Charter Oak Mine and Mill Historic Preservation Plan

Elliston Mining District
Helena National Forest, Montana

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Any errors of fact or interpretation in this preservation plan are the author's alone.

Introduction

Charter Oak (24PW476) is a historic, intact lead-zinc lode mine located approximately twenty-five miles southwest of Helena, Montana, on public lands administered by the Helena Ranger District of the Helena National Forest **(Figure 1)**. The historic mine site is located in the Little Blackfoot River drainage just west of the Continental Divide and MacDonald Pass. Charter Oak is listed in the National Register of Historic Places.

The Charter Oak mine was operated intermittently for about eighty years, from the early 1900s through the mid-1980s **(Figure 2).** Despite a significant level of industrial development at Charter Oak, the site never became a private, patented mining claim. Thus, when a fisherman observed a plume of Charter Oak mill tailings and an associated fish kill in the Little Blackfoot River below the mine in 1992, the last Charter Oak mine claimant ceased operations on National Forest lands. In 1995, once all mining claims were abandoned and after acquiring legal ownership of the mine buildings and equipment, the USDA Forest Service initiated an aggressive mine waste cleanup program under the authority of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). Building stabilization and other historic preservation work has been an integral part of this abandoned mine reclamation effort.

Abandoned mine remediation in 1996 and 1998 focused on mill tailings and waste rock removal, adit closure, water run-off control, and refuse disposal. Forest Service heritage staff and *Passport In Time* (*PIT*) program volunteer crews subsequently completed various preservation projects at Charter Oak. In 1999, under the supervision of the Region 1 Historic Buildings Preservation Team, the roof on the mill building was replaced "in kind," and its windows and board-batten siding were repaired (Davis 1999). In 2001, a *PIT* crew and Helena NF staff built a small viewing deck overlooking the ore bin at the top of the mill (Davis 2001). That same year a Helena High School X-CEL class prepared a National Register nomination (Davis et al. 2001) for the site and installed an interpretive kiosk and trail signing. The site is now open for public visitation on summer weekends.

The various mine waste cleanup and historic preservation projects at Charter Oak were reviewed by the Montana State Historic Preservation Officer (SHPO) and the federal Advisory Council on Historic Preservation (ACHP) to comply with the National Historic Preservation Act (NHPA) (Davis 1996, 1998, 1999, 2001). To provide a broader context for these projects and to facilitate compliance review, a set of basic preservation goals and a long-term vision were developed by Helena National Forest staff (Appendices A and B). These form the backbone of this historic preservation plan.

Despite some modifications resulting from age and mine remediation, the Charter Oak site possesses a high degree of physical integrity. It has remained largely unaltered since World War II, the site's primary period of National Register significance. Unlike the majority of lode mines in southwestern Montana, Charter Oak was not "cannibalized" for equipment, parts, and scrap metal during its lean years. Although located within the popular Little Blackfoot River recreation corridor, the site has not suffered a high degree of vandalism or natural degradation. This historic mine is uniquely preserved both inside and out, and its integrity is easily appreciated by anyone who visits the site.

History of the Charter Oak Mine and Mill in the Elliston Mining District

The history of metals mining in Montana follows the course of mining development throughout the American West. The simple shovel and sluice box technology of the early 1860s gold rush quickly gave over, by the early 1870s, to more aggressive and efficient hydraulic mining that involved water, ditches, flumes, hoses, and nozzles (Rohe 1985). Using this method, and later with mechanical dredges, miners extracted enormous quantities of free gold mixed in river and stream gravels throughout the region, leaving behind dramatically altered landscapes and barren piles of river cobble. As the rich gold placers played out, the search for parent veins or the "mother lode" began in earnest, hailing the advent of hardrock lode mining in Montana.

From the early 1880s to about 1910, underground lode mines in Montana produced millions of dollars worth of gold, silver, and copper from high-grade ore, but steady production eventually necessitated mining of lower grade ore bodies. Not coincidentally, during the early 1900s in Australia, successful flotation milling, whereby metals were extracted from pulverized low-grade ore in oil or water mixed with chemicals, led to its rapid adoption and widespread use in the United States (Bunyak 1998:26; Young 1970:231–233). The Butte & Superior lead-zinc flotation mill, developed in 1911, is generally regarded as the first flotation plant in Montana. This new technology was the economic salvation of mining in the West, and it fostered mining of low-grade metallic ore through World War I, the Roaring Twenties, and the precipitous years of the Great Depression.

World War II gave the mining industry a much-needed economic boost. Gold Limitation Order L-208 closed all mines not engaged in production of "strategic metals" for the war effort, and Government-sanctioned mines such as Charter Oak briefly flourished in lead, zinc, and copper production. However, by the mid-1950s, the mining industry throughout the West had largely converted to open-cut (pit) mining. In this new economic climate, most small quartz lode operations were either bought out by larger corporations or became non-competitive and were closed. From this time forward, mining in Montana and the West became a large-scale, open-pit, corporate proposition (Malone et al. 1991:323–328; Smith 1987:123).

Placer mining was never extensive or very productive in the Elliston mining district in the Little Blackfoot River drainage (Beck 1989; Fairchild and Horstman 1995; Lyden 1948). However, by the 1890s, the district had become an active center of underground lode mining. The nearby community of Elliston supported this burst of underground mining, along with woodcutting for the Anaconda Copper Mining Company's smelter and quarrying and processing of lime at the nearby Elliston Lime Plant adjacent to the Northern Pacific Railway. Important early lode operations included the Beatrice, Evening Star, Golden Anchor, Julia, Lily, Monarch, Ontario, and Telegraph mines (Fairchild and Horstman 1995; Thomas and Thomas 1997:65,77). Gold-silver-lead ore was shipped to the East Helena and Washoe (Anaconda) smelters.

Despite much community optimism, production was sporadic in the Elliston mining district after 1911 (Pardee and Schrader 1933:262), which resulted in little demographic growth outside of the communities of Avon and Elliston. Charter Oak and a handful of other lode mines were responsible for a production peak during World War II that breathed new life into the Elliston mining district for about a ten-year period. In 1936, electrical power was brought up the narrow river valley to service the Golden Anchor and a few other large mines in the Elliston District. The community of Elliston was the beneficiary of this electrification because the power lines had to pass directly through town (Thomas and Thomas 1997:99, 178). By the early 1950s, ore production in the Elliston district had again fallen off, although small-scale prospecting and mining continued..

Fred W. Hopkins located the Charter Oak quartz lode claim in March of 1912 on ground, according to the Certificate of Location, vacated by the Kineo Mining Company. Originally from Bangor, Maine, Hopkins moved at age seventeen to the Elliston area with his family in 1904 (*HIR* 1962). His father, Joshua W. Hopkins, was involved with the Kineo lead-silver mine in the Zozell District in Powell County. Legal records do not indicate why Hopkins chose the name Charter Oak. According to legend, colonists hid the State Charter of Connecticutin the hollow of a white oak tree when the English Governor of New England demanded its surrender in1687. Because it was hidden in the "charter oak," the document was never relinquished (Platt 1992:84). As a former resident of New England, Hopkins perhaps drew on this historical tidbit anoint his claim. The names of his other claims are more prosaic.

Fred Hopkins developed and operated a small lode mine at Charter Oak. Its first reported production was in 1916 when 7 ounces of gold, 221 ounces of silver, and 6,658 pounds of lead were obtained from 40 tons of ore (Table I). Not much is known about this early operation. A set of old concrete footings and rotted lumber piles near the tailing pile may be all that is left of a stamp mill, although there is no mention of this structure in available mining records. The origins of the old log (residence) cabin and storage shed are also obscure. Fred Hopkins lived in a small house located a mile or so north of the mine near the current-day Lions Sunshine Camp (Mary Craig, personal communications, 2002). So it seems doubtful that Fred Hopkins built the log cabin at Charter Oak. Miners with the Kineo mining company or earlier homesteaders may have built the cabin but Government Land Office (GLO) plat maps dating to 1904 do not show a mining claim, homestead entry, or cabin in the site area. Whatever their origins, both buildings, and several other now demolished log buildings (see Figure 5) were actively used throughout the operational life of the Charter Oak mine.

Ore production at Charter Oak was extremely varied throughout the 1920s. The mill processed 164 tons of silver-lead ore in 1927 but only 1 ton in 1928. This productivity was typical of isolated, small-scale mining operations in southwestern Montana whose operating budgets were slender at best. Mining of the low-grade silver-lead ores was marginally profitable until the stock market crash resulted in a depressed metals market, and the mine became inactive throughout the early years of the Great Depression. In contrast to other mines in the area, the Charter Oak operation did not profit from an increase in gold prices in 1934. This was due to the complex sulphide ores present at Charter Oak, which were spotty and had limited gold in them. The mill also remained inactive through most of the Great Depression, from 1930 to 1936. In 1937, the plant was re-opened and 10 tons of silver-lead ore was processed during the year.

Mining at Charter Oak was invigorated by the close involvement of Fred Hopkins' older brother Ralph in the early 1940s **(Figures 3 and 4)**. At age 23, Ralph T. Hopkins had also come to Montana with his parents, brother Fred, and two sisters (*HIR* 1949). He mined in the Elliston area for a few years before moving to Mexico City to do metallurgical work. Following a brief return to Maine, he, and his wife Avis, returned to Montana in 1913 and spent the next twenty years working at the Drumlummon mine in Marysville and the Jay Gould mine near Lincoln. Apparently, Ralph also maintained an active interest in his brother's mining operation at Charter Oak. In 1941, he, Avis, and their two sons, John Fiske and Ralph Weston, settled on the Little Blackfoot River at Charter Oak.

In 1942, Ralph Hopkins and his two sons formed the Hopkins & Sons Mining Company. The newly formed corporation leased the Charter Oak, H&H Quartz, and Pine Tree quartz lode claims and the Charter Oak mill site from Fred Hopkins, who was to receive 10 percent of the net returns of all ore taken from the property. Anticipating better mining profits as America prepared for war, the Hopkinses assembled a 50-ton, gas-powered, flotation mil in the late 1930s–early 1940s. What this effort exactly constituted is unknown, but William Manning, a technical advisor for the War Production Board, in March of 1943 reported, "The Hopkins & Sons started at scratch on this property a couple of years ago, at which time it was a rather favorable looking prospect. . . This company has collected second-hand used material in all directions and put themselves up a small mill" (Manning 1943). Apparently, the garage, small bunkhouse, compressor house, reagent shed, and assay building were added to the mine complex at this time.

Table 1.
Mine productivity at Charter Oak Mine from 1916 through 1966
(From McClernan 1976:48, Table E-8)

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1916	40	7	221		6,658	--
1918	5	1	34	--	913	--
1921	55	10	1,360	--	24,534	--
1922	16	3	361	--	9,009	--
1925	2	1	116	--	1,606	--
1926	121	7	934	50	16,569	--
1927	164	6	414	--	8,795	--
1928	1	1	44	16	1,115	--
1929	10	1	89	--	2,070	--
1937	10	2	270	23	5,486	--
1941	63	6	1,152	108	13,064	--
1942	573	3	1,628	164	21,926	--
1943	2,208	10	4,570	1,106	72,207	25,742
1944	1,493	9	3,615	778	62,516	46,580
1945	404	3	937	171	15,247	11,622
1946	757	31	4,191	1,180	62,915	15,461
1947	610	42	4,223	1,258	67,251	13,275
1948	735	22	3,629	645	46,137	10,422
1949	920	80	6,123	2,721	129,846	20,049
1950	277	8	692	663	9,904	1,470
1951	68	5	1,058	245	5,070	1,291
1952	115	11	757	713	20,208	5,458
1953	4	4	32	--	--	--
1954	345	89	1,937	--	52,900	13,800

1955	70	16	551	--	14,000	2,500
1956	2	1	45	1,000	100	--
1964	7	1	41	--	400	400
1965	50	1	63	200	200	100
1966	2	1	59	--	500	--
	9,127	382	39,146	10,041	672,046	168,270

The few local World War II records that exist concerning the Charter Oak operation are informative. On March 1, 1943, Ralph Hopkins, acting on behalf of the corporation, applied to the War Production Board for a serial number under Preference Rating Order No. P-56 (Hopkins 1943). As he explained to the board, they were a new company or partnership operating an old mine. He reported slow going because capital was limited, but that they had assembled "a 50-ton, gas-powered flotation mill comprising the usual standard equipment." He further indicated that the mine was developed to the point where it could supply enough ore to keep the mill busy. Their shipments so far had been lead concentrates. They were making zinc concentrate but had not shipped any because they could not bring the arsenic to a low enough point for electrolytic reduction. A smelter in Amarillo, Texas, was willing to accept their concentrates, but the corporation preferred to ship to a local smelter (East Helena) to save on freight charges. Hopkins indicated that they had only a small crew but were putting on more men that month. He acknowledged the possibilities for development and was gathering data for a loan from the Reconstruction Finance Corporation (RFC). Unfortunately, existing War Production Board Records at the Montana Historical Society do not indicate whether he was successful in acquiring a loan.

Charter Oak came into its own during the rush for the base metals lead, zinc and copper during World War II (**Figures 5 and 6**). Mining for strategic metals was supported by federal subsidies, while Gold Limitation Order L-208 closed all gold mines as nonessential to the war effort in 1942. The year 1943 was arguably the glory year for Charter Oak, as it produced 98 percent of the ore, 53 percent of the gold, 89 percent of the silver, 93 percent of the lead, 100 percent of the copper, and 82 percent of the zinc for the Elliston Mining District, all of which was taken from 2,208 tons of ore (Table 1; various *Minerals Yearbook* entries for Charter Oak are also included in Fairchild and Horstman [1995] and Foster [1995]). Only a few other years in this period came close to that level of production. By this time, ore concentrate was shipped by truck and rail to the Asarco smelter in East Helena.

Ralph Hopkins died of a heart attack on December 28, 1949, at the age of sixty-eight (*HIR* 1949). He was buried in the Elliston Cemetery. His son John Hopkins and Henry (Hank) Lauri, a company employee and experienced miner from Elliston and Harry Thompson, kept the operation afloat for several years, and reported significant production in 1950. (**Figure 7**). Ralph's other son Ralph Weston Hopkins was working for Boeing Aircraft in Seattle. John remained associated with the Charter Oak operation from the 1950s to the early 1970s and developed other mining ventures in the area, including a nearby mine above Charter Oak on Negro Mountain (the mountain and mining district were referred to as Nigger Hill until the 1960s). Fred Hopkins disappeared from Charter Oak mining scene by the 1940sbut was residing at 305 North Ewing in Helena at the time of his death at age eighty-five on June 24, 1962 (*HIR* 1962).

In the early 1950s**,** James T. Bonner became involved with the Charter Oak mining operation. Bonner hailed from Columbus, Nebraska (*HIR* 1983) **(Figure 8).** He had earned a degree in mining and metallurgy from the University of Utah. After serving in the Army in World War, he earned a master's degree from the University of Washington. Bonner then worked as a chemist in a variety of mining enterprises throughout the Pacific Northwest. Prior to World War II, his mining company worked the Oro Mine in Downieville, California, until Gold Limitation Order L-208 closed non-strategic metal producing mines (James "Jim" Bonner Jr., personal communications, 2002). Bonner then moved to Home, Oregon, where he was involved with cinnabar (mercury) mining on the Idaho side of the Snake River (Home, located on the Oregon side of the Snake, now lies under Brownlee Reservoir).

After the war Bonner returned to Downieville, then moved with his wife Esther to Elliston (**Figure 9**). He worked at the lime mine near Elliston until he had gathered enough mining equipment and capital to start operating the Charter Oak mine. He had befriended Ralph Hopkins' widow, Avis, and their son John. He eventually developed a partnership with John Hopkins to work the Charter Oak property—apparently on a handshake basis inasmuch as these business arrangements are not documented in Powell County legal records. Bonner and John Hopkins, with the hired help of Henry Lauri and another local Elliston miner, Enard "Swede" Lindquist upgraded and ran the Charter Oak flotation mill with equipment Bonner had shipped in from California.

Bonner called his operation the Charter Oak Mining Company. The company reported fairly significant production in lead and zinc is from 1951 to 1955, limited production from 1955 to 1964, and no production after 1966 (Table 1; Robertson 1956; Fairchild and Horstman 1995; Foster 1995). In 1956, Bonner did some development work at Charter Oak, and in 1957, the Charter Oak Mining Company, was producing some gold, silver-lead, and zinc. In 1958, Bonner claimed the mill site and the lodes, and in 1960 he was granted surface rights. at Charter Oak but his mining activities at were very sporadic.

James Bonner and his wife Esther lived full-time at the Charter Oak mine from 1963 to 1968until poor health required that they take up residence in Helena. During their tenure at Charter Oak, the Bonners enjoyed wildlife and refused to dynamite the beaver dams beyond the mill tailings, despite the pleas of their up- and downstream neighbors (James "Jim" Bonner Jr., personal communication, 2002). Their wildlife conservation efforts no doubt helped to insulate the Little Blackfoot River from the toxic mill tailings piled up on the floodplain below the Charter Oak mill. . James Bonner died on March 7, 1983, at the age of eighty-eight at the Veteran's Administration Hospital at Fort Harrison. His wife Esther died on April 23 the following year at Cooney Convalescent Home in Helena (*HIR* 1984). Both are buried in the Elliston Cemetery. Bonner's interest in the Charter Oak mine was conveyed to long-time employee and family friend, Henry Lauri (Mary Craig, personal communication, 2002).

From 1961 to 1968, Henry Lauri and John Hopkins who had formed his own Hopkins Mine Incorporated) intermittently worked the Charter Oak mine with the help of Swede Lindquist **(Figure 10).** Lindquist, who had a minimal financial interest in the operation, reported that they ran ore from other claims through the mill, which helped keep the mill operational through the early 1970s (Foster 1995). John Hopkins was also mining his nearby claims above Charter Oak on Negro Mountain into the late 1970s. He had also partnered with Pat Phalen of Helmville in the Eldorado Uranium Exploration Corporation, but their relationship had gone sour by 1969 because Hopkins had not lived up to his assessment work. John Hopkins continued to mine in the Elliston area but his uranium claims became the property of the Golden Basin Company owned by the Phalen family in Missoula, Montana.

