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Upper Turnagain Landscape Assessment

Glacier Ranger District, Chugach National Forest
USDA Forest Service, Region 10, Alaska

Photo: Portage Glacier and Portage Lake, 1984.

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EXECUTIVE SUMMARY

This Upper Turnagain Landscape Assessment (UTLA) is an ecosystem analysis at the landscape scale; it is both an analysis and an information gathering process. The purpose is to develop a geographically explicit understanding of the important resources, processes, patterns and interactions occurring on the assessment area. The assessment focuses on the issues and key questions identified for this area. The area is described in terms of its physical, biological and social features.

This report is not a decision document; rather it is intended to serve as a mid-level document between the 2002 Chugach National Forest Revised Land and Resource Management Plan (Forest Plan) and the implementation of projects and management decisions. The Landscape Assessment is provided as a tool to managers, resource specialists and interested publics, to aid in the synthesis of available information and identification of topics of interest or concern.

The UTLA area encompasses 324,516 acres. A team of resource specialists from the Glacier Ranger District and Chugach National Forest Supervisor's Office prepared this assessment.

Following are the general stages used to conduct the analysis and corresponding chapters in this report

Step 1 – Introduction (Chapter 1)
Step 2 – Characterization of the Study Area (Chapter 2)
Step 3 – Key Questions (Chapter 3)
Step 4 – Synthesis and Recommendations, including potential future projects and management ideas (Chapter 4)

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CHAPTER 1 – INTRODUCTION

Purpose

The purpose of the Upper Turnagain Landscape Assessment (UTLA) is to develop a geographically explicit understanding of the important resources, processes, patterns and interactions occurring on the assessment area. The UTLA includes a description of the current condition, trends, and resources of all lands and people (both public and private) in the area being studied. This report is not a decision document; rather it is intended to serve as a mid-level document between the 2002 Chugach National Forest Revised Land and Resource Management Plan (hereafter referred to as Forest Plan) and the implementation of projects and management decisions. The Landscape Assessment is provided as a tool to managers, resource specialists and interested publics, to aid in the synthesis of available information and identification of topics of interest or concern.

The assessment includes a characterization of the study area; identification of key questions and topics of importance based on input by the public and the Landscape Assessment team; description and discussion of identified key questions; synthesis and interpretation of information; and a list of potential future projects and management opportunities. Existing data and information have been compiled and synthesized into an easily accessible format. This assessment identifies current data gaps and future data collection needs, and new data were not collected specifically for this assessment.

The Analysis Area

The UTLA study area boundary is based upon watershed associations as identified in the Forest Plan. The UTLA study area includes the group of watersheds that surround the eastern end of Turnagain Arm, about 30 to 50 miles southeast of Anchorage, Alaska, and immediately east and south of Girdwood, Alaska (Figure 1.1). The area is bounded by the Chugach Mountains to the north, Prince William Sound to the east, Turnagain Arm to the west, and the Kenai Mountains to the south. The analysis area lies within the Glacier Ranger District of the Chugach National Forest, and the National Forest boundary defines the northwestern and northern boundaries of the analysis area. The Seward Highway between Girdwood and Turnagain Pass, the Portage Glacier Highway, and the Alaska Railroad provide access to much of the analysis area.

The analysis area includes the Twentymile River, Portage Creek, Placer River, and Seattle-Ingram watershed associations, as well as the portions of the Glacier Creek, Eagle River, and Lake George watersheds that are within the National Forest boundary (Table 1.1). With the exception of the small, heavily glaciated segments of the Eagle River and Lake George watersheds, each of these watersheds drains into the upper portion of Turnagain Arm. The UTLA area consists of high relief coastal and mountainous terrain. Glaciers have carved spectacular valleys in this area, and large glaciers still exist in the upper portions of the watersheds.

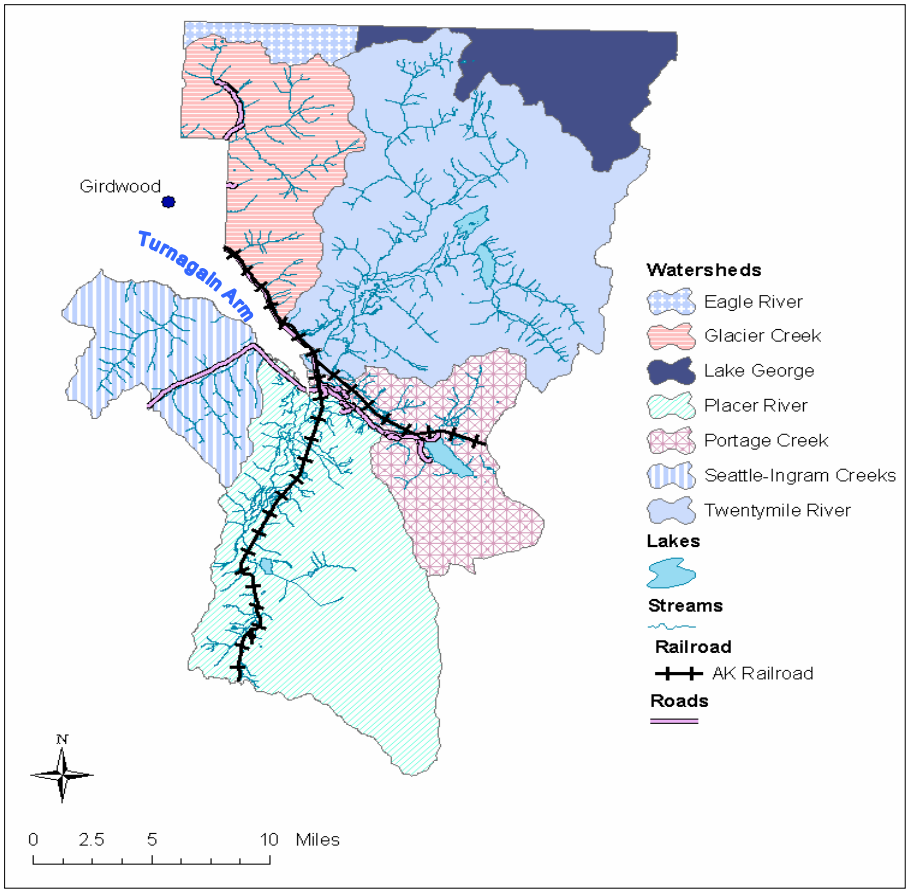

Figure 1.1. Watersheds in the Upper Turnagain Landscape.

Table 1.1. Watersheds in the Upper Turnagain Landscape.

Watershed Association	Drainage Area (acres)	Max elev (ft)	% of area as glacier
Glacier Creek *	39,196	6540	10
Twentymile River	106,856	6635	22
Portage Creek	34,778	6000	37
Placer River	80,678	6532	37
Seattle-Ingram Creeks	31,890	4660	0.4
Eagle River *	6244	6635	76
Lake George *	24,874	7400	83
TOTAL	**324,516**	**7400**	**29**

* Represents only the part of the watershed association that falls within the National Forest boundary.

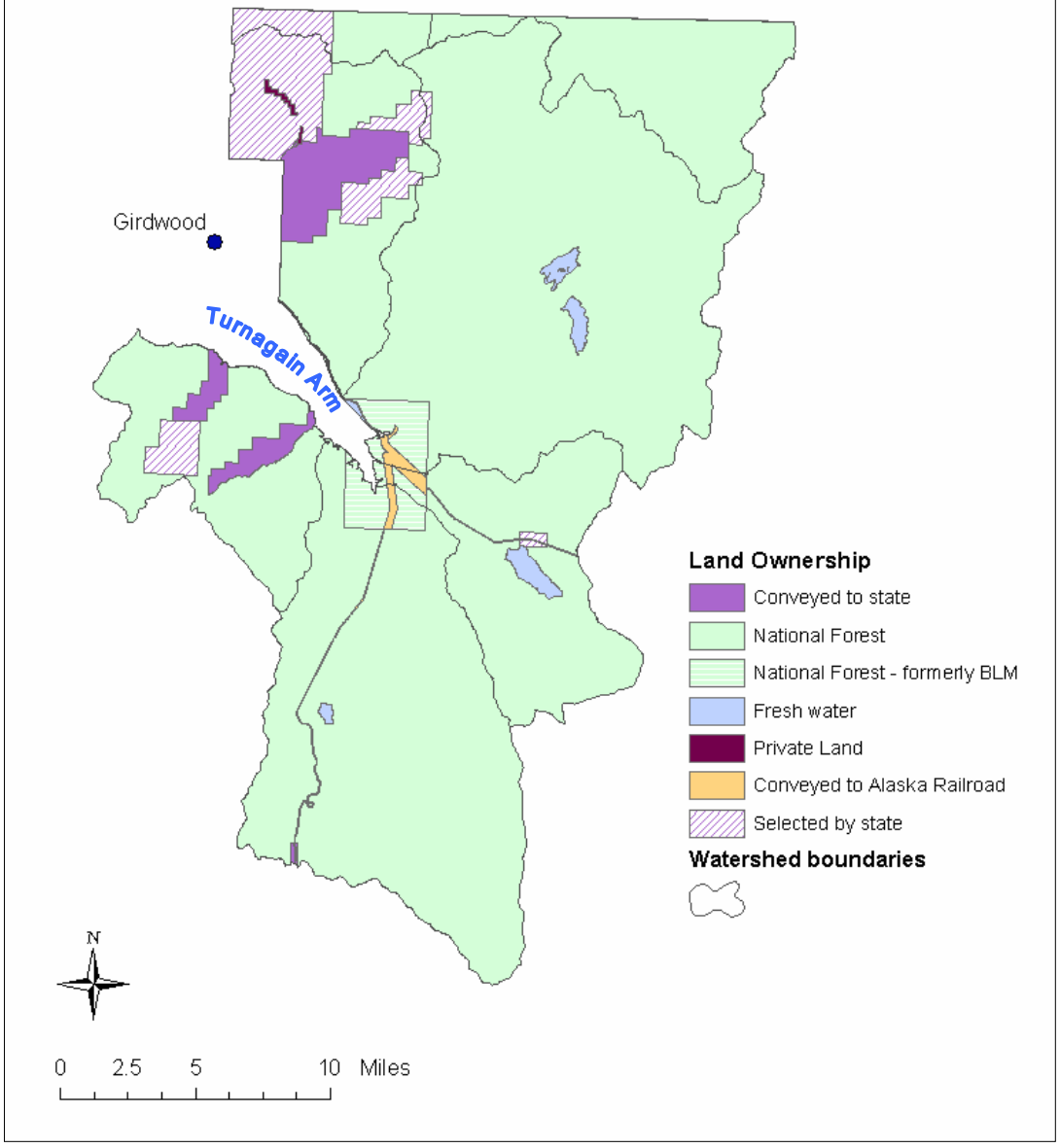

Figure 1.2. Landownership in the Upper Turnagain Landscape.

The Upper Turnagain analysis area covers approximately 324,516 acres (507 square miles) of high relief coastal and mountainous terrain. Of this area, 311,360 acres are currently under National Forest management. Land status within the study area as of May 5, 2003 is shown in Figure 1.2. The intent of the UTLA is to assess landscape conditions on National Forest lands. Although the Forest Service cannot and does not intend to implement management decisions on the state and private land contained within Forest

boundaries, these areas may occasionally be discussed in the UTLA where appropriate to provide a more holistic consideration of the landscape.

Relationship to the Forest Plan

This Landscape Assessment document is based on direction provided in the Forest Plan, which was revised and the Record of Decision signed in May 2002. Full text and maps from the Forest Plan are available online at http://www.geographynetwork.com/chugach/. Also available on this website are most of the Chugach National Forest corporate Geographic Information System (GIS) layers used by resource specialists in this report, including metadata and downloading information.

Forest-wide direction applicable to the UTLA is found in Chapter 3 of the Forest Plan, while Chapter 4 provides detailed descriptions of management prescriptions. Management prescriptions applicable to the UTLA area are shown in Figure 1.3. Of the possible 21 different management prescriptions on the Forest, 7 are present in the study area: (1) Backcountry, (2) Scenic River, (3) Fish, Wildlife and Recreation, (4) Recreational River, (5) Minerals, (6) Major Transportation/Utility Systems, and (7) Developed Recreation Complex. These designations determine management direction, current allowable use and potential future uses of National Forest lands.

The 311,360 acres managed by the CNF included as part of the UTLA comprises 5.7 percent of the Forest's 5.4 million acres. The Backcountry management prescription accounts for 285,150 acres, or 91.6 percent of the UTLA study area (Table 1.2). The acreage of the UTLA area that falls under the Scenic River management prescription (14,270 acres in the Twentymile River valley) represents 89.4 percent of all Scenic River management prescription acreage on the Forest.

Table 1.2. Study Area Management Prescription Acreage Summary

Management Prescription	Forest Prescription Acreage	Prescription Acreage Pct of Forest	Study Area Prescription Acreage	Prescription Acreage Pct of Study Area	Prescription Acreage Pct of Forest Prescription Acreage	Prescription Acreage Pct of Forest Acreage
210 Backcountry	1,830,400	33.3	285,150	91.6	15.6	5.2
231 Scenic River	14,270	0.3	12,760	4.1	89.4	0.2
312 Fish, Wildlife and Recreation	159,880	2.9	9,750	3.1	6.1	0.2
331 Recreational River	6,080	0.1	2,280	0.7	37.5	0.0
441 Developed Recreation Complex*	n/a	n/a	0	n/a	n/a	n/a
521 Minerals	6,850	0.1	430	0.1	6.3	0.0
522 Major Transportation/Utility Systems	5,900	0.1	990	0.3	16.8	0.0
Total	5,488,960	100.0	311,360	100.0	---	5.7

*Developed Recreation Complex prescription refers to specific locations; acreage not calculated

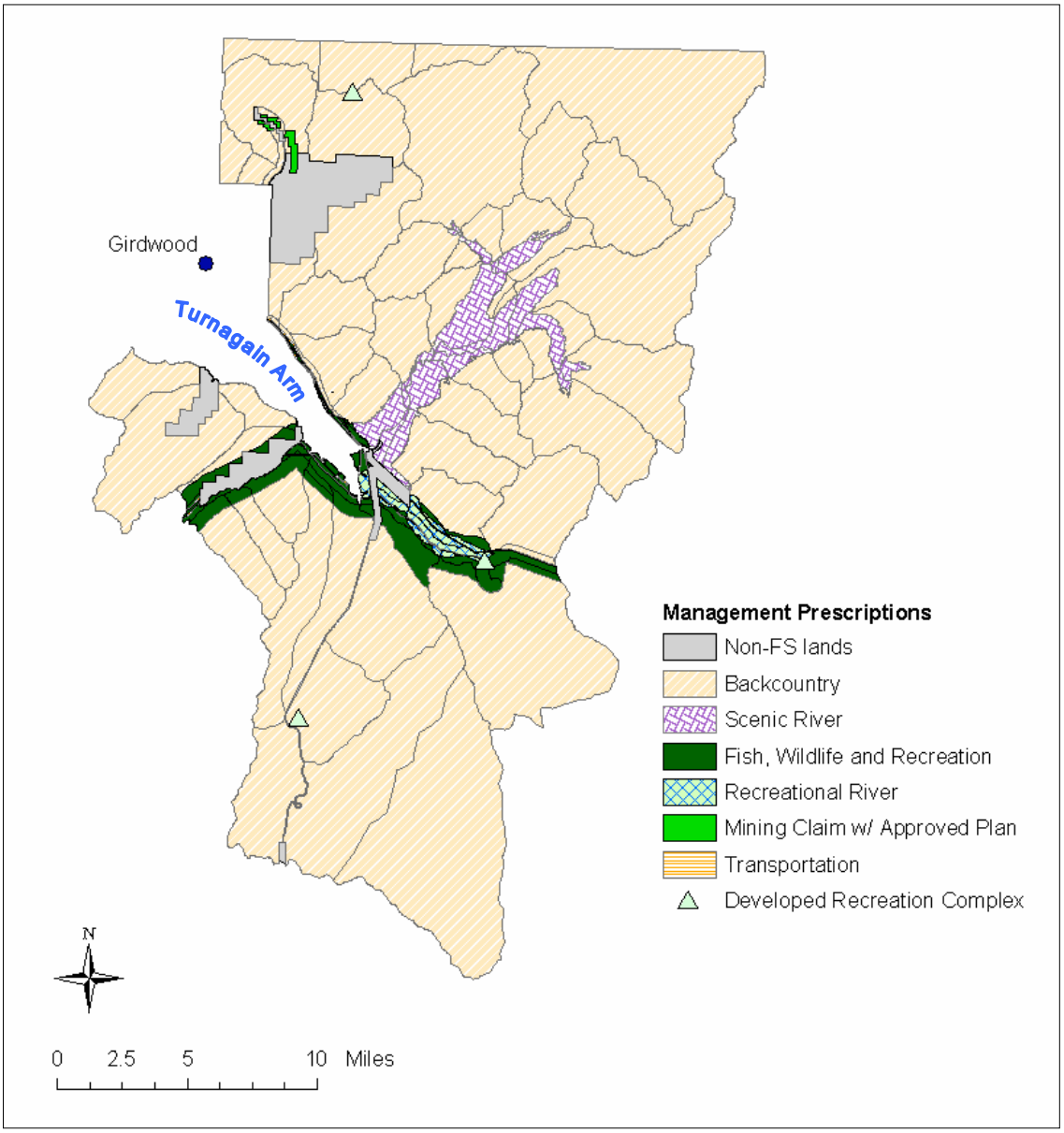

Figure 1.3. Management Prescriptions applicable to the Upper Turnagain Landscape.

CHAPTER 2 – CHARACTERIZATION OF THE ANALYSIS AREA

Physical Characteristics

Climate

Several weather stations and snow measurement sites are located in or near the UTLA area. They are not indicative of all of the climatic variations throughout the area, particularly those conditions at high elevations. Average annual daily temperatures are 37º F at Girdwood and 40º F at Whittier. Girdwood experiences colder winters and warmer summers than Whittier, and temperatures decrease dramatically with increasing elevation. Average minimum temperatures in January are 14º F at Girdwood and 22º F at Whittier. Average maximum temperatures in July are 65º F at Girdwood and 62º F at Whittier.

Precipitation increases dramatically from west to east and with increasing elevation. Storms generally approach the area from Prince William Sound, east of the UTLA area. These storms cross Portage Pass and create extreme climatic conditions of heavy precipitation and strong winds in Portage Valley. The western portion of the analysis area lies in a rain shadow created by the Chugach and Kenai Mountains. Mean annual precipitation ranges from over 160 inches at high elevations along the eastern side of the analysis area to less than 50 inches at low elevations along Turnagain Arm (Figure 2.1). Rainfall is the heaviest in September and October, and June and July receive the least precipitation. Winter months receive more precipitation than summer months.

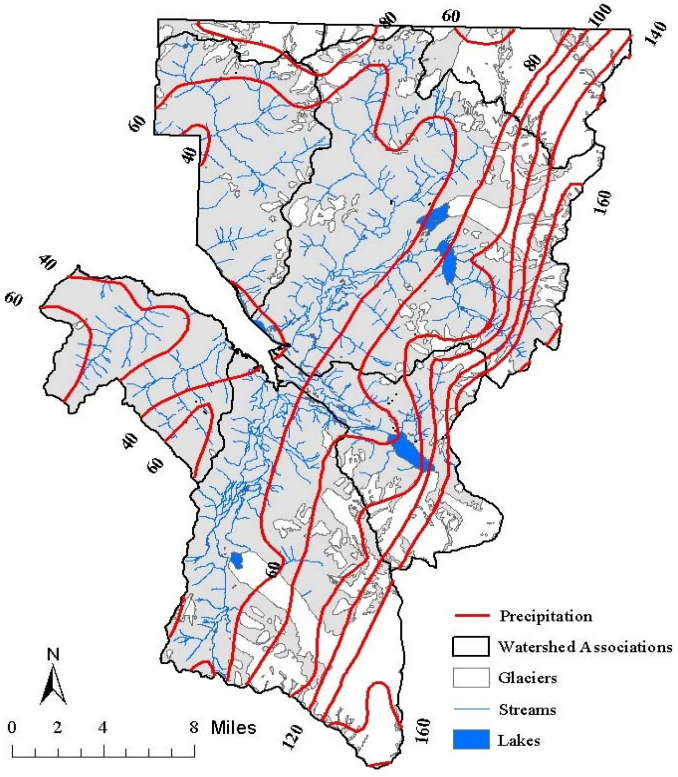

Figure 2.1. Isohyet map showing mean annual precipitation (inches) in the UTLA area.

Snowfall increases dramatically with elevation. Less than 30% of the total precipitation at Portage Valley and Girdwood falls as snow. This increases to over 60% in the higher elevation areas in the analysis area. Snow measurement sites at Mount Alyeska and Turnagain Pass have average late winter snowpack of about 100 inches and generally retain snow through June and

sometimes into July. Glaciers are located in the high elevation areas in the eastern portion of the analysis area that receive the highest snowfall.

Geology

The bedrock geology of the study area is dominated by undifferentiated sedimentary rocks consisting primarily of graywacke, shale, slate, and conglomerates (Clark 1972). The study area is part of the Valdez Group, which together with the McHugh Complex makes up the Chugach Terrane. This terrane is part of an assemblage of arcing terranes that were thrust onto the North American Continent late in the Cretaceous Period resulting in uplifting that formed the Chugach-Kenai Mountains (Kelly 1985).

The characteristics of the sedimentary rocks found in the study area are the result of a relatively quick succession of geologic events. These rocks were formed from material that was being eroded from the continent and deposited into a submarine trench. This trench was uplifted in a relatively short time after deposition. The rapid progression of these events (in terms of geologic time) prevented the sediments from going through any significant consolidation or metamorphism, resulting in rocks that are weaker and more prone to weathering (Davis et al. 1980).

The surficial geology that overlays most of the bedrock is in the form of frost-shattered rocks in the high alpine areas, colluvium and glacial drift on the side slopes, and alluvium and glacially deposited materials on the valley floors (Combellick 1984).

1964 Good Friday Earthquake

The same geologic forces responsible for the mountainous terrain in the study area are responsible for the 9.2 magnitude earthquake that struck Southcentral Alaska on March 27, 1964. The release of force from the Alaska-Aleutian subduction zone caused dramatic changes in elevation throughout the affected areas. Portage Valley dropped as much as 8 feet in elevation due to tectonic subsidence and the liquefaction of fine sediments found in the valley (Combellick 1992). The town of Portage was deserted thereafter and some of the spruce-cottonwood forests near the Turnagain Arm were exposed to salt water brought in by high tide. Much of the change in elevation has been restored to pre-earthquake levels from the constant action of intertidal silt deposition (Combellick 1992). The sunken structures and gray tree snags visible off the highway in Portage are evidence of these events.

Ecological Classification

The most general level that describes the overall processes affecting landscapes is the Ecological Subsection (Davidson 1999), where large landscapes with similar geology, lithology, geomorphic process, soil groups, climates, and potential natural plant communities are delineated into logical units. There are portions of 5 ecological subsections found within the UTLA area. The subsections represented are: Chugach Icefields (53% of area); Eastern Kenai Mountains (26%); Turnagain Arm (19%); Western Kenai Mountains (2%); and Prince William Sound Mainland (<1%). Figure 2.2 displays the distribution of these subsections.

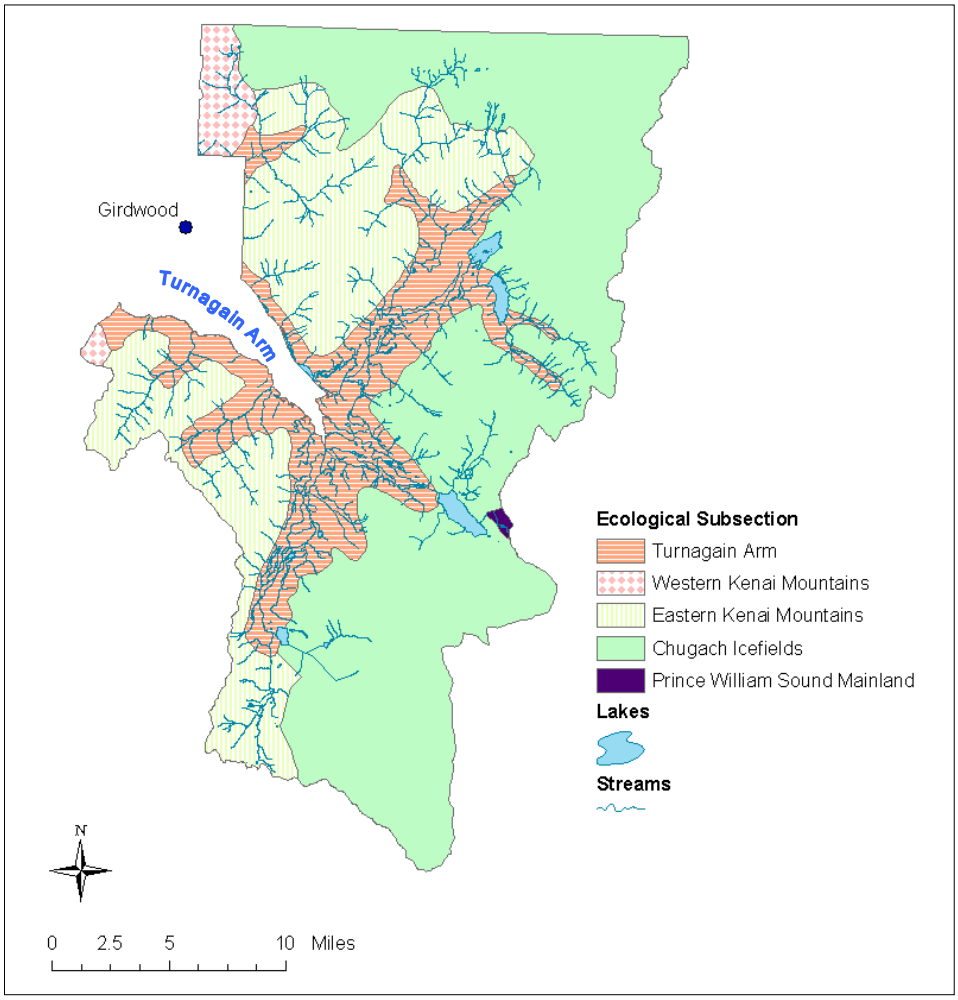

Figure 2.2. Distribution of Subsections in the UTLA area.

