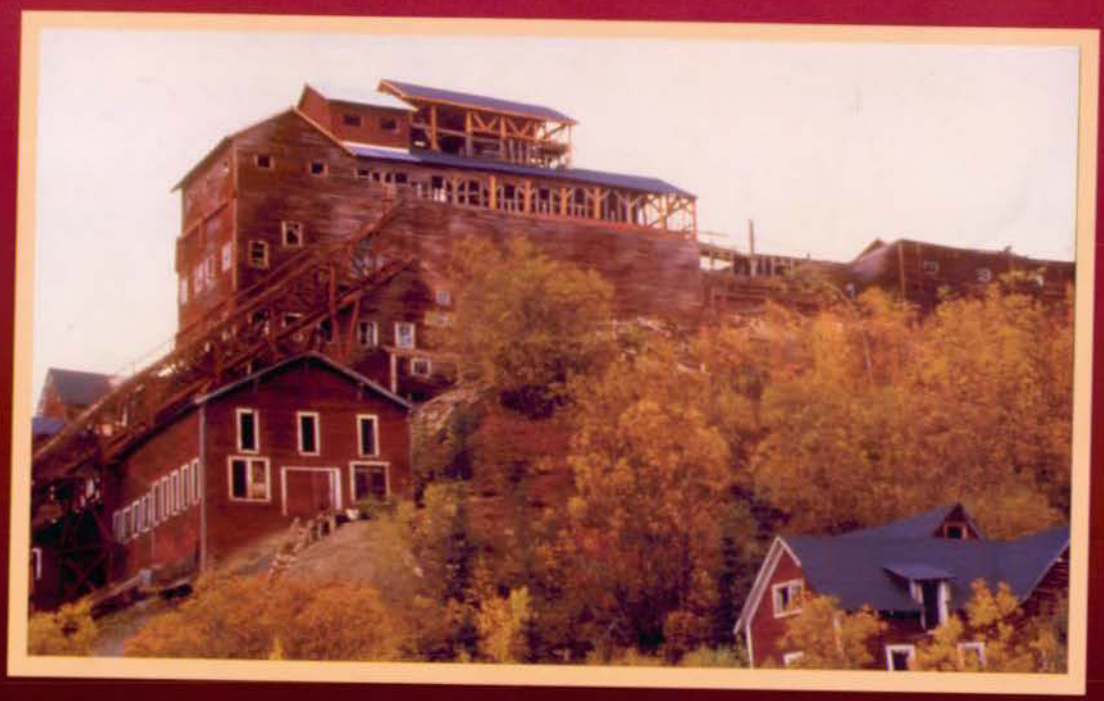
CULTURAL LANDSCAPE REPORT

KENNECOTT MILL TOWN



WRANGELL-ST. ELIAS
NATIONAL PARK AND PRESERVE
ALASKA

CULTURAL LANDSCAPE REPORT
KENNECOTT MILL TOWN

BY

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WRANGELL-ST. ELIAS NATIONAL PARK
AND PRESERVE, ALASKA

2001

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U.S. Department of the Interior
National Park Service

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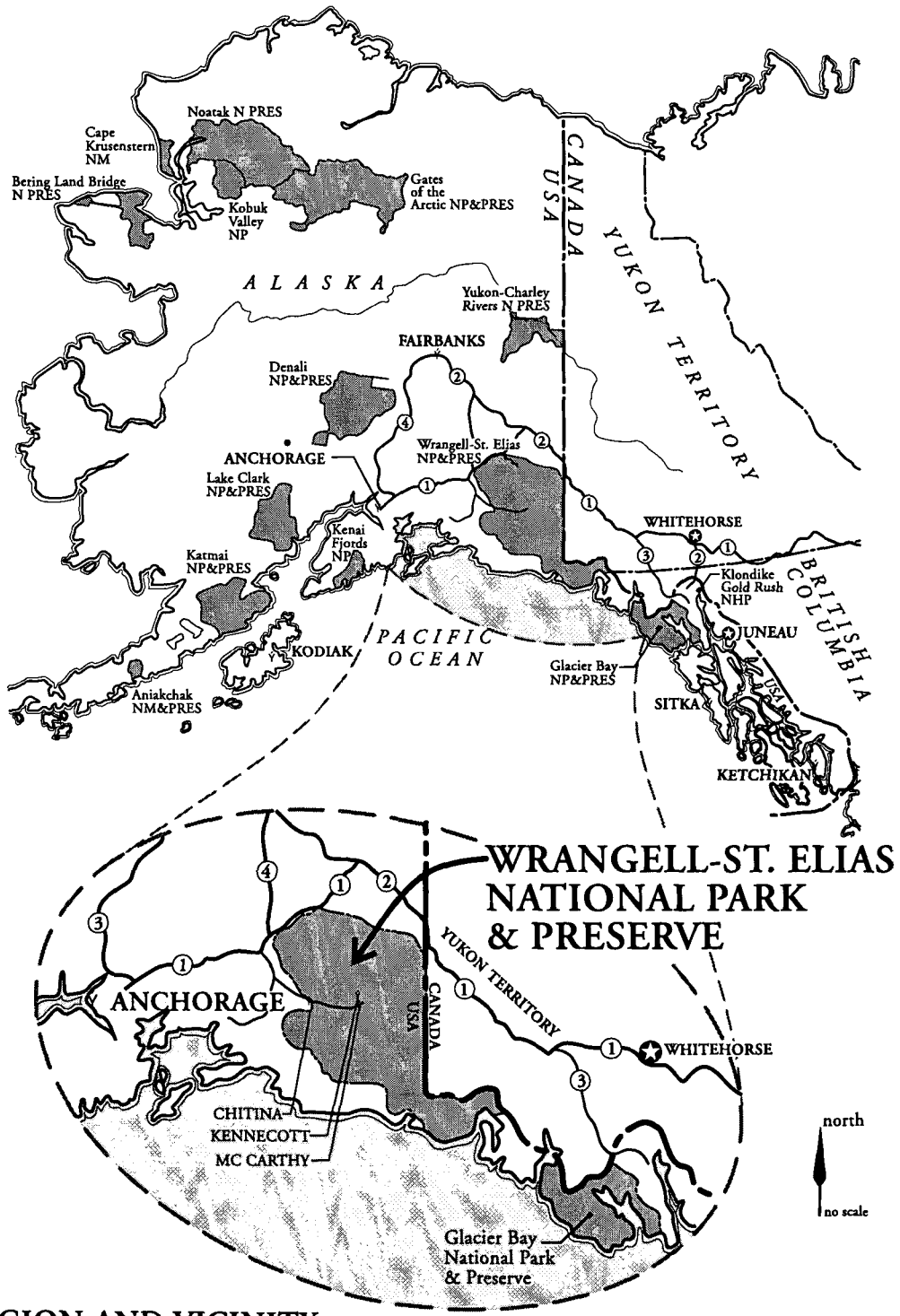


REGION AND VICINITY

Wrangell-St. Elias National Park & Preserve Alaska

United States Department of the Interior • National Park Service
DSC/April 1999/190/20,019

INTRODUCTION

MANAGEMENT SUMMARY

In June 1998, the National Park Service (NPS) acquired the land, mineral rights, and associated holdings of the Kennecott Copper Mines in south-central Alaska.[1] Located in the center of Wrangell-St. Elias National Park and Preserve, the area is a designated National Historic Landmark (NHL) District, encompassing 7,700 acres of public and private lands. The 2,839 acres purchased by the NPS includes property and structures in the historic mill town (figure 1), which was the center of operations between 1901–1938.

After the Kennecott Copper Corporation left the site in 1938, portions of the

Figure 1. View north from the entry road to the lower Kennecott mill town, part of the National Historic Landmark District. (NPS park files, WRST, 1997.)

property were sold to private individuals. Over the years the NPS has provided technical assistance to local organizations and individuals interested in documenting and stabilizing historic structures in the town. With the purchase of Kennecott the NPS has become a partner in the management of Kennecott. Committed to working with the community and private landholders, the NPS is fulfilling agency policies and legal mandates to preserve resources and provide public access.

Prior to the 1998 purchase, the NPS completed several special studies and reports to assist in the clean up of hazardous materials and to assess the requirements for stabilizing historic structures. Although these reports were helpful in understanding individual resources in the mill town, there was no single document addressing the relationship among resources or the landscape as a whole. Without a complete and holistic understanding of Kennecott's resources, management of the NHL would be fragmented. This Cultural Landscape Report (CLR) was undertaken to consolidate existing research and to document and evaluate significant landscape resources. Based on the resource evaluation, this CLR proposes treatment for stabilization, preservation, and use of the cultural landscape at Kennecott.

Historical Summary[2]

Mining operations at Kennecott occurred between 1901–1938. During this period the Kennecott copper mines were among the nation's richest, containing the last of the great high-grade copper ore deposits in the American West. The initial discovery of copper was made in 1900 on Bonanza Ridge, some 4,000 feet above the lateral moraine of the Kennicott and Root glaciers in central Alaska. By 1907, with control of the mining claims assured and finances secured, construction was under way on the concentration mill sited in the developing mill town below the mine. By 1911 the railroad had reached the town and shipment of ore to Cordova and outside markets began.

Throughout the 1910s and 1920s, the mines continued to expand with new discoveries and increased investment (figure 2). Substantial facilities and infrastructure were established to advance the work and support the work force. Individual mine sites were self-sufficient camps, with structures for operating

Figure 2. View of Kennecott, circa 1930, showing cleared vegetation, roads and trails, concentration mill, support structures, cottages, flumes, crib dam, and tramway up the hill. (Evonne Sullivan, park files, WRST.)

the mine and housing the workers. In the mill town, the largest surface facility was a 14-story concentration mill, surrounded by several industrial support buildings, including a power plant, leaching plant, shops and warehouses, and machine shop. Utilities and infrastructure were developed to route power and water for processing the ore and for domestic use. Scattered throughout the town, but concentrated on its edges were residential structures, including bunkhouses and individual cottages that provided housing for the mill workers, staff, and families. Most buildings in the town had indoor plumbing and steam heat. Community services included recreational facilities, space for church services, a school, and garden. Over the years, the industrial town took on the character of a small, self-sufficient community with domestic gardens, boardwalks, a store, and gathering areas.

Low copper prices forced a temporary closure of the mine between 1932–1934. Once the mines were reopened in 1935, the depletion of ore body finally led to the mines' closure in 1938. The company salvaged relatively little from the site. Some items, such as small tools, were shipped out for resale. Other items were simply left in place. Furniture was left in the residences, the powerhouse was

left fairly intact, and the electrical shop retained enough equipment to maintain power.

In 1965, the Consolidated Wrangell Mining Company acquired rights to the area and began mining copper from the surface deposits below the Bonanza Mine. In 1967, the company installed a mechanical separation unit on the south side of the concentration mill. Today, tailings from that operation have piled against the log office building dating from the Kennecott era. Flooding on National Creek, which runs through the center of the mill town, has also taken its toll, depositing gravel and debris in several historic structures.

As tourism has increased in recent years, an effort has been made to preserve the character of the historic mill town and associated mines, which are located about five miles from McCarthy, Alaska, in what is now the heart of Wrangell-St. Elias National Park and Preserve. In recognition of Kennecott's historical significance, 7,700 acres of the site were designated a National Historic Landmark in 1986. Since then the Kennecott Corporation has undertaken removal of hazardous materials, and proposals for lead paint abatement are in place. In addition, several private property owners have rehabilitated their buildings, while the Friends of Kennicott and other partners have overseen emergency stabilization of critical industrial structures. The NPS has provided technical advice and support to local organizations and has completed several inventories and resource assessments, providing baseline information to park management.

In 1998, the NPS became an official property owner in Kennecott by purchasing 2,839 acres of the site, including properties in the historic mill town. With this purchase, the NPS assumes a partnership role in the stewardship of this significant site, preserving the resources that convey the historical role of copper mining in the Alaska frontier.

Scope of Work and Methodology

The CLR for the Kennecott mill town is divided into two parts. Part I includes the *Site History*, *Existing Conditions*, and the *Analysis and Evaluation* of cultural landscape characteristics. Part II includes *Treatment* of the cultural landscape and includes recommendations and a five-year management plan.

The CLR is an interdisciplinary document, compiled by historical landscape architects, archeologists, mining historians, historical architects, planners, and natural resource specialists. The Wrangell-St. Elias National Park and Preserve serve initiated the project in the spring of 1997. In addition to park and regional staff in the Alaska office, project agreements with other NPS offices and contracts with Michigan Technological University (MTU), and the Wrangell Mountain Center provided topical information on the physical history, vegetation, and archeological resources. The Denver Service Center was contracted to undertake the planning and public processes associated with the *Kennecott Interim Management Plan* (1999), portions of which are incorporated into Part II of the CLR.[3]

Because there is a significant body of literature on the history and mining technology associated with operations at Kennecott, no additional historical research was undertaken for this project. Furthermore, the CLR does not address the use of the area by native peoples, prior to or after the historic period.

Using both primary and secondary sources from the park and regional files, MTU compiled the Site History for the mill town. New work was undertaken to inventory, describe, and assess the condition of historical archeological features, historic structures, and characteristics of the cultural landscape throughout the mill town. This work is contained in the *Analysis and Evaluation* section of the document. MTU also generated a series of detailed GIS/AutoCAD site maps (computer-generated, geographic information surveys) that illustrate existing conditions, archeological resources, and the historical development of Kennecott.

Recommendations and priorities for the treatment of cultural landscape resources in the mill town are based on the landscape characteristics that contribute to the significance of the site. In addition to the treatment recommendations, a proposed action plan is incorporated into the CLR. This plan is excerpted from the *Kennecott Interim Management Plan* and reflects findings from the CLR, public input, and NPS management objectives for the site. The primary purpose of the interim plan was to address the immediate (five-year) management requirements for the site. The CLR's recommendations support actions in the interim plan, including associated design guidelines, and also address the long-term stewardship of the mill town.

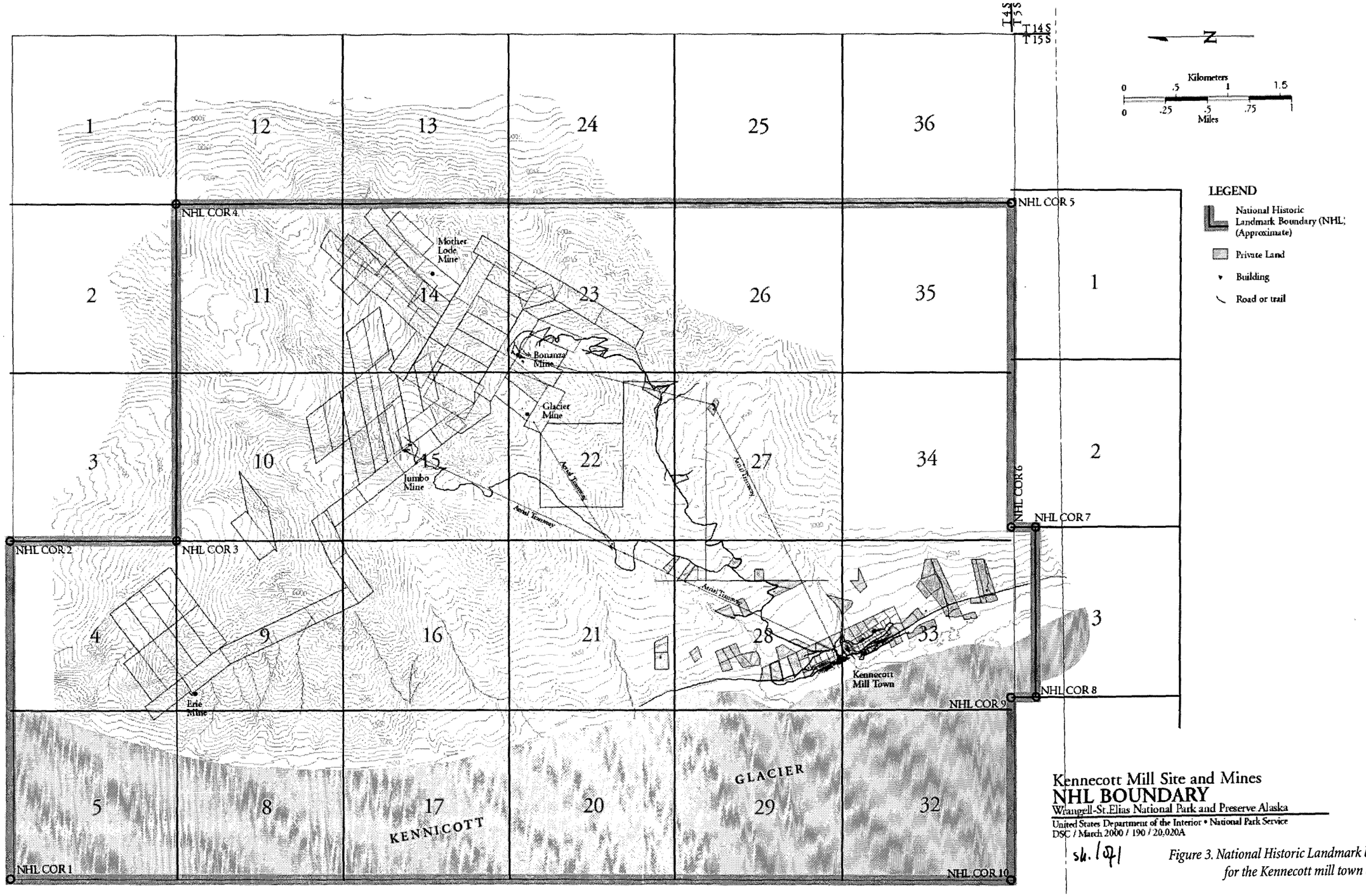
Study Boundaries

The focus of this CLR is the Kennecott mill town, located within the 7,700-acre NHL (figure 3). The NHL district boundaries were drawn to include the landscape and associated resources used by the Kennecott Copper Corporation from 1900–1938. While the CLR focuses on the mill town, limited information is included on the history and existing conditions of four of the five mine sites and associated resources on Bonanza Ridge.[4] Although the mines and associated structures were essential to the operations at Kennecott during the historic period, determining appropriate management options for these individual sites will require additional investigation beyond the scope of this report.

The structural complex of the mill town covers approximately 100 acres at the base of Bonanza Ridge. The study area includes all of the historic structures associated with the mill town, including the industrial buildings and tailings, various support buildings, roads and trails, and infrastructure systems. Although important for understanding the mill town as a whole, this report does not address private property in the study area. The study boundary on the west roughly parallels the moraine of the Kennicott Glacier. At a point north of the historic fuel tank, the boundary turns east following the access road to the Bonanza Mine, wrapping around the east side of the mill, above the tram terminus, and across National Creek to Silk Stocking Row. Following Silk Stocking Loop Road, the boundary cuts down the hill south of the Kennicott Glacier Lodge and ends where the old wagon road from McCarthy enters the site.

Summary of Findings

The landscape of Kennecott contains a number of contributing resources that define the physical character of the mill town as it existed between 1900–1938. The critical landscape characteristics are those that historically influenced development of the site. This includes the historic structures, archeological resources, circulation systems, the spatial organization of the mill town, and the large-scale natural systems. These resources may be considered individually and managed as isolated features, but the whole story of Kennecott is enhanced when these resources are observed and interpreted in relation to each other and within an environmental context.



Kennecott Mill Site and Mines
NHL BOUNDARY
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Figure 3. National Historic Landmark boundaries for the Kennecott mill town and mines.

ON MICROFILM

The recommendations made in this report reflect a holistic approach to managing the complex resources at Kennecott. While most treatments target the need to achieve basic stabilization, other treatments deal with appropriate rehabilitation of structures, changes in land use, removal of encroaching vegetation, conservation of archeological features, and adaptive use of historic circulation features. As requested by the park, no effort was made to restore the landscape to the historic period. The desire to retain the "evocative character of an abandoned mining town," while somewhat ephemeral, did influence the selection of stabilization as the primary preservation treatment.

This CLR was undertaken in conjunction with the *Kennecott Interim Management Plan*, which involved public participation in the planning process. Included in the plan were several actions proposed for the NPS properties within the mill town. Key actions are as follows:

- Organize the mill town into land use areas or zones reflecting historic land use patterns and relationships
- Selectively thin the vegetation around historic structures to reduce the risk of fire and to reestablish historic views and vistas
- Establish interpretative media and trails routing visitors through the site
- Rehabilitate and make adaptive use of the company store as a visitor contact point
- Rehabilitate the railroad trestle

The Kennecott CLR builds on those actions and provides additional direction regarding design guidelines and implementation.

SITE HISTORY

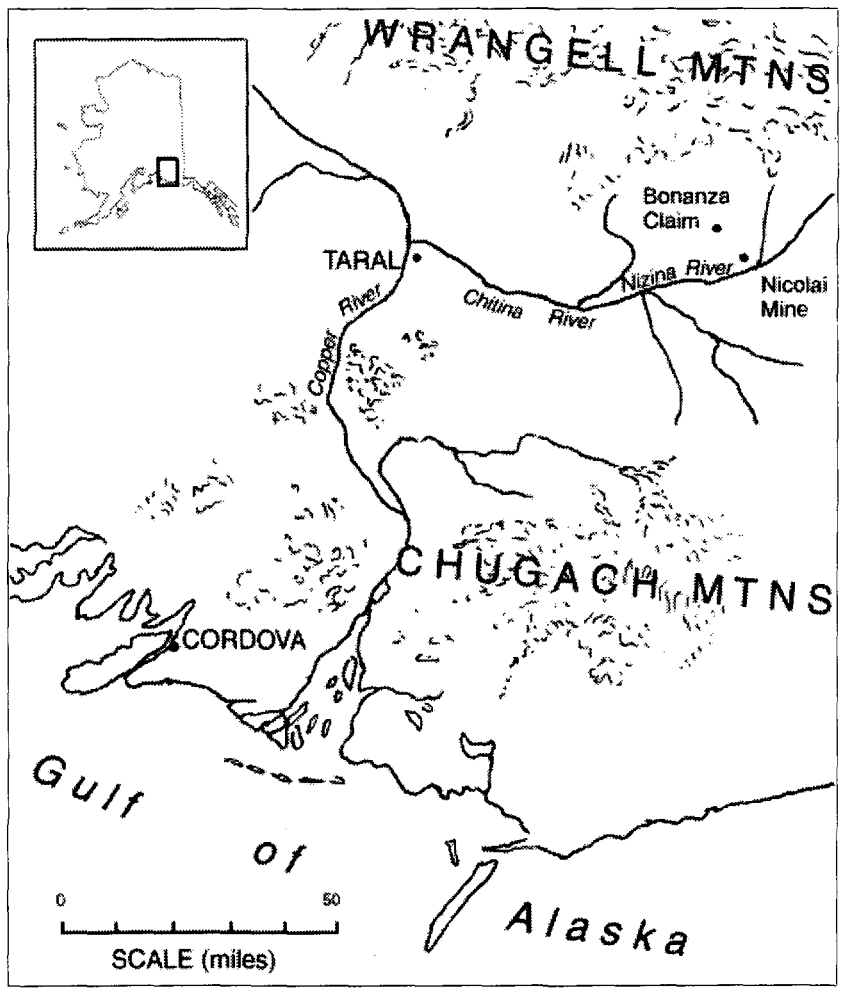
EARLY EXPLORATION AND SETTLEMENT

Interest in the metallic wealth of the Copper River Basin, located in south-central Alaska, extends back at least 500 years. Archeological evidence indicates that the region's early settlers (probably ancestors of the modern Ahtna) worked native copper into tools such as knives and prongs and other implements that could be traded.[1] The unequal distribution of copper enabled the Lower Ahtna, residing on the lower reaches of the Copper and Chitina rivers, to monopolize the copper trade. Precontact trading networks likely linked them to the coastal Eyak and to the Tutchone and Gwitch'in groups in the Alaskan interior.[2] By the late-eighteenth century, a rudimentary copper trade existed between the Ahtna and Russian traders who had settled on the coast, but copper remained secondary to furs. Despite numerous attempts to establish interior trading posts and assess the mineral wealth of the district, both weather conditions and occasional violent confrontations with the Ahtna dissuaded major European exploration of the Copper Basin until near the close of the nineteenth century.

In 1884, Brig. Gen. Nelson A. Miles of the U.S. army sent Lt. William R. Abercrombie to the Copper River with orders to investigate "the alleged hostility of natives."[3] Abercrombie's expedition encountered serious obstacles at the lower reaches of the Copper River and it was not until the following year, under a second and more diminutive expedition led by Lt. Henry Allen, that the Chitina River was first explored by Europeans. The success of Allen's expedition rested upon his enlistment of Chief Nicolai (alternately spelled Nicoli, Nicholai, and Nikolai) as a guide. Visiting both the village of Taral, located at the head of Wood Canyon on the Copper River (figure 4), and Nicolai's hunting grounds in the interior of the Chitina Valley, Allen witnessed the use of copper utensils and tools by the villagers.[4]

Toward the end of the nineteenth century, the U.S. government conducted further military exploration of the Copper River Basin and its tributaries through the Copper River Exploring Expedition. Led by Captain Abercrombie, these

Figure 4. Map of Copper River Basin



expeditions aimed to investigate the feasibility of an "all-American route" between Valdez and Eagle City on the Yukon.[5] While primarily intended to serve military purposes, the opening of a route was also viewed as a way to relieve the port of Valdez from a dire situation caused by the arrival of thousands of prospectors duped into thinking a Valdez-Klondike route already existed.[6] Oscar Rohn, a topographer and geologist from the United States Geological Survey (USGS), accompanied the 1899 expedition to further investigate the Chitina Valley and assess its mineral wealth. While the majority of prospectors traveling with Abercrombie's expedition planned to wrest fortunes from gold deposits on the Yukon, a few were interested in prospecting for gold and copper in the Chitina region. One prospecting outfit, known as the McClellan group, arrived at the village of Taral to find the inhabitants near starvation. Capitalizing on the

situation, the McClellan prospectors exchanged with Chief Nicolai their knowledge of a food cache on the Bremner River (left the previous year by the Allis group) for the location of his copper mine. Led to the ore deposits by Taral Jack, the prospectors' assays indicated the Bornite ore (a copper iron sulphide) was as rich as 63 percent copper. The McClellan party staked three claims in July 1899, the first such copper claims in the district.[7]

After returning to Valdez, prospectors Jack Smith and Clarence Warner of the McClellan group ventured back to the vicinity of the Nicolai claims for additional prospecting. In the interval, Rueben McClellan transferred the interests of the group to the Chittyna Exploration Company in return for company stock. In the summer of 1900, Smith and Warner prospected in the vicinity of the Kennicott Glacier, 10 miles west of the Nicolai mines, following a contact zone between limestone and greenstone that appeared favorable to mineral concentration.[8] On July 22, the two prospectors discovered the "Bonanza" lode, a rich copper outcrop at the crest of a rugged mountain ridge 4,000 feet above the glacier (figure 5). They staked 11 claims at the discovery site, at least five of which were staked in the names of McClellan party members using power of attorney.[9] Arthur C. Spencer, a geologist for the USGS, independently discovered the same deposit one month later by tracking the limestone and greenstone contact along the ridge line.[10] In a subsequent report, Spencer noted the ore to be practically pure chalcocite (copper sulphide) with exposed masses "from 2 to 4 feet across and 15 feet or more in length ... with their depth being not apparent."[11]

Figure 5. Location of the Bonanza claim, circa 1903. The rich chalcocite ore body is visible as the diagonal striations oriented toward the upper right of the photograph. (Mendenhall, 1905.)

The discoveries of rich copper ore did not end with Bonanza. Smith and Warner went on to discover the "Jumbo" deposit in a steep cirque, approximately one mile northwest of Bonanza.[12] This rich chalcocite deposit, 15 feet long and 12 feet thick, was also claimed under the interests of the McClellan group.

LITIGATION AND THE ALASKA SYNDICATE: 1900–1908

Upon hearing news of the Bonanza discovery in the fall of 1900, Stephen Birch, a 28-year-old graduate of the Columbia School of Mines, negotiated the purchase of a share of the Bonanza claim. Birch had been involved in both the

1898 and 1899 expeditions lead by Abercrombie and knew the prospectors personally. In November 1900, Dan Kain, a member of the McClellan group, sold to Birch half of his one-eleventh interest in the property for $2,500. Birch's trust of Kain and enthusiasm for the deal is evident, given that he did not inspect the property until after its purchase.[13] The contract was made financially possible through Birch's connection to the Havemeyer family, who had not only funded his education, but also sent him to Valdez for the specific purpose of seeking out investment opportunities. In 1900, under the laws of West Virginia, H. O. Havemeyer and James Ralph, another eastern investor, formed the Alaska Copper Company, placing Birch on a $300 per month stipend.[14] After the purchase of Dan Kain's interest, Birch negotiated for the purchase of all McClellan party claims. On March 6, 1902, the Alaska Copper Company (which soon changed its name to the Alaska Copper and Coal Company) bought the option on 45 copper claims on Bonanza Ridge—totaling around 3,000 acres of mining property—at a cost of $1.1 million.[15]

Transfer of these claims did not run smoothly. In 1902 the Copper River Mining Company purchased the Chittyna Exploration Company with the explicit aim of pursuing litigation over the Bonanza claims on the grounds that Jack Smith and Clarence Warner were technically under the employ of the Chittyna Exploration Company at the time of discovery.[16] The subsequent trial and high court appeal secured ownership of the Bonanza claims for the Alaska Copper and Coal Company, but only after nearly three years of legal struggles.

Figure 6. Mining experts at the future site of Kennecott, circa 1902. (Photo courtesy of the National Archives.)

The course of the trial seriously impeded development of the claims. The Alaska Copper and Coal Company undoubtedly guarded the property during the summer months, but construction of permanent structures probably did not take place until after the court settlement in 1905 (figure 6).[17] What activity did occur at the site focused on determining the quality and quantity of ore, the latter being particularly important to the acquisition of other financial backers. Assays conducted by the USGS and others indicated the extraordinary quality of the Bonanza outcrop, which contained upwards of 70 percent copper with 14 ounces of silver per ton.[18] Estimates varied more widely regarding the size of the ore body. Although Birch remained confident of the worth of the claims, large-scale investors such as the Guggenheims and Morgans still sent in their own experts to assess the situation.[19]

Between 1902–1905, the Alaska Copper and Coal Company investigated means to develop the claims. It was clear that the workability of the isolated Bonanza deposit depended on the development of a reliable and extensive transportation network. Construction of a railroad between the mine and a suitable port facility at Valdez, 200 miles away, required funding of a monumental scale.[20] While far beyond the financial resources of the Alaska Copper and Coal Company, a number of wealthy East Coast banking houses had already earned reputations for their sizable investments in American industry.[21] In 1906, Birch successfully brought together the interests of the Guggenheims, House of Morgan, Havemeyers, and Kuhn, Loeb & Company to form the Alaska Syndicate.[22] Later that year, the Alaska Copper and Coal Company was reincorporated as the Kennecott Mines Company with Birch as managing director. The change in company name apparently awarded Guggenheim interests a 40 percent share of the property.[23]

The Kennecott Mines Company set aside $25 million for construction of a concentration mill and railroad. It also pooled considerable existing resources. The Guggenheim-controlled American Smelting and Refining Company assured the availability of a smelter in Tacoma, Washington to process copper ore from the Bonanza and Jumbo mines. Syndicate ownership of the Alaska Steamship Company further reduced transportation expenses between the smelter and port.[24]

In the early 1900s, transportation of supplies (including food, equipment, and construction materials) into the Chitina Valley remained both costly and unreliable. The high cost of summer freighting by horse ensured that the majority of supplies were hauled along the Copper and Chitina rivers during the winter season.[25] To improve on this, the company assembled the steamboat Chittyna in 1907, the first of four company-built steamers to work between Abercrombie Rapids and the Chitina River. These steamboats primarily supplied construction crews for the railroad, but shipped supplies closer to the mill camp during rare periods of high water on the Nizina.[26]

The Kennecott Mines Company encountered difficulties developing the individual mine claims. The nature of the landscape surrounding the Bonanza Mine placed restrictions on the spatial layout of mining infrastructure. Topographical constraints, namely the 4,000-foot change in elevation from the floor of the

Chitina Valley to the mine claim forced separation of the railroad facilities and the mine. In addition, the distance and traveling time between these areas required construction of separate support facilities and worker accommodations at each location. The lack of available building space at the mine sites led engineers to place some mining machinery, such as hoists and compressors, underground.[27]

Topography also affected the layout of circulation systems. The north-south alignment of the Bonanza Ridge, coupled with the Kennicott Glacier abutting its western edge, forced wagon routes, and later railroads, to follow the glacier perimeter. At higher elevations, the narrow cirques and steep valleys of the Bonanza Ridge formation influenced the placement of aerial tramways to link the mines to the concentrator site. Aerial trams could more economically negate rugged topography than land-based routes (figure 7).[28]

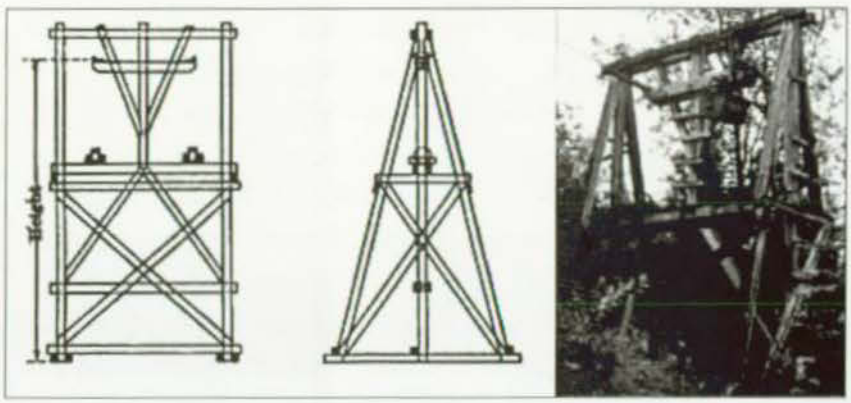


Figure 7. Aerial tramway infrastructure at Kennecott closely correlated with well established designs. (Peele, 1918; field documentation, 1997.)

Natural features and processes also influenced the location of lower camp and concentrator facilities. Glacial scouring left a rugged landscape incised with steep-sided gulches that were nearly devoid of level ground.[29] West of the Bonanza claims, however, two gulches channeled creeks (later named Bonanza and National) into close proximity, making them useful for domestic and industrial consumption.

Construction of the Copper River and Northwestern Railway, seen as critical to the profitable extraction of copper ore, had a strong influence on the selection of a mill town. The chosen site lay close to the moraine of the Kennicott Glacier and the toe of the ridge. At an elevation of approximately 2,200 feet, the railroad

approach to the mill town from the Chitina Valley was considered a reasonable grade. (Nonetheless, the paucity of flat land at the mill town forced trains to back up or down the grade to the nearest turnaround in McCarthy located five miles south of the concentrator complex.) The location of the concentration mill also left enough space for the disposal of tailings, a critical consideration in the planning of milling facilities.[30]

During the winter of 1906, a party led by Rueben McClellan sledded construction materials for the concentration mill and tramway from Valdez. By the end of 1907, two log structures—a one-and-a-half story general manager's office and a slightly larger storage building—had been constructed at the bottom of a south-facing slope on cleared land north of National Creek.[31] In this period of early development, additional clearing in the area around National Creek provided both open lands for future construction and fuel for domestic use.[32]

Four additional buildings were built the following year: a small blacksmith shop, a one-story post office or storage facility, a one-and-a-half story bunkhouse, and a 10,000 square-foot sawmill that spanned a shallow gully at the south end of the camp. A wagon road connecting the camp with the steamship landing on the Chitina River to the southwest crossed over the gully on a simple log bridge (figure 8). This road was widened the following year to accommodate freight transportation. A second road led eastward to the Bonanza claims to supply the

Figure 8. Kennecott mill town, circa 1908. View looking south with the sawmill in the foreground. (Photo courtesy of the Anchorage Museum of History and Art.)

mine, until later when an aerial tramway would be erected.[33]

Construction of the concentration mill began in 1908 at the top of the short, steep slope north of the two log buildings. Workers first erected the concentrator's upper story and tram deck so that the aerial tramway system could be used to move ore and supplies. By the winter of 1908, the 15,000-foot Bonanza aerial tramway was well under way with approximately half of the 40 tram towers completed.[34] Workers cleared vegetation from either side of the tramway to ensure access to the towers for repairs and to reduce the risk of damage from heavy snows, avalanches, and fallen trees.

Connections between the mines and port remained a primary concern in the early development of the site. In the summer of 1908, the Copper River and Northwestern Railway crossed the Copper River at Flag Point (mile 27 from Cordova), an achievement whimsically equated by some to the crossing of the Rubicon.[35] Progress on the railroad had been impaired largely by the poor selection of ports and routes. In 1906, for example, Michael J. Heney's successful location of a rail route through Abercrombie Canyon resulted in Katalla being chosen as the port over Valdez.[36] After a 1907 storm destroyed the railroad breakwater at Katalla (rendering the port unsafe for the landing of steamships), the Alaska Syndicate opted in favor of a third choice, Cordova.

Selecting the Copper River route for the railway (instead of Valdez) increased construction expenses by $12 million dollars, but enabled future savings provided that nearby coal fields could be purchased and opened as a means to fuel the railroad. The need to run the railroad cheaply, however, ultimately entangled the Alaska Syndicate with politics at the national level, generating not only more vociferous anti-Syndicate protests, but also a political climate that would ultimately change the company's management policies (figure 9).

Development and Corporate Expansion: 1908–1915

In 1907, the Alaska Syndicate negotiated privately with Clarence Cunningham and Associates for a half option on 27 claims in the Bering River coal fields in the hope of ensuring a cheap fuel supply for the railroad. Unfortunately, the

BUILDING LEGEND

1 Manager's Office
2 Tram Terminus
5 Bunkhouse
6 Sawmill/Carpentry
78 Warehouse
79 Blacksmith

Historic Base Map: 1900-1908
Cultural Landscape Report: Kennecott Mill Town
Wrangell-St. Elias National Park and Preserve
10/97

Aerial Photographs, NPS, 1991; Site Layout Map, Kennicott Pre-Acquisition Environmental Site Assessment, NPS, 1996; Fire Insurance Plan, Kennecott Copper Company, 1936; Topographic Survey, 1991-92, Drawing no. 190/80021. Field Investigations, 1997

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Figure 9. Kennecott Historic Base Map, 1900–1908.

Cunningham claims had been staked prior to the legal opening of the coal fields in 1904. In addition, the number of merged claims well exceeded 1904 legal stipulations allowing the consolidation of only four claims per company.[37]

In 1907, Richard Ballinger, recently appointed Secretary of the Interior by the Taft administration, began an investigation into these and other claims in the area. The inquiry specifically addressed issues of legality and awarded development patents to those claims made in good faith prior to the 1904 law. Problems arose with Gifford Pinchot, chief forester of the United States and major proponent of Theodore Roosevelt's conservation ethic. Pinchot realized the cancellation of all claims would pass control of the coal fields, by default, to the Forestry Department, which could then institute a leasing system. Discovering the fraudulent deal between the Alaska Syndicate and the Cunningham claims provided Pinchot with the necessary means. Aiming to discredit Ballinger and remove him from office, Pinchot alleged Ballinger's involvement in fraudulent dealings with the Cunningham claims and the Alaska Syndicate.

The ensuing Ballinger-Pinchot struggle for the control of Alaskan coal lands not only escalated public fears and resentment of big business in Alaska, but focused animosity directly at the Guggenheim-Morgan Syndicate. Newspapers portrayed the Syndicate as an immense political force aiming to exploit all of Alaska's resource wealth while ensuring that Alaska remain a U.S. territory (figure 10).

Figure 10. Political cartoon, circa 1910, published during the Ballinger-Pinchot affair.

Exaggeration of the Syndicate's Alaskan motives by Pinchot and other accusers was not completely without cause. (Judge James Wickersham, for instance, used the circumstances to push forward his bill for an elected Alaskan legislature.) The Syndicate had aggressively purchased a wide range of key Alaskan enterprises (steamship lines and fisheries in addition to the railroad and mines) and established itself in Alaska with an undeniable political presence.[38] Given the benefits to future Syndicate interests of a railway connecting coal fields with the Alaskan interior, J. P. Morgan's initial wish to donate the Copper River and Northwestern Railway to Alaska as a testament for pioneer enterprise (which he likened to Carnegie's gifting of libraries) cannot be considered entirely philanthropic.[39]

The Ballinger-Pinchot affair had serious ramifications on the Syndicate's operation and on Alaskan development. The eventual court injunction against opening Alaskan coal fields stymied development in the Copper Basin by other companies as well. The Copper River and Northwestern Railway would never prove to be the rapid catalyst that was initially forecasted for the industrial and agricultural development of the Copper Basin. Instead, the railway needed to charge higher freight costs because its profits and existence depended on Kennecott's success. Indirectly, this reduced available funds for surface improvements at the concentration mill and mine sites.

The Ballinger-Pinchot affair and the fear of provoking additional public outrage may have soured government dealings with the Syndicate. It may have also played a role in the Wilson administration's refusal to purchase the Copper River and Northwestern Railway from the Syndicate at low cost in 1915.[40]

Unlike the suit over the Bonanza claims a few years prior, the course of the Ballinger-Pinchot affair did not stop development in the mill town and mine sites. In 1908, the Kennecott Mines Company hired L. A. Levensaler, previously employed by the Anaconda Mining Company, to map gold placer mining claims on Dan Creek, a branch of the Nizina River located southeast of Bonanza Ridge.[41] In 1910, Levensaler received instructions to prepare the Bonanza and Jumbo claims for mining. While operation of the Bonanza tramway meant that ore could now be extracted from the Bonanza deposit, Levensaler preferred to work on site improvements until completion of the railroad. He assigned 30 laborers to the sawmill and buildings, while six workers stayed at the Bonanza Mine for "purely development and prospecting."[42] As a consequence, the lower camp underwent considerable expansion during the following two years.

Several major improvements and construction activities at the mill town contributed to the production of ore and the living environment for families and workers. Fundamental to the development of the site was a reliable supply of water for industrial and domestic consumption. By the close of 1910, Levensaler's workers had constructed a 150-foot-long crib dam made from local timber and located at the top of a small gorge above the manager's house. Located in close proximity to the camp, the dam stored drinking water and supplied water for a 250 horsepower hydroelectric plant constructed at the northern end of the mill

town. This in turn generated electricity for the camp and mines.[43] A central line running north to south with secondary lines meeting at near 90 degrees delivered power to camp buildings. A power line to the Bonanza Mine paralleled the aerial tramway to the mine and then continued over the ridge to the Jumbo Mine. Power to the Erie Mine, approximately three-and-a-half miles distant, followed a wagon road north along the edge of the glacier.

Considerable landscaping and development, particularly worker housing, transformed the area along the National Creek valley below the crib dam. Workers constructed a two-and-a-half story bunkhouse just east of the 1908 bunkhouse. On the north side of National Creek, a three-and-a-half story staff house and a one-and-a-half story manager's house, as well as a clothesline were positioned east of the general manager's office. A small assay office was built between the manager's office and the 1908 bunkhouse. A rustic water well immediately east of the staff house may only have served a decorative function, somewhat incongruous in the otherwise utilitarian landscape. Across the wagon road from the hydroelectric facility, a storage building also doubled as a general store. Northeast of the upper concentrator, away from all other structures in the mill town, the company built a small powderhouse.

Sometime between 1908–1915, the Kennecott Mines Company constructed facilities and allocated space for food procurement activities. South of the building complex, a dairy barn was constructed and a small number of cows were kept to supply fresh milk and cheese to the residents. The company allocated space east of the manager's residence for a community garden, about 100 square-feet in size. Vegetables and meat supplied by Chitina Valley residents supplemented those raised at the mill town. In spite of these efforts, most of the food supplied to Kennecott throughout its occupation was imported.[44]

Pedestrian circulation through the site was both formal—along wood-planked boardwalks—and informal, based on need and function. The boardwalks connected residential, administrative, and service buildings with established wagon trails. The graded rail bed provided less formal connections to industrial structures. Water, steam, and sometimes sewer pipes were typically grouped together and ran beneath boardwalks. These "utilidors," enclosed in sawdust-filled wood casings, reduced the clutter and excavation necessary for pipe laying and

provided additional insulation for the pipes. Fire hydrants, equipped with 100-foot long hoses and housed in distinctive trapezoidal casings, were installed within close proximity to buildings.

The layout and organization of residential and work areas reflected both social status in and functional needs. Positioning, room size, and exterior building color all reflected social status in the mill town. The manager's free-standing house was initially painted red with white trim, as were other utilitarian buildings, while the use of white paint, typically with dark trim, distinguished special buildings. Different exterior painting schemes distinguished similarly proportioned buildings, such as the staff house from the bunkhouse. Initially, management and administrative staff resided on the south-facing slope immediately north of National Creek. Their position close to the concentrator undoubtedly made for noisy accommodations, but visual prominence and central location were characteristic attributes of managerial residences in nineteenth and twentieth century company towns.[45] It is also likely that noise of industrial processes permeated the mill town. There were no facilities at the bunkhouses for families and as a consequence, miners and mill workers, if married, typically did not have their families with them.

Although construction of the lower levels of the concentration mill had begun in 1908, it was neither completed nor used in any operational capacity until after the railroad reached the lower camp in 1911.[46] As initially designed, the concentrator process was a relatively simple operation suited to the richness of the ores. Typical of the time, the building was constructed on a hillside, combining technological efficiency with local topography (figure 11). The 14-story concentrator cascaded down the hillside in a series of terraces, maximizing the use of gravity in the concentration process. Milling machinery—jigs and tables—could be gravity-fed and installed in such a manner that the movement of progressively less profitable ore through the concentrator did not generally require re-elevation of material between machines. Over time, changes to the mill made it a more complex structure. New machinery was introduced and outmoded or inefficient processes and machines were removed in response to changes in the grade and tenor of the ore.

Water necessary for operating mill equipment came from two pipes. One led

Figure 11. Concentration mill, circa 1912. Note the extensive crib work in front of the mill and the high-grade ore conveyor connecting the upper mill and the stacking shed. (Photo courtesy Alaska and Polar Regions Archives, Rasmusson Library, University of Alaska, Fairbanks, Alaska.)

from the National Creek dam to the concentration tables while a second pipe channeled water from a point above the dam to the upper concentrator. Initially, the milling process was unable to recover copper values from the carbonate ores. Milling also produced a significant amount of very fine particles known as "slimes," which could not be recovered easily. Some of these slimes were bagged and shipped off to the smelter. Most of the tailings, both carbonate and slimes, were put aside and stored for future handling.[47] Tailings from the concentrator were discharged on the north and south sides of the building, while an extended crib wall on the north side preventing tailings from slipping onto the rail grade.

Prior to completion of the railway, the Bonanza Mine consisted of just a few shafts and tunnels. Anticipating the expansion of work, a bunkhouse, mess hall, and blacksmith shop were built at the mine site by 1910.[48] Explorations indicated that the Bonanza ore body still contained high-grade ores, but that low-grade ores (assaying 13 percent) were increasing in quantity.[49] Seeking to ensure the vitality of their Alaskan investments, the Alaska Syndicate expanded the Alaska Copper and Coal Company's ownership of mining properties. In 1910, Stephen Birch purchased the Beatson Mine on Latouche Island in Prince William Sound.[50]

On March 29, 1911, the Copper River and Northwestern Railway linked the Kennecott mines with the port of Cordova 196 miles away. At the mill town, a 250-foot trestle bridge over National Creek extended the railroad to the high-

grade ore bins located at the bottom of the concentration mill.[51] As part of the ceremony, the chief engineer hammered a copper spike at the terminus of the line.[52] Completed at a cost of nearly $20 million, the railroad crossed the Copper River at three locations. The third of these, near the town of Chitina at the junction of the Chitina and Copper rivers, was temporary. The cost to rebuild the wooden trestle each spring after the ice breakup proved cheaper than the erection of a steel bridge. As a consequence, the railroad was not fully operational for several weeks each year. On April 8, a shipment of 1,200 tons of 60-70 percent copper worth $250,000 departed for Cordova by rail, arriving at the Tacoma smelter on April 14.[53] Subsequent shipments of ore occurred twice weekly. Now that the railroad was completed, the Alaska Syndicate phased out its sternwheelers operating on the Copper River.[54]

Given the expense of coal (imported 1,200 miles from British Columbia at a cost of $12 per ton), the railroad could not be a highly profitable enterprise.[55] It relied instead on the profitability and longevity of Bonanza Ridge ore deposits. But estimates regarding the size of the Bonanza Ridge ore body varied considerably due to the unpredictable nature of the ore bed. In fact, throughout Kennecott's operation, the mines were never run with more than four years worth of proven ore ahead of them.[56] As USGS geologist Fred Moffit noted, "[a] common experience in mining these ores is to find that an ore body terminates abruptly or that a tiny stringer of copper minerals, apparently of no value whatsoever, if followed a sufficient distance, opens out into a large mass of ore."[57] Consequently, the company explored all indications of mineralization on Bonanza Ridge, and conducted property explorations in the general area hoping to extend the life of the railroad and other associated investments.

Profits from Bonanza Ridge were forthcoming. At the close of 1911, the Kennecott Mines Company yielded its first dividend. By 1912, the company had paid $3 million in dividends, reporting a $4 million operating profit.[58] Development work at the Jumbo Mine, coupled with the discovery of the Erie location (approximately three miles north of the mill town), fueled optimism about the life and eventual profitability of the mines.[59] In 1914, miners discovered a sizable high-grade deposit between levels three and five in the Jumbo Mine. This ore block (350 feet long, 40 feet wide, and 40 feet high) contained approximately 70,000 tons of almost pure chalcocite, with an additional 20 ounces per ton of

silver, valued at one dollar per ounce.[60] It was one of the richest copper ore bodies ever found. In 1915, 227 men mined 750 tons daily from the Bonanza and Jumbo mines, a 300 percent increase on the previous year's production.[61] By May 1915, the mines had produced 86,000,000 pounds of copper and made upwards of $8 million in operating profits.[62]

Rising profits from the mines stimulated construction and renovation at the mill town. In 1912, improvements to the concentration mill included an ore sacking shed (complete with rail-bed scales) added to the west wall, an aerial high-grade ore conveyor down the south side of the concentrator, and a shed extension to the Bonanza tram deck. East of the concentrator, a storage bin held ore for future concentration. Unstable foundations forced the concentrator to cease operation in 1912 for repairs.[63] Stabilization of the structure may have involved attaching guy rope cables to the north and south sides of the mill's upper tram deck. A one-and-a-half-story, wood frame extension was added to the west wall of the general manager's office. The 16,000-foot Jumbo tramway became operational in 1913, superseding the use of a wagon road for ore removal. That same year, however, a snow slide destroyed part of the Bonanza tramway, suspending operation of the line, although the Bonanza still made shipments for the next eight months. Improvements to the mill town completed in 1915 included a hospital (located on the north side of National Creek and painted white) and six, small staff residences north of the concentration mill. However, company housing did not accommodate all workers. South of the mill town on the bank above the rail line, tents (probably supplied by the company) housed the overflow (figure 12a and b). Both forms of accommodation were located on the outskirts of the town where space for administrative and industrial facilities was not at a premium. Timber storage occupied areas immediately alongside the railroad tracks.

The spatial organization of the mill town developed from formative patterns that were established by 1908. An administrative and residential area grew around National Creek where ore was transferred from the mill and aerial tramway to the railway. This connection defined the center of the mill town both geographically and functionally. The location of the administrative core was largely determined by the need to be near transportation lines. Stores and shops serving the mines and the mill were closer to the tram and rail lines, while non-

industrial functions such as housing and community services were set back from the railway. Trash was dumped on the moraine away from residential areas.

Around 1913, Kennecott wanted to improve the efficiency of concentration operations and looked into the viability of leaching and flotation techniques for processing the fines. The higher-grade end product of the leaching method (75 percent opposed to 30 percent for flotation) warranted its selection because of the substantial reductions to transportation costs.[65] However, the ineffectiveness of acid leaching with the carbonate ores from the Bonanza Ridge claims necessitated use of an alternative reagent. E. Tappan Stannard, a chemist at the Federal Lead Company laboratory at Flat River, Missouri (and later Kennecott Copper Corporation president), first conducted ammonia leaching experiments on these ores and proved the process effective.[66] By the summer of 1914, the Kennecott Mines Company had erected a small test facility at the mill town to better determine its feasibility at the larger scale.

The Alaska Syndicate ceased to exist in 1915. The Kennecott Copper Corporation, dominated by former syndicate officials, took its place. The new company capitalized on the high prices for copper created by the First World War to finance a much larger public company. The new Kennecott Copper Corporation acquired the Kennecott Mines Company and the Beatson Copper Company along with the transportation interests of the now defunct syndicate. In addition, the new corporation purchased substantial positions in the Utah Copper Company and the Braden Copper Mines Company. This gave the company a solid foot-

Figure 12a. Panaroma of Lower Kennecott mill town, circa 1913. (Mears Collection, Rasmuson Library, University of Alaska, Fairbanks Alaska.)

hold in future development of extensive low-grade copper deposits. Utah Copper operated the Bingham mine, which at the time was the second largest copper mine in the U.S.[67] The change in corporate structure led to new management strategies at Kennecott and throughout the larger entity. Over the next two decades management became increasingly systematic at the Kennecott operations in Alaska and throughout the larger corporation as Kennecott Copper expanded into an international force.

KENNECOTT COPPER CORPORATION ERA: 1915–1938

Responding to the favorable economic conditions that World War I provided to extractive industries, Kennecott experienced rapid development within the first few years of the Kennecott Copper Corporation's existence (figure 13). Soaring copper prices in 1916 (above 28 cents per pound) and the guaranteed price of 23.5 cents per pound the following year enabled the company to step up production rates. In 1916, Kennecott produced 101,410,000 pounds of copper, a seven-fold increase over the previous year.[68] Visiting the mines that year, William Douglass, later superintendent at Kennecott, impressively compared them to the profitable Anaconda Mine in Butte, Montana. Although the latter employed 15,000 people and produced an average of 30,000,000 pounds of copper per month, Kennecott achieved one-third of Anaconda's production employing only 500 people, running considerably less powerful machinery and encountering more difficult mining conditions (such as inclined shafts with

Figure 12b. Panaroma of Lower Kennecott mill town, circa 1913. (Mears Collection, Rasmuson Library, University of Alaska, Fairbanks Alaska.)

multiple slopes and dog legs).[69]

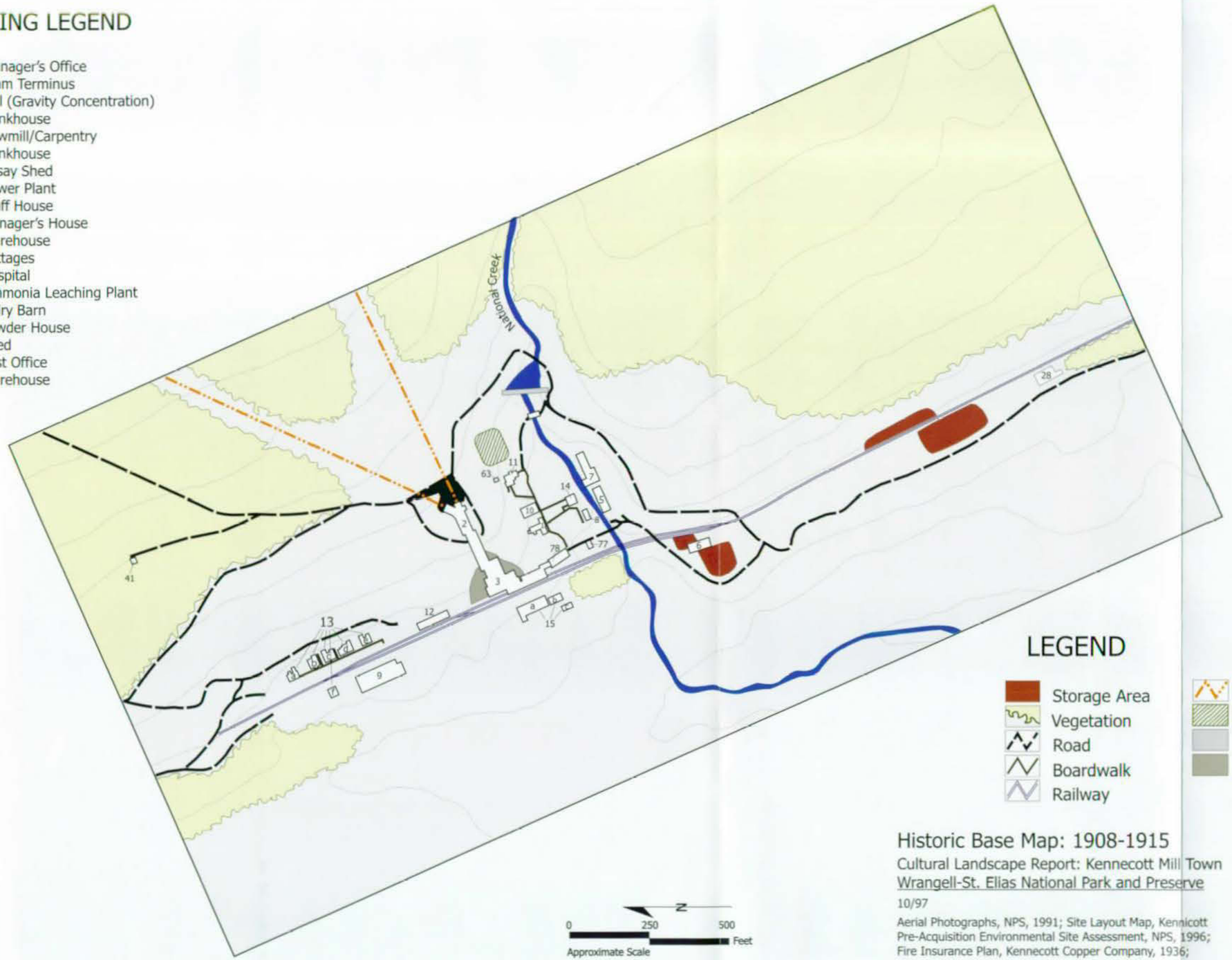
Success clearly rested on the unusual richness of the Bonanza Ridge ore deposits, but it also depended on the extractive efficiency of the concentration operation, which ultimately affected expenditure for freight costs. With favorable results from the experimental leaching plant, management turned their attention to include the full-scale processing of finer ore sizes.[70] In 1916, a 300-ton ammonia leaching facility (located west of the concentrator) started operation. Although a risky financial experiment, ammonia leaching enabled the reuse of old mill tailings and facilitated the mining of low-grade ores, marking a crucial shift toward the systematic extraction of copper at Kennecott. In its first year of operation, the plant processed 62,450 tons of 1.48 percent copper into 705 tons of 70 percent copper concentrate.[71] Two years later in 1918, the volume of raw material processed had more than doubled. Although the ammonia leaching plant treated mill tailings, it could not handle slimes efficiently. Consequently, ore sizes smaller than two-millimeters in diameter were screened from the mill feed and shipped directly to the Tacoma smelter. Slimes created in the concentrator were treated on tables and discarded.[72]

Improved efficiency at the concentration mill extended the use of tailings. A conveyor shed at the south end of the ammonia leaching plant redirected tailings from the leaching plant across National Creek in order to create usable space for future construction. A wooden crib erected between the carpenter shop and leaching plant, west of the rail grade, also held tailings for reclamation work. Hoist houses and scrapers positioned behind the leaching plant and warehouse were used to move the tailings.[73]

Water supply proved to be one of the most critical factors in operating the concentration mill facilities. The absence of enough water during the winter season required measures to conserve what was available. Improvements to the concentrator's water supply in 1917 (possibly by the installation of a cooling pond and water tanks to the northeast with which to recycle water) enabled the concentrator to run at full capacity for the first time.[74] The power plant, requiring 100 gallons per minute of new water for cooling purposes, received water from both Bonanza Creek (north of the mill town) and from the concentrator's cooling pond. In spite of the supply improvements, both the concentration mill

BUILDING LEGEND

1 Manager's Office
2 Tram Terminus
3 Mill (Gravity Concentration)
5 Bunkhouse
6 Sawmill/Carpentry
7 Bunkhouse
8 Assay Shed
9 Power Plant
10 Staff House
11 Manager's House
12 Warehouse
13 a-f Cottages
14 Hospital
15 a-c Ammonia Leaching Plant
28 Dairy Barn
41 Powder House
63 Shed
77 Post Office
78 Warehouse



LEGEND

Storage Area
Vegetation
Road
Boardwalk
Railway
Tram
Garden
Crib Dam
Tailings

Historic Base Map: 1908-1915
Cultural Landscape Report: Kennecott Mill Town
Wrangell-St. Elias National Park and Preserve
10/97

Aerial Photographs, NPS, 1991; Site Layout Map, Kennicott Pre-Acquisition Environmental Site Assessment, NPS, 1996; Fire Insurance Plan, Kennecott Copper Company, 1936;

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Figure 13. Kennecott Historic Base Map, 1908–1915.

and power plant used water "over and over until it was practically worn out."[75]

Consistent with the rise in profits from World War I copper prices and Kennecott's shift to vigorous extraction, exploration, and milling of its ore bodies, the company made substantial improvements to the concentration mill and mine sites. The installation of a tramway between the Erie Mine and the terminus of the road greatly improved access and the movement of supplies to the mine. At the Bonanza and Jumbo mines, new kitchens and dining rooms were built in 1917.

The mill town experienced particularly rapid development between 1916 and 1918. An extension to the power plant housed a turbine; an oil house stored "Bunker C" oil for use in the power plant; and a large machine shop located between the power and leaching plants repaired machinery for both the concentrator and mines. A small tramline ran from the tram deck at the top of the concentration mill to the machine shop, enabling (with the aid of a winch house) the repair and easy movement of heavy machinery. To prevent a complicated intersection between tram and railroad tracks, a drawbridge on the east side of the rail grade raised and lowered the tram rails across the railroad tracks when needed. In the National Creek area, a new rail depot replaced the 1908 structure. The log warehouse south of the concentrator was also removed to allow for a metallurgical laboratory extension.

Figure 14. Built in 1916, Stephen Birch's residence was situated near the Bonanza Mine ore bin and Jumbo aerial tramway tower, visible in the background. Photograph circa 1919. (USGS photo library, Moffit 754.)

Developments in 1916 also included substantial improvements to staff and managerial residences. Immediately north of the National Creek dam, a two-story residence built for manager Stephen Birch (painted white) sat perched on the rise of the slope, affording views to the concentrator, other National Creek structures, and the glacial moraine beyond (figure 14). Because Birch's residence occupied the space once used for the community garden, management allocated space for a new garden, measuring 100 feet by 160 feet, on the north side of the National Creek dam reservoir. New accommodations for staff were constructed at the north and south ends of the mill town. At the north end, three cottages were constructed next to the power plant alongside those built the previous year. Due to the steep drop-off on the west side of the rail grade, these cottages included lined basements and catwalks connected each cottage with a privy.[76] Toward the south end of the mill town an apartment house containing five, four-room apartments and farther south, four, six-room cottages

were located east and uphill of the rail grade. General living conditions were also improved in 1916 with the construction of a recreation hall on the west side of the rail grade, opposite the apartment block. The recreation hall became the social center of the town and found weekly use for basketball games, dances, and moving pictures.

The following year, in 1917, additional support facilities were constructed south of the sawmill on land leveled and reclaimed using tailings from the leaching plant. New structures included a large store and warehouse, a three-and-a-half story bunkhouse (called the West Bunkhouse), and a refrigeration plant for storing meat. A narrow gauge tram linked the store with the power plant and followed the west side of the rail grade. Behind the sawmill, a paint shop, morgue, and laundry facility were also probably built during this time. A row of three cottages reserved for married men working technical jobs was built on the hill above the apartment building, further improving staff accommodations.[77] To connect these residences to the town, a road known later as "Silk Stocking Loop," ran from the store to the cottages and then to National Creek dam. Improvements in 1918 saw a northern cluster of four cottages built on the Loop. These eight-room residences, complete with indoor plumbing, were among the most sought-after staff accommodations. Somewhere between 1915-1918, a schoolhouse, doubling as a church, was built south of the bunkhouse and store, necessitating the movement of the dairy barn to a new location at the southern entrance to the mill town. Schoolteachers, generally single women (but often married within the year), found accommodation in the staff house north of National Creek.[78]

Recreation facilities in the town improved with the addition of a tennis court located north of the concentration mill, a handball court located between the West Bunkhouse and school, and a baseball diamond located south of the school. Management provided a lending library and magazines for entertainment. Shopping catalogs were also available to meet workers' needs.[79] All leisure activities at Kennecott were, however, controlled and approved by management out of concern for discipline. For many workers, freedom and other forms of entertainment could be found in the town of McCarthy, five miles south of the mill complex. Among other activities in the satellite town, workers found bars and brothels. Not owned by the company, yet almost solely dependent upon the mines

for its existence, McCarthy's vitality was inextricably linked to Kennecott's profits.

By 1918, the mill town was approaching its peak of physical development. At a broad level, spatial organization of the mill town landscape retained a sense of functionality, primarily in regard to the placement of industrial buildings. The concentration mill, leaching plant, and machine shop were located in close proximity, reducing transportation costs incurred in the regular movement of ore and machinery. The linear separation of these and other industrial support structures (including the power plant, warehouses, and open storage areas) maximized access to the railroad. Administration and staff and managerial accommodations occupied the logical center of the site, placed close to the mill on the hillside.

The company located most of the remaining facilities according to the available space. Residential areas, for example, were placed next to industry in the administrative center and on the outskirts of the complex. Staff accommodations demarcated the limits of the town (approximately 2,700 feet in a north-south direction).[80] The company located recreation facilities near the edge of the complex on reclaimed land and in available space between structures. Consequently, the mill town provided intermixed spaces for work, domestic, and leisure activities.

Boardwalks continued to define pedestrian circulation at the center of the concentration mill complex and around staff housing. Elsewhere, circulation patterns followed the railroad grade and well-established vehicle trails. Silk Stocking Loop residents created informal paths down the hillside to improve access to the mill complex. Boardwalks behind the West Bunkhouse and machine shop led to areas of frequent waste disposal. The interface between the mill town and the glacial moraine continued to serve as a dumping area for both industrial wastes (tailings, broken machinery, used oil drums) and residential discard (domestic trash, sewage). Pipes and flumes channeled mill town waste (including sewage and tailings) toward National Creek where it could be inexpensively flushed.

