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United States Department of the Interior
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National Register of Historic Places
Multiple Property Documentation Form

This form is used for documenting multiple property groups relating to one or several historic contexts. See instructions in How to Complete the Multiple Property Documentation Form (National Register Bulletin 16B). Complete each item by entering the requested information. For additional space, use continuation sheets (Form 10-900-a). Use a typewriter, word processor, or computer to complete all items.

_X_ New Submission ____ Amended Submission

Cover

A. Name of Multiple Property Listing

Hinsdale County Metal Mining

B. Associated Historic Contexts

(Name each associated historic context, identifying theme, geographical area, and chronological period for each.)

Hinsdale County Metal Mining Historic Context, 1870-1950

C. Form Prepared by

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D. Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this documentation form meets the National Register documentation standards and sets forth requirements for the listing of related properties consistent with the National Register criteria. This submission meets the procedural and professional requirements set forth in 36 CFR Part 60 and the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation. (___ See continuation sheet for additional comments.)

Signature and title of certifying official — Date 8/26/99

Colorado State Historic Preservation Office
State or Federal agency and bureau

I hereby certify that this multiple property documentation form has been approved by the National Register as a basis for evaluating related properties for listing in the National Register.

Signature of the Keeper — Date 9/28/99

Signature and Title of Certifying Official — Date 9/7/99
Preservation Officer, Bureau of Land Management

HINSDALE COUNTY METAL MINING HISTORIC CONTEXT, 1870-1950

1.0 Introduction

The Hinsdale County Metal Mining Multiple Property Documentation Form includes historic resources that illustrate the types of features associated with the metal mining industry in northern Hinsdale County, Colorado from 1870 to 1950. The mining of metal ores was crucial to the development of the county, state, and nation during the latter half of the nineteenth and early twentieth centuries. This multiple property documentation form (MPDF) is a partial inventory within mining districts that span Hinsdale Counties, and represents the mining and economic development that occurred during this important period of the State's history. The document discusses important historic and technological trends in the region, provides descriptions of property types and registration requirements, describes the local geography and geology, discusses the methods used in developing the nomination, and lists the references.

There are four mining districts [redacted]. The principle or primary producing mines in Hinsdale County were the Ute-Ulay, Golden Wonder, Golden Fleece, Ocean Wave and Hidden Treasure. Other notable mines there include: Bon Homme, Yellow Medicine, Belle of the West, Ocean Wave, Empire Chief, Hidden Treasure, Pride of America, Palmetto Group, Big Casino, Ajax-Moro, Independence, High-Muck-a-Muck, Virginia, Silver Cord, Czar, Dolly Varden, Frank Hough, Contention, Hiwassee, Capitol City, Tobasco, Champion, Cashier, La Belle, Isolde, Mountain Chief, and Victor.

2.0 Historic Background

Prior to the Euro-American settlement of Hinsdale County, prehistoric Native American groups sporadically utilized the region over the past 10,000 years (Guthrie et al 1984). Prehistoric occupation of the county was probably restricted to the summer season, and short-term camps were likely established in the valley bottoms and passes. Hunting of big game such as elk, bison, deer, mountain sheep and goats would have been the most likely activity. In the past 300 years, the Ute were the primary group historically documented to have utilized the area. In fact, their presence was a limiting factor on the early mining and development of the county. Several of the higher peaks are known to be sacred to the Ute, including Uncompaghre Peak, near the base of which a recent discovery of brownware ceramics push the ancestral Ute occupation to ca. AD 1300-1500 (personal communication Julie Coleman-Fike).

2.1 Exploration Period (1761-1876)

Spain was the first European nation to lay claim to and attempt to colonize the southwestern United States. Although they did not draw specific boundaries, southern Colorado was perceived by the Spanish to

be within their sphere of influence. Initial contact between the Spanish and Ute led to a brisk trade in horses, which the Spanish had introduced to the New World. These peaceful trading relations aided the Spanish in their exploration attempts. Expeditions led by Juan de Rivera between 1761 and 1765 were based upon rumors of mineral wealth in the San Juan Mountains. They found and gutted some shallow gold and silver deposits, but returned to Santa Fe without having made any significant discoveries (Vandenbusche and Smith 1981:16). There is little known about additional Spanish exploration into the area.

Despite the incursions of the early trappers and traders, Colorado's Western Slope remained, in 1840, essentially uncharted and unknown, still the uncontested domain of the Ute Indians. However, flamed by tales of the men of buckskin, interest in the land beyond the Rockies was growing among both westward-bound emigrants seeking a place to settle and those visionaries who foresaw the commercial potential of a transcontinental railway. Pressured by these interests, the U.S. government dispatched numerous exploration and survey parties to the West between 1840 and 1880.

The first of the expeditions to pass through west-central Colorado was that led in 1843-1844 by John C. Fremont, who was en route from Missouri to California and back to South Park (O'Rourke 1980:36). The following year, 1845, Fremont again set out from Independence, Missouri, and, with Kit Carson as a guide, led his party west to California via the Arkansas, Eagle, Grand (Colorado), White, and Green River valleys. It is unclear just where the group left the Grand Valley and headed north to enter the White River Valley, but it was probably in the vicinity of Rifle or farther downstream. In 1848, Fremont once more entered west central Colorado, this time trying to evaluate the 38th parallel as an all-weather, year-round railroad route to the Pacific. Due to a miscalculation by guide Old Bill Williams, the 33 man expedition was trapped by extreme winter temperatures and heavy snowfall near Wannamaker Pass in the San Juans. Many perished and some were cannibalized. As news of this got out, after the survivors returned to Taos, the reputation of the "Pathfinder of the West" was forever damaged.

Exploration efforts intensified in the 1850s, due in large part because of the United States' acquisition of the southwest part of the country at the close of the Mexican War in 1848. Upon consolidation of the nation, a transcontinental railroad now seemed more possible. Lieutenant Edward Beale, Captain John Gunnison, and the diehard Fremont all led expeditions into west central Colorado in 1853. They followed essentially the same route named the Old Ute Trail--over Cochetopa Pass, into the Gunnison and Uncompahgre River valleys, past the confluence of the Grand and Gunnison Rivers at present day Grand Junction, and westward. While Beale's party made it to Los Angeles without event and Fremont's trek to Utah was successful, Gunnison and seven of his men were killed and mutilated by the Paiute in southwest Utah. Their exploration led to the opening of a wagon road along the same route through Colorado in 1858. However, enthusiasm over a transcontinental railroad slackened somewhat in the wake of Gunnison's demise and even more so in anticipation of the Civil War, the North and South being unable to agree on a railroad route, because each demanded that it run through its territory. In light of these events, Federal exploration of the Western Slope came to a halt until the 1870's.

After then, several expeditions touched on west central Colorado, but the most noteworthy were those led by Ferdinand Vandeveer Hayden between 1873 and 1876. Sponsored by Congress, Hayden's yearly expeditions involved topographers, surveyors, geologists, botanists, and photographers, who together mapped and reported on almost every mountain and valley of Colorado's western slope. A relatively minor military

expedition compared to those of Hayden's was led by George Montague Wheeler, who was sent to map portions of the country west of the 100th Meridian. The only significant contribution made by this company was by Lt. William Marshall. He developed a toothache while camping in Baker's Park in the San Juans, and in a successful attempt to return rapidly to Denver for treatment, he and companion Dave Mears crossed and recorded a pass that cut off 125 miles from the Cochetopa Pass wagon route. This pass, which still bears Marshall's name, was first used by Otto Mears as a toll road, then as the maiden route of the D&RG Railroad into the Gunnison area and onto the western slope.

2.2 The Utes and Mining

In July of 1859, mineral discoveries in the Dry Creek and Cherry Creek areas prompted a burst of activity along the Front Range and in the mountain parks of the Colorado Rockies. The white influx was so great that only two years later, in 1861, the Territory of Colorado was created. Pressure on the Utes' eastern borders led to a treaty conference with the United States in 1863. Held in Conejos, the conference attracted only the Tabeguache in sufficient numbers for negotiations. This was the first treaty to formally specify Ute boundaries, creating in effect the first Ute Reservation. The area agreed upon was bounded roughly by the Uncompahgre River on the west, the Colorado and Roaring Fork Rivers on the north, the Sawatch and Sangre de Cristo Mountains on the east, and the Rio Grande and the Continental Divide on the south (Hall 1895:60). The reservation was to be home for the Tabeguache and the Moache.

The 1863 treaty failed to remove the Utes from many desirable areas, however, and in 1868 representatives of all the Colorado Ute bands met in Washington, D.C., to discuss yet another agreement with the United States. The resultant 1868 Treaty placed the entire population of the Colorado Utes in an area about one-third the size of Colorado. The reservation boundaries were defined as the 107th degree of longitude on the east, a line 15 miles north of the 40th parallel of latitude on the north, the western border of the Colorado Territory on the west, and the southern border of the Territory on the south (Rockwell 1956:72). An agency for the Northern Ute bands was established on the White River near the present site of Meeker. Another was to have been established on the Los Pinos River, but the Tabeguache insisted that it be located on Cochetopa Creek instead. Since this agency was so distant from the Southern Utes, they continued getting supplies at their established agency in New Mexico.

In the first years of the 1870s, gold and silver discoveries in the San Juans precipitated another rush onto Ute lands--lands promised by the United States to remain forever in possession of the Utes by the Treaty of 1868. Despite efforts by government troops to keep the prospectors and miners out, they poured into the mineral-rich areas of the reservation (Rockwell 1956:96). Great political pressure was brought against the government to negotiate another treaty whereby the Utes would relinquish the gold- and silver-laden mountains. A meeting was held in August 1872 where, under the leadership of the Tabeguache spokesman Ouray, the supposed negotiations turned into a moral victory for the Utes, as treaty violations and other injustices were pointed out to the government commission. The commission returned to Washington without a new treaty.

The following year, another commission convened and a new treaty was agreed upon. It was called the Brunot Treaty, and by its enactment in 1874, the Utes ceded their rights to the San Juan country to the United States, an area of approximately four million acres. They relinquished most or all of the present

counties of San Miguel, Dolores, Montezuma, La Plata, Archuleta, Ouray, Hinsdale, and San Juan but kept their rights to most or all of the present counties of Rio Blanco, Garfield, Mesa, Delta, and Montrose, as well as parts of Gunnison, Pitkin, and Eagle Counties (Rockwell 1956:99). In 1875, the Los Pinos Agency (originally on Cochetopa Creek, then renamed Los Pinos Creek) moved to the Uncompahgre Valley 12 miles south of present Montrose, and reservation activity began to center in this area.

Having retained hunting rights on their ceded lands, the Utes continued to roam throughout western Colorado after the Brunot Treaty. However, many Utes, particularly those in the White River country, were very bitter about Ouray's giveaway of their lands to the whites, and plans were begun to overthrow him (Rockwell 1956:99). As more and more settlers poured into the region, hostilities between the Utes and whites intensified. Hostilities bloomed into violence at the White River Agency in the fall of 1879 where twelve whites where killed and the Utes fled their reservation.

The Meeker Massacre, as the event quickly became known, aroused not only the (white) people of Colorado but the entire nation as well. A congressional investigation of the violent outbreak led to the Treaty of 1880, which stipulated the removal of the White River bands to the Uintah Reservation in northeast Utah. The Uncompahgre band was to be given a small reservation in the vicinity of the confluence of the Colorado and Gunnison Rivers. Aware of the value of these agricultural lands, however, the commission charged with enforcing the terms of the treaty, under the direction of Otto Mears, manipulated the location process using a loophole in the treaty language, and the Uncompahgre were given lands in Utah near the Uintah Reservation. The Southern Ute bands were left on the small reservation in southwest Colorado that had been given them by the Treaty of 1873. On 1 September 1881, the last of the Utes were moved to their new reservations in Utah, and western Colorado was opened to the whites.

2.3 Early Mining and Settlement in the San Juans (1848-1870)

The discovery of gold in the mid-nineteenth century in Colorado was the main impetus for the settlement of the state, particularly for its mountain region. Precious metal was probably first discovered in the San Juan mountains in 1848 by a member of the Fremont party, but the discovery apparently was not followed by any search for mineral deposits (Henderson 1926:50). The 1858 gold strike by the William Russell party on Dry Creek, near Cherry Creek and on the South Platte River, brought thousands of placer gold seekers to Colorado. Prospectors followed the tributaries of the Platte River westward into the Rocky Mountains.

