore Olympic Peninsula marine waters of the Pacific Ocean and tributaries including Goodman, Mosquito, Cedar, Steamboat, Kalaloch, and Joe Creeks; Raft, Moclips, and Copalis Rivers	Quillayute River

Table 1 (cont.). Olympic Peninsula core areas; currently identified local populations; foraging, migration, and overwintering habitat; and research needs areas for bull trout. See also Figure 2.

Core Area	Local Population *(potential local populations[a] in italic type)*	Foraging, Migration, Overwintering Habitat[b]	Research Needs Area
Hoh River	Upper Hoh River (above confluence with South Fork Hoh) and tributaries, including Cougar and "OGS" Creeks		
	South Fork Hoh River and tributaries		
Queets River	Queets River and tributaries above the confluence with Tshletshy Creek		
Quinault River	North Fork Quinault River and tributaries, including Rustler Creek		
	Quinault River (East Fork) and tributaries above confluence with North Fork Quinault River		
	N/A[c]	Grays Harbor, including Humptulips and Wishkah Rivers	Hoquiam River
	N/A[c]	Lower Chehalis River Basin, including Wynoochee and Satsop Rivers	

[a] A potential local population is a local population that does not currently exist but that could exist and contribute to recovery, if spawning and rearing habitat or connectivity is restored in a known or suspected unoccupied area.

[b] Foraging, migration, and overwintering habitat is found both within and outside of core areas; such habitat identified in this table is habitat located outside of core areas, and is within watersheds not believed to support spawning.

[c] Distribution and abundance of most local populations of bull trout on the Olympic Peninsula are poorly known at this time. Where no spawning information was available, the presence of multiple age classes (small juveniles, less than 150 millimeters [6 inches], and adults) was used.

on the Olympic Peninsula range from sea level to 2,462 meters (7,962 feet) at Mount Olympus.

The Olympic Peninsula contains a total area of 13,768 square kilometers (5,316 square miles). Olympic National Park includes nearly one fourth (362,632 hectares [896,083 acres]) of the peninsula. Six Indian reservations occupy 92,862 hectares (29,467 acres); the U.S. Department of Agriculture Forest Service (U.S. Forest Service) controls 253,053 hectares (625,308 acres); and the Washington Department of Natural Resources has jurisdiction over 161,874 hectares (400,000 acres) (S. Brenkman, Olympic National Park, pers. comm. 2004).

Watershed boundaries of the Olympic Peninsula Management Unit overlap ceded lands of the Chehalis, Quinault, Hoh, Quileute, Skokomish, Lower Elwha S'Klallam, and Jamestown S'Klallam Tribes. These Tribes and other Native American Tribes have treaty fishing rights on the Olympic Peninsula.

Geological History. Geologists hypothesize that the Olympic Peninsula formed when the Juan de Fuca Plate, an ocean plate carrying a load of sandstone, shale, and lava flow, moved under the neighboring North American Plate (Storm *et al.* 1990; Kirk 1992). The upper portions of sedimentary deposit of the ocean plate crumbled and folded as it moved under the North American Plate. Deposits that were scraped off became part of the North American Plate, forming the steep rock layers and volcanic flows of the Olympic Peninsula. When the movement of plates decreased, the rocks rose and formed a large, uplifted area of sedimentary rock surrounded on three sides by basalt.

Glaciers pushing out from Canada covered northern Washington several times, most recently about 14,000 years ago. This ice sheet pushed against the Olympic Mountains, splitting the ice sheet into two lobes. One lobe pushed along the trough of Puget Sound, while the other followed the Strait of Juan de Fuca. Local glaciers advanced and retreated, with the larger ones forming the river valleys of the Queets, Quinault, and Hoh Rivers. During earlier glaciations, gravel and silt were deposited as far west as today's nearshore islands. Sixty major glaciers still cover the Olympic mountains, providing sources of cold water to the glacially fed rivers on the Olympic Peninsula. These same streams and rivers continue to cut into glacial debris and mountainsides, resulting in land

slumps or occasional massive landslides. This combination of geologic upheavals and weather conditions has produced about 30 major soil types on the western Olympic Peninsula alone (Storm *et al.* 1990; Kirk 1992).

