

CHAPTER 4. THE WESTERN POWER AND SMELTING AERIAL TRAM SYSTEM (24PA879)

-- Clear and warm. Visited the mines, found most of the lodes covered with snow from 2 to 10 feet deep, while a few are clear of snow. Most of the party are already becoming discouraged, & think the snow will remain all summer. I think different.

-A.B. Henderson, June 12th, 1873

from:

*“Journal of Various Prospecting Trips, Stampedes, and [etc.]
During the years 1871 and 1872”*

The Western Power and Smelting Company Tramway System

The Western Smelting and Power Company constructed the two-part aerial tramway to connect the Homestake and Gold Dust Mines to the company's copper smelter. Construction began on the tram system in 1923 and was completed in 1925. The smelter was built between 1916 and 1921. When completed, the tram operated at a speed of twelve miles per hour and was capable of delivering 250 tons of ore to the smelter every six hours. The right-of-way of the tram system was 30 feet wide and power was supplied by the company's 350 kilowatt hydroelectric plant on the Clark's Fork River. Although the smelter was completed by 1921 and the tram four years later, neither the tram nor the smelter were in operation by 1926. Further, there is no evidence that either component of the company's operation was ever used in commercial production. By late summer 1926, the Gold Dust Adit had reached 2,100 feet and had not tapped the Homestake's ore body at depth. In 1929, Lovering reported that Western Smelting and Power Company had failed to stockpile any ore since the expected ore body failed to materialize as promised. The company ceased operations in 1930. In 1940, the Yellowstone & Western Mining Company owned the property and indicated that they were converting the smelter to a 1,000-ton flotation plant, even though the mines had not been active since 1938 (Livingston Enterprise 1916; Lovering 1929; WPA 1940). The smelter was destroyed by fire in 1988 (Fredlund, et al. 1990). Figure 1-1 shows the basic location of the tram system.

History of the Tramway

The history of the Gold Dust Tramway begins in Aldridge, a coal mining complex, and nearby Electric, a coke oven facility. These historic mining communities are located just a few miles north of Yellowstone park, about five miles northwest of Gardiner, Montana, and about 70 road miles west of Cooke City.

The Park Coal and Coke Company was created by a small group of investors in about 1888. This company had sufficient capital to expand a small coal mine patented here in 1886, for the purpose of supplying Butte and Anaconda smelters. Briefly owned by J.H. Conrad, the mine produced 400 tons of coal in 1889. The ownership became the Butte and Yellowstone Coal and Coke Company in 1895. By this time there were 95 miners working underground at this site. In 1901, the Montana Coal and Coke Company (owned by Amalgamated Copper) took possession and provided expanded capital to the operation, which by then included 3000 acres of land, 200 coke ovens and several mines. A coal-fired generator provided power for lighting and mine equipment, including the aerial tramway that was built in 1905 to connect the mines, coke ovens and other facilities. By 1909, changing technology in the smelting process had resulted in a lower demand for coke. By 1910, the Montana Coal and Coke Company shut down its operation at Electric and Aldridge.

The Montana Coal and Coke Company replaced its flume transportation system with an electric freight and transportation tram in 1895. This electric rail tram was soon largely replaced by an aerial tram system. Construction of the electrically and gravity powered aerial tram system began in 1905. Its purpose was to connect Montana Coal and Coke Company's mines, washer plant and coke ovens. The first part of the aerial system

connected the Newton Mine with Electric, spanning 4,100 feet. A second part of the system connected the washer at Aldridge with the coke ovens at Electric, spanning 7,800 feet. A third line, 7,200-feet long, connected the Foster Mine to the washer at Aldridge. The Aldridge-to-Electric component of the system was manufactured by the Broderick and Bascom Rope Company of St Louis, Missouri. It used a 1 1/2-inch wire rope supported by wooden lattice towers, and carried twenty-four 1,450-pound capacity iron buckets suspended from the cable at 50-ft intervals. Each span required a drive tower and discharge station as well as the loading terminal and brakehouse. The tram could carry 210 tons of coal every eight-hour shift. The system required overcoming many engineering challenges associated with the steep terrain. The tram required support towers up to 75 feet tall and spaced about 100 feet apart. At each end, and at about every 1/4 mile, were tension maintenance devices. These large towers contain counterweights made from eight-foot square rock-filled wooden cribs suspended on pulley systems (Shovers 1987; Calvert 1912; Whithorn and Whithorn 1966, Magraw 1909). Figures 4-1 to 4-5 show aspects of the Montana Coal and Coke Company's trams at Aldridge and Electric.

Another challenge of construction was in stringing the 14,000-pound cables, which had to be hauled into place on the steep slope with draft horse teams. The Jack Wilson Freight Company hauled the cable, with Joe Narlow as the principal driver (Shovers 1987; Whithorn and Whithorn 1966). An eight-horse team pulled the cable spools seen here in the Aldridge area historic photographs and also found along the tramway site in the New World district. An oiler typically rode in the tramcars to perform routine maintenance. The benefit of the tram was, of course, faster transportation, and the ability to operate in cold weather (when the flume system would freeze). The disadvantage was higher transportation costs (30 cents per ton, versus three cents per ton with the flume) and continual maintenance problems (Shovers 1987; Calvert 1912; Whithorn and Whithorn 1966; Magraw 1909).

In 1908, Montana Coal and Coke Company abandoned the Aldridge-to-Electric tram, and went back to the flume system because of financial problems. When mining operations ceased entirely at the Aldridge-Electric area in 1910, Doctor G.L. Tanzers' New World Smelting Company, of Cooke City purchased a portion of the aerial tram system. Tanzer and his son, Bill, moved the tram equipment to the New World District with the help of Joe Narlow. Narlow devised a horse-powered spooler to wind up the cables for transport. At the New World district the system was adapted to haul hardrock ore from the Homestake Mine to the Gold Dust Adit (Shovers 1987; Calvert 1912; Whithorn and Whithorn 1966; Magraw 1909).

The Western Power and Smelting Company's aerial tram has two distinct segments. The upper tram, of the Bleichert type, spans about 700 feet (while dropping 400 ft) from the Homestake Mine to the Gold Dust Mine. The lower segment, of the Lawson type, runs from the Gold Dust Mine down the Fisher Creek valley for a distance of about 9,200 feet (while dropping 320 feet) to the WS&P smelter. The Lawson-type components, made by the Jones and Laughlin Company, were not developed until about 1919, so apparently this segment was state-of-the-art at the time and was not retro-fitted from the Aldridge system.