In 1979, the inveterate miner John Hopkins passed away of cancer at the age of 66 in Helena (*HIR* 1979). His mother, Avis Fiske Hopkins, , with whom he had lived at 401 North Montana Avenue in Helena, died in 1986 at the age of 103 (*HIR* 1986). By the early 1980s, all significant mining activity at Charter Oak had ceased. In 1984, Lee Adams took over the mill and claims from Henry Lauri apparently under less than equitable circumstances, and from that time forward, Lauri discontinued his long service at the Charter Oak mine (Mary Craig, personal communications, 2002). Lauri focused his mining interests elsewhere in the Elliston area. A resident expert on the mining history of the Elliston district, Henry Lauri died in 1987 and much local knowledge about the area's mining history was buried with him (HIR 1987).

Lee Adams, who operated a cyanide heap leach operation on the Viking Claim on nearby Telegraph Creek, and his partner, C. W. Norton of Florida, formed a new Charter Oak Mining Company. They planned to make a study of thiourea heap leaching for gold and silver. Powell County assessors valued the Charter Oak plant at $31,000. Adams lived on-site and made minor modifications to the mine/mill complex, such as attaching two trailer houses to the assay building (they were moved and demolished as part of mine reclamation). The remains of Adams' mining efforts piled up at Charter Oak in the form of trailers, mining equipment and domestic refuse. Unsuccessful in initiating a heap leaching process , Adams began trying to sell the property in 1988. In 1990, he was able to lease the mine to the Chickadee Mining Company, which soon became embroiled with the State of Montana over the right to conduct abandoned mine reclamation work there.

In 1992, a local fisherman spotted a plume of mill tailings in the Little Blackfoot River. His complaints led to an investigation by the State Department of Environmental Quality (DEQ). Adams and Norton, the mine owners, were found in violation of the Montana Water Quality Act. The State DEQ targeted Charter Oak for abandoned mine waste cleanup in 1993, with the Forest Service as the lead agency. After some initial confusion over ownership (Don and Bob Overson of Lincoln were interested in buying or leasing the property), it became clear that the Charter Oak Mining Company still held ownership of the mine and was potentially responsible for mine waste cleanup. However, in 1995, the Charter Oak Mining Company was dissolved and Adams quit claimed their property to the federal government, with an agreement that he would leave some equipment for historical interpretation. In 1995, the Forest Service initiated abandoned mine waste cleanup at Charter Oak.

Market forces, the transition to open-pit mining, and environmental regulations all contributed to the demise of the Charter Oak Mine. The spotty, low-grade ore at the site, perpetually slim operating margins, and the ebb and flow of family life also helped to bring Charter Oak to its abandoned state. This pattern of mine development, production, and demise at Charter Oak is duplicated at hundreds of small-scale quartz lode operations throughout Montana and the American West.

Charter Oak in Regional and National Context: Flotation Technology and World War II Strategic Metals Production

Western mining history and lore has traditionally been identified with the precious metals gold and silver. But by the turn of the 20th Century, the Industrial Revolution had instigated a strong demand for other metallic ore products, copper in particular as an electrical conductor in wire and equipment (Freeman 1943:43–67). Zinc, derived from complex lead-zinc-silver ores, was used to galvanize iron and sheet steel and was an important alloy, notably in brass. Lead too found use in an array of products and alloys. Tetraethyl lead would eventually become an important component of aviation and motor gasoline. Manganese, chromium, molybdenum, and tungsten became critical alloys in steel, enhancing its tensile strength and heat and corrosion resistance. In addition to its use in coinage and silverware, silver was used in some electrical works (it is a better electrical conductor than copper) and became an essential product of the photographic film industry. Non-metal products—such as asbestos, nitrates, mica, and phosphates—also came into high demand. None of these alloy and non-ferrous metals and non-metals had the allure of gold or silver, or backed the federal treasury, but they nonetheless became critical components of the 20th Century mining industry in the American West.

By the early 1900s, the boom years of western hardrock mining, financed by wealthy capitalists of the Gilded Age, had run its course. The Panic of 1893, caused by the repeal of the Sherman Silver Purchase Act and abandonment of the silver standard worldwide, had caused a severe economic depression throughout the Intermountain West (Chadwick 1982:16–31). In Montana, the so-called war of the copper kings had culminated in Anaconda Copper Mining Company monopoly by 1915. The Progressive Era in the United States prior to World War I (ca.1900–1916) focused attention on social issues and reform, including the human toll of industrial mining. Labor issues concerning wages, worker safety, and work hours consumed the time and energy of both miners and their corporate bosses (Shovers 1987; Wyman 1979). From a political and socioeconomic perspective, the first several decades of the new century were tumultuous for the western mining industry.

Compounding things was the simple fact that many high-grade ore bodies had become exhausted by the turn of the century and the technology to economically extract metals from low-grade (refractory) ores did not yet exist. World War I eventually spurred a short-term recovery, benefited by a plethora of successful large- and small-scale mines producing both precious and base metals (i.e., copper, lead), and operating under the guidance of trained mining engineers (Spence 1970). However, a significant factor in this resurgence of mining was the development of new milling technologies. A short digression is necessary to explain their significance.

Sulfide ores occur as veins filling fracture zones or as replacement deposits in country rock. These fine-grained, sulfide minerals were impossible to free using the dry milling and ore smelting practices of the mid-1800s (Schack and Clemmons 1982:62). By the turn of the 20th Century, various processes and inventions were being developed to process low-grade ore. Many of these had little scientific basis and were unsuccessful, and the whole enterprise was attributed by many in the mining industry to the so-called "process peddlers" (Young 1970:230–231).

In the 1870s, one process had emerged—chlorination—that enabled millers to extract gold from low-grade ore (Young 1970:273–274). The principle and process were simple: chloric acid dissolves gold. Gold concentrates were placed in a leaching vat to which chlorine was added either as bleaching powder or a gas. The gold chloride was drained off in solution and reduced with various base metals. There were many safety and practical problems with this process—chlorine gas was dangerous, bleaching powder was expensive, chlorine ate through equipment, including metal processing vats. Still, it was a way to extract gold from otherwise refractory ores.

A much more significant process, cyanidation, took hold from 1887–1897 and became widely used across the American West (Taggart 1951:505; Young 1970:283–285). It too was based on a simple principle: sodium cyanide is one of the few compounds for which gold has an affinity. Initially in this process, metal-bearing slimes and sands were agitated in a dilute sodium-cyanide solution to which air was also added. The dissolved gold was run in the solution over beds of zinc shavings, which precipitated the gold back to a solid. The zinc was then retorted off (like the mercury amalgamation process), leaving a sponge to be cast and sold. By the early 1900s, the process was used to mill lower grade ores in combination with gravity concentration and, later, flotation.

The froth-flotation process, first developed in Australia in 1905, is one of the most significant developments in low-grade ore milling (Bunyak 1998:26; Daman 1936:36–73; Fuerstenau 1962; Logue 1936:82–112; Young 1970:231–233). Two types of flotation were done: *bulk flotation* that separated all sulphides from gangue, and *selective flotation* whereby various minerals were floated separately using collectors, depressants, and activators. By either rather complex process, tons of otherwise commercially worthless low-grade, sulfide ore could be made to yield silver, copper, lead, and zinc.

In essence, flotation utilizes differences in surface tension of water to separate minerals from waste in a chemical solution. Ore was first finely ground in a primary (jaw) crusher. The crushed ore was then fed into a ball or rod mill for secondary crushing. The ball mill's drum was charged with water, chemicals, and hundreds of forged, softball-sized steel balls. The ore was pummeled by the balls into coarse grains as the drum turned (much like a cement mixer). A mechanical classifier located alongside the ball mill raked the crushed ore back and forth in a long trough, separating the coarse and fine solids. The finished pulp was ready for flotation while coarse solids in the classifier were sent back to the ball mill and ground again.

The finely crushed pulp composed of both mineral ore and gangue was sent as slurry in troughs or pipes from the classifier to the flotation cells or tanks. In the flotation cells the mixture was agitated in a chemical bath that was infused with air to form bubbles. The mineral ore or concentrate attached to bubbles as they rose through the cell and was collected in a thick froth in a baffle at the top of the cell. The froth concentrate was sloughed or scraped off, dried, bagged, and sent to smelter. A vacuum pump or filter was sometimes used to draw moisture out of the concentrate. The pulverized gangue and slimes were fed by gravity or pumped to a tailings heap.

The flotation mill man was part metallurgist, part chemist. The chemical environment in the flotation cell was crucial to the success of the enterprise. Flotation began by pretreating or *conditioning* the pulp in the ball mill with lime, soda ash, sulfuric acid, other chemicals, and water. This modified the pH value of the pulp to the desired alkaline limits, removed flotation-inhibiting salts, and cleansed sulfide minerals so that they would attach more readily to the air bubbles.

In the flotation cells, *collectors* were added that reacted with the desired mineral, causing it to become insoluble enough to attach to the air bubbles. Ethyl xanthate (a dithocarbonate derived from alcohol) was the most widely used collector of the western mining industry. *Frothers*, usually organic compounds such as pine oil and cresylic acid, provided buoyancy to the air bubbles and kept them from bursting when they reached the surface of the flotation cell. Chemical *depressants* were added to prevent, either temporarily or permanently, the flotation of particular minerals in complex ores. Lime and cyanide were widely used. Conversely, an *activator* such as copper sulphate was used to render depressed minerals floatable again. In light of this complex chemistry, mill men were extremely concerned about ore contamination during milling operations since it affected alkaline pH values and hence the ability of dressed ores to float, attach, and yield desired minerals.

Flotation tanks or cells generally worked by gravity, with pulp flowing as slurry from cell to cell through feed pipes (**Figure 11**). The pulp flowed into the bottommost mixing-aeration zone in the cell just above a rotor blade or impeller. Air injected through a standpipe in the middle of the tank, combined with the agitation caused by the impeller, thoroughly mixed the pulp and reagents. In the cell's middle separation zone, mineral-laden air bubbles became separated from the worthless gangue. This "middling product" was circulated back to the bottom agitation zone or into other cells for treatment and metals extraction. The top or concentrate zone contained the mineral-enriched froth which was removed with a baffle or discharged from the side of the machine.

In small mills like Charter Oak, a flotation circuit might include four to six conjoined cells located below the ball mill and classifier. The Denver Equipment Company was one of the leading manufacturers of flotation cells, as well as mining equipment of all kinds. They produced the popular "Denver 'Sub-A' (Fahrenwald) Flotation Machines" found inside the Charter Oak mill. The complexity of the circuitry depended on the minerals being extracted and the type of ore body. One cell might be used to clean the pulp, the adjoining one to float the first desired mineral product (i.e., silver or zinc), followed by the next, while the others handled the middlings and rougher concentrates. The pulp was passed back and forth between cells until all the desired minerals were extracted. The waste was then flushed from the cells through pipes located at the bottom of the tanks to a tailings pile outside the mill. Though the process has been improved, the basic flotation principles are still employed at mills today.

Technological innovation in the mining world in the early 20th Century greatly benefited American industry, but it did not translate directly to national defense. When the United States entered World War I in 1917, its Army initially was not prepared to fight the kind of mechanized, metal-dependent, trench-bound warfare that lay ahead. Thus, for the first time, the federal government stepped into the sacrosanct world of western mining to expand, control, and coordinate the production and stockpiling of critical metals (Smith 1989 105–107). This was accomplished through various war boards—a governmental precedent that was repeated during World War II. The bureaucratic efficiency of these first war boards is a matter of debate, but they helped the mining industry to rally around the war cause. World War I saw the rapid development in Europe and the United States of quick firing artillery, tanks and vehicles, planes, and infantry weapons, particularly the magazine rifle and machine gun. However, until wartime industry was brought up to speed, America's armed forces had to rely on French and British munitions when they first arrived on the Western Front in 1917 (Keegan 2000:372–375).

World War I had little lasting effect on the mining and stockpiling of what became known in governmental and military circles as "strategic materials." In fact, the War Department, Bureau of Mines, President Theodore Roosevelt's planning Committee for Mineral Policy, members of Congress, and others urged the government to accumulate adequate stockpiles of raw materials for future emergency (Leith et al. 1943:180). But worldwide disillusionment with the appalling realities of World War I—some ten million lives were lost on the Eastern and Western Fronts (Montana contributed 939 lives to that total [Malone, Roeder, and Lang 2001:269-270]) and the collapse of the old European order—soon saw these postwar strategic concerns fall on deaf ears in the United States and much of Europe. America embraced an isolationist philosophy and maintained the posture that critical supplies could largely be secured through international trade. Despite its warfare boost, the western mining industry struggled through the Roaring Twenties and the first years of the Great Depression. President Franklin Roosevelt's New Deal legislation and policies (i.e., the Silver Purchase Act, raising gold prices, Reconstruction Finance Corporation loans) breathed life into the industry, but ultimately it was the onset of World War II that made a critical difference for many western mine operations.

In 1940, America was again ill prepared to fight a major war, especially overseas on two fronts. President Franklin D. Roosevelt and his New Dealers' efforts to assist the Allies through the Lend-Lease Act, and ultimately to commit the United States to war, was a hard sell in isolationist America (Goodwin 1994:190–215; Kennedy 1999:615–668). Although heavily invested in military planning (the Rainbow Plan and invasion of Europe), Roosevelt had limited influence on actual military preparedness and stockpiling. Thus, in June 1940, less than 5 percent of the necessary materials to fight a war had been accumulated (Leith et al. 1943:180–181). This situation eventually led to civilian rationing and use of substitute products, development of low-grade domestic sources (a boon for mining), and the rapid development of new technologies and products.

In May 1940, Congress passed the Strategic Materials Act to expand and accelerate production and acquisition of strategic, critical, and essential materials (including minerals and metals) for the war effort (Holmes 1942:1). *Strategic materials* were those found entirely or substantially outside the United States while *critical materials* were those that could be obtained from domestic sources but not without procurement difficulties. *Essential materials* were important to national defense but were neither strategic nor critical. Not surprisingly, these lists prepared in 1939–1940 changed significantly as the war progressed (Freeman 1943:41–43).

Government agencies, mining engineers, economists, and military planners spent considerable wartime energy assessing the Allies and Axis Powers' global access to strategic metals (i.e., Holmes 1942; Leith et al 1943; Roush 1938). Board of Economic Warfare strategies to prevent the Axis Powers from gaining access to these strategic metals is an intriguing aspect of World War II and mining history. The United States' effort to buy up precious wolfram ore from war-neutral Spain and Portugal to keep them out of Nazi hands is a good example. Wolfram ores contain tungsten that was critical in the manufacture of steel and other alloys. It gives great tensile strength to metals.

The World War II planning effort benefited from Franklin Roosevelt's "alphabet soup" of government agencies set up to battle the Great Depression during the 1930s. The Reconstruction Finance Corporation (RFC) (established in 1932 by President Herbert Hoover under the Emergency Relief and Construction Act of 1932) gave grants and federal loans to states for emergency relief and public works projects. Some called the RFC a "breadline for big business" because it was managed by Texas millionaire Jesse Jones, charged high interest, and was very selective in awarding grants and loans (White 1991:468). However, during World War II, the RFC played a significant role in developing America's military arsenal. In his autobiography, Jones (1951:3) claims that the RFC was America's largest corporation and banking organization and loaned, spent, invested, and gave away some 35 billion dollars to combat the Great Depression and to build up America's armed forces.

The RFC set up the Metals Reserve Company (MRC) in June of 1940 to stimulate the mining and milling of metallic ores and to improve production of marginal ore sources (Jones 1951:315–386) **.** It served as a purchasing agent for the armed services and specifically, the War Production Board. It did not initiate procurement programs or set its selling prices, which was the job of the Office of Price Administration. The MRC authorized defense subsidies to producers of zinc, copper, and lead and less to those of iron and a few other metals. Among the maze of wartime bureaucracies, the Defense Supplies Corporation subsidized the mining producers while the Defense Plant Corporation financed the construction and rehabilitation of smelters. Needless to say, these two public "corporations" had a huge impact on the mining industry throughout the West.

From the viewpoint of southwest Montana mines, and specifically Charter Oak, it is worth noting that zinc was heavily subsidized by the MRC (Jones 1951:445). Derived from the sulfide known as sphalerite (abundant in the Boulder Batholith), zinc was in extraordinary demand as a key ingredient in cartridge brass, and it also saw extensive use in galvanizing (rust-proofing) iron and steel, dry cells (it has a very active or electropositive character), waterproof paint, rubber manufacture, cloth dyeing, and other products. Thus, domestic sources were heavily developed in the West and concentrates were brought in from Australia, Argentina, Bolivia, Canada, Mexico, and Peru (Freeman 1943:67). Electrolytic zinc plants were located in Kellogg, Idaho, and Great Falls and Anaconda, Montana.

Initially, the government held the price ceiling for zinc at 8 ½ cents a pound, but by the summer of 1941, it became clear that the desired zinc production would not be realized and mining of critical, but marginal, low-grade ores had to be made profitable (Jones 1951:445–446). Thus, zinc subsidies were supplemented by a premium price plan. Copper, lead, and zinc mine operators sold their output at OPA ceiling prices and received premium MRC payments for output exceeding War Production Board quotas. According to Jesse Jones (1951:446), some 211 million dollars had been distributed to 3,100 mines by June 1945. Presumably, the Hopkins and Sons Mining Company was a beneficiary of zinc price supports and premium payments.

Lead too was a strategic war material produced at Charter Oak and at small and large mines throughout the West. In 1943, about one-quarter of domestic lead was used in paint, but it also saw a wide range of uses in lead pipes, telephone and telegraph cable, storage batteries for vehicles and submarines, shot, bullets, shrapnel, roofing, battery plates and type metal, solder, fusible metal, automatic fire devices, bearing metal, and aviation and motor gasoline (Freeman 1943:61). Lead was alloyed with antimony, bismuth, tin, and other metals to make many of these products. These lesser-known metals were also mined during World War II.