The last glaciation (the Vashon Stade) can be correlated with fish distribution on the Olympic Peninsula (Mongillo and Hallock 1997). During this period, ice covered the northern, central, and eastern part of the Olympic Peninsula. The Chehalis River was the largest ice-free river, and the northern portion of this basin is commonly referred to as the Chehalis Refuge. As the ice receded, the coastal and interior drainages provided the major dispersal routes to the north for fish species from the Chehalis Refuge.

Climate. Precipitation on the west side of the Olympic Peninsula ranges from an average of 230 centimeters (90 inches) a year at the coast near Kalaloch to 508 centimeters (200 inches) or more for Mount Olympus. The ratio of overcast days to clear days is about two to one. This cloud cover keeps temperatures warmer in winter and cooler in summer. Little of the precipitation coming from the ocean reaches the east side of the mountains, and Sequim, Washington, located 56 kilometers (35 miles) northeast of the mountains, receives about only 46 centimeters (18 inches) of rain annually. The Olympic Peninsula's maritime climate exhibits mild fluctuations and few extremes, averaging 11 degrees Celsius (52 degrees Fahrenheit) annually with an average high of 16 degrees Celsius (60 degrees Fahrenheit) in July and 4 degrees Celsius (39 degrees Fahrenheit) in January.

Ecology. The Olympic Peninsula has the only temperate rain forest in the northern hemisphere. Kirk (1992) characterizes temperate rain forest as having the following characteristics:

- Wet, cool acidic soils.
- An abundant network of flowing water.
- Relatively little disturbance from wildfire or insect attack.
- Primarily conifers, fewer broadleaf trees.
- Multilayered growth providing canopies.
- Large numbers of epiphytes and mosses.
- Abundant organic debris covering the ground.

- Trees that include the largest and longest lived for their type.

Only about 3 percent remain of the more than one million acres of old-growth spruce (*Picea* spp.), hemlock (*Tsuga* spp.), and fir (*Abies* spp.) that historically carpeted the Olympic Peninsula. Most of the remaining old growth is in the Olympic National Park, which is also designated as a World Biosphere Reserve and World Heritage Site.

Fish Species. Currently 31 species of native fish inhabit the management unit (Table 2). The majority of native fish inhabiting the Olympic Peninsula are found in streams below 200 meters (656 feet) in elevation. The Satsop River area, just north of the mainstem Chehalis River, supports the greatest concentration of nongame native fish in Washington (Mongillo and Hallock 1997). In Hood Canal and the Strait of Juan de Fuca, fall Chinook salmon and summer chum (*O. keta*) salmon are listed as threatened species under the Endangered Species Act. In 2001, we proposed a rule to list the Dolly Varden as threatened in Washington due to similarity of appearance to bull trout (66 FR 1628). Marine and estuarine species that form an important prey base for bull trout include sandlance (*Ammodytes hexapterus*), surf smelt (*Hypomesus pretiosus*), and Pacific herring (*Clupea harengus pallasi*). Brook trout (*Salvelinus fontinalis*), common carp (*Cyprinus carpio*) and largemouth bass (*Micropterus salmoides*) are nonnative fish that are found on the Olympic Peninsula and known or believed to impact bull trout.

Description of Core Areas

Skokomish Core Area (Mason County) (Figure 3). The Skokomish River, which drains into the southernmost portion of Hood Canal, is the largest tributary and has the largest estuary in the Hood Canal basin. Upland, tideland, riverine, and estuarine wetland ecosystems are found within the Skokomish estuary. Considering the increasing rarity of natural estuaries in the Puget Sound region, the estuary plays an especially important role for aquatic species.

The three major tributaries of the Skokomish River include the South Fork Skokomish River, North Fork Skokomish River, and Vance Creek (Figure 3).

