NPS Form 10-900-b
(Jan. 1987)

OMB No. 1024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places Multiple Property Documentation Form

This form is for use in documenting multiple property groups relating to one or several historic contexts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. For additional space use continuation sheets (Form 10-900-a). Type all entries.

A. Name of Multiple Property Listing

LOGGING RAILROAD RESOURCES OF THE COCONINO AND KAIBAB NATIONAL FORESTS, ARIZONA

B. Associated Historic Contexts

RAILROAD LOGGING ON THE COCONINO AND KAIBAB NATIONAL FORESTS, 1887 TO 1966

C. Geographical Data

The geographical area covered by this multiple property listing includes the lands logged by means of railroads from 1887 to 1966 on what are now the Kaibab and the Coconino National Forests. Railroad logging occurred in two discontiguous areas, separated by a break in the ponderosa pine forest. Both areas are within Coconino County in northern Arizona (Figure 1).

The larger of the two areas measures 47 miles east-west by 43 miles north-south and encompasses approximately 1,293,000 acres. [redacted] The majority

☒ See continuation sheet

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 for Planning and Evaluation.

Evan J. McBloom — Federal Preservation Officer — 1-5-95

Signature of certifying official — Date

Forest Service

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.

for Edson M. Beall — Entered in the ~~National Register~~ — 2/24/95

Signature of the Keeper of the National Register — Date

of the land is owned by the USDA Forest Service and is administered by [redacted] The rest of the land is held by the Department of Defense (Navajo Army Depot), by state, county, or municipal governments, or by private landowners.

The smaller area, measuring 17 miles east-west by 10 miles north-south and encompassing approximately 108,000 acres, [redacted]. The USDA Forest Service [redacted] owns nearly all of the land; a private inholding called [redacted] is part of a land exchange currently being negotiated. If the exchange is culminated, this parcel would be acquired by the Forest Service.

E. Statement of Historic Contexts

Discuss each historic context listed in Section B.

Title of Historic Context:

RAILROAD LOGGING ON THE COCONINO AND KAIBAB NATIONAL FORESTS, 1887 TO 1966

INTRODUCTION

The Kaibab and the Coconino National Forests are part of the largest expanse of ponderosa pine in the world. The timber belt is approximately 400 miles long and a maximum of 60 miles wide. It stretches in a nearly continuous band from southern Utah to just west of the Rio Grande River (USDA Forest Service 1939: 9). Since the 1880s, lumbering has been a primary industry of this region. Logging was particularly important to the communities of Williams and Flagstaff, at times employing half their working populations, pumping millions of dollars into their economies, and building their infrastructures by constructing waterworks and power-generating plants (Matheny 1975: 364-378). The technology that helped the lumber industry achieve success was the logging railroad. From the late 1880s to the 1940s, lumber companies in the study area built a cumulative total of more than 770 miles of rail line to tap the riches of the forest. Logging railroads were the instrument that allowed timber barons to pursue their quarry down canyons, across washes, and up mountains with amazing tenacity. Almost no virgin stand proved safe from the whistle of the locomotive.

Three lumber companies and their successors built and operated these railroads: the Arizona Lumber Company (which became the Arizona Lumber and Timber Company and bought the Greenlaw Lumber Company), the Saginaw Lumber Company (reorganized as the Saginaw and Manistee Lumber Company), and the Flagstaff Lumber Manufacturing Company (which became the Flagstaff Lumber Company and was taken over by the W. M. Cady Lumber Company and Southwest Lumber Mills). Later sections of this nomination will discuss the histories of each of these companies, the areas they logged, and the railroads they built to access them. The following section discusses factors that contributed to the success and eventual obsolescence of railroad logging in the study area.

RAILROAD LOGGING TECHNOLOGY AND FACTORS AFFECTING ITS RISE AND DECLINE

The earliest logging efforts in the study area supplied local needs and were small in scale. The procurement strategy was to take the sawmill to the timber rather than vice-versa, for it was easier and more economical to move the mill than to pay the cost of hauling unprocessed logs by team and wagon. Portable steam-operated sawmills capable of processing no more than 10,000 board feet per day were used. The system of operating them was to cut all convenient timber within a radius of one or two miles, and then to move the mill to another favorable location when the local timber supply was exhausted (Plummer 1904: 14).