Placer mining is labor intensive but requires little capital or skill (Young 1970). Gravels are dug from the streambed and glory holes near the streams and then washed with water. Gold, which is heavier than the sand and gravel materials it is found with, is settled to the bottom of the device used to wash it, and can then be recovered by hand or mercury. The placer mining tools are technologically simple and inexpensive. They include a pick, shovel, pan, sluices, rockers, and long toms.

In 1860, Charles Baker and a small group of placer miners followed-up on the reports from the Fremont party. They explored in the vicinity of Silverton, establishing a camp at what was known as Baker's Park (O'Rourke 1980:59). As Baker promoted his placer finds, a small rush developed in the Spring of 1861. Up to 1000 miners advanced into the area by moving along a toll road up the Animas River to a town site,

both of which were constructed by Baker and his associates. However, the placer deposits and the rush fizzled by the fall. While the placer craze passed quickly in the San Juans, it did lay the foundation for future growth.

2.4 Opening of the San Juans (1870's)

Despite the early setbacks by placer mining, interest in the San Juans minerals persisted. During the early 1870's, it was determined that the mineral wealth in the San Juan mountains lay in the veins exposed on the mountain slopes and not the placer deposits. An initial flurry of exploration, prospecting and subsequent mine opening occurred. Most San Juan claims were filed on during this decade: 122 lode and 8 placer claims were filed within weeks after the organization of one mining district. This time was witness to tremendous change in Hinsdale County, as the region progressed from virtually uncharted territory to a developing area with settlements and commercial ventures that rivaled others in the state.

Three basic ingredients are essential for creating a major mining region: profitable mineralization, capital, and economical and reliable transportation (Smith 1982:18). By 1879 valuable surficial mineral deposits had been uncovered, making this point academic. Capital, to develop claims, construct smelters, underwrite mining expenses and maintain settlement had to be located. Without economical, year-round transportation, the cost of living would remain high, only the smaller deposits of high-grade ore could be mined profitably, and potential investors would tend to shy away.

Two pivotal political events occurred in the early part of the decade. First, the U.S. Congress passed the Mining Act of 1872. The new law formalized the rules for operations and claims. One of the provisions of the law was patenting claims to secure title. After a claim was filed, assessment work amounting to $100 had to be performed each year or the claim was forfeited. Most San Juan claims got no further; however, if the owner thought the property especially valuable after an outlay of at least $500, he could apply for a patent. This generally required a lawyer's help and involved a survey, patent notice publication in the nearest newspaper, sworn statement of ownership, and finally, if no adverse claim was filed, payment for the property at five dollars an acre. Only then was the claim safe; it was a bothersome procedure in the short run, but much cheaper over the long run. The second major political event was the enactment of the Brunot Treaty in 1874, which removed the Utes and the threat of conflict with miners from the San Juans.

Despite the presence of the Utes during the early 1870's, miners continued to prospect for gold. In the Lake City area, the Ute and Ule (name later changed to Ulay) Mines were discovered and claimed by Harry Henson, Joel Mullen, Albert Mead and Charles Goodwin in August of 1871 (Irving and Bancroft 1911:13). This mine complex was later bought and expanded by the Crooke Bros in 1876 (Henderson 1929:51). Other miners prospected Hinsdale County including Albert Burrows in 1873 who made a claim in the park to be named for him (Houston 1976). But early exploration in the county did not produce the results that would be seen later.

In June 1874, Hinsdale County was formed from Costilla, Conejos and Lake Counties. In hopes of capturing trade from San Juan City, the first Hinsdale County seat, merchants in Saguache (including the famous Otto Mears) formed a group to engineer and build a toll road from Lake San Cristobal (near present day Lake City) to Baker's Park (near Silverton) via Cinnamon Pass. Building got underway in August. During August, Enos Hotchkiss, while heading the road construction, discovered a rich gold vein now known as the

Golden Fleece and named it the "Hotchkiss" claim (Irving and Bancroft 1911:13). He and his compatriots loaded about $18,000 in ore on their wagons and headed back to Saguache. As news of the strike spread rapidly, Lake City blossomed. Hotchkiss with others incorporated the town in 1875, and the county seat was moved there. Of these early claims, the Ute-Ulay and Golden Fleece Mines proved to be two of the main producers in Hinsdale County.

Spurred by rich surface deposits, Lake City was one of two major commercial centers in the San Juan region to come to prominence in this decade. Blessed by a lower and more sheltered location than the nearby camps, Lake City was nestled in a valley large enough for ranching and farming. Water power for smelters and other industries flowed past its doorstep. Lake City also provided the best route to the towns of the eastern slope, via Saguache. Soon, a network of roads fanned out, spokes from a business hub, tapping all nearby mining districts in the very heart of the San Juan mountains. However, the farther the mine was situated from Lake City proper, the higher the freighting costs and generally worse the road; e.g., when reaching Burrows Park on the western edge, the costs and isolation increased substantially. One of the most important roads in the area was the Lake City and Uncompaghre Toll road built between Lake City and Ouray along Henson Creek by the Abbott brothers, Garbott and Woodward (O'Rourke 1980:68-69).

The town's founding fathers did not waste these attributes, parlaying them shrewdly to their advantage in the mid-1870s. As a regional center, Lake City served the outlying camps that were developed to meet the needs of the miners. The opening of mining camps such as Rose's Cabin (1874), Sherman (1877), Capitol City (1879), Carson (1882), and Tellurium and Argentum (1875) reflected the influx of miners into the areas where mining exploration indicated continued production (O'Rourke 1980:64). The early mining camps and towns in the San Juans were isolated, a condition due mainly to the terrain and climate. Isolation did not produce the self-sufficiency one would expect. Foodstuffs and other commodities had to be imported from the nearest railroad terminals (Canon City and Alamosa). Ore also had to be valuable enough to warrant the cost of shipping and refining. Therefore, roads were vital to the economic development of the region. The camps themselves were dominated by the emerging business class. The business district, the camp's heart, would be one of two types: the generalized one of the "little hamlet" or the more specialized one of the larger settlement.

Although some variations do occur, building and community development associated with the precious metal mining followed a general sequence of stages. In the initial stage the organization as well as the construction within the settlement was rudimentary. Development was sparse and limited in scope. Entire settlements and town plans often consisted of only three or four streets. The pattern and location of buildings were influenced largely by the terrain or other natural features, and most of the buildings were concentrated along the main thoroughfare which led in and out of town. The majority of the original buildings in a settlement were residences, which were usually small-sized and made of log or rough-cut lumber. Interspersed among the dwellings were a few commercial establishments that were also simple wooden structures. Early businesses were geared to the predominantly male populations of the mining settlements and included saloons, general stores and food and lodging accommodations. Often times, a single commercial building housed a variety of enterprises (Abele 1989:F-Apt-8).

Mining began as an individual effort, but many miners quickly realized that capital was required to sustain the recovery of the generally low-grade ore from the mine and to finance the milling and shipment of

the processed ore to market. Although individuals continued to pursue their dream of "the strike" and either explored on their own or continued to operate a mine with little if any help, it was the larger, commercial ventures that provided the long-term economic viability in Hinsdale County. Mining operations generally follow four stages: 1) Prospecting, the search for mineral deposits; 2) Exploration, the work involved in assessing the size, shape, location and economic value of the deposit; 3) Development, the work of preparing access to the deposit so that the minerals can be extracted from it; and, 4) Exploitation, the work of extracting the minerals. The stages can occur consecutively or may only be carried through the first one or two stages.

After a mineral deposit was identified, the principle means of exploration and initial development was the adit tunnel, which was short and easily operated. As depth was gained, however, long crosscut tunnels became necessary and these often proved disappointing. Several properties developed the veins by inclined shafts following the general dip of the vein. Most initial mining endeavors were conducted by individuals and were limited. A mine developed to a depth of forty feet was considered a going concern. Driving a tunnel into a hillside looked to be so much easier, a cheap way to tap veins and drain a property. Other so-called mines, holes blasted a few feet into a hillside or shafts just barely below the surface, proved to be rich only at the surface, and soon were abandoned or put on the market. Here, as elsewhere, the majority of the original locators did not have money for long-range development.

As the miners dug, they first encountered the secondarily enriched ore near the surface where water and weather had leached out many impurities, leaving easy-to-work ore. As they went deeper, they sooner or later encountered what was described as refractory ore, which could not be profitably milled with the methods at hand. Despite high assay reports, the mills proved unable to save the ore or could not work it at a profit.

In a pattern that has been played out throughout the history of the area, the larger mines were the major producers, however, they provided only short-lived bonanzas. The Golden Fleece (a gold mine in a mostly silver region) hit a vein inconsistent in value, and soon declined. As early as 1877, it was being described as a famous mine where work would soon resume, a sure sign of adversity. The Ute and Ulay (a pair of mines eventually worked as one) were to have a much more distinguished career but not in the 1870s, when inexperienced management, high development costs, and inconsistent ore deposits put them into periodic trouble (Smith 1982:24).

San Juan mountain ores, diverse in their mineral complexity, stubbornly refused to yield to simple reduction methods, a characteristic that earned for them the terms "rebellious" or "refractory." Two avenues were open for finding the best method. The ore could be shipped out for testing by various processes to find the one that would save the largest percentage of its assayed worth. Or a process could be brought in which it could only be hoped would be successful, or at least modified to work. Smelting, the reduction of metals by heat in a furnace, seemed to be the best available solution.

Silverton, closely pursued by Lake City, struggled to become a smelting center. The first smelter was a lead-based smelting operation which concentrated the ore, removing the gangue or worthless matter. The concentrated ore, called matte, was then shipped elsewhere and processed to completely separate the silver, lead, and small quantities of gold and copper. It was found that many local ores were unsuited for this process simply because there was not enough lime available for flux. In addition, the high costs of coal and coke (often

of poor quality despite the price) and freighting meant that operation expenses ran high and success low. A solution to overcome the ore shortage was the combination of mine and smelter into one company.

This idea was adopted at Lake City by the Crooke Brothers, who ran the most successful smelter in the 1870s. The Crookes, who owned a smelter in New York City, had solid financial backing and experience. Contemporary mining reporter Frank Fossett credits them with being the first eastern capitalists to show real interest in the San Juan mountains (they invested in the Lake City and Summitville districts). That interest had been whetted by favorable reports from the area, and their expectations were confirmed by a personal visit by John Crooke in 1876. That same year, they built a concentrator south of Lake City and shipped its products to New York to be refined. The process was improved in 1877 with the addition of reverberatory furnaces, which would separate silver from the lead bullion without shipping it elsewhere. Broadening the company's involvement, they purchased mines, including the Ute-Ulay. Because of their previous experience, sound financial structure, and conservative approach, plus Lake City's better transportation, the Crookes were able to succeed. Fossett estimated that $112,121 in bullion was produced in 1879 (Smith 1982:27).

Based on the Crookes involvement in the area, the year 1876 witnessed the peak of the first boom with the continued expansion of production and increased settlement in Hinsdale County. Smelters were built at Silverton, Ouray and Lake City, without consideration of process, ore type, or ore availability. Scattered throughout Hinsdale County were other smelters including the Lee Smelter at Capitol City, and the Ocean Wave and the Van Gieson Lixiviation Works at Lake City. Several floundered from the start and a few went through a trial and error period before righting themselves. The Lixiviation processing method gained a measure of popularity. It was based upon roasting the ore, then introducing various salts to leach or wash out the base metals and precipitate the silver. However, Lixiviation had its problems. Imperfect roasting resulted in the production of silver chloride that was poorly suited for chemical reduction. Less importantly, the process also had difficulty producing silver bullion free from lead (Irving and Bancroft 1911:13).

For a time, local mining interests suffered because of high reduction costs and low returns. A problem encountered by the miners was the inability of local smelters to pay for ore at a price close to its assayed value (Smith 1982:27). The smelters discounted for their profit margin, for transportation expenses, and for the expected loss of the minerals during processing. The smelters were also suffering because of the lack of ore. Due to the mining costs and low prices, the miners could only afford to sell high-grade ore, leaving the bulk of their labors on the dump. The solution was concentrating mills because they allowed lower-grade ore to be profitably mined, then concentrated into a form that could be economically shipped to the smelters. In this way, low-grade ore was saved from the dump, and the mine's life was lengthened. Consequently, concentrating mills appeared everywhere.