Chugach Icefields: This subsection consists of ice fields, glaciers and rugged rocky mountains that perimeter Prince William Sound. Most of the precipitation, which ranges from 140 to 220 inches, falls as snow to produce an annual snow pack ranging from 80 to 320 inches in depth.

Eastern Kenai Mountains: This subsection contains previously glaciated, relatively jagged mountains and alpine valleys overlaid with glacial till on the sideslopes and glacial outwash in the valley. The climate in this subsection still produces sufficient amounts of snow to retain alpine glaciers in the upper ends of the valleys. Precipitation ranges from 30" in the valleys to 80" in the alpine and a 40" to 120" snowpack respectively. The dominant vegetation types in the alpine and some of the mountain sideslopes are dwarf scrublands and herbaceous vegetation types. The remainder of the

sideslopes and the valley bottoms are covered with a needleleaf forest or a mixed needleleaf/broadleaf forest.

Turnagain Arm: This subsection includes all the lowlands and sideslopes adjacent to Turnagain Arm. The topography of the area consists of broad outwash plains bounded by steep, rocky, glaciated sideslopes. A major portion of the outwash plains consists of wetlands. Precipitation ranges from 20" in the valleys to 80" in the alpine and a 20" to 100" snowpack respectively. The dominant vegetation types in the alpine and some of the mountain sideslopes are dwarf scrublands and herbaceous vegetation types. The remainder of the sideslopes and the valley bottoms are covered with a mixed needleleaf/broadleaf forest.

Soils

Soils in the study area vary relative to their position on the landscape and microclimate. Soils found in the high alpine area will be considerably different than soils found on the valley bottom. Soil formation is also dependent on the material from which it was formed (parent material). The sedimentary rock types found throughout the study area do not vary enough to result in significant changes in the soil; however, the type of parent material, such as whether it was formed from alluvium or colluvium will have a greater impact on soil formation. These soils are relatively young because of the steepness of the sideslopes and the recent presence of glaciers in the valleys.

Soils information for the study area tends to be general for the higher mountainous areas and more detailed for some of the valley bottoms. Landtype Associations (LTA) can be used to generalize the type of soils as they occur on certain landscape types (Davidson, 1999). A more detailed description of soils and ratings for selected uses can be found in the Kenai Road Corridor Soil Survey by Davidson (1989).

The Mountain Summits LTA occurs on 34% of the UTLA area. These areas are characterized by mostly permanent ice, snow, and fractured rock. The soil that does occur tends to be stony, weakly developed and shallow. Subtle changes in the soil profile and depth will occur as you move from concave to convex positions on the landscape. Where soils have developed the vegetation consists of mostly ericaceous shrub, with other shrubs and low growing forbs.

The Mountain Sideslopes LTA occurs on 21% of the UTLA area. These areas are characterized by disturbance in the form of mass wasting and slope erosion. These soils formed from compact glacial till and the extent of pedogenesis is typically determined by where it occurs along the sideslope. The soils get deeper and more developed as you move from the higher, steeper, convex positions to the lower, gentler, concave positions down slope. Soils are typically medium textured and well drained. Areas that are not subject to continual erosion or deposition from material above, either mineral or snow, will usually exhibit greater soil development and will support mature conifer forests.

The Fluvial Valley Bottoms LTA occurs on 9% of the UTLA area. These soils are forming on active floodplains or in areas of old outwash sediments. Those soils forming from alluvial materials tend to be better drained than those forming from lacustrine silts and clays. Areas that are poorly drained can develop thick organic horizons within the

soil profile and support wetland vegetation. Soils that are well drained and thus better aerated can support productive conifer forests.

The Hills LTA occurs on 5% of the UTLA area. Soils are formed from glacial till or ice-scoured bedrock knobs. Soil type is highly dependent on landscape position. Soils on knobs and shoulder slopes will be shallower and less developed than those on sideslopes. Forested vegetation communities occur on slopes and hilltops. Those in toe slope positions and basins that receive and pond water will tend to develop organic soils and may support wetland vegetation.

The Depositional Slopes LTA occurs on 1% of the UTLA area. These soils are forming at the base of long sideslopes where sediments from higher slopes are accumulating. Soils are usually well drained, deep, and coarse textured, except where there is accumulation of subsurface runoff. Vegetation can range from lush grasses and herbaceous plants to old growth forests. Vegetation is strongly influenced by avalanche disturbance.

The Moraines LTA occurs on 1% of the UTLA area. These soils form on glacial depositional features such as esters, kettles, kames and moraines. Soils tend to be poorly to well-drained and are a mix of non sorted gravel, cobbles, and stones in a moderated to fine textured matrix (Davidson, 1999). Shrubs are the dominant form of vegetation. However, forest types can occur on well-drained sites.

The remaining 28% of the landscape is covered by glaciers, ice-fields, and rock peaks and have no soils or vegetation associated with them.

Erosion Processes

Erosion processes in the UTLA area can be looked at in terms of surface erosion, stream bank erosion, and landslides. Surface erosion is normally not a problem in areas as well vegetated as the UTLA area. Areas that have been recently deglaciated such as the shores of Twentymile and Portage Lake or areas that are high in the mountain summits and covered with frost-churned rocks are an exception. These areas may not have developed enough of a soil stratum to support vegetation and keep sediments intact and protected from wind and water. Areas that have recently been disturbed due to mass wasting or avalanches will also be more susceptible to surface erosion.

Stream bank erosion is a natural process that occurs as a stream migrates along a flood plain. A prime example of this is Portage Creek as it migrates back and forth between the railroad tracks and the highway. The riparian vegetation that occurs along streams stabilizes the bank by reinforcing the soil with its root system. The soils that support this vegetation along all the major streams in the UTLA area are formed on deep alluvial deposits of silt, sand and gravel, but organic materials essential for growth are found only in the very thin top layer of soil. Damaging riparian vegetation will leave the bank susceptible to increased rates of erosion until the vegetation recovers. Disturbing the riparian soils will leave the stream banks vulnerable for a considerably longer time.

Landslides in the study area are dependent on several slope stability factors that were developed by Douglas N. Swanston (1997) for the Tongass NF and later adapted for the Chugach NF by Dean Davidson. Of these factors, slope gradient is the most critical

(Davidson undated). In addition, areas that have drainage impeded by a restrictive layer such as compact glacial till or ash may have increased likelihood of slope failure. The Mountain Sideslopes LTA is particularly susceptible to landslides based on this criterion. Many of the soils on these landscapes are underlain by compact glacial till that can serve as a slippery surface if water is restricted and starts to flow just above it. Steep slopes that further reduce slope stability are also characteristic of this LTA. Landslides most frequently occur on slopes greater than 72% (Swanston 1997). Slopes between 56% and 72% can also be unstable if other stability factors are reduced.

Avalanches

Winter avalanches are common occurrences in much of the analysis area because of abundant snowfall, high relief, and steep valley walls. Avalanches are a particular concern where they impact structures, transportation networks, and heavily used winter recreation areas. Several large avalanche paths intersect the Crow Creek Road in the narrow Crow Creek Valley north of Girdwood. Avalanches in the Turnagain Pass area can be hazardous to winter recreational users. In Portage Valley, the Byron Glacier Trail is highly susceptible to large avalanches from the steep, wind-loaded east valley side, and these hazards can occur well into June.

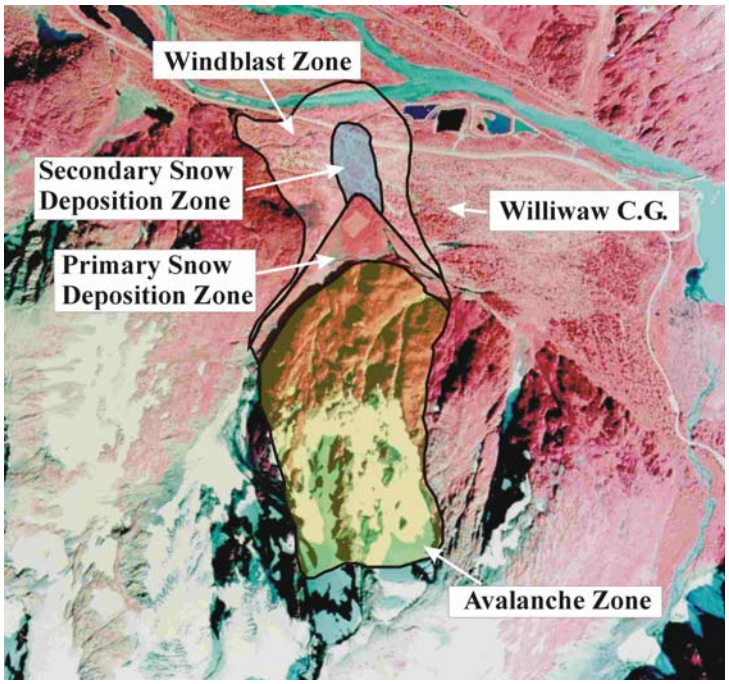

Figure 2.3. Area affected by January 18, 1980 avalanche at Williwaw Campground in Portage Valley. Modified from map by Doug Fesler, Alaska Mountain Safety Center.

A large avalanche released from a high peak just south of Williwaw campground in Portage Valley in January 1980 (Figure 2.3). Debris from the avalanche crossed to the north side of the Portage Glacier Highway, and the wind blast area crossed the southern channel of Portage Creek, damaging Williwaw Campground and knocking over several hundred trees (March and Robertson, 1982). Although this slide was likely on the order of a 100-year event (DOWL Engineers and Arthur I. Mears, P.E., Inc., 1983), similar events occurred here in 1982 and 1983.

Glaciation

Glaciation in this area began about 5 million years ago, followed by multiple episodes of glacial advance and retreat, the most recent occurring about 70,000 to 10,000 years ago (Péwé 1975). Glaciers filled valleys in the UTLA area during each glacial episode, carving wide, U-shaped valleys. Glacial thickness likely reached over 4,000 feet at the mouths of the valleys in the UTLA area, and the glaciers extended about 1000 feet below the current sea level. As a result of the warming climate, glaciers receded to the head of Turnagain Arm about 14,000 to 11,000 years ago (Bartsch-Winkler et al. 1983 and Reger and Pinney 1995). Glaciers continued to recede in the Holocene, and rising sea levels resulted in fiords extending many miles up the Twentymile, Portage, and Placer Valleys. Fine-grained marine sediments, as well as alluvial and glacial sediments, filled these fiords to near sea level by about 6000 to 8000 years ago (Blanchet 1995). Additional small-scale glacial advances and retreats occurred during the past several thousand years.

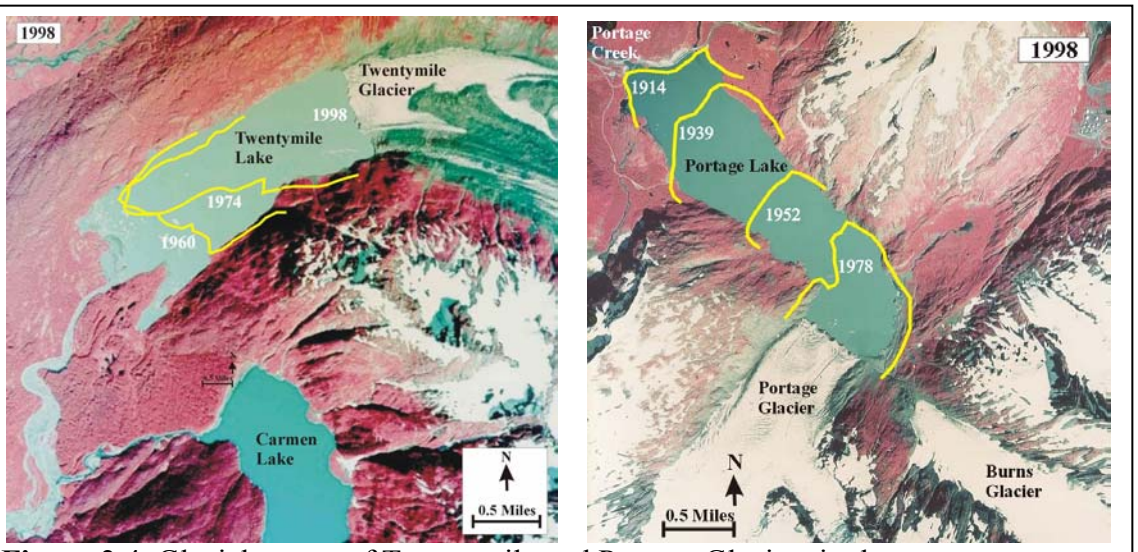

Figure 2.4: Glacial retreat of Twentymile and Portage Glaciers in the past century. Yellow lines indicate approximate historical positions of the glaciers.

The large valley glaciers in the Twentymile, Portage, and Placer Valleys have been in a state of glacial retreat during the past century (Figure 2.4), and smaller remnant glaciers throughout the area are retreating more slowly. Proglacial lake basins were formed during small-scale glacial advances between 100 and 200 years ago, as the advancing glaciers excavated soft sediments from the valley floor. Twentymile Lake first appeared in 1938, after glacial recession exposed and filled the excavated basin with melt water. In a similar manner, Portage Lake appeared in 1914 and Spencer Lake appeared prior to 1950. As these lakes increased in size and depth, the rate of glacial recession increased dramatically because of greater heat transfer and calving in the deep water. Glaciers currently cover about 95,000 acres, or 29% of the analysis area. Portage and Twentymile Glaciers are currently near the ends of their respective lakes, and recession rates have slowed almost to a point of equilibrium because these glaciers no longer terminate in

deep water. Spencer Glacier has not yet receded to the end of Spencer Lake. With the decreased rate of calving on Portage Glacier since about 1993, the number of icebergs in Portage Lake has diminished considerably, leaving the northwest shore more susceptible to bank erosion from wind-driven waves.

Streams

The analysis area includes 527 miles of mapped streams (USDA Forest Service 1998). Because of the numerous broad, low elevation glacial valleys extending to Turnagain Arm, 48% of these streams lie at elevations less than 500 feet. Glacial Outwash (GO), Palustrine (PA), and Floodplain (FP) channels, as defined by the Tongass National Forest Channel Type User Guide (USDA Forest Service Alaska Region 1992), are prevalent in the valley bottoms. Almost half of the streams in the analysis area are in the High Gradient Contained (HC) process group, as many steep tributary streams drain the headwaters and valley sides.

The geomorphic character of Twentymile River, Portage Creek, and the Placer River are all controlled by similar glacial dynamics. The formation of proglacial lakes below the Twentymile, Portage, and Spencer Glaciers has resulted in dramatic decreases in sediment delivery to the outwash fans downstream, as the lakes capture almost all of the glacial sediment. Decreased sediment loads have allowed the actively migrating, braided glacial channels downstream of the lakes to gradually stabilize and incise into the outwash fans. Decreased channel migration has also allowed vegetative growth to stabilize the floodplains. Most of the sediment transported by these channels now comes from erosion of the bed and banks. Alluvial deposits in these glacial valleys decrease in grain size down-valley, and numerous alluvial fans exist along the valley walls where steep drainages deposit sediment on the flat valley floor.

Current channel migration in Portage Creek is confined to the area between the Alaska Railroad and the Portage Glacier Highway. In addition to diverting small tributaries from the valley sides into the Twentymile and Placer River watersheds, these relatively new barriers constrict the active valley width to less than half of its original width in some places. Meander bends that encroached on the railway in two locations were reinforced with rip-rap. Two meander bends are also threatening the integrity of the Portage Glacier Highway. At the USFS Work Center, Portage Creek has migrated approximately 330 feet in the past 42 years and currently lies adjacent to the highway (Figure 2.3). Migrating channels will continue to threaten structures and roadways in this area. During the high flows of Typhoon Oscar in September 1995, elevated flows in Portage Creek threatened to shift into a new channel just upstream of the Moose Flats area downstream of the meander bend at the USFS Work Center (Figure 2.5). Flood flows created a 200-yard headcut that would have created a new channel if flows had not subsided.

At the mouth of Portage Valley, the Portage Glacier Highway and the Alaska Railroad have altered the watershed boundaries by diverting some of the small tributaries across the flat wetlands and into the adjacent Twentymile and Placer River watersheds. Beaver ponds also play an important role in the geomorphic character of some streams and side channels within the floodplains of Portage Creek, Twentymile River, and Placer River. Because beaver populations have decreased dramatically in the last one to two decades in

Portage Valley, many beaver dams on tributaries and side channels are blown out. Although spawning habitat improves where channels have blown out, rearing habitat for coho salmon is improved where dams remain in place.

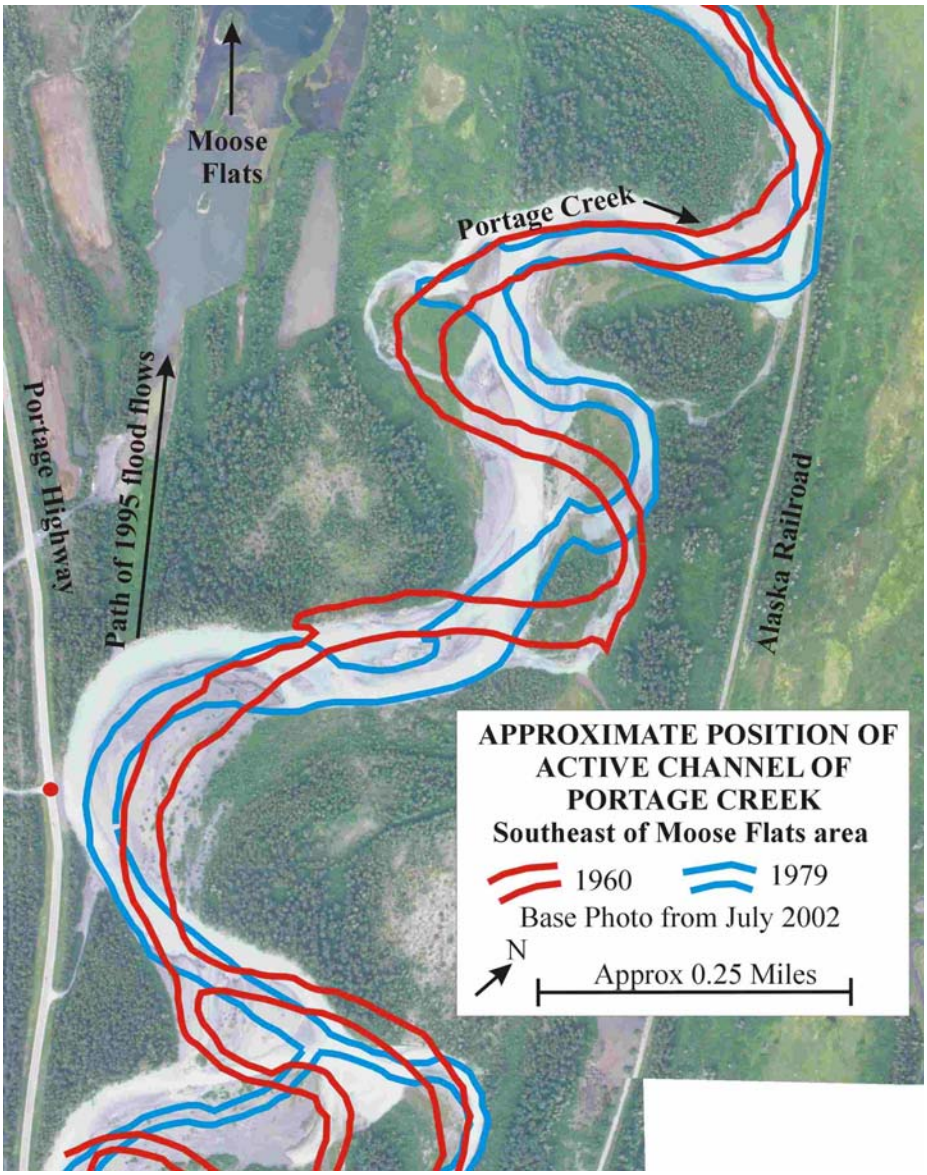

Figure 2.5: Channel migration on Portage Creek between 1960 and 2002. The meander bend near the USFS Work Center is on the left side of the photograph.

Groundwater

The flat valley floors of the Twentymile, Portage, and Placer Valleys consist of up to about 1,000 feet of marine, glacial, and alluvial sediments. These deep alluvial deposits are very porous, leading to abundant groundwater to depths of about 600 feet in Portage Valley (Blanchet 1979). Numerous tributaries, rainfall, snowmelt, and lakes recharge

this groundwater. Groundwater moves down-valley relatively quickly, although flow rates decrease down-valley as the grain size of the sediment decreases. Groundwater in this area does not freeze in the winter (Blanchet, 1979), and the water table is often the highest during the fall rainy season. Because of the shallow depths to the water table, the numerous gravel pits excavated in Portage Valley fill with groundwater, creating pond and wetland habitat for aquatic species.

Wetlands

Wetlands comprise approximately 25,000 acres, or 8% of the analysis area. These are located almost exclusively in the valley floors of the Twentymile, Portage, and Placer Valleys. These wetlands are primarily palustrine wetlands, including multiple side channels, ponds, and beaver ponds located in the floodplains of these large glacial rivers. Lacustrine, riverine, and estuarine wetlands are more limited in the analysis area.

Considerable changes to the wetlands at the head of Turnagain Arm have occurred in the last century. The construction of the Seward Highway and the Alaska Railroad required considerable fill material to elevate these structures above the wetlands. As a result, the highway and railroad impede water from flowing freely into Turnagain Arm, leading to increased wetland abundance upstream of the highway and railroad. Also, the 1964 earthquake caused 6 to 7 feet of subsidence at the head of Turnagain Arm, resulting in tidal inundation of the lower Twentymile, Portage, and Placer Valleys. Areas that were previously wetlands were replaced with salt-tolerant vegetation, and dead cottonwood trees remain standing in this area. Sedimentation and gradual uplift brought the land level to pre-earthquake levels by the early 1980's, allowing grasses and willows to re-occupy these wetlands. Over the past 30 years, wetland ponds have formed along the north side of the Alaska Railroad west of the Twentymile River, on the south side of the Seward Highway west of the Placer River, and at the Alaska Railroad junction at Portage.

Streamflows

Stream gauges are currently monitored on Portage Creek and Twentymile River, and historical data are available for Portage Creek and Glacier Creek (USGS, 2002). Peak flow data are also available for Granite Creek, located just south of the analysis area.

Streamflows in the Twentymile River, Portage Creek, and Placer River are controlled primarily by snowmelt and glacial melt (Figure 2.4). Runoff on these rivers generally begins in late May, with the onset of snowmelt runoff. Peak flows occur in late July and early August, during the peak of glacial melting, and high glacial flows persist through August. Glacial recession adds a considerable amount of water, previously stored as ice, to these rivers during the summer. Heavy fall rainstorms result in high magnitude, short duration peak flows and a secondary peak in the hydrograph. Because of the high proportion of impermeable rock and ice in the headwaters of these watersheds during late summer and fall, flows can be flashy, although Twentymile, Portage, and Spencer Lakes provide some flow attenuation. Contributions to streamflows from groundwater help to maintain a relatively steady base flow during the summer months.

Streams that drain smaller remnant glaciers, such as Glacier Creek, or that have non-glacial origins, such as Seattle and Ingram Creeks, are primarily controlled by snowmelt and rainfall runoff (Figure 2.6). Snowmelt runoff in these streams generally begins in May, with peak flows occurring earlier in the summer, usually in early June to early July. In non-glacial streams, flows drop substantially in mid to late June. In the partially glaciated Glacier Creek watershed, glacial melt sustains high flows into July, with flows gradually decreasing through August. Heavy fall rainstorms create high magnitude, short duration peak flows and a secondary peak in the hydrograph. Winter flows in all streams and rivers in the analysis area are minimal because of freezing conditions.