In October 1942, the federal government issued Gold Limitation Order, L-280 (Smith 1987:124). In essence, it closed most gold mines by refusing operators access to replacements or materials. This was the straw that broke the backs of many small Montana mines, but it was also a boon to lead-zinc producers such as Charter Oak and other mines in southwestern Montana. The RFC, MRC, and the War Production Board actively encouraged small mines throughout the United States to seek grants, loans, and strategic metals certification to upgrade their operations and ore production. The Hopkins and Sons Mining Company was very interested in obtaining a grant to develop new workings in its “old” Charter Oak silver-lead-zinc mine. Unfortunately the available War Production records at the Montana Historical Society do not indicate whether they were successful or not.

A voluminous literature exists concerning World War II and its effects on the United States. The war caused unprecedented chaos, death, and destruction in the European and Pacific theaters. By the same token, after long years of terrible poverty and hardship during the Great Depression, the war spurred and transformed the American economy, industry, and society. Much of the West had become a “vast wartime workshop” (White 1991:496–513) financed by the federal government through the Reconstruction Finance Corporation and various war boards. At war’s end, these wartime industrial facilities were sold back to private industry at bargain value and became the infrastructure of the postwar economic boom of the "New West." To paraphrase Richard White (1991:497), military planners, concerned about industrial concentration in the Northeast, had campaigned for and achieved a more even distribution of essential industries across the country. The old liabilities of the West—distance, remoteness, and aridity—had become virtues. Ultimately, the Axis powers were no match for America's overwhelming industrial strength (Kennedy 1999:615–668; see Overy 1997), although the Allies came perilously close to losing the war as these material and human resources were collected, transformed, and deployed on two fronts (see Keegan 1989; Morison 1997).

In a related vein, World War II mining fundamentally changed the relationship between the federal government and the mining industry. This once "hands-off" relationship, except as it pertained to intervention in labor disputes, changed into one of necessary partnership. Following World War II, this close relationship continued into the postwar boom years in the West, and mining of strategic metals (i.e., uranium) continued to play an important role in the unfolding drama of the Cold War and the global armaments buildup (Lovering 1944:11–12; Kennedy 1999:852–858; White 1991:496–501). The mining industry was not alone; the agriculture, ranching, and timber industries benefited from price supports, grants and loans, and other measures that spurred wartime productivity. The socioeconomic impact of World War II on modern industry may not yet be fully understood. Mining historian Duane Smith (1987:105–135) has suggested that many of today's environmental debates about natural resource extraction have their genesis in accelerated World War II production (for an insightful comparative analysis of the impact of World War II on the timber industry, see Hirt 1994).

Although World War II mining subsidies were dropped at the close of the war, reconstruction of postwar Europe, the Korean Conflict, and industrial and domestic growth through the 1950s in the United States kept the demand for base and precious metals at high pitch. But open-pit mining and mass ore processing eventually became the operational norm. There is no better example of this transition than Butte, Montana. The small, underground mine operator, propped up by World War II strategic metals subsidies, could not hope to compete in this new corporate environment, although intermittent prospecting, mine development, and processing of old tailings continued throughout the West.

By 1900, the environmental effects of mining were widely recognized by many people in the West, and some measures had been implemented to stop the worst of it, particularly hydraulic mining and, to some extent, air and water pollution. Still, environmental agitation did not truly affect mining until the 1960s, though not to the extent of changing mining's fundamental legal authority—the 1872 Mining Law (Smith 1987:136–148). Nonetheless, the high cost of mine development and reclamation, coupled with growing adverse public opinion in the United States, turned strong corporate attention to other countries and international trade beginning in the 1960s. This "globalization" of mining also contributed to the demise of the small lode miner in Montana and the West.

Material self-sufficiency is a goal of all nations. But Mother Nature has unevenly distributed her mineral wealth and even large countries like the United States lack significant deposits of some metal ores such as tin, manganese, cobalt, and nickel. Today, oil—a commodity that has been termed by some economists and military planners “as necessary as blood”—is one example of a very important strategic material. Synthetic plastics and related products have increasingly become metal substitutes, but it seems unlikely that these will entirely replace the durability and strength of all-metal products. If another national emergency of global scale looms in the future, small mines such as Charter Oak may again come to life.

Charter Oak is neither the most important nor impressive historic mining ruin in Montana or the American West. But when placed within the foregoing historical context, it becomes highly valuable in four aspects. First, Charter Oak retains an exceptional degree of physical integrity. Second, it is a surviving, intact representative example of 1940s–1950s flotation mill technology. Third, it is a surviving, intact representative example of World War II “strategic metals” mining. Lastly, the mine complex is located on public lands, is easily accessible from nearby communities such as Helena, and is therefore an excellent candidate for site stabilization, enhancement, and interpretation. National Park Service mining historians (Bunyak 1998:47, 55) consider the Charter Oak Mine to be one of the best-preserved, small-scale flotation mills in the western United States.

Access, Physical Setting, and Geology

The Charter Oak Mine is reached by traveling west from Helena on U.S. Highway 12 for 22 miles to the Little Blackfoot River turnoff (marked). Turn south off the highway and drive for 2.9 miles until it forks. Follow the right fork (Forest Road #227) for 1.3 miles. At this point, turn left on to Forest Road #227 B-1 and drive for 0.2 miles, passing through two gates. Both gates are locked and require a Forest Service key to open. Continue beyond these gates for an additional mile to the Charter Oak Mine and Mill.

Charter Oak is located near the base of Negro Mountain and adjacent to the Little Blackfoot River. The site’s legal location is: T9N, R7W, SW ¼ of the NE ¼ of Section 36, Powell County, and 46º29'27" north latitude and 122º25'04" west longitude **.** The site area is approximately 75 acres. The upper half of the site lies in Douglas fir and spruce forest. The lower half occupies a grass- and aspen-covered bench above the Little Blackfoot River floodplain. The Little Blackfoot River is a relatively constricted drainage whose headwaters lie in the Boulder Mountains west of Helena. The river flows northeast past Charter Oak until it turns west near the community of Elliston near Highway 12 West. From that point, the river flows west until it discharges into the Clark Fork of the Columbia River near Garrison.

The site has a northwest-facing aspect and receives summer sunshine throughout most of the day. During the winter, the amount of sunlight diminishes and the site is exposed to winter storms. The site’s exposure to winter storms and deep snow pack has affected the structural integrity of the wood and log buildings at Charter Oak.

The mountainous physiography of southwest Montana is controlled by Precambrian Belt series and later Paleozoic and Mesozoic sedimentary rocks, by the Boulder Batholith and later igneous intrusions, by Pleistocene glaciations, and by the Willow Creek Fault ("Perry Line") marking the north-south boundary between two major geological provinces (Knight 1989:37). The Charter Oak site is located within the Boulder Mountains, a mostly low (7,000' to 8,300' above sea level) and rounded mountain range located to the south and west of the community of Helena. The Boulder Mountains are underlain by Cretaceous and Tertiary volcanic rocks and the Boulder Batholith (Ruppel 1963:6–9). The Boulder Batholith is an enormous, highly mineralized body of granite that intruded as molten magma between 70 and 75 million years ago when the Northern Rocky Mountains were being formed (Alt and Hyndman 1972:87). Abundant metals in the Boulder Batholith are the primary reason that southwestern Montana has been mined so extensively since the 1860s. The area has since undergone uplift, erosion, and the accompanying deposition of alluvial sediments on the floodplains of the Little Blackfoot River and adjacent drainage systems.

The Charter Oak Mine (and some fifteen other major lode mines in the Little Blackfoot drainage and Elliston Mining District) was situated to take advantage of the precious and base metals embedded in the granitic/quartz gangue of the Boulder Batholith. It was primarily a lead and zinc producer, but it also yielded some silver, gold, and copper. The sulphide ore was low grade and spotty. Minerals mined at the site include argentiferous galena (lead sulphide with silver), boulangerite (lead-antimony sulphide), arsenopyrite (iron-arsenic sulphide), pyrite (iron sulphide), sphalerite (zinc sulphide with iron and manganese), plumbojaresite (hydrous sulphate of iron and potassium, with lead-antimony sulphide), and malachite (a secondary weathered zone of primary copper sulphides). These sulphide ores were produced as part of a metamorphic contact zone and are found in a quartz gangue. The rock is very unstable and caves easily. The sulphide ores required flotation for concentration. The sulphides, lead, and arsenic are the reason the mill tailings and waste rock are toxic to humans (MSE-HKM, Inc., 1996, 1998).

Description of Resources

The Charter Oak Mine and Mill was a small-scale operation from its beginnings in the early 1900s to its final demise in the mid-1980s. Throughout its history, the mine complex underwent various modifications to meet changing mining and milling technologies. The most significant changes occurred in the late 1930s and then in the early 1950s when the mill building and equipment were upgraded.. In its waning days, the Charter Oak Mine was also the recipient of mining and domestic equipment and parts. Today, the Charter Oak Mine and Mill is an amalgam of mine buildings, structures, equipment, and artifacts dating from roughly 1916 to 1995. However, the mine complex most clearly reflects the mine's primary production period during World War II—1938 to 1950—and it is to this period of significance that Forest Service mine stabilization, renovation, and interpretation is being directed.

Standing buildings, structures, and equipment at the Charter Oak mine include: 1) Flotation Mill; 2) Reagent/Work Shed; 3) Compressor Building; 4) Steel Water Tank and Pipe; 5) Assay Office; 6) Bunkhouse; 7) Main Residence Cabin; 8) Electrical Storage Shed; 9) Garage; 10) Tramway; 11) Mill Tailings Pile; 12) Adits; 13) Waste Rock Piles; and 14) Abandoned

Equipment (Figure 13).

1. <u>Flotation Mill</u>

The Hopkinses built the 50-ton flotation mill at Charter Oak. James Bonner upgraded mill equipment in the early 1950s **(Figures 14 and 15).** The single-story ball mill building measures 152' long and 74' wide at its widest. It is built of rough timber and dimensional lumber and rests on a post-and-stone cobble foundation. Vertical board-and-batten siding encloses the building. The roof is composed of plank sheathing, rolled asphalt, and tin. The roof slopes gently downhill. A wide assortment of fixed single-pane and fixed six-pane windows on all elevations provide ample sunlight into the building interior.

Rectangular single, double, and six-panel doors provide ready access into all sections of the building. The windows and doors were salvaged from elsewhere and used as needed at Charter Oak. A cache of extra window frames is located in the mill and adjacent reagent building. The building was a dirty and noisy place to work and was under constant need of repair, as exemplified by the ad hoc use of tarpaper, shingles, metal, and various kinds of lumber throughout the building. The ball mill was no doubt a "work in progress" throughout its life.

Built on mountain slope, the ball mill took advantage of gravity, beginning with the -the tipple-ore load-out at the top of the mill, and ending with the loading area at the bottom**.** The milling process began at the ore load-out deck, which measures 18' x 16'. Ore was brought out of the mine in ore carts by means of a cable pulley (still intact) and, from the tipple or log deck, was dumped into the ore bin or load-out below. The ore bin, measuring 6' x 16', separated ore either into the mill or into a tailing pile according to size and grade. The discarded ore was then sorted by hand, and the higher-grade ore was moved to the crusher within the mill building.

Powered by an electrical motor, a Pacific Jaw Crusher, made by Alloy & Metals Co. Los Angeles, was the primary ore crusher at Charter Oak. It is located in the first upper room of the flotation mill.. "Cob" hammers and irons hung on the walls nearby were used to clear jams in the crusher and to knock of gangue from out-sized ore pieces.

Following primary crushing, the ore was then carried on a conveyor belt and dumped into a second storage bin just above the ball mill. Crushed ore was fed into a small grizzly screener is located below the second ore bin. Ore was shoveled from the ore bin onto the screen, vibrated and crushed, and then fed into the ball mill. The manufacturer of the ball mill at Charter Oak is unknown, but it generally resembles a Denver Ball Mill. Its large feed scoop apparently was taken off the equipment and moved outside the building. In any case, it was uncovered in mine waste rock during mine reclamation. The ball mill used fist-sized steel balls to crush the ore in the large steel ball crusher. Discarded milling balls are found both inside and outside of the mill building.

Crushed ore was then fed into the classifier. The rake classifier is located adjacent to the ball mill. It is a homemade affair built of wood and an automobile drive shaft. The mechanism raked the pulp up and down a long trough to separate ore ground fine enough for flotation from coarser material that required further crushing in the ball mill. Finished pulp was sent to the adjoining flotation cells via wood troughs and later, PVC pipe.

The crushed ore was sent from the ball mill to flotation cells in the center of the mill building. This area contains two sets of metal flotation cells. The older tanks, located just below the ball mill and classifier, are Denver "Sub-A" flotation cells manufactured by the Denver Equipment Company. The other, newer set of metal cells is located a few feet away. away. Their manufacturer is unknown but these are the cells that James Bonner likely installed.. A "Sub-A" cell is located directly adjacent to the ball mill and might have been used as a conditioning tank. In both sets of cells, chemical reagents within the bath were agitated with the concentrate, with the resulting foam being skimmed off with paddles. The cells were fed with water stored in the large metal tank behind the compressor building. The crushed gangue (waste) was discarded into a tailing pile, and the metal concentrate was placed on large tables to dry in the concentrate storage area. It is possible that the concentrate was then dried out using a vacuum pump or filter, but this machinery is not present at the site today—although a small air compressor might be evidence of this type of equipment.

The lowest working area inside the mill was used for both loading ore concentrate into trucks and storing mill equipment.. Measureing21' x 56',it held the dried ore until it was ready to ship to the smelter in East Helena. The ore was loaded onto trucks through the connected 15' x 18' garage. Ore was dried before shipping by truck or rail (from Elliston) to the East Helena (ASARCO Inc.) smelter in order to reduce transportation costs.

2. <u>Reagent/Work Shed</u>

The reagent shed is located just to the northwest of the flotation mill (**Figure 16)**. It is a single-story building that measures 17' x 13' in plan. It sits directly on a pad of crushed waste rock and has no foundation. The floor is dirt. It is built of dimensional lumber framing and rough-sawn horizontal siding (balloon frame construction). The building has a gabled roof covered with rolled asphalt roofing. Fixed, horizontal, pane windows are located on three elevations. A rectangular door on the south elevation provides ready access to the mill.

The building dates to the mine's WWII operation. It was used to store reagents used in the flotation process. It was also a workshop. A 50-gallon barrel drum fireplace is located in one corner, and two workbenches, old drill bits, and various tools are still found inside. The building was apparently used for storage during the waning years of the operation as the building was jammed with post-1960s tools, machinery parts, and domestic furniture prior to abandoned mine reclamation. This building is in good structural condition.

3. Compressor Building

The compressor house lies on a bench directly above the ball-flotation mill **(Figure 17)**. This single-story building measures 16' x 32' in plan. It sits on a pad of crushed rock and has a dirt floor. It is built of dimensional lumber framing and rough-sawn horizontal siding (balloon frame construction). It has a gabled roof covered with plank sheathing and asphalt rolled roofing. In comparison to the other buildings at Charter Oak, the compressor building has few windows. Two fixed six-pane windows are located on the north and south elevations. The east elevation has a rectangular door made of dimensional lumber planks. The north elevation has a large rectangular double door that provided easy access to the compressor and electrical equipment. Ventilation and outlet pipes from the compressor extend through the south wall but are now disconnected with from pipes outside of the building.

The compressor building was constructed sometime between 1939 and 1941 to support the mine's World War II operation. It is almost completely intact with the Ingersol-Rand compressor, flywheel, belt, gauge, and electric motor still inside. Drill bits, machinery parts, and other mining refuse are located inside the building. Little cleaning occurred here during the mine reclamation, although scattered equipment located directly outside the building was either removed (if it was clearly post-1960 in age) or re-arranged around the building exterior.

4. Steel Water Tank and Pipe

A steel water tank is located just south and above the compressor building and the mid-level adit. It is 20' in diameter and 15' high. It was filled via a spring and creek located just behind the tank. A water pipe extends from the tank downslope to the mill building. The age of the tank is unknown. Piping from the tank into the mill indicates it that it was used in the 1940–1950s operation of the mine.

5. Assay Office

The assay office is located to the north of the mill building and adjacent to the dirt road that accesses the compressor shed, adit, and upper part of the mill **(Figure 18)**. It is a single-story building and measures 32' 6" x 16' 3" in horizontal dimension, including a covered front porch. It rests on a leveled earth-and-crushed-rock pad; it has no foundation. It is framed with dimensional lumber and covered with horizontal rough-sawn plank siding. The building has a gabled roof covered with plank sheathing and rolled asphalt roofing. Fixed four- and six-pane and double-hung four-pane windows are found on all elevations.

The assay office was used for assessing the quality of ore from the mine. For a few years during World War II, the office served as the assay station for most of the Elliston mining district. Assaying continued to be done through the 1980s in an effort to keep the Charter Oak enterprise afloat. It contained much of the laboratory equipment and technical literature used in the glory days of Charter Oak during World War II. These artifacts are being restored off-site and will eventually be used in the interpretation of the Charter Oak site.

Two modern metal trailers were once attached to the back of the assay office during the latter part of the mine's history. It, and an abundance of modern domestic refuse and garbage, were removed as part of the reclamation effort in 1998. Overall, the building is in good physical condition but requires a thorough cleaning to eliminate the threat of Hantavirus and chemical contamination before it can be opened for public visitation. In its current state, this building best represents the waning days of the Charter Oak operation from the 1950s to 1980s.

6. Bunkhouse

A small bunkhouse, measuring 12' by 14', is located midway between the assay office and the main residence cabin **(Figure 19).** It is of frame construction and has dimensional lumber siding. Its gabled roof is covered with rolled asphalt felt. A photograph on an old (1940s) Christmas card sent out to family and friends by the Ralph Hopkins family shows the bunkhouse next to their home—the log residence. The building was being used for storing domestic furniture such as mattresses, bed frames when the site was turned over the Forest Service in 1993. It is in good physical condition. According to informant Mary Craig (daughter of Henry Laurie), the bunkhouse was originally used as "guest house" for people visiting the Hopkins family.

7. Main Residence Cabin

The main residence cabin is the oldest building at the site, although its exact construction date is unknown.**(Figure 20).** The cabin originally measured 29' 5" x 15' 6", but a bedroom, storage shed, and covered porch were added in later years, with each measuring 11' x 15' 10", 9' x 11' 8", and 19' x 6' 3", respectively. The interior has been modernized over the years with carpet, linoleum flooring, and low ceilings. Due to the threat of Hantavirus contamination, furniture, appliances, and domestic refuse were removed from the cabin during the 1998 reclamation project. The cabin interior requires repair and cleaning before it can be opened for public visitation. The cabin exterior retains better integrity, and plans are to use the glass-covered entrance porch to house interpretive signs and information. However, substantial repairs (i.e., foundation and sill-log replacement) are needed to prevent this building from deteriorating further.

