

Kennecott Mines
McCarthy
VALDIZ Cordova/McCarthy Counties
Alaska

HAER No. AK-1

HAER
AK,
20. MCAR,
1-

PHOTOGRAPHS

HISTORICAL AND DESCRIPTIVE DATA

PHOTOGRAPHS OF HISTORICAL DRAWINGS

ADDENDUM
FOLLOWS...

Historic American Engineering Record
National Park Service
Department of the Interior
Washington, D. C. 20240

HISTORIC AMERICAN ENGINEERING RECORD

HAER
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The Kennecott Mines, 1898-1938

HAER No. AK-1

Location: McCarthy, Alaska

Date of Construction: Camp established in 1907

Original Use: Copper Mine

Present Use: Copper Mine

Original Owner: The Alaska Syndicate

Current Owner:

Significance: Kennecott's significance lies in its quality, as well as quantity, of high grade ore. The mine also illustrates the history of world and U. S. copper between 1907 and 1938. The rise and decline of Kennecott copper brought a parallel pattern in Alaska's mineral production. It also illustrates a chapter in American economic and business history: the discovery of one of the world's richest copper deposits which led to the development of one of the world's greatest copper conglomerates.

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Transmitted by: Jean P. Yearby, 1984

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Preface

The following study concentrates on the history and significance of the Kennecott area. I have emphasized the development of the town rather than include detailed discussions of the mines themselves. The appendices include a very brief history of McCarthy gleaned from the documents. A thorough oral history project should commence immediately to document that town's history while people are still alive to tell it. Since Lone Janson's The Copper Spike and the Alaska Division of Park's historic resource study of The Lower Copper and Chitina Rivers have compiled a history of the Copper River and Northwestern Railroad, I have only superficially touched that subject.

I would like to extend my appreciation to all those whom I have interviewed. Their insights added another dimension to this work. I especially want to thank William C. Douglass for his help, advice, and documents. Special thanks also go to Ralph MacKay for his photographs and to Jean Mattson for her librarian skills.

Discovery and Early Development

George Wilhelm Stellar, a naturalist who accompanied Vitus Bering's Russian expedition in 1741, reported the use of copper knives among the Natives on Kayak Island. Hostile Natives, however, deterred further Russian exploration. Only in 1847, when Rufus Sereberkinikoff and eleven Aleuts ascended the Copper River and wintered at the mouth of the Chitina, did the Russians investigate the river beyond its mouth. Unfortunately, Sereberinikoff antagonized the Copper River Indians who consequently turned on them and killed the whole party. [1]

Other traders, Russian and American, followed. But not until 1885 did a white man ascend the Chitina River, which was the source of copper used by the Natives. Lieutenant Henry T. Allen assisted by two men with only limited supplies explored and mapped the Copper and Chitina Rivers. After three weeks of subsisting on rabbits and rotten moose, Allen and his men stumbled half-starved into the camp of Nicolai, tyone of the Chitina Rivers. During his brief stay near the headwaters of the Chitina, Allen observed copper bullets used in double barrel, muzzle-loading shotguns but did not discuss the copper source and certainly did not contemplate that one of the world's richest copper deposits lay only two valleys away. [2]

After Allen's trip, little exploration occurred until the argonauts of the Klondike gold rush demanded and found new ways to reach the gold fields. In 1898 four thousand prospectors landed at Valdez in Prince William Sound, crossed the coast range over the Valdez Glacier, and straggled up the Copper River Valley prospecting as they journeyed. Only a few succeeded. As a result of this great deluge and sacrifice of lives, the Army and the United States Geological Survey tried to explore, map and describe the trails and mineral resources of Alaska. In 1899 Captain William R. Abercrombie put U.S.G.S. geologist, Oscar Rohn, in charge of exploring and mapping the Chitina Valley.

Rohn became the first man to record in detail the area known as Kennecott. He named the Kennicott and Root Glaciers and described basic geologic structures that he believed held copper ore--Chitistone limestone and Nikolai greenstone. [3] He analyzed the volcanic contact zones and favorably compared the Nikolai greenstone to the Lake Superior greenstone that had produced the richest copper in the United States. He summarized that further exploration was needed and encouraged a more detailed economic survey. [4] That same year in the same vicinity, the Nikolai mine at the head of Nikolai Creek was staked out. [5]

Confusing and contradictory stories have clouded the truth of the discovery of the Bonanza ore deposits adjacent to the Nicolai mine. [6] Apparently in August of 1900 Jack Smith and Clarence Warner discovered the green cliffs of outcropping malachite that legen has them mistaking as grass for their horses. Recognizing the ore on closer inspection, the

two men, including their freinds from the Nicolai mine, staked out their claims. Independently of Warner and Smith, A.C. Spencer of the U.S.G.S. found the outcropping by tracing the limestone and greenstone contact eastward from the Kennicott Glacier. [7]

At this point Stephen Birch, a young New York mining engineer attached to Captain Abercrombie's staff in a civilian capacity, became intrigued with the Bonanza ore potentail. Convincing his wealthy and influencial freinds, O. H. Havemeyer and Norman Schultz, to support his venture, Birch purchased the claims. Immediately Birch found his title in litigation. While battling competitors in court, Birch invested \$400,000 in development work to substantiate his belief in the wealth of the claims. At the same time he tried to interest the Guggenheims and Morgans who could afford the great capital outlay needed to develop the mines. Eventually Birch's Alaska Copper and Coal Company defeated the law suits in the courts of the famous Alaskan judge, James Wickersham. Stephen Birch, as a result of these battles, has been described as "an energetic, determined individualist" [8] and as "a fishy-eyed, cold booded S. of a B." [9]

While Birch fought his litigations, Meyer Guggenheim and his seven sons merged in 1901 with American Smelting and Refining Company to gain essentially a monopoly on the lead and silver business in the United States. [10] Turning their sights to Alaska, the U.S.G.S. assays of the Bonanza ore at over seventy percent copper and fourteen ounces of silver per ton tempted their appetite for greater expansion. [11]

Finally in November of 1906 Stephen Birch finally succeeded in merging the financial interests of the J. P. Morgans with the mining interests of the Guggenheims. This partnership, known as the Alaska Syndicate, purchased forty percent of the Bonanza. By 1909 the Syndicate had acquired the whole Company, three thousand acres of lode and placer claims, for \$2,987,500. [12] Coupling the delayed acquisition with his aggressive and hard-driving business acumen, Birch assured himself a prominent role as managing director in the new business.

The Alaska Syndicate and the Ballinger-Pinchot Affair

Although mining engineers reported ore bodies of pure chalcocite measuring four feet across and fifteen feet in length, [13] the Syndicate confronted serious transportation problems. These extraordinary rich claims unfortunately lay two hundred miles from the coast with only substandard winter trails and impossible summer trails on which to carry supplies. [14] Yet fortune seemed to smile. Only a few miles from the mouth of the Copper River a massive coal filed had been discovered. Thus, a railroad spur could transport its own fuel to carry the high grade copper ore to the smelters that could be built on the coastal coal fields. [15]

The Alaska Syndicate, as a partnership, sold no public stocks or bonds and agreed to invest a minimum of ten million dollars. With this basic capital the Syndicate eventually acquired, in addition to the Kennecott mines, the Copper River and the Northwestern Railway; the Beatson Copper Company on Latouche Island in Prince William Sound; and forty-six percent interest in Northwestern Commercial Company. Northwestern Commercial Company consisted of three subsidiaries; Northwestern Steamship Company, which became the Alaska Steamship Company, the largest maritime transportation company in Alaska trade; Northwestern Fisheries, which became Alaska's second largest packing company; and Northwestern Lighterage and Development Company, which engaged in mercantile business on the Seward Peninsula. [16] Although the Syndicate eventually sold off its Northwestern subsidiaries, it appeared that the Syndicate had a finger in every financial and exploitive venture in Alaska.

Recognizing the diversity of their holdings, copper and its transportation claimed the Syndicate's first priority. The Guggenheims assumed control over development of the Kennecott Mines Company while the Morgans tackled the transportation problem. The Syndicate's Copper River and Northwestern Railway was started first in Valdez, geographically the closest port to Kennecott. After expending \$85,000 in rock work in Keystone Canyon, the Bering coal fields attracted the Syndicate to the new town of Katalla.

A short railroad spur would allow the railroad to exploit the adjacent coal for use as fuel for the engines and smelters. Before leaving Valdez, the Syndicate assigned Deputy Marshall Edward Hasey to protect its interest in the Keystone Canyon in the eventuality that the Katalla route failed.

Katalla, too, presented serious problems. It lacked a port and required the investment of a million dollar breakwater. When a violent storm crushed and destroyed six months work, the Syndicate moved its railroad a third time, to still another new town, Crodova. Here the Syndicate brought, for \$500,000, the short track laid by Michael J. Heney. [17]

Although several railroads competed with the wealthy Syndicate, only the Alaska Home Railroad presented any problems. When the Copper River and Northwestern Railroad left Valdez for Katalla, Valdez townspeople became angry and disappointed. They played into the hands of con artist, H. D. Reynolds. He capitalized on their indignation and challenged them to build their own railroad. Enthusiastically the townspeople responded with all their savings and even their credit. Former governor John Green Brady served as treasurer. The Alaska Home Railroad actually laid grade up to the Keystone Canyon that was still held and guarded by Syndicate men. Driven on by Reynolds' "trust-busting" rhetoric proclaiming that the Railroad

Act of 1898 disallowed exclusively held right of ways, the Alaska Home Railroad men attacked the canyon. Deputy Marshall Edward Hasey found himself facing an unarmed mob that refused to retreat. He fired several rounds and one man was killed.

As a result of this "battle" a wave of anti-Syndicate feeling swept Alaska. Sides were drawn, and the work Syndicate became a political football. James Wickersham made charges of perjury, bribery, and jury-tampering against the Syndicate for entertaining Hasey's jurors. [18] Branded as a Guggenheim tool, Governor Wilfort B. Hoggatt lost his credibility as he supported the Syndicate against the admitted trespassing of the Reynoldnites. [19]

Meanwhile Reynolds found himself and his railroad facing bankruptcy. Reynolds deftly disappeared and former governor, Brady, tried to bring order into the financial chaos. As a result, Brady and seventeen hundred other hopeful investors lost their life's savings. Brady's political and financial life collapsed with Reynold's fraudulent railroad. He left on a mission to Chinca, a destroyed man.

Other lives were changed by the Syndicate's existence. Cordova became a "Syndicate or Guggenheim" town. The Cordova Daily Alaskan served as the media for the Syndicate's cause. Town leaders admitted that the Syndicate's plans took priority over the city. [20] By 1908, however, opposition developed primarily as a result of the "Keystone Massacre".

James Wickersham fanned this opposition into greater antagonism. Wicker am had offered his services as legal counsel to the Syndicate. Upon their rejection he ran for Alaska Delegate to Congress as a vehement anti-Syndicate and anti-monopoly politician. [21] On election day in 1908 the Syndicate loaded the flat cars with railroaders, transported them to Cordova, and carefully coached them to vote against the outspoken Wickersham. [22] Appalled by such tactics, Cordova voters turned to Wickersham assuring his election.

One other great alaskan hero found his life irreparably changed by the Syndicate. Proclaimed a hero by dramatically rescuing ice-bound and starving whalers in 1898, David H. Jarvis reached the pinnacle of his popularity and respect in 1904 when Teddy Roosevelt offered him the governorship of Alaska. Jarvis decided, instead, to take a more financially attractive position as the Syndicate's lobbyist. Championing the Syndicate's causes, he successfully blocked a government subsidized railroad and opposed self-government for Alaska. At the same time his popularity collapsed and his integrity was challenged. Gripped by depression and charged with graft, in 1911, Jarvis committed suicide. [23]

Yet the greatest impact was felt nationally as the Syndicate inadvertently became involved in the Ballinger-Pinchot Affair. The Syndicate was confronted not only with railroad problems but also with fuel problems-- fuel for locomotives and fuel for smelters. Coal seemed the answer. Despite the enormous coal fields found in southcentral Alaska, the United States' coal laws had not been extended to Alaska. In 1903, however, Clarence Cunningham, a mining engineer, organized an association to acquire coal land and form a company to market the coal. They proceeded to do exploratory work on several claims of 160 acres each. All work was null and void, however, because no law existed. Finally in 1904 Congress extended the coal laws to Alaska. The 1904 law even allowed the formation of associations providing they formed after patents had been received and consisted of not more than 640 acres per association. Regardless of the law, Cunningham and associates proceeded to pay for the surveys, filed notices of location, paid ten dollars per acre, and signed an oath that the coal was for the individual's benefit only. Despite the law and oath, Cunningham and associates still planned to poll their patented claims. [24]

Following closely on the 1904 law, President Theodore Roosevelt in 1906 withdrew all coal fields in Alaska that had not been legally filed upon. He justified the withdrawal as means to conserve natural resources and to prevent monopolies. Unfortunately, this withdrawal limited coal development to those claims filed upon in the preceding two years. Thus to the Syndicate, the Cunningham claims appeared not only attractive but one of very few opportunities to obtain coal for the planned railroad and smelters. On July 20, 1907, the illegally formed Cunningham association offered an option to the Syndicate. In December the Syndicate accepted the option to buy one-half interest of the Cunningham coal fields after patents had been received, for \$250,000. [25]

Meanwhile the Commissioner of the Central Land Office, Richard A. Ballinger, had two investigations into the Alaskan coal claims. Neither showed discrepancies. Under some political pressure from the former governor of Washington, who was one of Cunningham's associates, Ballinger, also from Washington, approved the patents. A young idealistic investigator, Louis R. Glavis, telegraphed that the claims should not be approved. As a result, Ballinger suspended the order until the conclusion of Glavis' investigation. Glavis, shortly after Ballinger resigned and returned to private practice, found Cunningham's 1903 journal entry of the verbal agreement to form a company. Cunningham, meanwhile, sought private attorney Ballinger's legal advice. Cunningham felt that no agreement existed as a result of the 1904 relocation of claims. Ballinger believed the mining engineer and prepared an affidavit to that effect.

When Ballinger once again returned to public office in 1909, as Secretary of the Interior, he told his subordinates of his role with Cunningham and told them he wanted nothing to do with the claims. Meanwhile a new act allowed extensive consolidation of coal claims made in good faith under the 1904 act. Glavis expressed concern to Gifford Pinchot, Chief Forester and tireless conservationist, that the Interior Department was trying to distort the 1908 law and allow the illegal Cunningham claims legitimacy. Both Glavis and Pinchot feared a Morgan-Guggenheim monopoly. [26] Pinchot, additionally, welcomed another opportunity to confront Secretary Ballinger who seemed to be destroying the conservation work of his mentor, Teddy Roosevelt. Pinchot encouraged young Glavis to appeal directly to President William Howard Taft. Unfortunately for Glavis, Taft exonerated Ballinger and recommended the dismissal of Glavis for "filing a disingenuous statement unjustly impeaching the official integrity of his superior officers." [27]

Without resigning his office, Pinchot appealed to the people over the head of his president. Collier's Weekly supported him even to the point of contriving a hoax implying that Taft was in collusion with the Morgan-Guggenheim Syndicate. [28] Having no choice but to make Pinchot a martyr, Taft fired Pinchot. Eventually a Congressional investigation cleared Ballinger of charges of misconduct, and the Land Commissioner invalidated the Cunningham claims. But the public remained unconvinced. Furthermore, Pinchot had not completed his destruction of the "anti-conservation" forces of Taft and Ballinger. He wrote Teddy Roosevelt in Khartoum, Africa and expressed sixteen ways that Taft had abandoned the Roosevelt policies. [29] Roosevelt returned to the United States, split from the Republican Party, formed his own Bull Moose Party, and inadvertently allowed the Democratic nominee, Woodrow Wilson, to win the presidential election of 1912. [30]

As a postscript to the Ballinger-Pinchot affair, in 1917 Daniel Guggenheim met Pinchot and urged him to correct his unjust statements that the Alaska Syndicate had attempted to obtain a monopoly in Alaska. Pinchot admitted that he could not dispute Guggenheim's facts, but "[The] Natural and inevitable result of what was actually done in your name was to produce the impression that an effort was under way to monopolize the resources of Alaska. Hence I find it impossible to agree with you that the fault lay with myself." [31]

The coal problem, however, remained unresolved and a thorn in the side of Alaskans for years. As a result of the coal land withdrawal, the Copper River and Northwestern Railway shifted to locomotives run by oil. Without coal the Syndicate could not afford to develop the promised railroad to the Yukon or the coastal smelters. Alaskans opposed Pinchot and all of his conservation policies and blamed conservationists for Alaska's lack of development. [32]

The Early Kennecott Mines

While the Syndicate wrestled with the inherent logistical and political problems, exploration and development of the mines, which everyone hoped would make the gamble worthwhile, plodded along. The relatively high prices of copper in 1907 and the accompanying "copper famine" had kindled the Syndicate's interest in Kennecott. Stephen Birch, as manager of the Kennecott Mines Company, continued to guide mine development.

After extending the first two tunnels crosscutting the ore body at Bonanza, Birch began development on the Jumbo claim, located nearly one mile northwest of the Bonanza. These two mines lay at the base of lofty cliffs over six thousand feet above sea level. Three miles and nearly four thousand feet lower, at the mouth of National Creek, the main camp and office were constructed. To facilitate communication and the transportation of supplies, a temporary wagon road connected the lower camp with the Bonanza.

Until the railroad joined the mines with the coast, the task of getting food, mining equipment, building materials, and other supplies to the mines presented a major problem. Because Alaska lacked good wagon roads or even well maintained trails, winter travel proved the most expedient. Once the swamps, muskeg, streams, and rivers had iced over and snow had fallen, dog teams, pack horses, and horse drawn sleds could carry freight more easily than during the summer months. The evolution of the reversible one horse sled relieved the problem of having a horse or sled get stuck. If that happened, the horse was hooked to the other end and continued up the mountain or through the woods repeating the task as necessary. [33] Only over Tasnuna trail, which had a snow plow, were heavy bobs used in place of the double ended sleds. [34]

Freighting of supplies during the short summer months was costly, difficult, and used only in an emergency. Nevertheless, one summer freighter preferred the longer but easier route through Canada to the Yukon. The Valdez trail wound through the coastal range, across glaciers, and forded glacier-fed streams. Grass for horses could not be counted on except during the early summer. On the other hand, the Donjek trail claimed better feed, no bad water crossings, plenty of wood, and proved to be twenty-five miles shorter. [35] Altogether freighting costs varied from an average of \$200 a ton during the winter to \$2000 a ton during the summer. [36]

To help alleviate the supply problem, the summer of 1907 saw the assemblage of the steamboat, Chittyna (later called the Chitina), that during the previous winter had been carried piece by piece above Abercrombie's Rapids. The steamer served mainly to supply the railroad but occasionally, during high water, was able to maneuver the Chitina River to bring supplies to the mines. [37]

A series of unforeseen circumstances in 1908 compounded the already severe supply problem. The early opening of the Chitina River hampered the shipment of supplies that had started along the frozen river the previous winter. The lower price of copper, from twenty cents to thirteen cents per pound, discouraged prospectors. This meant fewer supplies were shipped in over the snow and resulted in poorly maintained trails. In hopes of countering these problems, construction began on a short piece of railroad from the camp to the Chitina River. Once completed, the Syndicate anticipated that supplies and ore could be shipped on the steamer Chitina and two other steamboats thereby relieving the dependency on winter freighting. [38]

Meanwhile at the camp, horses packed in those supplies that could not wait until freeze-up. Unfortunately, because of the tramway's weight, much of its equipment had to be cached at the mouth of the Chitina River until winter. Thus, since only half of the tramway's towers were erected before winter, the wagon road to the mine was widened and graded to expedite the sledding of food and supplies. Additionally, a sawmill, bunkhouse, and blacksmith shop added necessary shelter and tools to the embryonic mining town.

At long last, in 1909, the railroad conquered the crossing of the Copper River. Now the railroad could ship more freight in one day to Abercrombie Canyon than could be taken over the Valdez Trail in six months. Four steamboats met the railroad above Abercrombie Rapids and conveyed the freight to other spots along the railroad and to the Kennecott camp. [39] Although the steamers helped bring in the supplies during the summer, horse sleds during the winter still transported most of the supplies. Once completed the one hundred ton tramway opened a new route to get the supplies from the camp to the mine. Large weights of freight could be readily raised to the mines, counterbalanced by equally massive quantities of ore lowered to the camp below.

The nearly completed railroad coupled with the summer steamboats had lowered the freighting costs for 1910. At the same time the Bonanza mine and the lower camp were fully equipped to ship ore. The Bonanza mine consisted of three different mines all mining the same ore deposit. The initial outcropping was called a "glory hole" and was the only ore body where open pit methods were used. Given the irregularity of the remaining ore bodies, subterranean tunnels were found more expedient. By 1910 these workings lay 150 feet below the surface. The ore from the underground mine proved to be at least fifty percent copper and could be bagged and shipped as it came from the mine.

Yet before man had discovered the Bonanza, nature had already begun to erode the chalcocite from the limestone. Thus ore could be found in the talus slide that assayed at thirteen percent copper. In addition, some ore had gone over the steep cliff to the west of the outcropping and had become buried in a glacier. These latter two "mines" consisted of low

grade ore and its shipment would mean paying high freight rates for a great deal of waste material. The hundred ton concentrator fulfilled the purpose of separating the ore from the waste rock. The separation involved mechanical crushers, oscillating or rocking tables, and jets of water to wash away the waste. [40] The heavier ore that remained was dried and sacked.

Although the tramway could carry the ore from the mines to the newly constructed ore bins at camp, [41] L. A. Levensaler, the superintendent, preferred not to attempt much mining until the railroad had problems with heavy snowfall, snow slides, frozen overflow, floods, winds, and moving glaciers, their deadline might not be met. Levensaler had the men constructing buildings to make the camp more habitable. Six men worked at the mine, but thirty men, at the lower camp, built the concentrator, steam plant, and other buildings. A dam on National Creek furnished water for the concentrator and hydroelectric power for the power plant. [43] Once again three hundred tons of fifty percent ore had been vrought on the gravity run tram simultaneously lifting the season's supplies to the mines.

Outside the Kennecott camp and the railroad construction camps, a wave of anti-Syndicate feeling, caused by the Keystone Massacre; the Hasey trial; and other unrelated dealings, swept Alaska and the eastern business world. Simon Guggenheim tried to present the Syndicate's perspective. He expounded on the virtues of large capitalist undertaking, primarily lode mining. "Alaska gets its first important railroad because of a lode mine . . . (but) the point is that the mine had to come first. No individual, corporation, or government in the world would or could afford to build a railroad to prospect unknown territory. It would be the limit of absurdity." [44] He appealed to the government to release the Bering Coal fields or warned that Alaska would be the loser. Alfred H. Brooks, Director of the United States Geological Survey in Alaska, and the highly respected Copper Handbook echoed his concerns. [45]

The 1911 Bonanza ore reserve report estimated 80,000 tons of fifty percent ore in the outcrop, 50,000 tons of twelve percent in the slide, and at least 80,000 tons of three to twenty percent mill ore around the high grade masses. As a result of these estimates, the reasonably objective and reputable Copper Handbook attempted to weigh the significance of the Kennecott mine. "The Bonanza mine probably is the highest grade copper mine in the world, and, with equal probability, may be called the most overrated copper mine in the world. Unless additional ore bodies are found, which is possible, but not entirely probable, the total amount of copper in the Bonanza mine is insufficient to render it more than a producer of the third rank." [46] Fortunately for the Syndicate, other mines had been discovered--The Jumbo, the Erie, and the Mother Lode.

Finally on March 29, 1911, at long last, the Copper River and Northwestern Railway joined the copper mines with the coast. At the enormous cost of nearly \$20 million, the railroad's basic purpose had been met--it carried the Kennecott ore to the waiting steamships at Cordova. [47] Yet because of the locked up coal reserves, the railroad failed to develop the valley as the earlier boasts had proclaimed it would. There was no spur to the coal fields, no smelters or industrial development along the coast, no track to the Yukon, and no reciprocal agricultural development. Nevertheless, the Syndicate had poured more money into Alaska than any agency other than the federal government. [48] Moreover when compared to the rates for winter freighting, the railroad rates appeared reasonably low. [49] With the final completion of the railroad, the Syndicate phased out their Copper River steamboats.

Alaskans celebrated the first shipment of copper into Cordova on April 8, 1911. On April 14, the steamer, Northwestern, carried into Seattle 1200 tons of sixty to seventy percent high grade copper ore worth \$250,000. [50] Following this initial shipment, the railroad carried ahdn sorted high grade chalcocite twice a week. As a result of the first real shipment of copper ore, the owners received their first dividend in 1911. At the same time the development of the Jumbo and Erie excited great dreams of even greater production potential. [51] Unfortunately the Jumbo tramway, shipped by rail in 1911, took several years to construct.

Kennecott's shipments doubled Alaska's copper production figures while the value of the copper jumped from \$538,685 in 1910 to \$3,366,584 in 1911. [52] Copper production in 1912 climbed still twenty percent higher despite unusual obstacles. [53] A landslide on the railroad tracks prevented ore shipment for six weeks. The mill, erected on unstable glacier moraine, suspended operations until structural stability was assured. Still, 1912 saw the first ore concentrated from the talus slide below the Bonanza. [54]

As a result of two years of production and 40,000,000 pounds of copper (or 29,000 tons of ore) at an average tenor of seventy percent copper, Kennecott Mines Company reported over four million dollars of operating profits. Thus in 1912 the company paid its owners \$3 million in dividends. [55] On the other hand, ore reserves shrank to 30,000 tons of fifty percent copper, 54,000 tons of thrity percent ore, and 30,000 tons of thirteen percent talus ore. [56]

Misfortune struck the Bonanza in 1913. A snowslide destroyed part of the tramway, and fire razed the compressor plant. Labor shortages arose as a result of an exodus to the Chisana placer district. Despite these problems the Bonanza made shipments for eight months, and the Jumbo went into limited production. [57]

Activity continued as the concentrator was expanded to handle 500 tons per day. As development work in the Bonanza reached the 700 foot level, further large quantities of high grade chalcocite of sixty to seventy-two percent copper were discovered. The Jumbo had reached the 400 foot level and its ore paid for all development despite having to be hauled to the mill by wagon. [58]

By May of 1915 the Kennecott mines had produced over 86,000,000 pounds of copper with operating profits of over \$8 million. The payment of \$7 million in dividends offset, in part, the lack of dividends from the Copper River and Northwestern Railway. Despite these seemingly high profits, the amount did not even equal the simple interest on the cash outlay. [59] The Alaska Syndicate evaluated its position and decided to invite public participation. The Syndicate valued their investment at \$28 million in stocks and bonds. Weighing their original investment of over \$50 million plus interest, the Syndicate seemed willing to pull out even at a sacrifice. [60] High copper prices and the correct prediction of the 1915 to 1916 boom made the time right for a public flotation of Kennecott stocks at twenty-five dollars per share. On May 27, 1917, the new corporation, Kennecott Copper Corporation, assumed all the Syndicate's holdings plus large holdings in Utah Copper and Braden Copper mines in Chile.

The evaluation of the significance of the Alaska Syndicate has been brandished about by historians for the last sixty years. [61] It has been viewed by some as an exploitive octopus and by others as an positive economic force. Without any doubt, it played an enormous, almost overwhelming role, in Alaska's history from 1905 to 1915. The Syndicate appeared to touch every facet of life from the political to the economic, from the national to the local level. In part, Alaska's small population necessitated the impact. Its steamships carried nearly all supplies and passengers between Alaska and Seattle; its railroad was the longest and best constructed in the territory with equitable rates operating at a loss each year; its fisheries, canneries, and merchandise outlets supplied needs to a developing territory; its copper production stimulated other mineral development; and its large capital investment infused economic opportunity into an isolated area. On the other hand, the Syndicate did involve itself in politics at the local and national level that, in the aftermath given the historical perspective of the era, could best be judged as "misconduct." Overall, however, their contributions seem to outweigh their liabilities.

The Beginnings of Kennecott Copper Corporation

The business world stood agape. A brazen newcomer had absorbed two older, larger, and better established companies. Some viewed it a triumph of high finance over technology; others resented the implication of becoming

subordinates to a tiny mine in Alaska. [62] Former Syndicate officials dominated the Board of Directors, and Stephen Birch continued as president. [63] In fact, Stephen Birch had pushed the merger with the Utah Copper Company and Braden Copper Mine in Chile. He wanted the Corporation to have the long term, stable investment of low grade porphyry mines as well as the high grade but low ore reserve profits of the Kennecott Mines. [64]

To capitalize on the high price of copper, the Corporation demanded greater capacity and efficiency from the Kennecott mines. Mining, being underground, went into year round schedules. Additions and improvements increased the concentrator's capacity to 800 tons a day. Nevertheless, only 84.6 percent copper was recovered from the ore mined in 1915. The Corporation felt a better average could be obtained.

Kennecott's uniquely high grade ore granted certain allowances that other ores could not afford, but its long and costly transportation set limits to those allowances. For instances, the high grade ore, thirty to seventy percent copper, could be bagged and shipped directly, but due to the distance and cost of transportation, the millgrade ore of seven to nine percent copper had to be reduced to a greater percentage of copper. The concentrator freed the basic sulphides, chalcite and covellite, from the waste rock. The big problem lay in obtaining the carbonates, malachite and azurite, also in the rock. These ores had been oxidized before the Glacier Age and did not respond to mechanical concentration. Prior to 1915, because of the ore's high return in profits and the corporation's needs for dividends to offset high development costs, these carbonates had been discarded with the mill tailings. Yet the Corporation recognized this waste and sent E. Tappan Stannard, a brilliant young metallurgist, to design a new method of leaching copper carbonates from the tailings. The common acid leaching plants, used throughout the industry, dissolved the carbonates leaving the host rock behind. Unfortunately, acid also dissolved Kennecott's host rock, limestone. Stannard began leaching experiments using ammonia that would dissolve the copper carbonates but not the limestone. [65]

By the end of 1915, Kennecott had pushed its production to 63,000,000 pounds of copper at a cost of 4.5 cents per pound. Since the price of copper averaged 19.5 cents, the full profit averaged nearly 15 cents per pound. [66] Kennecott climbed from the eighth rank copper producer to the fifth. [67]

Prices and profits continued upward in 1916. The copper industry reaped the profits of World War. Prices reached the highest point known, and production could not supply the insistent war demands. Smelting plants, overwhelmed with ore, became selective choosing the larger producers over the smaller miner. Ill feeling against Kennecott, who owned not only the transportation systems but also the smelters, swept through Alaska. Still, as the price of copper climbed to thirty-five cents a pound, along with it climbed the wage scale. [68]

At Kennecott E. T. Stannard took over as general manager. Output from the mines outshadowed all other Alaskan copper production. While mining engineers discovered enormous new bodies of ore, production from the Jumbo jumped ahead of the Bonanza. One Jumbo ore body, of almost pure chalcocite, measured 350 feet by 40 feet wide by 40 feet high and produced over 70,000 tons of seventy percent copper and 20 ounces of silver per ton. [69] Alan M. Bateman, respected geologist and later editor of the Journal of Economic Geology, called the mines "one of the most unique deposits in the entire world." [70] On the other hand, the company's ore reserves were never more than four years ahead of production. [71]

Also in 1916 the world's first ammonia leaching plant began treatment of the mill tailings. A filtering system solved an early problem of carbonate slime clogging up the system, and plans were made to double its capacity. From 62,450 tons of mill tailings averaging only 1.48 percent copper came 703 tons of 70 percent copper. The total cost of production remained about five cents a pound, but selling price soared above thirty cents. The Corporation shared its profits as dividends of \$5.50 per share. [72] The year 1916 proved to be Kennecott's greatest year in ore production and profits obtained.

As the capacity for the mine expanded, construction kept pace. The newly developed Erie mine was equipped with a tram. A hospital, recreation hall, apartment building, and guest house added to the town's dimensions. Additions to the power plant, including a steam heating system to provide heat to the staff's cottages, were built. Unfortunately, with the increased production and increased tension, accidents happened--during the year two men were killed and six men badly injured. [73]

Life at Kennecott seldom seemed dull. The mines' bunkhouses had been built on glaciers that moved occasionally each summer. Thus, the front ends had to be jacked back upstream to keep the buildings in tact. In 1916 the Bonanza bunkhouse burned down causing unpleasant living conditions. Mine water, always scarce, was obtained by shovelling snow into a tank and thawing it. The underground mines never rose above thirty-two degrees so "efficiency was high because it was too cold to sit down." [74] On the lighter side, the men staged badger fights, and the adjacent town of McCarthy exchanged dances with Kennecott. Since women were a premium, all women, dance hall girls and barmaids, were invited. In late October the Company began to show motion pictures in the new recreation hall.

Extraordinary activity and accelerated mine production marked the beginning of 1917. Improvements and enlargements of the mill, trams, and mines led to high levels of production that literally swamped the railroad. Unfortunately the World War, which had created such great

demand for copper, also resulted in the descent of profits. As the United States entered the World War, men left the labor force to join the military effort. Foreign miners and mill workers had already returned to fight for their home country. Despite a liberal wage scale, labor became scarce and inefficient. Supplies and transportation rates increased as everything became more expensive; the cost of living rose proportionally. Finally by fixing a stable price of 23.5 cents per pound, the government deprived the Corporation of its expected profits. Thus copper production costs had increased, whereas the profit margin had been arbitrarily lowered. Doomsayers predicted a copper famine. [75]

Production at Kennecott, meanwhile, rolled along. The mill, for the first time during the winter, had operated at full capacity. Changes in the water supply relieved the chronic water shortages that had previously required the mill's shutdown during the winter. The recovery had improved to 89.4 percent efficiency. [76] The ammonia leaching plant, the technological pride of Kennecott, had proved itself effective. A new store and warehouse plus still more living quarters for fifty men had been erected. With the profits from 1916 and the first half of 1917, Kennecott Copper Corporation essentially bought out Braden Copper Company in Chile and continued to buy Utah Copper Company's shares.

Amidst the bustle, Kennecott suffered its only strike. On June 12, 1917, the miners, unorganized by labor unions, demanded, instead of the sliding scale wage, a flat rate of \$5.75 per day. The Corporation advised them that their demands could not be met. Thus on June 16, two hundred miners walked out practically closing the mill. This move forced a total of four hundred employees in other departments to curtail their work. [77]

The controversy stemmed back to December, 1916, when a dispute over wages had been resolved by General Manager Stannard and the Miners Committee. Since the labor turnover was high, over sixty percent of the miners were new and did not feel bound by the agreement. The remaining forty percent claimed the Miners Committee had exceeded their authority and, thus, did not represent them.

During the strike both the Miners Committee and Kennecott Copper Corporation agreed to a joint request that McCarthy's saloons be closed. The United States Marshall arrived from Valdez to ensure order. Stannard also requested a thirty man detachment from the 14th Infantry to guard the bridges along the Copper River and Northwestern Railroad.

On July 1, Stannard expressed the Corporation's stand. He considered the men bound by the December, 1916 agreement and felt the differences could have been adjusted without a crippling strike. Since the sliding wage scale based on the price of copper had been adopted in principal

by all large producers, he could not agree to its abolishment, but he could offer to readjust the sliding scale to increase the daily wage. He accused the Miners Committee of being Industrial Workers of the World agitators and would, under no circumstances, be re-employed. The whole controversy he blamed on a pro-German agitator, who had since left the area.

On July 3, 1917, Stannard met with the Miners Committee to work out a compromise. The miners demanded that they be able to return to work collectively and complained about the poor working conditions at the Bonanza--no bunkhouse or bathing facility. Stannard told them in no uncertain terms that he would not take them back collectively but would entertain individual applications. Unfortunately, Stannard's aloof, even cold and domineering, personality presented a great liability when dealing with his men. [78] The miners refused his terms. Consequently the Corporation brought in two hundred men of all nationalities to serve as strikebreakers. Upon their arrival fifty millmen walked out in sympathy. [79] Despite the tension, the Labor Department's arbitrator complimented the men on their peaceful behavior. The Corporation, although at ninety percent work force, operated at less than fifty percent efficiency. The Corporation continued to lose money.

Finally on August, with the help of an impartial arbitrator, a compromise was reached. The sliding wage scale increased the wage to \$5.50 when copper was priced above 27.5 cents a pound. Thus, the miners received an increase of fifty cents a day. Stannard also agreed to build a new bunkhouse and messhouse plus a recreation hall at the Bonanza mine. In exchange for these concessions, Stannard demanded the right to decide which men could return to work. Only one member of the Miners Committee would be rehired. The miners accepted the terms but wrote to the Department of Labor, "The strikers wish to apologize to the Government for any inconvenience their actions may have caused . . . Fifty-eight of our members have already registered for the war and should the Government take over the Kennecott mines, they would have little trouble securing men at their own terms; for when Alaskans deal with the Government, they are patriots, but when they deal with the Guggenheims, they are hard fisted, cold-blooded flinty-hearted business men." [80]

The arbitrator expressed his belief that compared to other mines in Butte, Montana and Ely, Nevada the adjustment had been to the advantage of the miners. After forty-five days, the strike had ended.

Even after the strike, Kennecott felt the pinch caused by the war. Labor shortages prevented the mill from operating at full capacity and delayed the completion of the leaching plant's addition. Labor turnover averaged two hundred percent making efficiency only seventy-five percent.

Finally by August the Erie mine was shutdown for lack of labor. The war also resulted in an inability to obtain ammonia during the summer months. Furthermore, severe snowslides in the spring wrecked the tramways and curtailed production.

In spite of all these problems, Kennecott continued to explore and find new ore bodies. Tramway construction increased the Bonanza's capacity to 600 tons and connected the Glacier mine to the Jumbo tramway. More new cottages and additional dormitory accommodations were built. Suddenly, on November 11, 1918, the war ended.