Table 2. Native freshwater fish in the Olympic Peninsula Management Unit.

Common Name	Scientific Name
Bull trout	*Salvelinus confluentus*
Coho salmon	*Oncorhynchus kisutch*
Pink salmon	*Oncorhynchus gorbuscha*
Chinook salmon	*Oncorhynchus tshawytscha*
Chum salmon	*Oncorhynchus keta*
Sockeye salmon	*Oncorhynchus nerka*
Steelhead trout	*Oncorhynchus mykiss*
Cutthroat trout	*Oncorhynchus clarki*
Dolly Varden	*Salvelinus malma*
Mountain whitefish	*Prosopium williamsoni*
Pygmy whitefish	*Prosopium coulteri*
Olympic mudminnow	*Novumbra hubbsi*
Redside shiner	*Richardsonius balteatus*
Longnose dace	*Rhinichthys osculus*
Speckled dace	*Rhinichthys cataractae*
Peamouth	*Mylocheilus caurinus*
Largemouth sucker	*Catostomus macrocheilus*
Coastrange sculpin	*Cottus aleuticus*
Torrent sculpin	*Cottus rhotheus*
Prickly sculpin	*Cottus asper*
Riffle sculpin	*Cottus gulosus*
Reticulate sculpin	*Cottus perplexus*
Shorthead sculpin	*Cottus confusus*

Table 2 (cont.) Native freshwater fish in the Olympic Peninsula Management Unit.

Common Name	Scientific Name
Threespine stickleback	*Gasterosteus aculeatus*
Green sturgeon	*Acipenser medirostris*
Pacific lamprey	*Lampetra tridentata*
River lamprey	*Lampetar ayresi*
Western brook lamprey	*Lampetra richardsoni*
White sturgeon	*Acipenser transmountanus*
Longfin smelt	*Spirinchus thaleichtys*
Northern pikeminnow	*Piscivorous ptichocheilus*

The Skokomish River system contains approximately 89 kilometers (55 miles) of accessible habitat for anadromous fish: South Fork Skokomish River and tributaries with 59 kilometers (37 miles), North Fork Skokomish River and tributaries with 15 kilometers (9 miles), and mainstem Skokomish River with 15 kilometers (9 miles) of accessible habitat. The mainstem Skokomish River splits into the north and south forks at river mile 9. The Skokomish core area includes all streams flowing in the Skokomish River basin, Lake Cushman, Lake Kokanee, and the estuary of the river.

The North Fork Skokomish River flows southeast from its headwaters in the Olympic Mountains to its confluence with Lake Cushman, a distance of about 22 kilometers (14 miles). Lake Cushman is a 1,620-hectare (4,000-acre) impoundment in the Olympic National Forest. Before the completion of two dams in 1926 and 1930, Lake Cushman was a natural oligotrophic (nutrient poor but oxygen rich) lake with a mean depth of 61 meters (200 feet); it was smaller than the current reservoir (Brenkman 1998). Below the lower dam at river mile 17.27, the North Fork Skokomish River continues to flow southward to its confluence with the South Fork Skokomish River.