8. Storage Building-Bunkhouse

This old log building, located just north of the mill, originally served as a bunkhouse or living quarters during the 1949s, according to local informant, Mary Craig.**(Figure 21).** It was subsequently converted into a storage shed by either James Bonner or Lee Adams. During mine waste cleanup, much electrical equipment of all descriptions was found in the building, giving it its informal name, but it also stored a wide range of mining equipment, such as a Wilfley table, drill bits and related tools during the mine's operational life. The building consists of the original log building and an attached garage made of dimensional lumber. The original single-story log building measures 16' x 31' in plan. Its walls are composed of 8–10 logs that are held together with "saddle and V" corner-notching. It has a gabled roof covered with rolled asphalt roofing on one side and metal (flattened cyanide drums) on the other. Fixed four- and six-pane windows are present on three building elevations. Solid rectangular doors made of rough planks access the east and west ends of the building. The building has plank flooring.

The interior of the building contains industrial-sized shelving made of thick, rough dimensional lumber planks. The shelves were filled with an enormous amount of industrial and domestic equipment and refuse prior to cleanup during the 1998 reclamation project. This log structure dates to the earliest operation of the Charter Oak mine (1890–1930) and was probably built in conjunction with the main residence cabin.

A garage made of dimensional lumber was later added to the north end of this building. It measures 14' 6" x 31' in horizontal dimension. A small (5' x 8' 3") storage extension has been added to the back. The roof of the garage is nearly flat and is covered with rolled asphalt roofing. Two fixed, double four-pane windows are located on the garage's north elevation. The garage has a dirt floor. Large double doors access the garage on the east elevation. Post-1960s refuse and equipment were removed during mine reclamation. The garage was apparently added to the original log building sometime between 1936 and 1941 as part of the Hopkins operation.

The flattened cyanide drum roofing on this building is unique to the site. However, cyanidation was never part of the Charter Oak milling operation. Apparently, the roof was the beneficiary of extra cyanide drums hauled to the site by James Bonner in the early 1950s (Enard Lindquist, personal communications, 2002). Cyanide may have been used in flotation.

9. Garage

The garage was probably built in the early 1940s when the Hopkinses upgraded the mill plant **(Figure 22).** It is located northeast of the main residence cabin near the site entrance. It measures 18' x 20' 6" and is built on a pad of crushed waste rock. It is constructed of balloon framing consisting of 6" x 6" beams and scrap lumber. Sheathing is rough-sawn 1"-thick timber planks. The roof is covered with rolled asphalt roofing. The garage has two stalls with one door remaining, which is opened with an iron counterweight located on its eastern corner. An abundance of abandoned machine parts, appliances, domestic furniture, and other essentially modern refuse filled this building prior to the 1998 reclamation project. The garage's plank walls are in more deteriorated condition than others on-site, though it is not in an imminent state of collapse.

10. Aerial Tramway

The remains of a tramway system, linking the upper adits with the mill, are visible on the waste rock piles directly above the ball mill **(Figure 23).** The age of the tram is uncertain, but best evidence suggests that a tram system was used in the pre-World War II mine operation. Informants indicate that the tram was defunct well before the 1950s operations of the mine (Enard Lindquist, personal communications, 2002).

The tramway includes the highly deteriorated remains of a wooden tower and platform near one of the upper adits, pieces of the mid-slope tower, and cable extending down the entire face of the waste rock pile. Two tram buckets are located near the compressor building. The mid-slope tower remnants were partially removed during waste rock stabilization work in 1998. The cable and tower parts were placed back on the slope following these reclamation activities.

11. Mill Tailings Pile

Approximately 12,000 cubic yards of tailings were once located on the Little Blackfoot River floodplain below the mill **(Figure 24).** Tailings, composed of water, fine-grained ore and sediment, and chemicals, are the final waste product of flotation technology. At Charter Oak, they occurred as a large mound of fine-to-gritty white soil laced with buried cyanide drums, tires, and discarded equipment parts. The tailings were deposited as wet slurry using metal and plastic pipes connected to the flotation cells located inside the mill. The tailings were removed in 1996 to a repository located about 1.1 miles from the mine complex. The location of the former tailings pile is visible as a level, grassy plain adjacent to beaver ponds and the Little Blackfoot River. Partially buried black filter fabric surrounds this area to prevent leakage of any remaining tailings into the river.

12. Adits

Seven mine adits (the horizontal entrances to underground tunnels) were originally located at Charter Oak. All but two adits collapsed sometime prior to 1995, and therefore the five were filled with waste rock and earth during abandoned mine reclamation work in 1998. A sketch map of the underground workings prepared by James Bonner indicate that they once accessed some 755 feet of underground tunnels, 900 feet of drifts or excavations on ore veins, 250 feet of raises, and 30 feet of shafts. The map also shows stopes, veins, and dead ground.

One remaining intact adit is located at mid-slope near the compressor building. A filter discharge system was placed at the adit entrance in 1998 **(Figure 25)**. To protect both the historical integrity of the feature and bat habitat, a metal sleeve was placed inside the mouth of the adit and a portal was built with logs and dimensional lumber in order to replicate its original appearance. The adit is covered with metal grating to allow bats to pass through. The second intact adit is located north of the compressor building. It lacks a portal (entrance) and framing. It emits a substantial flow of acid discharge and is therefore fenced for public and wildlife safety. Federal and state reclamation agencies are currently determining the best way to close this adit and abate surface runoff.

13. Waste Rock Piles

Some 18,000 cubic yards of waste rock were once located on the steep slope directly above and surrounding the mill building. The waste rock actually occurred in seven discrete or overlapping piles below each mine adit at Charter Oak, but for descriptive convenience they are treated as a single feature here. The exposed and weathering waste rock piles release elevated levels of arsenic, cadmium, and lead and are prone to erosion and mass slumping during spring snow melt and after severe summer thunderstorms.

Several different mining features are associated with the waste rock piles, including the aforementioned tram system, collapsed adits, and several deteriorated wood chutes made of dimensional lumber. The latter were used to move ore from the tunnels to the ore bin at the top of the mill. During reclamation, the collapsed adits were left alone to the extent possible and the chute remnants were removed from harm's way. Some chute remnants were then put back atop the waste rock in their original locations.

In 1996, a small waste rock pile behind the compressor building was completely removed because it was partially in a small creek. In 1998, another small waste rock pile located below the open, leaking adit was also entirely removed. The former locations of these two waste rock piles are recognizable today by newly seeded vegetation and obvious evidence of mechanical activity.

The massive and visually prominent waste rock dump above the mill was stabilized by a combination of partial removal, contouring, and replanting (Davis 1998). Eight non-contiguous, 10'–12'-wide horizontal benches were excavated across the four most visible waste rock piles located directly above the mill. The bench cuts follow the tracks of the original bulldozer cuts and old adit/load-out access roads across the face of the dumps. Some 10,000 cubic yards of waste rock were removed via equipment staged on these bench cuts. The benches were seeded with grass and small bushy vegetation. In 1998, a small rock-lined "catch basin" was constructed at the toe-slope of the waste rock pile to prevent waste rock from eroding onto the parking area at the base of the mill and, ultimately, the floodplain of the Little Blackfoot River.

14. <u>Abandoned Equipment</u>

Numerous objects and artifacts associated with mining litter the site **(Figures 26 4).** Two "bone yards" of discarded equipment are located behind the main residence and assay office. The most obvious, non-historic objects dating to after the 1960s were removed during mine reclamation in 1998.

Historic objects readily visible on-site include: a Fageren flotation machine, a Dorr Thickener, a Dorr pump, a WemCo Classifier, a Union Ironworks wood flotation cell, a Kimball-Krogh Co. pump, a homemade slusher, Stoping drills, gasoline and diesel engines, metal railing, and ore buckets. The machinery and related artifacts were clearly abandoned on-site when the mill was refurbished in the late 1930s by the Hopkinses, then again in the early 1950s by James Bonner.

Building Condition Assessments and Preservation Needs

Stabilization and repairs are needed for each building and significant structural features at

Charter Oak to arrest ongoing deterioration and to allow for public access and use. This description is derived from informal building inspections completed by Helena NF engineering and Region 1 Historic Building Preservation Team staff. These assessments require more detailed structural and life-safety studies before specific stabilization projects can be developed. Thus, the exact costs associated with the stabilization and repair work described below are not included in this HPP.

Most western lode mines were never intended to last. Once the ore body played out or was too difficult to access, operations were intentionally abandoned, mining equipment was removed or scraped, and buildings were deserted, salvaged or destroyed. Eventually, new capital, enthusiasm, and technology might cause old mines to be reopened, worked, then abandoned again. Mines and their surrounding industrial landscapes were thus in a constant state of change and transformation (Francaviglia 1991:33–61). In this light, mine buildings and structures must be appreciated on their own terms—as relatively straightforward, functional, and often bare-bones industrial shelters or canopies with an intended short use-life. Many were "works-in-progress." Site preservation efforts must be sensitive to this historical condition.

For site management purposes, it is useful to identify an appropriate level of effort that should be expended to preserve the Charter Oak Mine and Mill. In historic preservation parlance, *stabilization* and *rehabilitation* of certain buildings and structures are necessary to protect the World War II character and integrity of the site. That is, measures should be taken to arrest immediate and potential structural problems that could appreciably accelerate building deterioration and destruction. *In-kind* replacement of rolled asphalt roofing and underlying plank sheathing is one example. Replacing significantly deteriorated sill logs is another. Both address two significant building preservation concerns—keeping out moisture and rodent infestation. Because the public is now invited to tour the buildings, rehabilitation of certain structural features—internal steps, stairs, and handrails—may be necessary. Again, this effort should attempt to replicate in-kind whatever feature is being repaired or replaced.

At each end of this preservation spectrum are *arrested decay* and site *restoration.* Arrested decay is simply doing the minimum necessary to preserve historic buildings as they now stand. The historic Montana ghost towns of Bannack and Garnett are two examples of arrested decay in practice. In contrast, under the concept of restoration, sites and buildings are retained, repaired, and preserved at exacting standards to a particular restoration period. Many of the historic mansions in Helena and the Grant-Kohrs Ranch in Deer Lodge are examples of restoration at work. Restoration requires good architectural, artistic, and photographic documentation in order to be accurately undertaken.

Given the overall condition of Charter Oak, arrested decay may, to some extent, depict current Forest Service management of the mine complex. Even basic stabilization needs at the site may exceed Helena National Forest capacity and budget. However, in-kind roof replacement and other rehabilitative measures that have already occurred at the site undoubtedly stretch this definition. Although the Forest Service has focused its preservation efforts on a particular restoration period—World War II—the site, in fact, is an amalgam of buildings spanning some eighty years. At present, very little architectural or photographic documentation exists for any period. Thus, to call ongoing work at Charter Oak restoration would also be a misnomer.

Perhaps the best preservation guideline to follow is simply not to over-stabilize or over-rehabilitate the Charter Oak complex in the interest of making the buildings and area safer and more pleasant. The recently constructed view platform near the tipple and load-out was a concession to both public safety and structural preservation (too many people were unsafely clambering over the structure to get a better view of the ore bin and mine). But some buildings, structures, and features may always remain off-limits to visitors. Western mines and mills were inherently dirty, smelly, noisy, and dangerous places to work. To a large extent, that is the ambiance that site visitors seek and appreciate the most. These are the intrinsic sensory messages that the mine conveys on its own, regardless of whatever Forest Service interpretation is provided. Thus, the following list of proposed projects for each building should be carefully and judiciously planned, reviewed, and implemented. The buildings are listed in order of priority importance for stabilization. Priority is placed on industrial buildings and structures with surviving machinery and equipment that exemplifies early mining technology.

1. <u>Flotation Mill</u>

The mill is arguably the most important building on-site because it houses intact milling and flotation equipment. In 1998, the old roof was replaced, windows were repaired, and rotten board-batten siding was replaced. Contaminated mill tailings on the mill floor were also removed. In both 1998 and 2001, some steps, railings, and platforms were repaired and/or replaced in-kind. The tipple and load-out (ore hopper) at the top of the mill complex presented the biggest safety concern, since they were inviting to walk on but in seriously deteriorated condition. In 2001, a small wooden viewing platform was built directly adjacent to the tipple and hopper. The tipple was barricaded with metal posts and signed. Interpretive signing that explains the tram system and other features would be appropriate on or near the new viewing deck.

Some doors need to be repaired or replaced—although conservators should be sure to match the varying *ad hoc* door (and window) styles characteristic of the building. Some drainage work was completed in 1998, but vigilance is required to clear the drainage channels and prevent water from draining toward the building. Some passageways present safety hazards (low door jambs) that could be marked. Rodent infestation will be a constant maintenance problem, and nests should be removed using appropriate safety masks and equipment whenever encountered.

a. Remove milling waste, chemicals, chemical drums, contaminated soil, and rodent nests inside mill building
b. Repair and/or replace unsafe steps, stairs, and platforms inside building
c. Remove extraneous, non-historic (post-1960s) lumber, tools, equipment, wiring, etc. inside and immediately outside building
d. Repair/replace deteriorated doors and locks
e. Replace rafters, plywood sheathing, and rolled asphalt roofing
f. Repair and/or replace windows; remove makeshift FS plywood shutters
g. Repair and/or replace rotten external board-and-batten siding
h. Remove dirt and waste rock from base of building
i. Repair and/or replace unsafe load-out above hopper/ore bin

j. Oil and grease milling and flotation equipment as necessary to prevent rust/decay
k. Apply preservative to building exterior (linseed oil–turpentine)

2. Compressor Building

This building contains an essential and substantial piece of equipment—a complete (and probably operable) Ingersol-Rand compressor and flywheel. It takes up most of the building. The only glaring structural problem is the roof, which leaks and needs to be replaced in-kind. Windows and doors are in good shape. The building also served as a work area, and there is a considerable amount of tools and industrial scrap on the dirt floor that either needs to be picked up and stored or removed (this was not done during the 1998 cleanup). A professional conservator of mining equipment should examine the compressor to determine ways to abate its natural deterioration. Rodent infestation is practically nil in this building due, in part, to the absence of insulation and other nesting material. The compressor begs for technical interpretation since, as the "lungs" (oxygen), power, and water supply for the underground workings, it holds great fascination for site visitors.

a. Remove contaminated soil, rodent nests, and safety hazards
b. Remove extraneous, non-historic lumber, tools, equipment, wiring, etc.
c. Replace rafters, plywood sheathing, and rolled asphalt roofing
d. Repair windows and sills
e. Apply preservative to building exterior (linseed oil–turpentine)
f. Oil-grease compressor equipment as necessary to prevent rust/decay

3. Reagent /Work Shed

This simple building is in fairly good shape. It helps form the picturesque and much photographed "alley" between the mill and reagent shed. A wide variety of domestic and industrial equipment was removed in 1998. The chemical- and oil-contaminated dirt floor in the building was replaced with clean soil during the 1998 reclamation project. The roof does not appear to leak badly, but this should be monitored. This building was a useful staging area for the 1999 and 2001 *PIT* projects, and its benches and tool racks still allow it to function as a work shed.

a. Remove chemicals, chemical drums, contaminated soil, and rodent nests
b. Remove extraneous, non-historic industrial and domestic refuse
c. Repair and/or replace windows
d. Replace rafters, plywood sheathing, and rolled asphalt roofing
e. Apply preservative to building exterior (linseed oil–turpentine)

4. Assay Office

This laboratory and assay office is perhaps the most interesting building other than the mill at Charter Oak. It is also the most contaminated by chemicals and rodent infestation. Much refuse was cleared from inside the building in 1998, but it still needs a thorough inspection and cleaning by trained professionals using protective gear to remove any residual chemical toxicity or Hantavirus threat. Removing the insulation in the front part of the office would go a long way toward making this structure less attractive to rodents and would not deter from its historical integrity. In fact, until this cleanup is done, the building should remain locked and off-limits to visitors. A full engineering inspection cannot be completed until this cleanup is done. At a glance, the building seems to be in relatively good condition. The flooring seems solid. Some windows need to be repaired. The opening that accessed the trailers once attached to this building needs to be permanently walled off with in-kind materials. Eventually, some laboratory equipment from the assay office (now stored in the Forest Supervisor's Office) could be returned to the building and be part of an interpretive display. The technical process of assaying ore to determine its economic value is a fascinating topic that also merits on-site interpretation.

a. Remove deteriorated insulation, rodent nests, and chemicals inside building
b. Thoroughly clean building to remove Hantavirus threat
c. Remove extraneous, non-historic tools and equipment
d. Repair/replace windows
e. Construct wall over the opening where trailers once accessed the building
f. Apply preservative to building exterior

5. Storage Building-Bunkhouse

This log building and the main residence cabin are the oldest structures at Charter Oak. They both contrast with the dimensional lumber and planking characteristic of the rest of the site. This storage building is in poor condition. The cyanide drums that were flattened into durable roofing have probably protected the structure better than rolled asphalt roofing would. But many of the sill and upper logs are seriously rotted. Daubing is badly deteriorated or missing. Windows and window framing are in bad shape. The place was once chockfull of industrial and domestic equipment and refuse. This was removed in 1998, and only the heavy shelving and mining-related artifacts remain. The building is amenable to stabilization, but this effort will likely be time consuming and expensive and should be done in the near future before the cabin is too far-gone.

a. Remove deteriorated insulation, rodent nests, and chemicals inside building
b. Remove extraneous, non-historic tools and equipment
c. Replace rotten sill logs, all sides
d. Re-daub entire log structure
e. Repair/replace windows and sills
f. Repair/replace deteriorated doors and lock
g. Apply preservative to building exterior