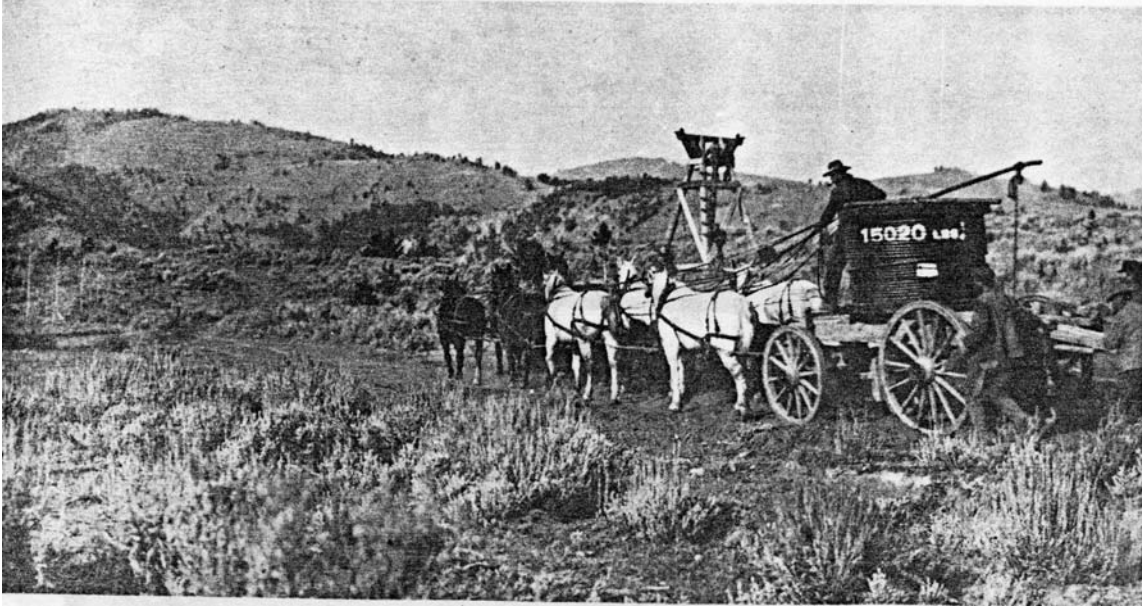


Figure 4-1. Hauling the 15,020-pound tram cable at Aldridge, ca 1906 (Bert Ruse Photo, from Whithorn and Whithorn 1966). A tram tower is seen in the background.



Figure 4-2. Eight-horse team hauling the 14,060-pound tram cable at Aldridge, ca 1906 (Tony Stermitz Photo, from Whithorn and Whithorn 1966).



Figure 4-3. Counterweight tower at Aldridge, ca. 1909 (Montana Historical Society Archives).



Figure 4-4. The Aldridge-to-Electric Bleichert Patent tram made by the Broderick and Bascom Rope Company. Photo ca. 1909 (Montana Historical Society Archives).

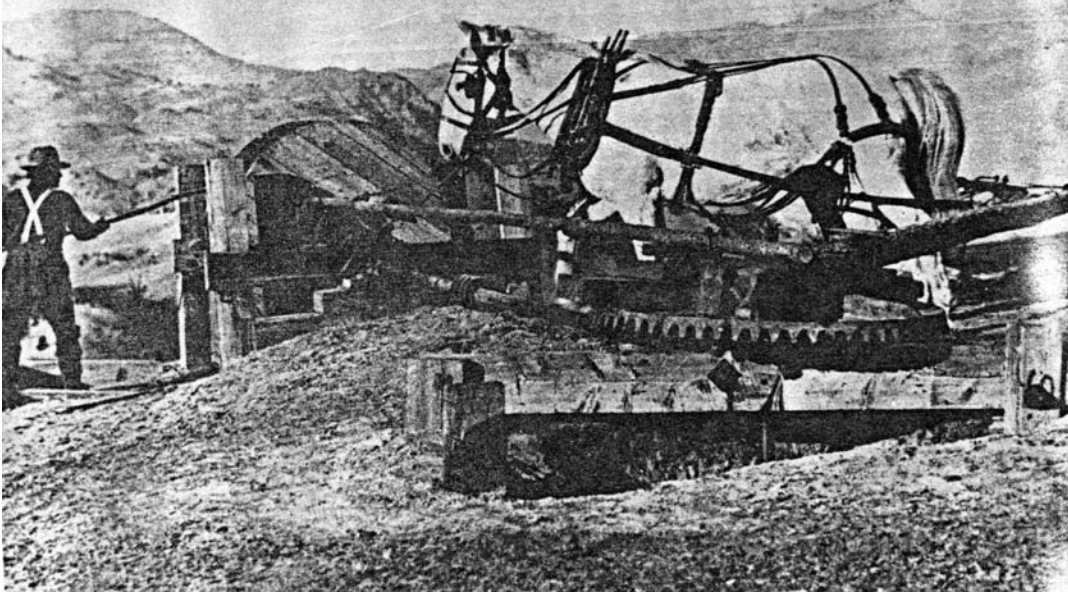


Figure 4-5. Joe Narlow designed this horse-powered cable spooler used to dismantle the Aldridge tram system for transport to the New World District, ca. 1910 (Bert Ruse Photo, from Whithorn and Whithorn 1966).

Western Power and Smelting's Upper Tram

The upper portion of the Western Power and Smelting Company Tram system incorporates the Aldridge-to-Electric, Bleichert-patent tram made by the Broderick and Bascom Rope Company. This segment traverses extremely steep terrain, dropping about 400 feet over a run of 700 ft (Figure 4-6). From top to bottom, the system begins at the loading terminal and brake house at the Homestake mine. Twin 1 1/2-inch wire track ropes supported by wooden lattice towers suspended an unknown number of the 1,450-pound capacity iron buckets. The buckets were suspended from the cable at 50-foot intervals at the Aldridge operation, but it is unknown if that distribution worked here. At the bottom of the system was the discharge terminal (Feature 5 at the Gold Dust Mine complex). Here the Homestake ore was unloaded, put through a Allis Chalmers gyratory crusher, transferred into an ore bin to be blended with ore from the Gold Dust Mine and finally loaded onto the lower part of the tram system for transport to the smelter.

Ore from the Homestake Adit was transported to an ore bin by rail ore cart. Remnants of the rail track remain at the site. The loading terminal was positioned so that a more or less level and straight track could be used from the adit portal to the ore bin. Ore carts were dumped into the bin, where loads were metered out to the tram cars. In practice, the empty ore buckets entered the loading terminal on the northwest side of the structure, where they disengaged from the track cable, revolved around the bull wheel riding on flat iron rails and were released from the traction rope. At this time, ore was deposited from an iron chute with a regulating door. The traction rope was re-engaged and the cars rolled off the terminal rail back onto the track cable. These features can still be seen within the somewhat precariously standing terminal structure at the Homestake Mine site.