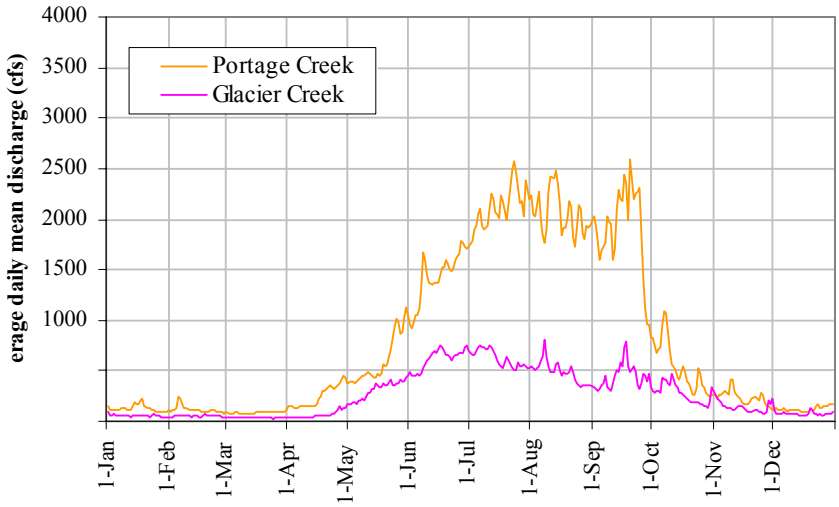

Figure 2.6: Hydrographs of average daily mean flows for Glacier and Portage Creeks. The Glacier Creek watershed is predominantly non-glacial, and the Portage Creek watershed is heavily glaciated.

Streamflows in the analysis area reflect precipitation trends. Unit discharges for the 2-year flood range from less than 50 cfs per square mile in the Glacier Creek and Seattle-Ingram Creeks watersheds to over 100 cfs per square mile in the Twentymile and Placer watersheds, and as high as 200 cfs per square mile in the Portage Creek watershed. These high values reflect the heavy winter snowpacks and extensive glaciation in the eastern portion of the analysis area.

Water Quality

Water quality data in the UTLA area are limited, although a small amount of historical data exists for most of the larger rivers and streams. Water bodies in the analysis area have few chemical pollutants because of limited access and development in much of the area. Portage Valley and the Girdwood area have a greater degree of development, leading to a higher potential for water quality degradation. Sources of potential water quality impairment include oil and gasoline from the Seward and Portage Glacier Highways, chemical spills from the Seward Highway and Alaska Railroad, and oil and gasoline from winter snow machine use. Glacial streams and rivers in the analysis area

generally have high sediment loads and turbidities, increasing with discharge. Suspended sediment concentrations in Glacier Creek during flood events can be over 1000 mg/L (USGS, 2002).

Minerals

Natural aggregates (sand, gravel, and crushed stone) are abundant within the UTLA area and have been locally mined commercially since Alaska's early mining years. These materials were used primarily as fill for railroad grades, roads, highways, and fill for structural development (houses and building) sites.

Within the UTLA area, natural aggregates have been produced from valley bottoms and rock outcrops adjacent to railroad grades or highways. The valley bottoms consist of deep alluvial deposits comprised of silts, sand, gravel, and rock on a relatively flat plain. Commercial sand and gravel deposits suitable for use as road fill and railroad bed fill are abundant throughout (Huecker 1979 and Davidson 1989). The valleys were glacially formed and still feature glaciers along their sideslopes and at the head of the valleys. Aggregate has been produced adjacent to existing transportation routes. Rock outcrops with designed rail or road cuts utilize the rock as fill for projects. Large cuts and fills can be observed along the Seward Highway and Alaska Railroad grade.

Primary extraction sites have included Glacier Creek (Girdwood), Portage Valley, Spencer Glacier and pits adjacent to the Seward Highway such as at Peterson Creek. Currently, in Girdwood, waste rock produced from the Girdwood Mine is still available for commercial purposes. Extraction from Glacier Creek ceased in the 1980's. There are no active pits along the Seward Highway within the UTLA area at this time. The highway pits have not been utilized to any extent in more than 15 years. The Whittier access project utilized the rock face adjacent to Portage Lake as fill in the late 1990's. The Spencer Glacier site has an active mine that the Alaska Railroad periodically uses and an adjacent rock quarry that produced until 1997. It is likely that within the next 5 years, production from this area will increase. Portage Valley has one open pit near the Williwaw Campground. It is anticipated that this pit will produce for 5 years or more.

The Forest Service manages the Portage Valley and Spencer pit area. Between 1991 and 1997 the Spencer pit produced approximately 375,000 tons of rock, sand and gravel. Portage Valley has several pits and produced approximately 1,000,000 tons of material over the last 20 years.

Gravel Extraction and Fish Enhancement

In the late 1970's and early 1980's biologists recognized and began documenting the potential for fisheries enhancement projects through gravel extraction in Portage Valley. Biologists recorded increasing number of salmon returning to the valley that were utilizing the pits which maintained enough habitable water and were connected to Portage Creek and Placer River. Beaver assisted in providing suitable salmon habitat by damming many of the drainage canals therefore providing suitable juvenile salmon rearing habitat. Additional benefits to waterfowl, shorebird, and other wetland and aquatic species also occurred through a natural restoration process.

The first fisheries enhancement project planned and completed utilizing a commercial need for gravel was the Williwaw Spawning Channel. This project was coordinated with the Alaska Department of Transportation and the Alaska Department of Fish and Game for the realignment of the Seward Highway at the head of Turnagain Arm in the mid-1980's. The extraction process adhered to the District Biologist and Forest Fisheries Engineer's requirements for construction of anadromous fish rearing ponds and spawning channel. The project was initiated in 1984 and construction completed in 1988. Four ponds totaling approximately 14 acres and 2,900 feet of spawning channel were constructed for sockeye and coho salmon spawning and rearing habitat and chum salmon spawning habitat. This project has been quite a success.

This strategy of utilizing commercial aggregate production to enhance other resources continues today. The projects attempt to strike a balance with the primary focus of fish habitat creation or enhancement and the needs of government agencies and contractors to secure commercial aggregate resources for local construction and public works purposes. As part of the construction and permitting planning process, a "pit plan" or “pond development plan” is developed which results in constructed ponds up to 20 acres in size and sometimes salmon spawning channels. The newly-created fish habitat is typically stocked with rainbow trout or other coldwater species as recommended by the Alaska Department of Fish and Game, or, the habitat is connected to anadromous streams for access by existing populations of salmon. The final result of the pit is a naturally-appearing small lake ecosystem. These lakes then have been managed for recreational use. The Moose Flats area has a developed recreation site in place of what was once an abandoned airstrip and local dump. To date, eight projects have been completed.

Biological characteristics

Fish

Community Composition and Aquatic Habitat

The UTLA area contains 199 miles of Class I streams (streams containing anadromous fish), 52 miles of Class II streams (streams containing only resident, nonanadromous fish), and 282 miles of Class III streams (streams with no fish). The relative distribution of these streams for each of the watersheds in the analysis area can be found in Table 2.1. Indigenous fish species documented in the analysis area include chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*Oncorhynchus nerka*), chum salmon (*Oncorhynchus keta*), pink salmon (*Oncorhynchus gorbuscha*), coho salmon (*Oncorhynchus kisutch*), Dolly Varden char (*Salvelinus malma*), eulachon (*Thaleichthys pacificus*), threespine stickleback (*Gasterosteus aculeatus*), ninespine stickleback (*Pungitius pungitius*), and sculpin (*Cottus* spp.) (Browning 1976; Krueger 1977; Nelson 1985; U.S.F.S., unpublished data). Additionally, three man-made ponds in Portage Valley (Willow Pond, Alder Pond, and Tangle Pond) are stocked annually with rainbow trout (*Oncorhynchus mykiss*) and nonnative Arctic char (*Salvelinus alpinus*). Recreational anglers have reported catching steelhead trout (sea-run rainbow trout) in the

Twentymile watershed (D. Bosch, ADF&G, Anchorage, personal communication) but verification by resource managers and biologists has not been documented.

Table 2.1. Miles of stream class and percentages of total miles for watersheds of the UTLA r I s e ab om id
Class II streams contain resident fish only, and Class III streams have no known fish

	UTLA t		Portage		Glacier		Placer R		Twentymile Rive		Seattle-Ingram Cree	
Stream Class	Miles of	%total stream	Miles of stream	miles stream	Miles of s	%total stream	Miles of s	%total miles stream	Miles of	%total miles stream	Miles of stream	%total stream
1	198.8	100	34.3	17.2	1.7	0.9	70.3	35.4	89.1	44.8	3.6	1.8
2	52.1	100	0.7	1.3	10.1	19.3	10.9	20.8	14.1	27.1	16.4	31.5
3	281.9	100	21.8	7.7	62.4	22.1	51.1	18.1	108.7	38.6	37.9	13.4
All	532.8	100	56.7	10.6	74.1	13.9	132.2	24.8	212.0	39.8	57.9	10.9

Aquatic habitat in the five primary watersheds of the analysis area ranges from highly productive estuarine channels located near the mouths of the larger streams to less productive higher gradient upper valley channels found in the smaller tributaries. Additionally, numerous natural and man-made lakes and ponds in the analysis area provide important spawning, rearing, and overwinter habitat for anadromous and resident fishes. Information on channel types for each specific stream in the analysis area can be found on the Anadromous Habitat GIS layer in the revised Chugach National Forest Plan (2000).

Aquatic habitat surveys conducted by Browning (1976), Krueger (1977), and Nelson (1985) found that the larger primary channels of streams in the UTLA area provide little spawning habitat for anadromous fish due to large amounts of glacial fines, large cobble, and boulder substrates. However, these areas provide juvenile fish with excellent rearing and overwinter habitat during low flow periods (late fall through spring) when suspended sediment loads are low. Further, the authors reported that quality spawning habitat and spawning fish were more common in the less turbid secondary and tertiary streams. Based on their minnow trapping results, these smaller streams also provided excellent rearing habitat for juvenile fish.

Species Distribution, Relative Abundances, and Forest Fisheries Management

Anadromous sportfish distribution for Alaska inland waters has been documented in the Alaska Department of Fish and Game (ADFG) Anadromous Waters Catalog (1998) and the Anadromous Fish GIS layer of the revised Chugach National Forest Plan (2000). All five primary watersheds in the analysis area are covered in the ADFG catalog and were last updated in 1998. A newer version was drafted in 2002 but the final edits have not been completed to date and therefore are not used in this analysis.

The most common techniques used to monitor adult salmon returns to freshwater (escapement) in the analysis area are through the use of aerial or foot surveys. These surveys can provide information on peak escapements and a relative index of annual variability, but they rely on visual observation of fish and are limited by weather and

water clarity. Therefore, because many of these streams are glacially turbid and the surveys have not occurred in a standardized manner or on a regular basis, data quality is considered poor and will not be used in this analysis.

Glacier Creek Watershed – The primary streams in this glacially influenced watershed include Glacier Creek and California Creek. Most portions of these streams are located on non-National Forest property or lands proposed for conveyance by the Chugach National Forest to the State of Alaska. Only a few sections of the headwater tributaries remain under management of the U.S. Forest Service.

Chinook, pink, chum, and coho salmon have been identified in the Anadromous Waters Catalog as occurring in the Glacier Creek Watershed. Dolly Varden have also been identified in Glacier Creek but are not yet listed in the catalog.

The small portion of this watershed currently managed by the Chugach National Forest is listed under the Backcountry prescription. Fisheries management guidelines in this prescription include minimizing the effect of human activity on ecological processes while allowing fish habitat improvements that blend into the area's natural features. However, as mentioned previously, Forest Service fisheries management in the watershed is almost nonexistent.

Twentymile River Watershed – This watershed contains the most Class I streams (89.1 miles) in the analysis area accounting for 44.8% of the anadromous fish habitat (Table 2.3). The entire watershed is located within the Chugach National Forest and is managed primarily under the Scenic River prescription. Under this prescription, "management of fisheries and riparian habitat will emphasize the maintenance of genetic diversity of wild indigenous fish stocks" and assure that ecological processes are largely unaffected by human activity. Instream fish habitat enhancement structures may be utilized if designed to blend with the natural setting and mimic naturally occurring events. The primary streams in this watershed include Twentymile River and Glacier River. Twentymile River is a relatively clear stream whereas Glacier River can be highly turbid due to influence from Twentymile Glacier. Upstream of the confluence with Twentymile Glacier, Carmen Lake tends to be much less turbid and provides 664 acres of important spawning, rearing, and overwinter habitat for anadromous and resident fish.

Chinook, coho, and sockeye salmon are the only anadromous fish species identified as using the Twentymile watershed in the ADFG Anadromous Waters Catalog. However, pink salmon, chum salmon, and Dolly Varden presence has been identified in the Anadromous Fish GIS layer of the revised Chugach National Forest Plan. Additionally, Kitto Spangler (2002) has conducted extensive research documenting eulachon presence and abundance in Twentymile River. The personal use fishery at the mouth of Twentymile River is one of the more popular places in the state to fish for eulachon.

Portage Creek Watershed – The majority of Class I and II streams in this watershed are managed under the Recreational River prescription. This prescription is designed to minimize effects of human activities on ecological processes. However, these areas are characterized by existing roads that improve human access and may have had some past development along the river corridor such as water impoundments or diversions. Fisheries management under this prescription will emphasize the preservation of genetic

diversity of wild indigenous fish stocks and habitat enhancement projects may occur if designed to imitate natural aquatic processes. Placer Creek, a Class I tributary of Portage Lake, is managed under the Backcountry prescription. This stream originates in Bear Valley, located near the northwest side of Portage Lake, and is highly valued for its pristine condition and quality fish habitat.

The primary waterway in this area is Portage Creek, however, most of the fish production probably occurs in the smaller clear tributaries. The ADFG Anadromous Waters Catalog identifies sockeye, pink, chum, and coho salmon use in this watershed. In addition to these species, the Forest Plan documents the presence of Dolly Varden in Portage Creek and one of its smaller tributaries. U.S. Forest Service crews have also visually observed chinook salmon in Placer Creek while conducting foot surveys. It is not known if a small distinct population of chinook salmon exists in this watershed or if they are strays from the Twentymile or Sixmile River systems of Turnagain Arm. As mentioned previously, several ponds in Portage Valley are stocked with rainbow trout and nonnative Arctic char.

Placer River Watershed – This watershed is managed under the Backcountry Area prescription except for an approximately one-half mile section of the lower Placer River and all of Explorer Creek. These two areas are part of the Fish, Wildlife, and Recreation prescription of the Forest Plan. This management theme emphasizes year-round recreational opportunities in both developed and dispersed settings. Whereas preservation of genetic diversity and enhancement of fish habitat is an emphasis for fisheries management under this theme, ecological processes may be moderately impacted by human activities.

The Placer River is the largest stream in this watershed but probably serves primarily as a corridor to more productive clearwater tributaries, ponds, and lakes. The Anadromous Waters Catalog identifies sockeye, pink, and coho salmon, as well as Dolly Varden char using this watershed. Chum salmon presence is also documented in the Anadromous Fish GIS layer of the revised Chugach National Forest Plan.

Seattle-Ingram Creek Watershed – These two watersheds have been combined for the purpose of this analysis and the majority of the streams located here are contained on lands that are non-National Forest or soon to be conveyed to the State of Alaska. Management prescriptions for the remaining land will include Fish, Wildlife, and Recreation and Backcountry.

Most of the aquatic habitat in Seattle Creek is not accessible to anadromous fish because of waterfalls that are a barrier to upstream fish migration. However, resident Dolly Varden char are believed to occur above the falls and both pink salmon and Dolly Varden have been documented in the short section below the falls. Ingram Creek contains Dolly Varden char and pink, chum, and coho salmon (ADFG 1998).

Threatened and Endangered, Invasive, and Management Indicator Species

Several of the fish species occurring in these watersheds are threatened or endangered in parts of their historical range. However, none are federally listed as threatened or endangered in the UTLA area.

The majority of these fish species are indigenous to this area and only one species, Arctic char, is known to be introduced. Arctic char are native to parts of Alaska, including the lower Kenai Peninsula (Mecklenburg et al. 2002), but are not thought to extend into the analysis area. These fish are now stocked in Tangle Pond, a landlocked pond in Portage Valley, to increase sportfishing opportunity. No known information exists that documents the escape and survival of these fish outside of Tangle Pond.

Coho salmon and Dolly Varden char are Management Indicator Species (MIS) for the Chugach National Forest and both are present in each of the five primary watersheds of the Upper Turnagain Landscape Assessment area. As mentioned previously, past data on population trends is limited and protocols are currently being developed to provide this information.

Vegetation

In the UTLA area, the highest elevations, which are covered by snow and ice or steep rocky side slopes, support no or very little vegetation. Where soils have developed in glacial deposits and where the microclimate is more favorable, plant communities range from dwarf-scrub and grasslands typical of alpine areas to a variety of forested uplands and wetlands on the side slopes and alluvial valley bottoms. On steeper slopes and drainages, avalanches play an important role in vegetation dynamics and patterns.

Distribution and structure of plant communities have developed in response to climate, landform, natural processes such as avalanche, insects and wildfire, and past and existing land uses. Because much of the landscape area is relatively undisturbed by human activities, the distribution of plant communities has not been heavily influenced by human uses. Avalanches, landslides, flooding, and to a lesser extent, fire, spruce bark beetle infestations, and other natural processes appear to be the major disturbance processes affecting the current patterns and distribution of the various cover types.

Vegetation Composition

Table 2.2 below displays the proportion of cover types across the UTLA area. This information has been summarized from the COVTYP GIS layer, which was developed from aerial photos from the 1950's to 1970's and may be outdated. A large portion (51%) of the UTLA area is not vegetated and consists of snow, ice, rock, or water. Hemlock, spruce, and cottonwood are the major forested types, accounting for 14% of the UTLA area. Shrubs, grass, and forbs cover the remaining areas (35%).

area.

Cover Type	Percent of UTLA
Snow and Ice	30%
Rock	19%
Grass and Alpine	16%
Alder	13%
Hemlock	7%
Hemlock-Spruce	3%
Cottonwood	3%
Willow	3%
Water	2%
Sitka Spruce	1%
Other Brush	1%
Other Non-forested	1%

Ecological Succession

Ecological succession is the change in species composition over time. It is the explanation of how plant communities replace each other. One species is gradually and predictably replaced by another. Succession typically starts when a disturbance, such as an avalanche, removes vegetation from a site. A simplified successional scenario would consist of establishment by pioneer species such as fireweed. Next would come alder and willow, then spruce, and finally hemlock forest. In some places within the UTLA area, primary succession would begin as glaciers retreat, exposing bare ground. On these sites, plant succession may start with the establishment of lichens and some algae, followed by moss. As soil begins to develop, other types of plants would begin to occupy the site.

Although a forest successional model has been developed for the Kenai Mountains (DeLapp et al. 2000), additional work is needed to develop a successional model for much of the UTLA area.

Structure

Ecosystem structure can be described as the relative sizes, stratification, and distribution of its populations and species. The TIMTYP coverage (see description below) contains information on stand size class ranging from seedling sapling to old-growth sawtimber. However, the information in this coverage is old (based on 1950s to 1970s photos) and may not accurately reflect current conditions. Since the majority of the UTLA area is not forested, 88% has no data. The following table displays the size class distribution for the forested area.

Other sources of plant composition and structure information are described in the vegetation specialist report prepared for this assessment.

Portion of UTLA area.

Size Class	Proportion
Seedling and Sapling	1%
Poletimber	68%
Young-Growth Sawtimber	7%
Old-Growth Sawtimber	24%

Disturbance Processes

Plant community structure and distribution have been affected by physical and natural processes (i.e. avalanches and glaciation), and past and present human uses. Among the most influential human uses are development around the community of Girdwood, past and ongoing recreational and commercial mining, recreational developments, and roads and highways that provide access to National Forest lands. In some places, mining may have altered current vegetation, particularly in riparian areas where mining may have been concentrated.

Of note in the UTLA area are the effects of the 1964 earthquake. During the 1964 earthquake, the area surrounding Portage dropped approximately 8 feet into the intertidal zone. As saltwater encroached into this area, the grass, alder, spruce, and cottonwood that occupied the site was killed. During the decade following the earthquake, as much as 2 feet of rebound occurred along Turnagain Arm. Intertidal silt deposition began immediately following the earthquake, and by 1980, much of the tidal flats in the Portage area had been restored to pre-earthquake levels (Combellick 1992).

Although the spruce bark beetle has had a large impact on the Kenai Peninsula, beetle activity within the UTLA area is not extensive. Figure 2.7 is a summary of spruce bark beetle activity within and around the project area. Beetle infestation is fairly light within the UTLA area and may be due to environmental and biological factors. Continued monitoring of beetle infestations may assist us in future vegetation management needs.

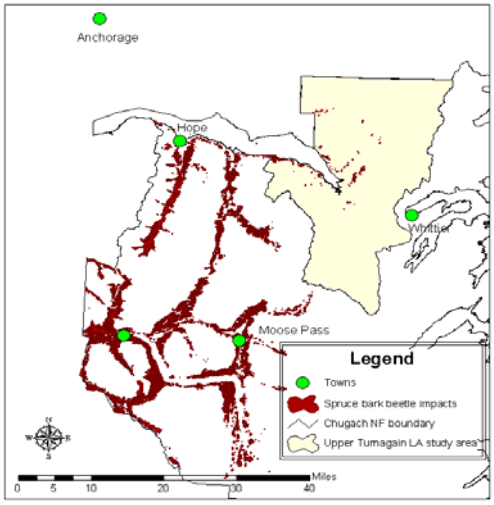

Figure 2.7. Summary of Spruce Bark Beetle around the UTLA area.

Non-Native Plants

In general the Chugach National Forest is not currently experiencing major problems of alien invasive species. However, alien plants have been observed in the Kenai Peninsula surveys (Duffy 2002 (draft)). Important factors affecting alien plant populations appear to be the high level of human use, the diversity of human use (including the use of pack animals, agriculture, mountain biking and other mans of mechanical recreation), and the change in natural communities due to road construction, and revegetation projects. All of these factors are projected to increase over time.

In the summer of 2003, the Winner Creek, Crow Pass and Portage Pass trails were surveyed for weeds. Although a final report has not been completed on these surveys, early indications show that weeds are only present in very low numbers along these trails (R. DeVelice, personal communication 2003). Additional sightings of relatively new non-native plants in the UTLA area include bird vetch and Canada thistle (Charnon, personal observation, 2003). Knapweed has also been sighted near the UTLA area along the Seward Highway between the communities of Anchorage and Girdwood (M. Shepard, personal communication 2003). These last three plants are fairly new to the area and are still confined to small, localized areas.

Sensitive Plants

A total of 11 Region 10 sensitive plant species are known or suspected to occur on the CNF. The UTLA area supports a diversity of habitats for all of these species. Currently the CNF GIS sensitive plants layer shows only 7 known locations of sensitive plants (Norberg's arnica and pale poppy) within the UTLA area, all in Portage valley. Since only a very small portion of the area has been surveyed for sensitive plants, this number does not reflect a complete assessment of sensitive plants locations. The current GIS

layer does not reflect new sightings of pale poppy in Portage Valley. This species grows on bare gravel and occurs on sites with recent ground disturbance. Another sensitive species that is locally abundant in Portage Valley is Norberg's arnica. A high concentration of existing and proposed developed recreation occurs in Portage valley and conflicts between this development and long-term viability of these species may occur.

A bioenvironmental database was developed during Forest Plan Revision, which summarizes climatic, vegetation, and landform features that can estimate site characteristics within the UTLA area. This information can be used to identify potential habitat for Alaska Region sensitive plant species known or suspected to occur on the Glacier ranger district.

Wildlife

There is little comprehensive information regarding species distribution within the analysis area but at least 100 vertebrate species are confirmed or suspected. Conclusions about presence, absence, and relative abundance of species within the analysis area are based almost entirely on unpublished reports, records, data, as well as personal observation and professional opinion.

A diversity of habitats exist within the analysis area including: hemlock and spruce forests and woodlands, open wet meadows, alder and willow uplands, alpine, and riparian cottonwood stands. The majority of these habitats are generally unaltered by management or human activities (USDA Forest Service 2002a). The analysis area does support a diversity of recreational activities throughout all seasons and is bordered by the small community of Girdwood. The Seward Highway, which is the busiest travel corridor in Alaska, intersects the analysis area. The Seward Highway may create a movement barrier to some wildlife species including moose, bears, lynx, wolves, and wolverines (USDA Forest Service 2002a).

Three large valleys (Twentymile, Portage, and Placer) dominate the analysis area and intersect one another at the head of Turnagain Arm. This zone of intersection and the main body of Portage Valley may be an important travel corridor for mainland and peninsular populations between the Kenai Peninsula and Southcentral Alaska. The Forest Plan expressed concern for impedance of dispersal corridors for Brown Bears, Wolverines, Wolves, Lynx and Moose (USDA Forest Service 2002a). Portage Valley is also an important passage route for diversity of migratory bird species including waterfowl, landbirds, and shorebirds. The productive wetland areas at the head of Turnagain Arm and within Placer and Twentymile valleys provide necessary stopover refuge for many waterfowl and shorebirds though numbers and species are currently undocumented. Banding efforts conducted in fall of 1996 and 1997 in Portage Valley have documented some 20 landbird species using forested habitats during migration (USDA Forest Service unpubl. data).

Tables 2.4 and 2.5 list species on the Chugach National Forest with potential conservation threats resulting from management actions and seasonality of habitat sensitivity.

Table 2.4. The MIS, TES, and SSI are defined in the Forest Plan (USDA Forest Service 2002b). Species in italics either do not regularly occur within the analysis or are not present during non-critical life stages.