An increasingly common phenomenon during this time was the creation of towns in anticipation of a rich strike and an associated demand for development in the vicinity. The fate of these speculative communities varied considerably. Many of them never progressed beyond the planning stage because their economic reason for being never materialized; but others were more fortunate due to discoveries of substantial mineral deposits that supported the speculative land ventures. The experience of the majority of the settlements that were established in the late 1800's fell somewhere between these two extremes. Some enjoyed a limited period of growth as mines were "salted" or other hoaxes kept alive the hopes that mineral wealth would be forth-coming. The longer lived communities sustained brief periods of mining prosperity and then

turned to other forms of economic activity for their primary support. The specific pattern of building in the different towns mirrors the ups and downs of the mines in their vicinity (Abele :E-5).

The 1870's in Hinsdale County produced a long trend of alternately increasing and decreasing mineral production and settlement. This is best illustrated at the close of that decade by the discovery of the Frank Hough mine on Engineer Mountain and the incorporation of Capitol City (1877) located at the junction of Henson Creek and its North Fork tributary. By 1879, neither had met their original expectations; and when the contagious excitement of their opening months waned, Lake City's mining was left in the doldrums and barely able to maintain its regional leadership. By 1880, the local smelter boom had also past because Lake City's troubles rested with its mines, whose ore only tantalized but did not sustain consistent production. The reduction of silver ore was troublesome to miners, who did not understand how to reduce it economically and profitably from ore to bullion. To compound the problems, Leadville was diverting much of the capital and interest from Hinsdale County and other areas.

2.5 Decade of Promise and Disappointment (1880's)

During the 1880's, Colorado became the number one mineral producer in the nation, despite the short lives of even the largest of the mining centers, as witnessed by the fall of Leadville and rise of Aspen. As the decade progressed, the price of silver declined, leading to growing concern about the vitality of that mineral. The decade also saw the regionalization of the smelting industry with the primary centers in Leadville, Denver, Durango and Pueblo. The events in Hinsdale County reflected that of the state. The decade opened with the largest mining boom in the County, but it was short-lived and by mid-decade production had come to virtual standstill.

Moving toward modernization with the need to grow from frontier camps into stable communities, mines and mining towns succeeded or failed in the period after 1881 according to their ability to procure for themselves electricity, a modern communications system, railroad transportation, and agricultural produce. The pace of development in Lake City reflects that of the decade as the population reached its all-time high of 865 in 1880 (Table 1).

Electricity played a large role in a town's development, and it was a symbol of civic pride to possess this modern marvel. In 1880, George W. Crowe generated sufficient electricity (hydroelectric power) at his Ocean Wave Mill to supply Lake City. However, an electric light system in Lake City was not added until 1891 because the early systems were based on direct current (DC), which was limited to 700 volts (Rickard 1902:697). The later use of alternating current (AC) had no voltage limit and used one sixteenth the amount of copper in the wires. Despite the limitations of DC, electricity not only benefitted the mining engineer and miner, but with the advent of the telephone, the communications gap was closed between mine, mill and town. In the early 1880's, telephone lines were strung between Lake City and Silverton, and connected the communities of Capitol City, Rose's Cabin, Ouray, Mineral Point and Animas Forks (O'Rourke 1980:66). It also improved the health of the men by assuring better safety, because a doctor could be secured in half the time.

TABLE 1. U.S. Census results for Lake City and Hinsdale County.

YEAR	LAKE CITY	HINSDALE COUNTY
1880	865	1487
1890	607	862
1900	700	1,609
1910	405	646
1920	317	538
1930	259	449
1940	185	349
1950	141	263
1960	106	208
1970	91	202
1980	206	408
1990	223	467

While the ore was present in the San Juan mountains, the cost of transportation to and from the mines strongly determined their economic fate. The development of a transportation system was severely hampered by the steep, rocky terrain, short summer season and threat of snowslides in winter. The long winter season with their deep snows either eliminated or drastically limited travel to the high altitude mining operations. Much of the travel in winter was by foot. The cost of shipping freight by wagon could account for up to half the cost of shipment. In the 1890's, freight cost on the average $.25/ton/mile to move. Lumber for mining and residential use cost $23.50-$26.50 per thousand feet, and $7.50 of that cost was for freight. A four horse team with wagon could transport a maximum load of 6,000 lbs (including the wagon), at 1.5 mph at a grade no steeper than 12 percent. Where the grade exceeded that the shipment had to occur via mules or donkeys. While mules could generally pack a larger load than donkeys (250 lbs upgrade and 350 lbs downgrade for mules vs 200 lbs both ways for donkeys) they required much more handling and fodder. The cost of this type of freighting was about $.75-$1.00 per ton per mile one-way, but this amount dropped if there was a return load (Rickard 1902:692-695).

The extension of railroads during the 1880's and 1890's into southwestern Colorado mirrored similar developments in the Central Rockies and eastern Colorado. The last two decades of the nineteenth century witnessed the remarkable expansion and consolidation of American industry. With rail lines that reached into southwestern Colorado came many of the characteristics associated with this national phenomena. Directed primarily at the region's growing mining industry, the entrance of investment capital, industrialization, and scientific innovation gave rise to a period of growth and transition (O'Rourke 1980:98).

The D&RG Railroad was built into the San Juan's in 1881 with the intention of capturing the region's ore transportation market. But the construction of a spur into Lake City was anti-climatic. A grade was under construction from Sapinero to Lake City in 1881, but was abandoned by 1882 (O'Rourke 1980:94). Lake City remained isolated without rail transportation until 1889, which limited the growth of mining in Hinsdale County by making shipping more expensive than surrounding centers and led to the closing of the Crooke's smelting operations in the mid-1880's. The depression that hit the County at this time was due not only to the lack of a rail spur but also to the consolidation of smelting processes into other regional centers including Leadville and Durango.

William Palmer, owner of the Denver and Rio Grande Railroad, and English financier William Bell saw this as an opportunity. Viewing the strategic location of Durango in relation to the Silverton mining district, the idea of building a smelter there was contemplated even before the railroad reached this destination. The businessmen moved to consolidate their holdings in local coal mines not only for fueling the trains but also for processing ore. Then in the summer of 1880, Palmer and Bell incorporated the San Juan and New York Smelting Company, and immediately acquired the Silverton smelting works owned by George Greene and Company. Palmer and his associates also purchased a limestone quarry because they wanted their enterprise to own everything required for reduction except the ores, which would come from the San Juan mining country. After converting the Silverton facility into a sampling works where ores could be evaluated before shipment, the San Juan and New York Smelter was built at Durango in 1882 (O'Rourke 1980:101).

A promising development during the early part of this decade, was the single ownership of mines and smelters, which seemed attractive if the mine could produce enough to absorb the lion's share of a smelter's operation. Mills and smelters were located to best take advantage of the two requisites to success: ore and water, and in the case of Hinsdale County that meant along the lower slopes of the major valleys. Also, smelters required coking material which was either limestone, charcoal or coal. Mills could be located at a major mine, such as the Ute-Ulay or in the vicinity of a major ore body or group of producing mines, such as the Empire Chief, Tobasco or Palmetto Mills. Other major mills in Hinsdale County include the Ocean Wave, Moro, Pelican, El Passo, and the Gunnison (in Burrows Park). Smelter locations are more centralized in relation to the mines they serviced. Major smelters include the Crooke and Lee's.

Two of the biggest producers in Hinsdale County, the Palmetto and Frank Hough mines on Engineer Mountain and the Ute-Ulay mines on Henson Creek, illustrate three overlying characteristics in the development of mining in the region: the trend towards consolidation of ownership of mining and milling, the ephemeral nature of even the best of mineral deposits, and the rapid change in economic conditions in mining. In 1880, the Palmetto group of mines and mill on Engineer Pass began production, with a 15-stamp mill, processing ore from the nearby Palmetto mine. Four hundred tons of ore were extracted and treated at the Palmetto mill by the amalgamation process, yielding $18,480. At the same time a nearby mine, the Frank

Hough, shipped sixty tons of ore with an average value of about $125 per ton. Another large consolidated operation was the Crooke Mining & Smelting Co., and the Polar Star mine and Ute-Ulay mines. They supplied the Crooke's mill to their full capacity with the first-grade ore going to the smelter, and the concentrates to Pueblo and Denver. The Palmetto, Crooke and Ute-Ulay mills continued at full production into1884 when they closed due to a dramatic decline in mine production (Henderson 1926:51).

Then between 1888 and1890, the San Juan and New York Smelting Company improved its plant at Durango by installing new roasting ovens, and enlarged and modernized its blast furnaces. As a result of these innovations, the smaller mountain smelters could no longer compete with the newer facilities due to the falling prices returned for silver and the higher reduction costs. By1889, there was very little silver production in Hinsdale County (Henderson 1926).

As silver production declined in the second half of the decade, a shift towards base metal production began in the state. The first recovery of zinc ore occurred in 1885, and lead reached a peak of production in the state in 1889. It was during 1887 that Aspen began to attain its prominence in lead in the state, and its production began in earnest in Hinsdale County, particularly at the Ute-Ulay, Vermont and Yellow Medicine mines (ibid.).

Figures 2 through 6 are graphs of gold, silver, copper, lead and zinc ore produced in Hinsdale County (after Henderson 1926). The graphs illustrate the cycles of the mineral boom and busts and the shift from silver and gold production to base metals prior to and following the twentieth century.

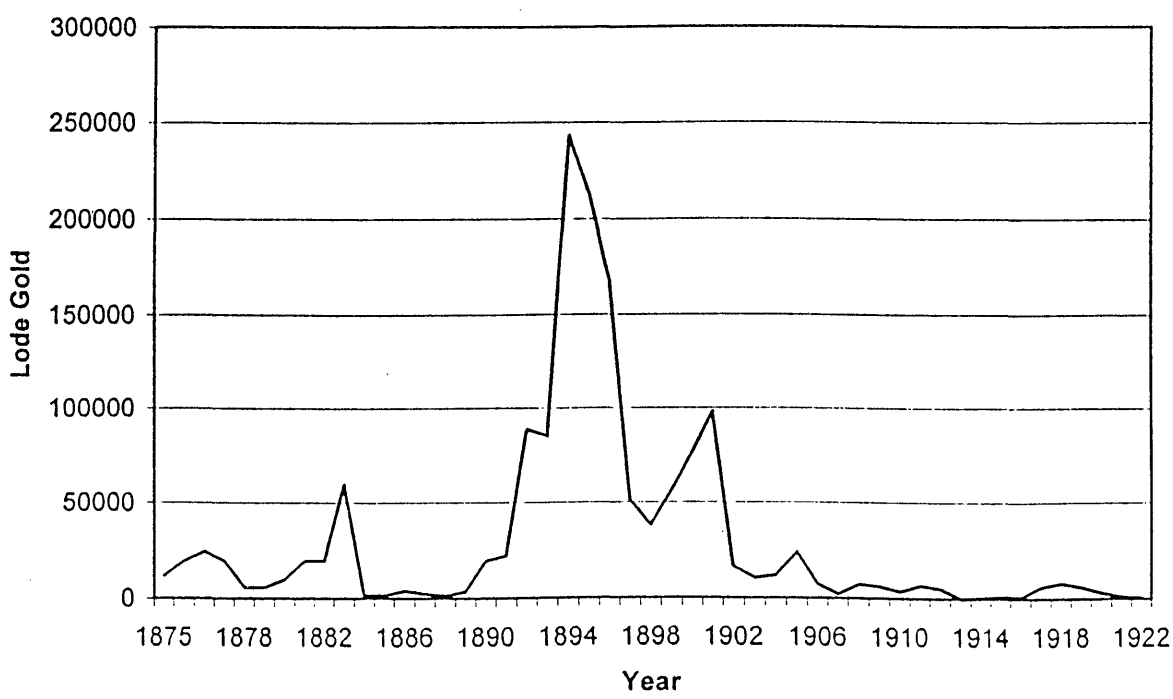

Figure 2. Hinsdale County gold production for the period 1875-1922.