The first known sawmill in the study area demonstrates this pattern of timber removal. In November of 1876, Mormons from Brigham City, Saint Joseph (Joseph City), and Sunset established a mill at Sawmill Springs to supply colonies along the Little Colorado River. Prior to Sawmill Springs, the mill had been stationed at Mount Trumbull, where it processed lumber for the Latter-Day Saints' temple in St. George, Utah. At Sawmill Springs, the mill was rigged with a quarter-mile flume and powered by steam. It remained at Sawmill Springs until 1882, when it was

☒ See continuation sheet

transferred to Pinedale, then to Pinetop and to Lakeside, where it eventually burned (McClintock 1921: 154-155; USDA Forest Service 1937; Matheny 1975: 43-44; Doyle and Stone 1980: 67-69).

Another early milling operation was that of W. Z. Wilson and Alvin Haskell, who set up a portable rig near Bill Williams Mountain for a few months in 1882 to furnish lumber to Prescott and Phoenix (Fuchs 1953: 35; Matheny 1975: 50).

The development of the Atlantic and Pacific (A & P) Railroad revolutionized the lumber industry, pushing it to an intense new level of operation. Construction of the transcontinental carrier created a tremendous demand for ties: an average of 3,000 to 3,400 were needed per mile (Chappell 1971: 7; Richmond 1989: 102). Loggers at first responded to this demand by establishing portable mills and tie cutters' camps near the proposed route of the A & P. Frank Parker set up such a mill at Chalender circa 1880, while John Young established a tie-cutters' camp at Leroux Springs in 1881 (Fuchs 1953: 45; Cline 1976: 98).

Logging operations changed from small-scale to large-scale with the arrival of Chicago entrepreneur Edward Everett Ayer in 1881. Ayer realized that the A & P would provide not only a local market for ties, but also a means to export lumber to distant areas. He secured contracts to supply miscellaneous lumber to the A & P and to sell ties and telegraph poles to the Mexican Central Railroad. The Ayer Lumber Company mill, located in Flagstaff, went into operation on August 19, 1882, just two weeks before the A & P reached town (Matheny 1975: 51-64). The facility cost $150,000 to build, employed from 150 to 250 men, and was capable of processing 100,000 board feet per day (Matheny 1975: 63; Kuhn 1981: 96-97).

Delighted "with the prospects of making a great deal of money" (Ayer cited in Matheny 1975: 63), the lumber baron strove to build the most efficient logging operation possible. Getting the log from stump to mill inexpensively was a critical variable affecting his margin of profit. Ayer at first attempted, with some success, to limit logging costs by turning potential competitors into subcontractors. The practice of these early loggers was to clear-cut stands of ponderosa by axe and crosscut saw ("felling"), saw the logs into lengths suitable for hauling ("bucking"), assemble the bucked logs into transportable piles using two-wheeled carriages called Big Wheels ("bunching" and "skidding"), and cart the logs to the mill on a four- or eight-wheeled wagon (Mackey 1991: 1-2). On level ground, a loaded team could travel only ten or so miles per day. A serious obstacle encountered by this system of logging was the irascible climate of northern Arizona. Melting snows and torrential rains could turn the soils of the forest into impassible quagmires. Logging crews were rarely able to work past October, before April, or during unusually wet summers (Matheny 1975: 67). Clearly, a system was needed for hauling logs above the boggy soils rapidly and in all seasons.

In 1887, such a system presented itself. In the summer of that year, Colonel James W. Eddy's Arizona Mineral Belt Railroad began service between Flagstaff and Mormon Lake, an area then being cut by Ayer's operation. Eddy's plan was to build a railroad connecting the mining community of Globe with the A & P at Flagstaff, but financial difficulties precluded completion

of the line (Trennert 1970). Ayer and local cattlemen were quick to see the advantages of the Arizona Mineral Belt and began using the carrier to haul logs and livestock to Flagstaff.