The Copper Slump, 1919-1922

Despite the armistice, the War Industries Board, in anticipation of postwar needs, encouraged all mines and smelters to maintain the existing high rate of production. The decision proved not only misfortunate but almost tragic---copper companies wound up with enormous stockpiles of unsold copper compounded by the sudden release, into the open market, of government scrap copper and brass. [81]

The high production and the consequent stockpiling had to stop. Kennecott began in early 1919 to curtail production. By April the mines and mills operated approximately one-third of normal. [82] The Copper River and Northwestern Railway, in an effort to offset the reduction in ore shipments, increased freight rates. In addition, labor remained a problem. High turnover rates caused inefficiency. Altogether, the fall in copper prices, the uncertainty of the market, the shortage of labor, and the high cost of supplies meant an increase in production costs, an unstable business climate, and the lowest production since 1914. Yet development continued. The completion of the Bonanza-Jumbo cross cut joined the two mines. But most important, Kennecott Copper Corporation acquired fifty-one percent interest in the adjacent and very profitable Mother Lode mine.

Founded in 1899 by the same two prospectors that had discovered Kennecott, the Mother Lode, on the other side of the mountain from Kennecott, developed independently. The ore deposits resembled the Bonanza ore, but lack of big capital kept production low. Without a railroad or a concentrator, wagons and sleds hauled only high grade ore to the Copper River and Northwestern Railroad. In 1915 a tramway connected the mine with bunkers on McCarthy Creek. Severe snowslides in 1919 wiped out the tramway and power lines. To repair the damage and to explore more extensively, the Mother Lode Copper Mines Company liquidated its stocks. Although separate books and accounts were kept, the Mother Lode Coalition Mines Company became a subsidiary of Kennecott Copper Corporation. Eventually a crosscut connected the Mother Lode and the Bonanza allowing the Bonanza tram to carry the Mother Lode ore to the Kennecott concentrator. [83]

As the price of copper remained low and stockpiles of copper and scrap stayed high, the copper slump became a world-wide depression. Coincidentally the continued low prices stimulated the consumer to make and find greater and greater uses for copper. This domestic use would eventually pull the copper industry out of the doldrums. In the meanwhile, many mines found themselves facing not only curtailment but actual shut-down. Each mine had to weigh the value of the ore, the ease in mining, and the transportation and smelting costs. Kennecott evaluated the situation and felt the mines could continue in production. Kennecott's costs were 10.84 cents per pound and copper, at the beginning of the year, sold at 17.5 cents. [84] This even allowed dividends of two dollars per share. In fact, production increased substantially above 1919 and Alaska regained her fifth rank among copper producers. [85]

Still, the business climate, for Kennecott and Alaska at large, became increasingly discouraging. [86] Although new ore bodies had been discovered and mining at Glacier mine began, the Erie mine remained closed. Labor shortages were a chronic concern. Additionally, since installation, leaching plant costs had increased thirty percent. Finally by the end of the year when copper prices dropped to thirteen cents per pound, Kennecott stopped selling copper.

Meanwhile administrative control at Kennecott shifted from E. T. Stannard, who moved on to become vice president and eventually president of the Corporation to William C. Douglass. Stannard had carefully groomed Douglass to take his place, training him in management and fiscal responsibility. Thus, Kennecott continued to run like clockwork during the ten years of his stewardship. [87]

Across the nation, 1921 became known as the worst year in copper history: mines were shutdown; employees dismissed; and warehouses were full of unsold metal. When the price of copper dropped below the cost of production, curtailment proved insufficient. Only shutdown seemed feasible, and then maintenance expenses entailed heavy losses. One small benefit that copper producers could perceive from this business nightmare was an opportunity to eliminate the radical element from the miners and reduce the inflated wage scale. [88]

Because of the general curtailment and shutdown, Alaska, despite Kennecott's own reduction, climbed into third place among the copper producing states. [89] Kennecott not only produced less ore in 1921, but the grade of ore proved lower than any mined since 1911. The 2.8 percent ore of the Glacier mine resulted in the low average, but the Bonanza and Jumbo also averaged lower than usual. [90] Except for remodeling the leaching plant's piping system, no improvements were made. For once, labor was plentiful and efficiency improved. Wages, however, had to be reduced by \$1.35 a day. Thus, the cost of producing copper at Kennecott decreased slightly, whereas, at Utah Copper Company, Kennecott's sister Company costs were nearly three cents a pound more. This difference forced the closure of Utah Copper for a year, but allowed Kennecott to continue at reduced status. [91]

By the last quarter of 1921, the demand for copper grew: the stockpiles diminished; European markets returned; and domestic consumption resumed. A steady growth of improving conditions prevailed. [92] During 1922 conditions also improved at Kennecott. Diesel engines replaced the steam turbines improving efficiency and decreasing the cost of power. Yet with the resumption of mining operations, a serious shortage of labor developed. Only by wage increases was the problem relieved. Nevertheless, the cost of producing copper shrank to 8.67 cents a pound while the selling price remained fairly stable at 13.6. [93]

Not only did business conditions revive at Kennecott, but the overall quality of life improved. Since it was often too cold to go to the messhall for lunch, Manager Douglass built lunchrooms in the underground mines. He added strip heaters, benches and lights. The cooks and waiters brought the food to the miners. If necessary, hot plates kept the food hot. Pipes, enclosed in boxes of sawdust, carried steam to heat the staff's houses. Douglass also installed a lighted skating rink where carnivals, hockey games, and skating contests occurred. During the summer the company sponsored a baseball team that played on the mill tailings. Douglass, himself, played on the team that played teams in McCarthy and Cordova. Each mine and the town had a recreation hall where movies were changed once a week on a rotational basis. Since women were still not allowed at the mines, the women of McCarthy often provided solace to lonely miners. [94]

Declining Years, 1923-29

The year 1923 marked a pivotal year for Kennecott. During that year Kennecott reached its greatest production, yet that year also signaled the beginning of a slow decline. [95] Prior to 1923 Kennecott generally reflected the overall conditions within the copper industry. With the early rise in copper prices in 1907, the Syndicate bought out Stephen Birch. Fortuitous timing had the mines and mill sufficiently developed to capitalize on the World War's demands for copper. Postwar overproduction and surplus copper hurt Kennecott as well as the rest of the nation. Finally by 1923, as the nation's copper producers rose out of their slump, Kennecott rose with them. Yet high production, demanded by the consuming public, could not be maintained. From 1924 to 1929 Kennecott's production and percentage of high grade ore declined.

The generally improved conditions of 1922 recovered further in 1923. Mines reopened, prices stayed high, and consumers demanded copper. All mines responded with a production equaled only by that during the World War. Conforming to pattern, the supply exceeded the demand, and a brief period of overproduction followed. [96]

Kennecott began production at seventy percent capacity yet completed the year with the greatest volume of ore mines in its history. [97] Because of the lower grade ore and the lower prices, the overall value proved less than during 1916 and 1917. Nevertheless, the production figures demonstrated to a reluctant Utah Copper Company that the brazen upstart could produce. Kennecott Copper Corporation absorbed seventy-seven percent of Utah Copper Company and extended the Board of Directors to include Utah's Daniel C. Jackling.

A new change in values occurred in 1923. The highly praised Bonanza and Jumbo mines, steadily declining since 1918, suddenly found that the Mother Lode had outstripped them. The Mother Lode, alone, produced what the Bonanza and the Jumbo produced together. [98] Although the Erie remained closed most of the year, development began on the Jumbo-Erie cross-cut that resulted in the discovery of a fair sized ore body.

With the mines' declining production and value, Douglass, in an effort to maximize the recovery of all copper, mined the Glacier mine, expanded and modified the concentrator and leaching plant, and finally, in 1923, built the flotation plant. The ammonia leaching plant had been specifically designed for Kennecott's unique deposits of copper carbonates, but it malfunctioned if either too fine a carbonate or slime found its way into the system. The newly constructed flotation plant received the slime directly from the concentrator, added more water and a minute amount of oil, and then blew air through the whole solution. The oil would stick to the surface of the metal (copper carbonates and sulphides and, if present, silver), and then the air would pick up the oil and metals. Thus, a froth of air, oil, and minerals floated to the top of the tank to be skimmed off as a rich concentrate while the worthless rock sank to the bottom. Flotation, thus, captured all forms of copper and silver as well. The main disadvantage to Kennecott resulted from the lack of water during the winter months. Overall recovery, with the addition of the flotation plant, increased to ninety-six percent. [99]

By controlling labor disturbances, Douglass further maximized efficiency. Although labor was in short supply, all workers had to sign a pledge that he was not a member of any organized union and that he would not join a union while working with Kennecott. If the worker wanted to join a union, he agreed to withdraw from Kennecott's employment. He also had to pledge not to try to unionize the camp. [100]

While the world copper industry greeted the high consumption and low copper surplus with enthusiasm and high production, Kennecott's mines could not respond. A definite decline began in 1924. Stephen Birch, possibly concerned about the mines' future, made his only visit to Kennecott since 1915. The Guest House had been specifically built in 1916 for him. [101] Later, with the dearth of important personages, the general manager assumed possession.

In anticipation of Birch's visit, Douglass compiled a summary of the present state of the Kennecott mines and plants. [102] He recorded that Kennecott had claim to 5226.4 acres in lode and placer claims. Employment, at the mines alone totaled 321, at the lower camp 249, and altogether 550 people. Payroll for these employees equaled \$86,337. Electricians and machinists earned the highest wages. In addition to their salary, the Company charged the employees \$1.45 a day for room and board.

Douglass detailed the exact costs for producing each pound of copper including exploration, development, mining, tramway, milling, leaching, sacking, freight, and smelter costs. After deducting the silver by-product, 1924's net cost proved to be 8.23 cents a pound. Available ore reserves, an important value in determining the mines' leverage, totaled 374,173 tons of 9.33 per cent ore with an additional 173,425 tons of unavailable ore. The total of the two reserves equalled only two years of production. The high grade ore, once assaying at seventy-five percent, now assayed at only fifty-two percent. Only the Mother Lode still assayed above sixty percent. Moreover, Douglass reported the discovery of only one new ore body.

Although two streams and a well supplied water, a chronic shortage appeared in all reports. Only 112 gallons per minute supplied the boilers, Diesels, condensers, concentrator, and flotation plant. Furthermore, a serious fire in August, 1924, destroyed part of the power plant, one dwelling, and a storehouse. Immediate construction began on a new power house resulting in only a slight interruption in power.

Between the years 1924 and 1928 copper prices averaged a stable fourteen cents a pound. This price encouraged consumers to use copper rather than other metals, and at the same time it gave the great copper companies a margin of profit. Consumption even surpassed the war years. In an effort to control world production and marketing, a cartel, with the Federal Trade Commission's approval, was formed--the Copper Exporters, Inc. By the end of 1928 most copper companies were taxing every productive facility to turn out sufficient copper to meet the demand. In 1929 when copper prices rose to twenty-four cents, the highest in ten years, the copper boom had reached its peak. [103]

Kennecott, unfortunately, was unable to capitalize on the boom. Nevertheless, the mines' production in 1925 kept Alaska as the seventh major copper producing state. On the other hand, Alaska's mineral production no longer represented the principal productive business. Its decline to second place was a direct result of Kennecott's own declining mines. [104] More disturbing, no new ore bodies had been found, and the ore reserves were becoming increasingly smaller. [105] Kennecott Copper Corporation,

meanwhile, bought out Braden Copper Company entirely and owned over ninety-five percent of Utah Copper. The Corporation had successfully used the rich and quick profits of Kennecott to invest in the longer living and, therefore in the long term, more profitable porphyry mines. In 1929 Kennecott Corporation moved to ensure a stable and secure market--they acquired Chase Brass and Copper Company.

Although production declined, life at Kennecott continued as usual. Twenty families, primarily staff members, lived in Kennecott. Four of the children growing up were the Douglass children. Two teachers taught all eight grades in a two room schoolhouse. If the teachers or nurses arrived single, they generally found themselves married by the end of the year. The children were not allowed around the bunkhouse where the single men lived "for fear of exposure to the hardened life." [106] Tourists came during the summer to see the camp, but fear of contagious diseases kept a healthy distance between them and the townspeople.

Amusements centered around skating or sledding during the winter and baseball during the summer. Occasional dances, bi-weekly movies, and Fourth of July celebrations in McCarthy marked special events. Hunting and fishing absorbed what little free time existed. Special drives occurred if one could obtain one of the few automobiles or get access to the "speeder" (a gasoline car driven on the railroad tracks). Kennecott maintained a library and subscribed to many magazines. Occasionally the radio could pick up a few night stations with a great deal of static.

Supplies and mail arrived by train several times a week. Some employees grew fresh vegetables while others raised chickens for eggs and meat. The Company owned a dairy that supplied butter and milk. The Company also ran the general store and meat market. Generally clothing was purchased through mail order catalogs. Overall, life in town passed pleasantly.

At the mines, arrival in itself was an adventure. The miners generally rode up the tram in the ore buckets. The bullcook assigned rooms according to the miner's nationality. The double decker bunk practically filled the small room. Although pool and billiard tables were available, card games proved the major diversion. On payday the games ran continuously until one or two men had most of the money. The lucky ones would then blow it all in the "wild" town of McCarthy. [107]

Depression, 1930-34

The high prices of early 1929 encouraged high production just as a serious business recession decreased the world's consumption of copper. These circumstances led to enormous stockpiles of unsold copper. Too late the copper producers realized what had happened. Immediately curtailment of all mining and smelting activities commenced.

Alaska happily reported being less affected by the world-wide business stagnation. [108] Kennecott, in an effort to expand their financial hold on the area, thoroughly explored nearby copper claims but failed to discover any ore bodies of mining size. The Mother Lode, too, expressed discouragement with exploration. [109] The Corporation's accumulation of copper stockpiles forced Kennecott to cut back on production. Meanwhile, William C. Douglass had left Kennecott and had turned over the managerial chores to Bevan Presley and later to E.J. Duggan, who had helped design the leaching plant.

Even with the still lower copper prices, Alaska's branch of the Geological Survey expressed reluctance to report the devastation of the 1931 mineral market. With false enthusiasm they tried to stimulate an apprehensive industry. [110] Copper prices finally hit bottom--five cents a pound. Although most of Utah's mines closed down, Kennecott, foregoing the expensive leaching process, continued minimal production.

Despite curtailment Kennecott Copper Corporation reported a net loss of almost two million dollars. Consequently when the Copper River and Northwestern Railway's bridge washed out in October of 1932, the Corporation decided to close all the mines until the price of copper rose above the cost of production. A small crew maintained the underground workings, plants, and equipment, and the essential staff needed to resume operations stayed at Kennecott.

For 1933 and 1934 the mines remained closed. Throughout the United States business came almost to a halt. The National Industrial Recovery Act finally approved a Code for the copper industry. The Code enabled certain regulation of the industry, provided a sales and marketing plan, and allocated sales quotas for the copper companies. [111] The cartel, Copper Exporters, Inc., had failed the industry in 1929 and by 1933 had ceased to function.

Stephen Birch retired to Chairman of the Board of Directors, allowing E.T. Stannard to take over command as president. For over twenty-five years Birch had served as president. Almost all of Kennecott's development and subsequent decline occurred under his administration. A Kennecott man, however, still directed the Corporation. As the market improved slightly, the Corporation cautiously expanded and bought out Nevada Consolidated Copper Company.

At Kennecott, Alaska, a clean-up of the concentrating plant resulted in the recovery of 520 tons of copper, the sole production of 1933. With the full impact of depression, the U.S.G.S., for the first time in the literature, realistically evaluated Kennecott's role and warned, "It must be remembered that the mines near Kennecott, which have contributed perhaps ninety percent of the Alaska copper, have been mining a unique deposit, not comparable with any known deposit in the world, so that inevitably their mineral wealth is being depleted and there is no justification for expecting that their loss will be offset by new discoveries of equally marvelous lodes." [112]

Although the 1930's represented economic decline and depression, to the people who lived those years they were simply life. Arthur N. Wilson, M.D. and Fred J. Hoff, mining engineer, perceived life from the rather comfortable status as staff members. [113] Emil Oliver Goulet, as a miner, discerned life differently. [114] Goulet arrived at Kennecott in 1930, Wilson in 1931, and Hoff in 1935. These three men and their wives observed portions of Kennecott's years of decline, depression, and temporary recovery.

In the winter of 1930-1931, Emil Goulet, a poor, young student, hiked from Cordova to Kennecott to seek employment. Employees usually rode the train and had the fare deducted from their salaries, but heavy snows had blocked the railroad for most of the winter. Assigned to the Jumbo mine, he had the choice of a four mile walk with a four thousand foot elevation gain or of riding the tramway. He chose the tramway. Before he could ride, he had to sign a form releasing the Corporation from responsibility for accidents, injuries, or deaths. After forty-five minutes, he arrived, quite shaken, at the Jumbo bunkhouse.

At the Jumbo, Goulet found three two-story barracks accommodating eighty men each, a cook shack, and a boiler house, all built on a glacier with only the corner of each building firmly anchored to solid ground. The semi-individual rooms were "very cozy" and were kept in good order. Empty dynamite boxes nailed to the wall served as shelves. A well-equipped gymnasium, pool and billiards tables offered some recreation variation.

The average day began with a seven o'clock breakfast. In the locker rooms the men dressed warmly in woolen clothing and filled their carbide lamps as only the main tunnels had light. By eight o'clock a skiff lowered them to the foreman's office where duties and levels were assigned. The deeper levels were drier and were preferred, whereas, the upper levels had melted snow or ice covered walls and constant fog floated in to irritate the throat. The men worked the cold subterranean pits of sixty to eighty feet in depth. They blasted first the high grade ore from a deposit,

removed it, then blasted out the mill grade ore. [115] Goulet drilled the powder holes preparatory to the blasting. In the course of this work, Goulet related a courageous and inspirational cave-in rescue, but he also told of less fortunate mine accidents.

The miners represented nearly all nationalities. Some were illiterate and requested help from Goulet with their correspondence. Altogether he enjoyed his companions, learned the rudiments of underground mining, saved some money, and experienced Alaska. When a notice of a ten percent reduction in wages appeared in the fall, however, he was ready to leave. He left the trap and travel.

During the depression years, Wilson and Hoff arrived by railroad happy to have work. The Wilsons lived on the second floor of the hospital in a steam heated apartment. They had been instructed "to bring nothing but their clothes". Everything from china and silver service to bedding and leather furniture was provided--even etchings and paintings for the walls. A woman came in weekly to do the laundry.

The eight-bed hospital never had more than five or six patients. Three nurses helped with surgery: an anethetist; a scrub nurse; and an assistant. An old X-ray machine served only to X-ray fractures and was very rarely used on the stomach. The surgery room, however, was adequate, and hospital supplies never ran short. Once a week Dr. Wilson rode up to the mines in the tram bucket. While the miners daringly stood, they forced him to sit cramped down inside.

The train arrived only once a week in the summer to bring supplies and fresh produce. In the winter when trains ceased because of snowslides, produce had to be specifically ordered and flown in. When the mines closed, Dr. Wilson stayed on to care for the staff and maintenance crew. For the rest of the men, the Company furnished transportation only as far as Cordova after that they were on their own.

Fred Hoff arrived in 1935 to work as assayer and then as assistant mining engineer. At Kennecott he met his wife working as a nurse. They moved out of the staff house and into the apartments above the store. Surprisingly enough the houses along the tracks were regarded more desirable than the larger ones on the hill because they were closer to work. Very few lived on Staff Row. The close proximity of the glacier bountifully supplied ice for the ice boxes. Shortage of other goods and supplies, however, reflected the continuing depression. One compromise included closing down the expensive winter railroad maintenance. Throughout the winter the Company sorted the concentrates and high grade ore. By May of 1936 over 56,400 sacks weighing 4500 tons and valued at \$860,000 lay awaiting the first spring train.

The social life of the thirties continued that of the twenties: poker games; bridge games; skating; basketball; pool; billiard; baseball; fishing; hunting; swimming; berry-picking; and walks. The thirties had the "speeder" but also a "snowsled", which was similar to an airboat on skis that carried four passengers at thirty miles per hour. A tennis court had been built on the hill behind the mill, but the mosquitoes were so bad that mosquito nets had to be used. Dances, held once every two weeks, did not regard social status. Miners, millworkers, and staff all danced with the few women, nurses, teachers, secretaries, and wives, that were available. The dentist came once a month as did the Episcopal missionaries, who had the contract for religious services. Although the depression years represented for many a time of hardship and unhappiness, to a lucky few Kennecott's patronage fostered a benevolent environment--a good life of few cares. [116]

Final Days

Meanwhile, the National Recovery Administration in 1935 allowed copper to rise from 4.5 cents to 9 cents a pound. Unfortunately, later that year the Supreme Court declared the Act unconstitutional, and the price of copper declined by one cent per pound. Nonetheless, Kennecott Corporation reopened, on reduced scale, its Alaskan mines. The mines helped, in part, to relieve unemployment in the Copper River region--one hundred seventy-five men worked at the mine and additional men worked the railroad. Exploratory work resumed but without locating any new ore showings. The Corporation's annual report began to forecast the eventual closing unless new ore bodies were found. [117]

Foreign countries, Great Britain and Germany primarily, consumed greater and greater quantities of copper. World consumption with a forty-five percent increase over 1935 finally outstripped production, and copper stockpiles were visibly reduced. [118] International copper organizations tried to force the industry to continue rational production. At the same time that Kennecott Copper Corporation finally acquired all of Utah Copper Company, its Alaskan mines, unable to disclose new ore, appeared short lived. [119] Moreover, a maritime strike, during November and December, on the Pacific Coast interrupted the transportation of ore and concentrates.

The shipping strike continued into 1937. Even after resolution, unrest, inefficiency, and uncertainty impaired normal operation. An additional hindrance resulted when the territorial legislature placed a license tax on all mining enterprises. Despite these problems, Kennecott produced more copper in 1937 than anytime since 1928 to 1929. [120] Since development work failed to find new ore bodies, the Corporation reported, "It is now expected to discontinue all operations at Kennecott in the

latter part of 1938 upon completion of the mining of the remaining tonnage of ore. [121] Throughout the world, rearmament and war alarms stimulated copper production. Kennecott, even at full capacity, could not capitalize on the boom.

Despite the threat of war, even as Hitler moved into Czechoslovakia, the Kennecott mines were closed. Phillip S. Smith, Alaskan Director of U.S.G.S., gave a fitting eulogy to the closure, "The records of these great mines mark a series of brilliant achievements in the history of Alaskan mining, and their closing forms a distinct loss not only to the mining industry but also to the development of the whole territory." [122]

When the mines closed in October, the Company gave two large farewell banquets and distributed bonuses. Equipment of salvagable value was removed and shipped out before the abandonment of railroad operations. Before closure, Dr. Ernest Gruening, Director of the Division of Territories and Island Possessions of the Interior Department, had visited the Kennecott-McCarthy area and had recommended that a National Park be established. [123]

In November following the closure of the mines, the Corporation abandoned the Copper River and Northwestern Railroad. [124] The annual washout of the Chitina River bridge completed the isolation of the deserted town of Kennecott. Although the "speeders" had been left, landslides and washout of the Kennecott River bridge in 1943 made Kennecott inaccessible.

Despite all reports to the contrary, several authorities refused to believe that the mines were exhausted. Although the Corporation's annual reports explicitly stated the continual decline, the U.S.G.S. chronicled the loss of production, and the local newspapers recorded rumors of the eventual closure, some believed that a result of labor problems, whether it was a push to organize labor on the railroad and in the mines or the maritime strike on the Pacific Coast, the Corporation closed the mines rather than concede to labor's demands. [125] Another authority, Lewis A. Levensaler, Kennecott's former superintendent and consultant mining engineer, wrote in 1972 when he was ninety-two years old, "Geologically I never thought Kennecott exhausted the possibility of another Bonanza. Kennecott was closed down during E.T. Stannard's administration--he hated Alaska and wanted to get out of it." [126] Yet in 1936 when the Mother Lode Coalition Mines Company hired Levensaler as a consultant, he advised that no commercial ore remained, that the development possibilities were too weak to justify prospecting, and that the mines should be abandoned. [127] Thus, speculation of the mines' current value continues to the present day.

The picturesque setting coupled with people's fascination for abandoned technology prompted an Anchorage airlines to fly in tourists on two day excursions. A Model T converted to rail was transported the visitors from

McCarthy. [128] Concern for the public's safety and an awareness that injury would mean expensive lawsuits, Kennecott Copper Corporation contracted with Ray Trotuchau to close the shafts and raze the buildings. In exchange for these services he would obtain the right to the surface estate. He supposedly agreed to pay \$6,000, but placed only \$1,000 down. He never completed more than precursory demolition: the roof of the concentrator was removed; the two superintendents' houses and staff house were destroyed; fixtures, furniture, and equipment in all buildings were salvaged. [129]

Trotuchau sold his quit claim deed to the Copper River Corporation. Kennecott Copper Corporation reserved the subsurface underground rights, water and tailings as well. Eventually Consolidated Wrangell obtained the quit claim deed and attempted "surface mining." They ran into a Kennecott injunction that prevented their mining. A lease was negotiated and mining, on a limited scale, began. [130] The distance, isolation, and expense proved unprofitable. The mines and town were left, once again, to the slow deterioration of time and nature.

Conclusions

When compared with the world's other great copper producers in 1938, Kennecott ranked eleventh (graph in Appendix G). [131] Whether the production valued \$300 million or \$200 million, the figure is insignificant. [132] Kennecott's significance lies not in its quantity but in its quality. Its high grade ore, fortuitously timed to reap the immediate profits of World War, allowed the acquisition of longer lasting copper mines. It was the aggressiveness and long range thinking of the Syndicate's leaders that promoted the merger with Braden and Utah not vice versa. The Kennecott mines provided the immediate capital to invest in these companies--Utah and Braden had enormously large capital outlay invested in the development of low grade mines. On the other hand, Kennecott's contribution to mining technology, the ammonia leaching plant, can hardly be equated with the remarkable technology developed by Utah Copper Company to mine porphyry ore. Again Kennecott's significance lies in the ore deposit. Articles have been written and are still being written describing the Kennecott deposits hoping to serve as a guide to similar properties. [133]

Kennecott can also be perceived as a mirror reflecting the history of world and United States copper between 1907 and 1938. The cause and the effect of each boom and slump affected Kennecott and the world alike. These booms and busts, however, cannot be isolated to the mining industry, they also changed the Territory of Alaska and the local communities of the Copper River Valley. Booms brought high employment, inflated wages, and better standards of living; slumps brought unemployment, depressed wages, and lower standards of living. Between gold in the 1890's and oil in the 1850's copper was Alaska's primary mineral. Thus, the rise and decline of Kennecott copper brought a parallel rise and decline in Alaska's mineral production.

On still another level, Kennecott represents not only the extension of western mining frontiers to Alaska but also provides a case study in the analysis of American business and economic history. In other words, the discovery of one of the world's richest copper deposits led to the development of one of the world's greatest copper conglomerates.

The Alaska Syndicate, comparable to the early Rockefeller and Carnegie enterprises, typified the nineteenth century business organization and tactics. Kennecott Copper Corporation, on the other hand, applied the methods and philosophy of twentieth century business management. This interesting contrast becomes fascinating when it is recognized that essentially the same people directed and controlled both organizations--Stephen Birch and the Guggenheims.

The basic goals of both organizations were to keep down production costs and raise copper prices. The Syndicate employed political means to achieve these business goals. As a result, threatened politicians lashed back crying "monopolism." Kennecott adroitly succeeded by controlling labor, acquiring competitive mines, and ensuring a ready market. Furthermore, rather than single-handedly attacking local or national politics as the Syndicate attempted, Kennecott Corporation joined with the rest of the copper industry in various organizations to lobby Congress, to stimulate national and international consumption, and to minimize cut-throat competition.

The broad diverse holdings of the Syndicate in a small geographic area opened the door to charges of trust and monopoly at a time when the words were anathema. The Corporation kept their holdings within the copper industry: mines, smelter, transportation services, and markets. Because of the large local investment in Alaska, the Syndicate became overly concerned with the economics and politics of the region. This concern resulted in the Ballinger-Pinchot involvement and smaller political fiascos. The Corporation, on the other hand, had expanded beyond Alaska to Utah and Chile. Their concerns became national and international, and events in Alaska could be viewed from a broader perspective.

The distinct difference in style and method of the two organizations directed by the same people reflects a change in national business philosophy and development. No longer were railroads, such as the Union Pacific and Southern Pacific, built as an end in themselves. The Copper River and Northwestern Railway served solely as the means to remove the profitable Kennecott copper. The fact it operated at a loss each year was expected and regarded as an operating expense. Furthermore, whereas the Syndicate provided only the basics of life, the Corporation added the amenities that made life in a company town pleasant, a prototype of an eventual movement known as "corporate socialism."

In the end the Syndicate failed because it had become an anachronism. Despite the expansion of the copper industry, its archaic tools and philosophy hampered its growth. Kennecott Copper Corporation, with a flexible business oriented philosophy, jockeyed with its competitors and became more than a partnership dependent on a few small Alaskan mines. Thus, Kennecott's broadest significance arises not from its achievements in the mining industry but from its role in the business and economic world.

Appendices

Appendix A - Recommendations

The preceeding history concludes that at least three buildings have significance: the ammonia leaching plant represents Kennecott's sole contribution to mining technology; the office is the oldest and most historic building that symbolizes the Kennecott enterprise, and Willaim C. Douglas, superintendent from 1920 to 1929, recommended its preservation; finally, for overall interpretive value, the concentrator excells all others. The less significant aspects of social life, depending on the state of repair and the resources available for preservation, could be depicted in the hospital, school, sotre, recreation hall, or one of the bunkhouses or cottages.

Appendix B - McCarthy

The history of the service town of McCarthy can only be briefly sketched from the documents. Only through oral histories of the few old-times can part of the history be saved. In 1916 two newspapers, The Copper Bee and The Avalanche, published for a couple of months each. These newspapers described the town as being dry--no liquor was legally sold. Peter Johnson was building a hotel on Second Street of logs, calked with burlap, and paneled with beaverboard on the inside. The newspaper regarded it as "one of the best and most substantial buildings in the country."

The following businesses advertised in the newspapers: McCarthy Steam Baths; McCarthy Meat and Grocery Co.; McCarthy Bar; W. W. Harvey and Co., Inc., a general store with lumber, hardware and hay; Merchants Cafe; Barber Shop; McCarthy Sheet Metal Works; A. E. Todd General Merchandise; Laurie Bros', a gentlemen's furnishing store; The Club, a pool hall and card room; J. R. Underwood, blacksmithing and repair; Otto Lubbe, dray and transfer; The Mecca, bar and pool room; Alaskan Bar; Charley's Place, Chinese resturant; and F. H. Foster, Attorney-at-Law. In 1916 supposedly thirty-three houses were started and the schoolhouse received new paint.

The newspaper briefly discussed a suggestion to incorporate the town--nothing came of the suggestion. James Wickersham spoke October 21, 1916, in the McCarthy auditorium on an inquiry into freight rates on the railroad and steamship lines.

Social life consisted of occasional pavillion dances shared with Kennecott, the Fourth of July celebration and rodeo, movies at Kennecott, and later a reading club. The town's wild reputation is illustrated in Emil Goulet's comment that beer was served in whiskey glasses for fifty cents, diluted whiskey for a dollar, and "if we got any change out of a ten-dollar bill, it was because they thought we were still sober." Other

Kennecott people also viewed the town as mostly saloons and prostitute houses.

By the 1930's Sig Wold owned most of the businesses. He owned the only car, and during the winter on dogsled he carried supplies between McCarthy and Kennecott. Because only two students attended school in 1931, the Commissioner of Education closed McCarthy's Territorial school.

The closing of the mines essentially closed up McCarthy. A few people stayed on--some to serve the few tourists; others because they liked the area.

Appendix C - Buildings and their Approximate Construction Dates

| | | |
|-----------------------|------|---|
| Camp established | 1907 | |
| Office | 1907 | |
| Bonanza tramway | 1908 | Completed 1909, destroyed by snowslides 1913, handled 400 tons 1914, additions to handle 600 tons 1918, destroyed by snowslides 1918 and 1919, additions to handle 1000 tons. |
| Sawmill | 1908 | |
| Bunkhouse | 1908 | |
| Blacksmith Shop | 1908 | |
| Manager's House | 1910 | |
| Ore Bunkers | 1910 | |
| Concentrator | 1910 | (100 tons), 1914 (500 tons), 1915 additions (800 tons), 1922 additions (1200 tons), 1925 painted gray. |
| Staff House | 1910 | |
| Messhouse | 1910 | |
| Assay office addition | 1910 | |
| Post Office | 1910 | |
| Store (not big one) | 1910 | |
| Barn | 1910 | |
| Powder House | 1910 | |

| | | |
|--|------|--|
| Snow Sheds | 1911 | |
| Jumbo Tramway | 1911 | Completed 1915, 1918 (600 tons), 1919 destroyed by snowslides. |
| Leaching Plant | 1915 | Operating 1916 (300 tons), enlarged 1917, completed 1918 (600 tons). |
| Oil Storage Tanks | 1916 | |
| Hospital | 1916 | |
| Manager's Cottage (Birch's House) | 1916 | |
| Apartment house | 1916 | |
| Recreation Hall | 1916 | |
| Erie Tram | 1916 | Destroyed by snowslides 1919, additions 1920 (600 tons). |
| Tailings Disposal System | 1916 | |
| Fuel Oil Storage Tanks | 1917 | |
| New Store and Ware- house | 1917 | |
| Living Quarters for 50 men | 1917 | |
| Glacier mine con- nected to Jumbo Tram | 1918 | |
| Number of cottages built | 1918 | |
| Dormitory accommoda- tions increased | 1918 | |
| Flotation Plant | 1923 | |

BUILDINGS WITHOUT DATES

Laundry

Schoolhouse

Storage

Electric Shop and Transformer Station

Carpenter and Paint Shop

Steel and Sack Storage

Bonanza mine

Bunkhouse 1910 Burned 1916, rebuilt 1917.