Species	Scientific Names	MIS	TES	SSI
Brown Bear	*Ursus arctos*	X		
Moose	*Alces alces*	X		
Mountain Goat	*Oreamnos americanus*	X		
Gray Wolf	*Canis lupus pambasileus*			X
Lynx	*Lynx Canadensis*			X
Marbled Murrelet	*Brachyramphus marmoratus*			X
River Otter	*Lutra Canadensis*			*X*
Sitka Black-tailed Deer	*Odocoileus hemionus sitkensis*			X
Townsend's Warbler	*Dendroica townsendi*			X
Wolverine	*Gulo gulo*			X
Bald Eagle	*Haliaeetus leucocephalus*			X
Northern Goshawk	*Accipiter gentiles*			X
Osprey	*Pandion haliaetus*		X	
Peale's Peregrine Falcon	*Falco pereginus*		X	
Trumpeter Swan	*Cygnus buccinator*		X	

Table 2.5. Seasonality of habitat sensitivity for MIS, TES, and SSI species present within the Upper Turnagain Area.

Species	Habitat Sensitivity	Season
Brown Bear	Anadromous Streams	Salmon spawning season
Moose	Winter Ranges	October through May
Mountain Goat	Kidding Areas Wintering Areas	Mid-May through Mid-June October through May
River Otter	Intertidal Feeding	Year-round
Bald Eagles	Nesting Areas	Mid-April August
Northern Goshawk	Nesting Areas	March through July
Trumpeter Swans	Nesting Areas	Mid-April through August

Threatened, Endangered, and Sensitive Species (TES)

The only TES species known to consistently occupy the UTLA area are Trumpeter Swans (USDA Forest Service unpublished data). A single pair has been documented using the marsh area associated with Ingram Ponds from 1998-2003. This pair regularly uses a nest platform placed in Ingram pond in the late 1970s. Additional potential habitat is available within the lowlands of Twentymile and Placer Valleys though other nesting pairs were not detected during waterfowl surveys conducted in the late 1980's and early 1990's (USDA Forest Service unpubl. data). Other TES species have not been documented using the UTLA area.

Management Indicator Species (MIS)

Management Indicator Species (MIS) are chosen for fine filter analyses because their habitat requirements, both specific and general, serve to indicate the outcome of management options implemented for many species with similar habitat requirements.

MIS species known to occur within the analysis area include: Brown Bear[1], Moose and Mountain Goat. Each is discussed in detail relative to the analysis area.

Brown Bear

The number of brown bears on the Kenai Peninsula is estimated at 280 but the accuracy is uncertain. The ADFG estimated this figure from grid-based densities obtained through aerial surveys and radio-collared point locations. While this is the current estimate, members of the Interagency Brown Bear Study Team (IBBST) are developing a genetic mark-recapture technique to better estimate the population. Results from this work will provide a better foundation for further effects analyses.

Brown bears exist throughout the analysis areas though their greatest concentrations are suspected in Twentymile valley (pers. com. *Sinnott)*. Denning has been documented in Twentymile, Girdwood, and Placer Valleys and is likely to occur throughout the analysis area. Researchers from Chugach National Forest and IBBST are developing a denning habitat model, which may prove useful for management of potential disturbance during winter months. Harvest of brown bears in the Kenai portion of the analysis area (unit 7) is by draw permit only and 20 permits are currently issued per year for the entire Kenai Peninsula. Harvest in the mainland portion of the analysis area (unit 14C) is limited to one bear to an individual every four years. Habitat modification and human activities have increased the number of brown bears killed in defense of life or property (DLP; Suring and Del Frate 2002).

Moose

Moose populations on Chugach National Forest currently appear to be stable (USDA Forest Service 1999c). Moose habitat in Southcentral Alaska is associated primarily with riparian and post-glacial early to mid-successional vegetation types; much of which is decreasing in frequency across the landscape due to natural plant succession (USDA Forest Service 2002a). On the Kenai Peninsula the factor limiting the growth of moose populations is the availability of early to mid-successional habitat, and the main mortality factors are predation, hunting, and mortality from collisions with vehicles along the highway and railroad (Lottsfeldt-Frost 2000).

An estimated population of 250 moose exists within the analysis area primarily within Twentymile, Placer and Portage valleys. Observers from ADFG and CNF have completed sporadic aerial surveys over the past decade and the population has proven to be highly variable with as many as 400 individuals estimated in the early 1990's. The source of this variation is poorly understood though initial results from a browse utilization study conducted in Twentymile and Portage valleys suggested available forage was underused (USDA Forest Service unpubl. data). Point locations collected during aerial surveys have been used to delineate winter concentration zones in Twentymile, Placer and Portage valleys (USDA Forest Service, GRD GIS layer). Winter recreation activities under special use permit have been directed away from these zones.

[1] The indicator status of this species is defined based on the geographic boundary of the Kenai Peninsula and thus individuals occupying lands within the analysis area that are not on the peninsula are not afforded the same concern regarding population viability and impacts from management activities.

The majority of moose harvest within the analysis area is open only through draw permit including, Twentymile, Placer, and Bear Valleys. Harvest from elsewhere within the analysis area is considered to be relatively low.

Mountain Goat

Mountain goats represent species using cliffs, alpine and subalpine, and old-growth forest habitats. The quantity and quality of winter habitat is the most limiting factor for mountain goats in Southcentral Alaska. Inland mountain goat winter habitat is found on windswept rocky alpine ridges and south facing cliffs where vegetation free of snow is available. Monitoring and aerial surveys indicate a slightly increasing population on the Kenai Peninsula and current estimates suggest 4,500-5,800 goats inhabit the Kenai Peninsula (USDA Forest Service 2002a). Hunted populations may be sensitive to over-harvest and human disturbance. Goats are also sensitive to low-level aircraft overflights (Foster and Rahs 1984, Cote 1996, Frid 2003).

Species of Special Interest (SSI)

Species of special interest (SSI) are chosen either because their habitat requirements are narrow enough that they may not be fully covered under a coarse filter approach, or because interest in them by the public or land managers is best treated by highlighting them separately from other species (USDA Forest Service, 2002a). SSI species known to occur within the analysis area include: Gray Wolf, Lynx, Townsend's Warbler, Wolverine, Bald Eagle and Northern Goshawk.

Gray Wolf, Lynx and Wolverine

Nothing specific to gray wolf, lynx or wolverine populations is known from the analysis area. Adequate habitat for these species certainly exists but has never been modeled nor quantified. Harvest records for these species are available through ADFG but have never been summarized for the analysis area. Wolves are rarely sighted in the Twentymile, Portage, and Placer Valleys as well as in the vicinity of Girdwood. Biologists from CNF and ADFG are currently attempting to establish a baseline population distribution for the wolverine in the upper Turnagain Arm and Northern Kenai Peninsula area. Results from this work may provide some direction for management of activities potentially detrimental to wolverine populations.

Townsend's Warbler

Nothing comprehensive is known regarding Townsend's Warbler populations or habitats within the analysis area. Breeding individuals have been detected on survey routes and captured at a banding station within the analysis area (USDA Forest Service unpubl. data).

Bald Eagle

There are currently only three nests known from the analysis area (USDA Forest Service unpubl. data). These nests are relatively removed from high human use areas and disturbance potential is relatively low. There is potential for additional nests within the analysis area but survey effort in this area has been limited. Large numbers (>100) of bald eagles have been documented using the Twentymile river during mid-May through

June when eulachon (hooligan) are running in this river (USDA Forest Service unpubl. data). This run of fish likely provides a significant food resource for Bald Eagles prior to the nesting season

Northern Goshawk

Nothing comprehensive is known regarding Northern Goshawk populations or habitats within the analysis area. A single nest is known from the Johnson Pass area where individuals have been seen regularly throughout the year since 1998. Individuals have been regularly sighted in the vicinity of Winner Creek Trail since 1999, and a single individual was spotted in 2000 at the Williwaw Campground in Portage Valley. Limited, unsuccessful, efforts were made to locate nesting areas at these locations. Systematic surveys have not been conducted within the analysis area (USDA Forest Service unpubl. data).

Other Species of Concern

Populations of these species are discussed in relation to the UTLA area as a result of national, state, or regional monitoring direction; public comment; public safety; or Forest Plan direction.

Landbirds

This group represents primarily passerine or songbird species dependent on terrestrial habitats during all life phases. Many members of this group include long distance, or neo-tropical migrants. There is not comprehensive distribution or population data for landbirds within the analysis area. Breeding season banding efforts, in support of an international program called Monitoring Avian Productivity and Survivorship or MAPS (Point Reyes Bird Observatory, 2000), occurred in Portage Valley between 1993 and 2002. Approximately 4000 individuals from 20 different species were banded during this time. Detailed information, at a local scale, was collected regarding species presence, abundance, breeding phenology, and productivity (USDA Forest Service unpubl. data). It is unlikely that this data could be used to characterize landbird populations throughout the analysis area. Additional banding efforts, collected in collaboration with Alaska Boreal Partners in Flight, during the migration season have identified Portage Valley as an important migration corridor for landbird species traveling between winter and summer grounds (USDA Forest Service unpubl. data). Forested habitats within Portage likely offer much needed food and cover resources for migrating individuals from a variety of landbird species.

Shorebirds

Little is known regarding shorebird species within the analysis area. Certainly habitat suitable for a variety of species exists particularly within the large wetland areas associated with Twentymile, Portage, and Placer valleys. No comprehensive attempt has been made to characterize species abundance and distribution of shorebirds within the analysis area. Various migratory shorebird species have been identified as using Portage Valley during spring and fall migrations. Aggregations of migrants have been noted feeding and resting in wetlands at the head of Portage, Twentymile, and Placer valleys as well as intertidal wetlands associated with Turnagain Arm (pers. obs).

Waterfowl

Comprehensive waterfowl surveys were completed for the Twentymile, Portage, and Placer valleys during the late 1980's. Murphy (1986) described distribution and abundance of waterfowl species as well as local habitat associations within the analysis area. This work has not been repeated since this time and because much of the land within these areas is undergoing rapid successional change, waterfowl distribution and use patterns have likely changed. Various migratory waterfowl species have been identified as using Portage Valley during spring and fall migrations. Aggregations of migrants have been observed feeding and resting in wetlands at the head of Portage, Twentymile, and Placer valleys as well as intertidal wetlands associated with Turnagain Arm (per. obs). Waterfowl hunters are a significant recreational user group within this area from early September though October though their numbers and demographics have never been assessed.

Black Bears

There are no conservation threats currently identified for black bears on CNF. They are discussed in this section as a potential threat to human safety resulting from negative interactions between human food-habituated bears and visitors to CNF as well as residents of lands surrounding the analysis area. These interactions offer some threat to individual bears as such interactions can result in extermination of bears (ADFG 2000). Recreational facilities including campgrounds, trails, picnic areas, and cabins have the potential to increase the likelihood of encounters between humans and black bears.

Negative encounters between black bears and humans ending in the death of offending bears, injury to humans, and property damage occur annually within the analysis area. No comprehensive data exists describing the frequency or type of these interactions though such data has been collected by ADFG. The majority of these incidents occur on private lands within the to the community of Girdwood (pers. com. Sinnott) though incidents have been documented from both developed and dispersed recreation areas on Forest land in Portage Valley.

Social characteristics

Human Occupation of the UTLA Area

Prehistoric Period:

Although prehistoric evidence from the study area itself is scarce, evidence from the Beluga Point site, and other similar sites found along Turnagain Arm in the past decade, indicate that humans occupied the area from early in the Holocene to the time of European contact. Studies at the Beluga Point site on the north side of Turnagain Arm have yielded tools comparable to early Holocene technological complexes in other parts of Alaska, and suggest that humans have occupied the vicinity of the study area prior to 8,000 years ago (Reger 1998:162).

These ancient peoples had both intermittent and permanent residences in the area, and were dependent on the many of the same subsistence resources that are present in the area

today, in particular salmon and Dall sheep. Other resources that may have been important include beluga, eulachon and caribou. Although caribou are not resident in the area today, they were likely available in the past. At the time of European contact, Dena'ina Athapaskans inhabited the upper Cook Inlet area, and communities were present at Point Possession (also known as Nicolai Village and Nicolai Point), Chickaloon Bay, and Ephanasy Point on the south side of Turnagain Arm (Cook Inlet Native Association 1975:59). Alaskan natives have continued to live and use the resources of the UTLA area from the early historic period through the present.

Historic period:

European Exploration and Trade

Captain James Cook entered the inlet that bears his name in 1778 A.D., searching for a Northwest Passage and beginning the period of European contact with the Dena'ina Athapaskans who lived there. Although he anchored his large ships off Point Possession, he sent boats into Turnagain Arm to briefly explore the body of water (Cook 1784:394). Another English captain, George Vancouver (1798), and Lieutenant William Broughton, commanding the *Discovery* and the *Chatham*, sailed to the head of Cook Inlet in 1794, and spent about a month adding to Cook's charts, correcting his observations concerning the nature of Turnagain Arm, and generally mapping and describing the coast. Russian and Native visitors to Vancouver's boat confirmed that a route leading to Prince William Sound to the east existed at the head of Turnagain Arm (Vancouver 1798:180).

The early Russian explorers, in contrast to the English explorers, stayed in Cook Inlet after their arrival and built permanent settlements. The closest permanent settlement to Turnagain Arm was the Nikolaevsk Redoubt (Fort Nicholas), established in Kenai in 1791.

In the summer of 1898, Walter Curran Mendenhall, a geologist with the U.S. Geological Survey explored in the Upper Turnagain area as part of a military expedition under the command of Captain E.F. Glenn. Mendenhall (1900) traversed Portage Pass, camped in the Portage Valley and explored the Glacier Creek, Crow Creek and Eagle River valleys prior to traveling up the Matanuska River and overland to the Tanana River.

Miners

In 1888, Alexander King reported finding gold in the Hope area of Turnagain Arm (Barry 1997:31). The first claims on Resurrection Creek were staked in 1893 and the Turnagain Arm Mining District was formed in May of that same year (Buzzell 1997:233). The valley east of Hope that included Sixmile Creek and the town of Sunrise was designated the Sunrise Mining District in 1895 (Barry 1997:36). In 1897, word of the Klondike Gold Rush reached Turnagain Arm, resulting in several hundred miners leaving the mining districts.

Despite its name, the Placer River does not appear to have seen much, if any, recorded placer mining activity. The same is true for the Portage River valley. Only one mining claim is currently known to have been prospected or worked in the Twentymile River valley.

James Girdwood discovered gold on Crow Creek sometime between 1896, when he arrived in Alaska, and 1900. He established four placer claims which became known as the Girdwood property, and by 1905 was operating a substantial hydraulic mine in the upper Crow Creek valley (Carberry and Lane 1986:166). Axel Lindblad, whose cabin still stands along California Creek, prospected in Sunrise, but then moved to Girdwood, where he managed the Girdwood mines at Crow Creek (Johnson 2004:22). Gold was discovered in 1909 within the Monarch-Jewel mining district, along Crow Creek north of Girdwood, by Conrad Hories, who had previous experience mining in the Sunrise District. He quickly filed the first lode claim there, and a minor stampede ensued, with an association of miners headed by Robert Michaelson filing additional lode claims at the head of Crow Creek late in 1909 (Schweigert 1999: I:121). Active mining began in 1910 and continued at the Monarch and Jewell mines, and other mines along Crow Creek and Winner Creek, until 1940.

The trails used by miners throughout the Kenai Peninsula and Alaska in general were, for the most part, trails developed and already in use by Native peoples (Schweigert 1999:III:1.F.2). These ultimately formed what is known as the Iditarod Trail, a network of primary and secondary trials that connect Seward to the interior of Alaska, and eventually the city of Nome.

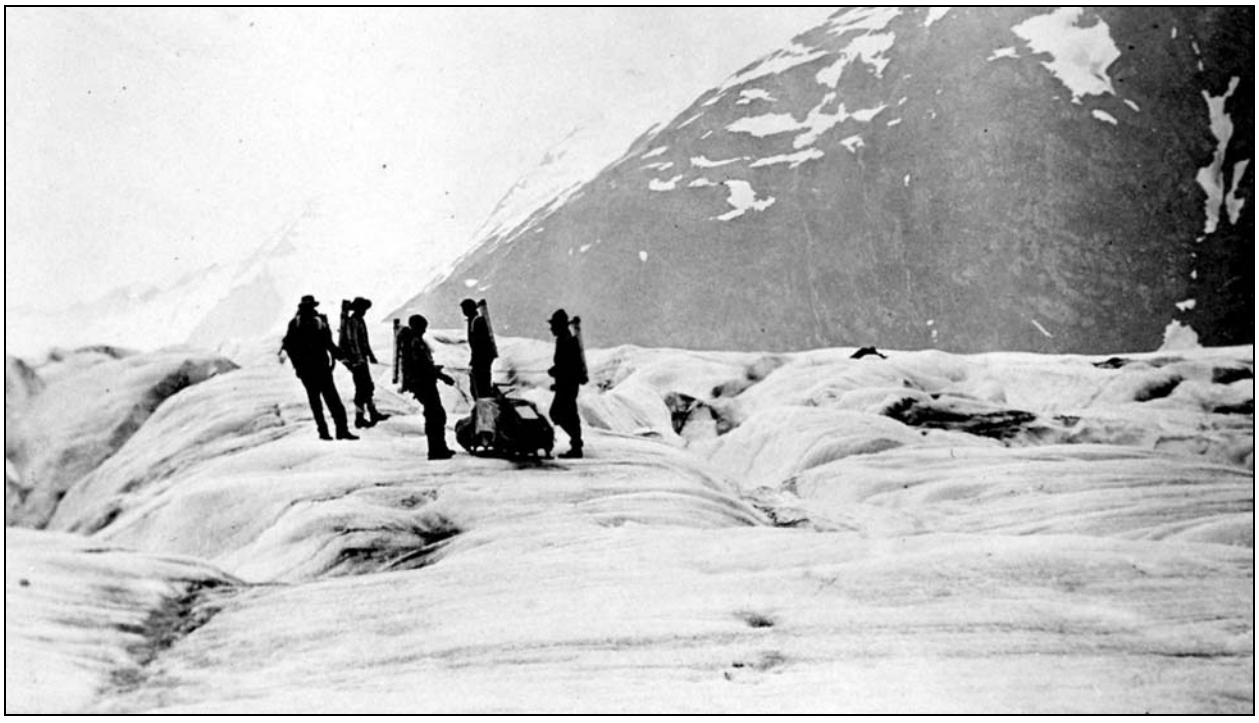

Figure 2.8. Using Yukon sled across Portage Glacier, Survey crew of R.P. Strough. NOAA Photo Library, NOAA Central Library; USC&GS Season's Report Strough 1914.

Railroad Period

What is now the Alaska Railroad Corporation began as the Alaska Central Railway in 1903 (Prince 1964:4). By 1907, construction had progressed to Kern Creek, within the UTLA area (Reger and Antonson 1977: IV-7). The Alaska Central Railway was taken over by the Alaska Northern Railway Company in 1910. This company only succeeded in constructing an additional 15 miles of track, to mile 70.8, by 1915. After Congressional action and appropriation of funds in 1914, the line was first leased, then purchased by the U.S. Government in 1915. Direction of the construction was taken over by Colonel Frederick Mears, who was appointed to his position in 1914. Mears had helped direct the construction of the Panama Canal, and successfully oversaw construction of the Alaska railroad between Turnagain Arm and Fairbanks, which was completed in 1923 (Clifford 1999: 93, 101; Crittenden 2002:48, 226).

Figure 2.9. Leveling crew entering tunnel on velocipede. USC&GS Season's Report Odessey 1923.

The Alaska Engineering Commission explored the route between Whittier and Portage for a potential rail line to connect Prince William Sound with the Alaska Railroad at Turnagain Arm, as early as 1914 (Bush 1943:364, Crittenden 2002:63-64) (Figure 3). The Alaska Railroad made a preliminary survey in 1939, the project was authorized and funded in 1941, and a contract was let in June for construction of two tunnels and 14 miles of new line along a route that was essentially the same as that explored in 1914 (Bush 1943:364). Construction of what was ultimately a 12.4-mile long branch of the Alaska Railroad called the "Whittier Cutoff" was completed in 1942, running between the main line at Portage Station and the town of Whittier on Passage Canal in Prince William Sound. The larger of the two tunnels, called the "Whittier" tunnel, was, at the time, the fourth largest in the world at 13,090 feet long. This tunnel is now on the National Register, and has recently been renamed the Anton Anderson tunnel. The shorter tunnel, named the "Moraine" tunnel was about 4,910 feet long. This line was intended to "safeguard the flow of military supplies and personnel" during World War II. It also provided a second deep-water port, in addition to Seward,

where connections could be made with ocean-going ships, and the increased tonnage of freight associated with the war could be more easily accommodated (Clifford 1999: 104). What is now known as the Upper Engineer's Camp served as the army construction camp on the west side of the tunnels, near Portage Lake. The personnel stationed there were almost entirely Alaska Natives.

Figure 2.10. Camp above Portage Glacier, between Turnagain Arm and Prince William Sound. Triangulation party of R.P. Strough. USC&GS Season's Report Strough 1914.

Road Construction

Prior to 1950, the U.S. Congress was not eager to fund road building in Alaska, because of the huge areas involved, the small number of existing roads, and the large percent of land that was public, which affected the matching-fund formula used for funding roadwork in Territories (Naske 1980:iii). While construction of wagon roads, winter sled roads (Figure 4), trails and low standard roads occurred between the inception of the Alaska Road Commission in 1905 and the late 1940s, it was not until the early 1950s that Alaska began to receive large road building budgets, primarily at the urging of the military, and because of the Cold War. The contracts to build the Seward Highway, between Anchorage and Seward, were let in 1949, and the road was officially opened with a ribbon cutting ceremony in Girdwood on October 19, 1951. Despite the availability of the road, however, the highway between Seward and Girdwood was still only considered 59% complete in June of 1952 (Alaska Road Commission 1952:4-5).

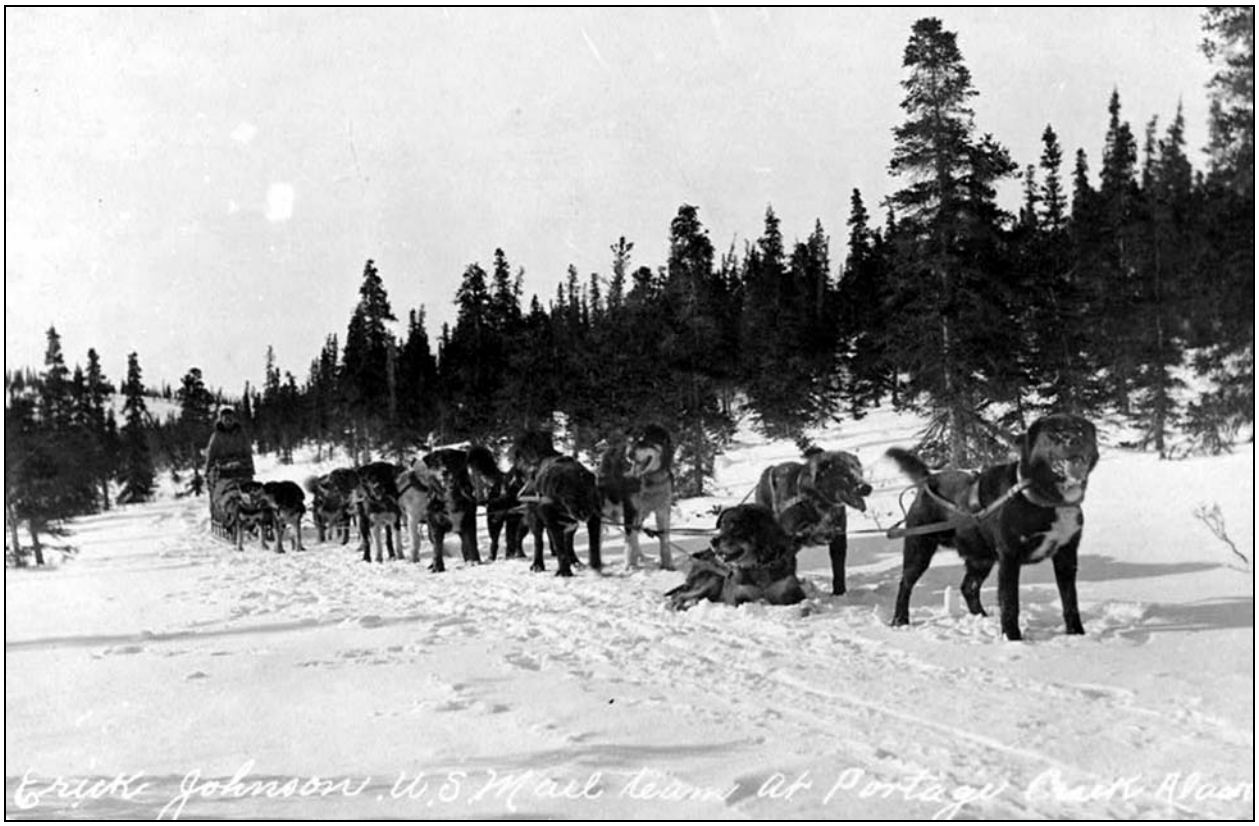

Figure 2.11. Erick Johnson with U.S. mail team at Portage Creek, Alaska, 1923. Frank and Frances Carpenter collection (Library of Congress).