Ayer's manager, Denis (often misspelled Den*n*is) Matthew ("Matt") Riordan, saw an additional opportunity offered by the Mineral Belt: if completed, it could deliver not only timber to mill, but also lumber to market. Riordan had been trying, with limited success, to compete against California lumber companies for business in southern Arizona Territory. A railroad from Flagstaff to Globe and on to the Southern Pacific Railroad would give him a decided marketing edge. Therefore, when the Mineral Belt faltered in 1887-1888 because of a major backer's (A & P's) refusal to reimburse construction costs, Riordan and associate Francis Hinckley quickly moved to acquire the line (Trennert 1970: 350-351). Riordan was on rather financially shakey ground himself in those days -- he had recently bought Ayer's operation and formed the Arizona Lumber Company (Cline 1976: 199; Kuhn 1981: 96) -- but he nonetheless persisted in his plan and completed acquisition of the Mineral Belt by the end of 1888 (Trennert 1970: 351-352). Although it never was extended to southern Arizona as Riordan planned, the carrier served him well. Soon a small network of railroad spur lines radiated from the main line to harvest timber south of Clark Valley (now Lake Mary).

Thus was born the first logging railroad in the study area. Riordan's line signaled the wave of the future for the timber industry. For the following fifty years, all large-scale lumber operations in the study area would build and depend on logging railroads to get timber from forest to mill.

By the late 1880s, all elements were in place for the efficient removal of timber by rail. First, the transcontinental line had created an enormous market for lumber locally and nationally. Second, manufacturers developed locomotives and other devices well suited to lumbering. Light locomotives (such as Shay's geared locomotives) designed for hauling logs over rugged roadbed made their appearance. The invention in the 1880s of the steam "donkey" engine (so-named because it was purportedly unworthy of being ranked in horsepower) also gave loggers new options in tractive power (Adams 1961: 16 and 73-75). Third, in the nineteenth century the lumber industry operated relatively free of government regulation; although the government sometimes took action against poachers on federal land (Ayer was so charged in the 1880s), timber barons were free to clear-cut the land on which they held timber rights (Putt 1991: 100-102). The logging companies purchased their timber rights from the transcontinental railroads, which had been granted "checkerboarded" (alternate) sections of land from the federal government.

From the late 1880s to the 1940s, logging railroads exploded across the landscape. Some of the lines, such as the Saginaw Southern and the Central Arizona Railway, were organized as common carriers. Others, such as the Flagstaff Southern, were operated simply as industrial railroads. Common carrier status gave a railroad the ability to condemn land for right-of-way (Adams 1961: 22-23), but it also meant that the railroad was expected to buy passenger equipment, print schedules, and have stations (Trennert 1965: 14). Railroads often sought common carrier status if they anticipated hostile landowners. If a landowner refused to sell an easement or wanted

an unreasonable price, the matter could be adjudicated if the railroad was a common carrier (Adams 1961: 23).

With the exception of the Arizona Mineral Belt, the first logging lines in the study area were built without benefit of engineers. It was not until shortly before World War I that logging railroad engineers (called "scenery inspectors") made their debut. It would be accurate to say that the earliest loggers *aimed* their railroads toward timber stands rather than platted, surveyed, or planned them (Adams 1961: 41). In fact, the term for locating a railroad line in the early days was "taking a shot in the brush". Using no more than a trusty compass and a good eye, the early logger would locate a main line into the area to be cut, and then would radiate spur lines off the main line to access stands for immediate cutting. Sometimes ballast was laid, but just as often ties were placed directly on the ground. Ties were often culls that larger carriers had refused to buy (Richmond 1989: 110). They were laid in an untreated state rather than preserved with creosote or zinc chloride, and so had a life expectancy of only five to eight years instead of the customary 10 to 16 years (Adams 1961: 67). Plentiful and expendable, ties were normally left in place to rot once a main line or spur was abandoned.

The same was not true of rails. Steel rails were one of the most expensive items involved in operating a logging line. Frugality was the key word regarding their utilization, and they were used and reused many times until they were little more than ribbons of rust through the forest (Adams 1961: 64). Bought used rather than new, they were referred to as "relay". Relay used in the study area usually had its origins with the A & P or its successor, the Atchison, Topeka, and Santa Fe Railroad. A variety of rail weights and gauges were used; "weight" referred to the size of the rail, while "gauge" referred to the distance that separated the rails. Often the lighter (that is, less expensive) rails and narrower gauges were used for short spurs, and the heavier rails and wider gauges were reserved for the main lines. In such cases, logs would have to transferred from a narrower-gauge train to a more standard-gauge train as they made their journey from forest to mill. Devices that facilitated the transfer of such cargo are poorly described in the literature of the study area.