Although the mines were entering their most productive phase, Kennecott's profits did not reach all interested parties. Miners struck in June 1917 (the only strike to occur at Kennecott) for a flat rate wage instead of the sliding wage scale based on copper prices. Since most other major copper producers had adopted

the sliding scale wage system, the Kennecott Copper Corporation refused to change its payment regime. In arbitration 45 days later, the company agreed to a 50-cent-per-day wage increase for miners and the installation of a new bunkhouse, mess hall, and recreation hall at the Bonanza Mine.[81] The company successfully refused to sign workers on collective contracts (preventing independent union representation) and retained the right to decide which men were eligible to return to work. It rehired only one member of the Miners Committee.[82]

World War I increased copper demand, but it also caused chronic labor shortages. Kennecott was no exception and the scarcity of labor forced the temporary closure of the Erie Mine in 1918.[83] The 1918 armistice would prove inversely as momentous to the copper industry as the war's outbreak in 1914. The ill-timed encouragement of the copper industry to continue high production levels by the War Industries Board and the saturation of the copper market with wartime scrap left copper producers stuck with large ore stockpiles and the need to curtail production. As a direct consequence, Kennecott reduced its production rate to one-third of normal in 1919.[84]

Geographic isolation compounded problems. The Copper River and Northwestern Railway increased freight charges to compensate for lost revenue. Snow slides in 1918 and 1919 destroyed tramway towers, telephone lines, and closed trails.[85] The dubious safety of bunkhouses at the mine sites caused miners to live in the tunnels for several days.[86] These events not only affected the Kennecott mines, but also claims worked on the other side of Bonanza Ridge. The Mother Lode Mine (essentially an extension of the Bonanza deposit) was so severely damaged by snow slides that the cost of repairs proved exorbitant.[87] Seizing an opportunity, the Kennecott Copper Corporation acquired 51 percent of stock in the Mother Lode Coalition in 1919.[88] Subsequent construction of a cross-cut tunnel linking the Mother Lode to the Bonanza Mine enabled Kennecott to process Mother Lode ore.

In 1921, when the price of copper fell below the price of production, Kennecott still produced copper, albeit in the lowest volume since 1911.[89] In spite of limited operations, some surface improvements continued at the site. In 1920, a 5,500 foot aerial tramway connected the recently opened Glacier Mine (located between the Jumbo and Bonanza mines) with the Jumbo tramway. This mine

worked a low-grade rock glacier (approximately 2.8 percent copper ore) using surface scrapers. Operations were seasonal only. In the absence of artificial thawing, the glacier could only be worked in the late summer (July to September).[90]

Improvements at the mill town also continued. The powerhouse received an extension to accommodate a diesel engine and additions were made to the east side of the hospital. Both bunkhouses on National Creek were renovated to accommodate more workers (figure 15).[91] The second bunkhouse (circa 1910) included a toilet, shower and laundry facilities, a poolroom, reading room, and locker room.

Employment at Kennecott remained high in spite of low copper prices (14 cents per pound). Of the 550 people employed at Kennecott, 321 men worked in the mines. Wages decreased slightly with the 1921 recession, but still remained fair. Electricians and machinists received a daily wage of $5.50 to $5.75, skilled workers earned up to $5.50, miners $5.25, and laborers $4.25.[92]

In the 1920s, the nature of Bonanza Ridge ores began to change. An increased percentage of carbonates in the ore made it more resilient to crushing, which in turn required finer grinding.[93] The subsequent installation of additional rolls, jigs, and separating tables at the concentration mill in 1922 warranted two extensions to the building: a sample mill room on the north side and a "Hancock" addition for the jigs immediately up-slope from the general manager's office.[94]

Figure 15. Administrative center of Kennecott showing the mill and industrial buildings, hospital (center foreground), staff house (right), and manager's office (center). Note the well, flagpole, picket fence, and boardwalks (center foreground). Photograph circa 1919. (USGS Photo Library, Moffit 753.)

The resultant increase in slimes and fine sands created by the milling process led to the installation of a small flotation unit to process the slimes. Laboratory experiments proved the ammonia leaching process could be extended to work with slimes, but costs for the expanded leaching process far outstripped those associated with the alternative—flotation—by three to four times.[95] As an added advantage to its cheaper cost, the flotation process extracted sulphide copper not recoverable by ammonia leaching.

Lack of consistent results when fine tuning the process in the laboratory, coupled with the variable experience of other flotation mills, delayed the plant's installation (an addition to the north end of the leaching facility) until 1923. The flotation process at Kennecott worked approximately 20 percent of the total ore tonnage and extracted between 72–75 percent of the copper from the slimes. This improved overall efficiency of extraction to 96 percent.[96] In 1924, Kennecott ceased the separation and direct shipment of slimes to the Tacoma smelter. Redirection of these slimes into the concentrator introduced more insolubles (such as alumina and iron oxide) into the mixture and decreased the efficiency of the flotation process by 5–10 percent, a problem still unresolved in 1928.[97]

The year the flotation plant began operating proved to be Kennecott's greatest year in terms of ore quantity mined. However, diminished ore quality meant profits did not exceed 1916 levels. The expected limited life of the mines influenced company decisions against installation of additional flotation cells to supersede the expensive leaching process. Kennecott Copper Corporation continued investments in other mining companies by purchasing the Blackbird mine in 1923 (adjoining the Beatson property on Latouche Island) for a little over a million dollars and by continuing the purchase of stock in Utah Copper (of which Kennecott owned 76 percent).[98]

The changes to the ore body marked a shift in the life cycle of the mines. Although the mines still extracted ore from known veins, the discoveries of new ore bodies were becoming less frequent.[99] This directly effected the nature of surface improvements to the mill town. Between 1918–1925, improvements at the site focused on increasing the amount of storage for equipment and supplies. The company expended little capital on improving residential and service facilities. Storage areas were located opposite the store and warehouse building,

Figure 16. Kennecott mill complex in 1925. West bunkhouse is at center with the schoolhouse and baseball field in front. (Photo courtesy of the Alaska Suite Library.)

between the recreation hall and barn, and north of the recreation hall (for a coal bunker). The company also constructed two garage facilities south of the dairy barn. Lumber storage areas occupied space near the railroad, including areas between the apartment block and schoolhouse south of the recreation hall and east of the upper mill complex. Facilities for workers that were constructed by 1925 included a bathhouse east of the company store, two cottages north of the recreation hall, and a tent cottage at the south end of the complex (figure 16).

In August 1924, a fire destroyed part of the power plant, a small storehouse, and one cottage in the mill town. By early the next year, however, a new power plant was operational. Structural debris from the old powerhouse, including furnace stacks, were dumped northwest of the plant, down slope from the staff houses on the west side of the rail grade. Nonstructural changes to the mill complex included priming or repainting the mill gray for a brief period (the red with white trim later readopted) and the expansion of garden plots around staff housing.

Much of the high-grade ore deposits at Kennecott had been depleted by 1924. A crosscut between the Jumbo and Erie Mines exposed five ore bearing fissures, all limited in their extent. The crosscut nevertheless improved the efficiency of ore transportation, since ore from the Erie Mine (and indeed other supplies) could now be transported by tram to the Jumbo Mine. Possibly concerned with the future of the Kennecott mines, Stephen Birch visited Kennecott in 1924, the

first time since 1915 (owing to his near permanent absence, the house built for Birch found use as a guesthouse).[100]

Following installation of the flotation plant, few technical developments occurred at the site. The concentrator, however, received continual improvements throughout its life span. In 1925, for instance, increasing inefficiencies in the leaching plant (caused by the clogging effect of intermediate sized grains) resulted in the installation of a ball mill feeding directly to the flotation plant. The concentration mill retained machinery no longer connected to the system. Continued accommodations for new machinery gradually increased the internal and external complexity of the concentration mill.[101]

By 1925 the decline of Kennecott ore bodies was serious. Attempts to locate new ore bodies in all likely sections had failed. Furthermore, continued prospecting in unlikely areas "reduced the expectation of other discoveries to so remote a possibility that they could no longer be counted on to extend the life of the mines."[102] By 1928, the Glacier Mine was scheduled to close, Bonanza and Jumbo reserves were largely exhausted, and the Mother Lode Mine had been nearly stopped.[103] This situation left Kennecott unable to take full advantage of the 1929 copper price boom (24 cents per pound, the highest in 10 years), but probably helped it weather the subsequent crash in 1931 that destroyed the copper market. Large copper stockpiles from other mines led the Corporation to close the Erie Mine and abandon the expensive leaching process at Kennecott.[104]

After the seasonal washout of the Copper River and Northwestern Railway Bridge at Chitina in 1932, the Kennecott Copper Corporation suspended operations on Bonanza Ridge. The next two years saw limited underground, tram line, and concentrator repairs conducted at the site. In 1933, Stephen Birch resigned as president of the corporation, succeeded by E. Tappan Stannard. Favorable copper prices set by Roosevelt's National Recovery Administration reopened the Kennecott mines in 1935.[105] Even with the intention of systematically closing the mines, exploration work resumed, but without success. Throughout the dwindling years of the Kennecott mines, the Kennecott Copper Corporation continued to expand. In 1926, it acquired 99 percent of stock in Utah Copper and in 1933 bought out the Nevada Consolidated Copper Company.

In October 1938, the Kennecott Copper Corporation closed mining operations on Bonanza Ridge and ended large-scale mineral production in the Wrangell Mountains. During their short period of operation, the Kennecott mines produced 591,535 tons of copper and 9 million ounces of silver. The value of the mines approximated $200 million, with net profits on the order of $100 million.[106] Kennecott's true value, however, proved far greater, for it provided its initial investors with an opportunity to expand into an extremely successful multinational copper corporation, all within the space of a few decades. The Corporation gradually expanded its holdings of large-scale and low-grade copper deposits. By 1974, the Kennecott Copper Corporation was the world's largest independent copper producer (figure 17).[107]

ABANDONMENT TO NPS ACQUISITION: 1938–1997

The well-foreseen closure of the Kennecott mines allowed the salvage of mill and mine equipment to be planned and executed with efficiency. Beginning in August 1938, the corporation removed the turbine unit from the power plant, assorted electric motors, warehouse stock, and several tons of brass scrap. At the closure of mining operations in October, the company removed all serviceable equipment (including drills, tools, and phones) sequentially from the Erie, Jumbo, and Bonanza mines. Dismantling of the machine shop, concentrator repair shop, and carpentry shop followed salvage of the concentrator and flotation plant equipment.[108] O. A. Nelson, from Chitina, purchased the Erie power line and remaining warehouse stock. W. E. Dunkle of Colorado Station (Alaska) acquired stationary diesel engines from the power plant, a four-ton mine locomotive, and most of the metallurgical and assaying equipment.[109] Material not sold locally to other mine operators was sent to Cordova for storage.

The expense of transportation and technological obsolescence argued against the full-scale removal of all machinery and equipment at Kennecott.[110] The power plant and electric shop were still potentially operational, albeit at limited capacity; crushers, screens, and concentrating tables remained in the mill; aerial tramways were left in place; and furnishings remained in the guesthouse, superintendent's residence, hospital, and staff residences on National Creek.[111] The sizable amount of material remaining after the official closure of the site on

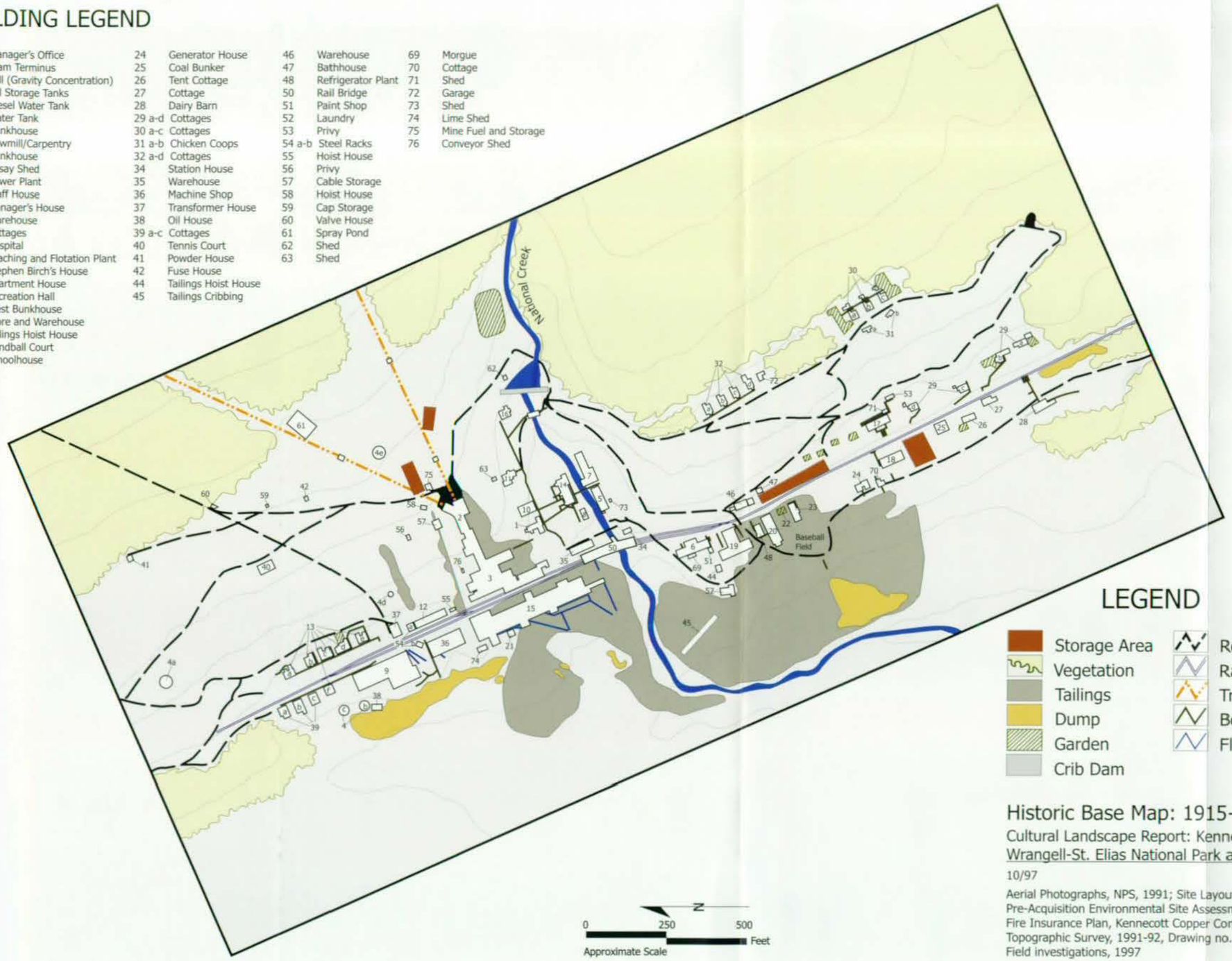
December 23, 1938 ensured a potential use for Kennecott in the event of future ore discoveries.

One month after the abandonment of mining operations at Kennecott, the Copper River and Northwestern Railway closed. After the last train departed for Cordova, as few as 15 families remained in the Chitina Valley, a vivid indication of Kennecott's influence on local settlement patterns.[112] During World War II, the Alaska Road Commission constructed a hand-operated tram across the Copper River at Chitina. In addition, the removal of rails and ties from the railroad grade enabled motor vehicle access from the tram to McCarthy and Kennecott.

Establishment of the McCarthy Lodge in the 1950s provided a means for tourists to visit the Chitina Valley and Kennecott. Around the same time, Kennecott Copper Corporation awarded a contract to Ray Trotochau for the demolition of all surface structures on the property. Trotochau demolished the staff house, manager's residence, and guest house in the central part of the complex, additionally removing the roof from the upper concentrator and rear portion of the company store roof.[113] Trotochau acquired surface rights to Kennecott in 1957. Eight years later, the Consolidated Wrangell Mining Company purchased the 3,000-acre property for $6,000 and commenced working surface copper deposits located below the Bonanza Mine.[114] A small-scale operation, Consolidated Wrangell constructed a small base camp and separation plant close to the workings. By 1967, operations relocated to the mill town. The prior demolition of residences along the south-facing slope of National Creek valley provided a suitably cleared area for the location of equipment, while extant structures in the mill town provided ample room for accommodation. Consolidated Wrangell positioned an ore bin and separation machinery (run by diesel generators) between the bottom of the slope and the site of the superintendent's residence.[115] A shed once associated with the superintendent's house found additional application for storage. A wooden chute constructed of reused timber and siding from the site connected the ore bin to the top of the slope east of the tram terminus. This allowed ore to be dumped directly from the Bonanza Mine road. Tailings created from the operation extended west and eventually pressed against the side of the manager's office. At the close of operations sometime in the mid-1970s, Consolidated Wrangell left most of its milling machinery behind.

BUILDING LEGEND

1	Manager's Office	24	Generator House	46	Warehouse	69	Morgue
2	Tram Terminus	25	Coal Bunker	47	Bathhouse	70	Cottage
3	Mill (Gravity Concentration)	26	Tent Cottage	48	Refrigerator Plant	71	Shed
4 a-c	Oil Storage Tanks	27	Cottage	50	Rail Bridge	72	Garage
4 d	Diesel Water Tank	28	Dairy Barn	51	Paint Shop	73	Shed
4 e	Water Tank	29 a-d	Cottages	52	Laundry	74	Lime Shed
5	Bunkhouse	30 a-c	Cottages	53	Privy	75	Mine Fuel and Storage
6	Sawmill/Carpentry	31 a-b	Chicken Coops	54 a-b	Steel Racks	76	Conveyor Shed
7	Bunkhouse	32 a-d	Cottages	55	Hoist House		
8	Assay Shed	34	Station House	56	Privy		
9	Power Plant	35	Warehouse	57	Cable Storage		
10	Staff House	36	Machine Shop	58	Hoist House		
11	Manager's House	37	Transformer House	59	Cap Storage		
12	Warehouse	38	Oil House	60	Valve House		
13 a-f	Cottages	39 a-c	Cottages	61	Spray Pond		
14	Hospital	40	Tennis Court	62	Shed		
15	Leaching and Flotation Plant	41	Powder House	63	Shed		
16	Stephen Birch's House	42	Fuse House				
17	Apartment House	44	Tailings Hoist House				
18	Recreation Hall	45	Tailings Cribbing				
19	West Bunkhouse						
20	Store and Warehouse						
21	Tailings Hoist House						
22	Handball Court						
23	Schoolhouse						



LEGEND

- Storage Area
- Vegetation
- Tailings
- Dump
- Garden
- Crib Dam
- Road
- Railway
- Tram
- Boardwalk
- Flume

Historic Base Map: 1915-1938

Cultural Landscape Report: Kennecott Mill Town
Wrangell-St. Elias National Park and Preserve

10/97

Aerial Photographs, NPS, 1991; Site Layout Map, Kennicott Pre-Acquisition Environmental Site Assessment, NPS, 1996; Fire Insurance Plan, Kennecott Copper Company, 1936; Topographic Survey, 1991-92, Drawing no.190/80021. Field investigations, 1997

Figure 17. Kennecott Historic Base Map, 1915–1938.

Much of this machinery remains throughout the mill town, scattered primarily in the National Creek area.

In 1976, the Great Kennicott Land Company acquired rights to the lower half of Consolidated Wrangell's property. Taking advantage of increased visitation and tourism in the area, the Land Company proceeded to subdivide the property for sale to the public.[116] In the mill town, a lot was assigned to practically each building. The dairy barn, schoolhouse, and generator shed were all adaptively reused for seasonal accommodations. Renovations to the apartment house transformed it into the Kennicott Glacier Lodge. Burned to the ground in 1983, the lodge was rebuilt in 1987 and later enlarged with a new south wing. During these renovations, two cottages immediately south of the lodge were removed to create a driveway and lawn. Relocated opposite the schoolhouse at the rail grade level (in the area previously used for wood storage), the cottages found service as staff accommodations for the lodge.

The creation of Wrangell-St. Elias National Park in 1980 culminated over 40 years of National Park Service (NPS) interest in the Chitina Valley. Ernest Gruening, director of the United States Department of the Interior's Division of Territories and Island Possessions, visited Kennecott just prior to its closure in 1938. In the subsequent proposal to create Kennicott National Monument, the mill town played a key role as the park's Visitor Center.[117] Plans were dashed in 1940 by the Kennecott Copper Corporation's decision to retain all mining claims, somewhat contradicting an earlier resolution. President Roosevelt decisively rejected the proposal in 1941 on the grounds of it being wartime, but also because he doubted visitor numbers would ever be high enough to sustain the park.[118] Alaska's passage to Statehood and the Alaska Native Claims Settlement Act caused further delays in the allocation of land for a national park.

At the formation of the Wrangell-St. Elias National Park and Preserve, Kennecott remained in private ownership, a substantially diminished role from earlier proposals by Gruening. Establishment of the park nevertheless revitalized McCarthy as a tourist center. This increased tourism and visitation to the concentrator and mines, as did Kennecott's designation as a National Historic Landmark in 1986 (figure 18). As one consequence, new construction occurred at the mill town, particularly at its southern entrance. A display board, guide office, and

Figure 18. Kennecott mill complex, 1985. (Historic American Engineering Record, Jet Lowe.)

shuttle bus turnaround presently occupy the area along the railway right-of-way just north of the Kennicott Glacier Lodge. Current development at the site involves construction of a commercial facility in the former location of the coal bunker, west of the lodge and rail grade. Recent landscaping around the dairy barn occurred when the property was advertised for sale. Mill tailings have also found reuse for the surfacing of roads and airstrips in the local area.[119]

The looting of portable artifacts and reuse of a variety of construction materials also stemmed from increased visitation. Natural forces have, however, proved equally if not more destructive. The 1964 earthquake felled tram towers and caused slippage of the tailing banks behind the West Bunkhouse. Although the slippage of tailings did not affect mill town structures, it damaged the area where domestic garbage had once been discarded.[120] Flood damage caused by the bursting of the National Creek dam in 1980, and again in 1983, recontoured the central part of the mill town and deposited large volumes of silt through the National Creek bunkhouses, hospital, and assay shed. The destruction of boardwalks and fire-hose casings in the National Creek area respectively eliminated indications of previously well-defined circulation and Kennecott's care in meeting fire insurance stipulations. West of the rail trestle, flooding ruptured the tailing crib and deposited tailings farther down-slope.[121] In the process, waste removal systems exiting into National Creek (such as flumes and pipes) sustained major damage.

Both natural and cultural agencies have contributed to the general deterioration of the mill town. The sawmill, oil house (west of the power plant), and almost all privies have entirely collapsed. The laundry building was demolished in the late 1970s as a hazard. Fallen wood siding surrounds the mill building and the southern end of the leaching plant. Decking between structures has fallen into disrepair.

As a means of preserving extant mill town structures, the NPS, along with Friends of Kennicott, reroofed a number of buildings (including the store, power plant, concentrator, and leaching plant) and in addition, stabilized the west wall of the concentrator. Renovated and modern buildings conform to historical paint schemes, although unpainted corrugated iron roofing visually differs from historic materials. Most of the buildings remain unoccupied, and repairs are conducted on an as-needed basis. Between 1993 and 1994, the Kennecott Corporation contracted to remove asbestos from utilidors and 33 structures in the mill town.[122] The capping of an ash pile behind the machine shop, along with the removal of other potentially hazardous wastes and proposed lead-paint abatement programs prepared the mill town for greater visitor numbers.

Generally viewed as a "ghost town," Kennecott shows no interpretation other than that acquired through guided tours. Similarly, there has been little effort to restore the industrial landscape. Vegetation, primarily alder and willow, encroaches upon buildings and formerly barren hillsides, particularly in the central part of the site and northeast mill town area, obscuring both historic landscape features (such as gardens) and vistas (such as the general approach to the mill town and view from the National Creek footbridge). More importantly, overgrowth in the National Creek area has entirely removed indications of its central function to Kennecott's operation.

Despite the absence of interpreted trails, circulation patterns generally conform with historic systems. The rail-bed acts as the main thoroughfare for pedestrian and vehicular traffic. Visitor circulation usually travels along this route and then up a loop road behind the concentrator, eventually connecting with Silk Stocking Loop. This altogether avoids circulation in the central area of Kennecott, once occupied by managerial residences and administration. Boardwalk routes, due to poor survival or complete absence, are not followed. The

creation of additional paths leading from Silk Stocking Loop to the lower mill town (cut by residents themselves) and the addition of roads in the southern portion of the site do not conform with historical circulation, but tend to be used by Kennecott residents rather than visitors. Circulation largely created by tourists involves informal routes to the glacial moraine, tailing piles, National Creek streambed, and discard areas. Pedestrian traffic in these areas does not conform to historic circulation patterns, and the lack of designated routes additionally threatens to disturb areas of archeological significance. Kennecott-era dumps, in particular, have sustained damages to integrity from continued looting.

Modern discard practices constitute a second threat to the archeological integrity of Kennecott-era dumps. Modern dumps are located primarily between the tailings slope and glacial moraine, predominantly at the southern end of the site. This largely conforms to historic patterns, and there is noticeable mixing of modern and historic refuse. Waste disposal remains a problem in the mill town.

Sixty years after the closure of the mines, Kennecott retains much of its historic fabric and complexity. The physical isolation of the site and the relatively difficult public access have played key roles in preserving the character of the site. However, recent and projected visitation levels have clearly placed new demands on the site, and closer monitoring and maintenance is required to ensure the survival of Kennecott as a resource for future generations.

EXISTING CONDITIONS

Kennecott is located along the south side of the Wrangell Mountains on the western slope of Bonanza Ridge. The ridge rises more than 4,000 feet from the Kennicott Glacier on the west before descending into McCarthy Creek on the east. The lower elevations of the ridge are forested with white spruce, alder, poplar, and willow. Farther up the ridge, the trees give way to shrubs and herbaceous vegetation. The ridge top is in the alpine zone.

The mill town is located on a valley wall at about 2,000 feet elevation along the lateral moraine near the confluence of the Kennicott and Root glaciers. The climate of the Kennicott valley is transitional between maritime and continental, with long, cold winters and short, warm growing seasons. The mean average temperature for the valley is -2 degrees centigrade and the mean annual precipitation is 40 centimeters.

WATER

Surface water in the area is created by glacial melt, groundwater discharge, runoff, and snow melt. Drainage off Bonanza Ridge flows in a westerly direction, either as subsurface outwash or along the margin of the Kennicott Glacier. Numerous creeks drain the ridge, including the Amazon, Jumbo, Bonanza, and National Creek. National Creek flows through the mill town and is fed by several small springs before it disappears underground about 20 feet from the glacier and one-half mile below the concentration mill.

SOILS

Soils around the mill town are derived primarily from lateral moraine deposits associated with the Kennicott Glacier. Except for fluvial deposits along National Creek, poorly drained soils in naturally occurring topographic depressions, and disturbed areas from recent tailings, the remaining soils have developed from well-drained tills as old as 11,500 years.

Vegetation

Before Kennecott was developed in the early 1900s, the physiographic character of the landscape was largely the result of recurring Pleistocene and Holocene glacial activity occurring over millions of years. Because of the repeated disturbances and the nature of the soils left behind, vegetation throughout the area was generally successional, supporting four primary plant communities and associations that stepped up the slope from the lateral moraine. The plant communities included:

- Seral herbs located along the moraine with scattered and newly establishing fireweed, yellow drya, soapberry, and seedling willow
- Open white spruce forest with white spruce, balsam poplar, paper birch, and an understory of willow and alder
- Closed white spruce forest on the upper slopes, dominated by mature white spruce of mixed age, with some paper birch, and an understory of willow and alder
- "Riparian" along National Creek where willow and alder were prevalent along with barren areas left from repeated flooding

Today a spruce-hardwood forest with alder, willow, poplar, and mixed herbaceous materials dominates existing vegetation at the site. In general there has been a significant change in the vegetation throughout the mill town since the historic period. Now, virtually all of the land cleared during the historic period has undergone revegetation to some degree, and most historic roadways and trails have either disappeared or become narrow footpaths through tunnels of encroaching alder and willow. Except for privately owned property, vegetation in Kennecott is not maintained.

Historic Structures

There are well over 100 historic structures in the historic mill town. With the recent acquisition of property in the mill town, the National Park Service (NPS) now owns 13 primary historic buildings and multiple secondary structures. In addition to these buildings, the NPS is also responsible for other structures, including the tailings and remnants of the flumes, tramways, crib dam, holding ponds, ore bins, bridges, and the railroad trestle. Many of these structures are in

poor condition and will require emergency stabilization measures to prevent further loss. Between 1997-1998, the Alaska Regional Office undertook a condition assessment of the historic structures. Findings from that work are referenced in the *Analysis and Evaluation* section of this report.

ARCHEOLOGICAL RESOURCES

A large number of industrial artifacts and features remain in the mill town and contribute to the character of the cultural landscape. Many of these features have significance for their association with historic activities at Kennecott (1900-1938), and they are managed as cultural resources. Included are various types of mining equipment and machinery, structural ruins, remnant cable, pipe, shieves, pulleys, and grinding wheels. There are also numerous artifacts from later periods of development, and although these features are compatible with the industrial character of the site, they are not managed as cultural resources.

CIRCULATION AND ACCESS

Vehicular access to the site is limited to the 3.5-mile road from the town of McCarthy, which enters the site from the south. Roads connecting the mill town with mine sites are located at the north end of town. A narrow, dirt road extends north from the tram deck toward the Bonanza Mine site. This road provides local access only. Another road is used as a trail following the moraine north toward the Erie Mine. Within the mill town, access for vehicles is confined to the use of historic roads, including Silk Stocking Loop (figure 19). Parking areas are informal and somewhat random, sited on the basis of need. Virtually all roads through the mill town double as foot trails and provide pedestrian access to most areas. Other foot trails are very informal, suggesting a route with no clear boundaries or defined tread.

LAND USE

Historic land uses in Kennecott reflected the activities associated with the mining and processing of ore, operations administration, housing for workers and staff, support services such as the store, recreation (tennis court, gym, and handball court), storage for goods and waste, and civic functions such as the school,

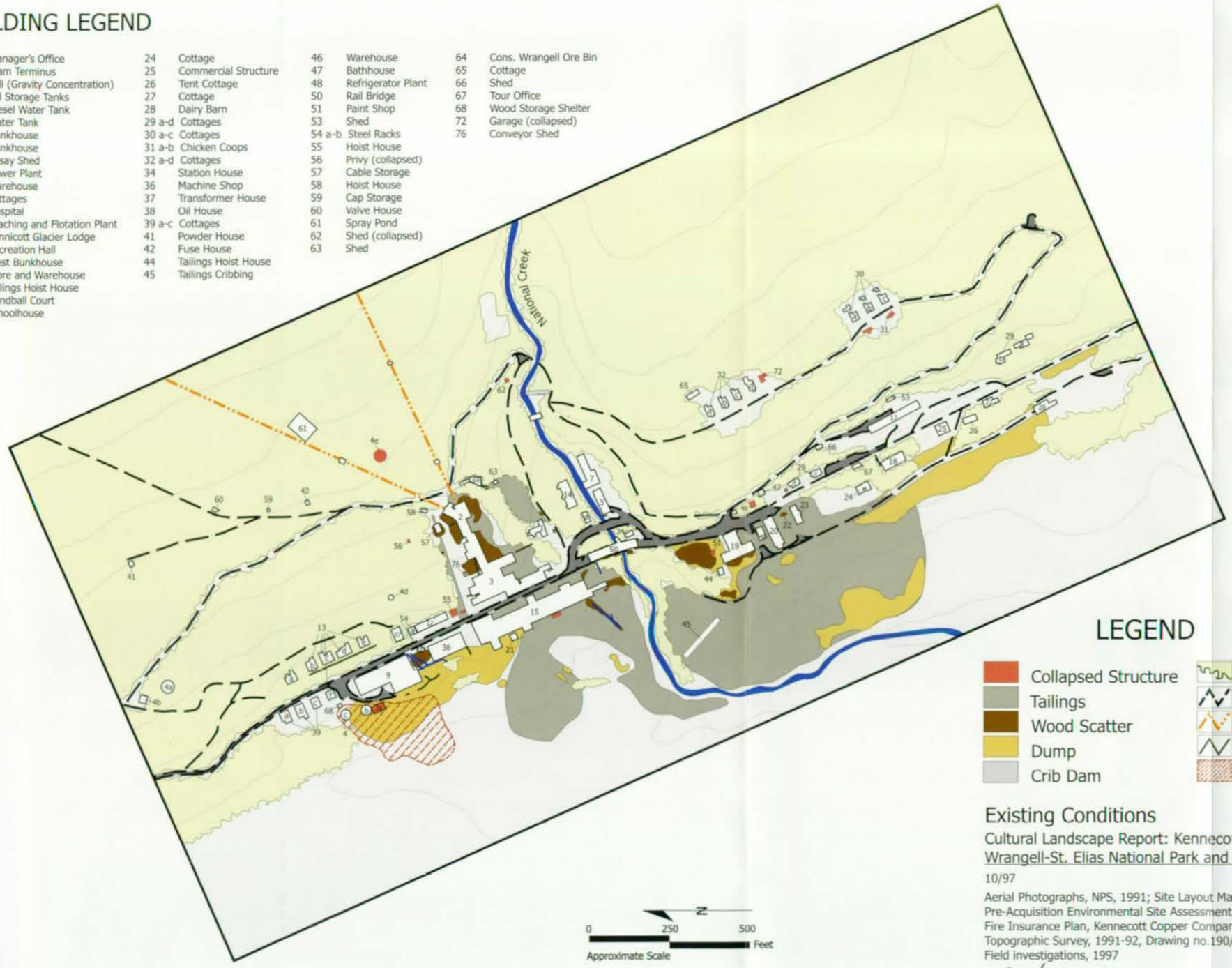
Figure 19. Shuttle bus drop-off near the Kennicott Glacier Lodge, 1997. (NPS photo file, WRST.)

churches, and cemetery. For the most part these individual land use activities were generally concentrated in specific areas of the mill town. Because the landscape developed over many years and was strongly influenced by the natural landscape, many specific land use activities were mixed within the town. These land uses came to an abrupt end in 1938 when Kennecott officially stopped operations and abandoned the site.

Today, many of the historic cottages and staff quarters are owned and occupied by private residents. The Kennicott Glacier Lodge continues to operate in a rebuilt structure near the location of the historic apartment house. Mixed use along the west side of the entrance road includes housing and a few businesses supporting tourism and recreation. The largest portion of the site, however, remains mostly abandoned and is used for interpretation and limited visitor services (figure 20).

BUILDING LEGEND

1	Manager's Office	24	Cottage	46	Warehouse	64	Cons. Wrangell Ore Bin
2	Tram Terminus	25	Commercial Structure	47	Bathhouse	65	Cottage
3	Mill (Gravity Concentration)	26	Tent Cottage	48	Refrigerator Plant	66	Shed
4 a-c	Oil Storage Tanks	27	Cottage	50	Rail Bridge	67	Tour Office
4 d	Diesel Water Tank	28	Dairy Barn	51	Paint Shop	68	Wood Storage Shelter
4 e	Water Tank	29 a-d	Cottages	53	Shed	72	Garage (collapsed)
5	Bunkhouse	30 a-c	Cottages	54 a-b	Steel Racks	76	Conveyor Shed
7	Bunkhouse	31 a-b	Chicken Coops	55	Hoist House		
8	Assay Shed	32 a-d	Cottages	56	Privy (collapsed)		
9	Power Plant	34	Station House	57	Cable Storage		
12	Warehouse	36	Machine Shop	58	Hoist House		
13 a-f	Cottages	37	Transformer House	59	Cap Storage		
14	Hospital	38	Oil House	60	Valve House		
15	Leaching and Flotation Plant	39 a-c	Cottages	61	Spray Pond		
17	Kennicott Glacier Lodge	41	Powder House	62	Shed (collapsed)		
18	Recreation Hall	42	Fuse House	63	Shed		
19	West Bunkhouse	44	Tailings Hoist House				
20	Store and Warehouse	45	Tailings Cribbing				
21	Tailings Hoist House						
22	Handball Court						
23	Schoolhouse						



LEGEND

- Collapsed Structure
- Tailings
- Wood Scatter
- Dump
- Crib Dam
- Vegetation
- Road
- Tram
- Boardwalk
- Oil Stained Soil

Existing Conditions

Cultural Landscape Report: Kennecott Mill Town
Wrangell-St. Elias National Park and Preserve

10/97

Aerial Photographs, NPS, 1991; Site Layout Map, Kennicott Pre-Acquisition Environmental Site Assessment, NPS, 1996; Fire Insurance Plan, Kennecott Copper Company, 1936; Topographic Survey, 1991-92, Drawing no.190/80021. Field investigations, 1997

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Figure 20. Existing conditions map

ANALYSIS AND EVALUATION

NATURAL SYSTEMS AND FEATURES

Like other mining operations, the presence and use of natural resources and large-scale landscape systems were major influences on the development and operation of the mines and concentrator at Kennecott. From the early exploration and discovery of ore concentrations on Bonanza Ridge to the actual siting of processing facilities, infrastructure, and associated services at the edge of the glacial moraine, the dramatic natural landforms and the general configuration of the landscape shaped the Kennecott operation and community. The valley sweeping down from Bonanza Ridge, the steep terrain, and the abrupt terminus of the valley at the glacial moraine defined the development of processing structures and the siting of administrative buildings, staff housing, and many service facilities (figure 21). For example, many of the early support services and structures were located along the wagon road, which generally followed the natural contour north into the site.

Directly west of this corridor was the moraine and directly east was a hill that

Figure 21. Kennecott, circa 1913, showing cleared vegetation, the complex of administration structures, and the concentration mill, tramway, crib dam, and railway along the bottom of the photograph. (Mears Collection, Rasmuson Library, University of Alaska, Fairbanks, Alaska.)

was too steep for siting buildings without significant modification. The open area toward the moraine provided additional storage space (for the sawmill) and was also used as a waste area (dump). Eventually, as the circulation system and size of the development grew, these areas were modified by grading and structural terracing to support additional development. This was especially evident through the interior of the site along National Creek. In addition to the construction of a crib dam on the creek and an associated reservoir, topography in the core area was modified to create a series of building terraces. Here, the manager's office and residence, staff quarters, hospital, and offices were constructed. Ore bins were also constructed at the top of this area near the tram terminus, making use of the natural slope and constructing a log-retaining structure.

Natural vegetation had a relatively short-term impact on development. As construction began, virtually all vegetation was cleared from every building site to allow for adequate construction space and staging of supplies and materials. The cut timber was used for fuel and construction material. Clearing trees was also necessary to control or reduce the risk of fire. By 1908, when the first wave of construction was over, approximately 30 percent of the original vegetation cover had been removed, creating a large clearing that stepped up the valley. Vegetation was also systematically cleared from the tramway corridors and associated terminals.

Historically, the natural system that perhaps had the greatest influence on development of Kennecott was the mineral deposits of copper ore on Bonanza Ridge. Between 1900–1901, four mines—Bonanza, Jumbo, Erie, and Glacier—were established on the ridge above the moraine. In the years that followed, these mines yielded some of the highest grades of surface copper ore ever found. In spite of its remote location, Kennecott was by 1916 the third largest producer of copper in the U.S. As the deposits were mined over the next 20 years, the quantity of high-grade ores diminished. The shift was accompanied by the addition or modification of technology and associated machinery required to process increasingly leaner grades of ore. The concentration mill was modified several times to accommodate changes in ore processing technologies. The four primary processes were crushing, gravity concentration, ammonia leaching, and flotation.[1]

The mill town existed to facilitate the concentration and transportation of ore. Ore was concentrated to a point where it could bear the cost of transportation and return a profit after shipping it to Tacoma, Washington. The concentrator was the connection between the tramways and the railway. Ore going out flowed south and goods coming in to support to operation flowed north from the coast. Everything in the mill town supported these efforts, usually directly, sometimes indirectly. Employee housing was essential. Water, heat, and sewer systems were necessary to support the industrial and domestic functions performed in the mill town. Both functions required their own maintenance and support services, ranging from machine shops to keep the equipment running to a recreation hall or tennis court to keep the workforce and management entertained.

Other natural systems also had a strong impact on development at Kennecott. Key among these was a reliable water source for both the operation of the mill and for domestic use. In 1910, a log crib dam was constructed on National Creek. Located at the top of a narrow gorge next to the camp, the dam supplied water for a small hydroelectric plant located at the north end of the site. This plant provided electricity for the developing town and mines. Drinking water, as well as water needed to operate the concentrator, was stored in a reservoir and carried to the lower town in wood and iron pipes, some of which remain today. As the size and complexity of the operation grew, additional sources of water were tapped, notably Bonanza Creek, which supplied water through an 18-inch line. Water was also drawn from National Creek at a second point some distance above the crib dam. These sources provided reliable water for Kennecott. Running through the middle of the mill town, National Creek was subject to seasonal and periodic floods and did considerable damage over the years, requiring many structures in this area to be rebuilt.

SUMMARY

Like other mining operations, the physical character and cultural landscape of Kennecott was historically linked to the supply and processing of naturally occurring ore and available water. In addition, the functional relationships within the physical complex of the mill town were influenced by large-scale landforms that created natural constraints and opportunities for site development. Many of these large-scale landforms, such as the ridge, valley, and moraine, remain today and contribute to the historical significance of the cultural landscape.

Major changes have occurred, however, to the interior of the site around National Creek. The integrity of the landscape—the historic structures, organization, use, circulation, and physical character—has been affected by floods and repeated inundation, loss of the crib dam and integrity of the water conveyance system, modification of the area due to subsequent use, and the regeneration of vegetation over several years. Field documentation indicates that some remnant features (major buildings, wood pipe, iron pipe, cribbing, scattered plant materials from the gardens, and boardwalk) do remain in various states of condition and degrees of historical context and setting. These features are considered archeological resources and as an aggregate, contribute to the significance of the landscape.

The entire historic mill town has been negatively affected by the regeneration of vegetation throughout the site. With the exception of private holdings where vegetation has been kept down or replaced with nonhistoric cover (turf grass), the overall extent, scale, and characteristics that contribute to the cultural landscape are either covered with vegetation or significantly altered as a result of vegetation that post-dates the historic period.

Spatial Organization

Kennecott was spatially organized to accommodate mining activities such as the collection, transportation, storage, and processing of ore. Because the mines were located on the ridge above the mill town, they were separated by a significant distance from the processing complex. In addition, Jumbo, Bonanza, and Erie mines had their own structural complexes and support buildings, and in many ways were self-sustaining developments.[2] Individual mine camps were connected to the lower mill town by aerial tramways, creating a "spoke" system for funneling ore to the concentration mill.

The initial structures built to connect the mines to the railway, process the ore, and support these operations were clustered along National Creek because it provided the single largest area of available building space close to the mill. The mill was sited to take advantage of a steep slope, available water, and provide a connection between the aerial tramways and the railway. Functions within this area were generally mixed, although structures requiring proximity to the rail-

way such as the train shed, depot, and warehouses, were sited closer to the grade. Other structures, such as the residences not directly related to the railway, were farther away.

As the scale of the operation increased, the structural core of the mill town was no longer sufficiently large to hold everything needed. Shops and warehouses associated with the railway or the tramway were built on level land made from tailings along the railway line.

The spatial organization of the cultural landscape was influenced by two primary factors: the natural landforms, which influenced the type and extent of development in specific areas, and the siting of structures, which was based on the functional and logistical requirements of processing the ore and getting it to outside markets. Under the influence of these two factors, Kennecott formed around four areas of spatial organization, which were logically related to land use patterns and circulation systems. The four areas of spatial organization can generally be identified as the industrial core, administrative core, housing area, and service-related facilities.

INDUSTRIAL CORE

The industrial core of Kennecott is most clearly reflected in the concentration mill, which grew between 1911–1938 into a structural complex stepping down the hill from the terminus of the tramlines coming from the Bonanza and Jumbo mines (figure 22). From the tram deck at the top of the concentrator, ore traveled through the crushing operation and the gravity concentrator to the flotation and ammonia leaching plants, and ended either in rail cars or piles of tailings. This remarkable structural complex was the heart of the industrial townscape. Many of the support structures for the concentrator, including the power plant, warehouses, machine shop, various small sheds and storage structures, and the rail system for transporting ore down the valley, were sited either directly adjacent to or very near the concentrator. At this scale of operation, circulation depended on the tramlines bringing the ore to the plants and rail line for transport to ports and markets. Other patterns of circulation focused on the internal system associated with the operation of machinery within the concentrator.

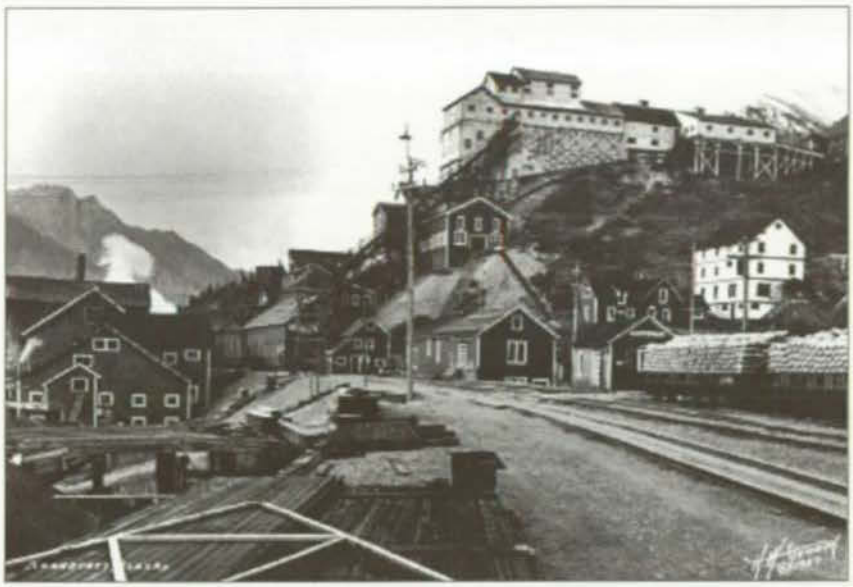


Figure 22. View northward from the railway line, circa 1927, showing the concentration mill and industrial area. (Mears Collection, Rasmuson Library, University of Alaska, Fairbanks, Alaska.)

Administrative Core

Occupying the central area within the mill town, the manager's office and residence, the staff house, hospital, bunkhouses, assay shed, and community garden compose the administrative core (figure 23). Individual buildings were larger and more stylized than in other areas of the town. The manager's residence reflected a hierarchy and social status typical of other company towns. Constructed in 1916, the manager's house was a two-story structure, painted white, and sited on the highest portion of the mill town. Circulation through this area was somewhat formalized along boardwalks that linked key buildings stepping down the valley from the crib dam along National Creek and ending at the rail-

Figure 23. View of administrative core showing boardwalks, flag pole, and primary structures, including the manager's house, staff housing, hospital , and barracks buildings. Photograph circa 1930. (Evonne Sullivan, photo files, WRST.)

road. Small-scale features, such as picket fences and clotheslines, added a domestic quality to this area.

HOUSING AREA

Two functionally related clusters of cottages and residential structures on the north and south sides of the mill town made up the housing core (figure 24). North of the concentrator, four individual cottages were constructed between 1908–1915 on the east side of the railroad tracks. These cottages were the first constructed in the mill town and they provided housing for families. As the town expanded between 1915–1938, four more cottages were built directly west. These cottages included lined basements and catwalks to individual privies. Collectively, these structures defined the northern edge of the mill town. Also during this period, seven cottages making up "Silk Stocking Row" were built on the hill south of the crib dam. These residences also had several associated outbuildings, including garages, chicken coops, outhouses, and gardens.

Down the slope from Silk Stocking Row, eight tent cottages were established between 1908–1915 along the rail line, then replaced in 1916 with individual cottages. In this same area, an apartment building was constructed, providing five, four-room apartments for guests. These residential structures created the southern edge of the mill town. Housing for workers was provided in two bunkhouses, which, in addition to staff quarters, were located in the administrative

Figure 24. View of cottages in the north end of the mill town, circa 1930. (Jim McGavock, photo files, WRST.)

area. An additional bunkhouse was also located along the west side of the rail corridor between the carpenter shop and the store and warehouse.

Service-Related Structures

The fourth core area defining the spatial organization of the landscape was created by the rail line, which ran through the lower town and formed a strong linear orientation to the support structures, services, and facilities along its corridor. Established early in the development of Kennecott, the rail line ran north to south, dividing the town rather dramatically. Although the town naturally developed along a north-south axis, following the lateral moraine, the rail line emphasized this orientation.

Summary

Four core areas historically defined the spatial organization of the Kennecott landscape. While virtually all development was directly tied to the operation of the concentration mill, the landscape historically reflected distinct patterns of spatial organization based on function, land use, circulation patterns, and the structures supporting the concentrator. In some ways, the spatial organization of the town reflects a layout typical of other company towns. There is a separation and conceptual hierarchy of the residents, with staff and management occupying larger, individual homes on prominent locations and workers living in barracks in the lower portions of town.

Of the four areas defining the spatial organization of Kennecott between 1908–1938, three retain a relatively high degree of spatial integrity: the industrial complex and support structures, the housing areas, and the railroad corridor. The administrative core of the mill town along National Creek has lost integrity of spatial organization due to repeated inundation and seasonal flooding and encroaching vegetation. Further, reestablishment of vegetation throughout the town has made it difficult to discern the functional relationships among all the key areas of Kennecott. In spite of this impact, the physical space and concentration of resources in the industrial area, housing areas, and the railroad corridor remains and contributes to the significance of the cultural landscape.

CIRCULATION SYSTEMS

The earliest circulation systems at Kennecott were intended to connect the remote mines on Bonanza Ridge to ports some 200 miles down the valley, and even more distant markets. Even before development of the mill town, the Alaska Syndicate set aside funds to construct a railroad line, guaranteeing the immediate use of their steamship lines to carry ore to smelters in Tacoma, Washington. Until the rail line was constructed, most supplies required at the site were hauled during the winter season by horses along the Copper and Chitina rivers, or by sled from Valdez. By 1907, steamboats were used to bring equipment and supply construction crews working on the rail line. During this period, a wagon route was constructed to the Chitina River, improving supply systems to the site. Seasons later, this road was improved and served as the primary access route to the site, crossing National Creek before heading up the ridge to the mines. By 1908, construction on a 16,000-foot aerial tramway between the Bonanza Mine and the developing mill town below was well under way, supplementing the movement of supplies and materials. Eventually this line would carry up to 600 tons of copper a day between the mine and the concentration mill.

Between 1908–1915, core circulation systems were established that would influence virtually all future development at Kennecott. Key to this circulation system was the rail line connecting the mill town with Cordova, about 196 miles away (figure 25). In 1908, the Copper River and Northwest Railway crossed the Copper River at Flag Point near Cordova. After many physical and political obstacles, the railroad finally reached the Kennecott mines in the spring of 1911.

Figure 25. Railroad trestle through the mill town was the primary link to outside markets and supplies. Note the wagon road extending up the hill, south of the bunkhouse buildings. Photograph circa 1913. (Mears Collection, Rasmuson Library, University of Alaska, Fairbanks, Alaska.)

The track entered the site from the south on an alignment just east of the existing wagon road. Extending north, the track crossed National Creek on a 256-foot trestle bridge and ended at the ore bins at the base of the concentration mill. Completion of the railroad had a dramatic effect on construction at Kennecott. First, it provided a reliable source of supplies and a transportation system for the ore. Second, the railroad established a strong linear framework for both the structural and functional development of the mill town.

In 1913, a second tramway was completed connecting the Jumbo Mine with the concentrator below. As a result (and in spite of constant maintenance demands on the towers), the two trams to Bonanza and Jumbo mines became the primary link between the mine sites and the mill town. (The Erie and Mother Lode mines were linked with the Jumbo and Bonanza trams via a 12,000-foot tunnel. The Glacier Mine was linked to the Jumbo tram at the junction station.)

While the early wagon road through the mill town continued to be used during this period, it was rerouted in some areas to facilitate circulation in relation to the rail line. The original route, however, remained basically the same, especially as it le d up the south side of National Creek before crossing and heading north to the mines. An additional road was established north of the concentration mill, connecting the tram terminus at the top with the new cottages at the north end of the growing town.

Also during this period, wood plank boardwalks were constructed, linking primary residential structures (cottages and staff quarters) and service buildings (the hospital, manager's office, and assay office). While these boardwalks primarily served a functional purpose, they also served to formalize footpaths and provided some sense of domesticity in an otherwise industrial landscape (figure 26). In contrast, the paths between the industrial buildings were based on need and function, were informal in character, and did not follow straight lines and sharp angles.

Between 1915–1938 the circulation system was expanded once more to provide access between new residential structures and staff housing on the southern portion of the site and services within the mill town. Silk Stocking Loop extended from the crib dam on National Creek, past the cottages, and down the

Figure 26. Wood boardwalks and foot paths through the administrative area of the mill town, linking primary buildings, circa 1919. (Photo courtesy of F.H. Moffit, USGS.)

side of the hill above the newly constructed apartment house, connecting with the wagon road across from the store and warehouse.

With few minor changes, the circulation system of rail line, tramways, wagon road, boardwalks, and footpaths remained in use through all significant periods of development and operation.

SUMMARY

Existing and remnant circulation systems and features from all three historic periods remain at Kennecott, in variable condition. Of the large-scale primary systems, the rail line remains in its original position, although it has been long abandoned as an active track. The trestle bridge and some of the terraces supporting the rail grade have been rebuilt or stabilized. The right-of-way functions as the terminus of the road from McCarthy and remains the primary access to the site today. The old wagon road route is discernible as it passes the Kennecott cemetery entering the mill town from the south as it did historically. It is used today by hikers and bikers from McCarthy. Silk Stocking Loop and the route down the hill on the north side of the site also remains. The tramlines survive as remnants. Of the many boardwalks that were present historically, only one segment remains intact, that being the one in front of the cottages on the east side of the road past the concentrator.

The primary circulation systems that remain today include the rail line and corridor, primary roads plus the north loop, Silk Stocking Loop, the road up the south side of National Creek, the remnants of the tram lines, and the old wagon road. Overall, these circulation systems have a high degree of integrity and contribute to the overall significance of the district. In addition, several minor

Figure 27. Remnant boardwalk section in front of cottages along the north end of the mill town. (NPS, photo file, WRST, 1997.)

features contribute as remnant features of circulation. These include the segment of boardwalk in front of cottages 13a–e, a portion of stairways, railing, and boardwalk in the National Creek area and below Silk Stocking Row (figure 27).

Structures

Between 1915–1938, the Kennecott mill town was made up of well over 100 primary and secondary structures, including a variety of mill buildings and support structures, ore bins, conveyors, tramways, tailings, flumes, dams, holding ponds, bridges, and railroad structures.

Tramways

The first tramway constructed at Kennecott was completed in 1909 (figure 28). This three-mile aerial line began at the Bonanza Mine and extended approximately 4,000 feet down the ridge to the concentration mill. An angle station was sited halfway down the ridge. At the mine, ore was stockpiled in a three-story ore bin for transport to the concentrator and from there it was loaded into buckets on wire cables supported up by wood towers. The tram not only transported ore to the concentrator, but it also transported workers and carried supplies to the mine site.

In 1913 another tramway was constructed, extending four miles from the terminus of Jumbo Mine below Castle Peak to the Kennecott concentration mill. This tram superseded the use of a wagon road for ore removal.

Following the Jumbo tramline, a junction station (station #3) was constructed and a "spur" tramline was built between 1916–1920, linking the Glacier Mine to the concentrator. This line also carried ore from the Bonanza Mine site when snow damaged that line. The station itself consists of a two-story building, miscellaneous machinery (cable, bull wheels, and buckets), and an operator's house.

Remnants of the tramway system at Kennecott include cables, tram towers, junction houses, tram decks, and ore bins. These structures and associated features are still evident in the landscape of Kennecott and are contributing resources of the cultural landscape.

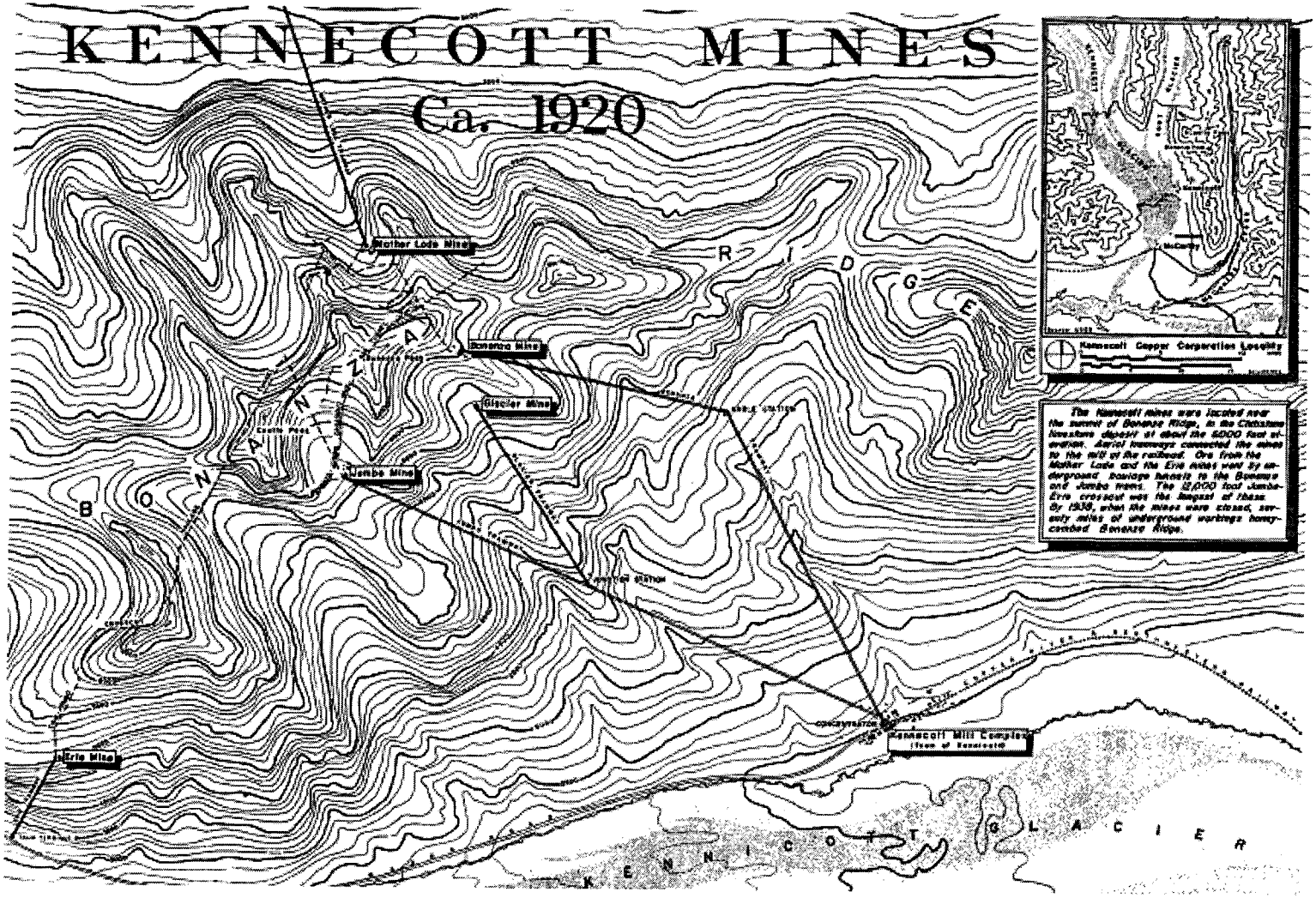


Figure 28. HAER drawing of Kennecott tramway.

BRIDGES

From 1900–1938, several bridges were constructed across the National Creek corridor as part of the wagon road, rail system, and pedestrian circulation systems through the mill town. By 1938 as many as five bridges crossed National Creek. Two were associated with the wagon road as it crossed the creek from the south. One of the bridges was sited above the crib dam and the other below it where the road crossed the creek to the warehouse (Building #78). Two pedestrian bridges were also constructed, both of which were below the crib dam. The easternmost bridge connected the route from Silk Stocking Row to the administrative core. The other bridge connected the hospital on the north side of the creek with the bunkhouses on the south side. The other major bridge structure was the railroad trestle, crossing the creek as it flowed out to the moraine. All of these structures were constructed of timber.

Today there are four crossings on National Creek, including the railroad trestle, the access road east of the main road, a pedestrian bridge below the crib dam, and a footpath crossing the creek above the crib dam. All of the crossings are in their historic location, but only the railroad trestle and the pedestrian bridge below the crib dam retain physical integrity and are contributing structures. The other crossings have been structurally modified. Although they are compatible in terms of location and association, they do not retain the historic design, material, or character, and are therefore not contributing.

RAILROAD TRESTLE

The Copper River and Northwest Railway reached Kennecott from the Port of Cordova in 1911. The rail line entered the mill town from the south, crossing a 250-foot trestle and terminating at the concentrator (figure 29). The railway and associated trestle became the dominant circulation structure in the town, defining the overall industrial infrastructure and building complex. The trestle originally served two pairs of tracks, one pair on the west and one on the east. The rail bed was constructed of pressure-treated beams, cribbing, and railroad ties. The posts supporting the bed structure are a combination of pressure-treated round poles and untreated spruce trees.

The railroad trestle is an important historic structure and although it is in poor condition, is still an important contributing feature of the Kennecott mill town.

Figure 29. Railroad trestle structure as it looks today. (NPS, photo file, WRST, 1998.)

TAILINGS[3]

The tailings at Kennecott were investigated in 1992 to determine their structure and composition (figure 30). Based on this work, the maximum depth of tailings in and adjacent to the mill town is approximately 12.6 feet. Composition is 95 percent limestone due largely to the efficiency of the copper recovery process. The oldest tailings were deposited on both sides and west of the concentration mill. The leaching plant was built atop some of these tailings, which were intentionally placed to create a building site over the moraine. Tailing age increases vertically. The second phase of tailing deposition was west of the leaching plant. The third phase is represented by the tailings south of National Creek. A covered conveyor was built from the leaching plant across the creek to a location west of the company store (overlaying the glacial moraine deposits). These tailings are sparsely vegetated due to the high permeability and lack of organic soil content that has retarded plant establishment.

Over the years, the tailings have been used as aggregate in building foundations and for surfacing roads and airstrips in the Kennecott-McCarthy area. Still it is estimated that the volume of tailings remaining at the site is approximately 600,000 cubic-yards. Tailings are important physical structures from the historic period and they contribute to the cultural landscape.[4]

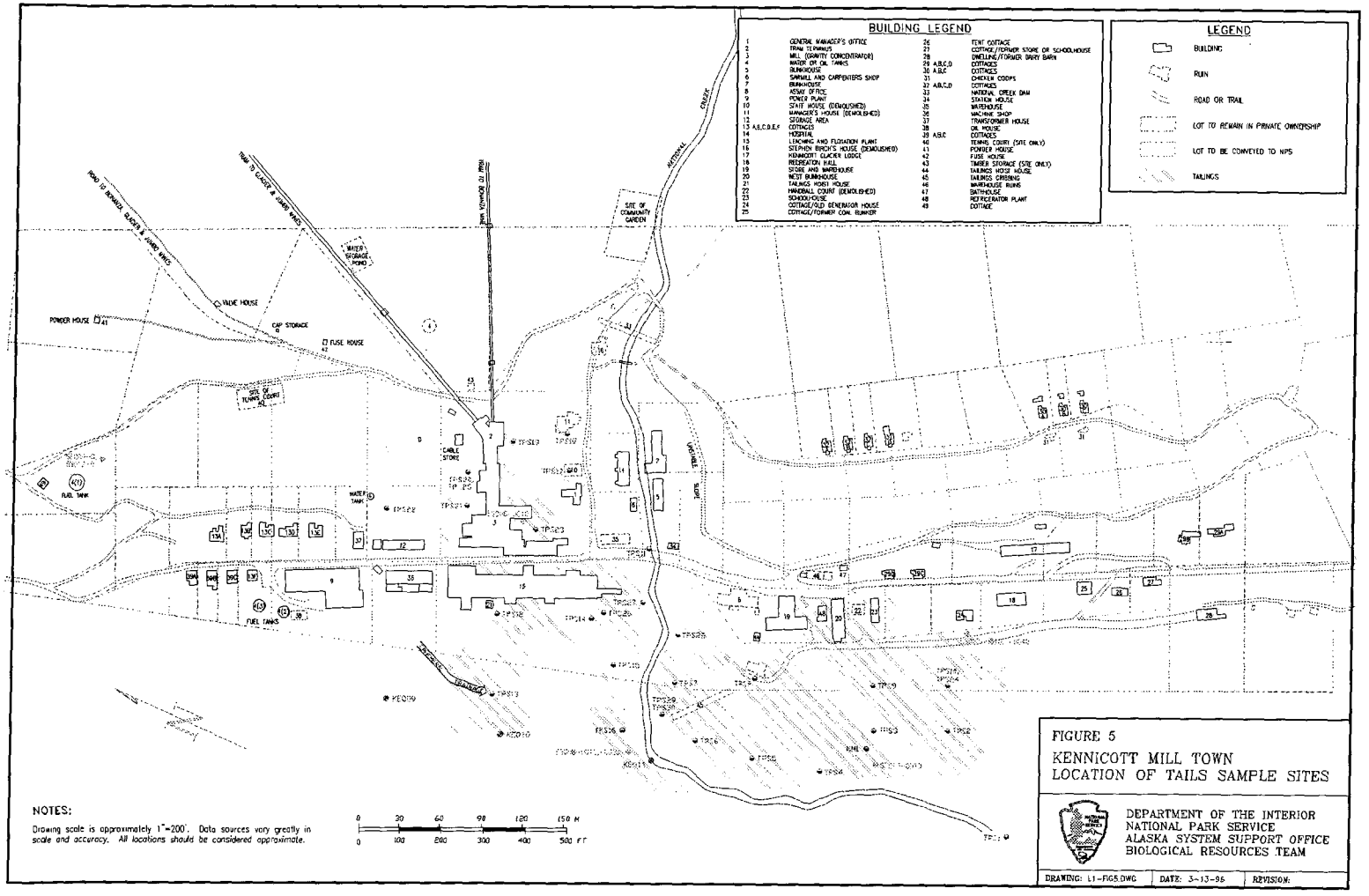

BUILDING LEGEND
1 GENERAL MANAGER'S OFFICE
2 TRAM TERMINUS
3 MILL (GRAVITY CONCENTRATOR)
4 WATER OR OIL TANKS
5 BUNKHOUSE
6 SAWMILL AND CARPENTERS SHOP
7 BUNKHOUSE
8 ASWC OFFICE
9 POWER PLANT
10 STAFF HOUSE (DEMOLISHED)
11 MANAGER'S HOUSE (DEMOLISHED)
12 STORAGE AREA
13 A,B,C,D,E,F COTTAGES
14 HOSPITAL
15 LEACHING AND FLOTATION PLANT
16 STEPHEN BIRCH'S HOUSE (DEMOLISHED)
17 KENNICOTT GLACIER LODGE
18 RECREATION HALL
19 STORE AND WAREHOUSE
20 WEST BUNKHOUSE
21 TAILINGS HOIST HOUSE
22 HANDBALL COURT (DEMOLISHED)
23 SCHOOLHOUSE
24 COTTAGE/OLD GENERATOR HOUSE
25 COTTAGE/FORMER COAL BUNKER
26 TENT COTTAGE
27 COTTAGE/FORMER STORE OR SCHOOLHOUSE
28 DWELLING/FORMER BARN BARN
29 A,B,C,D COTTAGES
30 A,B,C COTTAGES
31 CHICKEN COOPS
32 A,B,C,D COTTAGES
33 MATANUSKA CREEK DAM
34 STATION HOUSE
35 WAREHOUSE
36 MACHINE SHOP
37 TRANSFORMER HOUSE
38 OIL HOUSE
39 A,B,C COTTAGES
40 TENNIS COURT (SITE ONLY)
41 POWDER HOUSE
42 FUSE HOUSE
43 TIMBER STORAGE (SITE ONLY)
44 TAILINGS HOIST HOUSE
45 TAILINGS CRIBBING
46 WAREHOUSE RUINS
47 BATHHOUSE
48 REFRIGERATOR PLANT
49 COTTAGE
LEGEND
BUILDING
RUIN
ROAD OR TRAIL
LOT TO REMAIN IN PRIVATE OWNERSHIP
LOT TO BE CONVEYED TO NPS
TAILINGS
ROAD TO BONNIE, GLACIER & JARGO MINES
TRAM TO GLACIER & JARGO MINES
TRAM TO POWER PLANT
CREEK
WATER STORAGE POND
SITE OF COMMUNITY GARDEN
VALVE HOUSE
POWDER HOUSE
CAP STORAGE
FUSE HOUSE
SITE OF TENNIS COURT
CABLE STORE
WATER TANK
FUEL TANK
FUEL TANKS
TRAM
NOTES:
Drawing scale is approximately 1"=200'. Data sources vary greatly in scale and accuracy. All locations should be considered approximate.
0 30 60 90 120 150 M
0 100 200 300 400 500 FT
FIGURE 5
KENNICOTT MILL TOWN
LOCATION OF TAILS SAMPLE SITES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
ALASKA SYSTEM SUPPORT OFFICE
BIOLOGICAL RESOURCES TEAM
DRAWING: L1-FIG5.DWG
DATE: 3-13-96
REVISION:

Figure 30.