Girdwood, which had been a busy mining town prior to World War II, declined to a community of about ten families until construction for the Seward Highway began in 1949. During the early post wartime, few visitors came to Girdwood. The train would stop and leave a few families who had property in the valley. They would gather their belongings and walk down to the Dipper where Joe [Danich], with one of the few vehicles in town, would chauffeur them down Crow Creek Highway" (McPhearson 1981:9). However, the town began to grow again after 1951, and recreation became an important economic factor in the development of the Upper Turnagain area. While cross-country skiing had long been a form of transportation, downhill skiing became popular in Alaska with the advent of the military, in particular the 10th Mountain Division, during World War II. At least two small ski facilities with rope tows were permitted by the Forest Service during the 1940's: on Manitoba Mountain near Summit Lake, and near Lost Lake, north of Seward. In the late 1940's, veteran Ernie Baumann searched by plane between Denali and Seward for a mountain that would be suitable for development of a ski resort. He believed that the mountain east of Girdwood, which he initially called "Solar" Mountain, would be excellent for such a venture. When the Seward Highway opened in 1951, Baumann brought fellow skiers Joe Gayman and Winter Olympian Sven Johanson to Girdwood to encourage local residents to support the idea. Eleven Girdwood

residents formed a non-profit association called the Alyeska Ski Club in 1956, and purchased 160 acres from BLM at bottom of Mount Alyeska. Initially, skiers had to hike up the mountain to ski down, but by 1957 a 1300 ft. rope tow was in place to access the lower slopes, expert skiers were flown to the top of the mountain by helicopter and a small warming hut was open (Bercee 1998:15, Daniels 1981:5, Johnson, Lana, 2004 personal communication). That same year, the non-profit group reorganized as a for-profit business. Slowly but surely, recreation has continued to gain economic importance in Girdwood, as well as the rest of Alaska. The addition of the hexagonal Mt. Alyeska Round House (SEW-0997) to the State's Alaska Heritage Resource Survey (AHRS) is recognition of the place of the resort and recreation in the history of the area. Originally constructed in 1960 to house the return terminal for Chair 1, the Round House is currently used by the ski patrol for their warming station and dispatch operations (AHRS 2004).

Cultural Resources

There are 99 known historic and archaeological sites, and historic trail segments, within the Landscape Assessment Area. While a large number of these have been recorded in the Alaska Heritage Resource Survey (AHRS), a database managed by the State, some have only received a Forest Service (FS) number, and a few have no cultural resource related number. Less than 2% of the area has been archaeologically surveyed, so it is likely that other unknown historic and prehistoric sites exist in the area. Two sites, a tunnel and a mine, are on the National Register of Historic Places. Two other sites, the Monarch mine and the Skookum Alaska Railroad Bridge, have been evaluated and determined eligible for the National Register of Historic Places. Seven sites are trails which have been evaluated and determined to be National Historic Trails or Trail segments. Three sites, the Whittier Access Corridor, the Girdwood School, and the Portage Upper Engineer's Camp, also known as the Portage Military Camp, have been evaluated and found ineligible for the National Register. The Girdwood School has been demolished. The Portage Upper Engineer's Camp, however, was determined ineligible in 1986, so needs to be re-evaluated in light of the determination being over five years old, because of recently changed standards, and also needs to be re-evaluated because new remains associated with the camp were found in 2001, and have not yet been fully assessed. All sites that are associated with the Iditarod National Historic Trail and managed by the Chugach National Forest are subject to the provisions of the "Programmatic Agreement… Regarding Management of the Iditarod National Historic Trail and its Associated Historic Properties".

Of the known sites, five are believed to be **prehistoric sites**. At least one prehistoric burial site is likely to be present in the vicinity of the Crow Creek Trail or Eagle Glacier, as evidenced by a human bone that was discovered in the 1990s, however the exact location in which it was found is not known. It is likely that other prehistoric and early historic Native Alaskan sites are present in the Upper Turnagain area, given the documentation of hunting camps in the upper creek valleys by Mendenhall and Herron (see above), but have simply not been found due to the lack of survey in those high probability areas. All the known prehistoric sites are currently unevaluated for the National Register of Historic Places.

All seven **trail segments** are historically documented, but are likely to have prehistoric origins. There are seven National Historic Trail segments that are either part of, or are associated with, the Iditarod National Historic Trail. Six of these trail segments have been designated National Historic Trails. Only the Turnagain Arm Trail (Forest Service # 495) is unevaluated. The Crow Creek Roadhouse (ANC-0759) and the Girdwood Roadhouse (SEW-0102) are two sites, which are identified as associated with the Iditarod Trail, but have yet to be evaluated.

Of the ten documented sites that are either **historic mines** or are **associated with mining**, one, Crow Creek Mine (SEW-0191), is on the National Register, and one, the Monarch Mine (ANC-0271), has been determined eligible for the National Register. The other eight sites have yet to be evaluated.

Although five **mines** in the Upper Turnagain area have been documented and given AHRS numbers, as potential historic properties, two lode mines, eight placer claims, and five prospects are known, but have not had on-the-ground verification, and are currently unevaluated for the National Register of Historic Places.

The majority of the sites known from the UTLA Area are related to the **construction or the use of the Alaska Railroad**. Ten of the sites with AHRS numbers are the locations of camps, stations, flag stops with buildings, or the remains of such sites. Of the eight tunnels, one has been evaluated and is on the National Register of Historic Places. Of the four railroad bridges with AHRS numbers, one has been determined eligible for the National Register of Historic Places, while the other three are unevaluated. The Whittier Access Corridor has been evaluated and determined ineligible for the NRHP. The five snowsheds are unevaluated. The Portage Upper Engineer's Camp (SEW-299) needs re-evaluation because of the discovery of additional structures in 2002. The Alaska Railroad has been rerouted slightly from time to time, particularly in the vicinity of the Loop District, south of the UTLA area, but most of the right-of-way, and many of the bridges and other structures are in their original locations. The right-of-way has narrowed from 500 feet or more to its current 100 feet, and has effectively transferred many historic railroad associated sites to Forest management.

In addition to the four Alaska Railroad bridges that are listed in the AHRS, **16 railroad bridges** that do not have AHRS or Forest Service numbers, but are potentially historic properties, cross streams in the landscape assessment area. They are currently being evaluated for the National Register of Historic Places as a part of a proposed undertaking by the Alaska Railroad Company.

Nine **other sites** are known in the Turnagain Valley Landscape Assessment Area. One, the Girdwood School (SEW-00995) was found ineligible for the National Register of Historic Places, and has been demolished. The other eight have not yet been evaluated. All sites that are associated with the Iditarod National Historic Trail and managed by the Chugach National Forest are subject to the provisions of the "Programmatic Agreement… Regarding Management of the Iditarod National Historic Trail and its Associated Historic Properties".

Recreational Uses and Facilities

Recreation use of the UTLA area is concentrated along two main highways and several miles of secondary roads. Most of the developed recreation sites are road-accessed, except for several cabins and the Eagle Glacier Nordic Training center. The amount of recreation use diminishes with increasing distance from access routes. Although there is less use further from roads, those who are using these more remote areas have expended much more in time, energy and/or money than those who are recreating closer to the roads. Ninety-two percent of the UTLA area is in the Backcountry Management Area in the Forest Plan, which is managed to emphasize a variety of recreational opportunities in natural appearing landscapes. Of the remaining lands, all are in management areas where recreation use is emphasized, generally at a more developed level.

Tourism is expected to grow in Alaska and accounts for a significant amount of recreation use in the UTLA area, especially in the summer. This growth will add more demand for all types of summer recreation opportunities, but especially to those areas already most heavily used.

Existing Conditions

Starting from the North, the existing conditions of concentrated and developed recreation use areas on National Forest Lands are presented.

Glacier Creek Watershed: There are two existing backcountry trail systems managed by the Forest Service: Crow Pass Trail and Winner Creek Trail. Both of these are to be included with the Iditarod National Historic Trail (INHT) proposal, which has an Environmental Assessment (EA) completed in 2003.

Crow Creek Road, Crow Pass Trailhead, trail, cabin: This area receives a significant amount of recreation use, primarily in the snow-free months. Crow Creek Road is a dirt road that climbs up to approximately 1,500', becoming narrower and more rugged the further up you travel. The last mile is approximately 15' wide, with several turnouts for passing. Its surface has many large potholes. The trailhead has parking for up to 50 vehicles, which on occasion fills up, forcing people to park along the road, creating even less of a travelway. People also park along this narrow stretch of road (Figure 2.13) to hike the alpine areas and harvest fiddlehead and other new-plant growth (Figure 2.12). Vandalism has been a recurring problem at this trailhead.

The Crow Pass trail climbs through alder and salmonberry with several switchbacks before breaking out to open alpine terrain. It sustains close to 20% grades, and provides spectacular views of surrounding mountains and waterfalls. The ruins of the Monarch Mine are a popular stop. A small plaque describes a little of the mine's history. The A-frame cabin is another mile past the mine ruins and is located near a small tarn, with snowbanks present almost year-round. The cabin's outhouse is routinely pushed over by snow and or high winds. High use of this outhouse combined with rocky soils creates a problem. When the pit fills up, another site is difficult to find and construct. The trail crosses several slopes with high potential avalanche hazards, so winter use is not encouraged. The cabin is taken off the reservation system for the winter and does not have a stove, to discourage winter use.

Figure 2.12. People hiking and picking fiddleheads and other plant growth.

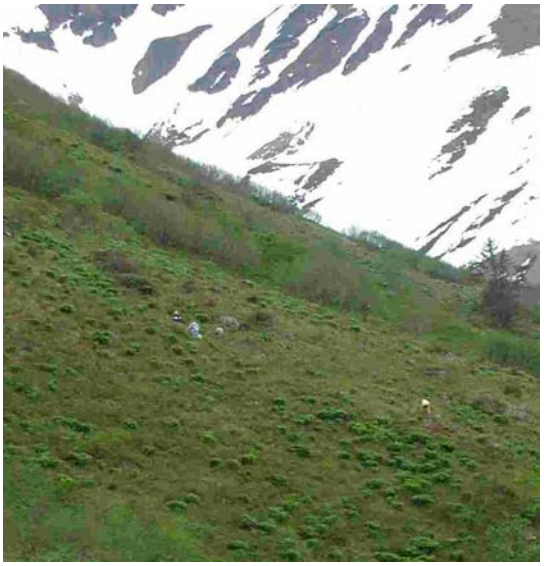

Figure 2.13. Parking along Crow Creek Road.

Winner Creek Trail: This trail begins at the Alyeska Prince Hotel, on an easement across state and Municipality of Anchorage (MOA) lands that has mature spruce-hemlock forests, up to Winner Creek, where the trail forks. The downstream fork was constructed and maintained by the Forest Service until the land was conveyed to the state in the early 1990's. It is now a locally maintained trail. The upstream fork continues on an FS easement another 2 miles, although maintenance drops off at the cabin ruins, approx. ½ mile from the fork.

The trail from the Resort to the forks and downstream is part of a very popular loop that crosses Winner creek at a narrow gorge, the crosses Glacier Creek on a hand tram, and continues up to Crow Creek Road about 3 miles up from it's intersection with the Alyeska Hwy. An existing portion of the Iditarod National Historic parallels Crow Creek Road and continues the loop system back towards "downtown" Girdwood, where bike paths can be used to return to the hotel. The Forest Service maintains only the first section of this loop.

The Forest Service portion of this trail has been degraded over the past decade due to its increasing popularity, and location through forested wetlands. Split log boardwalks installed in the early 1980's are beginning to rot, and areas that do not have boardwalk become quagmires after rain events. People try to avoid the mud by walking around the wet areas, widening the trail. Several years of month-long efforts by trail crews have been put into maintaining the trail, but much more is needed. A Capital Improvement Project (CIP) to work on the trail was submitted in 2002. This CIP would reconstruct the

existing trail and construct new trail to the Pass that separates Winner Creek Valley from the Twentymile River Valley. This route is occasionally used by people that bring one-person pack rafts along, and use them to float out on the Twentymile River. The CIP is expected to receive survey and design funding in 2005, with construction to follow over a three-year period.

This trail is also part of the INHT proposal, and would continue over to the Twentymile valley. A shelter at the Pass is included in the INHT proposal that would be for summer use only. This trail would not be managed for winter use due to high avalanche hazards.

The remainder of National Forest Lands in the Girdwood area does serve an important function of providing a scenic, wildland setting for everyone living or visiting this resort community. The importance of this scenic setting for a mountain resort community has been noted in the Girdwood Area Plan (MOA), and the Turnagain Arm Management Plan (State of Alaska). See Figure 2.14 for a map of trails and facilities in the Girdwood Area. Table 2.6 provides a summary of trails and facilities in the Girdwood area.

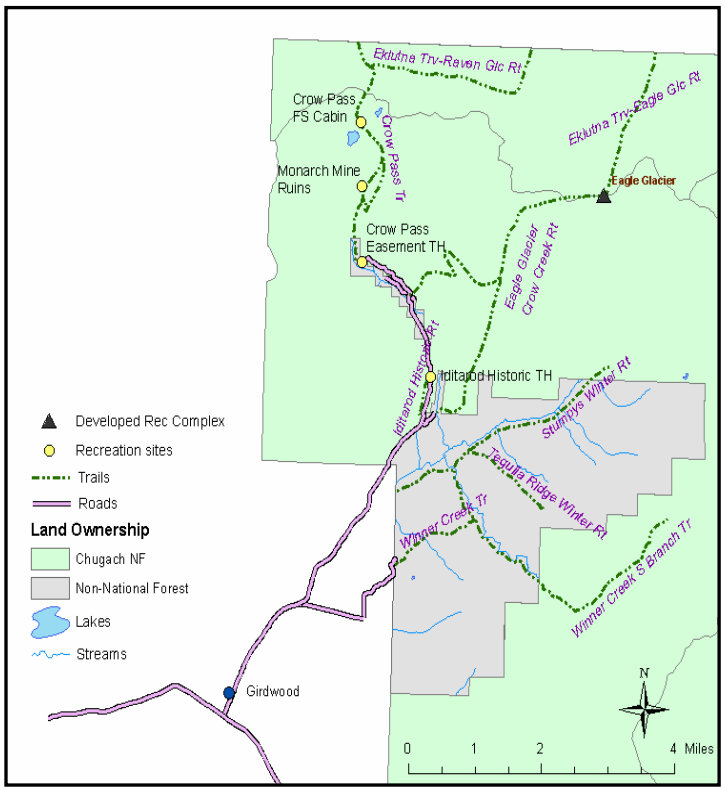

Figure 2.14. Trails and facilities in the Girdwood Area.

Table 2.6. Summary of trails and facilities in the Glacier Creek Watershed.

Recreation Sites	Trails	Type	Miles
Crow Pass FS Cabin	Crow Pass Tr.	Hiking	4.8
Crow Pass Trailhead	Crow Pass Alt. Rt.	Hiking	0.7
Monarch Mine Ruins	Iditarod Historic Rt.	Hiking	0.6
Eagle Glacier Nordic Training Center (SUP)	Winner Cr. N. Branch Tr.	Hiking	0.8
Iditarod National Historic Trailhead	Winner Cr. Tr.	Hiking	1.5
GRD Office Information Site	Winner Cr. S. Branch Tr.	Hiking	4.0
	Stumpy's Winter Rt.	Skiing	
	Tequila Ridge Winter Rt.	Skiing	
	Iditarod Natl. Historic Tr. *(proposed)**	Hiking	40.4 *(new trail)*

** This trail crosses all areas in the UTLA*

Turnagain Arm Sites: The next four sections (from Kern Creek to Peterson Creek) discuss trails and facilities along Turnagain Arm, which are summarized in Table 2.7 on page 42.

Kern Creek is the next area of use. There is an unmaintained trail to a small waterfall, which receives very little use. It is not labeled on any visitor maps and has no directional signs to inform people of its existence. There is no parking other than the highway shoulder, or at the Chugach NF entry sign. People have to cross the railroad tracks, although there is no officially designated crossing. There is also small but consistent use of the mouth of Kern Creek by people angling for salmon in late summer.

Peterson Creek: The next creek south from Kern Creek is Peterson Creek. There is a user-made target shooting area in an old gravel pit here. It is a neglected site. Although efforts to discourage target shooting through cleanup and rehabilitation have occurred, this site continues to be used for target shooting and remains in a degraded condition.

Hooligan Fishery: From this point south along Turnagain Arm, the most noticeable recreation activity outside of viewing scenery is the hooligan fishery (Figure 2.15). This activity occurs from late May through mid June. Most people park on the north-bound side of the Seward Highway. They have to then cross the two lane, 65 mph highway with nets, coolers and buckets to get to the fishing sites. There are no restroom or garbage facilities for people pursuing hooligan, resulting in human waste and garbage problems (Figure 2.16).

Figure 2.15. People dip-netting for hooligan next to Twentymile River.

Figure 2.16. Toilet paper alongside old highway segment near Twenty-mile River bridge.

Bore Tide: This extreme tidal change is one of the reasons why Turnagain Arm has Bore Tides (Figure 2.17), a natural phenomenon that attracts people to the area. There are several pullouts where the bore tide can be seen. The bore tide can distract drivers and add to safety concerns when there are pedestrians along the highway. Chugach State Park has some interpretive signs about Bore tides at pullouts north of Girdwood, but there is an opportunity for more information to be incorporated into sites the Forest Service might develop along Turnagain Arm.

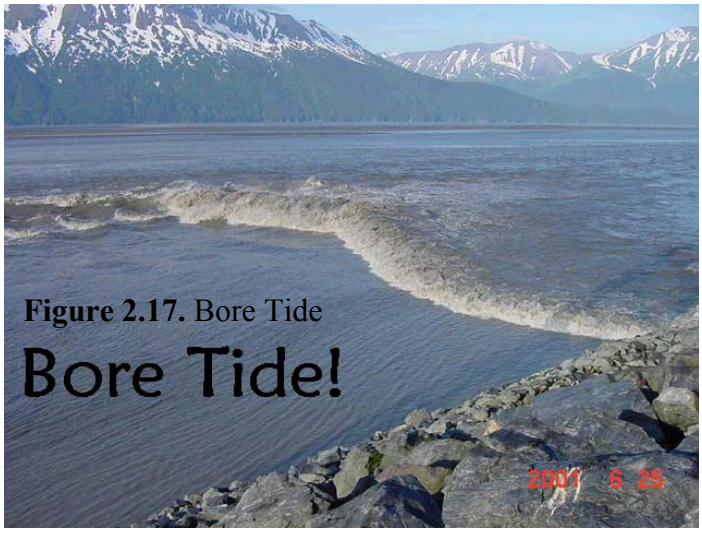

Figure 2.17. Bore Tide

The INHT proposal includes a bike path along Turnagain Arm from Girdwood to Ingram Creek. This section of highway will be reconstructed in the next decade, and the proposal on the Statewide Transportation Improvement Program includes the bike path. Three or four trailheads are planned in this section; they would be across the highway from the Girdwood Tesoro Station, the north edge of Twentymile Valley, and one or two sites near Ingram Creek. The Twentymile valley site could also serve as a hooligan parking. All INHT trailheads would include interpretive signs related to the trail.

Table 2.7. Summary of facilities and trails along Turnagain Arm.

Recreation Sites	Trails	Type	Miles
Peterson Cr. Target Shooting Area	Kern Cr. Loop	Hiking	
Eulachon Net Site	Peterson Cr. Tr.	Hiking	
20-Mile Boat Launch and Eulachon Net Site	20-Mile Homestead Tr.	Hiking	
Portage Creek Take Out			
Placer River Boat Launch			
Placer River Winter Trailhead			
Ingram Creek Fish Access			

Twentymile Valley: This is the next area to the south with concentrated recreational use. Currently, the river corridor is the only area receiving significant use in the snow-free season, while most of the valley floor is accessible during winters with adequate snow cover and freezing temperatures. Several snowmobile tour permitees operate in the valley, and a helicopter skiing permitee operates on some of the slopes in this vicinity. The Forest Plan has restricted winter motorized use to a corridor in the first 4.5 (approx.) miles of the valley from the highway. The INHT proposal includes a primitive trail up this valley and over a 2000' pass to the Winner Creek valley. A cabin proposed as part of the INHT approximately six miles in from the highway is also expected to attract many

more users to this area. The valley's swampy floor and its steep sided, forested slopes makes off-trail travel almost impossible in warm weather. The INHT in the upper valley will not be actively managed for winter uses because many avalanche chutes exist along the side slopes. Table 2.8 provides a summary of facilities and trails in the Twentymile area.

Table 2.8. Summary of facilities and trails in Twentymile area.

Recreation Sites	Trails	Type	Miles
	Glacier River	Boating	
	20-Mile River	Boating	

Portage Valley has many developed recreation sites and receives consistently high summer use. The Begich, Boggs Visitor Center (BBVC) on Portage Lake is devoted to telling the story of Glaciers and their effects on life and landscapes of the Chugach. The exhibits were recently refurbished, including many more cultural messages and updating exhibits to reflect current conditions. Up to 500,000 people a year visit the BBVC with 90% of this use between Memorial Day and Labor Day. An educational building to be located adjacent to BBVC has been funded and is in the design phase, to be constructed in the near future.

Portage Lake has been closed to boat use, primarily to provide a boat-free view of the lake for people viewing the movie at BBVC. The movie's end features the curtains opening to a view of the lake, which originally included a distant view of Portage Glacier. This closure restricts access to a large portion of the valley, since the shores of Portage Lake are either thick alder or so steep that walking is impossible or very difficult.

A valley-long trail (Trail of Blue Ice) is under construction. It will provide hiking opportunities that are accessible to people with disabilities and will link BBVC to campgrounds and day use areas in the valley. This trail is slated to become part of the IHNT, which is proposed to extend, as it did during the gold rush era, to Whittier, by way of Portage Lake and Portage Pass Trail. Another trail, in Bear Valley, has been proposed for development and is scheduled to have survey and design work done in 2007, with construction in the following year. It would be a short easy hike to a place with a view of Portage Glacier. See the facilities map for all the sites in the Valley (Figure 2.18). Table 2.9 provides a summary of facilities and trails in Portage Valley.

Some concerns in this valley are a lack of a consistent design theme on facilities; facilities with very high maintenance costs; trash and human waste; target shooting; and lack of RV dumps resulting in dumping along side roads.

Table 2.9. Summary of facilities and trails in Portage Valley.

Recreation Sites	Trails	Type	Miles
Moose Flats Picnic Area, Fishing Dock	Moose Flats Angler Tr.	Hiking	0.1
Alder Pond Fishing Site	Moose Flats Wetland Tr.	Hiking	0.2
Explorer Glacier Interpretive Site	Tr. of Blue Ice Ponds Loop	Hiking	1.3
Tangle Ponds Fish Site	Gary Williams Mem. Tr.	Hiking	0.1
Black Bear Campground	Byron Glacier Tr.	Hiking	0.8

Williwaw Campground, Fish Viewing, Ponds Trailhead	Portage Pass Tr.	Hiking	1.5
Begich Boggs Visitor Center	Tr. of Blue Ice *(under const)*	Hiking	5
Portage Creek Put-in	Glacier View Tr. *(proposed)*	Hiking	1.0
Gary Williams Memorial Trailhead	Portage Creek	Boating	
Portage Glacier Lodge (SUP)	Prtge-Bear Valley Water Rt.	Boating	
Byron Glacier Trailhead			

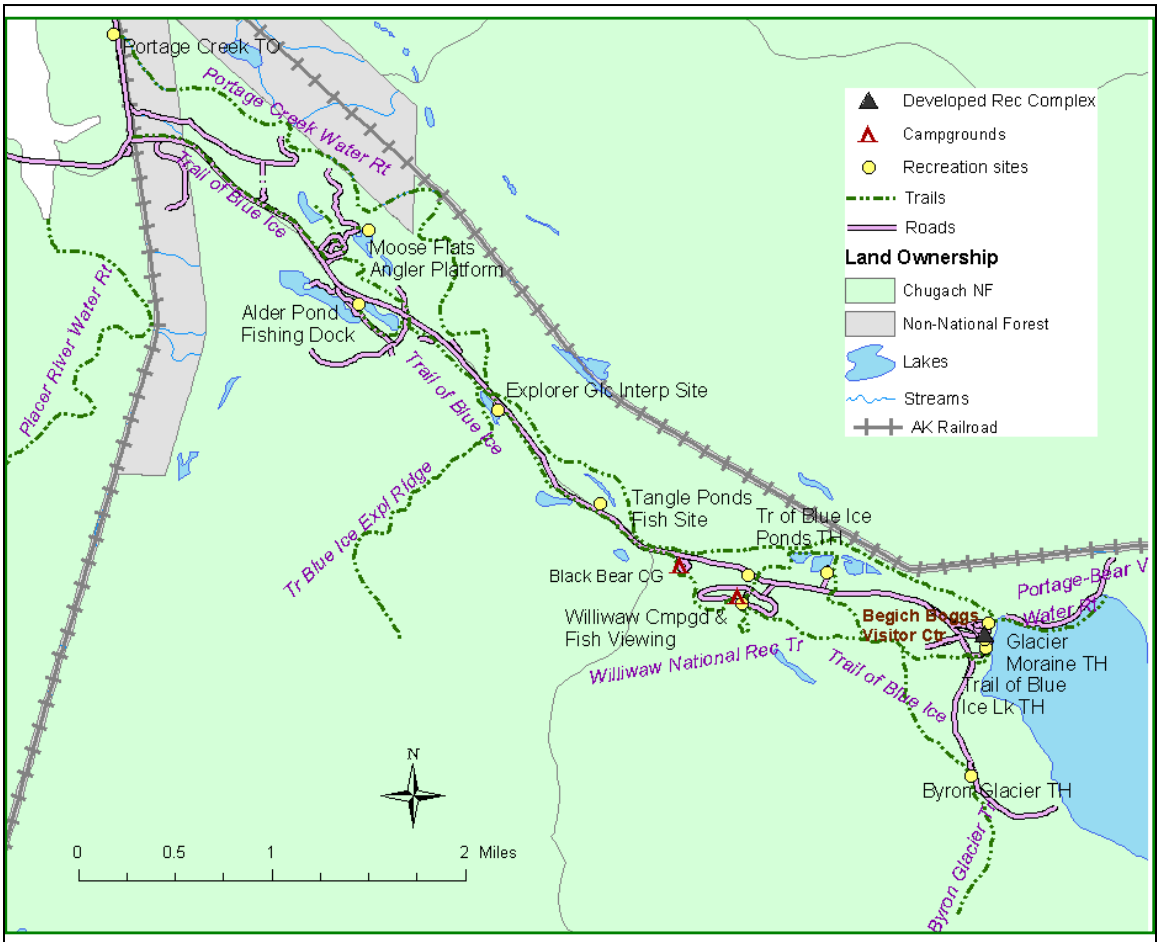

Figure 2.18. Map of trails and facilities in Portage Valley.