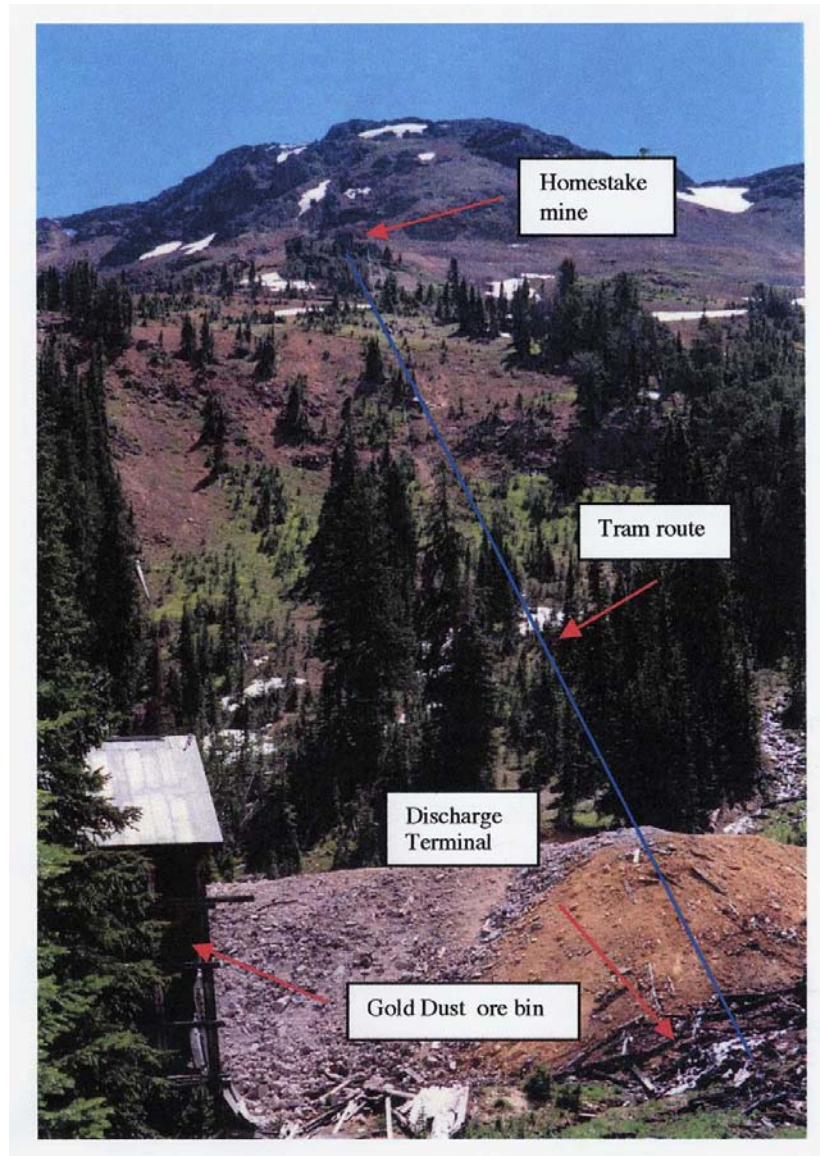


Figure 4-6. Overview of the WS&P aerial tram route from the Homestake Mine to the Gold Dust Mine.

The Bleichart Tram System

The Broderick and Bascom Rope Company Tram used the two-rope design patented by a German, Adolph Bleichart, in 1888. This system used two-wheeled ore cars suspended upon a stationary “track” of heavy cable. A lighter traction cable, providing the drive, ran in a closed-loop. The ore carts were attached to the traction cable by a friction grip. By disengaging the friction grip, the ore cars are stopped for loading or unloading (Figures 4-7 to 4-10). The Broderick and Bascom Rope Company had modified the Bleichart design around 1900, by adding an improved guide sheave system and friction grip system. A distinct advantage of this model was the ability to use a variety of car types. In addition

to ore cars, specialized cars could be built to carry timbers, pipe or other supplies up to the mine (Trennert 2001; Whithorn and Whithorn 1966).



Figure 4-7. A Bliechert-style tram showing support tower and discharge terminal (Trennert 2001).

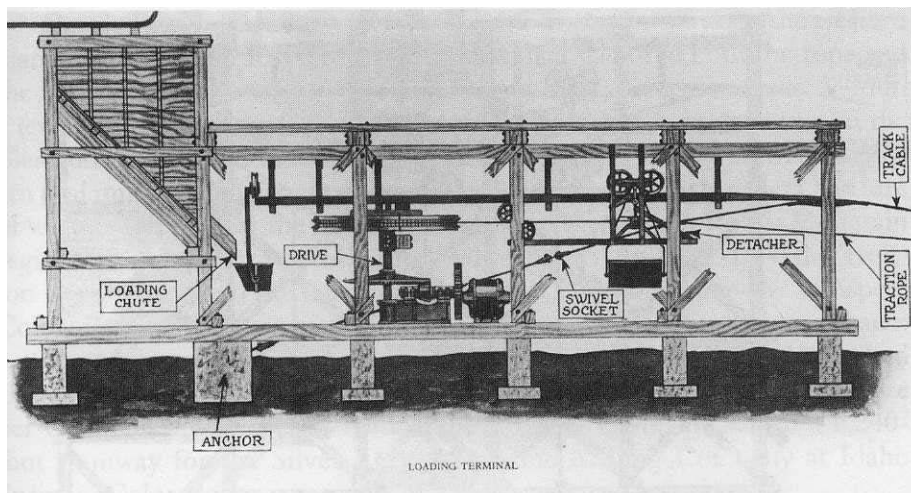


Figure 4-8. Sketch of Bliechert-style loading terminal (Trennert 2001).