BUILDINGS

Architectural Character

The buildings in Kennecott reflect the various stages of development and adaptive use over several years. Most of the buildings are of wood frame construction on post and sill foundations and have gabled roofs, although several cottages have hipped roofs.[5] Buildings associated with heavy industry are of post and beam construction on wood post foundations. The large concentration mill, built on the steep hillside, is supported on cribbing.

The majority of the buildings and structures in Kennecott have horizontal siding. Four of the early residences, cottages 13a–f, have board and batten siding, while several small sheds have metal siding and roofs. Eaves and verge detailing vary both by construction date and the importance of the structure. Windows range from one-over-one, double-hung units in the domestic and administrative structures, to four-over-four and six-over-six, double-hung windows in the industrial structures and older cottages. In some cases, double-hung windows were turned sideways to accommodate grade and architectural convenience. With few exceptions, the wood frame structures were painted red with white sash. Small utilitarian structures, such as woodsheds, privies, chicken houses, cold frames, and boardwalks, were also made of wood or metal.

Altogether there were 76 primary and secondary buildings in the mill town during the historic period (1915–1938). While many of these buildings are small outbuildings, sheds, and cable houses, the physical collection of buildings as a whole and their function in the context of the mining operation at Kennecott are considered significant and contributing to the cultural landscape.

The following summary of buildings includes documentation for both publicly and privately owned structures. For the primary buildings managed by the NPS, information includes: the name of the structure, the building number, date of construction, size in square feet, lot number, and a physical description and significance statement. The priority for treatment is also ranked from very high to low according to historical and architectural value.[6]

Significant Buildings[7]

Manager's Office (figure 31)

Building Number: 1
Date of Construction: 1906, 1907
Square Feet: 2,451
Lot: Mill Reservation
Ownership: Public

Figure 31. Manager's office, 1998. (NPS photo file, WRST.)

Description: Built in stages, the original portion of the manager's office is a one-and-a-half-story, saddle-notched log structure with sill log foundation. The main door and two windows are on the south façade. One-over-one, double-hung windows are in the gable end above the first floor. An addition is set back on the west side of the log structure and has a roof line running perpendicular to the original roof. A small one-story office wing was also constructed on the east side. And on the rear of the log structure, a large two-story wing was constructed.

Significance: This structure is the earliest documented structure built at Kennecott, and was the administrative center for the mining operation. Like other structures at Kennecott, additions to the building were made to accommodate the expansion of mining operations. The office is architecturally significant, reflecting a distinct building technology and style, and is historically significant for its association with the mining operations of Kennecott.

Historical Value: High
Architectural Value: High
Overall Value: High

SIGNIFICANT BUILDINGS

Tram Terminus (figure 32)[8]

Building Number: 2
Date of Construction: 1908
Square Feet: See Building #3
Lot: Mill Reservation
Ownership: Public

Figure 32. Tram terminus viewed from the south side of National Creek, 1998. (NPS, photo file, WRST.)

Description: A large deck on the top portion of the concentration mill (Building 3), the structure served as the terminus for the tramway to the mines on Bonanza Ridge. Both the tram deck and the upper concentrator were covered by a long gable roof, with a cross gable over the first structural bay to the west. The entire upper level was constructed on a heavy timber post and beam framework, similar to the railroad trestle.

Significance: This structure is physically and functionally associated both with the tramways and the concentration mill. It is architecturally and historically significant for its association with the mining operations of Kennecott.

Historical Value: Very High
Architectural Value: Very High
Overall Value: Very High

Significant Buildings

Concentration Mill (figure 33)

Building Number: 3
Date of Construction: 1910, 1915, and 1922
Square Feet: 85,000
Lot: Mill Reservation
Ownership: Public

Figure 33. View northward toward the concentration mill, 1998. (NPS photo file, WRST.)

Description: The concentration mill is a 14-story, multi-gable, wood frame structure in the center of Kennecott. Easily the most impressive structure in the mill town, it is built on a series of terraces supported by timber cribbing, stepping 150 feet up the hill on the east side of the rail line. The concentration mill is the product of numerous building modifications, each reflecting change in the technology and expansion of the mining operation (figure 33). Additions to the original structure were constructed to house various support structures for operating the concentrator, water tanks, space for mechanical equipment, and storage. Windows throughout the building include double and single sash, randomly placed depending on interior requirements for lighting. Later additions have bracketed gable ends, although plain verge boards with exposed purlins are most common.

Significance: The concentration mill is the historic and structural heart of the mill town. Through this structure, copper ore from the mines on the ridge was concentrated through a long series of mechanical processes before undergoing chemical separation in the leaching plant and shipment to Cordova. The concentrator provided the transition between the mountains, the leaching plant, and the outside market economy. This building is architecturally and historically significant for its association with the mining operations of Kennecott.

Historical Value: Very high
Architectural Value: Very high
Overall Value: Very high

SIGNIFICANT BUILDINGS

Bunkhouse (figure 34)

Building Number: 5
Date of Construction: 1908
Square Feet: 3,750
Lot: 60
Ownership: Public

Figure 34. Bunkhouse along National Creek. (NPS photo file, WRST, 1998.)

Description: Sited along National Creek, this bunkhouse is a rectangular, one-and-a-half-story structure with a gable roof, and shed roof dormer on the south side. Two gable roof dormers provide additional light and space to the north and south side rooms. A shed-roofed porch is on the south side of the building, extending the length of the structure. The boardwalk on the north side of the building has been buried by flood rubble. Gable and verge overhangs are detailed with a narrow fascia board.

Significance: This is the first bunkhouse constructed at the site, and it housed the majority of single men working at the concentration mill. This structure is significant for its association with the mining operations of Kennecott.

Historical Value: Medium
Architectural Value: High
Overall Value: High

Significant Buildings

Assay Office (figure 35)

Building Number: 8
Date of Construction: 1910
Square Feet: 512
Lot: 61
Ownership: Public

Figure 35. West façade of the assay office. (NPS photo file, WRST, 1998.)

Description: The assay office is a small, one-story, wood frame structure, located east of National Creek. Primarily a functional structure, there are few decorative features. Four-over-four, double-hung windows are located to provide light for interior work areas. A louvered ridge cupola provides ventilation to the attic.

Significance: This structure is significant for its historical association with the mining operations of Kennecott.

Historical Value: High
Architectural Value: Low
Overall Value: Medium

SIGNIFICANT BUILDINGS

Power Plant (figure 36)

Building Number: 9
Date of Construction: 1924[9]
Square Feet: 13,218
Lot: Mill Reservation
Ownership: Public

Figure 36. View northwest toward the power plant with four smokestacks. (NPS, photo file, WRST, 1998.)

Description: Characterized by four towering smoke stacks and constructed in three phases, the power plant is a three-story structure located north of the concentration mill on the west side of the railroad corridor. The south portion of the structure has a sheet metal gable roof and tall, nine-over-nine, double-hung windows. Paneled doors provide access to the south platform and front entrance of the structure. The north side of the building has an addition that includes a lower story with a central doorway and six-over-six, double-hung windows. A three-story west wing extends downhill from the rear of the south portion of the structure. One-story shed roofs flank this wing.

Significance: This structure provided power for the entire mill town, for both industry and domestic use. The building is architecturally and historically significant for its association with the mining operations of Kennecott.

Historical Value: High
Architectural Value: High
Overall Value: High

Significant Buildings

Leaching and Flotation Plant (figure 37)

Building Number: 15
Date of Construction: 1916, 1917,1918, and 1923 (stacking shed)
Square Feet: 22,200
Lot: Mill Reservation
Ownership: Public

Figure 37. Leaching plant, east elevation. (NPS photo file, WRST, 1998.)

Description: The leaching plant is on the west side of the railroad bed, north of National Creek. A one-and-a-half story, wood frame structure with a basement opening to the rear (west) grade, the building is utilitarian in nature. Having little ornamentation, the plant is characterized by varying rooflines reflecting periods of growth and development in the mining operations in Kennecott. The original portion of the structure (now collapsed) contains the leaching tanks and is one story below grade, with a central gabled wing extending to the roadway. Six-over-six, double-hung windows are common on the first floor, and six light windows are on the second floor. A two-story addition on the north end of the structure has a central pavilion, with double doors opening toward a loading dock at the side elevation.

Significance: Although acid leaching methods were practiced in the processing of copper ore prior to 1916, the unique geology of the Wrangell Mountains prevented the application of this technique at Kennecott. As a result, the world's first ammonia leaching plant was designed and installed at Kennecott. This structure reflects a major contribution to the technology of copper mining and is architecturally and historically significant for its association with the mining operations of Kennecott.

Historical Value: Very high
Architectural Value: Very high
Overall Value: Very high

SIGNIFICANT BUILDINGS

Recreation Hall (figure 38)

Building Number: 18
Date of Construction: 1916
Square Feet: 2,280
Lot: 7
Ownership: Public

Figure 38. Recreation hall, west elevation. (NPS photo file, WRST, 1991.)

Description: The recreation hall is located on the west side of the railroad corridor south of National Creek. A two-story, balloon frame structure, the hall is rectangular in shape and set on 6x6 wood post foundations. Two louvered cupolas provide ventilation at the ridge of the gable roof. Windows are four-over-four, double-hung sash.

Significance: As the center of social activity in the mill town, the recreation hall was the site of numerous community gatherings such as films, dances, basketball games, and holiday parties. Providing a center for recreation within the industrial town, the hall was a significant building in the social framework of the community. The building is architecturally significant for its association with the mining operations in Kennecott and for its historical association with the lifeways of the Kennecott community.

Historical Value: Medium
Architectural Value: Medium
Overall Value: Medium

Significant Buildings

West Bunkhouse (figure 39)

Building Number: 19
Date of Construction:
Square Feet: 11,830
Lot: 12
Ownership: Public

Figure 39. West bunkhouse. (NPS photo file, WRST, 1998.)

Description: The west bunkhouse is a rectangular, balloon-frame, four-story structure, oriented perpendicular to the west side of the main road, south of National Creek. The foundation is wood post on pier. There is a gable roof over the structure with three dormers on each side of the gable. Windows are double-hung single light sashes. The ground floor is approximately nine feet below the grade of the railroad line, with timber cribbing retaining the adjacent bank.

Significance: Built as a combination mess hall and bunk house for single men working at Kennecott, the structure was the first dormitory constructed in the mill town and is a good example of the architectural style typical of Kennecott. The building is architecturally and historically significant for its association with the mining operations in Kennecott.

Historical Value: Medium
Architectural Value: High
Overall Value: High

SIGNIFICANT BUILDINGS

Store and Warehouse (figure 40)

Building Number: 20
Date of Construction: 1917
Square Feet: 13,185
Lot: 11
Ownership: Public

Figure 40. View southward to the store and warehouse. (NPS photo file, 1998.)

Description: One-and-a-half story, T-shaped, wood commercial building with gabled store facade and recessed entrance with bracketed verge overhangs, exposed eve rafter ends, and double-hung and fixed sash. Catwalks extend to the warehouse entrances on each side wing of the rear warehouse structure. Gable roof porches are at each entry above a full-height basement containing additional storage rooms. A receiving area, complete with a conveyor, is located on the west half of the structure.

Significance: Providing services to the community of Kennecott, the warehouse supplied parts and fixtures for the industrial complex as well as general merchandise to the residents. The building is architecturally significant for its association with the mining operations in Kennecott, and for its historical association with the lifeways of the Kennecott community.

Historical Value: High
Architectural Value: High
Overall Value: High

Significant Buildings

Schoolhouse (figure 41)

Building Number: 23
Date of Construction: Ca 1915–1938
Square Feet: 1,200
Lot: 10
Ownership: Public

Figure 41. View eastward toward the schoolhouse. (NPS photo file, 1998.)

Description: The schoolhouse is a rectangular, wood frame, gable roofed structure, located on the west side of the main road into the mill town. Four-over-four and two-over–two, double-hung windows are on the north and south facades. A central louvered cupola is located on the ridge of the gable, which is flanked by two small chimneys. Grounds surrounding the structure were used for sporting activities and recreation.

Significance: For many years, the schoolhouse served as a center of everyday activity for the families of Kennecott. As many as 20 children attended daily classes. The structure also served as the community church. This building is significant for its historical association with the lifeways of the Kennecott community.

Historical Value: High
Architectural Value: Medium
Overall Value: High

SIGNIFICANT BUILDINGS

Station House (Depot) (figure 42)

Building Number: 34
Date of Construction: Ca 1910–1912
Square Feet: 336
Lot: 60
Ownership: Public

Figure 42. The station house, or depot, was constructed between 1910-1912. (NPS photo file, WRST, 1998.)

Description: Sited next to the rail bed, the station house is a small, one-story wood frame structure on post and sill foundation. The entrance vestibule has a shed roof and the windows are four-over-four, double-hung. A wood decking wraps around the north, west, and south sides of the building.

Significance: The station house was the point of contact for goods and people coming to and from Kennecott, and is significant for its historical association with the mining operations in Kennecott

Historic value: Medium
Architectural Value: Medium
Overall Value: Medium

Significant Buildings

Machine Shop (figure 43)

Building Number: 36
Date of Construction: 1916
Square Feet: 5,550
Lot: 91
Ownership: Public

Figure 43. View northwest to the machine shop, constructed in 1916. (NPS photo file, WRST, 1998.)

Description: The machine shop is located on the west side of the main road, north of the leaching plant and south of the power plant. Rectangular in plan, the wood frame structure has six front bays of six-over-six, double-hung sash. The front elevation faces east and is parallel to the main road. The roof is gabled in three sections: aluminum to the south, and center and tarpaper on the north section. Large double doors are set in the south, east, and north sides of the structure. An overhead hoist enters the building above a door on the south end of the structure. The grade falls away to the west, with storage for machinery, tools, fittings, and gears stored under the building.

Significance: The machine shop is architecturally and historically significant for its association with the mining operations of Kennecott.

Historical Value: Medium
Architectural Value: Very high
Overall Value: High

SIGNIFICANT BUILDINGS

Refrigerator Plant (Meat Cooler) (figure 44)

Building Number: 48
Date of Construction: Ca. 1915–1938
Square Feet: 778
Lot: 11
Ownership: Public

Figure 44. View westward to the refrigerator plant or meat cooler. (NPS photo file, WRST, 1998)

Description: The refrigerator plant is sited between the bunkhouse and the store and warehouse on the west side of the main road. Timber cribbing retains the railroad right of way, which is approximately seven feet above the level grade of the structure. Rectangular in shape, this structure is built around a large walk-in refrigerator. An exterior meat hoist extends around the front, above a platform and into the building above the main entry. Four-over-four, double-hung windows provide light into the refrigerator compartment.

Significance: The refrigerator plant is architecturally and historically significant for its association with the mining operations of Kennecott.

Historical Value: Medium
Architectural Value: Medium
Overall Value: Medium

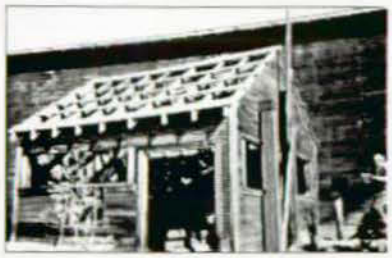


Figure 45. View eastward to the hoist house. (NPS photo file, WRST, 1998.)

Other Buildings, Structures, and Ruins (Public and Private)

Oil Storage Tanks (4a–c)
Diesel Water Tank (4d)
Water Tank (4e)
Bunkhouse (7)
Warehouse (12)
Cottages (13a–f)
Hospital (14)
Kennecott Glacier Lodge (17)
Tailings Hoist House (21)
Handball Court (22)
Cottage (24)
Chicken Coops (31a–b)
Oil House, (38)
Powder House (41)
Fuse House (42)
Tailings Hoist house (44)
Tailings cribbing (45)
Shed (53)
Hoist House (55)
Cable Storage (57)
Hoist House (58)
Cap Storage (59)
Valve House (60)
Spray Pond (61)
Shed (63)
Cottage (65)
Shed (66)
Wood Storage Shelter (68)
Conveyor Shed (76)

Summary

Within the Kennecott mill town, a relatively large number of significant structures remains from the historic period and contributes to the historic district. While the physical condition of these features varies, there remains a high degree of architectural and historical significance associated with several individual structures. The highest concentration of historic structures is in the original industrial building complex. Of these core structures in public ownership, 11 have high architectural and historical significance.[10] In addition to these structures, several secondary structures (such as the hoist house, various sheds, the fuse house, cribbing, conveyor shed, and storage tanks) collectively have historical significance because they contribute to the structural complex holistically, defining the cluster and operation of the mill.

ARCHEOLOGICAL RESOURCES

Located throughout the Kennecott site today are a large number of industrial artifacts. Among these are remnant cable, pipe, shieves, pulleys, grinding wheels, various types of mining equipment and machinery, structural ruins, and isolated features (dumps and storage piles from the concentration mill and community). Many of the features have significance for their association with historic activities at Kennecott (1900–1938). Some features from later periods support the industrial character of the site, but they are not managed as cultural resources.

An inventory of archeological features within the mill town was conducted in 1997 by Michigan Technological University (MTU). For the purposes of the inventory, the mill town was divided into 16 sections, generally following lot lines, roads, and natural features (figure 46). Archeological resources and structures within these 16 sections were identified and mapped. (For detailed building descriptions, see the section titled, *Analysis and Evaluation: Structures.*) In addition, all archeological features were described and a summary assessment of the potential significance was completed. Important in this assessment was an evaluation of both individual features and the historical and physical context within which they exist.

This information was compiled and used to develop a rating system consisting of five categories (see the following table). These categories were used to assess the significance and integrity of archeological resources.

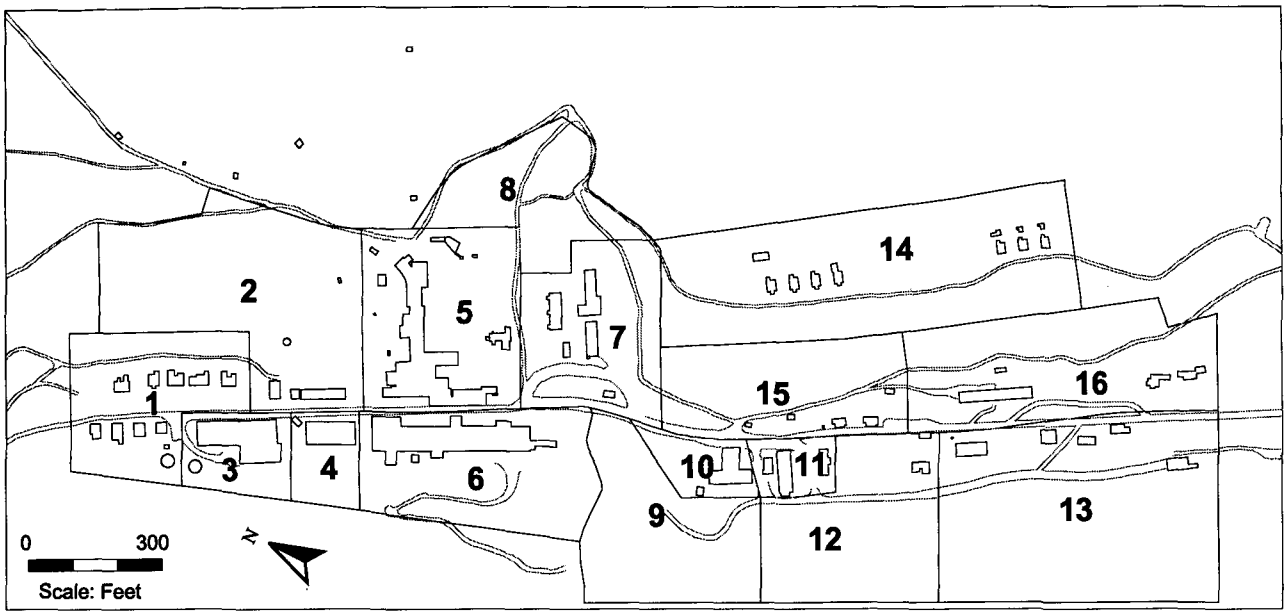


Figure 46. Kennecott mill town showing 16 archeological survey divisions, or sections.

Table 1. Categories of Significance for Archeological Resources

Category and Rating Number	Description
1	Features associated with the operation of Kennecott during the historic period (1900–1938) that remain in historical physical context
2	Features associated with the operation of Kennecott during the historic period (1900–1938) that are not in historical/physical context
3	Structural ruins that remain in their original location
4	Features from multiple periods requiring additional investigation
5	Features that post-date the period of significance and are noncontributing

Features with a rating of 1 are the most significant and are a high priority for preservation and conservation. Features with a rating of 2, 3, and 4 are also significant (or potentially significant), but may require additional research prior to determining appropriate treatment and interpretation. In all cases, artifacts and features in categories 1–3 are contributing resources in the context of the cultural landscape. Features designated in category 5 are not managed as cultural resources and may be removed from the site as required for safety, access, or other management needs.

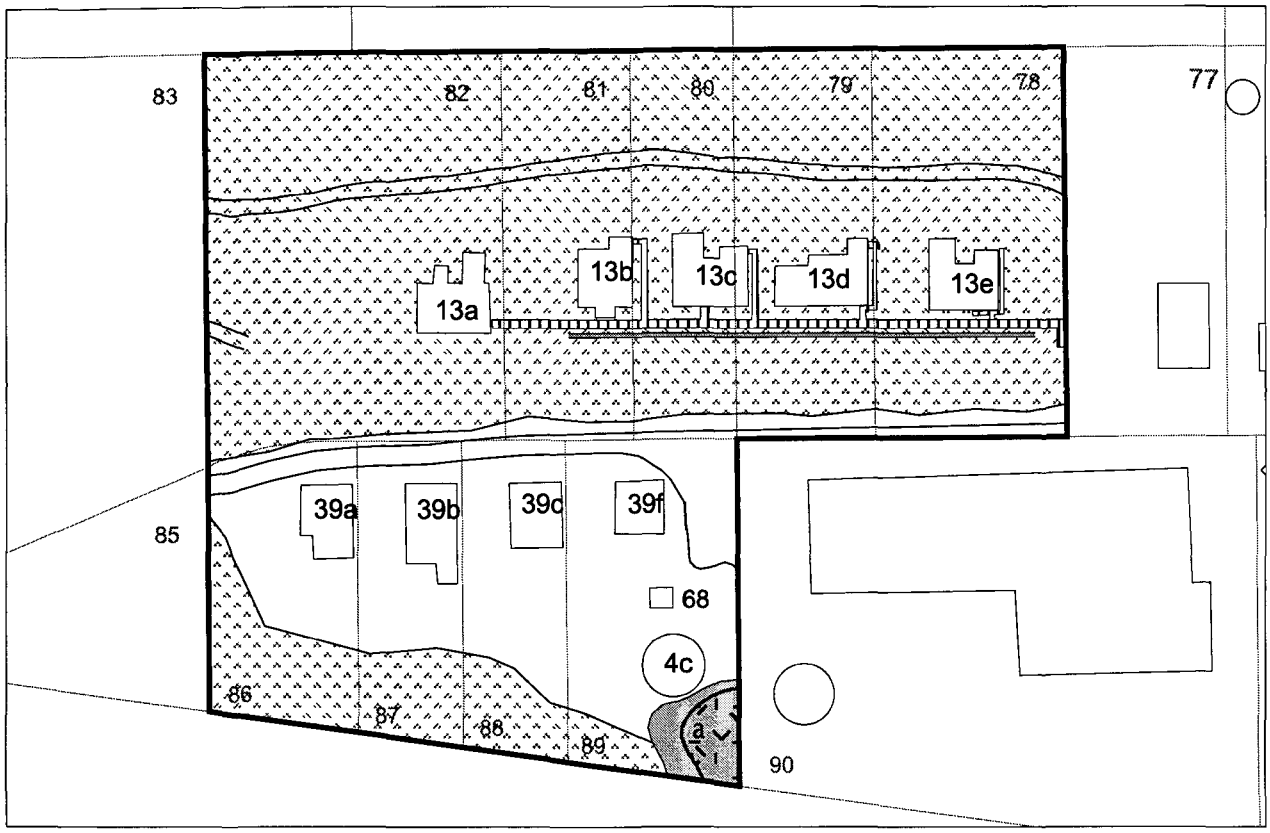
For each of the 16 inventory sections within the mill town, archeological resources are documented in three ways. A narrative description provides a summary of available historical information and existing conditions. Then a chart summarizes the feature and lists the priority ranking for preservation. Listed features may include multiple artifacts, aggregates of features, or be isolates. Each feature is labeled and keyed to a location map.

SUMMARY

A total of 113 archeological features were documented and evaluated in the inventory of archeological resources in the mill town. Of these, less than 17 percent had a rating of 5, leaving 94 individual artifacts and features (aggregate) that are historically significant and contribute to the cultural landscape.

The following section provides a description and feature assessment for each of the 16 inventory sections in Kennecott. Within the description and feature assessment for a given section, each archeological feature is assigned a letter (a, b, c, etc.) and is referred to in the text by that letter.

SECTION 1



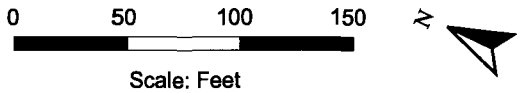


Figure 47. Map of Section 1, Kennecott mill town

LEGEND

- 70 Property Boundaries/Numbers
- Buildings
- Boardwalks
- Roads and Trails
- Utilidors
- Oil Stained Soil
- Dumps
- Vegetation

13 a-f Cottages
39 a-c Cottages
4c Oil Tank
68 Wood Storage

a Includes boilers, pipes, firebricks, drums, sheet metal, flues. Recent domestic trash overtop firebrick close to oil tank includes enamelware.

INVENTORY

Section 1 (figure 47)

Table 2: Feature Assessment of Section 1

Feature	Assessment	Significance Rating
a	Dump, including power plant debitage—boilers, pipes, firebricks, sheet metal, and flues Probably formed from a large dumping event after the 1924 power plant fire. Domestic trash around storage tank 4c overlies firebrick dumps. This is likely the result of later dumping events, probably after the Greater Kennecott Land Company sold the cottages in the 1970s.	1

Description: During the Kennecott era, staff housing dominated this section. Between 1915–1916, the company constructed ten freestanding cottages (13 a–f and 39 a–c) in rows on either side of the rail grade.

The five cottages in the east row are set back from the rail grade and are currently obscured by vegetation (post-1938). Vegetation also obscures an access road to the rear of the cottages and evidence of Kennecott-era vegetable gardens. An extant boardwalk west of the cottages continues to define pedestrian circulation. A utilidor—conveying water, steam, and sewer pipes to the cottages—runs west of the boardwalk (figure 48). Firehouses are located south of structures 13a and 13d.

The west row of four cottages fronts the rail grade (figure 49). Constructed on a hillside, these cottages include lined basements. Historically, catwalks extended from the rail grade level to privies west of the cottages. Two privies from this system are currently extant. The rail grade separating the rows of cottages continued north as a wagon road to the Erie Mine, with a spur leading around the eastern extent of the mill town. Both roads are extant, although the route to Erie Mine eventually narrows to a walking trail.

An extensive discard area (a) lies down the terrace scarp, southwest of the cottages (figure 50). This scatter extends south to the power plant. Materials asso-

ciated with the first power plant (destroyed in 1924) are found at the bottom of the scarp, including firebricks from the furnaces and furnace stacks from the flues. Modern domestic artifacts are intermixed with industrial detritus in the vicinity of the oil storage tank (4c).

Except for the loss of the fifth cottage on the west side during the 1924 power plant fire, a boardwalk between the west row of cottages and the powerhouse, and growth of vegetation in the eastern portion of the section, there have been few alterations to the Kennecott-era landscape. A wood storage structure (68), between the oil storage tank and west cottage row, is a recent but low-impact addition to the area. All cottages are currently held in private ownership; four of them (13c, 13d, 13f, and 39c) have been restored.

Figure 48. Boardwalk in front of staff cottage north of power plant and east of rail grade. (NPS photo file, WRST.)

Figure 49. Restored staff cottage (13f) north of the power plant. (NPS photo file, WRST.

Figure 50. Dump west of power house and staff cottages. Oil tanks 4b and 4c at terrace scarp. First power plant remains at left middle distance. (MTU field documentation, 1997.)

SECTION 2

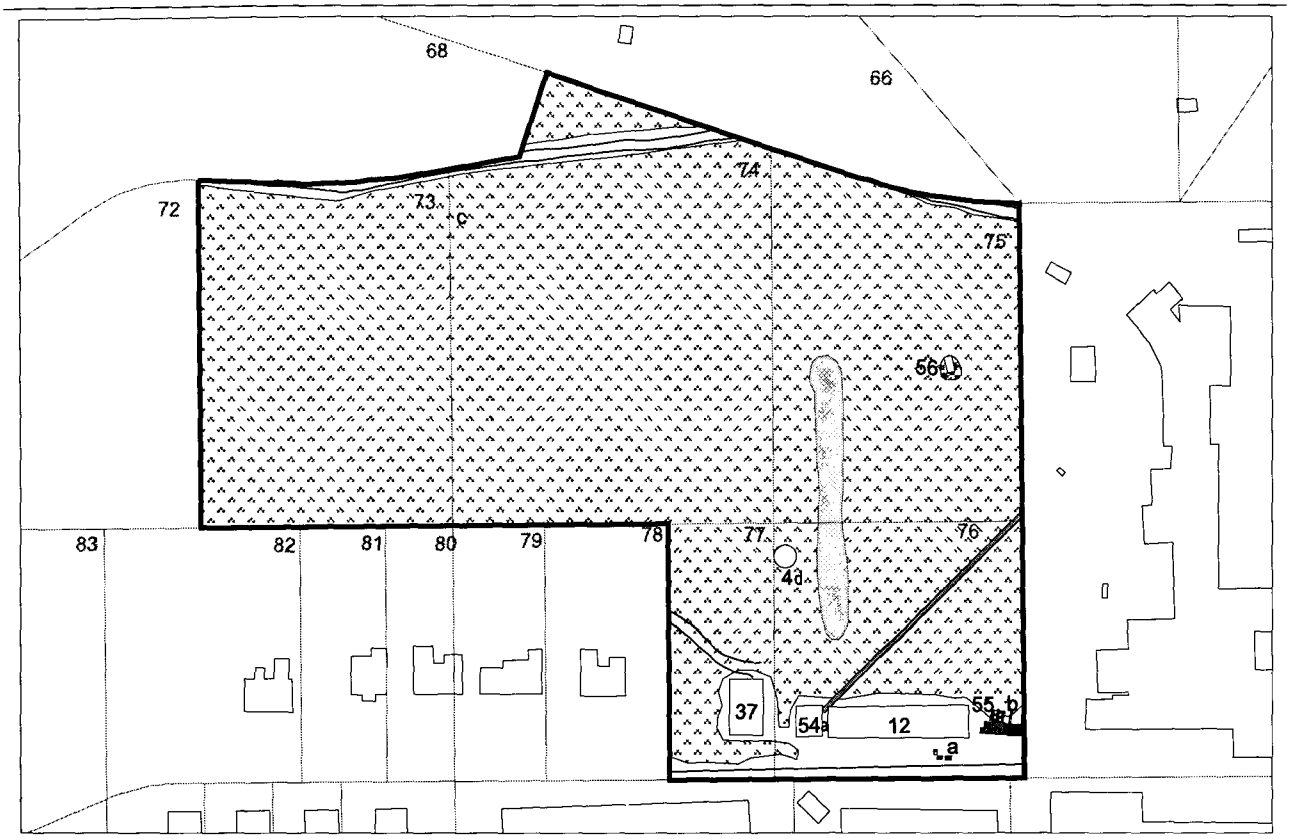


Figure 51. Map of Section 2, Kennecott mill town

0 50 100 150 200

Scale: Feet

N

LEGEND

- Property Boundaries/Numbers
- Buildings
- Artifacts
- Roads and Trails
- Utilidors
- Cribbing
- Wood Scatter
- Vegetation
- Tailings

4d Water and Diesel Storage
12 Warehouse
37 Transformer House
54a Steel Rack
55 Hoist
56 Privy

a Tram cable spools
b Wooden spool
c Site of tennis court

Section 2 (figure 51)

Table 3: Feature Assessment of Section 2

Feature	Assessment	Significance Rating
a	Cable spools. Cables are of locked coil type, employed in the aerial tramway system. Their present location (just outside of the storage facility) is in keeping with the area's general use from 1906–1938.	1
b	Wooden spool. Its position close to the hoist suggests it may be a left over from cable replacement.	1
c	Site of tennis court. As the tennis court was cantilevered over the hillside and the wood later removed (probably by Ray Trotochau or Consolidated Wrangell), there is little surface evidence of its existence other than a few pieces of timber. Archeological investigation may reveal postholes and court dimensions.	3

Description: The clustering of structures in the west part of this section indicates historic use and circulation centered alongside the rail grade. The majority of structures served storage functions. The largest building (12) stored steel, perhaps for working in the machine shop, and sacks for bagging ores. Constructed in 1910, this warehouse is presently in a dilapidated state. Three spools of steel cable (a) employed in the aerial tramway system lie directly outside the warehouse and are in keeping with the area's general use. North of the warehouse, a wood-rack structure (54a) stored steel, line shafts, and machine shop items for the concentrator and mines. A tank (4d) upslope of the steel rack supplied water to the power plant.

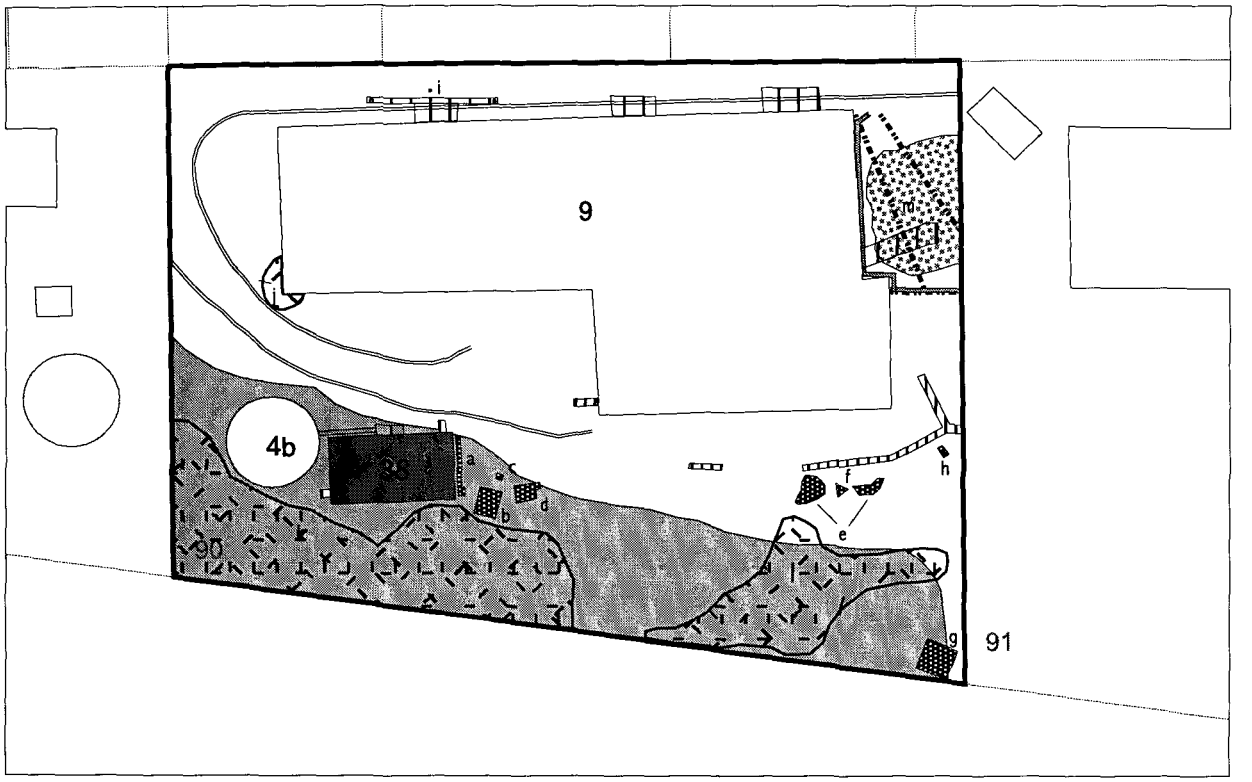
Other structures in this section contributed to the daily running of the mill town. A transformer house (37) distributed electricity for Kennecott's operations. Power lines from the transformer building ran to the Erie Mine, Bonanza Mine, the concentration mill, and the greater mill town. Telephone lines also connected to this building and led to the Jumbo Mine and mill town. No power or telephone poles remain standing, but concrete bases indicate original line routes. A hoist house (55) facilitated the movement of machinery between the concentrator and mines. This building, of which a concrete pad and winch

remain, powered a drawbridge that raised and lowered the tracks of a service tram line between the concentrator and machine shop (also see Section 5b, o).

The area between the rail grade structures and concentrator loop road served multiple functions. The company dumped tailings on the hillside east of the warehouse. These tailings may actually relate to Wrangell Consolidated workings in the 1960s, although the proximity of a workers' privy (56) suggests management considered the hillside a suitable refuse area. A short boardwalk from the three-hole privy may indicate a designated route south to the concentrator building or east to the loop road. Numerous pipes and utilidors run through this area, of which a wood-encased utilidor connecting between the concentrator and power plant is a visible and particularly well preserved example. A few scattered planks just west of the loop road in the northeast part of the section (c) compose the sole remains of the mill town's tennis court.

Figure 52. View north from tram terminus over section 2. Power plant (9) on left, and staff cottages in middle distance. (NPS photo file, WRST.)

SECTION 3



0 20 40 60 80 100

Scale: Feet

N

Figure 53. Map of Section 3, Kennecott mill town

LEGEND

- Property Boundaries/Numbers
- Buildings
- Ruins
- Decking
- Boardwalks
- Artifacts
- Roads and Trails
- Utilidors
- Flumes
- Dumps
- Wood Scatter
- Oil Spill

- 4b Oil Tank
- 9 Power Plant
- 38 Oil House

- a Ceramic block wall
- b Stacked metal flues
- c Waterwheel
- d Furnace latches and braces
- e Ore sacks
- f Wooden trig
- g Wood fram
- h Boiler tubes

- i Vent pipe and oil filters
- j Firebrick scatter
- k Includes boilers, pipes, firebricks, drums, sheet metal, flues. Recent domestic trash over top firebrick close to oil tank.
- l Includes drums, cable, pipe, cans, firebrick, ceramic block, roofing.
- m Remnants of deck between power plant and machine shop.

Section 3 (figure 53)

Table 4: Feature Assessment of Section 3

Feature	Assessment	Significance Rating
a	Ceramic block wall. May have been stacked after power plant fire, although its location in the space of an oil storage tank suggests it dates after Kennecott's operation.	5
b	Stacked metal flues. Neat stacking suggests Kennecott salvaged materials after the power plant fire in 1924.	1
c	Waterwheel. Given its proximity to b and d, this was likely dumped during Kennecott's operation	1
d	Furnace latches and braces. As with b, their neat stacking suggests they were salvaged from the old power plant.	1
e	Sacking, likely relating to the stub tram which brought "sand" up from the glacial moraine forvarious uses in the mill town and mines. Location of the sacks next to the trig f (the upper terminal of the stub tram) suggests they reside in primary context.	1
f	Wooden trig, making up the upper terminal of the stub tram that brought up sand from the glacial moraine to supplement various operations at Kennecott.	3
g	Wood frame. Probably housed the hoist for the stub tram winch, although it has evidently moved down the slope from its location from historic fire insurance maps.	2
h	Boiler tubes. Perhaps displaced from original context, but possibly associated with 1924 fire, or from machine shop discard.	2
i	Vent pipe and oil filter. These were part of the power plant system, but heavily damaged during asbestos removal procedures in 1995.	2
j	Firebrick scatter, perhaps from old power plant. The looseness of the scatter, however, suggests it formed in more recent times, from either salvaging activities or perhaps during asbestos removal.	5
k	Dump (see Section 1, a).	4
l	Dump. Includes drums, cable, pipe, cans, firebrick, ceramic block, roofing. Similar to k, the formation of this dump likely post-dates the 1924 power plant fire. Presence of broken concrete suggests floor removal (probably from old power plant). Else, this dump may be a continuation of machine shop discard.	4
m	Remnants of deck once connecting between the power plant and machine shop. Considerable wood scatter, although most of decking was probably removed in the Trotochau period.	3

Description: The power plant is sited on a terrace between the rail grade and glacial moraine. A road from the rail grade accesses the north and west sides of the building. This road also facilitates pedestrian access to mill town structures located farther south. A light scatter of tailings covers the surface of the road and rail grade. An oil house (38) and oil storage tank (4b) are positioned at the western edge of the terrace.

Immediately south of the oil house are stacks of furnace latches, braces, metal plate, and ceramic blocks (a, b, d). These artifacts derive from the powerhouse, perhaps salvaged by the company after the 1924 power plant fire (figure 54). The remnants of a boardwalk lie between the power plant and oil house. A second boardwalk, farther south connected the power plant with the machine shop dump (figure 55). Extensive dumps (k,l) west of the terrace scarp contain predominantly industrial and construction-related materials (barrels, concrete, and firebricks), although domestic artifacts are also present.

Kennecott did not use the slope between the terrace and glacial moraine solely for waste disposal. A small wood crib (g) probably housed the hoist for a stub tram that brought sand from the glacial moraine to the power plant. (The sand likely found use for construction and blacksmithing activities at the concentrator and mines). This structure has moved approximately 80 feet down the slope from its original location. A wooden trig post (f) at the top of the terrace functioned as the upper terminus for the tram.

Remnants of a deck (m) connecting to the machine shop lie south of the powerhouse. Flumes crossing underneath the decking directed wastewater from the power plant to an outflow by the machine shop. A utilidor beneath one of the flumes conveyed water and steam between the power plant and leaching plant.

An oil intake platform (i) and two other decks are the only features east of the power plant (figure 56). The oil intake platform suffered heavy damage during 1995 asbestos removal procedures. The two decks likely served as temporary storage for machinery loaded off the railroad.

Figure 54. Power plant fixtures, including furnace latches and braces (background), stacked during asbestos removal in 1995. View looking south. (MTU field documentation, 1997.)

Figure 55. View north at boardwalk connecting between power plant (right) to machine shop dump. Trig post (middle left) marked the upper terminus of a stub tram bringing sand up from the glacial moraine. (MTU field documentation, 1997.)

Figure 56. West side of the power plant (9), looking toward the oil tanks and platforms. (NPS photo file, WRST.)

SECTION 4

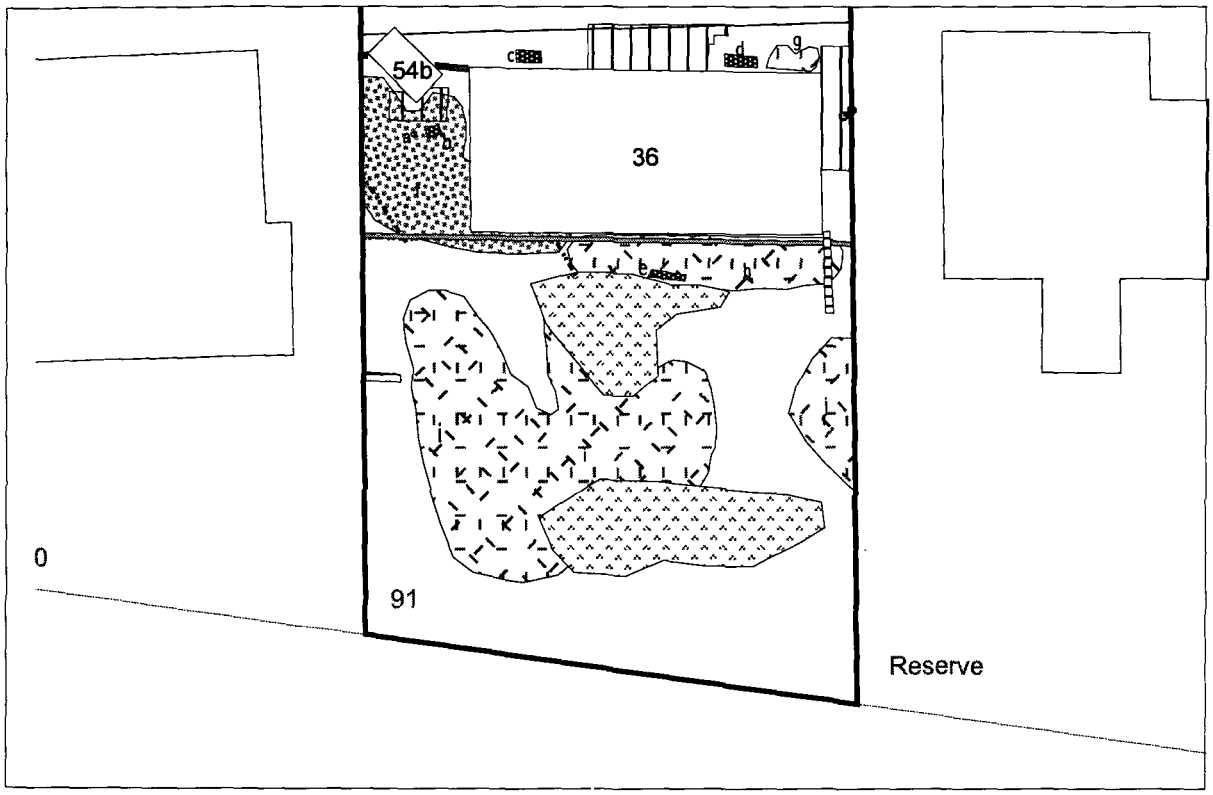


Figure 57. Map of Section 4, Kennecott mill town

0 20 40 60 80 100

Scale: Feet

N

LEGEND

- Property Boundaries/Numbers
- Buildings
- Decking
- Boardwalks
- Artifacts
- Roads and Trails
- Tram-lines
- Utilidors
- Flumes
- Cribbing
- Wood Scatter
- Dumps
- Vegetation

36 Machine Shop
54b Steel Rack

a Grinder
b Battery storage unit
c Tailings scraper
d Machine base on wood foundation
e Engine
f Remnants of deck between power plant and machine shop
g Includes shieves, grinding wheels
h Includes pump, filling chutes, wheels (large castings), wood ventilation cupolas.
i Scrap metal dump. Includes pipe, coil, stove parts, latches, wheels, cogs, tools, compressor, bed frame. Most artifacts are broken. North section of dump is capped with concrete and surfaced with tailings.
j Includes drums, cable, wire, drill bits, belt wheels, buckets, rope, sacks, tin sheet, food cans. Considerable number of wood shingles.

Section 4 (figure 57)

Table 5: Feature Assessment of Section 4

Feature	Assessment	Significance Rating
a	Grinder found under decking material. Probably extensions of machine shop storage.	1
b	Battery storage unit found under decking material. Indicates this area may have been used as a generic storage area for a variety of equipment.	1
c	Scraper. Although removed from its functional context (employed either in the landscaping of tailings or scraping of talus slopes at the Bonanza and Glacier mines), this scraper may have been repaired by the machine shop.	1
d	Machine base on wood foundation. Not in direct context with machine shop activities.	2
e	Engine. Close proximity to machine shop suggests it may have been stored there for future use (perhaps scrap metal).	1
f	Remnants of deck (see Section 3, m).	3
g	Collection of machinery pieces, including shieves and grinding wheels. As with b, c, and d, these artifacts do not associate directly with the machine shop, but may have been repaired/ waiting for repair. These items were likely employed in the concentrator, and were probably removed to this location by the concentrator tramline.	1
h	Dump, includes pump, filling chutes, wheels (large castings), wood ventilation cupolas. Probable extension of machine shop storage area. Cupolas, however, appear to be dumped from re-roofing, perhaps in recent times.	4
i	Scrap metal dump. Includes pipe, coil, stove parts, latches, wheels, cogs, tools, compressor, and bed frame. Most artifacts are broken and are in the context of a machine shop dump. Northern section of dump, which included an ash pile is capped with concrete and surfaced with tailings. This was undertaken in the 1990s.	1
j	Dump. Includes drums, cable, wire, drill bits, belt wheels, buckets, rope, sacks, tin sheet, food cans. Considerable number of wood shingles. Range of artifacts suggests no segregated dumping, but it may also be the result of (and perhaps created during) disturbance in recent times, such as during asbestos removal procedures in 1995.	4

Description: The machine shop fronts the rail grade on the same terrace as the ammonia leaching plant and southern part of the power plant. A boardwalk leading from the southwest side of the power plant accesses the north, west, and south sides of the machine shop. The design of the machine shop, with practically the whole building on raised wood pilings, kept the working floor level with the rail grade. The crib wall supporting the west side of the rail grade extends south to the rail bridge (50). Space created beneath the machine shop found suitable use for parts storage. A hoist at the southern end of the shop moved stored equipment to the level of the shop floor (figure 58). Similar to areas beneath the shop, a discard area (h) immediately west of the building includes machinery parts likely associated with shop activities. However, some materials, such as wood ventilation cupolas, were likely discarded during a roof restoration effort.

A wood scatter (f) north of the machine shop (figure 59) resulted from the collapse of a connecting deck between the machine shop and power plant. Artifacts amongst the wood scatter include a grinder (a) and battery storage unit (b), which may be a continuation of shop storage. An extant section of the connecting deck abuts the west side of a wood-framed steel rack (54b). This deck also traveled west and joined with the boardwalk leading from the southwest side of the power plant. Extending west, this deck served as a platform for the dumping of machine shop refuse.

Dumps down the terrace scarp (i, j), which contain broken tools, machinery, and scrap metal, closely correlate with machine shop activities. A flume close to the west wall of the machine shop directed wastewater from the Pelton wheel in the powerhouse into this area (figure 60). A recently poured concrete cap over the northern half of this dump mitigates a hazardous ash pile.

Large decks east and south of the machine shop facilitated the storage and transfer of supplies from the railway, concentrator tramline, and narrow gauge line from the general store (19). Machinery parts either side of the east deck, include a tailing scraper (c), machine base (d), and shieves (g). These appear to have been dumped out of convenience, but they may still relate to Kennecott-era use areas.

SECTION 5A

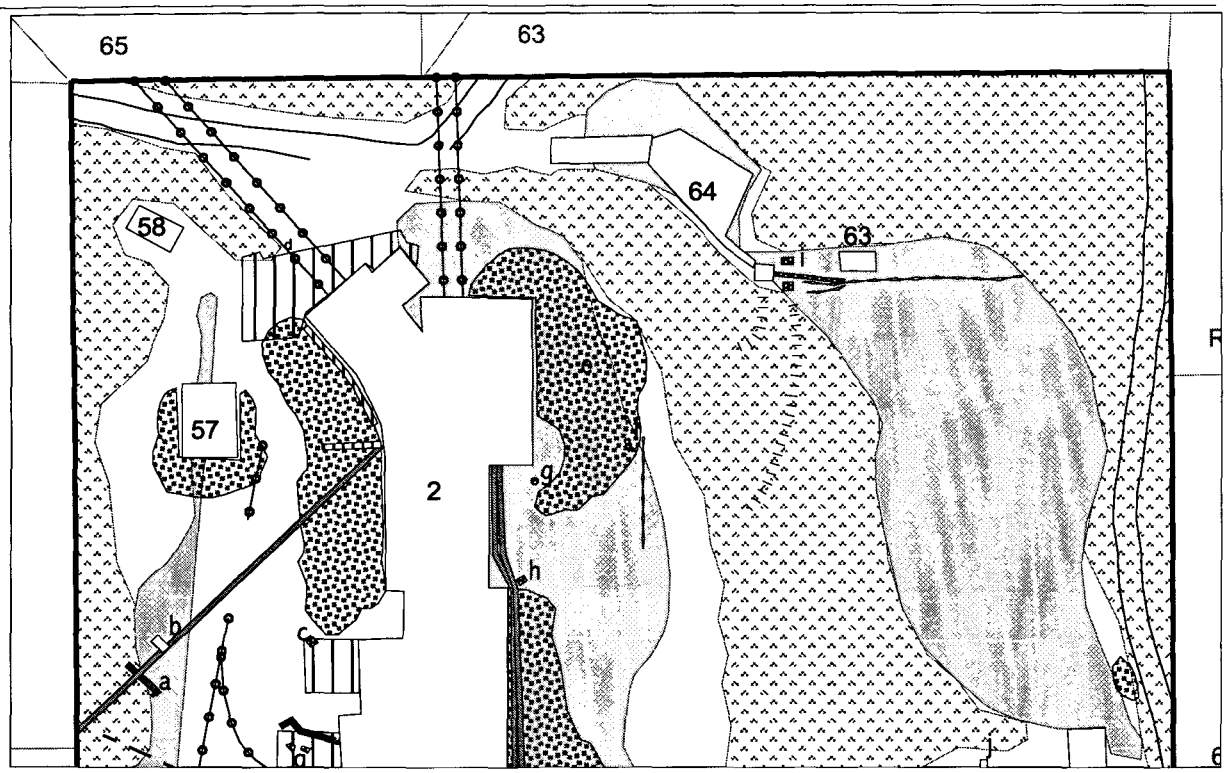


Figure 61. Map of Section 5a, Kennecott mill town

LEGEND

- Property Boundaries/Numbers
- Buildings
- Ruins
- Decking
- Boardwalks
- Artifacts
- Roads and Trails
- Tram-lines
- Utilidors
- Pipes
- Cables
- Cribbing
- Terraces
- Wood Scatter
- Tailings
- Vegetation

2 Tram Terminus
57 Cable Storage
58 Hoist House
63 Storage Shed
64 Wrangell Consolidated Workings

a Wood box, possibly for screening
b Fire House
c Large machine parts
d Cable, rail, hooks, shieves, tram rail
e Roof gable, tram line parts, rail amongst extensive wood scatter
f Screen
g Pulley
h Scoop
i Screen inside timber crib, conveyor, and two shaker/crusher machines. Electric motor located to north.

Section 5a (figure 61)

Table 6: Feature Assessment of Section 5a

Feature	Assessment	Significance Rating
a	Wood box, perhaps for screening/prospecting ore. Location suggests it was dumped and not important to later operations at the mill town.	2
b	Fire house (formerly holding 100 feet of hose) on utilidor line between concentrator and power plant. Significant as a fire protection measure installed in the mill town.	1
c	Large machinery parts on decking area. Position outside concentrator indicates this was one of the areas in which new, redundant, and broken machinery was temporarily stored from the tramline.	1
d	Assorted artifacts: cable, rails, hooks, shieves, and tram rail from collapse of Jumbo aerial tramway. Kennecott-era materials, although this section of the tramway may have been removed during the Trotochau, Consolidated Wrangell period in order to access the ore chute (64).	4
e	Discard area, including roof gable, tramline parts, and tram rail amongst extensive wood scatter. Tram parts relate to Bonanza line. General destruction of this area likely attributable to efforts of Ray Trotochau.	2
f	Screen. Probably Kennecott-era, but probably dumped from upper tram-deck after close of operations.	2
g	Pulley (see f)	2
h	Scoop (see f)	2
i	Consolidated Wrangell machinery, including screen inside timber crib, conveyor, and two shaker/crusher machines. Electric motor to the north. All date to the movement of Wrangell crushing operations to the mill town area in 1957.	5

Description: The concentrator tram terminus (2) extends west from the top of a hill scarp above the rail grade. Decks around the concentrator, as well as their contents, are for the most part well preserved (see c and d, and figure 62). Together with the track incline system connecting the tram terminus with the crushing unit of the concentration mill and machine shop, these features illustrate the system by which concentrator machinery was installed, repaired, and temporarily stored.

Not all features around the concentrator are well preserved. A deck once extending east from the Bonanza Mine terminus has entirely collapsed. The hoist house (58) and storage shed (57) north of the tram terminus have also collapsed. Coiled metal sheets and rolls of cable stacked on the floor of the storage shed attest to the building's function. The hoist house (possibly once a blacksmith shop constructed in 1907–1908) operated the incline tram between the concentrator and machine shop.

Utilidors run along both sides of the concentrator. A firehouse (b) is located north of the building along a utilidor connecting with the power plant. Cribbing in the vicinity indicates a measure to stabilize the once devegetated hillside.

A light scatter of tailings covers the ground surface north and south of the concentration mill. These tailings were deposited before construction of the ammonia leaching plant and constitute some of the earliest tailings at Kennecott. Much of the debris on the north and south sides of the concentrator derives from fallen wood siding off the upper levels of the tram terminus. Artifacts among the debris relate to the aerial tram system (d, e) and general concentrator operations (f, g).

During the 1960s, Consolidated Wrangell operated a concentration mill southeast of the tram terminus (figure 63). Remains of Wrangell workings include an ore chute, storage basin, conveyor, crushing machinery, and a storage shed (63, 64). Tailings from Wrangell operations were directed west of the crushing machinery. This eventually covered areas formerly occupied by the manager's residence and staff office building (removed 5–10 years prior), two sites having potential archeological value.

Figure 62. Tram terminus (2) for the Jumbo Mine aerial tramway. (NPS photo file, WRST.)

Figure 63. Wrangell Consolidated operations (64). View northeast from tailings toward shaking and crushing machinery. A shed (63) once behind the manager's house, circa 1910, is at middle right. (MTU field documentation, 1997.)

SECTION 5B

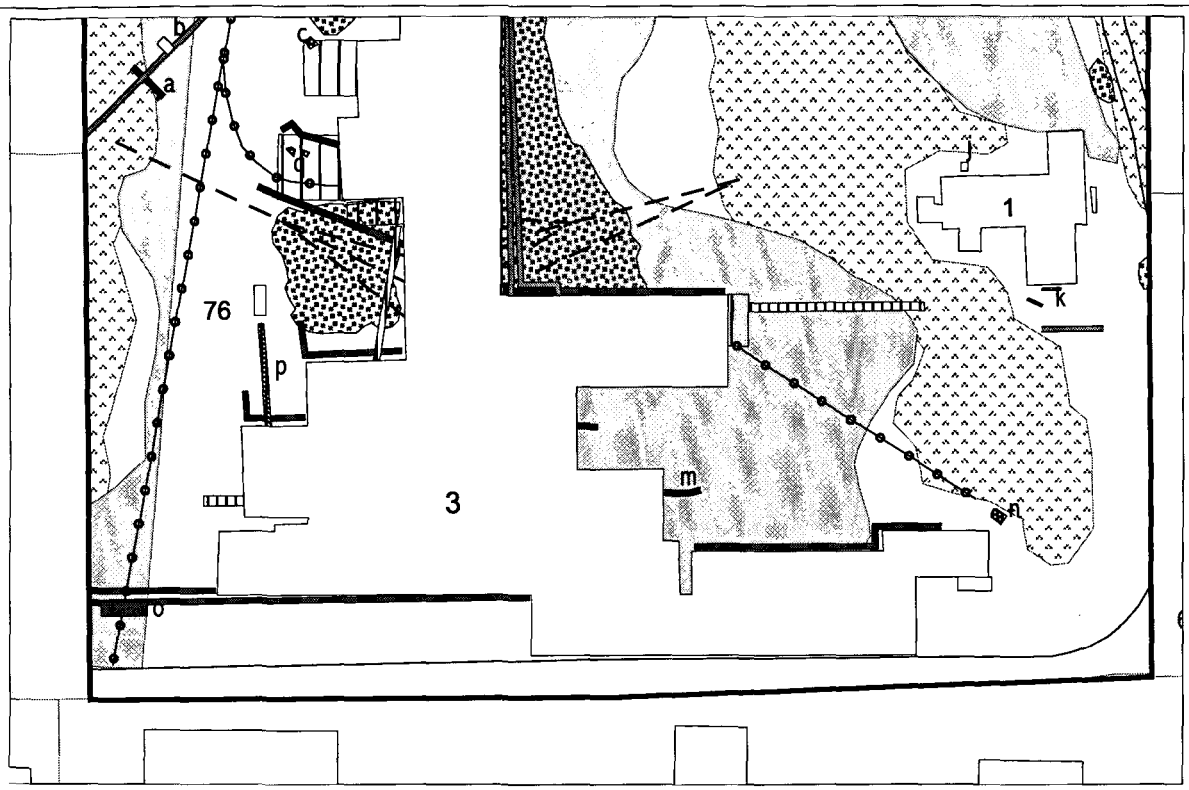


Figure 64. Map of Section 5b, Kennecott mill town

0 20 40 60 80 100

Scale: Feet

N

LEGEND

- Property Boundaries/Numbers
- Buildings
- Ruins
- Decking
- Boardwalks
- Artifacts
- Roads and Trails
- Tram-lines
- Utilidors
- Pipes
- Cables
- Cribbing
- Wood Scatter
- Tailings
- Vegetation

1 General Manager's Office
3 Concentration Mill

j Fire House
k Flower planters
l Piping, screen, wooden box, canvas belt, sheet metal, tar paper.
m Sheet metal backed by sand bags
n Crusher
o Tram drawbridge
p Conveyor
q Large machinery. Crane rails above deck.

Section 5b (figure 64)

Table 7: Feature Assessment of Section 5b

Feature	Assessment	Significance Rating
j	Fire house (formerly holding 100 feet of hose). Significant as a fire protection measure installed in the mill town.	1
k	Narrow wooden troughs, perhaps employed as flower planters. (If so, these would meet significance as a "beautification" measure in the mill town area.)	1
l	Artifact scatter on decking, including piping, screen, wooden box, canvas belt, sheet metal, tar paper. May indicate use of tramline to move up supplies to the Hancock addition of the concentrator. Some material on the deck probably dumped in salvage activities around and after the time of Kennecott's closure.	4
m	Sheet metal backed by sandbags, used to retain loose rock on hillside. Indicates one use for sand likely acquired from the "sand pit" at the glacial moraine (see Section 3).	1
n	Ball mill, painted green. Largely out of context with Kennecott milling and repair facilities. Likely relates to the Consolidated Wrangell period.	5
o	Tram drawbridge. Part of the tramline system that moved machinery from the upper tram deck, concentrator, and machine shop. Significant as an indicator of the importance of machinery repair and installation to the general running of the mill town and mines.	1
p	Remains of a conveyor, possibly dumping high-grade ore into storage bins. Kennecott-era associated with concentrator and structure 76.	1
q	Large machinery on decking. Position outside concentrator indicates this was one of the areas new, redundant, and broken machinery was temporarily stored from the tramline. Decking includes a frame superstructure that supported rails for a crane, significant as a method employed to transfer heavy machinery to and from the concentrator building.	1

Description: The concentration mill occupies the hillside between the tram terminus and the rail grade. Similar to the tram terminus, areas around the concentrator were used to move ore, waste, and machinery. A conveyor shed (76) transferred high-grade ore to a storage bin beside the railroad. Tailings north and south of the concentrator were deposited prior to the ammonia leaching facility. Decks on the north and south sides (l, q) still hold machinery and parts. Near the rail grade, a drawbridge (o) aided by a hoist (see Section 2,

Building 55) raised and lowered tram tracks over the rail grade for the movement of machinery (figure 65). A tramline on the south side of the concentrator likely aided the installation of jigs and other machinery into the concentrator's 1922 "Hancock" addition.

Vibrations from concentrator machinery necessitated the attachment of guy ropes on the north and south sides of the structure. Alternatively, these may have been attached in 1912 when the instability of foundations forced temporary closure of the concentrator. Beneath the west side of the concentrator, three generations of foundation cribbing document its gradual expansion between 1911–1938 (figure 66).

Although the rail grade provided general access to the concentration mill, boardwalks indicate pedestrian circulation traversed the hillside. A boardwalk between the manager's office (1) and the concentrator is the only substantial survival of a once well-defined pedestrian circulation in the National Creek area (figure 67).

After Kennecott's closure, this area sustained minor damages. Fallen siding contributes primarily to wood scatters around the concentrator. The manager's office sustained damage from the piling of Consolidated Wrangell tailings on its eastern side. An ore crusher (n) close to the south tramline likely dates to Wrangell Consolidated operations, well after the closure of Kennecott.