Great care was taken to utilize rails fully or to liquidate what could not be used. When loggers needed to build new spurs, they would pull the steel from old ones, even if they anticipated reusing the old spurs again in the future. Interesting statistics on the cost-effectiveness of this practice are found in the records of the Saginaw and Manistee Lumber Company, which, in 1917, pondered whether to buy five additional miles of relay for its Bellemont operation or to pull it from existing Bellemont spurs. The first alternative would cost $15,000, but the second would cost only $1,500, even taking into the account the cost of reinstalling the rail in the future along original spurs (Saginaw and Manistee 1917). The high cost of rail in 1917 was a function of the steel shortage experienced during World War I. Steel rail was never cheap, but its price could skyrocket or plummet depending upon changes in the economy. For example, in September of 1893, Matt Riordan offered to sell the Santa Fe, Prescott, and Phoenix Railway 1,800 tons of 56-pound rail from unused portions of his Central Arizona (old Mineral Belt) line for $36 to $48 per ton (the lower price was for rail suitable only for spurs and sidings). When the financial panic of 1893 hit

the nation, Riordan cut his price in half and threw in spikes and fastenings for free (Riordan 1893). The Ashfork to Phoenix carrier jumped at the reduced price and purchased the material in early 1894.

When steel rails were unavailable, pole roads or tram roads were built, at least for short hauls. The former employed parallel, debarked logs for tracks, while the latter used sawn timbers (Labbe and Goe 1961: 49). In the study area, pole and tram roads occur mainly within and adjacent to logging camps.

With second-class ties, used rails, casual roadbed engineering, heavy cargo, and a northern Arizona climate capable of frost-heaving spikes, derailments were common and expected (Richmond 1989: 110). Most were unspectacular events in which the locomotive left the tracks for a short distance and stopped, upright. In such cases, the errant train could be coaxed onto the rails ahead by means of steel humpbacks ("car frogs"), carried as standard equipment on most locomotives (Adams 1961: 114). More obstinate iron horses could be hoisted back by steam donkeys or derricks. Derailments would have been far more common and fatal were it not for the fact that fully loaded logging trains averaged only 8 1/2 miles per hour and rarely negotiated grades exceeding 1 1/2 percent (Adams 1961: 115).

Since logging railroads were single-tracked, hazards included the possibility of collisions with speeders, the gasoline or kerosene powered vehicles used to haul company officials and other dignitaries along the rails. A common contrivance for helping one vehicle pass another in such situations was the railroad siding. Wyes and looping spurs were constructed to help a train change direction. Wyes were so-named for their "Y" shaped ground plan. The forked top (not the base) of the "Y" articulated with the main line or spur. By heading up one branch of the wye and backing down the other, a train could thus reverse its direction. Turntables were not used in the study area.

Despite their functional nature, some logging railroad resources were items of considerable beauty and grace. Trestles, built to assist the train's passage through topographic irregularities, approached monumental proportions. The Saginaw and Manistee's trestles at Hardy Hill and Frenchy Canyon and the Arizona Lumber and Timber Company's trestles through Volunteer Canyon are examples of such structures. While wood was overwhelmingly favored for the job of bridging any gap exceeding ten feet, other materials were also occasionally used. For example, the Arizona Lumber and Timber Company chose rock to build a 500 ft buttressed trestle along its 1920s and 1930s line to Howard Spring. Other logging railroad marvels include the incline built by the Flagstaff Lumber Company in 1917 to steam-donkey trains to Anderson Mesa (Trennert 1965: 12-13).