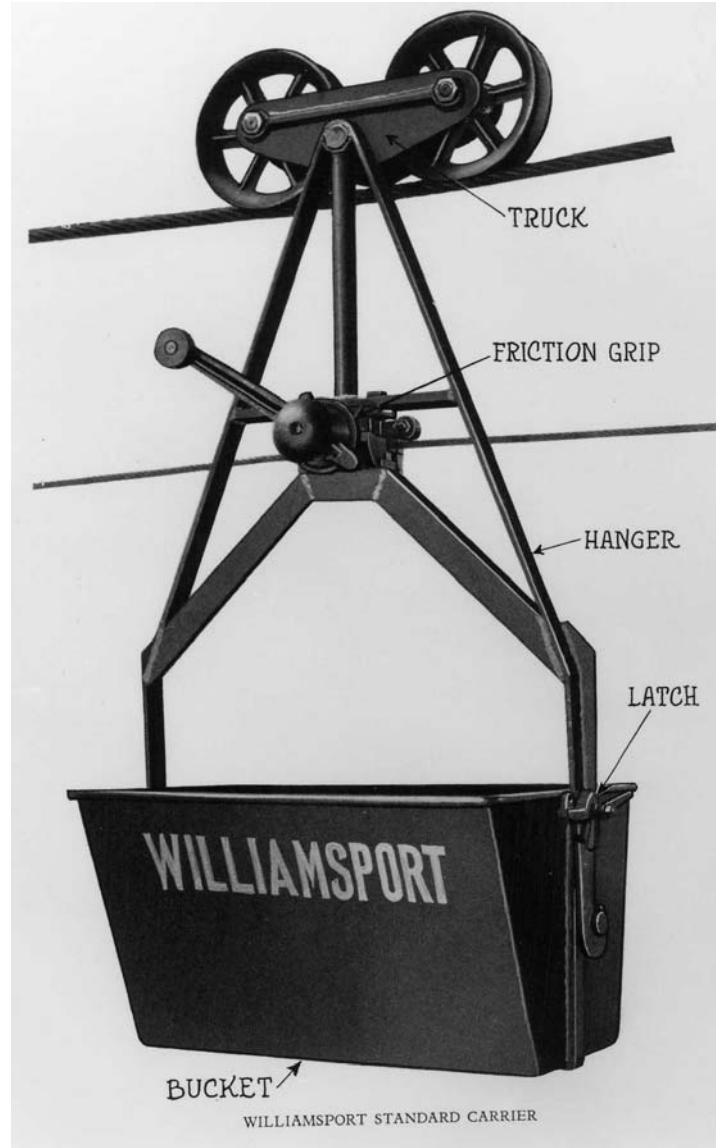


Figure 4-9. Diagram of a Bliechert-style tram car (Trennert 2001).

Gravity acting on the loaded cars would pull the empty cars up the hill. The electrical drive, in this case located at the discharge station (Gold Dust complex Feature 5), would supplement the system as needed. Sometimes the electric motor would be used to carry supplies or materials up to the mine. When the mine was active, the ore loads coming down would be sufficient to pull the occasional carload of material back up. The energy of the loaded tram cars coming down was also used to generate electricity to operate other equipment and to provide lighting. The friction of electrical generation served as a brake to help control the speed of the tram, which needed to be fairly constant despite widely varying loads. Additional braking was required and this was controlled from a brake house, located at the upper terminal. Here, a retarding gear mechanism acted as a

transmission, reducing the rate of rotation of the bull wheel. It also timed the ore loading and traction rope disengaging system with the tram cars. A supplemental mechanical friction brake is located on the main axle, immediately below the bull wheel at the upper terminal. It consists of twin metal bands about 6 inches wide wrapped around a pair of drum wheels about 6 inches wide by 5 feet in diameter. The brake is applied by pulling levers that draw the bands, which are lined with wooden “brake pads,” against the drum creating friction. From the appearance of the wood blocks, it appears to have been little used, or perhaps they replaced shortly before the system was abandoned. In any case, the gear reduction and electrical generation seems to have been the primary method of controlling the speed of the tram.

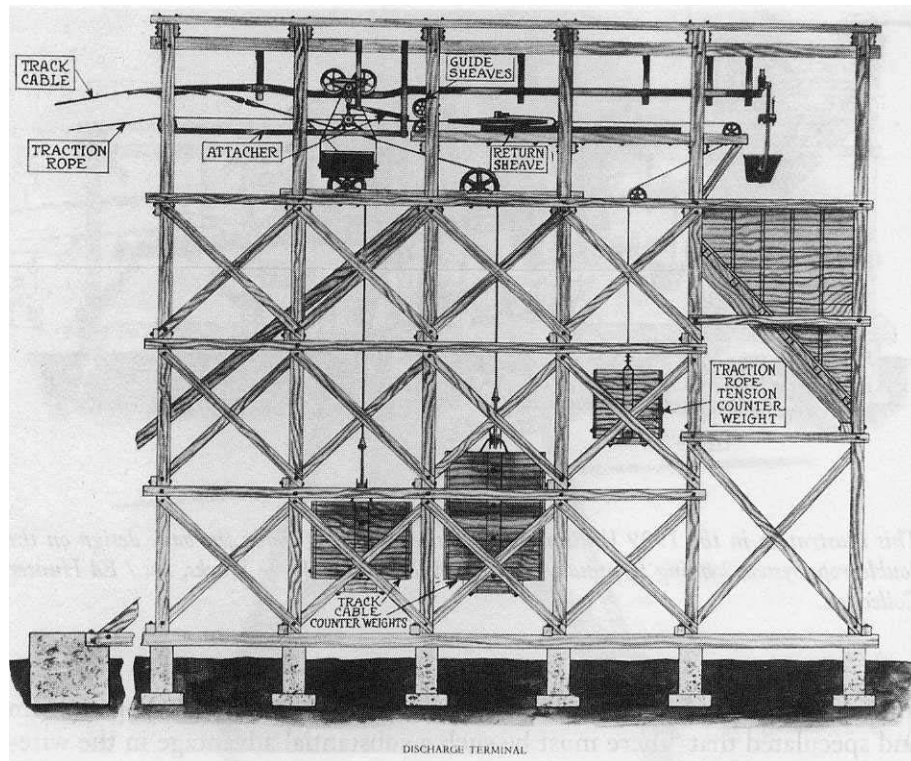


Figure 4-10. Sketch of Blichert-style discharge terminal (Trennert 2001).

Figures 4-11 and 4-12 are simplified diagrams of the flow of materials from the Homestake Mine to the upper tram and from the upper tram to the lower tram. Figures 4-13 to 4-26 show the various components of the WS&P upper tram, beginning at the Homestake Mine and continuing down to the Gold Dust Mine.