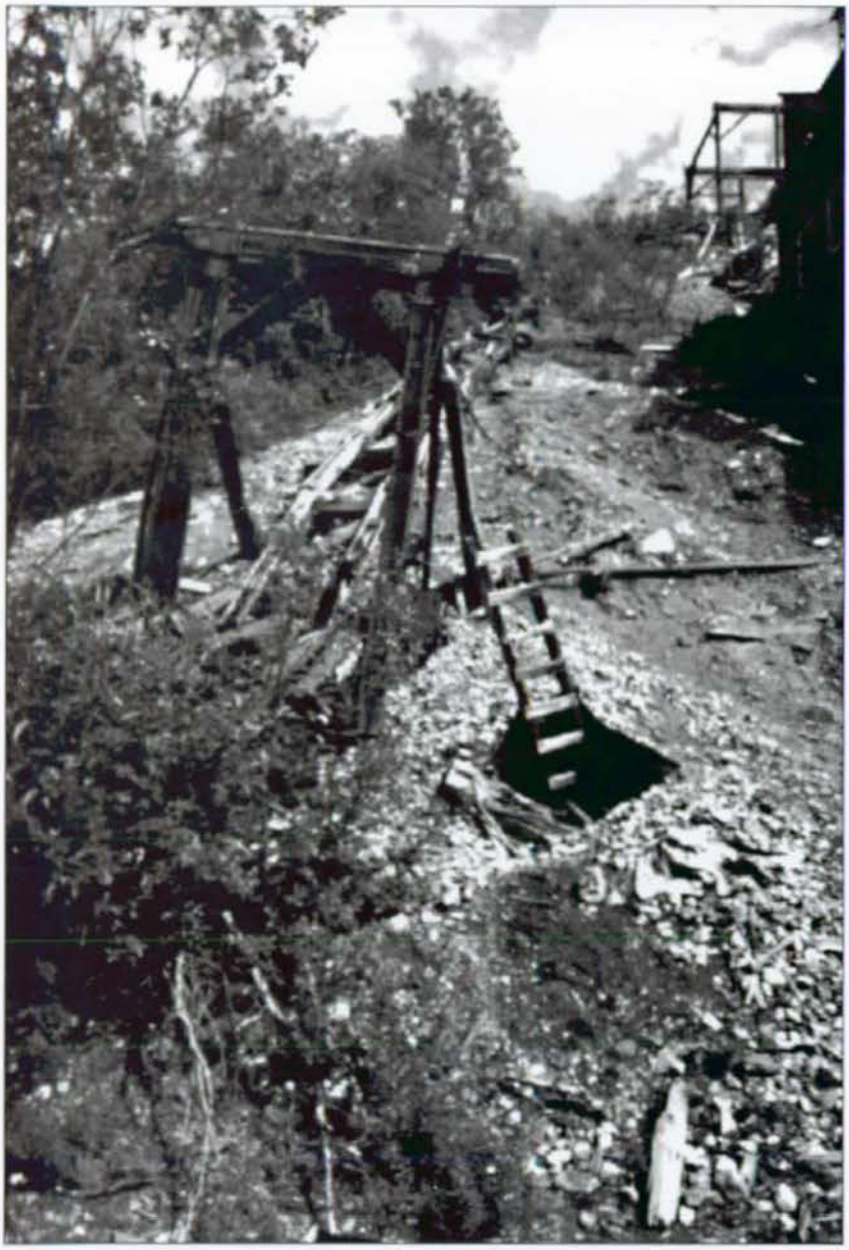


Figure 65. Drawbridge of service tram between tram terminus (2) and machine shop (36). (MTU field documentation, 1997.)

Figure 66. West wall of concentration mill (3) showing three generations of foundation cribbing. (MTU field documentation, 1997.)

Figure 67. Manager's office building. Vegetation between the building and the tram terminus (upper left) occurred after Kennecott's closure. (NPS photo file, WRST.)

SECTION 6

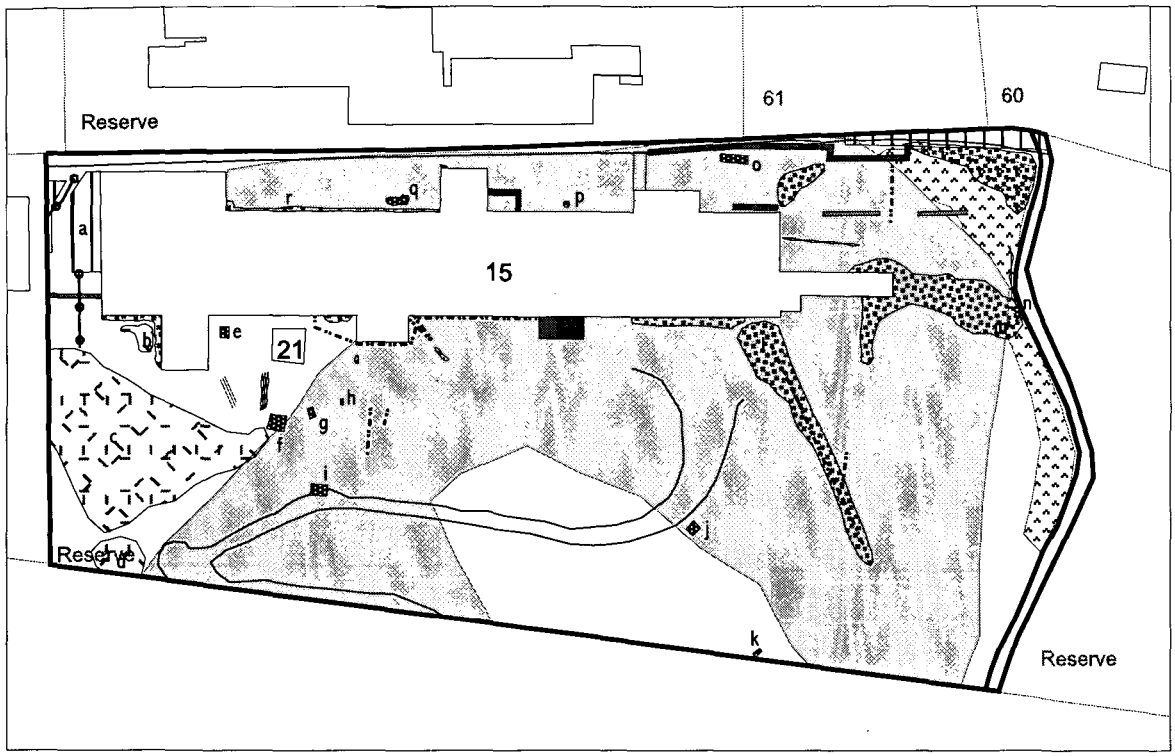


Figure 68. Map of Section 6, Kennecott mill town

0 50 100 150 Feet

LEGEND

- Property Boundaries/Numbers
- Buildings
- Ruins
- Decking
- Artifacts
- Roads and Trails
- Tram-lines
- Utilidors
- Pipes
- Flumes
- Cribbing
- National Creek
- Wood Scatter
- Dumps
- Tailings
- Vegetation

15 Ammonia Leaching Plant
21 Tailings Hoist House

a Deck supporting tram tracks
b Drum drop, occupying site of lime shed
c Includes drums, cable, wire, drill bits, belt wheels, buckets, rope, sacks, tin sheet, food cans. Considerable number of wood shingles.
d Drum dump
e Drum crusher
f Wood-frame platform
g Tailings scraper
h Sample separator
i Wood frame
j Sorting funnel
k Sled
l Wood scatter around confluence of pipes. Rollers, gears screens, drums, brackets, and line shafts also present.
m Truck transmission
n Crudely made pelton wheel
o Screen, painted green
p Pulley wheel
q Ore sacks
r Drum
s Floor joists and decking

Section 6 (figure 68)

Table 8: Feature Assessment of Section 6

Feature	Assessment	Significance Rating
a	Deck supporting tram tracks, mostly collapsed. The tram tracks were part of the system of machinery transfer between the machine shop, concentrator, and upper concentrator terminal.	3
b	Drum dump occupying site of a lime storage shed. Not in keeping with area's historic use and likely created by the asbestos removal team in the mid-1990s.	5
c	Dump (see Section 4, j).	4
d	Drum dump, probably formed at the same time as Section 4, j.	5
e	Crusher. Old machinery perhaps used early in concentrator's development. It may have been dumped from the concentrator prior to construction of the flotation plant addition to the leaching plant (circa 1923). Significant as an earlier piece of machinery used at Kennecott.	2
f	Wood-frame platform, serving as part of the tailings scraper system. Significant as a method used by Kennecott to reclaim, store, and landscape concentrator tailings.	3
g	Scraper used in landscaping tailings. Lies in context, and associated with the winch house (21), and wood crib (f).	1
h	Sample separator for use in assaying. Possibly discarded prior to construction of flotation plant in 1923.	2
i	Wood frame. Makeshift noncontributing structure not associated with Kennecott-era mill town activities. Undoubtedly created after the road to the leaching plant was pushed through in 1995 to back-fill tailings into the leaching plant.	5
j	Hopper with grizzly. Perhaps used in the back filling of tailings into the leaching plant in 1995. Its location suggests it was not employed by either Kennecott or Consolidated Wrangell operations.	4
k	Sled, probably associated with Kennecott-era. Although too small for freighting, the sled may indicate an informal recreational use of the area during winter.	2
l	Wood scatter around the confluence of waste disposal pipes. Artifacts, including rollers, gears, screens, drums, brackets, and line shafts, may have been dumped during asbestos removal.	4 / 5
m	Truck transmission beside National Creek. Unknown context, but likely of minimal significance.	5
n	Crudely made Pelton wheel, dating to either the Kennecott or Consolidated Wrangell era. Significant as an alternative power source for concentration operations.	4

o	Green-painted ore screen. Location suggests it was dumped from the rail grade. The machinery is probably associated with Consolidated Wrangell operations (appears same vintage as ball mill in Section 5b, n) although it was likely dumped after the closure of their operations.	5
p	Pulley wheel. Probably Kennecott-era, but devoid of associative context.	2
q	Sacks at base of leaching plant feed trestle. The sacks lie in close proximity to the ore sacking room of the flotation plant, but the rail grade area was unlikely used for empty sack storage.	2 / 5
r	Drum, minimal significance.	5
s	Floor joists and decking, either the footprint of an extension to the leaching plant (seen in the 1935 fire insurance plan) or else decking constructed to facilitate the back-filling of the leaching plant with tailings in 1995. Closer examination should indicate whether it is indeed a foundation and whether it has potential archeological significance.	3

Description: The ammonia leaching plant (15) is sited below the rail grade on the same terrace as the machine shop. Areas on the north, south, and west sides of the plant were primarily used for refuse disposal. Decking on the north side of the plant (a) supported an extension to the concentrator and machine shop tramline. The extensive dump created (c) includes broken machinery (probably from the machine shop), wood shingles, and drums.

Tailings around the plant primarily derive from the concentration mill and were likely deposited prior to construction of the flotation plant. A tailings launder, at least in place by 1917, directed mill tailings (including fines that the leaching process could not treat) toward the glacial moraine. Finely stratified tailings are exposed beneath a conveyor shed at the southern end of the plant. The conveyor shed distributed leaching plant tailings across National Creek and aided the creation of construction space in the southern mill town (see Section 11). A hoist house (21), crib (f), and scraper (g) on the west side of the leaching plant indicate additional methods used by Kennecott to disperse leached tailings (figure 69).

Flumes and pipes south and west of the leaching plant directed both tailings and wastewater toward National Creek. A cluster of flumes (l) extended from the southwest corner of the leaching plant (figure 70). The southern part of the leaching plant sustained significant damage during the flooding of National

Creek in 1980 and 1983. In addition to damaging flume systems west of the bridge, floods deposited tailings previously filling the rail bridge crib against the eastern wall of the conveyor shed.

Most artifacts around the leaching plant lack direct associative context with the leaching process or with the disposal of tailings and wastewater. Some machinery (such as the crusher) may have been discarded prior to construction of the leaching facility. Post-Kennecott disturbances west of the leaching plant include a bulldozed track and a makeshift wooden frame (i), perhaps supporting a tent frame. The asbestos removal team formed a road in 1995 for the purposes of depositing tailings onto the leaching plant floor. Machinery likely dumped after Kennecott operations includes a hopper (j), conveyor (o), truck transmission (m), and crudely fashioned water wheel (n).

Figure 70. Ammonia leaching plant (15), looking northeast. Flumes and pipes for waste removal in foreground. (MTU field documentation, 1997.)

Figure 69. Scraper used in landscaping tailings, located west of leaching plant (15). (MTU field documentation, 1997.)

SECTION 7

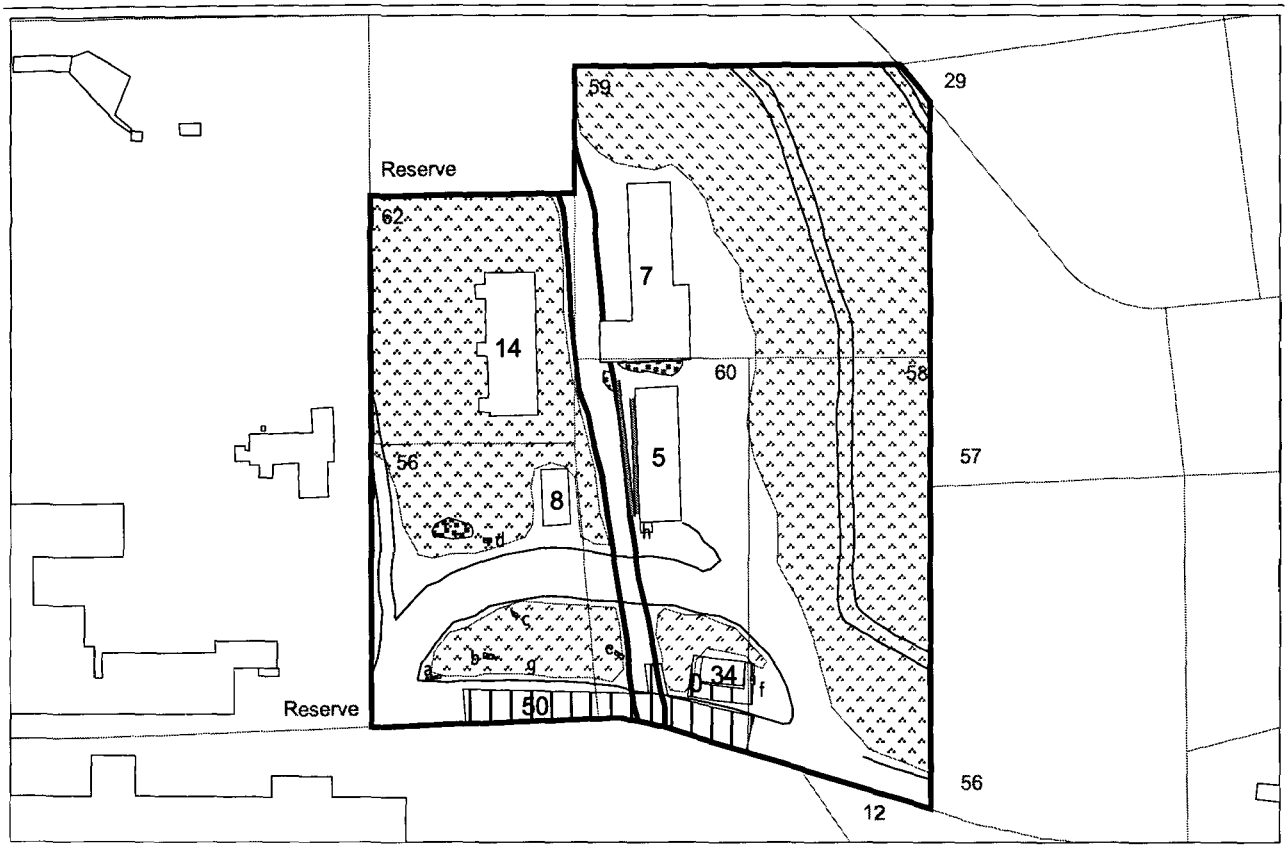


Figure 71. Map of Section 7, Kennecott mill town

LEGEND

- Property Boundaries/Numbers
- Buildings
- Decking
- Artifacts
- Roads and Trails
- Utilidors
- National Creek
- Wood Scatter
- Vegetation

5 Bunkhouse
7 Bunkhouse
8 Assay Shed
14 Hospital
34 Railway Depot
50 Rail Bridge

a Conveyor
b Sorter
c Screens
d Electric motor
e Sled
f Sorting funnel
g Site of warehouse
h Fire house

Section 7 (figure 71)

Table 9: Feature Assessment of Section 7

Feature	Assessment	Significance Rating
a	Green-painted, screw-thread conveyor. Appears approximately same vintage as screen (Section 6, o) and ball mill (section 5b, n). Likely relates to Consolidated Wrangell or asbestos removal team.	5
b	Sorter. Likely disturbed context.	2
c	Screens. Likely disturbed context.	2
d	Electric motor. Possibly relates to Consolidated Wrangell or asbestos removal team.	5
e	Sled, similar to Section 6, k.	2
f	Hopper with grizzly. Out of context with location and probably relating to either Consolidated Wrangell machinery or asbestos removal practices.	5
g	Warehouse site. Some foundations visible on the southwest corner, otherwise site is damaged by leveling and growth of vegetation.	3
h	Fire house (formerly holding 500 feet of hose). Significant as a fire protection measure installed in the mill town and one of only two extant in the National Creek area.	1

Description: This area contains five extant buildings clustered around National Creek. A rail bridge (50) and a vehicle road currently access the west portion of this area (figure 72). This area provided accommodations for workers (5, 7), medical services (14), storage (g), transportation and administration (34), and metallurgical testing (8).

The flooding of National Creek in 1980 and 1983 damaged the integrity of much of this area. Floods brought large volumes of silt and gravel into the ground floor levels of the hospital, assay shed, and both bunkhouses, weakening the structures. Tailings held in the rail bridge crib were re-deposited against the leaching plant (see Section 6). The narrow gauge line on the west side of the rail bridge was entirely removed and flume systems on both sides of the bridge were damaged. In addition to the deposition of gravels over much of the ground surface, water action exposed some areas to bedrock. As a consequence, small-scale features have either been removed or buried. Boardwalks and decking, for

example, are almost entirely absent (with exception of a small area abutting the west side of the hospital). Floods likely removed a storage shed that had been located south of the 1908 bunkhouse (5) (figure 73). A firehouse (h) abutting the west side of this bunkhouse is still extant, but at least two others were once in the area (between the two bunkhouses and north of the assay shed).

Indications of former infrastructure have not entirely been destroyed. Foundation (g) between the rail grade and road demarcate the southwest edge of a warehouse built in 1916. Woodpiles to the north of the assay shed are possible demolition materials from the manager's house, staff house, or guest house. On the hillside south of National Creek, a vehicle road, overgrown and washed out in places, runs between the National Creek dam (33) and general store (19).

The current vehicle road east of the Rail Bridge, provided vehicle access to the concentrator during emergency stabilization procedures in 1991. Historically, this road connected to the warehouse and did not continue beyond. Machinery on both sides of the access road includes a conveyor (a), screens (c), and an electric motor (d). These likely relate to Wrangell Consolidated operations.

Figure 72. View of south mill town from tram terminus (2). Rail bridge (50) and depot (34) in foreground, store (19) and west bunkhouse (20) in background. (MTU field documentation, 1997.)

Figure 73. View east with 1908 bunkhouse (5) in foreground and 1910 bunkhouse (7) in background. The road is on the right is built on gravel brought in during the 1980 and 1983 National Creek floods. (NPS photo file, WRST.)

SECTION 8

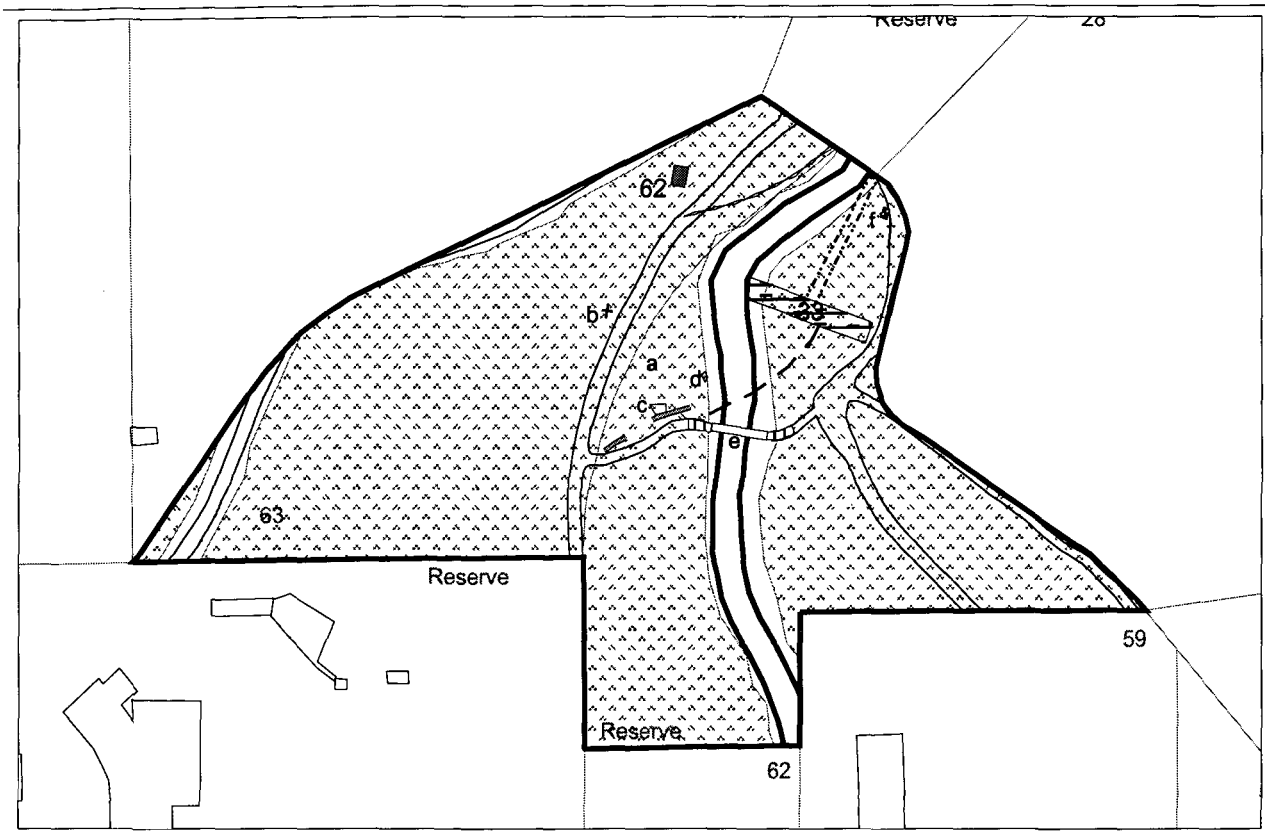


Figure 74. Map of Section 8, Kennecott mill town

0 50 100 150 Feet

LEGEND

- Property Boundaries/Numbers
- Crib Dam
- Ruins
- Boardwalks
- Artifacts
- Roads and Trails
- Utilidors
- Pipes
- Flume
- Cable
- National Creek
- Dumps
- Vegetation

33 National Creek Dam
62 Storage Shed

a Stephen Birch's house site
b Wood clothesline
c Pipes, metal headboard
d Fence posts (painted green), sledge hammer
e Sluice grate

Section 8 (figure 74)

Table 10: Feature Assessment of Section

Feature	Assessment	Significance Rating
a	Stephen Birch's house site. Demolished by Ray Trotochau in the 1950s and now largely overgrown. No surface evidence of house site other than water pipes. In spite of poor surface preservation, site may retain high archeological integrity.	3
b	Wooden rotary clothesline partially buried. Resembles form of clothesline shown in historic photos between staff house and manager's house. Probably constructed circa 1911–1917 when staff and managerial accommodations were constructed in the National Creek area. Significant as a rare survivor of domestic activities carried out in the mill town.	1
c	Small scatter of pipes, including a metal headboard, possible demolition materials from Stephen Birch's residence dumped by Ray Trotochau.	2
d	Fence posts (painted green) and sledge hammer. The fence posts are all that remains of a fenced garden or lawn extending west from Birch's residence. Indicates spatial segregation in the mill town.	3
e	Footbridge over National Creek. Partially dilapidated condition. Important as a functional and aesthetic component to the National Creek area.	1
f	Sluice grate, removed from dam flume (its likely original position).	2

Description: The area at the eastern edge of the mill town served a number of important functions. Roads to the concentrator, general store, and staff residences on Silk Stocking Loop connected above the dam and also joined with a pedestrian route from the administration area.

In spite of major breaches in 1980 and 1983, the National Creek Dam (33) retains a high level of structural integrity (figure 75). Cribbing, facing boards and a spillway are extant.

Other structures in the area are not well preserved. A storage shed northeast of the dam (62) has collapsed entirely. A footbridge (e) across National Creek, west of the crib dam, is in need of repair and boardwalks on both sides of the footbridge are poorly preserved (figures 76 and 77).

The site of Stephen Birch's residence (a) retains little integrity. The house was demolished in the 1950s and flooding in the 1980s further damaged its archeological integrity.

Even with the general loss of context, artifacts relate to this area's residential function. A partially buried rotary clothesline (b) near the Birch house site is similar in style to one constructed between the staff house and manager's residence. A couple of fence posts (d) along the National Creek bank probably demarcated a garden/lawn around the residence. A small discard pile west of the guest house (c) includes a metal headboard.

Roads to the concentrator and Silk Stocking Loop remain in use. Roads leading west toward the rail grade, including the road to the general store (19) and the 1960s road following a prior boardwalk route, are overgrown and exposed to bedrock in places.

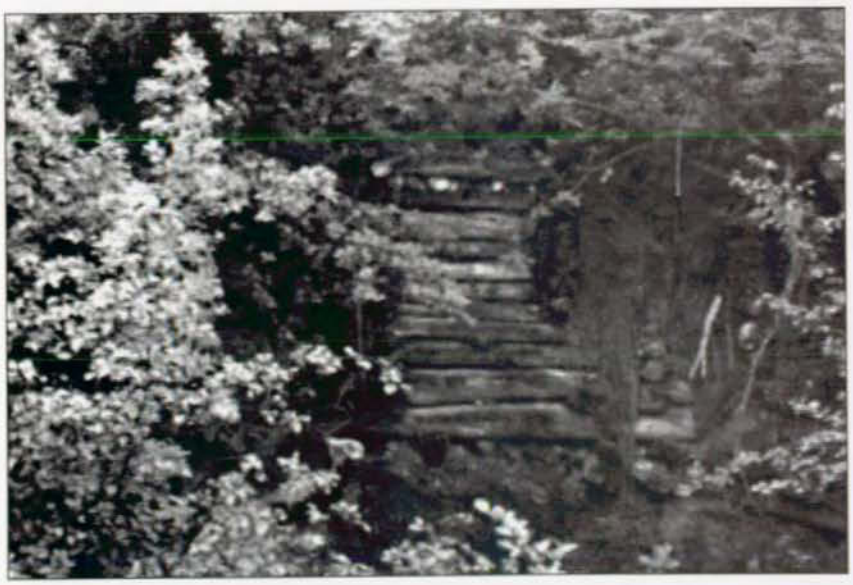


Figure 75. Detail of west face of National Creek Dam (33), built circa 1911. (NPS photo file, WRST.)

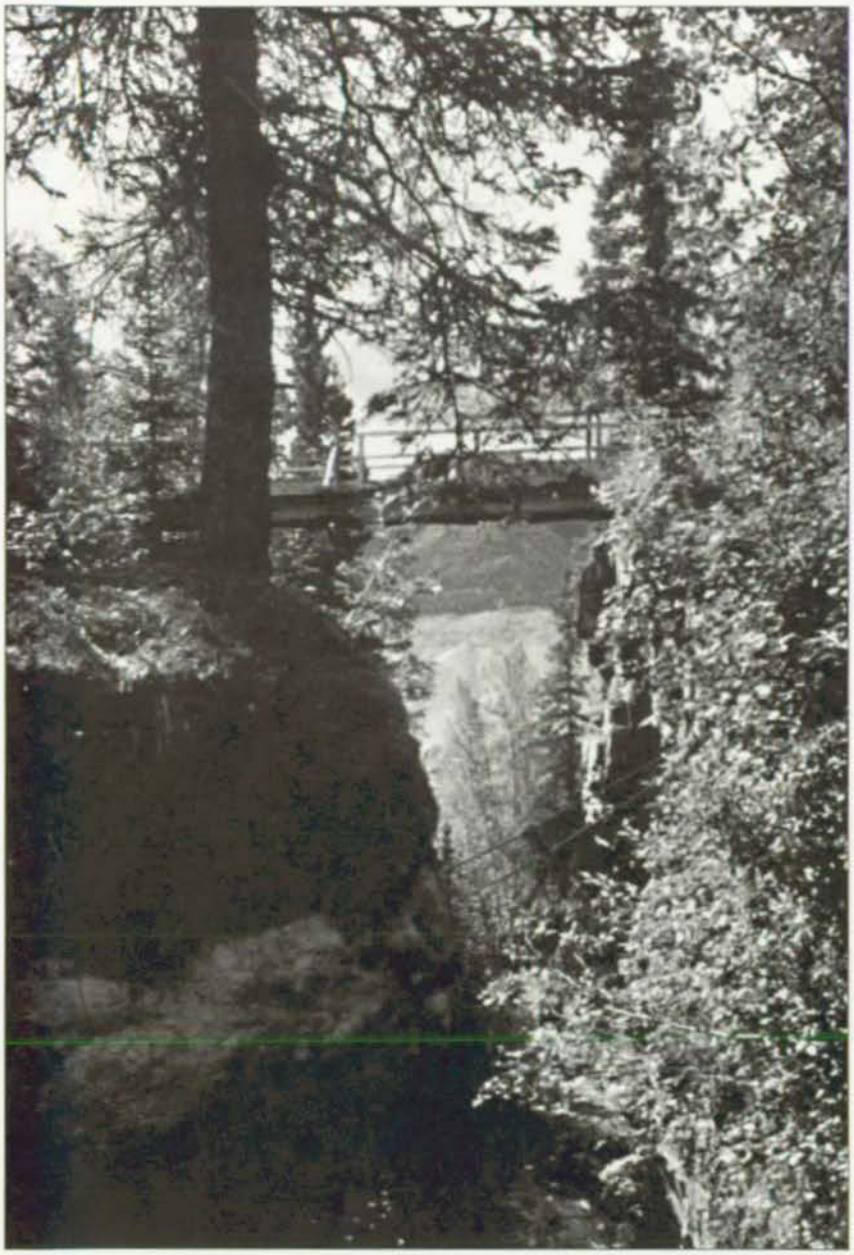


Figure 76. Footbridge over National Creek, west of dam. View looking west. (NPS photo file, WRST.)

Figure 77. Looking west from footbridge over National Creek. Central mill town bunkhouses (5, 7) can be seen in the background. Vegetation has grown since Kennecott's closure. (MTU field documentation, 1997.)

SECTION 9

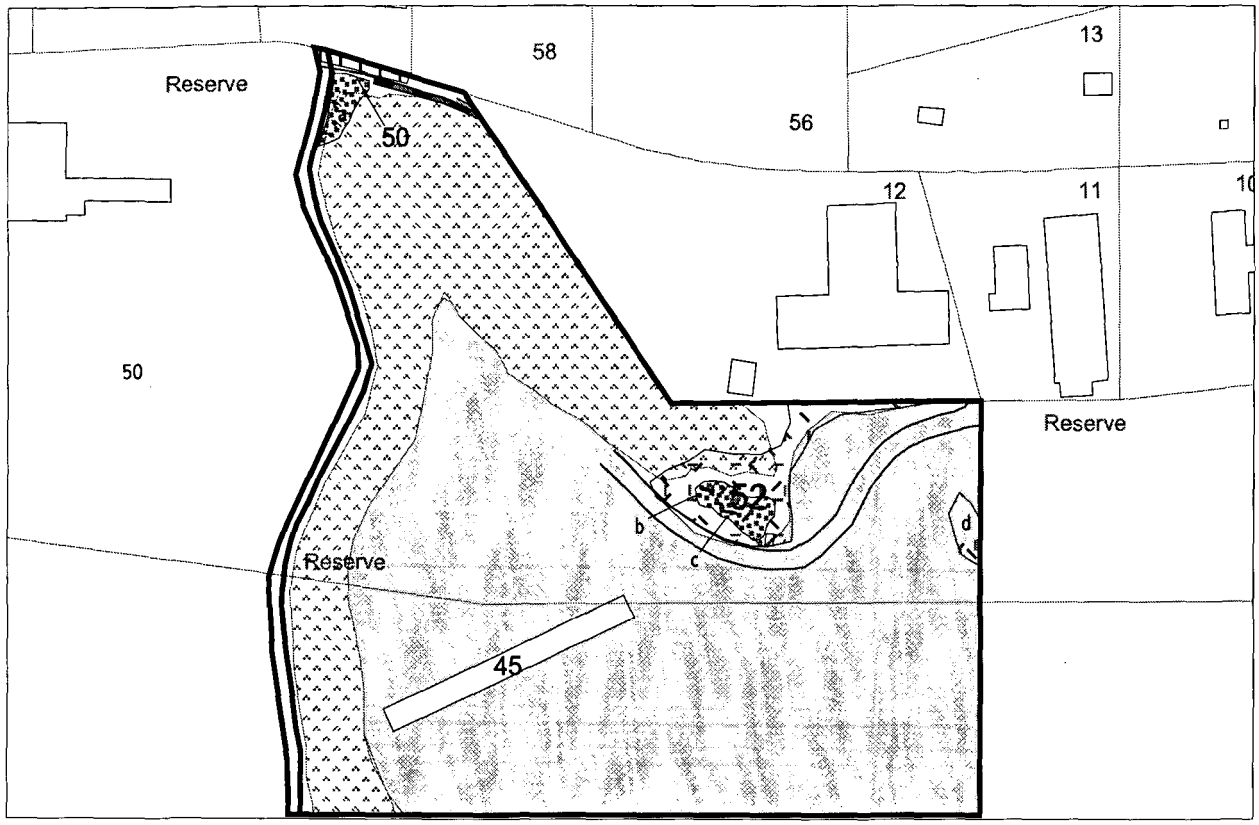


Figure 78. Map of Section 9, Kennecott mill town

LEGEND

- Property Boundaries/Numbers
- Tailings Dam
- Decking
- Artifacts
- Roads and Trails
- Utilidors
- Cribbing
- National Creek
- Wood Scatter
- Dumps
- Vegetation
- Tailings

45 Tailings Crib
50 Rail Bridge
52 Laundry (1938)

a Wood and rail scatter including collapsed flume and numerous pipes
b Laundry sink
c Wooden bench
d Can dump. Includes Spam, ham tins, Pabst Blue Ribbon cans, AVO milk cans, two bed headboards.

Section 9 (figure 78)

Table 11: Feature Assessment of Section 9

Feature	Assessment	Significance Rating
a	Remnants of a waste disposal system and narrow gauge tram between warehouse and power plant. Comprises flume, numerous pipes, wood and rail scatter. Integrity severely damaged by the flooding of National Creek in 1980 and 1983.	1
b	Wash sink, in associative context with remains of the laundry building.	1
c	Wooden bench, associated with laundry building.	1
d	Can dump. Includes spam containers, ham tins, Pabst Blue Ribbon cans, AVO milk cans, and two bed headboards. Includes coffee and tobacco tins and ceramics in west portion. Items likely date to the period of Kennecott's operation, although the dump may have formed later.	4

Description: The area west of the rail bridge (50) and south of National Creek found use during the Kennecott era for tailings storage and waste disposal (figure 79). Approximately 300 feet west of the rail grade, a wooden crib (45) held tailings for future reprocessing and land reclamation in the mill town (particularly in the area south of National Creek). Flumes and pipes directed wastewater between the rail bridge and tailings crib. A sewer pipe from central mill town structures, including the hospital (14) and bunkhouses (5, 7), discharged west of the tailings crib.

Flooding of National Creek in 1980 and 1983 damaged the north section of the crib and carried off a substantial portion of the stored tailings (figure 80). Floods additionally undermined and removed numerous waste water pipes. Pipe and flume sections are found west of the rail bridge (a), on the west face of the crib dam, and approximately 50 feet northeast of the dam. The orientation of several pipe sections undoubtedly differs from original positions.

A terrace southeast of the tailings dam extended along the southern extent of the mill town and provided space for the construction of mill facilities (see Sections 10–13). Remains of a company laundry (built by 1925) occupy the northwest corner of the terrace (figure 81). This one-story, wood frame structure has entirely collapsed (apparently destroyed as a potential hazard in the late 1970s),

although not all structural information has been lost. A large section of an end gable lies amid the scatter of wood siding. Building foundations, particularly on the north and west sides, are also discernible. Water pipes, wood benches, and a set of washing tubs (a) amongst the wood scatter verify the building's function.

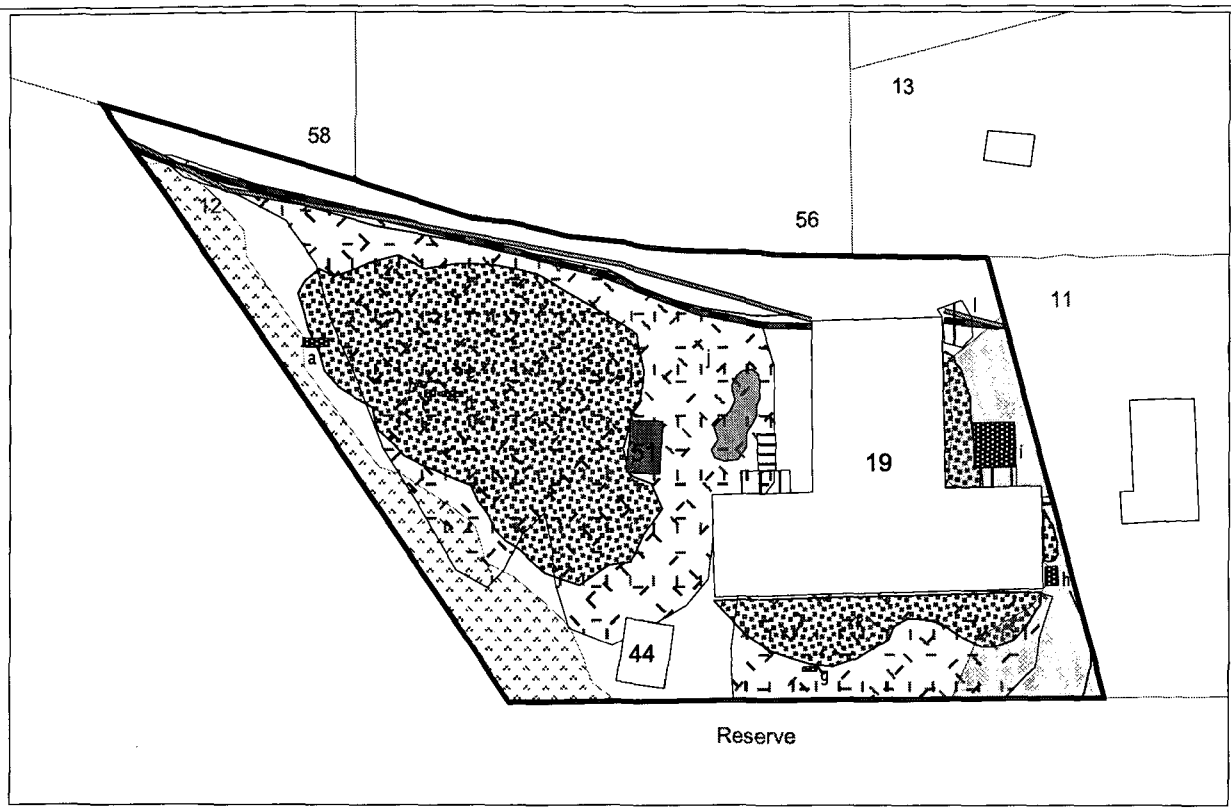
A bulldozed road connecting with the McCarthy walking trail to the south delineates the western edge of the terrace and leads partly down the slope toward the tailing dam. The current configuration of the road deviates from an earlier route east of the laundry that connected to the administration area (Section 7). Ray Trotochau or Consolidated Wrangell may have formed the northern extension of the current road to the tailings in the 1950s or 1960s. The road was further extended during asbestos removal operations and in 1994–1995 by America North in order to put in a drill hole.

Figure 79. Looking towards the store, west bunkhouse and tailings crib dam (45). This area received substantial damage during the National Creek floods. (NPS photo file, WRST.)

Figure 80. Tailings cribbing (45) looking northeast. (NPS photo file, WRST.)

Figure 81. Looking southeast toward laundry remains, including corner post (center) and rock wall (left). Warehouse (19) appears in upper left. (MTU field documentation, 1997.)

SECTION 10



0 20 40 60 80 100

Scale: Feet

Figure 82. Map of Section 10, Kennecott mill town

LEGEND

- Property Boundaries/Numbers
- Buildings
- Ruins
- Decking
- Boardwalks
- Artifacts
- Roads and Trails
- Utilidors
- Cribbing
- Wood Scatter
- Dumps
- Oil Stained Soil
- Tailings
- Vegetation

19 Store and Warehouse
44 Hoist House
51 Paint Shop

a Workbench
b Electric motor
c Edger
d Carriage
e Flywheel
f Flywheel
g Small bedframe
h Otis machine
i Wood frame
j Concentration of rails
k Wood scatter from roof of warehouse
l Terminus of narrow gauge railway

Section 10 (figure 82)

Table 12: Feature Assessment of Section 10

Feature	Assessment	Significance Rating
a	Workbench, in associative context with carpentry building.	1
b	Electric motor, power source for some carpentry equipment.	1
c	Edger machine, same context as workbench (a).	1
d	Machine carriage, same context as workbench (a).	1
e	Flywheel, same context as workbench (a).	1
f	Flywheel, same context as workbench (a).	1
g	Small bed frame, probably from Kennecott era. Probably discarded by Trotochau during his partial demolition of the warehouse building. Indicates presence of children in the mill town.	2
h	Otis machine, still in crate. In good context next to the store and warehouse building.	1
i	Wood frame, possibly for holding steel or wood. Kennecott-era.	1
j	Concentration of rails discarded from rail grade in either the Trotochau, Consolidated Wrangell period, or by the Alaska Road Commission in the 1940s.	2
k	Wood scatter from roof of warehouse, created by Ray Trotochau during building demolition.	4
l	Warehouse terminus of narrow gauge railway to power plant. One of the only easily visible remnants of transportation system within the mill town.	3

Description: The mill town contained two structures important to its operation: the warehouse and the carpentry building. The warehouse (19) not only stored machinery and parts, but also included a general store and post office. North of the warehouse, the carpentry building supplied sawn lumber and furnishings for the mill town and mines. Constructed on a terrace 6–8 feet below the level of the rail grade, the buildings were accessed by boardwalks and steps. A wood crib supporting the west wall of the rail grade continues south for the entire extent of the mill town. A utilidor from the power plant follows the line of a crib wall. To maintain a level surface, the south part of the terrace was built up with tailings. A hoist house (44) is located northwest of the warehouse (figure 83).

Areas surrounding the warehouse retain a high degree of integrity with the Kennecott era. Decks outside second-story entrances to the warehouse once extended to the rail grade and enabled the efficient movement of bulk supplies into the warehouse. The southern catwalk doubly served as the terminus for a 36-inch-wide service track between the store and power plant. A small shed partially attached to the warehouse may also have been associated with the narrow gauge line. A robust wood frame (i) beneath the southern catwalk served as an outside storage rack for the warehouse. A machine still in its packing crate (h) lies outside a side entrance to the warehouse and retains associative context with the storage facility.

The carpentry building north of the warehouse has almost entirely collapsed (figure 84). Of the few wall sections remaining, all lack stability. Some standing walls may belong to the paint shop (51) or to a later extension of the carpentry. Artifacts in the wood scatter include a workbench (a), an edging machine (c), and flywheels (e and f), and clearly relate to work activities in the shop.

Post-Kennecott disturbances in this area include a rail scatter (j) northeast of the carpentry. The rail dump may date to the Consolidated Wrangell or Ray Trotochau period or to the Alaska Road Commission when converting the rail grade between Chitina and McCarthy into a vehicle road.

Figure 83. Detail of hoist house (44), looking north. Concentration mill in background. (MTU field documentation, 1997.)

Figure 84. View south toward store and warehouse (19). Remains of carpentry shop (6) in foreground. Hoist house (44) appears at right background. (MTU field documentation, 1997.)

SECTION 11

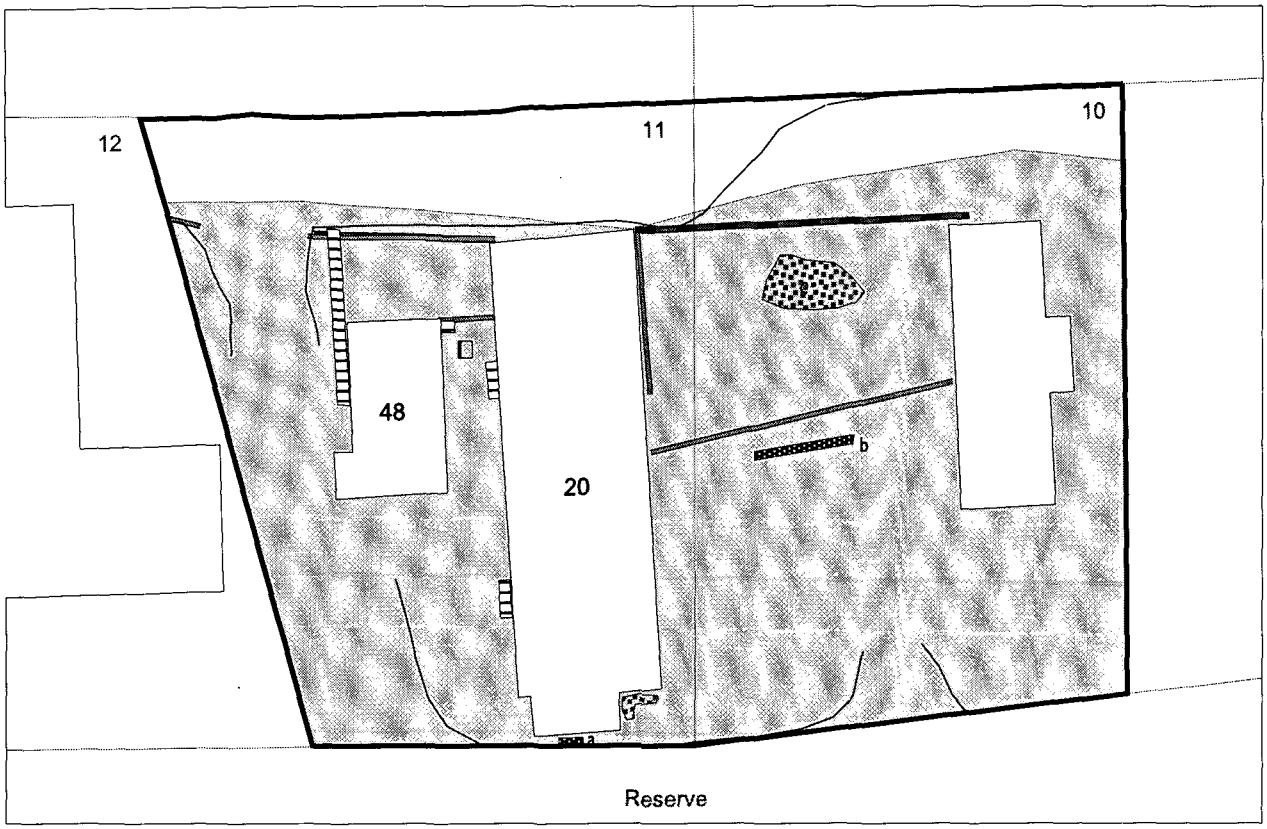


Figure 85. Map of Section 11, Kennecott mill town

0 20 40 60

Scale: Feet

N

LEGEND

- Property Boundaries/Numbers
- Buildings
- Decking
- Boardwalks
- Artifacts
- Roads and Trails
- Utilidors
- Cribbing
- Wood Scatter
- Tailings

20 West Bunkhouse
23 Schoolhouse
48 Refrigeration Plant

a Stove parts
b Conveyor
c Remnants of handball court

Section 11 (figure 85)

Table 13: Feature Assessment of Section 11

Feature	Assessment	Significance Rating
a	Stove parts, probably salvaged from the west bunkhouse building.	2
b	Conveyor. Brought in by the asbestos removal team in 1995 as a method to back-fill the leaching plant floor with tailings (the machine, however, was never used for these purposes)	5
c	Remnants of handball court, consisting of a few scatters of wood. Possible archeological integrity. The site is significant as a recreation facility provided by Kennecott for workers.	3

Description: The refrigeration plant (48), bunkhouse (20), and schoolhouse (23) are located west of the rail grade on a tailings terrace formed around 1917–1919. Roads demarcate the north, west, and east boundaries of the section. The access road on the north side, present during the Kennecott era, connects the rail grade to the building terrace and enables pedestrian and vehicular access around the buildings. A road west of the structures connects with the walking trail (wagon road) to McCarthy. This replaces an earlier road destroyed in the slippage of tailings during the 1964 earthquake (see Section 12). The present route is closer to the structures, but follows the edge of the terrace scarp in keeping with the historic route.

The surrounding area is largely devoid of artifacts and small-scale features. Utilidors, conveying water, steam, and sewage lines parallel the retaining wall and connect between the bunkhouse and schoolhouse. A smaller utilidor, probably conveying water and steam lines, connects the bunkhouse and refrigeration plant (figure 86). A wooden platform and chute on the north side of the refrigeration plant aided the delivery of meat carcasses to the building from the rail grade (figure 87).

A small area of wood planking and joists (c) between the bunkhouse and schoolhouse constitute the remnants of the handball court (figure 88). A scatter of stove parts (a) immediately outside the bunkhouse was likely deposited after Kennecott operations. The location of an ore conveyor (b) west of the handball

court (brought in but not adopted in 1995 as a means to back-fill the leaching plant floor with tailings) is anomalous to designated equipment areas during the concentrator's operation.

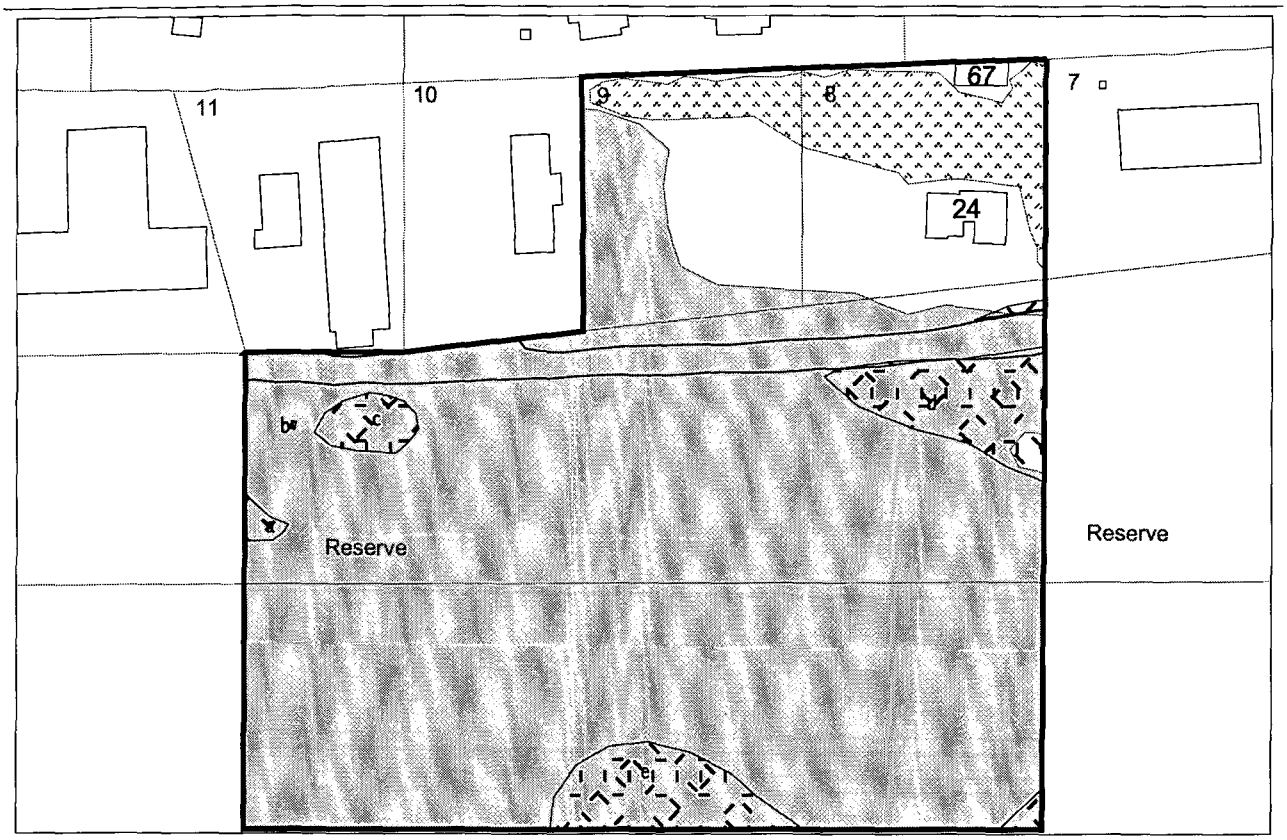
The general paucity of artifacts and small-scale features in this area is attributable to the area's historic use rather than post-Kennecott damages. Spaces around the bunkhouse, refrigeration plant, and schoolhouse were not used historically for the open-air storage of milling equipment, lumber, and supplies.

Figure 86. Retaining wall and covered utilidor east of the refrigeration plant (48). View looking southeast. (NPS photo file, WRST.)

Figure 87. View showing refrigeration plant (48) with west bunkhouse (20) in background. (NPS photo file, WRST.)

Figure 88. Looking southeast toward the schoolhouse (23). Conveyor and remains of handball court can be seen in center left. (NPS photo file, WRST.)

SECTION 12



0 50 100 150

Scale: Feet

Figure 89. Map of Section 12, Kennecott mill town

LEGEND

- Property Boundaries/Numbers
- Buildings
- Artifacts
- Roads and Trails
- Dumps
- Tailings
- Vegetation

24 Cottage
67 Guide Office

a Can dump. Includes Spam, ham tins, Pabst Blue Ribbon cans, AVO milk cans, two bed headboards. West portion includes coffee, tobacco tins and ceramics.

b Scraper

c Modern can dump. Most tins opened with can opener. Diamond pattern Coca Cola cans, *rubber boot, ceramics.*

d Loose discard scatter, mixed with modern materials. Bedding wire, pipe, cans, canvas belt, bucket.

e Large domestic dump. Includes ceramics, glass, food cans, drums. Non-domestic artifacts include flywheel, screens, tubs.

Section 12 (figure 89)

Table 14: Feature Assessment of Section 12

Feature	Assessment	Significance Rating
a	Dump (see Section 9, d).	4
b	Scraper employed in the landscaping of tailings. Associated with hoist house (44). Pit around scraper, however, not necessarily from Kennecott operations, but may indicate reuse of tailings for resurfacing areas of the mill town and McCarthy.	1
c	Modern can dump. Most tins opened with can opener. Diamond pattern Coca Cola cans, rubber boot, ceramics.	5
d	Loose discard scatter, including bedding wire, pipe, cans, canvas belt, bucket. Modern materials are also mixed in.	4
e	Large domestic dump. Includes ceramics, glass, food cans, and drums. Nondomestic artifacts include flywheel, screens, and tubs. Dump partially damaged by landslide after 1964 Alaska earthquake and by looting, but still contains high integrity as the primary discard area for domestic waste during the Kennecott era.	1

Description: The general absence of structural remains in this section reflects the area's historic use for recreation and storage. The company positioned a baseball field south of the schoolhouse and designated the area along the western edge of the rail grade for open-air storage of piping and lumber.

Of the two buildings in this area, one cottage retains historical significance. The cottage (24) is located on the terrace west of the rail grade. Formerly a generator shed, it is currently used as a private residence. A small wood-framed building (67) on the rail grade level was built in 1994–1995 as a tour guide office.

During Kennecott's operation, the western edge of the rail grade terrace included a fire station, framing platform, and areas for wood and pipe storage. While no remnants of these activities are extant, the area may retain some archeological integrity (potentially revealing decking foundations and pipeline to the fire station). A large dump (e) located at the bottom of the terrace scarp includes ceramics, glassware, and food ways (figure 90). In excess of 28,000 square feet,

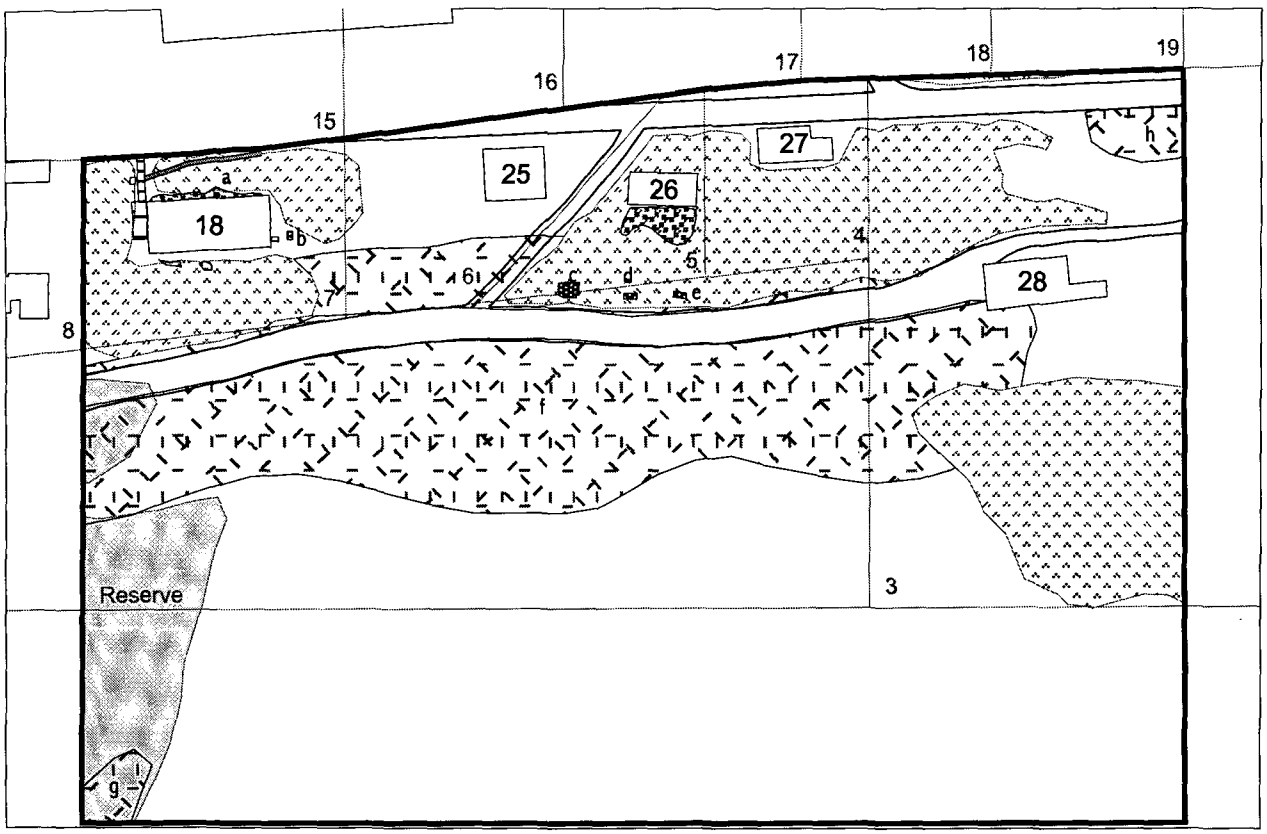
this dump was the primary domestic refuse area during Kennecott's operation.

In 1964, the Alaska earthquake caused the tailings bank to slip. Not only did this damage the main domestic dump, but the slide also removed an historic access route at the edge of the scarp. The current road travels a similar route along the scarp edge, but lies approximately 50 feet east of the original road.

Activities since Kennecott's operation have left significant impacts on this area. Discard areas (c) in close proximity to the west bunkhouse (see Section 11) either formed after the concentrator's closure or have become mixed with modern refuse (d). The recent mining of tailings in this area is evidenced in a pit close to the west bunkhouse. A scraper (b) in the vicinity of the pit is similar to others found around the mill town and likely associates with the hoist house west of the company store (see Section 10). Residents have adaptively reused a variety of artifacts on the terrace as a means to cordon off private property. These artifacts, however, were undoubtedly taken from the general mill town area and have no provenience. The main domestic dump has also been the site of looting.

Figure 90. Main domestic dump viewed from tailings terrace. View looking south. (MTU field documentation, 1997.)

SECTION 13



0 50 100 150

Scale: Feet

Figure 91. Map of Section 13, Kennecott mill town

LEGEND

- Property Boundaries/Numbers
- Buildings
- Decking
- Boardwalks
- Artifacts
- Roads and Trails
- Utilidors
- Wood Scatter
- Dumps
- Tailings
- Vegetation

18 Recreation Hall
25 Commercial Building
26 Cottage
27 Cottage
28 Dairy Barn

a Bucket
b Cart
c Cement mixer
d Washer
e Water heater

f Loose discard scatter, mixed with modern materials. Bedding wire, pipe, cans, canvas belt, bucket.
g Large domestic dump. Includes ceramics, glass, food cans, drums. Non-domestic artifacts include flywheel, screens, tubs.
h Industrial dump, including rail, pipe, link belt, chain, machinery, screens.

Section 13 (figure 91)

Table 15: Feature Assessment of Section 13

Feature	Assessment	Significance Rating
a	Bucket, minimal significance.	5
b	Cart.	5
c	Cement mixer, or early ball mill.	5
d	Washer, minimal significance.	5
e	Water heater, minimal significance.	5
f	Dump (see Section 12, d).	4
g	Large domestic dump (see Section 12, e).	1
h	Industrial dump, including rail, pipe, link belt, chain, machinery, screens. Follows west side of rail grade for a few hundred meters. This area holds high significance as one of Kennecott's primary machinery dumps, in use (according to fire insurance maps) by at least 1935.	1

Description: This section includes five structures west side of the rail grade. In keeping with the use of southern mill town structures (generally mixed use and low density), the Kennecott Copper Corporation used these buildings for storage (25, 27), accommodation (26), recreation (18), and food procurement (28).

Wood debris accounts for most of the discard around the recreation hall. An extant staircase connects the recreation hall with the rail grade. A firehouse and utilidor (the latter passing beneath the steps) are visible from the stairs. A new building (25), differing in construction style from all other mill town structures, occupies the former space of the coalbunker and is currently operated by a commercial business. Kennecott used the space between the commercial building and the recreation hall for open-air wood storage. Recent construction, however, has deposited debris and filled in this area (figure 92). Two wood frame buildings alongside the rail grade (26, 27) are extant. The southern structure (presently vacant) was originally used for storage. The growth of vegetation as well as a wood scatter west of the cottage to the north (26) obscures evidence of a former vegetable garden.

A dispersed dump, containing both modern and Kennecott-era materials, extends north of the dairy barn. A second and more concentrated refuse dump west of the rail grade at the southern extent of the mill town primarily contains industrial artifacts (such as link belts, screens, and machinery). This area is less disturbed by modern refuse and retains high archeological significance (figure 93). Isolated artifacts located in the scrub between the cottage (26) and the former wagon road includes a concrete mixer, washer, and water heater. These were, in all likelihood, used during Kennecott's operation.

Numerous modifications occurred in this area after the closure of Kennecott. A modern road between the northern cottage and recent commercial facility provides vehicle access from the rail grade to the former McCarthy wagon road. Recent landscaping around the dairy barn has destroyed its surrounding context (figure 94). Decking extending east from the dairy barn to the rail grade is no longer present.

Figure 92. Looking north from the old wagon road toward the recreation hall (18). Landscaping (foreground) derives from the construction of a commercial facility in the south mill town. (MTU field documentation, 1997.)

Figure 93. Industrial dump located at south entrance to the mill town. View southeast with rail grade at left. (MTU field documentation, 1997.)

Figure 94. Looking northwest toward the dairy barn (28). Landscaping around the barn is a recent disturbance. (MTU field documentation, 1997.)

SECTION 14

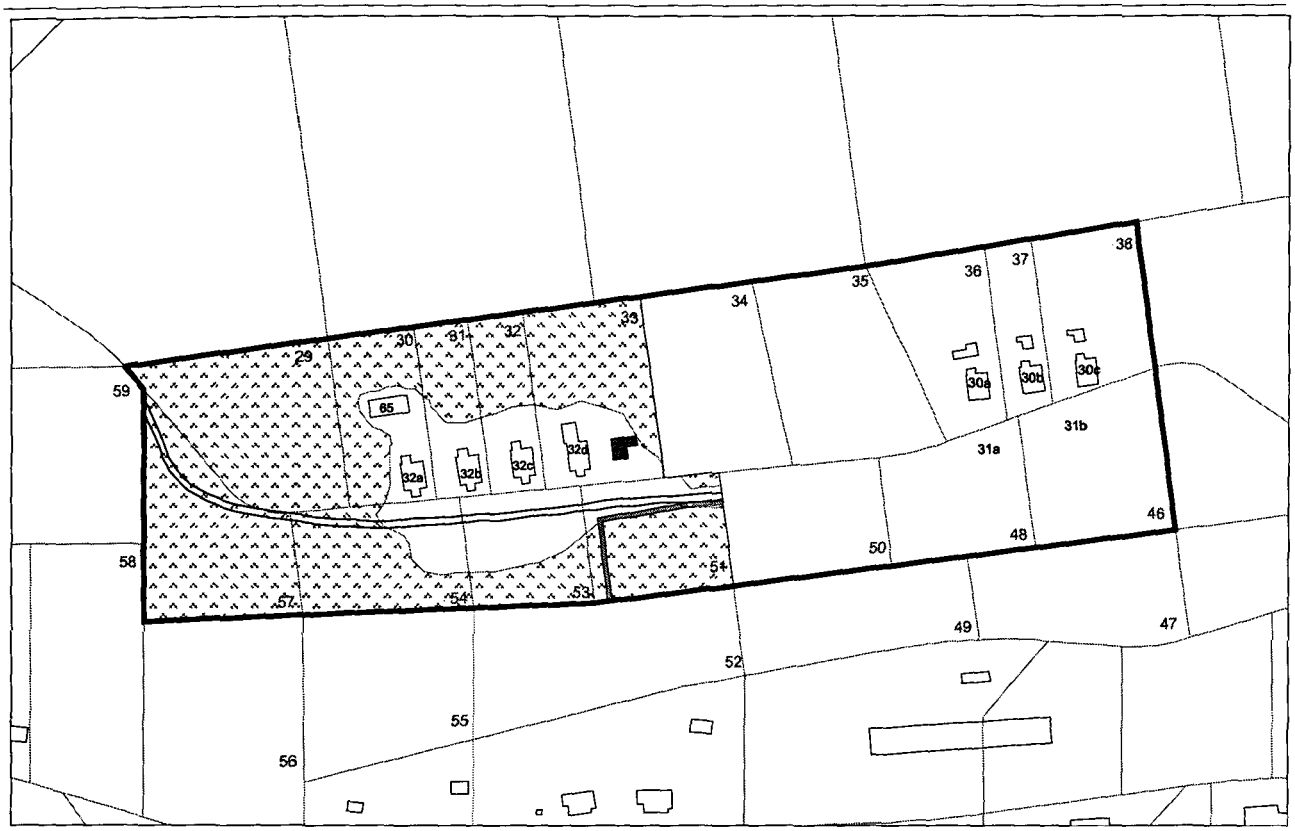


Figure 95. Map of Section 14, Kennecott mill town

0 100 200 300

Scale: Feet

N

LEGEND

- 70 Property Boundaries/Numbers
- Buildings
- Ruins
- Boardwalks
- Roads and Trails
- Utilidors
- Vegetation

30 a-c	Cottages
31 a-b	Chicken Coops
32 a-d	Cottages
65	Cottage (modern)
72	Garage

Section 14 (figure 95)

Description: This area marks the southeast limits of the mill town. It was used for residential purposes, and between 1916–1918 the company erected two clusters of freestanding cottages (30 a–c, 32 a–d).