Messhouse 1910

Blacksmith 1910

Compressor by 1915

Recreation Hall 1917

Jumbo Mine

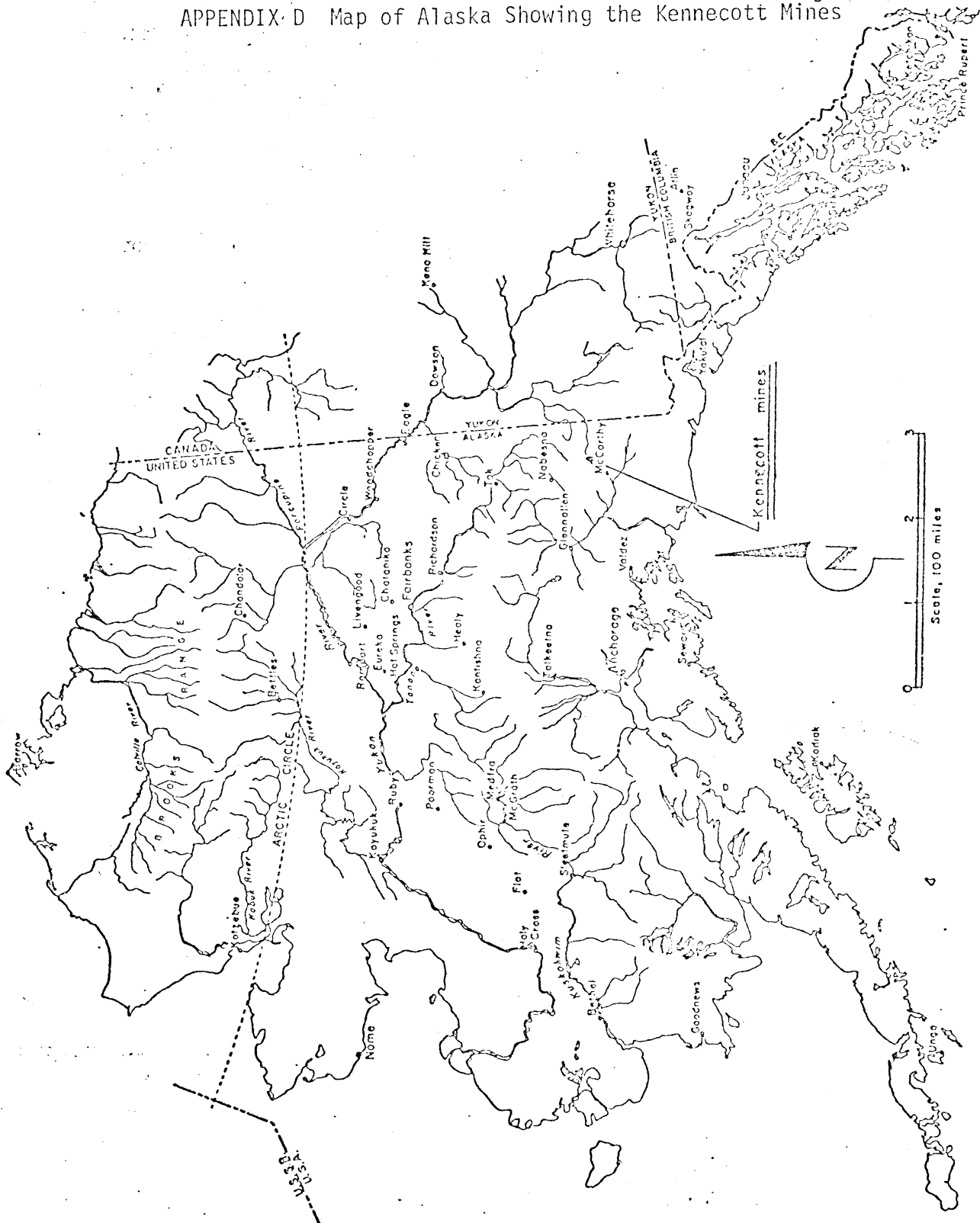
Bunkhouse by 1915

Messhouse by 1915

Blacksmith by 1915

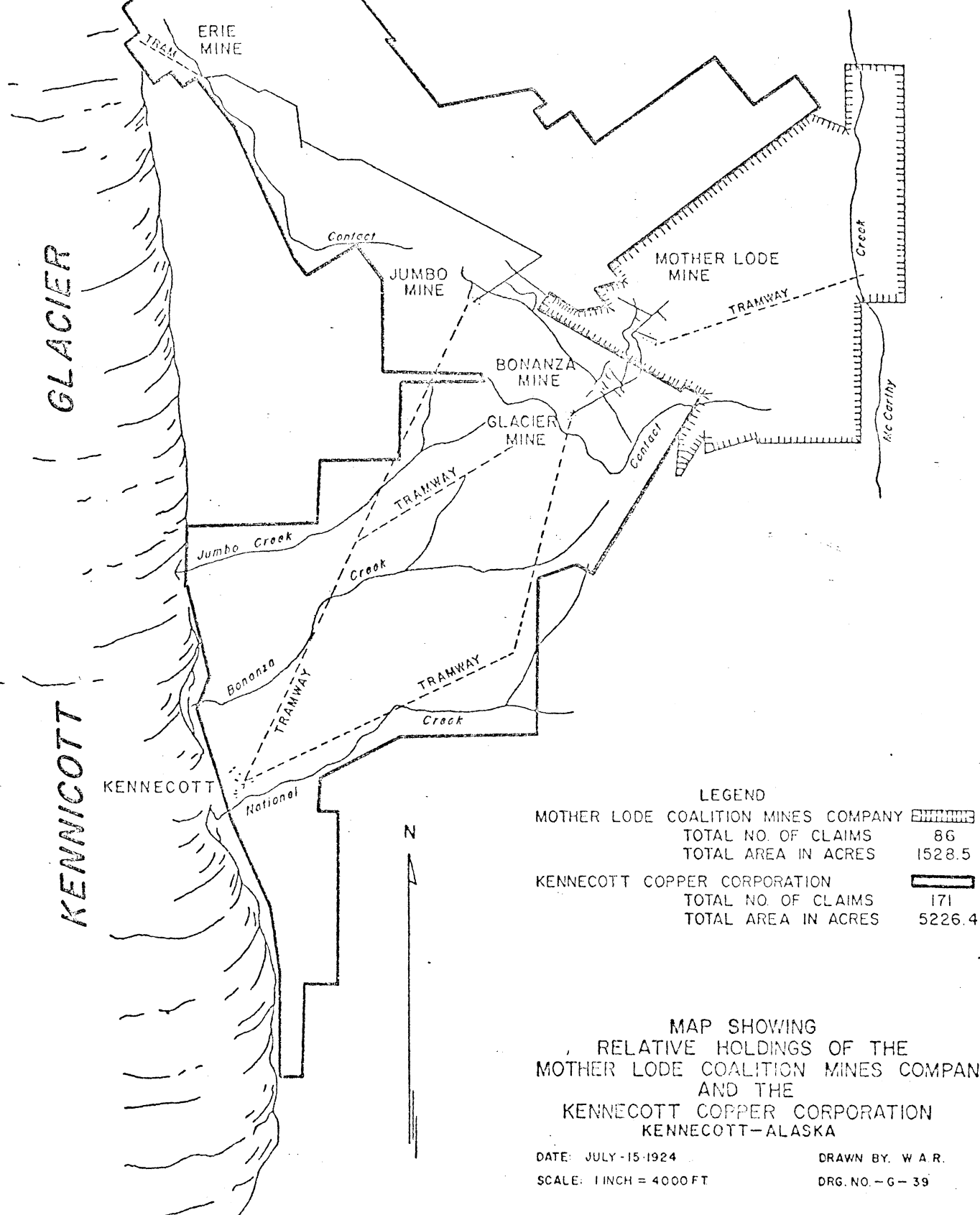
Loading station of tram moved underground 1919

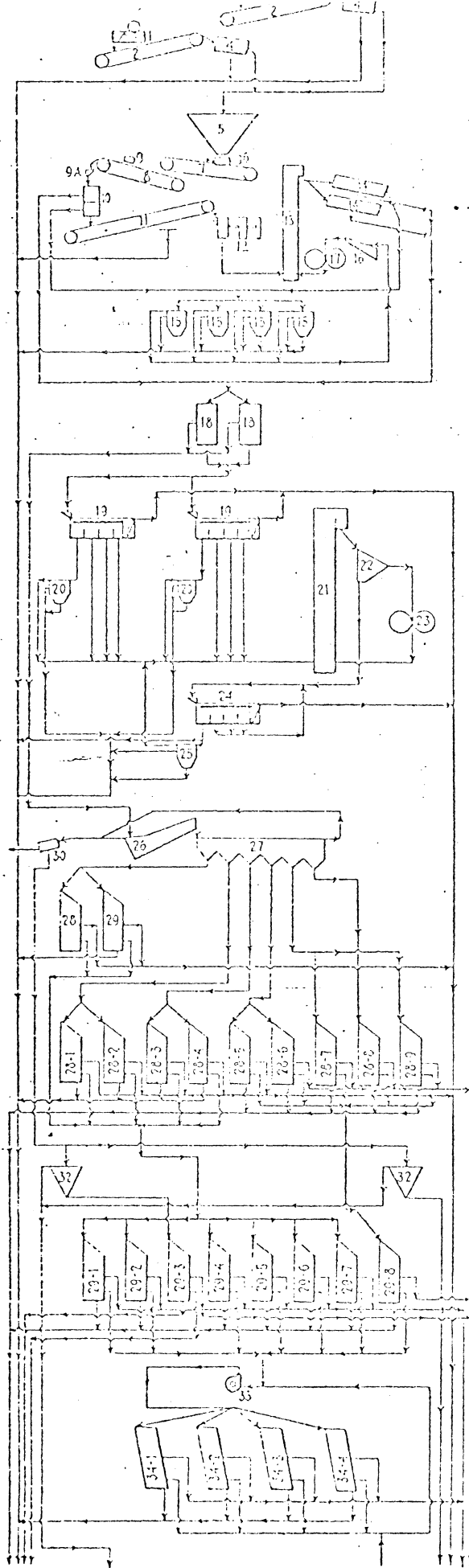
Erie Mine



APPENDIX E Map of Kennecott Mines

From A History of the Kennecott Mines by William C. Douglass





- 1 2 Buchanan jaw crushers—Size 13x24 in.; r.p.m., 250, opening 3½ in.
- 2 2 conveyors {Jumbo—Length 205 ft., width 22 in., 5 ply; Bonanza—Length 196 ft., width 22 in., 5 ply}
- 3 1 cobbing magnet
- 4 2 trommels (Jumbo and Bonanza). Each 9 ft. long, 4 diam., 2-mm. opening, 1½-in. slope per foot; of punched plate, max. length, 32 ft., max. depth, 20 ft.
- 5 1 ore bin, available capacity, 100 tons, max. width, 12 ft.
- 6 1 Stevens-Adams apron feeder
- 7 1 conveyor—length, 40 ft., width, 32 in., 5 ply; 60 ft. minute
- 8 1 conveyor—length, 52 ft., width, 32 in., 5 ply; 60 ft. minute
- 9 1 cobbing magnet
- 9a 1 Vezin head sampler
- 10 1 trommel—diameter, 4 ft.; 27 in.; 11 mm.; 30 in., 1 mesh; r.p.m. 16
- 11 sorting conveyor—length, 40 ft.; width, 32 in.; 5 ply; ft. per minute
- 12 Symons crusher—size 36 in.; oscillations, 335; r.p.m., 1 opening, 1 in.
- 13 2 elevators—length, 58 ft.; width, 18 in.; 10 ply; 380 ft. minute; 54 cups
- 14 2 trommels—diameter, 4 ft.; length, 9 ft.; r.p.m., 18; punched plate with 11 mm. openings
- 15 4 Bull Jigs

| No. | Stroke, Inch. | R.P.M. | Screen |
|-------|---------------|--------|--------|
| No. 1 | 2½ | 189 | 8 in. |
| No. 2 | 2 | 194 | 9 in. |
| No. 3 | not running | | 9 in. |
| No. 4 | not running | | 9 in. |
- 16 Drag dewaterer—length, 32 ft.; width, 32 ft.; chain No. 8, slope, 6½ in. in 12 in.; 45 ft. per minute
- 17 Traylor rolls—size, 54x20 in.; r.p.m., 83
- 18 2 trommels—diameter, 4 ft.; length, 9 ft.; r.p.m., 15; punched plate with 1½-mm. openings
- 19 2 Hancock jigs each

| R.P.M. | Lift, Inch | Throw, Inch | Depth of Pocket, Feet | Width of Pocket, Feet |
|--------|------------|-------------|-----------------------|-----------------------|
| 195 | ½ | 3 | 3½ | 3½ |
- Screens

| Inches of screen | 15½ | 35 | 10 | 25 | 20 | 15 | 25 | 15 | 40 |
|---------------------|---------|----|----|----|----|----|----|----|----|
| Total | 221 in. | | | | | | | | |
| Size in millimeters | 4 | 6 | 9 | 13 | 6 | 13 | 6 | 13 | 4 |
- 20 2 single hutch Harz jigs; r.p.m., 265; stroke, 3 in.; 4-m. screen
- 21 1 elevator—length, 50 ft.; width, 18 in.; 10 ply; 400 ft. minute, 45 cups
- 22 1 Colorado impact screen—size, 3x3 ft.; No. of impact 324; size of opening, 2½ mm.; slope, 22 deg.
- 23 1 set Traylor rolls—size, 36x16 in.; r.p.m., 125
- 24 1 Hancock jig,

| R.P.M. | Lift, Inch | Throw, Inch | Depth of Pocket, Feet | Width of Pocket, Feet |
|-----------|------------|-------------|-----------------------|-----------------------|
| No. 3 195 | ½ | 3 | 3½ | 3½ |
- Screens

| Inches of screen | 68½ | 9 | 22½ | 9 | 27 | 18 | 13½ | 18 | 18 |
|---------------------|---------|---|-----|----|----|----|-----|----|----|
| Total | 222 in. | | | | | | | | |
| Size in millimeters | 4 | 9 | 4 | 13 | 4 | 9 | 13 | 9 | 6 |
- 25 1 2-compartment Harz jig; r.p.m., 265; stroke, 3 in.; 4-m. screens
- 26 1 drag dewaterer—length, 32 ft.; width, 30 in.; chain No. 8, slope, 3½ in. in 12 in.
- 27 1 Richards hindered settling classifier: No. of spigots, 4; water head, 30 ft.
- 28 1 Wilfley table: stroke, ½ in.; slope, 2 in. 12; r.p.m., 250
- 29 1 Plat-O table: stroke, ½ in.; slope, ½ in. 12; r.p.m., 335
- 30 1 Chip Trommel—length 5 ft.; diameter, 3 ft.; r.p.m., 18; screen, 4-mm. opening
- 23 9 Wilfley tables—

| | R.P.M. | Slope Per Foot, Inches | Stroke, Inches |
|------|--------|------------------------|----------------|
| 28-1 | 256 | 1½ | 3½ |
| 28-2 | 270 | 1½ | 3½ |
| 28-3 | 248 | 1½ | 3½ |
| 28-4 | 276 | 1½ | 3½ |
| 28-5 | 258 | 1½ | 3½ |
| 28-6 | 257 | 1½ | 3½ |
| 28-7 | 259 | 1½ | 3½ |
| 28-8 | 256 | 1½ | 3½ |
| 28-9 | 260 | 1½ | 3½ |
- 29 8 Plat-O tables—

| | R.P.M. | Slope Per Foot, Inches | Stroke, Inches |
|------|--------|------------------------|----------------|
| 29-1 | 335 | 1½ | 3½ |
| 29-2 | 335 | 1½ | 3½ |
| 29-3 | 335 | 1½ | 3½ |
| 29-4 | 261 | 1½ | 3½ |
| 29-5 | 320 | 1½ | 3½ |
| 29-6 | 262 | 1½ | 3½ |
| 29-7 | 315 | 1½ | 3½ |
| 29-8 | 318 | 1½ | 3½ |
- 32 2 8-ft. Callow cones
- 33 1 2-in. Wilfley centrifugal pump
- 34 4 James tables—

| | R.P.M. | Slope Per Foot, Inches | Stroke, Inches |
|------|--------|------------------------|----------------|
| 34-1 | 245 | 1½ | 3½ |
| 34-2 | 247 | 1½ | 3½ |
| 34-3 | 230 | 1½ | 3½ |
| 34-4 | 230 | 1½ | 3½ |

COPPER MINING IN NORTH AMERICA

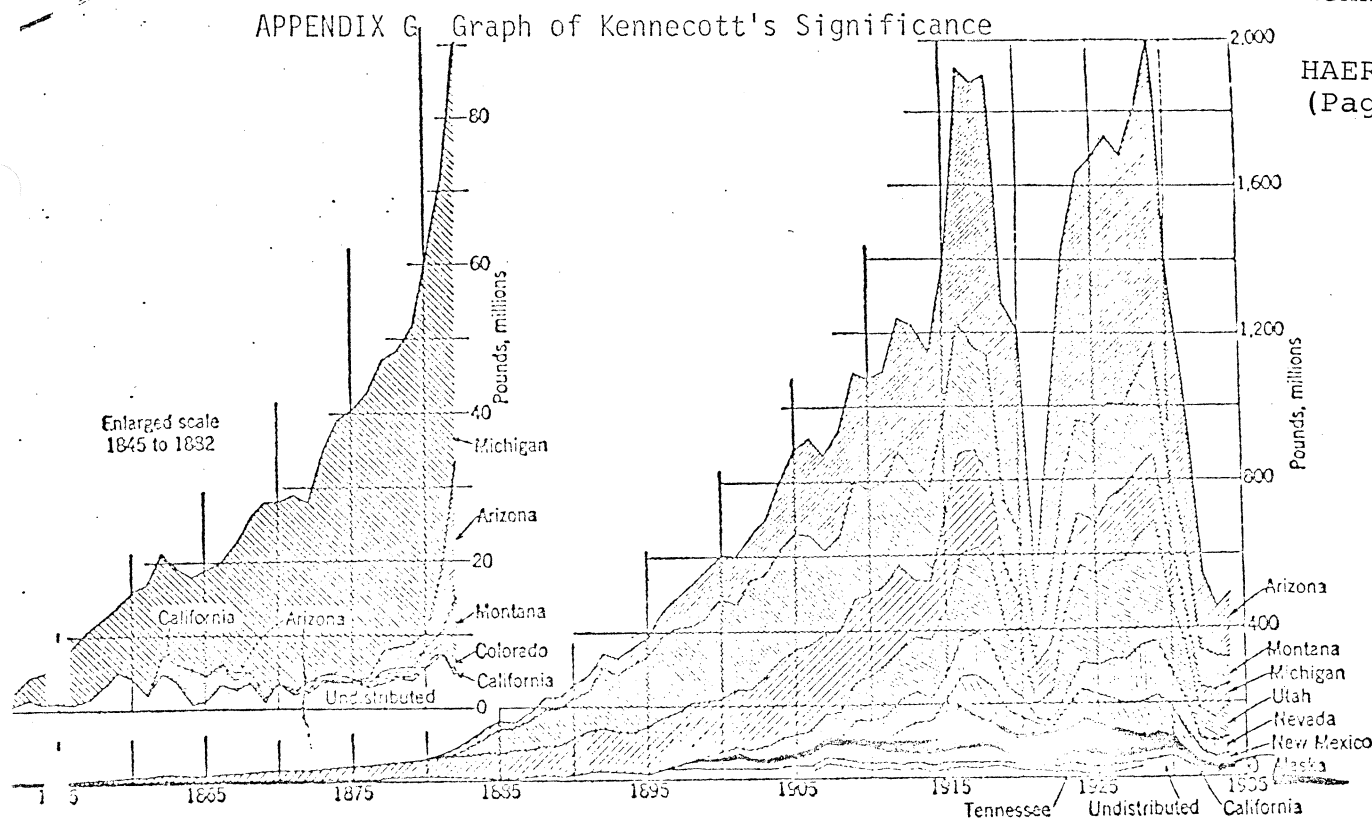


FIGURE 1.—Distribution of United States copper production (smelter) by States, 1845-1934.

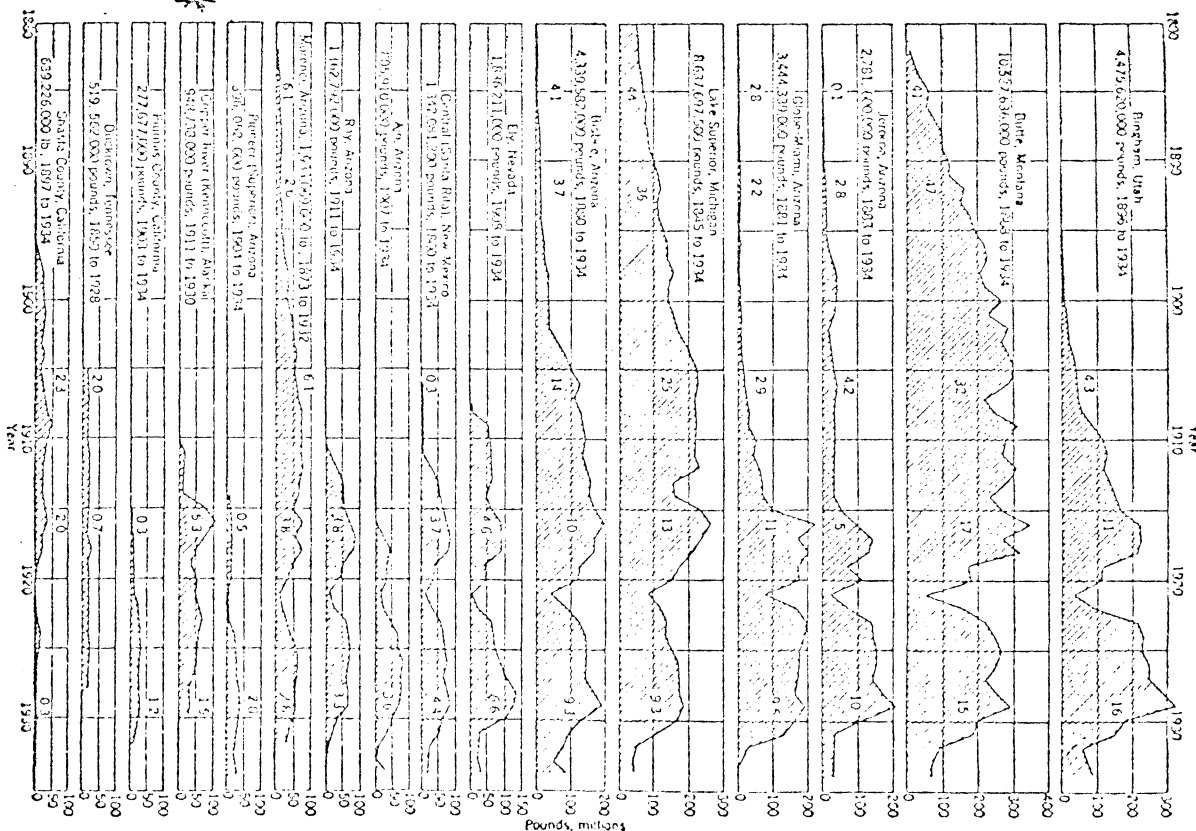
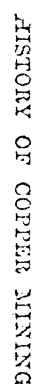


FIGURE 2.—Production of principal United States crops, annual, 1880-1929. 1892, 1906, 1916, and 1929 indicate percentages of United States total.

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VIII. Interviews

William C. Douglass, former Superintendent of Kennecott, 15 February 1976, Seattle, Washington.

William D. Douglass, son of Kennecott Superintendent, written reminiscences, 25 March 1976.

Julian Feiss, former staff geologist for Kennecott Copper Corporation, 4 February 1976, Washington, D.C.

James Harrower and Tony Oney, members of Consolidated Wrangell Mining Company's Board of Directors, 24 February 1976, Anchorage, Alaska.

Fred and Eva "Mickey" Hoff, former Kennecott mining engineer and nurse, 29 March 1976, Mesa, Arizona.

William Humphries, child of a Kennecott purchasing agent, 8 March 1976, Fairbanks, Alaska.

Dr. Arthur N. and Dagmar Wilson, former Kennecott doctor and his wife, 16 February 1976, Ketchikan, Alaska.

Appendix I Photographs

1. Kennecott in 1910 - Seattle Historical Society
2. Kennecott in 1910 - Eugene McCracken Collection, University of Alaska Archives
3. Kennecott in 1911 - Alaska Historical Library
4. Kennecott about 1912 - Ralph MacKay Collection
5. Kennecott Concentrator, 1913-1915 - Seattle Historical Society
6. Kennecott, 1912-1915 - Seattle Historical Society

7. Kennecott in 1915 - R.N. DeArmond Collection
8. Kennecott, 1917-1924 - R.N. DeArmond Collection
9. Kennecott, 1920-1924 - LuLu Fairbanks Collection, University of
Alaska Archives
10. Kennecott in 1925 - LuLu Fairbanks Collection, University of Alaska
Archives
11. Kennecott in 1916 - Ralph MacKay Collection
12. Kennecott in the 1930's - Seattle Historical Society
13. Diesel Engine - Ralph MacKay Collection
14. Receiving End of Kennecott Tramway - Ralph MacKay Collection
15. Bonanza Tram - Ralph MacKay Collection
16. McCarthy - Seattle Historical Society
17. Blackburn - Ralph MacKay Collection
18. Bonanza Mine - Seattle Historical Society
19. Jumbo Mine - Charles Bunnell Collection, University of Alaska Archives
20. Mother Lode Mine - Ralph MacKay Collection
21. Underground Messhall - William C. Douglass Collection
22. Winter Freighting Outfit - Ralph MacKay Collection
23. Kuskulana Bridge, C.R. & N.W.R.R. - Seattle Historical Society
24. Gilhina Bridge, C.R. & N.W.R.R. - Seattle Historical Society

Footnotes

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2. Allen, Expedition to Copper River, pp. 50-57, 132.
3. Rohn, Reconnaissance of the Chitina River, pp. 400-01.
4. Ibid, p. 438-39.
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16. Stearns, "The Morgan-Guggenheim Syndicate," p. 2; Arends, "The Guggenheims in Alaska," p. 7.
17. The whole story of the Copper River and Northwestern Railway can be found in Lone E. Janson, The Copper Spike (Anchorage: Northwest Publishing Co., 1975).
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19. Gruening, The State of Alaska, p. 337.
20. Stearns, "The Morgan-Guggenheim Syndicate," pp. 302-13.
21. Ibid., pp. 313-28, Stearns portrays Wickersham as "Flickering Wick" because of his shifting politics. He describes an actual fist fight between Wickersham and Frank Mondell, Chairman of the House Committee on Public Lands; Janson, The Copper Spike, p. 61.
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26. Ickes, Not Guilty, p. 16; Pinchot, Breaking New Ground, p. 398.
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53. Alfred H. Brooks, "The Mining Industry in 1912," Mineral Resources of Alaska, U.S.G.S. Bulletin 542 (Washington, 1913), p. 18.
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57. Alfred H. Brooks, "The Alaskan Mining Industry in 1913," Mineral Resources of Alaska, U.S.G.S. Bulletin 592 (Washington, 1914), p. 60.
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59. Berger, "Story of Kennecott Copper," p. 934; Walter Harvey Weed, The Mines Handbook, Vol. 12 (New York City: The Stevens Copper Handbook Co., 1916), p. 661.
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64. Kennecott Copper Corporation, Annual Report, 1915, p. 6; Henry Carlisle, "Alan M. Bateman: An Interview," Mining Engineering, November, 1964, p. 75.
65. Lawrence Eddy, "Ammonia Leaching of Copper Ores," Engineering and Mining Journal, 107 (28 June 1919): pp. 1162-67; E.J. Duggan, "Flotation and Leaching at Kennecott," Engineering and Mining Journal, 126 (29 December 1928): 1008-15; E.J. Duggan, "Ammonia Leaching at Kennecott," Transactions of the American Institute of Mining and Metallurgical Engineers, Vol. 106, 1933, pp. 547-558; Summer S. Smith, The Mining Industry in the Territory of Alaska During the Calendar Year, 1915, Bureau of Mines Bulletin 142 (Washington, 1917), p. 38; and F.F. Hintze, "Copper," G.A. Roush, ed., The Mineral Industry, Vol. 24 (New York: McGraw-Hill Book, 1916), p. 137.
66. Kennecott Copper Corporation, Annual Report, 1915, pp. 6-9.
67. Watson Davis, The Story of Copper (New York: The Century Co., 1924), p. 66; Weed, The Mines Handbook, Vol. 12, p. 1310.
68. Walter Harvey Weed, "Copper," G.A. Roush, ed., The Mineral Industry, Vol. 25 (New York: McGraw-Hill Book Co., 1917), p. 150.
69. Douglas, A History of Kennecott, p. 7; Carlisle, "Alan M. Bateman," p. 75.

70. Carlisle, "Alan M. Bateman," p. 76.
71. Douglas, A History of Kennecott, p. 7; Braden Copper Company had known ore reserves to last thirty-two years, Kennecott Copper Corporation, Annual Report, 1915, p. 10.
72. Kennecott Copper Corporation, Second Annual Report, 1916, pp. 5-7; Fred H. Moffitt, "Mining in the Lower Copper River Basin," Mineral Resources of Alaska, U.S.G.S. Bulletin 662 (Washington, 1918), p. 174.
73. Summer S. Smith, The Mining Industry in the Territory of Alaska During the Calendar Year 1916, Bureau of Mines Bulletin 153 (Washington, 1917), pp. 62-71.
74. Henry Carlisle, "David D. Irwin: An Interview," Mining Engineering June, 1964, p. 89; Moffit, "Mining in the Lower Copper River Basin," p. 164.
75. Walter Harvey Weed, "Copper," G.A. Roush, ed., The Mineral Industry, Vol. 26 (New York: McGraw-Hill Book Co., 1918), p. 137.
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77. Most of the facts regarding this strike came from a letter of Commissioner of Conciliation, Charles T. Connell to Secretary of Labor, W.B. Wilson, 15 August 1917, in Federal Mediation and Conciliation Service, file No. 33/515. Dispute Case File Box 25, Record Group 280, Federal Record Center, National Archives.
78. Interview by author with William C. Douglass, former superintendent of Kennecott, at his home in Seattle on 15 February 1976; interview by author with Julian Feiss, former staff geologist for Kennecott Copper Corporation, at Washington, D.C., 4 February 1976.
79. Cordova Daily Times, 20 July 1917; Connell to Wilson, 15 August 1917.
80. Connell to Wilson, 15 August 1917, contained letter from Miners Committee to Department of Labor, 1 August 1917.
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82. Kennecott Copper Corporation, Fourth Annual Report, 1918, p. 11; G.C. Martin, The Alaska Mining Industry in 1918, U.S.G.S. Bulletin 712-A (Washington, 1919), p. 31; unsigned report, 4 February 1919, in Folder 12, Box 3, Eugene McCracken Papers, University of Alaska Archives.
83. Douglass, A History of the Kennecott Mines, pp. 8-9; Stearns, "The Morgan-Guggenheim Syndicate," p. 264; Mendenhall and Schrader, The Mineral Resources of the Mount Wrangell, p. 28; Moffit, "Mining in the Kotsina, Chitina Valley," p. 84; H.A. Keller to the Mother Lode Copper Mines Company, "Report on the Mother Lode Property in the Chitina Mining District, Alaska," 16 September 1912, filed in Bureau of Mines, Juneau; Brooks, "The Alaskan Mining Industry in 1913," p. 61; Hurja, "Cordova, Alaska: Changes at the Bonanza," p. 449; W. Bertram Hancock, Mines Company, 11 January 1916, Bureau of Mines, Juneau; Smith, The Mining Industry in the Territory of Alaska During the Calendar Year 1915, p. 38; Martin, The Alaska Mining Industry in 1918, p. 31.
84. Kennecott Copper Corporation, Sixth Annual Report, 1920. p. 7.
85. Davis, The Story of Copper, p. 66; Walter Harvey Weed, The Mines Handbook, Vol. 15 (Tuckahoe, New York: The Mines Handbook Company, 1922), p. 39.
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89. Davis, The Story of Copper, p. 66.
90. Total Ore Production of Kennecott Copper Corporation's Kennecott Mines: 1911-1938, "William C. Douglass Collection, Private, Seattle, Washington.
91. Kennecott Copper Corporation, Seventh Annual Report, 1921, p. 7.

92. Crump, Copper, p. 116; Walter Harvey Weed, "Copper," G.A. Roush, ed., The Mineral Industry, Vol. 31 (New York: McGraw-Hill Book Co., 1923), p. 157.
93. Kennecott Copper Corporations, Eighth Annual Report, 1922, p. 7.
94. An unpublished manuscript by Ralph MacKay provides insight to the individual men and their life at Kennecott.
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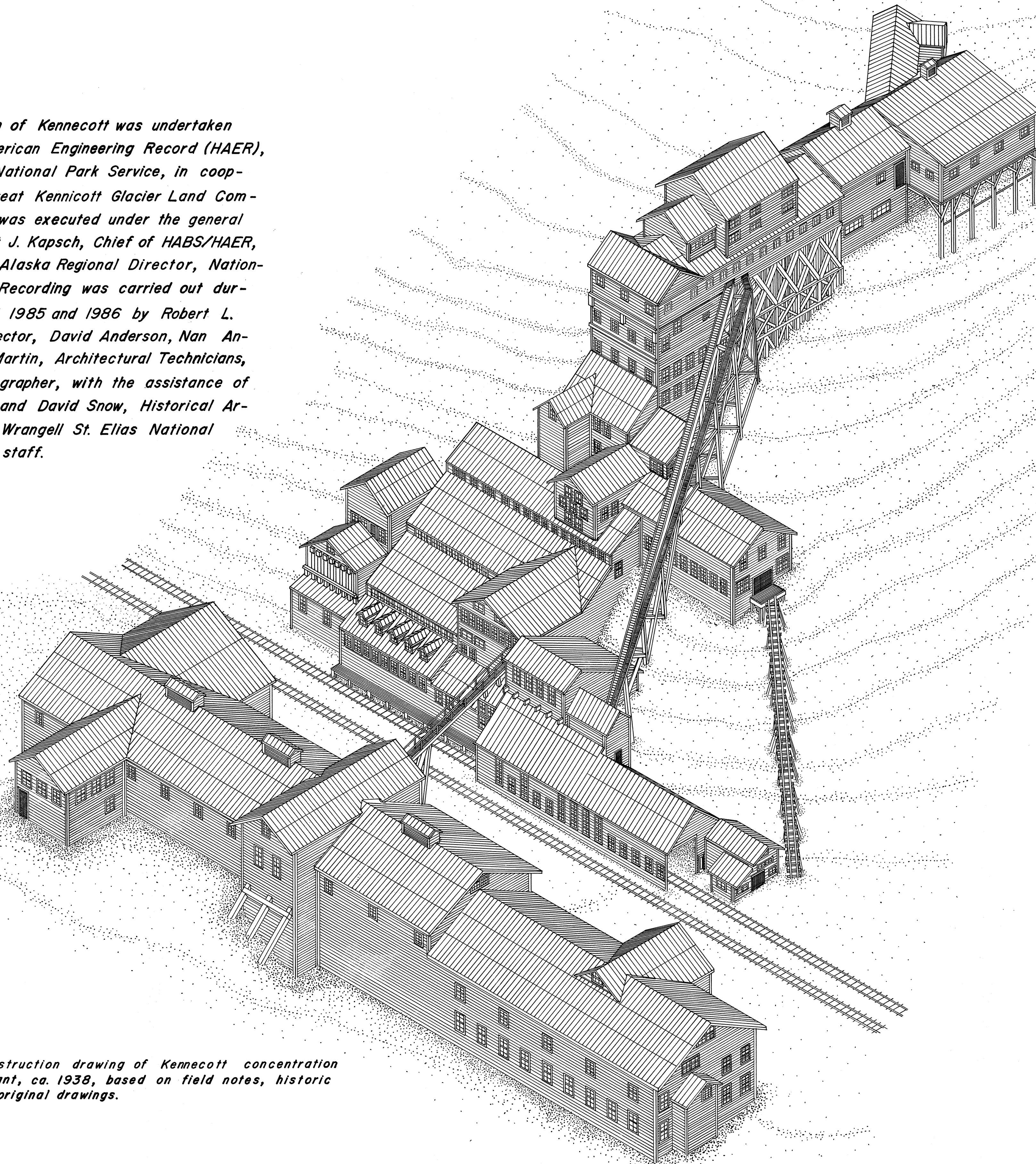
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KENNECOTT COPPER CORPORATION

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.



Note: Partial reconstruction drawing of Kennecott concentration mill and leaching plant, ca. 1938, based on field notes, historic photographs, and original drawings.

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 House 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 Kennicott 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 benefaction. The first successful application of the ammonia leaching process occurred here in 1915.

In 1916, the most productive year, the copper produced amounted to 55,085.8 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 Kennicott 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: The town and glacier are named for Alaska explorer Robert Kennicott. The company name is a misspelling of the glacier name.