6. Main Residence Cabin

This log cabin was occupied or used well into the 1980s. It has been modernized inside with a low, paneled ceiling, carpets, and modern appliances and furniture. Like the log storage building, this abandoned cabin is in relatively poor condition due to neglect, weathering, and rodent infestation. A large load of domestic refuse and dilapidated furniture was removed from the cabin in 1998, although some appliances are still in the cabin. But the building and its attached woodshed still need a thorough cleaning to remove remaining human and rodent refuse—and the threat of Hantavirus. The roof leaks and needs to be replaced. Sill logs and some of the flooring likewise need to be replaced. Windows are in poor condition. The front porch—door, flooring, and screen—is very dilapidated. In the long view, if this cabin was gutted inside and repaired, it would make an ideal interpretive center and gathering space at Charter Oak. However, this very general structural analysis suggests that the stabilization and rehabilitation to meet public access standards could be time consuming and expensive. This work also needs to be done in the near future in view of the building's relatively poor condition.

a. Thoroughly clean cabin to remove Hantavirus threat
b. Remove deteriorated insulation, rodent nests, and refuse inside building
c. Replace rotten sill logs, all sides
d. Re-daub entire log structure
e. Replace/repair roof
f. Repair/replace windows and sills
g. Repair/replace deteriorated doors and lock
h. Repair/replace flooring
i. Remove interior appliances, carpets, panel ceiling
j. Apply preservative to building exterior

7. <u>Bunkhouse</u>

This small, simple building, located between the residence cabin and the assay office, is in fair condition. Old mattresses and furniture inside this building were removed in 1998. Like the other buildings at Charter Oak, the bunkhouse needs a new roof. Of more immediate concern, the floor sags in one corner and needs to be braced and replaced. It is an access point for rodents. Some windows need repair, and the front door is currently missing (the building is boarded shut). The building needs to be inspected to detect any Hantavirus concerns.

a. Thoroughly clean building to remove Hantavirus threat
b. Remove extraneous, non-historic tools and equipment
c. Repair/replace deteriorated doors and locks
d. Replace rafters, plywood sheathing, and rolled asphalt roofing
e. Repair/replace wood flooring
f. Repair/replace windows
g. Apply preservative to building exterior

8. <u>Garage</u>

The garage, located near the entrance to the mine site, is in fair condition. Non-historic refuse, particularly appliances and loads of domestic refuse, was removed from the building interior in 1998, but some additional cleanup would be beneficial. The clever jerry-rigged garage-door hoist system is broken, so the garage door is half-open. This should be fixed to prevent large rodents and game animals from inhabiting the garage. The roofing needs to be replaced. Although this building is rather shabby and mundane in appearance, it is the first building that site visitors see and walk by on a tour of Charter Oak.

a. Replace rafters, plywood sheathing, and rolled asphalt roofing

b. Repair/replace windows
c. Apply preservative to building exterior

9. Aerial Tramway

The tramway system is in poor condition, and only the ruins of the upper tower remain. Yet the tram is central to understanding the early mine operation when the upper tunnels were worked. It is a fascinating feature for visitors. In fact, the new viewing deck near the old tipple and load-out actually sits atop the collapsed ruins of the large tramway deck attached to the mill. Deterioration of the upper tram ruins could be arrested using cables and bolts to brace surviving structural members. Preservative should be applied to this feature. The remaining tram cable could be extended downslope so that the visitor might better appreciate how the tram operated from the upper head frame and shaft, to the deck and ore loadout. In fact, a small interpretive sign, explaining the tram system, reconstructed adit, and waste rock reclamation—and placed on or near the load-out/viewing deck—has been suggested by a variety of *PIT* volunteers and site visitors. A tram bucket was placed near the old deck (and new viewing platform) during the 2001 *PIT* project.

a. Stabilize collapsing framing with cables and bolts, as necessary
b. Apply preservative to structural members
c. Extend remaining cable downslope atop waste rock toward mill

10. Abandoned Equipment

Abandoned mining equipment is located throughout the Charter Oak mine complex. Mining experts have identified some of this mining equipment, but other pieces remain a mystery. Efforts should continue to identify this equipment to enhance current understanding of the early Charter Oak mine operations and to aid in on-site interpretation. Experts (i.e., from the National Park Service) in the preservation of metal machinery need to be consulted to determine ways to arrest deterioration of these artifacts in this harsh mountain environment. Some should be keyed to the interpretive brochure since site visitors are invariably drawn to this picturesque machinery.

11. Steel Water Tank and Pipe

This structure is located directly behind the compressor building. It was protected during the 1998 reclamation project. It appears to be in good shape, and no specific stabilization measures seem warranted at present. The tank should be actively monitored since its big tank walls could invite graffiti and vandalism when the site is open to the public.

12. Adits

Five of the seven adits accessing mine tunnels at Charter Oak are collapsed. In1998, the best-preserved adit and portal near the mill was reconstructed as a mitigation measure in conjunction with reclamation work atop the waste rock pile directly above it. A metal sleeve was inserted into the tunnel to prevent it from collapsing, and a log and dimensional lumber adit portal was constructed as a heritage resource mitigation measure. The adit opening was covered with a metal grate. The reconstructed adit was covered with linseed oil and turpentine preservative in 2001. A small ore cart, obtained from Dillon, Montana, was placed in front of the reconstructed adit on original small-gauge railing from Charter Oak. The ore car is the only "new" equipment that has been brought on-site for interpretive purposes.

Other than regular monitoring, no further work is necessary at this or the other adits at Charter Oak. However, the extent of underground workings (some 1,500 feet of tunnels) at Charter Oak is of great interest and should be part of interpretive signing or brochures. A map of the underground tunnels has been obtained from the Bureau of Mines in Butte.

13. <u>Waste Rock Piles</u>

Waste rock was the subject of the 1996 and 1998 reclamation projects when the various piles were completely removed, or partially removed and stepped or benched (Davis 1998). The remaining waste rock piles are in good shape, and no specific stabilization measures, such as run-off controls, seem warranted. An interpretive trail that uses one or more of the waste rock benches to gain access to the tram tower ruin could be considered in the future--it is difficult to keep people from hiking on them now. Given the pitch and compactness of the waste dumps, however, public safety will likely be an issue of some concern.

14. <u>Mill Tailings Pile</u>

The mill tailings pile on the Little Blackfoot River floodplain was entirely removed during the 1996 reclamation project (Davis 1996). The grassy floodplain, filter-cloth fencing, and small monitoring pipes are the only evidence of its existence. The pile was thoroughly photographed and documented as a project mitigation measure prior to its removal.

Elimination of mine waste is important to understanding the milling process at Charter Oak and is key to understanding the reclamation story. The location of the mill waste should be identified with on-site interpretive signs. A small trail leading to the Little Blackfoot River could cross through the old tailings site. The riparian area on the floodplain is frequented by moose and other wildlife and thus offers another interpretive theme at Charter Oak.

Stabilization and Interpretation Costs

Detailed engineering evaluations for each building are necessary to assign costs to the various projects described above. Beyond the price of materials, costs will vary depending on the kind of labor used—*Passport in Time (PIT)* volunteers versus contracted professional builders. Other variables also apply, such as the need for specialists to remove toxic materials prior to implementing stabilization work.

A general estimate of potential stabilization costs, however, can be derived from two past *Passport in Time* projects at Charter Oak (Figure 27).. In 1999, the roof of the mill was repaired in-kind (Figure 25). Roofing and other construction materials for the 1999 project cost about $2,500. Labor was provided by *Passport in Time* volunteers under the supervision of Forest personnel and members of the Region 1 Historic Preservation

Team. A local carpenter was also hired to assist in technical project supervision. The Forest Service supplied the *PIT* field camp at Kading Cabin. The direct cost of the 1999 stabilization project was about $5,000.

The viewing deck built in 2001 was more complex, time consuming, and expensive **(Figure 27).** About $4,500 was spent on construction supplies. *PIT* volunteers and Forest Service personnel completed the work under the direction of the Historic Preservation Team and a local carpenter. This field project cost about $7,500 to implement.

These projects are indicative of the low-key stabilization efforts that will likely occur at Charter Oak over the next decade, particularly in light of Helena National Forest heritage funding levels. Some projects will be more complicated and expensive. For example, roofing and sill-log replacement projects at the various buildings could range in cost from $5,000–$8,000 if done under the auspices of the *PIT* volunteer program and supervised by the Region 1 Historic Preservation Team. In total, these basic stabilization (i.e., roof, sill-log, window-replacement) projects could represent $100M worth of basic site stabilization work over the next decade (2000–2010). The overall integrity and appearance of the site would stay fundamentally the same.

More complicated projects—such as the internal renovation of the main residence cabin or the assay office—will add substantially to this cost. This work will likely involve the Region 1 Historic Building Preservation Team and professional builders to complete once all human-health hazards are addressed. It is impossible to accurately estimate the cost of such projects at the main residence cabin or assay office with detailed engineering evaluations. But clearly these projects will be expensive and fall outside the capabilities of *PIT* program volunteers. In total, these major projects could add another $75M to $100M to the site stabilization-rehabilitation total.

In contrast to stabilization work, site interpretation will be less expensive. In fact, the Helena High School X-CEL class has already built a kiosk and wood signs at Charter Oak with minimal cost to the Forest Service. The professionally fabricated signs are more expensive. Additional professional-quality signs are needed near or on the viewing deck to explain the tram system above the mill building and the mill tailings reclamation on the floodplain. Other signs to explain the assay operation and equipment may also be beneficial—contingent on what is recommended in the site interpretive plan (sign clutter should be avoided). Still, a full suite of interpretive signs should not be extremely expensive to design, manufacture, and install.

An interpretive program will require funding to initiate and maintain, whether interpretation is done by Forest Service employees, a contractor, volunteers, or some combination thereof. Both will require some funding investment to initiate and maintain. Supply costs (i.e., brooms, toilet paper, water coolers) will also be associated with the program. Although these costs will be small (ca. $1,000-$2,500 annually), they will nonetheless need to be anticipated in the annual heritage resource program budget.

Finally, the Vision Statement (Appendix B) describes additional visitor comfort facilities—new toilet, water well—that are undoubtedly beyond the reach of the heritage resource program. In fact, the decision to install such facilities will require careful consideration of all resource concerns on the part of the Helena Ranger District. Funding for these projects would likely come from the Regional Capital Investment Program (CIP), which is competitive and long range. A new toilet would cost between $10,000 and $15,000 (although the existing outhouse at Charter Oak is still in relatively good condition). A well and pump would likely fall in the same cost range. Re-connecting the electrical power to the site for administrative and interpretive purposes is another idea that is frequently suggested by *PIT* volunteers and site visitors. While these "amenity" projects are undoubtedly secondary to the stabilization work at Charter Oak, they may be necessary developments at some future point if the site becomes a heavily visited mining history interpretive site in southwestern Montana.

Site Interpretation: Interpretive Ideas, Topics, and Media

Mining history interpretation on the Helena National Forest is in its infancy. Except for a few old, routed wood signs at Montana Bar and Diamond City in the Big Belts, little on-site interpretation has been done. The Helena National Forest's interpretive strategy (Teegarden 1995) identifies mining as an important heritage interpretive topic, provides some specific interpretive goals and objectives, and targets a sample of historic mining districts and sites worthy of interpretation, including the Elliston mining district and the Charter Oak Mine. The inclusion of Charter Oak in the forest interpretive strategy was important in early discussions about the fate and future of this mining site.

In 1995, Rae Ellen Lee, a former Forest Service landscape architect, created a model for interpreting historic mining sites on the Helena National Forest as part of her coursework at Clemson University (Lee 1995). In her innovative study, Lee described the importance of mining history in the Helena Valley area. She developed a series of mining-history discovery routes and characterized each in well-researched "route resumes" by mining district, theme, access, chronology, minerals recovered and value, important mines, reclamation, and Gee Whiz Facts. Lee then described interpretive media—brochures, trails, signs, and facilities—appropriate to various types of mining ruins.. Unfortunately, Lee did not include the Little Blackfoot River drainage or the Elliston Mining District in her sample of discovery routes. Still, the model could be easily applied to this area and its abundant historic mining ruins, including Charter Oak.

Abandoned mine reclamation has been a Helena National Forest work focus since the early 1990s. To date, at least a dozen mines on the Helena have been reclaimed; that is, tailings and waste rock piles have been removed, dangerous buildings and features demolished, tunnels and shafts closed, and access roads obliterated. Historic preservation concerns have factored into the decisions on how and where reclamation should be accomplished and, as mitigation, what buildings and mining features should be left standing and protected (i.e., Davis 1996, 1998). These decisions were usually predicated on the idea that these historically significant, but reclaimed, mining sites would eventually be the focus of public interpretation. To date, for various reasons, little on-site interpretation has happened at most reclaimed sites. One important exception is the Charter Oak mine..

Since 1996, Forest Service employees have given numerous tours at Charter Oak for school classes, civic groups, and history organizations **.** Local Butte, Deer Lodge, Great Falls, and Helena newspapers have covered reclamation and preservation work at Charter Oak over the last five years. The site, and all the recent reclamation and preservation activity, have been clearly visible from the Little Blackfoot River road. Thus, the Charter Oak Mine has some “name recognition” in southwestern Montana.

In 2000, the Helena National Forest opened Charter Oak for public visitation on select Saturdays during the summer. A severe fire season required closing the site after the first weekend tour in mid-July. The mine was again opened for weekend visitation in 2001, with Forest Service heritage staff acting as tour guides. Approximately 250 people visited the site on about a half-dozen Saturdays in July through September.. In 2002, the Charter Oak was opened on seven summer weekends in July and August. The Forest Service hired Mary Lee Larison from Helena to serve as interpreter and site guide. The author also served as tour guide on a couple of additional weekends. In total, some 500 people visited the site in 2002.

During all three seasons, visitation schedules were published in local newspapers and posters were distributed in the Helena community and local Forest Service campgrounds. A movable wood sign was placed at the intersection of the Little Blackfoot River road and the Forest Road 227-B, the access road into Charter Oak. A few general “demographics” from these three seasons are worth summarizing:

About 65 percent of the visitors were from the local area local area—Butte, Deer Lodge, Elliston, Great Falls, and Helena. The 2002 season saw a substantial increase in visitors from out –of state, including Idaho, Illinois, Washington, Wisconsin, and Vermont (Larison 2002). This increase can no doubt be attributed to better radio, newspaper, and poster publicity. Most visitors had seen some form of advertisement in the Helena area, but the road sign spontaneously attracted a few visitors. Visitors parked in the lot below the mill and congregated at the kiosk until the Forest Service interpreter arrived from a previous tour. In 2002, visitors were strongly encouraged to write their names, addresses, and comments in a “sign-up” sheet posted at the kiosk.

Visitor composition ranged from families to couples to small groups of middle-aged adults. They were either interested in local history or were simply curious about all the publicity about the Charter Oak Mine and what was going on at the end of Forest Road 227B. Visitors stayed on the average of about one hour, including the 15–30 minute guided tour provided by FS interpreters (Larison 2002). Visitors tended to congregate at the interpretive kiosk and on the viewing deck at the top of the mill. Most visitors were comfortable with, and capable of, walking through the site and buildings, especially the mill, but some elderly tourists were not. In these instances, Forest Service interpreters drove physically challenged visitors to the viewing deck at the top of the mill.

In three seasons, Forest Service interpreters encountered surprisingly little negative feedback from visitors. People were genuinely pleased with and appreciative of the information provided by the FS interpreters, the interpretive signs, brochure, and trail. Some self-professed mining history “junkies” wanted more technical information than was provided.. Following the guided tours, it was common for groups of visitors to revisit the parts of the tour that held the most interest for them Others enjoyed and often photographed or painted the buildings, old equipment, or outdoor scenery. A few visitors caught a glimpse of Charter Oak’s resident moose and her calf!

At the end of the 2002 season, interpreter Mary Lee Larison provided an analysis of her efforts and included recommendations to improve on-site interpretation (Larison 2002). One of her key recommendations was to develop specific answers to a variety of often-asked technical and personal questions about the Charter Oak operation. Some of this information is included in this preservation plan, but answers to other questions still require research. This information needs to be conveyed in a simple way, such as via laminated “fact sheets,” photographs, and technical illustrations carried by the tour guide. By way of physical improvements, Larison also recommended the following:

1) Upgrade the interpretive trail and make it safer for physically challenged visitors;
2) Refine and clarify the trail brochure;
3) Delineate the parking and comfort facilities more clearly;
4) Use several guides and schedule regular tours;
5) Construct additional signage (i.e., on the viewing platform to explain the aerial tram; along the trail to explain abandoned equipment);
6) Use displays, models and audiovisual devices to describe technical processes (i.e., flotation) and to better convey the feel of a mine operation;
7) Display artifacts and photographs in stabilized-restored buildings; and
8) Incorporate the geological and reclamation story into Charter Oak interpretation.

In a broader context, an interpretive plan, tiered to this historic preservation plan, needs to be developed for the Charter Oak Mine. It should consider Charter Oak in its broadest landscape context (i.e., Francaviglia 1991), particularly since the intact ruins at Charter Oak provide an effective visual template for understanding poorly preserved mining ruins elsewhere on public lands. As touched upon by Larison (2002), interpretation at Charter Oak should focus on the following topics and themes:

General (Context) Topics

- History of mining in Montana and its relationship to the Industrial Revolution in the United States
- Technological evolution of mining in Montana and the West
- Socioeconomic development of Montana caused by mining
- Composition and background of Montana miners, families, and communities
- Reclamation of abandoned mine sites in Montana and the West

Specific (Charter Oak–Elliston Mining District) Topics

- Early history of lode mining in the Elliston mining district, 1870–1910
- Later history of lode mining in Elliston mining district: World War, 1910–1950
- World War II strategic metals mining; Elliston mining district and Charter Oak
- Capitalization and economics of lode mining at Charter Oak
- Transportation systems to Charter Oak
- Family-based versus corporate-based mining
- Mining workforce in Elliston mining district and Charter Oak
- People and families in their own voices, oral history of mining lifeways in Little Blackfoot River drainage and Charter Oak
- Reclamation and environmental issues at Charter Oak and in the Little Blackfoot drainage

The story of Montana mining is told in some detail at other mining interpretive sites, such as Bannack, Garnett ghost town, Virginia City, and the World Museum of Mining in Butte. Therefore, other than establishing the general context for lode mining in the Elliston District, interpretation at Charter Oak might not repeat this same story in detail from Gold Rush to reclamation. Rather, its role as a 20th Century strategic metals lode mine–flotation mill should be the focal point..