Placer Valley: This valley is similar to the Twentymile River valley, except that the Alaska Railroad goes up the valley and over to Moose Pass, providing more access and creating a more developed area. The Railroad will drop people off in the Grandview area (the divide between Placer and Trail River drainages) for alpine hiking and camping in a wilderness setting. The Forest Plan calls for a whistle-stop campground in the Grandview area. There are several new summer recreational uses provided by Special Use permitees. One includes a train ride to the Spencer Lake area and a short raft trip on the lake, then return by rail. Another is for snowmachine tours on Spencer Glacier this

summer, where clients come in via helicopter from Girdwood. A third new permit is for salmon fishing/sightseeing.

There are at least two salmon runs up the Placer, although they are not as popular yet as the runs up the Twentymile river. Anglers can access some of the sloughs by walking the railroad tracks. However, the Alaska Railroad owns the land 100' each side of centerline along the tracks, with a larger width in the areas near Turnagain Arm in both Portage and Placer valleys and they do not allow pedestrian access along the tracks. In addition, most of the rest of the valley bottom is wetland. The valley's sideslopes do not extend to the highway, and the wetlands make summer access to the sideslopes nearly impossible.

During winters with adequate snowfall, this valley has become very popular for snowmachiners to access the extensive icefields, via Spencer Glacier. Two snowmachine permitees include this valley in their operating area. A Helicopter skiing permitee also operates on some of the slopes in this vicinity.

There are currently few problems or issues relative to recreational use in this valley. If use increases with the development of Railroad-accessible facilities, management concerns will increase. For example, the need for adequate sanitary and refuse facilities would increase. One existing concern is the lack of adequate parking for snowmachiners. During the 2001-2002 winter, several weekend days saw over 100 vehicles parked in all the available turnouts, and some on the highway shoulders, between Twentymile Valley and Ingram Creek. Table 2.10 provides a summary of trails in Placer Valley.

Table 2.10. Summary of trails in Placer Valley.

Recreation Sites	Trails	Type	Miles
	Spencer Glacier Winter Rt.	Skiing	
	Bartlett Glacier Ski Tr.	Skiing	
	Placer River	Boating	

Ingram Creek: The lands on both sides of the Seward Highway (easily accessible for recreational use) are owned and managed by the State of Alaska as general-purpose lands. There is approximately one mile of highway within the UTLA area where National Forest lands are adjacent to the highway. People can cross state lands to access the National Forest. There are currently no facilities on National Forest land in the portion of Ingram Creek in the UTLA area. The Turnagain Pass rest areas are in the Six Mile Creek Landscape Assessment area.

The INHT proposal includes trails along both sides of the Seward Highway through this area; most would be on easements through the state lands. The NF would manage the trail and any associated facilities. On the west side of the highway, the INHT is proposed to be a winter-only snowmachine trail, on an easement through state lands, located just above the powerline, and essentially linking a series of muskegs to allow easy snowmachine use from Turnagain Arm to Turnagain Pass. On the east side of the highway, the INHT is proposed to have 2 year-round trails. One would stay on state lands, running between Ingram Creek and the Highway. There is an existing easement for this trail that was part of the conveyance to the State from the CNF. The other trail is proposed to be entirely on NF lands and would provide access to alpine areas. The INHT

proposal also includes an access trail from an existing highway pullout about halfway up to the Pass that would make it easier to hike this section in day-long segments. A cabin is proposed for a site in the sub-alpine near upper Ingram Creek on NF lands. One or two trailheads are included in the IHNT proposal for the Ingram Creek area. Only one would be needed if connecting trails are built to link all the areas without a surface crossing of the Seward Highway.

There are currently few problems or issues relative to recreational use in this area, although use may increase with the proposed developments. The proposed INHT trailhead(s) would include restrooms to help accommodate this increase. The popularity of this area for winter sports of all types invites conflicts between the various user groups. This conflict would continue and grow as use increases. A potential for conflict may be bear baiting on state lands. The proposed IHNT would close the area within 1/4mile of this trail to bear baiting stations. There are many stations set up in this area each year that would no longer be legal.

Seattle Creek: This area receives moderate winter use, and is an area of wildlands within relatively easy access, much of it now state managed as general purpose lands, and more selected by the state for its potential for winter sports development. Currently there are no existing or proposed facilities. There is use by experienced snowmachiners riding over from Turnagain Pass area to both machine and do other winter activities. Non-motorized recreationists have expressed issues and concerns regarding motorized recreation.

Recreation Opportunity Spectrum (ROS)

ROS provides a framework for stratifying and defining classes of outdoor recreation environments, activities, and experience opportunities. The six original classes of the ROS are: Primitive (P), Semi-Primitive nonmortized (SPNM), Semi-Primitive motorized (SPM), Roaded Natural (RN), Rural (R), and Urban (U). The Chugach National Forest has added another class, semi-primitive nonmotorized summer, motorized winter (SPNMA). The amount of the UTLA in these 5 ROS classes is shown in Table 2.11 and Figure 2.19. Definitions for the ROS classes are in Table 2.12.

Table 2.11. Acres by ROS.

ROS Class	Acres	% of NF Land
SPNM	85,577	27
SPNMA	55,957	18
SPM	159,722	51
RN	9,505	3
R	433	0.1

The SPM areas allow **summer motorized activity** under two scenarios:

1) On designated routes or helicopters (area surrounding Eagle Glacier Nordic Training Center and area within 1 mile of the Seward Hwy)
2) Helicopters.

The SPM and SPNMA areas both allow **winter motorized activity**, with adequate snow cover. Together they make up 69% of the NF lands in UTLA. Access into approximately half of the winter motorized area is very challenging by any means outside of helicopters.

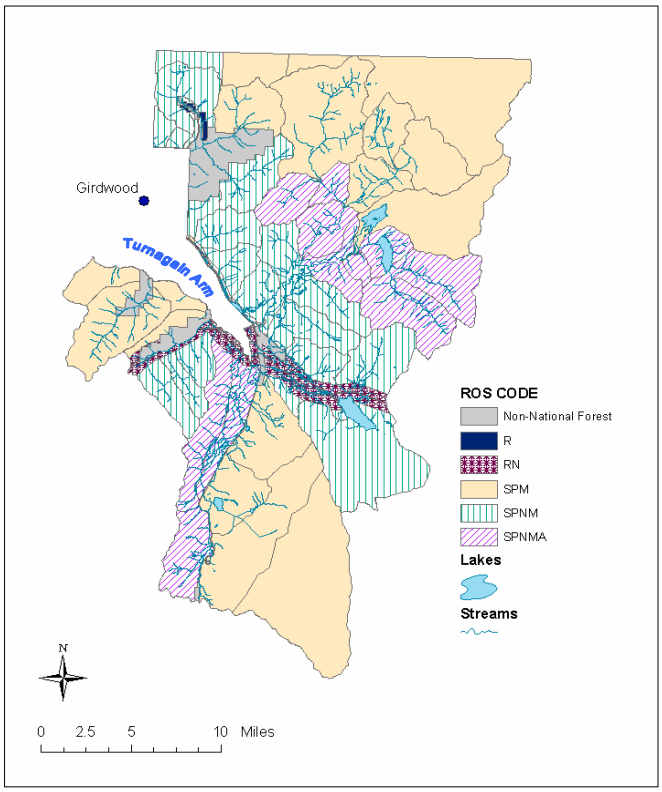

Figure 2.19. Map of ROS classes in the UTLA area.

Both Twentymile and Placer rivers flow through SPNM or SPNMA ROS classes. They both receive consistent motorized watercraft use throughout much of the summer, especially during salmon runs in August and September. The SPNM designation for these areas does not apply to watercraft. Noise from motors will be present near these rivers.

Table 2.12. ROS Class Definitions.

ROS Class	Solitude	Encounters on trails	Encounters off trails	Max. party size	Level of challenge	Develop-ments
SPNM	High-Moderate	<15/day; <3 camps within site or sound	<6/day; no camps within site or sound	24	High-Moderate	Cabins, prim. Cg, no fake materials
SPNMA				24S; 30W		
SPM	Moderate			30		
RN	Moderate-Low	>15/day		NA	Moderate-Low	Cabins, rustic lodges
R	Very Low	NA	NA	NA	Very Low	Comfort & convenience

Lands and Special Uses

There are a number of recreation and non-recreation special use permits authorized in the UTLA area. There are a total 56 outfitter/guide permits, of which 6 are administered by the Seward Ranger District. There are a total 22 lands and other permits, one of which is administered by the Seward Ranger District. Table 2.13 displays the activity by area for outfitter/guide permits. Table 2.14 displays the activity by area for Lands permits.

Table 2.13. Outfitter/Guide permit holders

Use Area	Permit Holder	Activity Type
Glacier Creek/Eagle River	Misty Mountain	ski touring
	Alyeska Dogteam Adventures	Glacier Dogsled Tours
	Ryan Recreation	Paragliding
	Alpine Air	flightseeing/landing
Placer	Alaska Snow Safaris	snowmobile tours
	GCST	snowmobile tours
	Class V	rafting
	Garrett's Angling Adv.	fishing and motorized boat tours
	Snow Dynamics	motorized avalanche courses
	Wilkinson	canoeing and skiing
	CPG	heli-skiing
	Alpine Air	flightseeing/landing
Portage	Bus Permits (41)	BBVC and day use sites in Portage Valley
	Ascending Path	ice and rock climbing instruction, mountaineering, and hiking
	AK Two Legged Tours	Hiking
(admin. by Seward)	AK Outdoors	Hiking
(admin. by Seward)	Austin-Leman Tours	Hiking
	Class V	rafting
(admin. by Seward)	Get Up and Go Tours	Hiking
	Misty Mountain	hiking and ice climbing
	UAA	hiking
	Wilkinson	Canoeing, hiking, ice skating, skiing, camping
Turnagain Arm	Alaska Snow Safaris	snowmobile tours
	GCST	snowmobile tours
	AK Two Legged Tours	Snowshoeing
	AK Mountain Safety	Avalanche Courses
	Misty Mountain	Snowshoeing
	Snow Dynamics	motorized and non-motorized avalanche courses
	UAA	Hiking and camping
(Admin. by Seward)	Victor Emanual	Hiking
Twentymile River	Alaska Snow Safaris	snowmobile tours
	GCST	snowmobile tours
	Hope Fishing Charters	fishing (motorized boat)
	Ryan Recreation	motorized boating, rafting, fishing
	Misty Mountain	ski touring

Table 2.13. Outfitter/Guide permit holders		
Use Area	**Permit Holder**	**Activity Type**
	CPG	heli-skiing
Crow Pass	Ascending Path	Hiking, mountaineering, backcountry skiing
	Wilkinson	Hiking
	UAA Experiential Ed.	Hiking and camping
(Admin. by Seward)	Turnagain Trails	horseback riding
	Misty Mountain	Hiking
	AK Two Legged Tours	Hiking
	UAA Athletics	foot race
	Adventure Treks	Hiking
	AIE	Hiking
	A&P	Hiking
(Admin. by Seward)	Askja Reizen	Hiking
(Admin. by Seward)	Austin Leman Tours	Hiking
(Admin. by Seward)	Get Up and Go Tours	Hiking

Table 2.14. Lands and other uses permit holders.		
Use Area	**Permit Holder**	**Activity Type**
Glacier Creek/Eagle River	Alaska Pacific U.	Eagle Glacier Nordic Training Center
Portage	Portage Glacier Lodge	Concession/Lodge
	Westours (Portage Glaicer Cruises	Lake Boat Tour
	Big Game Alaska	road sign
	Scott Shelley	Road to property
	Walter Kjera	Road to property
	USGS	Earthquake Research Study BBVC
	NOAA	Weather modification device
	Myron Rosenberg	Photography
	FAA	Navigational Equipment
Turnagain Arm	AK Women's Retriever Club	Dog Trials
	Midnight Sun Gun Assoc.	Dog Trials
	Retriever Club of AK	Dog Trials
	Greater Anchorage React	Highway Safety Coffee Stop
	Sean Dewalt	Snow Research Study Site
Twentymile River	Leslie Maxwell	Isolated Cabin
	Samuel Maxwell	Isolated Cabin
Crow Pass	UAA Athletics	Foot Race
Multiple Areas	Alaska Railroad	blaster boxes, avalanche detection devices, weather stations
(admin. by Seward)	Chugach Electric	Powerline
	Alaska Locations	Photography
	Scout Alaska	Photography

CHAPTER 3 - KEY QUESTIONS

Following are key questions identified by the interdisciplinary team. The purpose of identifying key questions is to focus the analysis on the key elements of the ecosystem that are most relevant to management questions and objectives, human values, or resource conditions with the assessment area.

Physical

What are the effects of human activities, structures and modifications on bank stability and erosion processes? Are there risks to facilities, recreation areas, transportation routes and other infrastructure as a result of erosion or potential bank instability, particularly as related to flood events?

This key question relates to bank and riparian damage from uses such as boating, hiking, and fishing. This issue also explores both natural and human-caused streambank erosion processes and potential threats to facilities, roads, and structures built in the valley floors. Past changes and potential future changes are evaluated using aerial photography. The effects of human activities on erosion processes are minimal at this time because of the inaccessibility of most of the study area, with the exception of Portage Valley. As access increases with the introduction of trails so will the disturbance of the natural vegetation along the sideslopes and stream banks. Monitoring of these areas should be conducted in order to assess any degradation to the vegetation and soils. The effects of human activities on streambanks as well as flood hazards can also be evaluated using an EMDS/NetWeaver knowledge base.

Natural factors largely control the hydrologic processes in the UTLA area. Although much of the analysis area is remote and inaccessible, human activities and resource management can have variable effects on water resources in the developed areas, including the area around Girdwood, much of Portage Valley, and the highway and railroad corridors. Management can influence some of the factors identified as key questions and determine the degree to which they influence water resources.

Effects of human activities on stream bank erosion:

The degree of susceptibility to stream bank erosion from human activities is related to channel type (USDA Forest Service, Alaska Region, 1992). The vegetated banks of Estuarine (ES), Floodplain (FP), Alluvial Fan (AF), and some Glacial Outwash (GO) channels are highly sensitive to stream bank erosion from activities such as hiking, fishing, boating, and camping. Riparian soils can become compacted by human trampling, leading to damage and loss of riparian vegetation, physical bank erosion, decreased bank integrity, and increased sediment loads. Erosion from waves generated from motorized boat traffic can also damage stream banks. Although floodplain channels naturally migrate and meander across valley floors, stable, vegetated banks reduce the sediment loads carried by these streams. Human activities have little effect on large, braided glacial outwash channels because of their very high natural migration rates.

The degree of bank damage from human activities is related to the proximity to roads, trails, and recreational facilities. Areas most affected include much of Portage Valley, the lower several miles of the Twentymile and Placer Rivers, and some of the tributaries to Glacier Creek. With the exception of Portage Valley, where recreational use is heavy, the degree of bank damage from human uses is minimal, but will increase with increased use in the future. Twentymile Valley will become accessible to foot traffic with the construction of the proposed Iditarod National Historic Trail. This and increased boat traffic will lead to increased fishing use and the potential for further bank degradation. A commercial boating operation on the Placer River may contribute to increased bank damage and erosion in places. Human manipulations of beaver populations also have considerable effects on bank erosion and channel stability, as blown out beaver dams result in highly dynamic channels. Information concerning bank erosion caused by human disturbances is very limited throughout the analysis area, and no studies have been conducted to measure any effects of these activities.

Effects of structures and modifications on bank stability and erosion:

Portage Valley demonstrates the effects of road and railroad construction in a dynamic valley floor. Historically, Portage Creek migrated back and forth across the valley floor, bounded by the valley walls. The construction of the Alaska Railroad and the Portage Glacier Highway confined the river to a width about half that of the original valley. As the river continues to migrate between the railroad and the highway, it threatens to erode the railroad and highway at meander bends. Where Portage Creek is adjacent to the railroad or highway, it has no riparian zone, and the bank must be artificially reinforced. Management cannot stop the dynamic channel migration that occurs in Portage Creek, although the channel and floodplain continue to stabilize as long as Portage Lake catches the majority of the sediment derived from upstream glaciers.

Risks to facilities, recreation areas, and transportation routes:

Most of the recreation areas, many facilities, and 2 transportation routes are located in Portage Valley, an area that is highly susceptible to flooding and dynamic channel changes. Migrating meander bends in Portage Creek threaten both the Alaska Railroad and the Portage Glacier Highway. The meander bend at the USFS Work Center upstream of Moose Flats currently flows adjacent to the highway, and high flows may cause further erosion and damage as the channel continues to migrate toward the road. Efforts can be made to reinforce banks where meander bends are eroding into the road and railroad, although the meander bends will generally continue to migrate, increasing the length of the channel adjacent to the road or railroad, and increasing the need for additional bank reinforcement. Eventually, the channel will shift away from the road as it shifts into a new meander bend.

Flooding and dynamic channel changes that occur during flood flows on Portage Creek can affect some of the recreation areas in Portage Valley. During the 1995 flood, Portage Creek overtopped its bank at the meander bend upstream of Moose Flats and nearly created a new channel along the abandoned airstrip and through the gravel extraction ponds at Moose Flats (Figure 2.4). This would have damaged the recreation area and destroyed the fishing ponds. Future dynamic channel changes are likely to occur on

Portage Creek during high flows. Management activities can limit development in the active floodplain between the highway and the railroad. Gravel pit excavations in these areas increase the possibility of stream capture.

Bank erosion on the northwest shore of Portage Lake at the Begich Boggs Visitor Center is also a concern during periods of high water in Portage Lake. High water can cause flooding at the visitor center, and the dramatic reduction in the number of icebergs in the lake since about 1993 has resulted in increased bank erosion from wind-driven waves. Riprap placed offshore in front of the visitor center, designed to dissipate some of this wave energy following the 1995 floods, controls this erosion to some degree. Bank erosion also occurs along Portage Creek just downstream of the lake outlet. Although management activities cannot control the magnitude of the waves on Portage Lake, continuing efforts can be made to provide reinforcement of the northwest bank and dissipate wave energy to minimize bank erosion.

What is the study area's capacity for production of common variety minerals? Does gravel pit development in valley bottoms impact hydrology?

Aggregate (sand, gravel, and crushed stone) is a non-renewable resource. However, on a worldwide scale, the potential supply of aggregate resources is so large, there is no real concern about running out. But natural aggregate of suitable quality for an intended use can be in short or non-existent supply on a regional or local scale. In the realm of sustainability, having an accessible local supply of aggregate resources takes on great significance because transporting aggregate long distances not only adds to the overall cost of the product, but also adds to the overall cost to the environment.

Despite society's dependence on natural aggregate, urban expansion often works to the detriment of the production of those essential raw materials. "Resource sterilization " occurs when the development of a resource is precluded by another land use. For example, aggregate resources that exist under a housing development or shopping center would not be extracted. This has occurred in Portage Valley and the issue has been brought up at the Spencer Quarry site. The competing resource uses are recreation development and aggregate production. Several aggregate pit sites in Portage Valley have been intentionally planned and converted into recreation use areas. These sites are Moose Flats, Tangle Pond, Alder Pond and Williwaw Spawning Channel. It is unlikely future aggregate production will occur near these recreation use areas as industrial activities are generally not considered compatible with outdoor recreation. Recreational opportunities at the Spencer Quarry site have been under discussion recently. Recreational outfitters and guides are currently utilizing the quarry. If the quarry is to remain an active aggregate production site, recreational use will have to be carefully controlled and maintained at a level that will not have significant effects on production.

The Glacier Ranger District currently has three approved aggregate production sites. Two of them, previously mentioned, are within the UTLA. The third is the Mile 62 pit site near Turnagain Pass. There has been a consistent demand from local and regional contractors needing aggregate for projects as far away as Homer. The Spencer quarry provides a source readily available for shipment on the Alaska Railroad. Portage Valley

continues to be an active source of aggregate production. In 2002, over 50,000 tons of aggregate was sold from the Williwaw pit. A significant portion of the aggregate was used to repave a section of the Seward Highway from Girdwood to Ingram Creek. In 2003, approximately 40,000 tons have been sold from the pit. Project use includes airstrip reconstruction, wildlife park development, road construction, sewer and water line fill, and trail construction. Much of this aggregate is transported to Girdwood. Government and private permit holders use the pit. Local contractors provide the local communites with readily available aggregate from the Williwaw pit. The total number of users benefiting from this aggregate pit is unknown, though it clearly is an important local community resource.

The quarry site at Spencer Glacier should have a production life of 10 years or greater. Production timing and length will depend on future land management planning decisions. The production life of the Williwaw pit depends on the intensity of requests for aggregate. The pit has been operating for three seasons. Roughly, one quarter of the available planned aggregate has been removed prior to July 2003. It is likely the pit will remain open for the next 5 years. Predicting aggregate needs locally is difficult. Past production rates are not a good measure. Local contractors' need of a few thousand tons annually is a reliable estimate. Government financed projects typically utilize greater quantities but requests are sporadic and depend on more complex budget protocols prior to initiating a production operation. These requests are not at all predictable.

Market forces demand the available aggregate be located near an existing transportation route. The Williwaw pit is within one-quarter mile of the Portage Highway and the Spencer Quarry is within one mile of a railroad siding for loading. There is no reasonable transportation route within the Twenty-Mile Valley, as no road exists except the Seward Highway that was built on aggregate fill to cross the wetlands and tidal flats of upper Turnagain Arm. In lower Placer Valley the situation is the same as the Twenty-Mile Valley. The Alaska Railroad maintains an active rail-line through Placer Valley, much of it also on fill as it courses through wetlands. As the rail-line nears Spencer Glacier it sits on uplands where the Spencer Quarry is located. There is now a road and rail-line through Bear Valley ending in Whittier. Bear Valley has been utilized for limited quantities of aggregate to construct the short span of rail-line the roadway within the valley. Aggregate is readily available within the Valley a short distance from both rail and road.

Aggregate is available within the Anchorage bowl 40 to 50 miles from Girdwood. Aggregate on the Forest competes with the available material sources in Anchorage for uses in Girdwood. Portage Valley is 20 miles from Girdwood; therefore haul costs are a significant consideration for contractors to determine where to get aggregate. Portage Valley aggregate is sold as "pit run" or in an "as is" condition. Contractors must process it themselves (crush, screen, etc) to meet various project specification. If processing is necessary they must bring in specialized equipment to produce the product they want. This adds additional costs to the aggregate. Processed aggregate is available in Anchorage and is often selected for projects in Girdwood even though the haul costs are higher. Companies such as Anchorage Sand and Gravel can produce specific aggregate types at their facility and load trucks in Anchorage efficiently. Portage Valley aggregate

is rarely hauled into Anchorage, as local Anchorage sources are readily available and much cheaper.

Gravel extraction influences the hydrology of an area. As gravel pits fill with groundwater to form ponds and wetlands, they can affect the elevation of the water table, groundwater dynamics, streamflows, and water quality. Specifically in Portage Valley gravel pit development can influence groundwater dynamics. Groundwater moves relatively quickly down-valley, decreasing in speed with decreasing grain size. Gravel extraction pits expose the shallow water table, and groundwater moves more quickly through the excavated pits because they provide less resistance to flow. As a result, gravel pits draw groundwater from all directions, which can cause this water to concentrate at the surface in these areas. Little data on water table elevation are available for Portage Valley, although several monitoring wells were established in 2002 upstream of Williwaw Campground.

What are the avalanche hazards to people and facilities throughout the study area?

Avalanches commonly occur throughout most of the analysis area. Avalanches can potentially cause damage to recreation areas, trails, roads, and facilities, and avalanche danger exists in backcountry ski and snowmachine terrain throughout the analysis area. This key question addresses avalanche hazards as related to winter human uses and the locations of developed areas. Aerial photography, historical accounts, and snowpack and weather data can be used to identify avalanche-prone areas. An EMDS/NetWeaver knowledge base can also be used to identify particular areas of concern.

Risks associated with avalanches exist in areas that have high avalanche potential and frequent winter use or human development, including those areas used for winter backcountry recreation, developed recreational areas and facilities, and roads and railroads. Avalanches in the numerous inaccessible backcountry areas that receive little or no winter use are of little concern. Avalanche danger can persist well into June in areas such as Byron Valley, creating unrecognized hazards to trail users. Management will have no effect on avalanche occurrence, as most avalanches occur naturally, and the amount of avalanche activity is not likely to change dramatically in the future. However, management activities can limit construction in avalanche prone areas and provide additional avalanche education for backcountry users.