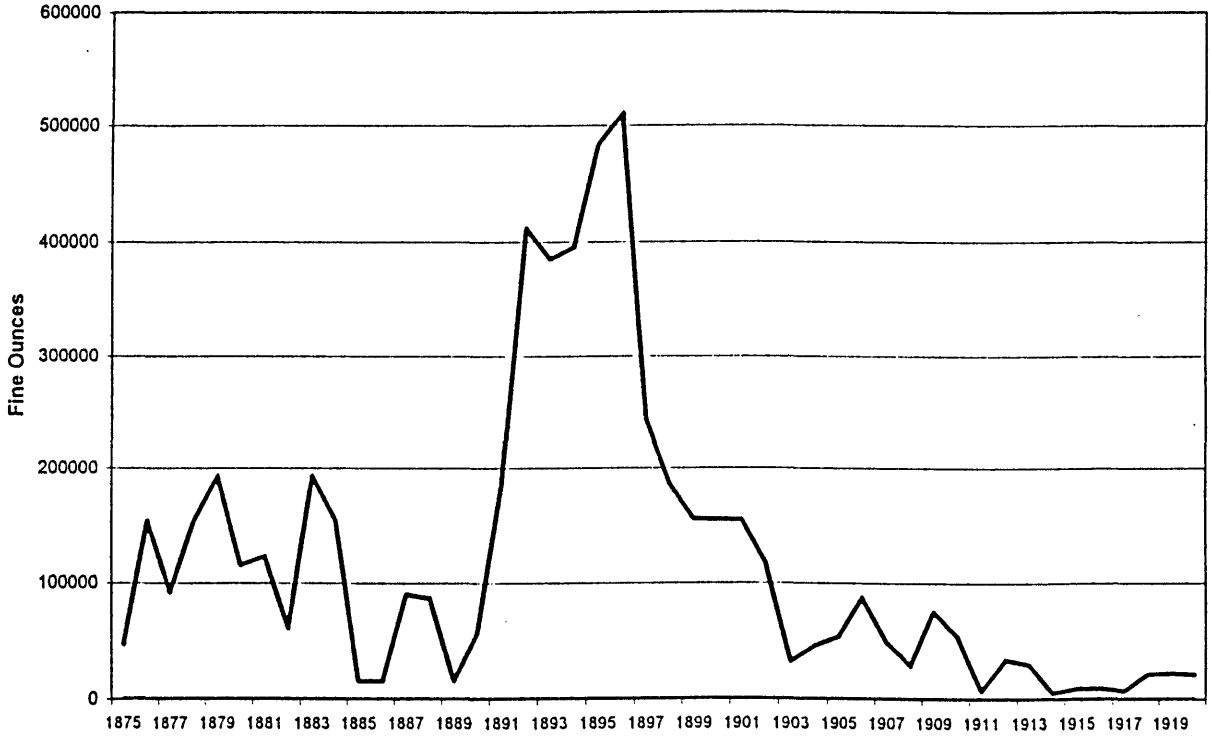

Figure 3. Hinsdale County silver production for the period 1875-1922.

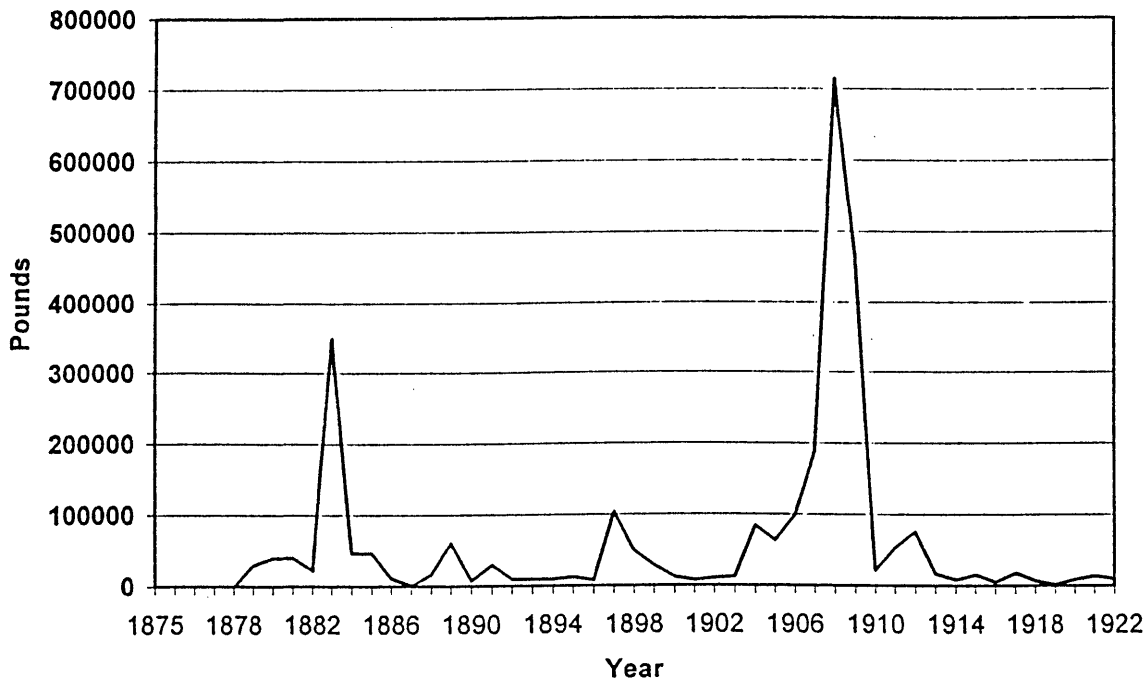

Figure 4. Hinsdale County copper production for the period 1875-1922.

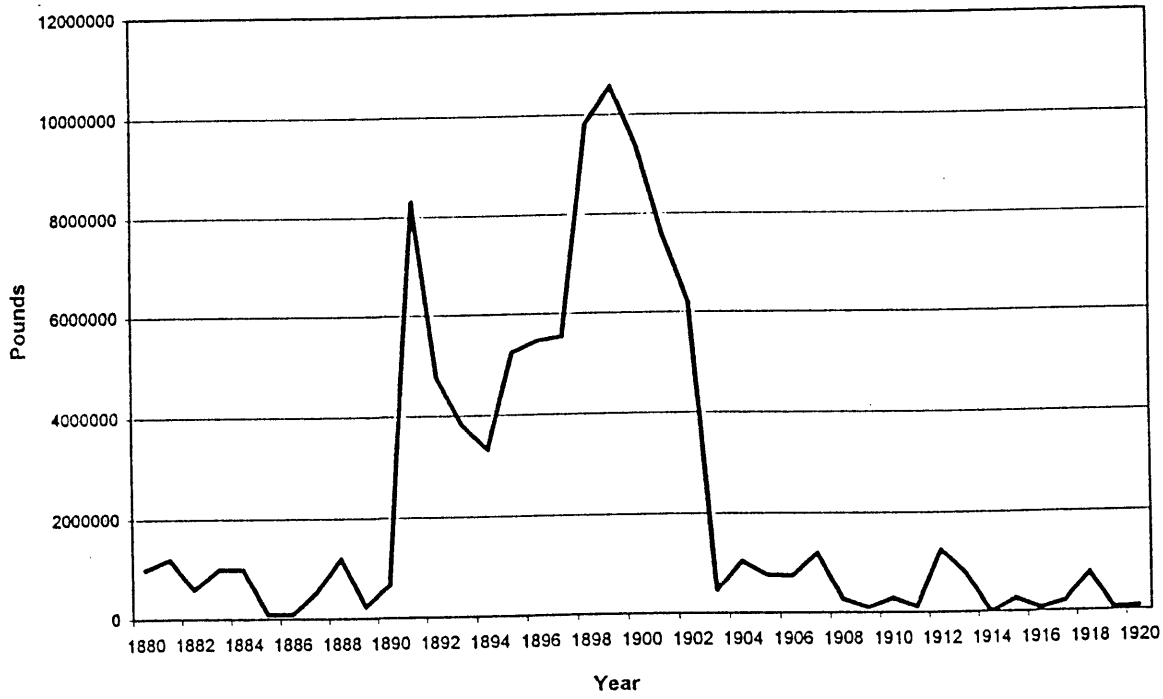

Figure 5. Hinsdale County lead production for the period 1875-1922.

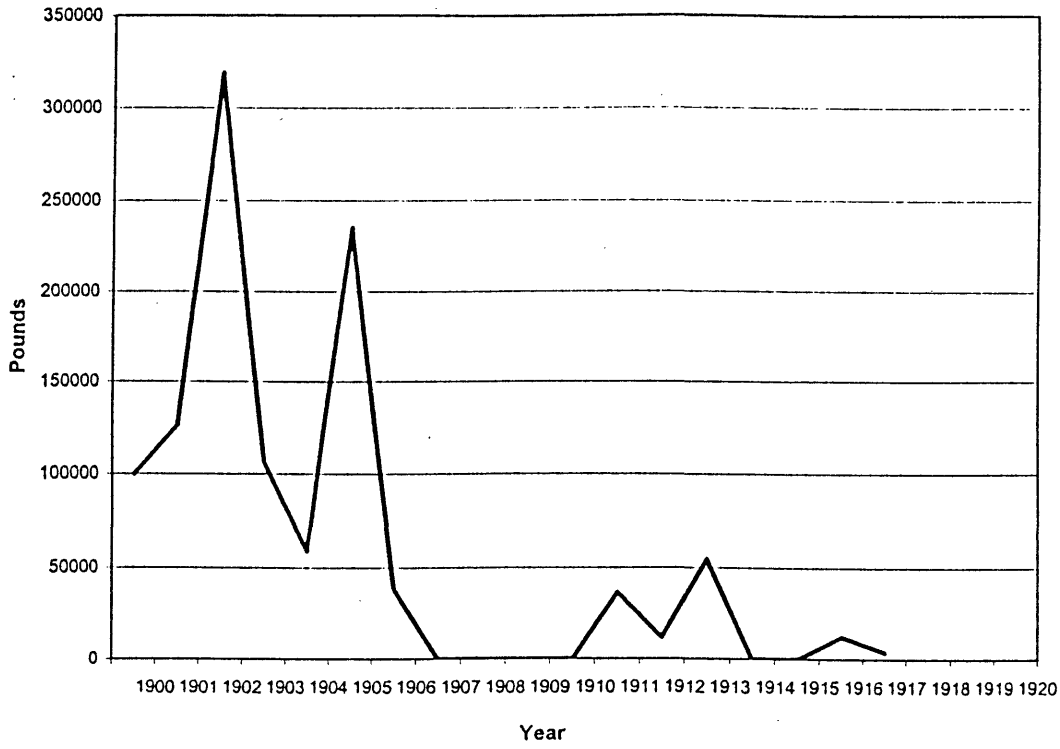

Figure 6. Hinsdale County zinc production for the period 1875-1922.

2.6 The Gilded Age (1890's)

The long awaited arrival of the D&RG in 1889 set the stage for the mining expansion in Hinsdale County during the 1890's. The location of railroad routes and shipping points in proximity to successful mining regions facilitated the transportation of ore and promoted the growth of localized milling and smelting industries. With more efficient and less expensive forms of transportation, larger quantities of ore could be shipped, and the machinery to process that ore could be easily imported to the mining centers of the region. Coupled with a find of very rich ore at the Golden Fleece mine–a single car of petzite ore from there reportedly yielded $50,000--a boom period was initiated that lasted about ten years.

In 1890, about 20 mines in the Lake City quadrangle were shipping ores. The first mines to ship ore by rail from the county were the Hidden Treasure, Independence, High-Muck-a-Muck, and Virginia. (Coincidentally, these mines were also the last to ship by rail.) West of Lake City, mining activity intensified on Engineer Mountain at the head of Henson Creek. There, the Polar Star, Ben Butler, and Frank Hough mines were worked and their ore processed at the fifteen stamp Palmetto mill, located at the confluence of Henson Creek and Palmetto Gulch (O'Rourke 1980:99).

Mineral production in Hinsdale County mirrored the high levels of that of the state during this period. In 1891, the Ute-Ulay alone produced over $400,000 worth (Meadows 1959:e). The production of gold, silver and lead reached all time highs despite an economic crash and devaluation of silver prices. The gold and silver production of Hinsdale County in 1897 of over 500,000 fine ounces each was unequaled in later years. Lead ore production had an earlier and shorter lived burst of activity in the period of 1890-1891 when it hit 10,000,000 pounds. (Henderson 1926:128).

During the late 1800s, Colorado gained national recognition as its mineral production generated millions of dollars. Investors, eager to share in this wealth, poured large sums of money into the state. With this influx of capital, metal mining began to develop into a full scale industry. Exploration activities were stepped up. Earlier random methods of prospecting were replaced with systematic surveys based upon an understanding of geology and scientific methods. Mining operations became sophisticated as capitalistic business practices and an assortment of personnel became commonplace. This expansion and the evolution of the mining activities was directly expressed in the growth of the communities in Hinsdale County, the percentage of county residents hit an all time high in the late 1890's, although the population in Lake City was lower than that during the 1880's (Table 1).

At the same time the railroad facilitated ore production, scientific advances improved mining techniques. The introduction of hydroelectric power to light mines and mills, and the use of electricity to operate power drills, dramatically altered the nature of the mining industry. Geologic expertise was utilized to locate and identify types and quantities of ore. A more complete understanding of chemistry and geology prompted the introduction of revolutionary reduction processes, whereby base metals could be more easily separated from complex ore.

