Kenai Peninsula
Fish Habitat Partnership

Strategic Plan

Purpose
The purpose of the Kenai Peninsula Fish Habitat Partnership is to create and foster effective collaborations to maintain healthy fish, healthy people, healthy habitat, and healthy economies in the Kenai Peninsula Borough.

Mission
To protect, maintain, restore and enhance fish habitat.

Vision
For future generations to have healthy, sustainable fish and aquatic ecosystems.

A Participating Partner of the

NATIONAL
FISH HABITAT
ACTION PLAN

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Executive Summary

The Kenai Peninsula Fish Habitat Partnership formed to foster and create effective collaborations to maintain healthy fish, healthy people, healthy habitat, and healthy economies within the Kenai Peninsula Borough. The geographic area covered by the Partnership is approximately 25,000 square miles, encompasses 14 major watersheds, and contains over 20,000 miles of stream habitat as well as more than 350,000 acres of wetland habitat. The Kenai Peninsula is one of Alaska's premier destinations for both residents and out of state visitors and is known for its world-class sport fishing and wildlife viewing opportunities. The peninsula's salmon stocks and resident fish species like rainbow trout, Arctic grayling, and lake trout support vital commercial, sport, and subsistence fisheries, are important sources of food for brown and black bears, bald eagles, marine mammals and a variety of other animals, and are a key source of nutrients for both terrestrial and aquatic environments. The national importance of these resources is particularly evident when compared to habitats and fish populations elsewhere in the nation, where many resources have been severely impacted by human expansion and development.

Increased population growth, unregulated development, habitat fragmentation, degraded water quality, loss of water quantity, and climate change are all threats faced by fish habitat in the Kenai Peninsula. Partnership members and other stakeholders are challenged by these threats as they work towards maintaining healthy fish habitat that supports self-sustaining fish populations. The Kenai Peninsula Fish Habitat Partnership will address habitat needs of freshwater and marine fish species that reside in the waters of the Kenai Peninsula Borough at some point in their lifecycle. The Partnership is taking a strategic approach to protecting healthy aquatic systems while working to restore degraded systems in support of the National Fish Habitat Action Plan by drafting a strategic action plan that identifies the partnership, biological complexity, water quality and quantity, science and technology, education and policy as the highest priority areas to focus its efforts.

The Strategic Plan of the Kenai Peninsula Fish Habitat Partnership is the collective thinking of a diverse group of interests that includes participation from non-governmental organizations, private industry, local government, state and federal resource agencies and representatives from Alaska Tribes. The partnership has come together to focus on Fish Habitat within our region and to develop this plan in a self-identified, self-organized and self-directed manner. From the outset of this planning exercise, the partnership set geographic boundaries recognizing hydrological watersheds and the adjacent Fish Habitat Partnerships.

The National Fish Habitat Action Plan's goals and objectives provide the framework from which the Partnership will conduct its protection, restoration, and enhancement efforts. In addressing the goals and objectives of its strategic plan, the Kenai Peninsula Fish Habitat Partnership will be supporting the national goals and objectives of the National Fish Habitat Action Plan.

INTRODUCTION

The Kenai Peninsula environs and people are described below, with language borrowed and in some case taken verbatim from three major planning documents for the area. These supporting documents were the Kenai Peninsula Borough (KPB) Coastal Management Plan (2008), the Cook Inlet Regional Planning Team (CIRPT) plan for Cook Inlet (2008), and the Kenai Watershed Forum (KWF) educational text. We are indebted to the authors of these plans for allowing us to use their material in preparation of this document.

Geography

The KPB is bounded on the east by the Gulf of Alaska and Prince William Sound and on the north by Turnagain Arm, Upper Cook Inlet and the divide of the Susitna watershed; on the west side it generally follows the major divide of the Alaska Range and the Aleutian Range and thus is bordered by the Bristol Bay watershed to the west. On the south it follows the Naknek River drainage and then out to Point Douglas and across the north end of Shelikof Straits to a point north of the Barren Islands.

The KPB lies directly south of Anchorage, the State's principal population center. The Cook Inlet divides the borough into two land masses. The geographic peninsula itself encompasses 99 percent of the borough's population (50,000 people) and most of the development. The Kenai Mountains run north and south through the peninsula, contrasting to the lowlands lying to their west.

The west side of the Inlet is sparsely inhabited, with the village of Tyonek being the largest populated settlement. The boundaries of the borough encompass a total of 25,600 square miles, of which 15,700 square miles are land. In comparison, the total land mass of the borough equals that of Massachusetts and New Jersey combined. However, the total borough population is less than 1/400th of that same area.

The geographic Kenai Peninsula is surrounded by saltwater, it is practically an island. The connection between the peninsula and the mainland is only nine miles wide. The land itself, with an area of almost 9,500 square miles, contains plentiful fresh water in the form of wetlands, streams, rivers, lakes and glaciers.

Land use on federal lands varies from wilderness to intensive use for minerals, oil, gas, and timber. The use is dependent upon congressional mandate and the resource base of these lands. In addition to the six million acres of uplands in federal ownership, there are about four million acres of submerged federal lands in the KPB.

On the 2.3 million acres of state land within the KPB, use varies from the intensely developed gas fields, timber sales, and proposed coal-mining projects, to developed recreation sites, protected game refuges and critical habitat areas and wilderness parks. State game refuges, sanctuaries and critical habitat areas are located in Kachemak Bay, Trading Bay, McNeil River, Kalgin Island, Fox River, Anchor River-Fritz Creek and Clam Gulch, and near the Homer Airport; they total 248,000 acres. The Kachemak Bay State Park, which is 323,000 acres, and the other, designated recreation and special management areas (including Kenai River) total 340,000 acres. For a variety of purposes, the state has leased over half of its 2.0 million acres of tidelands and submerged lands in Upper Cook Inlet.

The KPB has received patent to 91,500 acres out of its entitlement of 156,000 acres. Over 27,500 acres have been sold or leased to the private sector. Current and future land use leans toward the development side; for school sites, municipal uses, subdivisions, and small tracts, mineral or material sites, grazing permits, agricultural, small timber sales and wood cutting areas

Land use activities will tend to be the highest on private lands (and adjoining state and Borough lands) in the next five to ten years.

The large portion of commercial timber on a portion of Port Graham and English Bay Native Corporation lands has been logged during the past 25 years. Much of the remaining timber was lost to an infestation of the spruce bark beetle.

Mineral extraction, tourism, and other development may also occur on these Chugach Alaska village and regional lands on the southern and eastern peninsula. The lands belonging to the Cook Inlet Regional Incorporation (CIRI) region and villages have the potential for timber, mineral, oil and gas, recreation and land development as markets develop. These lands total approximately 900,000 acres in four major locations and offer a variety of resource development opportunities. A portion of CIRI's subsurface land, received as a part of the Cook Inlet Land Settlement Agreement in the Swanson River area, is an operating oil and gas field.

There are 242 allotments totaling 27,000 acres; primarily located along the coast and lowlands. Many of these private lands, held in trust by the Bureau of Indian Affairs, have commercial timber and developable land. The BIA estimates that it will sell 100 to 150 million board feet of exportable timber from these allotments in the next ten years if the owners desire this type of development. Other allotments may be sold for recreation and land development.

Land use activities on the remaining 241,000 acres of private land are high as this land includes community areas, industrial sites, schools, harbors, roads, railroads, rural subdivisions, small tracts, fish camps, homesteads, agriculture and mining claims. Except for the Tyonek area, the majority of this land is on the central and southern peninsula, concentrated on the Kenai lowlands from Nikiski to Homer. The remainder of the private land is located in Seldovia, Port Graham, English Bay, Seward, Moose Pass, Cooper Landing, Hope and Sunrise.

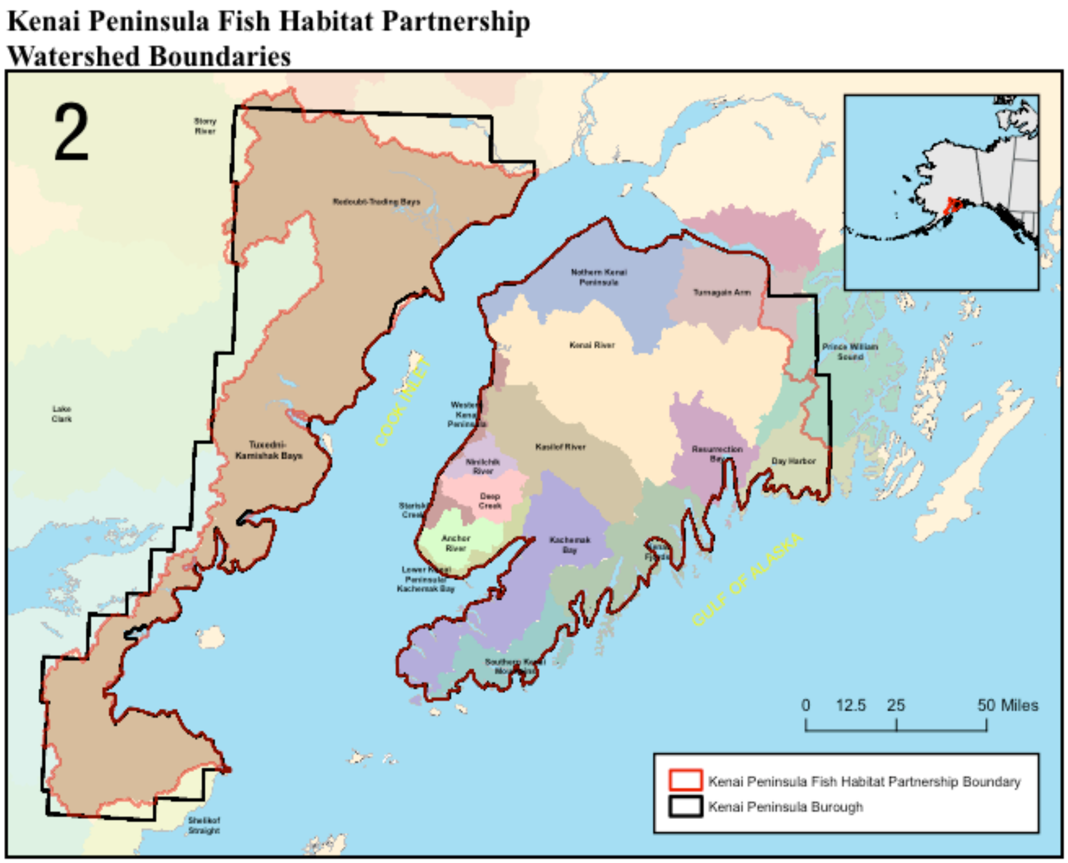

Figure 1. Location map

Climate

Climate within the KPB varies considerably, but it can be divided into two zones. The southeast coast and Kenai Mountains experience a maritime climate, characterized by heavy precipitation, cool summer and mild winters. Prevailing winds and storm tracks are from the southeast. The moisture-laden maritime air masses from the Gulf of Alaska are lifted by the Kenai Mountains, condensing the moisture and forming rain or snow, most of which is deposited on the windward side and tops of the mountains.

The outer coast receives about 50 inches of precipitation a year. In some areas of the Kenai Mountains, annual precipitation exceeds 100 inches, falling mostly as snow. These areas are often heavily glaciated, such as the Harding Ice Field, which receives approximately 400 inches of snow per year.

The Cook Inlet basin is within the transitional climate zone. This area lies in the rain shadow of the Kenai Mountains and receives 15 to 30 inches of precipitation a year. Without the moderating effects of the Gulf of Alaska, air mass temperatures in the Cook Inlet area are more extreme. Occasionally during the winter months, this area will experience short periods of extreme cold and/or high winds, when strong pressure gradients force cold air southward from interior Alaska.

Due to its more southerly location and proximity to open oceanic waters, Homer experiences intermediate temperatures between those of Seward and Kenai, although annual precipitation is still relatively low due to the rain shadow effect.

Climatic conditions in the lowland areas of the Kenai Peninsula are marginally suitable for agriculture. Late spring and early fall frosts and moderate summer temperatures limit the total number of growing degree-days. During June, daylight increases to 19 hours of daylight on the Kenai Peninsula.

The effects of climate change on the Kenai Peninsula are readily observed and have been documented by a number of researchers. Receding glaciers, drying wetlands and reduction in lake levels have all been documented. Please see appendix F for a summary reference paper. The observed trends attributed to climatic changes will have an impact on fish habitat, and more research is needed to understand what these impacts may be, how severe they might be and what can be done to mitigate such changes.

Air Quality

There is little ongoing air quality monitoring in the KPB, but air quality is generally considered to be good. Most of the land in the KPB is classified as a Class II air shed by the Alaska Department of Environmental Conservation (DEC). Class II air sheds are generally pollution free and allow some industrial development. Class I air sheds are designed to protect pristine areas such as parks and wilderness areas. The Chisik Island area is the only area within the KPB which has been classified as a Class I air shed at this time. This area was formerly the Tuxedni Bay National Wildlife Refuge and is now part of the Alaska Maritime National Wildlife Refuge.

Several industrial and energy processing facilities located in the Cook Inlet and Kenai/Nikiski area emit air pollutants including particulate matter, sulfur oxides, carbon monoxide, nitrogen oxides and hydrocarbons. The impact of these emissions tends to be localized. Prevailing winds from the north and east tend to move any pollutants towards the Lower Cook Inlet and the open sea. Temperature inversions, which could trap pollutants, are not common in this area. Low visibility due to snowfall or fog is occasionally a problem in the Cook Inlet area.

Cook Inlet Bathymetry

The bottom topography of Cook Inlet is extremely rugged with many deep areas and shoals. The depths in the upper inlet north of the forelands are generally less than 120 feet, with the deepest portion located in Trading Bay, east of the mouth of the McArthur River. South of the forelands, two channels extend southward on either side of Kalgin Island and join in an area west of Cape Ninilchik. South of the Cape, this channel deepens to approximately 480 feet and widens to extend across the mouth of Cook Inlet from Cape Douglas to Cape Elizabeth. Large traveling sandbars are known to exist in Cook Inlet and have caused extensive problems with cross-inlet pipelines and navigation. Few areas in Cook Inlet are naturally suitable for deep-water port development. The 60-foot depth contour lies generally 2.5 to 3 miles offshore along the lower peninsula, except for a three-mile stretch near Cape Starichkof, where it falls within 0.7 miles from the shoreline. This area therefore, has a high potential for future deepwater port development. The southeast coast of the Kenai Peninsula along the Gulf of Alaska consists of a series of deep glacially carved fjords. Resurrection Bay near Seward is one such fjord. Water depth increases rapidly to over 100 feet within a few hundred feet of the shoreline, making this area a natural deepwater port. The Seward waterfront and Fourth of July Creek area across the bay from the city both have developed deepwater port facilities.

Tides and Circulation

Tides in the Cook Inlet and Resurrection Bay are semidiurnal, with two unequal high tides and two unequal low tides per day. The diurnal range varies from 13.7 feet at the mouth of Cook Inlet to 29 feet in Upper Cook Inlet, and averages 10.5 ft. at Seward.

In Cook Inlet, maximum current speeds average about three knots in most of the inlet; however, during monthly extremes currents exceed 6.5 knots in the Forelands area. Current speeds of up to 12 knots have been reported in the vicinity of Kalgin Island and Drift River. Crosscurrents are common, and water is turbulent throughout the water column. Tidal bores of up to 10 feet sometimes occur in the Turnagain Arm.

Salinity and Sediment

Large amounts of sediment are discharged into Cook Inlet from glacial streams, especially from the Susitna and Matanuska Rivers. Most of this sediment is deposited on the extensive tidal flats or removed by tidal currents along the west side during ebb flow. Sediment loads vary from greater than 1700 mg/1 near Anchorage to less than 2 mg/l at the mouth of Cook Inlet. Longshore transport of sediment within Cook Inlet is generally up the inlet, although Kamishak, Tuxedni and Kachemak Bays are areas where this trend is reversed. Homer Spit was created by a submarine terminal moraine and is maintained by longshore sediment transport from the north.

Salinity increases rapidly and almost uniformly down the inlet, from Point Possession to East and West Foreland, with slightly higher salinities on the east side. This rapid increase can be attributed to glacial runoff from the Matanuska, Susitna and Knik Rivers and subsequent sediment settling in Upper Cook Inlet. Local areas of depressed salinity occur off the mouths of Tuxedni and Kamishak Bays, both of which have major rivers. East of Kalgin Island, the effects of freshwater from the Kenai and Kasilof Rivers can be measured.

Temperature and Ice Conditions

The water temperature in Upper Cook Inlet varies with the seasons from 32.0 to 60.0 Fahrenheit (0.0 to 15.5 C). The Lower Cook Inlet is affected by the intrusion of warmer waters from the Gulf of Alaska; thus water temperatures range from 48.0 to 50.0 Fahrenheit (8.8 to 10 C). Sea ice generally covers the Upper Cook Inlet area north of the forelands during four months of the year.

Flow ice occasionally drifts as far south as Anchor Point. Ice concentrations have been observed in Kamishak Bay extending outward to Augustine Island. Iniskin, Chinitna, Tuxedni and other western Cook Inlet bays may also have occasional ice cover. The east side of the inlet is less susceptible to ice buildup, however during cold weather; flow ice from Bradley River often accumulates in Kachemak Bay. If there were not tidal action in Cook Inlet, a solid sheet of ice would form at freeze up in the fall and remain until breakup in the spring. Tidal action and tidal currents leave inlet ice in a shattered condition. Most of the ice in Cook Inlet is shore ice, which is estimated to increase in thickness by as much as one inch per day. The ice cakes may be as much as four feet thick and are usually mixed with smaller chunks of brash ice. The ice situation in Cook Inlet is complicated by large piles of ice called stamukhas, which form on the tidal flats from broken beach ice. Stamukhi grounded in shallow areas have been observed with thicknesses greater than 40 feet. Sea ice could hinder or prevent oil spill containment and clean up during winter months and occasionally causes navigation problems. In Resurrection Bay and the Gulf of Alaska water temperatures range from 38–52 degrees F (3–11 degrees C). Other than occasional skim ice near freshwater streams, Resurrection Bay and the Port of Seward are ice free all year.

Ground Water

Geology, topographic features and permafrost control the movement and availability of groundwater. Areas where bedrock is at or near the surface, i.e., the Kenai Mountains, usually have low groundwater potential and depend on water saturated fracture zones at reasonable depth for water supplies. Coarse-grained, fractured sandstone and conglomerates offer the best groundwater potential.

Virtually all of the domestic and industrial water used in the Kenai/Soldotna area is from wells. Near surface deposits of sand and gravel, believed to range in thickness from 20 to 100 feet, contain a water table aquifer at depths ranging from 20 to 60 feet below the surface. A clay stratum containing silty and sandy clay, and sand and gravel lenses is under the water table aquifer. Two confined aquifers exist below this confined stratum, but there is much hydraulic discontinuity within and between the aquifer. Four wells drilled in the Beaver Creek aquifer at a depth of 200 to 250 feet supply municipal water for the City of Kenai. The City of Soldotna obtains municipal water from five wells within the City located at depths ranging from 225 to 295 feet. It is generally believed that both the water table and the upper artesian aquifers in the central peninsula receive recharge primarily from local precipitation. Principle areas of recharge occur on well-drained soils underlain by glacial drift. Recharge, therefore, occurs over large areas and is not confined to a few critical areas.

Several industrial users draw large amounts of groundwater from wells in the North Kenai/Nikiski area. Controversy has arisen in the past over the impact of industrial withdrawals on water levels of the shallow lakes in the North Kenai area. The U. S. Geological Survey in cooperation with the State and Borough has an ongoing program to collect groundwater data in this area. Data indicated that lake levels and upper aquifer levels have declined in areas immediately surrounding pumping areas, but lower aquifers are generally stabilized by leakage from upper aquifers and decreased discharge to Cook Inlet. (1) Groundwater yields in the southern Kenai Peninsula are generally low, ranging from 10 to 150 gpm. Unconsolidated glacial deposits, from Anchor Point to Ninilchik, are usually thin veneers, yielding 0 to 150 gpm. Moderate yields (25 to 300 gpm) can also be expected in the fine-grained floodplain deposits of the lower sections of Anchor River and Deep Creek. The area immediately south of Anchor Point reports yields from 100 to 1,000 gpm. Most of the area from Homer north and east is underlain at shallow depths by bedrock (the Kenai Formation), which yields 10 gpm in the bench areas to more than 50 gpm north of the escarpment crest. The City of Homer municipal water supply is 100 percent surface water from Bridge Creek north of the City.

Groundwater potential is severely limited in Nanwalek, Port Graham and Seldovia by bedrock at or near the surface on slopes and by saltwater intrusion and high water table in some of the low lying areas. Shallow alluvial fans support a few domestic wells, but community and industrial systems rely primarily on surface water.

Bedrock is close to the surface on most of the steep slopes in the Seward area. Although fractured bedrock contains some water, the hydraulic properties of Seward-area bedrock (graywacke and phyllite) limit the potential for groundwater development in some of the shallow bedrock areas. Groundwater occurs in the unconsolidated deposits at the head of Resurrection Bay and in alluvial fan areas, which underlie most of the City. Appreciable recharge to the shallow groundwater body occurs from stream flow losses through sand and gravel deposits of alluvial fans and from rainfall and snowmelt infiltration in the upper part of the Resurrection River valley. The public water supply in Seward is a combination of groundwater and surface water obtained from four wells at the Fort Raymond Subdivision, surface water at Marathon Springs and a well at Fourth of July Creek. A shallow well at Lowell Canyon is a back-up source. Residents outside the service area are provided water by domestic wells. Most wells in excess of 50 ft. demonstrate artesian characteristics.