There are several trails and facilities that are located within areas where avalanches have occurred in the past, listed below:

- Crow Pass Trail
- Winner Creek S Branch Trail
- Byron Glacier Trail
- Proposed Iditarod National Historic Trail and Trailhead (MP 3.9 Crow Creek Rd)
- Williwaw Campground, Fish Viewing, Ponds Trailhead
- Portage Pass Trail
- Trail of Blue Ice (under construction)
- Turnagain Pass Winter Non-motorized/Motorized Use Areas

The Chugach Avalanche Center will help keep winter recreationist informed of current snowpack conditions. More staff out in the field can also help inform people of the hazards and hopefully reduce the occurrence of avalanche fatalities.

Biological

Are there small, vulnerable stocks of fish in the study area drainages that may be susceptible to increased guided and recreational fishing, development, and management practices?

There are no threatened or endangered fish species in the UTLA area. However, there is concern that the small populations of chinook salmon in the Twentymile River watershed and Glacier Creek watershed may be distinct stocks that are susceptible to increasing angler use and future management practices. A distinct stock is a randomly mating group of a particular species that maintains temporal, spatial, and behavioral integrity through local adaptations and restricted gene flow.

Very little is known about the spatial and temporal distribution, relative abundance, and habitat use of chinook salmon in these two watersheds. Anecdotal information and mail-in angler surveys indicate these populations exist but scientific documentation is very limited. ADFG conducts aerial escapement counts for coho salmon in the Twentymile Watershed but these do not occur until well after the chinook salmon have presumably spawned. USFS crews have been limited in their efforts to obtain index counts of these stocks because of the difficult access to nonturbid "countable" streams in these watersheds. Fish counting weirs can provide relatively reliable data on species presence, run timing, and abundances of adult fish entering streams; however, no such data could be found for Twentymile or Glacier River.

The best information source available to address this key question is a mail-in angler survey conducted by ADFG. Questionnaires are mailed annually to a randomly selected list of Alaska sportfishing license holders and they are asked to answer questions pertaining to their sportfishing effort. Unfortunately, these surveys are mailed out five to eight months after the end of the primary sportfishing season (fall) and participants are asked to remember how many times they fished, where they fished, how many fish they captured, and how many fish they harvested. If enough anglers respond for a particular river or lake, estimates are generated to address angler effort, catch, and harvest for that system. Because of the delay between the survey and the actual sportfishing, results will likely be broad estimates but it is felt they will still provide reasonably accurate trends.

Enough survey responses were received for both Twentymile River and Glacier Creek to generate catch and harvest estimates for chinook salmon for the period of 1990 to 2000. During this 11- year period, chinook salmon sportfish catch tended to increase, with the largest catch in both Twentymile River (129 chinook) and Glacier Creek (20 chinook) occurring in 2000 (Figure 3.1). The survey also revealed that no chinook have been harvested in either stream except in 1991 when it was estimated that six chinook salmon were harvested in Twentymile River.

An estimate for sportfishing effort (angler-days) has been generated for Twentymile River; however, enough responses were not received to estimate use on Glacier Creek. Since 1990, angler use on Twentymile River has fluctuated annually but there appears to be a slight decreasing trend (Figure 3.2). This may be a result of the growing popularity of the nearby Bird Creek coho salmon fishery that has been maintained by annual stocking efforts of ADFG since 1992. Because of the high rate of success for anglers in this stream and the close proximity to Anchorage, this fishery may be reducing angler pressure on other streams.

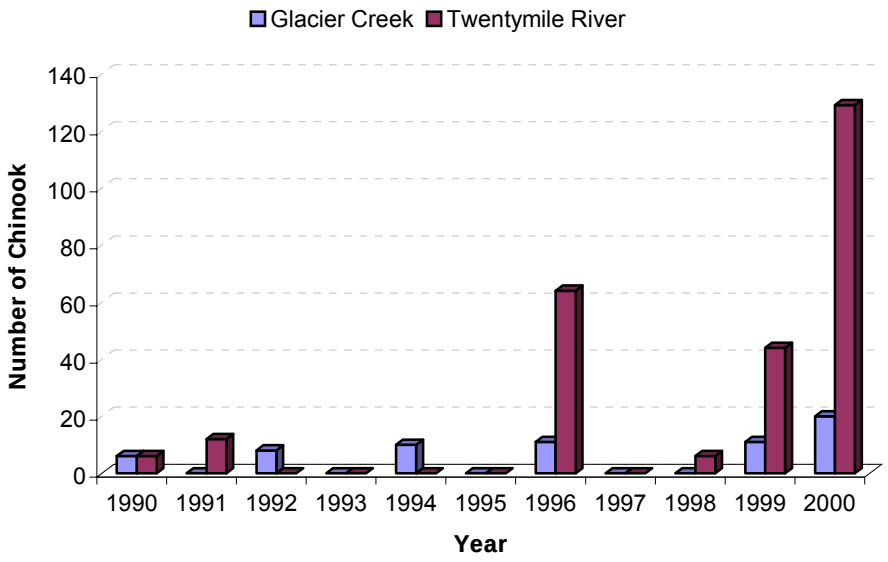

Figure 3.1. Estimated sportfish catch of chinook salmon in Twentymile River and Glacier Creek, Alaska for the period of 1990 – 2000.

Although angler use does not appear to be growing rapidly on Twentymile River, the number of chinook salmon caught by sport anglers in Twentymile River and Glacier Creek is increasing. Incidental chinook catch by sport anglers while fishing for other species is undoubtedly a concern. Twentymile River has a native run of coho salmon that enters the river in mid-July while chinook salmon are still in the river. This early run of coho salmon experiences heavy fishing pressure that puts the chinook salmon at risk of incidental catch. Even though these chinook salmon should be released back into the river, they are still susceptible to stresses associated with being captured and immediate or delayed mortality could result.

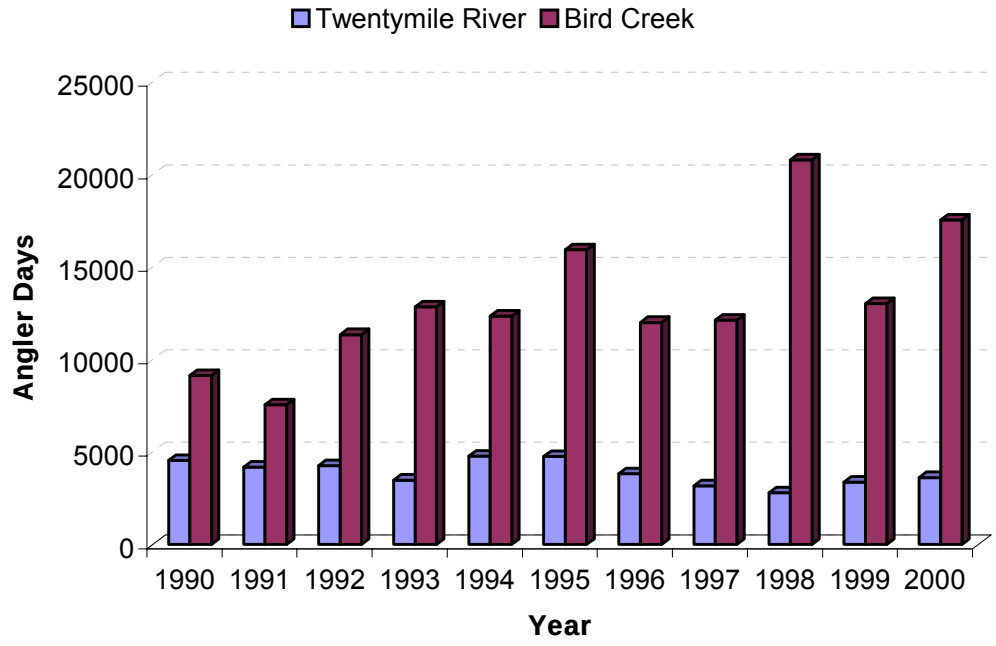

Figure 3.2. Estimated angler use (angler-days) for Twentymile River and Bird Creek, Alaska for the period 1990 – 2000.

Do opportunities exist for introduction of new species to waters within study area and what are the potential impacts of any introduced fisheries?

Recreational fishing is a very popular activity for both residents and visitors of Alaska and demands for quality fishing opportunities continue to grow. Introducing a new fish species to a body of water in the UTLA area can have several positive aspects that could create, enhance, or diversify a quality experience on the Chugach National Forest. Several streams in the analysis area do not have large, fishable populations of sportfish or have large populations of certain species but not others. By introducing a new species of fish or enhancing an existing smaller population, resource managers can create a recreational fishery where one did not exist or conditions are insufficient to support a healthy wild population large enough to sustain a quality recreational fishery. These management actions can expand the range of "desirable" species and help recruit anglers to streams and lakes of the Chugach National Forest.

Additionally, artificial fisheries can also play an important role in redirecting harvest-oriented fishing effort that might otherwise exploit wild fish populations. By creating a productive fishery in designated streams, lakes, or ponds, these artificial fisheries can increase angler catch rates and absorb the desire of anglers to harvest fish in a natural setting. These benefits can play a large part of wild fish preservation on the Chugach National Forest considering the close proximity of the UTLA area to the city of Anchorage.

However, introducing a new fish species to a pond, lake, or stream can have detrimental effects on wild fish populations as well as other aquatic and terrestrial organisms (Taylor et al. 1984; Leary 1991; White 1992; Van Vooren 1995). Most introduced species will be at a disadvantage when placed in an environment that they did not previously exist. They do not have the benefit of previous generations passing on local genotypic and phenotypic adaptations needed to survive and reproduce in that particular environment. But sometimes these exotic species may find the new conditions favorable enabling them to proliferate and interact with the native species. These interactions can cause many biological problems including competition, displacement, predation, disease transmission, and altered genetic structure of wild stocks through interbreeding. Because fisheries managers today have a much better understanding of these impacts and interactions associated with native and exotic fish, species introductions are critically evaluated to determine if any short-term gains will be worth the long term risks.

Fisheries managers also need to be extremely careful that they do not pass on to the public the misconception that species introductions are an acceptable alternative to habitat protection and restoration. Forest users may be mislead into thinking healthy watersheds are not as important to maintaining a quality recreational fishery if we can always produce plenty of replacement fish artificially. This impression may divert public attention and needed funds away from our efforts to effectively manage our natural fisheries resource on the Chugach National Forest by protecting, restoring, and enhancing aquatic habitats.

Are human uses, activities and infrastructure impacting wildlife species of local interest and/or management concern in the study area? Are wildlife species coming into conflict with human uses including recreational use, facilities development and subsistence?

Recreational activities can result in the direct loss of wildlife habitat through infrastructure and facility development, displacement from important habitats, and disturbance of wildlife species.

Infrastructure and Facility Development:
Facility development and the resulting increased numbers of recreationists supported by such facilities may adversely affect habitat and individuals. By altering natural habitats facility development may decrease forage and cover opportunities resulting in greater potential for decreased resources and increased predation. Increased human activity at facilities may also displace individuals from species negatively impacted by human presence and increase densities of species that benefit from human presence. Either result can have negative consequences for species richness, abundance, and community composition by altering competitive, facilitative, and predator-prey relationships (Knight and Gutzwiller 1995). Species potentially impacted by facility development include the brown bear, wolves, wolverine, lynx, Northern Goshawk, landbirds, shorebirds, moose, and to a lesser extent, goats.

The analysis area includes one of the most highly visited sites on the Forest at Portage Valley. A diversity of recreation use, activities, and supporting infrastructure exist within Portage Valley (Figure 2.18), which is only 50 miles from Anchorage, with a population close to 300,000. Recreationists regularly use Portage Valley and those areas accessible via the Seward Highway throughout the year. Concerns may occur from further facility development within Portage Valley as well as existing highway, railroad, and private land development by potentially disrupting migration of brown bears, wolves, wolverines, and lynx into and out of the Kenai Peninsula (USDA Forest Service 2002a).

Development of trails may indirectly impact wildlife by allowing easier access to hunters and trappers. Potentially impacted species include wolverines, wolves, and lynx.

A specific area of concern for the goshawk may be development in the vicinity of Johnson Pass Trailhead and the Granite Creek Campground where a nesting pair has been regularly seen since 1998. This area is just south of the analysis area. Impacts to goshawks may occur when hiking trail expansion penetrates remote and dense forest stands. Possible examples from the analysis area include the expansion of the Winner Creek Trail and the development of the Iditarod National Historic trail. Individual northern goshawks have been regularly seen in the forested lands in the vicinity of Winner Creek.

Of additional concern would be fragmentation of late seral habitats in the analysis area supporting specialist landbird species. Such activity could reduce habitat quality by introducing competitors and nest predators (Knight and Gutzwiller 1995). Such impacts to habitat may be especially detrimental in Portage Valley, which is used by a variety of migrating landbird species and is also the focus of most existing and proposed recreation facility development within the analysis area.

Shorebirds concentrate at the mouths of Portage, Placer, and Twentymile valleys as well as in tidally inundated ponds adjacent to the Seward highway from late April through mid May and September through mid October. Hundreds of migrants from 6-8 species congregate there. Potential concern would come from development of facilities that would alter the character of wetland and lowland habitats that currently support seasonal aggregations of these species.

Moose may be negatively impacted by a loss of winter habitat if facilities construction removes habitat features resulting in a loss of foraging opportunities of cover. Negative impacts may also occur if moose are subject to displacement that results in a drain on energy reserves. Because they are often in an environment where snow is deep, flight during winter months can be energetically costly. The literature indicates flight and stress are most likely when the source of the disturbance is unpredictable, severe to sensory perception, and in close proximity. There is also the possibility that if disturbances are not of this nature, moose may habituate to human activities and show high tolerance. Moose may even seek centers of human activity as security from predators (Giest 1971).

Facility development is unlikely to have a major impact on goats. Currently the only existing trail within the analysis area that passes through goat habitat is Crow Pass Trail.

Additional development of alpine trails or recreational facilities may increase goat disturbance and displacement resulting from human encounters during summer months.

The majority of negative human-bear (primarily black bear) interactions occur on private lands in and around the community of Girdwood, but USFS and ADFG officials have responded to complaints within developed facilities in Portage Valley and Turnagain Pass. Increased facility and access development within the analysis area, particularly in lowlands associated with salmon spawning streams, has the potential to increase negative bear and human encounter. In recent years efforts have been made within developed areas of the analysis area to ensure proper food and garbage storage as well as bear awareness among recreationists.

Summer Recreation:

The most constant human presence within the analysis area is likely to occur during the summer months (approximately June-September). However, the majority of this activity is restricted to within a short distance of the Seward and Portage highways, generally termed *front country*, as dense vegetation and rugged terrain features make much of the area inaccessible to the majority of recreational users. Additional summer access is possible for boat-based recreationists along the river corridors of Twentymile, Portage, and Placer. However, this use is also generally restricted to within a short distance of the waterway because of dense, wetland vegetation and rugged terrain features.

Recreation in the major valley bottoms (Twentymile, Portage, and Placer) has the greatest potential to impact a variety of wildlife species. For example, brown bears are relatively rare within the analysis area but they tend to concentrate along salmon streams during late summer. This is often the season of highest human use in these areas, especially anglers, and the location of most CNF facility developments (USDA Forest Service 2002a). Activities like establishment of new fisheries, development of boat launch facilities, and commercial boat-based operations all have potential to increase human densities and thus bear-human interactions along these river corridors.

These valley bottoms are also important habitat for breeding and migrating ducks, geese and swans. Many hunting opportunities exist in the in portions of these drainages within a couple miles of highway systems and river corridors. The head of Turnagain Arm receives a fair amount of hunting use as a result of its close proximity to a large waterfowl hunting population in Anchorage. Of potential concern is the unknown magnitude and extent of hunting within these areas. Comments received in support of the UTLA indicate an interest in continued and increased waterfowl hunting opportunities in Twentymile, Portage and Placer Valleys.

As many as 100 bald eagles congregate at the confluence of Twentymile, Portage, and Placer rivers during the eulachon run (mid-May through the end of June). Preliminary surveys show the majority concentrates on the first six miles of Twentymile feeding on Eulachon and roosting in cottonwoods and along the riverbanks. One year of disturbance trials show that approximately 80% of individual eagles along this stretch of river elicited some overt disturbance response to upstream motorized boat traffic (USDA Forest Service unpubl.data). Currently little information exists regarding the type and magnitude of boat traffic in the Twentymile system during this time of year. Increased

users on this system have the potential to disrupt Bald Eagle feeding activity at this important seasonal site.

Trumpeter Swans have documented sensitivity to a variety of human recreational activity (Henson and Grant 1991, Shea 1979). They are only present in the analysis area during summer months, approximately May through September, and are only known from Ingram Ponds. A small amount of canoe-based recreation occurs within these ponds and has coexisted with a pair of nesting Trumpeter Swans since at least 1998 (pers. obs.). Assuming recreation in the Ingram ponds complex does not increase greatly in magnitude, or taken on a more disruptive character, there appears to be little threat to this species from recreation within the analysis area.

Winter Recreation:

Winter season (approximately December through April) supports the farthest-reaching recreation as deep snow and frozen bodies of water allow easier access into backcountry areas. Winter recreation within the analysis includes, snow machining, heli-skiing, cross country skiing, telemark skiing, snowboarding and snow shoeing. This dispersed recreation has the greatest potential to reach remote areas of the analysis area and potentially overlap with important wildlife habitats. This is especially true of winter motorized recreation. Snow machines are able to travel dozens of miles into backcountry form road access points along the Seward Highway. Additionally a single commercial company offering heliski opportunities, Chugach Powder Guides, is currently permitted to operate in a number of remote locations within the analysis area. There is also an unknown amount of private aircraft use and air-taxi services transporting individuals into backcountry locations during winter months.

Winter recreation impacts many wildlife species. For example, winter recreation negatively affects moose in the Twentymile, Portage, and Placer areas where moose tend to focus their winter use patterns. Compacted snow trails resulting from consistent use by snow machines may provide movement corridors for moose during winter months. While this may allow moose easy travel between habitat patches it may also have potential deleterious effects resulting from increased mobility of predators (e.g., wolves) and increased potential for moose and snow machine collision (Oliff et al 1999). This ease of mobility that can benefit wolves may also expose wolves to increased risk from trappers and hunters (Clarr et al. 1999). For wolves, winter recreation has the greatest potential to disrupt natural movement and habitat use during periods of winter foraging and early spring denning. During these critical early weeks, pups are especially vulnerable to den site disturbance that may keep the female away. Wolves will sometimes abandon a den if regularly disturbed by humans (Mech et al. 1991).

Recreational impacts to brown bears and wolverines are of greatest concern during the denning season. Increasing winter backcountry recreation in remote, high elevation alpine habitat may overlap with denning bears and wolverines. A better understanding of denning habitat and dispersed winter recreation use would help identify potential overlap.

Helicopter based recreation has the greatest potential for indirect effects on mountain goat populations. To minimize this type of disturbance, 16 no-fly zones have been

developed in support of the 2003 Chugach Powder Guides EIS (USDA Forest Service 2003). However, alpine skiing and snow machining also overlap with winter habitat in multiple locations on the CNF. A better understanding of goat winter habitat and dispersed winter recreation use would help identify potential overlap.

Non-motorized recreation activities, such as backcountry cross-country skiing or snowshoeing, may affect lynx because the disturbance associated with these activities is dispersed and unpredictable (Gabrielsen and Smith 1995, in R. L. Knight and K. J. Gutzwiller 1995). Snow machining may be particularly adverse to lynx because this activity occurs when animals are frequently in poor condition due to winter stress (Anderson 1995, in R. L. Knight and K. J. Gutzwiller 1995). Recent information (Canada Lynx Conservation Assessment and Strategy 2000) suggests that snow compaction from over-the-snow uses (motorized and non-motorized) could lead to increased competition for lynx prey resources from coyotes.

SOCIAL

What is the public demand for recreation opportunities in the study area, and how does this compare to available opportunities?

The public demand for recreation opportunities seems fairly high, based on growing use levels documented by district personnel over the years. This demand is concentrated along the road and stream corridors, where people can easily and inexpensively access the land. Demand for the backcountry is growing as well, as indicated by the growing number of outfitter/guides offering trips to more remote parts of this area. The INHT scoping revealed a high level of interest for a trail up the Twentymile Valley, more evidence that there is a high demand for backcountry recreation opportunities. The information from the Human Uses Opportunity Inventory (Reed 2003), table five, shows that the entire are is open (or conditionally open) to all the recreational activities listed (recreational gold panning, non-motorized summer and winter recreation, day use facilities, recreational rental cabins, campgrounds, hardened dispersed sites and viewing sites). Additionally, 44% of the area is closed to summer motorized recreation, and 31% is closed to winter motorized use. In the summer, all areas are open for subsistence motorized use. Summer motorized use is limited to helicopters or along designated routes, which should reduce the amount of time motors would be heard. The areas closed to motorized use are generally more highly valued for nonmotorized users because they are generally quieter; however, as noted earlier, both Placer and most of Twentymile Rivers receive use by motorized watercraft.

The demand for specific activities such as fishing, camping, hiking and skiing is not very well known. However, based on demand for fishing in other places in Alaska, demand for this activity is expected to remain fairly high, especially where there are opportunities to catch salmon. There is a higher demand to catch king (chinook) salmon; silvers (coho) seem to rank second, followed by reds (sockeye), pinks (humpys) and chum. Ingram Creek may offer an opportunity to satisfy some of this demand.

Demand for car-based camping is high on holiday weekends. Other times our existing campgrounds are not fully occupied. Traveling by recreational vehicle (RV) continues to be a popular way to tour through this area. The Black Bear campground was designed for car/tent campers and does not have generous parking spaces favored by RV campers. No dump stations or utility hookeups for RV's exist in the UTLA area. Providing for needs of this group is lacking. RV's carry all their own waste and need places to dump this waste and refill their fresh water supply as they travel. There is no dump station near Williwaw Campground, which is heavily used by RV's. The closest dump station is in Girdwood, approximately 15 miles from Williwaw Campground. There have been repeated cases of RV's dumping their effluent on secondary roads in Portage Valley. Campgrounds in high demand are located by an attraction. Portage Valley sites are better used than sites in Turnagain Pass (just outside the UTLA area). The sites at Turnagain Pass do not have any large attraction like Portage Glacier.

Recent growth in numbers of people hiking and mountain biking indicate a growing demand for these activities. The INHT and Glacier View trails will increase miles of trail in the UTLA area by 200%, satisfying this demand. There are currently 21.4 miles of trail, the INHT would add an additional 40.4 miles, plus it would reconstruct 17.6 miles

The District and Forest has received requests for more rental cabins, especially ones located with easy or inexpensive access. The INHT proposes to add up to three cabins (two in Twentymile, one in Turnagain Pass).

The demand for skiing is expected to remain strong. The UTLA area includes some popular backcountry skiing areas, but there are no existing set ski tracks on National Forest lands. The INHT would provide trails and bridges that are open for cross country skiing, but the Forest Service does not expect to groom any of these trails. The Trail of Blue Ice in Portage Valley could provide additional places for set-tracks. This may be an area where a commercial provider could step in. All the areas in UTLA are open to skiing, however access to much of the area requires a large amount of time or money. Access is being provided by helicopter and fixed-wing companies under permit with the Forest. This use and whether or not to increase it, all ties into the motorized/nonmotorized use issues. Much of this area is also high avalanche hazard area. The District's avalanche center will help inform winter sports enthusiast of the existing avalanche conditions.

What is the capacity of the study area for outfitter/guide use and other permitted land uses?

The Twentymile area is currently under a capacity study. Areas still needing capacity studies include Placer Valley and Portage Valley.

Does the shooting range at Peterson Creek pose a health and safety risk?

Many people recognize the Peterson Creek drainage near mile 84.3 of the Seward Highway as the rifle range. The area presents several concerns regarding health and safety. It is visually disturbing as it is littered with bullet casings, shotgun shells, shot up targets, appliances and trash. Over the years individuals have been cited and warned for littering in the area, but that has had little effect on how people treat the area. Safety has

been a concern on a number of occasions when hikers and recreation gold panners are in the area when people are target shooting. Misconduct of firearms and alcohol has also been reported in the area. In 2002 an individual was killed with an accidental discharge of a firearm. State Troopers reported that alcohol was involved. Hazardous waste is also an issue in the area with the dumping of household appliances like refrigerators and LP fuel tanks. It is also possible that years of firearm shooting in the area and no monitoring has contaminated the topsoil with high concentrations of lead. The area needs to be cleaned up. Suggestions for how the area could be managed have ranged from closing the area to target shooting to encouraging a local shooting club to adapt the area bringing the area up to safe standards as a shooting range.

What are the current or potential future impacts of forest activities on cultural resources in the study area?

Where are the areas where proposed development may have direct and indirect effects on heritage resources?

Any trail areas, as most trails on the district are historic and associated with mining; anywhere along the railroad; within the Twentymile, Portage, and Placer River Valleys, as these are natural transportation corridors and also have been associated with the railroad, and mining.

Is it feasible to develop a predictive model for areas where proposed development may have an impact on heritage resources?

Yes. However, this will require additional survey, because of the small percentage of the landscape area that is currently surveyed to standard, and the current bias of surveys to particular project areas.

What are the effects of hikers, boaters, and other recreation users on cultural resources?