Although the workforce that built the railroads and logged the forest was commonly referred to as "Swede power" (Adams 1961: 51-52; Richmond 1989: 104 and 120), the term does not give proper credit to the many hard-working ethnic groups that contributed to the industry. By the late nineteenth century, most crews building track for the Arizona Lumber and Timber Company were

Mexican or Mexican-American (La Boone 1981: 9). The ranks of Mexican workers grew during World War I when many U.S. laborers went into combat. In the late 1910s and the 1920s, employment rosters of the Saginaw and Manistee indicate that nearly half its woodland workforce had Hispanic surnames, and that Mexicans and Mexican-Americans were in the majority on railroad construction crews. The Saginaw and Manistee roster for 1920 noted that Mexican crews were paid less than their U.S. counterparts (Saginaw and Manistee 1920). By 1923, the Saginaw and Manistee also had a "Black squad" of at least seven members (Saginaw and Manistee 1923a: 15); its function is unknown. African-Americans entered the northern Arizona lumber industry in great numbers following the purchase of the Flagstaff Lumber Company by the W. M. Cady Lumber Company in 1924 (anonymous 1926: 53-94). Cady had literally logged itself out of business in Louisiana, and relocated its operation and workforce to the White Mountains of eastern Arizona and to Flagstaff. Cady also employed Apache and Navajo Indians as brush pilers on its Arizona operations (anonymous 1926: 71; Adams 1961: 52). One Cady-era resource with a strong Navajo signature is a logging camp (site AR-03-04-05-414) on Mormon Mountain that exhibits the remains of a forked-stick hogan and several cribbed hogans.

Workers were housed at logging camps close to the areas being cut. Keeping the men close to their work reduced travel time and costs (Saginaw and Manistee 1923b). At least one company, the Saginaw and Manistee, may have maintained specialized camps. When it logged the Bellemont area from 1904 to 1926, Camp Numbers 1 and 2 housed track construction crews and railroad operators/mechanics, respectively. These camps remained in the same locations near Bellemont for many years. The Saginaw and Manistee simultaneously operated one, two, and sometimes three additional camps, primarily for loggers; these camps were used for a season or two and then relocated as the nearby timber was depleted. Circa 1920, the Saginaw and Manistee developed portable camps that could be loaded onto logging trains and completely relocated in a day's time (Saginaw and Manistee 1923a: 6). By the 1920s, both the Flagstaff (Cady) Lumber Company and the Arizona Lumber and Timber Company were using portable camps (Saginaw and Manistee 1923a: 6; anonymous 1926).

Logging camps were massive fueling and repair centers for workers, locomotives, and, in many instances, horses. It would be difficult to overstate the amount of eating that went on in these encampments. Of necessity, workers ate a lot in order to survive the caloric demands of incredible exertion and cold winters. One food historian estimates that the average caloric intake of a logger was 7,610 per day (Conlin 1979: 168). Chopping a tree with an axe burned about 10 calories per minute. Bucking it with a cross-saw required about 8.6 calories/minute, while topping and delimbing required about 8.4 calories/minute. Additional calories were burned just to stay warm on the job. Conlin's research, like that of Andrews (1954:94) and Richmond (1989: 114-115), indicates that lumber companies fed their workforce extremely well. Fresh meats, vegetables, fruit, and dairy products were standard fare; meals exhibited variety (no same-thing-every-day); baking was done with extraordinary skill; professional cooks were employed; and sit-down dining halls with tableware and table service were common. Loggers "were fed like prima donnas with heavy, solid food...The tables groaned with food...Cups were big and saucers deep and wide for blowing and

slurping" (Andrews 1954: 97). Dumps containing massive quantities of food-related items are common features at the sites of logging camps found in the study area today.

The horses and mules that skidded logs to trains and performed miscellaneous other chores also required massive fueling and upkeep. They were no Clydesdales but they were nonetheless real hay-burners. When the Arizona Lumber and Timber Company had 125 such animals in the early 20th century, feeding them required an average of 300 to 500 tons of hay per winter (Kuhn 1981: 98-99). It was not until the stock market crash of 1929 that the A L & T got rid of its horses. The Saginaw and Manistee, too, continued to use horses and mules for Big Wheel skidding and miscellaneous other tasks into the late 1920s (Putt 1991: 112). Horses and mules not only had to be fed, but also properly shod, so blacksmiths set up shop at many of the logging camps. Smithies not only tended animals, but also repaired logging machinery.