Until the early 1890's, there was nominal gold production in southwestern Colorado (Henderson 1926). A profound new development occurred in 1887 and came into common use during the next ten years that made obsolete every mill and process previously used to extract gold (Young 1970:283). Known

as the cyanide process, it was a method whereby gold or silver could be more easily separated from low grade ores, or those with a low percentage of valuable metals. Simply stated, the cyanidation process involved treating finely crushed gold-bearing ores with solutions of sodium or potassium cyanide. The solution in which the gold dissolved was deposited upon zinc or copper plates, where the valuable metal precipitated. With this process, gold producers could recover profit from previously discarded ores. Shipment of low grade ores to modern processing plants was made feasible by the availability of railroad transportation (O'Rourke 1980:100).

In the 1880's, electricity and its possible uses in mining was beginning to be considered. Too new to make much of an impact, it had limited use until the 1890's when year- round operations, at least on the larger properties, became relatively standard. The ability to transport alternating current made the use of electricity viable in the 1890's because the amount of power (voltage) could be significantly increased without raising the cost of transportation (Smith 1982:99).

Other technological innovations also eased the miners burden. A modification in the construction of ore chutes by putting the logs butt end out rather than sideways-seems immaterial, yet they wore longer and allowed passage of heavier rock down the chutes. Power drills came into more general use, especially in the larger operations, while compressors became larger, able to operate more drills. Wet drills also came into common use in the large mines which reduced the incidence of silicosis and miners consumption thus improving the health of the miners. Cages, carried by improved steel cables and run by more powerful engines, replaced earlier hoist buckets. Finally, the safety cage, with a safety brake, overhead roof, and mesh on the sides, provided the miner with a degree of protection never before experienced (Smith 1982:100).

A national financial crash occurred in 1893 (Smith 1982:92). It and the following depression was the worst the United States had yet suffered. It brought hard times that were too easily and erroneously blamed by many easterners on the Sherman Act, which they claimed depleted the treasury of its gold to buy silver. President Grover Cleveland agreed, and together they had enough votes to repeal the act during a special session of Congress in 1893. The market for that metal completely collapsed after the government discontinued its policy of purchasing silver at set prices; the price of silver promptly plunged to sixty cents per ounce, a drop of twenty cents in four days. Economical ramifications appeared immediately. The decline of silver production created numerous personal hardships, businesses went under, and silver towns such as Leadville declined or were deserted (O'Rourke 1980:100).

Mines shut down or curtailed production, laying off miners and adversely affecting Colorado's entire economy. Colorado, hard hit, fought to redeem silver, and the silver question boiled. A higher price for silver was desired that would be based on parity with gold at 16 to 1, and the assurance of a government market, if the world market could not absorb production. Business throughout the San Juans declined sharply, whether in the neighborhood store or on the railroads, followed by inevitable failures and bankruptcies. The gloom grew darker during the winter of 1893-1894. Otto Mears spoke for many when he wrote that it was impossible to work silver mines with present prices, and that the shutting down of mines meant the closing of many enterprises affiliated with them.

The collapse of silver sparked a new search for gold, a search that in the San Juans softened hard times and eventually stabilized the regional economy (Smith 1982:92). Many of the larger mines, particularly Telluride's, which yielded both metals, had been less drastically hurt. By mid-decade the changeover was

noticeable. Gold mining was coming on strongly, while silver production came to be centered in bimetal districts where the emphasis simply changed from silver to gold. For Hinsdale County the annual production of silver, lead and gold had reached nearly three-quarters of a million dollars by 1895. This was produced primarily from the Golden Fleece, Ute-Ulay, Hidden Treasure, Vermont, and Yellow Medicine Mines (Vanderwilt 1947:440).

In the period following 1895, gold mining was centered primarily in the established centers of San Miguel, San Juan, and Ouray Counties. In the five years from 1897 to 1901, gold production of these counties alone approximated $20 million, or one- sixth of the entire State's output for those years. From 1898, the significant gold mining operations of southwestern Colorado were located mainly in the Telluride District of San Miguel County, and came from the mines of three major companies, the Tomboy Gold Mines Company, the Liberty Bell Gold Mining Company, and the Smuggler Union Mining Company (ibid). Although the majority of operations were located in the western San Juan region, Hinsdale County mines did show some gold production during this period. Peak production occurred in 1895 and 1896, particularly at the Ute-Ulay and Hidden Treasure mines (Henderson 1926). During the following year, 8136 ounces of gold, 243,437 ounces of silver, 4 tons of copper, and 2775 tons of lead were produced (Lee 1902).

Probably the most important single factor in the development of gold mining and the mining industry in general during the 1890's was the use of new ore reduction processes (O'Rourke 1980:101). One form of reduction, the stamp mill (ideally combined with concentrating machinery) made a comeback in the 1890's, particularly in San Juan County, but also in some of the smaller gold-producing areas. Rather than evidence of disillusionment with other reduction methods, its use showed the upswing of interest in gold. During the last fifteen years of the nineteenth century, the smelting and milling of low-grade and complex ores increased in importance as efficient reduction methods meant the difference between profit and loss for many mining operations (Smith 1982:58-59).

Further developments in mining technology supplemented the industry's growth in the 1890's and the early 1900's and also lowered costs. Improved facilities for the transportation of ore from mines to mills was provided by trams. Tramways (consisting of ore cars attached to wire-rope cables and supported by large wooden towers) stretched from mine to mill or mine to roadway, offering unmistakable advantages in year-round operation. With gravity's assistance, they overcame geographic obstructions and lowered costs (full buckets coming down pulled empty ones back up). The freighter and burro could not compete. Trams could be constructed almost anywhere--over cliffs, up mountains, across streams--and, in theory, were cheaper to maintain than roads; however, a snow slide might carry away a couple of towers and alter that advantage. They quickly transported ore, supplies, and miners; a tram system with a bucket capacity of 750 pounds traveling at 350-450 feet per minute had a capacity of 250-400 tons per 10 hour. In 1902, as the tram became economically feasible and popular in the San Juan's, the cost of construction was from $2.50 to $8.00 per foot of cable with an average of $3.25 per foot (Rickard 1902:695). A wooden tram-support network used to transport ore from the Tobasco Mine to the Tobasco mill is still in evident on Cinnamon Pass.

The spread of precious metal mining brought wealth and people to the mountain communities of Hinsdale County during the late 1890's and early 1900's. The development within the mining towns reflected this evolution as its early rudimentary structures were replaced with more substantial ones. The added wealth and population contributed to the construction of a number of "high style" architectural residences in Lake

City. Growth of the settlements and the increasing sophistication of the mining operations had brought people to the area with a variety of skills. This made the construction of larger or more elaborate housing possible. The wealth and the increasing social stratification of the population of the communities created a demand for houses that reflected the popular styles of the day as well as ones' social position. As a result, housing became differentiated in size, construction and styling (Houston 1976).

2.7 All That Glitters Is Not Gold (1900-1950)

During the period from 1881 to 1920, due to improvements such as railroad transportation, the discovery of new ore processing methods, and the entrance of major capital investment, mining in southwestern Colorado went through numerous changes. By 1900, the industry showed little resemblance to its nineteenth century predecessor. Mining companies, financed by Colorado, eastern States and European investors, spent millions of dollars in the construction of mine shafts, tunnels, underground railroads, smelters, and reduction plants (O'Rourke 1980:98-99).

The following is a capsular view of the turn of the century mining in Hinsdale County as presented in a Report of the State Bureau of Mines for the years 1901-1902 (Lee 1902). It discusses mine developments within three of the principle districts of the county.

> The Galena Mining District is located along Henson Creek starting in Lake City and extending west to the Ouray and San Juan county lines. As the name indicates the predominate ore produced and marketed from the district was lead sulfide. At the turn of the century, the county's largest producer was the Ute and Ulay veins located about four miles up Henson Creek. The mine was equipped with a 100-ton concentration mill, which yielded a product high in lead. A new twenty-one-drill compressor was added during that year and a new three-compartment shaft was started. The Hidden Treasure mine, adjoining the Ute and Ulay, also had a 100-ton mill, and the mine was largely developed. The California mine, under lease to a Black Hills company, was driving a cross-cut tunnel, to develop the group. The Red Rover Mining Co., located about seven miles up Henson Creek included a group of eleven claims, but the principal development was being conducted on the Lilly, which includes the construction of a modern fifty-ton concentration mill and the addition of hydroelectric power supplied by a 2-foot diameter, 3,700 foot-long pipeline that produced a head of nearly four hundred feet. The Hanna Mining and Mineral Co., at the Moro and Ajax mines, near Capitol City, erected a fifty-ton concentration plant. At this time the mine had developed three adit levels that exposed a four to six-foot vein throughout the workings. The mine and mill were connected by a 4,600-foot tramway. The T. M. Anchor Co. was developing a group of claims east of Shafer basin by driving a cross-cut tunnel. Similarly, the Silver Star group was being developed by a cross-cut tunnel. In 1901 their tunnel was at 1000 feet and they expected to cut the vein about 1,500 feet from portal and 600 feet below apex. The Henson Creek Lead Mines Company had been under development for two years and was producing galena, iron and copper pyrites. A 100-ton concentration mill was nearly completed at the site and hydroelectric power was being generated. The Gold Mine located in Horse Shoe Basin was being developed by tunnel. In sum, nearly all the numerous claims in this section had been accorded development.

The Lake District (Lake San Cristobal) adjoins the Galena district on the west and includes the north and east portions of the county and generally includes the drainage basin of the Lake Fork River. The principal mining operations were conducted on Hotchkiss Mountain, located about four miles south of Lake City. The Golden Fleece group of eighteen claims was largely developed at this time and included a system of tunnels, the lower being driven about 4,000 feet. The property was well equipped and connected to a fifty-ton concentration mill. It produced a large amount of high grade telluride ore (predominately petzite). The Hotchkiss A.T. & R. Co. had also carried on extensive development work. The main feature of their operation was an 850-foot cross-cut tunnel branching from Golden Fleece tunnel and connecting upper works from tunnel level. The same company owns the Black Crook and Hiawassee groups, aggregating about 300 acres.

In the Burrows Park (Whitecross) Mining District, located near the head of Lake Fork of the Gunnison and about 12 miles southwest of Lake City, there was a great deal of development and prospecting activity at this time. Several important strikes were made and the veins in this district were generally large and gold-bearing. The Isolde Mine located about eighteen miles from Lake City had opened up about 1,500 feet of tunnel and encountered some high grade telluride gold ore. Also, the Pennsylvania group was undergoing systematic development, and the La Belle, equipped with power plant, had driven a 715 foot-long cross-cut tunnel. The Tobasco Gold Mining Co. had been systematically developing its holdings by erecting a new 100-ton mill operated by electricity from a hydro-electric plant nine miles distant. The Bon Homme had been producing regularly and developing on a somewhat extended scale a cross-cut tunnel, that was expected to cut the vein at a depth of nearly 1,000 feet below apex. The George III Mine, near Carson, was also being developed by a cross-cut tunnel. The results from this development throughout this section stimulated mining, and a number of new organizations contemplated starting operations.

At the turn of the century, the advent of high finance, geologic expertise, and industrialization gradually ended the era of the wandering prospector and the small-time mine owner. Many of these mining-frontier pioneers left southwestern Colorado in search of the "virgin vein" (O'Rourke 1980:98). The larger towns like Lake City lost large percentages of population. The steady decrease of population in Hinsdale County after 1900 is testimony to the fact that mining alone could not support the large numbers once living in the boom towns (Table 1). But some remained, becoming miners for the larger companies.

Joined by other emigrating Americans and large numbers of European immigrants, the wage-earning miners and millworkers constituted a substantial labor force in the late nineteenth and early twentieth centuries. Working conditions were often primitive and dangerous, and pay was low. Like other wage earners in America at this time, the hard-rock miners organized labor unions to demand higher wages and improved working conditions. Unions like the Western Federation of Miners (WFM) and the United Mine Workers (UMW) made known their grievances. Town authorities and company officials resisted union activity, thus prompting confrontation and violence (O'Rourke 1980:98). A strike in 1899 at the Ute-Ulay was typical of the labor strife elsewhere in the state at that time.

By 1900, markets for lead, copper, and zinc (base metals) increased because of the general expansion of American industry and the appearance of new products; e.g., copper for electrical wiring and lead for

automobiles (O'Rourke 1980:99). Smelters continued to be important, and Durango retained its lead as the smelter center though not without rivals.