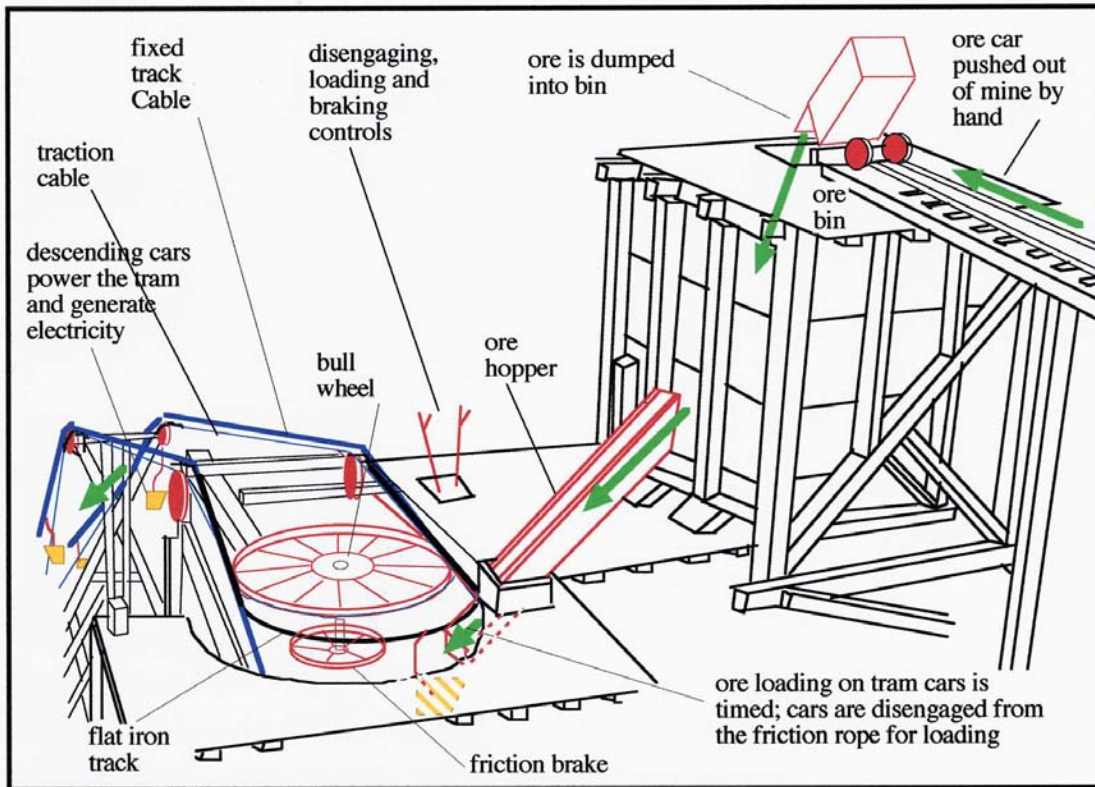


Figure 4-11. Simplified diagram of ore moving system at the Homestake Terminal.

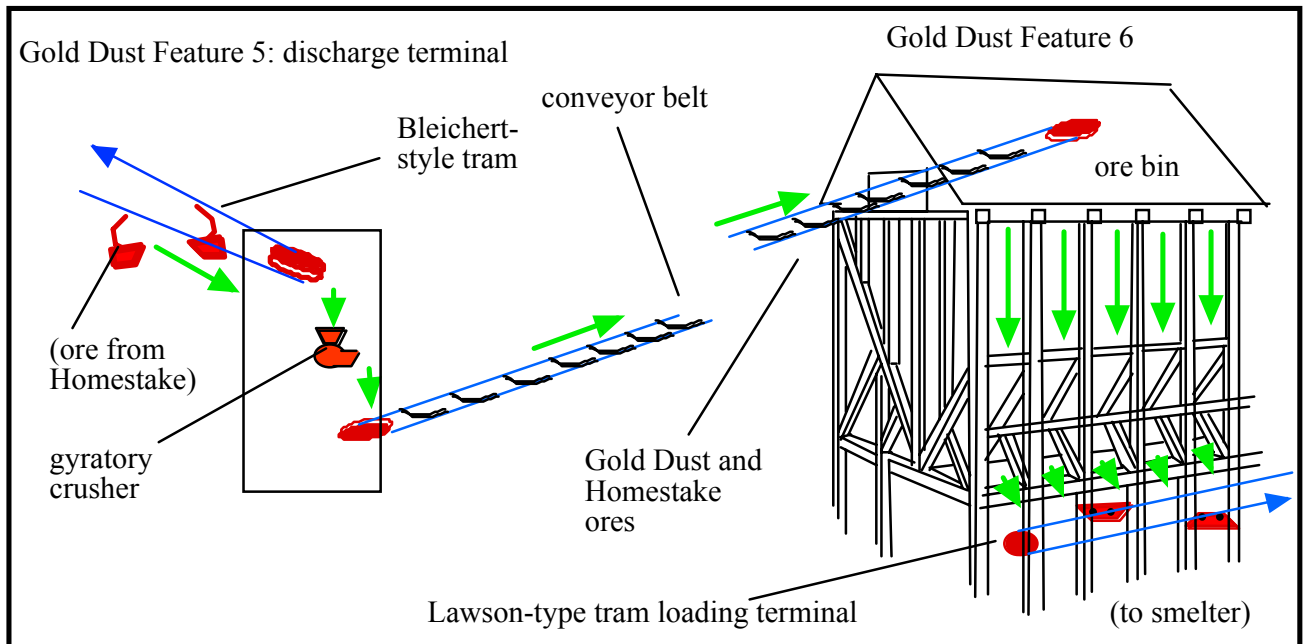


Figure 4-12. Simplified diagram of ore moving system at the Gold Dust Mine Terminal.



Figure 4-13. The brake house and Homestake ore bin, looking north.



Figure 4-14. Tram route looking down toward Gold Dust Mine from loading terminal



Figure 4-15. The upper terminal, brake house and ore bin in 1990 (GCM file photo).



Figure 4-16. Detail of casting marks on the upper bull wheel.



Figure 4-17. Detail of the friction brake system at the upper terminal, located below the bull wheel.

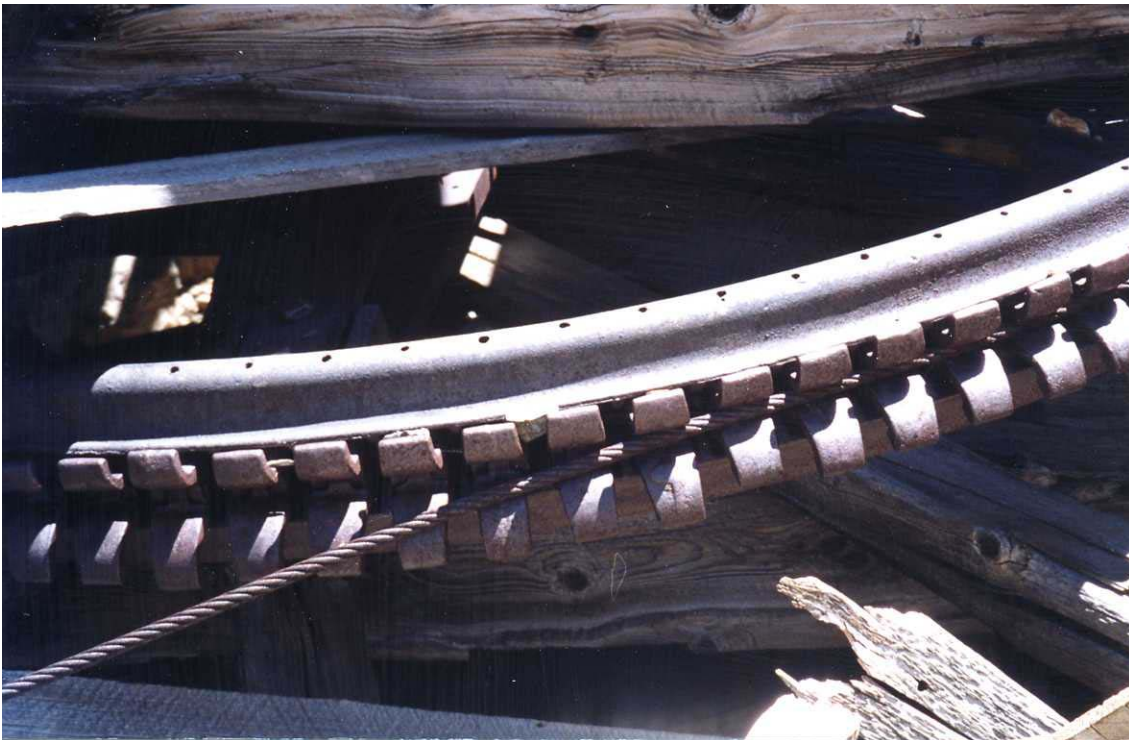


Figure 4-18. Detail of the traction rope bull wheel.