Site interpreters at Charter Oak should be prepared to direct interested people to other historic mining sites and ghost towns in southwestern Montana. Muriel Sibell Wolle's *Montana Pay Dirt* is a comprehensive source for such sites in Montana, while Beth and Bill Sagstetters' more recent (1998) Colorado mining guide describes the kinds of ruins and equipment that visitors are likely to see, albeit in a deteriorated state, on the ground. There is no shortage of literature about mining history and technology. Conversely, information about Charter Oak should be available at established mining history interpretive sites, thus creating a historic mining travel loop or route(s) on a larger scale than envisioned by Lee (1995). Eventually, interpretive signs, brochures, and other media could be coordinated in terms of design, content, and theme within Region 1 of the Forest Service.

Opportunities abound at Charter Oak to implement "living history," special historic preservation training, environmental and interdisciplinary education programs, and various partnership projects, such as working with the X-CEL program at Helena High School. Multidisciplinary educational and interpretive programs should be predicated on an "inquiry" (problem-solving) approach to learning. The many stories and interpretive themes at Charter Oak can be related in a group-learning environment that opens up other problems and questions to consider, discuss, research, and perhaps resolve (Terry Beaver, personnel communication, 2002). Certainly, as this HPP attests, there still is much to learn about Charter Oak and its surrounding environment. The multidisciplinary learning potential at Charter Oak has barely been tapped. These various opportunities and projects should be articulated and evaluated in an interpretive plan that is integrated with the preservation goals identified in this HPP.

Mining and Montana history go hand-in-hand. The socioeconomic and environmental impacts of mining are intertwined. Mine reclamation is now an important part of the mining story and should be featured as an interpretive theme at Charter Oak. Interpreters should be schooled in the chronology of site reclamation and basic mine remediation concepts such as the kinds of toxic metals present, where they occur, their hazards, and where and how they are disposed of. A discussion of past and contemporary uses of various metallic ores, and how these were mined and milled, provides a useful context for these environmental discussions. Forest Service and local Environmental Protection Agency reclamation specialists should be involved in developing these interpretive topics. Mining is a contentious issue in Montana and the West and it is essential that site interpreters present this information in an informed and neutral way. As stated in the on-site interpretive sign:

> *"The Charter Oak Mine is a window into our mining heritage, and the benefits and drawbacks of underground lode mining, minerals processing, and mine waste cleanup. This insight is critical to making informed decisions about the future of mining and environmental health in Montana."*

Finally, given the popularity of the Charter Oak Mine, it should be opened for public visitation on a more consistent basis throughout the summer. One way to accomplish this objective is to hire seasonal employees or contractors as site interpreters, as was done in 2002. Another is to establish a host or stewardship program using local community volunteers. Such programs are successful elsewhere in the Forest Service, including on more geographically remote National Forests than the Helena, so there is no reason that this program cannot be successful in the Helena–Deer Lodge Valley area. Site stewards, recruited from Passport in Time projects, guided on-site tours, public presentations, and media outreach, could be involved in interpretation, maintenance, and monitoring. Certainly, having a spectrum of agency personnel and private individuals participating in the maintenance and interpretation of Charter Oak will enhance the site's reputation as a valuable public resource.

Project Compliance, Protection, and Monitoring

All mine reclamation and historic preservation work at Charter Oak constitute a potential effect on a significant heritage property and therefore must be reviewed by the Montana SHPO and federal ACHP to comply with the National Historic Preservation Act. Reclamation activities are still being considered at Charter Oak, including removal of the last bit of tailings on the floodplain and treating contaminated water in several discharging adits. These projects will require compliance review (i.e., Davis 1998, 2001). All site stabilization and rehabilitation work at Charter Oak must likewise follow the Secretary of Interior's preservation standards and guidelines. When possible, the Region 1 Historic Buildings Preservation Team should be closely involved with all stabilization and other building work at Charter Oak.

Outside the context of abandoned mine reclamation, site stabilization and NHPA compliance,, several other management issues need to be considered to protect and manage Charter Oak as a significant heritage resource property.

Two locked gates and an easement now control access to Charter Oak across private land. The main road up the Little Blackfoot River is located across the river from Charter Oak. These two factors have undoubtedly prevented arson, vandalism, and other depreciative behavior from occurring in the mine complex. The access road to Charter Oak should remain closed and be opened only to administrative use for reclamation monitoring and heritage site interpretation. The road is now closed through a temporary closure order. *A permanent road closure is needed.*

As the Charter Oak site becomes better known, it is possible that the site's limited access will not deter those people who choose to wade the river and walk to the site on Road 227B. Most visitors will likely be recreationists curious about all the activities at the site. But anti-government and/or environmental (anti-mining) sentiment, as well as malicious mischief, could threaten Charter Oak. V*andalism and arson are strong possibilities*. This concern needs to be integrated into the Helena National Forest law enforcement plan. Law enforcement officers, heritage staff, and recreation and other Helena NF personnel should be vigilant in monitoring the site during the months that it is snow-free from May through October.

In 2002, Charter Oak experienced its first break-in and vandalism—minor forced entry into several buildings. As a consequence, site interpreter Mary Lee Larison (2002:5) recommended better building security (locks), signage (including around the site perimeter), and regular patrols and building checks by Helena National Forest staff. In fact, Charter Oak can be readily observed from a wide spot on the Little Blackfoot Road. Regular examination of the area with field glasses will help insure that people are not scrambling around the site. Nighttime surveillance is more problematic. To date, uncontrolled public access has not been a major problem at Charter Oak, but it is something to look out for in the near future in light of what occurred in 2002.

Another concern is that *Charter Oak could be harmed or consumed by wildfire*. The site is recognized by Helena National Forest staff as worthy of significant protection efforts were a fire to start in this area of the Little Blackfoot drainage. This concern needs to be carried forward into the Forest's and Helena Ranger District's fire protection plans. Tactical plans to protect the buildings with fire shelter, hoses and sprinklers, and retardant need to be devised. Fire shelter and other materials need to be stockpiled somewhere on the Helena RD or Helena NF for this purpose. Following an inspection by Forest fire management officers, it is likely that the site area needs to be thinned of ladder fuels to help abate a significant burn. The wildfire concern cannot be overemphasized, and preparedness is critical.

A fourth concern is *deterioration caused by significant erosion, water runoff, rodent infestation, and other natural events*. These may be of less immediate concern than vandalism (arson) or wildfire, but heritage staff still need to be vigilant about monitoring and immediately correct problems when they are found. For example, waste rock that is slumping toward or into the buildings (such as on the backside of the mill) needs to be removed. Water draining toward or under the buildings needs to be channeled away via ditches. A significant invasion of rodents or birds in a building (and their resultant nests and droppings) may require trapping or eliminating these creatures. Given the present deteriorated condition of most buildings, it will be difficult to arrest all of the structural problems. However, concerted attempts should be made to address small maintenance problems before they become overwhelming.

The physical condition of the Charter Oak mine should be monitored as a means to protect both the buildings and the people who are in and around them. *Building inspections by Forest Service engineers need to occur on a regular basis, particularly before, during, and after the summer season when guided hikes and interpretive programs occur at Charter Oak.* These regular inspections are essential public safety requirements and are necessary to assess maintenance and stabilization needs of the historic buildings and more modern facilities (signs, tables, viewing deck, toilets). These inspections should be systematically tracked and used as a basis for competing for Capital Investment Program (CIP) and grant funding. Work at Charter Oak should be tracked in the Helena National Forest Annual Compliance Report to the Montana SHPO.

Currently, the protection, stabilization, and interpretation of the Charter Oak mine could be regarded as an experiment largely unduplicated anywhere in Region 1. The simple fact is that there are very few intact, isolated, standing lode mines and mills on National Forest lands in Montana that are now open for public visitation. Currently, there are only a handful of mine preservation "roadmaps" to follow, and these primarily concern mining ruins in California, Idaho, and Nevada. After five years of active preservation work at Charter Oak, it seems clear that the goals outlined in this HPP will primarily be accomplished through a public and private constituency of individuals—agency personnel, site stewards, *PIT* volunteers, civic and educational groups, and local mining history enthusiasts—who are all dedicated to preserving this unique historic mining ruin, one project at a time, one building at a time, one year at a time.

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Appendix A

Preservation Goals for Charter Oak

A small Helena NF staff group who were involved with on-going Charter Oak mine reclamation developed the following preservation goals in 1997. The goals were intended to give Helena NF managers and Montana SHPO staff a clear idea of site preservation plans at Charter Oak in the immediate context of abandoned mine reclamation as well as into the future. The goals are not prescriptive and simply represent the *ideal* site preservation and "adaptive use" scenario as viewed by this small staff group. None-the-less, the goals have been invaluable in proposing and planning preservation work at Charter Oak, and some of them have already been met.

- The Charter Oak site fits within a recreation-forest visitor complex in the Little Blackfoot River corridor: first as a historic site and second as a recreation site (but not as a recreation staging area). Opportunities exist to accomplish multiple resource objectives. The site should be formally nominated to the National Register of Historic Places.

- Minimal public facilities will be developed at the site: signs, trails, parking, comfort facilities. Management will be consistent with the Forest Plan direction for the area; ROS setting; adjacent landowner concerns; etc. Public access to the area will be maintained and potentially upgraded. Any development will complement the historical period and architecture to the fullest extent possible. The area's "cultural (mining) landscape" will be maintained unless demonstrable environmental and life-safety concerns are present.

- Key buildings (i.e., mill) will be stabilized and cleared/cleaned for preservation and interpretive purposes. Unnecessary, unsafe, or badly deteriorated buildings and clutter will remain either (tastefully) boarded and locked or removed. The Region 1 Historic Preservation Team will be involved in all stabilization efforts.

- All major environmental and life-safety concerns will be corrected (hazardous mine openings, toxic dumps) prior to encouraging and allowing public access at Charter Oak—recognizing that some inherent risks are involved with old mine sites, historic buildings, and outdoor recreation. Historic interpretation and recreation improvements are consistent with water quality, fisheries, and other resource standards in the Little Blackfoot River drainage.

- This historic site will provide a theme-oriented experience (mining) with specific interpretive objectives: primary message = history; secondary message = reclamation. The focus will be on the mining (industrial) system, technology, and lifeway.

- Interpretive materials will be consistent with Forest and Regional themes and design standards. Interpretive efforts could be tied to off-Forest community and forest programs. The Helena NF will encourage RO [Regional Office?] to help integrate interpretation from Forest to Forest for consistency of theme, design, and materials.

- Visitors will have a self-guided discovery experience; guided by low-key signs and an explanatory brochure and augmented by occasional forest special tours and events. "Site stewards" and/or volunteers may or may not be used. Charter Oak could be "marketed" in a variety of ways, including videotape documenting the site and reclamation work.

- Charter Oak management will be tied into recreation and heritage operations and maintenance budgets and supplemented/augmented with partnership dollars. Site stabilization funding should be part of the Regional CIP program. Work could be accomplished via the R-1 Historic Preservation Team, Passport in Time volunteers, etc. Chipping away at it a little each year, the Forest could eventually accomplish a lot. Forest should foster and maintain partners via a "Friends of Charter Oak" group, "site stewardship" program, etc.

Appendix B

Long-range Vision for Charter Oak

Site preservation goals, as outlined in Appendix A, can be cumbersome to understand and digest. In 1998, as both abandoned mine reclamation and preservation work at Charter Oak progressed, the preservation goals in Appendix B were put in a more readable format for easier dialogue with Forest staff and the Montana SHPO. A long-range site preservation vision was also necessary for seeking grant funding for site stabilization and interpretation. Like the preservation goals, the vision statement depicts the *ideal and desired scenario* at Charter Oak rather than its current condition. This long-range vision will undoubtedly be modified as reclamation, preservation and interpretation work at Charter Oak continues.

> Abandoned mine reclamation work is complete at Charter Oak. This effort has cleaned up the toxic waste and made the site safe for public visitation with some necessary cautions. During mine reclamation, non-historic trailers, equipment, and refuse—all dating to after 1960—have been removed to a local landfill. Waste rock has been removed from around some buildings, drainage ditches route water away from buildings, and access roads and the parking area have been improved. These actions were identified as benefiting mitigation measures in the memoranda of agreement prepared for the Montana SHPO as part of the Section 106 review for mine cleanup projects.
>
> The Charter Oak Mine is recognized locally and regionally as a historic mining site well worth visiting. A site brochure is available in Forest Supervisor Offices, Ranger Stations, state, county and local (i.e., World Museum of Mining) museums, Chambers of Commerce, and other historic mining sites throughout Montana. Visitation schedules are clearly printed in the brochure, and Charter Oak is identified on FS road signs in the Little Blackfoot drainage. Helena NF information assistants are likewise knowledgeable about Charter Oak and when it is open for public visitation.
>
> The Charter Oak Mine's important role as a World War II "strategic metal" producer is documented in a formal National Register of Historic Places nomination. Site stabilization efforts are directed at preserving the mine's Depression–World War II-era integrity and character. Forest heritage personnel have interviewed people related to or knowledgeable of the mine operators—the Hopkins and Bonner families and later leasers. The nomination and various research documents form the backbone of the stabilization and interpretation plans.
>
> Site stabilization has been active since 1997, and a number of buildings have been treated. The treatment schedule is based on building condition assessments and a stabilization plan prepared by Helena NF staff and members of the R-1 Historic Preservation Team. Their immediate focus is on the industrial buildings containing intact mining equipment. Treatments have included in-kind repair or replacement of roofs, windows, doors, sill logs and foundations, lower walls, steps, railings, and landings. Preservative has been applied to some buildings. Areas and buildings unsafe for public access have been boarded or fenced off and signed accordingly.

The stabilization work has been accomplished on an opportunistic basis with Passport in Time and local volunteers and with grant and appropriated heritage and CIP funding. These stabilization and volunteer efforts have been recognized in local media and have attracted much interest in this project. The Region 1 Historic Preservation Team uses Charter Oak occasionally as a hands-on training center.

Interpretive kiosks and professional-quality signs have been constructed at Charter Oak at strategic points identified in the interpretive plan. The interpretive plan has both a technological and human dimension. A platform has been placed near the mill load-out to deter people from walking atop it and to provide a vista point at the top of the mill complex. Interpretive signing at the vista point describes the old tram system atop the waste rock dumps, as well as the former mill tailings on the floodplain and their cleanup. Simple wood signs also identify equipment both inside and outside the buildings. An interpretive trail has been developed on the site. Metal signposts on the trail route are keyed to a self-guided brochure. The main residence cabin has been entirely gutted and refurbished with only simple wood flooring. Interpretive displays showing mining artifacts are housed in this building. All site interpretation has been identified in a well-thought-out interpretive plan. Interpretation is integrated in design theme and style to other FS mining sites in Region 1.

A new toilet has been built on-site near the old one behind the main residence cabin. A well and pump have been installed for fire protection and to accommodate Site Stewards and site visitors. Several picnic tables and garbage containers are located on the site in the aspen grove near the main cabin and kiosk, and near the compressor shed above the mill, for the comfort of families and tour groups. A small walking path to the Little Blackfoot River allows small children to wade while part of their group tours the site. Fisheries biologists and other specialists have been involved in the location of this small river access trail.

The access road to the Charter Oak Mine is open only for administrative use—when Charter Oak is open for public visitation during the summer months. Several FS-trained Site Stewards, recruited from the local area, manage public visitation during the summer months under the supervision of the Forest Archaeologist. They are knowledgeable of historic mining and enthusiastically lead tours upon request. They are guardians of the site and work under the direct supervision of the Forest Archaeologist and the Helena Ranger District. Space is available behind the residence cabin to park the Site Steward's camper truck or RV. In addition to "walk-in" visitors, the Helena NF heritage staff accommodates a variety of special tours and education programs for school, historical, and civic groups throughout the year when the site is snow-free.

A "Friends of Charter Oak Mine" group, whose membership is derived from the communities of Avon, Elliston, Deer Lodge, and Helena, assists in the planning and implementation of stabilization, interpretation, and education projects. Their partnership has been critical in seeking grant funding to complete needed projects. The Helena National Forest Foundation is likewise instrumental in drawing attention and funding to the Charter Oak project. Collaboration and communication is critical, and Helena NF staff work closely with other agencies and entities managing significant historic mining sites across the state.

Appendix C

Glossary

Mining terminology is both technical and exhaustive. The following definitions, derived from Daman (1936), Pioneer Technical Services (1995), Noble and Spude (1992), and Young (1970, are primarily relevant to the mining and milling technologies at Charter Oak and the Elliston Mining District.

Activator—A reagent such as copper sulphate used in a selective flotation circuit that renders floatable again minerals that have been temporarily depressed.

Adit—The opening of a horizontal tunnel driven in a rock face to access underground workings or to dewater the mine.

Advisory Council on Historic Preservation- An independent federal agency responsible for administering the National Historic Preservation Act of 1966, its implementing regulations (36 CFR Part 800). Oversees state historic preservation programs (SHPOs).

Air Shaft—A passageway excavated to direct surface air into underground workings and to discharge stale air.

Amalgamation—A metallurgical process by which mercury is alloyed with other precious metals into a solid mass or amalgam. Mercury is then retorted away.

Aerial Tramway—A system of towers, cables and large metal buckets over which ore is moved from the mine to the mill.

Assay—The laboratory process of determining the amount of valuable metal in ore, done with chemicals, heat and other processes.

Baffle—A plate on a flotation cell that collects the mineral enriched froth.

Ball Mill—A rotating horizontal cylinder in which ore is ground by quartz, porcelain or steel balls, water and various chemicals; the secondary crusher in a ball mill circuit.

Bit—The part of the hydraulic drill that cuts into the rock face for purpose of drilling holes for blasting. May be fixed or detachable.

Blasting—Forcing off portions of a rock face in a tunnel using explosives; holes are first made with hand jacks or hydraulic drills, into which explosives are inserted and fired.

Boulder Batholith—An enormous, highly mineralized body of granite underlying the Butte-Deer Lodge-Helena area; formed about 70-75 million year ago.

CERCLA—Comprehensive Environmental Response, Compensation, and Liability

Act of 1980, supercedes National Environmental Policy Act (NEPA) but various resources must still be considered.