DELINEATED BY: K. Martin, 1986

HISTORIC AMERICAN ENGINEERING RECORD
UNITED STATES DEPARTMENT OF THE INTERIOR

KENNICOTT

KENNECOTT COPPER CORPORATION: COVER SHEET
WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE

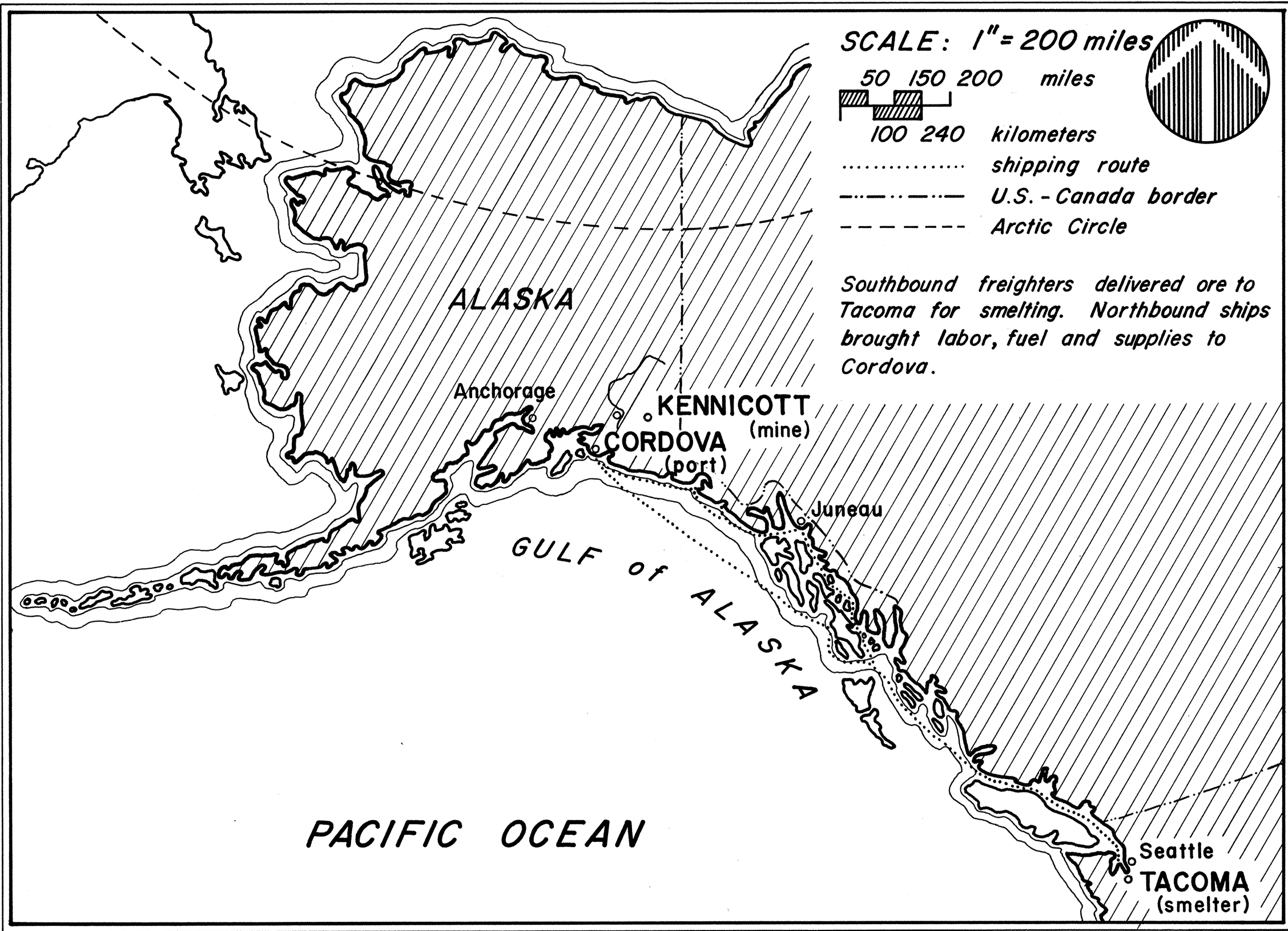
ALASKA

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COPPER ORE TRANSPORTATION 1911-1938



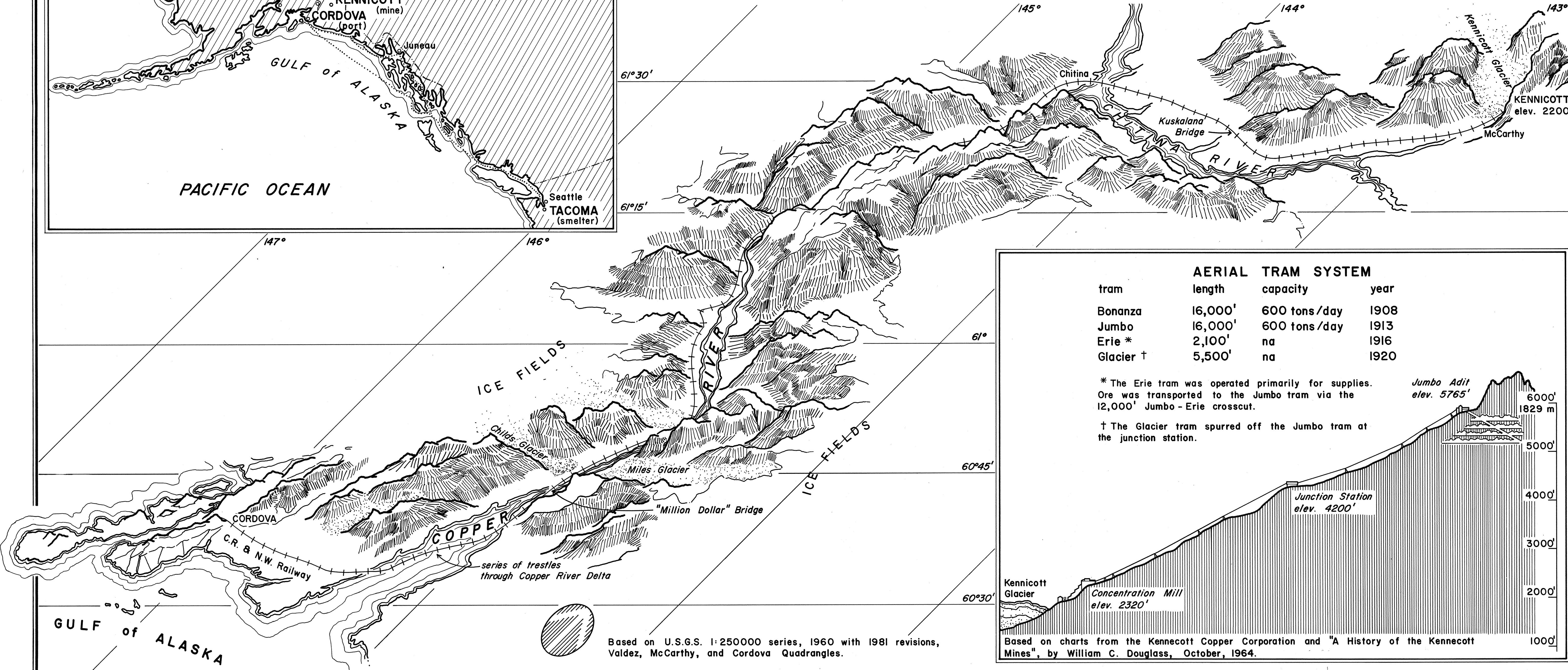
Three modes of transportation carried Kennecott ore from mine to smelter:

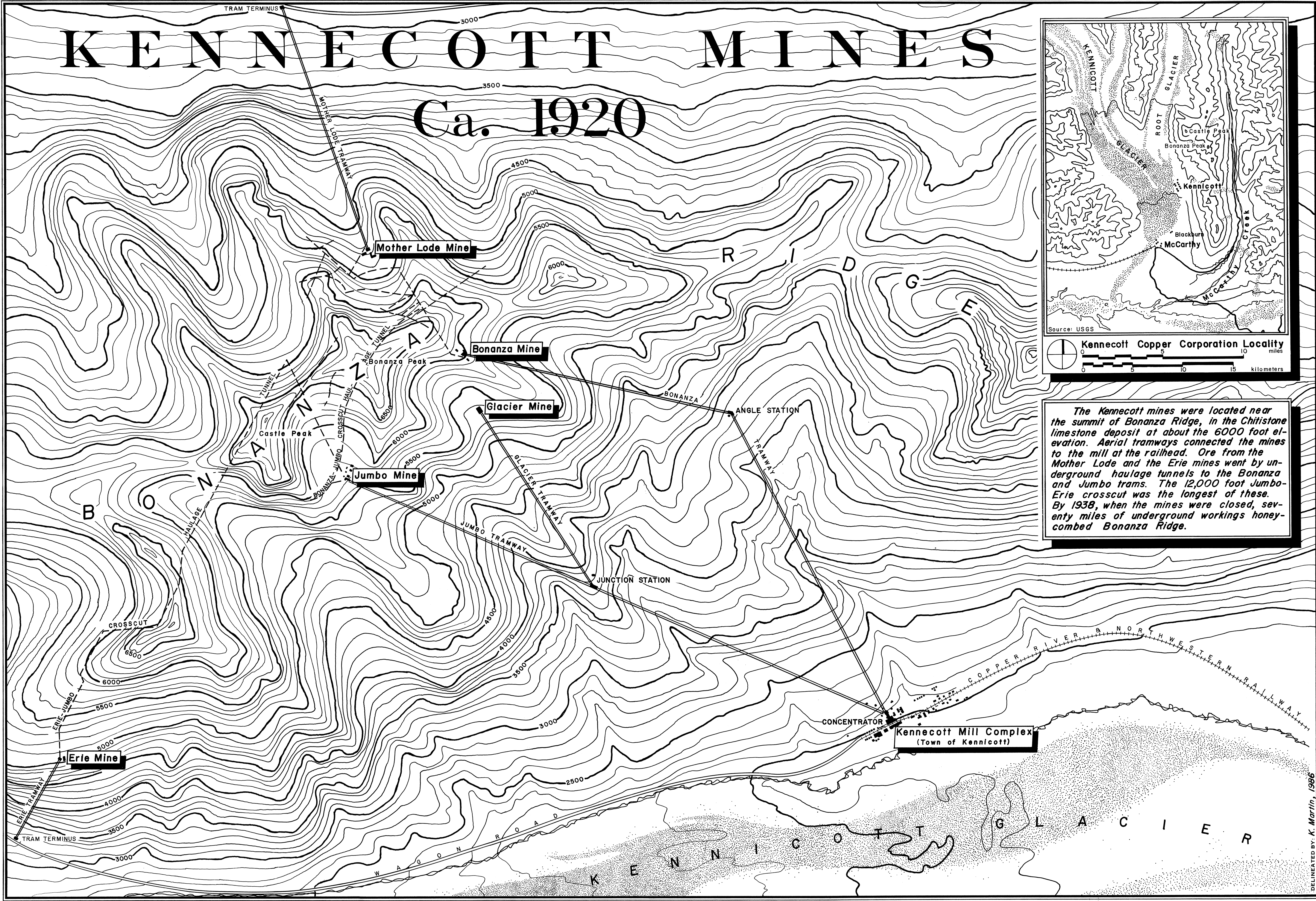
1. Aerial Tramways (manufactured by the Trenton Iron Company)
2. Railroad (the Copper River & Northwestern Railway, a 196 mile line from Cordova to Kennicott, completed in 1911 at a cost of \$23,000,000)
3. Steamship (operated from Cordova to Tacoma by the Alaska Steamship Company)

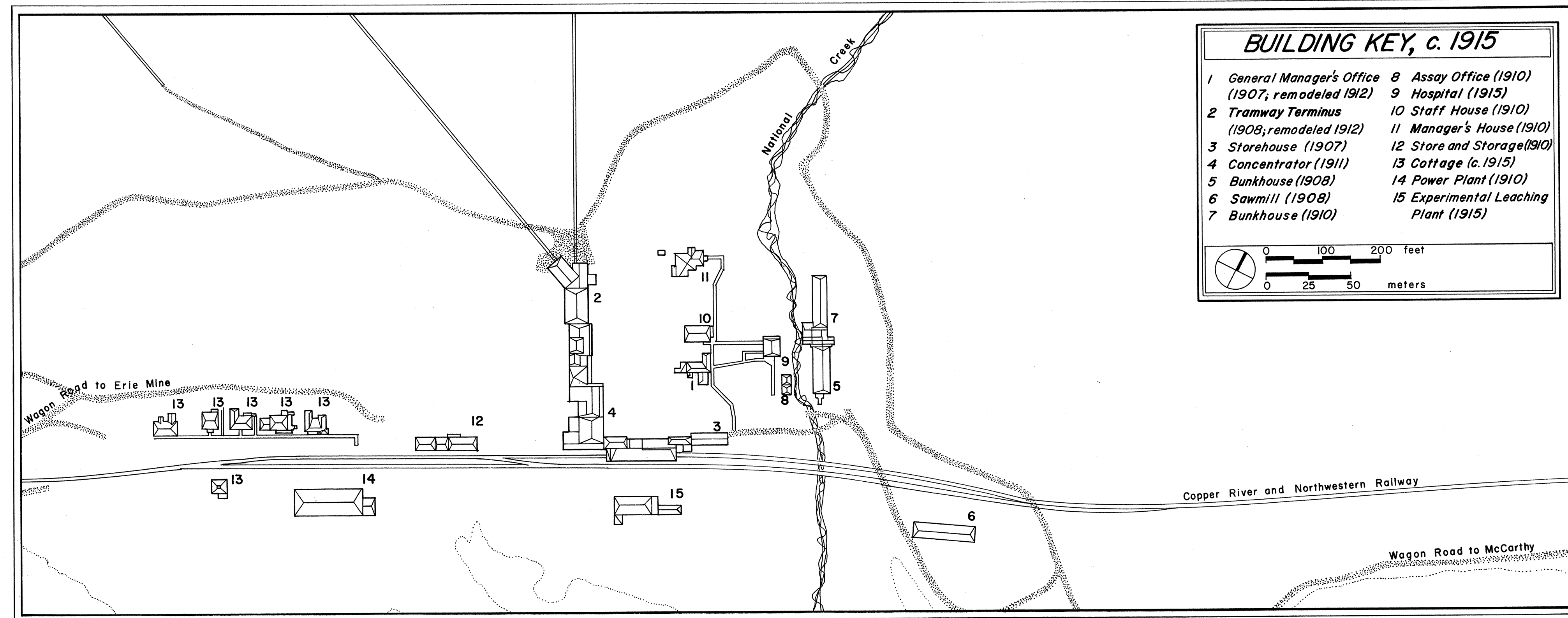
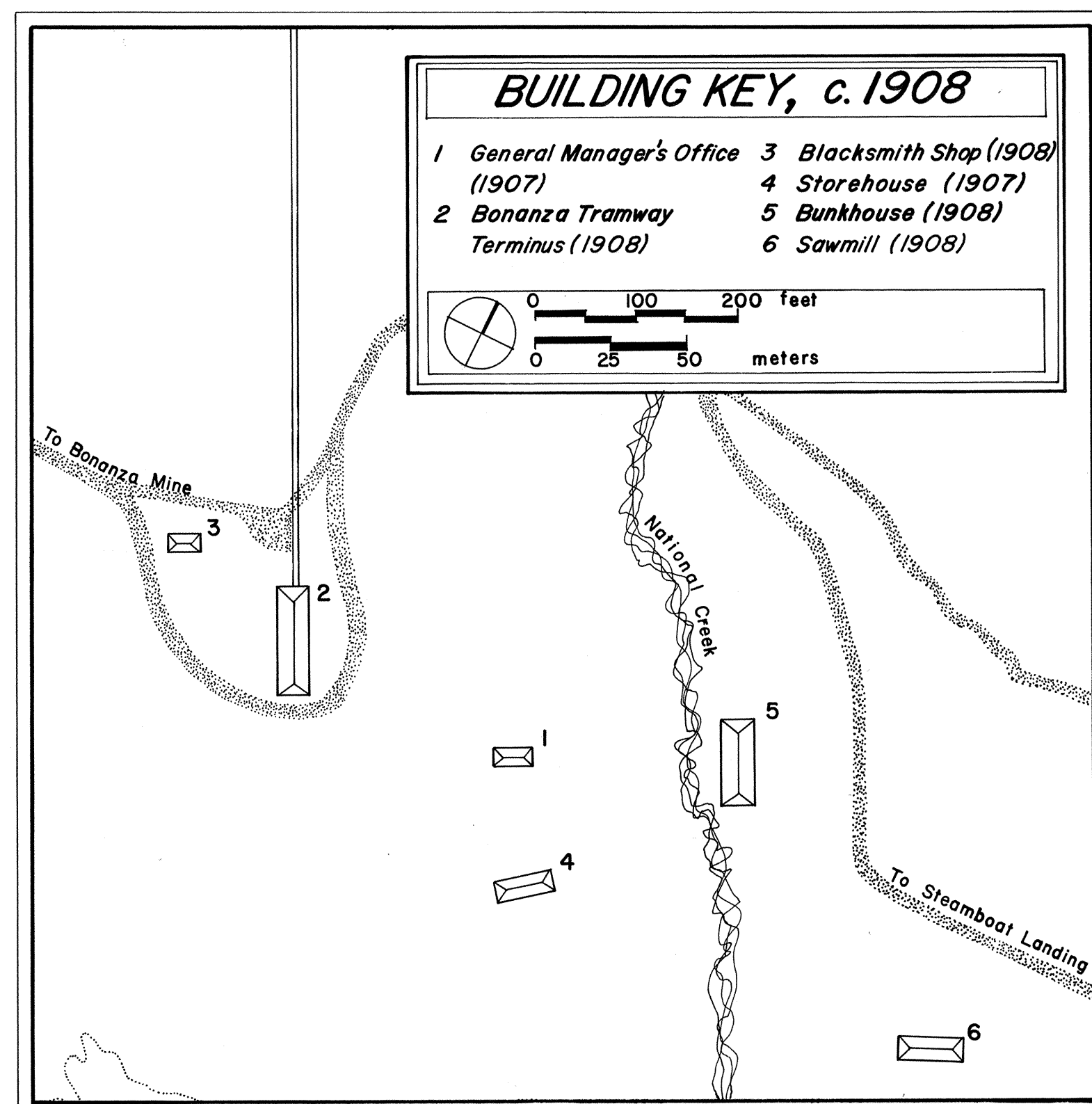
All three systems were controlled by the Alaska Syndicate, an organization consolidating the backing of H.O. Havemeyer, the House of Morgan, the Guggenheims and the Kuhn Loeb Company. In 1915 the syndicate incorporated as the Kennecott Copper Corporation.

Trams and the railway both ceased operations in 1938 when Kennecott closed its mines. Only the Alaska Steamship Company continued servicing Alaska's coast until superceded by air transport in 1971.

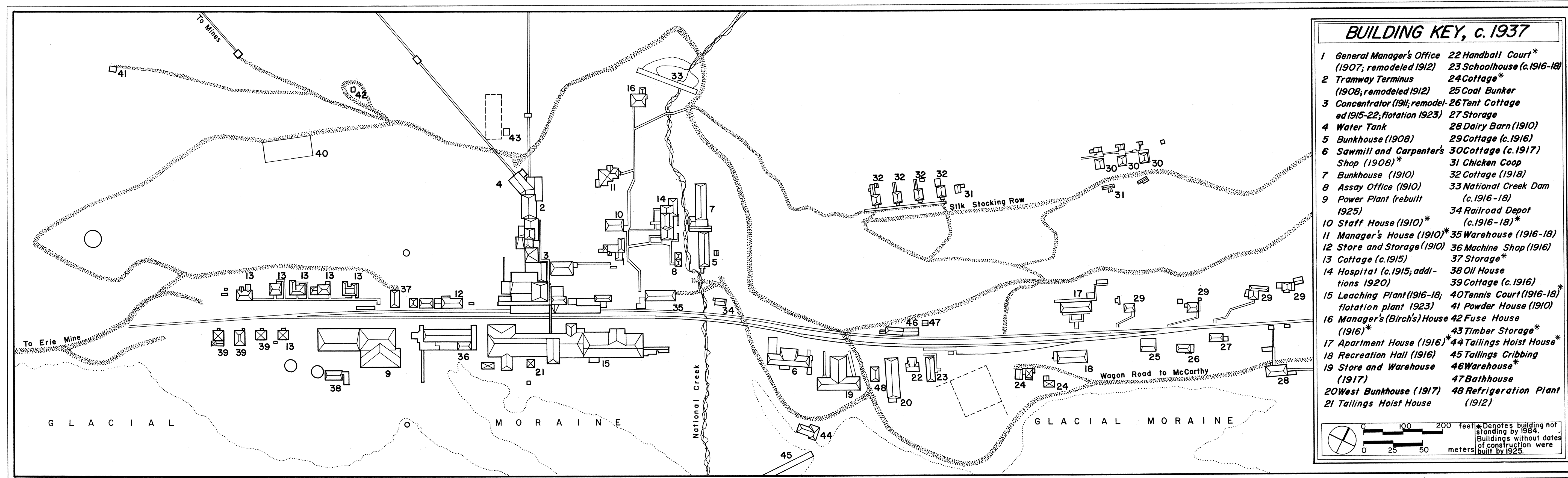
NOTE: Though the town name is spelled Kennicott, the company name is spelled Kennecott.







KENNICOTT MILL TOWN



DELINEATED BY: K. Marlin, 1986 Source for maps: O'Sullivan, Kennicott, (1981), and historic photographs.

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KENNICOTT COPPER CORPORATION: SITE PLANS
WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE

ALASKA
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HISTORIC AMERICAN
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CONCENTRATION MILL / LEACHING PLANT

c.1938

In 1938, the concentration mill process was divided into four departments:

- 1.) Crushing (1911)
- 2.) Gravity Concentrating (1911)
- 3.) Ammonia Leaching (1916)
- 4.) Flotation (1923)

High grade ore, 60 to 65 percent copper, was hand sorted after the primary crushing and main ore bin. This high grade was unique to Kennecott and was shipped directly to the Tacoma smelter. Most of the copper ore occurred as malachite and azurite, the remainder being sulphides - chalcocite and covellite. Sulphides were easily recovered by gravity concentration.

Ammonia leaching, a process developed at Kennecott by E. T. Stannard in 1916, was incorporated to treat the calcareous gangue and retrieve the carbonates. The leaching plant, however, could not treat the minus 2mm. sand and slime. Until 1923, the finer material was screened from the mill feed and shipped directly to the smelter. In 1923, the flotation plant was added for treatment of the copper carbonate slime. After the flotation plant's installation, only minor mill alterations were made. Characteristically, these later developments had a jerry-built quality. The mill retains its overall configuration and is the most complete example of an early twentieth century copper concentrator.

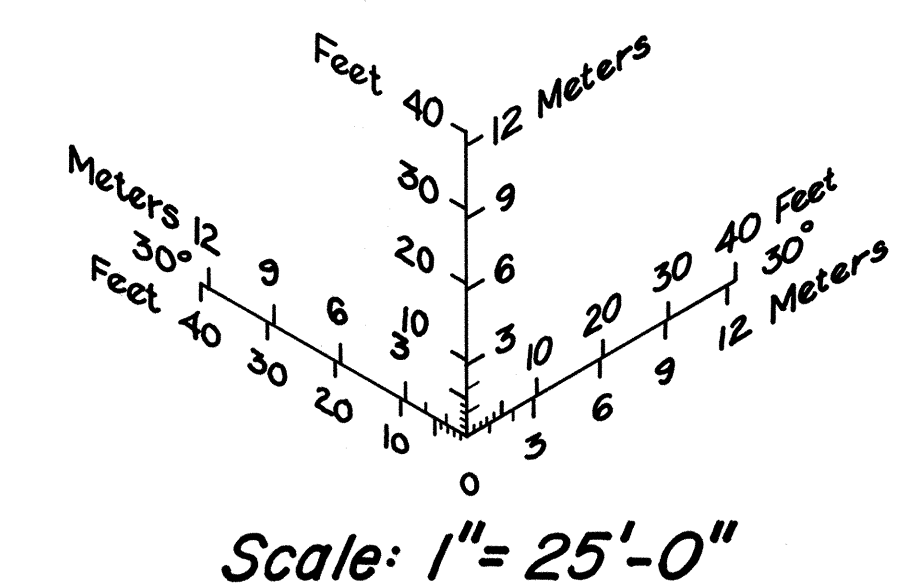
1. Tramway from Jumbo Mine
2. Tramway from Bonanza Mine
3. Buchanan jaw crushers
4. Conveyors
5. Ore bin
6. Trommel
7. Sorting conveyor
8. Symons disc crusher
9. Elevators
10. Vibrating screens
11. Traylor roller mill
12. Hancock jigs
13. Drag dewaterer
14. Richards hindered settling classifier
15. Harz jigs
16. Wilfley tables
17. Plat-O tables
18. Callow cones
19. James tables
20. Dorr thickener
21. Ball mill
22. Plat-O slime tables
23. Table concentrate tanks
24. Ore bins
25. High grade ore bin
26. Drag conveyor
27. Ammonia leaching tanks
28. Storage tanks
29. Absorber
30. Condenser
31. Evaporator
32. Filter
33. Janney cells
34. Oliver filter
35. Track scales

GRAVITY CONCENTRATION

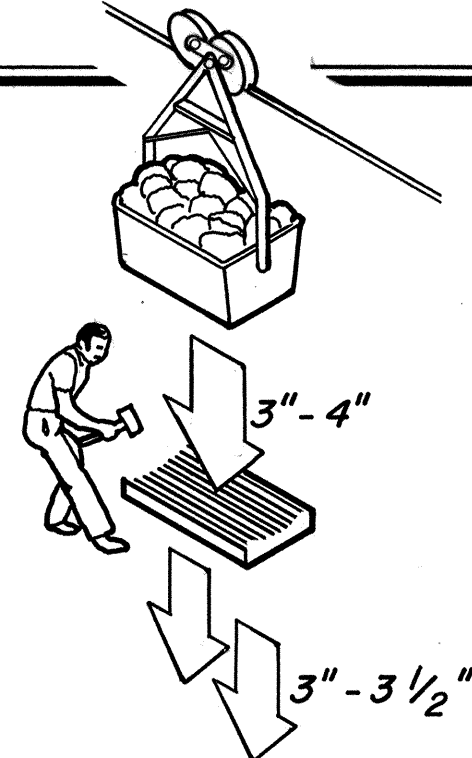
AMMONIA LEACHING

FLOTATION

Tailings from
Concentrator, Flotation,
and Leaching



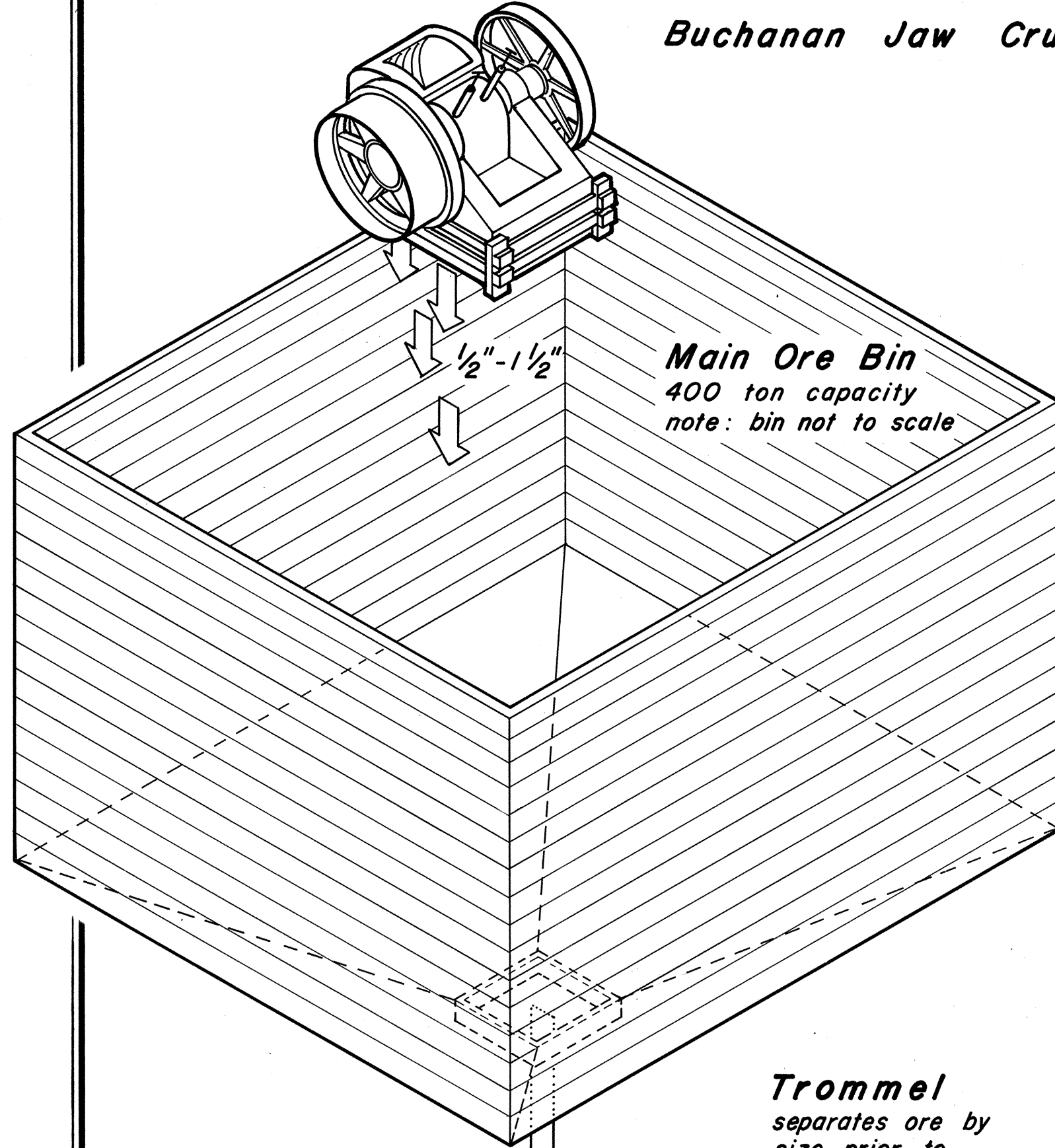
CRUSHING DEPARTMENT



Aerial Tram
2 trams delivered up to
1200 tons of ore per day

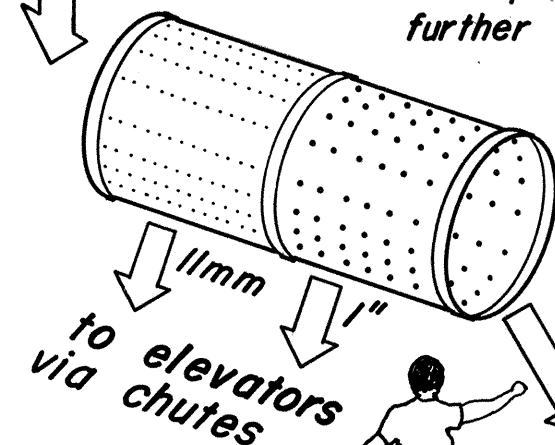
Grizzly
a grate with $3\frac{1}{2}$ " openings;
oversized ore was crushed by
hand-held sledge

Buchanan Jaw Crusher



Main Ore Bin
400 ton capacity
note: bin not to scale

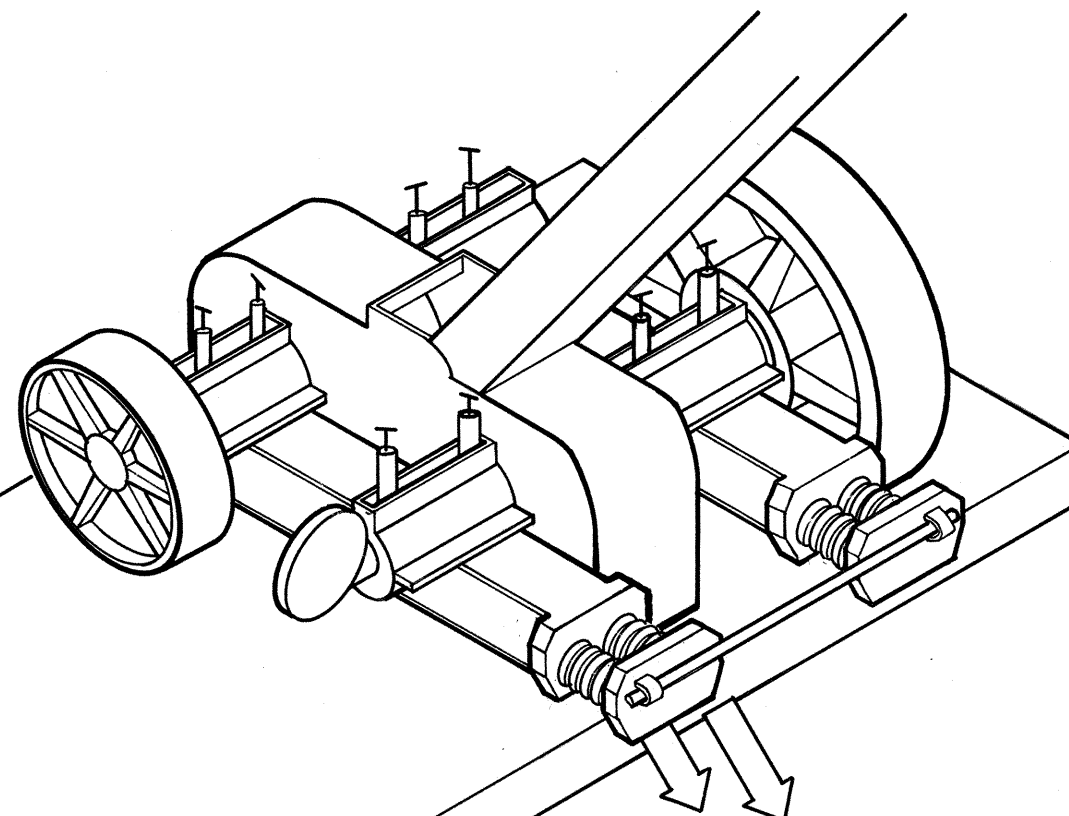
Trommel
separates ore by
size prior to
further crushing



to elevators
via chutes

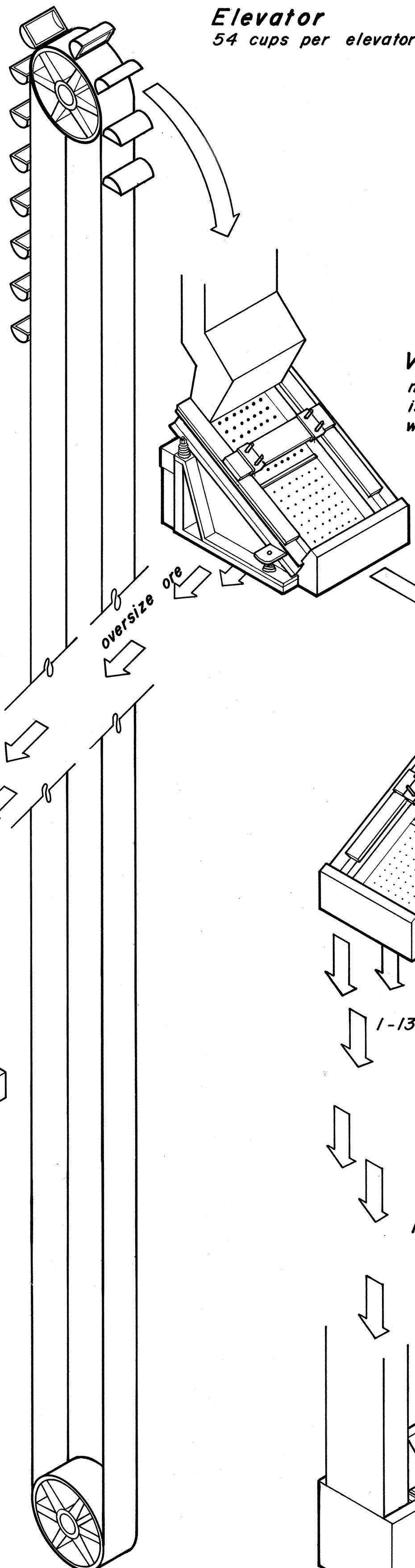
hand sort
of high grade

Traylor Roller Mill



pebbles

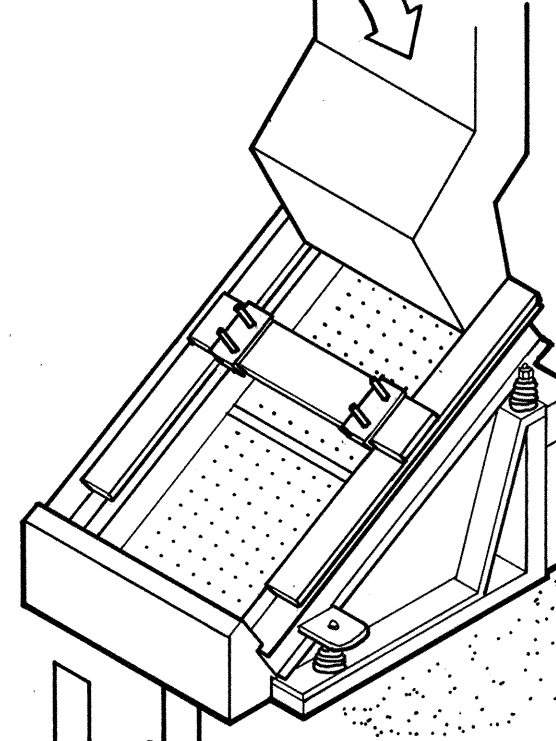
1" and smaller
from trommel



Elevator
54 cups per elevator

Vibrating Screens

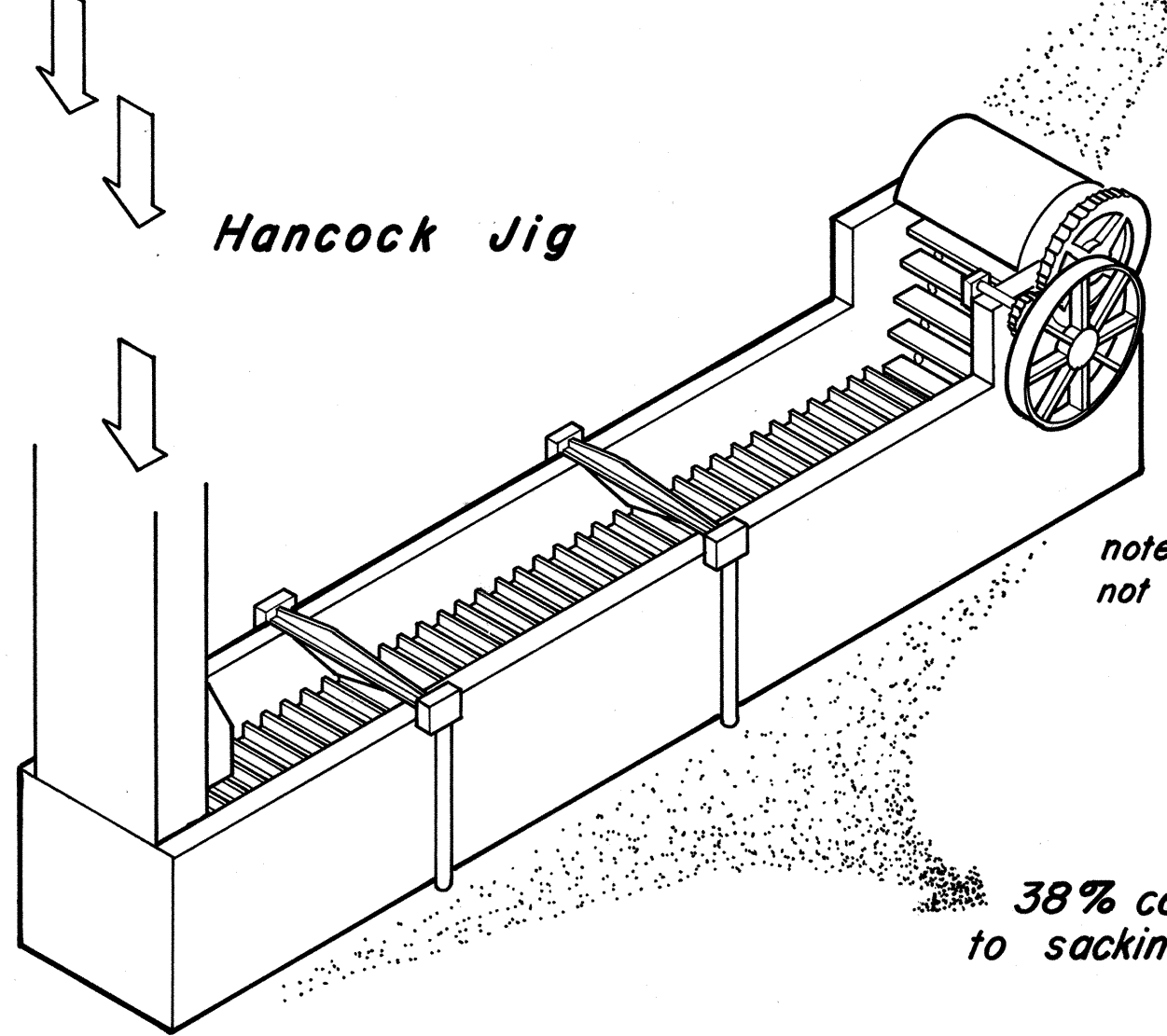
note: extant machinery
is shown; vibrating mechanisms
were salvaged



0-1.3 mm

Hancock Jig

1-13 mm

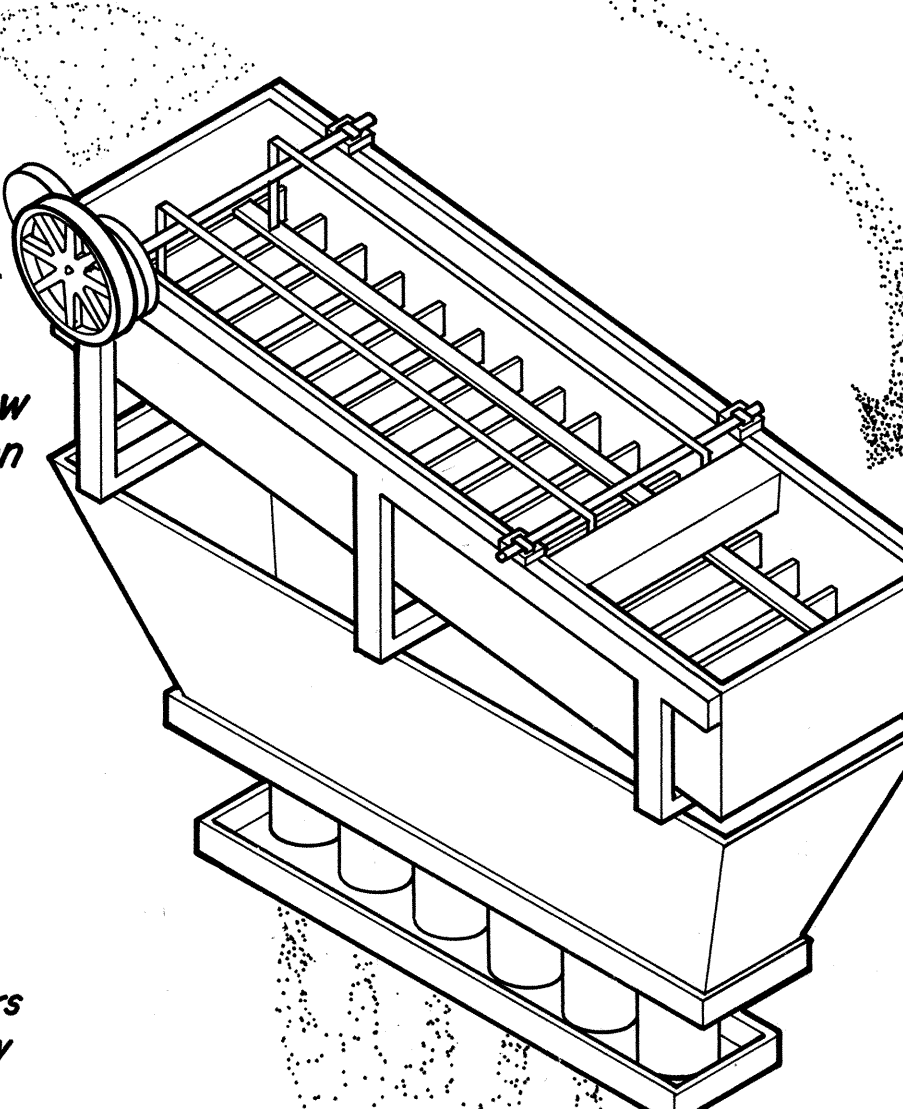


note: drag dewaterers
not shown for clarity

38% copper concentrate
to sacking via bull jig

overflow
to flotation

2mm+
to leaching

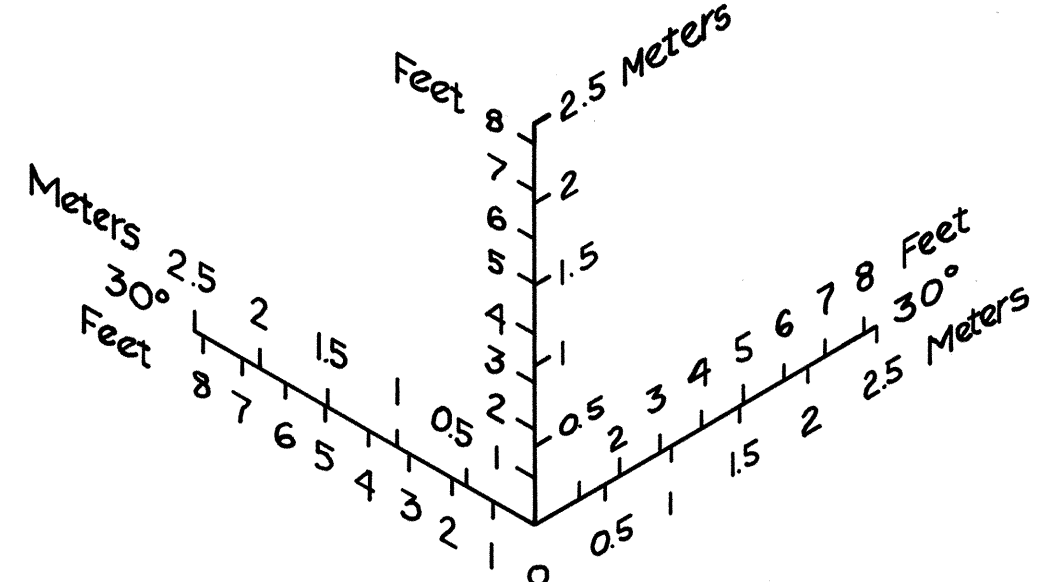


to concentration tables

Ore trammed from the mine was dumped in to two Buchanan jaw crushers, the primary crushers, which reduced the ore to golf ball size in preparation for the secondary crushers. From the main ore bin the ore passed by a hand sorter, who picked highgrade ore for direct shipment, then continued on through the Symons disc crusher. The crushed ore was scooped by an elevator to the vibrating screens located in the mill's upper floors. Finer ore was screened for chuting on to the gravity concentration department while coarser ore was directed to the Traylor roller mill for recrushing. The roller crusher continued the fine milling until a sand was produced. Sands and gravels passed via the vibrating screens to the gravity concentration department which was divided between Hancock jigs, which separated the shipping copper from pebble-size ore sent to the leaching plant, and the concentration tables.