In Hinsdale County, the depletion of the rich ores in the shallow zones of oxidation brought on a decline in annual output of gold to $100,000 or less by 1903, which was only exceeded during the period 1906-1910 principally due to ores from the Frank Hough, Highland Chief and Hidden Treasure Mines (Vanderwilt 1947:440). At the close of that period (1909 to 1911), the advance in the prominence of base metals over those of silver and gold can be seen in the peak production of copper in the county and the lowest level of silver production (Henderson 1926).

In 1908, the production of zinc and lead declined due to a fall in prices for approximately five years. Then, new technology and increased demands for the product brought on by World War I revitalized the base metals industries. Accordingly, from 1915 to 1920, the mining industry in southwestern Colorado had a brief resurgence when the value of all metals produced rose by thirty percent (Smith 1977:103). The Ute-Ulay Mines in the Galena Mining District yielded a considerable amount of low grade ore containing large quantities of zinc-blende, and Hinsdale County's production of zinc peaked in the period of 1916-1920.

Following the close of WWI, metals prices fell as stockpiles were released onto the market, and metal mining declined to its lowest level since the early 1890's (Smith 1977:111). At the same time, the population of Hinsdale County reached an all time low, falling to one-third of that in 1900 (Table 1). Lake City became famous as a ghost town where burros released from the mines roamed the streets.

By 1920, the affects of industrial consolidation, a significant change in the federal currency programs, and national economic depression caused the disappearance of many individual mining operations and small camps. The larger mines survived and in 1922 base metal prices began an increase that continued for seven years. A reflection of this was that mills--including those at the Empire Chief and Ute-Ulay in Hinsdale County—were either rebuilt or newly constructed in the mid-1920's. Flotation tanks were installed in a number of mills at that time (Vanderwilt 1947: 440).

After this seven year respite, the country fell into the Great Depression of 1929 and so did the Colorado mining industry. As the nation and state recovered from the depression, an economic revival occurred as ore prices slowly rose in the l930's (Del Rio 1960:12-20). Gold production in the state hit a twenty year high in 1936; unfortunately, a number of mills had been dismantled and were not economically accessible, which hampered the mine production (Smith 1977: 113-117).

In Hinsdale County, the early 1930's were dismal and there was no appreciable production. During the 1930's and 40's, no more than a half dozen mines operated there. A slight revival occurred in 1937 when new flotation units were installed in the Ute-Ulay mill. As a result, in 1943 the entire production of the Galena District was from the Ute-Ulay group, which amounted to 34 ounces of gold, 9329 ounces of silver, 5 tons of copper, 191 pounds of lead, and 16½ tons of zinc (Vanderwilt 1947:112-117,440).

The beginning of the conflict in Europe in 1940 resulted in an increased demand for base metals and in prices that stabilized the market. During World War II, their value continued a slow rise, but gold and silver prices dropped. In spite of the prices, gold, lead and zinc production in Hinsdale County was at its highest in

20 years, but silver and copper production declined. These years produced a scarcity of skilled laborers to work the mines, and much of the unused mining and milling equipment was salvaged for the war effort.

Despite the small revival during the war years, the mining industry of Hinsdale County was in a depressed condition for many years. It was not until 1952 that ore production again attained interesting figures. During that year, 110 ounces of gold, 27,320 ounces of silver, 12 tons of copper, 748 tons of lead, and 156 tons of zinc were produced (Del Rio 1960:157).

3.0 Site Type Descriptions

3.1 Name of the Property Type: **MINING HABITATION PROPERTIES**

3.1.1 Description

This property type consists of vernacular dwellings constructed to provide shelter for the miners at the camps or mines in the late nineteenth and early twentieth centuries in Hinsdale County. Three property types are defined: camps and towns, single residences and boarding houses. Camps were constructed in those areas where a number of mines showed promise, single cabins were built at or near mines that were at a great distance from towns, and boarding houses were built at or near larger, commercially developed mines, especially in late 1800's and early 1900's. The purpose of the structures was to house miners who worked too far from a town or camp for travel on a daily basis.

Subtype: Mining Camps and Towns

Although some variations do occur, building and community development associated with the precious metal mining followed a general sequence of stages. In the initial stage the organization as well as the construction within the settlement was rudimentary. Development was sparse and limited in scope. The pattern and location of buildings were influenced largely by the terrain or other natural features. Entire settlements and town plans often consisted of only three or four streets. Most of the buildings were concentrated along the main thoroughfare which led in and out of town. The majority of the original buildings in a settlement were residences. These early homes were usually small-sized, and made of log or rough-cut lumber. Interspersed among the dwellings were a few commercial establishments, which were also constructed of simple wooden structures. Early businesses were geared to the predominantly male populations of the mining settlements and included saloons, general stores, and food and lodging accommodations. Often times, a single commercial building housed a variety of enterprises. Only a few of the camps grew to towns with an organized form of government and development. Most remained unincorporated communities with little if any organized system of development and government, with populations of miners and businessmen growing and declining as the real and perceived fortunes of the nearby mines drew interest to the area.

The form of the building was determined by functional requirements rather than stylistic considerations. Construction methods and materials were expedient, usually of log, with some or all the later buildings being made of milled lumber. Generally, commercial buildings were larger than the domestic dwellings, although both functions might be combined into single building (Abele 1989:F-Apt-8).

Subtype: Single Residences

This subtype includes single structures that were constructed for miners' domestic residences, and were either located at or near the mines. Most of the single residences were built at remote mine sites for one or two miners. They would have been especially important for shelter during the long harsh winters, when transportation was extremely limited or non-existent and travel to towns or camps was not feasible. Expedient construction methods and materials were utilized.

The most commonly used building material was log. Logs were readily available from the nearby forested mountain slopes and did not require transportation or the expenditure of money for construction. The

ease of erecting the basic log structure plus its solid construction was well suited to the harsh climate. Other materials used in the construction such as doors, windows, flooring material, and roof covering were purchased from a commercial source.

The logs were notched at each end and placed horizontally on top of each other. They were finished in a variety of ways: the simplest was to leave the log round with the bark on; or with the bark stripped and/or the logs squared on two or four surfaces. The two most common means of notching were "V" or saddle. An unusual corner system was used in Hinsdale County called "hog trough construction" that did not use notches. The logs were joined at the corners with an open or "L-shaped" opening. The butt ends of the logs were covered with boards, which held the wall together.

Spaces between the logs on the exterior wall were commonly filled with split wood and mud, or occasionally cement. The interior wall spaces were most commonly filled with mud daubing. Roofs were constructed of a framework of logs or more infrequently lumber and covered with limbs, boards, earth, tarpaper, canvas or corrugated metal. Most roofs were gable shaped. Most of the foundations were either rock pillars at the corners and other support posts, or occasionally a log sill was laid for a foundation. The footprint was either a simple square or rectangle with at most two rooms. Heat was most frequently supplied by a wood or coal stove, although fireplaces constructed of native rock were used occasionally.

Subtype: Boarding Houses

Boarding houses were relatively large structures built to house miners at remotely located mines where a large work force was required on a year-round basis. The buildings were also commonly used for office and storage space. The boarding houses were built by mining corporations, especially after the turn of the century.

Construction materials were either logs or lumber, or a combination of the two types of materials. The large structures (maximum dimension up to 75 feet) had a rectangular footprint and usually were two stories. The lower story contained the kitchen, dining room, offices and other rooms and the upper story housed the miners. Typically the wood frame buildings were constructed with a balloon frame covered with either planks, horizontal overlapping boards, vertical board and batten, or corrugated metal. Occasionally, shed additions or porches were attached to the exterior of the structure. Simple gabled roofs covered with corrugated metal were typical. Heating was with wood or coal stoves.

3.1.2 Significance

The mining habitation type properties are historically significant at the local level because they represent the sheltering of the miners which was essential to metal mining in Hinsdale County in the late nineteenth and early twentieth centuries. The camps, single residences and boarding houses represent the economic influences, social composition and physical forms in the early mining community, and illustrate the initial efforts and people who settled the area.

Mining camps and towns, and single or multiple habitation structures are significant because their age and location are important manifestations of the pattern of settlement and growth in the region. The establishment and abandonment reflects the ebb and flow of mine production in the region. The buildings in the towns and camps are the physical manifestations of the day to day needs of the miners- not just for the necessities of life, such as food and mining supplies, but for human association and entertainment. Camps

were located in areas perceived to have the potential for wealth, i.e. where mines possessed commercial value. Therefore, in addition to providing services for miners, the camps designate areas which had potential mineral wealth.

Mining habitation properties may be eligible for listing in the National Register under the category of Criterion A in the area of exploration/settlement if they represent the earliest and first permanent settlement of Hinsdale County. These properties may be eligible in the area of industry for their indirect association with mining activities, indicating by their location and size the extent of nearby mining activity. Mining habitation properties may be eligible under Criterion B for their association with individuals important to the history and development of Hinsdale County metal mining. Properties may be eligible under Criterion C in the area of architecture if they represent a type of habitation associated with metal mining in Hinsdale County. Mining habitiation properties may by eligible under Criterion D if they contain archaeological resources that have the potential to yield important information related to mining habitation. They may be eligible in the area of ethnic heritage for their ability to yield important information related to ethnic associations or in the area of social history for important information related to the lifeways of social groups. These sites could yield data on the physical patterns of community organization, date of use, and the origins of the commercial sources of consumer supplies.

3.1.3 Registration Requirements

To qualify for listing in the National Register of Historic Places under Criteria A, B, or C, a property in this category should be relatively unaltered and have its original function readily apparent. Properties eligible under Criterion D in this category could be an historic archaeological site with documented associations to Hinsdale County metal mining. Despite the absence of intact buildings, the location and setting of a camp reflects the location of short term mineral rushes. The camps at Sherman, Carson, Tellurium, Argentum, White Cross, Rose's Cabin and Henson meet the registration requirements, as does the town of Lake City which is already listed in the Register.

3.2. Name of the Property Type: **ORE EXTRACTION PROPERTIES**

3.2.1 Description

This property type consists of the features that result from the initial exploration and assessment work at a mine or those mines developed for commercial exploitation of ores. Mining operations generally follow four stages: 1) Prospecting, the search for mineral deposits; 2) Exploration, the work involved in assessing the size, shape, location and economic value of the deposit; 3) Development, the work of preparing access to the deposit so that the minerals can be extracted; and 3) Exploitation, the work of extracting the minerals. The stages can occur consecutively or may only be carried through the first one or two stages.

Subtype: Prospecting/Exploration Properties

Most initial mining endeavors were conducted by individuals using hand tools which limited the scale. Exploration for ore began by visual inspection of the surface, examining the rock outcrops for mineralized zones, faults, veins or other apparent changes in the color or composition of rock on the surface. Next the miner had to obtain a sample for assay to determine the mineral content and quality of the ore. The usual result was a shallow prospect pit or adit. If the assay of the ore proved promising, work began in earnest; and/or if the claim was unpatented, yearly assessment work had to be completed to maintain the claim. Because of the shallow nature of the veins in Hinsdale County, the tendency of the mineral value to decrease with depth, and the basic nature of mining wherein many holes had to be dug to find a promising deposit, an area could have a number of prospect pits or shallow adits and not have been commercially viable.

The most notable features included in this property type would include: prospect pits, shallow adits (less than 50 feet), and waste piles.

Subtype: Developed Mines

When the mineral values were perceived or proved to be commercially viable, the mine was developed to most efficiently produce the ore present. The essence of the mine operation was the removal of the ore and the rock that contained the mineral. The vein or fissure that contained the ore was followed into the ground, removing only as much material as necessary to recover the ore. In Hinsdale County, mine access was usually through an adit, a horizontal opening into the earth's surface, although shafts were occasionally used. Operations at an adit tended to be simpler, because the equipment to produce power and lift from the shaft was not required.

The ore vein was removed by first drilling holes into the face of the rock, placing explosives into the holes, igniting the charge and then removing the broken rock (mucking). Generally, this cycle was repeated each day, with the charge set at the end of the day, and the removal of the ore-bearing rock at the beginning of the next day. Transportation of the rock from the working face to the outside was initially by animal (mule and donkey) or human power, either by pulling or pushing ore cars along track, or in hauling wheel barrows. Outside, the rock was sorted, and the material less desirable was discarded. The potential ore-bearing rock was stored for later transport to a processing facility such as a mill or smelter. As the mine progressed into the ground, a large mound of waste rock would accumulate outside the portal. As the rock piled up, rails for the ore cars would be extended across the top. Occasionally, a bin would be added at the end of the rail to store the ore intended for shipment. Also associated with the mines are assay offices and associated artifacts.