Figure 4-19. Detail of the ore metering device at the loading terminal.



Figure 4-20. Detail of the ore bin hopper at the loading terminal.



Figure 4-21. Detail of gear reduction system.

The retarding gear system, from foreground to background, reduced the rate of rotation of the vertical bull wheel axle while converting it to a horizontal axle, then reversed the direction of rotation and again reduced its rate of rotation. An electrical generator would have been connected to the furthest gear. Electrical generation helped control the speed of the loaded tram and provided lighting in the mine.



Figure 4-22. Brake house with detaching mechanism, and loading and brake controls on a ratchet system visible on the floor.



Figure 4-23. Detail of loading rail adjacent to traction rope bull wheel. The cars slid off the track rope onto the rails that led them around the bull wheel and back onto the track rope leading the opposite direction.



Figure 4-24. 1990 photograph of collapsed support tower. A Bleichert-type ore car can also be seen. Note the large diameter track cable and the small diameter traction rope.



Figure 4-25. Another ore car (center) next to a compressor tank (right) and an unidentified “homemade” bucket device (left), near the discharge terminal.



Figure 4-26. The discharge terminal and gyratory crusher (Gold Dust mine Feature 5). Note the cable, sheave wheels and flat iron track. This structure, collapsed as of 1990, was also burned in recent years.

Western Power and Smelting's Lower Tram

The lower tram is of the Lawson-patent design and has a 9,200 foot span. There were originally 92 support towers, including tension regulating towers along this segment. When recorded in 1990, two tension regulation towers and several support towers were standing. None remained standing as of 2001. The towers are located approximately 100 yards apart, with tension-regulating towers approximately every 1/4 mile apart. The collapsed remains of the wooden lattice towers can be found located at the expected distances. The route of the tram is easily followed because the cables are lying on the ground in essentially their operational location. In 1990, several tram cars were present. As of 2001, most of the cars have been removed.

William Lawson, founder of Interstate Equipment Corporation, developed a “loop-line” tramway in about 1919. The Lawson system uses wheeled cars, resembling small ore carts that ride on double, fixed “track” heavy cables (Figure 4-25). As with the Bleichert system, the cars are pulled by a smaller traction cable. The cars are loaded at a tippie or loading terminal and emptied at the discharge terminal, the empty cars returning on a parallel track (Trennert 2001). On this system, the more-or-less symmetrically shaped ore cars were flipped on their backs for dumping at the discharge terminal, and returned to the loading station in the upside-down position. The return track is located below the other track. Unlike the retro-fitted Bleichert system, the Lawson system was the latest in tram technology. It boasted speeds of 250 to 500 feet per minute, and all ore handling

was automated. It could also handle incoming supplies such as lumber or other freight.

The lower (Lawson) tram consists of four major feature types: tram support towers, cable tension regulating towers, cables and buckets (Figures 4-27 to 4-36). The tram support towers are around 40 feet tall and are 11.4 x 11.4 feet at the base. The tension-regulating towers contain six to eight counter weights consisting of rock-filled wooden cribs suspended on cables from the track cables.



Figure 4-27. A Lawson style tram (Trennert 2001). The empty cars return upside-down on a lower set of parallel, static track cables. A small traction wire rope provides the drive.



Figure 4-28. Viewing west toward the Gold Dust Mine, ca. 1920s (USFS file photo).



Figure 4-29. Another view of the lower portion of the tram, viewing west toward the Gold Dust Mine. This photo was also taken from near the discharge terminal, ca 1920s (USFS file photo).



Figure 4-30. The lower tram's discharge terminal at the remains of the WS&P smelter, ca. 1960s (Glidden 1976).



Figure 4-31. A support tower still stood in 1990 (GCM file photo).



Figure 4-32. A partially collapsed counterweight tower (1990 GCM file photo).



Figure 4-33. One of the Lawson-style ore carts, now part of the landscaping decor at a local summer cabin.



Figure 4-34. End view of the Lawson-style ore car. The cable guide wheel in the foreground is not part of the car.



Figure 4-35. One of the Lawson-style ore cart, its wheels removed, lies next to the cables (1990 GCM file photo).



Figure 4-36. Detail of the bottom of a Lawson-style bucket showing how the traction rope is attached to the car (1990 GCM file photo).

The ore from the Homestake Mine was to be blended with that of the Gold Dust. This would have occurred, had production started, in the large ore bin and loading terminal for the lower tram. Because of the deterioration of Feature 5, it is difficult to interpret how Homestake ore was transferred from the gyratory crusher at the Homestake discharge terminal (Gold Dust Feature 5) to the Gold Dust ore bin (Gold Dust Feature 6), a slightly inclined span of about 65 feet. It appears that the upper tram ended at Feature 5. Here ore was dumped from the Bleichert-style tramcars, and passed through the crusher. From there, a conveyor belt must have carried the ore into the Gold Dust bin. The Gold Dust ore bin has an opening in the upper part of the structure, facing Feature 5. This opening is too small to admit the suspended tram-style ore buckets (Figure 4-37). Inside the upper part of the ore bin structure are U-shaped rollers which indicates that a conveyor belt system was used. There is no evidence that the conveyor system from the Homestake tram terminal to the Gold Dust ore bin was fully completed or operational. On the other hand, it may have been salvaged or completely removed after the mine was closed.

The ore was to be carried into the opening in the upper part of the ore bin where it could be dumped into any one of a series of ore bins for blending. These bins fed through hoppers, by gravity, to the lower level. The loading terminal for the lower tram buckets was at the lower level (Figure 4-37, 4-38). The metering device and Lawson-style terminal is intact in the lower part of the ore bin structure.

Figure 4-40 is another view of the lower tram as it appeared in the 1920s. Figures 4-41 to 4-43 show the remains as seen today. Figures 4-46 and 4-47 are overviews of the lower tram system.