The southern cluster, built in 1916, includes a row of three, freestanding wood frame cottages (30 a–c, figure 96). The cottages sit to the east of Silk Stocking Loop. Two collapsed chicken coops (31 a–b) are located west of the cottages on the other side of the dirt road. A utilidor carried water and steam lines to a firehouse between the chicken coops. Utility lines were not conveyed into the cottages and privies were built to the rear.

Figure 96. South cluster of cottages built in 1916 on Silk Stocking Loop road. (NPS photo file, WRST.)

In 1918, the company constructed a second cluster of four cottages (32 a–d) 300 feet north of the first group (figure 97). Although of similar design and orderliness to the southern cluster, the northern cottages were fitted with water, steam, and sewage lines. Remnants of the utilidor between the west bunkhouse (20) and cottage 32d are found down the hillside. It is likely that the firehouse, water, and steam lines conveyed to the southern cluster of cottages occurred during the construction of the 1918 cottages. Pipes between the building clusters follow the west side of Silk Stocking Loop. A collapsed garage (72)

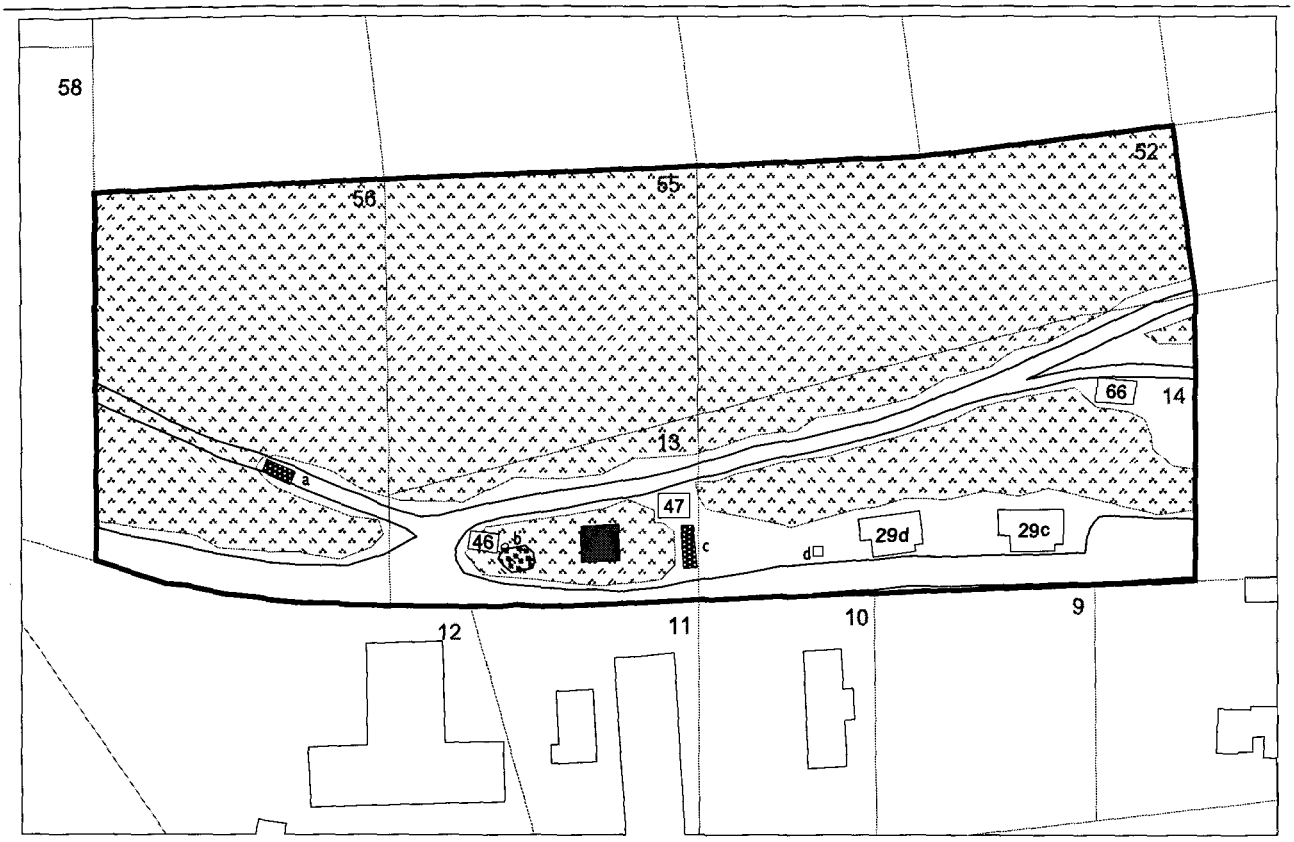
Figure 97. North cluster of cottages (32 b-d) built in 1918 on Silk Stocking Loop road. (NPS photo file, WRST.)

Post-Kennecott-era disturbances to this area include a residence located east of cottage 32a in the north cluster. Dense vegetation between the cottages and the mill town has largely grown since Kennecott's abandonment and limits the historic vista from the cottages. Vegetation also obscures private gardens planted by staff families. The road between the north cottages and storage dam (33) narrows to a walking trail. Cleared areas west of each cluster of cottages are used for vehicle parking. Informal trails lead from the clearing down to the mill town and may follow historic routes. One trail parallels the utilidor down the hillside. All cottages are currently in private ownership and a number have found commercial uses (such as a bed and breakfast and the office of a charter air service).

Section 14: Feature Assessment

Private property—no assessment conducted.

SECTION 15



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Scale: Feet

Figure 98. Map of Section 15, Kennecott mill town

LEGEND

- 70 Property Boundaries/Numbers
- Buildings
- Ruins
- Artifacts
- Roads and Trails
- Dumps
- Vegetation

29 c-d	Cottages
46	Tool Shed
47	Bath House
66	Generator Shed

a	Crane
b	Scatter of pipe bends
c	Drum stack (modern)
d	Privy

Section 15 (figure 98)

Table 16: Feature Assessment of Section 15

Feature	Assessment	Significance Rating
a	Alaska Department of Works crane, probably brought in by the 1950s to 1970s, and may have been used to demolish mill town buildings.	5
b	Scatter of pipe bends. In context with area being used as a tool shed and oil warehouse.	1
c	Drum stack, occupying space formerly used for open lumber storage. Drums are modern and comprise a noncontributing element to the Kennecott Landscape	5
d	Privy, likely moved with one of the staff cottages during renovations to the Kennicott Glacier Lodge in the mid 1980s.	2

Description: This section of the mill town predominantly served storage and transportation functions. Structures positioned close to the rail grade included a tool shed (46), oil storage building, and open-air lumber storage. Although the tool shed remains intact, a small wood scatter and leveled ground testify to the presence of the one-story oil warehouse to the south. Artifacts in the vicinity, including pipe bends, relate to the tool shed. Extant decking south of the oil storage building contains gears, sections of pipe, and corrugated iron. The latter likely derived from the roof of the oil storage building or an abutting shed. An extant bathhouse, southwest and up the hillside from the deck, probably served families living in the south mill town not connected to a water supply (figure 99).

Kennecott used the area south of the deck, adjacent to the rail grade, for storage of lumber brought in by the railway. After Kennecott's closure, this area was used for storage of oil drums (c) and the relocation of two staff cottages (29 c–d) that were originally positioned south of the apartment building (see Section 16). The area south of the cottages is currently used as a vehicle turnaround for shuttle buses from McCarthy.

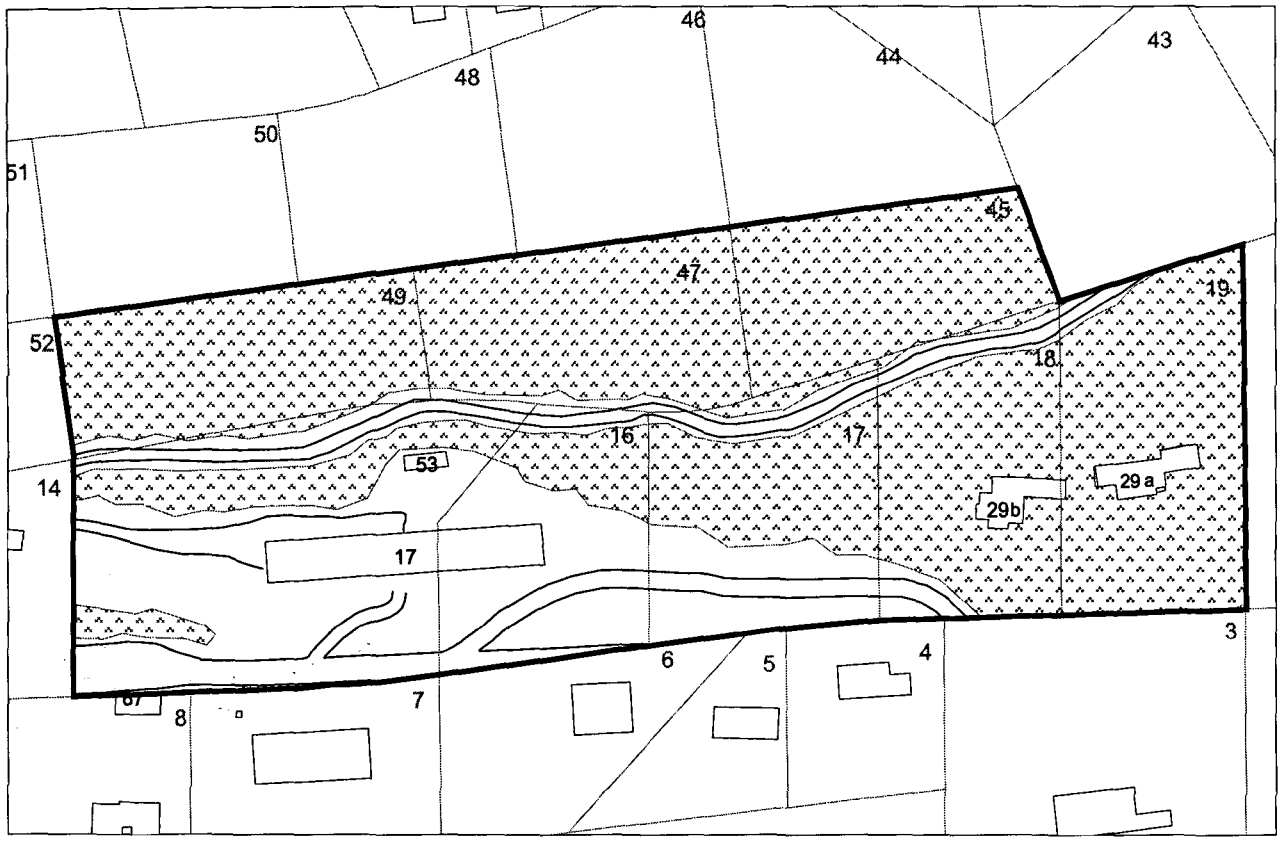
Two roads join the rail grade adjacent to the general store (19). The road leading northeast served as part of the original wagon route to the Bonanza Mine. However, the section running between the general store and the National Creek

dam (33) is no longer in use and currently overgrown (see Section 7). An Alaska Public Works crane is located a short distance up the road from the rail grade. The Silk Stocking Loop road, created around 1916 and still in use, leads southeast and connects staff cottages on the hillside with the mill town and storage dam. A modern driveway off this road leads to the rear of the apartment building (17). A generator shed (66) for the Kennicott Glacier Lodge, may have been moved from a prior location east of the apartment block.

Vegetation on the hillside obscures evidence of at least two small garden plots.

Figure 99. Bathhouse (47) seen from Silk Stocking Loop road, looking southeast. (MTU field documentation, 1997.)

SECTION 16



0 50 100 150

Scale: Feet

N

Figure 100. Map of Section 16, Kennecott mill town

LEGEND

- Property Boundaries/Numbers
- Buildings
- Boardwalks
- Roads and Trails
- Vegetation

17	Kennicott Glacier Lodge
29 a-b	Cottages
53	Privy

Section 16 (figure 100)

Description: During the Kennecott era, this section of the mill town accommodated staff with families. The five residential structures, built in 1916, replaced tent cottages pitched in the area. An apartment block (17) contained five, four-room apartments. Four free-standing cottages (29 a–b) were constructed farther south. Similar to the south cluster of Silk Stocking Loop cottages (see Section 14), which were also constructed in 1916, the four residences were fitted with electricity, although they did not include running water or steam heat. A five-hole privy (53), now disused, serviced the apartment block. The four cottages south of the apartments were each fitted with privies.

Post-Kennecott-era disturbances occurred close to the rail grade and around the apartment building. In the late 1970s, the apartment building became refurbished as the Kennicott Glacier Lodge. After a fire in 1983, the lodge was rebuilt in keeping with its original form. In 1992–1993, in order to allow for a southern extension to the building, two staff cottages (29 c–d) were moved down to the rail grade level (see Section 15 and figure 101). Modern landscaping around the guest lodge includes a southern entrance driveway and grass lawn. The current steps leading up to the lodges were probably remodeled after the 1983 fire. At the rail grade level, management has built an information sign and planted berry shrubs on the hill slope.

Figure 101. Looking south along rail grade in south mill town area. The cottage (29 c) in foreground was moved during renovations of the Kennicott Glacier Lodge (17) seen in the background. (NPS photo file, WRST.)

Section 16: Feature Assessment

Private property—no assessment made.

Part II

Treatment

CULTURAL LANDSCAPE CHARACTER AREAS

Based on an evaluation of landscape characteristics, the Kennecott mill town and associated mine sites exhibit several key patterns, relationships, and individual features that contribute to the historical significance of the National Historic Landmark District (NHL). On the largest scale, the entire NHL is viewed as a single cultural landscape, with four elements or "systems" that historically defined the physical character of the landscape. The four systems are the:

- Mill town, where ore was processed and transported and where the community supporting the operation lived
- Mine sites on the ridge where the ore was extracted
- Tram system, linking the mine sites with the town below
- Transportation (regional) systems, focusing on the railroad and road systems that moved goods and supplies in and out of the mill town to the valley and ports beyond

In addition to these primary cultural landscape systems, the natural landforms, topography, and hydrology historically defined the configuration, scale, and environmental context within which these elements developed. More than a collection of individual structures, features, or artifacts, it is the relationship among these cultural and natural resources that provides the foundation for holistic management of the cultural landscape.

Although this document deals specifically with resources in the Kennecott mill town, any management action affecting the mill town will affect resources in other areas of the NHL. While some of these effects are addressed in the recommendations, a more thorough assessment of the potential impacts on areas outside the mill town should be undertaken prior to any management action.

Management Philosophy and Primary Treatment

Cultural landscape resources and values within the Kennecott mill town provide a range of options for management and interpretation that are generally compatible with current use and long-term preservation of the site. Although the mill town contains resources from all periods of historical development, no effort will be made to "freeze" the landscape to a specific date, or "recreate" a landscape that no longer exists. What makes the cultural landscape of Kennecott so extraordinary is the degree to which the remaining patterns, relationships, and features reflect the historic character and physical layout of the site over a long period of development and subsequent abandonment.

The goal for management of the cultural landscape is to stabilize, preserve, and interpret the key patterns, relationships, and remaining structures and features that historically define the character of the historic district. In some cases, individual features may have such a high degree of historical significance that rehabilitation or restoration is warranted, but in most cases the primary treatment for the cultural landscape is stabilization and interpretation.

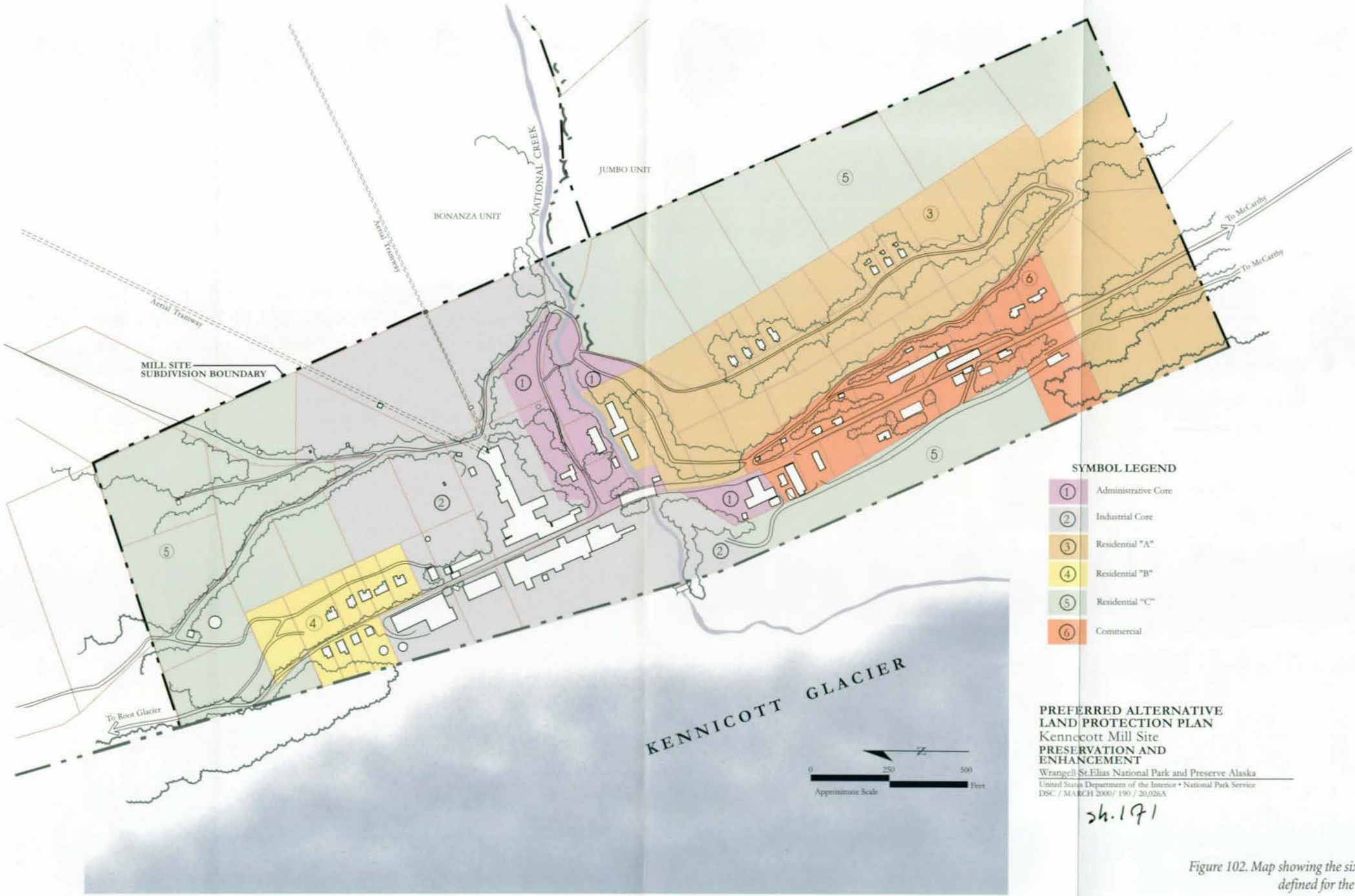
In developing a plan for the long-term management of the site, the National Park Service (NPS) will work closely with all landowners to ensure access to and protection of private property. The strategy and options for protecting private property, preserving cultural resources, and integrating public use of the site will be determined through the planning process and public involvement.

Criteria for Delineating Management Zones:

- **Preserve areas in the mill town that contain a significant concentration of cultural resources that possess a high degree of physical integrity and context.**
- **Retain the historic land use patterns as a framework for locating new facilities.**
- **Protect areas in the mill town with resources and landscape characteristics that are historically important, but have no integrity due to loss of fabric or physical context.**
- **Identify and provide buffers for private holdings that are not addressed in the recommendations.**

Management Zones

Based on the evaluation of significant cultural landscape resources, the mill town has been divided into six management zones (figure 102). These zones are defined by the physical location, concentration, and integrity of significant historic resources as documented in this report. The purpose of management zones is to consolidate findings from the *Analysis and Evaluation* and establish management priorities for treatment of the cultural landscape.



PREFERRED ALTERNATIVE
LAND PROTECTION PLAN
Kennecott Mill Site
PRESERVATION AND ENHANCEMENT
Wrangell-St.Elias National Park and Preserve Alaska
United States Department of the Interior • National Park Service
DSC / MARCH 2000/ 190 / 20,026A

sh.171

Figure 102. Map showing the six management zones defined for the Kennecott mill town

TREATMENT PLAN

The treatment plan for the Kennecott mill town outlines a series of actions the NPS plans to implement over the next several years (figure 103). The plan is based on an evaluation of cultural landscape resources and management goals and objectives defined by Wrangell-St. Elias National Park and Preserve in partnership with the Kennecott community. Through a series of public meetings focussing on the future of Kennecott, four alternative plans were developed. From these four plans, a preferred alternative was selected, consolidating ideas and concepts from all of the proposals.[1] The *Interim Operations Plan* (IOP) outlines several actions to be undertaken by the NPS. Key actions include:

- Rehabilitate and adaptively use the company store for administration and as a visitor contact point.
- Rehabilitate the railroad trestle.
- Organize the mill town into land use areas or zones that reflect historic land use patterns while accommodating contemporary land use patterns and needs.
- Selectively thin vegetation around historic structures to reduce the risk of fire and reestablish historic views and vistas.
- Develop interpretative media and establish trails to enhance visitor understanding of the site.

The treatment plan provides a preliminary framework for management of Kennecott. The initial emphasis of the plan is on stabilization of critical resources, and as such there is considerable flexibility for accommodating treatments based on emergency needs and funding allocations. More detailed treatments for the mill town are described in the written recommendations. The purpose of the written recommendations is to guide the stabilization and preservation of significant cultural landscape resources and to the degree possible, retain the evocative character of an abandoned historic mill town. The recommendations are therefore aimed at retaining the historic character, activities, and key structures that defined the town between 1900–1938, while also allowing appropriate adaptive reuse of structures and interpretation of the site. Recommendations are organized into six categories: buildings and structures, circulation systems, archeological resources, vegetation, views and viewshed, and small-scale features.

It is important to note that while many privately owned structures and properties are a critical part of the mill town and larger historic district, these resources are not specifically addressed in this document. However, many of the recommendations that follow provide guidance to individual property owners interested in treatment for their historic properties.

Treatment Recommendations

Buildings and Structures

The 13 primary structures and all secondary structures owned by the NPS are considered contributing structures and should be stabilized and preserved. Priority for treatment is based on the *Evaluation of Historic Structures* (see Appendix I). The treatment goal is to prevent further deterioration and ensure future management options by taking all actions required to protect the site and buildings. Table 17 shows the current priorities for building stabilization.

Table 17: Priorities for Building Stabilization

Priority[2]	Building No.	Description
1	2 and 3	Concentration Mill and Tram Terminus
2	15, North section	Leaching and Flotation Plant
3	9	Power Plant
4	36	Machine Shop
5	20	Store and Warehouse
6	1	Manager's Office
7	5	Bunkhouse (National Creek)
8	19	West Bunkhouse
9	23	Schoolhouse
10	8	Assay Office
11	15, South section	Leaching and Flotation Plant
12	18	Recreation Hall
13	34	Depot
14	48	Refrigerator Plant

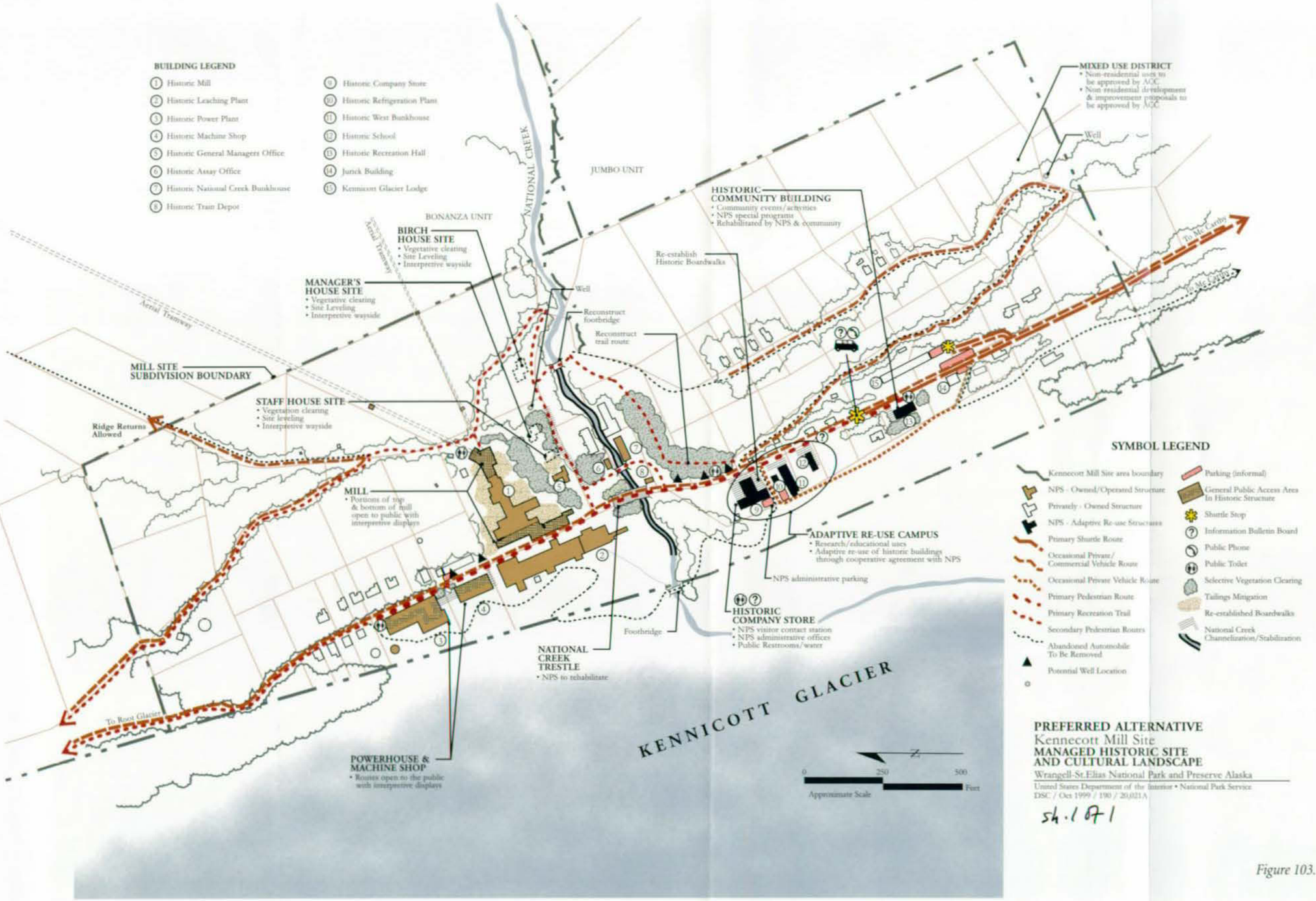


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Figure 103. Map showing treatment plan for the Kennecott mill town

SPECIFIC RECOMMENDATIONS

- Conduct a condition assessment to identify both the immediate and long-term stabilization needs and initiate treatment to arrest irreversible damage (collapse).

- Based on condition assessments and available funding, implement a systematic program of stabilization. Required treatments will vary from building to building and may include weather-proofing roofs, walls, and foundations and repair to structural connections at floors, walls, and foundations to resolve lateral loads. All treatments shall be undertaken in a manner consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties.*

- Identify buildings that meet the structural requirements for rehabilitation and make the modifications to allow for visitor, administrative, or operational use. All changes to buildings shall respect the historic character of the building and be completed in a manner consistent with *the Secretary of the Interior's Standards for the Treatment of Historic Properties.*

- Stabilize the National Creek railroad trestle (the primary circulation structure in the mill town) and replace failing structural members.

- Retain where possible the remnants of the historic tramlines, including wooden towers, tram decks, and ore bins. Most of these features are in their historic context and remain the primary physical and interpretative resources linking the mine sites on the ridge to the lower mill town.

- Retain and stabilize the pedestrian bridge located below the site of the crib dam. Consideration should be given to incorporating this bridge into an interpretative trail that routes visitors past the remains of the crib dam, and features associated with the water conveyance system that historically served the town.

- Mitigate all hazardous building materials identified in compliance with the NPS/ADEC Agreement.

ARCHITECTURAL CHARACTER

Most of the buildings in the Kennecott mill town are of wood-frame construction on post and sill foundations. Most buildings have gabled roofs, although several of the cottages have hipped roofs. Buildings associated with heavy industry are of post and beam construction on wood-post foundations.

The majority of the buildings and structures in Kennecott have horizontal siding. Some early residences have board and batten siding and several small sheds have metal siding and roofs. Windows range from one-over-one double-hung units in the domestic and administrative structures, to four-over-four and six-over-six double-hung windows in the industrial structures and older cottages. In some cases, double-hung windows were turned sideways to accommodate grade and architectural convenience. With few exceptions, the wood-frame structures were painted red with white sash. Small utilitarian structures, such as woodsheds, privies, chicken houses, cold frames, and boardwalks, were also made of wood or metal. (Also see "Structures" in the Analysis and Evaluation section.)

- Remove all building materials that post-date the historic period or present safety hazards to visitors.

- Discourage construction of new buildings within the historic district. If new structures are required, they should be carefully sited (location, design, mass, and scale in relation to surrounding structures and landscape features) and constructed using materials compatible with the architectural character of the mill town.

Circulation Systems

The majority of existing circulation systems throughout the mill town reflect historic patterns, and these should be maintained whenever possible. Contributing circulation systems include the (abandoned) railroad corridor, Silk Stocking Road, the loop road on the north side of the site, portions of the original wagon road extending northeast toward the mine sites, and the primary pedestrian trail across the east edge of the mill town.

Specific Recommendations

- Many historic footpaths in the mill town are currently obscured by overgrown vegetation, or have been abandoned altogether. Where possible, reestablish these historic trails and either incorporate them into interpretative trails or integrate them into circulation systems throughout the site.

- In some areas, vegetation has encroached on historic roads and reduced the original width of the road. Currently these segments function as pedestrian trails or limited access routes for private vehicles. To the extent possible, these roads should be retained as functional roadways.

- The addition of new roads within the mill town should be discouraged. If new roads are required they should be informal in character (unpaved or gravel surface), and reflect a hierarchy from primary roads to access and service roads.

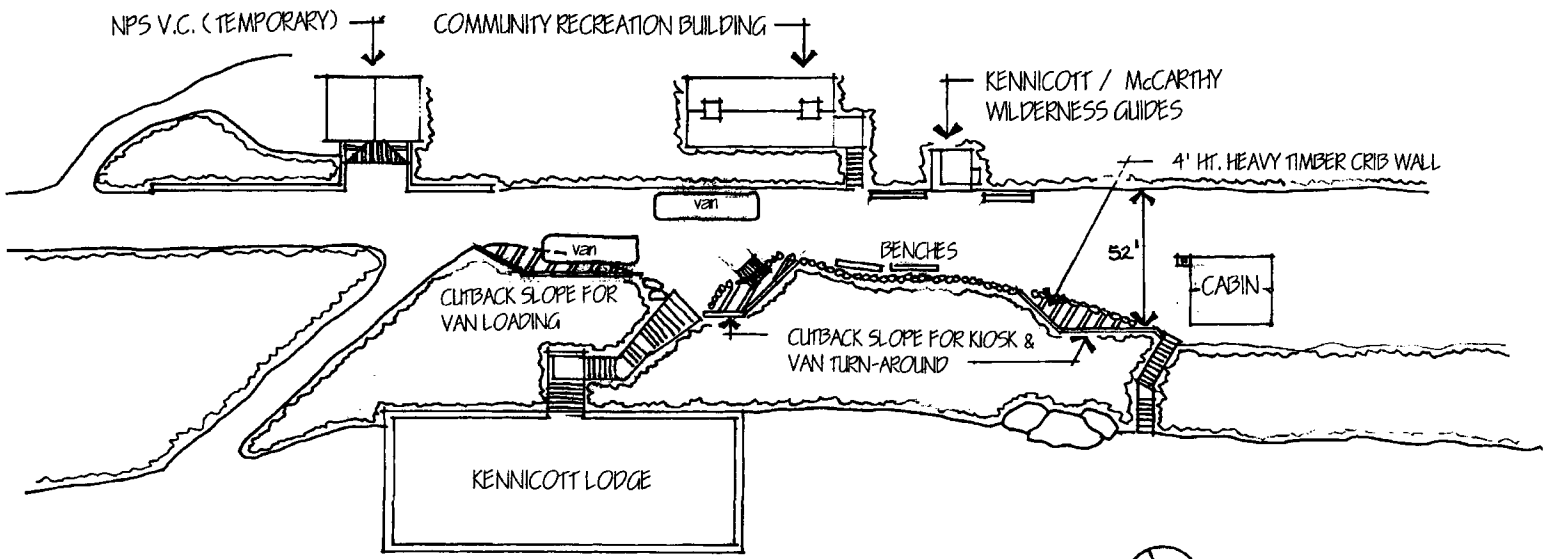
Design Character: Roads and Trails

Characteristic of other mining sites, historic roads in the mill town were informal in character with only slight variations in design and material. Early wagon roads such as the road from McCarthy, the road from the mill north to the Bonanza and Erie mines, and the road along the south side of National Creek, winding up the slope to the crib dam, were relatively narrow dirt roads approximately 10 feet wide. These roads were somewhat defined by a roadbed cut into the slope or by treads delineating the route.

Shoulders and drainage swales were not commonly used along these roads, and the condition of each road varied seasonally. Documentation indicates that in some cases, over the years, tailings were used as a surface material on some of the more heavily used roads.

Secondary roads and access for service vehicles was even less formal, with undifferentiated routes based on functional need and building access. This resulted in few, if any "formalized" roads around the industrial complex. Instead, most of these access routes were no more than compacted soils, leaving large denuded areas around buildings.

Pedestrian routes include foot trails and boardwalks. Foot trails were narrow dirt trails, 18-24 inches in width. Wood cribbing was used when required for steps and grade changes. Boardwalks ranged in size, from 4-5 feet in width. Individual planks were approximately 4 inches wide.



• VISITOR ARRIVAL AREA •

- When new trails and pedestrian trails are required, every effort shall be made to conform to standards established by the Americans with Disabilities Act (ADA) and provide universal accessibility.

VEGETATION

Existing vegetation throughout the mill town is largely the result of growth since the historic period. In many cases, this change in plant cover compromises the physical integrity of key resources and impairs access (physical and visual) to the significant areas of the historic mill town. Consideration should be given *selective* thinning of vegetation in several areas within the town.

SPECIFIC RECOMMENDATIONS

- Remove vegetation encroaching around historic structures as necessary to assure long-term preservation of the structures.

- Limit the use of ornamental vegetation (annuals, perennials, shrubs and trees, planter boxes, and other materials for decorative purposes) to the residential cottages and the lodge. Use of nonnative ornamentals in other areas of the mill town is inappropriate.

- Prepare a Vegetation Management Plan for the Kennecott mill town and adjacent areas as appropriate. All treatments proposed in the plan should be consistent with the management objective of preserving the cultural landscape and historic scene in the mill town between 1900–1938.

- For interpretative purposes, reestablish the vegetable gardens that were part of the historic landscape, including the large plot on the north side of National Creek and several of the smaller plots associated with Silk Stocking Row.

GUIDELINES FOR TREATMENT OF VEGETATION

- **Retain vegetation that provides privacy (screening) to and from private residences.**

- **Remove vegetation as a way to expand or direct circulation within the town and to protect or expose significant archeological resources.**

- **Thin tree canopy and understory materials in a manner that provides or enhances historic viewsheds (from specific view points to key resources).**

- **Selectively remove vegetation around historic structures to reduce the risk of fire and pests.**

- **Remove vegetation as required and feasible to retain or redefine the tramline cable corridors from the tram deck to the mine sites on bonanza ridge.**

LAND USE

To preserve the spatial integrity of the cultural landscape, historic land use patterns established in the early development of Kennecott should be retained and used as the framework for new activities and functions within the mill town. In all cases, adaptive use on public lands will comply with appropriate uses as specified (see "Treatment Plan").

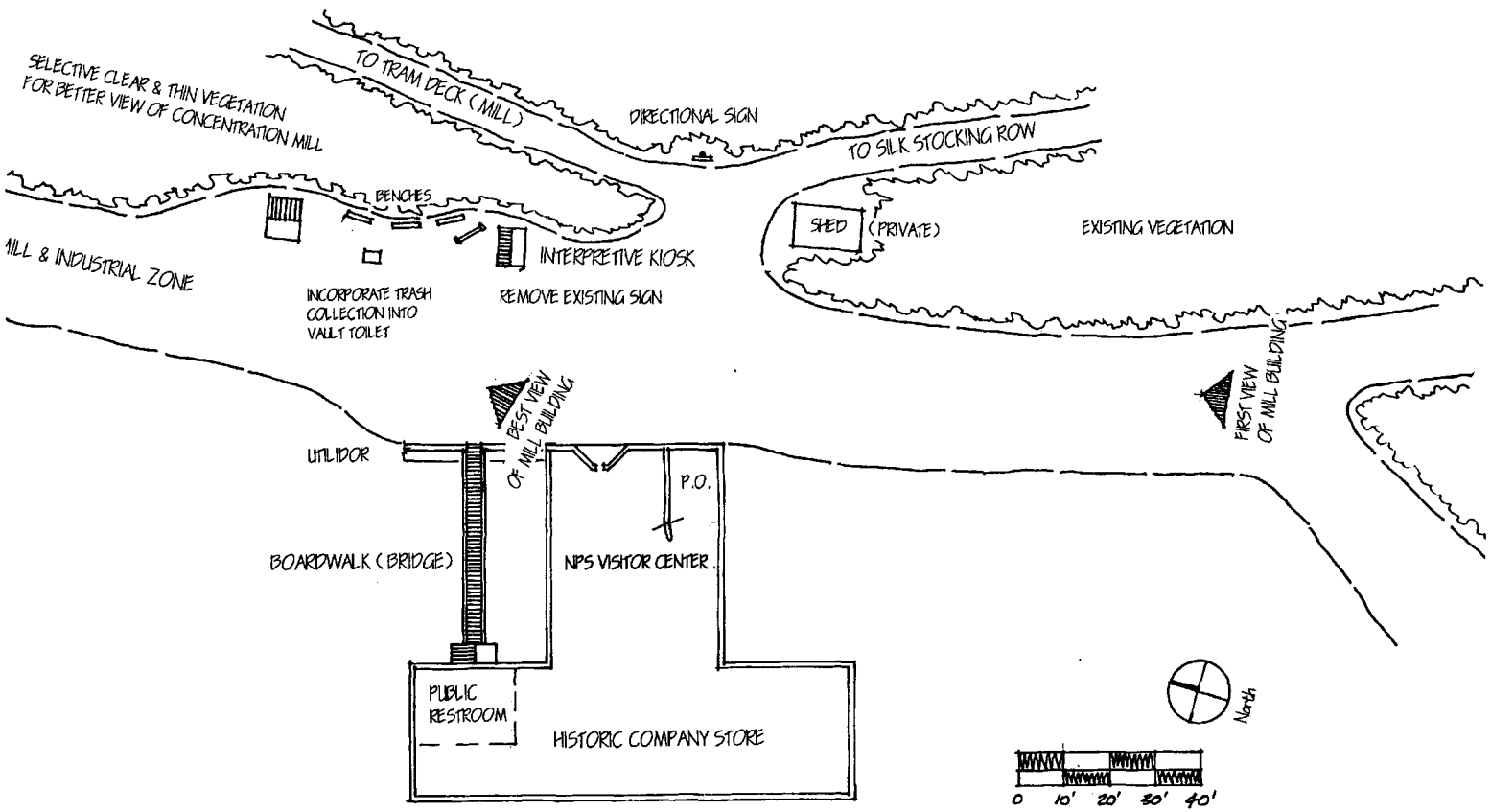
These land use patterns are summarized in Table 18, Management Zones and Land Use.

Table 18: Management Zones and Land Use

Zone	Historic Land Use	Appropriate Adaptive Land Uses
Zone 1: Administrative Core	Office Manager's Residence Depot (Station) Hospital Staff housing	NPS Operations Administrative offices Interpretation Visitor Center
Zone 2: Industrial Core	Concentration Mill Tram Deck Power Plant Leaching Plant Machine Shop Tailings Flumes Support structures Warehouses	Interpretation Exhibits Storage Equipment Repair Workshops Utility Infrastructure Maintenance facilities
Zone 3: Residential B	North end Cottages	Private Residences[3] Interpretation
Zone 4: Residential A	Silk Stocking Row Old Lodge Barracks Access Roads	Private Residences[4] Interpretation Lodging (temporary) Tent Cabins
Zone 5: Commercial	Store Post Office Resident Services Meat house Community Facilities Housing Tent Cabins	Concessions/Commercial (outfitters, bike rentals, guide services, gift shop, book store) Offices Community Center
Zone 6: Limited Development	Vegetated hillsides Cleared hillsides Historic dumps	Natural resource protection Interpretation

VEGETATION MANAGEMENT PLAN

- **Designates vegetation management zones for the mill town**
- **Assesses the condition of existing plant communities and associations**
- **Identifies management issues for each zone**
- **Proposes treatments (maintenance, alteration, and limited restoration)**
  - **Nonnative vegetation (existing)**
  - **Hazard trees**
  - **National Creek riparian corridor**
  - **Alpine communities**
- **Prepares a list of appropriate plant materials for each zone within the mill town. (For screening views or structures, supplemental plantings around new facilities, and restoration as a result of ground disturbance or rehabilitation of historic structures and roads.)**



• COMPANY STORE SITE PLAN •

SPECIFIC RECOMMENDATIONS

- Areas to the west and beyond the extent of the historic structural development (including tailings and dumpsites) should remain undeveloped and managed primarily for natural resource values.

- The cemetery located south of the town site is historically significant and should be preserved as part of a cyclic maintenance preservation program.

ARCHEOLOGICAL RESOURCES

SPECIFIC RECOMMENDATIONS

- Consideration should be given to the role and use of artifacts, features, and structural ruins that post-date the period of significance (with a priority rating of 5). While many of these features are not managed as cultural resources, they may still provide historical information, and in their setting add to the industrial character of the mill town.

- Mitigate potential safety hazards for visitors by protecting structural ruins, remnant structural foundations (dam, bridges, and flumes), and isolated archeological features and artifacts throughout the site. Suitable mitigation techniques include moderate clearing of vegetation to increase visibility, rerouting "formal" circulation routes to bypass or provide only distant views of the features, signage, or restricted access (such as a guided tour only).

- Small-scale features and remnants in the vicinity of National Creek, such as the clothesline, boardwalk, and well should be stabilized and if appropriate, reestablished as interpretative tools for understanding the domestic character of this area.

PRIORITIES FOR PRESERVATION OF ARCHEOLOGICAL RESOURCES (TABLE 19)

Priority 1 Features associated with the operation of Kennecott during the historic period (1900–1938) that remain in historical and physical context.

Priority 2 Features associated with the operation of Kennecott during the historic period but have lost their original context.

Priority 3 Structural ruins from the historic period, in situ.

Priority 4 Features from multiple periods requiring additional investigation.

Priority 5 Features that post-date the period of significance (not managed as cultural resources).

Artifacts, features, and structural remains dating from the Kennecott era (1900–1938), as documented in the *Analysis and Evaluation* (priority ratings 1, 2, and 3), are contributing resources and should be preserved in context and stabilized as part of a Collection Management Plan.

Views and Viewsheds

Throughout the historic period views were characteristically unobstructed as most of the vegetation was removed to provide raw materials for construction, reduce the fire hazard, or create space for siting structures. Over the years, vegetation has not been actively managed and encroaching trees and shrubs obstruct many historic views. While wholesale removal of existing vegetation would re-establish all of the historic viewsheds, the primary treatment should remain rehabilitation. In this regard, management should target management of *selected* views and viewsheds that enhance the interpretative environment of the cultural landscape, while maintaining appropriate privacy for individual property owners.

Specific Recommendations

- Selectively thin or remove vegetation to preserve or reestablish historic views in the mill town.[5]

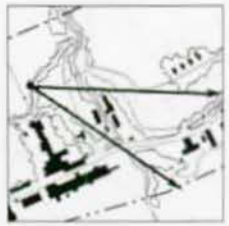
- Work with property owners to maintain privacy (screen views) between public spaces and private residences.

- Selectively remove encroaching vegetation from historic trails, structures, and roads. Retain the natural visual character of shoulder areas around circulation routes and structures by thinning rather than brushing out vegetation.

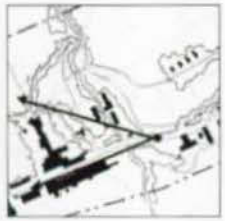
- Use views and vistas as interpretative tools to enhance the visitor experience. This can be accomplished by: removing vegetation to open foreground and middle-ground views from interpretative trails; framing views to specific features; creating a visual sequence of experiences along a trail or road that reveals a view; or, by providing unique and discrete views from the interior of the structures to the larger landscape setting.

- Concentrate visitor services and activities in areas that provide vistas to natural and cultural resources of the mill town and surrounding areas.

PHOTO KEY: PRIMARY VIEWS TO PRESERVE OR REESTABLISH

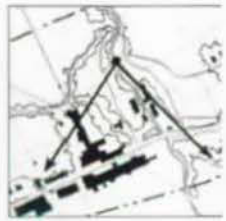


- View from the trail between National Creek and the tram deck southwest to the National Creek area, and toward the south end of town.

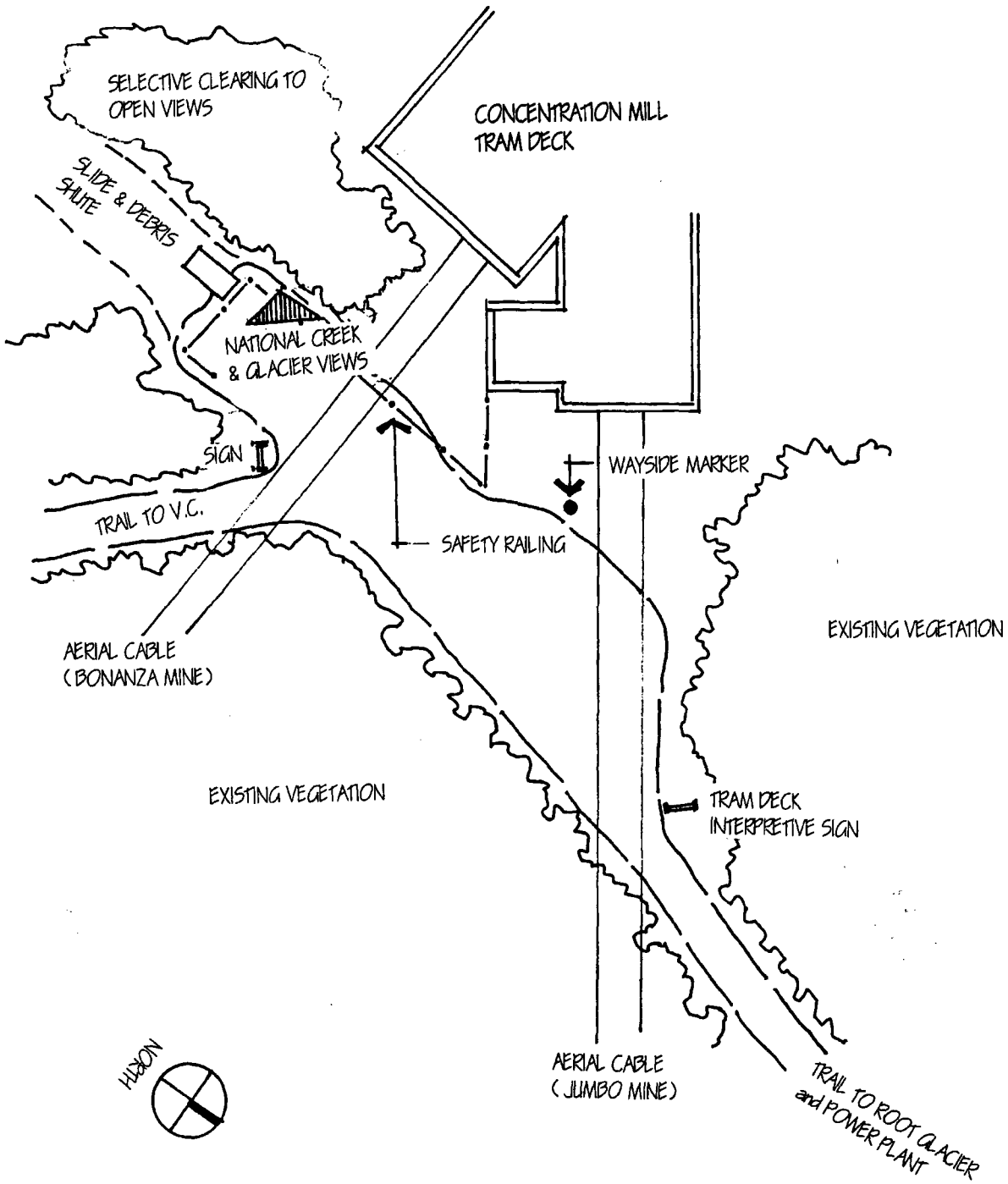


- View looking north along the railroad trestle to key structures in the mill town.

- Views from the north end of the town, looking south to the cottages, power plant, leaching plant, and concentration mill.



- Views through the National Creek area from the pedestrian crossing above the barracks.



• AERIAL TRAM DECK SITE PLAN ——•

NOT TO SCALE

SMALL-SCALE FEATURES

Small-scale features in the mill town historically included a variety of functional and ornamental elements, most of which no longer remain. In many cases, these features—such as benches, plank bridges, steps and handrails, etc. were fashioned at the site using available materials. In some cases, furniture that was brought to the site for use in specific structures may have found its way to a porch, or the front of the store. Other small-scale features were constructed based on need using materials that could be salvaged. For example, metal pipe was used for the handrail along the trail and steps from Silk Stocking Row to the company store. In other areas (around the managers office), a wood handrail was used. Altogether small-scale features reflected the working industrial character of the town.

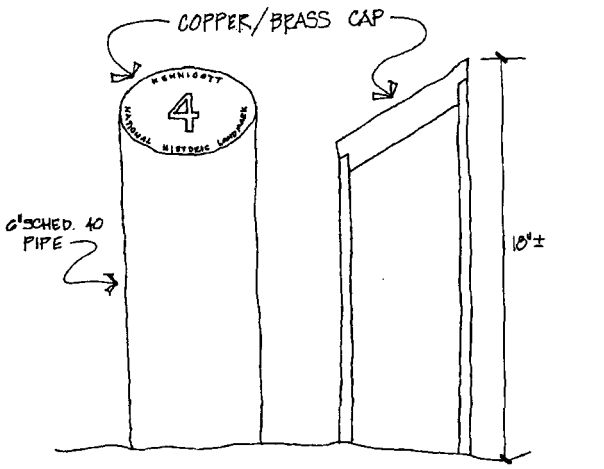
In order to allow the NPS flexibility in the preservation or establishment of new small-scale features the following design guidelines are proposed.

SPECIFIC RECOMMENDATIONS

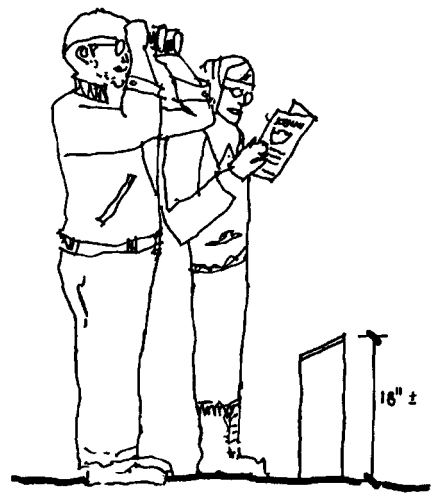
- All small-scale features, including light fixtures, benches, garbage cans, and interpretative displays, should be visually compatible with the historic character of Kennecott, and should meet all applicable codes and regulations. Complementary design rather than replication is the preferred treatment when rehabilitating or replacing historic site features.

- To enhance the interpretive environment, consideration should be given to reestablishing nonextant, small-scale structures and features. These features include functional and ornamental elements (such as benches and clotheslines), utilities (light standards, utilidors, and water systems) and mining features (such as flumes). Reestablishment or reconstruction of small-scale features should be based on historical documentation.

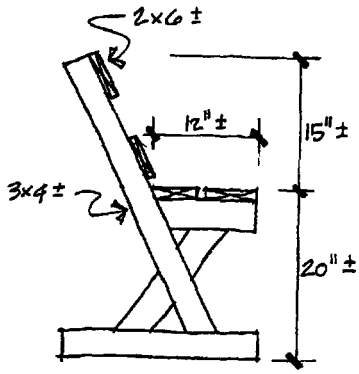
- Whenever possible, reestablishment of nonextant features should be based on either:
  •Individual features as they comprise a system (utilidors or water systems)
  •Aggregate features defining a land use area such as the administrative area around National Creek (picket fences, boardwalk, handrails, clotheslines, gardens, etc.)



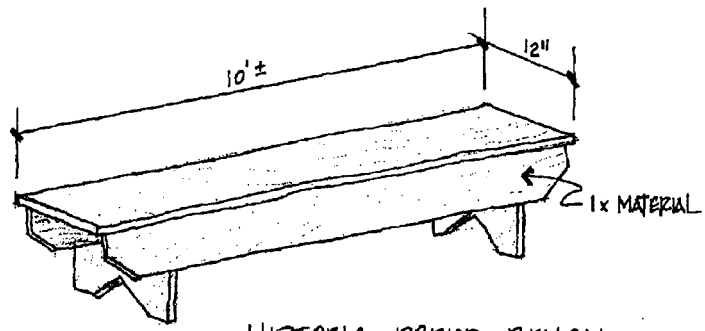
INTERPRETIVE GUIDE MARKER



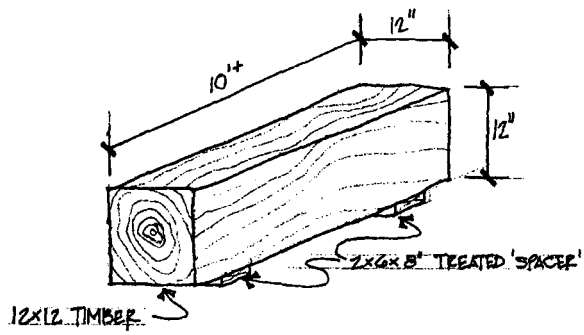
GUIDE MARKER



HISTORIC PERIOD BENCH



HISTORIC PERIOD BENCH



TIMBER BENCH

Materials

- The use of metal as a material for signs, seating, and fencing in the industrial core is appropriate. If paint is required, apply a nonreflective matte surface paint whenever possible to reduce the visual impact of an element in the landscape.

- Retain the use of metal for handrails in the industrial core when needed for safety or interpretive trails.

- Maintain the gravel and dirt surfacing of roads and trails whenever possible. Accessible trails should be paved using compacted granite, soil cement, or chip seal.

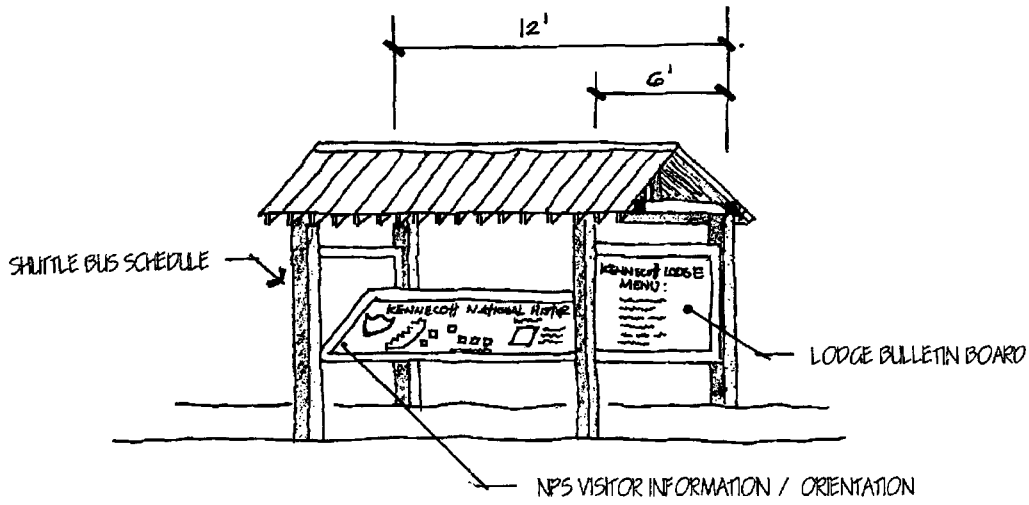
Utilities

- Conduct additional archeological investigations and site work to identify, document, and assess the condition and viability of abandoned utilities through the mill town. Where appropriate, reestablish a portion of this system for interpretive purposes.

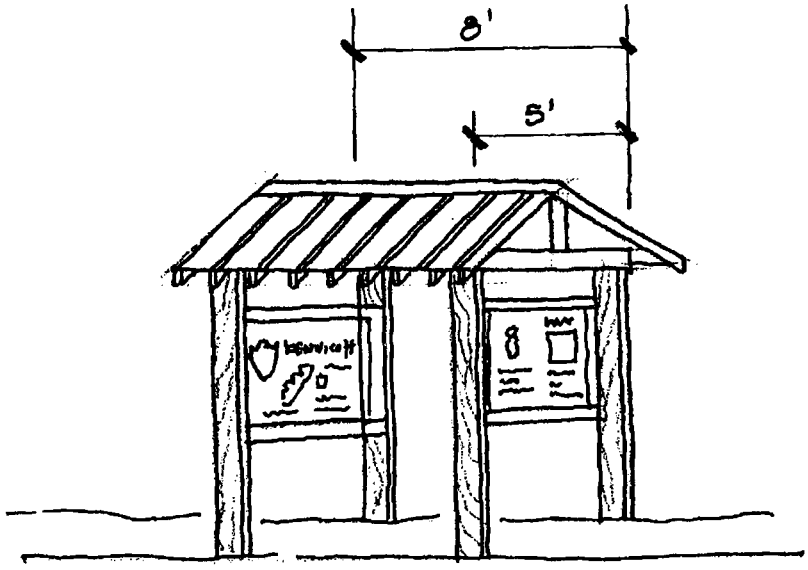
- Develop a lighting plan for the mill town that addresses both function and safety. Functional issues include the scale, color, and design of the fixture in the context of the mill town. Safety issues include modern techniques for illuminating the ground to meet both safety and security needs. All lighting concepts for the town site must also preserve the natural qualities of the environment.

Site Furniture

- Assure that all garbage cans meet applicable health, safety, accessibility, and wildlife standards. Material and surface treatments should be visually compatible with the historic character of Kennecott. If treatment with rust inhibitor primer is required to reduce maintenance or meet standard, finish with compatible matte paint color.



KIOSK / VISITOR ARRIVAL
NOT TO SCALE



KIOSK / COVERED

- Locate benches in areas designated for visitors (trailheads, kiosks, interpretive contact points, tour areas, hotel, etc.). Benches should be simple in design, without back structure, and constructed of wood.

Signs

- Individual signs and informational markers were not used in Kennecott during the historic period. Because of this, the addition of new signs within the NHL is considered an intrusion on the historic character of the site, and should be kept to a minimum. When signs are required, they should be materially compatible with other built structures (wood, concrete, and metal) in the district, and be located in an unobtrusive manner. Design guidelines for new signs in the NHL are organized into three categories:

- Orientation (or directional) Signs and Safety Information

- Interpretive Information

- (Commercial) Business Signs

Orientation Signs and Safety Information

- All visitor orientation or directional signs (to specific features and facilities) should be clustered and concentrated in high visitor contact locales.

- Large kiosks are appropriate when used adjacent to historic structures or associated with designated visitor staging areas (trailheads, visitor "center", shuttle turnaround, etc.).

- Safety signs should be consistent in material, form, and style. Variations in size and siting will be required based on specific site needs and issues. Safety signs will be used to identify permanent and restricted access areas, and delineate temporary closures for areas under construction or limited seasonal use.

Building Signs:

Use 3" painted white letters (Verdana Style) on red background, attach directly to structure.

Approximate sign size @ 8" x 38"

Directional Signs:

Use 2" painted white letters on red background, attach with 2 – 4x4 posts

Warning & Safety Signs:

Use standard metal commercially available signs. Attach directly to structures.

Interpretative Information Signs

- Develop an interpretative sign plan for the NHL. The plan should be consistent with the overall sign plan for the district and the proposals outlined in the interpretive plan for the NHL to be developed by the NPS.

- Interpretative signs include waysides, markers highlighting individual site components, and trail indicators. In all cases, the introduction of new interpretative signs should be based on overall interpretative plan and management goals and objectives for visitor experience at Kennecott.

- Design emphasize should be given to the use of specific materials, siting, and color of interpretative signs to assure visual compatibility between signs and other landscape features.

- Interpretative signs should not be attached directly to any historic structure mining equipment (remaining on the site), vegetation, or archeological feature.

Commercial Signs

- A limit of one sign per commercial building is recommended. The sign should fit flush and not protrude from the structure.

- The scale and size of the sign should not exceed the façade of the structure, and should be visually compatible with the structure. The use of bright colors, neon, or lettering styles not identified in the sign plan for the district, is not appropriate.

ENDNOTES

INTRODUCTION

[1]Kennicott and Kennecott are the correct names of two different but closely associated places. Kennicott with an "i" refers to the Kennicott Glacier and River named in 1899 by the U.S. Geological Survey in honor of Robert Kennicott, a pioneer Alaska explorer. Kennecott with an "e" refers to the mining company that took its name from the Kennicott Glacier but for some unknown reason misspelled the name. The error occurred early in the history of the mines, perhaps as early as 1901. Regardless, the Kennecott Mines Company was in operation in 1906. In 1908, a U.S. Post Office was established at Kennecott. In recent years, upon the transfer of the surface estate to the Great Kennicott Land Company, the two spellings have been used casually and interchangeably. This has caused some unnecessary confusion. Broadly speaking, references to Kennicott with an "i" stress the natural history of the area while Kennecott with an "e" addresses the human history of the area. The National Park Service adheres to this convention, which follows from the official designation of the area as the Kennecott Mines National Historic Landmark. See Donald J. Orth. *Dictionary of Alaska Place Names*, US Geological Survey Professional Paper 567 (Washington: USGPO, 1967), p. 510.

[2]Information is excerpted from the Kennecott Pre-Acquisition Environmental Site Assessment, pgs. 25–30, and the Site History section of this document.

[3]*The Kennecott Interim Management Plan and Environmental Assessment* will be used as an amendment to the park's General Management Plan.

[4]See Appendix H for a summary of the development of the mines on Bonanza Ridge. Also note that the Mother Lode Mine on the east side of Bonanza Ridge was historically an important ore body associated with the operations at Kennecott. Because it is privately owned, the Mother Lode Mine is not addressed in this report.

SITE HISTORY

[1]Early archeological sites in the Copper River Basin are limited in number, but the working of copper is indicated through the recovery of by-products. Refer Donald Clark, "Prehistory of the Western Subarctic" in *Handbook of the North American Indians: Volume 6, Subarctic* (Washington: Smithsonian Institution, 1981), 124. It is likely that native copper was initially found as placer deposits.

[2]Frederica De Laguna and Catharine McClellan, "Ahtna," in *Handbook of the North American Indians*, 651–2 (see n. 1).

[3]William R. Hunt, *Mountain Wilderness: Historic Resource Study for Wrangell-St. Elias National Park and Preserve* (Alaska: National Park Service, 1991), 41.

[4]Lt. Henry Allen, *Report of an Expedition to the Copper, Tanana, and Koyukuk Rivers in 1885* (Washington: GPO, 1887), 132, 158.

[5]Morgan Sherwood, Exploration of Alaska, 1865–1900 (New Haven: Yale Univ. Press, 1965), 162–3.

[6]William R. Hunt, *North of 53: The Wild Days of the Alaska-Yukon Mining Frontier 1870–1914* (New York: Macmillan Publ. Co., 1974), 63–8.

[7]Elizabeth A. Tower, *Ghosts of Kennecott: The Story of Stephen Birch* (Privately published, 1990), 12; Hunt, *Mountain Wilderness*, 41 (see n. 3). While the copper deposits revealed to the McClellan Party was probably not Chief Nikolai's real source the find encouraged further exploration.

[8]Oscar Rohn considered the limestone-greenstone contact a likely source for copper deposits in his 1899 expedition and likely passed on his findings to the McClellan group. Oscar Rohn, "A Reconnaissance of the Chitina River and the Skolai Mountains, Alaska," *US Geol. Survey Twenty-First Annual Report, 1899–1900*, part 3, 489. Ocha Potter, staker of the Mother Lode claims disproved Rohn's theory in 1906 by showing the Kennecott deposits ran across rather than parallel to the contact zone. Ocha Potter, *Sixty Years* (unpublished manuscript on file at NPS Alaska office, 1939), 50–1, 65–7.

[9]The use of power of attorney enabled prospectors to stake more than the two discovery claims legally allowed per prospector. Before 1912, prospectors could stake claims in the names of other people without their knowledge or consent. The discoverer would then purchase the claim for a token amount.

[10]Frank Schrader and Arthur Spencer, "Geology and Mineral Resources of a Portion of the Copper River District, Alaska," *U.S. Geol. Survey Bulletin Special Publication* (1901).

[11]Ibid., 86.

[12]William C. Douglass, *A History of the Kennecott Mines, Kennecott, Alaska* (Manuscript, 1964, on file at NPS Alaska Office, Anchorage), 5.

[13]Tower, *Ghosts of Kennecott*, 17 (see n. 7).

[14]Ibid., 17.

[15]Lone Janson, *Copper Spike*, eighth printing (Privately published, 1975),10.

[16]Tower, *Ghosts of Kennecott*, 22 (see n. 7).