Detailed groundwater data is not available for the west side of Cook Inlet. Alluvial deposits at the mouth of the McArthur and Chakachatna Rivers and other major streams have the potential for moderate groundwater yields. Soil and bedrock conditions limit groundwater potential in the rest of this region.

Surface Water

The major surface streams in the Kenai/Soldotna area are, in order of decreasing average annual runoff: Kenai River (mean annual discharge 5963 cfs), Kasilof River (2385 cfs), Swanson River, Bishop Creek and Beaver Creek. The Kenai is a high-yield glacial river with high mid-summer flows. The Kasilof River is also partially fed by glacial melt water. The others are non-glacial lowland streams with only moderate flows in later summer and fall. Surface water sources are important sources of community and industrial water on the southern Kenai Peninsula where groundwater supplies are limited. The largest surface freshwater sources in the southern Kenai Peninsula are the Ninilchik and Anchor Rivers (201 cfs) and Deep Creek. Other streams include the Chakok River, Clam Creek and Stariski Creek. Caribou Lake might be utilized as a water supply, but is 25 miles from Cook Inlet or Homer. A dam on Bridge Creek, a tributary of the Anchor River, is utilized to impound water for Homer's municipal water supply. The City owns a buffer strip around the reservoir and a 6-acre parcel within the watershed, but the remainder of the 3.2 square mile watershed is privately owned. Steep slopes and wetlands limit the development potential of much of this land. Cattle farming were proposed at one time, which raised concerns about watershed protection. Smaller creeks in the Homer area and along Kachemak Bay are potential domestic water supplies, but low flows during winter freeze up and summer dry periods limit their potential as a source for major quantities of water.

In Seldovia, the community water supply comes from the gravity-fed Lagoon Creek Reservoir and from Fish Creek. Fish Creek is susceptible to pollution from upslope development and septic tank leakage. The Nanwalek and Port Graham community water systems also depend on surface water from small streams near the communities. The Seldovia River has been identified by USGS as a future source of water for these communities, with the possibility of power generation from pumping water over the ridge to Port Graham and taking advantage of the drop to produce power.

The Resurrection River, which originates in glaciers and ice fields of the Kenai Mountains, is the major surface water drainage system of the Seward area. Other significant streams are Lowell Creek, which forms the alluvial fan on which Seward was founded, Japanese Creek, which has formed a similar alluvial fan at the edge of the Resurrection River floodplain, Spruce and Tonsina Creeks, both to the south of Seward, Fourth of July Creek, across the bay from the city, and Salmon Creek, a tributary of the Resurrection River.

There is a number of major drainage systems located on the west side of Cook Inlet. Major watersheds include the Beluga, Chuitna, Nikolai, Chakachatna, McArthur, Tuxedni and Pile Rivers. Along with these major watersheds, there are also a number of smaller streams and creeks that drain the region.

Water Quality

In general, water quality is good in both surface and ground waters, with the exception of localized areas or seasonal periods where high concentrations of iron, silica, color and dissolved organic material may be present. Most of the surface water in the study area is of the calcium magnesium bicarbonate type and is generally low in dissolved solids, chloride and hardness. Most surface waters meet all known drinking water standards except for iron and color. The concentration of silica, dissolved solids, iron, hardness and color are generally less in the Kenai River than in the small non-glacial streams, but the Kenai River contains considerable glacial flour.

Water from the water table aquifers is generally of the calcium magnesium bicarbonate type, characteristically low in dissolved solid content, but high in iron content. Artesian aquifers, which range in depth from 60 to 300 feet below the land surface commonly, exhibit the best quality groundwater in the study area. Salt-water intrusion is a problem on the Homer Spit and other low-lying costal areas.

Although water quality is generally good, there are a number of isolated areas within the KPB, which are experiencing water quality problems. Septic tanks have caused water quality problems in a number of high density residential areas where lot size and drainage are not adequate for on site sewage disposal, and public sewers are not yet available. Contaminants associated with petrochemical production, refining, or storage have been discovered in isolated areas in all major cities, communities and rural areas where oil and gas have been mined and/or stored.

Geology

Alaska is made up of a complex variety of terranes. The bedrock in the Chugach Mountain Range and the Kenai Mountains arrived in Alaska around 140 million years ago. The rock was part of an oceanic plate which collided with the North American continental plate. The oceanic plate subducted, or slid under, the lighter continental plate at a rate of two to three inches a year. During that process, sedimentary and igneous rocks were scraped off and subjected to enormous pressure as they were folded squeezed and heaved up into mountain ranges.

The Kenai Peninsula is one of the most tectonically active parts of the world. The Pacific plate is subducting under the North American plate. Most of the action is underwater in the Gulf of Alaska and deep underground. Above ground the evidence of plate movement in the string of volcanoes that begins northwest of the Kenai Peninsula across Cook Inlet and extends all the way out the Aleutian chain.

An additional effect of the plate subduction is that Cook Inlet and the western Kenai Peninsula are slowly sinking. This area lies between two terranes. For 65 million years it was a large valley, not part of the ocean, which drained the surrounding mountains and interior Alaska. As the underground plate movement pulled the basin downward, sediments filled the area.

The glacial history of the KPB is complex and detailed discussions are beyond the scope of this document. Reger et. al. 2007 noted that at "the climax of the last major glaciation, roughly 23,000 years ago, most of south-central Alaska was buried beneath the Cordilleran ice sheet, and equilibrium-line altitude in the Kenai Mountains is estimated to have been ~300 to ~700 m (~985 to ~2,300ft) lower than today". Glacial events were a major perturbation to the landscape and the readers are referred to Reger et. al (2007) for a complete history of these events.

Soils and Vegetation

The coastal lowlands from Point Possession south to the head of Kachemak Bay, including Kenai, Soldotna, and Homer, generally include low rolling glacial moraines and depressions filled by lakes and muskeg. Many rivers and streams flow through the area. Soils range from gravelly clay loam to gravelly sand mantled with silty material and bands of volcanic ash. Elevation is generally below 500 feet. In general, the well-drained soils on the upland areas are suitable for settlement, cultivation or forestry. Many of the other soils have limitations such as high water table, flooding, steep slopes, poor stability or slow permeability, which limit their development potential. There is no permafrost in this area; however, in some areas soils remain frozen until late summer. Most of the hills, terraces and outwash plains in this area are forested by spruce cross and paper birch, with some aspen and cottonwood. Black spruce is the principal tree on soils with poor drainage. Muskeg vegetation includes mosses, sedges, low shrubs and forbs.

The lowland areas south of Kachemak Bay and along the Gulf of Alaska have soils formed from very gravelly and stony glacial till. Areas of poorly drained peat are common on many of the slopes at the base of the Kenai Mountains. Because of mild temperatures and heavy snowfall, soils seldom freeze. Steep slopes and poor drainage limit development potential in most of this area. In some areas soils support stands of commercial timber, but logging is limited in most places due to terrain.

Soils in the Seward area and highway corridor south of Moose Pass consist of thin layer of loess over gravelly drift or colluviums. Most of the City of Seward is constructed on alluvial fan deposits from rivers and creeks originating in the Kenai Mountains. All of these soils, except for a few in high alpine areas are free from permafrost. Forests surrounding Seward are primarily spruce and hemlock. Additional data on soils and timber in the Chugach National Forest north of Seward is available from the U. S. Forest Service. The Kenai Mountains occupy most of the interior of the southern Kenai Peninsula, covering about 6,500 square miles.

The elevation of the Kenai Mountains ranges from 3,000 feet to 5,000 feet with several peaks over 6,000 ft. The entire range is heavily glaciated. Approximately 720 square miles is covered by the Harding Ice Field and 34 major glaciers radiating from the ice field. The process of glaciations, combined with tectonic movements, has created numerous submerged canyons, bays, rock cliffs and islands along the Gulf of Alaska coastline. Thin soils occur in the vegetated areas on lower slopes and valleys, but almost all are stony and shallow over bedrock or boulder deposits.

The coastal lowlands between Tuxedni Bay and Granite Point consist of nearly level, poorly drained outwash plains from large glaciers in the Aleutian Range and Chigmit Mountains. The outwash plains are braided with meandering and shifting stream channels. Most soils consist of sandy glacial outwash, silt, tidal sediments and gravelly river wash. The high water table and flooding is limiting to development in most of this area. The exception is a few well-drained natural levees and ridges. Sedges, mosses, willows and shrubs are the dominant vegetation, with some cottonwood and alder in areas with better drainage.

North of Granite Point, soils and topography are similar to the coastal lowlands on the east side of Cook Inlet, with glacial moraines and depressions, pothole lakes and soils formed from gravelly clay, sand and silt. Forests in this area are primarily mixed white spruce and birch, with patches of hemlock, Sitka spruce and aspen. Black spruce, mosses, sedges and shrubs are found in poorly drained areas.

South of Tuxedni Bay, terrain is dominated by the Chigmit Mountains and the volcanic peaks of the Aleutian Range. In the mountains, soils are thin and interspersed with thin layers of volcanic ash. In the lowland areas and along the coast soils are formed from glacial deposits, sediment carried by streams, and volcanic ash. Willows, alder and grasses are the dominant vegetation along the streams. Steep slopes and low temperatures limit the potential for agriculture or forestry.

Spruce Bark Beetle Damage

Changes in forest character are most noticeable in the distribution of forestland by stand-size class. Prior to expansion of the infestation, the bulk of the productive forest was in saw timber-sized stands.

A 1987 inventory estimated 348 thousand acres of the 492 thousand acre total was in saw timber stands. By 2000, saw timber acreage had dropped to 212 thousand acres, a decrease of almost 40 percent. Saw timber sized stands of white and Sitka Spruce forest types declined by 156 thousand acres while slight increases in saw timber stands of other forest types resulted in a net decline of 136 thousand acres.

Aquatic Resources

Finfish - other than Salmon

A number of ecologically important fish species inhabit the waters of the KPB. In freshwater for example over 34 species, representing 16 taxonomic families have been identified in the Kenai River system. Four of these are exotic species, 12 are resident, 11 are anadromous and 11 are estuarine (Alaska Department of Natural Resources 1998).

The total economic importance of finfish species other than salmon is difficult to track; however, it is in excess $100M. This is based on 2007 ex-vessel values from the State of Alaska landings within the Kenai Penisula Borough. Halibut was estimated at $78M, groundfish at $8M, and sablefish at $22M. The economic value of sport caught species is also measured in the $100M dollar range.

Dolly Varden (*S. malma*), lake trout (*Salvelinus namaycush*), arctic grayling (*Thymallus arcticus*), round whitefish (*Prosopium cylindraceum*), Bering cisco (*Coregonus laurettae*), longfin smelt (*Spirinchus thaleichthys*), Eulachon (*Thaleichthys pacificus*), and Pacific lamprey (*Lampetra tridentate*) are just a few of the species that serve important ecological roles in the aquatic system of the KPB. Unfortunately, population levels and productivity of these stocks of fish are not well known.

Northern pike (*Esox lucius*) are not native to the Upper Cook Inlet UCI area but have been introduced by human activities. This invasive species has expanded into numerous lake and stream systems and has led to significant declines in resident and anadromous fish populations. Over 100 lakes in the UCI area have northern pike.

In the marine environs fish species such rockfish, halibut, Pacific cod, sand lance, Pacific herring, and more than other species contribute to the ecological functions of these near shore area. Habitat types range from rocky coast to predominately sandy substrates.

Salmon

The KPB has literally thousands of small stream systems within its boundaries. These streams total hundreds of miles in length and as previously noted vary from glacial to clear water systems. Collectively Salmon provide over $300M to the local economy of the KPB.

All five species of Pacific salmon plus Steelhead (*Oncorhynchus mykiss*) spawn and rear in the waters of the KPB. Average annual production (harvest plus escapement) of wild Pacific salmon is in excess of 10 million fish (5 million sockeye salmon (*O. nerka*), 3 million coho salmon (*O. kisutch*), 1 million chum salmon (*O. keta*), 2-20 million pink salmon (*O. gorbuscha*), and 150,000 Chinook salmon (*O. tshawytscha*) (Fox, personal communication).
In an effort to quantify significant stocks within UCI the Cook Inlet Regional Planning Team characterized the major stocks based on abundance criteria (Appendix B lists the significant stocks for UCI).

Stocks that were designated "significant" were of a sufficient size to sustain them even though it might be at a level well below what users would judge to be the optimum level or what the habitat could probably support. This definition should not be construed to devalue the collective importance of the many smaller or "non-significant" stocks.

In addition to significant stocks the CIRPT also prepared a list of wild salmon stock genetic reserves. The results of this designation process was the establishment of twenty-seven anadromous salmon "wild stock sanctuaries / stock reserves" in the Cook Inlet region. Of that total number seven are for king salmon, six for sockeye salmon, five for coho salmon, five for pink salmon and four for chum salmon. The criteria for selection and a listing of these stocks are presented in Appendix B.

The single largest producer of sockeye salmon in UCI is the Kenai River, which includes 5,200 square kilometers (km) of the western Kenai Peninsula. Cook Inlet second largest producer of sockeye salmon is the Kasilof River which drains an area of approximately 190 km and contains the largest glacial lake in the Cook Inlet area (Tustumena Lake – 295 km). The Susitna River drainage, the third largest producer, is located both in the KPB and Mat-Su Borough and drains an area exceeding 49,000 km.

The Susitna River is also the major producer of chum, coho, pink, and Chinook salmon in UCI. Chum salmon are also found in a number of smaller systems along the west side of UCI. Chum salmon are not found in the Kenai or Kasilof River systems in any significant number. No exact estimate of chum salmon production by river system is available.

Coho salmon are distributed through out the KPB and the numerous smaller streams systems provide important spawning and rearing habitat for these species. As with chum salmon there are limited data on the production of coho salmon by river system. ADF&G tagging studies have estimated 3 million coho salmon entered the inlet during a two-year study. The major producer of coho salmon is the Susitna River but the Kenai River and the Little Susitna River (outside the KPB) are also significant producers of coho salmon.

Pink salmon are found mainly in the Susitna River (peak annual production has been estimated at 20 million fish – Fox, personal communication). Peak production in the Kenai River has reached 10 million in even years. However, production in most years is probably significantly below these levels. Pink salmon abundance varies between even and odd years with even years being most abundant.

Chinook salmon production comes primarily from the Susitna River (100,000 to 150,000 fish) while the Kenai River average chinook production is estimated at 50,000 to 75,000 fish. The Kasilof, Anchor, Deep Creek, Ninilchik, and numerous western KPB systems contribute to the total return to the UCI but their contribution is smaller.

Shellfish

Species inhabiting intertidal and subtidal areas of Cook Inlet include sea urchins, chitons, limpets, whelks, mussels, clams, cockles, polychaetes, bryozoans, sponges, sea stars, sea cucumbers, snails, octopus, skate, barnacles, and crabs. Species in nearshore and offshore waters include sea cucumbers, many species of sea star, nudibranches, octopus, tunicates, worms, and sea leeches.

Clams are abundant along many Cook Inlet beaches. Stocks of razor clams (*Siliqua patula*) are concentrated in the Polly Creek area on the west side of Cook Inlet, and along the east side from Anchor Point to the Kasilof River. Razor clams are usually found on sandy beaches from about 4 ft above mean low water to depths of 180 ft. Razor clams become sexually mature between 3 and 7 years old. Breeding, which occurs in the summer between May and September, is closely associated with temperature. After hatching, microscopic larvae, which bear little resemblance to adult clams, spend 5 to 16 weeks in a free-swimming form, then begin to develop shells and settle into the sand. Razor clams can live to be as old as 18 years. Razor clams are filter feeders, obtaining their food by straining plankton from seawater.

Other clam species include littleneck (*Protothaca staminea*) and butter clams (*Saxidomus giganteus*), which are prolific in Kachemak Bay, south of the lease sale area, as well as species such as *Axe sp., Mya sp., Tresus sp*., *Spisula sp., Telina sp.,*and *Macoma sp*. Migrating birds Tiger rockfish. *ADF&G* and resident shorebirds may depend on stocks of a small bivalve, *Macoma balthica*, perhaps exclusively for rock sandpipers. Densities of littleneck clams were low in 2005, based on surveys at two islands.

Tanner crabs (*Chionoecetes bairdi* and *C. opilio*) are found on the soft bottom of deep waters. Tanner crabs reproduce at 5 or 6 years of age, and may brood up to 450,000 eggs each year. Eggs incubate for a year on the female's abdominal flap, hatching in spring. Tanner crab hatch into free-swimming larvae, molt many times through distinct stages, then settle to the ocean bottom. They may live up to 14 years. Their prey includes mussels, clams, snails, crabs, shrimps, and worms, and they scavenge on dead fish. Although little is known of their migration patterns, males and females are found in separate areas for much of the year, and migrate to the same area during the reproductive period.

Several species of **shrimp** are found in Cook Inlet, including pink (*Pandalus borealis*), sidestripes (*P. dispar*), humpy shrimp (*P. goniurus*), coonstripe shrimp (*P. hypsinotus*), and spot shrimp (*P. platyceros*). Shrimp typically hatch in the spring into planktonic, free-swimming larvae. After undergoing several molts, they settle to the bottom where they live for a few years before maturing into adults. Depending on species and life stage, shrimp inhabit a wide range of habitats and water depths, ranging from rock piles, coral, debris-covered bottoms, and muddy bottoms; and depths ranging from shallow waters of a few fathoms to deep waters up to 800 fathoms. Shrimp may undergo seasonal migrations, from deep to shallow waters and vertically in the water column. Shrimp eat a wide variety of foods, including worms, diatoms, detritus, algae, and invertebrates. They are preyed upon by fish such as Pacific cod, walleye pollack, flounders, and salmon.

Other shellfish species include octopus, green urchin, sea cucumber, and scallops. The predominant octopus species in Cook Inlet is the giant Pacific octopus (*Enteroctopus dofleini*). Maximum age for octopus is probably 3-5 years and they reach sexual maturity at
1.5 to 2 years. Octopus spawn only once. They stop feeding and die soon after spawning. Abundance of green urchins (*Strongylocentrotus droebachiensis*) and sea cucumbers (*Parastichopus californicusappears*) are low. Sea cucumbers are benthic detritus feeders. They are important in the marine food web because they recycle detritus into nutrients for primary producers by ingesting significant amounts of fine substrate. Weathervane scallop (*Patinopecten caurinus*) stocks declined sharply in 1987 in the Kamishak area, but by 1993 there appeared to be a small but healthy stock in the Kamishak area. Sharp declines were observed in 2003, but based on age composition appear to be healthy.

Freshwater and Marine Invertebrates

From kelp forests to six-foot sand waves, the underwater landscape of the KPB area is diverse, and productive. The variety and physical complexity of hard, soft, and vegetated marine habitats, such as kelp beds, eelgrass beds, and rocky and soft substrates, accommodates a great variety (>400) species of macroinvertebrates. Strong populations of sea otters (*Enhydra lutris*) attests to the invertebrate prey abundance, as otters consume one-third of their body weight daily to meet their metabolic needs. Storm waves in the Gulf of Alaska and sea ice in Cook Inlet create bare patches in rocky intertidal communities each year. Where the coastline is protected from violent winter storms diverse and relatively stable invertebrate communities develop. These communities are organized by tidal wave exposure. Periwinkle snails characterize the uppermost zone and share the zone with a few acorn barnacles. Lower down, thrive mussels, black leather chitons, breadcrumb sponges, hermit crabs, dogwinkle, sea stars, and limpets. In the lowest intertidal zone, frilled anemones, Christmas anemones, and sea stars are commonly found.
Below the surface, eelgrass beds have associated communities of hydroids, bristle worms, isopods, amphipods, shrimp, hermit crabs, gastropods, clams, and other invertebrates that graze the eelgrass blades for epiphytic diatoms, algae, bacteria, and other food sources. Beneath mudflats, sand and gravel beaches a variety of marine invertebrates thrive, including many species of worms, clams, especially softshelled clams and Baltic macoma, harpacticoid copepods and mysids, plus other small crustaceans.

Students in K-12 study the diversity of marine invertebrates, and hundreds of tourists each year gather during low tides to view the multitude of invertebrate life found in tidal pools.

The streams and rivers of the KPB area support over 90 taxa of freshwater macroinvertebrates, including a variety of mayfly, stonefly and caddisfly larvae, and a great diversity of dipteran (fly) larvae. These invertebrates sustain millions of juvenile salmon that rear in the streams.

Non-Aquatic Species

Birds

Over 275 species of birds are found in the KPB with many of these dependent on healthy aquatic habitat for their survival. Habitat diversity is critical to these species as staging, nesting, and/or feeding sites and aquatic habitats are used seasonally to meet critical life functions.

In the spring, for example, estuarine areas at the mouth of major systems provide a haven for migrating shorebirds and waterfowl. Literally hundreds of thousands of shorebirds migrate through the KPB in the spring, including western, least, and semi-palmated sandpipers, godwits, dowitchers, plovers, and dunlins. Waterfowl include snow geese, Canada geese, cackling geese, white-fronted geese northern pintails, green-wing teal, northern shoveler, trumpeter swans, and American widgeon.