Shafts required power to lift the loads from the ground, and therefore exhibited a more complex assemblage of equipment. The most frequent source of power was steam, generated in a boiler with coal or wood. The steam in turn powered a winch and a cable that was suspended from a large timber frame (head frame). Later additions to this equipment assemblage were an air compressor to supply compressed air for the drills and other equipment (ore cars). When electricity became available in the 1890's and 1900's, lighting and ore car power was added. When powered drills also became available, either steam or later electricity provided the necessary power. In most cases, a structure was constructed to cover the equipment located at the mine surface. At the more remote or corporate sponsored mines, buildings for company offices, assaying and equipment maintenance were constructed. Most of the materials and methods used to construct the features

at the mines were expedient and inexpensive. Logs, milled lumber, and corrugated metal were the most commonly used building materials.

The principle or primary producing mines in Hinsdale County were the Ute-Ulay, Golden Wonder, and Golden Fleece. Other notable mines in the county include: Bon Homme, Yellow Medicine, Belle of the West, Ocean Wave, Empire Chief, Hidden Treasure, Pride of America, Palmetto Group, Big Casino, Ajax-Moro, Independence, High-Muck-a-Muck, Virginia, Silver Cord, Czar, Dolly Varden, Frank Hough, Contention, Hiwassee, Capitol City, Tobasco, Champion, Cashier, La Belle, Isolde, Mountain Chief, and Victor.

3.2.2 Significance

The ore extractive properties of Hinsdale County are historically significant on the local level for their association with the history of mining in the region. The ore extraction property types may be eligible for listing in the National Register under Criterion A in the area of industry if they are associated with metal mining. They may be significant under Criterion B if they are associated with people important to Hinsdale County metal mining. They may be eligible under criterion C in the area of engineering if they contain features that illustrate the evolution of mining techniques and technology and/or features that illustrate the various levels of individual and corporate mining effort.

3.2.3 Registration Requirements

To qualify for listing in the National Register of Historic Places, a property in this category should be relatively unaltered and have its original function readily apparent; or, it may be a good example of a type or mining process; or, it may have a historic association with events or people significant on a local level. Properties that would qualify for nomination would include those where all or most of the mining related support structures are intact and illustrate a period of use, or contain a set of mining related features that functioned together- such as a head frame, hoist, boiler and other associated components. Related properties that would not qualify individually, such as most of the prospecting/exploration subtypes could be eligible as part of a mining landscape.

Mines that should be considered for nomination include: the Ute-Ulay, Frank Hough, Empire Chief, Golden Wonder, Golden Fleece, Ocean Wave, Hidden Treasure, Independence, High-Muck-a-Muck, Virginia, and other mines in the Burrows Park area (Champion, Isolde, La Belle, Gunnison, Mountain Chief, Napoleon, Oneida, Black Wonder, and Cracker Jack) associated with the early period of use.

3.3 Name of the Property Type: **MINING TRANSPORTATION PROPERTIES**

3.3.1 Description

This property type consists of roads and trails, railroad features and facilities, and trams constructed for the purpose of transporting ore, or to transport people and supplies to the mines, camps, mills and other facilities.

Subtype: Roads and Trails

Roads and trials were essential to the development of mining in Hinsdale County. Prior to the arrival of the miners, trails along the valley bottoms were the primary means of travel. An early important trail into the county was the Horse Thief Pack Trail, which ran from Rose's Cabin to south of Ouray. In fact, the discovery of the mineral potential in the county was the direct result of the first effort to build a road into the area, when Enos Hotchkiss discovered the Golden Fleece mine while directing the road construction in 1873. As miners entered the area, other individuals attempted to capitalize on the potential profits to be realized at the camps and mines by construction of several roads. One of the most important was the Lake City and Uncompaghre Toll road built between Lake City and Ouray along Henson Creek by the Abbott Brothers in 1876.

Transportation to and from the mines strongly determined their economic fate. The farther a mine was situated from Lake City, the higher the freighting costs and generally worse the road. For example, upon reaching the western edge of Burrows Park, the costs and isolation increased substantially. [Rates for one wagon and team was 6¢/mile and each additional team was 2¢/mile; a one-horse vehicle was 3¢/mile, and a saddle animal was 1.5¢/mile; a pack animal was 1¢/mile (Grant Houston, personal communication February 1999).] The development of a transportation system was severely hampered by the steep, rocky terrain, short summer season and threat of snowslides in winter. The long winter season with the deep snows and the mines location at high altitudes, either eliminated or drastically limited travel and mine operations. Much of the travel in winter was by foot.

Subtype: Railroads

The following discussion and description of the subtype is taken from the Colorado Mountains Historic Context (Mehls 1983):

> No other single theme had greater influence on or was more influenced by the economic development of the Colorado mountains than the area's railroad network. Rail connections were the outstanding symbol of modernity for town builders and promoters during the late nineteenth century. Towns and regions rose and fell depending on whether or not the iron horse blessed them with its presence. Despite all the promoting and booming early Coloradans did, chances are that rails would not have been laid, especially not to the extent they were, without the lure of the rich mining traffic. The mineral trade encouraged rail builders to face the obstacles inherent in mountain railroading. Attempts to capture those rich cargoes led more than one individual to spend his millions trying to conquer the hills (ibid.:III-66).
>
> The impact the railroads had on the region cannot be underestimated. Civilization rode into the mountains on the steamcars, keeping the area up to date on news and trends as well as making nationally-marketed goods readily available. Rail transportation allowed lower grades of ore to be profitably mined by lowering shipping costs to smelters... Without the railroads, much of the region would not have developed as quickly and extensively as it did. They made towns more readily available to outsiders, and towns often relocated their business districts to take advantage of the transportation system. The iron horse further served as the major transportation corridor with a network of wagon roads extending their impact far beyond the locales the steel bands touched. Eventually, these same roads became

highways, and the competition from trucks as well as decreased mine traffic caused many rail lines to be abandoned (ibid.:III-70).

Subtype: Aerial Trams

Trams, bucket-carrying cables supported by towers, stretched from mine to mill or railroad siding, offering unmistakable advantages in year-round operation. With gravity's assistance, they overcame geographic obstructions and lowered costs (full buckets coming down pulled empty ones back up). The freighter and burro could not compete. Trams could be constructed almost anywhere, over cliffs, up mountains and across streams. In theory, they were cheaper to maintain than roads; however, a snow slide might carry away a couple of towers and alter that advantage. Versatile, they carried ore out and brought supplies in, and transported venturesome miners relatively quickly. In 1902, as the tram became economically feasible and popular in the San Juans, the cost of construction ranged from $2.50 to $8.00 per foot of cable with an average of $3.25 per foot. A tram system with a bucket capacity of 750 pounds traveling at 350-350 feet per minute had a capacity of 250-300 tons per 10 hour (Rickard 1902:695).

A tram system consisted of a loadout facility at or near the mine(s), towers to support the cable and ore bins and an unloading facility at the terminus of the line. Materials for the construction of trams consisted of heavy milled timbers, lumber and hardware for assembling the loadout, towers and terminus. This material was commercially available and would have been freighted from either a town or railhead source.

3.3.2 Significance

In order to qualify for listing, the mining transportation property type must have been used for the movement of people and goods to the mines or the ore from the mines to other locations such as mills, smelters or other transportation systems. Trams were constructed as an alternative form of transportation to roads and trails but served the same ends. The properties must be intact examples of one of the identified subtypes: roads and trails, railroad features and facilities, and trams. Roads and trails may be eligible under Criterion A in the area of transportation if they served as important links in the local road network and in the transportation of goods, raw materials or people within the county, and are intact. Transportation properties may be eligible under Criterion B in the area of transportation if they are associated with people [e.g.Otto Mears and Enos Hotchkiss] important to mining in Hinsdale County. Mining transportation properties may be eligible under Criterion C in the area of engineering if they are good examples of an engineering type.

3.3.2 Registration Requirements

To qualify for listing under Criteria A, B or C, a property in this category should be relatively unaltered, be a good example of a type, or historically associated with events or people significant on the local level. The form and setting of the road or trail must be intact. Trams should have the primary components intact (towers, loadouts) and have those components in direct association with one another. Railroad properties must be one of the following identified subtypes:

Sites include: Ash Pits, Railroad Beds, Tunnels, Bridges...Camps and resources associated with minorities who worked on the railroad..... Structures include: Car Shops, Coal Chute, Depot, Engine House, Freight House, Loading Dock, Section House, Signals/ Signal Tower, Tunnels, and Water Tower/Standpipe as well as the Rolling Stock and Locomotive used on the rails to move people and goods. Districts include: Yards, Sections of the Rail line with associated structures Materials include: Ramps, Switch Stands and Tools used to operate and maintain a railroad as well as the Vehicles and Locomotive used on the rails to move people and goods (Mehls 1983:III-70,71).

3.4 Name of the Property Type: **HYDROELECTRIC-POWER GENERATION PROPERTIES FOR MINING**

3.4.1 Description

This property type consists of facilities constructed to generate hydroelectric power for the operation of mines and mills in Hinsdale County.

The introduction of hydroelectric power to light mines and mills, and the use of electricity to operate power drills and hoists, dramatically altered the nature of the mining industry. In the 1880's, electricity and its possible uses in mining was beginning to be considered. Too new to make much of an impact, it remained unnoticed until the 1890's. Year-round operations, at least on the larger properties, became relatively standard once electricity was available. The ability to transport alternating current made the use of electricity viable in the 1890's because the amount of power (voltage) could be significantly increased without raising the cost of transportation. Direct current was limited to 700 volts, whereas with alternating current, there was no limit, and it used one sixteenth the amount of copper in the wires.

Hydroelectric generation required four components: a dam and reservoir to store the water and produce enough pressure (head) to run the turbines, a pipeline to move the water between the dam and the generation facility, a power house where the water was utilized to turn the generators, and poles and wires to transport the electricity. Obviously, the complex had to be located on a stream. But because of the long winters and low temperatures it was desirable to place the dam at a location where there was sufficient water flow and depth to preclude the water from totally freezing, and thereby limiting the facilities production. There were two factors to be considered in the location of the dam. In order to generate sufficient pressure to drive the generators, the dam had to be placed upstream from the power house at enough distance and increased elevation to provide the necessary pressure. It also had to be at a point where the dam sides could be anchored into the walls of the stream channel and where the stream was deep enough to create a pool behind the dam.

The pipe carrying the pressurized water between the dam and the power house had to be of sufficient strength to withstand the water pressure. The early pipes were constructed of heavy gauge metal strips wrapped in a spiral and riveted at the seams. Heavy metal collars connected the sections of the pipes.

The location of the dam would be the dominate factor in determining where a power house could be located, but it was obviously advantageous to have the power generated at or near the mine. The power house would have consisted of a foundation (usually concrete), turbines or penstocks to generate the electricity and

other equipment to support the operation. The generators would have been commercially manufactured and shipped to the power house location.

3.4.2 Significance

Hydo-electric power generation properties are locally significant under Criterion A in the area of industry. Electricity at the mine and mill would have greatly increased the efficiency of the operation and added amenities such as lighting in the mine and residences. Hydo-electric generation properties are significant under Criterion C in the area of engineering if they represent a distinguishable type of power generation resource associated with metal mining in Hinsdale County.

3.4.3 Registration Requirements

To qualify for listing in the National Register of Historic Places, a property in this category should be relatively unaltered, be a good example of an engineering type, or historically associated with events significant in the history of metal mining in Hinsdale County.

3.5 Name of the Property Type: **ORE REDUCTION PROPERTIES**

3.5.1 Description

This property type consists of the arrastras, kilns, mills and smelters in Hinsdale County. The primary purpose of the mills was to process and upgrade the ore, thereby increasing the value and creating an economical unit for shipment to other processing facilities. Mills were vital to the miner in Hinsdale County because of the general low grade quality of the ore, distance to market and high cost of transporting the ore. Milling could increase the value of ore up to six times its value in the raw state.

The milling of ores involved three stages: crushing, amalgamation, and concentration. All of the processes usually relied on gravity to assist the movement of processed ore through the mill. Therefore, most mills were constructed on steep slopes with a ready supply of water nearby. The end product was either a concentrated ore that could be shipped to a smelter or, more commonly a concentrate that needed further reduction at a refinery.

Subtype: Arrastra

One of the first efforts to separate ore from the base rock was a technique brought from Mexico and California, the arrastra. An arrastra was used to crush the rock in an attempt to separate the gold from the native rock. The arrastra consisted of a mill stone set in the ground and muller stones that rotated around the mill stone crushing the rock. Arrastras were small and very inefficient. At best, the arrastra recovered only 30% of the gold.