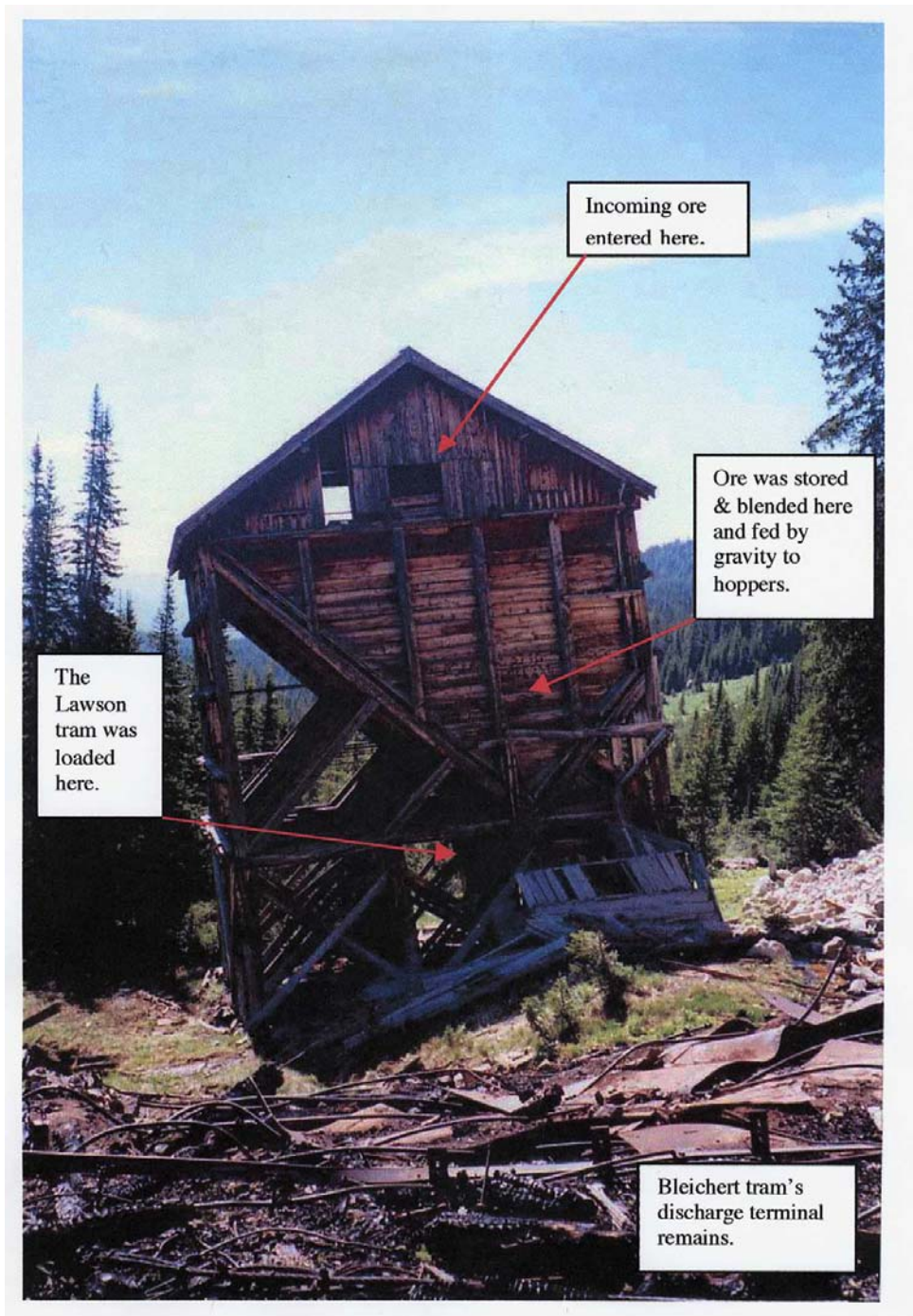


Figure 4-37. A view of the Gold Dust ore bin (Feature 6) facing the Homestake discharge terminal (Feature 5, remains in foreground). Note the upper story opening for incoming Homestake ore. It was fed by a conveyor belt loader system.



Figure 4-38. The loading terminal of the Lawson-style tram at the Gold Dust ore bin. (1990 GCM file photo).



Figure 4-39. Conveyor belt rollers are visible in the upper level of the Gold Dust ore bin.



Figure 4-40. The lower tram line, looking southeast toward smelter site, ca. 1920s (USFS file photo).



Figure 4-41. The remains of a collapsed counterweight crib at a tension-control tower.

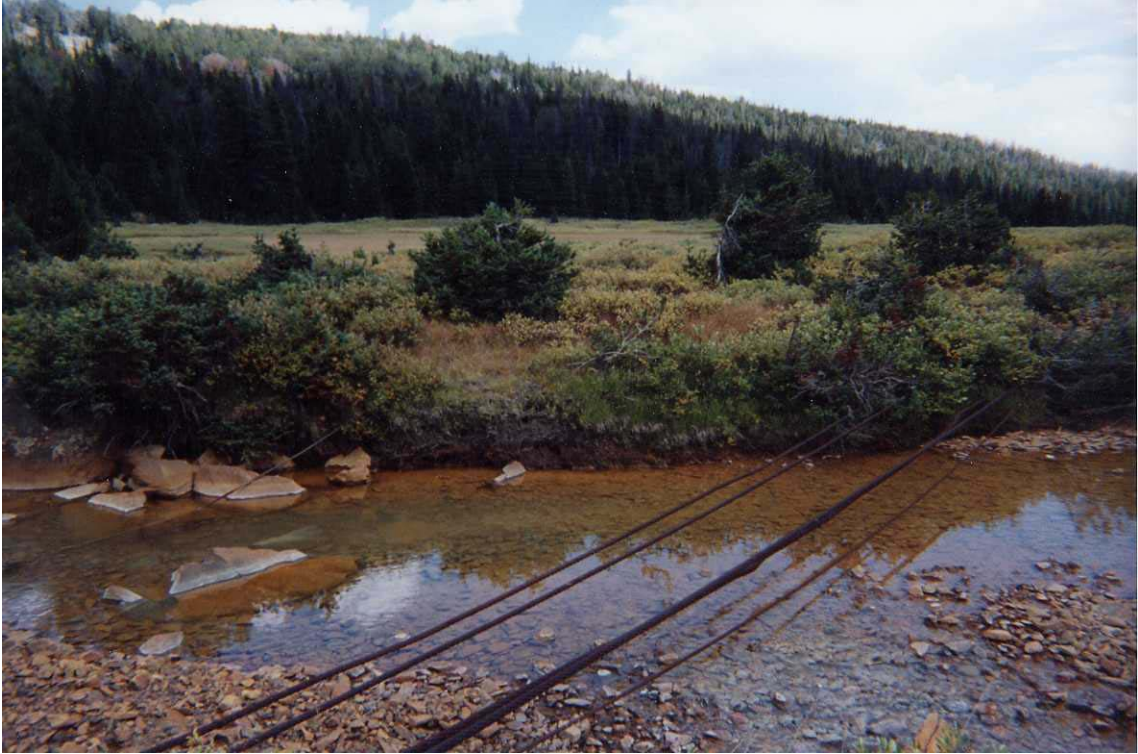


Figure 4-42. The lower tram cables crossing Fisher Creek.



Figure 4-43. Collapsed lower tram support tower remains as they are now found.



Figure 4-44. Collapsed lower tram counterweight tower remains as they are now found.



Figure 4-45. A cable spool lies along the tram route (1990 GCM file photo).