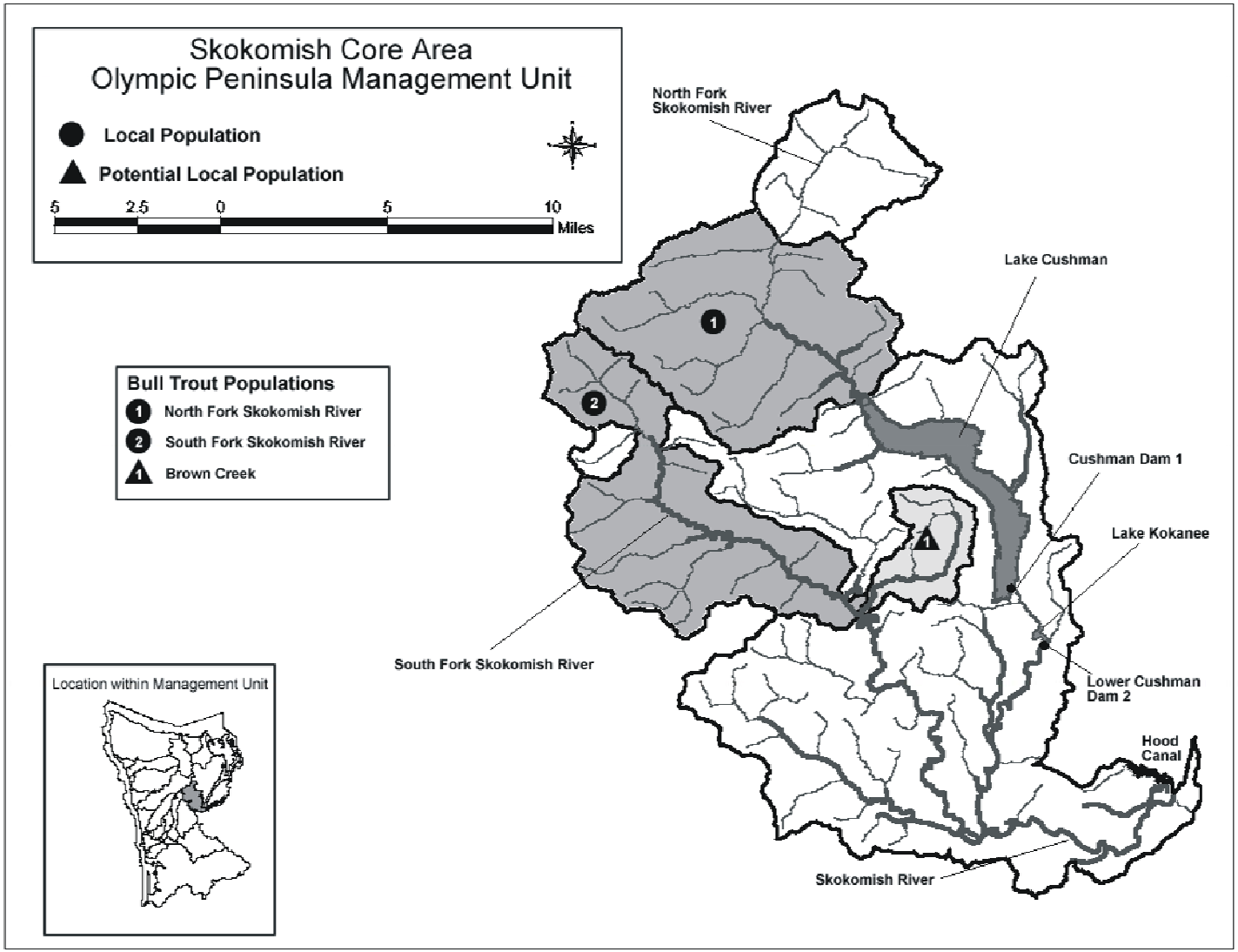

Figure 3. Skokomish core area for bull trout. Highlighted streams are key freshwater habitat for recovery.

The river basin upstream of Lake Cushman drains 126 square kilometers (49 square miles). The river descends in elevation from 1,622 meters (5,321 feet) in the headwaters to 225 meters (738 feet) at its confluence with Lake Cushman. Steep montane topography in basaltic geologic material results in high-gradient tributaries in the upper basin. River discharge† is strongly influenced by rainfall in the winter, while spring runoff is predominately influenced by snowmelt (Brenkman *et al.* 2001). Mean annual precipitation from 1984 to 1996 at Cushman Dam No. 1 was 231 centimeters (91 inches), most of which occurred as rain from November to January (Brenkman 1998).