Recreational users of the Forest who are uneducated about cultural resource ethics, and the illegality of digging in subsurface cultural deposits, or removing artifacts from historic sites, may unwittingly damage sites and break cultural resource laws. Artifact collectors do, unfortunately, intentionally vandalize both prehistoric and historic sites. Removal of artifacts from a site on public land is considered theft, and is illegal. Anyone who collects artifacts without a permit, or damages sites that are over 100 years old is liable for civil or criminal prosecution under the Archaeological Resources Protection Act. Theft of artifacts or damage to sites that are between 50 and 100 years old may result in prosecution under statutes that apply to theft of and/or damage to government property.

What is the desired level of interpretation of cultural resources in the Upper Turnagain area?

Given the large number of visitors to the UTLA area, and a general public interest in history, including mining, railroads, and military and Native history there is great potential for interpretation of cultural resources in this area. Currently, no Forest managed sites in the UTLA area are interpreted, and no special efforts have been taken to preserve such sites. All the Forest managed sites are in various states of deterioration.

Interpretation could occur along the Iditarod Trail segments, at public use cabins, in areas where the Alaska Railroad takes on or lets off passengers, or in the form of brochures or posters that can be read during a train ride, at the Turnagain Pass Day Use area, and at the Upper Engineers Camp near Begich Boggs Visitor Center.

What are the opportunities for partnership with local organizations for heritage interpretation?

There are numerous opportunities for partnerships with local organizations. It may be possible to integrate partnership opportunities with recreation development. The recent Presidential Executive Order 13287 directs agencies to search out partners for cultural resource interpretation, preservation, and heritage tourism. A large number of opportunities for partnership exist, some of which include Cultural Resource Stewardship agreements with Outfitter/Guides, and partnerships with groups that have specific interests, such as CIRI Regional Native Corporation, the University of Alaska, historical societies such as the Hope-Sunrise Historical Society, the Association of American Railroads, Railroad Research Foundation, and RailFanClub, the Anchorage Museum of History and Art, and the Alaska Natural History Museum.

Concerns regarding indirect effects:

Indirect effects are those effects that may occur outside the direct footprint of a proposed project. An example is the creation of a new recreation trail which passes by a historic cabin or an archaeological site. By increasing the ease of access, and routing the public into the vicinity of the cultural resource, the integrity of the resource is put at risk of either purposeful vandalism or accidental disturbance by the public, and must be addressed by the project. Another example is a decision to prescribe a particular management style for an area. Although there might be minimal management desired for an area, the National Historic Preservation Act nevertheless requires that properties in the area which "may be eligible for the National Register are managed and maintained in a way that considers the preservation of their historic, archaeological, architectural, and cultural values in compliance with section 106 of this Act and gives special consideration to the preservation of such values in the case of properties designated as having National significance" (16U.S.C. 470-2(a)(2)(B)). Historic properties in such a management area could not simply be neglected, because "Neglect of a property that causes deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe" is considered an adverse effect (36 CFR Part 800.5(2)(vi). The Forest considers indirect as well as direct impacts when planning projects and land management.

CHAPTER 4 – SYNTHESIS AND RECOMMENDATIONS

Physical

Stream Dynamics

Stream bank erosion

Areas most affected by human activities include much of Portage Valley, the lower several miles of the Twentymile and Placer Rivers, and some of the tributaries to Glacier Creek. With the exception of Portage Valley, where recreational use is heavy, the degree of bank damage from human uses is minimal, but will increase with increased use in the future. Twentymile Valley will become accessible to foot traffic with the construction of the proposed Iditarod National Historic Trail. This and increased boat traffic will lead to increased fishing use and the potential for further bank degradation. A commercial boating operation on the Placer River may contribute to increased bank damage and erosion in places. Information concerning bank erosion caused by human disturbances is very limited throughout the analysis area, and no studies have been conducted to measure any effects of these activities.

- *Recommendations*: Monitor rates of bank erosion and identify areas of concern on the lower portions of the Twentymile and Placer Rivers, areas that are receiving increased use from fishing, hiking, and boating. Such baseline information can be useful in determining the effects of these uses.

Risks to facilities, recreation areas, and transportation routes

Portage Valley has the most risk due to the relatively heavy development and because the area is highly susceptible to flooding and dynamic channel changes. The construction of the Alaska Railroad and the Portage Glacier Highway confined the river to a width about half that of the original valley. Migrating meander bends in Portage Creek threaten both the Alaska Railroad and the Portage Glacier Highway. The meander bend at the USFS Work Center upstream of Moose Flats currently flows adjacent to the highway, and high flows may cause further erosion and damage as the channel continues to migrate toward the road. Efforts can be made to reinforce banks where meander bends are eroding into the road and railroad, although the meander bends will generally continue to migrate, increasing the length of the channel adjacent to the road or railroad, and increasing the need for additional bank reinforcement. Eventually, the channel will shift away from the road as it shifts into a new meander bend.

Flooding and dynamic channel changes that occur during flood flows on Portage Creek can affect some of the recreation areas in Portage Valley, such as Moose Flats. Limiting development in the active floodplain between the highway and the railroad may help avoid additional problems. Gravel pit excavations in these areas increase the possibility of stream capture.

Bank erosion resulting from wind-driven waves on the northwest shore of Portage Lake at the Begich Boggs Visitor Center is also a concern during periods of high water in

Portage Lake. Riprap placed offshore in front of the visitor center, designed to dissipate some of this wave energy following the 1995 floods, controls this erosion to some degree. Bank erosion also occurs along Portage Creek just downstream of the lake outlet.

Avalanche Hazards

Risks associated with avalanches exist in areas that have high avalanche potential and frequent winter use or human development, including those areas used for winter backcountry recreation, developed recreational areas and facilities, and roads and railroads. Management will have no effect on avalanche occurrence, as most avalanches occur naturally, and the amount of avalanche activity is not likely to change dramatically in the future. However, management activities can limit construction in avalanche prone areas and provide additional avalanche education for backcountry users.

The Chugach Avalanche Center will help keep winter recreationist informed of current snowpack conditions, especially where existing trails and facilities are located in areas where avalanches have occurred in the past. More staff out in the field can also help inform people of the hazards and hopefully reduce the occurrence of avalanche fatalities.

Minerals

Capacity for Production: Spencer Quarry can provide a variety of aggregate types including sands, gravels, and shot rock. Large quantities of aggregate are available at this site. Total volumes have not been measured to date. The production is dependent on rail-based transport from the site. This is more costly than road-based production but has certain advantages that market forces determine. The availability of aggregate in Portage Valley is currently limited by competing resource uses. Most road accessible pit sites have been developed and taken out of production for recreational use. Williwaw is the only remaining operational source. Other areas within the valley could be developed but would have to withstand evaluation and analysis relative to the values of other National Forest resources that would include wildlife, recreation use, noise, and scenic viewsheds. As with Portage Valley, depending on competing land management needs, Bear Valley provides an opportunity to produce aggregate in the future and should be studied for that purpose.

The concepts of resource sterilization and sustainability associated with aggregate production are apparent in Portage Valley. There are abundant reserves of aggregate in the Valley. Over the past several decades the aggregate removed has provided a highly valued resource for the local community, the public in general, and economy. Yet over time competing uses have limited aggregate production opportunities to currently one site. There are several questions relative to aggregate production the Forest Service must answer associated with land management principles. They are: Do we want to provide a sustained developable aggregate resource? How important is aggregate availability to the local economy relative to competing resource values? Are we concerned about the economic effects of eliminating a local aggregate source? Do we know what those economic effects are?

Impacts to Groundwater: Gravel pit development in Portage Valley can influence groundwater dynamics. Groundwater moves relatively quickly down-valley, decreasing in speed with decreasing grain size. Gravel extraction pits expose the shallow water table, and groundwater moves more quickly through the excavated pits because they provide less resistance to flow. As a result, gravel pits draw groundwater from all directions, which can cause this water to concentrate at the surface in these areas. Little data on water table elevation are available for Portage Valley, although several monitoring wells were established in 2002 upstream of Williwaw Campground.

- *Recommendations*: Continue monitoring groundwater levels in various locations in Portage Valley to determine the effects of gravel extraction on water table elevations. Baseline data collected prior to gravel mining can be useful for determining the effects of these operations, as well as for designing pond and wetland habitat in old gravel pits.

Biological

Fish

Currently, one of the most significant issues concerning the Glacier Ranger District's fisheries program in the UTLA area are the potential impacts of increased guided and recreational fishing, development, and management practices on the seemingly small chinook salmon populations in Twentymile River. Whereas other anadromous fish species are found throughout the assessment area, chinook salmon are limited in their distribution and potentially more susceptible to impacts associated with these activities. It is apparent, after synthesizing existing data, that more information on the life histories, stock composition, and abundance of these chinook salmon is needed to adequately address these concerns. Furthermore, until this information is collected, a cautious approach to Forest management should be followed in the Twentymile River watersheds.

One option to collect needed fisheries information on Twentymile River would be the use of a fish weir. A weir is an excellent research tool that would allow reliable monitoring and provide much needed information on species composition, run timing, relative abundance, and peak escapements for all anadromous fish species using the watershed. Additionally, weirs can provide the opportunity to collect tissue samples that would determine the presence of distinct populations of chinook salmon in the watershed. But weirs can be expensive to build and operate. Also, finding a good location to place the weir is a difficult task critical for proper operations. Therefore, if such a monitoring study were to take place, it would probably be best to cooperate with other interested state or federal agencies so costs and labor could be shared.

Another option to collect needed information on temporal and spatial distribution and critical habitat for adult chinook salmon within the watershed would be a radio telemetry study. Chinook salmon could be captured in the lower river using entanglement nets, fitted with radio tags, and followed to upriver spawning habitat with radio tracking equipment. This would help define critical chinook salmon habitat in the Twentymile River watershed and allow us to focus our efforts in preserving, protecting, and

enhancing such habitat. While this technique could also provide information on run timing, it would not provide accurate information on the population size of chinook salmon in this watershed.

Finally, an on-site angler survey would be an excellent opportunity to provide more reliable and accurate information on guided and recreational angler use, catch and harvest of coho salmon, and incidental catch of chinook salmon in the Twentymile River watershed. Twentymile River provides a unique opportunity to collect this information because most angler access is by boat and there is only one boat ramp at the mouth of the river. The number of anglers would be relatively simple to monitor, estimates of total angler use would be much more accurate than the ADFG mail-in survey, and data on catch and harvest would also be much more accurate because it could be collected as soon as anglers leave the river. This information would be very valuable in directing the management of the fisheries resource in Twentymile River and preserving the stocks of anadromous fish that use this watershed.

Another management options that the Glacier Ranger District is interested in investigating is the opportunity to introduce new fish species to provide enhanced recreational fishing in the UTLA area. However, as mentioned previously in this document, this management technique must be pursued very cautiously to prevent damage to the existing fisheries resource. Probably the best opportunities for fish introductions in the assessment area with minimal impacts to the native fish populations would be the many ponds in Portage Valley that were created through the District minerals program. Several of these man-made ponds have already been stocked by the ADFG with hatchery rainbow trout and Arctic char to create recreational fishing opportunities for visitors to Portage Valley. Another 15 acre pond is currently being developed in upper Portage Valley and should be ready for stocking as soon as it is completed. These ponds are typically landlocked and usually do not have a direct connection to area waterways. This will minimize interactions between native and exotic fish species except during times of extreme flood events.

Another opportunity for an enhanced fishery may exist on Ingram Creek. This stream supports natural runs of pink, chum, and coho salmon as well as Dolly Varden char. However, each of these salmon runs is relatively small compared to the other streams in the assessment area (U.S.F.S., unpublished data). Ingram Creek appears to have little potential to naturally support large populations of these fish and because of the convenient road access, an annual coho stocking program may create a quality recreational fishery and recruit additional angler activity on the Glacier Ranger District. Also, such a fishery may benefit other local wild fish populations by alleviating fishing pressure on other nearby streams.

Overall, the Glacier Ranger District should be very conservative in its approach to recommending the introduction of new fish species to water bodies in the UTLA area. The risks to the existing biological integrity of these watersheds may be significantly greater than the benefits gained from a species introduction. Furthermore, if an introduced species develops into a self-perpetuating population, it can be nearly impossible to remove if it is found to be negatively impacting the existing resource.

Vegetation

Much of the existing spatial vegetation data is either old (based on aerial photos from the 1950's to 1970's), or very general (i.e. conifer forest), or covers very little of the UTLA area (i.e. EMU coverage), or has not been adequately ground verified. A recommendation is to develop an existing vegetation layer to help identify potential vegetation management opportunities and as a basis to analyze effects of management activities.

Many valleys are experiencing rapid successional change. However, there is little information regarding succession in the UTLA area. A potential future project would be to develop a successional model to provide information in developing predictions of vegetation compositional changes, which in turn can be used for vegetation management, wildlife habitat management, and recreation management.

In general the Chugach National Forest is not currently experiencing major problems of alien invasive species. However, alien plants have been observed in recent years. Species such as bird vetch, Canada thistle and knapweed are fairly new to the area and are still confined to small, localized areas. A recommendation would be to work on identifying the extent of infestation, containing and eradicating populations of these species. Since many of these plants occur on state and private lands, cooperative agreements may be needed. In addition, an extensive review of non-native plant on the Chugach National Forest, Duffy (draft 2002) recommends additional surveys within the UTLA area. These include in order of priority: 1) Front-country areas such as Portage, Whittier, and Girdwood; 2) Backcountry recreation sites such as trails, cabins, and kayak/boating campsites that receive high visitor use; 3) Surveys in wild areas; and 4) Surveys in wetlands. In addition to these surveys, Duffy also recommends future monitoring of surveyed sites and the inclusion of alien plants in USFS field guides.

Portage Valley supports large populations of two Region 10 Sensitive plant species: pale poppy and Norberg's arnica. A high concentration of existing and proposed developed recreation occurs in Portage Valley and conflicts between this development and long-term viability of these species may occur. These species, in particular pale poppy, are very tolerant of disturbance. In fact, pale poppy tends to grow on bare gravel and may have been more common in habitats recently exposed from glacial retreat. Current activities that expose bare gravel appear to provide habitat for this species. A recommendation is to develop a conservation strategy to address the viability of these species through active management, preservation, and continued monitoring of populations.

Wildlife

Summary

Facility Development: Terrestrial wildlife habitats within the analysis area remain relatively unaltered by human activity. The majority of alteration of these habitats is in the form of existing major highway and railroad corridors, private land development, and CNF recreational facilities. Though not extensive in scale relative to the analysis area, these developments have likely disrupted natural distributions and movements of a variety of wildlife species. Future facilities developed by CNF or permittees should be undertaken with careful consideration of potential cumulative effects of habitat

fragmentation at a minimum of the watershed, if not the landscape scale. Facility development within Portage Valley is likely of most concern as this valley supports the most CNF facilities within the analysis area. Additionally, Portage Valley has the potential to serve as an important migration corridor for various wildlife species (USDA Forest Service 2002a).

Recreationist Disturbance: The physical presence of recreationists has the potential to disrupt the distribution and movements of wildlife within the analysis area. Restricted access resulting from rough terrain and dense vegetation confines the majority of summer recreation to areas adjacent to access corridors such as highways, trails, and navigable stream courses. During winter deep snow and frozen water bodies allow much better access to recreationists during a period of the year when wildlife are potentially food and cover stressed and restricted to smaller patches of habitat (Olliff et al 1999).

Recreation may impact wildlife (e.g., Oliff et. al. 1999), although correlating disturbance with population level effects has rarely been demonstrated and may be difficult to quantify. There is potential that many species will habituate to recreational activities. However, without a clear characterization of spatial and temporal distribution of recreation as well as an accurate, updated, characterization of existing recreation activities managers can say little about potential disturbance effects to wildlife (Knight and Gutzwiller 1995, Liddle 1997).

Recommendations: The following recommendations are presented in order of priority of need with respect to assessment of potential impact of recreation activities.

- Create a monitoring program designed to collect spatially and temporally referenced dispersed recreation data, especially winter season activity, with emphasis on Placer, Twentymile, and Portage valleys to be compared to important wildlife habitats.
- Evaluate the extent of natural cover habitats conducive to dispersal and migration of large carnivores (brown bear, wolverine, gray wolf, lynx) remaining within the Portage Valley system. Identify potential corridors for wildlife movement through portage valley and assess risk of habitat fragmentation resulting from further facility development.
- Attempt to identify denning habitat for brown bears and wolverines and continue to monitor population numbers and distribution of mountain goats, wolverine, and moose within the analysis area.
- Create a plan to minimize human conflicts with black bears in relation to facility development and access management.
- Collect and map a baseline of harvest data for bears, wolverines, lynx, and wolves within the analysis area for potential correlation to access management within the analysis area.
- Attempt to characterize the existing waterfowl harvest activity within the analysis area and evaluate the need for increased harvest opportunities.

Social

Cultural Resources

A wide variety of historic and prehistoric themes and time periods are represented by the known resources of the landscape assessment. The majority of the known sites in the UTLA area are from the historic period, and more particularly from the first half of the twentieth century. However, it is likely that more sites from the prehistoric and early historic other periods exist, but have not yet been found due to the small amount of archaeological survey in the area. The richness of the known cultural resources in the UTLA Area, along with the ease of access to the area, makes proactive documentation and public interpretation desirable.

The Forest will continue to conduct standard archaeological surveys for projects in the UTLA area, as required by law. The following recommendations for future projects and management of sites are oriented toward both the attainment of management objectives and the involvement of the public through partnerships or in an educational manner, whenever possible.

1) A proactive management approach would be to completely archaeologically survey several valleys that continually have either large numbers of projects conducted, or have a high degree of public use, raising issues of both direct and indirect use. Project specific partial surveys of these valleys have been done over the years, however with the continuous and/or increased use of these valleys by both visitors and the Forest Service, complete archaeological surveys, resulting in more complete knowledge of both the location and significance of cultural resources, will make future planning and management activities more efficient. Such information will allow sites to be avoided, interpreted, rehabilitated and, in some cases, used, looking at the "big picture" for a valley or the landscape area as a whole. Partnerships for such surveys could include UAA, Alaska Native organizations, and interested public groups such as the Girdwood Trails Committee, the Hope-Sunrise Historical Society, and the Alaska Historical Society.
The goal would be to document all cultural resources in each valley. Although presented together here, the suggested surveys may be broken down into smaller parts for easier accomplishment.

At a minimum, such surveys would include four valleys:

- Crow Creek/Glacier Creek Valley Crow Creek Trail is hiked and run annually by a large number of residents and visitors to Girdwood. The potential for location of previously undocumented Native hunting camps in the Crow Creek Valley is high. A complete survey would allow a better understanding of both the use of the valley and its resources in the prehistory and early history, and the potentially conflicting use of resources between miners and Native peoples in the early twentieth century.
- Twentymile Valley Access to the Twentymile Valley is about to be promoted by construction of a segment of the Iditarod Trail project. In the Twentymile valley,

such a complete valley survey would result in documentation of known and reported sawmills and logging camps, documentation of new sites, and interpretation for visitors on the Iditarod Trail.

- Portage Valley Portage Valley has a large number of visitors and Forest Service projects because of the Begich Boggs Visitor Center, the campgrounds and administrative buildings, and the use of the valley as a transportation corridor between Whittier and the Seward Highway. The Portage Valley has been used since prehistoric times as a transportation corridor, was the location of one of Mendenhall's camping spots and was home to men in two military camps during building of the railroad spur to Whittier.
- Placer Valley Recent requests for Special Use Permits related to Outfitter/Guide rafting use underscore the increased tourist interest in this valley. Known cultural resources in the valley are mainly railroad related, however the potential exists for prehistoric and other historic sites to be found.

2) Documentation and interpretation of individual sites can be done in partnership with various interested groups.

a. Portage Upper Engineer's Camp, SEW-00299 NHPA requires, and the State Historic Preservation Officer has requested, that this site near Begich Boggs Visitors Center be re-evaluated for the National Register of Historic Places, as new structures were found, and new information gathered, during the 2002 bunkhouse construction project. In addition to fulfilling requirements of NHPA, such a re-evaluation could result in interpretation of the site, an informational brochure that could be distributed at the Visitors Center, and could be done in partnership with the University of Alaska, interested Alaska Native, military, and historic groups, and the Alaska Railroad.

b. Lindblad Cabin on Winner Creek, SEW-01029 Data recovery, evaluation for the National Register and interpretation at this site is urgently needed because of signage advertising the cabin, and continuing vandalism of artifacts from the site. This work could be done in partnership with the Anthropology and/or History departments at UAA, and interested public groups such as the Girdwood Trails Committee and the Alaska Historical Society, and by incorporating volunteers through the Forest Service's Passport In Time (PIT) program.

c. Kern, SEW-00092 Data recovery, evaluation for the National Register, and interpretation for the public needs to be accomplished at this site, which has already been heavily vandalized by visitors. This work could incorporate PIT volunteers, and could involve partnering with the Alaska Railroad Corporation, UAA, and interested historical societies.

3) Interpretation and monitoring of mining cultural resources, including the Monarch, Jewell, and Girdwood Mines along Crow Pass Trail, could be done in partnership with Outfitter/Guides through Stewardship Agreements, and with interested groups such as the Girdwood Trails Committee and interested historical societies.

4) Interpretation of Railroad-related sites and their historic significance could be accomplished through brochures, and on-board interpretation for train passengers bound for Seward, Anchorage, and backcountry destinations, in cooperation with the Railroad and Outfitter/Guides with Stewardship Agreements. If a backcountry destination, such as a cabin, or a rail car on the siding at Grandview or Spencer, becomes a District goal, then historic interpretative panels could be placed in the structure.

5) The Heritage Program has begun to encourage Stewardship Agreements with Outfitter/Guides to interpret historic sites for clients and monitor sites for the Forest. This results in a win-win situation, as the Forest provides historical as well as archaeological ethics information on the sites to the Outfitter/guides which they may present to their clients, and in return, the Outfitter/guides provide the Forest with photographs and information of the condition of the sites monitored, helping the Forest better manage valuable public resources. An increase in the number of Stewardship Agreements, and heritage resource interaction with Outfitter/Guides is desirable for future management of the UTLA Area.

Recreation

Glacier Creek: In the Crow Creek area, reconstruct the Crow Creek road to a standard 2-lane width, with additional parking turnouts. To address vandalism at the trailhead, replace the existing wood-frame toilet with a more vandal-resistant design. Increase law enforcement patrols of the trailhead, especially during long daylight periods. Add interpretive information at both the trailhead and at the Monarch Mine ruins. Locate and design the outhouse at the cabin to reduce annual maintenance. Explore using explosives or other methods to create a large pit for the outhouse that would take many years to fill, and build the outhouse to withstand wind and snow loads.

In the Kern Creek area, there is an opportunity to develop the unmaintained trail, provide parking and work with the railroad to create a safe crossing.

Hooligan fishery: An opportunity exists to create safe, sanitary parking places for this activity. Including sanitary facilities at any developed parking spots would reduce the problem of human waste. Many small pullouts would better serve hooligan fishing than one large centrally located area due to the nature of the hooligan fishing, since people spread out along the water's edge, each claiming a stretch of waterfront for their use, shoulder to shoulder with fellow netters. There is no existing space for people to move along the water line, and the 30'plus tides result in an ever-changing water-line location.

Portage Valley: Some solutions to the problems identified earlier include adequate funding to keep up with needed maintenance and provide additional law enforcement patrols. Closing secondary roads would help reduce trash, but would also remove an opportunity for everyone, including those who use these roads responsibly. Adequately fund and implement a design theme using colors that are more legible. Revising the Closure Order on Portage Lake would allow more recreational opportunities along its shores, and access to the face of portage glacier for people wishing to do this on their own instead of using the commercial operation. An overall mission of BBVC is to get

people excited to learn more about the environment of the Chugach, particularly the valley. Increasing interpretive programs outside of BBVC would help do that. This could take the form of signs, programs, video cameras, etc. The new educational building will help provide more learning opportunities. Adding trails and reversing the closure of Portage Lake would provide more places for people to explore and learn about the local environment.

Placer Valley and Twentymile Valley: The district has been considering an idea to develop some kind of public-use overnight facility in the Spencer Lake area in cooperation with access provided by the railroad. Another site to consider in Placer Valley is at Grandview. These two sites may also offer opportunities for dispersed campsites, since they are well off the highway, but easily accessed from the railroad, creating a wilderness setting with easy access. In Twentymile, there is an opportunity to develop a cabin at Carmen Lake, which is accessed by a short floatplane or airboat ride.

Ingram Creek: If a salmon fishery were enhanced on Ingram creek, a campground in this area may be warranted. However, careful analysis of trumpeter swans may be conducted.

General Recommendations: All facilities developed for recreational use need to provide access for people with disabilities. The Forest Service has developed guidelines that describe how to provide this access while also maintaining the setting as described by the ROS. Facilities need to be readily locatable by the public. Adequate sign plans and implementation of these plans is needed to ensure people can find the recreation opportunities we are providing. Internet information currently helps pre-trip planning and needs to be enhanced and maintained.

Data gaps for recreation use include reliable, local, site-specific data that describes current use amounts, what current users want, where they come from, as well as information from people who no longer use the area. Conflicts between what various users may want will continue to be a management challenge. Goals to increase, decrease or maintain the status quo are needed. Marketing strategies need to be developed to achieve these goals. Funds to maintain and operate recreation facilities or to establish partnerships are needed.

Public comments suggested developing a soundscape plan for this area. The plan would inventory the area's existing natural quiet and natural sounds as well as the unnatural sounds, and make recommendations regarding the desired conditions and how to attain them. Due to public interest in this issue, recommendations to develop such a plan for this area may be warranted.

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