Chlorination—An early method of removing gold from waste rock by introducing chlorine into milled or roasted ore.

Claim—An area of land claimed by an individual or corporation for the purpose of mining; a lode claim measures 600 by 1,500 feet.

Classifier—Milling equipment used to divide and grade crushed ore or sand. In a ball-flotation mill circuit, crushed ore is fed into a through the classifier to insure that it is fine enough for flotation.

Cob—Mining slang for breaking off worthless parts of ore cobbles with hammers and bars in conjunction with primary crushing.

Collector—Reagents used in flotation that aid or facilitate the attraction of mineral particles to the froth by causing the desired mineral to become insoluble enough to attach to air bubbles. Ethyl and amyl xanthates are widely used collectors.

Complex Ore—An ore containing a number of minerals of economic value, such as silver-lead ores of the Boulder Batholith.

Compressor—A machine that compresses air to ventilate underground mine workings, power hydraulic drills and pump water for drilling. Comprised of a gas or electric motor, flywheel, belts, compression chamber, piping and gauges.

Concentrate—The process of separating metal or ore from surrounding barren rock or gangue (also called country rock); or enriched ore after the removal of most waste material in a milling process.

Conditioner—Reagents used to pre-treat ore pulp in a ball or rod mill to bring it within desired alkaline limits, remove salts, and cleanse sulfide pulp so that it attaches more readily to air bubbles. Popular conditioners include lime, sulfuric acid and soda ash.

Country Rock—Mining slang for mineral-barren rock surrounding or penetrating the mineralized ore vein.

Crosscut—Either a tunnel driven at right angles to an underground portal or a horizontal tunnel driven across the mineralized ore vein.

Crusher—A machine for crushing rock or ore; includes primary jaw crushers and secondary crushers comprising stamp, ball and rod mills.

Cresylic Acid—An organic compound widely used as a frothing reagent in flotation.

Cyanide—A salt or ester of hydrocyanic acid used to dissolve metal from the gangue or barren ore. Also used as depressant in the flotation process.

Cyanidation—The process of dissolving gold and silver in a solution of alkaline cyanide.

Dead Ground—Mining slang for the portion of the lode where there is no ore.

Depressant—A reagent used in selective flotation that prevents, temporarily or permanently, the flotation of certain mineral constituents of complex ores. Lime, sulphites, alkaline cyanides, and glues and starches are among the best known depressants.

Dredging—Mining of placer deposits in streambeds with either a large, floatable barge equipped with buckets on an endless chain or a motorized dry land dragline. Both used screening machinery and stacker belts for discarding waste rock.

Drift—A horizontal tunnel underground that follows the mineralized ore vein; also used in underground placer mining.

Dump—A pile of waste or country rock that is dumped below adits and shafts during underground mining. Usually have higher than normal (background) concentrations of heavy metals due to exposure and leaching.

Face—The surface exposed by underground excavation.

Flotation—The process of separating minerals in ground pulp inside a water and chemical bath that is both mechanically agitated and infused with air, causing some minerals to sink and others to rise to the top in froth. *Bulk flotation* involves the separation of all sulphides from gangue while in *selective flotation* various sulphides are floated separately using collectors, depressants and activators.

Flotation Cell- A wood or metal tank in which the froth flotation process takes place. Multiple cells allow for pulp conditioning, aeration and differential mineral extraction.

Frother —A reagent used in flotation that provides buoyancy to air bubbles and keeps them from bursting when they reach the surface of a flotation cell. Pine oil and cresylic acid were popular frothers.

Gangue—The worthless rock associated with economically valuable minerals in ore.

GLO, L-280—Gold Limitation Order, issued by the federal government in October 1942, during World War II closing all gold mines not producing strategic metals.

Grizzly—A rugged screen and roller devise used to separate large ore from smaller ore and fines prior to crushing in a ball mill.

Headframe—A timber or metal frame located above a shaft which carries the sheave and pulley system for the hoist; lifts ore from the shaft and tunnels and transports men to the underground workings.

Hydraulic Mining—Excavation of placer deposits by washing out stream gravel and sand using high-pressure nozzles and water hoses, and then screening the muddy slurry in long sluice boxes.

Intake—A passage through which fresh air is drawn or forced into a mine tunnel or tunnel section.

Jaw Crusher—A primary crusher that reduces large ore into sizes capable of being handled by a secondary (ball or rod) crusher; operates with a moving jaw hinged one end, which swings toward and away from a stationary jaw.

Jig—A machine to separate minerals in a pulsating water bath; the pulsating motion stratifies the minerals for separate removal. Frequently used in gold mills.

Leaching—The process of extracting metal from ore by selectively dissolving it in a water and chemical (i.e., sulfuric acid, cyanide, thiourea) solution. Also called heap leaching.

Level—A main underground tunnel that provides access to working areas and also provides for ventilation and haulage of ore.

Lime—A caustic, dry white powder consisting essentially of calcium hydroxide; used to obtain alkalinity in the flotation process and as a depressant.

Loadout—A large bin for ore awaiting treatment or shipment.

Lode—A regular vein exhibiting or producing any kind of metal.

Milling—The processing of ore to produce a product.

Mining—Excavating the earth to extract ore and other economic materials.

Mining District—A geographically defined area, usually a major drainage basin, where concentrated mining has occurred; concept derived from the ad hoc governments of placer miners to adjudicate claims during the Gold Rush, and expanded to regulate water and waste disposal in hydraulic mining areas. Became an organizing construct for evaluating and monitoring the potential and real productivity of lode mines by mining organizations and government entities.

Mineral—An inorganic substance occurring in nature that has a definite chemical composition and distinctive physical properties or molecular structure.

MRC—Metals Reserve Act, legislation passed by Congress in June of 1940 on the eve of World War II to stimulate metals production; administered by the War Production Board.

Muck—Ore that has been broken up from blasting in the stope and is ready for haulage in ore carts to the ore bin.

NHPA—National Historic Preservation Act of 1966; as amended in 1998; legislative basis of the SHPO review process and the National Register of Historic Places.

Open Pit Mining—Also called open-cut mining**,** a method in which the ore body and workings are open at the surface as opposed to excavating underground.

Ore—A mineral or mineral aggregate containing precious or useful metals. An *ore body* may include ore that is both economical and non-economical to mine, while an *ore deposit* generally refers to an ore body that is economical to mine.

Ore Bin—A wood or metal receptacle for ore awaiting treatment or shipment.

Patent—A written title to land granted by the government after fulfilling certain legal conditions. A mining claim could be patented after $500 worth of work had been completed on the property.

Percussion Drill—A compressed air, actuated hammer type drill used in underground lode mining. Used with both fixed and detachable bits.

PIT*—Passport in Time,* a national volunteer program sponsored by the Forest Service that involves citizens in historic preservation projects.

Placer—Concentrations of valuable minerals found in the sands and gravels of streams and beaches resulting from weathering of the main ore body.

Portal—The surface entrance to an underground mine, through an adit, shaft or tunnel.

Prospect—A mineral property whose value has not yet been proved by exploration, typified on the ground by excavation pits and trenches.

PRP—Potentially Responsible Party, under CERCLA state and federal agencies are required to determine if the owners of abandoned mines have responsibility for mine waste cleanup.

Pulp—A mixture of ground ore, water and often chemicals capable of being treated in jig and flotation mills.

Raise—A vertical or inclined opening that connects a lower tunnel with an upper tunnel; a raise is excavated upward while a winze is driven downward.

Reagent—Chemicals or a chemical solution used in mineral assays and flotation. Includes activators, collectors, conditioners, depressants and frothers.

Reconstruction Finance Corporation—A federal agency established in 1932 under the Emergency Relief and Construction Act to provide for public works and financial assistance during the Great Depression. RFC helped build up America's military arsenal during World War II.

Refactory Ores—Ores that resist treatment with chemicals and require roasting and other methods such as flotation to recover valuable minerals.

Rehabilitation—As a historic preservation term, to replace extensively deteriorated, damaged or missing features of a building using traditional or substitute materials with or without reference to a restoration period.

Restoration—As a historic preservation term, to retain, repair and preserve buildings and structures to a particular restoration period.

Shaft—A vertical excavation that accesses underground workings.

SHPO—State Historic Preservation Officer, state official and agency charged with administering the National Historic Preservation Act of 1966 (as amended).

Slimes—Ore reduced to a very fine powder and held in water, so as to form a very fine mud.

Sluice—A long trough in which placer gravel is washed in order to catch gold and other heavy minerals on its riffles or blankets.

Slurry—Fine solid particles suspended in water that is of a consistency to flow by gravity or pumping.

Smelting—Reducing ore or ore concentrate by means of intense heat.

Stablization—As a historic preservation term, measures that repair or replace critical structural elements of a building or structure to arrest immediate or potential deterioration or destruction.

Stamp Mill—Milling equipment that crushed ore under a battery of heavy metal shoes or stamps that is lifted by a cam; the precursor of rod and ball mills.

Stope—The area in underground mining where the desired ore body is removed.

Strategic Metals—Metals designated by the federal government during World War I and II as essential to the war effort.

Sulphide—Also written as sulfide, a compound of sulphur with another element. A basic component of lead-zinc ores in the Boulder Batholith.

Tailings—The waste product or effluent resulting from milling ore in a flotation circuit; usually contains concentrated heavy metals.

Thickener—Milling equipment comprised of a large, round tank used to separate solids from solution by centrifugal force.

Timber—Any wooden support inside mine workings.

Tipple—A deck or structure where ore from a cart is dumped into a loadout or ore bin. Sometimes referred to as a load-out.

Tunnel—A horizontal or nearly horizontal underground passage that is usually open to the air at both ends.

Vacuum Pump—A type of machine used to draw out water from the finished flotation froth or concentrates prior to shipment to the smelter. Comprised of an air compressor, centrifugal pump, vacuum trap, and low-pressure blower.

Vanners—An agitating device used to separate pulp in water based on the principle of specific gravity, superceded by flotation.

Waste Dump—The rock or gangue that is too low in grade to be of economic value that is dumped outside of shafts and adits, or screened and discarded during milling.

Wilfley Table—A type of concentration equipment consisting of a vibrating rectangular table that concentrates gold and heavy metals in riffles as water is passed over it.

Xanthate—A dithocarbonate derived from alcohol, used in flotation, the most widely used collector of the western mining industry.

Appendix B
Charter Oak Mine In Local Historic Context

Mining holds an important place in Western history, whether viewed from a traditional (i.e., Young 1970) or revisionist perspective (i.e., White 1991). The simple shovel and sluice box technology of the early 1860's gold rush in southwestern Montana quickly gave over to more aggressive and efficient hydraulic mining involving water, ditches, flumes and hoses by the early 1870's (Rohe 1985). Free gold and silver mixed in placer deposits were extracted in enormous quantities by this method in rivers and streams throughout this region of Montana. As the rich placers played out, the search for parent veins or the "mother lode" began in earnest, hailing the advent of hardrock lode mining (Malone et al. 1988; Sahinen 1938).

From the 1880's through the 1920's, underground lode mines produced millions of dollars worth of precious metals from high-grade ore but steady production eventually necessitated mining of lower grade ore bodies. Not coincidentally, experiments first undertaken in Australia in 1911 led to the eventual development and widespread use of flotation technology in the United States whereby precious metals were extracted from pulverized low-grade ore in oil or water mixed with chemicals in flotation cells (Hardesty 1985; Wyman 1979; Young 1970). This new technology was the economic salvation of mining in Montana and the West, and fostered mining of low-grade ore through the precipitous years of World War I and the Great Depression (Bunyak 1998).

World War II gave the mining industry a much-needed economic boost. Government Order L-208 closed all mines not engaged in production of "strategic metals" for the war effort and Government-sanctioned mines such as Charter Oak flourished in lead, zinc and copper production. However, by the mid-1950's, mining throughout the West was undergoing another technological change to open-pit mining. In this new economic climate, most small operations were bought out by larger corporations or were non-competitive and permanently closed. From this time forward, mining of precious metals became a large-scale, open-pit, corporate proposition (Smith 1987).

The history of the Charter Oak Mine, and the Elliston Mining District in general, mirrors the synopsis presented above. Placer mining within the Elliston Mining District was never extensive or very productive (Fairchild and Horstman 1995; Lyden 1948). The district became important in the 1890's as an area productive for lode mining. The nearby community of Elliston supported this burst of underground mining, along with woodcutting for the Anaconda Copper Mining Company's smelter and quarrying and processing of lime at a nearby plant adjacent to the Northern Pacific Railway. Important early lode operations included the Big Dick (Evening Star), Julia, Monarch and Ontario mines. Gold-silver-lead ore was shipped to the East Helena and Washo smelters. Production was sporadic in the Elliston mining district after 1911, which undoubtedly resulted in little socioeconomic (community) development in the Little Blackfoot River drainage outside of the community of Elliston. However, Charter Oak and a handful of other lode mines were responsible for production peak during World War II and breathed new life into the Elliston Mining District for about a ten-year period. After that, ore production at Charter Oak (and elsewhere in the Elliston District) fell off sharply, thus necessitating the operators of Charter Oak to expand their minerals assaying operation and to prospect elsewhere on the Helena National Forest.

Charter Oak was originally located in 1912 by Fred Hopkins as a lode mine and flotation mill site. Its first reported production was in 1916. The first Charter Oak flotation mill was located on the same spot where it was rebuilt just prior to WWII, and where the second mill still stands today. There is a set of old concrete footings and rotted lumber piles near the tailings that may represent an older operation, but there is no mention of this building in any available records. Their uncertain history and lack of integrity make these concrete structures a noncontributing element of the Charter Oak site.

Small-scale production of silver-lead ores by Fred Hopkins, his brother Ralph, and their families continued through the 1920s. The log buildings at Charter Oak relate to this initial period of mining, as does much of the first milling equipment (i.e., wood flotation cells, Dorr Thickener) scattered throughout the site and "bone yards". There were good years and bad years, which was typical of small operations in the Elliston

Mining District and throughout the West. Mining of the low-grade silver-lead ores was marginally profitable until the stock market crash resulted in a depressed metals market, and the mine became inactive throughout the Great Depression. In contrast to other mines in the area, the Charter Oak operation did not profit from an increase in gold prices in 1934. This was due to the complex sulphide ores present at Charter Oak, which were spotty and had limited gold in them. The mill remained inactive through most of the Great Depression from 1931-1936. In 1937, the Hopkins reported net proceeds of $160 from 4 ½ tons of processing ore, yielding a little gold, some silver and 1782 pounds of lead. Production costs of about $4328 left a net loss of $168.

In 1941, a new company, Hopkins & Sons Mining Company was formed. According to informants, the mine was operated, if not actually leased, by James Bonner, a mill man from Nevada. The Hopkins did the representation work. This relationship is not clear in Powell County legal records. In any case, the Hopkins, apparently with the help of Bonner, tore down the old log mill, but left the log cabin and log electrical shed standing. The older equipment was replaced with flotation cells and ball crusher, of which the latter was installed on new concrete footings. Abandoned machinery and scrap was moved to several "bone yards". Besides the new equipment, a garage, small bunkhouse, compressor house, reagent shed, and assay office were added to the mine complex.

Charter Oak came into its own during the rush for metals like lead and zinc during World War II. Mining for strategic metals was supported by federal subsidies, while Government Order L-208 closed all gold mines as nonessential to the war effort in 1943. The year 1943 was arguably the glory year for Charter Oak, as it produced 98% of the ore, 53% of the gold, 89% of the silver, 93% of the lead, 100% of the copper, and 82% of the zinc for the Elliston Mining District, all of which was taken from 2,208 tons of ore. Other years in this period came close to that level of production. Ore was generally shipped by truck to the Asarco smelter in East Helena, where it was usually penalized for the arsenic in the ore. It is certain that strategic metals production during World War II at Charter Oak Mine and other government-sanctioned mines contributed to the economic well being of East Helena and surrounding communities. However, translating individual mine production records into a larger economic perspective is made complicated by poor or inaccessible (Asarco Company) tax and related records. Further research into these records would enhance understanding of the socio-economic impact of Charter Oak and other lode mines in southwestern Montana both prior to and after World War II.

About 5 tons of ore were shipped per day to the East Helena smelter during the war years (Trauerman and Reyner 1950). In 1943, Ralph Hopkins applied to the War Production Board for a Serial Number under Preference Rating Order No. P-56. He reported that they were a new Company or partnership operating in an old mine. He reported slow going because capital was limited but that they assembled a 50-ton, gas-powered flotation mill comprising the usual standard equipment. They had developed the mine to the point where it could supply enough ore to keep the mill busy. Hopkins further stated that shipments so far (March 1, 1943) had been lead concentrates. They were making zinc concentrate but had not shipped any because they could not bring the arsenic to a low enough point for electrolytic reduction. A smelter in Amarillo, Texas was willing to accept their concentrates but the Hopkins preferred to ship to a local smelter to save on freight charges. Hopkins indicated that they had only a small crew but were putting on more men that month. He acknowledged the possibilities for development and was gathering data together for a development loan from the Reconstruction Finance Corporation.

Ralph Hopkins died in January of 1952, at the age of 68. Considered a miner, metallurgist and long-time resident of Elliston, Hopkins was survived by his wife Avis, and sons Weston and John, who remained active in mining for year years. (John Hopkins had formed a business partnership with Pat Phalen of Helmville, called the Eldorado Uranium Exploration Corporation in 195). The death of Hopkins brothers and of the aging of James Bonner (who lived onsite with his wife for years) brought the mine into its long period of decline. Fairly significant production in lead and zinc is reported from 1951-1955 but no production is reported after 1966 (Robertson 1956). In 1956, Bonner did some development work at Charter Oak, and in 1957, the Charter Oak Mining Company, under the direction of John Hopkins, was producing some gold, silver lead and zinc. In 1958, Bonner claimed the mill site and the lodes, and in 1960 he was granted surface rights. However, his interest lay with the placer deposits in Townsend area and in 1961 he solid the claims to Henry Laurie of Elliston.