The logging railroad systems described above were expensive to build and elaborate to operate but more than paid for themselves when timber stands could be removed intensively rather than selectively. The nineteenth-century practice of clear-cutting made railroad logging cost-effective indeed. When physical obstacles were encountered, the lumber company simply built another spur or a trestle or abandoned the stand entirely for a more lucrative area.

Several factors began to erode the profitability of railroad logging in the early twentieth century. A major factor was that the federal government became actively involved in the management of forests and the regulation of timber cutting (Matheny 1975: 198-223). From 1893 to 1910 the study area became the subject of a flurry of Presidential Proclamations and Executive Orders that created Forest Reserves, expanded them, renamed them, realigned them by transferring land from one reserve to another, and finally redesignated them as National Forests. The Coconino National Forest and the Kaibab National Forest were formed as the result of this process. In 1910, the Forest Service began establishing sustained yield programs for each forest (Putt 1991: 105). These programs emphasized self-sustaining forest administration, whereby annual timber harvest would not exceed annual timber growth. Working largely with data provided by the Fort Valley Experimental Station (in the heart of the study area), the USDA Forest Service developed plans and regulations to ensure the long-term survival of northern Arizona's forests. All were based on the selective rather than intensive removal of timber. Predictably, clear cutting was not compatible with the new policy of sustained yield.

Logging companies were now faced with a litany of regulations that resonated through every cutting contract. Trees to be cut were to be marked first by the government, and no unmarked tree was to be cut. Loggers were to leave on each acre two mature seed trees to promote forest regeneration. Young trees less than 11 inches in diameter when measured 18 inches above ground were to be spared. Only a few small, unmarked trees could be cut for skid poles on pole roads. Damage to young growth and waste were to be avoided. Lumber companies were now required to clean up after their operations by disposing of trash at logging camps and clearing slash in cutting areas. Companies were also required to finish cutting their sale units before moving on to new ones: no longer could an area be abandoned and an easier one tackled when the going got rough.

In addition to establishing how much would be cut, the federal government also set the pace of where and when it would be cut. Sometimes the units designated by the government were small and scattered -- too small and scattered for logging by railroad.

Another factor that decreased the profit margin of railroad logging involved freight rates charged by long-distance carriers. Railroads such as the Santa Fe became a source of trouble after the turn of the century when they raised rates to what lumbermen thought were unrealistic and unreasonable levels (Putt 1991: 99-100). Particularly hard-hit by this adverse trend was the Saginaw and Manistee, for it used the Santa Fe not only to deliver milled wood to market, but also to bring logs from Bellemont and Chalender to the Williams mill. The freight rate problem was so serious by 1910 that the Saginaw and Manistee joined with the Arizona Lumber and Timber Company to bring a suit against the Santa Fe and the Southern Pacific. Although a court decision ruled in favor of the plaintiffs and ordered the carriers to cut their freight charges by twenty-eight percent (Putt 1991: 100), rates soon began to climb again. In 1921 the problem had progressed to the point that the Saginaw and Manistee conducted a study to determine if it could curtail its use of the Santa Fe by building a line of its own from Williams to Garland Prairie (Saginaw and Manistee cited in Arizona Lumber and Timber 1921a).

A third factor contributing to declining profits for logging railroads was a high accident rate leading, in turn, to high insurance premiums. Logging by rail only added to what was already an accident-prone industry. Mile for mile, logging roads presented some of the most dangerous railroading conditions of all times:

> "Brakemen on logging lines had an accident rate higher than that of high climbers, or tree toppers, the latter occupation having been classified by the National Safety Council as one of the five most dangerous in the country. A shortage of fingers became the badge of the brakeman's work as much as it was the sawyer's down at the lumber mill" (Adams 1961: 120).

By the early 1920s, employee safety and welfare committees had been formed in companies such as the Saginaw and Manistee to ensure that workers were not treated like expendable pieces of machinery (Saginaw and Manistee 1923a). Employee welfare was further safeguarded following the formation of the Industrial Commission of Arizona in the mid 1920s. The Commission did a diligent job of ensuring that timber companies carried adequate insurance to cover claims resulting from injuries (La Boone 1981: 43-46). In *addition*, some timber companies, such as the Arizona Lumber and Timber, carried aggregate stop-loss insurance with Lloyds of London to limit their liability in case of particularly accident-prone years. Although stop-loss insurance was extremely expensive -- in the late 1920s it cost 50 cents per $100 of payroll -- it was apparently considered a wise investment. The Arizona and Lumber Timber Company had to utilize (draw on) its stop-loss policy two or three times to cover bad years (La Boone 1981: 43).