[17]McClellan explained in a 1903 interview that the company (Alaska Copper and Coal) "did not care to put out the money necessary for improvement [of the property] while the title was in controversy." *The Post Intelligencer*, Nov. 29 1903, quoted in Tower, *Ghosts of Kennecott*, 24–6 (see n. 7). A secondary effect of the trial was the proliferation of different accounts pertaining to the Bonanza discovery and transfer of claims. Five such versions are discussed in Robert A Stearns, "Alaska's Kennecott Copper and the Kennecott Copper Corporation," in *The Alaska Journal* (1975), 130–9.

[18]Melody Webb Graumann, *Big Business in Alaska: The Kennecott Mines, 1898–1938* (Occasional Paper No. 1, Cooperative Park Studies Unit, Fairbanks: Univ. of Alaska, 1977), 7. The richness of this deposit is even more anomalous given that mining engineers in the 1900s classed five percent copper as high grade ore.

[19]Ibid., 6.

[20]Valdez was the first choice for a port. Cordova was eventually selected. A third possible terminus for the CR&NW was Katalla where a breakwater was constructed and some track laid. The railway abandoned the prospect after the facilities were destroyed by a storm in 1907." Janson, *Copper Spike*, pp. 51–54.

[21]John K. Winkler, a biographer of J. P. Morgan, noted the rise of American industrial promoters in an "unprecedented boom period between 1898 and 1901." According to Winkler, the industrial promoter "would invade a given industry, buy up a string of competing plants at inflated prices, combine them under a high-sounding name, and offer stock to the public." *Morgan the Magnificent: The Life of J. Pierpont Morgan, 1837–1913* (New York: Garden City Publishing Co., Inc., 1930), 200. Carnegie, Guggenheim, and Morgan were among the well-known financial houses that supported industry through long-term loans and syndicates..

[22]Large-scale backing of industry was by no means foreign to any of the Alaska Syndicate backers. J. P. Morgan, for instance played an important role in the development of railways and the steel industry. In 1901, Morgan purchased US Steel from Andrew Carnegie for $25 million and capitalized the US Steel Corporation at $1.4 billion dollars. The Guggenheims (who already operated the Guggenheim Exploration Company) preferred to invest in the development of mines rather than in their working. Herbert L. Salterlee, *J. Pierpont Morgan: An Intimate Portrait* (New York: The MacMillan Company, 1939); Thomas R. Navin, *Copper Mining and Management* (Tucson: Univ. of Arizona Press, 1978), 255.

[23]Horace J. Stevens, *The Copper Handbook*, vol. 9 (Houghton, Michigan: Horace J. Stevens, 1909), 840.

[24]Tower, *Ghosts of Kennecott*, 39 (see n. 7).

[25]Graumann, *Big Business in Alaska*. (see n. 18).

[26]Ibid., 16.

[27]Anon., *Outline of Geology and Mining Methods of Kennecott Mines, Kennecott Copper Corporation, Alaska*, (Kennecott Copper Corporation internal report, c. 1924), 6–7.

[28]A 1937 Bureau of Mines publication on aerial tramways noted "their operation is practically unaffected by snow or other weather conditions. Construction costs may vary greatly with topography, but operating costs are affected very little. Mountain ranges are crossed and ravines and streams are spanned without expensive grading or other preliminary work." O. H. Metzger, "Aerial Tramways in the Metal-Mining Industry: Part 1," in *Bureau of Mines Information Circular 6948* (September 1937), 5.

[29]A review of the local topography appears in Alan M. Bateman and D. H. McLaughlin, "Geology of the Ore Deposits of Kennecott, Alaska," in *Economic Geology*, vol. 15, no. 1 (1920), 4–5.

[30]A list of favorable conditions appears in Robert Peele (ed.), *Mining Engineers' Handbook* (New York: John Wiley & Sons, 1918), 1706. Here, the author informs mill towns "should be [located] at the most advantageous point respecting: receiving of crude ore and delivering of products; power for operation; water supply; disposal of tailing; room for future growth; safety from floods and snow slides. Other things being suitable, mill should be just below mine opening."

[31]Photographic documentation suggests these structures may have been constructed earlier (c. 1904). They were definitely in use by 1907.

[32]In order to rid an area of insects, prospectors often resorted to vegetation removal. Prospectors in the Chugach Range 30 miles south of Kennecott, for instance, burned off much of the vegetation, including good quality timber stands. Refer Fred Moffit, "Geology of the Hanagita-Bremner Region, Alaska," *U.S. Geol. Survey Bulletin 576* (1914), 13.

[33]Graumann, *Big Business in Alaska*, 15 (see n. 18).

[34]The double-reversible aerial tramway system adopted represented an "off-the-shelf" technology. The use of through-type towers, junction stations, and

breakovers closely followed established designs (these are shown in Peele, *Mining Engineers' Handbook*, 1555–98 (see n. 29)). A junction station joined two tramways into one (at Kennecott this was used for the Jumbo and Glacier line). Breakovers enabled the aerial tramway to curve over ridge crests. An angle station (on the Bonanza line) allowed the tramway to make a horizontal jog. Cables for the tramway were of locked coil construction. The cost of running the aerial tramways at Kennecott amounted to $6.27 per hour. O. H. Metzger, "Aerial Tramways in the Metal-Mining Industry: Part 2," in *Bureau of Mines Information Circular 7095* (February 1940), 29. Tower, *Ghosts of Kennecott*, 67; Graumann, *Big Business in Alaska*, 17 (see n. 18).

[35]Janson, *Copper Spike*, 76 (see n. 15).

[36]The syndicate purchased the right-of-way through the canyon for one-quarter-million dollars. While the Copper River route would cost the company $12 million extra to build, it did allow for a potential merger with coal fields to run the railway that the Valdez route did not. Janson, *Copper Spike*, 33–4 (see n. 15).

[37]Ibid., 112.

[38]Among the Syndicate's possessions, The Alaska Steamship Company became the largest maritime transportation company in Alaska trade, and Northwestern fisheries, Alaska's second largest packing company. Graumann, *Big Business in Alaska*, 8 (see n. 18).

[39]Herbert L. Salterlee, a biographer of J. P Morgan, noted that Morgan viewed the railway up the Copper River as a great risk, but one that "held possibilities for the future." *J. Pierpont Morgan: An Intimate Portrait*, 448–9 (see n. 21); Martin Harrais, "Gold Lunatics," unpublished manuscript, Polar collections, Rasmusen Library, Univ. of Alaska Fairbanks, 212.

[40]Janson, *Copper Spike* 140–4 (see n. 15).

[41]Tower, *Ghosts of Kennecott*, 57 (see n. 7).

[42]Lewis A. Levensaler to William A. Dickey, letter 6 May 1910 (on file at WRST

office). As early as 1907, development at the Bonanza claim included a cabin outside the main adit. A sketch in F. Moffit and S. Capps, "Geology of the Nizina District, Alaska," *U.S. Geol. Survey Bulletin 448* (1911), 87 depicts a cabin outside the Bonanza adits. The authors explain earlier that structural developments relied upon 1907 field recording. A map included in the pocket, dated 1911, appears more up to date, with the railroad and Bonanza mine tram terminus mapped in.

[43]Lewis A. Levensaler to William A. Dickey, letter 6 May 1910 (on file at WRST office). A smaller power plant conceivably operated at the site prior to 1910.

[44]William Cronon, "Kennecott Journey: The Paths Out of Town," in William Cronon, George Miles, and Jay Gitlin (eds.), *Under and Open Sky: Rethinking America's Western Past* (New York: W. W. Norton, 1992), 47.

[45]Margaret Crawford's study of company towns in the American South similarly notes visibility as a main attribute of managerial residences. Margaret Crawford, "Earle S. Draper and the Company Town," in John S. Garner (ed.), *The Company Town* (New York, Oxford Univ. Press, 1992), 139–72 (especially figure 5.3, 149). Although managerial residences were often removed from the industrial area, this was not always the case. Indeed, there may well have been some attraction in the existence of industrial enterprise in an otherwise natural setting. See for instance an 1803 description of Dowlais Ironworks quoted in Bruce Thomas, "Merthyr Tydfil and Early Ironworks in South Wales," in *The Company Town*, 33 (see above).

[46]Janson, *Copper Spike*, 146 (see n. 15); Douglass, *History of Kennecott Mines*, 6 (see n. 12).

[47]Descriptions of the milling process including changes over time can be found in Horace M. Lawrence, "Ammonia Leaching of Copper Tailings at Kennecott, Alaska", *Engineering and Mining Journal* 104,18 (November 3, 1917): 781–787, and in E. J. Duggan, "Flotation and Leaching at Kennecott," in *Engineering and Mining Journal* vol. 126, no. 26 (1928), 1009.

[48]Graumann, *Big Business in Alaska*, Appendix C, (see n. 18).

[49]Ibid., 18.

[50]Tower, *Ghosts of Kennecott*, 57 (see n. 7).

[51]Janson, *Copper Spike*, 104 (see n. 15).

[52]Ibid., 104. The substitution of a copper rather than traditional gold spike at the line terminus, while novel, was not unusual practice. This, for instance, occurred in 1899 at the completion of a railroad for the Mt. Lyell Company copper mine, Tasmania. Refer Geoffrey Blainey, *The Peaks of Lyell*, second edition (Australia: Melbourne Univ. Press, 1959), 115.

[53]Graumann, *Big Business in Alaska*, 20–1 (see n. 18).

[54]Ibid., 20.

[55]Walter H. Weed, *Copper Handbook*, vol. 10 (Houghton, Michigan: Horace J. Stevens, 1913), 50.

[56]Douglass, *History of Kennecott Mines*, 7 (see n. 12).

[57]Fred Moffit, "The Metalliferous Deposits of the Chitina Valley," *U.S. Geol. Survey Bulletin 755-b* (1924), 64.

[58]Graumann, *Big Business in Alaska*, 21 (see n. 18).

[59]Ibid., 21.

[60]Douglass, *History of Kennecott Mines*, 7 (see n. 12).

[61]Janson, *Copper Spike*, 148 (see n. 15).

[62]Graumann, *Big Business in Alaska*, 22 (see n. 18).

[63]This may have been caused by mill foundations being set into permafrost.

[64]Graumann, *Big Business in Alaska*, 22 (see n. 18).

[65]E. J. Duggan, "Ammonia Leaching at Kennecott," in *Transactions of the American Institute of Mining Engineers*, vol. 106 (1933), 548; Horace M. Lawrence, "Ammonia Leaching of Copper Tailings at Kennecott, Alaska," in *Engineering and Mining Journal*, vol. 104, no. 18 (November 3, 1917), 781–7.

[66]E. J. Duggan, "Ammonia Leaching at Kennecott," 548 (see n. 63).

[67]Thomas R. Navin, *Copper Mining and Management*, 262 (see n. 21).

[68]Graumann, *Big Business in Alaska*, 26–8 (see n. 18).

[69]Douglass, *History of Kennecott Mines*, 10 (see n. 12).

[70]Kennecott officials consistently mentioned freight costs as a key factor in the development of the ammonia leaching facility. Refer Horace M. Lawrence, "Ammonia Leaching of Copper Tailings at Kennecott, Alaska," 782 (see n. 63); E. J. Duggan, "Flotation and Leaching at Kennecott," 1008 (see n. 45); E. J. Duggan, "Ammonia Leaching at Kennecott," 548 (see n. 63).

[71]Walter H. Weed, *Mines Handbook* (New York: Stevens Copper Handbook Co., 1920), 299–304.

[72]E. J. Duggan, "Flotation and Leaching at Kennecott," 1009 (see n. 45).

[73]Kennecott Copper Corporation. *Annual Report for 1936, Kennecott Copper Corporation, Alaska Mines* (Internal report, 1936), 12.

[74]Graumann, *Big Business in Alaska*, 28 (see n. 18).

[75]Douglass, *History of Kennecott Mines*, 10 (see n. 12).

[76]*HAER inventory*, Sept. 1982, lots 86–9.

[77]*HAER inventory*, Sept. 1982, lots 36–8.

[78]Douglass, *School Days* (Douglass Collection, Univ. of Alaska Fairbanks), quoted in Hunt, *Mountain Wilderness*, 75–6 (see n. 3).

[79]Hunt, *Mountain Wilderness*, 76 (see n. 3).

[80]The small neighborhoods formed by staff accommodations likely buffered the appearance of industry at Kennecott and may also have helped discourage rowdiness amongst workers in the mill town.

[81]Graumann, *Big Business in Alaska*, 28–30 (see n. 18).

[82]Ibid., 30.

[83]Ibid., 30.

[84]Ibid., 32.

[85]While through towers were one of the most sturdy tower designs available, they still required annual repairs and maintenance, particularly in steep and rugged terrain. At Kennecott, a number of through towers were not anchored to their footings, perhaps in order to improve the speed of repair [refer National Park Service, *Mining Compliance Site Inventory Form XMC 086* (on file at WRST office)].

[86]Hunt, *Mountain Wilderness*, 73 (see n. 3); Douglass, *History of the Kennecott Mines*, 9 (see n. 12).

[87]The Mother Lode Mine was discovered and staked in 1906 by Ocha Potter, a Michigan College of Mines graduate. Although Potter's prediction of the value of the ore body would later prove correct, he became disillusioned with the value of his prospect in 1913 and soon sold it to a speculator. Ocha Potter, *Sixty Years*, 65–7 (see n. 8).

[88]Hunt, *Mountain Wilderness*, 85–8 (see n. 3); Douglass, *History of the Kennecott Mines*, 9 (see n. 12).

[89]Graumann, *Big Business in Alaska*, 35 (see n. 18).

[90]Anon., *Outline of Geology and Mining Methods*, 9 (see n. 26).

[91]Renovations entailed constructing an extra story on the 1910 bunkhouse and developing the attics of both bunkhouses, complete with dormer windows. Steven Peterson, Raymond Todd, and Richard Silva, *Historic Structures Report: Kennecott National Historic Landmark 1992 Emergency Stabilization Recommendations* (Alaska: National Park Service, 1992), 71, 112, 122.

[92]Hunt, *Mountain Wilderness*, 75 (see n. 3).

[93]Duggan, "Flotation and Leaching," 1009 (see n. 45).

[94]Ibid.; Steven Peterson, Raymond Todd, and Richard Silva, *Historic Structures Report*, 9 (see n. 89).

[95]The flotation technique used sodium sulphide, coal-tar creosote, sulphur, quicklime, and steam-distilled pine oil (listed in decreasing amounts required) as reagents to encourage the separation of ore. With the addition of water and forced air, this process created a rich froth of copper concentrates (32 to 35 percent copper), which could then be skimmed from the top of the flotation tanks. Duggan, "Flotation and Leaching," 1013 (see n. 45).

[96]Ibid.; Graumann, *Big Business in Alaska*, 38 (see n. 18).

[97]Duggan, "Flotation and Leaching," 1013 (see n. 45).

[98]Tower, *Ghosts of Kennecott*, 74 (see n. 7).

[99]Alan Bateman, consulting geologist for the Kennecott Mines, related Kennecott's mining operation to four stages: active exploration and development (1910–1915); vigorous mining and increasing ore reserves (1915–1922); exploitation of reserves with few new discoveries (1922–1930); clearing up and robbing of pillars (1930–1938). Refer Alan Bateman, *Residuary Life of the Kennecott Mines* (Kennecott Copper Corporation Company Internal Report, 1939), 3.

[100]Graumann, *Big Business in Alaska*, 39 (see n. 18).

[101]The mill began as a tall narrow structure with defined levels. By the close of Kennecott operations, however, alterations had gradually transformed the mill structure into a delta form with numerous mezzanine floors.

[102]Alan Bateman, "Internal Report 25 Sept. 1925," quoted in Bateman, *Residuary Life of the Kennecott Mines,* 5 (see n. 97).

[103]Ibid., 6.

[104]Graumann, *Big Business in Alaska*, 43 (see n. 18).

[105]Michael Lappen, *Whose Promised Land?: A History of the Conservation and Development Management Plans for the Wrangell and Saint Elias Mountains Region, Alaska 1938–1980* (Univ. of California MA thesis, 1984), 29.

[106]Douglass, *History of the Kennecott Mines*, 11 (see n. 12).

[107]Thomas R. Navin. *Copper Mining and Management*, 254–72 (see n. 21).

[108]Salvage operations were indeed so well-arranged that the last shipment made the last train from Kennecott on November 10. Kennecott Copper Corporation, *Annual Report for 1938, Alaska Mines.* (Kennecott Copper Corporation Manuscript 1938), 31–5.

[109]Ibid.; The equipment purchased by W. E. Dunkle was transferred to the Golden Zone Mine south of Mt. McKinley. National Park Service, *Kennicott Pre-Acquisition Environmental Site Assessment* (Alaska: National Park Service, 1996), 28.

[110]Kennecott Copper Corporation, *Annual Report for 1938* (see n. 106), 34; National Park Service., *Kennicott Pre-Acquisition*, 28 (see n. 107).

[111]Kennecott Copper Corporation, *Annual Report for 1938* (see n. 106).

[112] Lappen, *Whose Promised Land?*, 39 (see n. 103).

[113]The tennis and handball courts, a storage facility opposite the West Bunkhouse, and two garages and one cottage south of the schoolhouse may also have been removed during this time.

[114]National Park Service, *Kennicott Pre-Acquisition*, 29 (see n. 107).

[115]A roughly made water-wheel west of the railway bridge over National Creek may relate to the Consolidated Wrangell period, indicating the use of alternate power sources.

[116]National Park Service, *Kennicott Pre-Acquisition*, 29 (see n. 107).

[117]John D. Coffman and Harry J. Liek, *Report on Proposed Alaska National Park* (National Park Service, 1938).

[118]Lappen, *Whose Promised Land?*, 43 (see n. 103).

[119]National Park Service, *Kennicott Pre-Acquisition*, 30 (see n. 107).

[120]Ibid., 22 (see n. 103).

[121]Ibid., 33 (see n. 103).

[122]Ibid., 42 (see n. 103).

ANALYSIS AND EVALUATION

[1]High-grade ores were crushed, bagged and shipped to the smelter as soon as the railway was completed in 1911. Lower grade ores were treated by gravity concentration typical of the day. Carbonate ores, which were not amenable to gravity concentration or conventional leaching techniques, were treated with a site-specific ammonia leaching process after 1916. Finally particles too small to respond to gravity concentration or be treated profitably by ammonia leaching were subjected to flotation after 1923.

[2]Glacier Mine operated seasonally, and supported a tent camp and two wooden structures.

[3]Excerpted from Kennecott Pre-Acquisition Environmental Site Assessment, National Park Service, December 1996. Pgs. 30–33.

[4]See Recommendations for preservation philosophy and management of health/safety issues.

[5]The notable exception is the log section of the manager's office.

[6]See Appendix B for a description of the evaluation criteria used to assess priorities for treatment.

[7]Over the years, there have been a variety of names and numbers associated with individual structures at Kennecott. As part of the CLR, the effort was make to cross-reference and verify the location and name of every building to determine the most appropriate system. As a result of this effort, the names for buildings and associated numbers used in the CLR are taken from the historical record, as documented in this report. Construction dates for building are taken from Graumann, 1987, and the Historic American Engineering Record (HAER)recording project, 1980. Additional building descriptions are from Wheaton, 1979, and from Peterson, et.al. 1992. Condition is from Peterson, et al., 1992, and field documentation, 1997 and 1998. Significance statements are taken from the National Register nomination, 1984 and HAER documentation, 1980. Building descriptions and significance statements are not given for structures in private ownership.

[8]Although integrated both structurally and functionally with the Concentration Mill, the Tram Terminus was built prior to the mill structure, and has a significant historical relationship to the tram system, as a staging area for receiving the ore from the mines. It is considered here as a discrete structure, related to both.

[9]The first power plant was constructed in phases between 1911 and 1924, before it was destroyed by fire. Documentation indicates that the second building

followed the general plan of the first plant with boilers in the north end, turbines on the south, and transformers in an extension to the west.

[10]This evaluation is based on architectural and historical records for individual structures conducted in 1996. Also see Appendix B.

TREATMENT RECOMMENDATIONS

[1]For the complete text of the preferred alternative contained in the *Interim Operations Plan*, see Appendix A.

[2]Priorities for stabilization of historic structures is based on preliminary assessments conducted between 1996 and 1998. Priorities designated in this document are subject to change based on seasonal assessments, management needs, funding, and support.

[3]New construction and rehabilitation of existing structures shall be reviewed by the Architectural Control Committee in accordance with covenants and deed restrictions associated with individual properties.

[4]New construction and rehabilitation of existing structures shall be reviewed by the Architectural Control Committee in accordance with covenants and deed restrictions associated with individual properties.

[5]Historic views have been identified using the photographic record for Kennecott, and to lesser degree, oral histories. Although a scientific assessment of views has not been undertaken, it is well documented that vegetation throughout the mill town was virtually non-existent as a result of construction and operations at the site, (beginning in 1900 and continuing off and on until abandonment in 1938). As a result, the landscape was quite open, allowing foreground, middle-ground, and distant views. Because the majority of vegetation in the mill town has not been actively maintained, most of the historically open views have been lost.

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APPENDICES

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INTERIM OPERATIONS PLAN
KENNECOTT NATIONAL HISTORIC LANDMARK

The purpose of this Interim Operations Plan for the Kennecott National Historic Landmark (NHL) is to develop management strategies for the National Park Service (NPS) at the NHL in the Wrangell-St. Elias National Park and Preserve. Such a plan became necessary when the National Park Service acquired the privately owned site in June 1998. The Kennecott site, mined for its copper in the early 1900s, is in the center of the park, approximately 5 miles from where the McCarthy Road ends at the Kennicott River. The National Park acquired-2,839 acres, including much of the historic mill town, the subsurface rights to the mine, and the surrounding natural area.

With this acquisition, the Park Service assumed new responsibility for protecting the important elements of the historical, cultural and natural landscape. In addition to being a historic site of national significance, the NHL also includes natural areas easily accessible to visitors and is a gateway to the park's backcountry. Its cultural landscape reflects a mixture of historic mining era buildings and artifacts intermixed with the ongoing life of an Alaska bush community, members of which own lands and businesses intermingled with NPS holdings at Kennecott and in the nearby area of the town of McCarthy.

Preserving such a site and providing visitor access to and interpretation of Kennecott requires analysis of the condition of the historic landscape and stabilizing selected important elements that are deteriorating, determining where visitor services should be located, and providing visitors with ways to explore the history of the site. It requires an understanding of the natural features and processes of the site, in order to both preserve historic values and provide appropriate protection of, access to and interpretation of its natural values for visitors. And it requires cooperation with residents and non-federal landowners, whose partnership is necessary for protection and public appreciation of the area. Existing Mill Site Unit covenants will be modified to more closely reflect the current and anticipated future land usage. There is provision within the covenants for modification of the restrictions by majority lot owner vote by September 2001.

Under private ownership, several important structures were stabilized through the efforts of the nonprofit group Friends of Kennicott. However, many health and safety problems remain on the site, artifacts continue to be lost, historic buildings continue to deteriorate, and many remaining artifacts are at risk. In addition, as part of the preliminary scoping for this plan with the community, there are many issues pending that which are beyond the scope of this effort which will require future planning efforts. Some of these issues include the proposed McCarthy Road upgrade, the impact of the new Princess Hotel in Copper Center on visitation, and identified utility and infrastructure needs of the larger community. This plan, along with the forthcoming associated cultural landscape report, will be an amendment to the park's General Management Plan. This interim operations plan will be for approximately a five year period, which represents how long it will take for the NPS to get basic operations underway. At the conclusion of this interim, start-up period, there will be an opportunity to re-evaluate the plan and make any needed adjustments.

Kennecott's designation as a NHL reflects its exceptional importance to the history of the United States - only 3% of properties listed on the National Register have the status of a NHL. Its significance as an early 20th century mining landscape is multi-dimensional, a fact represented in the many themes of American history that can be discerned through the layers of its material culture. Among others, these themes include the evolution of mining technology at one of the richest copper ore sites in the United States, the physical development and evolution of a company mill town over four important decades of industrial growth, and the history of labor, family life, and environment on one of the last American frontiers.

The site's interpretive potential as a cultural landscape is compelling. As defined by the National Park Service, cultural

landscapes are geographic areas, including cultural and natural resources, associated with a historic event, activity, or person. However, a landscape's age and associations do not automatically warrant preservation. As a cultural landscape, Kennecott's preservation is critical because its physical structures, characteristics, and features defining its historical significance remain. Individual buildings and archeological features are important, but when considered within the holistic context of the cultural landscape, they are of an even greater value in communicating that significance. Because this landscape is largely intact, understanding Kennecott as a cultural landscape is a useful approach to preserving and interpreting its historical legacy.

Stewardship of the cultural landscape at Kennecott is addressed through the many aspects of this Interim Management Plan, which covers a wide range of topics including: cultural resources (including landscape features, land use, and design standards, archeological resources, museum collections and archives, buildings, and structures), natural resources (air quality, surface water, wetlands, vegetation, and wildlife), and interpretation. Integral to the Kennecott plan are management issues related to its administration and operations such as building leases, tours and seasonal use, land acquisition and easements, concerns related to utilities and infrastructure, and the paramount needs for safety and security.

The plan includes the following components:

Provides for both short-term and long-term NPS actions focused on compatible design, incremental change, and the reestablishment of the historic character of the site. Over the next five years the NPS would initiate rehabilitation of the company store for a visitor contact station, offices, and storage. Interpretive programs would be offered by the NPS, concessioners, and other cooperators. Exhibits would be developed in coordination with the McCarthy Museum. Structures would be stabilized on a priority basis. A number of buildings would be opened for visitors to tour independently. Historical pathways would be reestablished and some vegetation clearing would take place. The NPS would work cooperatively with the community to address the rehabilitation of the community building and fire and EMS response.

Management Concept

The primary NPS management goals of this Interim Operations Plan (see figure 103 in preceding Cultural Landscape Report) is to enhance visitor understanding of Kennecott by preserving, protecting and interpreting key remaining structures and landscape features, patterns and relationships that define the historic, cultural and natural character of the NHL.

The approach taken would reflect the 1997 Park Service report supporting federal ownership of the NHL, "Kennecott Acquisition Past, Present and Future". That report stated (page 25):

"What is (to be) maintained is the sense of ..., a site abandoned but still haunted by past residents, a place that has not been... sanitized. It is a place of discovery for the visitor, but one where investigation and inquiry can be done safely and with respect for the remaining historic objects and structures."

The plan incorporates key aspects of more than a decade of public discussion of acquisition and management of the NHL. One key result of the discussion was the desire for cooperative management of the NHL by the Park Service and local residents and nonprofit organizations.

More recently, the community and one such local nonprofit organization, the Friends of Kennicott, have endorsed a shared vision for the NHL. This shared vision will provide a strong foundation for the work that follows and a way to evaluate NPS plans and actions. Most interested parties within the community envision a future in which Kennecott:

- is stabilized to prevent deterioration of historic structures or artifacts and to make them available to the public.
- is managed with a "light touch" in which projects are undertaken in small steps, at modest costs, with minimal intervention process.
- is not just an abandoned mining town, but also is a place that reflects the vitality, creativity, and community spirit of today's residents.
- retains the slow pace, quiet, and spaciousness that foster contemplation and individual reflection.
- is part of a larger community in which residents act both individually and collectively to guide the future of the area.
- contributes to a strong, reasonably diverse economy that includes locally owned and operated businesses, community-based nonprofits, and traditions of barter and subsistence.
- protects and honors small-town values: safety, cooperation, self-sufficiency, and personal freedom.
- Is a place where tourism is allowed to evolve within the capacity of the community, rather than a place where external intervention and control accelerate growth.
- Is seen by local residents and visitors alike in its true context: a remote outpost of civilization in the midst of an enormous mountain wilderness.
- Is managed to protect the cultural and natural resources of this historic mining district and the surrounding glacial landscape; and provides a safe, educational, and rewarding experience for the area's visitors and residents.

The NPS supports the goals that the community and Friends of Kennicott have articulated above. The NPS will endeavor to implement this plan so that these goals are realized . While the NPS does not anticipate that these goals would conflict the NPS goals, policies and mandates, if such a conflict were to occur, NPS mandates would have to take precedence.

Major actions in this plan would include implementing a program of stabilization for historic structures; reestablishment of historic circulation routes; restoration of selected historic views and vistas through selective thinning of vegetation; preservation treatment of significant archeological features; and the addition of interpretive facilities, including trails, waysides, and a visitor contact station. This plan would also allow development within the historic landmark to the degree that proposed changes would be compatible with the historic character of the site. In this regard, individual actions, such as a change in land use or the addition of new structures within the historic district, would be considered and evaluated within the context of the cultural landscape as a whole.

Partnerships

The National Park Service considers itself a partner with the community. In consultation with local residents, landowners and organizations, the Park Service will establish procedures for early and regular discussion with the community of proposed Park activities at Kennecott. These discussions will occur at strategic times, such as prior to when the Park intends to submit budget proposals, before large scale projects are implemented, and on a periodic basis to clarify ongoing operations. It is understood that there may be some activities proposed where complete consensus may not be reached. While the NPS is committed to resolving such conflicts, there may be some instances where NPS mandates may take precedence over community concerns. In establishing these discussions, the Park Service acknowledges that:

- the success of the Kennecott NHL depends on the quality of relationships between NPS and its neighbors.
- there are a variety of vested interests in the area that are not necessarily organized into one official "representative" body, but all of whom will have the opportunities to participate in setting the course of action.
- conflicts should be resolved locally if possible.

The NPS will be receptive to participation in ongoing conversations with the community on issues of mutual concern. Specifically, the NPS considers itself a partner with the community in seeking funding to rehabilitate the community building for community functions and for visitor interpretive programs. The NPS would rent a private building as a temporary community center and park office space. Additionally, the NPS will foster community participation in a variety of ways, such as;

- establish a communication and conflict resolution process for implementing the NPS and community partnerships.
- establish a procedure for joint NPS/community review of proposed adaptive reuse of structures within the prescribed area..
- Consult with interested community members before implementing activities in administrative area, including selective thinning, routing of trails and boardwalks, development of interpretation and evaluation of techniques that may minimize flooding along National Creek.
- Coordinate with community members on certain infrastructure and utility rights-of-ways issues.

Additionally, the National Park Service, in consultation with the local community, will explore partnership proposals from nonprofit organizations that wish to share in the operation and management of Kennecott. Friends of Kennicott have expressed an interest in developing such a relationship. Accordingly, such a strategy will be evaluated. Additionally, the National Park Service will be developing a concessions plan for the NHL. It is hoped that this strategy will be integrated in the overall partnership strategy.

This plan is based on the evaluation of cultural landscape resources, NPS management guidelines and legal mandates, discussions with private landowners, and public meetings. The NPS would continue to work in partnership with the local residents to manage the area in a manner that protects natural and cultural resources and serves the long-term interests of the community by ensuring the protection of private property and access for all landowners.

The living aspects of day-to-day life in Kennecott, both summer and winter, are of significant interest to visitors. The NPS recognizes this and will seek means of satisfying this visitor interest in a way that does not adversely impact the private lives of the area residents.

The National Park Service recognizes that a viable and diverse community of families and individuals existed prior to the area being designated a national park, and will work with this local community to manage the landmark in such a way as to maintain the character of Kennecott and McCarthy.

Architectural Control Committee and Mill Site Subdivision Covenants

When the NPS purchased the 2,839 acres within the landmark boundaries, it became the largest landowner of the area, but not the majority landowner within the Mill Site Unit, which contains most of the original buildings and in-holder lots. Lots within this unit were originally conveyed with residential-type covenants and these covenants now require modification to more closely reflect current land uses and to meet the needs of the NPS as outlined within this document. Modifications of existing covenants will be initiated through an open and inclusive process of all Mill Site lot owners, determined by majority vote and implemented and enforced by the Unit's Architectural Control Committee (ACC). It is the NPS' intention to recruit other landowners to serve on the ACC, as part of this process.

Cultural Resources

Cultural Landscape

The National Park Service has a responsibility to abide by regulations governing the management of historic resources. It must comply with the legal and regulatory requirements as outlined in Director's Order-28: *Cultural Resource Management*, the National Historic Preservation Act, and *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*, among others. Those regulatory requirements address NPS policy, federal legal mandates, and acceptable standards for the treatment of the Kennecott historic properties. The National Park Service will also abide by the covenants attached to the mill site town subdivision.

Land Use. This plan responds to historic land use patterns and uses (see Land Protection Plan, figure 102 in preceding Cultural Landscape Report) while providing for contemporary uses (within the historic context . Six land use "zones" would be delineated with the necessary covenant modification, providing for appropriate contemporary uses within the primary historic use areas that include the industrial core, administrative complex, housing areas, and service-related areas. The following chart outlines the six land use "zones," according to their contemporary and historic use. These zones will promote sensitive and appropriate development and will protect the historical nature of the Mill Site area.

TABLE 1: LAND USE DESIGNATION

Zone	Name	Historic Land Use	Appropriate Uses
1	Administrative Core	Office, manager's residence, depot, hospital, staff housing	NPS Operations, offices, interpretation, visitor center
2	Industrial Core	Concentration Mill, tram deck, power plant, leaching and flotation plant, machine shop, tailings, flume structures, warehouses	Interpretation, storage, equipment repair, workshop, utility infrastructure
3	Residential "A"	Silk stocking row: old lodge, barracks, local access roads	Interpretation, residential, lodging, tent cabins
4	Residential "B"	North end cottages	Private residences, interpretation
5	Residential "C"	Vegetated hillsides, cleared hillsides, historic dumps	Residential, undeveloped, natural resource protection
6	Commercial	Store, post office, storage, resident services, meat house, community facilities, housing, tent cabins	Concession/commercial (outfitters, bike rentals, guided tours, guest services, gift shop, bookstore), offices, community center

Design Standards. To guide development in the Kennecott NHL — especially in the mill town subdivision — the park would work with the community to establish design standards and guidelines for structures and landscape features consistent with the modified covenants. These guidelines would address the use of appropriate materials as well as the size, scale, massing, and character of individual structures and landscape features. The architectural control committee has the responsibility for implementing these guidelines with the Mill Site Subdivision. The ACC will be composed of representatives from the NPS , other non-NPS Mill Site property owners.

Circulation and Access. Vehicular access would continue on all current routes. All abandoned vehicles would be removed from NPS properties. The park would work with the community to remove all other abandoned vehicles from properties within the NHL, particularly along the historic railroad bed. Primary and secondary pedestrian paths would be

identified and reestablished within the NHL, particularly in the mill town subdivision. The primary pedestrian corridor would continue along the historic railroad bed and the existing road through the mill town. Existing service access roads will continue to be used.

Foot trails and pedestrian paths would serve a variety of functions, including interpretive, hiking, and local access for residents. All pedestrian routes that are adjacent to or pass through private property will be developed with consultation of the landowners.

An interpretive trail would be established on the west side of the mill town with views to the powerhouse, the machine shop, and the leaching plant. A footbridge across National Creek would be added to the trail to provide access to the company store. A pedestrian walking loop would be established which begins at the Company store and follows a historical road up National Creek to the footbridge and continues back down the creek to the Assay Office. With further evaluation, portions of this route may have limited vehicle access. Other pedestrian trails — including those to both Silk Stocking Row and Bonanza Mine, the historic carriage road to McCarthy, and paths behind the mill building — would be maintained. The primary pedestrian trail to Root Glacier would continue to be maintained north of the mill town.

Views and Vistas. In this proposal, historic views and vistas at Kennecott would be addressed. Selective thinning of vegetation on NPS properties would enhance historic viewsheds throughout the cultural landscape yet be consistent with maintaining the character of the abandoned mining town partially reclaimed by nature. The type and degree of clearing would be based on recommendations in the Kennecott Cultural Landscape Report. Selective thinning means removal of key trees to enhance a significant landscape feature and provide protection to the buildings and site from the effects of fire. Selective thinning would occur to mark the location of manager's residence, Birch residence, staff house annex, assay office north of National Creek, and areas adjacent to the mill. Selective thinning would also occur around the machine shop, power house, mill and leaching plant. If asked the NPS would assist landowners in planning selective thinning on their properties.

Archeological Resources

Features determined noncontributing to the historic district would be removed if they presented a safety hazard to visitors or residents. All other archeological resources, including historic dumps, would remain.

Museum Collections and Archives

The National Park Service would amend an existing scope of collections statement regarding the collection of artifacts and would follow regulations and NPS *Director's Order #28: Cultural Resource Management* to ensure the preservation and protection of artifacts.

Historically significant, site-related artifacts would be retained in their present locations unless they were at risk or contributed to interpretation. Artifacts determined to be noncontributing and incompatible to the historic district would be removed.
Historic documents, manuscripts, archival material, and associated papers within the scope of collections would be collected from NPS properties and placed in appropriate curatorial storage. Objects not requiring special environmental considerations will be curated in a NPS repository on site. NPS will provide technical assistance to the McCarthy Museum to assist the museum with caring and preserving its collection.

Structures

The National Park Service has a responsibility to abide by regulations governing the management of historic resources. It must comply with the legal and regulatory requirements as outlined in Director's Order-28: *Cultural Resource Management*, the National Historic Preservation Act, and *The Secretary of the Interior's Standards for the Treatment of Historic Properties,* among others. Those regulatory requirements address NPS policy, federal legal mandates, and acceptable standards for the treatment of the Kennecott historic properties.

Buildings. A structural stabilization program would be developed for NPS-Kennecott properties according to a three-tiered plan: items to be addressed immediately (high priority); items to be addressed in the third and fourth years; and long-term needs beyond four years, subject to funding.

Assessments would be made as needed to identify high priority needs such as those created by environmental conditions or because of unforeseen circumstances. The park would continue to work with local residents in ongoing stabilization or contracting efforts. The park would stabilize as appropriate, the upper and lower portions of the mill structure, the powerhouse, and the machine shop to make them safe for unescorted visitor access. The park would work with local interests to rehabilitate the historic community building for community activities and NPS programs. Structures that would be available for adaptive reuse would be the company store, the school, the west bunkhouse, and the meat locker. The company store would be rehabilitated to provide a safe structure for NPS operations, curatorial storage, and limited visitor activities. NPS would seek the involvement and participation of cooperators in the rehabilitation and reuse of the company store. Individuals and groups interested in adaptive reuse would be subject to an agreement with the NPS. Proposed uses would be limited to those of an educational nature. Adaptive reuse of buildings in addition to the store and community building are not as likely in the next five years other than for some minor administrative uses.

PRESERVATION GOAL: The goal of the National Park Service's Kennecott preservation program is to stop the deterioration of key historic buildings within the Kennecott NHL by repairing and replacing deteriorated roofs, walls and foundations while preserving the present abandoned character of the site. This goal will preserve future management options as well.

Specific tasks include:

- Mitigate all life safety issues in and around the structures
- Stop the imminent collapse and damage to the structures, which has resulted from years of abandonment
- Preserve and protect the historic landscape of the site and retain the industrial artifacts in place as part of the landscape character
- Reestablish a weathering skin by repairing roofs, walls and foundations using materials compatible with the historic period and consistent with the Secretary of Interior's Standards for Rehabilitation
- Repair deteriorated structural connections at floors, walls, and foundations and resolve vertical and lateral loads on the buildings resulting from winds and snow
- Mitigate water problems due to rain, site percolation and periodic flooding of National Creek.
- Establish a day labor crew
- Undertake a site cleanup to remove noncompatible building materials resulting from recent demolition and mining activities.
- Preserve and protect documents and artifacts remaining within the structures.
- Acquire additional parcels deemed critical to protecting the historic integrity of the site and management of the site. A prioritization process for determining the critical parcels will be developed. Parcels would be acquired on a willing seller basis only.

The tailings dumped against the building in the 1950s as part of a demolition effort would be removed.

Tram Towers. Mine cables would be lowered from the tram towers as funds become available or as hazardous conditions require. The structural condition of tram towers and cables would be evaluated on an annual basis. Selected tram towers above the timberline would be stabilized to reinforce a sense of scale and extent of the historic district.

Bridges. A low-water crossing at National Creek in front of the assay office would be established to allow vehicular access for residents and for NPS administrative needs. The historic railroad trestle across National Creek would be stabilized and rehabilitated to offer safe access for pedestrians, people in wheelchairs, and on ATVs and bicycles. The park would work to reestablish the historic tracks across the National Creek railroad trestle from the company store north to the mill structure as an interpretive component. Pedestrian bridges across National Creek (one east of the historic railroad trestle) would be reestablished in its historic location as part of the trail system. A new footbridge would be constructed west of the trestle.

Historic Boardwalks. To provide access to historic buildings, boardwalks would be rehabilitated or reconstructed based on historical documentation. Priority would be given to re-establishing walkways in areas around the company store, school, meat locker, bunkhouse(s), leaching plant, machine shop, powerhouse, and parts of the manager's house and historic administrative area.

Character-defining architectural features, such as the powerhouse smokestacks, the concentration mill ore chute, and the leaching plant/mill conveyor, would be stabilized and reconstructed as necessary.

Natural Resources

As part of a comprehensive resource management program, the National Park Service would initiate programs for ongoing monitoring of natural resources at periodic intervals. This would include a program to monitor water quality and quantity on National Creek, an assessment and monitoring of wildlife populations and sensitive plant species documented on Bonanza Ridge in 1967, and development of a bear management plan. In addition, the mill site would be monitored for the establishment of invasive non-native plant species.

Selective thinning of vegetation would occur on NPS properties to reestablish historic views and viewsheds and to protect the site from the effects of fire and damage to the buildings. The focus of the selective thinning would be in the historic administrative area, including the manager's residence, Birch residence, the staff house annex, the assay office area north of National Creek, and areas adjacent to the mill structure. The NPS will undertake a demonstration project in a small section of the administrative area to illustrate what is meant by selective thinning to help community members understand what a finished project in the area might look like. Encroaching vegetation around the historic community building, the company store, the machine shop, the powerhouse, and the leaching plant would also be thinned.

Vegetation around historic structures would be selectively thinned to mitigate potential damage to the buildings and to enhance the historic character of the mill town. Vegetation removal would be necessary for lead paint abatement, building stabilization, site regrading, and fire management. In all other instances, natural processes would be allowed to continue. The park would work with private property owners who wanted to conduct selective clearing on their properties in a manner consistent with historic district goals and objectives. The park supports the continued functioning of the community garden.

The NPS would explore channelization of National Creek as one alternative to protect cultural and natural resources

from seasonal flooding through the historic administrative area and west of the historic railroad trestle. This would be consistent with historic channelization structures and methods, while acknowledging the post-mine re-establishment of natural stream processes. Other alternatives evaluated to protect historic resources include, moving structures and re-establishing the dam. The NPS realizes that none of the alternatives may be successful and flooding may continue to occur.

Parts of the NHL were not public land before the National Park Service acquired the property, and it was not open to subsistence uses. Hunting, berry picking, and gathering firewood would have only been permitted with permission of the previous landowners. As it is now public lands, subsistence activities would be permitted. However, if it appeared that such activities would interfere with NPS management of the property, the agency could seek to limit some subsistence uses.

Interpretation

The National Park Service would enter agreements with qualified local providers to conduct guided tours. For consistency and accuracy of interpretive content, yearly training would be provided by NPS. Interpretive programs at Kennecott would be expanded from existing levels, enabling visitors to learn about the mines and the mill town, the historic relationship of Kennecott to McCarthy, natural resources, and the contemporary community through a variety of media, interpretive techniques, and programs. The guided tours would be expanded to include a wider variety of tour subject matter and tour lengths.

Evening and special programs conducted by NPS personnel would continue. They would be conducted in various locations, including the historic company store and community building. The park also would offer seasonal interpretive tours through public areas. Consistent with the management philosophy a limited number of unobtrusive interpretive displays would be designed and installed in areas open to the public or where the public has a view into a structure such as in the leaching plant, powerhouse, the machine shop, and the concentration mill. In all cases, the park would work with commercial and nonprofit organizations, primarily locally based, using universal design principles to establish accurate and consistent interpretive information and program content. A bookstore offering educational and informational material, interpretive books, posters, and similar products would be encouraged in the historic company store. Interpretive wayside displays would be established in the historic administrative area north of National Creek in association with the former Birch house and the buildings that were the manager's house, the staff house, and the manager's office.

The safety of potential tours to the mine sites and through the underground tunnels would be assessed, and the National Park Service would evaluate the possibility of offering one or more such tours in the future.
A short, captioned video production of the Kennecott story would be produced and displayed in the company store during visitor hours for a historical overview.

Interpretive wayside exhibits would be established in conjunction with selected circulation routes.

The development of interpretive exhibits, brochures, walking tours, and site-related information for Kennecott would be coordinated with the McCarthy museum so that they would be complementary and not competing. NPS would work with interested groups in the development of walking tour materials, brochures, and other interpretive media that would be available for their own use and for NPS use.

Accessibility

The Department of the Interior has administratively determined that it will follow the Americans with Disabilities Act Accessibility Guidelines, provided by the U.S. Architectural and Transportation Barriers Compliance Board, when such design guidelines are equal to or greater than those of the Uniform Federal Accessibility Standards. Since the Americans with Disabilities Act (ADA) was based on the requirements of section 504, ADA regulations and technical assistance materials, especially title I, provide additional in-depth resources for implementation of a reasonable accommodation process. The NPS would invite a panel of people with expertise in issues pertaining to handicap accessibility. The group will work with the NPS in developing a plan that provides long-term guidance on issues of programmatic and physical accessibility for the site.

Administration and Operations

Park Management

The park would pursue a short-term lease in a private building for onsite administrative office space and storage for interpretation and maintenance. These operations eventually would be relocated into the company store as funding became available for the necessary rehabilitation to bring the structure into regulatory compliance as an operations facility.

The National Park Service would enter if at all possible into multi-year agreements for others to conduct building tours, and to adaptively reuse some structures. All park-related management operations eventually would be located in the company store. Preference would be given to hiring local residents for concession agreements and for all rehabilitation and stabilization efforts undertaken and administered by the National Park Service.

The National Park Service would continue to evaluate opportunities to acquire additional properties and/or easements within the NHL as those opportunities arose. Acquisition would be limited to willing sellers on a priority basis. Priorities would be determined according to the land use designations outlined in this plan. (See Land Protection Plan map.)

Living space for the short-term and long-term seasonal , permanent and contractor employees would be managed in a variety of ways. Living space in the historic west bunkhouse would be made available for some employees as the rehabilitation of that structure was completed. Other structures that the NPS acquired would be evaluated as potential living quarters. Temporary cabins would be placed on NPS property that would be utilized for living space. Offsite housing would be sought as well. Additionally, some NPS employees and contractors' employees would find their own housing at market rates.

Work on historic buildings would be done between May and October of each year. Restroom, shower and laundry facilities would be required for work crews.

NPS Utilities and Infrastructure

Administrative and maintenance storage would be accommodated in the lower level of the company store. This would include the storage of minor equipment and materials. Hazardous materials, vehicles, fuel, garbage, and large materials would be stored at remote locations, including the McCarthy airstrip.

Vault toilets would be provided for visitor use along the main road through the site. The toilets would be installed in compliance with applicable Alaska Department of Environmental Compliance (ADEC) regulations. Toilets would be pumped every fall by contract and the sewage hauled to Glennallen. The park would seek long-term strategies for developing a septic system on NPS property or, if feasible, tying into a community sewer system to provide service to NPS facilities south of National Creek.

Bearproof trash containers would be placed at strategic locations along the main road. Trash would be hauled across the pedestrian bridge at McCarthy as needed and taken to a park-owned solid waste transfer facility at the end of McCarthy Road. A planned transfer facility would feature an incinerator, recycling bins, and dumpsters. Wastes associated with stabilization (lumber, packaging, and construction materials) would be hauled by a contractor from the transfer site to an approved landfill. Lumber coated with lead paint would be stockpiled and annually hauled across the river for incineration at the transfer site.

Generators and solar photovoltaic equipment would supply power for NPS structures when appropriate and feasible. In conjunction with community entities, the park would pursue long-term power supply strategies. Photovoltaic power, hydroelectric generation from National Creek, or a centralized community generator would be considered among other possibilities. Consideration will be given to technologies that are compatible and consistent with the cultural and natural environment of the abandoned Mill Site Area. Any potential threats to water resources from the construction and use of this type of facility would be addressed in a separate document.

No water would be supplied for visitors until the company store building was rehabilitated. Efforts would be made to arrange for a long-term water supply for visitors and for NPS operational use. This might be achieved by drilling a well or developing a surface water collection and treatment system on National Creek. The system installed would be to ADEC standards and preclude any conflict with other landowners.

Fuel for portable generators and all-terrain vehicles (ATVs) would be hauled in small quantities across the footbridge corresponding to immediate needs. As fuel requirements increase, aboveground bulk storage tanks would be located on NPS-leased property at the McCarthy airstrip. A contractor would deliver diesel fuel by air or ground transportation to a bulk tank. Fuel would be transferred from the bulk tank to Kennecott in a pickup-mounted tank.

Safety and Security

Hazardous materials and debris that could present safety concerns would be removed from NPS properties. This would include items like boards with exposed nails, shards of metal, cable fragments, miscellaneous tools or machinery, and other potentially dangerous articles.

NPS would initiate a program to limit and control access to buildings. Signs restricting or prohibiting access into NPS properties would be placed in appropriate locations. Broken doors and locks would be repaired and replaced as appropriate. Windows would be replaced, and mechanisms to prevent unauthorized and unsafe access would be used such as shutters, wire mesh, or other appropriate devices. Identified visitor access routes into and around buildings would be improved to remove all immediate dangers, and signs would be located appropriately to indicate safe routes.

According to the National Fire Protection Association, the single largest cause of fire in historic buildings is arson. The NPS would undertake a fire assessment and implement a fire prevention program. Fire extinguishers would be placed in all NPS-owned properties. Fire escape routes would be identified for all NPS-owned buildings, and battery lights would be available for emergencies. A local year-round caretaker would be hired to provide site security.

The park would work with the community to improve community firefighting capabilities, including participating in a volunteer fire department for the mill town and the ability to temporarily dam National Creek and pump water for fire suppression. A portable pump and hose would be on hand to draw water from National Creek for firefighting. There are existing water rights, and future requests to withdraw surface water would be analyzed individually.

In the long term, a system would be established to detect fire and security risks on all NPS-owned structures. As a water supply was developed, sprinkler systems would be installed in the visitor center and other occupied NPS buildings south of National Creek. The park would initiate hazardous-fuel reduction measures around NPS-owned properties to reduce the fire hazard from adjacent landscape elements and would work with the community to reduce fire hazards on private properties.

The park would continue to work with the community to develop a strategy for community-wide emergency medical services. Law enforcement would continue to be addressed individually through various jurisdictional entities including the NPS, where appropriate.

Hazards

As part of the acquisition of the Kennecott properties by the National Park Service, a number of stipulations pertaining to hazardous wastes and lead paint were established. The National Park Service has entered agreements with the Alaska Department of Environmental Compliance, the U.S. Environmental Protection Agency, and the Justice Department. Under those agreements, the National Park Service affirmed its obligation pertaining to the abatement of lead paint hazards in accordance with state and OSHA regulations pertaining to worker safety and training. Asbestos will be removed from Jumbo Mine; Erie Mine would be closed to access due to asbestos; and monitoring will be conducted in the dumpsites at the mill town. The historic dumps do not pose an unacceptable risk, but the groundwater will be monitored for hazardous substances.

Budget

The table below describes both projects that are ongoing and those that are anticipated within the next five years. There is no guarantee that projects on the requested list will be funded. The full scope of work and the budgetary requirements are presently being developed for a longer stabilization effort. As the NPS begins to work at the site, questions and operational procedures pertaining to logistics, production and capabilities of the local work crews, potential contracting options and technical difficulties are becoming more clearly defined. Accordingly, funding requirements in subsequent years will be clearer

COMPLETED OR ONGOING PROJECTS	Costs ($)
STRUCTURAL STABILIZATION	
Stabilize Ore Chute, Repair Mill Building, Regrade Creek area	225K
Correct Unsafe Building Deficiencies	55.7K
Stabilization of Kennecott Machine Shop & Railroad Depot	180K
Lead Paint Mitigation	1.5M
Stabilize Recreation Hall	150K
RESEARCH & DOCUMENTATION	
Collection Management Plan for Machine Shop	47.5K
Implementation of Kennecott Cultural Landscape Report	30.4K
Produce Kennecott Kids Oral History	10K
ENVIRONMENTAL	
Mine Openings Survey, Design and Safing	25K
FUTURE REQUESTS	**Costs ($)**
STRUCTURAL STABILIZATION	
Stabilization of Assay Building.	60K
Stabilization of Mill Building	140K
Stabilization of Manager's Office & Store	130K
Stabilization of Tram Turnhouse, Tailings Hoist House & Refrigeration Plant	120K
Stabilization of West Bunkhouse & Power Plant	120K
Stabilization of Kennecott Leaching Plant	140K
Rehabilitate Kennecott Store for Visitor Contact Station	700K
RESEARCH & DOCUMENTATION	
Historic Resource Study	150K
Kennecott NHL on CD-ROM	100K
HAER Documentation of Kennecott Tram System	33.6K

Visitation

Completion of major upgrades to the existing Chitina to McCarthy gravel road is not expected within the next five years. While levels of visitation may increase with improved maintenance of the road, high annual increases are not expected. However, when the McCarthy Road is upgraded a re-evaluation of visitor impacts will be needed.

The recently upgraded McCarthy airstrip has the potential for handling a greater number of visitors to the area. The new Princess Hotel slated for opening in Copper Center in 2002 may yield increased visitation by this means. However, it is not known at this time how many visitors this may entail.

Promotion of the area needs to be moderated by the desire of the NPS and the community to offer visitors a quality experience, and to minimize impacts on the surrounding community and natural areas.

Anticipated Visitation-

From McCarthy Road /Chitina Roundtable Project, April 2000 and State of Alaska Department of Transportation and Public Facilities . Statistics are from the low growth scenario of .75%

Year	Anticipated Number of Visitors by Road (vehicles)	Anticipated Number of Visitors by Air (planes)
2000	8,012	470
2005	8,704	822
2010	9,527	1174
2015	11,098	1526
2020	11,864	1878

Appendix B: Compendium of Sensitive Sites

The National Park Service is required by federal regulations in Title 36 CFR 2.1(5) to protect areas such as Kennecott National Historic Site by designating areas and conditions under which people may visit and use the cultural and archeological sites. The designations and conditions are designed to protect sensitive cultural and archeological sites and to protect the public from hazards in those sites. The Park Service proposes to continue to permit access to the Kennecott Historic Site with many of the same conditions that existed when the area was private property. The National Park Service does not intend these regulations to regulate the actions of people on private property in the National Historic Site.

The Park Service will continue to permit public access to the grounds throughout the historic site.

CONDITION 1) Entry is prohibited into buildings that are barricaded or signed as closed. Do not pass beyond barricades, climb through windows, or remove boards to enter closed buildings.

This closure protects both the historic structures and contents from vandalism and the public from the safety hazards found in these unstable buildings.

CONDITION 2) Mine tunnels and other openings in the Kennecott Historic Site are closed to entry.

STAY OUT AND STAY ALIVE. These abandoned mines contain hazards that could result in serious injury or death. They have decayed support timbers, unsafe ladders, rotten structures, unstable explosives, deep pools of water, cave-ins, rocks falling from unstable ceilings and walls, deadly gas, lack of oxygen, concealed or thinly covered vertical shafts in tunnel floors. YOU ARE COURTING SERIOUS INJURY OR DEATH BY ENTERING THESE OPENINGS. STAY OUT AND STAY ALIVE.

CONDITION 3) Camping is not permitted in, or on, any of the historic structures in the Kennecott National Historic Site. Camping is not permitted in the mill town. The mill town is the collection of buildings clustered around the mill on both sides of National Creek.

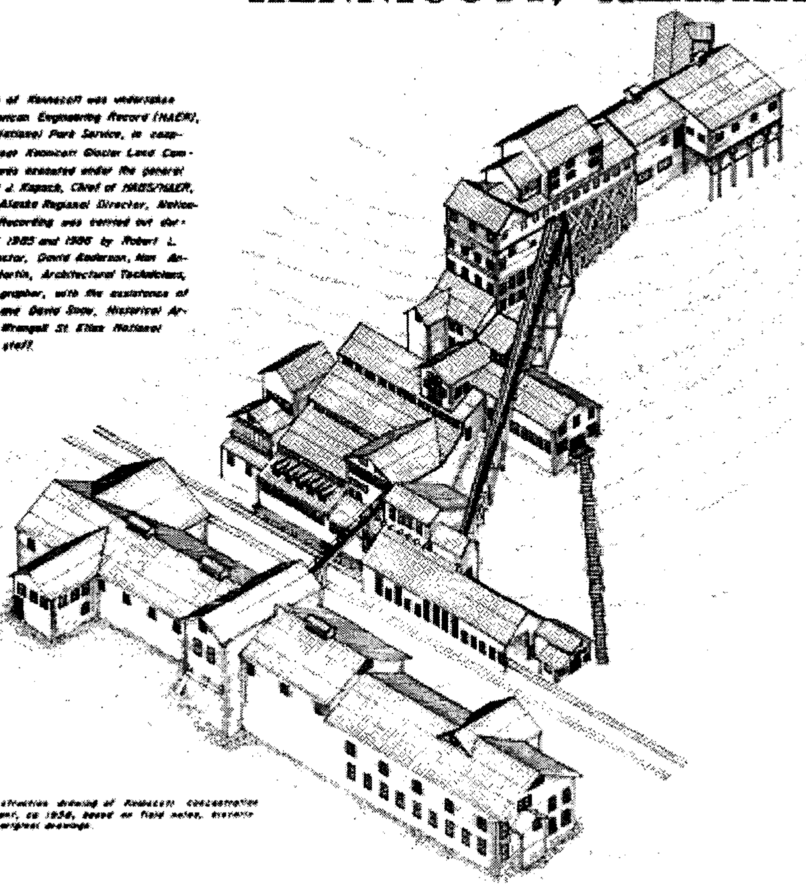
Part of the attraction of the Kennecott Mill Town is the historic scene presented by the mill buildings. Camping is prohibited to preserve the historic scene and to lower the temptation to use the buildings for shelter. Camping is permitted north of Jumbo Creek.

CONDITION 4) Fires are not permitted inside of any building or within 300 feet of any of the historic buildings or structures in the Kennecott National Historic Site.

The historic buildings and structures are made of wood There is no way to put out a structural fire at the site.

KENNECOTT COPPER CORPORATION
KENNICOTT, ALASKA

Documentation of Kennecott was undertaken by the Historic American Engineering Record (HAER), a Division of the National Park Service, in cooperation with the Great Kennicott Glacier Land Company. The project was executed under the general direction of Robert J. Kapsch, Chief of HABS/HAER, and Boyd Evison, Alaska Regional Director, National Park Service. Recording was carried out during the summers of 1985 and 1986 by Robert L. Spude, Project Director, David Anderson, Nan Anderson, and Ken Martin, Architectural Technicians, John Lowe III, Photographer, with the assistance of Richard Anderson and David Snow, Historical Architects, and the Wrangell St. Elias National Park and Preserve staff.



In 1900, prospectors discovered the copper outcrops located atop Bonanza Ridge in the Wrangell Mountains, Alaska. The high-grade surface ore, assaying up to 70% copper, astounded the mining world, but years of litigation over ownership and the distance from cheap transportation delayed development of the mines. In November, 1906, the houses of JP Morgan and Company and the Guggenheims united to consolidate ownership of the richest claims, fund mine work, build a milling plant, and complete the Copper River and Northwestern Railway from the coast to the Kennecott mines. The railroad reached Kennecott on March 29, 1911, and full scale production began.

The high grade ore was shipped directly to the Guggenheims' Tacoma smelter, while low grade ore was first processed in the concentration mill below the mines. The mill town and mines were equipped with advanced machinery and the latest technological innovations in mineral beneficiation. The first successful application of the ammonia leaching process occurred here in 1913.

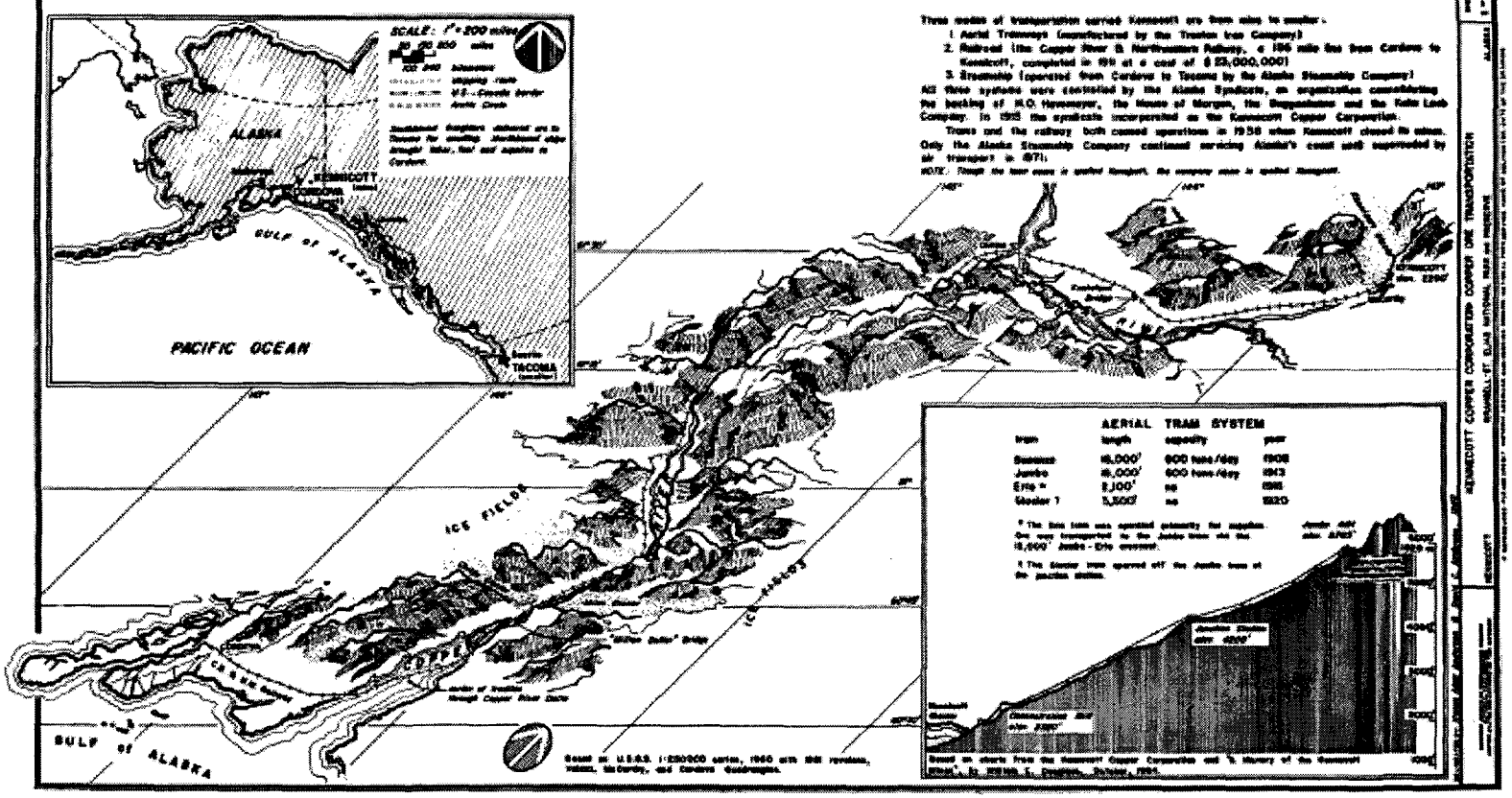
In 1916, the most productive year, the copper produced amounted to 53,085.8 tons, making the Kennecott mines the third-largest producer in the United States. That year, the newly formed Kennecott Copper Corporation began acquiring other properties which would eventually include mines throughout the world.

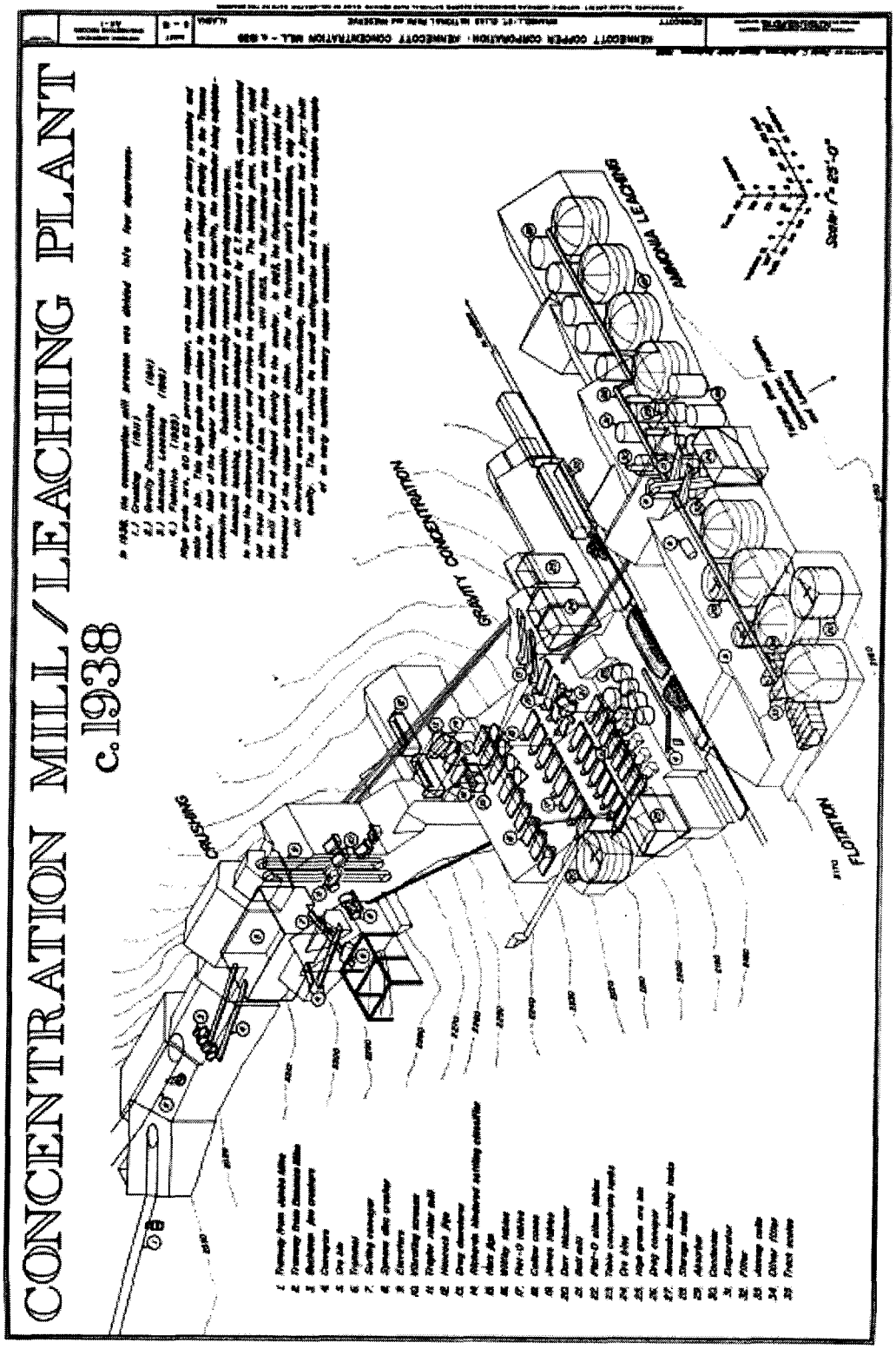
The Kennecott deposit, though a unique, high grade deposit, proved to be of limited extent. Altogether, $300 million worth of copper and silver were produced by the time Kennecott closed the mines in 1938. Standing above the mill town, the mill and its machinery remain today, a classic example of early twentieth century mining technology, while the Kennecott Copper Corporation continues as an international mining conglomerate.