NOTE: Machinery is drawn to scale.
Locations are approximate.

SCALE: $\frac{1}{4}$ " = 1'-0"



**Drag Dewaterer &
Richards Hindered
Settling Classifier**

DELINATED BY: Nanon Adair Anderson & David C. Anderson, 1985

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UNITED STATES DEPARTMENT OF THE INTERIOR

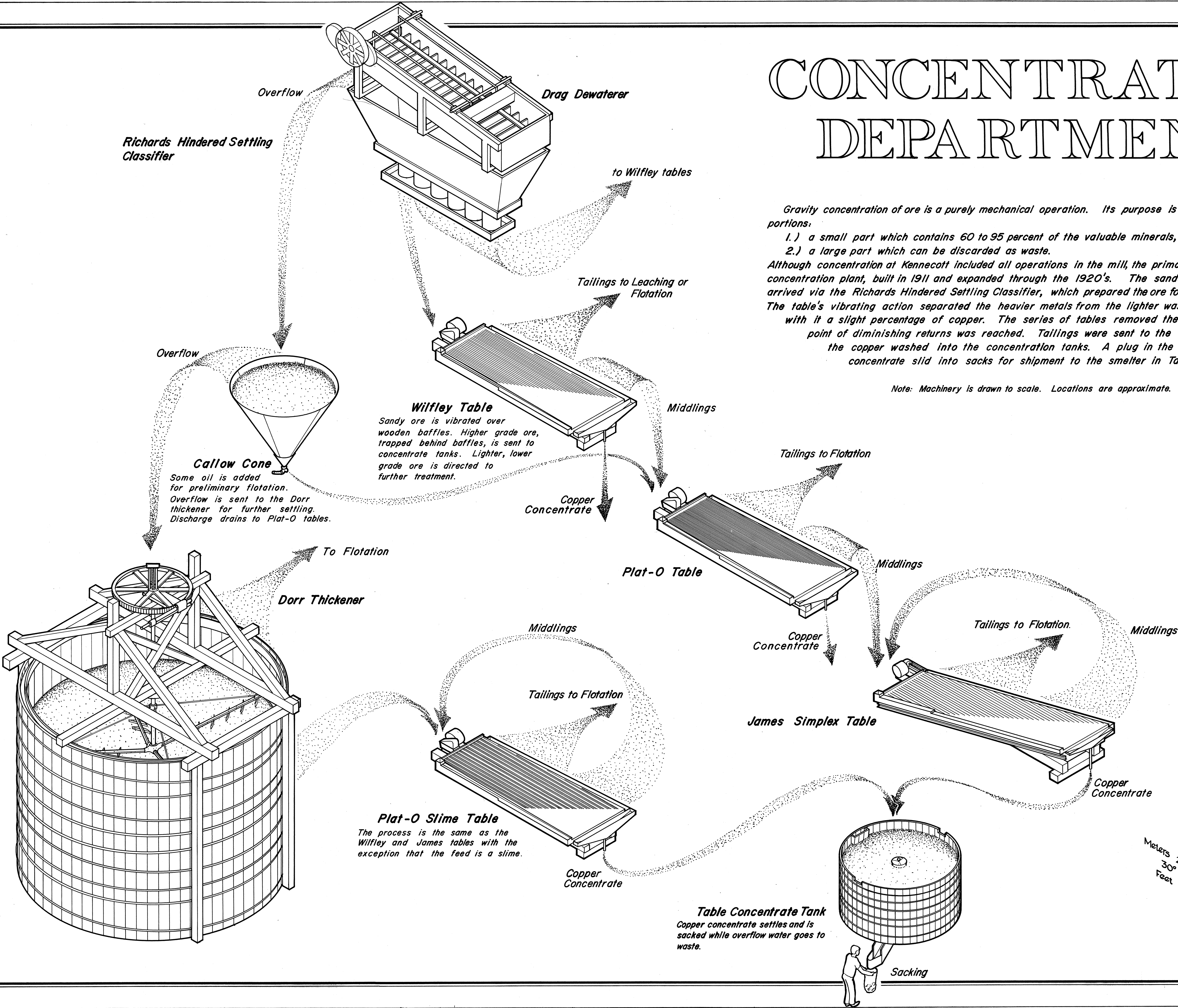
KENNICOTT

KENNECOTT COPPER CORPORATION: CRUSHING DEPARTMENT
WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE

ALASKA
SHEET 6 of 15
HISTORIC AMERICAN ENGINEERING RECORD
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CONCENTRATION DEPARTMENT

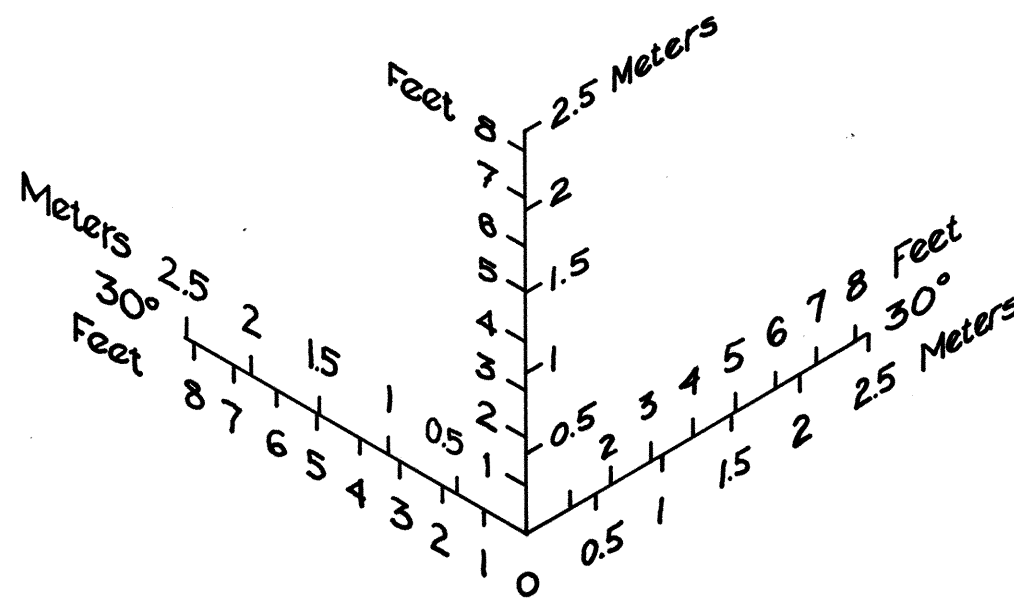


Gravity concentration of ore is a purely mechanical operation. Its purpose is to separate the ore into two portions:

- 1.) a small part which contains 60 to 95 percent of the valuable minerals, and
- 2.) a large part which can be discarded as waste.

Although concentration at Kennecott included all operations in the mill, the primary process was in the gravity concentration plant, built in 1911 and expanded through the 1920's. The sands from the crushing department arrived via the Richards Hindered Settling Classifier, which prepared the ore for the 39 concentration tables. The table's vibrating action separated the heavier metals from the lighter waste rock, which always carried with it a slight percentage of copper. The series of tables removed the copper from the waste until the point of diminishing returns was reached. Tailings were sent to the leaching or flotation plant, while the copper washed into the concentration tanks. A plug in the tank was removed and the copper concentrate slid into sacks for shipment to the smelter in Tacoma.

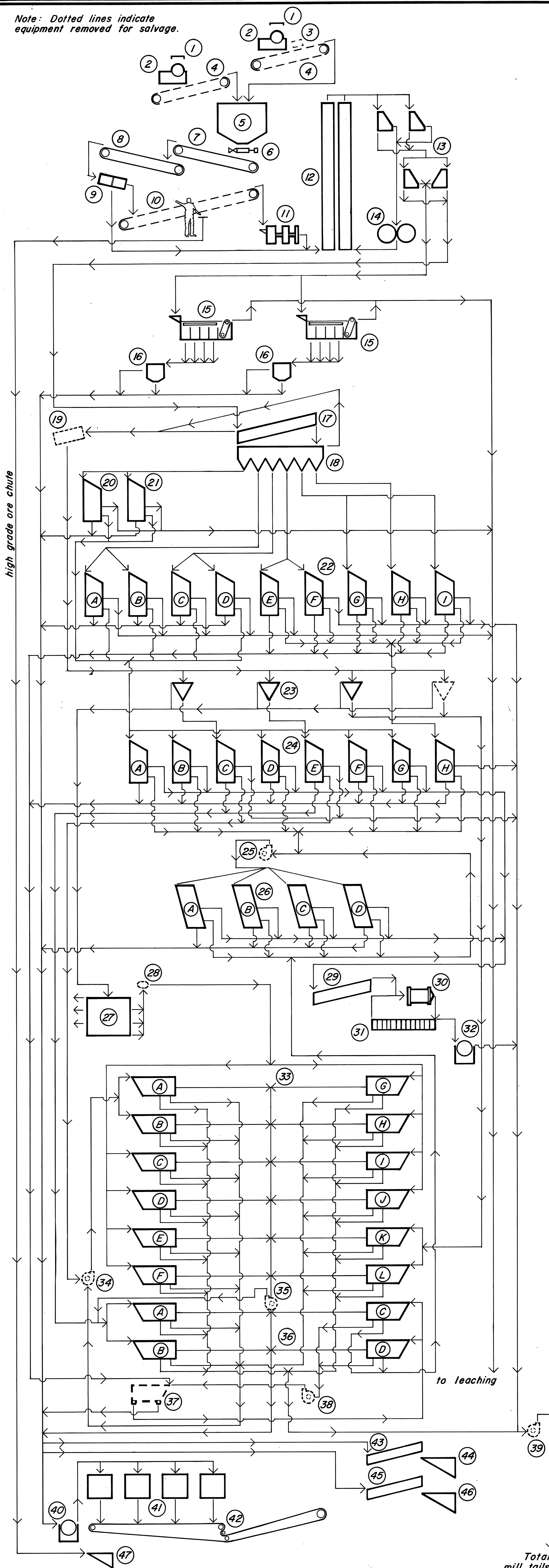
Note: Machinery is drawn to scale. Locations are approximate.



SCALE: 1/4" = 1'-0"

Note: Dotted lines indicate equipment removed for salvage.

CONCENTRATION MILL - 1938 FLOW SHEET



1. 2 Grizzlies
2. 2 Buchanan jaw crushers: 13" x 24"; 250 rpm; 3 1/2" opening
3. Cobbing magnet
4. 2 Conveyors: Jumbo & Bonanza - 22" width; 5 ply
5. Ore bin: 400 ton; 32' width; 32' length; 20' depth
6. Stevens - Adamson apron feeder
7. Conveyor: 40' length; 32" width; 5 ply; 60 fpm
8. Conveyor: 52' length; 32" width; 5 ply; 60 fpm
9. Trommel: 4' diameter; 27"-11mm; 30"-1" mesh; 16 rpm
10. Sorting conveyor: 40' length; 32" width; 5 ply; 50 fpm
11. Symons disc crusher: 36"; 335 oscillations; 135 rpm; 1" opening
12. 2 Elevators: 58' length; 18" width; 10 ply; 380 fpm; 54 cups
13. 4 Vibrating screens
14. Traylor rolls: 54" x 20"; 83 rpm
15. 2 Hancock jigs: 195 rpm; 1/8" lift; 3/8" throw; 3'-1 1/2" depth of pocket; 3'-7 1/2" width of pocket
16. 2 Harz jigs: 265 rpm; 3/4" stroke; 4 mm screen
17. Drag dewaterer: 32' length; 30" width; no. 830 chain; 3 7/8" in 12"
18. Richards hindered settling classifier; 6 spigots; 30" water head
19. Chip trommel: 5' length; 3' diameter; 16 rpm; 4mm screen
20. Wilfley table: 15 1/16" stroke; 3/4" in 12" slope; 258 rpm
21. Plat-O table: 13 1/16" stroke; 1 1/16" in 12" slope; 304 rpm
22. 9 Wilfley tables:

| | rpm | slope per foot inches | stroke, inches |
|---|-----|--------------------------|-------------------|
| A | 256 | 13/16 | 3 1/4 |
| B | 270 | 7/8 | 1 |
| C | 248 | 7/8 | 7/8 |
| D | 276 | 5/8 | 1 1/16 |
| E | 258 | 13/16 | 1 1/4 |
| F | 257 | 15/16 | 1 1/4 |
| G | 259 | 13/16 | 15/16 |
| H | 256 | 13/16 | 15/16 |
| I | 260 | 13/16 | 7/8 |

23. 4 Callow cones: 8' diameter
24. 8 Plat-O tables:

| | rpm | slope per foot inches | stroke, inches |
|---|-----|--------------------------|-------------------|
| A | 335 | 9/16 | 1/2 |
| B | 335 | 9/16 | 5/8 |
| C | 335 | 1/4 | 3/4 |
| D | 261 | 7/8 | 7/8 |
| E | 320 | 7/8 | 3/4 |
| F | 262 | 13/16 | 5/8 |
| G | 315 | 9/16 | 7/8 |
| H | 318 | 9/16 | 7/8 |

25. Wilfley centrifugal pump: 2"
26. 4 James tables:

| | rpm | slope per foot inches | stroke, inches |
|---|-----|--------------------------|-------------------|
| A | 245 | 5/8 | 3/4 |
| B | 247 | 5/8 | 3/4 |
| C | 230 | 5/8 | 3/4 |
| D | 230 | 5/8 | 1 1/16 |

27. 2-tray Dorr thickener: 20' diameter; 16' height
28. Dorr pump
29. Drag dewaterer
30. Ball mill: 4' x 4'; 30 rpm
31. Esperanza classifier
32. Frenier pump
33. 12 Plat-O slime tables: each 305 rpm; 7/8" in 12" slope; 9/16" stroke
34. Frenier pump: 48" x 6"
35. Frenier pump: 48" x 6"
36. 4 Plat-O slime tables:

| | rpm | stroke, inches |
|---|-----|-------------------|
| A | 305 | 9/16 |
| B | 305 | 9/16 |
| C | 280 | 7/8 |
| D | 280 | 7/8 |

37. 2 spigot classifier
38. Byron Jackson centrifugal pump: 2" x 9"
39. Wilfley centrifugal pump: 4"
40. Frenier pump: 48" x 6"
41. 4 Table concentrate tanks: 9' diameter; 5' height
42. 2 Conveyors: 25' length; 22" width; 5 ply; 14 fpm; 5 7/8" in 12" slope
43. Drag dewaterer (from Hancock jig concentrate): 26' length; 40" width; 3 7/8" in 12" slope; 12 fpm
44. Bin: 110 ton capacity
45. Drag dewaterer (from bull jig concentrate): 26' length; 14" width; 3 7/8" in 12" slope; 12 fpm
46. Bin: 140 ton capacity
47. High grade ore bin

Based on 1928 flow sheet from "Flotation and Leaching", E. J. Duggan, *Engineering and Mining Journal*, 1928, and on 1985 field observations

DELINEATED BY: Nanon Adair Anderson & David C. Anderson, 1985

HISTORIC AMERICAN ENGINEERING RECORD
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KENNICOTT

KENNICOTT COPPER CORPORATION; CONCENTRATION MILL FLOW SHEET 1938
WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE

ALASKA

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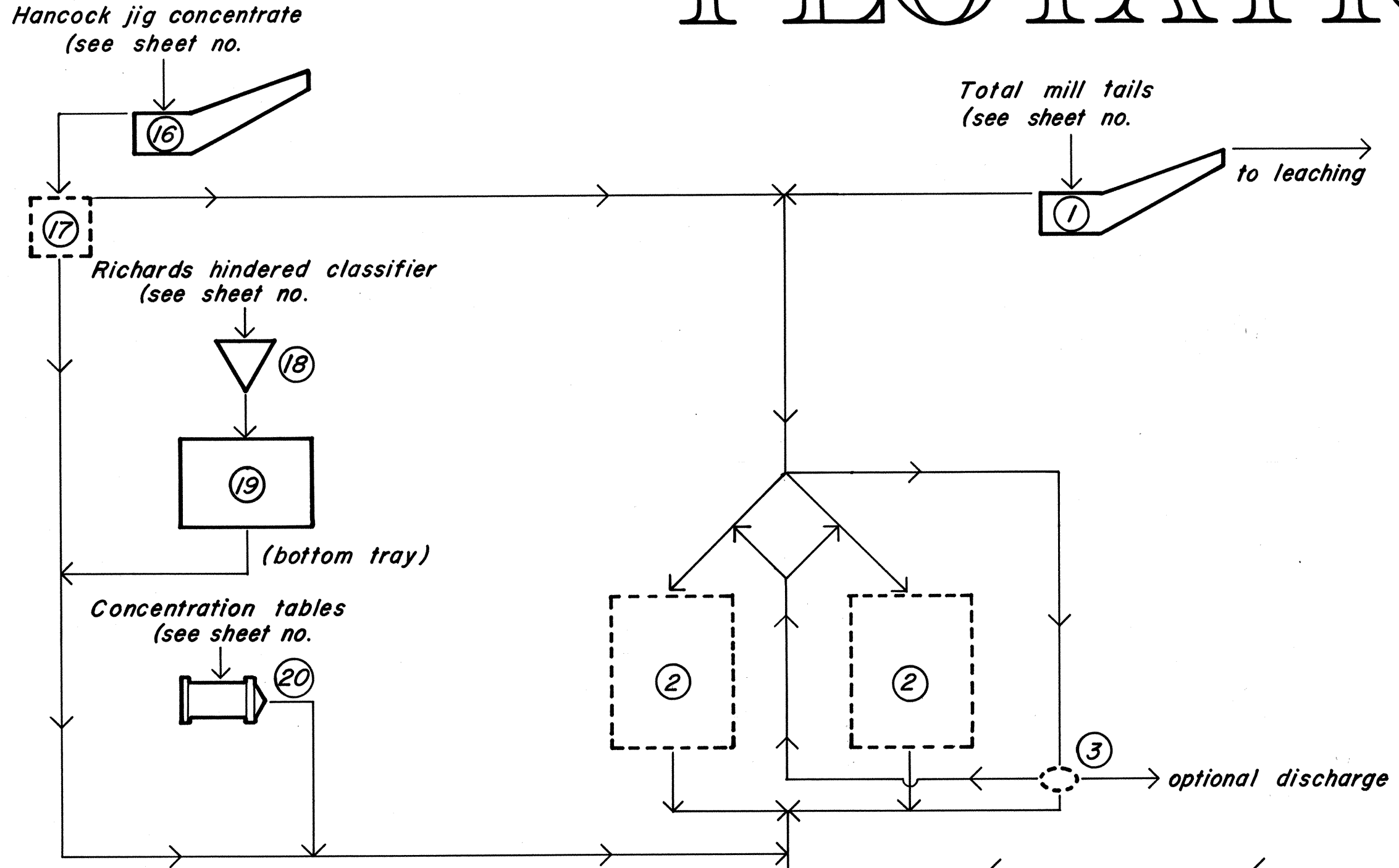
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FLOTATION DEPARTMENT

With a feed of 3-4% copper from the concentration tables, the flotation process mixed in reagents which removed more copper in a frothing action. After settling, filtering and drying, a concentrate was produced that assayed 32-35% copper, ready for shipment.

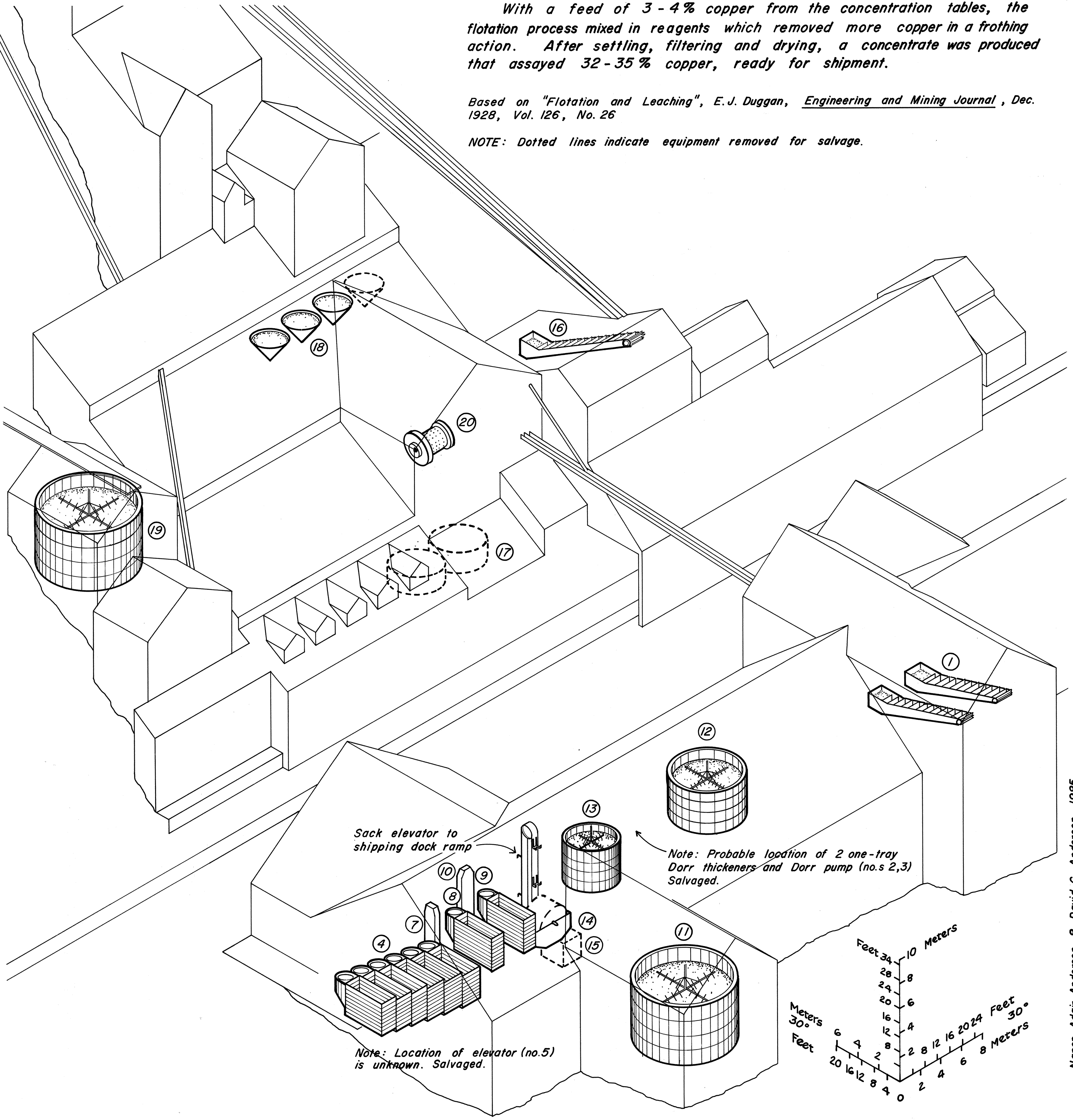
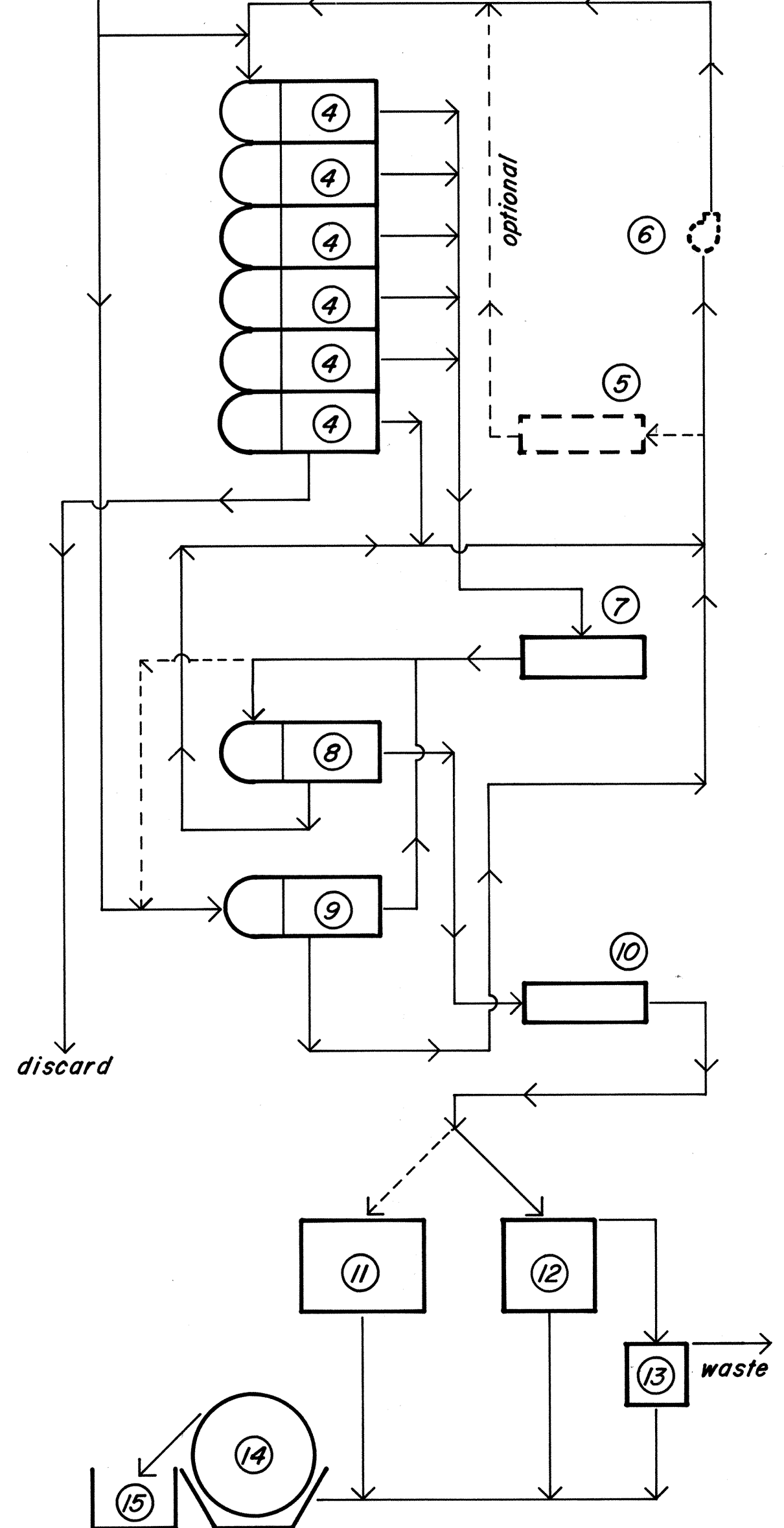
Based on "Flotation and Leaching", E.J. Duggan, *Engineering and Mining Journal*, Dec. 1928, Vol. 126, No. 26

NOTE: Dotted lines indicate equipment removed for salvage.



FLOW CHART

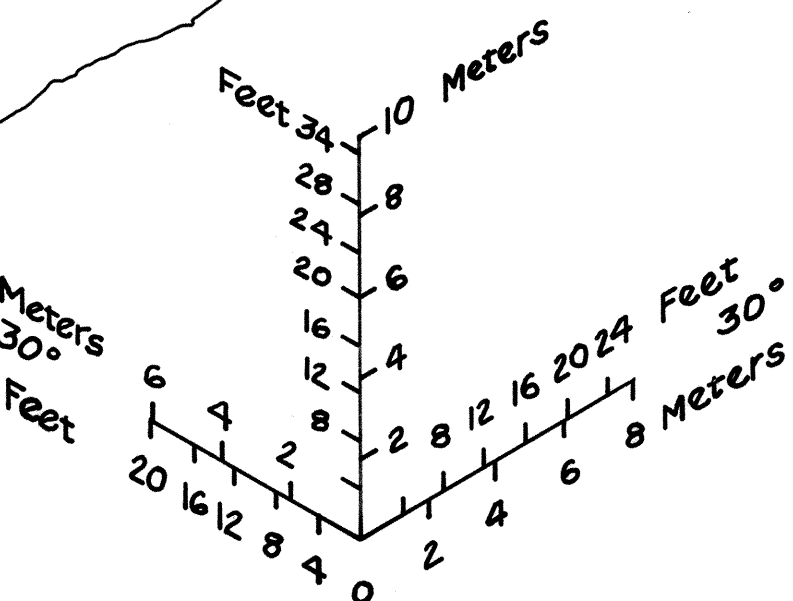
1. Esperanza drag classifier
2. 2-1 tray Dorr thickeners
3. Dorr pump
4. 6 Standard 24" Janney cells as roughers
5. 10" Elevator
6. 2" Centrifugal pump
7. 10" Elevator
8. 1 Standard 24" Janney cell as cleaner
9. 1 Standard 24" Janney cell as mixer
10. 10" Elevator
11. 25' Dorr thickener
12. 18' Dorr thickener
13. 12' Dorr thickener
14. Oliver filter; 4' x 8' diameter
15. Concentrate bin
16. Drag dewaterer
17. 2 Mill table concentrate tanks; 12' diameter
18. 8' Callow cones
19. 25' Dorr thickener
20. Ball mill



Sack elevator to shipping dock ramp

Note: Probable location of 2 one-tray Dorr thickeners and Dorr pump (nos. 2, 3) Salvaged.

Note: Location of elevator (no. 5) is unknown. Salvaged.



SCALE: 1/16" = 1'-0"

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HISTORIC AMERICAN ENGINEERING RECORD
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KENNICOTT

KENNICOTT COPPER CORPORATION; FLOTATION PROCESS
WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE

ALASKA

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HISTORIC AMERICAN
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DATE OF DRAWING

AMMONIA LEACHING FLOW DIAGRAM

SOLUTION SECTION

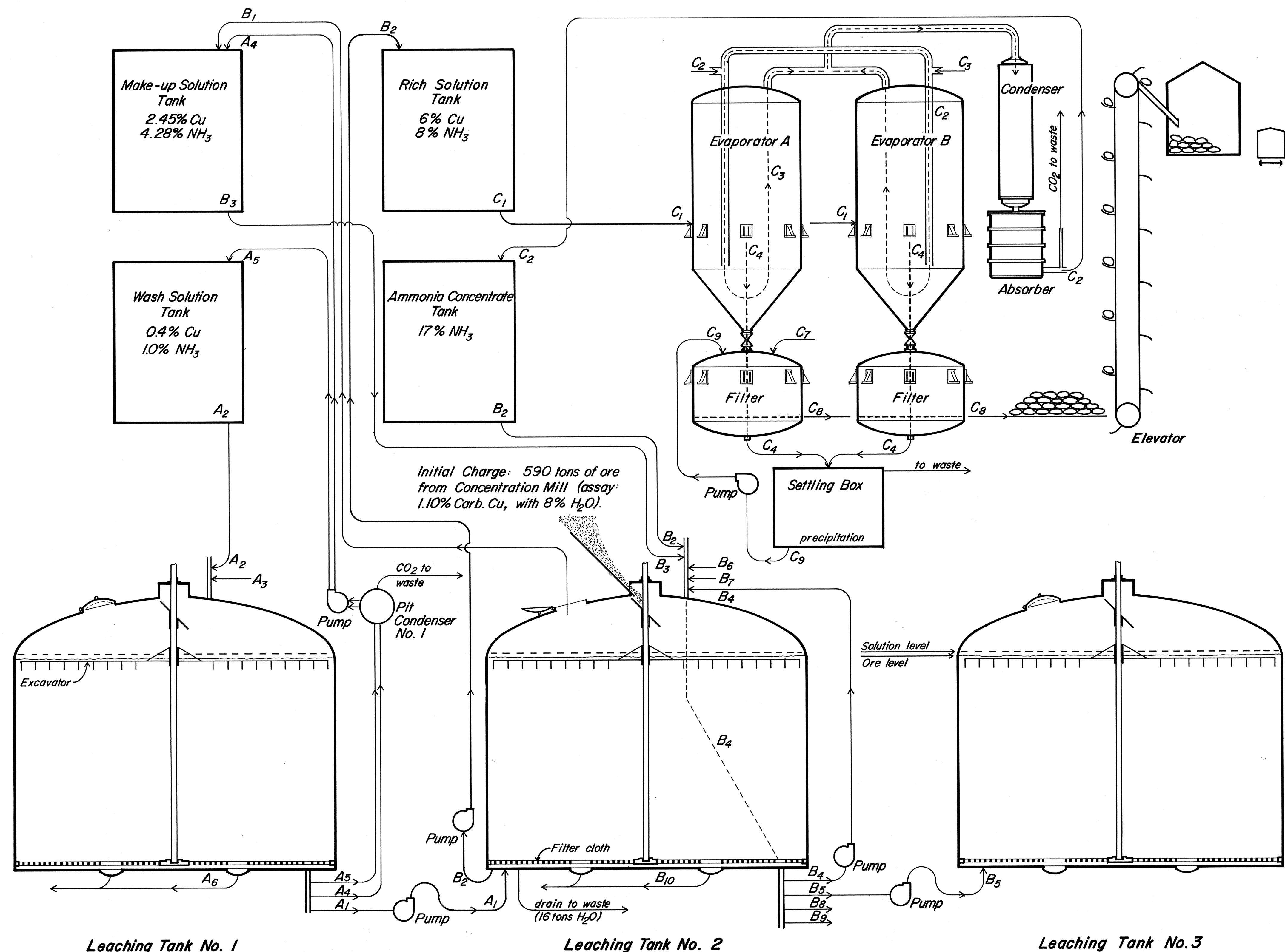
(Showing 1 set of Evaporators, designated "A" & "B")

- C_1 21 tons of rich solution to A & B.
 C_2 Steam into A - vapors from A into B to condensers. Ammonia concentrates to storage tank (assay: 17% NH_3).
 C_3 After boiled out, solution assays .03% NH_3 in A. Steam off A turned directly into B.
 C_4 Solution from A dumped into filter. Filtrate pumped to settling box. Precipitates 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 steamed after receiving 3 dumps of 15 lb. for 4 to 5 hours. Condensate to settling box.
 C_8 Precipitates (assay: 75% Cu with 18% 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 8 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 pit condensers to make-up tank.
 A_5 16 tons of wash solution (assay: 0.4% Cu, 1.0% NH_3).
 A_6 Tailings to waste.
 B_1 8 tons of diluted solution syphoned to wash tank by gravity (assay: 0.4% Cu, 1.0% NH_3). If syphoned to waste, which is not always practical owing to varying amounts of H_2O in tails, assay not to exceed 0.1% NH_3 .
 B_2 At end of 12 hour still leach, 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: 1.81% 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 pit condenser No. 2.
 B_9 Same as A_5 (Leaching tank No. 1) via pit condenser No. 2.
 B_{10} Same as A_6 (Leaching tank No. 1).