During summer nesting season a number of birds stay within the KPB. These include Arctic and Aleutian terns, Red –necked cormorants, a variety of gulls, waterfowl, warblers, dippers, and other taxa can be found in adjacent stream riparian areas, in the lakes and streams, and in the estuarine environs. The interaction of aquatic resources with these species is critical. For example, over 30,000 herring gulls nest and raise young at the mouth of the Kenai River. Herring gulls start to arrive in April and they are dependent on the arrival of eulachon as prey. In addition, they and various shorebirds feed on estuarine invertebrates- marine worms are abundant. During the summer nesting season the arrival of salmon furthers the food base and by fall salmon carcasses and the arrival of longfin smelt continues to provide energy for growing juveniles as well as built fat reserves for the return migration south.

In the marine environ in the summer thousands of seabirds nest in the coastal areas of the KPB. Nesting concentrations for common murres, puffins, kittiwakes, auklets, cormorants, and other seabirds can number in the tens of thousands. Marbled and Kittlitz's murrelets are found in the marine waters near Homer and Kenai Fjords National Park.

The reverse migration in the fall is of longer duration than the spring migration. By the end of October most spring migratory birds have moved south. However, resident birds like bald eagles; ravens, northwestern crows, chickadees, and red-breasted nuthatches are still using aquatic resources. Over 500 bald eagles have been counted in the Kenai/Soldotna area during the Audubon Christmas Bird Count. Adding to the list of winter birds are those that move to the KPB to over winter. Approximately 10,000 rock sandpipers (half the population) can be found in the tidal flats of Homer, Kasilof, Kenai, and Westside areas. In addition, Trumpeter swans over winter at the outlet of large glacial lakes while redpolls and pine siskin winter along various streams.

Marine Mammals

There are several marine mammal species present, at least seasonally, in the KPB. The more common species are the sea otter, Steller sea lion, harbor seal, beluga whale, dall porpoises, and harbor porpoises. Killer whales (orcas) and humpback whales also feed in the Gulf of Alaska and Lower Cook Inlet. Sea mammal viewing is a popular tourist attraction for tour boats in the Kenai Fjords and Kachemak Bay areas.

Sea otter populations are considered relatively stable with a slightly increasing population. In 2002, the number of sea otters found in Cook Inlet was approximately 10,000 animals. They are commonly seen along the shoreline of the Gulf of Alaska, Lower Cook Inlet, Kachemak Bay, Resurrection Bay and the Kenai Fjords. Nearly half of the sea otter population surveyed was found on the west side of Cook Inlet. Sea otters feed on benthic invertebrates, including sea urchins, mussels, clams, and crabs.

Sea lion distribution in the study area is limited to the Gulf coast of the southern Kenai Peninsula and the Augustine Rocks in outer Kamishak Bay. Concentrations also occur in the Barren Islands, just south of the KPB boundary and in the Chiswell Islands south of Seward. Currently, sea lions are listed on the endangered species list. Within the KPB, most of the haul out grounds and rookeries are located within the Kenai Fjords National Park and Alaska Maritime National Wildlife Refuge.

Harbor seals generally inhabit marine, estuarine and freshwater environments from the coast to a few miles offshore. The west shore of Lower Cook Inlet is probably the most populous, while Upper Cook Inlet is seldom used by harbor seals except during salmon runs. Population estimates for the Gulf of Alaska stock of harbor seals (which includes Cook Inlet) is considered stable, with a population estimate of approximately 29,000. The diet of the harbor seal is highly varied, including herring, eulachon, pollock, octopus, salmon, shrimp and flounder. Like sea lions, harbor seals haul out on offshore rocks, sandbars and beaches.

The beluga or white whale is a common inhabitant of Cook Inlet and has recently been listed as an endangered species. During spring and summer months these whales concentrate around river mouths in Cook Inlet. While the winter distribution of this stock is not fully known there is significant evidence that most of these belugas inhabit Cook Inlet year-round. Abundance of beluga whales in Cook Inlet is estimated in the 300 range. Their food includes salmon, smelt, flounder, sole, sculpin, shrimp and mussels. Critical habitat for Cook Inlet beluga whales is being defined by the National Marine Fisheries Service.

Dall and harbor porpoises are commonly seen in Cook Inlet, the Gulf of Alaska and in Kachemak Bay. The Gulf of Alaska stock of harbor porpoises population (which includes the KPB) is around 25,000. These mammals have been seen traveling or feeding in groups of 25-30, but often are observed in much smaller groups. Solitary individuals are commonly observed. Their prey includes large fishes and small marine mammals.

Killer whales are often observed in Kachemak Bay and the Gulf of Alaska. Several other species of whales, such as humpback, finback, minke and sei whales, are present in Cook Inlet and are common inhabitants of the Gulf of Alaska.

Terrestrial Mammals

The KPB is rich is the diversity of terrestrial mammals that depend on the aquatic resources of the KPB. Moose are found along most streams and lakes foraging in the near shore waters for aquatic plants. Moose numbers are in the thousands within the KPB. Calving areas for moose are located on islands in the major stream systems and provide refuge from predators.

Brown and black bears number in the hundreds in the KPB and depend on the rich aquatic life for sustaining themselves through the winter. Salmon streams provide a critical role for these animals. Bears are known to double their weight from the spring to fall in large part due to the consumption of large quantities of fish. Bears also serve an important role in marine nutrient transfer to terrestrial systems. Waste products from brown bears, which contain marine nitrogen from eating salmon, has been measured hundreds of feet from the river banks and thus contributes to riparian and forest plant health.

In addition to bears and moose the KPB has populations of Dall sheep, Mountain goats, caribou, wolves, fox, coyote, and numerous other fur bearers. For example, mink are typically found in the riparian zone along many streams foraging on aquatic life. Beavers dam small stream systems creating pond habitat for rearing salmon and resident fish. Beavers have also blocked migration of adult salmon into some spawning areas and stopped the movement of juvenile fish upstream. Therefore, beavers have been viewed as both ecologically positive and negatively within the KPB.

Focus Area Overview

Summary

Work necessary to reach our desired future conditions for fish habitat has been divided among six focal areas. It was the collective thinking of the planning participants that in order to achieve our stated purpose, vision and mission the work needed to be categorized into components. Our approach to breaking down the workload fell into these six focal areas.

The six major focal areas and goal statements are:

Partnership: Ensure organizational capacity and effective operating systems are in place for the Partnership to make positive and lasting contributions to the protection and the restoration of fish and aquatic habitat.

Biological Complexity: Protect, restore and maintain the biological integrity of ecosystems that support healthy fish habitat

Water Quality and Quantity: Ensure necessary water quality and quantity to support healthy fish communities and aquatic ecosystems.

Science and Technology: Facilitate and increase the use and availability of scientific knowledge to guide Partnership priorities, policy development and management decision making

Education: Increase the awareness and knowledge of the goals and objectives of the Partnership for everyone that lives, works, recreates, visits, regulates or otherwise has an influence on the strategic issues of the Partnership.

Policy: Identify, prioritize and communicate the importance of adequate regulations, polices and planning processes to support the protection of fish habitat necessary to support self-sustaining fish populations.

The focal areas are intended to be broad, covering the many needs of fish habitat protection, restoration and enhancement. The focal areas contain more identified need than could be accomplished in a 20-year timeline; therefore, steps have been taken to show priority for those efforts the partnership would like to see move forward in the next 3 to 5 years. Over the next five years we anticipate funding and effort being driven to the six focal areas in relative proportion as illustrated in figure 3. The partnership will work toward each objective in the focal areas with the priority given to those activities described under priority activities found at the end of each focal area description.

Relative target effort levels of focal areas (Time and Funding)

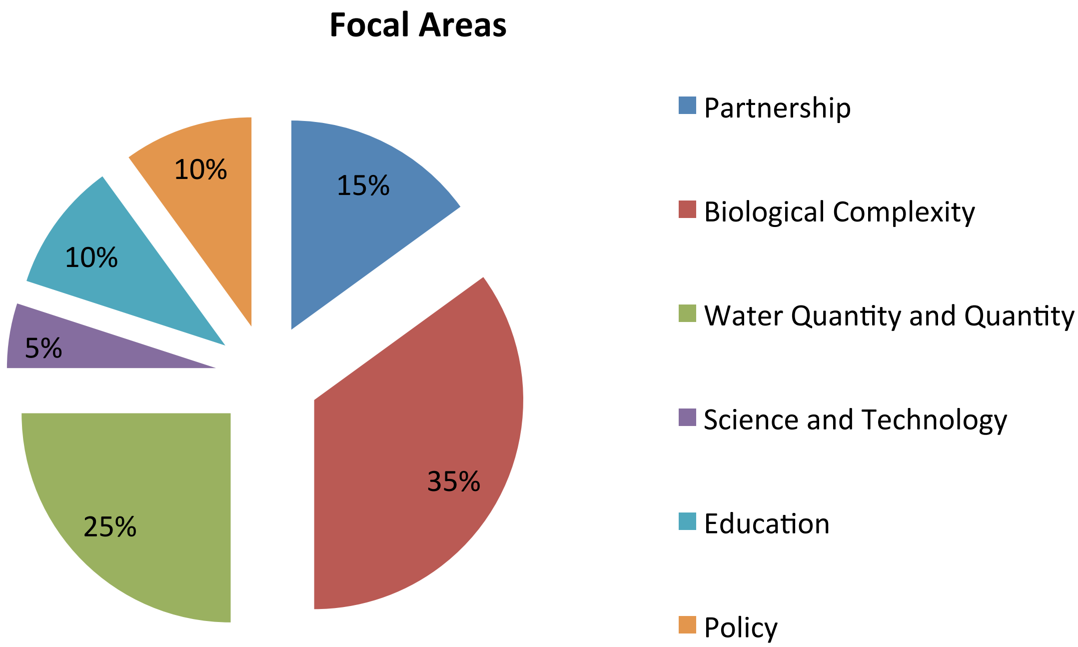

Figure 3 to be revisited by partnership every 5th year. The Steering committee desires to have consensus on the relative effort put forth by the partnership's work. If, over time, a particular focal area is receiving all the resources to the detriment of other focal areas, an adjustment to annual priorities may be desired.

Each of the partnerships six focal areas as described herein are important to the protection, restoration and enhancement of fish habitat within the geographic boundary of the Kenai Peninsula Fish Habitat Partnership. This graphic illustrates our thought on the relative need to achieving meaningful long-term change from the existing current conditions and moving us toward the desired future conditions. The target effort is guidance that the partner members and steering committee can use as an internal metric to evaluate areas that are not receiving adequate attention and help set future priorities.

The relative effort was established with a few key assumptions: 1) The partnership is allowed to allocate funding to the focal areas without external prioritization and restrictions; 2) The annual funding levels to the partnership would be approximately $1M, allowing the top action priorities to be funded in each focal area. The focal areas efforts should be tracked and revisited annually, with an evaluation after 5-years.

Overarching Current Condition of Fish Habitat

Major efforts of certain fisheries stocks of economic and recreational importance are monitored and reported by the Alaska Department of Fish and Game. The condition of fish habitat in Alaska is largely unknown and unmonitored, yet the majority of the fish habitat in the Kenai Peninsula's partnership geography is reasonably assumed to be healthy and intact. Salmon enumeration in major systems are estimated through a variety of techniques conducted by the Alaska Department of Fish and Game. Such enumerations are generically the basis for the assumption that fish populations and fish habitats are healthy. There are large gaps in knowledge and data, particularly for non-salmonid species. There are no fish are listed on the endangered species list.

Within the partnership, three marine mammals populations with close ties to fish and fish habitat are listed as endangered, the Humpback Whale, Stellar Sea Lion and Cook Inlet Beluga Whale. One migratory bird also with close ties to fish and fish habitat is listed as threatened, the Stellar Eider.

One waterbody, the Kenai River, is listed on as having impaired water quality under § 303(d) of the federal Clean Water Act. Due to the actions of many of the partners involved in this partnership, the impairment status of the Kenai River from Total Aromatic Hydrocarbons has been addressed and is anticipated to come off the 303(d) list in 2010.

Overarching Desired Future Condition of Fish Habitat

Water Quality
No impaired water body listings under the Federal Clean Water Act. An increase in the number of water bodies that have sufficient and credible evidence that they are meeting established water quality standards for fish and aquatic life.

Endangered Species
No Threatened or Endangered listings of fish species under the Endangered Species Act.

Knowledge and supporting documentation that there are no fish habitat limitations for the recovery of existing Threatened and Endangered species

A means to quantify fish habitat should be established such that one could measure and document no net loss of fish habitat.

Fish habitat should have a higher priority than opportunity and no opportunity should be lost due to impacts to habitat.

Water quantity

Other socio-economic goals (stepped down from “healthy people, healthy economies”)?

Focal Area: Partnership Capacity

Goal : Ensure organizational capacity and effective operating systems are in place for the Partnership to make positive and lasting contributions to the protection and the restoration of fish and aquatic habitat.

The purpose of this focal area is to create and maintain the infrastructure necessary to have a broad base partnership. The focal area will provide provisions for the essential components of fully functioning partnership including; members, coordinator, steering committee, science and data committee and ad-hoc committees.

Current Condition

Many of the existing entities involved in convening this partnership have previously worked together on fisheries and fish habitat concerns. Efforts to date have been conducted on a case-by-case basis without formal structure, yet significant accomplishments have been made. No one effort has been comprehensive and focused solely on fish habitat. The National Fish Habitat Action Plan comes at an opportune time for the Kenai Peninsula, where a significant number of interested stakeholders are willing to come together and build on recent successes, under the Kenai Peninsula Fish Habitat Partnership.

Desired Future Condition

The Kenai Peninsula Fish Habitat Partnership has a vibrant, active and diverse membership, a robust operating plan, including defensible project selection and evaluation procedures. The partnership receives the necessary amount of annual unrestricted operating support and project funds in order to sustain its coordination responsibilities, meet the project support needs of member organizations, and achieve overall goals and objectives.

Member terms

The Kenai Peninsula Fish Habitat Strategic Plan is the result of many individuals from diverse agencies and organizations working to achieve a common vision for the conservation of fish and aquatic habitat in this region. Partner participants must agree to:

- Publicly support the vision, mission, goals and objectives of the Plan;
- Participate in the implementation of the Plan;
- Invest time and/or funding to sustain the capacity of the Partnership; and
- Adhere to the governing structure and organizing principles of the Partnership as described below and as amended.

Organizing Principles:

- Strive to work and make decisions by consensus;
- Ensure accountability and transparency for all Partnership activities;

- Focus Partnership activities on issues pertaining to habitat conservation and restoration - **not** fishery management allocation decisions;
- Apply the best available scientific information to Partnership funding and management decisions and the development and evaluation of partnership projects;
- Employ the precautionary (do no harm) management principle to Partnership decisions and actions, especially in the absence of scientific and/or technical information needed to make an informed decision;
- Maintain the Partnership as a voluntary self-directed organization actively working to achieve the goals and objectives of the Plan; and
- Ensure that the Partnership complements the various missions and purpose of individual member groups.

Governing Structure

Member Groups:

Organizations must support the Strategic Action Plan in order to become recognized as a member group. Member groups assist with implementation of the Strategic Action Plan by providing guidance on plan activities and also assisting with or otherwise participating in the implementation of the Partnership's annual work plan. Member groups serve on the Steering Committee, Science and Technical Committee, and Ad-Hoc committees of the Partnership. Member groups participate in the annual evaluation of the Partnership Coordinator. There is an expectation that member groups participate at the annual meeting of the Partnership and other strategic planning activities. In coordination with the full Partnership, member groups may also receive funding through the Partnership to implement aspects of the Plan. There is no limit to the number of member groups.

Coordinator:

The Kenai Watershed Forum shall serve as the initial Partnership Coordinator. Duties include:

- Facilitate Steering Committee and full Partnership meetings;
- Point of contact with the National Fish Habitat Board;
- Point of contact for inquires about the Partnership;
- Maintains Partnership website and keep member groups informed of the Partnership activities; and
- Coordinate with other fish habitat partnerships in Alaska and those partnerships in the Lower 48 that also serve Alaska.

Steering Committee:

The Steering Committee shall have 9 representatives. Seven (7) seats shall be drawn from the full Partnership on a rotating basis with each representative serving for two consecutive one-year terms. Two (2) seats shall be represented by U.S. Fish and Wildlife Service R7 and National Oceanic and Atmospheric Administration.

The Steering Committee works with the Coordinator to facilitate day-to-day activities of the Partnership. The activities of the Steering Committee directly support achievement of the Strategic Plan. Roles of the committee include:

- Guide development, implementation, monitoring, and evaluation of habitat conservation actions and priorities identified in the Plan;
- With input from the full Partnership and the Science and Technical Committee, rank actions (projects) for funding and communicate project priorities to funding organizations;
- Annually, reevaluate Partnership project priorities and set new priorities, as needed;
- Participate in outreach efforts to garner additional resources to build support for the Partnership;
- Coordinate with other Fish Habitat Partnerships where there is geographic proximity or overlap with species and habitats;
- Report results to partners, stakeholders, and the National Fish Habitat Board and their working groups (*i.e.*, Science and Data and Communication Committees) on the status, accomplishments, and needs of the KPFHP;
- Help conduct annual meetings and guide future strategic planning activities; and
- Conduct an annual evaluation of the Coordinator, in consultation with the full membership.

<u>Science and Technical Advisory Committee:</u>

The Science and Technical Committee is a standing committee of the Partnership. It is established to ensure that the Partnership's strategic planning, project design, implementation, monitoring and evaluation are scientifically sound. The Partnership will determine the scientific disciplines desired for the committee and the Steering Committee will recruit experts in those fields to be members. The Committee will make recommendations on future research needs of the Partnership. Projects to be funded under the auspices of the Partnership shall be first reviewed by the science committee and any interested member group. Comments and recommendations made by the Science Committee and/or member groups will be forwarded to the Steering Committee for final selection and ranking. The Steering Committee will communicate the Partnership's project needs to the National Board and other funders.

The Science and Technical Committee will also develop generic guidance on a range of habitat protection and restoration techniques to assist member groups implement defensible project monitoring and evaluation procedures.

Ad Hoc Working Groups**:**

Working groups will be established at any time to facilitate the work of the Partnership. Member groups may at any time recommend development of an Ad Hoc working group for approval by and additional guidance from the Steering Committee. Working groups can include individuals and organizations that are not member groups of the Partnership.

Objectives

Objective 1: Over the next three years, maintain a high positive rating of the Kenai Peninsula Fish Habitat Partnership among member groups and ensure our Partnership is viewed as a trusted and credible source of information about fish and aquatic habitat protection and restoration.

1.1. Conduct an independent organizational assessment/review of Partnership within three years from the date of formal partnership recognition by National Fish Habitat Board;

1.2. Conduct annual evaluation of the performance of the Partnership by the membership;

1.3. Regularly update Partnership operations, projects and activities on the Partnership website to ensure transparency and accountability to member groups and the public;

1.4. Prepare a summary of Partnership accomplishments and report on the organizational and financial position of the Partnership, annually;

1.5. Coordinate with other fish habitat partnerships in Alaska to conduct a biennial "fish habitat science symposium" – the purpose of which is to share information on individual partnership activities and project outcomes, identify technical information gaps and opportunities for collaboration among candidate and formal fish habitat partnerships in Alaska; and

1.6. Define terms and conditions that set the scientific foundation of the Partnership.

Objective 2: Continually improve and strengthen the organizational effectiveness and operations of the Partnership and implement the highest priority projects benefiting fish habitat.

2.1. Adopt formal administrative proceedures within 1-year of formal recognition as a NFHAP partnership;

2.2. Develop a system for ranking and recommending projects for funding, in full consultation with member groups and funding agencies;

2.3. Establish the scientific disciplines that will serve on the Science and Technical committee and recruit experts in those fields to be members, within 6 months;

2.4. Annually review additional scientific and other relevant information regarding fish habitat and ensure that the project and programmatic priorities of the Partnership consider this information; and

2.5. Identify and seek funds from multiple private and public sources to support Partnership project priorities and operations.

Objective 3: Within three years, obtain on-going unrestricted operating support in order to sustain the facilitation and coordination functions of the Partnership Coordinator, Steering Committee and Science and Technical Committee.

3.1. Develop annual budget and work plan for operations of the Partnership and selected committees.

3.2. Develop and implement a plan to sustain unrestricted operating support for the services provided by the Coordinator, Steering Committee, and Science and Technical Committee.

Priority Activities

The partnership focal area is unique relative to the remaining five focal areas in that several priority activities are fundamentally necessary to ensure a functional partnership exists. Activities 1 through 3 are essential to accomplish within 1-year of formal partnership recognition.

Activity 1: Adopt formal administrative By-Laws for the Partnership – **Obj. 2.1**

Who: Coordinator, Steering Committee, full Partnership
When: within 1-year of formal recognition as a NFHAP partnership
Development cost: $10,000 for partnership facilitation and coordination and preparation of bylaws.
Anticipated annual cost: none

Activity 2: Establish the scientific disciplines that will serve on the Science and Technical committee and recruit experts in those fields to be members. **Obj. 2.3**

Who: Coordinator and Steering Committee
When: Within 6 months of formal recognition as a NFHAP partnership
Development cost: $5,000 for partnership facilitation and coordination and committee recruitment activities.
Anticipated annual cost: $5,000 – $10,000 for committee travel, conference calls and meeting support.