Subtype: Stamp mill

Preparation of the ore for separation from the waste rock and then concentration of the mineral required that rock with the ore be reduced. The first stage- rock breaking -was performed by jaw or gyratory type crushers, and could be accomplished at the mine. The second stage was the stamp mill. These used a "mortar and pestle" technology to pulverize the ore by dropping heavy iron capped wooden poles (stamps) onto the rocks. The stamps, usually ten or twenty in a mill, were attached to a rotating camshaft that lifted and

dropped them. After being crushed the ore was either sluiced or treated with mercury or both. Stamps were replaced by the ball mill and then the rod mill.

Subtype: Mill

Amalgamation is the process of separating the mineral from the waste rock. The finely ground ore is chemically treated so that the desired mineral adhered to a particular chemical which could then be further separated. A mixture of water, ore and chemical was passed over a table-type device with baffles on its surface that served to sort out the various minerals. Initially mercury was used, especially for gold ore processing. In the 1900's, chlorination became popular for a brief period of time. This was followed by cyanidation, which is still utilized (O'Rourke 1980:101).

The final milling process was concentration. Here further recovery of the mineral from the waste ore and additional processing to concentrate the mineral was performed. A process whereby the amalgamated mineral was passed over a baffle table was developed in Colorado and named for its inventor, Wilfley. Later in the 1920's, a flotation process was developed and became the industry standard. Flotation is the most widely used concentration process for sulfide ores. The finely ground ore was mixed with water and special reagents to make the ore minerals water repellent and responsive to attachment with air bubbles. As the minerals move to the surface on the air bubbles, mechanical paddles remove the concentrate (ibid.).

Mills were divided into two types: custom and integrated depending upon the quantity and quality of ore from the mines. Custom mills were not limited to a single mine. The operators bought the ore from mines at the assay value, and sold either the concentrate to a smelter or its matte bullion to a refiner. Milling was very speculative business because the assay value could differ significantly from the actual output. If production from a mine or series of mines owned by a single entity warranted the capital outlay, an integrated mill was built to process the ore. These mills would process other mines' ore as time and economics warranted (ibid.:103).

Subtype: Smelter

The complex mineralogy of many primary ores in Colorado presented problems that defied early milling processes. Most mineral deposits varied considerably in grade and mineralogy. Many offered problems in economic exploitation due to the low grade, or because they were not amenable to known milling and metallurgical practices.

It was discovered that the rich and free milling oxidized ores mined near the surface graded with depth into complex sulfide ores which were not amenable to amalgamation. This led to the growth of a smelting industry. Smelters reduced the ore by treating them with heat, which was generated with a combination of coke and air blasts. The end result was still a product that needed further refinement prior to being shipped to a refinery, the desired end to all mineral mining. The first smelter was a lead-based smelting operation that concentrated the ore, removing the gangue or worthless matter. The matte was then shipped elsewhere to separate completely the silver, lead, and small quantities of gold and copper. Many local ores were unsuited for this process simply because of a lack of limestone for flux. In addition, the costs of coal and coke and freighting were often prohibitive. A method to overcome at least the ore shortage was by combining mines and smelter into one company.

Lixiviation, a method based upon roasting the ore, then introducing various salts to leach or wash out the base metals and precipitate silver, gained a measure of popularity. Lixiviation had its troubles, especially when imperfect roasting resulted in silver chloride, which was poorly suited for chemical reduction. Less importantly, the process had difficulty producing silver bullion that was free from lead.

The use of smelters on Colorado ores dates to the early 1860's when mine owners shipped high grade ores to England for refinement. However the high costs of transportation meant that only the richest ores could be profitably processed. Also, it was found that much of the Colorado gold could not be successfully refined by the existing English methods due to the chemical composition of the ores. In 1867, Nathaniel Hill opened a smelter in Black Hawk that successfully reduced the area's gold sulfide ores.

As greater quantities of silver were mined smelting processes changed to refine the silver ores especially those high in lead content. Two types of blast furnaces were introduced to achieve the high temperatures needed for efficient melting of the ores. Hill's smelter, a modification of the open hearth furnace, needed much horizontal space and involved a time consuming process. In contrast, the blast plants were vertically oriented, and were far more fuel and time efficient. Once these two basic furnace patterns as well as to raise the precious metal recovery rate. These included T.S. Austin's Pyritic process and the MacArthur-Forrest Cyanide process. Mine owners sought ways to pre-refine the ores before smelting to increase profits: foremost being concentrators, roasters and the Wilfley table.

Mills and smelters were located to take advantage of two requisites for success: ore and water, and in the case of Hinsdale County that meant along the lower slopes of the major valleys. Also, smelters required coking material which was either limestone, charcoal or coal. Mills were often located at a major mine, such as the Ute-Ulay or in the vicinity of a major ore body or group of producing mines, such as the Empire Chief, Tobasco or Palmetto Mills. Other major mills in Hinsdale County include the Ocean Wave, Moro, Pelican, El Passo, Hanna, Black Wonder, Treasure and the Gunnison. Smelter locations were more centralized in relation to the mines they serviced. Major smelters included the Crooke and Lee's.

Subtype: Kilns

Two types are included in this category: charcoal kilns and lime kilns. Two charcoal kilns are known in the Capitol City area; and, the Rose Lime Kiln, a National Register site, is located along Henson Creek above Capitol City.

The following is an excerpt from Leadville: Colorado's Magic City (Blair 1980:104) that describes charcoal kiln operations:

> Charcoal was used as a fluxing agent to supplement coke until 1889, when coke totally replaced charcoal. The process involved cutting native trees and "cooking" them until they were nearly pure carbon. To accomplished this cone-shape, "beehive" kilns were constructed, usually out of brick, although a few stone kilns were constructed. They were usually built so that they could be served by the railroad and were situated against a hill making it easy to feed them from the top as well as from the side. They averaged twenty to thirty feet in height and fifteen to twenty feet across at the base. Wood was cut from the surrounding hills, hauled to the site, and stacked floor to ceiling in the kiln. The wood was

stacked loosely so that the air could circulate, then hot coals were placed around the base and all doors were closed and sealed with mortar. Around the base of the cone were three rows of openings that could be opened or closed by simply placing a brick in the space. These vents were used to regulate the flow of air. Once the process was set in motion the cone was whitewashed to prevent any uncontrolled leakage of air. Fire was never allowed to break out, and the oxygen flow was regulated to permit the wood to smolder until virtually everything was burned out, except the carbon. Finally, all vents were closed and the smoldering process died out after about a week. Another four or five days were required to let the kiln and contents cool.

The smelters required ten bushels of coke to every ton of ore, and it would appear the need for charcoal was even greater. As a result, wages were exceptionally high for charcoal workers. Men chopping timber received from one dollar to one dollar and two bits per cord, and a good man and a sharp ax could pile up from four to six cords in a day. A man and team hired out to charcoalers for eight dollars a day. Contemporary reporters claimed that as many as seventy-five bushels (each about fourteen pounds) of charcoal could be obtained from a cord of good wood, and a bushel brought anywhere from six to ten cents. While pockets were lined with cash from the charcoal industry, it was one of the worst offenders where the land was concerned. Not only did it inundate the area with smoke, but it left the land barren and without the cover necessary to prevent erosion.

In the Lake City area two types of lime kilns were operated: a "mixed feed" type and a "perpetual feed" type. The former employed a conical-shaped brick oven similar to that of the coke ovens wherein alternating layers of limestone and coke were burned. The latter type is best exemplified by the Rose Lime Kiln, which is the last surviving structure in Lake County that was built by George Lee. Lee hired Samuel Tarkington, a local brick mason, to construct the kiln in April of 1881. Tarkington designed this "perpetual feed kiln" which represented a distinct technological advancement. This type featured external furnaces on either side of the chimney which separated the burning coke from the limestone and removed the possibility of contamination from ash. The result was a pure white lime which was considered a superior building product for which Lee charged one dollar per bushel at the kiln (Houston 1992:5-6).

The kiln still stands on Henson Creek between Capitol City and Rose's Cabin. It resembles a large chimney that rises 44 feet high and is 10 feet square at the its base, excluding the twin fire boxes. It sits on the level site that measures approximately 50 feet by 10 feet, and is bounded by a retaining wall of rough stonework. Brick and masonry construction was used throughout, and iron bars reinforce the lower sections that have helped to preserve the structure. When in operation, the chimney was loaded through a hatch near the top, then the boxes along the side were fired and the interior of the chimney was heated to a calcining temperature between 1000° and 1200°C. In this process the carbon dioxide is released from the limestone which then decomposes into a product called quicklime. This kiln could produce 600 bushels of lime per day. Limestone was mined at the Rose Lime Lode located about 1/4 mile east of the kiln (ibid.).

3.5.2 Significance

The ore reduction resources of Hinsdale County are historically and technologically significant on the local level for their association with the history and technology of metal mining in the region. The ore concentration property types may be eligible for listing in the National Register Criteria A or B in the area of

industry if they are associated with significant events or persons in the county's metal mining history. Ore reduction properties may be eligible under Criterion C in the area of engineering if they contain features that illustrate the evolution of milling techniques and technology and/or features that illustrate the various levels of individual and corporate milling effort. Properties may be eligible under Criterion D in the area of industry if they have the potential to yield important information related to the processes of ore reduction and to the relationships between mining and ore reduction.

3.5.3 Registration Requirements

To qualify for listing in the National Register of Historic Places, a property in this category should be relatively unaltered, be a good example of an engineering type, or historically associated with events or people significant to Hinsdale County metal mining.

National Register Listed Properties

The following properties are listed in the National Register of Historic Places and meet the registration requirements defined above:

Lake City Historic District – Mining Habitation Properties/Mining Camps and Towns

Rose Lime Kiln – Ore Extraction Properties/Kilns

4.0 Geographical Data

The geographical area associated with the Hinsdale County Metal Mining MPDF consists of that portion of Hinsdale County north of a line defined by the Continental Divide. This is the portion of the county in the Pacific Ocean drainage.

5.0 Summary of Identification and Evaluation Methods

The Hinsdale County Metal MPDF was prepared by Grand River Institute under a contract funded by Bureau of Land Management, Gunnison Field Office. Carl E. Conner served as Principal Investigator and prepared the final document with the assistance of Barbara Davenport. Michael Pointkowski served as project historian and field supervisor. Susan Medville served as field crew member and historical researcher. The field work was performed in the summer of 1998. The contract had three phases.

The first phase of the contract required the field recordation of twenty three properties, including five isolated finds. An isolated find was defined as a single prospect pit or adit with a simple waste pile. Ten of the sites had been previously recorded, but were recorded to the same level as the newly recorded sites.

The sites and isolated finds were recorded on the site forms provided by the Colorado Historic society, OAHP. In addition, all sites were photographed with color and black and white film and detailed site maps and building drawings were completed. All standing structures were measured and drawn to scale. Every effort was made to locate diagnostic features on the sites for identifying as closely as possible the period of use. This included locating dumps and privy holes, diagnostic building materials such as nails and patent dates on machinery. In addition, every site was examined for the presence of purple glass, hole in the top cans and square nails, the diagnostic artifacts most important in determining the period of use of a site. Site boundaries were identified upon the visual extent of any human modified material that appeared to be related chronologically and or functionally.

The second phase of the contract involved detailed archival research to document the site history and use, and to evaluate the on-site diagnostic features and artifacts. The following sources were used in the archival research: Denver Public Library; U.S. Geological Survey library, Denver Region Center; Office of Archaeology and Historic Preservation, Denver; Colorado Historical Society research library; Colorado Bureau of Mines; Gunnison County library, Gunnison; Hinsdale County Museum, Lake City; Hinsdale County Library, Lake City; Mesa County Library, Grand Junction; Mesa State Library, Grand Junction; Colorado School of Mines Library, Golden; Colorado State Archives, Denver; BLM, Denver, Gunnison; Gunnison County Courthouse, Gunnison; Hinsdale County Courthouse, Lake City; WEB sites for: Carlweb(library database), USGS, DPL, and, National Archives (includes PO). Primary records that were searched included: photographs, maps, manuscripts, personal records, business records, personal interviews, mine records, books, newspapers, site forms, mineral surveys, mine patents, Post Office records, survey records and plats, and master title plats.

The third and final phase of the contract required the preparation of the MPDF that included the historic context. This effort focused on the chronological development of Hinsdale County and emphasized several key themes such as mining, milling, development of mining camps, and ore production through time.

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