The South Fork Skokomish River originates within Olympic National Park, approximately 1,005 meters (3,297 feet) above sea level and 44 kilometers (27 miles) upstream from the mainstem Skokomish River. A series of 5- to 10-meter (15- to 30-foot) waterfalls at river mile 24 prevent upstream migration of bull trout in the South Fork Skokomish River. The two major tributaries of the South Fork Skokomish River are Vance Creek with 7 kilometers (4 miles) of accessible stream and Brown Creek with 9 kilometers (6 miles) of accessible stream. Accessible habitat in the remaining tributaries is relatively short, ranging from 0.4 kilometer (0.2 mile) to 2 kilometers (1 mile). The area upstream from river mile 19 has remained relatively pristine. The majority of juvenile and subadult (less than 400 millimeters [16 inches]) bull trout in the system are found between river mile 19 and the anadromous barrier at river mile 24 (Ogg and Taiber 2002). Downstream from river mile 19.3, the river increasingly meanders through a wide valley until the valley constricts into a steep-walled canyon known as the “gorge” at river mile 10. This area, relatively inaccessible to anglers, contains deep pools and a stable channel. At river mile 3, the South Fork Skokomish flows into the Skokomish Valley and eventually joins the North Fork Skokomish River to form the mainstem Skokomish River. The mainstem Skokomish River channel within the valley is highly aggraded† (filled with sediment deposits) and floods frequently.

The upper North Fork Skokomish River and most of the 14 named tributaries upstream from Lake Cushman are located primarily within Olympic National Park, and small private landowners occupy the majority of the valley. The U.S. Forest Service and private timber companies own the majority of the upper South Fork Skokomish River. The Skokomish Indian Reservation, located

at the mouth of the Skokomish River, includes the lower 10.5 kilometers (6.5 miles) of the mainstem.

Quinault Core Area (Jefferson and Grays Harbor Counties) (Figure 4). The Quinault core area includes the mainstem Quinault River, North Fork Quinault River, tributaries, Lake Quinault, and the estuary of the river. The upper mainstem Quinault River upstream from the confluence with the North Fork Quinault River is sometimes referred to as the East Fork Quinault River. The Quinault River originates at Anderson Glacier in the Olympic Mountains and flows approximately 113 kilometers (70 miles) to the Pacific Ocean, with a total watershed area of 118,933 hectares (293,880 acres). The North Fork Quinault River originates as meltwater and springs along the slopes of Mount Seattle before it joins the mainstem Quinault River at river mile 48. From the confluence of the North Fork Quinault River, the gradient decreases and the Quinault River meanders for another 16 kilometers (10 miles) down the valley to Lake Quinault, a 1,509-hectare (3,729-acre) natural lake. Downstream of the lake the terrain becomes gentle, and the river widens out into the sinuous, braided channel† characteristic of large alluvial† glacial rivers as it flows the remaining 53 kilometers (33 miles) to the mouth at the Pacific Ocean, near the community of Taholah, Washington. The lowlands in the western part of this watershed contain several hundred feet of glacial deposits and lake and swamp deposits formed during interglacial periods.

Annual precipitation in the Quinault Basin is high, averaging 371 centimeters (146 inches) at Lake Quinault. In the upper watershed much of the precipitation falls as snow, while most precipitation falls as rain west of Lake Quinault. Water temperatures in the glacier-dominated upper watershed are cold and suitable for bull trout, with a maximum summer temperature of 13.5 degrees Celsius (56 degrees Fahrenheit) and minimum winter temperature of 0.5 degrees Celsius (33 degrees Fahrenheit) recorded at the United States Geological Survey gauging station on the North Fork Quinault River (river mile 47.5) between 1960 and 1985. Water temperature data taken at river mile 37.5 just above Lake Quinault indicate that the daily averages ranged from 10.1 to 13.6 degrees Celsius (50.2 to 56.5 degrees Fahrenheit) in the summer. The lake stratifies thermally during the summer months, with the surface layer being warmer and a thermocline† preventing mixing of the layers. During 1989 and 1990, surface