Activity 3: Adopt system for ranking and recommending projects for funding, in full consultation with member groups and funding agencies. **Obj. 2.2**

Who: Coordinator, Steering Committee Chair, Science and Technical Committee Chair
When: Within 6 months of formal recognition as a NFHAP partnership
Development cost: $5,000 for conference calls, coordinator facilitation, face-to-face meetings.
Anticipated annual cost: $15,000 for conference calls, travel support and ranking facilitation, preparation of project summaries for communication to NFHAP and other funders.

Activity 4: Conduct a biennial "fish habitat science symposium" – the purpose of which is to share information on individual partnership activities and project outcomes, identify technical information gaps and opportunities for collaboration among candidate and formal fish habitat partnerships in Alaska. **Obj. 1.5**

Who: Coordinator and Steering Committee, in collaboration with Mat-Su and Southwest Alaska Partnership Steering Committees and full Kenai Peninsula Partnership
When: Within 24 months of formal recognition as a NFHAP partnership
Development cost: $5,000 for conference calls, facilitation, face-to-face meetings
Anticipated annual cost: Approximately, $20,000 (every two years). Funds used to support symposium coordination, meeting space/logistics, guest speakers.

Activity 5: Develop and implement a plan to sustain unrestricted operating support for the services provided by the Coordinator, Steering Committee, and Science and Technical Committee. **Obj. 3.2**

Who: Coordinator, Steering Committee Chair, Science and Technical Committee Chair
When: within 12 months of formal recognition as a NFHAP partnership
Development cost: $5,000 for partnership facilitation and coordination and preparation of operating procedures.
Anticipated annual cost: TBD

FOCAL AREA: BIOLOGICAL COMPLEXITY

Goal: The biological integrity of ecosystems that support healthy fish habitat are protected, maintained, or restored.

The purpose of this focal area is to promote sustainable watersheds through ecosystem management, which include the long-term health of local communities and their economies. Ecosystem management is an integrated approach to management that considers the entire ecosystem, including humans and recognizes the impacts of climate change. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition. Ecosystem based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative effects of different sectors.

Current Condition

- To the best of our collective knowledge, wild fish populations are healthy despite some known but un-quantified loss of natural habitat.

- To the best of our collective knowledge, wild fish population have sufficient intact habitat to sustain historical population levels with some habitat loss. The lost habitat is assumed to have reduced the resiliency of fish populations to withstand future natural and anthropogenic disturbances.

- We do not know what percentage of fish habitat that has been reduced by fragmentation; however we do know 48% of assessed culverts do not support unrestricted movement of juvenile coho salmon.

- We do not have sufficient assessments, nor working ecosystem-based habitat models to help guide strategic actions of our partnership.

Desired Future Condition

- The partnership will be able to identify and quantify key areas of fish habitat loss by major watershed assessments and through protection, restoration and enhancement projects, regain lost resiliency.
- Fish and other aquatic organisms have unrestricted access to at least 99% of available habitat within each of the 14 major watersheds covered by our geographical focus
- All wild fish populations within our geographical focus will remain self-sustaining at recent historical levels.
- No fish populations or species with critical ties to fish within our geographical focus are listed under the Endangered Species Act.

Objectives

Objective 1: Create a prioritized list and implement proposed projects that support healthy fish habitat.

1.1. Conduct or support the restoration of at least 5 priority barriers annually ***interim priority**:* Note list completed and attached appendix; restore a minimum of 5 priority barriers during 2010

1.2. Update and improve the prioritized inventory of fish passage projects

1.3. Establish and maintain an prioritized inventory of fish habitat restoration projects

1.4. Conduct or support the implementation of at least 3 fish habitat restoration projects annually

1.5. Establish a prioritized inventory of projects to address aquatic invasive species

1.6. Acquire land and water rights through fee simple title, easements, or reserved rights **(presently not eligible)**

Objective 2: Develop and integrate a prioritized list of ecological & social indices, benchmarks for ecosystem-based models that define and support healthy fish habitat.

2.1. Obtain and summarize existing ecosystem-based fish habitat models to define which models offer the best opportunity for use in the study area;

2.2. Contract with experts in the field of ecosystem-based modeling to prepare a list of ecosystem indices/metrics and model options;

2.3. Select a high priority watershed to develop and test an ecosystem-based fish habitat modeling approach; and

2.4. Define the information and data requirements for refinement of model outputs.

Objective 3: Establish a risk assessment model that evaluates threats and prioritizes restoration efforts of fish habitat

3.1. Establish a formal mathematical approach to risk analysis for a high priority watershed;

3.2. Test and refine the model results based on an adaptive management approach;

3.3. Implement recommendations of risk assessment and ecosystem modeling reports; and

3.4. Comprehend the amount of consumptive use of natural resources that allow aquatic ecosystem function and sustainability to be maintained.

3.5. Report on ecosystem health that supports fish habitat (**sequential task to be completed after 3.1 -3.4**);

FOCAL AREA – WATER QUALITY AND QUANTITY

Goal: Ensure necessary water quality and quantity to support healthy fish communities and aquatic ecosystems.

The purpose of this focal area is to protect, maintain and restore a fundamental element of aquatic ecosystems, the water. Consistent with guidance from the National Fish Habitat Board, we will seek protections for water quantity and quality. Climate change is affecting the quantity and seasonal distribution of stream flow and lake levels in all aquatic systems. Changes from climatic impacts are more readily observed in glacial dominated systems; however, drying of low lying wetlands has also been documented. Less clear is the connection between drying wetlands, changes in the seasonal distribution of flow and the impacts to fish habitat.

Current Condition

The Alaska Clean Water Action Plan developed and maintained by the Alaska Department on Environmental Conservation assess water quality and quantity concerns annually and produces a priority list for waters of concern. The partnership seeks to understand and provide input into this process. http://www.dec.state.ak.us/water/acwa/acwa_index.htm

Desired Future Condition

No waters would be considered impaired for water quality. Sufficient in-stream flows are available for all salmon bearing streams.

Objectives

*Objective **1:** Secure instream flow reservations for the protection of healthy fish communities and aquatic ecosystems on streams with existing water quantity data.*

1.1. Identify streams with no reservations that have sufficient water quantity data and file applications

1.2. Determine which streams already have adequate instream flow reservations for the protection of healthy fish communities and aquatic ecosystems;

1.3. Collect additional data on those streams that have some hydrological record, but need additional data to file instream flow reservation; and

1.4. Identify streams with no hydrologic data that should be prioritized for stream gauging efforts.

Objective 2: Work within the Alaska Clean Water Action process to ensure protection of healthy fish communities and aquatic ecosystems.

2.1. Nominate streams with existing water quality data related to Alaska's Water Quality Criteria and nominate waterbodies for appropriate status;

2.2. Identify freshwaters and near shore marine habitats that should be prioritized for baseline water quality data collection based on current or future development and/or potential for catastrophic events.

2.3. Collect additional data to support baseline datasets on streams of concern; and

Objective 3: Identify & recommend activities to restore and protect water quality and/or quantity.

3.1. Examine efficacy of existing riparian setbacks to protect water quality and/or quantity and provide suggested improvements to policy makers (consistent with policy focal area);

3.2. Identify and prioritize watersheds/parcels for land acquisition and conservation easements where those acquisitions would facilitate improved water quality and/or quantity;

3.3. Examine efficacy of existing wetland protections to protect water quality and/or quantity and provide suggested improvements to policy makers;

3.4. Examine efficacy of existing wastewater management systems to protect water quality and/or quantity and provide improvements to policy makers.

3.5. Identify existing plans where the Partnership can play a role in implementation of BMPs, and participation in cost share programs

3.6. Seek partner participation in Alaska Clean Water Actions (ACWA) evaluation of waterbodies

Objective 4: Reduce Borough-wide water consumption.

4.1. Identify the greatest sectors of water consumption and help them develop conservation strategies;

4.2. Create a Water Demand Management Plan to identify practical steps for communities to reduce water usage;

4.3. Meter all water use for public water sources to generate a benchmark to measure water conservation efforts;

4.4. Quantify water use of private well water sources through well logs and implement a process for sending well information to DNR at point of sale of property.

FOCAL AREA – SCIENCE AND TECHNOLOGY

Goal: Facilitate and increase the use and availability of scientific knowledge to guide Partnership priorities, policy development and management decision making.

This purpose of this focal area is to consolidate, synthesize and summarize existing scientific knowledge of fish habitat as it relates to the partnership's purpose and geographic area. The scientific and decision making community periodically needs a forum on aquatic ecosystems to share information about on-going research and restoration efforts. This information needs to be shared in the appropriate format among non-technical partners and with overlapping goals. In existing plans and literature, there are identified information and monitoring data gaps. The short-term objectives of this goal are to prioritize and begin to fill the known information and data gaps through research and monitoring with the anticipation that successful endeavors of the Biocomplexity and Water Quality/ Quantity focal area goals may provide better direction for monitoring programs in three to five years.

Current Condition

The current state of scientific knowledge related to fish habitat is both inaccessible and insufficient. Relevant data, analyses and reports are not readily available to researchers or policy makers in any one location or in electronic formats. Our fish habitat knowledge is limited by numerous data gaps and a lack of final project review that might lead to improved future project design and development.

Desired Future Condition

Our desired future state of scientific knowledge is that fish habitat information is accessible to researchers and policy makers in one location, electronically. Our fish habitat knowledge is comprehensive and the Partnership provides periodic opportunities to share on-going research. Continuous monitoring and thorough project evaluation allows us an efficient feedback mechanism to improve project design and development.

Objectives

Objective 1: Synthesize existing fish habitat information and make it accessible to the Partnership.

1.1. Support science based fish habitat symposiums for Partners to share relevant information.

1.2. Create a metadata data base or annotated bibliography with links and post on Partnership website;

1.3. Identify existing plans and information sources;

Objective 2: Fill data gaps identified in other goals and in existing fish habitat plans

2.1. Monitor stream temperatures to identify watersheds at greatest risk to landscape and climate change

2.2. Survey streams to identify fish distribution and support Alaska's Anadromous Waterways Catalog development

2.3. Map wetlands in watersheds that have not been mapped and seek to understand wetland functions as they relate to fish habitat;

2.4. Establish gaging sites to measure water quantity in watersheds of concern with known data gaps, such as the Anchor River, Chuitna River, and potential hydro project sites;

2.5. Identify, monitor and evaluate the impact of invasive species on the health of aquatic ecosystems;

2.6. Monitor recreational activities and evaluate impacts to fish habitat;

2.7. Map impervious cover in watersheds that have not been mapped and do a 10-year update on previously mapped watersheds;

2.8. In concert with other on-going programs, develop and implement a water quality monitoring program to address current, future and/or catastrophic threats;

2.9. In concert with other on-going programs, develop and implement a strategic plan for stream gaging to characterize hydrology in a range of watershed sizes;

2.10. Monitor existing culverts and road crossings to identify new fish passage problems;

2.11. Monitor coastline and riparian development and assess impacts of shoreline alteration;

2.12. Survey biodiversity and biomass in freshwater and nearshore marine systems relevant to the listed threatened and endangered species that depend on fish and fish habitat.

Objective 3: Evaluate efficacy of past and current protection and restoration efforts to provide guidance to project design and development.

3.1. Review and assess the effect of local and state regulations that are intended to provide fish habitat protections;

3.2. Where fish passage restoration occurs, build on existing juvenile fish movement studies to evaluate the broad ecological changes before and after a suspect barrier is removed and replaced;

3.3. Design and implement a study to monitor and evaluate current practices of commonly utilized streamside bank restoration.

FOCAL AREA: EDUCATION

Goal: Increase the awareness and knowledge of fish habitat for everyone that lives, works, recreates, visits, regulates or otherwise has an influence on the strategic issues of the partnership

The purpose of this focal area is to provide learning opportunities for policy makers, landowners, resource managers, resource users, interest groups and the public; including, but not limited to K-12 programs. Educational efforts should recognize fish as part of an entire ecosystem, including humans. This focal area should support educational and outreach programs that facilitate a better understanding of the complex needs and systems of fish and aquatic life, the Priority issues from our other focal areas should also be integrated in annual educational themes or planning efforts.

Objectives

Objective 1: Complete an education and outreach plan for the KPFH partnership.

1.1 Frame consistent messages for use under the Partnership name ;

1.2. Identify the key issues and target audience from the identified threats in appendix C for education messages as reflected in focal areas of Biological Complexity, Water Quality/ Quantity, Science and Technology and Policy

Objective 2: Ensure educational messages and products are available for use to KPFH partners and target audiences, help and encourage leaders of target audiences spread educational messages among their peers.

2.1 Sponsor a science symposium

2.2 Sponsor at least 1 workshop for policy makers on critical issues identified in Goals 1-3 every 24 months *(also identified in the policy activities).*

2.3 Engage the resource users in the delivery of educational messages;

2.4 Support existing education coalitions including Kenai Peninsula Environmental and Cultural Educators (KPECE) and Kachemack Bay Environmental Education Alliance (KBEEA) for all things fish habitat and K-12;

2.5 Engage the business community in the delivery of educational messages;

2.6 Offer fish conservation oriented K-12 teacher continuing education course

2.7 Hold annual KPECE meeting with KPFHP branding.

Objective 3: Effectively use the KPFH Web site as a communication tool and source of information on Kenai Peninsula Fish Habitat

3.1 Keep a website maintained with updates at least every 6 months; and

3.2 Stay current with website trends and new features as they become available.

Objective 4: Increase understanding and capacity for informed planning among policy makers.

4.1 Create a watershed stewardship education program for government officials, tribal leaders, and the general public within the University of Alaska or Non-Governmental Organization.

FOCAL AREA: POLICY

Goal - Identify, prioritize and ensure adequate regulations, polices and planning processes are in place to support the protection of fish habitat.

The purpose of the Policy focal area is to gather and make available relevant data, tools and protocols that can enable appropriate government bodies to enact, change or more effectively enforce legislation and policy that will protect fish habitat. The Partnership **does not lobby** for change and will coordinate and share information about existing laws and policies, including identifying gaps so that appropriate government bodies can enable aquatic habitat protection, restoration, and enhancement to meet the Partnership's goals and objectives.

Current Condition

Although laws and policy to protect fish and aquatic habitats in the Kenai Borough exist on federal, state and local levels, they are neither universally compatible nor universally applied. Some are enforced throughout the region; others are enforced only in certain areas or under certain conditions. These differences reduce the effectiveness of landscape-level habitat conservation and restoration throughout a watershed or the region.

Desired Future Condition

Policies that are designed to protect fish habitat will receive regular review to help ensure they keep pace with change. Change comes in many forms, for example: new scientific knowledge about the essential needs of fish habitat; a growing population that requires new land conversion practices; changes in other regulatory policy that has an indirect effect on fish habitat. The partnership desires a condition where local, state, federal and tribal policy makers better understand and appreciate the need to address policy issues prior to new listings of impaired waters, threatened and endangered species.

Objectives

*Objective 1: Conduct a **policy analysis**[1] to identify and address specific zoning ordinances to maintain and increase ecosystem services, function and protections to fish habitat.*

1.1. Complete a review of KPB code of ordinances including but not limited to: habitat protection (21.18); floodplain (21.06); material site extraction (21.29); and roads (14.06) as they relate to fish habitat.

1.2. Use the current threat matrix to identify and prioritize specific development actions to be addressed to increase protection of ecosystem services and fish habitat;

1.3. Research, identify, and implement a method (tool) to conduct a policy analysis of appropriate Federal, State, Borough, and City planning policies and /or regulations;

1.4. Identify existing regulatory processes and structures;

Objective 2: Define reform options of institutional structures and processes to better support sustainable fish habitat initiatives.

2.1. Initiate dialogue with municipal officials about the policy needs for fish habitat;

2.2. Promote the development of an innovative process and policy analysis that incorporates watershed scale planning (e.g., watershed councils);

2.3. Provide technical support to local decision-makers, drafting specific language, need statements, and justification why these efforts should be addressed and incorporated in federal, state, borough and city planning process;

2.4. Review and identify opportunities for judicial system reform that emphasize fish habitat protections (for example, establish arbitration/ mediation as an alternative to legal prosecution).

2.5. Establish initiatives that facilitate meaningful local involvement in fish habitat management decisions;

2.6. Work closely with municipal officials and enforcement personnel to ensure the biological attributes are effectively monitored for regulatory compliance;

Appendices

Appendix A – Definitions

Words used by the partnership in the strategic plan and any subsequent documents should refer to these definitions for clarity and consistency among partners.

ABIOTIC is nonliving; specifically, the nonliving components of an ecosystem, such as temperature, humidity, the mineral content of the soil, etc.

ADAPTIVE MANAGEMENT – assumes that scientific knowledge is provisional and focuses on management as a learning process or continuous experiment where incorporating the results of previous actions allows managers to remain flexible and adapt to uncertainty (Grumbine 1994)

ANDROMOUS FISH are species such as salmon that are born in fresh water, migrate and feed in a marine environment, and return to natal freshwater systems to spawn.

BEHAVIOR is all of the acts an organism performs, as in, for example, seeking a suitable habitat, obtaining food, avoiding predators, and seeking a mate and reproducing.

BENTHIC is the bottom surfaces of aquatic environments.

BIODIVERSITY is the variety of genes, species, and ecosystems in a region. Each category describes different aspects of a living system and is scientifically measured in different ways to characterize the composition (identity and variety of living forms), structure (physical organization), and function (ecological and evolutionary processes) of the system.

BIOMASS is the dry or wet weight of organic matter comprising a group of organisms in a particular habitat.

BIOTIC – pertaining to life or living things, or caused by living organisms; or to biological factors or influences concerning biological activity.

BUFFERS – a strip of grass, shrubs, and trees used to separate a watercourse from an intensive land use area to protect water quality, prevent bank erosion, and maintain in-stream habitat.

BURDEN OF PROOF – The responsibility to demonstrate an activity will or will not lead to overfishing or negative effects on the ecosystem.

BYCATCH – Unintentional catch; i.e., catch that occurs incidentally in a fishery that intends to catch fish with other characteristics (e.g., size, species).

CARRYING CAPACITY – The numbers or biomass of resources that can be supported by an ecosystem.

CHRONIC INABILITY means the continuing or anticipated inability to meet escapement thresholds over a four to five year period, which is approximately the generation time of most salmon species.

CONSERVATION CONCERN means concern arising from a chronic inability, despite the use of specific management measures, to maintain salmon escapements for a stock above a sustained escapement threshold (SET); a conservation concern is more severe than a yield concern.

CONSERVATION AND MANAGEMENT – The rules, regulations, conditions, methods, and other measures (A) which are required and useful to rebuild, restore, or maintain any fishery resource and the marine environment; and (B) which are designed to ensure that: (i) a supply of food and other products may be taken, and that recreational benefits may be obtained, on a continuing basis; (ii) irreversible or long-term adverse effects on fishery resources and the marine environment are avoided; and (iii) there will be a multiplicity of options available with respect to future uses of these resources (NMFS 1996)

DENSITY DEPENDENT FACTOR is any factor influencing population regulation that has a greater impact as population density increases

DENSITY INDEPENDENT is any factor influencing population regulation that acts to reduce population by the same percentage, regardless of size

ECOLOGICAL NICHE is the sum total of an organism's utilization of the biotic and abiotic resources of its environment.

ECOLOGICAL SUCCESSION is the transition in the species composition of a biological community, often following ecological disturbance of the community; the establishment of a biological community in an area virtually barren of life.

ECOLOGY is the study of how organisms interact with their environments.

ECOREACH -- a subunit of an ecoregion, determined based on gradients, barriers, and other physical, chemical, and biological features of the ecoregion.

ECOREGION -- a unit determined by hydrology, plant and animal community structure, and substrate (if any). This unit is used both for assessing the quality of a resource relative to appropriate reference conditions and for conservation of natural resources while supporting local economies and culture for the lasting benefit of people living in or associated with the ecoregion.

ECOSYSTEM the complex set of relationships among living resources, habitats, and residents of a region. An ecosystem includes people, wildlife, fish, shellfish, plants, wetlands, water, and any other living and non-living entities that are necessary for the ecosystem to function over the long-term.

ECOSYSTEM BASED MANAGEMENT– is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. Ecosystem based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors (Scientific Consensus Statement on Marine Ecosystem Based Management 2005)

ECOLOGICAL INTEGRITY– is protecting total native diversity (species, populations, ecosystems) and the ecological patterns and processes that maintain that diversity.

ENDANGERED SPECIES is a species that is in danger of extinction throughout all or a significant portion of its range.

ENDEMIC is an organism found only in one particular location.

ENHANCEMENT means efforts applied to a stock of fish in the form of specific manipulation, such as hatchery augmentation or lake fertilization, to enhance its productivity above the levels that would naturally occur; "enhanced stock" includes an introduced stock, where no wild fish stock had occurred before, or a wild stock undergoing manipulation, but does not include a stock undergoing rehabilitation, which is intended to restore a stock's productivity to a higher natural level.

ESSENTIAL FISH HABITAT means those waters and substrate necessary to fish for spawning, breeding, feed, or growth to maturity." (Magnuson-Stevens Act).

FISH HABITAT - The aquatic environment and the immediately surrounding terrestrial environment that, combined, afford the necessary biological and physical support systems required by fish species during various life history stages..

FOOD WEB is the elaborate, interconnected feeding relationships in an ecosystem.