Leaching Tank No. 1

Leaching Tank No. 2

Leaching Tank No. 3

Note: This drawing represents one complete cycle in the leaching plant.

Based on K.C.C. Leaching Plant Flow Diagram, 1921.



Scale: $\frac{1''}{4} = 1'-0''$

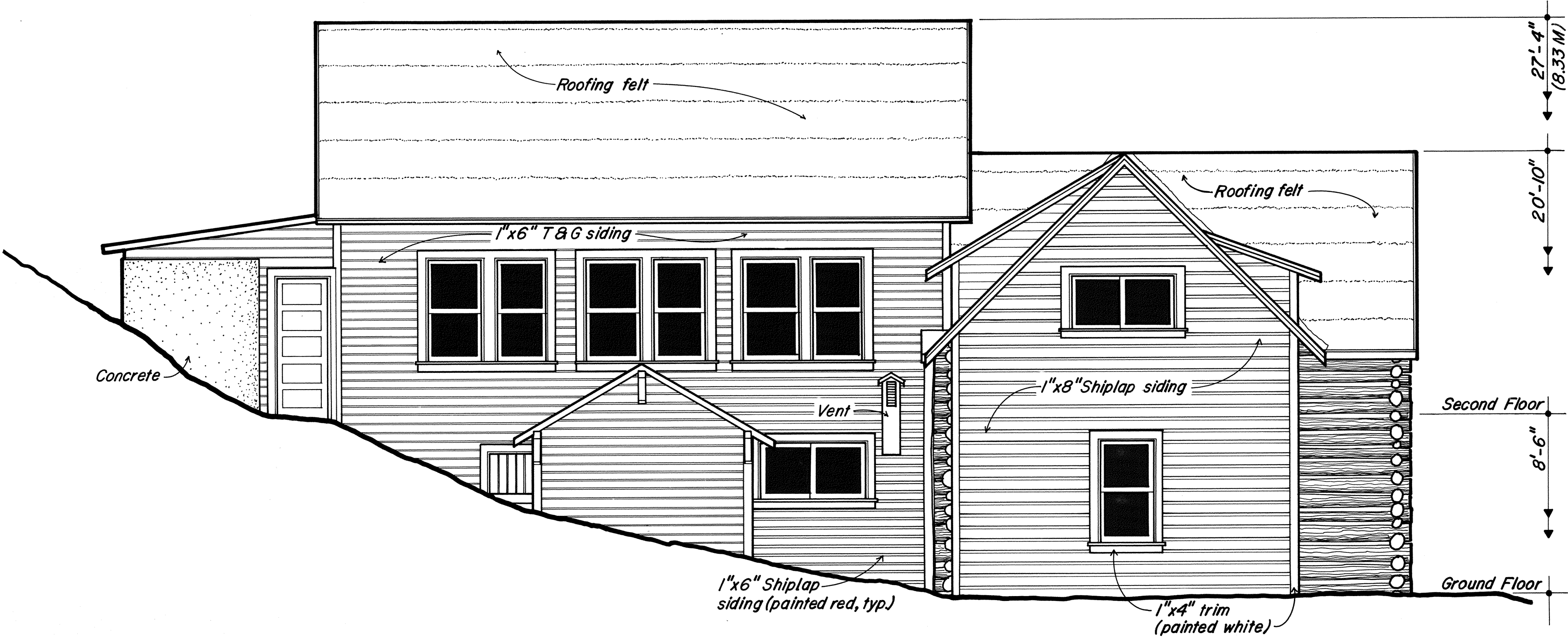
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GENERAL MANAGER'S OFFICE

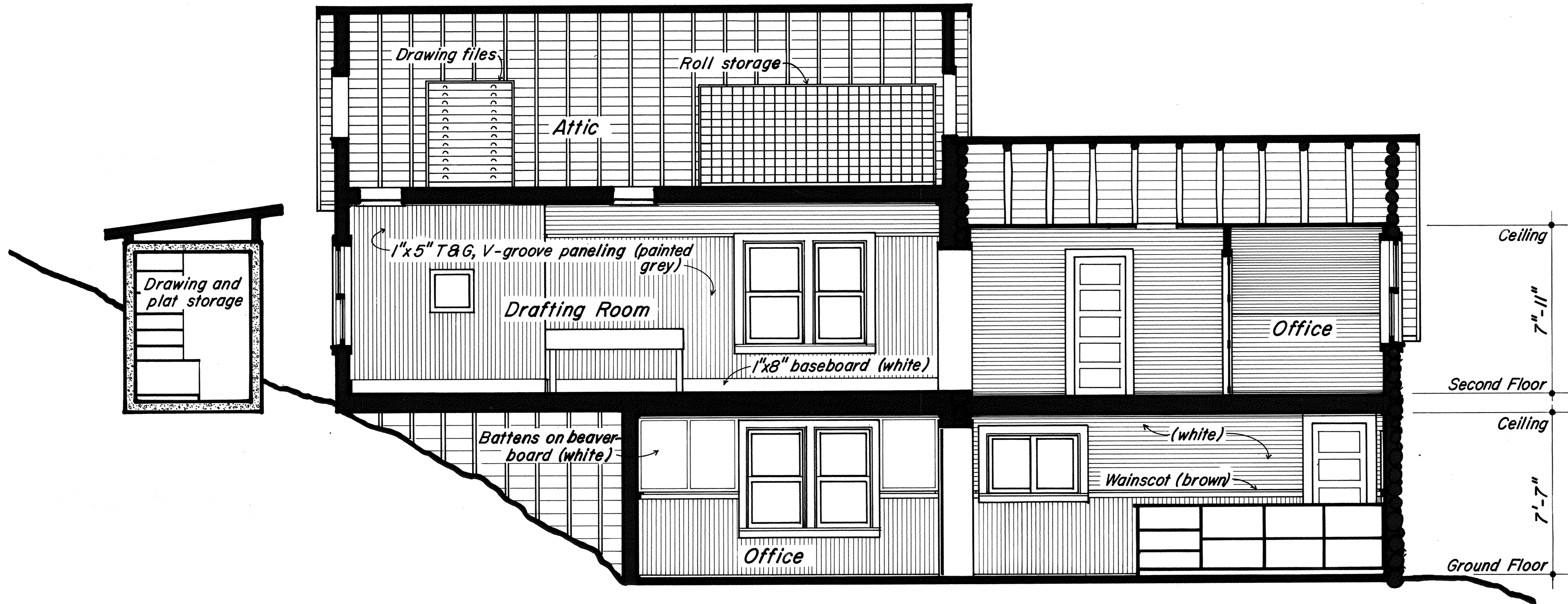
Note: The 1907 log structure was expanded into the General Manager's Office. It is the oldest standing structure in Kennicott. The building is in deteriorated condition.



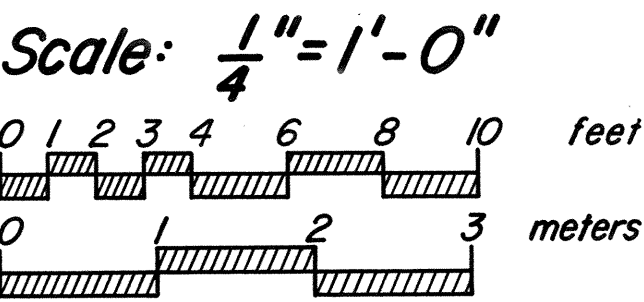
SOUTH ELEVATION



WEST ELEVATION



SECTION A-A



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KENNICOTT

KENNICOTT COPPER CORPORATION: GENERAL MANAGER'S OFFICE

WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE

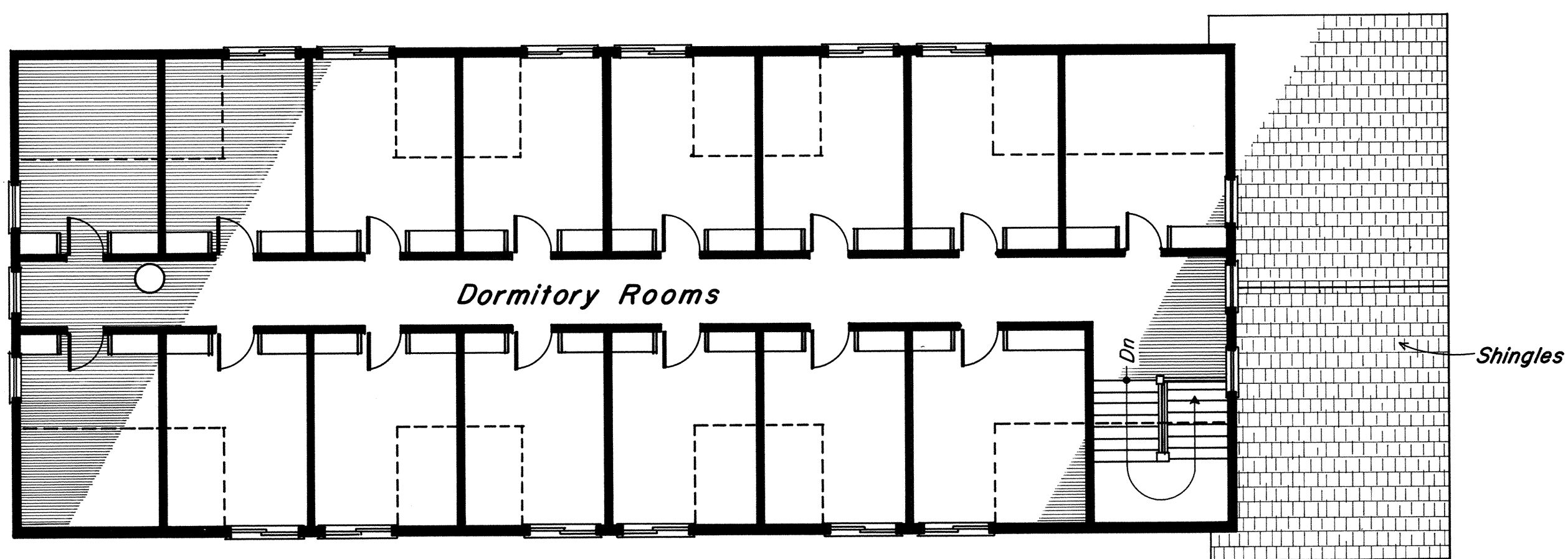
ALASKA

SHEET
12 of 15

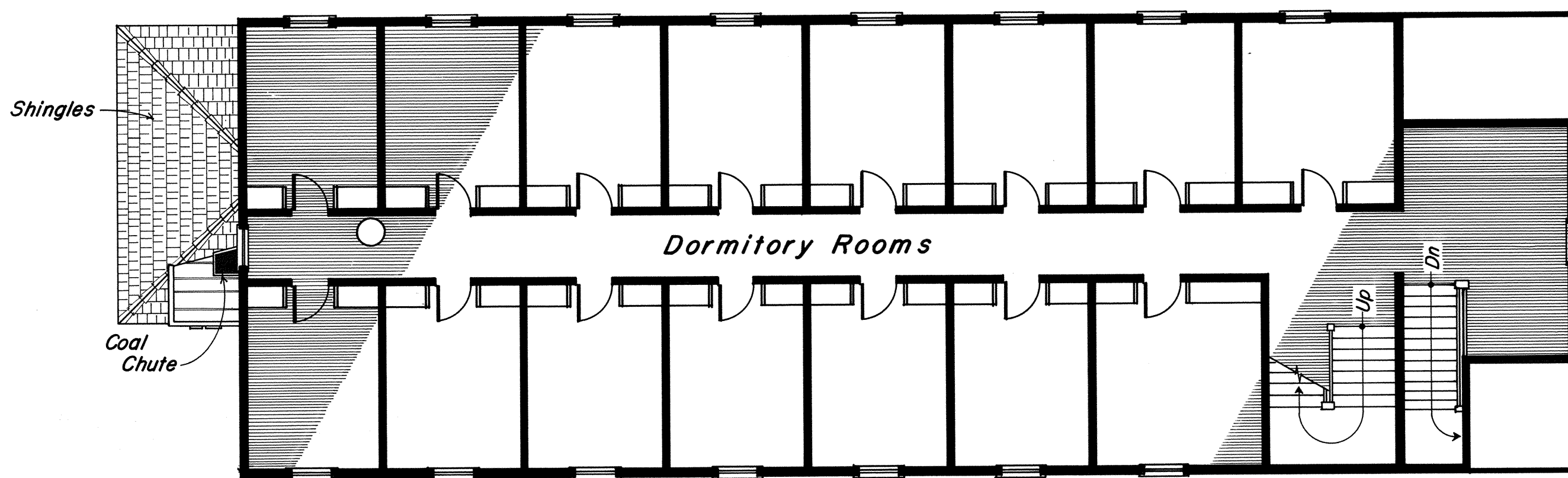
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AK-1

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THREE NUMBER

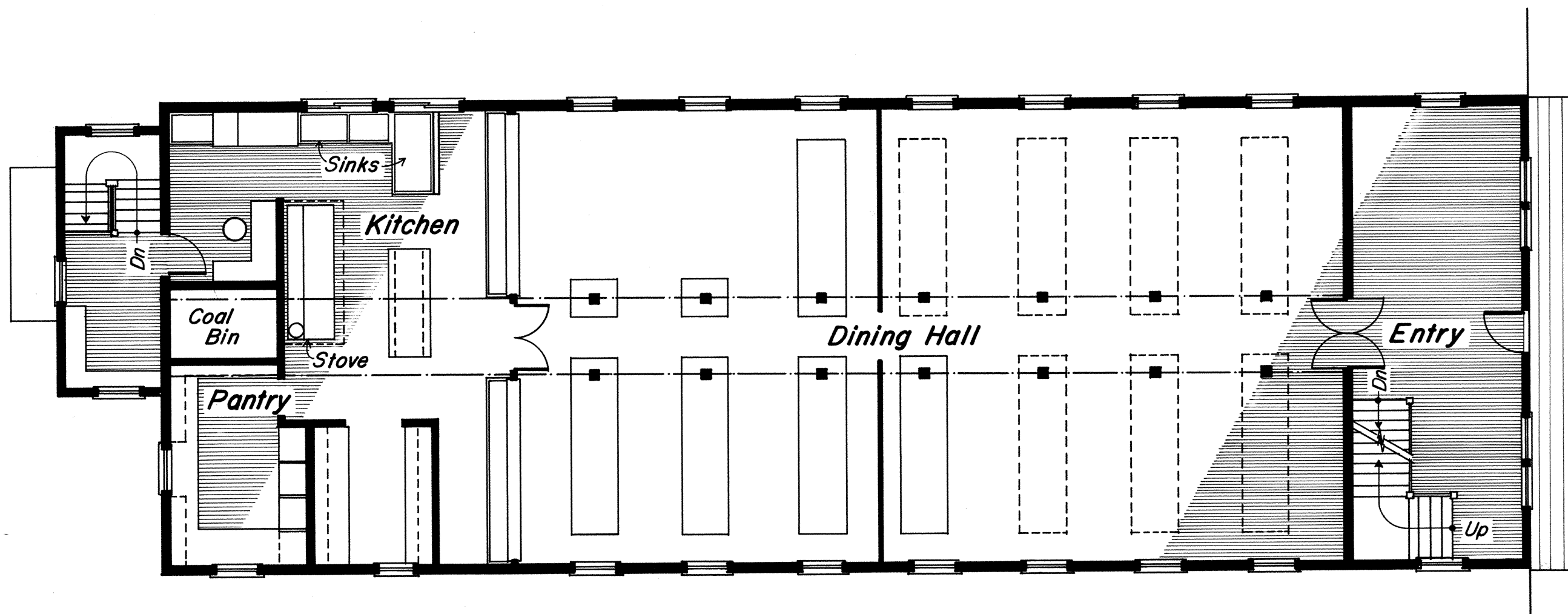
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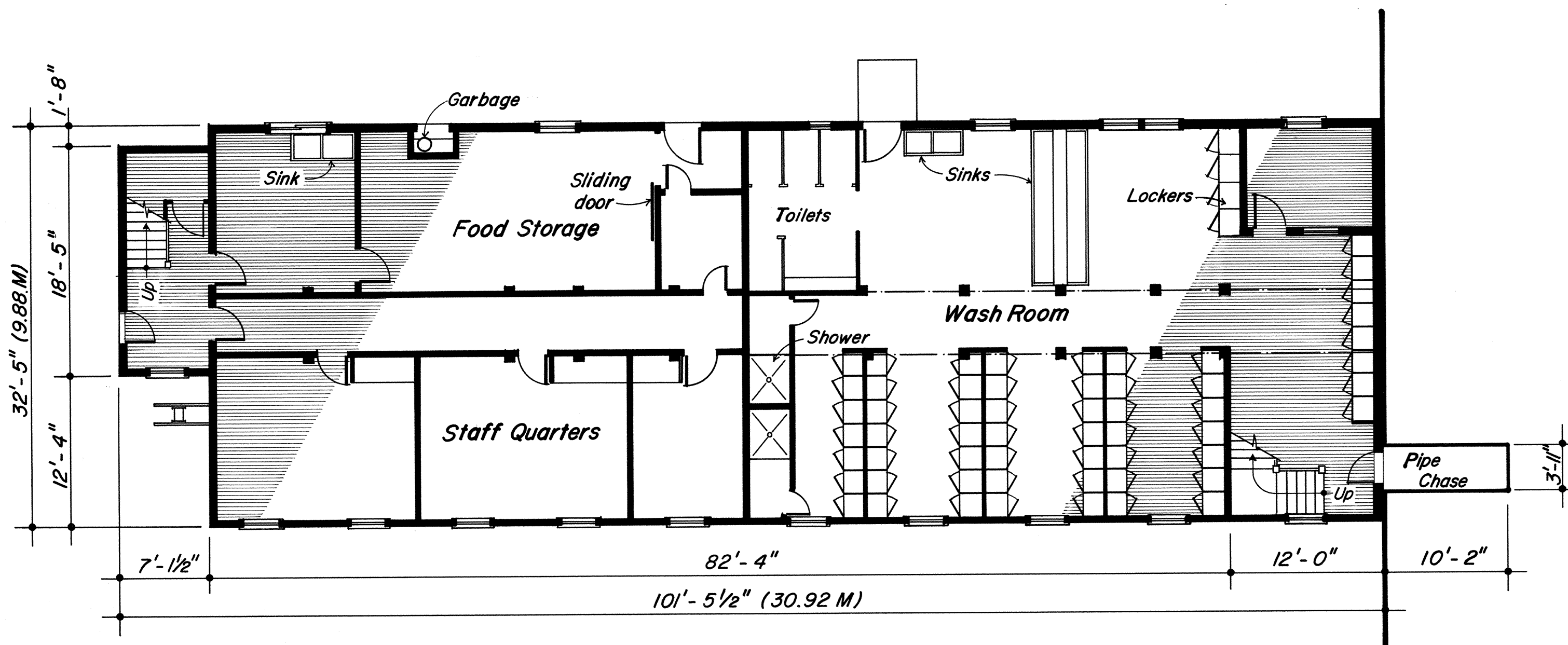
THIRD FLOOR PLAN



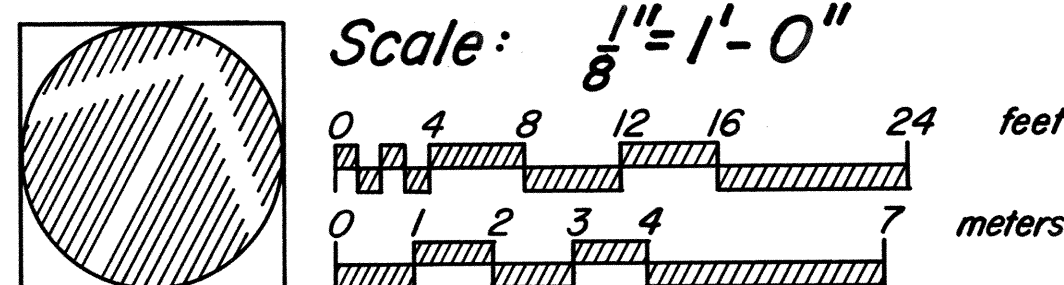
SECOND FLOOR PLAN



FIRST FLOOR PLAN



GROUND FLOOR PLAN



DELINEATED BY: David C. Anderson, Nanon Adair Anderson, 1985

HISTORIC AMERICAN ENGINEERING RECORD
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

KENNICOTT

KENNICOTT COPPER CORPORATION: WEST BUNKHOUSE

WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE

ALASKA

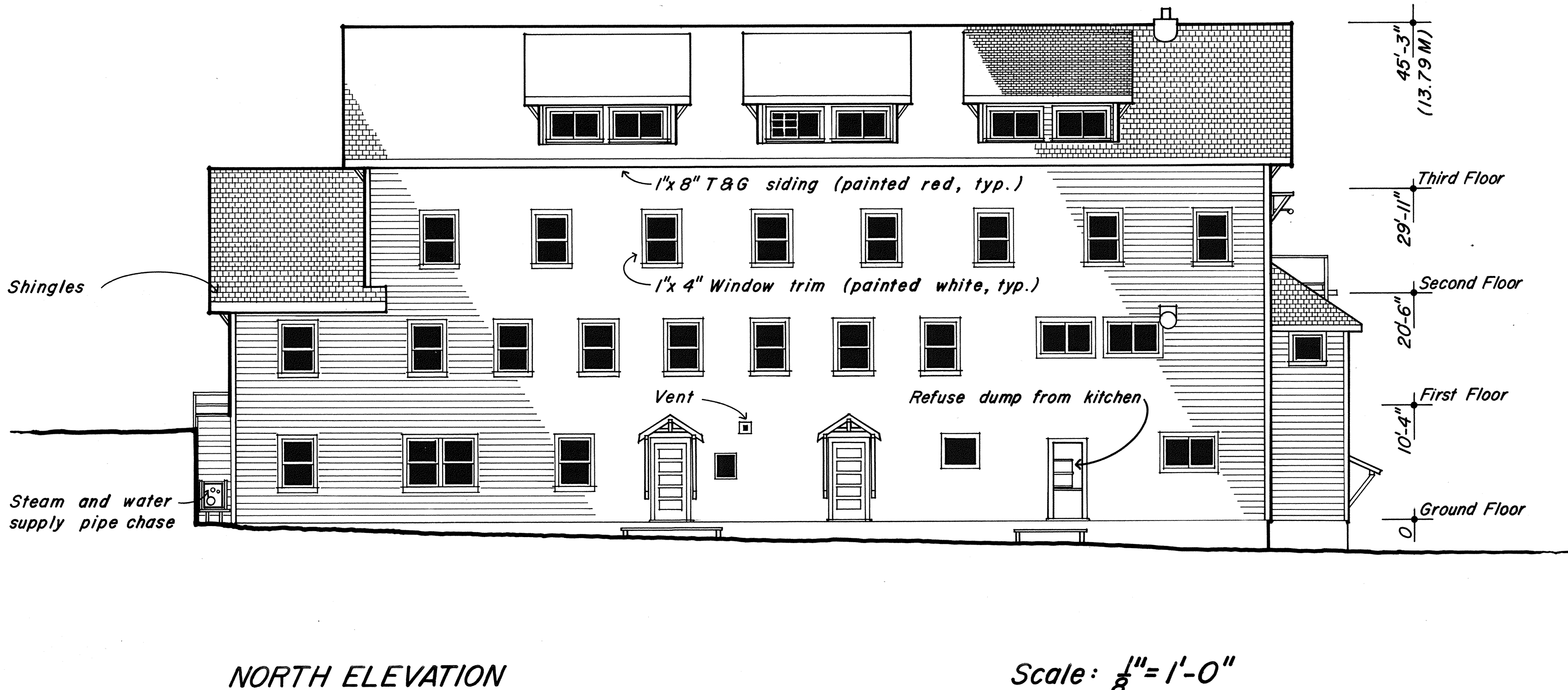
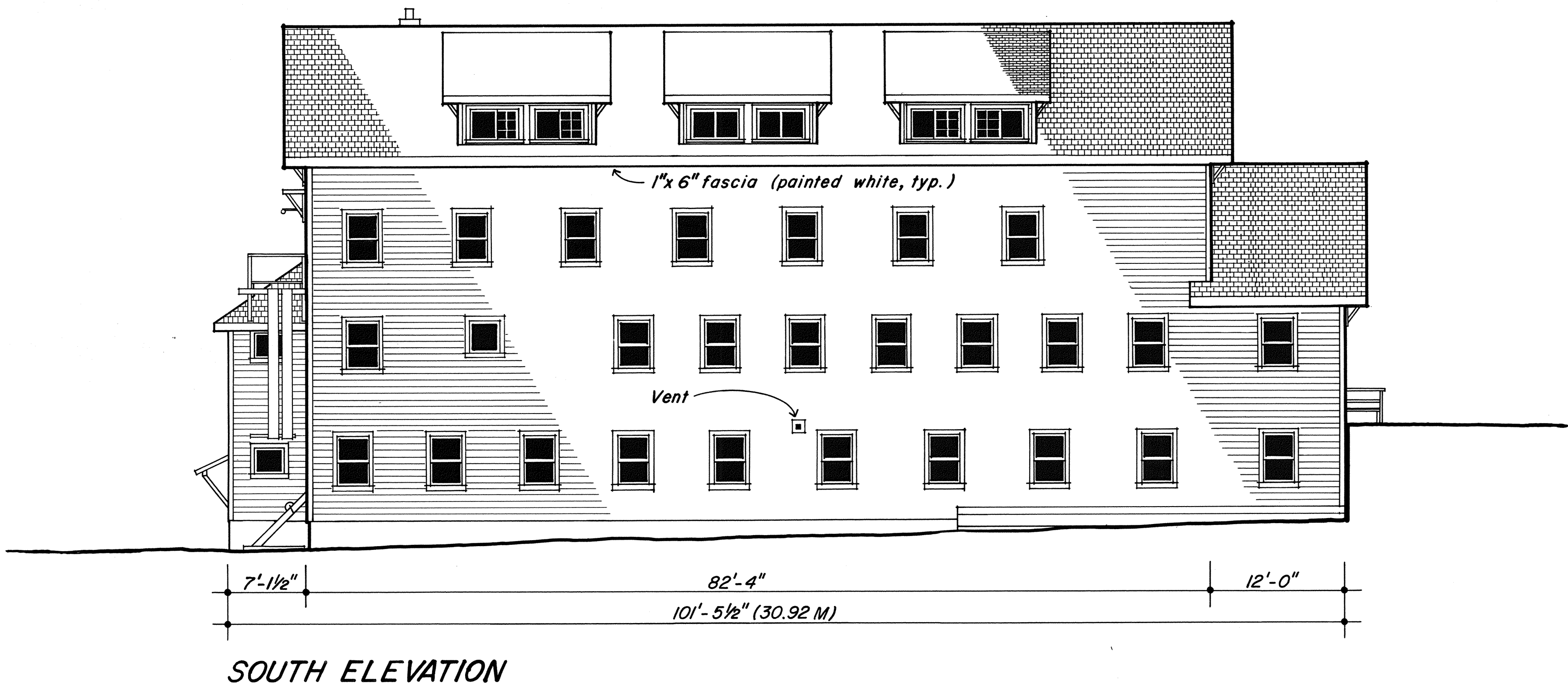
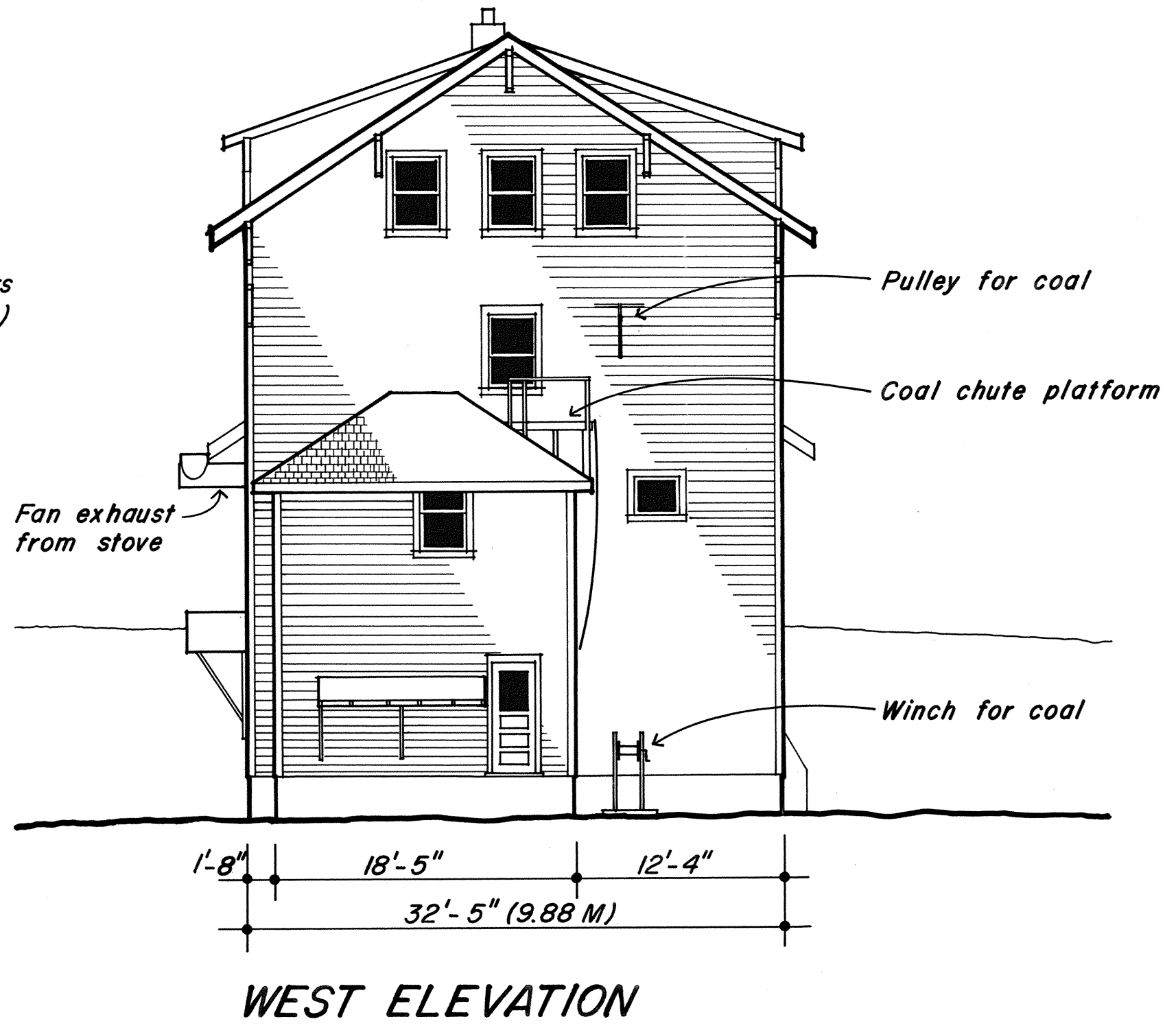
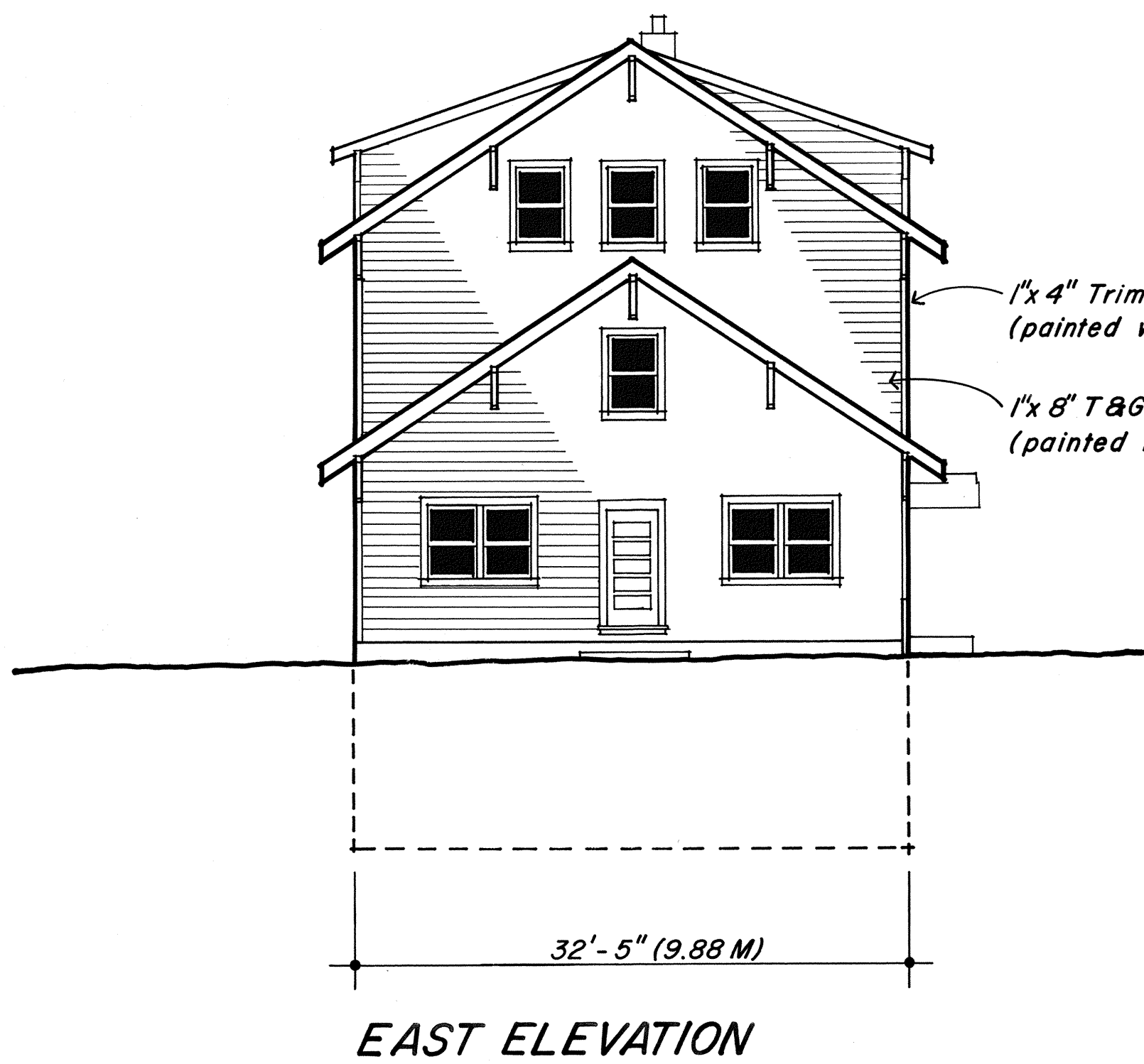
SHEET
13 of 15

HISTORIC AMERICAN
ENGINEERING RECORD
AK-1

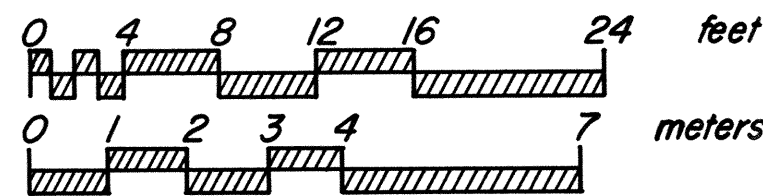
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PHOTO NUMBER

IF REPRODUCED, PLEASE CREDIT: HISTORIC AMERICAN ENGINEERING RECORD, NATIONAL PARK SERVICE, NAME OF DELINEATOR, DATE OF THE DRAWING

WEST BUNKHOUSE



Scale: $\frac{1}{8}" = 1'-0"$



DELINEATED BY: Nanon Adair Anderson, David C. Anderson, 1985

HISTORIC AMERICAN ENGINEERING RECORD
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