Lumber companies found that they could not easily pass the costs of high insurance and freight rates on to the customer by raising prices. In the twentieth century, wood faced too much competition from cement. Customers were choosing cement rather than lumber for construction.

Therefore, lumber companies sought to maintain profits by cutting costs. To help contain costs, they searched for technologies more appropriate for the changing times. Company managers closely scrutinized their logging railroads, for these had evolved into the single most costly phase of the logging business (Adams 1961: 124).

Motorized trucking emerged as the technology more suitable for transporting timber from the woods. Logging trucks made their appearance in the study area in the 1920s and slowly gained in importance as railroads declined. Trucks, with their less expensive roadbeds, lower initial expenses, ability to negotiate sharper curves and steeper grades, and capacity to access isolated units of timber, became a more cost-effective transportation tool.

Although the logging truck killed spur logging (that is, the use of railroad spurs to collect timber), it did not supplant railroad logging entirely. In some instances, the two modes of transporting logs were used in tandem. For example, in the early 1930s, Bruce and Ira Gibson, the prime subcontractors of the Arizona Lumber and Timber Company, delivered logs by truck both to the mill in Flagstaff and to the railroad at Newman Park; the Gibsons were paid thirty percent less if they chose the latter option (Arizona Lumber and Timber 1931-1932). The system of delivering logs by truck to railroads was used in the study area as late as 1966, at Allan Lake landing.

The lumber recession of the mid 1920s, the Depression of the 1930s, and the fact that the lumber companies had, by 1940, cut nearly all good timber in the study area dealt successive blows to railroad logging. The Saginaw and Manistee and the Arizona Lumber and Timber companies were forced to scale back operations. Cady's Flagstaff operation ceased to exist (although Cady did survive in the White Mountains). World War II dealt an additional blow to the era of the logging railroad as rails, locomotives, and other metal items were aggressively and systematically collected for the war effort. The Coconino National Forest took a lead in collecting scrap iron from the countryside. By the spring of 1942 it had amassed 75 tons of the material and printed the following notice:

> "If you have old *railroad rails* [emphasis added], old wire, old car frames, broken machinery, or similar scrap notify the local ranger as to where and how much is available...Your scrap iron may be in the next bomb to fall on Tokyo" (*Coconino Sun* 1942b: 6).

The two lumber companies then in operation in the study area contributed to the war effort. The Saginaw and Manistee sold its Number Two, Three, and Four Spot locomotives for scrap (Richmond 1989: 111-112), while Arizona Lumber and Timber sold tons of rail and other machinery. While patriotism weighed in their decisions, the two companies also realized that the wartime shortages and premium prices then paid for iron provided an excellent opportunity to liquidate the relics of a technology that was fast becoming obsolete.

The following sections provide more detailed information about lumber companies in the study area, the areas they logged, and the railroads they built to access them.

THE ARIZONA LUMBER AND TIMBER COMPANY AND THE CENTRAL ARIZONA RAILWAY

The Arizona Lumber and Timber Company (AL & T) was a locally-based firm that evolved during a four-year period in the late 1880s. In 1886 and 1887, Matt Riordan purchased the Flagstaff mill, equipment, and timber of the Ayer Lumber Company. In June of 1887 Riordan and his brothers, Michael and Timothy, reorganized the business as the Arizona Lumber Company (Matheny 1975: 88 and 111). By late 1889 the company had negotiated 25-year contracts for virtually all the timber owned near Flagstaff by the Atlantic and Pacific Railroad (868 sections) and two cattle companies (238 sections). On January 21, 1890, the Riordans, Francis Hinckley, and Fred Sisson reincorporated as the Arizona Lumber and Timber Company (AL & T).