GENETIC means those characteristics (genotypic) of an individual or group of salmon that are expressed genetically, such as allele frequencies or other genetic markers.

GENETIC VARIABILITY, referred to in some quarters as "genetic integrity", for purposes of this planning effort can be thought of as maintenance - in "an unimpaired condition" - of that interaction of genes within a given gene pool which allows the stock to maintain a high level of natural adaptability.

GUILD is a group of species that perform more-or-less the same ecological role, making similar use of the same resource. Having more species per guild may increase the stability, and hence the productivity over time, of a marine community. Conversely, a loss of a number of species per guild could render a marine community more vulnerable to wild swings in stock sizes and productivity.

HABITAT CONCERN means the degradation of habitat that results in, or can be anticipated to result in, impacts leading to yield, management, or conservation concerns.

INDICATOR SPECIES are species that, by virtue of its reliable occurrence in a specific substrate, community, or ecosystem, is used as a gauge for the condition of that ecosystem.

INTRODUCED STOCK means a stock of fish that has been introduced to an area where that stock had not previously occurred and a salmon stock undergoing continued enhancement.

KEY SPECIES -- ecologically and/or economically important organisms that usually also are numerically abundant.

LIFE CYCLE is the entire sequence of stages in the life of an organisms, from the adults of one generation to the adults of the next.

LIFE HISTORY PATTERN is a group of traits, such as size and number of offspring, length of maturation, age at first reproduction, and the number of times reproduction occurs, that affect reproduction, survival, and the rate of population growth

LONG TERM means the fact that an ecosystem approach time frame extends beyond the next year, budget cycle, or election, to ensure that ecosystem dynamics occur within ranges that do not exceed the resilience of the system.

MARINE -- the sea realm, comprising more than 99% of Earth's biosphere, and housing 31 of the 32 known animal phyla. Many conservation concepts developed for terrestrial systems must be considerably modified for marine systems due to the distinct physicochemical, biological, and valuation differences between the two types of systems.

MAXIMUM SUSTAINABLE YIELD – A management goal specifying the largest long-term average catch or yield (in terms of weight of fish) that can be taken, continuously (sustained) from a stock or stock complex under prevailing ecological and environmental conditions, without reducing the size of the population.

MULTIVARIATE is the term that describes statistical, mathematical, or graphical techniques that consider multiple variables simultaneously.

NUTRIENT LOADINGS -- refer primarily to nitrogen and phosphorus pollution derived from municipal and industrial wastewater (point sources) and in agricultural runoff (non-point source).

ORGANISM is an individual living thing, such as a bacterium, fungus, protist, plant or animal.

OPTIMUM YIELD – (A) the amount of fish which will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; (B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and (C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery (NMFS 1996).

OVERFISHED -- harvesting greater numbers of a species than are replenished by natural reproduction. The definition of overfishing should include at a minimum seven elements that define management targets and thresholds (status determination criteria, maximum fishing mortality threshold, minimum biomass threshold, biomass target, optimum yield, maximum rebuilding time period, control law or fishing mortality management strategy). (see Murawski, S.A. 2000. Definitions of Overfishing from an Ecosystem Perspective ICES Journal of Marine Sciences 57:649-658).

OVERFISHING– Fishing at a rate or level that jeopardizes the capacity of a stock or stock complex to produce maximum sustainable yield on a continuing basis (NMFS 1996).

PREDATOR is an organism that eats other living organisms.

PREY is an organism eaten by another organism.

PRIMARY PRODUCTION is the creation of organic matter by plants through photosynthesis (using inorganic carbon, nutrients and external energy source) to form the base of the food chain.

QUOTA is a specified numerical objective for landings (excluding discard mortality), the attainment (or expected attainment) of which may cause closure of a fishery.

RECRUITMENT– a measure of the weight or number of fish which enter a defined portion of the stock such as fishable stock (those fish above the minimum legal size) or spawning stock (those fish which are sexually mature).

REGIME SHIFT – major changes in levels of productivity and reorganization of ecological relationships over vast oceanic regions which could be caused by various sources including climate variability or overfishing.

REHABILITATION means efforts applied to a stock to restore it to an otherwise natural level of productivity; "rehabilitation" does not include an enhancement, which is intended to augment production above otherwise natural levels.

RETURN means the total number of salmon in a stock from a single brood (spawning) year surviving to adulthood; because the ages of adult salmon (except pink salmon) returning to spawn varies, the total return from a brood year will occur over several calendar years; the total return generally includes those mature salmon from a single brood year that are harvested in fisheries plus those that compose the salmon stock's spawning escapement; "return" does not include a run, which is the number of mature salmon in a stock during a single calendar year.

RUN means the total number of salmon in a stock surviving to adulthood and returning to the vicinity of the natal stream in any calendar year, composed of both the harvest of adult salmon plus the escapement; the annual run in any calendar year, except for pink salmon, is composed of several age classes of mature fish from the stock, derived from the spawning of a number of previous brood years.
to augment production above otherwise natural levels.

"**FISH STOCK**" means a locally interbreeding group of fish that is distinguished by a distinct combination of genetic, phenotypic, life history, and habitat characteristics.

SHORT TERM is the fact that many traditional management decisions are confined to a yearly, budgetary, or political cycle. Ecosystem processes occur on the scale of life spans of the ecosystem inhabitants, often on the order of decades or even centuries.

STANDARDIZATION -- refers to the need to have consistent usage of data format, ecological indicators, and language and acronyms across regions and agencies. It is necessary to instill conformity of accepted measurements or values that are applied to fisheries management through the use of similar indicators for data collection, data processing, and reporting such as with Geographic Information Systems.

STOCK ASSESSMENT is an evaluation of a stock in terms of abundance and fishing mortality levels and trends, and relative to fishery management objectives and constraints, if they have been specified.

STRESS (STRESSOR) -- refers to a factor, environmental or anthropogenic, that causes or drives a behavior or outcome.

SURPLUS PRODUCTION– is the total weight of fish that can be removed by fishing without changing the size of the population. It is calculated as the sum of the growth in weight of individuals in a population, plus the addition of biomass from new recruits, minus the biomass of mortality of animals lost to natural mortality, during a defined period (usually one year).

SUSTAINABILITY -- of a fishery must be defined in terms of goals within four separate categories. Together, these science and policy components interact transparently to form a dynamic and adaptive process: Biology – harvest is managed to maintain populations at sizes within defined ranges that take into account natural environmental stochasticity and observed effects of management and other human activities; Society – maintain or enhance diverse societal attributes of the fishery (cultural, aesthetic, spiritual, religious) for a specified planning time horizon (may include but not limited to ceremonial use, viewing aquatic species, fishing community heritage, dietary benefits, community diversity, ecosystem benefits, subsistence harvesting, area closures, promote environmental justice); Economic – the fishery constitutes a viable economic endeavor for a specified planning time horizon and yields a positive return to society measured as cumulative economic output that remains within a defined range; and Legal – the fishery must exist within a governance structure that ensures system integrity, including but not limited to regulatory authorities, treaties, constraints, requirements and infrastructure.

SUSTAINABLE HABITAT ---- is the physical space and collection of biotic and abiotic processes and entities that constitute a properly functioning ecosystem capable of maintaining itself within the bounds and patterns produced by natural disturbance processes (MacDonald D. et. al 2000)

"**SUSTAINED ESCAPEMENT THRESHOLD**" is a level of escapement, below which the ability of the salmon stock to sustain itself is jeopardized; in practice, SET can be estimated based on lower ranges of historical escapement levels, for which the salmon stock has consistently demonstrated the ability to sustain itself and is established by the Department in consultation with the board, as needed, for salmon stocks of management or conservation concern."

TROPHIC LEVEL is the division of species in an ecosystem on the basis of their main nutritional source. The trophic level that ultimately supports all others consists of autotrophs, or primary producers.

TROPHIC STRUCTURE is the different feeding relationships in an ecosystem that determine the route of energy flow and the pattern of chemical cycling

WATERSHED is all of the land area that contributes surface run-off to the water supply of a body of water such as a river, stream, or lake.

"**WILD STOCK**" means a stock that originates in a specific location under natural conditions; "wild stock" may include an enhanced or rehabilitated stock if its productivity is augmented by supplemental means, such as lake fertilization or rehabilitative stocking.

WILD STOCK RESERVE" is defined by three conditions: (1) it must have no previous history of enhancement and is precluded from future enhancement; (2) it must be of a size sufficient to allow for substantial egg takes without posing serious threat to the viability of the stock; (3) it must be believed to be representative of the stocks of the area..

WETLAND is an area where saturation or repeated inundation with water determines the nature of the soils, the plants, and the animals of the area. Wetlands include wet meadows, lake and river banks, swamps, bogs, marshes, embayment, bayous, river flood plains, and estuaries.

"**YIELD CONCERN**" means a concern arising from a chronic inability, despite use of specific management measures, to maintain expected yields, or harvestable surpluses, above a stock's escapement needs; a yield concern is less severe than a conservation concern.

Appendix B Significant Salmon Stocks

SIGNIFICANT SALMON STOCKS
WILD STOCK SALMON GENETIC RESERVES

The Cook Inlet Regional Planning Team (CIRPT) has constructed its initial lists of the significant stocks in Upper Cook Inlet, Alaska. The CIRPT is made up of representative of the Alaska Department of Fish and Game (ADF&G) and the Cook Inlet Aquaculture Association (CIAA). The planning document was reviewed by state, federal, and private organizations and the general public prior to publication.

The concept of local significance is discussed in the ADF&G *Genetics Policy* and further amplified in Chapter 3.0, Section 3.3.2.3 of the planning document.

Stocks that were designated "significant" were of a sufficient size to sustain them even though it might be at a level well below what users would judge to be the optimum level or what the habitat could probably support. This identifies the major discrete components of the total salmon resource of the region. This definition should not be construed to devalue the collective importance of the many smaller or "non-significant" stocks. The number of salmon streams number in the thousands in the Kenai Peninsula Borough.

The absence of a significance designation may mean a run smaller than the established size criteria, the absence of that species in that system or the absence of information about that species in that system.

This approach was developed and adopted by the CIRPT in the absence any other suggested approach that appeared to be broadly applicable

The following five exhibits (EXHIBIT 14-1 through 14-5, taken directly from the CIRPT Plan) consolidate the significant stocks from the ten planning units by species. The exhibits include some stocks that are outside the KPB. These include Knik and some Susitna River and Turnagain Arm stocks. We elected not to exclude them because of the relationship of these stocks to the total Upper Cook Inlet area and the critical nature of the relationship of the partnerships that are both north and south of the KPB.

The underlying size criteria are further qualified by the currency of the information as cited in the five parts of the second exhibit in each of the planning unit chapters. In the legends of the following five exhibits the size criteria for the species is identified as is reference to the age of the data. Three situations are identified: (1) the most recent qualifying data meets the size criteria and is less than two life-cycles old; (2) the most recent qualifying data meets the size criteria but is more than two life-cycles old; and (3) the most recent qualifying data do not meet the size criteria but an historic count does. At the least either of the latter two designations should trigger questions about the need for more current information or the causes of lower levels of production.

EXHIBIT 14-1 SIGNIFICANT KING SALMON STOCKS

Stream name appearing on USGS maps

Unnamed on USGS map but identified by its locally-used name

AWC = Anadromous Waters Catalog

most recent count meets minimum size criteria (400 fish) and is less than 12 years old	significant
most recent count meets minimum size criteria (400 fish) but is more than 12 years old	significant
historic count meets minimum size criteria (400 fish), but recent count does not	significant

STOCK	AWC NUMBER	PLANNING UNIT	STATUS
NONE	NONE	Kamishak Bay	NONE
McArthur River	247-10-10080	Westside Unit	significant
Nikolai Creek	247-10-10200	Westside Unit	significant
Chuitna River	247-20-10010	Westside Unit	significant
Beluga River	247-30-10090	Westside Unit	significant
Theodore River	247-30-10080	Westside Unit	significant
Lewis River	247-30-10070	Westside Unit	significant
Susitna River	247-41-10200	Susitna River Unit	significant
Alexander Creek	247-41-10200-2015	Susitna River Unit	significant
Lower Sucker Creek	247-41-10200-2015-3035	Susitna River Unit	significant
Wolverine Creek	247-41-10200-2015-3035-4019	Susitna River Unit	significant
Yentna River	247-41-10200-2053	Susitna River Unit	significant
Peters Creek	247-41-10200-2053-3150-4060	Susitna River Unit	significant
Cache Creek	247-41-10200-2053-3150-4120	Susitna River Unit	significant
Lake Creek	247-41-10200-2053-3170	Susitna River Unit	significant
Camp Creek	247-41-10200-2053-3170-4057	Susitna River Unit	significant
Sunflower Creek	247-41-10200-2053-3170-4067	Susitna River Unit	significant
Fish Lake Creek	247-41-10200-2053-3180	Susitna River Unit	significant
Skwentna River	247-41-10200-2053-3205	Susitna River Unit	significant
Talachulitna River	247-41-10200-2053-3205-4053	Susitna River Unit	significant
Canyon Creek	247-41-10200-2053-3205-4067	Susitna River Unit	significant
Red Creek	247-41-10200-2053-3225-4015	Susitna River Unit	significant
Kitchatna River	247-41-10200-2053-3229	Susitna River Unit	significant
Deshka River / Kroto Creek	247-41-10200-2081	Susitna River Unit	significant
Unnamed Tributary	247-41-10200-2081-3065	Susitna River Unit	significant
Moose Creek	247-41-10200-2081-3100	Susitna River Unit	significant
Twentymile Creek	247-41-10200-2081-3181	Susitna River Unit	significant
Willow Creek	247-41-10200-2120	Susitna River Unit	significant
Deception Creek	247-41-10200-2120-3020	Susitna River Unit	significant
Little Willow Creek	247-41-10200-2130	Susitna River Unit	significant
North Fork Kashwitna River	247-41-10200-2180-3061	Susitna River Unit	significant
Sheep Creek	247-41-10200-2200	Susitna River Unit	significant
Goose Creek	247-41-10200-2230	Susitna River Unit	significant
Montana Creek	247-41-10200-2250	Susitna River Unit	significant
Talkeetna River	247-41-10200-2370	Susitna River Unit	significant
Chunilna River	247-41-10200-2370-3041	Susitna River Unit	significant
Praitire Creek	247-41-10200-2370-3301	Susitna River Unit	significant
Chulitna River	247-41-10200-2381	Susitna River Unit	significant

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EXHIBIT 14-1 (continued) SIGNIFICANT KING SALMON STOCKS

Bunco Creek	247-41-10200-2381-3161-4085	Susitna River Unit	significant
Indian River	247-41-10200-2551	Susitna River Unit	significant
Portage Creek	247-41-10200-2585	Susitna River Unit	significant
Little Susitna River	247-41-10100	Knik Arm Unit	significant
Ship Creek	247-50-10060	Knik Arm Unit	significant
Chickaloon River	247-60-10110	Turnagain Arm Unit	significant
Kenai River	244-30-10010	Upper Peninsula / Kenai River Unit	significant
Killey River	244-30-10010-2076	Upper Peninsula / Kenai River Unit	significant
Benjamin Creek	244-30-10010-2076-3095	Upper Peninsula / Kenai River Unit	significant
Olson Creek	no AWC number	Upper Peninsula / Kenai River Unit	significant
Russian River	244-30-10010-2158	Upper Peninsula / Kenai River Unit	significant
Quartz Creek	244-30-10010-2177	Upper Peninsula / Kenai River Unit	significant
Crescent Creek	244-30-10010-2177-3012	Upper Peninsula / Kenai River Unit	significant
Kasilof River	244-30-10050	Mid-Peninsula / Kasilof River Unit	significant
Crooked Creek	244-30-10050-2024	Mid-Peninsula / Kasilof River Unit	significant
Ninllchik River	244-20-10090	Mid-Peninsula / Kasilof River Unit	significant
Deep Creek	244-20-10100	Mid-Peninsula / Kasilof River Unit	significant
Anchor River	244-10-10010	Mid-Peninsula / Kasilof River Unit	significant
NONE	NONE	Kachemak Bay Unit	NONE
NONE	NONE	Gulf Coast Unit	NONE
NONE	NONE	Greater Resurrection Bay Unit	NONE

EXHIBIT 14-2 SIGNIFICANT SOCKEYE SALMON STOCKS

Stream name appearing on USGS maps

Unnamed on USGS map but identified by its locally-used name

AWC = Anadromous Waters Catalog

most recent count meets minimum size criteria (2,000 fish) and is less than 10 years old	significant
most recent count meets minimum size criteria (2,000 fish) but is more than 10 years old	significant
historic count meets minimum size criteria (2,000 fish), but recent count does not	significant

STOCK	AWC NUMBER	PLANNING UNIT	STATUS
Douglas River	248-40-10100	Kamishak Bay Unit	significant
Kamishak River	243-10-10040	Kamishak Bay Unit	significant
Mikfik Creek	243-20-10050	Kamishak Bay Unit	significant
Chenik Creek	243-30-10200	Kamishak Bay Unit	significant
Amakdedori Creek	243-40-10010	Kamishak Bay Unit	significant
Crescent River	245-30-10010	Westside Unit	significant
Harriet Creek	245-40-10010	Westside Unit	significant
Little Jack Slough	245-50-10110	Westside Unit	significant
Big River	248-20-10070	Westside Unit	significant
McArthur River	247-10-10080	Westside Unit	significant
Chuitna River	247-20-10010	Westside Unit	significant
Threemile Creek	247-20-10002	Westside Unit	significant
Beluga River	247-30-10090	Westside Unit	significant
Packers Creek	246-20-10020	Westside Unit	significant
Susitna River	247-41-10200	Susitna River Unit	significant
Fish Creek	247-41-10200-2020	Susitna River Unit	significant
Alexander Creek	247-41-10200-2015	Susitna River Unit	significant
Yentna River	247-41-10200-2053	Susitna River Unit	significant
Hungryman Creek	247-41-10200-2053-3150-4090	Susitna River Unit	significant
Lake Creek	247-41-10200-2053-3170	Susitna River Unit	significant
Fish Lake Creek	247-41-10200-2053-3180	Susitna River Unit	significant
Skwentna River	247-41-10200-2053-3205	Susitna River Unit	significant
Eightmile Creek	247-41-10200-2053-3205-4027	Susitna River Unit	significant
Shell Creek	247-41-10200-2053-3205-4050	Susitna River Unit	significant
Talachulitna River	247-41-10200-2053-3205-4053	Susitna River Unit	significant
Happy River	247-41-10200-2053-3205-4112	Susitna River Unit	significant
Hewitt Creek	247-41-10200-2053-3213	Susitna River Unit	significant
Unnamed Tributary	247-41-10200-2053-3213-4050	Susitna River Unit	significant
West Fork Yentna River	247-41-10200-2053-3229-4110	Susitna River Unit	significant
Trapper Creek	247-41-10200-2081-3050	Susitna River Unit	significant
Caswell Creek	247-41-10200-2190	Susitna River Unit	significant
Question Creek	247-41-10200-2300-3011	Susitna River Unit	significant
Birch Creek	247-41-10200-2320-3010	Susitna River Unit	significant
Trapper Creek	247-41-10200-2341	Susitna River Unit	significant
Talkeetna River	247-41-10200-2370	Susitna River Unit	significant
Chunilna River	247-41-10200-2370-3041	Susitna River Unit	significant
Unnamed Tributary	247-41-10200-2370-3080	Susitna River Unit	significant

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EXHIBIT 14-2 (continued) SIGNIFICANT SOCKEYE SALMON STOCKS

Praitire Creek	247-41-10200-2370-3301	Susitna River Unit	significant
Little Susitna River	247-41-10100	Knik Arm Unit	significant
Fish Creek	247-50-10330	Knik Arm Unit	significant
Cottonwood Creek	247-50-10300	Knik Arm Unit	significant
Chickaloon River	247-60-10110	Turnagain Arm Unit	significant
Bishop Creek	247-90-10030	Upper Peninsula / Kenai River Unit	significant
Kenai River	244-30-10010	Upper Peninsula / Kenai River Unit	significant
Moose River	244-30-10010-2063	Upper Peninsula / Kenai River Unit	significant
Hidden Creek	244-30-10010-2137	Upper Peninsula / Kenai River Unit	significant
Jean Creek	244-30-10010-2135	Upper Peninsula / Kenai River Unit	significant
Russian River	244-30-10010-2158	Upper Peninsula / Kenai River Unit	significant
Quartz Creek	244-30-10010-2177	Upper Peninsula / Kenai River Unit	significant
Moose Creek	244-30-10010-2225-3013	Upper Peninsula / Kenai River Unit	significant
Railroad Creek	244-30-10010-2225-3021	Upper Peninsula / Kenai River Unit	significant
Johnson Creek	244-30-10010-2225-3031	Upper Peninsula / Kenai River Unit	significant
Ptarmigan Creek	247-60-10110-2231	Upper Peninsula / Kenai River Unit	significant
Snow River	247-60-10110-2231	Upper Peninsula / Kenai River Unit	significant
Kasilof River	244-30-10050	Mid-Peninsula / Kasilof River Unit	significant
Shantatalik Creek	244-30-10050-2059	Mid-Peninsula / Kasilof River Unit	significant
Nikolai Creek	244-30-10050-2060	Mid-Peninsula / Kasilof River Unit	significant
Bear Creek	244-30-10050-2075	Mid-Peninsula / Kasilof River Unit	significant
Moose Creek	244-30-10050-2099	Mid-Peninsula / Kasilof River Unit	significant
Seepage Creek	244-30-10050-2127	Mid-Peninsula / Kasilof River Unit	significant
Clear Creek	244-30-10050-2135	Mid-Peninsula / Kasilof River Unit	significant
Deep Creek	244-20-10100	Mid-Peninsula / Kasilof River Unit	significant
English Bay River	241-30-10500	Kachemak Bay Unit	significant
Delusion Lake C.	232-23-10390	Gulf Coast Unit	significant
Desire Lake Creek	232-23-10120	Gulf Coast Unit	significant
Delight Lake Creek	232-23-10120	Gulf Coast Unit	significant
Aialik Lake / Lagoon	232-40-10230	Greater Resurrection Bay Unit	significant
Salmon Creek	231-30-10080-2010	Greater Resurrection Bay Unit	significant
Bear Creek	231-30-10080-2010-3065-4010	Greater Resurrection Bay Unit	significant