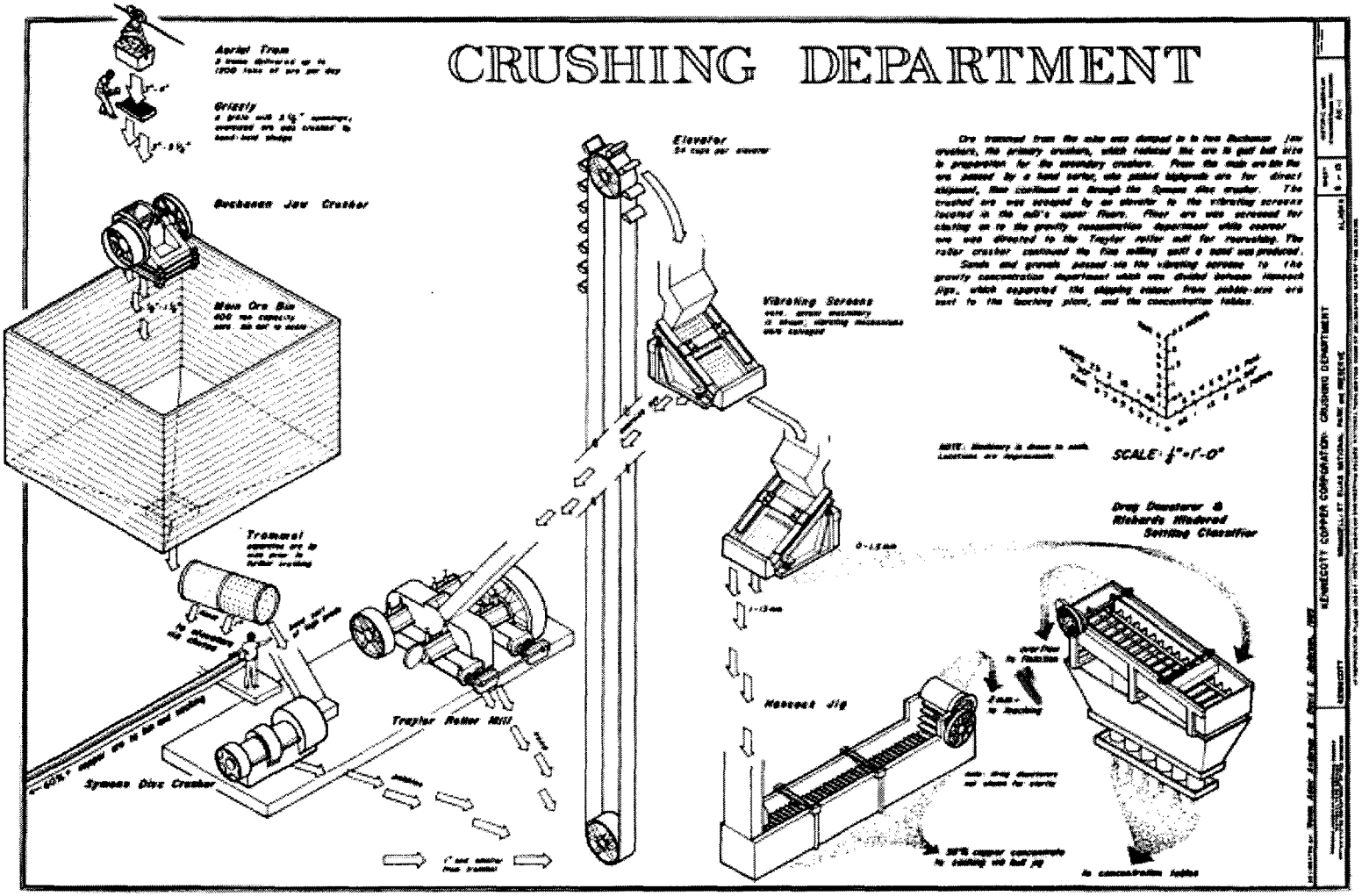
Note: Partial reconstruction drawing of Kennecott concentration mill and leaching plant, ca 1938, based on field notes, historic photographs, and original drawings.

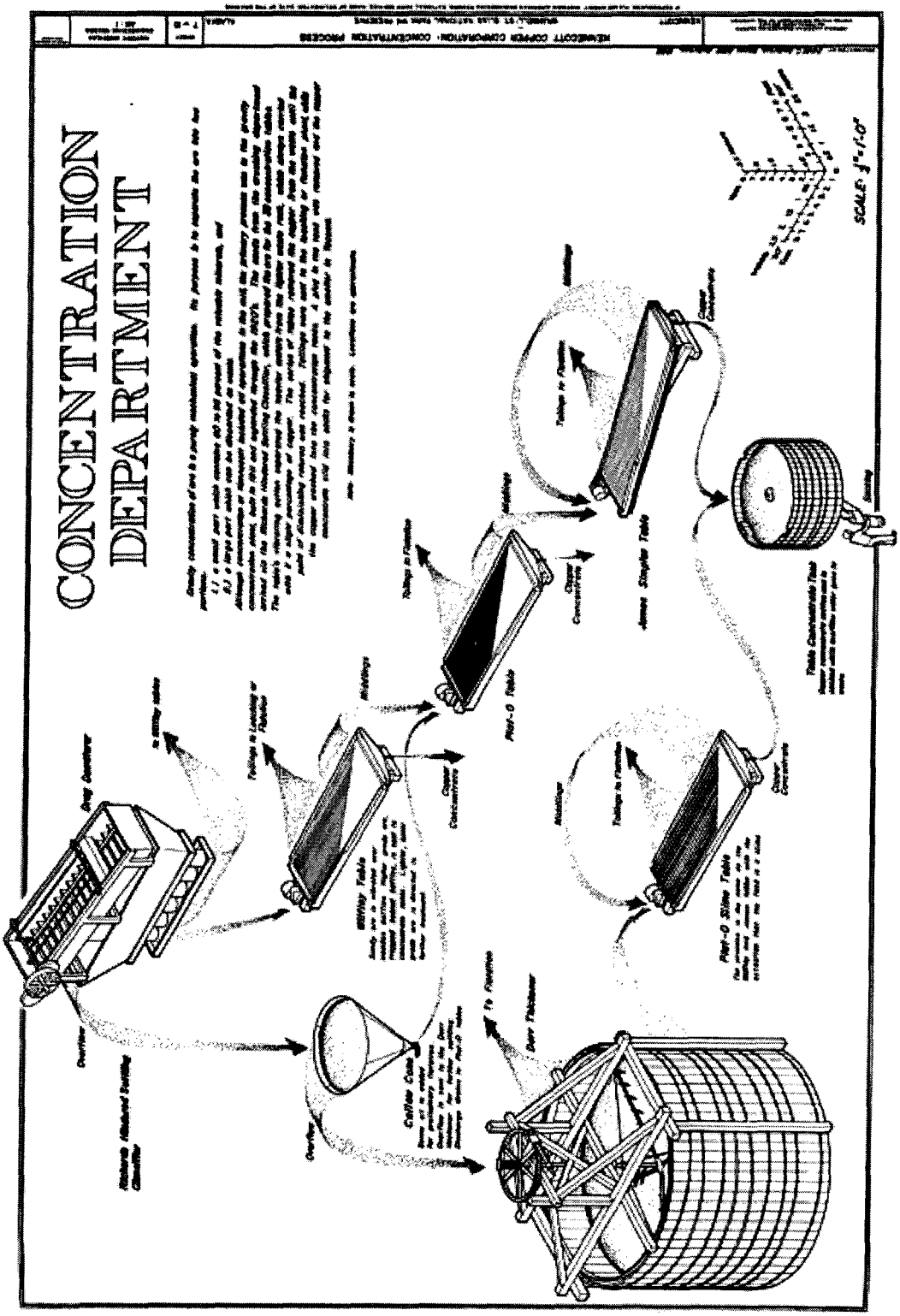
Note: The town and glacier are named for Alaska explorer Robert Kennicott. The company name is a misspelling of the glacier name.

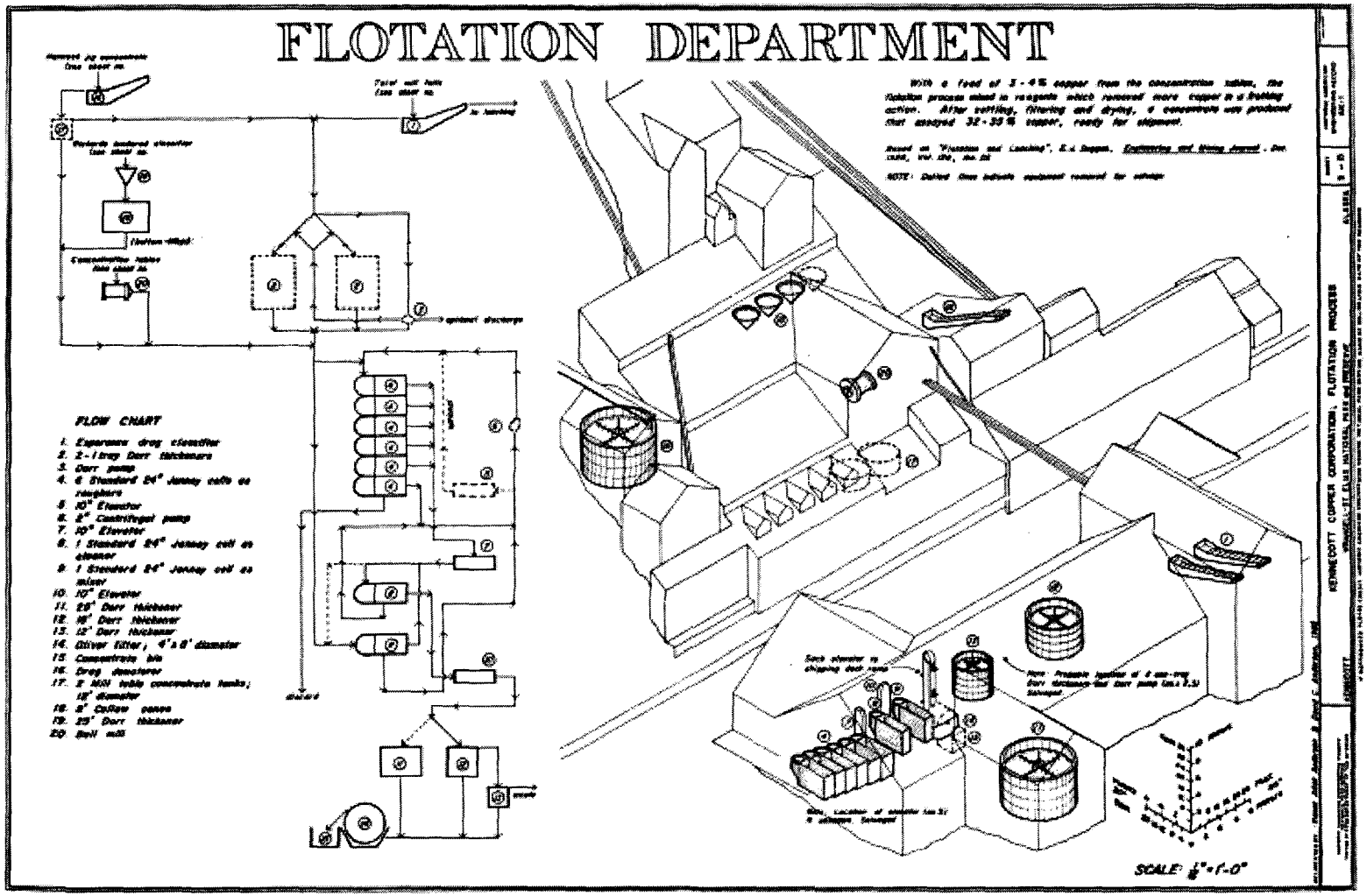
COPPER ORE TRANSPORTATION
1911-1938




CONCENTRATION MILL / LEACHING PLANT
c.1938
CRUSHING
GRAVITY CONCENTRATION
AMMONIA LEACHING
FLOTATION


CRUSHING DEPARTMENT
Aerial Tram
Grizzly
Buckeye Jaw Crusher
Mine Ore Bin
Trommel
Symons Disc Crusher
Traylor Roller Mill
Elevator
Vibrating Screens
Hancock Jig
Drag Classifier &
Richards Hindered
Setting Classifier
SCALE: 1"=1'-0"
KENNECOTT COPPER CORPORATION: CRUSHING DEPARTMENT


CONCENTRATION
DEPARTMENT


FLOTATION DEPARTMENT
FLOW CHART
1. Esperanza drag classifier
2. 2-1 tray Dorr thickeners
3. Dorr pump
4. 6 Standard 54" Jonsay cells as roughers
5. 10" Elevator
6. 6" Centrifugal pump
7. 10" Elevator
8. 1 Standard 54" Jonsay cell as cleaner
9. 1 Standard 54" Jonsay cell as miner
10. 10" Elevator
11. 28' Dorr thickener
12. 18' Dorr thickener
13. 12' Dorr thickener
14. Oliver filter, 4' x 8' diameter
15. Concentrate bin
16. Drag classifier
17. 2 Mill table concentrate tanks, 18' diameter
18. 6" Callow cones
19. 25' Dorr thickener
20. Ball mill
SCALE: 1/8" = 1'-0"

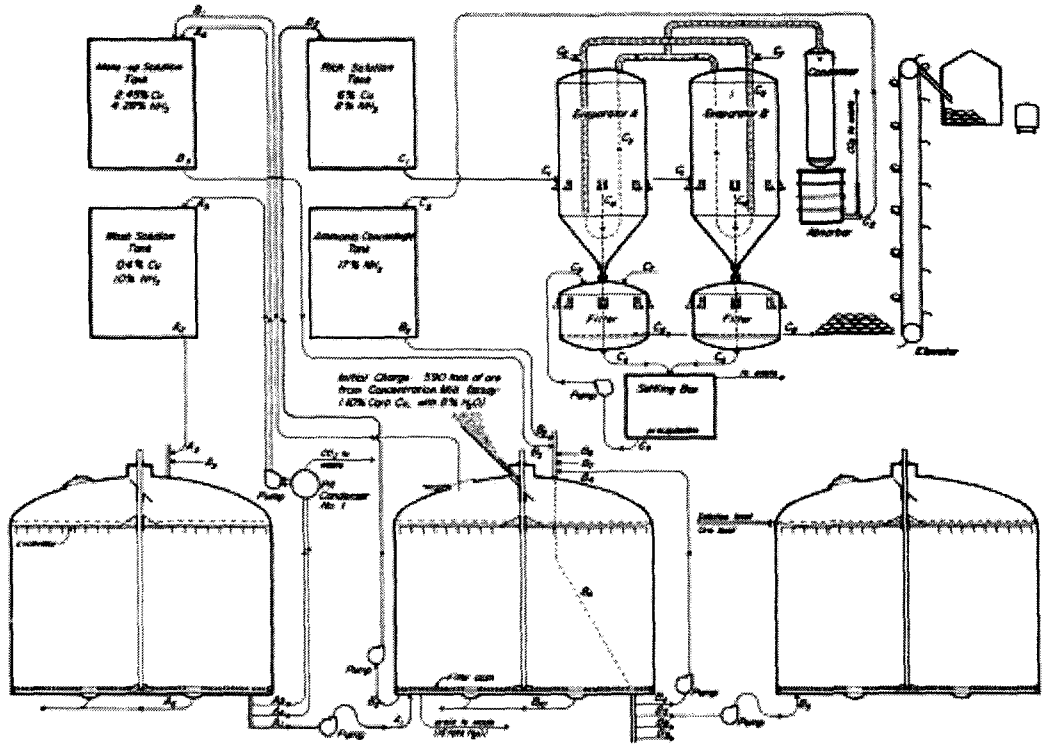
AMMONIA LEACHING FLOW DIAGRAM

SOLUTION SECTION
(Showing 1 set of Evaporators, designated "A" & "B")

- C_1 81 tons of rich solution to A & B.
- C_2 Steam into A — vapors from A into B to condensers. Ammonia concentrates to storage tank (storage (7% NH_3).
- C_3 After bottled out, solution assays .03% NH_3 in A. Steam off A turned directly into B.
- C_4 Solution from A pumped into filter. Filtrate pumped to settling box. Precipitate in filter assay 75% Cu (with 28% H_2O)
- C_5 A recharged - same as C.
- C_6 Same as C. (Reversed).
- C_7 Filter cleaned after receiving 3 charges of 45 lb. for 4 to 5 hours. Condensate to settling box.
- C_8 Precipitate (assay: 75% Cu with 8% H_2O) sacked and sent up to storage room for shipment to smelter.
- C_9 Precipitates from settling box pumped into filter at end of each month.

LEACHING SECTION
(Showing 4 of 7 solution storage tanks and 3 of 6 leaching tanks - Leaching Tank No. 1 "A"; Leaching Tank No. 2 "B")

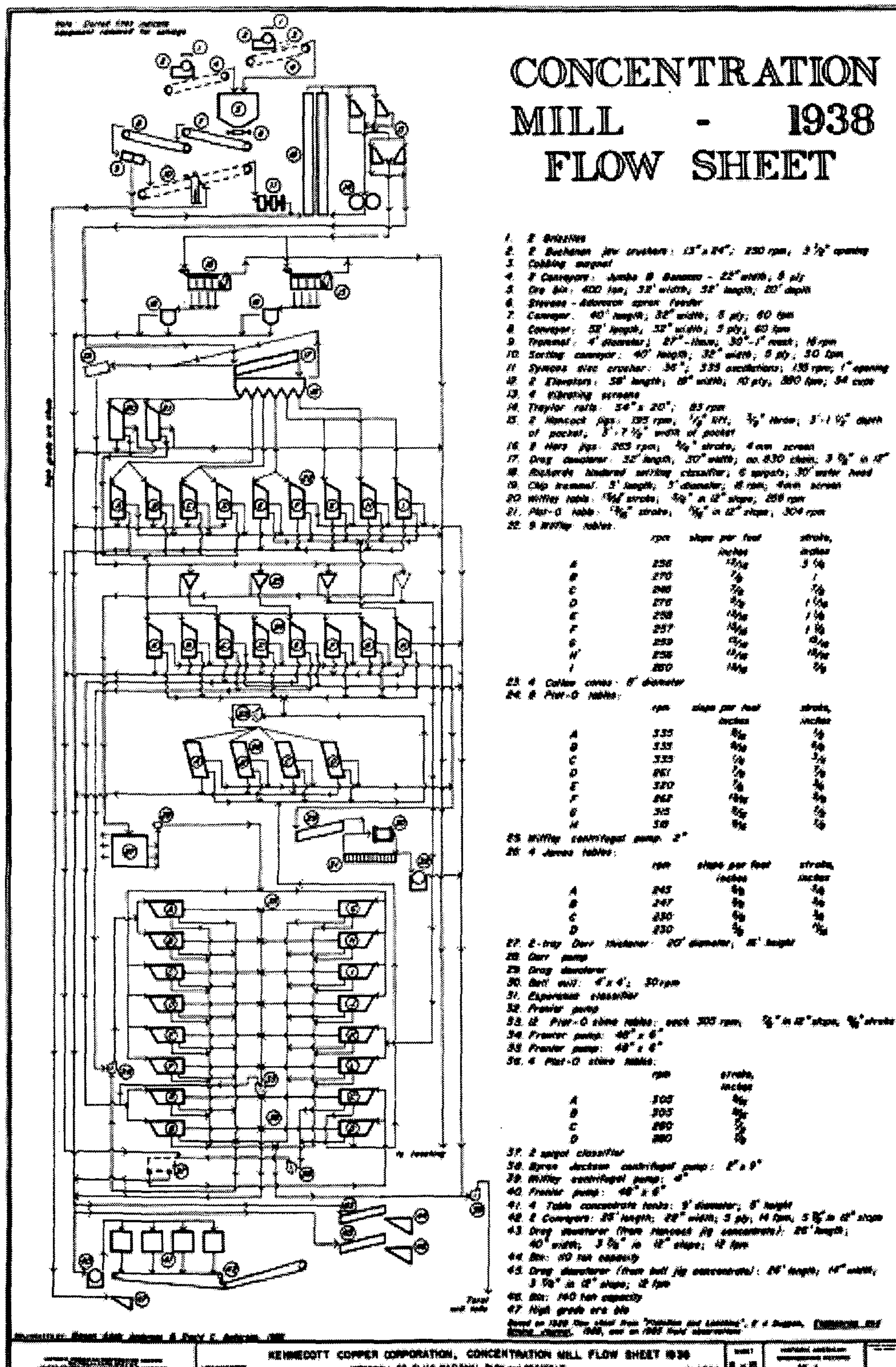
- A_1 End of 32 hr. circulating leach and start of pumping direct to L.T No 2. 164 tons solution (assay: 4.5% Cu, 8.0% NH_3).
- A_2 24 tons of wash solution pumped on top of charge after start of A_1 solution (assay: 0.4% Cu, 1% NH_3)
- A_3 35 tons of steam at 110 lbs. pressure.
- A_4 After charge in L.T No 2 is covered completely, 45 tons of solution (assay: 2.45% Cu, 4.28% NH_3) is pumped off via pH condensers to make - up tank.
- A_5 15 tons of wash solution (assay: 0.4% Cu, 1.0% NH_3)
- A_6 Pumped to waste
- B_1 5 tons of diluted solution sprinkled to wash tank by gravity (assay: 0.9% Cu, 1.0% NH_3). If pumped to waste, which is not always practical owing to varying amount of H_2O in tank, assay not to exceed 0.7% NH_3
- B_2 At end of 12 hour shut down, 84 tons of rich solution is pumped to storage tank for distillation (assay: 6 % Cu, 8 % NH_3). At same time 40 tons of ammonia concentrate is pumped on top of charge (assay: 17% NH_3)
- B_3 After concentrate is pumped on, 45 tons of make-up solution is added to recover charge as before B_2 (assay: 2.45% Cu, 4.28% NH_3)
- B_4 32 circulating leach (assay at start: 1.8% Cu, 8.0% NH_3)
- B_5 Same as A_1 (Leaching Tank No. 1)
- B_6 24 tons of wash solution pumped on top of charge after start of B_5 to leaching tank No. 3.
- B_7 35 tons of steam at 110 lbs. pressure, same as A_3 (L. T No. 1)
- B_8 Same as A_4 (Leaching Tank No. 1) via pH condenser No. 2.
- B_9 Same as A_5 (Leaching Tank No. 1) via pH condenser No. 2
- B_{10} Same as A_6 (Leaching Tank No. 1)



Note: This drawing represents one complete cycle in the leaching plant.

Based on K.C.C. Leaching Plant Flow Diagram, 1931.

KENNECOTT COPPER CORPORATION - AMMONIA LEACHING FLOW DIAGRAM


CONCENTRATION
MILL - 1938
FLOW SHEET
KENNECOTT COPPER CORPORATION, CONCENTRATION MILL FLOW SHEET 1938

APPENDIX D: KENNECOTT NATIONAL HISTORIC LANDMARK LANDCOVER TYPES

	Landcover Type	Acres	% of Total Acreage	% of Total Cloudless Acreage	% of Total Vegetated Acreage
Vegetated Areas					
Trees	Closed broadleaf	380.29	2.68	3.04	6.75
	Open white spruce	128.54	0.91	1.03	2.28
	Open broadleaf	20.24	0.14	0.16	0.36
Total acreage		**529.07**	**3.73**	**4.23**	**9.39**
Low and tall shrubs	Closed tall shrub	1,020.10	7.20	8.15	18.09
	Open low shrub	767.02	5.41	6.13	13.60
	Closed low shrub	462.57	3.26	3.69	8.20
	Open tall shrub	327.58	2.31	2.62	5.81
Total acreage		**2,577.27**	**18.18**	**20.59**	**45.70**
Dwarf shrubs		**689.63**	**4.87**	**5.51**	**12.23**
Herbaceous plants	Graminoid	239.07	1.69	1.91	4.24
	Dry Bryoid	89.85	0.63	0.72	1.59
	Wet Bryoid	12.45	0.09	0.10	0.22
	Forb	1.33	0.01	0.01	0.02
Total acreage		**342.70**	**2.42**	**2.74**	**6.07**
Sparse vegetation[1]		**1,499.13**	**10.57**	**11.970**	**26.59**
Total acreage		**5,637.80**	**39.77**	**45.04**	
Unvegetated Areas	Barren[2]	5,077.16	35.82	40.54	
	Glacier/snow	1,799.36	12.70	14.37	
	Water	7.78	0.05	0.06	
Total acreage		**6,884.30**	**48.57**	**54.97**	
Clouds/shadows		**1,650.36**	**11.64**		

Classification based on Pacific Meridian Resources, "Wrangell-St. Elias National Park and Preserve Landcover Mapping Project: Final Report" (1997). Map has an overall minimum classification accuracy of 78.7%.

APPENDIX E: RARE PLANT COLLECTIONS FROM BONANZA RIDGE

ABBREVIATIONS:
G = global rank
R = state rank
G1 = critically imperiled globally, (5 occurrences or fewer)
G2 = imperiled globally (6–20 occurrences)
G3 = either very rare and local throughout its range or found locally in a restricted range, 21–100 occurrences, threatened throughout its range
G4 = widespread and apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery
G5 = demonstrably secure globally, although it may be quite rare in parts of its range
T# = global rank of the described subspecies or variety
G#G# = global rank of species uncertain, best described as a range between the two ranks
G#Q = some uncertainty about taxonomic status that might affect global rank
S1 = critically imperiled in the state, 5 or fewer occurrences
S2 = imperiled in the state, 6–20 occurrences
S3 = rare or uncommon in the state, 21–100 occurrences

Taxon	Common Name	Family	AKNHP Rank[1]	Collector	Coll. No.	Date	Habitat	Herb[2]
Aphragmus eschscholtzianus	Aleutian cress	Brassicaceae (mustard family)	G3/S3	Nordell & Schmitt	163	1976		LD; ALA
Carex preslii	Presl's sedge	Cyperaceae (sedge family)	G4/S1	Nordell & Schmitt	544	1976	Very common along the old road, up to about 1,200 m., forming dense tussocks up to 40 cm tall	LD
Cystopteris montana	Mountain fragile fern	Dryopteridaceae (wood fern family)	G5/S3	Nordell & Schmitt	580	1976	Solitary specimens in *Populus* scrub	LD; ALA
Juniperus horizontalis	Creeping savin	Cupressaceae (cypress family)	G5/S1S2	Nordell	s.n.	1976		LD; ALA
Minuartia biflora	Mountain stitchwort	Caryophyllaceae (pink family)	G5/S2	Nordell & Schmitt	95 416b 450	1976		LD; ALA
Papaver alboroseum	Pale poppy	Papaveraceae (poppy family)	G3/S3	Dodge		1993	Rubble and talus slope, 5,800 ft.	WRST
Papaver albsroseum	Pale Poppy	Papaveraceae (Poppy Family)	G3/S3	Nordell & Schmitt	1 101 160 166 171 301 464	1976		LD; ALA

1. AKNHP = Alaska Natural Heritage Program
2. Herbarium of deposition. ALA = University of Alaska, Fairbanks Museum. LD = Lund University, Norway; WRST = Wrangell-St. Elias National Park and Preserve.

APPENDIX F: RARE PLANTS KNOWN TO OCCUR IN THE CHITINA VALLEY
(besides those on Bonanza Ridge that are listed in Appendix E)

ABBREVIATIONS:
G = global rank
R = state rank
G1 = critically imperiled globally, (5 occurrences or fewer)
G2 = imperiled globally (6–20 occurrences)
G3 = either very rare and local throughout its range or found locally in a restricted range, 21–100 occurrences, threatened throughout its range
G4 = widespread and apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery
G5 = demonstrably secure globally, although it may be quite rare in parts of its range
T# = global rank of the described subspecies or variety
G#G# = global rank of species uncertain, best described as a range between the two ranks
G#Q = some uncertainty about taxonomic status that might affect global rank
S1 = critically imperiled in the state, 5 or fewer occurrences
S2 = imperiled in the state, 6–20 occurrences
S3 = rare or uncommon in the state, 21–100 occurrences

Taxon/Family/Common Name	AKNHP Rank[1]	Number of Occurrences in Park	Habitat
Agoseris glauca Asteraceae (sunflower family) pale agoseris	G4G5 S1	2	Alpine meadows
Agrostis thurberiana Poaceae (grass family) Thurber's bentgrass	G5 S2	2	Mesic alpine meadows
Arabis calderi Brassicaceae (mustard family) Calder's rockcress	G3G4 S1 New to Alaska	1	Alpine and subalpine meadows
Arabis codyi Brassicaceae (mustard family) Cody's rockcress	G1G2 S1 New to Alaska	1	Unstable alpine slopes
Arabis drepanoloba Brassicaceae (mustard family) rockcress	G? S?[2] New to Alaska	1	Alpine talus slopes
Arenaria longipedunculata Caryophyllaceae (pink family) longstem sandwort	G3G4Q S3	1	Calcareous or serpentine gravels and rock crevices
Arnica mollis Asteraceae (sunflower family) hairy arnica	G5 S1	1	Alpine meadows
Astragalus harringtonii Fabaceae (pea family) Harrington milkvetch	G5T2T3 S2S3	3	Meadows, streambanks and scree
Carex crawfordii Cyperaceae (sedge family) Crawford's sedge	G5 S2S3	1	Well-drained lake and river meadows
Carex eburnea Cyperaceae (sedge family) bristleleaf sedge	G5 S2S3	2	Dry sand or rocky places
Carex interior Cyperaceae (sedge family) inland sedge	G5 S1	1	Wet or damp calcareous meadows

Taxon/Family/Common Name	AKNHP Rank[1]	Number of Occurrences in Park	Habitat
Carex lenticularis var. *dolia* Cyperaceae (sedge family) tufted sedge	G5T3 S3	4	Muddy shores, sheltered ponds, lakes, and river flats
Carex parryana Cyperaceae (sedge family) Parry's sedge	G3G4 S1	1	Wet places, gravel bars
Carex preslii Cyperaceae (sedge family) Presl's sedge	G4 S1	1	Dry grassy alpine meadows
Castilleja miniata Scrophulariaceae (figwort family) scarlet Indian paintbrush	G5 S3	5	Alpine and subalpine meadows
Douglasia alaskana Primulaceae (primrose family) Alaskan Douglasia	G2G3 S1	3	Sandy soil, gravel, scree slopes in the alpine
Draba incerta Brassicaceae (mustard family) Whitlowgrass	G5 S2S3	11	Calcareous screes
Draba kananaskis Brassicaceae (mustard family) longstalk Whitlowgrass	G51Q S1	2	Rocky alpine slopes
Draba oblongata Brassicaceae (mustard family) Whitlowgrass	G3 S?	1	Clay and gravel slopes, silt and sand gravel flats, rocky open areas, exposed hillsides, rocks and swales
Draba porsildii Brassicaceae (mustard family) Porsild's Whitlowgrass	G3 S1S2	7	Alpine scree, gravel and open shale slopes and meadows
Draba praelta Brassicaceae (mustard family) tall Whitlowgrass	G5 S1S3	1	Alpine shale cliffs, moist banks, steep hillsides, limestone talus, subalpine slopes
Draba ruaxes Brassicaceae (Mustard Family) Rainier Whitlowgrass	G3 S2S3	24	Windy ridge, scree slopes and cliffs
Draba stenopetala Brassicaceae (Mustard Family) Anadyr Whitlowgrass	G3 S3	27	Stony ridges and rocky alpine summits
Eriophorum viridi-carinatum Cyperaceae (sedge family)	G5 S2	1	Subalpine and alpine meadows
Erysimum pallasii Brassicaceae (mustard family) Pallas' wallflower	G4 S3	10	Alpine scree, talus, gravel slopes, and meadows; often near animal burrows
Festuca brevissima Poaceae (grass family)	G3 S3	16	Exposed, dry rocky tundra and scree slopes
Festuca lenensis Poaceae (grass family)	G4 S2S3	9	Gravel and scree slopes
Festuca minutiflora Poaceae (grass family)	G? S?[2] New to Alaska	1	Alpine tundra, meadows, and scree slopes
Minuartia dawsonensis Caryophyllaceae (pink family) rock stitchwort	G5 S?	4	Moist, sandy places

Taxon/Family/Common Name	AKNHP Rank[1]	Number of Occurrences in Park	Habitat
Najas flexilis Najadaceae (naiad family) naiad	G5 S1S2	1	Shallow fresh or brackish water
Oxytropis huddelsonii Fabaceae (pea family) Huddelson's locoweed	G3 S2S3	24	Ridge tops, alpine tundra, heath
Phacelia mollis Hydrophyllaceae (waterleaf family) soft phacelia	G2 S2S3	19	Dry slopes, roadsides, sandy or gravelly soils, rock outcrops, and open woods
Potentilla drummondii Rosaceae (rose family)	G5 S1	6	Meadows to ridges, subalpine to alpine
Rumex beringensis Polygonaceae (buckwheat family) Bering Sea dock	G2G3 S2S3	18	Sandy places on tundra, solifluction lobes, frost boils
Salix setchelliana Salicaceae (willow family) Setchell's willow	G3G4 S3	6	Gravel bars and sandy slopes
Saxifraga adscendens ssp. *oregonensis* Saxifragaceae (saxifrage family) small saxifrage	G5T4T5 S2S3	8	Moist gravelly and rocky alpine sites
Stellaria alaskana Caryophyllaceae (pink family) Alaska starwort	G3 S3	24	Rock outcrops, talus slopes and moraines in alpine tundra
Swertia perennis Gentianaceae (gentian family) star gentian	G5 S3	2	Mesic subalpine meadows
Taraxacum carneocoloratum Asteraceae (sunflower family)	G3Q S3	10	Alpine slopes and coarse, well-drained substrates
Thlaspi arcticum Brassicaceae (mustard family) Arctic pennycress	G3 S3	1	Scree slopes and turfy places in alpine tundra
Trichophorum pumilum var. *rollandii* Cyperaceae (sedge family)	G? S?[2] New to Alaska	1	Moist grassy slopes and tundra, willow and alder thickets, meadows and along creeks; alpine and subalpine

NOTE: Plants with an Alaska Natural Heritage Program (AKNHP) state rank of <3 are considered rare.
1. AKNHP = Alaska Natural Heritage Program. G = Global Rank. R = State Rank.
2. Some taxa new to Alaska have not yet been ranked.

Vegetation Documentation for the Cultural Landscape Report: Kennecott Mill Town

Kennecott National Historic Landmark
Wrangell-St. Elias National Park and Preserve

March 1998

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INTRODUCTION

Wrangell-St. Elias National Park and Preserve is in the process of completing a Cultural Landscape Report for the Kennecott town site. As part of that documentation it is necessary to characterize the vegetation, as it existed prior to, during, and after the mining era. Based on fieldwork and photo interpretation conducted in the spring of 1998, this report delineates, describes, and discusses the vegetation of the Kennecott National Historic Landmark for 5 historical time periods:

- Pre-Mining
- 1900-1908
- 1908-1915
- 1915-1938
- Existing Conditions

STUDY AREA

The town of Kennecott (61°28' N, 142°52' W) was built along the active lateral margin of the Kennicott Glacier, at an elevation of approximately 2000 feet. Slope aspect in the town site is generally west, and slopes angles range from 0° (flat) to 25°. Bedrock under the town site consists of greenstone with intrusions of porphyritic dacite (MacKevett, 1978), but soils are primarily derived from the lateral glacial deposits of the Kennicott Glacier. The ages and character completely submerged under ice during both the Early Wisconsin and the Late Wisconsin glaciations (Bateman, 1922), with the ice retreating from its maximum position 17 thousand years ago to approximately its current position by 11.5 thousand years ago (Williams, 1989). Work by Denton and Karlen (1977) in the nearby Skolai Pass region found evidence of two smaller glacial advances during the Holocene: one from 2900-2100 years ago, and a second, slightly smaller one (the Little Ice Age) from 450-138 years ago. Both of these Holocene advances partially covered the study area with advancing ice, and stagnant ice from the latest of these advances is still retreating from the lowest reaches of the study area. With the minor exceptions of fluvial deposits along National Creek, poorly drained peats in topographic depressions, and recently deposited mining tailings, then, soils in the study area have developed from well-drained tills ranging in age from 11.5 thousand years to virtually newborn.

The climate of the Kennicott Valley is transitional between maritime and continental, with long, cold winters and short, warm growing seasons. Mean annual temperature for the Valley is -2° C and mean annual precipitation is 40 cm, distributed mostly evenly throughout the year (Pewe, 1975). Spruce-hardwood forests dominated by white spruce (see attached species list for scientific names of all plants discussed in text) are the predominant forest type on well-drained soils in this region.

Given enough time free from major disturbance, virtually all of the study area (which has little or no permafrost) would likely develop into a spruce-hardwood forest dominated by mature, open to closed stands of white spruce and scattered paper birch over a very dense shrub layer of Sitka alder and willows with an understory of clubmosses, horsetails, and red-currants. But as the following narrative will explain, the Kennecott mill town has a history of major disturbances the result of advancing glaciers, floods, spruce beetle infestations, fire, and humans. The current vegetation of the Kennecott mill town is best understood as a patchwork of related vegetation types in differing stages of primary or secondary succession.

The following is a description of each vegetation unit (polygon) in the mill town site, through each of the key historic periods. Vegetation units are mapped and identified on maps and were delineated to level IV of the Alaska Vegetation Classification (Viereck et al., 1992).

DESCRIPTIONS OF HISTORICAL VEGETATION

Pre-Mining

Before mining development, the land that eventually became the Kennecott mill town was recovering from a series of Holocene Glacial advances as described above. The Kennicott Glacier was still actively depositing till (a heterogeneous mixture of boulders, rocks, sands, silts, and clays with little or no organic materials) as it continued its retreat from the Little Ice Age Maximum. Above that active lateral moraine, the glacier's previous fluctuations had left a series of surficial deposits on the adjacent hillside, three of which were prominent in the study area: (from lowest to highest) the lateral moraine left by the 1860 glacial advance, the lateral moraine left by an earlier Holocene advance (2900-2100 years ago) and subsequently undercut by the Little Ice Age advance, and well-developed soils deposited by a mixture of colluvial processes and the late-Wisconsinan (over 12,000 years ago) glacial advance.

Before 1900, all of these areas were in some successional stage of white spruce forest. Without any photos available of this pre-mining vegetation, and with no evidence of 19th century fires, spruce beetle outbreaks, or human activity in the study area, it is assumed that the age and character of the surficial deposits described above (and not secondary disturbances) provided the primary determinants of vegetation type. Polygons are delineated on the basis of unpublished surficial geology field notes for the study area (Yehle,1996). Because of the lack of photographic evidence, and because the characteristics (species composition and density, individual plant size, etc.) that distinguish early from late-serial stages of white spruce forest are subtle, it should be understood that the vegetation polygon boundaries are approximate.

Before the mining era, there were probably only two exceptions to this close coupling of surficial deposits. First, a wet, poorly drained topographic depression in the northern portion of the study area had a unique mixture of dwarf birch and willow. Second, the immediate vicinity of National Creek from the gorge down to the glacier was periodically flooded, scouring the banks and maintaining an open mixture of alder and willow.

a1) Barren

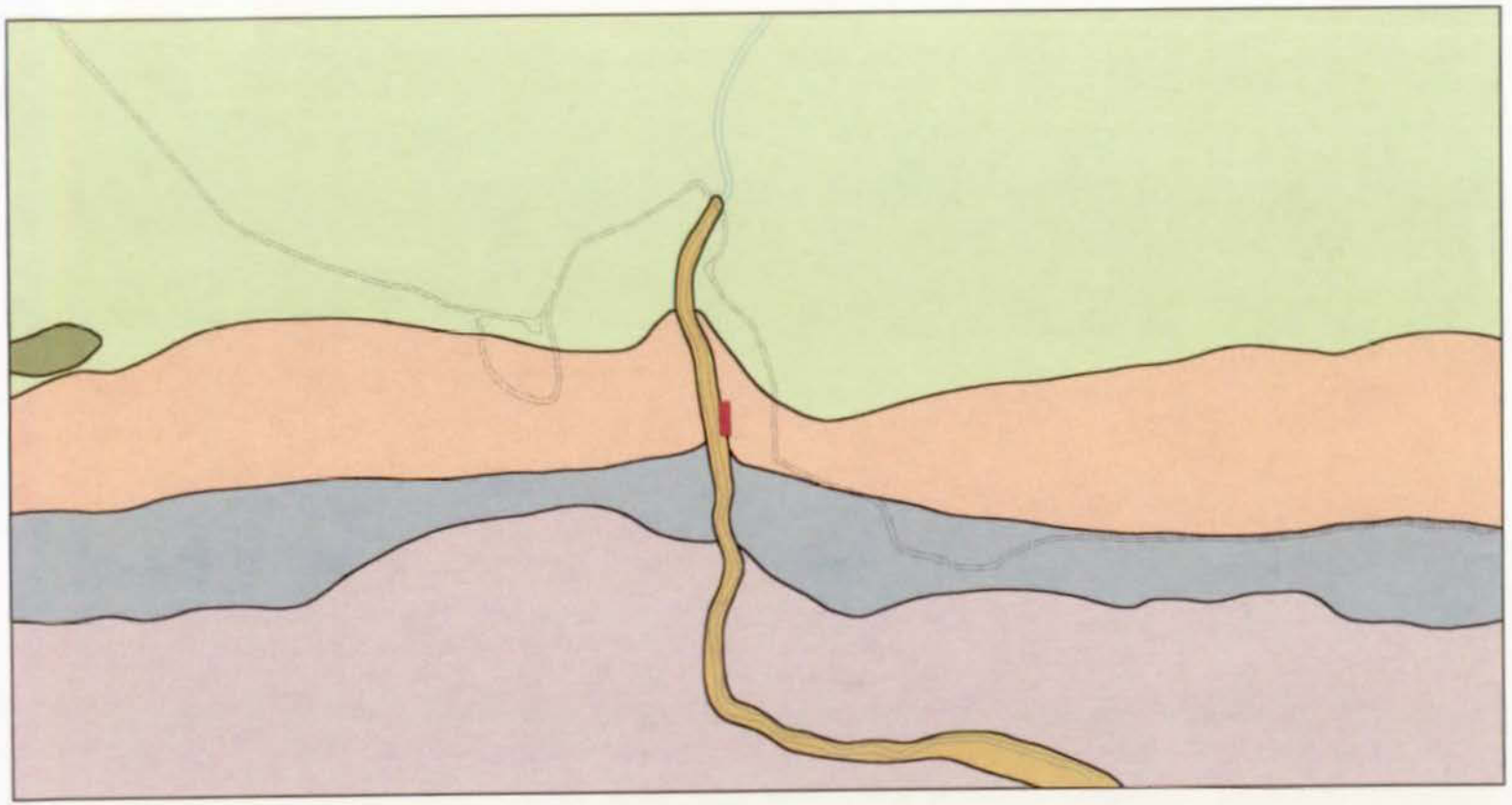
The active lateral moraine of the Kennicott Glacier. A thin covering of barren till overlay ice, which was much higher than it is now, with little to no soil development. On this cold and unstable surface, there was no vegetation here except for the very occasional fireweed, prickly saxifrage, or yellow dryas.

a2) III.B.1.a. Seral Herbs

The recently abandoned lateral moraine of the Kennicott Glacier, deposited during the Little Ice Age advance that peaked around 1860. By this time the moraine had been stabilizing and warming for less than 100 years, but significant colonization by fireweed, yellow dryas, soapberry, and willow seedlings had already taken place. These pioneer plants were contributing organic matter and nitrogen to the barren soil, which probably qualified by this time as excessively well drained entisol: a mineral soil with weak or nopedogenic horizons. The organic (duff) layer was 1-2 cm deep. Successional stage within this polygon varied from still barren to well-developed willow thickets.

I.A.2.e. Open White Spruce Forest

Surficial deposits in this polygon had their origins in the 2900-2100 year old glacial advance, and soils were hence developed to a much greater degree than in #a2. They were well-drained entisols, but with greater



Pre-Mining Era

Vegetation Documentation for Cultural Landscape Report: Kennecott Townsite

quantities or organic matter and nitrogen and a generally deeper duff layer: from 2-8 cm. On the other hand, the Little Ice Age glacial advance tended to undercut the steeper slopes in this polygon, however, destabilizing the ground surface and promoting small sluffs and slides. The mature spruce forest in this polygon was kept somewhat open by this instability and perhaps the cold microclimate generated by the nearby glacier, leaving room for balsam poplars, scattered paper birch, and a fairly dense understory of willow and alder.

a4) I.A.1.j. Closed White Spruce Forest

This area had not been disturbed by glaciation or major landslides in over 10,000 years, and a fairly dense white spruce forest had developed on these inceptisols: moderately well-drained soils with much higher organic matter, base saturation, and nutrient content than the entisols further down slope. Duff layers here ranged from 8-15 cm. There is no evidence of fire, spruce beetle outbreak, or other catastrophic disturbance to this area in the last 500 years, and the forest had developed old-growth characteristics: mixed age distribution, large quantities of standing and downed dead wood in various states of decay, and low recruitment rates for young spruce. Paper birch was a common tree associate, and the understory was sparse to fairly dense alder and scattered willow.

II.B.2.d. Open Tall Alder-Willow Shrub

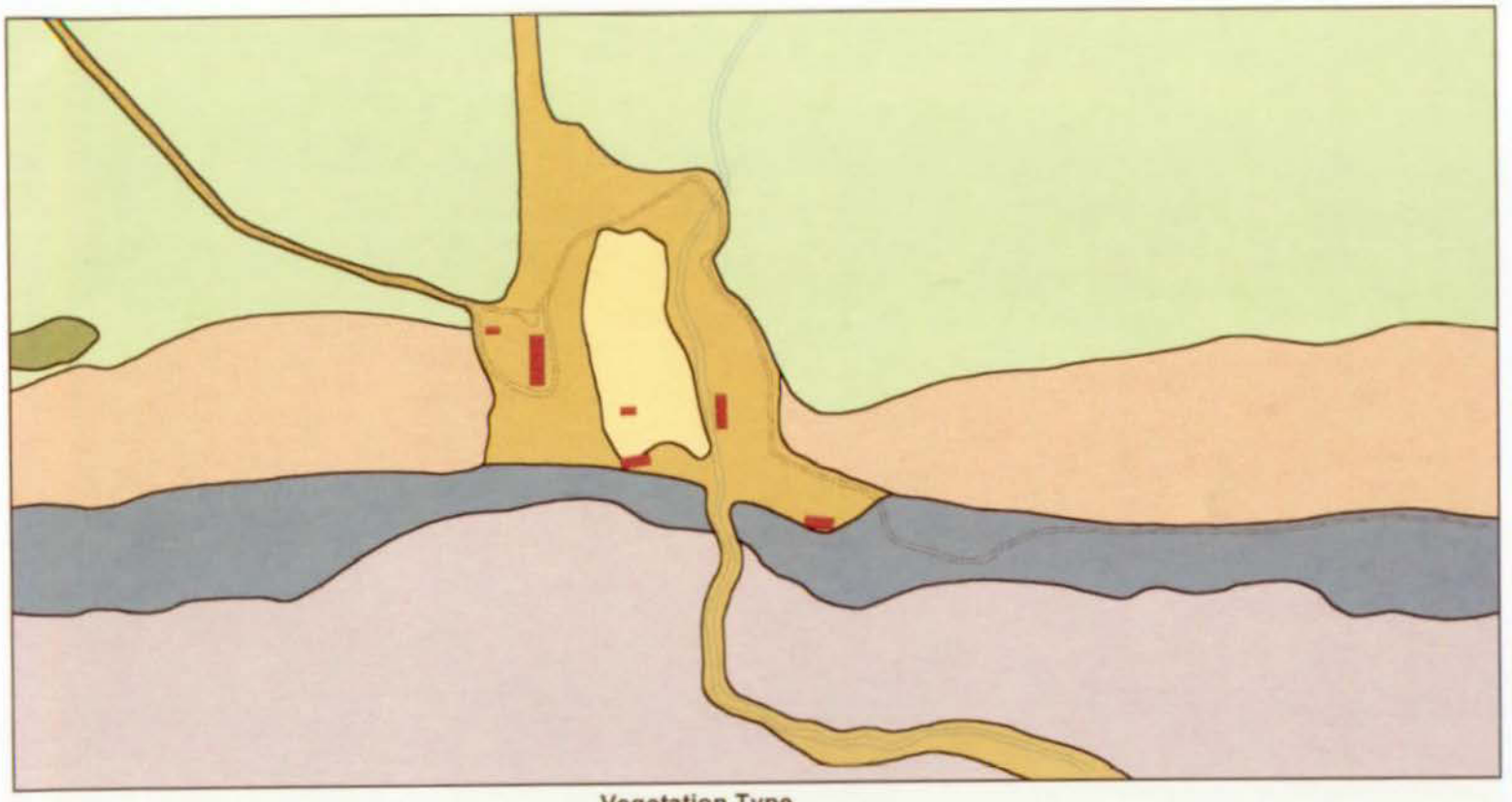
The "riparian zone" along lower National Creek. As it winds its way through a bedrock gorge and then spills out onto the lateral moraine of the Kennicott Glacier, National Creek frequently flooded and changed course. These frequent disturbances prevented the soils from developing past the early stage of entisols with a minimal duff layer, and maintained an open mosaic of willow, alder, and barren ground.

a6) II.B.2.e. Open Tall Birch-Willow Shrub

This topographic depression in the northern portion of the study area caught surface and subsurface flow from the hillside above and developed very wet, cold, organic-rich soils. These aquepts (poorly-drained inceptisols) had a deep layer of undecomposed organic matter and duff over 20 cm deep, and supported dwarf birch, shrub willows, and the very occasional white or perhaps black spruce where this polygon intergrades with #a4 on drier microsites.

1900-1908

In this first period of development, three major kinds of disturbance took place: logging to provide lumber and minimize fire danger; clearing for pasture, camping areas, roads and buildings. Most land was cleared by simple logging, and subsequently revegetated with alder, willow and eventually new tree seedlings. A large central area on the north bank of National Creek, however, shows a more "manicured" appearance in early photos. This area was logged and probably burned - a common practice of early miners to clear land and provide pasture for livestock (Lutz, 1956). For much of the mining era, this central area (which eventually became the site of Stephen Birch's house, the Manager's house, the Staff house, and the Manager's Office) was probably the largest area of open ground, actively maintained either by grazing or hand clearing. Most other lands in the study area, with the exception of building and storage areas, gardens, trails, and roads were simply logged and then left to re-grow in whatever mix of scrubby native vegetation took hold.



1900 - 1908

Vegetation Documentation for Cultural Landscape Report: Kennecott Townsite, 1998

b1) Barren

Active lateral moraine of the Kennicott Glacier, mostly unchanged from #a1. A few more plants may have colonized the still-retreating glacial moraine. Minimal disturbance by miners.

II.B.2.a. Open Tall Willow Shrub

Around this time, enough willows had colonized this recently abandoned lateral moraine and to overtop the seral herbs and justify a reclassification of the polygon. Compared to #a2, there is a more waist-to-chest high willow, a denser understory of soapberry, and fewer herbaceous perennials like fireweed and yellow dryas. Some of the southern portion of this unit was disturbed by construction of the first road into Kennecott, and some of the central portion might have been buried by debris sliding downhill from the mill construction site. Sitka alder was uncommon in this polygon, but would have been a strong component of the vegetation that began re-colonizing these disturbed areas.

b3) I.A.2.e. Open White Spruce Forest

What remained of this polygon after being diminished by logging was probably little changed from the characteristics of #a3.

b4) I.A.1.j. Closed White Spruce Forest

What remained of this polygon after being diminished by logging was probably little changed from the characteristics of #a4.

b5) II.B.2.d. Open Tall Alder-Willow Shrub

This vegetation type, which originally occupied only a small area along National Creek, was by this time entering a period of rapid expansion. Most of the forested areas logged by early miners were left rather raw: a combination of stumps, ragged brush, and abandoned slash. Vegetation recovery was usually swift, dominated by alder and willow. Some scattered poplar, paper birch, and white spruce may have remained and also started in as seedlings. Areas adjacent to road, building, and other construction were probably more heavily disturbed and alder returned more vigorously than willow on these sites, some of which remained barren for several years. Even the original, "natural" vegetation of this type, in National Creek, was probably quite disturbed by water diversions, tailings and gravel deposition, and the like.

b6) II.B.2.e. Open Tall Birch-Willow Shrub

No change from #a6.

b7) III.A.2.c. Bluejoint-Shrub

This was probably the very first area cleared in Kennecott, even prior to the logging of polygon #b5. The original clearing probably included both logging and burning, and for many years this area contained the most maintained vegetation cover in the area. At least one corral is visible in old photographs of this area and grazing was probably one way of maintaining the relatively open character of this meadow. After the initial burning, increases of bluejoint grass and fireweed would be expected because (in addition to favoring the enhanced light levels), both species reproduce by rhizomes and rapidly invade burned areas of boreal forests

(Dyrness et al., 1986). No photos show it appearing completely grassy, and it is likely that fireweed, wild rose, raspberry, red currant, alder, and willow shared the site with bluejoint.

1908-1915

By 1908, logging opened a great deal more land, and the mill is surrounded by a large area in various stages of secondary succession. At the same time, primary succession is continuing on the younger moraines of the glacier margin. Both of these processes are causing a dramatic overall increase in the amount of willow and alder in the study area, and the total area of spruce forest is continually diminishing. The first significant amounts of mining tailings are evident in the mill town, appearing to the south and north of the mill building. These tailings provide additional areas for succession, but tailings generally lack the very fine silts and clays common in glacial till and are consequently slower to develop a significant vegetative cover.

c1) III.B.1.a. Seral Herbs

Around this time, enough herbaceous perennials had colonized the lateral moraine of the Kennicott Glacier to justify reclassifying this polygon. Although many barren areas remain, it is clear from old photos that this polygon had begun to stabilize and fireweed, yellow dryas, and dwarf willows had all begun to occupy these soils in greater number. In addition, the size of this polygon had by this time grown substantially as completion of the railroad, further road construction, and the ongoing growth of the mill and its associated tailings created large new areas of essentially barren soil that entered directly into primary succession. Some of these areas were kept barren on purpose, especially near roads, buildings, and the railroad tracks; other areas were kept barren as an indirect consequence of severe soil disturbance. As a consequence, plant colonization was quicker and diversity higher near roads, the mill, and new building site than they were on the moraines undisturbed by humans. Weeds such as dandelion, wormwood, and fireweed were probably common.

c2) II.B.2.a. Open Tall Willow Shrub

Diminished in area from #b2 by ongoing construction, and with a greater density of willow, but otherwise little changed.

c3) I.A.2.e. Open White Spruce Forest

Much diminished in area from #b3 by ongoing logging, but little changed where the original vegetation remained.

c4) I.A.1.j. Closed White Spruce Forest

Diminished in area from #b4 by ongoing logging (including the construction of the second tramway), but little changed where the original vegetation remained.

c5) II.B.2.d. Open Tall Alder-Willow Shrub

This polygon was still increasing in area as development of the mill town continued. By this time, lumber was being brought to the site by rail and most logging activities were undertaken to clear land for new building sites, or minimize fire danger. As some areas were being logged for the first time, other areas were over a decade into their recovery with significant re-growth of poplar and white spruce, leaving this large area was a heterogeneous mix of dense shrub thickets, almost barren ground, and everything in between. Many of the

Vegetation Type

- Buildings
- Roads
- Railroad
- National Creek
- Garden

300 0 300 600 Feet

- I.A.1.j. Closed White Spruce Forest
- I.A.2..e. Open White Spruce Forest
- II.B.2.a. Open Tall Willow Shrub
- II.B.2.d Open Tall Alder-Willow Shrub
- II.B. 2.e. Open Tall Birch-Willow Shrub
- III.A.2.c. Bluejoint-Shrub
- III.B.1.a. Seral Herbs

1908 - 1915

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soils in this area were by this time heavily disturbed, and the overall proportion of alder in this area had increased.

c6) II.B.2.e. Open Tall Birch-Willow Shrub

No change from #b6.

c7) III.A.2.c. Bluejoint-Shrub

The construction of several new buildings, boardwalks, and a large garden in this area diminished the overall area extent of the vegetation, but probably did little to alter its essential character. Notably, the buildings constructed here in this period and subsequently were the homes and offices of the town's upper classes. In addition to the limited evidence provided by early photos, this fact supports the notion that this area was "groomed" more than most other areas in the town. Sitting on the north bank of National Creek, with adjacent corrals for horses and quite probably flower gardens planted near the buildings, this "meadow" was the pastoral home of the manager, higher staff, and eventually Stephen Birch.

c8) Gardens

This is mapped as an early garden, but because this area was buried under the tailings deposits of the Consolidated Wrangells Mining Company, there is currently no evidence of what was grown here.

1915-1938

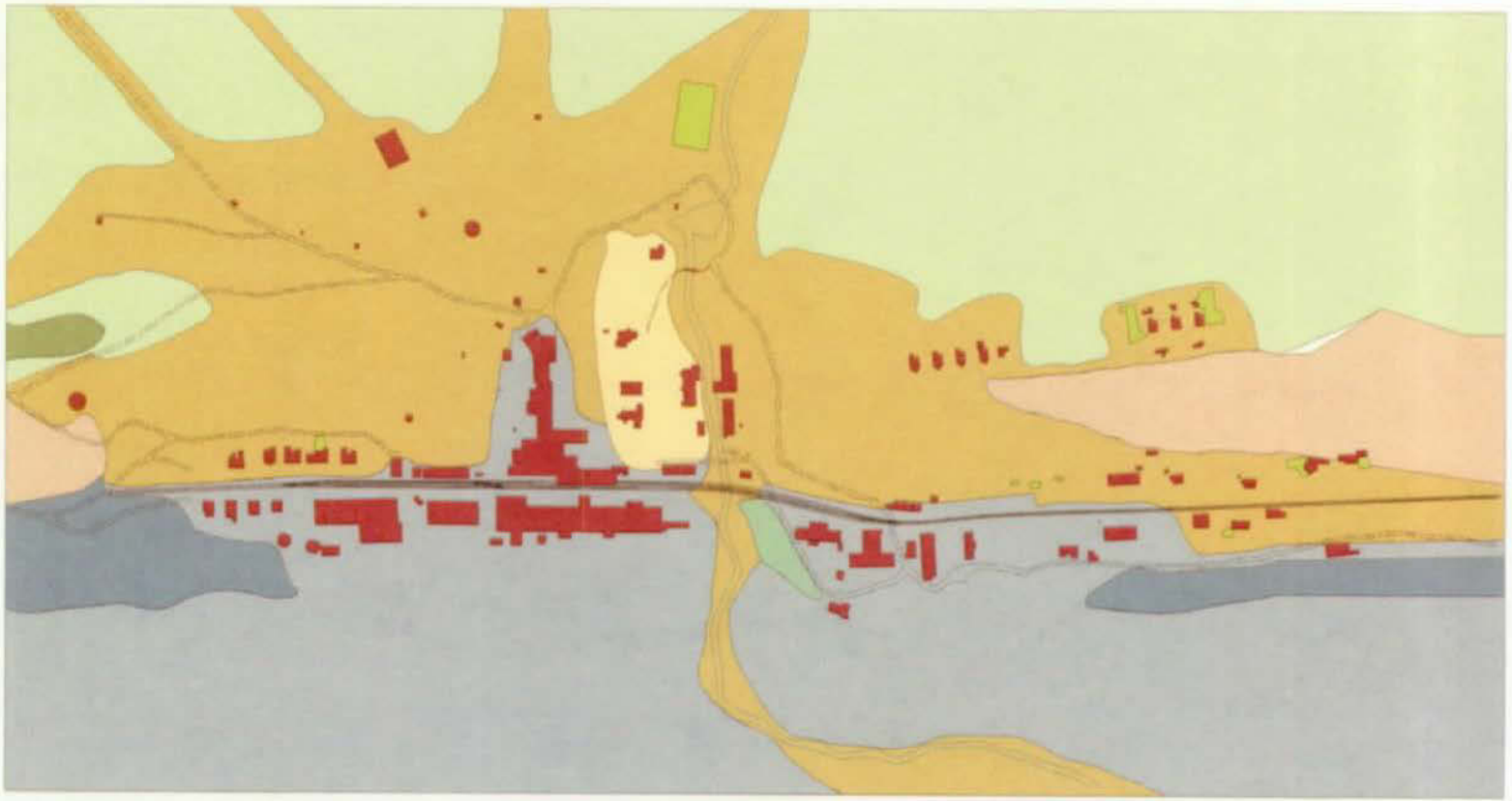
In this period, the heyday of the Kennecott mines, removal of vegetation reaches its most extreme. Much of the original vegetation in the study area has been destroyed, whether by logging, burning, road construction, or burial under the rapidly growing tailings piles. Even as this activity takes place, however, the processes of primary and secondary succession are taking place. Most of the study area is slowly recovering from some form of disturbance by growing an increasingly dense cover of herbs, shrubs, and tree seedlings. Gardens are tended, roadsides, trails, and the railroad are kept clear, and the central open area is still maintained. The majority of land cleared for mining activities has however, become an area covered with high shrubs, spruce stumps, slash, and mining debris.

d1) III.B.1.a. Seral Herbs

In the lower area of this polygon, the Kennicott Glacier was continuing its rapid retreat, and the slow invasion of perennial herbaceous plants and perhaps willow was continuing. Higher up, ongoing development and industrial activity was creating new barren land at the same time that older disturbed areas were becoming overgrown by native pioneer species. During this period, one important change was the drastic increase in the area covered by mining tailings, particularly below the leaching plant and to either side of National Creek. These areas, by virtue of continual disturbance and the extremely poor suitability of tailings for vegetation, remained virtually barren for many years (in some areas, up to the 1990s).

d2) II.B.2.a. Open Tall Willow Shrub

Little change from #c2 with the probably exception of sporadic and small-scale disturbances by human activity.



Buildings
Roads
Railroad
National Creek
Gardens

300 0 300 600 Feet

Vegetation Types

I.A.1.j. Closed White Spruce Forest
I.A.2.e. Open White Spruce Forest
III.B.1.a Seral Herbs
II.B.1.d. Closed Tall Alder-Willow Shrub
II.B.2.a. Open Tall Willow Shrub
II.B.2.d. Open Tall Alder-Willow Shrub
II.B.2.e. Open Tall Birch-Willow Shrub
III.A.2.c. Bluejoint-Shrub

1915 - 1938

Vegetation Documentation for Cultural Landscape Report: Kennecott Townsite, 1998

d3) I.A.2.e. Open White Spruce Forest

Much diminished in area from #c3 by ongoing logging, but little changed where the original vegetation remained. There may have been scattered selective cutting of white spruce in these areas by this time.

d4) I.A.1.j. Closed White Spruce Forest
Logging to clear land, but little changed where the original vegetation remained. At the margins of this mature spruce forest, adjacent to logged areas, old photographs show that large trees were suffering relatively heavy mortality, due largely perhaps to their increased exposure to wind and snow-loading. The edges of this polygon were thus growing more "ragged" over time.

d5) II.B.2.d. Open Tall Alder-Willow Shrub

The simultaneous processes of logging, soil disturbance, and re-growth continued in this area. At this point in time, the northern part of this unit (near the powder shack) was probably characterized by chest-high vegetation with lots of stumps scattered in the brush. The rest of the unit was probably getting very overgrown (maybe even closed) with alder, tall, tree-like willow, and ramets (clonal clumps) of poplar gaining height.

d6) II.B.2.e. Open Tall Birch-Willow Shrub

No change from #c6.

d7) III.A.2.c. Bluejoint-Shrub

No change from #c7, except for the addition of Stephen Birch's house at the upper (eastern) edge of this polygon.

d8) Gardens

Numerous gardens were now scattered around the mill town during this period, with the largest garden now located along the northern bank of upper National Creek. One photo from this period shows a cow in a cow-pen somewhere near the old dairy barn, in the southwestern portion of the study area. Further research was unable to determine the exact location of this pen.

d9) II.B.1.d. Closed Tall Alder-Willow Shrub

By this time, several parts of the "open tall alder-willow shrub" polygon (#d5) probably had enough cover to warrant the designation "closed." Only one area, down by the southern bank of lower National Creek, alders and willow had grown in quite densely and numerous white spruce seedlings were notable in the understory.

Existing Conditions

There is more total vegetation cover today than at any time since the start of the mining era. This is due primarily to the ongoing retreat of the Kennicott Glacier and the consequent colonization of its abandoned lateral moraines. Virtually all of the land cleared during the mining era has revegetated to some degree, and most roadways and trails have either disappeared or become narrow paths through a tunnel of encroaching alder and willow. With the exception of privately-owned property (the Kennicott Glacier Lodge, Silk Stocking

Buildings
Roads
National Creek
Garden

300 0 300 600 Feet

Vegetation Types

III.B.1.a. Seral Herbs
II.B.2.a Open Tall Willow Shrub
I.A.2.e. Open White Spruce Forest
I.A.1.j. Closed White Spruce Forest
II.B.1.d. Closed Tall Alder-Willow Shrub
II.B.2.d. Open Tall Alder-Willow Shrub
II.B.2.e. Open Tall Birch-Willow Shrub

Existing Conditions

Vegetation Documentation for Cultural Landscape Report: Kennecott Townsite, 1998

Row cabins, etc.) virtually all of the vegetation in Kennecott is now unmaintained. The old gardens are grown over, the central open area has been obliterated by encroaching brush and the tailings deposits of the Consolidated Wrangells Mining Company, and even the old railroad cooridor (now the main road through town) is sprouting an occasional shrub or bush.