KENNICOTT

KENNICOTT COPPER CORPORATION; WEST BUNKHOUSE

WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE

ALASKA

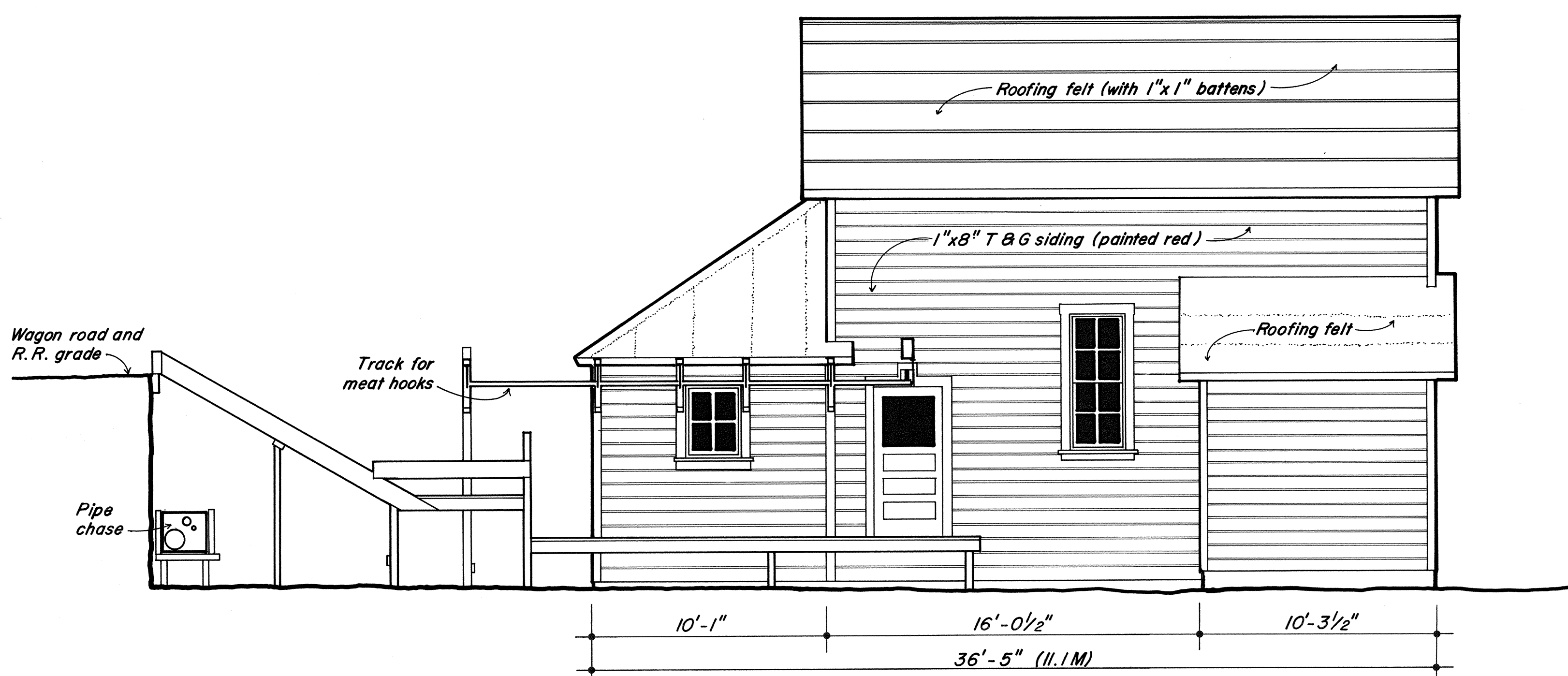
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14 OF 15

HISTORIC AMERICAN
ENGINEERING RECORD
AK-1

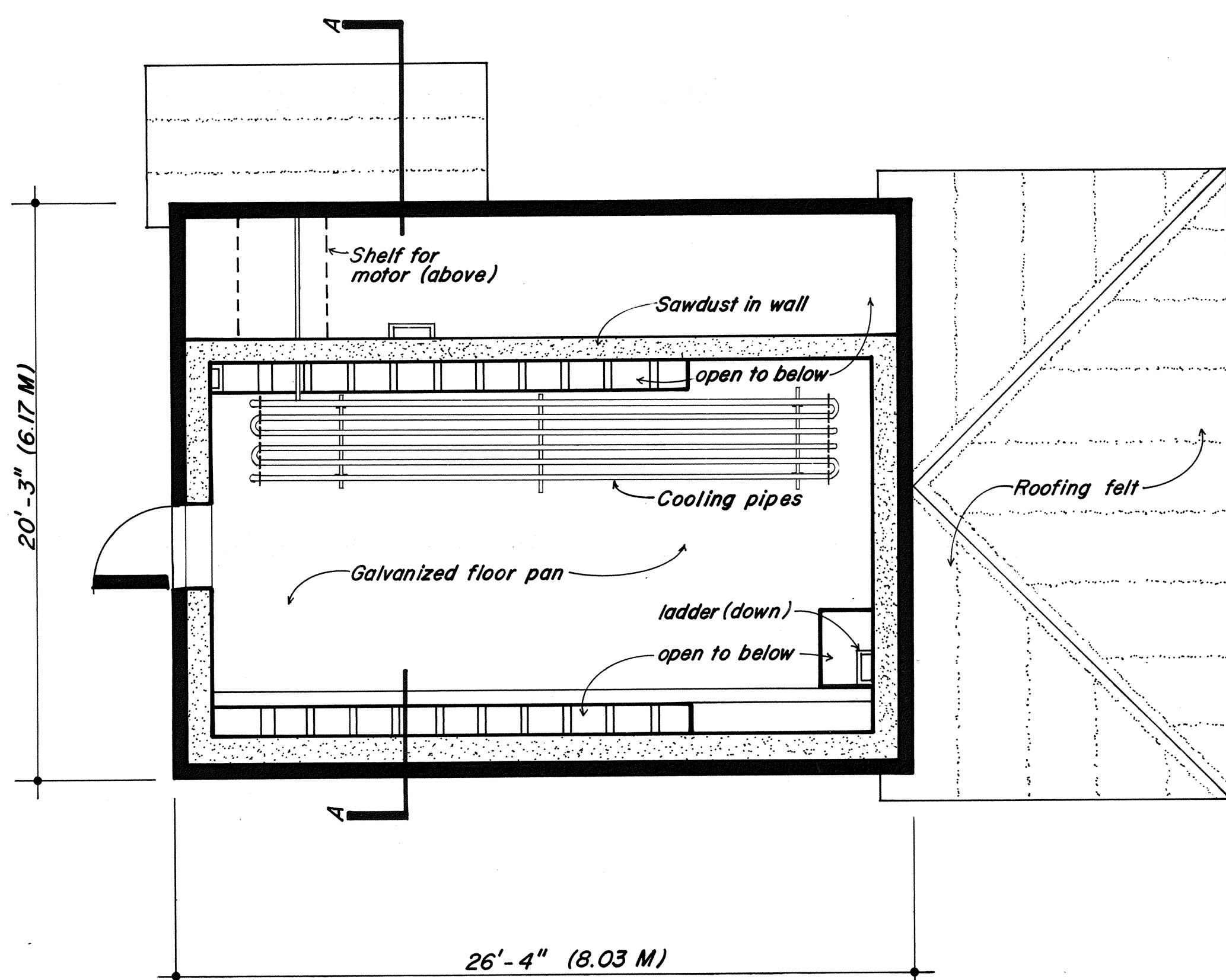
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INDEX NUMBER

IF REPRODUCED, PLEASE CREDIT: HISTORIC AMERICAN ENGINEERING RECORD, NATIONAL PARK SERVICE, NAME OF DELINEATOR, DATE OF THE DRAWING

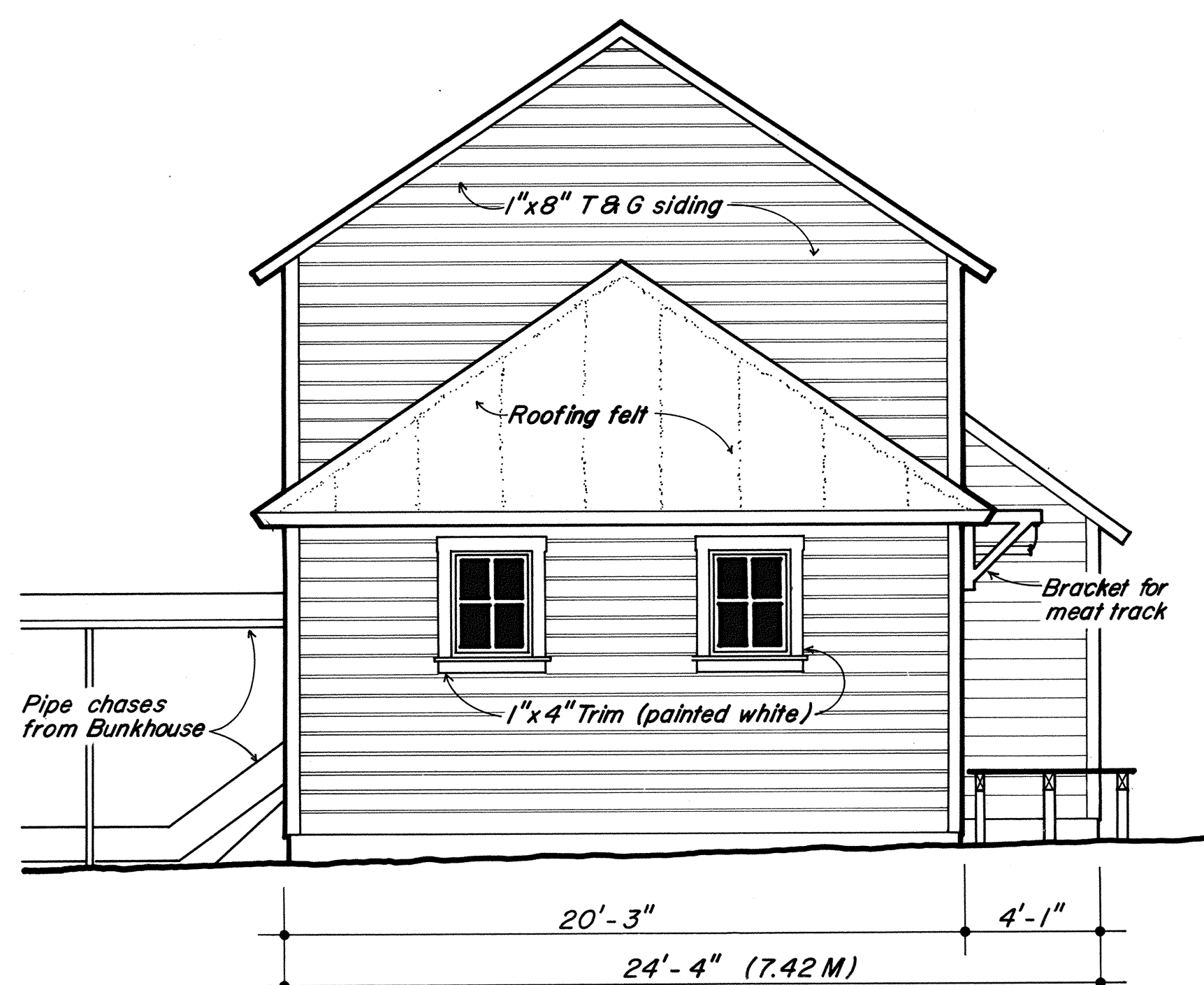
REFRIGERATION PLANT



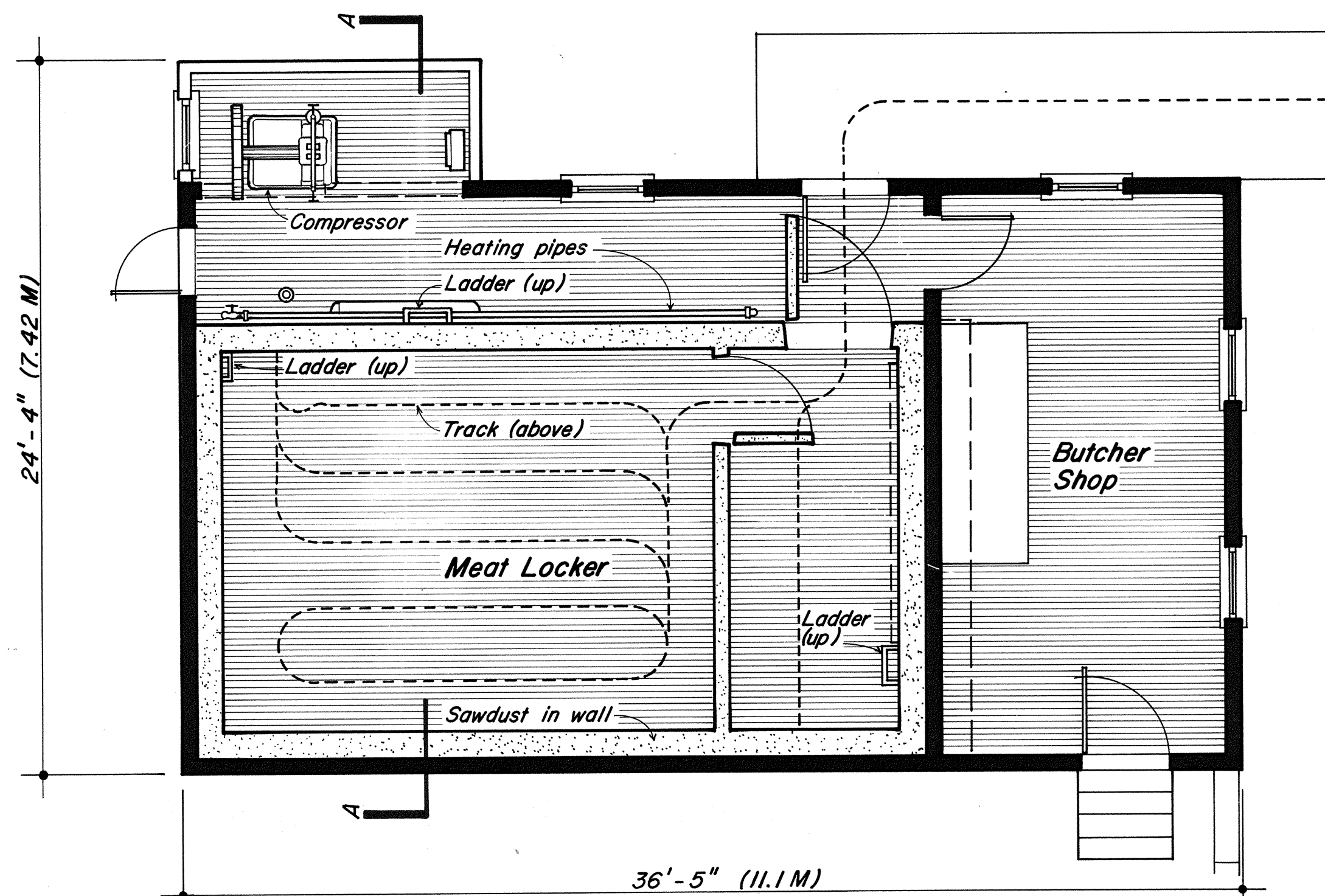
NORTH ELEVATION



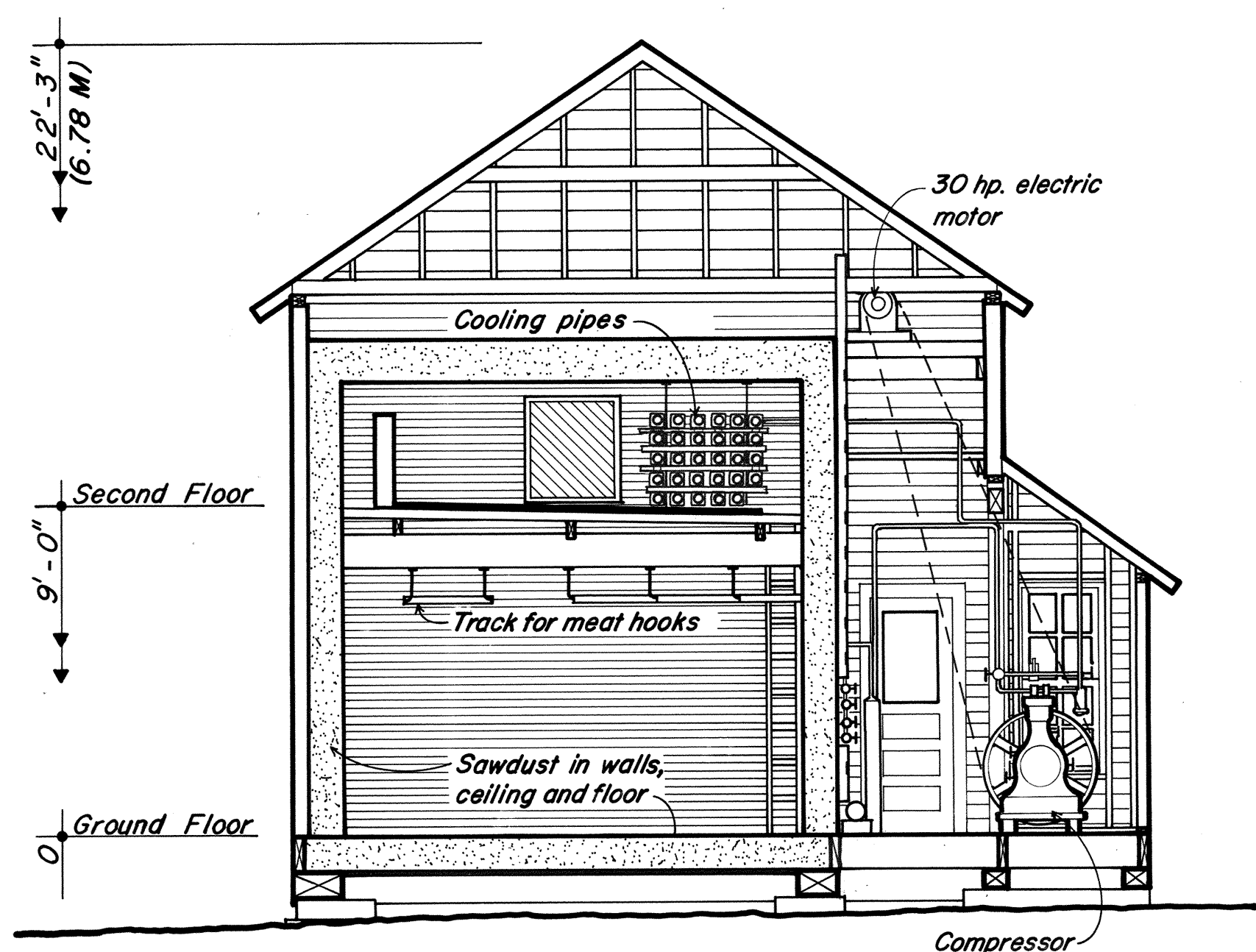
SECOND FLOOR PLAN



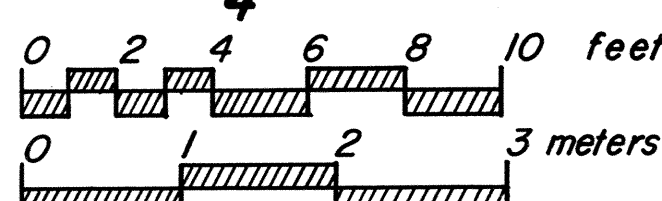
EAST ELEVATION



GROUND FLOOR PLAN



Scale: $\frac{1}{4}$ " = 1'-0"



SECTION A-A

DELINEATED BY: Nanon Adair Anderson, David C. Anderson, 1985

KENNECOTT COPPER CORPORATION: REFRIGERATION PLANT

HISTORIC AMERICAN ENGINEERING RECORD
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

KENNECOTT

WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE

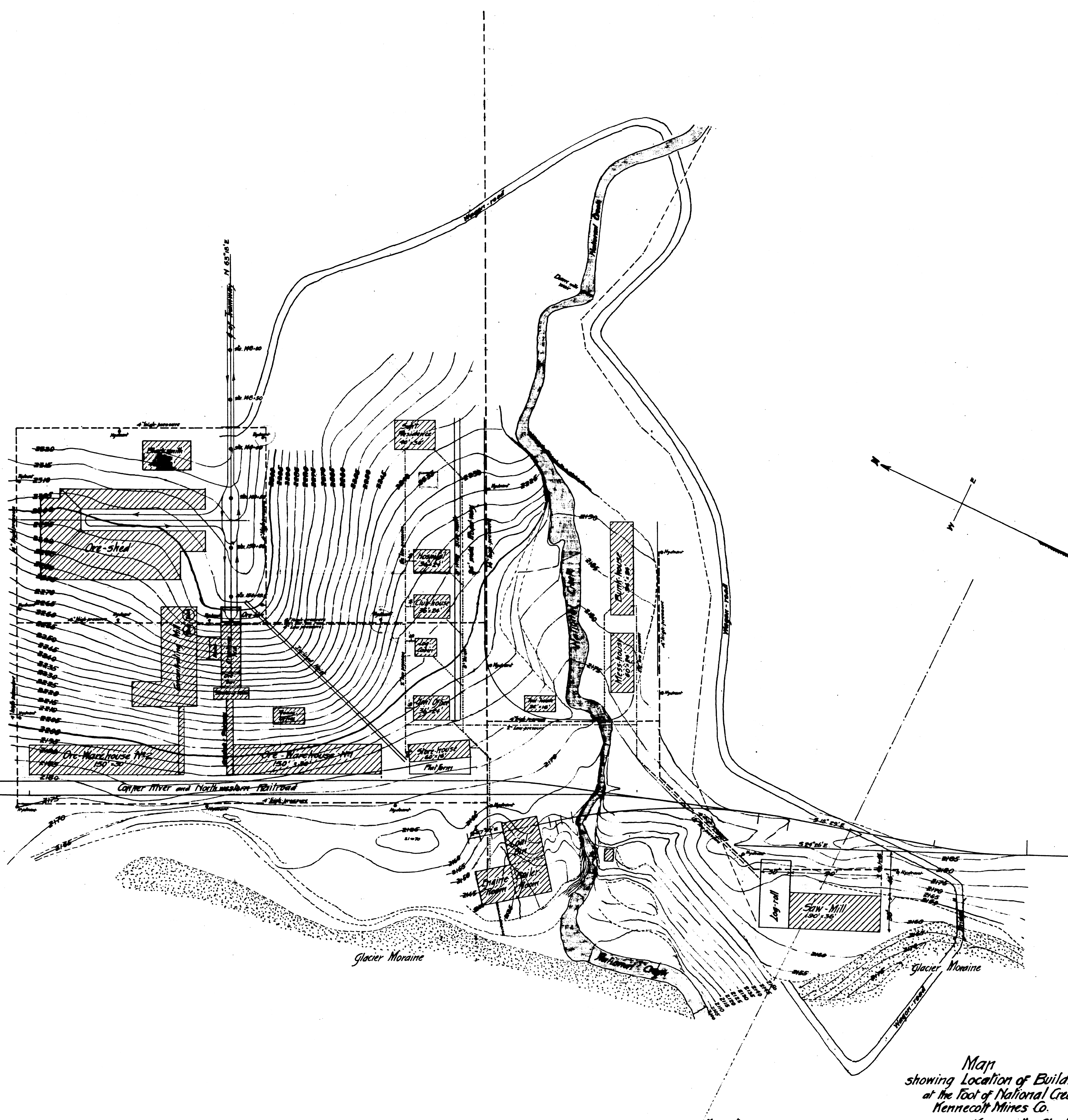
ALASKA

SHEET
15 OF 15

HISTORIC AMERICAN
ENGINEERING RECORD
AK-1

LIBRARY OF CONGRESS
TEXT NUMBER

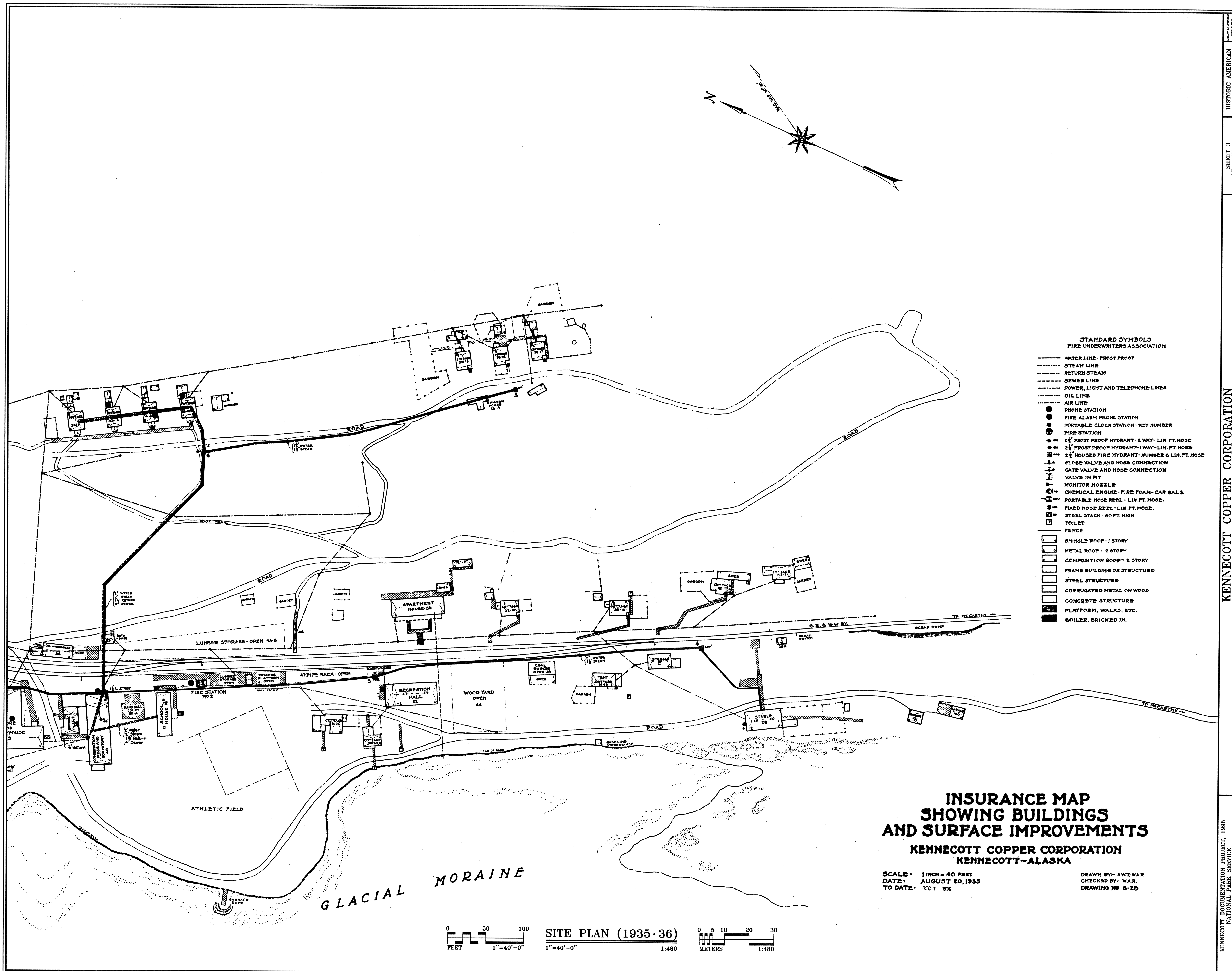
IF REPRODUCED, PLEASE CREDIT: HISTORIC AMERICAN ENGINEERING RECORD, NATIONAL PARK SERVICE, NAME OF DELINEATOR, DATE OF THE DRAWING



Map
showing Location of Buildings
at the Foot of National Creek
Kennecott Mines Co.
Kennecott-Alaska.



Drawing No. 8
Date: Aug. 23rd 1907
Scale: 40 ft. = 1 inch
File No.



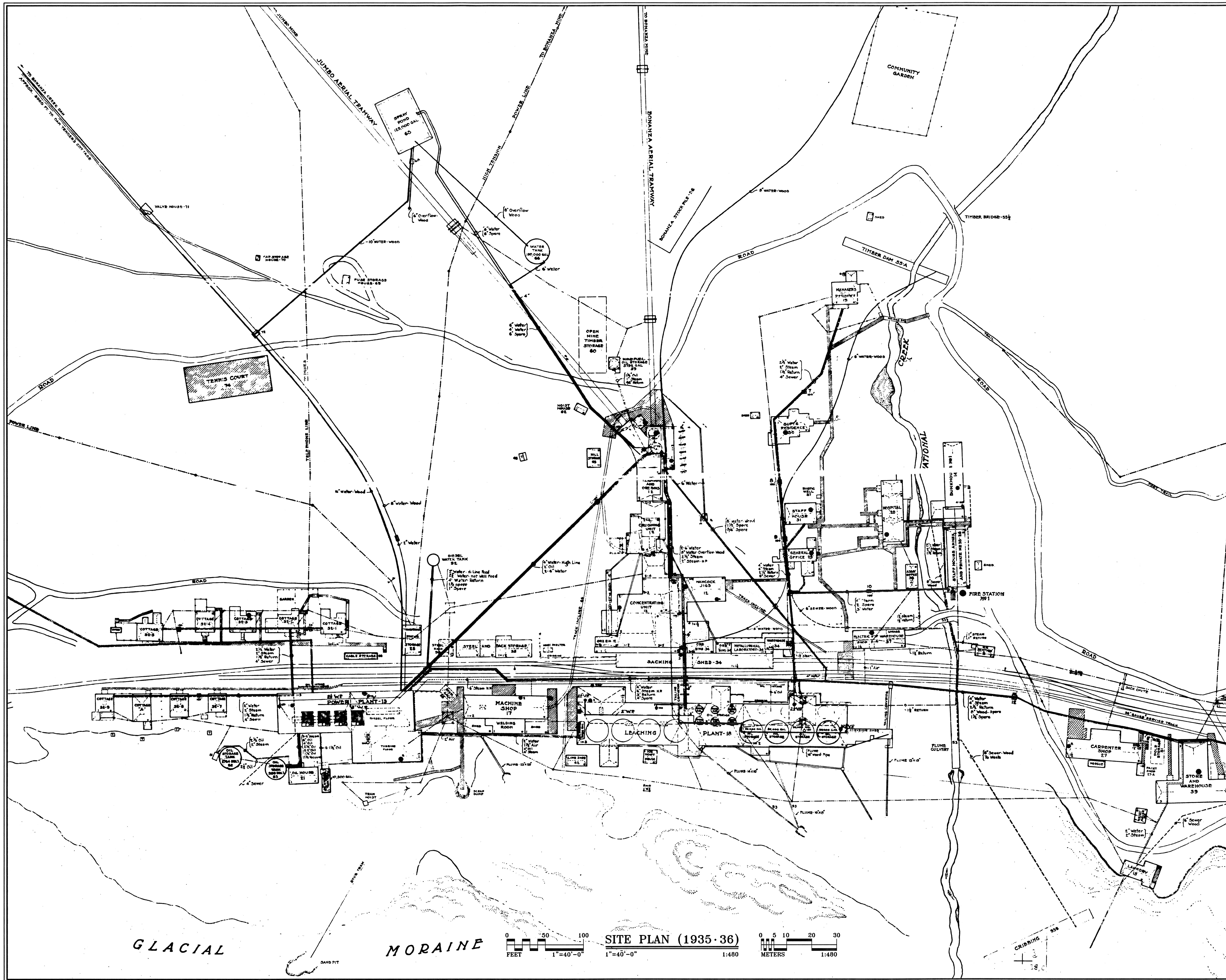
- STANDARD SYMBOLS
FIRE UNDERWRITERS ASSOCIATION
- WATER LINE - FROST PROOF
 - STEAM LINE
 - RETURN STEAM
 - SEWER LINE
 - POWER, LIGHT AND TELEPHONE LINES
 - OIL LINE
 - AIR LINE
 - PHONE STATION
 - FIRE ALARM PHONE STATION
 - PORTABLE CLOCK STATION - KEY NUMBER
 - FIRE STATION
 - 2 1/2" FROST PROOF HYDRANT - 2 WAY - LIN. FT. HOSE
 - 2 1/2" FROST PROOF HYDRANT - 1 WAY - LIN. FT. HOSE
 - 2 1/2" HOUSED FIRE HYDRANT - NUMBER & LIN. FT. HOSE
 - GLOBE VALVE AND HOSE CONNECTION
 - GATE VALVE AND HOSE CONNECTION
 - VALVE IN PIT
 - MONITOR NOZZLE
 - CHEMICAL ENGINE - FIRE FOAM - CAR GALS.
 - PORTABLE HOSE REEL - LIN. FT. HOSE
 - FIXED HOSE REEL - LIN. FT. HOSE
 - STEEL STACK - 80 FT. HIGH
 - TOILET
 - FENCE
 - SHINGLE ROOF - 1 STORY
 - METAL ROOF - 2 STORY
 - COMPOSITION ROOF - 2 STORY
 - FRAME BUILDING OR STRUCTURE
 - STEEL STRUCTURE
 - CORRUGATED METAL ON WOOD
 - CONCRETE STRUCTURE
 - PLATFORM, WALKS, ETC.
 - BOILER, BRICKED IN

**INSURANCE MAP
SHOWING BUILDINGS
AND SURFACE IMPROVEMENTS**
KENNECOTT COPPER CORPORATION
KENNECOTT-ALASKA

SCALE: 1 INCH = 40 FEET
DATE: AUGUST 20, 1935
TO DATE: DEC 1, 1935
DRAWN BY: AWT:WAR
CHECKED BY: W.A.R.
DRAWING NO. 6-20

0 50 100
FEET 1"=40'-0"
0 5 10 20 30
METERS 1"=40'-0"
1:480

SITE PLAN (1935-36)
1"=40'-0"
1:480

























HAER No. AK-1-1



HAER No. AK-1-2

HAES 700-AK-1-3





HAER No. AK-14



HAER No. AK-1-5





HAER NO. AK-1-7

143E No. AK-1-8



HAER No. AK-1-9



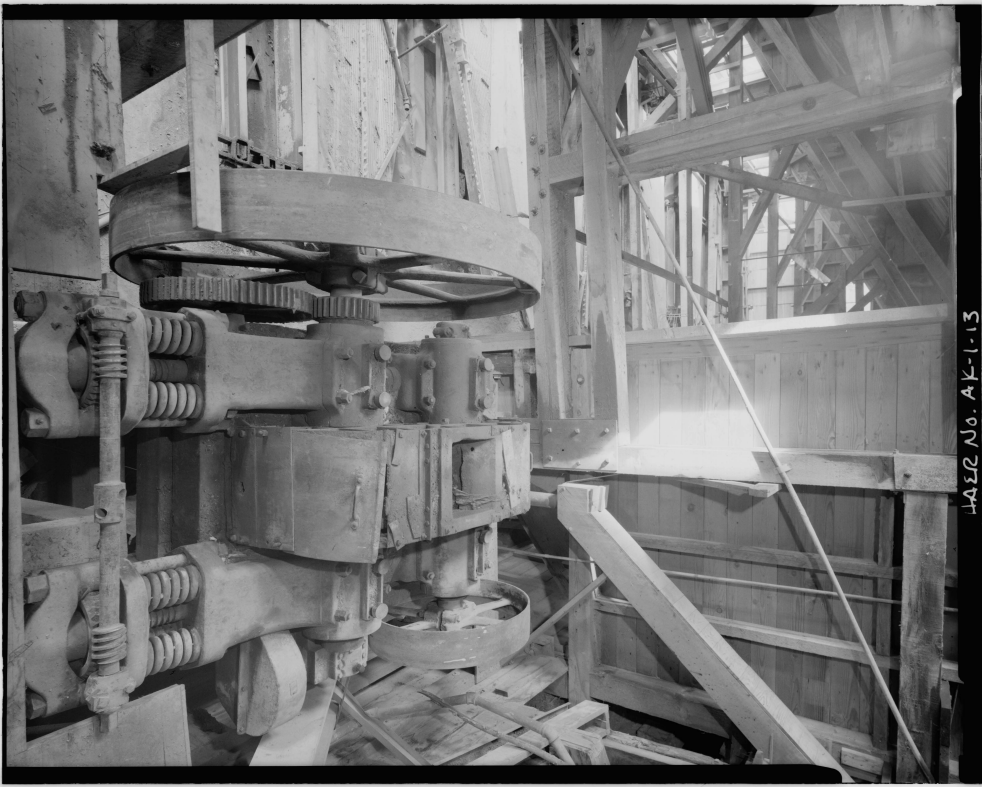


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HAER No AK-1-12



HAER No. AK-1-13



HAER No. 4K-1-14

HAER No. 4K-1-15



W&R No. AK-1-16





HAER NO. AK-1-17



HAER NO. AK-1-18



91-1-3A .CH 93A-1

HAER NO. AK-1-20



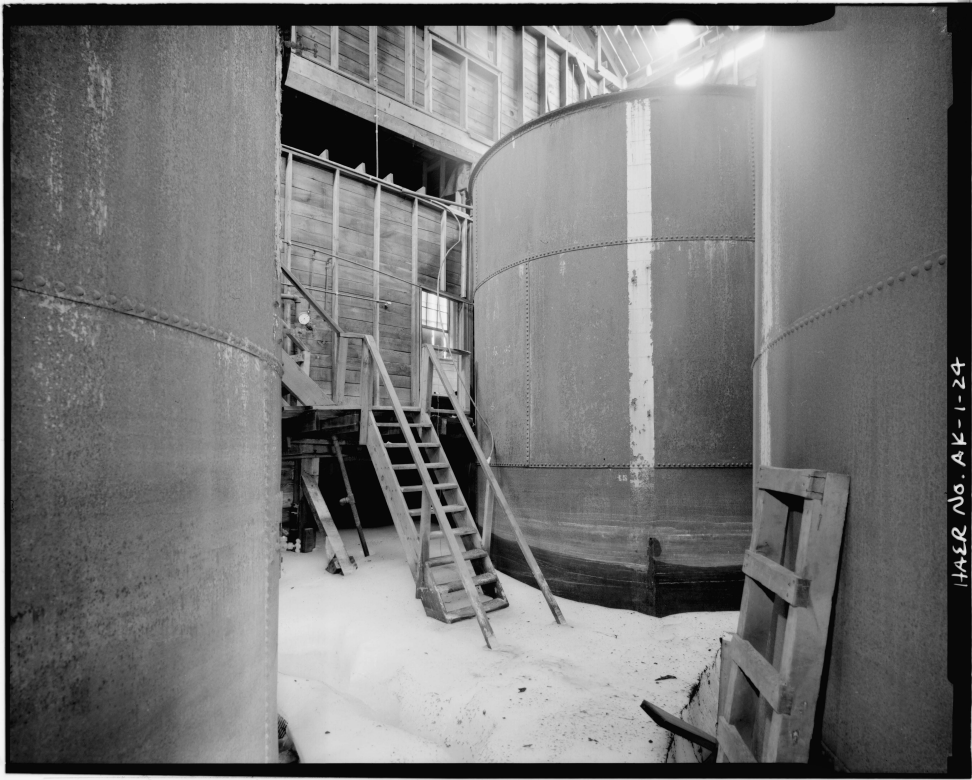


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1736 W. A. K. 1-53





HAER No. AK-1-24



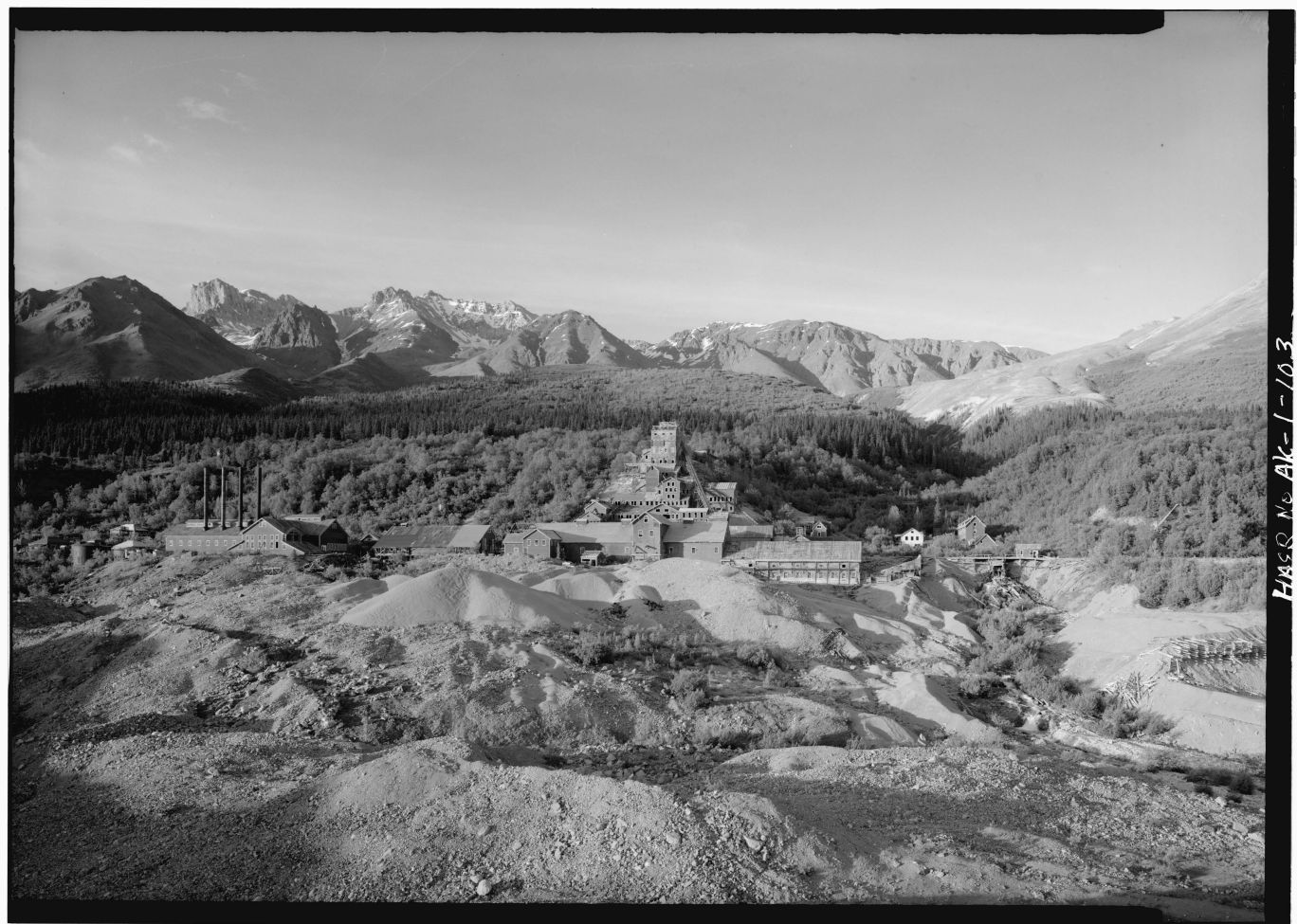
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HAER NO. AK-1-28