EXHIBIT 14-3 SIGNIFICANT COHO SALMON STOCKS

Stream name appearing on USGS maps

Unnamed on USGS map but identified by its locally-used name

AWC = Anadromous Waters Catalog

Legend	
most recent count meets minimum size criteria (800 fish) and is less than 8 years old	significant (green)
most recent count meets minimum size criteria (800 fish) but is more than 8 years old	significant (yellow)
historic count meets minimum size criteria (800 fish), but recent count does not	significant (orange)

STOCK	AWC NUMBER	PLANNING UNIT	STATUS
NONE	NONE	Kamishak Bay	NONE
Chinitna River	243-10-10030	Westside Unit	significant (orange)
Silver Salmon Creek	245-10-10050	Westside Unit	significant (green)
West Glacier Creek	245-10-10060	Westside Unit	significant (orange)
Polly Creek	245-40-10050	Westside Unit	significant (orange)
Little Jack Slough	245-50-10110	Westside Unit	significant (orange)
Cannery Creek	245-50-10010	Westside Unit	significant (orange)
Drift River	245-50-10085	Westside Unit	significant (orange)
Big River	248-20-10070	Westside Unit	significant (orange)
Kustatan River	245-50-10010	Westside Unit	significant (green)
McArthur River	247-10-10080	Westside Unit	significant (orange)
Chuitna River	247-20-10010	Westside Unit	significant (green)
Beluga River	247-30-10090	Westside Unit	significant (orange)
Theodore River	247-30-10080	Westside Unit	significant (orange)
Lewis River	247-30-10070	Westside Unit	significant (orange)
Packers Creek	246-20-10020	Westside Unit	significant (orange)
Susitna River	247-41-10200	Susitna River Unit	significant (green)
Alexander Creek	247-41-10200-2015	Susitna River Unit	significant (green)
Yentna River	247-41-10200-2053	Susitna River Unit	significant (green)
Peters Creek	247-41-10200-2053-3150-4060	Susitna River Unit	significant (orange)
Lake Creek	247-41-10200-2053-3170	Susitna River Unit	significant (green)
Fish Lake Creek	247-41-10200-2053-3180	Susitna River Unit	significant (green)
Skwentna River	247-41-10200-2053-3205	Susitna River Unit	significant (green)
Talachulitna River	247-41-10200-2053-3205-4053	Susitna River Unit	significant (green)
Kitchatna River	247-41-10200-2053-3229	Susitna River Unit	significant (orange)
Deshka River / Kroto Creek	247-41-10200-2081	Susitna River Unit	significant (green)
Willow Creek	247-41-10200-2120	Susitna River Unit	significant (green)
Caswell Creek	247-41-10200-2190	Susitna River Unit	significant (green)
Sheep Creek	247-41-10200-2200	Susitna River Unit	significant (green)
Montana Creek	247-41-10200-2250	Susitna River Unit	significant (green)
Sunshine Creek	247-41-10200-2300	Susitna River Unit	significant (green)
Talkeetna River	247-41-10200-2370	Susitna River Unit	significant (green)
Chunilna River	247-41-10200-2370-3041	Susitna River Unit	significant (orange)
Little Susitna River	247-41-10100	Knik Arm Unit	significant (green)
Fish Creek	247-50-10330	Knik Arm Unit	significant (orange)
Cottonwood Creek	247-50-10300	Knik Arm Unit	significant (orange)
Wasilla Creek	247-50-10270	Knik Arm Unit	significant (orange)

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EXHIBIT 14-3 (continued) SIGNIFICANT COHO SALMON STOCKS

Matanuska River	247-50-10220	Knik Arm Unit	significant
Kink River	247-50-10200	Knik Arm Unit	significant
Ship Creek	247-50-10060	Knik Arm Unit	significant
Campbell Creek	247-60-10340	Turnagain Arm Unit	significant
Bird Creek	247-60-10280	Turnagain Arm Unit	significant
Twentymile River	247-60-10230	Turnagain Arm Unit	significant
Sixmile Creek	247-60-10170	Turnagain Arm Unit	significant
Chickaloon River	247-60-10110	Turnagain Arm Unit	significant
Swanson River	247-90-10020	Upper Peninsula / Kenai River Unit	significant
Kenai River	244-30-10010	Upper Peninsula / Kenai River Unit	significant
Moose River	244-30-10010-2063	Upper Peninsula / Kenai River Unit	significant
Jean Creek	244-30-10010-2135	Upper Peninsula / Kenai River Unit	significant
Russian River	244-30-10010-2158	Upper Peninsula / Kenai River Unit	significant
Quartz Creek	244-30-10010-2177	Upper Peninsula / Kenai River Unit	significant
Kasilof River	244-30-10050	Mid-Peninsula / Kasilof River Unit	significant
Crooked Creek	244-30-10050-2024	Mid-Peninsula / Kasilof River Unit	significant
Deep Creek	244-20-10100	Mid-Peninsula / Kasilof River Unit	significant
Anchor River	244-10-10010	Mid-Peninsula / Kasilof River Unit	significant
Clearwater Creek	241-14-10645-2060	Kachemak Bay Unit	significant
NONE	NONE	Gulf Coast Unit	NONE
Bear Creek	231-30-10080-2010-3065-4010	Greater Resurrection Bay Unit	significant

EXHIBIT 14-4 SIGNIFICANT PINK SALMON STOCKS

Stream name appearing on USGS maps

Unnamed on USGS map but identified by its locally-used name

AWC = Anadromous Waters Catalog

most recent count meets minimum size criteria (5,000 fish) and is less than 4 years old	significant
most recent count meets minimum size criteria (5,000 fish) but is more than 4 years old	significant
historic count meets minimum size criteria (5,000 fish), but recent count does not	significant

STOCK	AWC NUMBER	PLANNING UNIT	STATUS
Kamishak River	243-10-10040	Kamishak Bay Unit	significant
Little Kamishak River	243-10-10030	Kamishak Bay Unit	significant
Amakdedori Creek	243-40-10010	Kamishak Bay Unit	significant
Bruin Bay River	243-50-10050	Kamishak Bay Unit	significant
Sunday Creek	248-10-10002	Kamishak Bay Unit	significant
Brown's Peak Creek	248-10-10040	Kamishak Bay Unit	significant
North Head Creek	248-20-10060	Kamishak Bay Unit	significant
McArthur River	247-10-10080	Westside Unit	significant
Nikolai Creek	247-10-10200	Westside Unit	significant
Chuitna River	247-20-10010	Westside Unit	significant
Threemile Creek	247-20-10002	Westside Unit	significant
Beluga River	247-30-10090	Westside Unit	significant
Theodore River	247-30-10080	Westside Unit	significant
Lewis River	247-30-10070	Westside Unit	significant
Susitna River	247-41-10200	Susitna River Unit	significant
Alexander Creek	247-41-10200-2015	Susitna River Unit	significant
Wolverine Creek	247-41-10200-2015-3035-4019	Susitna River Unit	significant
Yentna River	247-41-10200-2053	Susitna River Unit	significant
Peters Creek	247-41-10200-2053-3150-4060	Susitna River Unit	significant
Bear Creek	247-41-10200-2053-3150-4080	Susitna River Unit	significant
Hungryman Creek	247-41-10200-2053-3150-4090	Susitna River Unit	significant
Lake Creek	247-41-10200-2053-3170	Susitna River Unit	significant
Skwentna River	247-41-10200-2053-3205	Susitna River Unit	significant
Talachulitna River	247-41-10200-2053-3205-4053	Susitna River Unit	significant
Donkey Creek	247-41-10200-2053-3220-4030	Susitna River Unit	significant
Red Creek	247-41-10200-2053-3225-4015	Susitna River Unit	significant
Kitchatna River	247-41-10200-2053-3229	Susitna River Unit	significant
Unnamed Tributary	247-41-10200-2053-3229-4110	Susitna River Unit	significant
Deshka River / Kroto Creek	247-41-10200-2081	Susitna River Unit	significant
Willow Creek	247-41-10200-2120	Susitna River Unit	significant
Little Willow Creek	247-41-10200-2130	Susitna River Unit	significant
North Fork Kashwitna River	247-41-10200-2180-3061	Susitna River Unit	significant
Sheep Creek	247-41-10200-2200	Susitna River Unit	significant
Goose Creek	247-41-10200-2230	Susitna River Unit	significant
Montana Creek	247-41-10200-2250	Susitna River Unit	significant
Birch Creek	247-41-10200-2320-3010	Susitna River Unit	significant
Talkeetna River	247-41-10200-2370	Susitna River Unit	significant
Chunilna River	247-41-10200-2370-3041	Susitna River Unit	significant

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EXHIBIT 14-4 (continued) SIGNIFICANT PINK SALMON STOCKS

Unnamed Tributary	247-41-10200-2370-3041-4010	Susitna River Unit	significant
Unnamed Tributary	247-41-10200-2370-3080	Susitna River Unit	significant
Indian River	247-41-10200-2551	Susitna River Unit	significant
Little Susitna River	247-41-10100	Knik Arm Unit	significant
Campbell Creek	247-60-10340	Turnagain Arm Unit	significant
Bird Creek	247-60-10280	Turnagain Arm Unit	significant
Portage Creek	247-60-10220	Turnagain Arm Unit	significant
Resurrection Creek	247-60-10150	Turnagain Arm Unit	significant
Chickaloon River	247-60-10110	Turnagain Arm Unit	significant
Kenai River	244-30-10010	Upper Peninsula / Kenai River Unit	significant
Kasilof River	244-30-10050	Mid-Peninsula / Kasilof River Unit	significant
Humpy Creek	241-14-10510	Kachemak Bay Unit	significant
China Poot Creek	241-15-10370	Kachemak Bay Unit	significant
Tutka Lagoon Creek	241-16-10090	Kachemak Bay Unit	significant
Jakolof Creek	241-16-10040	Kachemak Bay Unit	significant
Barbara *(Barabara)* Creek	241-11-10800	Kachemak Bay Unit	significant
Seldovia River	241-11-10730	Kachemak Bay Unit	significant
Port Graham River	241-20-10550	Kachemak Bay Unit	significant
Dogfish Lagoon Creek	242-10-10300	Gulf Coast Unit	significant
Port Chatham Creek	242-10-10230	Gulf Coast Unit	significant
Windy Left Creek	242-32-10170	Gulf Coast Unit	significant
Windy Right Creek	242-32-10160	Gulf Coast Unit	significant
Rocky River	242-31-10120	Gulf Coast Unit	significant
Port Dick *(Head)* Creek	242-42-10460	Gulf Coast Unit	significant
Slide C.	242-42-10450	Gulf Coast Unit	significant
Middle C.	242-42-10440	Gulf Coast Unit	significant
Island Creek	242-42-10430	Gulf Coast Unit	significant
South Nuka Island Creek	232-15-10260	Gulf Coast Unit	significant
James Lagoon Creek	232-23-10260	Gulf Coast Unit	significant
Desire Lake Creek	232-23-10120	Gulf Coast Unit	significant
Aialik Lake / Lagoon	232-40-10230	Greater Resurrection Bay Unit	significant
Tonsina C.	231-30-10040	Greater Resurrection Bay Unit	significant
Salmon Creek	231-30-10080-2010	Greater Resurrection Bay Unit	significant
Bear Creek	231-30-10080-2010-3065-4010	Greater Resurrection Bay Unit	significant
Thumb Cove	231-30-10160	Greater Resurrection Bay Unit	significant
Humpy Cove	231-40-10140	Greater Resurrection Bay Unit	significant

EXHIBIT 14-5	SIGNIFICANT CHUM SALMON STOCKS

Stream name appearing on USGS maps

Unnamed on USGS map but identified by its locally-used name

AWC = Anadromous Waters Catalog

most recent count meets minimum size criteria (800 fish) and is less than 8 years old	significant
most recent count meets minimum size criteria (800 fish) but is more than 8 years old	significant
historic count meets minimum size criteria (800 fish), but recent count does not	significant

STOCK	AWC NUMBER	PLANNING UNIT	STATUS
Kamishak River	243-10-10040	Kamishak Bay Unit	significant
Little Kamishak River	243-10-10030	Kamishak Bay Unit	significant
McNeil River	243-20-10035	Kamishak Bay Unit	significant
Bruin Bay River	243-50-10050	Kamishak Bay Unit	significant
Ursus Cove River	248-10-10020	Kamishak Bay Unit	significant
Cottonwood Creek	248-20-10040	Kamishak Bay Unit	significant
North Head Creek	248-20-10060	Kamishak Bay Unit	significant
Sugarloaf Creek	248-20-10070	Kamishak Bay Unit	significant
Iniskin River	248-20-10080	Kamishak Bay Unit	significant
Fitz Creek	245-10-10010	Westside Unit	significant
Chinitna River	243-10-10030	Westside Unit	significant
Marsh Creek	245-10-10040	Westside Unit	significant
Middle Glacier Creek	NO AWC	Westside Unit	significant
Crescent River	245-30-10010	Westside Unit	significant
McArthur River	247-10-10080	Westside Unit	significant
Susitna River	247-41-10200	Susitna River Unit	significant
Fish Creek	247-41-10200-2020	Susitna River Unit	significant
Yentna River	247-41-10200-2053	Susitna River Unit	significant
Lake Creek	247-41-10200-2053-3170	Susitna River Unit	significant
Skwentna River	247-41-10200-2053-3205	Susitna River Unit	significant
Talachulitna River	247-41-10200-2053-3205-4053	Susitna River Unit	significant
Unnamed Tributary	247-41-10200-2053-3205-4099	Susitna River Unit	significant
Willow Creek	247-41-10200-2120	Susitna River Unit	significant
Montana Creek	247-41-10200-2250	Susitna River Unit	significant
Talkeetna River	247-41-10200-2370	Susitna River Unit	significant
Chunilna River	247-41-10200-2370-3041	Susitna River Unit	significant
Byers Creek	247-41-10200-2381-3180	Susitna River Unit	significant
Indian River	247-41-10200-2551	Susitna River Unit	significant
Portage Creek	247-41-10200-2585	Susitna River Unit	significant
Little Susitna River	247-41-10100	Knik Arm Unit	significant
Portage Creek	247-60-10220	Turnagain Arm Unit	significant
NONE	NONE	Upper Peninsula / Kenai River Unit	NONE
NONE	NONE	Mid-Peninsula / Kasilof River Unit	NONE
Seldovia River	241-11-10730	Kachemak Bay Unit	significant
Port Graham River	241-20-10550	Kachemak Bay Unit	significant
Dogfish Lagoon Creek	242-10-10300	Gulf Coast Unit	significant

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EXHIBIT 14-5 (continued) **SIGNIFICANT CHUM SALMON STOCKS**

Rocky River	242-31-10120	Gulf Coast Unit	significant
Port Dick *(Head)* Creek	242-42-10460	Gulf Coast Unit	significant
Slide C.	242-42-10450	Gulf Coast Unit	significant
Middle C.	242-42-10440	Gulf Coast Unit	significant
Island Creek	242-42-10430	Gulf Coast Unit	significant
Petrof R.	232-10-10330	Gulf Coast Unit	significant
Tonsina C.	231-30-10040	Greater Resurrection Bay Unit	significant

WILD STOCK SANCTUARIES / STOCK RESERVES

CIRPT has also identified the stocks it has designated as "wild stock sanctuaries / stock reserves". The concept of "wild stock sanctuaries / stock reserves" is discussed in the ADF&G *Genetics Policy* and further amplified in Chapter 3.0, Section 3.3.3.5 of the planning document. That information is consolidated in EXHIBIT 14-6.

A "wild stock sanctuary / stock reserve/" is defined by four conditions: (1) it must have no previous history of enhancement and is precluded from future enhancement; (2) it must be of a size sufficient to allow for substantial egg takes without posing serious threat to the viability of the stock; (3) it must be believed to be representative of the stocks of the area; and (4) it must be so designated by the CIRPT. This definition was developed and adopted by the CIRPT based on the concept suggested in the ADF&G "Genetics Policy".

The results of this designation process was the establishment of twenty-seven anadromous salmon "wild stock sanctuaries / stock reserves" in the Cook Inlet region. Of that total number seven are for king salmon, six for sockeye salmon, five for coho salmon, five for pink salmon and four for chum salmon.

EXHIBIT 14-6 WILD STOCK SANCTUARY / STOCK RESERVE DESIGNATION SUMMARY

CHAPTER	PLANNING UNIT	KING	SOCKEYE	COHO	PINK	CHUM
4.0	KAMISHAK BAY UNIT	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*	Bruin Bay River (mid-July / mid-September)	Cottonwood Creek (late July / August)
5.0	WESTSIDE UNIT	Theodore Creek (June / July)	Crescent River (July)	Big River (August)	*NONE DESIGNATED*	Crescent River (July)
6.0	SUSITNA RIVER UNIT	Talachulitna River (June) Alexander Creek (June) Prairie Creek (June)	Judd Lake (July) West Fork of the Yentna River (July) Larson Lake (July)	Talachulitna River (July / August) Chulitna River (July / August)	Talkeetna River (July / August)	Talachulitna River (July)
7.0	KNIK ARM UNIT	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*	Little Susitna River (July / August)	*NONE DESIGNATED*
8.0	TURNAGAIN ARM UNIT	Chickaloon River (June)	Chickaloon River (June)	Chickaloon River (July / August)	*NONE DESIGNATED*	Chickaloon River (July / August)
9.0	UPPER PENINSULA / KENAI RIVER UNIT	Benjamin Creek (May / June) Kenai River watershed above Skilak Lake (July)	Russian River below the falls (July)	Killey River (July / August)	Kenai River (August)	*NONE DESIGNATED*
10.0	KASILOF RIVER / MID-PENINSULA UNIT	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*
11.0	KACHEMAK BAY UNIT	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*
12.0	GULF COAST UNIT	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*	Port Dick *(Head)* Creek (mid-July / September)	*NONE DESIGNATED*
13.0	GREATER RESURRECTION BAY UNIT	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*	*NONE DESIGNATED*
REGIONAL WILD STOCK SANCTUARIES / STOCK RESERVES BY SPECIES		7	6	5	5	4

Appendix C Threats

Complete List of Threats to the Kenai Peninsula Aquatic Ecosystems and the Relationship to Goals in the KPFHP Plan.

Existing Causes/Potential Threats	***Bio-complexity***	***Water***	***Assessment***	***Education***	***Policy –***
increasing impervious surfaces	X	X	X	X	X
loss of wetlands	X	X	X	X	X
alteration of riparian zone	X	X	X	X	X
warming temperatures/climate change	X	X	X	X	X
climate change, reduced snow pack	X	X	X	X	X
hydroelectric projects	X	X	X		
waterfront development	X	X	X	X	X
upland development	X	X	X	X	X
new energy project - tidal/current/hydro	X	X	X	X	X
lack of biocomplexity reservations	X	X	X		X
toxic discharge	X	X	X	X	
herbicides	X	X	X	X	
timber harvest	X	X	X		X
gravel mining	X	X	X		X
wetland conversion	X	X	X		X
Forest Practices Act	X	X	X		X
gold mining	X	X	X		X
coal mining	X	X	X		X
oil and gas development	X	X	X		X
water use	X	X	X		X
catastrophic spill	X	X	X		X
port expansions	X	X	X		X

vessel traffic	X	X	X		
Existing Causes/Potential Threats	Bio-complexity	Water	Assessment	Education	Policy –
flooding	X	X	X		
fires	X	X	X		
channelization	X	X	X	X	X
agricultural farming/ranching	X	X	X	X	
groundwater withdrawals	X	X		X	X
diversion of surface water flows	X	X		X	X
groundwater contamination	X	X		X	X
population growth/migration into area	X	X		X	X
beetle outbreaks	X	X			
recreational activities (fishing, ATV, etc.)	X		X	X	X
roads/railroads/utilities, culverts	X		X	X	X
invasive species	X		X	X	X
loss of LWD source or removal	X		X	X	
shoreline simplification	X		X	X	X
shoreline hardening	X		X	X	X
sea level rise - rate of change	X		X		
loss of estuarine habitat	X		X		
mariculture	X		X		
overharvest	X		X		
poor understanding of system process/planning	X				
response time to disasters	X				
lack of (zoning) regulations	X			X	X
past/present/future	X				
habitat fragmentation	X			X	X
septic		X	X	X	X
loss of habitat		X	X	X	X
no zero discharge		X	X	X	X

Existing Causes/Potential Threats	Bio-complexity	Water	Assessment	Education	Policy –
sewage discharge		X	X	X	X
sewage treatement - settling pond capacity		X	X	X	X
spill management		X		X	X
agencies/org with no common goals				X	X
poor communication				X	X
lack of planning capacity				X	X
poor political/gov't support				X	X
no BMP				X	X
poor planning				X	X
no holistic planning				X	X
no accountability				X	X
lack of long-term time frames				X	X
unregulated development				X	X
lack of education of public				X	X
policy-making process				X	X
no mitigation				X	
lack of understanding economic ecosystem				X	X
compartmentalization	X	X	X	X	X
lack of financial incentive to do right thing				X	X
economics				X	X
gaps in regs				X	X
land use regs				X	X
revise 50' setbacks				X	X
revise parking requirements				X	X
variances				X	X
(Conditional use permits)				X	X

Existing Causes/Potential Threats	Bio-complexity	Water	Assessment	Education	Policy –
no ecosystem management					X
poor implementation of design standard				X	X
outdated design standards				X	X
Environmental Education Standards				X	
complacency				X	X

Appendix D Prioritized Fish Passage Barriers for Interim

Prioritized Fish Passage needs list for Focal Area Biological Complexity

Reconnect fragmented aquatic habitat within the Anchor River, Deep Creek, and Kenai River Watersheds. Efforts will be focused on fragmented sections of first, second, and third order streams.