Just as it was before the miners ever arrived, virtually all of the vegetation is a seral stage of white spruce forest. Boundaries between these various seral stages are in some cases quite vague, leaving the casual observer with a general impression of shrubbiness. Small patches of emerging spruce, poplar, and birch crown dense alders and willows, and little of the site's complicated history is readily apparent. One change is obvious, however. The total proportion of vegetated land in early to middle succession is much higher than it was a hundred years ago, and the proportion of late successional (mature) white spruce forest is much reduced. An ongoing spruce beetle outbreak that began in 1990 has killed many mature spruce in these latter areas and will probably contribute to an even further reduction in the total area of mature forest in the foreseeable future.

e1) III.B.1.a. Seral Herbs

The colonization of this now stabilized lateral moraine by fireweed, yellow dryas, and now a significant component of willow and poplar in some areas continues. Much barren ground remains, but as organic material and seed sources in this area increase, vegetation growth should be expected to accelerate in this area. Tailings piles remain very resistant to colonization, however, and will probably take many decades to revegetate to any significant degree. This is due largely to the absence of fine-grained material in mining tailings, with consequently poor water retention and nutrient availability.

e2) II.B.2.a. Open Tall Willow Shrub

Head-high and taller willows are now common in this area, and many spruce and poplar saplings have begun to overtop the willows. This area will soon be an open white spruce forest.

e3) I.A.2.e. Open White Spruce Forest

With some evidence of selective logging by miners and probably modern residents, the mature spruce remaining in this forest, which was quite open even before the mining era, is very reduced. Nonetheless, many old spruce remain in the small remaining area of this polygon and there is moderate recruitment by young spruce and paper birch.

e4) I.A.1.j. Closed White Spruce Forest

That any old-growth forest remains so close to the Kennecott town site is perhaps surprising. The mature white spruce forest that remains in the study area is a testament to the Kennecott Mines' reliance on outside supplies of wood and fuel. The near future for this forest is grim, however. On average, 40% of the mature spruce in this polygon have been killed by a spruce beetle outbreak that began in 1990, and more are still being killed each year (though the outbreak seems to be slowing). Furthermore, recruitment of young spruce in these beetle-killed areas is very low, and a recent study predicted that the current recruitment rate is insufficient to balance the continuing mortality of mature trees (Loso, 1998). Even in the absence of selective logging by local residents (which occurs sporadically), it is likely that the forest in this polygon will become much more open over the next few decades, and that without a ground-clearing disturbance such as fire, the recruitment of new spruce to fill these gaps will be slow, if it occurs at all. Under this scenario, the density of alder and willow is expected to grow.

e5) II.B.2.d. Open Tall Alder-Willow Shrub

With a few exceptions where the activities of current residents or visitors are disturbing the vegetation, this large heterogeneous polygon of brush and emerging trees is continuing its process of secondary succession. Poplar, tall willows, and white spruce are slowly turning some of this area into a young forest, but most of this polygon is revegetating more slowly than the rest of what was #d5, which is now categorized as "closed tall alder-willow shrub" (#e9). The reason for this slight difference in regrowth is not known. The area along National Creek has been flooded several times, as in the past, and remains in a very open stage much like it did before the commencement of mining operations in the early century.

e6) II.B.2.e. Open Tall Birch-Willow Shrub

No change from #d6.

e7 Gone

As a result of secondary succession by alder and willow and more directly because of tailing deposition by the Consolidated Wrangells Mining Company, nothing remains of the historic "meadow" that occupied the central portion of the town site.

e8) Gardens

Rhubarb and chives are known to still grow in the remnants of the largest garden, and further fieldwork this summer may provide evidence of the hardy crops that have survived the ensuing decades of neglect.

e9) II.B.1.d. Closed Tall Alder-Willow Shrub

Much of what was formerly "open tall alder-willow shrub" has now filled in with enough alder, tall willow, spruce, birch, and poplar to qualify as "closed." Some of the area is almost young forest. This closed and almost impenetrable thicket is a dominant vegetation type in the vicinity of many historic buildings now.

Site History

Kennecott Mine Sites

By Logan Hovis

Introduction

The Kennecott mines are located on Bonanza Ridge, high above the mill town, and several thousand feet above the Kennicott Glacier. The structural complex associated with these mines were industrial communities in their own right, distinct from the mill town below. During the winter months, the extreme cold, heavy snow, and high winds frequently isolated these camps. Wagon roads and trails quickly disappeared in the snow and high winds curtailed operation of the aerial tramway. In response to these conditions, the camps were became self-supporting to the degree possible, providing housing for the miners and support facilities to advance the underground works.

Over the life of the operation at Kennecott four principal underground mines were developed, each with its associated surface camp: the Bonanza, Jumbo, Mother Lode, and Erie mines.[1] The locations of the camps were somewhat precarious to say the least, built on steep mountain slopes and in avalanche paths. Access to the ore in such a hostile mountain environment forced site selections that were usually the lesser of several evils. All four major camps were adjacent to the greenstone-limestone contact, which defined the locations of the ore. Once constructed, securing the structures and protecting them from extreme weather became a basic part of the operation. For example buildings were cabled to the rock, snow fences and avalanche breakers were placed to direct the flow of snow between the buildings and around structures. In other cases, such as the aerial tramways, ongoing maintenance included the seasonal need to reconstruct towers and restring cable damaged by wind and snow.

Two surface operations were also established as satellites of the Bonanza camp. The Glacier Mine and the Slide ore body were summer operations on the west and east sides of the Bonanza outcrop respectively. The Glacier Mine had a few, smaller crew shacks erected on the glacier. This unusual mine, which recovered high-grade ore from the ice of the glacier, was connected to and supported from the Bonanza Mine camp. The Slide ore body was located on the slope below the Bonanza camp.

Both the Slide and Glacier operations were connected to the larger operations by aerial tramways. A short stub tramway fed ore from the Slide up to the Bonanza loading terminal. The Glacier was doubly connected with ore going down slope to join with the Jumbo tramway at the Angle Station and a short tramway running up from the Glacier to the Bonanza to transport men and supplies.

[1] The Mother Lode Mine is not described in detail in this report because it remains private property within the boundaries of the NHL. It should be noted however, that the Mother Lode Mine was historically an important ore body and integral to the operations at Kennecott during the historic period.

The relative significance of the mines can be crudely expressed in terms of total production figures.[2]

Mine	Ton of Ore	Tons of Copper
Bonanza	1,523,526	194,922.9
Jumbo	1,505,768	215,021.0
Mother Lode	1,340,162	166,038.3
Glacier	163,028	3,526.3
Erie	56,941	8,565.5
Slide Ore	36,484	3,461.4
Totals	**4,625,909**	**591,535.4**

These figures provide a somewhat distorted view when they are used to compare the various mine camps. Ore from the Mother Lode Mine was raised through the Bonanza Mine for transport to the mill, as was the ore from the Slide deposit. In addition, the Glacier mine was in part a satellite of the Bonanza even though it was connected to the mill by a tramway.

Over the life of the Kennecott operations, the Bonanza and the Jumbo camps were regularly occupied until the entire operation closed. The Bonanza, Mother Lode and Jumbo mines served by these camps operated continuously once they went into production. The other camps operated for shorter periods of time or intermittently as indicated below.

Mine	Years of Operation
Bonanza	1911 – 1938
Jumbo	1913 – 1938
Slide Ore	1913 – 1916
Mother Lode	1914 – 1938
Erie	1916 - 1918, 1924 - 31, & 1937 - 38
Glacier	1920 - 1928

Within broad limits and making some allowances for non-production exploration and supply operations at the Erie, the camps associated with these mines can be assumed to have operated on similar schedules.[3]

Collectively, these mine camps were the contact points between the production and processing functions at Kennecott. Broken ore was raised to the surface at the mine camps and transferred to aerial tramways for transportation to the mill for concentration and shipment to the smelters and world markets. They also reflected over time, changing corporate realities and the progress of the mining operations.

The importance of any single mine camp reflected the wealth of the mine it served and the development sequence of the underground workings. The Bonanza camp was first prominent as the readily accessible outcrop of ore was exploited and the outcrop explored at depth. The Jumbo camp to the west of the Bonanza supported the exploration and mining of a separate and equally rich ore body. To the east, across

[2] "Kennecott Copper Corporation, Kennecott Mines, Total Ore Production, 1911 to Date [1938]," NPS/AKSO files.

[3] *Ibid.* All Kennecott mines were closed 1933-34. The date for when the Mother Lode first shipped is from Alfred H. Brooks, "The Alaskan Mining Industry in 1914," in Mineral Resources of Alaska: Report on Progress of Investigations in 1914, US Geological Survey Bulletin 622 (Washington: USGPO, 1915), p. 44. Kennecott production figures for the Mother Lode doe not start until acquisition in 1919.

the ridge in the McCarthy Creek drainage the Mother Lode camp supported the efforts of the Mother Lode Copper Mining Co., a separate and competing entity until 1919.

Once Kennecott acquired the Mother Lode, the camp was little used and ore from the Mother Lode was transported underground to the Bonanza where it was raised to the surface. The Erie camp was established to support the exploration of the Erie ore body. Once it was found to be smaller than hoped, the Erie camp served as a supply point for further explorations deep in the mountain. Over time, the various mines were connected underground allowing options in the servicing of the mines and the transportation of ore. At the end, it was possible to enter the mines at the Erie Mine overlooking the Root Glacier, pass through the Jumbo, Bonanza, and Mother Lode mines, and exit in Independence Gulch overlooking McCarthy Creek.

The locations of the mine sites are fixed in geological realities and the camps to serve these mines were located as close as reasonably possible. The topographical extremes of Bonanza Ridge also imposed restraints on the location and configuration of the camps. Steep slopes, slide paths, and snow and ice fields did not prevent construction in a given area so much as they demanded engineering solutions and an acceptance of risk which, while common at the time, would not be accepted today.

At the present time, all the mines are in various states of collapse: the Erie bunkhouse is probably the most intact structure and the Mother Lode camp the most ruined of all. But all of these mine camps contain a wide variety of structures and artifacts to help define the nature of life in the Kennecott mines. All are more or less accessible to the general public and there is evidence of casual pilfering, looting and vandalism. The harsh environment is a mixed blessing. Long winters produce damage from high winds, avalanches and snow loads; the extreme cold freezes much in place for months on end and arrests the processes of decay.

Bonanza Mine

The Bonanza Mine camp is situated on an east-facing slope at the head of Bonanza Creek immediately below the Bonanza ore outcrop. The site is at approximately 6,000 feet elevation and is about three miles from the railhead and the mill site. Snow is on the ground nine months out of the year and in the air all year round. The Bonanza Mine was the first camp established on Bonanza Ridge. The outcropping of chalcocite and copper carbonate, both rich ores of copper, was first located in 1900. The camp was established sometime thereafter but was little developed until after 1906 when title to the mines had been clarified through litigation.[4]

Development work on the site prior to the end of the 1907 season included two crosscut tunnels driven into the ore one above the other. The lower tunnel started slightly above a "L"-shaped cabin that may have been constructed several years earlier. The cabin was described as the "miners lodgings" on company maps. The utilitarian nature of the structure is evident in its location immediately adjacent to the waste rock dump from the lower tunnel.[5]

Photographic evidence suggests the building was modified and expanded on several occasions to accommodate more miners. More important, early photographs show a level cut made in the hillside running south from the lower tunnel for approximately 200 feet. This cut carried the track from the mine to the waste dump. This linear feature appears on the basis of subsequent photography to define the main axis of all subsequent development on the site. The aerial tramway loading station was erected at the south end of the cut and shops at the north end.[6]

Constructing the Bonanza camp on a steep slope required the excavation of terraces and the erection of wood cribbed retaining walls to produce building platforms. Mine buildings were further secured to the

[4] Considerable confusion and controversy persists about the discovery and early history of the Kennecott mines. While interesting, these questions are not germane to the Cultural Landscape. Litigation consolidated control in the hands of Stephen Birch and the Alaska Syndicate prior to major investment and construction activities.. Versions of the discovery and initial ownership of the mines are discussed in Robert Stearns, "Alaska's Kennecott Copper and the Kennecott Copper Corporation," *Alaska Journal* 5 (1975): 130 - 139; see also Melody Webb Graumann, "Big Business in Alaska: The Kennecott Mines, 1898 - 1938," Anthropology and Historic Preservation, Cooperative Park Studies Unit, University of Alaska, Fairbanks, Occasional Paper #1, March 1977; see also her "Kennecott: Alaskan Origins of a Copper Empire, 1900-1938," *Western Historical Quarterly* 9,2 (April 1978): 197-211.

As the first mine to be brought into production, the Bonanza's name dominated the entire Kennecott operation for several years. For example, the facilities along National Creek were initially included as one in the same in discussions of the Bonanza Mine and later as the Bonanza-Kennecott Mine. Once the Jumbo Mine became important contributor to production, the name distinction between the mill town and the various mines became common, even assumed, in the literature.

[5] Fred H. Moffit and A.G.Maddren," The Mineral Resources of the Kotsina and Chitina Valleys, Copper river Region" in mineral resources of Alaska: Report on Progress of Investigationsin 1907, US Geological Survey bulletin 520 (Washington: USGPO, 1908), pp, 163-164; and Fred H. Moffit and Stephen R. Capps, *Geology and Mineral Resources of the Nizina District, Alaska*, USGS Bulletin 448 (Washington: USGPO, 1911), p. 87; see also "Bonanza Surface Plant & Underground Work," Kennecott Mines Map Inventory, Drawer 40, Roll 6, n.d. (M-59), copy in NPS/AKSO files.

[6] Two early views of the cabin and the side hill cut are provided by USGS geologists; see USGS Photographic Library, Capps, S. R. # 119 and Moffit, F. H. # 364. A photograph taken approximately 5 years later shows the cut covered with a snow shed connecting the tunnel with the top of the tramway loading station. New buildings, presumably bunkhouses and shops are erected above and below the snow shed; Alaska Mining photo #141 34 [circa. 1912], Photographic Archives, Museum of History and Industry, Historical Society of Seattle and King County, Seattle, Washington.

LEGEND

- Adit
- Wood Scatter
- Dump
- Decking
- Telephone Line (fallen)
- Cable
- Trail

BUILDING LEGEND

1 Bunkhouse
2 Shed (unknown function)
3 Tram Terminus
4 Transformer Building
5 Steel Shed/Blacksmith
6 Tent Frame (site only)

Bonanza Mine
Existing Conditions

Cultural Landscape Report: Kennecott Mill Town
Wrangell-St. Elias National Park and Preserve

10/97

Aerial Photographs, NPS, 1991; Topographic Survey, 1991-92, Drawing no.190/80021; Archeological records and files, WRST, HABS Documentation, 1982; Field Investigations, 1997.

mountainside with steel cables. Most major structures at the mine were positions at a similar elevation with the line of buildings following the arc of the cirque.

Early access to the mine was by trail. In 1908, the wagon road to the mine was widened and graded to permit winter sledding of supplies. Construction of the aerial tramway connecting the Bonanza mine with the railway at National Creek started in 1908 and was completed in 1909. It started operation in August that year. The tramway provided the necessary connection to place the mine in production once the railway arrived at Kennecott.[7]

In addition to the early cabin and the tram terminus, other construction was underway or completed by 1912, after regular production began. New buildings included a two-story, "T"- shaped bunkhouse located below the snow shed and near the original cabin. A second significant structure was erected at the north end of the snow shed containing a blacksmith shop, compressor room, and heating plant. In 1911, the ore bins and loading terminal were enlarged to increase capacity.[8]

Mining operations proceeded underground and on the surface. In 1912, a larger donkey engine pulled itself up the mountain and was used to run scrappers mining the Slide ore. This ore was located down slope from the Bonanza outcrop and contained a large amount of loose chalcocite and other copper ores. The donkey engine was positioned above the snow shed on a small platform excavated into the hillside. The cables ran through or over the shed. How the ore was raised to the tramway-loading terminal is not immediately obvious in the photograph although a stub tramway was constructed in 1917 to connect the slide ore deposit with the terminal.[9] Workers at the slide area, a seasonal activity, may have been housed at the Bonanza or in tents closer to the their work.[10]

In early 1913, the tramway and compressor plant was destroyed by a snow slide and fire, forcing the Bonanza mine to shut down. By March, the company was erecting a new compressor building at the mouth of the mine and was repairing the tramway damaged by the slide.[11] Additions to the camp around this time include changes to the ore bins with a new tunnel connecting the underground workings directly to the loading terminal. Additional housing—a three-story bunkhouse—and a privy block were constructed south of the loading terminal and connected to it by a covered walkway.

Major modifications in 1916 and 1917 included significant changes to the organization of the mine

[7] Fred H. Moffit, "Mining in the Kotsina-Chitina, Chistochina, and Valdez Creek Regions," in Mineral Resources of Alaska; Report on Progress of Investigations in 1908, US Geological Survey Bulletin 379 (Washington: USGPO, 1909), pp. 153-154; Fred H. Moffit, "Mining in the Chitina District,"in Mineral Resources of Alaska; Report on Progress of Investigations in 1909, US Geological Survey Bulletin 442 (Washington: USGPO, 1910), pp. 160; and "Bonanza Copper Mines," Northwest Mining Journal 7:1 (January 1909): 7.

[8] See Alaska Mining photo #141 34 [circa. 1912], Photographic Archives, Museum of History and Industry, Historical Society of Seattle and King County. Dating is based on the presence of the large donkey engine used to raise Slide ore to the snow shed level. This equipment did not arrive on site until 1912; see "Activity at Kennecott Mine and McCarthy," The Chitina Leader 2nd year, No. 21 (1 March 1912); 1. For tram terminal expansion see Kennecott Mines Company [drawing], "Mine Ore Bin and Loading Terminal, Cross Section and Side Elevation, 1911 Installation," NPS/AKSO files.

[9] Fred H. Moffit, "Mining in Chitina Valley," in Mineral Resources of Alaska; Report on Progress of Investigations in 1912, US Geological Survey Bulletin 542 (Washington: USGPO, 1913), p. 84; "Activity at Kennecott Mine and McCarthy," The Chitina Leader 2nd year, No. 21 (1 March 1912); 1; "Bonanza Surface Plant ...," *op. cit.*; and Kennecott Copper Corporation, "East Slide Tram Terminal," Drawing No. T-7, July 6, 1917.

[10] A small tent camp immediately below the Bonanza Mine was recorded during the 1997 existing conditions survey.

[11] Alfred H. Brooks, "The Alaskan Mining Industry in 1913," in Mineral Resources of Alaska; Report on Progress of Investigations in 1913, US Geological Survey Bulletin 592 (Washington: USGPO, 1914), pp. 60-61; and "Activity in Copper Mining," The Chitina Leader 3,22 (18 March 1913); 1.

site. In 1916, a newly constructed four-story bunkhouse burned.[12] In 1917, a site was cleared to build a new bunkhouse. When completed later that year, the combination bunkhouse and mess hall also served as a recreation and amusement hall.[13]

As new structures appeared, others disappeared. The snow shed connecting the miners' lodgings with the loading terminal was gone as were the original miners lodgings and the "T" shaped bunkhouse. The snow shed still connected the buildings but now they went from the vicinity of the heating plant to the lower levels of the tramway loading terminal as well as from the upper level of the terminal to the earlier three story bunkhouse to the south.

By 1926, the mine site was essentially as today's ruins suggest. Moving from north to south, the main structures include the Steel Shop at the original mine portal and the Transformer House located above the portal. To the east is the one-story frame Heating Plant. The four-story Bunkhouse, Messhall and Amusement Hall dominate the north end of the site. The center of the site is dominated by the Ore Bins and tramway-loading terminal. Further to the south are the older three-story frame bunkhouse and the privies. Show sheds still connected the major elements of the site.[14]

The new four-story bunkhouse followed designed developed for the major bunkhouses in the mill town. As a group they were three to four stories tall with shed-roofed dormers. Floor plans were also similar with the buildings severing a variety of ends: cooking, dining, recreation, and change rooms for washing and drying clothes. Aesthetic details such as the red with white trim paint scheme were also employed in this last major construction at the Bonanza mine.

While no new significant structures were added to the camp after 1918, smaller modifications to the physical plant were probably the norm. Increases in the capacity of the tramway in 1918 may have been reflected in changes to the ore bins and the loading station. During periods of construction, small tent cities came and went as necessary. Finally, minor modifications to the buildings occurred almost up until the end. In 1936, the Company reported enlarging the cook's quarters by building another room in the Bonanza Bunkhouse.[15]

During peak production, approximately 72 men worked the Bonanza mine, most of whom were undoubtedly housed at the Bonanza camp. Another 146 worked the Mother Lode that was supplied through the Bonanza mine. In all, well over 200 men worked and lived in the camp at its height.[16] By 1924 the Bonanza camp supplied compressed air for the connected mines.[17] When finally closed, the Bonanza incline

[12] The loss of this structure and the subsequent housing shortage it created may have contributed to tensions among the workers, and the miners' strike the following year

[13] Graumann, *op. cit.*, p. 27; Alaska Territorial Mine Inspector, *Report of the Territorial Mine Inspector to the Governor of Alaska for the Year 1917*; Kennecott Copper Corporation, and *Third Annual Report of the Kennecott Copper Corporation for the Year ended December 31, 1917.*

[14] Kennecott Copper Corporation, "Fire Insurance Map, Bonanza Mine," Drawing No. G-5, March 14, 1922 updated to November 20, 1926.

[15] Kennecott Copper Corporation, *Fourth Annual Report of the Kennecott Copper Corporation for the Year Ended December 31, 1918*, p. 8; photographic evidence of the housing of construction workers in tents may be found in Rasmusen Library, UAF, Clara Rust Collection, 67-110-401N, and WRST, Kennecott Kids Collection, Jean Girad photographs; Kennecott Copper Corporation, "Annual Report for 1936, Alaska Mine," p. 12.

[16] Employment figures taken from "General Points of Interest on the Kennecott & Mother Lode Mines, Kennecott, Alaska, July 15, 1924," p. 1, NPS/AKSO files.

[17] "Outline of Geology and Mining Methods of Kennecott Mines, Kennecott Copper Corporation, Kennecott, Alaska, [c. 1924], p. 10, NPS/AKSO files.

giving access to the mine extended downward from the 150 foot level where the camp was located to the 1250 foot level, a depth of 1,100 feet. At that depth a crosscut connected the Bonanza Mine with the Mother Lode where the incline went down through the production and exploration levels to 2800 foot level, 2, 650 feet below the Bonanza camp.[18]

Production continued in the Bonanza Mine until the end of October 1938; the last shipment of ore left on October 31st. Salvage operations continued until November 10th. The camp was permanently abandoned on December 23rd.[19] Sometime around the end of November the last man left the Bonanza Mine.

The camp remained relatively undisturbed until the 1950s when the Consolidate Wrangell Mining Company attempted to recover surface ores from the Bonanza basin. By this time, the surface title had passed from Kennecott Corporation to Alaska interests. Reportedly, to reduce personal liability by preventing people from occupying the bunkhouse at the mine, the building was set fire and destroyed. The fire also destroyed the power plant and the snow shed at the north end of the camp. Additional damage to the site came from exposure to the elements overtime.

Consolidated Wrangell Mining Company built roads into the Bonanza basin in 1964, and erected a small camp including a small bunkhouse and copper recovery plant at the 4,000 foot level. the following year, 1965. The process was not a success and the camp and plant was abandoned in favor of an operation based near the Kennecott concentrator. This operation closed in 1967. The camp in the Bonanza basin was eventually destroyed by a snow slide.[20]

Sixty years after Kennecott Copper walked away from the site, the Bonanza camp is still a complex site, despite the ravages of fire and time. Little is as it was; almost every building is in some degree of collapse. The tramway terminal and loading station are solidly built and relative intact. The roof is collapsed on the blacksmith shop but the walls are still up and many small tools remain inside. The transformer building is sound even though its metal skin has been stripped away. The ashes of the bunkhouse and power plant are mixed with twisted metal girders, the remains of the boilers and rusting bed frames. Today, the Bonanza Mine is visited frequently by those willing to hike up the mountain. While many appreciate the site for itself, others take the opportunity to loot this most accessible of all the Kennecott mines.

[18] Kennecott Copper Corporation, "Projection Showing Bonanza-Mother Lode Vein in Relation to Various Ore Bodies," copied 1/30/66, Kennecott Mines Map Inventory, Drawer 40, Roll C. There were at least eleven levels in the Bonanza mine and thirteen in the Bonanza-Mother Lode. There were also numerous sub-levels. As to the spacing between levels, "Formerly [prior to c. 1924] levels were driven each hundred feet, this distance was increased to 200 feet, which was found to be too great, and 150 feet has been accepted as the best distance, all things considered," "Outline of Geology and Mining Methods," *op. cit.*, p. 7.

[19] W. A. Richelsen to E. T. Stannard, February 17, 1939, copy in NPS/AKSO.

[20] Telephone interview with Howard Knutson, a partner in Consolidated Wrangell Mining Co., 19 October 95, Logan Hovis, NPS/AKSO.

Jumbo Mine

The Jumbo Mine was the second ore body located on Bonanza Ridge. Like the Bonanza, it was located in 1900, and by the same party. And, like the Bonanza the Alaska Syndicate did not develop it to any degree until after the consolidation of ownership of the mines in 1906. As of 1907, the ore body was explored by two short, 12-foot long tunnels in the south face of the ridge towering above the glacier at the head of Jumbo Creek.[21]

Once the Bonanza mine was established and shipping, attention was extended to the Jumbo where "a considerable body of ore was in sight at the surface before any work was done."[22] A tramway was purchased and shipped to Alaska in 1911. Work proceeded slowly, and the tramway was not completed until 1915. None-the-less, the Jumbo managed to ship limited quantities of ore by hauling it to the mill in wagons.[23]

The location and construction of the Jumbo camp presented a number of problems. The only space available to build was on the edge of a small glacier and the buildings were constantly moving. Several solutions were devised to meet the demands of the site. The Jumbo bunkhouse was set on rollers and the building was anchored to the cliffs with cables. Consequently, the foundations moved while the buildings remained fixed.[24] Triangular avalanche barriers between the cliff and the camp provided additional protection from ever-present snow slides. These rock filled cribs split the force of the snow slides and directed them between the buildings.[25]

By 1915, the Company felt that both mines were well equipped with bunkhouses, blacksmith shops, compressors and other necessary equipment. In 1917, a new transformer house was erected at the east end of the camp where much of the early development had occurred. In 1919, additional protection was provided to the aerial tramway and the workmen by moving the Jumbo loading station underground. [26]

The sequence of construction at the Jumbo camp is little understood at this time. It is safe to assert that the major expansion of the site came along with the discovery of additional rich deposits of copper ore in 1914 and the completion of the aerial tramway in 1915. Compressors and power were installed early on and large numbers of men were engaged in the construction efforts.[27] When the bunkhouses and other structures were erected can be derived with some accuracy from the 1926 Fire Insurance Map of the Jumbo Mine.

[21] Stearns, *op. cit.*, p. 135; and Moffit and Maddren, USGS Bulletin 520, *op. cit.*, p. 165,

[22] Moffit, USGS Bulletin 542, *op. cit.*, p. 84.

[23] Graumann, *op. cit.*, pp. 21-22; Brooks, USGS Bulletin 592, *op. cit.*, p.60; and Sumner S. Smith, *The Mining Industry in the Territory of Alaska During the Calendar Year 1915*, US Bureau of Mines Bulletin 142 (Washington: USGPO, 1917), p. 37.

[24] Alan M. Bateman and D. H. McLaughlin, "Geology of the Ore Deposits of Kennecott, Alaska," *Economic Geology* XV.1 (January-February 1920): 16; B. D. Stewart and B. W. Dyer, *Annual Report of the Territorial Mines Inspector to the Governor of Alaska, 1921.*

[25] The construction dates for the avalanche control devises is problematic at this time. They do not show on the 1926 fire insurance plan of the Jumbo mine.

[26] Smith, USBoM Bulletin 142, *op. cit.*, p. 38; Kennecott Copper Corporation, Jumbo Transformer House, April 14, 1917, Drawing No. B-38; and Fred H. Moffit, "Mining in Chitina Valley," in *Mineral Resources of Alaska; Report on Progress in Investigations in 1919*, USGS Bulletin 714 (Washington: USGPO, 1921), p. 195.

[27] "News of the Camps," The Pacific Mining Journal 2:6 (June 1913): 116; "News of the Camps," Alaska and Northwest Mining Journal 5:1 (July 1914): 157.

LEGEND

- Adit
- Wood Scatter
- Dump
- Tramway
- Trail

BUILDING LEGEND

1 Tram Terminus
2 Bunker
3 Bunkhouse
4 Multi-Purpose Building
5 Horseshoe Pit

Jumbo Mine
Existing Conditions

Cultural Landscape Report: Kennecott Mill Town
Wrangell-St. Elias National Park and Preserve

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Aerial Photographs, NPS, 1991; Topographic Survey, 1991-92, Drawing no.190/80021; Archeological records and files, WRST, HABS Documentation, 1982; Field Investigations, 1997.

Earlier constructions were necessary to advance the underground works. At the east end of the camp an adit with a snow shed connected to small shops and storage areas. As services were moved underground, the service area became less important and 1926 erected a new blacksmith shop directly over the rail bed. The tramway station, close by another adit, was erected sometime between 1911 and 1915. This structure was not removed when the loaning station was moved underground in 1919. There are four bunkhouses numbered sequentially from one to four, which may be significant in itself. Given that the "Bunkhouse No. 1" is close to the tramway station, not in line with the other three, and atypical in design, it is probably the first bunkhouse on the site. The other three—three, two, and four story respectively—may well have been added in sequence. At some point prior to 1926, a heating plant and other minor structures were added to create the footprint evident today.[28]

The less severe slope of the camp site allowed a more casual orientation of the buildings. They are spread in a general east-west sweep across the edge of the glacier. The long axes of the bunkhouses as all major features on the site run north south, but hardly parallel. The bunkhouses followed the wood-frame and gable style adopted elsewhere at Kennecott. Tarpaper covered most of the exterior walls rather than paint. A five-hole privy was located south of the heating plant.

After 1926, only minor changes were made to the surface plant. In 1930, the blacksmith shop was moved underground to better serve a larger area of the mine. Power transmission lines relocated underground so that the Jumbo was supplied through the Bonanza mine. Ongoing repair costs due to snow slides and weather in general were greatly reduced.[29]

The Jumbo mine closed in 1938, along with the rest of the Kennecott operations. Often called the "richest mine," the Jumbo produced more copper if not more ore than any of the other four mines.

Lack of maintenance and the general extremes of the climate and elevation took their toll although the site held up well for at least ten to fifteen years. In the 1950s, Ray Trotoshau constructed a road to the Jumbo.[30] Mine waste down slope from the camp was recontoured in the fashion of a dike or wall along the south face of the camp. At one point the aerial tramway cables come into contact with the road surface. There is no immediate record of Wrangell Consolidated Mining Company efforts at the Jumbo.

Few structures remain standing. One bunkhouse, a tramway break-over, and the surface bunkers associated with the original loading facility. Even these structures are in poor repair and in danger of collapse as the ground continues to shift and twist the buildings. Everything else is in ruins. Bunkhouse No. 4 may have been partially salvaged, or the roof and upper stories may have been carried away by a slide.

[28] Kennecott Copper Corporation, "General Surface, Fire Insurance Map, Jumbo Mine," November 25, 1926, Drawing No. G-4, NPS/AKSO. The heating plant at the Jumbo was replaced at least once as the older plant was installed in the Erie mine camp in 1937; see Kennecott Copper Company, "Annual Report for 1937, Alaska Mines," p. 15.

[29] Kennecott Copper Corporation, "Alaska Mines, Annual Report, 1930, p. 12.

[30] Knutson Interview, *op. cit.*

Erie Mine

The Erie outcropping was located in 1900, shortly after the discoveries made at the Bonanza and Jumbo. It is highly likely that the prospectors simply followed the line of the contact west from one showing to another. Initially, the deposit proved to be too small and too remote. Development of the site was delayed in favor of the larger Bonanza and Jumbo deposits. The Erie was located on a steep mountain slope about 3_ miles north of National Creek and a little over 1,000 feet above the Glacier. Little work was initially done on the Erie. As of 1909, debris had been cleared away and an open cut made in the contact to better expose the ore.[31]

The relative isolation of the Erie mine raises questions about where and how the work force was housed and supported. Tents can be assumed at first and more permanent structures would follow. A number of smaller frame structures were observed in the ravine approximately 200 feet below the present Erie camp during the 1993 survey of mine openings associated with the Kennecott operations. These ruins would have supported work on the 310 portal. Similar structures may well have erected on the site of the present bunkhouse when work was initially undertaken on the 100 Level where the bulk of the structures are now clustered.[32]

Significant exploration and development work began on the Erie in 1913.[33] Access to the site was by way of a trail, later upgraded to a wagon road, along the eastern moraine of the Kennecott and Root glaciers. 1916 had driven three prospecting tunnels driven at the Erie. The upper most, at the present camp level, was 700 feet long. Access to the Erie was by way of an aerial tram from the moraine to the upper tunnel. Ore mined from the Erie was sacked and stockpiled for sledding to the mill once enough snow was on the ground.[34]

Building space was at a premium at the Erie. The main tunnel and the tramway terminal were located in the limestone cliffs at the head of a steep gully. The flanks of the gully were steep necessitating cutting trails, building terraces and at least one structure—the blacksmith shop—into the rock. Support structures were tightly clustered along the gully wall close to the tunnel and tramway.

Work continued at the Erie in a "desultory manner" with some ore mined and sledded to the mill in 1918. [35] When the main bunkhouse was built is not know with certainty. It was designed in its current configuration in 1924; this work may have been additions and modifications to an existing structure.[36] The need for the bunkhouse was real in 1924, as the Erie had been successfully connected underground with the Jumbo mine on July 15th. The Erie-Jumbo Cross-Cut intersected five ore bodies which were mined more or less continuously until 1931.[37]

[31] Moffit and Capps, USGS Bulletin No. 448, *op. cit.*, pp. 91-92,

[32] See Danny Rosenkrans, "1993 Kennecott Mine Openings and Tram Survey Report;" and L. W. Hovis field notes and photologs for July 19, 1993, NPS/AKSO.

[33] "Mines Tributary to Cordova," The Chitina Leader 4,15 (27 January 1914): 3; and "Alaska Coast Development," Alaska and Northwest Mining Journal 4:1 (January 1914): 3, 4.

[34] Moffit, USGS Bulletin No. 662, *op. cit.*, pp.173-174.

[35] "General Points of Interest," *op. cit.*, p. 8.

[36] Kennecott Copper Corporation, "Erie Mine, General Drawing of Bunkhouse, 1924 Addition – Surface Plant," August 18, 1924, Drawing No. B-19, NPS, AKSO. The question remains was the bunkhouse an addition to an existing building or completely new addition to the surface plant.

[37] Kennecott Copper Corporation, *Tenth Annual Report of the Kennecott Copper Corporation For the Year Ended December 31, 1924*, p. 6.

LEGEND

- Ruin
- Adit
- Wood Scatter
- Trail
- Scarp

BUILDING LEGEND

1 Tram Terminus
2 Water and Oil Tanks
3 Generator Shed (collapsed)
4 Transformer (collapsed)
5 Blacksmith
6 Tram Terminus (collapsed)

Erie Mine
Existing Conditions

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Aerial Photographs, NPS, 1991; Topographic Survey, 1991-92, Drawing no.190/80021; Archeological records and files, WRST, HABS Documentation, 1982; Field Investigations, 1997.

The Erie mine and camp was a smaller operation; seventeen men were employed on average in 1924 when the bunkhouse was erected or enlarged. Production levels, and presumably manpower levels, remained steady through the 1920s suggesting few major alterations to the camp during the period.[38] The three-story frame bunkhouse included rooms, washing facilities, a kitchen and mess hall, a reading room, a commissary, which was a part of the larger foreman's office and quarters. Rooms were available for twenty men on the second floor: 14 in shared rooms and six in private rooms including one each for the cook and the foreman. The other four may have been for lead hands or others of higher status.

The bunkhouse was covered with tarpaper and left unpainted. The privy was connected to the south end of the bunkhouse by a boardwalk. Upslope and closer to the mine entrance a frame storage building held water and fuel tanks. An addition to this structure housed a generator with concrete footings. The transformer building north of the bunkhouse was built on pilings to compensate for the lack of level space. The blacksmith shop, one of the earlier facilities on the site was recessed into the rock face.

Just as the local topography defined the placement of buildings, circulation was equally limited. The principal pathway connected the bunkhouse with the mine adit. Between the adit and the blacksmith shop the trail was cut into the rock. Walkways and staircases connected the other structures. Handrails were provided.

Access to the Erie was probably by the aerial tramway of through the mines once the connections were in place. Sections of a well defined trail connecting the camp with the moraine can be seen in the steep gully immediately south of the camp, and all mines were more or less connected by a trail that traced the contact from the Bonanza mine to the Erie. Once the mines were connected underground, ore traveled to the Jumbo and the Erie tramway was reserved for supplies. This situation continued until 1930, when the Erie Bunkhouse was closed on November 1st. A new shop built underground at the Jumbo mine, which improved the overall efficiency of the operation, replaced the blacksmith shop. Ore continued to be produced for another year; support for the operations came from the Jumbo mine camp.[39]

In the final years of operation, a few new ore bodies were discovered in the Erie mine and the bunkhouse was reopened in June 1937. Repairs were made to the roof at the time, and heating stoves, which had originally warmed the building, were replaced with a low-pressure steam boiler and radiator system previously used in the heating plant at the Jumbo mine. Power lines connecting the Erie with the mill town were also repaired.[40] The Erie remained open nearly to the end: "Mining operations at the Erie mine were discontinued at the end of the shaft on October 14, however, main level haulage continued over to Jumbo until October 15, when the entire personnel and camp equipment were moved to Bonanza."[41]

No further work has taken place at the Erie. As at the other mines, natural processes, particularly wind and snow slides have damaged or destroyed the structures. The bunkhouse, the water and oil storage building and the tramway terminal are the only relatively intact structures. The paths are precarious or swept away. Despite the relative inaccessibility of the place, looters have taken many of the portable items—including the pool table—in recent years.

[38] "General Points of Interest," *op. cit.*, p. 1; and "Total Ore Production," *op. cit.*

[39] KCC, "Alaska Mines, 1930," *op. cit.*, p. 12.

[40] KCC, "Alaska Mines, 1937,: *op. cit.*, pp. 7, 16.

[41] Kennecott Copper Corporation, " Annual Report for 1938, Alaska Mines," p. 19.

Glacier Mine

The Glacier mine was the most unusual ore body worked at Kennecott. Like the Slide Ore, the Glacier deposit was formed by the rapid and continued erosion of the extremely high-grade ores on the ridge above at the Bonanza outcrop. Unlike the Slide Ore, the Glacier material was encased in ice, not loose in the scree. As the material fell down it was encased in the glacier and the lateral moraine of the alpine glacier. Ice literally became the "country rock" for ore. Miners worked in the ice—drilling, blasting, and even timbering as they would in rock.[42]

Initially, two tunnels—the Glacier Tunnel and the Upper Tunnel—were driven in the ice to explore the potential of the deposit. A third tunnel was driven later to further define the extent of the ore. The main tunnels ran parallel to the lateral moraine and several cross-cuts ran at right angles to establish the width of the deposit. During the exploration phase, access to the Glacier was by way of an aerial tramway connecting the surface of the glacier with the Bonanza mine 500 feet above.[43]

The decision to mine the Glacier was made sometime prior to 1918 when construction started on the 5,000-foot long Glacier tramway to connect the mine with the Jumbo tramway. The tramway was completed in 1920 and immediately put into operation. Production was heavy from the first.[44]

Once the Glacier mine went into production, drilling and blasting were abandoned in favor of scrappers to move the material the sorting facilities at the head of the Glacier tram. The mine was worked for approximately three months out of the year, July through September, when the ice melted sufficiently to release about 30,000 tons of ore. Some experiments were conducted in artificial thawing, but the increased costs of mining during the cold months were deemed too great for the return.[45]

The winch house and the tramway terminal building were the two major structures at the Glacier mine. The tramway terminal was located at the toe of the glacier as was the associated sorting facilities and waste rock dump. The winch house was built on skids, a movable structure, and was placed as advantageous. In all probability, moves were not frequent as blocks and other rigging devices allowed the scraper cables to turn corner with relative ease. Cable anchors, loose cable, sheaves, and scrapers scattered about the site attest to various organizations of the works.

Accommodations on the Glacier were rude, probably no more than a tent frame or two. The remains of one, complete with a wood burning stove, are located up-slope from the winch house. This small shelter may have served as a lunch room, temporary quarters when it was unsafe to ride the tramway back up to the Bonanza mine, or as part of the regular quarters for men working on the Glacier. The seasonal nature of the work and the limited size of the ore body precluded any need or justification for additional, more extensive facilities.[46]

[42] Bateman and McLaughlin, *op. cit.*, pp. 23 - 24.

[43] "Bonanza Outcrop, Kennecott Mines Co., Glacier Mine," [circa 1917], Kennecott Mines Map Inventory, Drawer 40, Roll R (Drawing No. M-5), copy at NPS/AKSO; and Stewart and Dyer, *op. cit.*, p. 52.

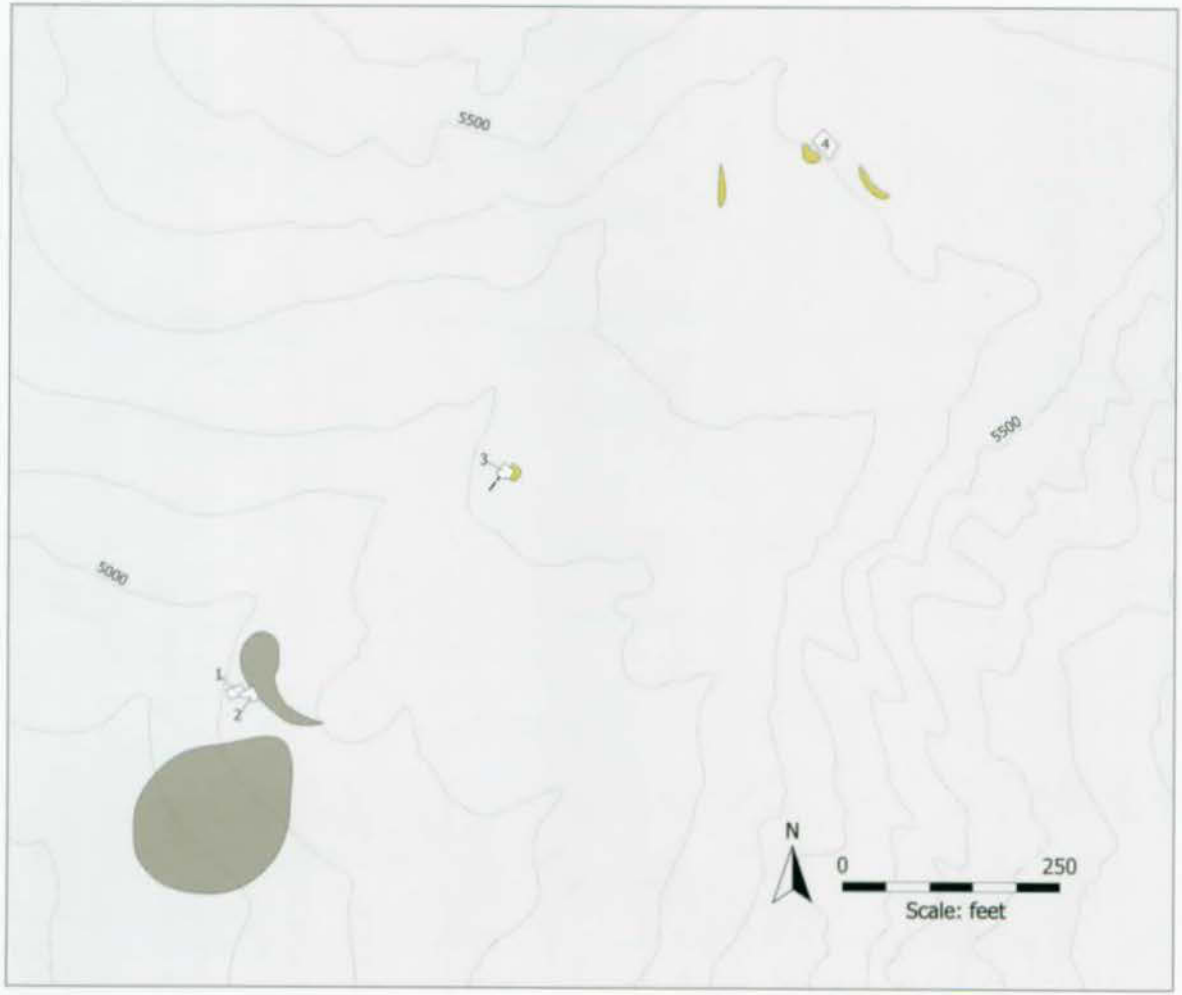
[44] Kennecott Copper Corporation, *Fourth Annual Report of the Kennecott Copper Corporation for the Year Ended December 31, 1918*, p. 8, and *Sixth Annual Report of the Kennecott Copper Corporation For the Year Ended December 31*, 1920, p, 7: and Alfred H. Brooks, "The Alaskan Mining Industry in 1921," in *Mineral Resources of Alaska; Report on Progress of Investigations in 1921*, USGS Bulletin 739 (Washington: USGPO, 1923), p. 23.

[45] "Outline of Geology and Mining Methods, *op. cit.*, p. 9.

[46] WRST, "NPS Site Inventory Form, XMC-125," July 16, 1993. Several terraces are evident on the site suggesting other possible locations for the winch house and possible crew quarters.

Kennecott last produced ore from the Glacier mine in 1928. Over the nine seasons it operated the Glacier Mine shipped a little over 160,000 tons of ore containing a total of 3,526 tons of copper.[47] From the first to the last, the Glacier was an unusual operation: a placer mine on a glacier high in the mountains of Alaska.

[47] "Total Ore Production," *op.cit.*



LEGEND

Dump
Tailing
Cable

BUILDING LEGEND

1 Tram Terminus
2 Ore Bin
3 Winch House
4 Tent Cottage (site only)

Glacier Mine
Existing Conditions

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Aerial Photographs, NPS, 1991; Topographic Survey, 1991-92, Drawing no.190/80021; Archeological records and files, WRST, HABS Documentation, 1982; Field Investigations, 1997.

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Evaluation of Historic Structures

August 20, 1998
Steve Peterson

Preservation of the Kennecott Mill Complex of buildings requires a clear set of priorities, substantial financial investment and years of focused work. The scale and extent of the work that is required to stabilize the buildings also needs to be cognizant of the limitations of a relatively short field season, the potential for the work effort to overwhelm the community and the intermittent available of financial resources available to the NPS. Over 60 years of abandonment have resulted in many serious preservation problems that will not be resolved quickly. In recognition of these issues, the NPS has evaluated and prioritized the preservation tasks at Kennecott in the following manner.

Step #1: Evaluation of the Buildings to Establish Resource Value and Priorities for Preservation:

Each of the 13 historic buildings at the Kennecott mill complex was evaluated to determine their individual architectural value. Each building received a value ranging from very high to very low. To determine the value a single point was given for each of the criteria that the building met. Scores ranged from 4 points = very high, 3 = high, 2 = medium, 1 = low. The specific elements that were evaluated include;

- Architectural significance: A determination of architectural quality and importance was made for each building to determine if the building is of primary or secondary importance.
- Relationship to the railroad corridor: Is the building important in defining and delineating the railroad alleyway.
- Importance to mill complex: Is the building an important part of the milling technology or management of the enterprise?
- Value of the massing of the buildings: How important is the building to the massing and form of the mill complex. Would its removal significantly alter or change the character and massing of the complex of buildings?

The buildings were ranked from Very High to Very Low based upon the structure's historic function and thematic importance to the Kennecott mining activity and community.

In the Comparison Chart below the historic and architectural values were evaluated to determine an overall rating in order to establish the importance of a specific building relative to the other buildings and establish a long-term preservation priority.

Historical Value	Architectural Value				
	Very High	**High**	**Medium**	**Low**	**Very Low**
Very High	Very High	Very High	High	High	Medium
High	Very High	High	High	Medium	Medium
Medium	High	High	Medium	Medium	Low
Low	High	Medium	Medium	Low	Very Low
Very Low	Medium	Medium	Low	Very Low	Very Low

BUILDING RANKING

BUILDING	ARCHITECTURAL AND SPATIAL VALUE	HISTORIC VALUE	OVERALL VALUE
1. Mill Structure 85,000 sq ft	Very High	Very High	**Very High**
2. Mill Structure – Ore Chute	Very High	Very High	**Very High**
3. Leaching Plant – north section 22,200 sq ft	Very High	Very High	**Very High**
4. Powerhouse 13,218 sq ft	Very High	Medium	**High**
5. Machine Shop 5,550 sq ft	Very High	Medium	**High**
6. Company Store and Warehouse 13,185 sq ft	High	High	**High**
7. East General Manager's Office 2,451 sq ft	High	High	**High**
8. National Creek Bunkhouse 3,750 sq ft	High	Medium	**High**
9. National Creek Railroad Trestle	Medium	High	**High**
10. West Bunkhouse 11,830 sq ft	High	Medium	**High**
11. Schoolhouse 1,200 sq ft	Medium	High	**High**
12. Assay Building 512 sq ft	Low	High	**Medium**
13. Leaching Plant-south section 22,200 sq ft	Low	High	**Medium**
14. Recreation Hall (community hall) 2,280 sq ft	Medium	Medium	**Medium**
15. Depot Building 336 sq ft	Medium	Medium	**Medium**
16. Meat House 778 sq ft	Low	Low	**Low**

Stabilization of the Kennecott Buildings

The goal of the National Park Service's Stabilization Program is to stop the deterioration of the 13 historic buildings that the NPS acquired within the Kennecott National Historic Landmark. Stabilization tasks will include emergency stabilization or "triage", long term stabilization and possibly adaptive reuse of some of the buildings depending upon which of the alternatives is selected under this planning effort. Every effort will be made to protect the site and buildings to insure future management options and insure the preservation of the Kennecott Buildings. In order to do meet this goal, the NPS will;

- Conduct on a building by building basis a condition assessment to determine emergency and long-term stabilization needs.
- Conduct emergency stabilization or "triage" repair in the first two years to arrest the imminent collapse and irreversible damage to the structures as a result of over 60 years of abandonment.
- Beginning in year 3, Implement a systematic program of stabilization to reestablish of a weathering skin for the buildings by repairing roofs, walls and foundations using materials compatible with the historic period and consistent with the Secretary of Interior's Standards for the Treatment of Historic Properties.
- Repair deteriorated structural connections at floors, walls, and foundations to resolve vertical and lateral loads on the buildings as a result of winds and snow.
- Mitigate water problems due to rain, site percolation and periodic flooding of National Creek.
- Undertake a site cleanup to remove non-compatible building materials.
- Preserve and protecting documents and artifacts remaining in and around the structures.
- Mitigate of all hazardous materials identified at the site in compliance with the NPS/ADEC Agreement
- Undertake building modifications to facilitate visitor use in a manner that respects the historic character of the buildings.

Chronological List of Historic Architectural/Engineering Drawings, Kennecott Mines[1]

Compiled by Logan Hovis, 1998

Year	Drawing Date	Drawing Legend and Numbers
1907	JUL 22, 1907	**[Bonanza Tramway]**, Final Location of Discharge Terminal, Drawing No. 2, File No. T-183
1907	AUG 23, 1907	Map Showing Location of **Buildings at the Foot of National Creek**, Kennecott Mines Co., Kennecott—Alaska, Drawing No. 8
1907	OCT 10, 1907	**[Bonanza Tramway]**, Sketch of Angle-Station with Ore-bin, Drawing No. 10
1907	OCT 21, 1907	**Bunkhouse [East Bunkhouse, National Creek]** at the Foot of National Creek, Drawing No. 12, File No. B-25
1907	DEC 06, 1907	**[Bonanza Tramway]**, Elevation of Loading Terminal for Kennecott Mines Co. Designed by the Trenton Iron Co., Trenton, N.J.
1910	JAN 04, 1910	**[Concentrating Mill]**, Concentrator, General Framing Plans for Lower Transfer Bins, A-4
1910	JAN 06, 1910	**[Concentrating Mill]**, Concentrator, Complete Drawing for Upper Transfer Bins, A-5
1910	JAN 12, 1910	**[Concentrating Mill]**, Concentrator, Detailed Framing Plans for Lower Transfer Bins, A-6
1910	SEP 12, 1910	**[Concentrating Mill & Tramway]**, Tramway, Skeleton of Store Bins and Housing for Lower Terminal Rail Extension
1911	JAN 06, 1911	**[Concentrating Mill]**, Concentrator, Framing Plans for Upper Trans fer Bins, A-5
1911	JAN 12, 1911	**[Concentrating Mill]**, Concentrator, Detailed Framing Plans for Lower Transfer Bins, A-6

[1] Bracketed and bold titles in the drawing legend are provided by the editor (Hovis) and are for clarification of the information contained on the sheet. All other information in the drawing legend portion of the list is taken (verbatim) from the title block of each individual drawing. Bin numbers, reference numbers, file locations, and cross-references relate to system(s) used by the Kennecott Corporation during the historic period. To date, the most comprehensive extant file of these drawings is in the Alaska Regional Office of the National Park Service, Anchorage, Alaska.

1911	JAN 24, 1911	**[Concentrating Mill]**, Concentrator, Detailed Framing Plans for Lower Transfer Bins, A-4
1911	MAY 23, 1911	**[Concentrating Mill]**, High Grade Bin, General Drawing [revised Aug. 6, 1923]
1911	JUL 02, 1911	**[Concentrating Mill]**, Esperanza Dewaterer
1911	JUL 03, 1911	**[Concentrating Mill]**, Concentrator, Esperanza Classifier - Detail Drawing, Kennecott Office - DRG. No. [9532?]
1911	JUL 05, 1911	**[Concentrating Mill]**, Gen. Drg. Floors in Jig Section, C.M. 4
1911	AUG 22, 1911	**[Concentrating Mill]**, Crushing Plant, Storage Bins, General Drawings
1911	AUG 26, 1911	**[Concentrating Mill]**, Setting 36"x16" Recrushing Roll
1911	OCT 07, 1911	**[Bonanza Tramway]**, Passenger-Car for Kennecott Mines Co., Designed by the Trenton Iron Co., Trenton, N. J.
1911	OCT 11, 1911	**Power Plant** – General Plan, Mine File. Superseded by P.P. 90, Sept. 1924
1911	OCT 12, 1911	**Power Plant** – Sections, Mine File
1911	OCT 12, 1911	**Power Plant** – Sections, Mine File No.
1911	OCT 13, 1911	**Power Plant** – Section, Mine File No.
1911	NOV 12, 1911	**[Bonanza Mine], Mine Ore Bin and Loading Terminal**, Cross Section and Side Elevation, 1911 Installation
1911	DEC 09, 1911	**[Concentrating Mill]**, Coarse Crushing Dept., Crusher Setting, Mine File No. 7, Superseded by Drawing No. CM-66 dated 1-17-23
1912	JAN 09, 1912	**[Concentrating Mill]**, Coarse Crushing Department, Conveyor Pit
1912	JAN 09, 1912	**[Concentrating Mill]**, Coarse Crushing Department, Conveyor Pit [plan at top of mill]
1912	FEB 18, 1912	**[Concentrating Mill]**, Sections of Building, Track Scale & Sacking Shed

1912	FEB 21, 1912	**[Concentrating Mill]**, General Drawing, Track Scale & Sacking Shed
1912	FEB 28, 1912	**[Concentrating Mill]**, Coarse Crushing Unit, Crusher and Conveyor [Section at top of mill]
1912	FEB 29, 1912	**[Concentrating Mill]**, Coarse Crushing Unit, Crusher & Conveyor
1912	JUL 05, 1912	**[Concentrating Mill]**, Mill Cribbing, Details of Crib No. 1
1912	JUL 10, 1912	**[Concentrating Mill]**, Coarse Ore Bin Showing New Bracing
1912	SEP 07, 1912	**[Concentrating Mill]**, Detail of Bull Jig, Traced from Tailing Jig, Bunker Hill and Sullivan M and C Co., 20-X11-1909, 2536
1913	JAN 04, 1913	**[Concentrating Mill]**, Allis-Chalmers Co., Mining Department, Milwaukee, Wis., 19'-0" Hancock Jig L. H., General Drawing (Stan dard), Drawing No. MU 337.
1913	NOV 1913	Profile of Wire Rope **[Jumbo Mine] Tramway**, for Kennecott Mines Co., Sheet No. 2
1915	JAN 13, 1915	**[Concentrating Mill]**, Location of Disc Crusher
1915	[MAR 4], 1915	**[Concentrating Mill]**, Sampling Plant
1915	MAR 18, 1915	**[Leaching Plant]**, Kennecott Mines Co., Arrangement of Ammonia Leaching Plant, Capacity 400 Tons Per 24 Hours, No. 1
1915	AUG 16, 1915	**[Concentrating Mill]**, Proposed Arrangement of New Crushing Unit, Drwg No. 1
1915	AUG 16, 1915	**[Concentrating Mill]**, Proposed Arrangement of New Crushing Unit, Drwg No. 2
1917	FEB 24, 1917	Surface Buildings, General Drawing of **Apartment House**, Lower Camp – South End, DRG B-6
1917	MAR 07, 1917	**[Leach Plant]**, Ground for Proposed Extension to Leaching Plant, DRG No. L.P.-1 [Other structures showing include Machine Shop, Oil Tank Sack House, Leaching Plant, Sacking Shed, and Mill.]
1917	APR 01, 1917	**[Leach Plant]**, Distributor Drive Gear, Kennecott Copper Corpora tion, Latouche, Alaska, DRG. No. L.P. 7

1917	APR 14, 1917	**Jumbo Transformer House**, Drg. No. B-38
1917	APR 17, 1917	**Bunkhouse No. 1 [East Bunkhouse, National Creek]** Proposed Alterations, DRG B-24
1917	MAY 31, 1917	Proposed **Bunkhouse, Bonanza Mine**, DRG. No. B-36 [marked Obsolete]
1917	JUL 06, 1917	**East Slide [Bonanza Mine] Tram Terminal**, DRG. No. T-7
1917	JUL 27, 1917	Ventilation Door, **Bonanza [Mine] Bunkhouse**, DRG B-33
1917	JUL 28, 1917	**[Leach Plant]**, Storage Bin, L. P. Addition, L. Plant, DRG. No. L.P.-34
1917	AUG 26, 1917	**Bonanza [Mine] Bunkhouse**, Floor Plans, First and Second Floor [BK 27]
1917	[AUG 28 1917]	**Ammonia Leaching Plant**, Capacity [8]00 Tons, L.P. 44
1917	SEP 09, 1917	**Bonanza [Mine] Bunkhouse**, Heating Layout, Brg. No. B-35
1917	DEC 1917	**Power Plant** Extension, Turbine Room, PP-11
1918	JUN 1918	**[Mine Equipment]**, 60 Cu. Ft. – 30" Gauge Ore Skip for Bonanza Mine, DRG No. MS 34
1918	JUL 27, 1918	**Five Room House**, B-28 [2 versions]
1918	SEP 03, 1918	**Leaching Plant**, General Drawing, Double Effect Evaporator Unit, L.P. 37
1918	NOV 22, 1918	**Glacier Tramway**, Station No. 1, DRG. No. T-159
1919	FEB 28, 1919	**[Mine Equipment]**, Jumbo Skip Pocket Deflector, DRG. No. M 92
1919	JUN 20, 1919	**[Concentrating Mill]**, Wearing Ring for Symons Crusher, Drg. No. C.M. 71
1920	JAN 03, 1920	Surface Buildings, Alterations to Annex in 1920, **Building No. 26 – Lower Camp [Two-Story Bunkhouse, National Creek]**, B-26
1920	JAN 13, 1920	**[Concentrating Mill]**, Plan, Platform for Sampler, Mill Tailings, C.M. 73

1920	FEB 23, 1920	**[Mine Equipment]**, The Wellman-Seaver Morgan Co., Cleveland, Ohio, USA, C.O. 8426, General Drawing of 36" x 36" Single Drum Geared Electric Hoist, Drawing No. 63019.
1920	JUN 15, 1920	**[Mother Lode Mine]**, Section Showing 1250 Level Pockets, Mother Lode Vertical Shaft, Drwg. No. M.L. - 12, Sheet 1
1920	JUL 17, 1920	**[Concentrating Mill]**, Proposed Change Hancock Jigs, Drg. No. CM-75
1920	OCT 30, 1920	**Leaching Plant**, Details of Rakes and Rake Arms, Excavator – 30 Ft. Diam. Leaching Tank, L.P. 64
1921	JAN 20, 1921	**Leaching Plant**, Flow Diagram, Representing One Complete Cycle, L.P. 65
1921	SEP 16, 1921	**[Concentrating Mill]**, Hancock Addition, C-48
1922	MAR 27, 1922	**Power Plant**, General Drawing, Addition For Diesel Installation, P.P. 63 (showing revisions date 4-5-22 and 5-4-22]
1922	APR 13, 1922	**Concentrating Mill**, Standard Brass Washer For-Simons Disc Crusher, DRG. No. C.M. 82
1922	AUG 18, 1922	**Concentrating Mill**, Timber Sets – Conveyor Tunnel
1922	AUG 28, 1922	**Concentrating Mill**, Foundation Drawing, Addition for Sample Mill, C.M. 91
1922	OCT 12, 1922	**Concentrating Mill**, General Drawing, Addition for Sample Mill, C.M. 107
1922	OCT 15, 1922	**Concentrating Mill**, Revision – West End, Addition for Sampling Mill
1922	NOV 01, 1922	**Concentrating Mill**, Floor Diagram – 3rd, 4th & 6th Floors, Addition to Table Section
1922	DEC 09, 1922	**Concentrating Mill**, Conveyor Details, Addition for Sampling Mill, Final
1923	APR 18, 1923	**Mine Equipment**, General Drawing Matteson Mine Car, Self Dump ing – Type 33 – Capacity 18.75 Cu. Ft., DRG. M.S. 20 [Manufactured by Joshua hendy Iron Works, San Francisco, Calif.]

1923	JUL 20, 1923	**Leaching Plant**, Details of Intermediate & Old Trusses, Sacking Shed – Flotation Unit, L.P. 32
1923	JUL 27, 1923	**Leaching Plant**, Roof Truss Details, Sacking Shed – Flotation Unit, L.P. 80
1923	AUG 04, 1923	**Concentrating Mill**, Proposed High Grade Bin, Sacking Shed [216 Tons Capacity]
1924	MAY 18, 1924	**Concentrating Mill**, Addition for Vezin Sampler, Sample Mill,
1924	AUG 18, 1924	**Erie Mine**, General Drawing of **Bunkhouse**, 1924 Addition – Surface Buildings, DRG. No. B-19
1924	AUG 19, 1924	**Erie Mine**, Basement and Second Floor Plans, 1924 Addition to **Bunkhouse** – Surface Buildings, DRG. No. B-19
1924	SEP 03, 1924	**Power Plant**, Details of Roof Truss, Boiler Unit, PP-94
1925	APR 10, 1925	Surface Structures, General Drawing, **National Creek Flume**, B-[?]
1925	MAY 20, 1925	**Bonanza Tramway**, Detail of Gear Wheel and Pinion, Tram Drive – Angle Station, T-146
1925	MAY 22, 1925	**Mother Lode Mine**, Standard Layout of Stations & Pockets, Mother Lode Incline, DRG. No. 3[0]
1925	OCT 16, 1925	**Concentrating Mill**, Alterations to Scale Pit, Track Scales – Loading Shed, C.M. 41
1926	MAR 30, 1926	**Bonanza Mine**, General Drawing of Skip Dump, Incline Shaft – Above 500 Level, DRG No. M-15
1926	JUN 18, 1926	**Jumbo Mine**, General Layout of Station & Pockets, 2100 Level, DRG. No. M-12
1926	OCT 20, 1926	Fire Insurance Map, **Bonanza Mine**, Drg No G-5
1926	NOV 25, 1926	General Surface, Fire Insurance Map, **Jumbo Mine**, Drg No. G-4
1930	JUN 21, 1930	Surface Structures, General Darawing & Details, **National Creek [Foot] Bridge**, Drw No. B-15-2

1932	SEP 19, 1932	Storage Diagram, Basement, Kennecott **Warehouse and Store**, B-44-3
[1932]	[SEP ?, 1932]	[Storage Diagram, First Floor, Kennecott **Warehouse and Store**]
1932	SEP 05, 1932	Storage Diagram, Second Floor, Kennecott **Warehouse and Store**, [?]
1933	JUN 10, 1933	**Copper River Tramway**, General Drawing and Profile. Lower or East Terminal, Drg. No. 69-1
1933	JUN 16, 1933	**Copper River Tramway**, General Drawing and Detail, Tension Station, Drg. No. 69-2
1937	FEB 04, 1937	**Mine Equipment**, Sleeve for 1" Sectional Drill Steel, Drg. No. M-147-1

Undated Drawings

Drawing No.	Description
6-[.]	[Two elevations of undefined timbered structure, possibly related to a tramway or tramway bunker or elements of Mother Lode mine camp], **Mother Lode Coalition Mines Co., Kennecott, Alaska**
11-73-P	Heine Safety Boiler Co., [Phoenixville, PA], Piping Plan for One Heine Boiler Made for **Mother Lode Copper Mines Co.**, Alaska.
	Profile of Proposed **[Bonanza] Wire Rope Tramway** for Alaska Copper and Coal Co. (Angle Station Route)

Drawings Referenced but not found:

Drawing No.	Description
	SURFACE BUILDINGS DRAWINGS
B-19	Sheet No. 1 – General Drawing of [Erie Mine] Bunkhouse
B-19	Sheet No. 3 – Details of Ash Pit – T-36-8 Jdeel [?] Boiler

CONCENTRATING MILL DRAWINGS

C.M. 108	[Sample Mill], Timber Foundation Drawing and Track Layout, [c. 1922]
C.M. 109	[Sample Mill], Roof Truss Details. [c. 1922]

MINES

M. 16	Details of Skip Dump Above 500 Level, [Bonanza Mine, c. 1926]
M. 108	Details of Standard Shaft, Bonanza Mine [c. 1926]

POWER PLANT DRAWINGS

P.P. 64	Foundation – Addition to Building [c. 1922/1924?]
P.P. 65	Foundation – Allis Chalmers Generator [c. 1922/1924?]
P.P. 66	Foundation – Gen. Electric Generator [c. 1922/1924?]
P.P. 67	Roof Truss and Details [c. 1922/1924?]
P.P. 68	Details of Crane Runway Girder [c. 1922/1924?]
P.P. 69	Plate Girder Details [c. 1922/1924?]
P.P. 70	Details of Roof Girder [c. 1922/1924?]
P.P. 71	Retaining Wall for East Side of Building [c. 1922/1924?]
P.P. 72	Steel Details [c. 1922/1924?]
P.P. 74	Sections Through Building [c. 1922/1924?]
P.P. 86	General Drawing of Power Plant (c. 1924)
P.P. 90	Foundation Drawing of Diesel & Boiler Unit (c. 1924)
P.P. 92	Roof Truss, Diesel Unit (c. 1924]
P.P. 93	Roof Truss, Turbine Unit (c. 1924]
P.P. 104	Details of Steel Purlins [c. 1924]

*U.S. GPO 2001-0-691-136