HAER No AK-1-108



HAER No AK-1-105





HAER No AK-1-107



HAEE No AK-1-108



HAER No AK-1-109



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HAER No AR-1-114



HAER No AK-1-115

HASE NO AC-1-116

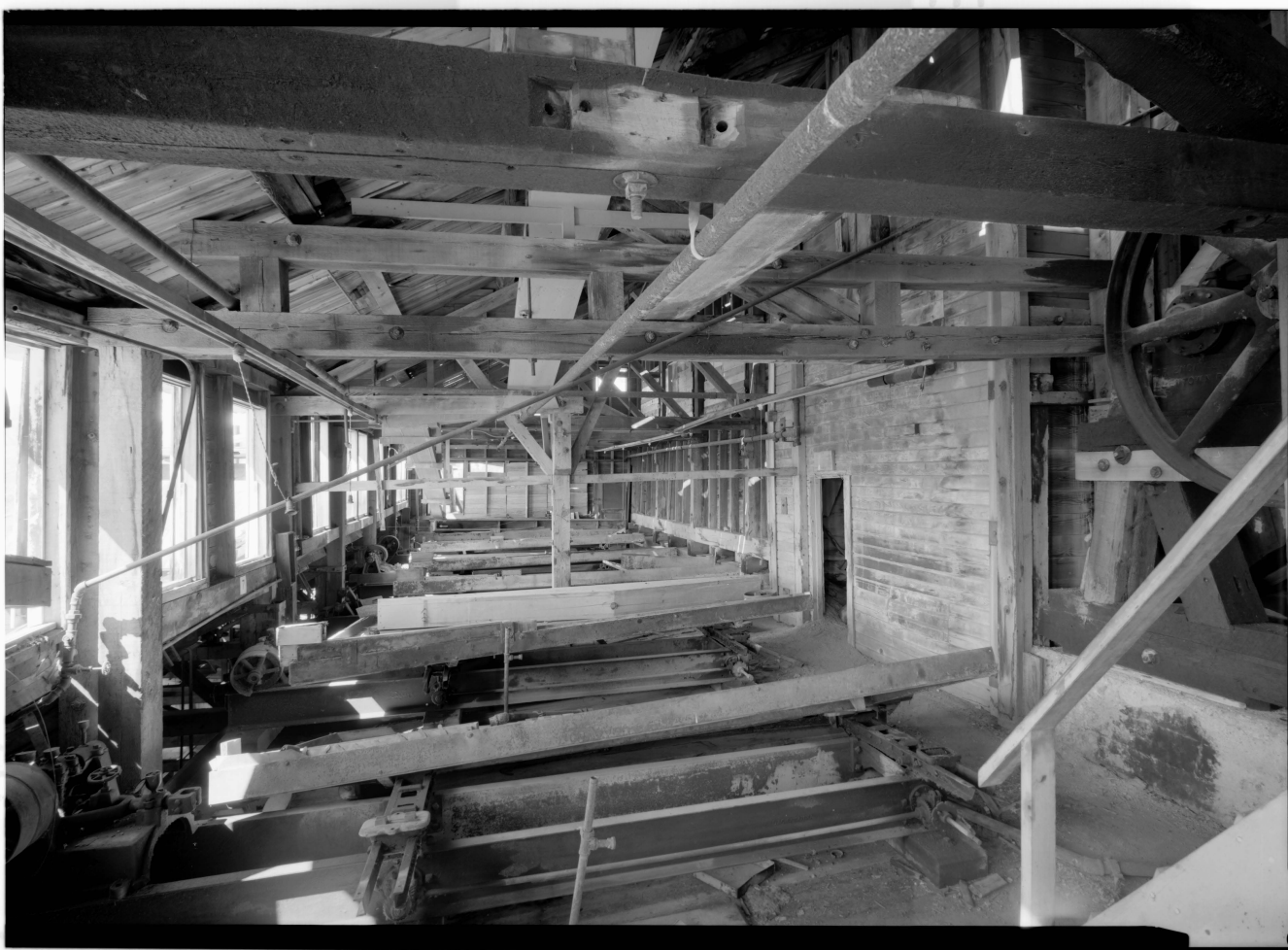




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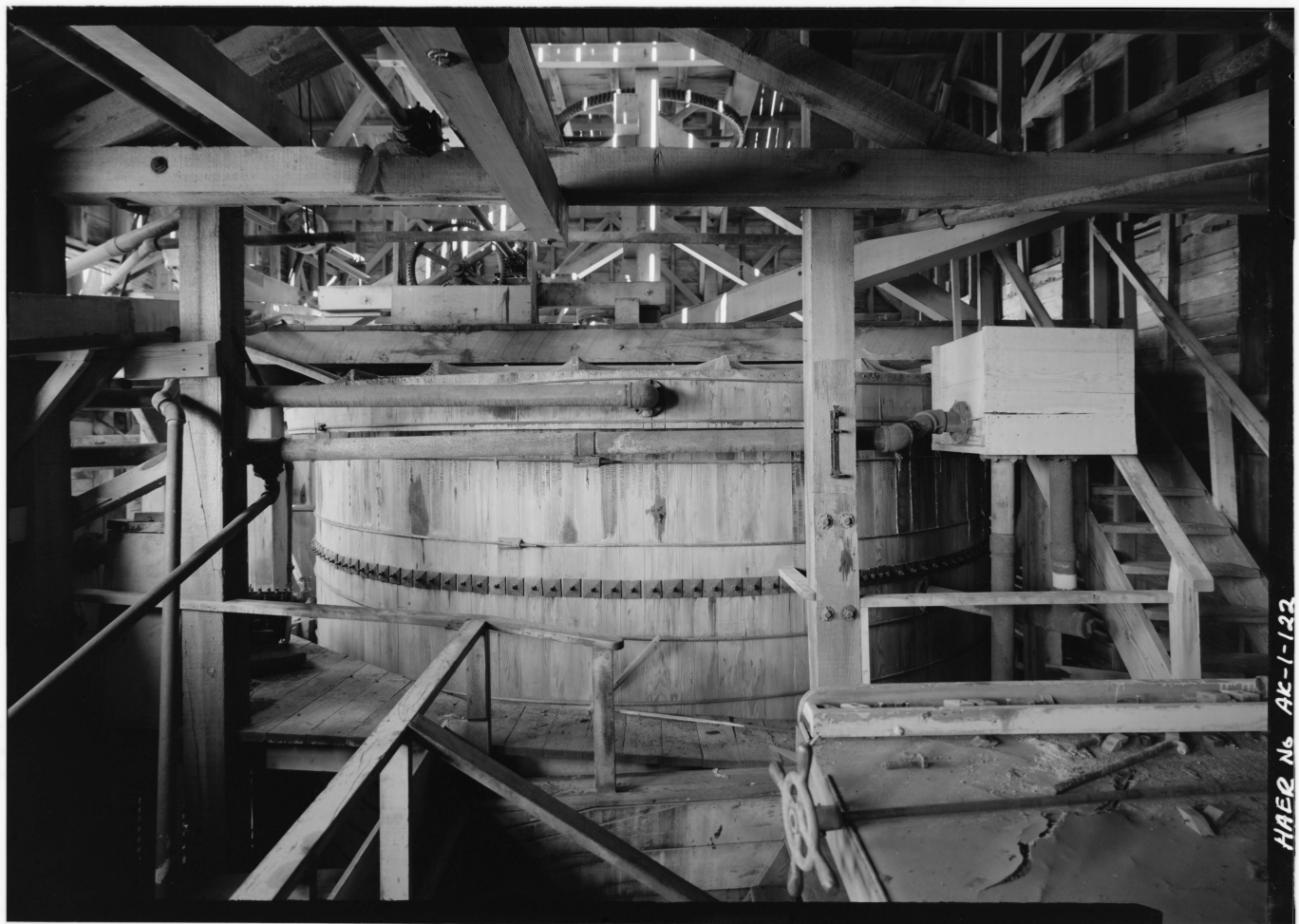
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HAER No 46-1-121



HAER No. AK-1-122



HAER No AK-1-123

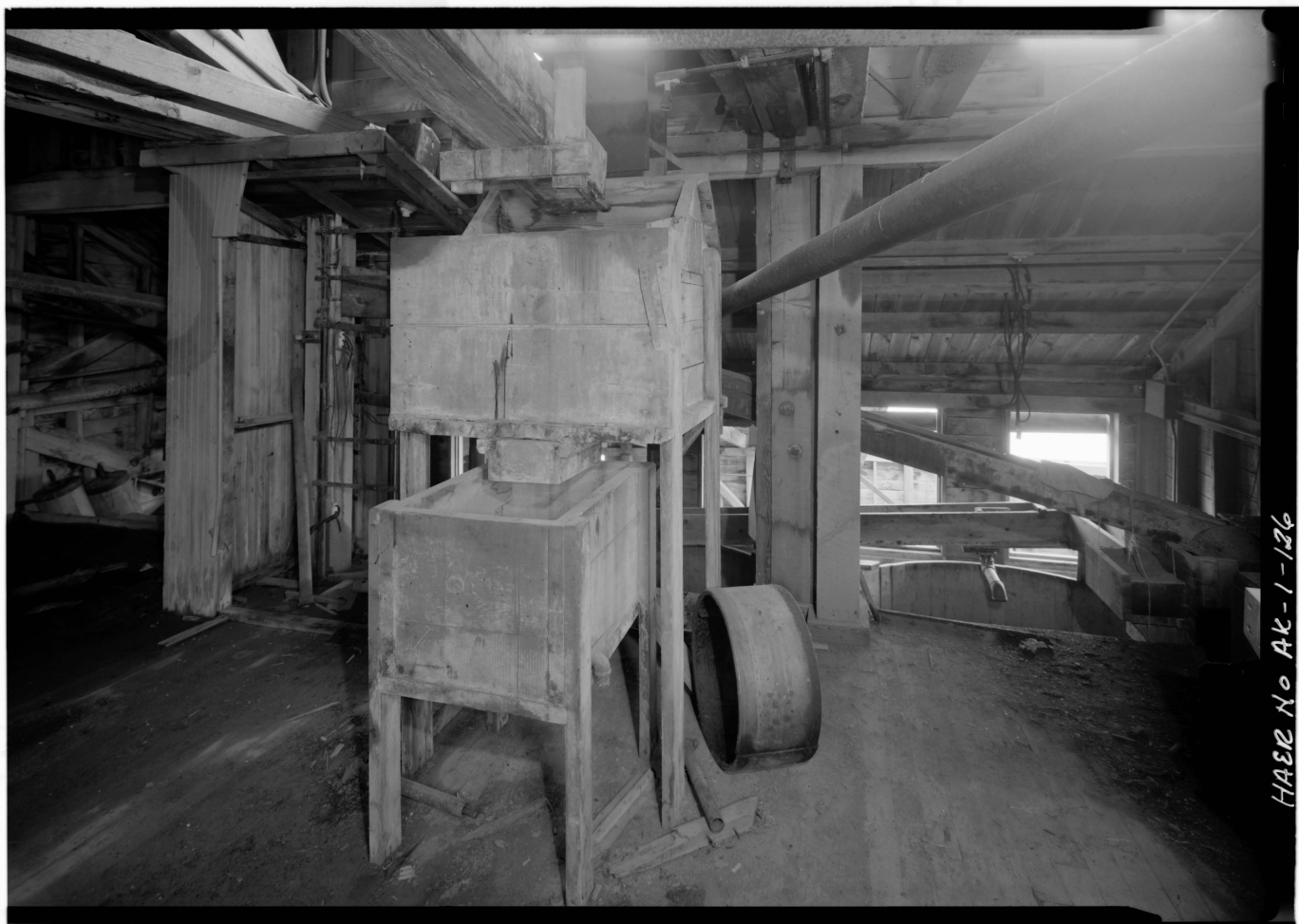
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HAER No AK-1-125





HAER No AK-1-126



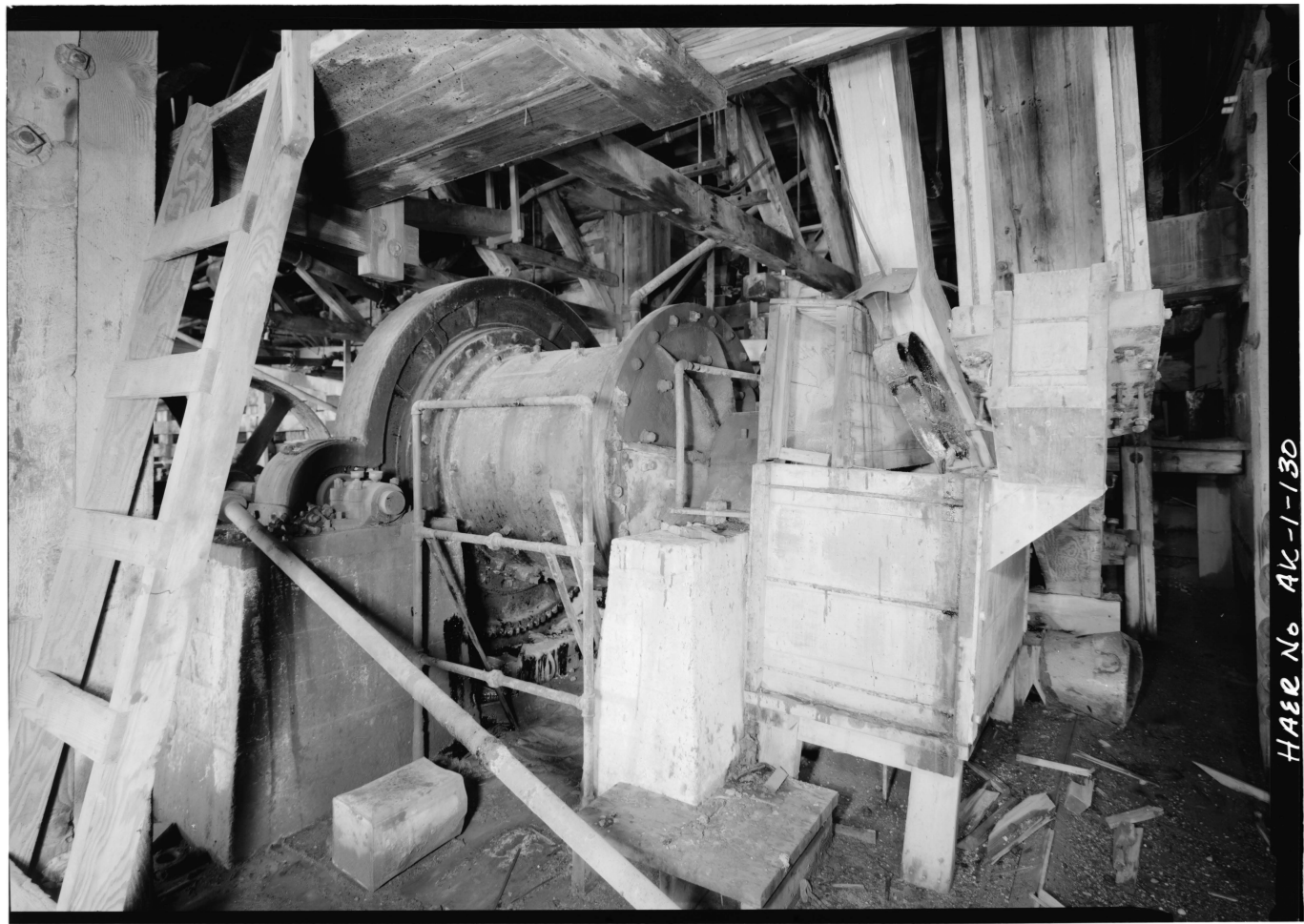
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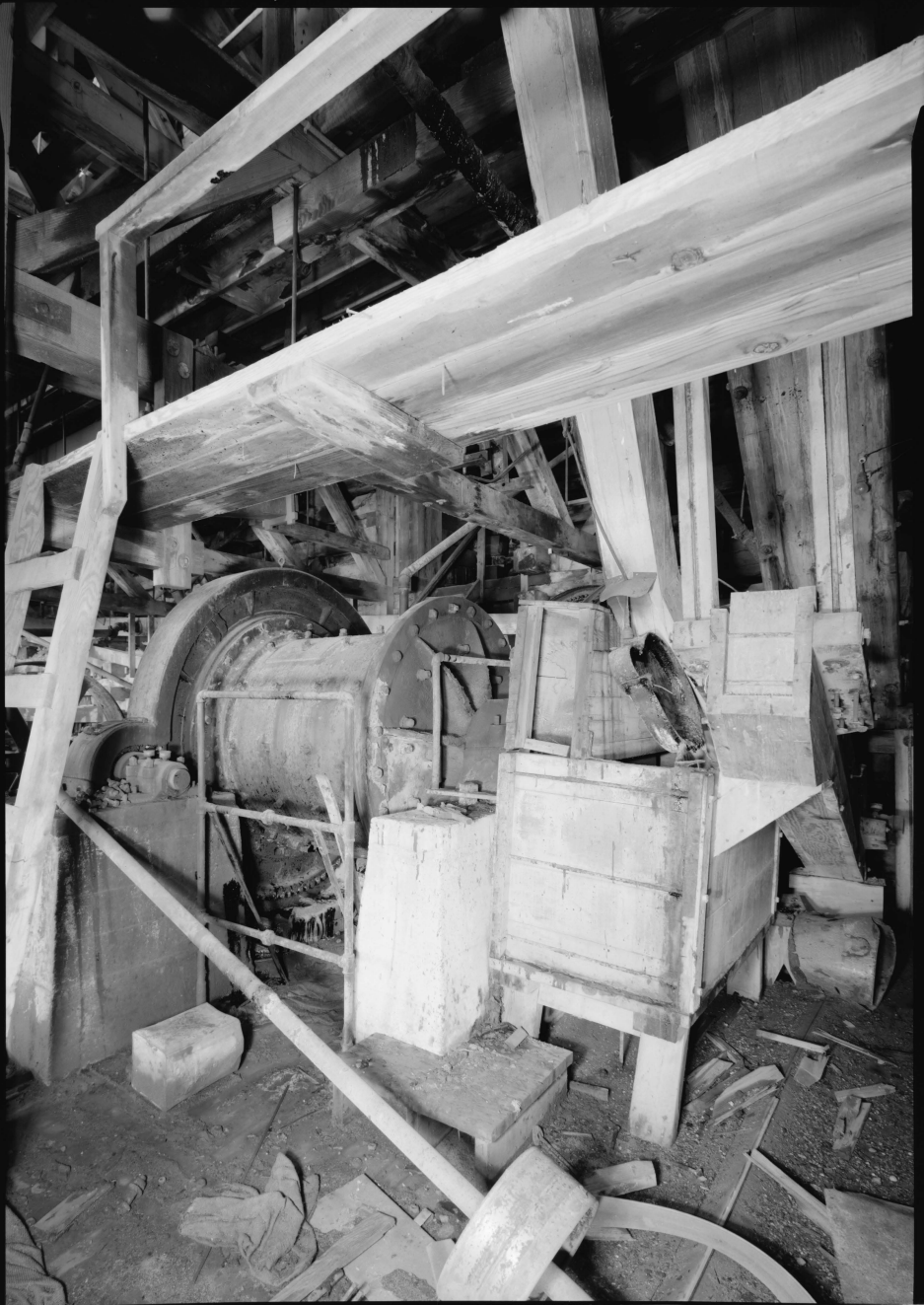
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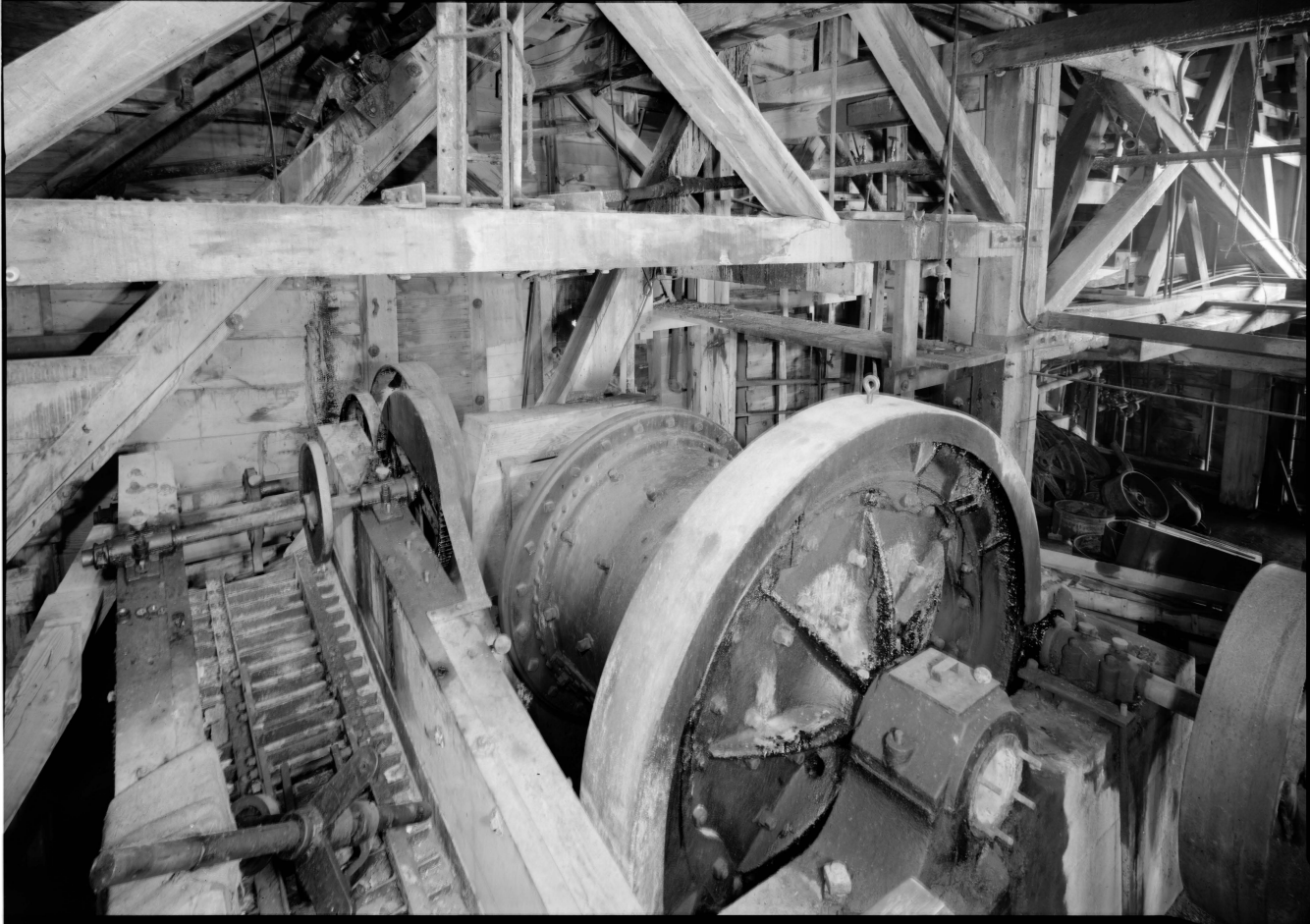




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HAER No. A6-1-134 (131)





HAER No AK-1-132



HAER No AK-1-133



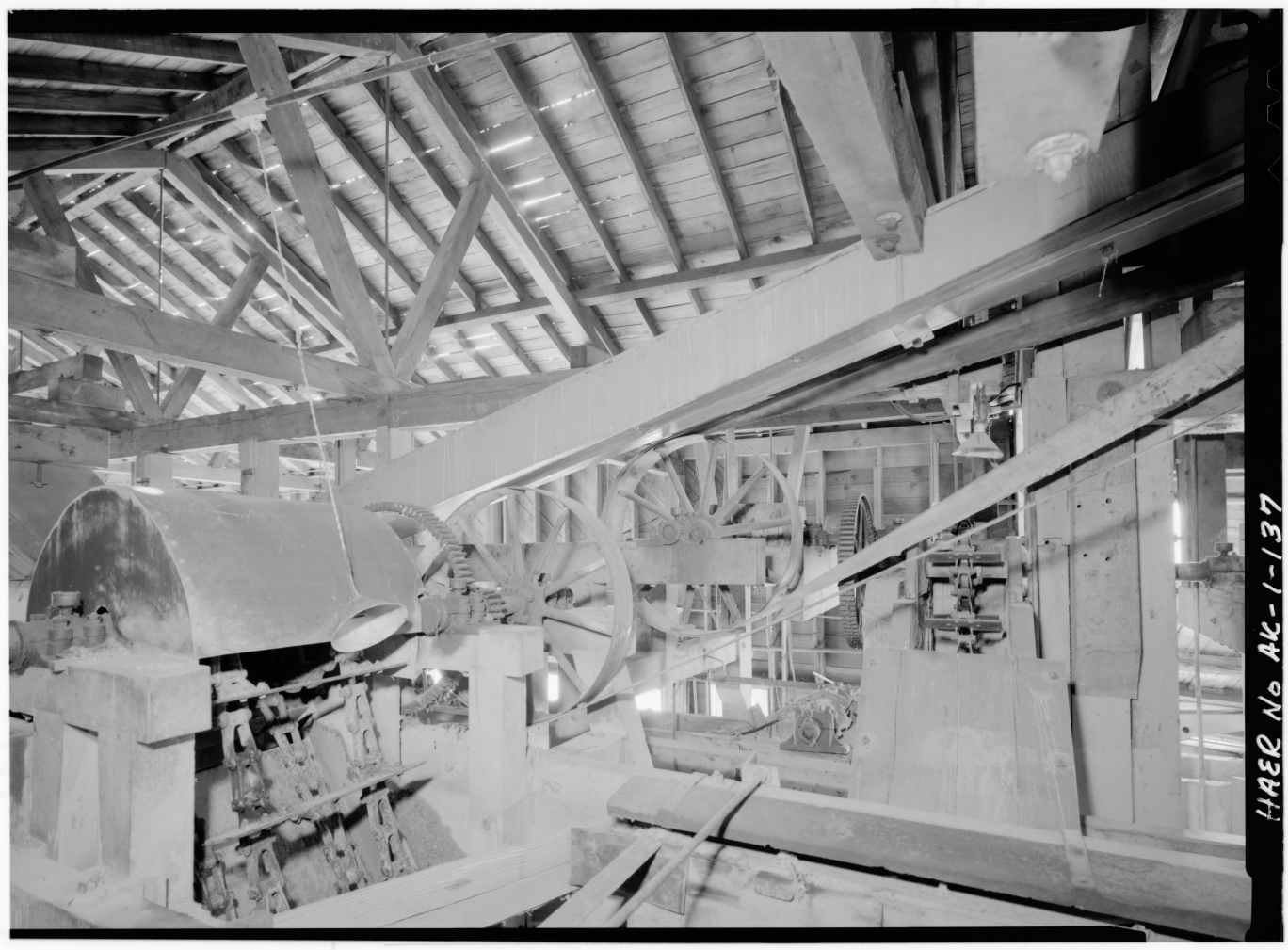
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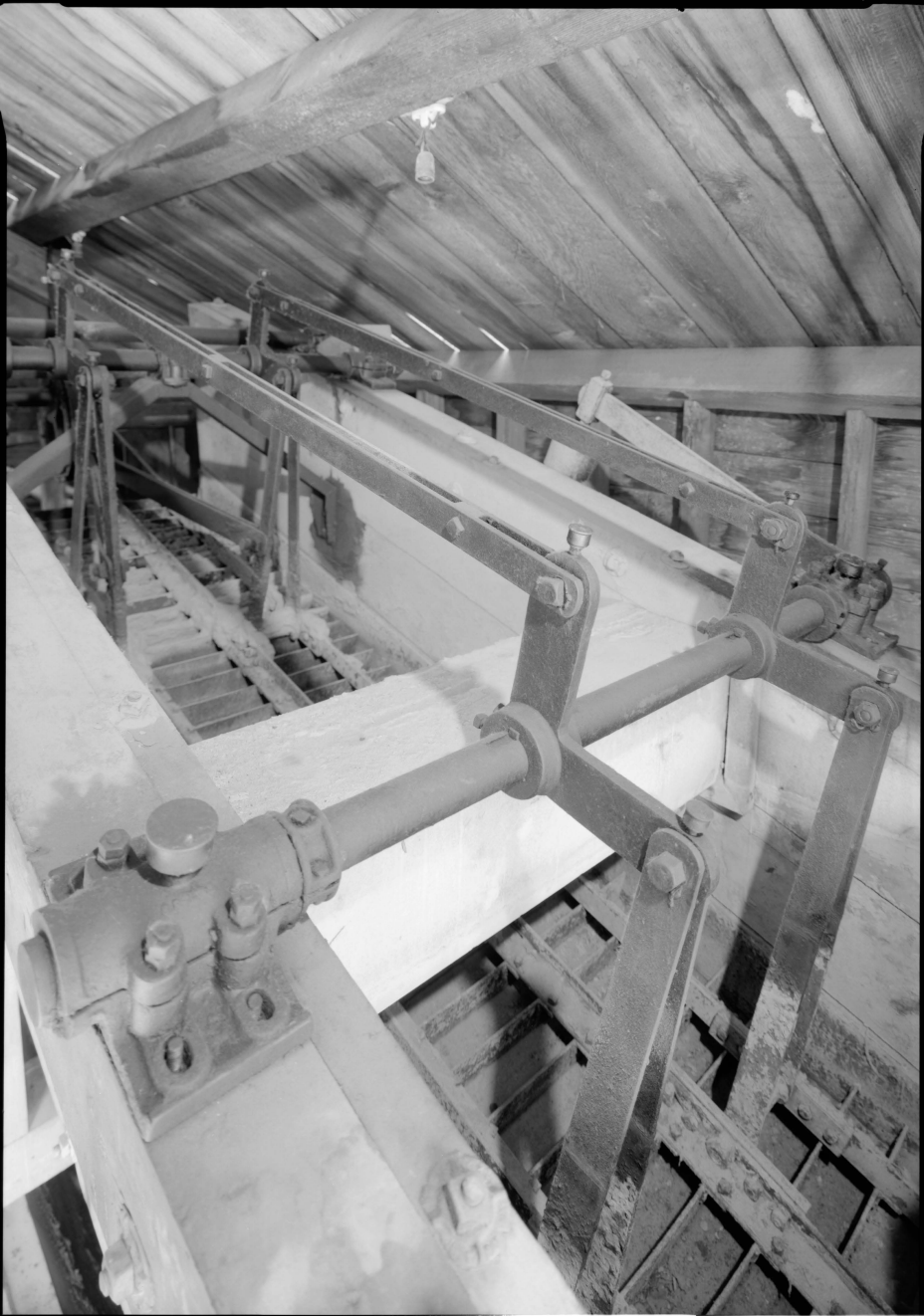


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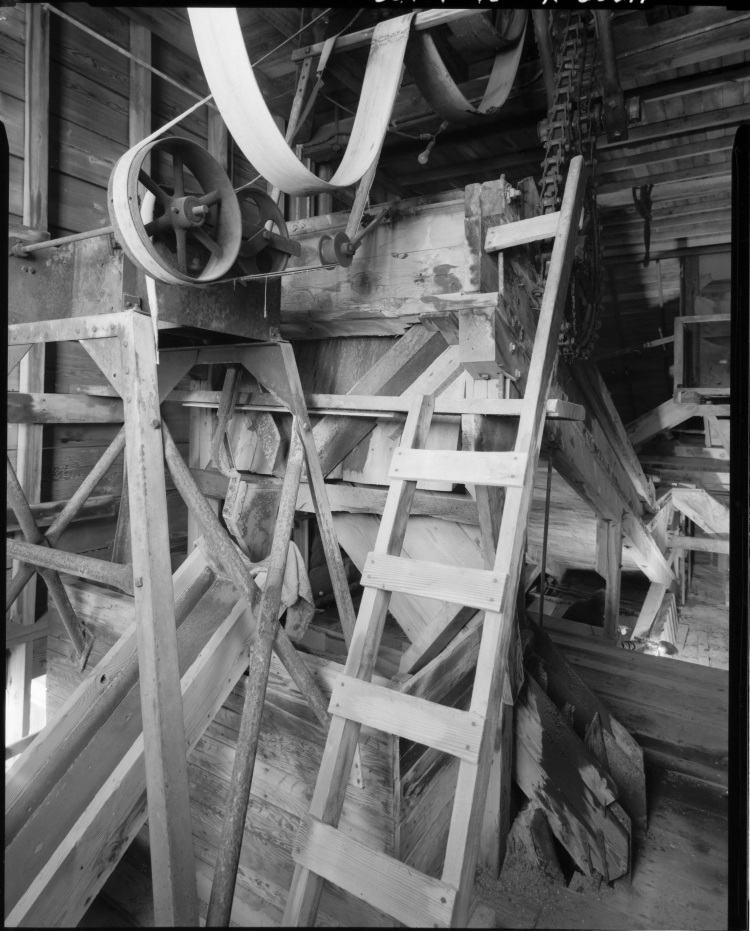


HAER No AK-1-137

HABE No AK-1-138



HASB No Ak-1-139



HAER No AK-1-140



HAER No. AR-1-141



НВК № 1-145





HAER No AK-1-143



HAER No. 14-1-144