Anchor River Drainage

North Fork Road, Unnamed Steam (KPCS1NK022)
Sterling Highway, Two Moose Creek (KPCS1NK024)
Sterling Highway, Ruby Creek (74_2006)
Chakok River Tributary (KPC041A062)

Deep Creek Drainage

Unnamed Steam on Oil Well Road (KPC041A023)

Kenai River Drainage

Bean Creek at Ptarmigan Road (KPCS1EK046)
Unnamed Stream at Stephens Road (KPCS1NK085)
Unnamed Stream at Messer Street (16_2006)
Soldotna Creek at Keystone Drive (121_2006)
Unnamed Creek at Funny River Road (92_2006)
Unnamed Creek at Unnamed Road (98_2006)
Unnamed Creek at Unnamed Road (99_2006)
Unnamed Creek at Unnamed Road (100_2006)
Unnamed Creek at Unnamed Road (29_2006)
Unnamed Creek at Kalifornsky Beach Road (KPCS1NK036)
Unnamed Creek at Beaver Loop Road (12_2006)
Unnamed Creek at Lawton Drive (9_2006)
Unnamed Creek at Kenai Spur Highway (8_2006)
Unnamed Creek at Kenai Spur Highway (KPCS1NK010)
Unnamed Creek at Kenai Spur Highway (KPCS1NK011)
Unnamed Creek at Cohoe Avenue (71_2006)
Unnamed Creek at Cohoe Avenue (72_2006)
Unnamed Creek at First Avenue (54_2006)
Unnamed Creek at Fourth Avenue (80_2006)
Unnamed Creek at Scout Lake Loop (KPCS1NK087)

Appendix E Prioritized Restoration Needs

Prioritized Fish Habitat Restoration needs list for Focal Area Biological Complexity

Anchor River Drainage

- *People Hole*
- *Gravel Pit Capture*
- *2002 Flood Damage Sites*
  - *Road washout (168_2006)*

Deep Creek Drainage

Kenai River Drainage

- *Dave's Creek – Channel realignment and plan for adjustment*
- *Cooper Creek – Channel realignment and plan for adjustment*

Appendix F Climate Change Summary

This section is taken verbatim from Kenai Peninsula Refuge Notes – Dr. Berg is expected to return to Alaska from an extend international travel and we will request his assistance in reviewing and incorporating climate change in the climate section of the plan. In the interim, we felt it was not appropriate for us to modify his work and elected to include this summary as an attachment.

Climate Change on the Kenai Peninsula Version 1.22

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USFWS: Kenai National Wildlife Refuge June 21, 1999

The following paragraphs summarize recent observations about climate change on the Kenai Peninsula, and with special attention to the Kenai National Wildlife Refuge.

(1) **Rapid glacial retreat**. Wiles and Calkin (1994) developed a 2000 year chronology of glacial advance and retreat on the Kenai Peninsula, and found that glacier front positions on the western side of the Kenai Mountains are controlled primarily by summer temperatures, whereas glacier fronts on the Prince William Sound side are controlled by winter snowfall. They showed that glacier fronts have generally been receding since the end of the Little Ice Age in the 1860's. For example, they dated the outermost terminal moraine of Grewingk Glacier in Kachemak Bay at 1858, and showed that the ice has pulled steadily back more than 4 kms since that time.

Rice (1987) examined aerial photographs of the Harding Icefield in the Kenai Mountains and found 5% loss of ice area between 1950 and 1985. A recent study by Adalgeirsdottir (1997) from the UAF Geophysical Institute reported a 70' reduction in the thickness of the Harding Icefield between the early 1950's and mid-1990's.

(2) **Rising treeline**. Sitka and white spruce on the flanks of the Kenai Mountains show a strong upslope gradient to younger trees. We have found that ring-widths of these trees generally do not show a strong correlation with temperature records of local meteorological stations. This indicates that the trees are not stressed for temperature and that they could grow at still higher elevation. Physiological tree line thus appears to be advancing so rapidly that the trees have not kept up with it. Local residents in Kachemak Bay say that treeline has visibly risen at least several hundred feet since the 1940's (Yule Kilcher, pers. obs., 1997).

Furthermore, this process appears to be unidirectional, because one does not see old dead trees at treeline that might suggest that treeline has temporarily receded at some point in the past. This unidirectional character of all climate-driven processes on the Kenai is quite striking, and suggests that this climate change is a long-term trend and not an oscillating process.

(3) **Wetland drying.** This takes several forms on the Kenai Peninsula:

(A.) **Kettle pond disappearance**. The hilly moraine areas of the KNWR have many kettle holes, left by foundered blocks of ice during retreat of the glaciers about 13,000y ago. The 1950 USGS quadrangle maps and 1950 aerial photos show these kettles as water-filled ponds, but today many are grassy pans with varying degrees of spruce and hardwood invasion. They do not appear to have been water-filled in recent years, and they would no longer be mapped as wetlands. Horse packers who in the past depended on these ponds report increasingly difficulty in finding water holes for their horses during fall moose hunts (Lou Albrant of Sterling, pers. obs., 1998).

One could ask if 1950 was such a wet year that ponds had an unusually high (but transient) water table; on the contrary, the winter-summer of 1949-50 had very low total precipitation (Kenai reported 12.8" for Sept-July as opposed to a mean of 16.5", SD " 3.4"), so if these ponds were ever to be dry, they should have been dry when photographed in August 1950.

Many small ephemeral ponds used by wood frogs on the Refuge have either gone dry or their levels have dropped drastically between the first wood frog survey in 1991 and the most recent survey in 1998 (Ted Bailey, KNWR, pers. obs., 1998) .

Spruce invasion of the 'Island' soil series has been noted at least since the 1960's (Rieger et al. 1962). This soil series consists of dark silt loam andisols, usually found in small, open bowl-shaped depressions in forest uplands. Prominent hummocks provide a thick insulating sod that keeps soil temperatures low and has effectively repelled trees in the past. Comparison of these depressions with the 1950 aerial photography, however, shows rapid forest encroachment (Scott Stewart, Mike Gracz, Homer NRCS, pers. obs., 1998).

Rieger et al. (1962) reported that in the Kenai-Soldotna area many of these depressions are completely forested. They still have the hummocky surface characteristic of the Island soils, but the soils have taken on most of the properties of the surrounding 'Soldotna' soil series, which are more acidic. We thus see a continuum from water-filled kettle ponds to grassy hummock depressions (with Island series soils) to forested depressions with forest-influenced soils of the Soldotna series. We expect that a careful look at tree ages and aerial photos will show that there is again a unidirectional process here, that the process initiated within the last 100-150 years and that it has greatly accelerated since the 1950's.

(B.) **Spruce invasion of wetlands.** The Kenai lowlands have tens of thousands of acres of shallow lakes and marshes. Many of the marsh edges show invasion of stunted black spruce trees that appear to be living at the limit of their tolerance to water-logged soils. In some cases distinct halos of small black spruce can be seen around wetlands; in most cases the invasion is more diffuse and has no distinct boundary. We sampled black spruce at two marsh edges and found that trees 1' - 2' tall were as much as 30-40y old, with fairly even recruitment beginning in the 1950's. Like treeline, we observed no visible mortality (dead stems) in the stunted trees, which would have indicated a temporary rise of water level above what the trees could tolerate (EB, KNWR, pers. obs, 1996). This recruitment also acts like a unidirectional process.

(C.) **Spruce invasion of muskegs**. There are extensive glacial lake beds of Naptowne age (~16,000y) south of the Kenai River toward Kasilof and in the Anchor Point area (Reger and Pinney 1997). These are very flat with only an occasional channel for drainage. They are dominated by sedges, Sphagnum moss, ericaceous shrubs, and cloudberry (Rubus chamaemorus) on the wet end and grade into grass (Calamagrostis canadensis) on the dry end. We see every stage of spruce invasion on these lake beds, from open treeless areas to scattered stunted black spruce to closed canopy black spruce thickets. We have not aged any of these trees but would expect that most of this recruitment has taken place within the last 100-150 years, as water levels have slowly declined. Again, one does not see stands of dead trees on these lake beds, and we infer that the water table has declined unidirectional.

(D.) **Falling lake levels**. On the Kenai lowland there are many examples of lakes whose water levels have fallen several feet in recent years. Residential boat docks can be seen which no longer reach the water (e.g., Bernice Lake, EB, KNWR, pers. obs, 1998). In some cases we see willow, cottonwood, or alder recruitment on the newly exposed shores, but in other cases we see only herbaceous weeds which favor exposed mineral soil. These patterns suggest that lake levels have fallen within the last five years or so.

Closed basin lakes are probably the best candidates to show water table changes, because they are fed exclusively by the water table and slope runoff. Nevertheless, changes have also been observed in open basin lakes; for example, a chain of several lakes (below Upper Jean Lake) has dried to the point that there is no longer a stream flowing from lake to lake, and water level at one these lakes has fallen at least 4' below its former outfall. Abundant cottonwood shoots on the exposed shore indicate that the lake level has been down for several years but not longer. There are no flooded stems which would indicate that lake level had once been lower; so this again indicates a unidirectional process (EB, KNWR, pers. obs., 1998). Water levels have also declined significantly in Picnic, Browse, and Campsite Lakes over the past 5 years, changing the characteristics of these lakes, i.e., with increased submergent vegetation and algae (Ted Bailey, KNWR, pers. obs., 1998).

It is worth remarking that various long-term hydrological changes occurred on the western Kenai Peninsula as a result of the March 27, 1964 earthquake. These should not be confused with climate change effects. Some lake levels fell after the earthquake, such as that of Coyote, Birch, and Buteo Lakes at the end of Swan Lake Road. Coyote Lake, for example, has a broad shoreline shelf with birch regeneration dating to the late 1960's and an old shoreline ~5-6' above the present water level . Other lakes dropped for a few months until the following summer (1965), because they were seasonally perched above the wintertime low of their regional water tables, and drained when their substrates were fractured (Waller 1966). In the Snow River floodplain at the head of Kenai Lake the water table rose and killed many trees, some of which are still visible as standing snags (pers. obs., Dominique Collet of Sterling, and Dona Walker, a lifelong resident of Seward, 1998).

The elevated water table was presumably caused by an eastward tilting of the Kenai Lake basin (Waller 1966) as well as compaction of sand and gravel underlying the floodplain. The numerous "ghost forests" along the eastern shores of Cook Inlet were caused by salt water intrusion into soils following tectonic subsidence of the bedrock and compaction of unconsolidated shoreline sediments (Plafker 1969).

(4) **Strongly increasing temperatures** at the Kenai and Homer meteorological stations. Kenai records a 2.9^{o}F/50y increase in mean annual temperature since the mid-1940's, and Homer records a 3.9^{o}F/50y increase in the same period. Summer degree-days (>60^{o}F) likewise increased 56 deg-day/50y in Kenai and 86 deg-day/50y in Homer. Much of this increase occurs in warmer Decembers (~9^{o}F/50y) and Januarys (~7^{o}F/50y), but summer temperatures are up 2.5^{o}F/50y in Kenai and 4.1^{o}F/50y in Homer. These are extremely strong gradients. (Data are from monthly NOAA Climatological Data Reports.)

Annual precipitation varies considerably on the Kenai Peninsula, with Kenai annual precipitation ranging from 11" to 27" with mean of 19.2 "3.7"(SD) (N=53yr), and Homer annual precipitation ranging from 13" to 38" with mean of 24.7" "5.6" (N=65yr). In spite of great year-to-year variation at both stations there is no apparent long-term trend toward lower or higher precipitation values, such as we see in the temperatures.

If precipitation is more-or-less constant and temperatures are rising, this suggests that increased evapotranspiration is the source of the declining water tables described above.

(5) **Treeline chronologies**. The instrumental meteorological record on the western Kenai Peninsula begins in 1932 in Homer and 1944 in Kenai. It is possible to reconstruct pre-instrumental temperatures from treeline tree rings. At tree line the trees should be stressed for temperature (and not precipitation), so a warm year should produce a wide ring and a cold year should produce a narrow ring. Such temperature-sensitive trees are good recording thermometers, and their ring-widths can be used to estimate past temperatures. KNWR Grad student Andy DeVolder recently prepared a 290 year chronology from hemlock trees growing on a north-facing slope at tree line on the Skyline Trail. He found that the hemlock ring-widths correlated best with growing season temperatures (May-July), and that growing season temps at this site have increased from a low of ~47EF in the 1810's to the present ~50EF. Like the stock market, this chronology has many local ups and downs, but the long-term trend at this treeline site is clearly upward, with ~3EF in 200 years.

(6) **Drought stressed trees and spruce bark beetles**. Many of the larger white/Lutz/Sitka spruce trees in mature stands show substantial narrowing of the annual rings in recent decades. Slow growing spruce trees are especially vulnerable to bark beetle attack (Hard 1985, 1987). Part of this narrowing is due to increased canopy competition as the stands have matured. Part of it, however, may be due to drought stress, which is a potentially greater problem for large trees than small trees.

Spruce bark beetle outbreaks have followed two recent periods of multi-year warm weather drought stress (the central Peninsula in 1968-69 and the southern Peninsula in 1989-1997).

We have substantial tree-ring evidence of regional beetle outbreaks in the 1820's and especially in the 1880's (Berg, 1998; Fastie et al., in preparation). Andy DeVolder's temperature chronology (see above) shows a major cool period in the 1810's and a very dramatic cooling in 1876-78, presumably caused by three high latitude volcanic eruptions in 1875 and 1876. In these two cases the beetle outbreaks occur after a cool period, rather than during a warm period such as 1968-69 or 1989-1997. Probably, the key variable here is drought rather than temperature. Warm summers can certainly create drought stressed trees, but low annual precipitation can also create drought stress. We are hoping to study this problem by preparing a chronology of stable carbon isotopes (C-13/C-12) in tree rings, which should be a better measure of drought stress than ring widths.

Conclusion: climate change on the Kenai Peninsula differs in some dramatic respects from the Interior, because the Peninsula has virtually no permafrost. Melting permafrost in the Interior is producing visibly striking thermokarst on a landscape scale and there is abundant water on the poorly drained land surface. The Kenai Peninsula presumably went through this phase at some point in the last 10,000y since deglaciation, and it is now in a much drier mode. Wetland drying and falling lake levels may thus be the most visible expressions of future climate warming on the Peninsula.

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Version NumberThis memo is assigned a "A version number", similar to computer software, with the expectation that the memo will be upgraded periodically to record new observations. Version 1.0 was the first version.

Last updated: September 11, 2008

Appendix F Freshwater - Conservation Action Plan

FRESHWATER TARGETS --- WHAT WE WANT TO CONSERVE

Target #1: Steep coastal streams

Focal Target Description: Includes non--glacial high gradient streams and tributaries that flow directly into the ocean. Includes all instream and riparian habitat and associated wetlands. In general, these are relatively short (< 20 km), high gradient (>5%) watersheds that drain coastal mountains. These streams usually have a short low--gradient reach near tidewater that provides suitable spawning habitat for pink and chum salmon, and some streams have a short reach with gradients less than 3% that provides suitable spawning and rearing habitat for small populations of coho salmon. Although individual streams support small populations of salmon, collectively these coastal streams produce sizeable runs of pink, chum, and coho salmon. Hydrographs usually peak in spring and early summer with peaks in snowmelt run--off, but can also experience peaks during freshets associated with rainfall events, typically in the fall. Water temperatures in these streams are likely resilient to changes in air temperature.

Examples include Rocky River, Humpy Creek, Jakalof Creek, Seldovia River, Granite Creek, and other streams on the outer coast of the Kenai Peninsula.

Nested Target # 1: Pink & Chum salmon spawning
Nested Target # 2: Coho salmon rearing

Target #2: Non---glacial mountain rivers

Focal Target Description: Includes non--glacial rivers and tributary streams that drain mountainous terrain. Includes all instream and riparian habitat and associated wetlands. Some shorter (< 20 km) mountain streams and rivers become tributaries of larger glacial rivers and some longer (> 20 km) rivers flow directly into the ocean. These streams and rivers follow typical dendritic morphology with small high gradient tributary streams joining to form larger streams and rivers that gradually increase in size and decrease in gradient over their course. These rivers and streams typically provide spawning and rearing habitat for chinook and coho salmon. Hydrographs usually peak in spring and early summer with peaks in snowmelt run--off, but can also experience peaks during freshets associated with rainfall events, typically in the fall. Water temperatures in these streams and rivers are likely resilient to changes in air temperature.

Examples include the Chuit River, Sixmile Creek, Quartz Creek, Resurrection Creek, Ptarmigan Creek, Juneau Creek.

Nested Target # 1: Coho and Chinook salmon all life stages

Target #3: Glacial rivers without lakes

Focal Target Description: Includes glacial rivers and streams that are not associated with lakes. Includes all instream and riparian habitat and adjacent wetlands. These streams and rivers follow typical drainage basin morphology with small high gradient tributary streams joining to form larger streams and rivers that gradually increase in size and decrease in gradient over their course. These systems typically provide spawning and rearing habitat for sockeye and coho salmon, although individual spawning populations are generally small. Estuaries and sloughs are extremely important for fish production because of the general lack of good quality rearing habitat and fish in many of these systems likely complete some of their freshwater rearing in estuaries. These streams are fed by glacial melt and have hydrographs that peak during the summer. Water temperatures in these streams and rivers are likely resilient to changes in air temperature.

Examples include Fox River, Placer River, Sheep Creek, Battle Creek.

Nested Target # 1: Chinook, Sockeye and coho salmon all life stages
Nested Target # 2: Hooligan
Nested Target # 3: Pink and chum in spawning life stage

Target #4: Glacial rivers w/ lakes

Focal Target Description: Includes glacial rivers and streams that are associated with lakes. Includes all instream and riparian habitat and adjacent wetlands. These rivers provide spawning and rearing habitat for Chinook, coho, and sockeye salmon. These streams are fed by glacial melt and have hydrographs that peak during the summer. The large lakes associated with some of these rivers (Kenai Lake, Skilak Lake, Tustumena Lake) act as buffers to rapid changes in streamflow and changes in temperatures. Water temperatures in these streams and rivers are likely resilient to changes in air temperature.

Examples include Kenai River, Kasilof River, Crescent River (west side Cook Inlet), Bradley River.

Nested Target # 1: Sockeye, Chinook, coho salmon all life stages
Nested Target # 2: Rainbow trout/steelhead
Nested Target # 3: Lake trout
Nested Target # 4: Hooligan
Nested Target # 5: Dolly Varden

Target #5: Lowland groundwater/wetland---dominated systems

Focal Target Description: Includes most lowland streams and rivers that are primarily influenced by complex wetland and groundwater interactions. Includes all instream and riparian habitat and associated wetlands. These streams and rivers provide spawning and rearing habitat for most salmonid species. Hydrographs usually peak in spring and early summer with peaks in snowmelt run--off, but can also experience peaks during freshets associated with rainfall events, typically in the fall. Water temperatures in these streams are closely linked to increases in air temperature.

Examples include Anchor River, Chickaloon River, Swanson River, Deep Creek, Ninilchik River, Stariski Creek.

Nested Target # 1: Chinook and coho salmon all life stages
Nested Target # 2: Dolly Varden
Nested Target # 3: Rainbow trout/Steelhead

Target #6: Closed---basin lakes

Focal Target Description: Includes all closed--basin lakes, ponds, and open--water wetlands, most of which occur in the Kenai Peninsula lowlands. Includes all in--lake and shoreline habitat and short connective stream segments. Water levels in these lakes and ponds are primarily influenced by complex wetland and groundwater interactions. These small lakes and ponds provide habitat for numerous endemic fish species including Arctic char, rainbow trout, longnose sucker, and stickleback. Water temperatures in these lakes are closely linked to changes in air temperature. **Examples** include lakes in the Swanson and Swan River canoe systems and many named and un--named lakes on the northern Kenai Peninsula lowlands.