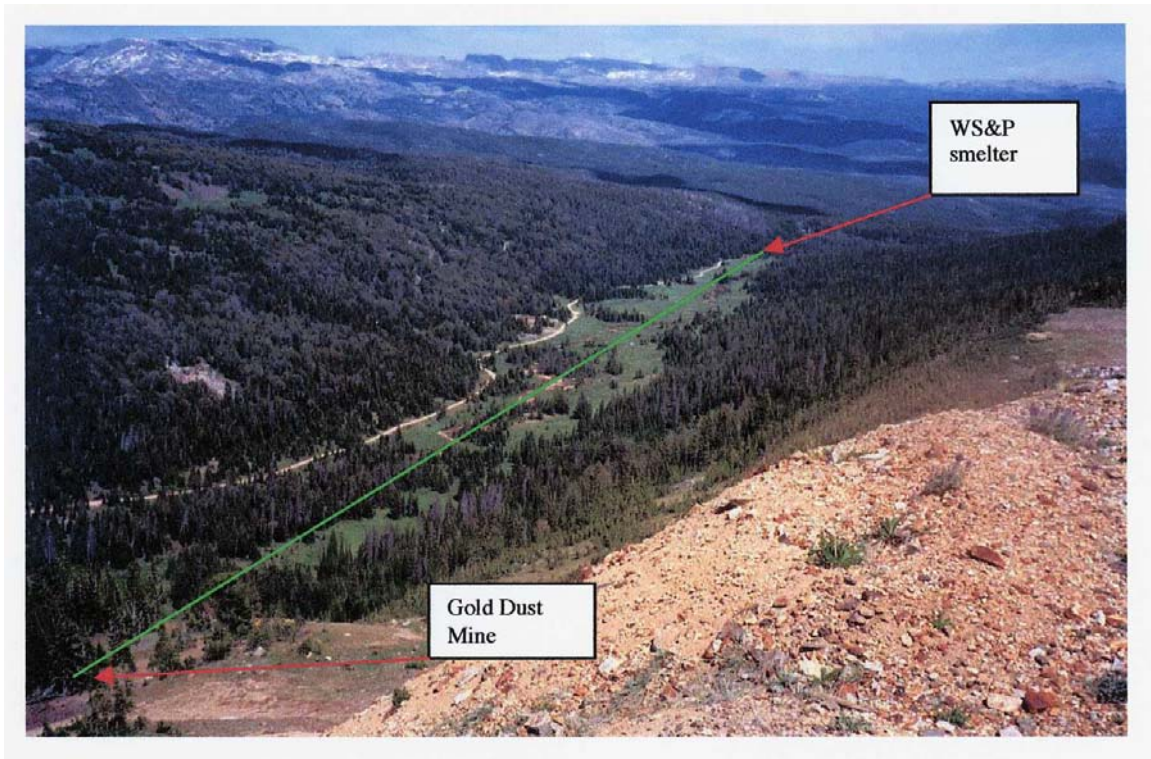


Figure 4-46. The route of the lower tram as seen from the Homestake Mine.

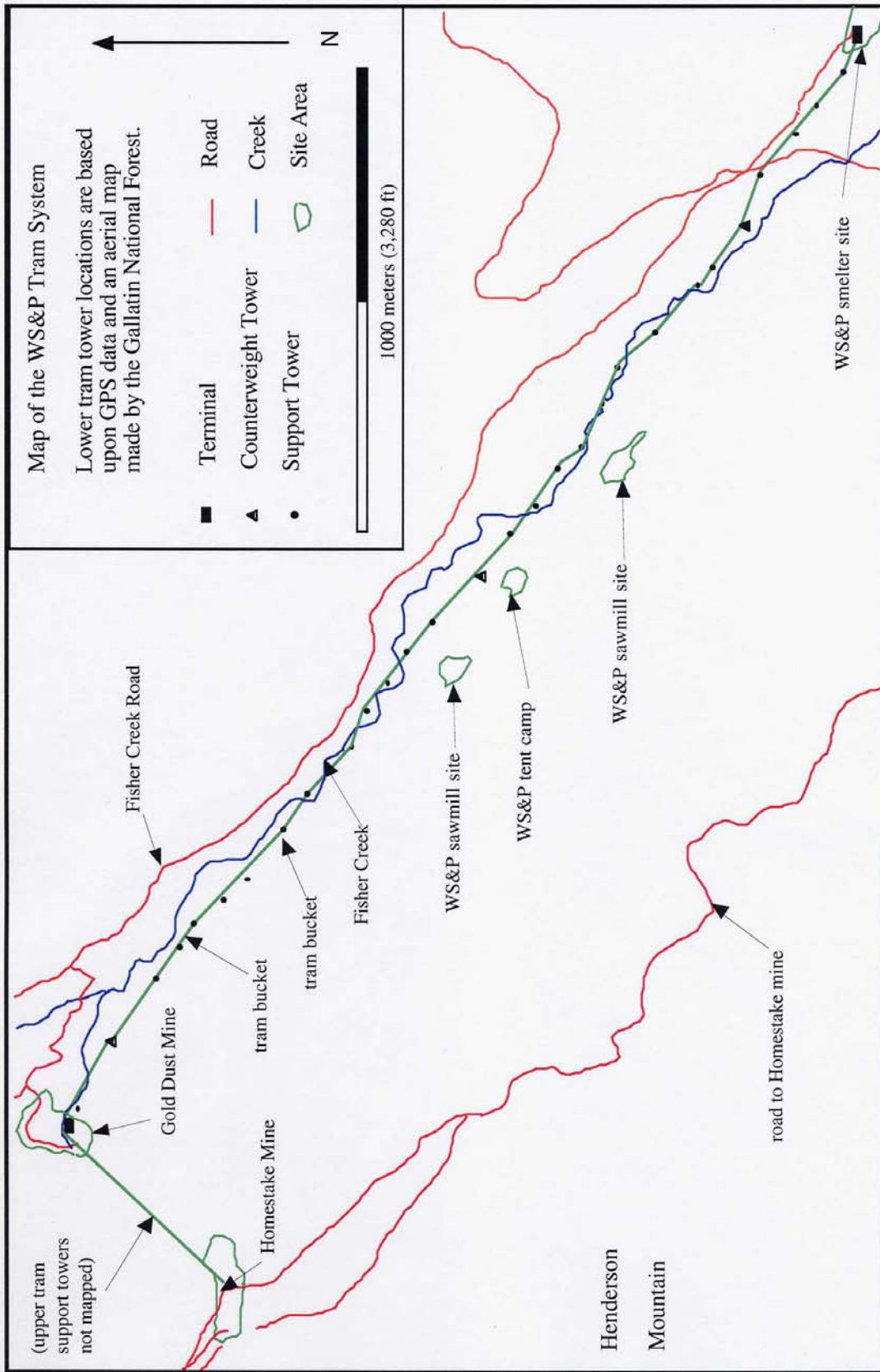


Figure 4-47. Diagram of the WS&P aerial tram system, based upon GPS data from the Gallatin National Forest.