From 1961-1968, Laurie and John Hopkins, of Hopkins Mine Incorporated, intermittently worked the Charter Oak mine. Elliston resident, Swede Lundquist, sometimes worked with John Hopkins (a son of Fred Hopkins) and ran ore from other claims through the mill, which was reportedly kept operational into the 1970s. John Hopkins relationship with Pat Phalen (and the Eldorado Uranium Exploration Corporation) had gone sour by 1969 because he had not lived up to his assessment work. Hopkins, who was living in Salt Lake City, relinquished his claims and mining involvement in the Elliston area. Hopkins Mines, Inc., became the Golden Basin Company owned by the Phalen family and headquartered out of Missoula.

By 1979, all significant mining activity had ceased. In 1984, Lee Adams purchased the mill and claims from Laurie. Powell County assessors valued the plant at $31,000. Adams operated a cyanide help leach operation on the Viking Claim. Adams and his partner, C.W. Norton of Florida, formed the Charter Oak Mining Company. They planned to make a study of thiourea leaching for gold and silver, but were mostly in the assaying business. Adams substantially upgraded the existing assay office with laboratory and other equipment. Two trailer were also attached to this building, which have since been removed as part of the mine reclamation project. The remains of their efforts piled up at Charter Oak in the form of trailers, a trommel, a bulldozer, and assorted mining scrap and modern debris (all of which is considered intrusive to Charter Oak's primary period of historical significance). Unsuccessful in initiating a thiourea leaching process for gold and silver, Adams began trying to sell the property in 1988. Eventually, he was able to lease the mine to the Chickadee Mining Company in 1990, who soon became embroiled with the State over the right to conduct abandoned mine reclamation work there.

In 1992, a local fisherman observed a plume of mill tailings in the Little Blackfoot River. His complaints led to an investigation by the State Department of Environmental Quality. Adams and Norton, the mine owners, where found in violation of the Montana Water Quality Act. The State designated Charter Oak for abandoned mine waste cleanup in 1993, with the Forest Service as the lead agency. After some confusion over ownership (Don and Bob Overson of Lincoln were interested in buying or leasing the property), it became clear the Charter Oak Mining Company was responsible for mine waste cleanup. In 995, the Charter Oak Mining Company was dissolved and Adams quit claimed their property to the Federal Government, with an agreement that he would leave some equipment for historical interpretation. In 1995, the Forest Service initiated abandoned mine waste cleanup at Charter Oak.

In sum, market forces, the development of open-pit mining as a capital-intensive endeavor, and environmental regulations all contributed to the demise of the Charter Oak Mine, as well as small-scale hardrock mining in general. The spotty, low-grade ore at the site and the ebb and flow of family and human life also helped to bring Charter Oak to its abandoned state.

The Charter Oak Mine is eligible for listing in the National Register of Historic Places in four aspects. First, it retains an exceptional degree of physical integrity. Second, it is a surviving, intact example of 1930-1940's flotation mill technology. Third, it is a surviving, intact example of World War II "strategic metals" mining. Lastly, it is located on public lands, is easily accessible from nearby communities such as Helena, and is therefore an excellent candidate for site stabilization, enhancement and interpretation. National Park Service mining historians (Bunyak 1998:47, 55) consider the Charter Oak Mine to be one of the best-preserved, standing, small-scale flotation mills in the western United States.

Appendix C
Regional and National Context:
World War II Strategic Metals Production

Western mining history has traditionally focused on the precious metal gold and silver that made the fortunes of mining capitalists, contributed significantly to the West's economy and lore, and fed the national Treasury. However, by the turn of the 20th Century, the Industrial Revolution had precipitated a strong demand for new metals, copper in particular as an electrical conductor in wire and equipment (Freeman 1943:43-67). Zinc, derived from complex lead-zinc-silver ores, was used to galvanize iron and sheet steel, and was an important alloy, notably in brass. Lead too found use in an array of products and alloys. Tetraethyl lead would eventually become an important component of aviation and motor gasoline. Manganese, chromium, molybdenum and tungsten became critical alloys in steel, enhancing its tensile strength, heat resistance and corrosion resistance. In addition to its use in coinage and silverware, silver was used in some electrical works (it is a better electrical conductor than copper) and became an essential product of the photographic film industry. Non-metal products—such as asbestos, nitrates, mica, and phosphates—also came into high demand. None of these alloy and non-ferrous metals and non-metals had the allure of gold or silver, but by they nonetheless became important components of the 20th Century mining industry in the American West.

By the early 1900s, the boom years of hardrock mining financed by wealthy capitalists and entrepreneurs of the Gilded Age had come to a close. The Panic of 1893, caused by the repeal of the Sherman Silver Purchase Act and abandonment of the silver standard worldwide, partly precipitated this economic down swing. But many high-grade ore bodies had become exhausted and the technology to efficiently extract metals from low-grade (refractory) ores did not yet exist. The rise of the labor movement in the United States brought new attention to the human toll of industrial mining, and labor issues concerning wages, safety and work hours consumed considerable energy (and suffering and bloodshed) among the miners and their bosses (see Wyman 1979). The mining industry eventually recovered from this slump, benefited by a plethora of successful small-scale operations producing needed metals other than gold and silver and university-trained mining engineers.

Another key factor in the upswing in mining was new milling technologies, specifically cyanidation and flotation. A short digression is necessary to explain their significance. Sulfide ores occur as veins filling fracture zones or as replacement deposits in country rock. These fine-grained, sulfide minerals were impossible to free using the milling practices of the mid-1800s (Schack and Clemmons 1982:62). By the turn of the 20th Century, various processes and inventions were developed to process low-grade ore. Many of these had little scientific basis and were unsuccessful, and the whole enterprise was attributed by many in the mining industry to the so-called “process peddlers” (Young 1970:230-231).

However, in the 1870's, once process did emerge—chlorination—that enabled millers to extract gold from low-grade ore (Young 1970:273-274). The principle and process were simple: chloric acid dissolves gold. Gold concentrates were placed in a leaching vat to which chlorine was added either as bleaching powder or a gas. The gold chloride was drained off in solution and reduced with various base metals. There were many safety and practical problems with this process—chlorine gas was dangerous, bleaching powder was expensive, chlorine ate through equipment, including metal processing vats. Still, it was a way to extract gold from otherwise refractory ores.

A more significant process, cyanidation, took hold from 1887-1897 (Taggert 1951:505; Young 1970:283-285). It too was based on a simple principle: sodium cyanide is one of the few compounds for which gold has an affinity. In this process, gold-bearing slimes and sands were agitated in a dilute sodium-cyanide solution to which air was added. The dissolved gold was run in the solution over beds or of zinc shavings, which precipitated the gold back to a solid. The zinc was then retorted off (like the mercury amalgamation process), leaving a sponge to be cast and sold. This process had fewer apparent safety drawbacks than chlorination, and became widely used across the West. Abandoned equipment at Charter Oak suggests that cyanidation was part of the Hopkins' early operation; indeed, the roof of the storage building is composed of flattened cyanide drums.

The froth-flotation process, first developed in 1911, is one of the most significant developments in low-grade ore milling (Bunyak 1998:23-24; Young 1970:231-233). Through a rather complex process, tons of otherwise commercially worthless low-grade, sulfide ore could be made to yield silver, copper, lead and zinc minerals. In essence, flotation utilizes differences in surface properties (tension) to separate minerals from waste in a chemical solution. Ore was first finely ground in a ball or rod mill. The crushed mineral ore and gangue was then mixed with water and special chemical reagents and agitated in conditioning tanks. It was then fed into flotation cells where the mixture was agitated in a chemical bath infused with air to form bubbles. As the bubbles rose through the cell, the mineral ore attached to the bubbles was collected in a thick froth at the top of the cell. The froth concentrate was sloughed or scraped off, dried, bagged and sent to smelter. The pulverized waste was pumped to a tailings heap.

The flotation mill man was part alchemist, part metallurgist. The chemical environment of the flotation cell was crucial to the success of the enterprise. Flotation began by pre-treating the ground ore with a small quantity of light oil, usually xanthates, in the ball mill. These so-called collectors react with the desired mineral, causing it to become insoluble and available to attach to the air bubbles. Frothers, usually organic compounds such as pine oil and cresylic acid, provided buoyancy to the air bubbles and kept them from bursting when they reached the surface of the flotation cell. Finally, Chemical conditioners were added to the bath to maintain the pH of the mixture within tight limits. In effect, the collector cleaned the surface of the desired mineral so that it would attach to the bubbles. Mill men were extremely concerned about ore contamination from mining operations since it affected pH values and hence the ability of dressed ores to float and yield desired minerals.

Modern warfare put a fine point on the need for metal and non-metal resources mined from the earth. But when America entered World War I in 1917, it was ill prepared to fight the kind of new mechanized, metal-dependent warfare that lay ahead. For the first time, the federal Government stepped into the sacroscant world of mining to expand, control and coordinate the production and stockpiling of critical metals. This was accomplished through various war boards—a governmental precedent that was repeated during World War II. The bureaucratic efficiency of these first war boards is a matter of historical debate but they helped the mining industry to rally around the war cause. World War I saw the rapid development of munitions, tanks and vehicles, planes and military equipment in the United States and abroad. This level of production mining benefited in the extreme, but only after this exhausting war did some mining leaders complain about governmental interference (Smith 19__).

The lessons of World War I seem not to have had much lasting effect on mining or stockpiling what eventually became known in governmental and military circles as “strategic materials”. In fact, the War Department, Bureau of Mine, President Theodore Roosevelt’s planning Committee for Mineral Policy, members of Congress and others urged the Government to accumulate adequate stockpiles of raw materials for future emergency. But the extreme public disillusionment with harsh realities of World War I soon saw these concerns fall on deaf ears. The United States embraced an isolationist philosophy and maintained the posture that critical supplies, with some exceptions (i.e., potash in New Mexico) could be secured through international trade. Despite its warfare boost, metal mining industry limped through the Roaring Twenties and the first years of the Great Depression. President Franklin Roosevelt’s New Deal legislation and policies (i.e., the Silver Purchase Act, raising gold prices, Reconstruction Finance Corporation loans) breathed new life into the industry but ultimately it was the onset of World War II that made the critical difference for many mine operations.

In fact, America was again caught off-guard in its preparations for war, including having sufficient materials to fight a modern war on two fronts. President Franklin D. Roosevelt’s various attempts to precipitate the United State’s entry in World War II went nowhere in isolationist America. Although heavily involved in military planning (the Rainbow Plan and invasion of Europe), Roosevelt seems to have had limited influence on actual military preparedness and stockpiling. Thus, in June of 1940, less than 5% of the necessary materials to fight a war had been accumulated. This situation quickly led to civilian rationing and use of substitute products, development of low-grade domestic sources (a boon for mining) and rapid development of new technologies.

In May of 1940, Congress passed the Strategic Materials Act to expand and accelerate production and acquisition of strategic, critical, and essential materials critical to the war effort (Holmes 1942:1). Strategic minerals were those found entirely or substantially outside the United States while critical minerals were those that could be obtained from domestic sources but not without procurement difficulties. Essential minerals were important to national defense but were neither strategic nor critical. Not surprisingly, these lists prepared in 1939-1940 changed significantly as the war progressed (Freeman 1943:41-43).

Government agencies, mining engineers, economists and others spent considerable wartime assessing the Allies and Axis Powers global access to critical strategic metals (i.e., Holmes 1942; Leith et al 1943; Roush 1938). Board of Economic Warfare strategies to prevent the Axis Powers from gaining access to these strategic metals an intriguing but seemingly obscure aspect of World War II and mining history. The United States' effort to buy-up precious wolfram ore from war-neutral Spain and Portugal to keep them out of Nazi hands is a case in point. Wolfram (and sheelite and hubnerite) ores contain tungsten that was critical in the manufacture of steel and other alloys. It gives great tensile strength to metals.

The World War II planning effort benefited from Franklin Roosevelt's "alphabet soup" of government agencies set up to battle the Great Depression. The Reconstruction Finance Corporation (RFC) (established in 1932 by President Herbert Hoover under the Emergency Relief and Construction Act of 1932), gave grant federal loans to states for emergency relief and public works projects. The RFC was called by some a "breadline for big business" because it was managed by Texas millionaire, Jesse Jones, and charged high interest and accepted few proposals (White 1991:468). However, during World War II, the RFC played a significant role in developing America's military arsenal. In his autobiography, Jones claims that the RFC was America's largest corporation and banking organization, and loaned, spent, invested and gave away some 35 billion dollars to combat the Great Depression and to build up America's military arsenal (Jones 1951:3)

The RFC set up the Metals Reserve Company (MRC) in June of 1940 to stimulate the development of metals and ores, and to improve production of marginal sources (Jones 1951:315-386). It served as a purchasing agent for the armed services and specifically, the War Production Board. It did not initiate procurement programs or set its selling prices (which the Office of Price Administration did). The MRC authorized defense subsidiaries to producers of zinc, copper, and lead, and less to those of iron and a few other metals. Among the maze of wartime bureaucracies, the Defense Supplies Corporation subsidized the mining producers while the Defense Plant Corporation financed the construction and rehabilitation of smelters. Needless to say, these two public "corporations" had a huge impact on the mining industry throughout the West.

From the viewpoint of Montana mines, and specifically Charter Oak, it is worth noting that zinc was most heavily subsidized by the MRC (Jones 1951:445). Derived from the sulfide known as sphalerite (abundant in the Boulder Batholith of southwestern Montana), zinc was in extraordinary demand as a key ingredient in cartridge brass, and it also saw extensive use in galvanizing ("rust-proofing") iron and steel, dry cells (it has very active or electropositive character), waterproof paint, rubber manufacture, clothe dyeing and other products. Thus, domestic sources were heavily developed in the West and concentrates were brought in from Australia, Argentina, Bolivia, Canada, Mexico and Peru (Freeman 1943:67). Electrolytic zinc plants were located in Kellogg, Idaho, and Great Falls and Anaconda, Montana.

Initially, the Government held the price ceiling for zinc at 8 ½ cents a pound but by the summer of 1941, it became clear that the desired zinc production would not be forthcoming and mining of critical but long-considered "marginal" ores had to be made profitable (Jones 1951:445-446). Thus, zinc subsidies were supplemented by a premium price plan. Copper, lead and zinc mine operators sold their output at OPA ceiling prices and received premium MRC payments for output exceeding War Production Board quotas. According to Jesse Jones (1951:446) some $211 million dollars had been distributed to 3100 mines by June of 1945.

Lead too was a strategic war material produced also at Charter Oak and throughout the West. In 1943, about ¼ of domestic lead used in paint (1943), but also saw a wide range of uses as lead pipes, telephone and telegraph cable, storage batteries for vehicles and submarines, shot, bullets, shrapnel, roofing, battery plates and type metal, solder, fusible metal, automatic fire devices, bearing metal, and aviation and motor gasoline (Freeman 1943:61). Lead was alloyed with antimony, bismuth, tin and other metals to make many of these products. This lesser-known metals were also mined during World War II.

In October of 1942, the Federal Government issued Gold Limitation Order, L-280. In essence, it closed nonessential mineral (generally gold) mines by refusing operators the access to replacements or materials. This was the straw that broke the backs of many Montana mines but it was also a boon to silver-lead-zinc producers such as Charter Oak and other mines in the Elliston and surrounding mining districts. While this historic mining literature has been little explored, available mine records document a lively dialogue between operators and the RFC, MRC and the War Production Board. As described earlier in this documents, the Hopkins Brother who operated Charter Oak were very interested in obtaining a grant to develop new workings in their "old" silver-lead-zinc mine.

Summary statistics about the impact of World War II mining in Montana are hard to come by. Certainly, World War II strategic metals production played a significant role in those mining districts rich in sulfide ores such as those underlain by the Boulder Batholith in southwestern Montana. On a regional scale, Richard White (1991:496-513) aptly described the West during World War II as a "vast wartime workshop". The basis of this work depended largely on a variety of metals derived from mining. 90% of the federal government's investment capital from 1941-1945 was provided the by the aegis of the federal government through the Reconstruction Finance Corporation and various War Boards. To paraphrase Richard White (1991:497), concerned about industrial concentration in the Northeast, the military actively campaigned for a more even distribution of essential industries across the country. For military planners, the old liabilities of the West—distance, remoteness, aridity—became virtues.

In sum, World War II strategic metals mining fundamentally changed the relationship among the Federal Government, the mining industry and Westerners. The once "hand-off" relationship in mining (except as in pertained to labor management issues) changed to one of a necessary partnership brought about by events beyond either's control. The War built up both industrial and domestic infrastructure that laid the foundation of the post-War boom in the West (White 1991:496-501). It is worth noting that the history of the logging industry during and after World War II has many parallels to the mining industry (see Hirt 1994). The full impact of the World War II on both industries is not yet fully comprehended nor understood. Certainly, World War II set expectations of resource extraction and industrial production that became the crux of the natural resource (environmental) debates in the 1960s and 1970s (Smith 19__). In another vein, World War II spurred a global private armaments industry whose activities and ethics still perplex the world today (see Lovering 1943:11-12).

The World War II "boom years" of mining subsided as quickly as it developed. Reconstruction of post-war Europe, the Korean Conflict, and post-war industrial and domestic growth in the United States kept the demand for metals at high pitch. But the quest for these metals buried deep in the earth was soon accomplished through open-pit mining and mass-processing technologies. There is no better example of this transition than Butte, Montana. The small mine operator, propped up by World War II strategic metals subsidies, could not hope to compete in this new corporate environment, although intermittent prospecting, mine development, and processing of old tailings continues to the present throughout the West. By the early 1900s, the environmental effects of mining were recognized by many and some measures were implemented to stop the worst of it (i.e., hydraulic mining). Still, environmental agitation did not truly affect mining until the 1960's, though not to the extent of changing mining's fundamental legal authority—the 1872 Mining Law. Nonetheless, the high cost of mine development and reclamation in the United States turned strong corporate attention to other countries and international trade beginning in the 1960s.

Material "self-sufficiency" is a goal of all nations. But Mother Nature has unevenly distributed her mineral wealth and even large countries like the United States lack significant deposits of some strategic metal ores such as tin, manganese, cobalt and nickel. Today, oil—a commodity that has been termed "as necessary as blood"—is one example of a strategic material. Synthetics plastics and related products have increasingly become substitutes for some metals but it seems unlikely that these will entirely replace the durability and strength of metal products—especially if another national emergency of global scale looms in the future.