Nested Target # 1: Arctic char
Nested Target # 2: Suckers, stickleback
Nested Target # 3: Endemic populations/assemblage

Target #7: Clearwater connected lakes with associated streams

Focal Target Description: Includes clearwater lakes that are part of a larger watershed that ultimately drains to the ocean. Lakes are a primary hydrologic influence--if lakes were missing, the system would be very different. Includes all in--lake and shoreline habitat and short connective stream segments. Water levels in these lakes and ponds are primarily influenced by annual snowmelt. These lakes provide spawning and rearing habitat for sockeye salmon and lake trout, and provide rearing habitat for coho salmon. Water temperatures in these systems are closely linked to changes in air temperature.

Examples include Hidden Lake/Creek, Fuller Lakes, Juneau Lake, Crescent Lake, Fox Creek, Chenik Creek, upper and lower Russian River lakes.

Nested Target # 1: Chinook and Sockeye salmon all life stages
Nested Target # 2: Coho salmon rearing and spawning
Nested Target # 3: Lake trout
Nested Target # 4: Dolly Varden

FRESHWATER TARGET VIABILITY TABLE

	Conservation Targets	Landscape Context	Condition	Size	Viability Rank
	Current Rating				
1	Steep coastal streams	Very Good	Good	Good	**Good**
2	Non-glacial mountain rivers	Very Good	Good	Good	**Good**
3	Glacial rivers w/o lakes	Very Good	Very Good	Good	**Very Good**
4	Glacial rivers w/ lakes	Good	Good	Good	**Good**
5	Lowland groundwater/wetland-dominated systems	Fair	Fair	Good	**Fair**
6	Closed-basin lakes	Good	Good	Good	**Good**
7	Clearwater connected lakes with associated streams	Very Good	Good	Good	**Good**
	Project Health Rank				**Good**

FRESHWATER POTENTIAL THREATS RANKING TABLE

	Potential Threats Across Targets	Steep coastal streams	Non-glacial mountain rivers	Glacial rivers w/o lakes	Glacial rivers w/ lakes	Lowland groundwater/wetland-dominated systems	Closed-basin lakes	Clearwater connected lakes with associated streams	Overall Threat Rank
	Project-specific threats	1	2	3	4	5	6	7	
1	Injurious aquatic invasive species				Low	High	High	High	High
2	Warmer climate		Medium		Low	Medium	Medium	Medium	Medium
3	Incompatible road development		Low	Medium	Low	Medium		Low	Medium
4	Residential development in riparian zone				Medium	Medium			Medium
5	Hydro development	Low	Medium	Low	Low			Low	Low
6	Incompatible mining	Low	Low			Medium			Low
7	Catastrophic spill (vehicle, tank farm, pipeline)				Low	Medium			Low
8	Urbanization/development outside the riparian zone				Low	Medium			Low
9	Incompatible ORV use					Medium			Low
	Threat Status for Targets and Project	Low	Medium	Low	Medium	High	Medium	Medium	Medium

- **Many others noted, with a low rank.**

Potential Threats to our Partnership's Geography

All of the conservation targets are potentially impacted by multiple threats, which act together to alter their viability. Based on the information from surveys, monitoring and personal observations over the past several decades, the freshwater science team members collectively ranked the highest critical threats as:

1. Injurious invasive aquatic species (present and potential species)
2. Warmer climate
3. Incompatible road development
4. Residential development in riparian zones

These four potential threats have direct impacts for all freshwater system targets of the Kenai Peninsula Partnership.

At a local scale, many other impacts exist that can affect important aquatic habitats. One example is historic mining and hydro---development that significantly altered Cooper Creek. In that particular drainage, restoring habitat based on historic activities would be a high priority for our US Forest Service partner as they are the land manager for that creek and the partnership would be supportive of their efforts. Other similar examples exist; however, our task to identify and prioritize potential threats is at a larger landscape scale, focusing on impacts across our entire partnership geography.

Injurious Invasive Aquatic Species Strategies

Objective: Novel species of invasive flora and fauna that are injurious to native fish or their habitats will not be allowed to establish within the Kenai Peninsula Borough. Existing populations of Northern Pike, Reed Canary Grass and Elodea will be contained to the host watershed(s) and efforts to eradicate within sub---watershed boundaries will only be supported where a high probability of success exists.

Target(s): Three targets are at higher threat levels; Lowland groundwater/ wetland dominated systems; Closed basin Lakes; Clearwater connected lakes with associated streams

Key Attributes: Migratory pathways, food web dynamics, vegetation structure and complexity

Key Threats: Lowland groundwater/ wetland streams – Habitat connectivity, Nutrient dynamics; Closed Basin Lakes – Nutrient dynamics, spawning habitat; clearwater connected lakes and associated streams – Nutrient dynamics, spawning habitat, habitat fragmentation.

Overarching Approach – Watersheds without invasives remain free of invasives. Support mechanisms to rapidly respond to first detections of novel invasive species. Contain existing invasive species within the smallest watershed boundary practical while seeking to eradicate populations within the smallest watershed boundaries. Work with partners and the larger community to prevent the introduction of novel species and the reintroduction of eradicated species into the Kenai Peninsula Borough.

Warmer Climate Strategies

Objective: Maintain current cold---water temperatures and prevent increases in stressful water temperatures above the inevitable warming due to a changing climate.

Target: Lowland groundwater/wetland---dominated systems; Clearwater connected lakes with associated streams

Nested Targets: All cold---water fish species

Key Attribute: Water Temperature

Key Potential Threat(s): Loss of shade and groundwater connections; increase in water withdrawals

Overarching Approach – In response to the inevitability of some degree of regional warming, we need to improve watershed resilience to thermal change. As we gain more understanding of current stream temperature profiles and can assess which streams are most vulnerable to the impacts of climate change, we will implement conservation and protection measures to help keep cold water cold and reduce additional stressors to freshwater systems that are warm and will get warmer.

Incompatible Road Development Strategies

Objective: No new roads on the Kenai Peninsula will impede juvenile salmon movement. Existing barriers created by roads will continue to be restored for full aquatic organism movement and will be evaluated for sources of excessive sediment and mitigated for where necessary

Target: Glacial rivers without lakes, lowland groundwater/wetland---dominated systems

Nested Targets: All migratory fish species in their native assemblage

Key Attribute: Migratory corridors, water quality (sediment)

Key Potential Threat(s): Fragmentation, excessive sediment input

Overarching Approach Protection of habitat fragmentation for intact waterways will ensure the vast majority of our systems will support access to diverse aquatic habitats necessary to support all life cycles of migratory fish. The majority of low cost exiting barriers have been restored; the remaining known barriers should continue to be corrected with an emphasis on the more difficult barriers on our two major highways. Road crossings of waterways are also a prime source of sediment and more attention needs to be focused here.

Residential Development in riparian area strategies

Objective: Protect and maintain ecological integrity of existing riparian zone and restore degraded areas

Target: Glacial rivers with lakes, lowland groundwater/wetland---dominated systems

Nested Targets: Chinook, Sockeye and Coho all life stages, Hooligan, Rainbow Trout, Steelhead, Lake Trout, Dolly Varden

Key Attribute: Connectivity to off channel habitat, groundwater and wetland flow connections, timing and magnitude of adjacent surface water delivery, water quality (nutrient dynamics and toxic contaminate filtering), water temperature

Key Potential Threat(s): loss of direct surface water aquatic habitat connectivity to adjacent wetlands and other off channel habitat, loss or disruption of groundwater patterns, loss of primary nutrient input (grass, leaves, insects, etc.), increases in impervious surfaces.

Overarching Approach: Increasing residential pressures for waterfront development should be minimized and managed.

Appendix G Marine - Conservation Action Plan

MARINE TARGETS --- WHAT WE WANT TO CONSERVE

Target #1: Salt marsh & estuarine system (Intertidal)

Focal Target Description: Salt Marsh and Estuarine System (low supratidal to upper intertidal) exist in coastal areas near or above intertidal zone where low wave energy provides stable, elevated, well drained sediment substrate. Floral species are typically perennial vascular with high tolerance to saline soil conditions, eg sedges and grasses. Associated marine infauna and inverterbrates predominate. Areas: Western Cook Inlet, Kamishack and Kachemak Bay, Chickaloon Flats.

Nested Target # 1: Forage fish
Nested Target # 2: Salmon --- Juvenile rearing and emigration
Nested Target # 3: Larval and Juvenile Faunal Invertebrate

Target #2: Nearshore sediment substrates (Intertidal)

Focal Target Description: Nearshore Sediment Substrates (low supratidal to lower intertidal) six composition types are generally recognized, though substrate complexity is highly variable: 1) mud beaches, 2) fine---grained sand beaches, 3) coarse grained sand beaches, 4) mixed mud, sand and gravel beaches, 5) exposed tidal flats, and 6) sheltered tidal flats. Areas: Cook Inlet (clam beaches), Kamishack and Kachemak Bay.

Nested Target # 1: Razor clams
Nested Target # 2: Hard shell clams
Nested Target # 3: Larval and Juvenile Fish and Invertebrate Species

Target #3: Rocky nearshore (Intertidal & Subtidal)

Focal Target Description: Rocky Nearshore (intertidal through Subtidal) Four composition types are generally recognized, though substrate complexity is highly variable: 1)sheltered bedrock shores and out crops experiencing low to moderate wave energy, 2) sheltered bedrock, boulder and cobble complexes experiencing low to moderate wave energy, 3) exposed bedrock shores and out crops experiencing moderate to high wave energy, and 4) exposed bedrock, boulder and cobble complexes experiencing high to moderate wave energy. Kamishak and Kachemak Bay, outer coastal zones, tabletop reefs in Kamishak Bay.

Nested Target # 1: Spawning Herring and other Forage Fish Species
Nested Target # 2: Larval and Juvenile Fish and Invertebrate Species

Target #4: Canopy kelps (Subtidal)

Focal Target Description: Canopy Kelps (Subtidal) Kelp species occur in submerged nearshore, unconsolidated substrates. Their structure provides foundation and living substrate, microhabitat, and cover for numerous fish, invertebrate, and plankton species. Kelp beds also provide nutrient for trophic productivity through plant decay. Area: Kachemak Bay and numerous Kenai Peninsula Bays and Coves.

Nested Target # 1: Crab larvae
Nested Target # 2: Forage fish

Target #5: Seagrass beds (Subtidal)

Focal Target Description: Seagrass Beds (Lower Intertidal to Subtidal) Seagrass beds are predominantly found in submerged nearshore, unconsolidated substrates and provide foundation and physical structure, substrate and cover for numerous fish, invertebrate, and plankton species. Seagrass beds also provide nutrient for trophic productivity through plant decay. Areas: Kachemak Bay, Westside, Inniskin, Illmina, outer Coast.

Nested Target # 1: Forage fish
Nested Target # 2: Crab larvae
Nested Target # 3: Shrimp

Target #6: Reefs (Subtidal & Offshore)

Focal Target Description: Submerged rocky reefs (2m ‐‐‐ 100m depth) are a predominant feature of the outer Kenai Peninsula coast. This habitat provides consolidated complexity in rock outcrops, caves and crevices. Between consolidated rock structure are unconsolidated sediment substrates. This contrasting substrate complexity fueled by off shore nutrient import provide nesting and nursery habitat to multitudes of fish and invertebrate species, algae, sea grass and kelp species. Area: Outer Coast and Kenai Peninsula Nearshore.

Nested Target # 1: Lingcod
Nested Target # 2: Rockfish (demersal shelf, pelagic shelf)
Nested Target # 3: Forage, Groundfish and Invertebrate Species at many life stages.

Target #7: Benthic habitat (Offshore ‐‐‐ sand, mud, clay, gravel)

Focal Target Description: Benthic substrate in Southern Cook Inlet is generally a smooth bottom, ranging from relatively fine to coarse sands, gravel, cobble and boulder complex. In Northern Cook Inlet predominantly muddy silts, sand with gravel and cobble composite. Benthic substrate in Kamishak Bay ranges from mud, to sand and gravel composition. Inner Kachemak Bay is silty grading to mud and rippled sand in the outer Bay. Outer Kachemak Bay is characterized by shell debris, while the shallow subtidal area is a composite of boulder, cobble and gravel.

Area: Kachemak and Kamishak Bay. South Central Cook Inlet

Nested Target # 1: Scallop
Nested Target # 2: Shrimp
Nested Target # 3: Crabs
Nested Target # 4: Flatfish
Nested Target # 5: Slope rockfish

Target #8: Pelagic waters (Offshore)

Focal Target Description: Pelagic (Offshore 3‐‐‐D) Pelagic habitat includes several layers of water with distinct characteristics in salinity, density, temperature, and light penetration. These characteristics fluctuate, influenced by weather, bathymetry, tides and currents, as well as terrestrial fresh water runoff provide soft moving substrate and nutrient availability. Area: Southern vs Northern is further discussed, though our discussion may want to focus on Southern? Area: Cook Inlet (all) and the outer coast (up to 12 miles offshore from Cook Inlet east to Cape Fairfield) remains undetermined?

Nested Target # 1: Salmon --- adult & migration
Nested Target # 2: Cod & pollock --- adult, spawning, juvenile

MARINE TARGET VIABILITY TABLE – WHAT IS THE PRESENT CONDITION OF OUR TARGETS

	Conservation Targets	Landscape Context	Condition	Size	Viability Rank
	Current Rating				
1	Salt marsh & estuarine system (Intertidal)	Good	Good	Good	**Good**
2	Nearshore sediment substrates (Intertidal - sand, mudflats, gravel including pebble, cobble, boulder)	Good	Fair	Very Good	**Good**
3	Rocky nearshore (Intertidal & Subtidal)	-	Fair	Very Good	**Good**
4	Canopy kelps (Subtidal)	Very Good	Good	Good	**Good**
5	Seagrass beds (Subtidal)	Very Good	Very Good	Good	**Very Good**
6	Reefs (Subtidal & Offshore)	-	Good	Very Good	**Very Good**
7	Benthic habitat (Offshore - sand, mud, clay, gravel)	Very Good	Fair	Very Good	**Good**
8	Pelagic waters (Offshore)	-	Good	-	**Good**
	Project Health Rank				**Good**

MARINE POTENTIAL THREAT TABLE

	Potential Threats Across Targets	Salt marsh & estuarine system (Intertidal)	Nearshore sediment substrates (Intertidal - sand, mudflats, gravel including pebble, cobble, boulder)	Rocky nearshore (Intertidal & Subtidal)	Canopy kelps (Subtidal)	Seagrass beds (Subtidal)	Reefs (Subtidal & Offshore)	Benthic habitat (Offshore - sand, mud, clay, gravel)	Pelagic waters (Offshore)	Overall Threat Rank
	Project-specific threats	1	2	3	4	5	6	7	8	
1	Tanker/nontank vessel spill	High	Medium	Low	Low	Low	Low		Low	Medium
2	Incompatible shoreline development	Medium	Low	Medium		Low				Medium
3	Beach alteration/ modifications		Medium							Low
4	Pipeline / tank farm spill	Low	Low	Low	Low	Low		Low		Low
5	Chronic contaminant/oil discharges - point sources (platforms, waste treatment)		Low	Low	Low	Low		Low	-	Low
6	Chronic oil discharges - nonpoint (e.g. boats, runoff, production platforms?)		Low	Low	Low	Low		Low		Low
7	Global emissions/ocean acidification		Low					Low	Low	Low
8	Damage from incompatible recreational use	Low				Low				Low
9	Oil spill response		Low					Low		Low
	Threat Status for Targets and Project	Medium	Medium	Low	Low	Low	Low	Low	Low	Medium

- **Many others noted, with a single target low rank.**

Potential Threats to our Partnership's Geography

All of the identified conservation targets are potentially impacted by multiple threats, which act together to alter the ability of habitat to support viabile sustainable fisheries. Based on our current understanding of the science, the complexity habitat types and those roles, potential threats and history of impacts, the marine science team members collectively ranked the highest critical threats as:

1. Large Scale Oil Spill -- Petroleum Discharge (Oil/Gas)
2. Incompatible shoreline development
3. Beach Armoring

Oil Spill Prevention

Objective: Assist in the prevention of large scale oil spills in Cook Inlet. Ensure all available measures are currently in position and being exercised to prevent rather than respond to a large scale oil spill. In the event of a spill, assure no long--term impairment (see KEAs) of vulnerable coastal and marine habitats.

Target: All marine habitats identified here are potentially impacted by a large scale spill/discharge. However, those habitats most likely to incur the greatest or prolonged impact are 1) salt marsh and estuaries, 2) near shore sediment substrates, and 5) nearshore sea grasses and vegetation.

Nested Targets: Include but are not limited to larval and juvenile stages of anadromous, forage, ground fish and invertebrates species. Numerous species of epi--vegetation and flora, countless infaunal species as well as water quality, all of which influence marine species productivity. The more permeable substrates listed here have the capacity to absorb and retain oil in substrate, thus increasing the impact as well as influencing the ability to restore to original condition.

Key Attribute: These nearshore habitats are essentially fisheries nurseries. Large numbers of species are represented within these categories and guilds, where they spawn, rear, feed, inhabit or migrate through these marine waters and habitats types during some life history phase.

Key Potential Threat(s): Decreases in habitat complexity and loss of productivity will ultimately degrade the sustainability of many of the populations of fish and the vegetative and nutrient sources that provide the habitat complexity defining our current understanding of these areas as fisheries nurseries.

Overarching Approach: Conduct an assessment of currently existing measures to prevent and respond to oil spills from these sources in regional marine waters. Consult with regional expertise (Agencies, NGOS, Operators) to receive briefings and come to a better understanding of current needs and approaches in this discussion. Identify, more clearly who/what entities are responsible for identifying what oil production and transportation infrastructure are currently in operation or non--operational.

In currently active operations such as platforms, vessels and pipelines, learn what are the currently existing organizations, mechanisms and planning processes established to prevent and respond to large scale oil spills, discharges or near misses. On inactive operations, platforms and pipelines, learn what existing organizations are already established to monitor the condition of currently non--operating infrastructure.

Incompatible Shoreline Development

Objective: To assure no long--term impairment of vulnerable coastal habitats from incompatible shoreline development. Low impact near shore development is achievable when marine ecosystem processes and associated floral and faunal populations are considered in the early design of projects. Alterations to current and tidal regimes and influences on nearshore substrates and associated populations can be minimized in marine nearshore processes. Properly designed development can minimize long term impacts when implemented with marine ecosystem services and processes in mind.

Target: Intertidal marine habitats most likely to incur the greatest or prolonged impact from large scale development actions described here are, 1) salt marsh and estuaries, 2) near shore sediment substrates, and 3) nearshore sea grasses and vegetation beds.

Nested Targets: Of greatest concern are the intertidal and nearshore habitat containing sea grass and eel grass beds. These vegetative substrates are inhabited by countless larval and juvenile stages of anadromous, forage, ground fish and invertebrate species.

Vegetation and associated unconsolidated substrates are sensitive to alterations in intertidal and current regimes, and changes in water quality and characteristics.

Key Attribute: As previously mentioned in the marine discussion, these nearshore habitats are fisheries nurseries supporting large numbers of larval and juvenile and fish and invertebrate species who at some life history stage inhabit, rear, feed, or migrate through these intertidal waters.

Key Potential Threat(s): Depending on the development action, altering natural nearshore marine processes or degradation and fragmentation of marine habitats known to support fisheries population diversity.

Overarching Approach: Lay the scientific foundation for good decision making related to large shoreline infrastructure decisions (e.g. ports). Make the science information available to decision makers and other interested parties while bringing the Cook Inlet marine side into the larger development discussion.

Beach Alteration Strategies

Objective: Protect and maintain productive razor and hard shell clam habitat, especially where those habitat zones have been identified and already facilitate sustainable populations for commercial or non-‐commercial use.

Ensure all available measures are currently being exercised to prevent further degradation and alteration to these unconsolidated substrates. Assure no long-‐term impairment (see KEAs) of vulnerable coastal and marine habitats.

Target: Numerous combinations of substrate components/composition provide marine habitat for clam species in Cook Inlet and Kachemak Bay. Those habitat types most likely to incur the greatest or prolonged impact from human influenced shoreline development-‐disturbances are 1) salt marsh and estuaries, 2) near shore sediment substrates, and 3) nearshore sea grasses and vegetation.

Nested Targets: Razor and hard shell clam species, also include but are not limited to larval and juvenile stages of some fish and invertebrates species. Numerous species of flora, vegetation and numerous faunal species (infauna and epifauna).

Key Attribute: Intertidal unconsolidated sediment substrates.

Key Potential Threat(s): Beach alteration, disruption of larval transport, settling, feeding, and mobility. Incompatible structures and activities along the beach can disrupt sediment and nutrient transport, composition, distribution and quality thereby minimizing and degrading habitat values due to fragmentation. Clams, especially larval and juvenile stages are sensitive and subject to impacts when sediment substrates are altered or become impenetrable. Incompatible activities and/or structures can alter larval transport and settling to beaches. Sedimentation can suffocate clams. The identified strategies will be supported by the partnership and could be funded in whole by the partnership.

Overarching Approach –In response to incompatible structures and activities we need to gain a more thorough understanding of factors that impact clam populations including: larval transport and circulation patterns within and between Cook Inlet and Kachemak Bay, spawning, larval settling, juvenile survival and growth. Update and/or develop management plans to address structures and activities that are incompatable with razor clam habitats. Develop an outreach program that communicates the conservation and protections measures required for maintaining clam habitat. .