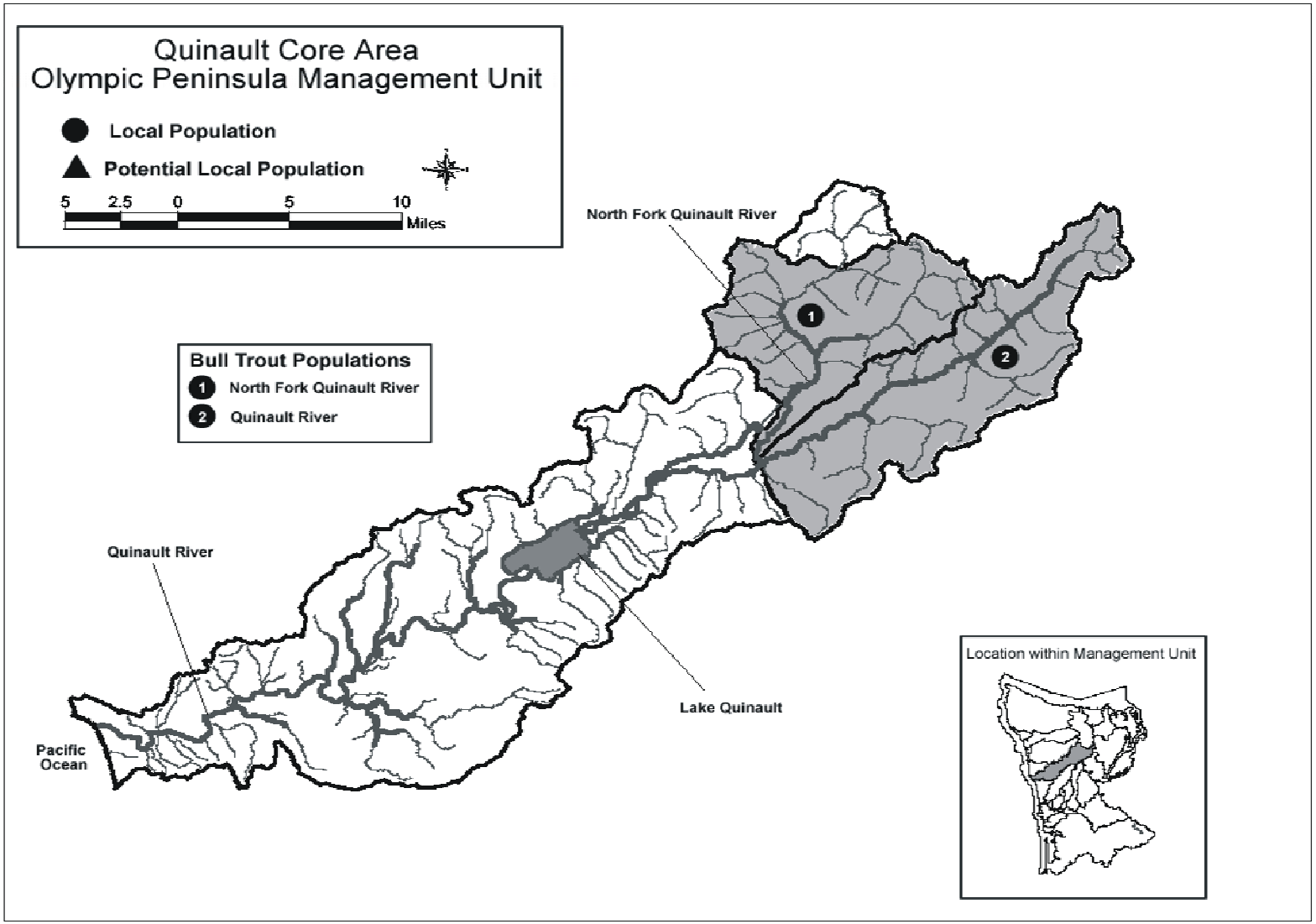

Figure 4. Quinault core area for bull trout. Highlighted streams are key freshwater habitat for recovery.