For most of its history, the AL & T maintained its main mill in Flagstaff at the location of the old Ayer mill, just west of what is now South Milton Road and south of what is now Route 66. The facility was destroyed by fires in 1887 and 1898 but was rebuilt and modernized. Circa 1890 at least three satellite mills were also operating on as as-needed basis. Although their locations are not precisely known (Matheny 1975: 133), one of them may have been at a spot now covered by Upper Lake Mary (Schuppert 1985: 2).

In 1897 the AL & T scored a business coup when it acquired a major competitor, the Greenlaw Lumber Company. Brothers Charles and E. F. Greenlaw had worked for the Ayer Lumber Company in the early 1880s. In 1886 they established their own company and soon became contractors for the Arizona Lumber Company. For the next twelve years the Greenlaws continued to operate as independents, sometimes under contract to the AL & T, and at other times in direct competition with it (Schuppert 1985). When the Greenlaws encountered financial straits in 1897 (a situation in part engineered by the AL & T; see Matheny 1975: 138-141), the Riordans and associates quickly moved to neutralize their competitor. On October 20, 1897, the AL & T purchased the Greenlaw Lumber Company for $40,000 (Schuppert 1985: 4). The AL & T continued to operate the company under the Greenlaw name until 1923. The Greenlaw sawmill was located at the Cliffs siding, on land that is now occupied by the Flagstaff Mall. During the period 1907 to 1923, the AL & T used the Greenlaw mill for cutting the areas north, northeast, and south of the mill. The company demolished the mill in 1925 (La Boone 1981: 14B). It should be noted that the Greenlaw Lumber Company built no logging railroads of its own; all were built by the AL & T (operating as the Central Arizona Railway).

During the Depression, the AL & T acquired the Flagstaff facilities of the Flagstaff Lumber Company, then owned by the Cady company, and moved its mill to that plant. In 1941 the AL & T leased its whole works to the Saginaw and Manistee. Southwest Lumber Mills acquired the lease in 1952 and, in 1953, exercised its option to buy the AL & T (Kuhn 1981: 102). A corporate name

changed occurred in 1959, when Southwest Lumber became Southwest Forest Industries. In April of 1987, Southwest Forest was purchased by the Stone Container Corporation and, a year later, was given the name of Stone Forest Industries to distinguish it from the paper and container operation (Stone Forest Industries nd).

Although the AL & T was not engaged in the lumber and timber business after 1941, it remained in operation as a land leasing and investment company into the 1980s. Presidents of the AL & T included Matt Riordan, who served until 1898, Timothy Riordan, who held the position from the time of his brother's resignation until 1933, Joseph C. Dolan, who served until his death in 1971, Mrs. J. C. Dolan (1971-1979), and Joseph P. Riordan (no relation to the earlier Riordans), president until the company's demise in the 1980s (Kuhn 1981: 97-98). General managers of AL & T during its lumbering days were Matt Riordan, I.B. Koch (1914-1932), and Joe Dolan (1933-1941) (Kuhn 1981: 97-98).

The first railroad used by the AL & T for logging was purchased from the Arizona Mineral Belt Railroad in late 1888. From 1889 to 1937, the AL & T built and operated numerous main lines and spurs under the name of the Central Arizona Railway (CARy). Although the Riordans and their associates had grandiose plans to extend their common carrier to Utah and Mexico, these plans never materialized, and the CARy remained essentially a logging railroad for its entire history. The CARy accessed numerous areas for the AL & T: Clark Valley (1887-1897), Rogers Lake South (ca 1900 to 1915), Greenlaw North (1907-1917), Greenlaw South (1918 to 1923), Rogers Lake North (1924-1926), Woody Ridge (1926-1927), and Munds Park-Howard Spring (1927-1931). Each of these railroad networks is discussed below.

Clark Valley

In late 1888, D. M. Riordan and Frank Hinckley acquired Colonel James Eddy's Arizona Mineral Belt Railway, a line Riordan had been using since 1887 to haul timber from Clark Valley, the area now known as Lake Mary (Trennert 1970: 350-351). The Mineral Belt, rechristened the Central Arizona Railway by Riordan and Hinckley, was approximately 36 miles long and extended from Flagstaff through Clark Valley to just south of Mormon Lake (Robertson 1986: 73). Although Riordan and Hinckley purchased the entire line, there is no evidence that they ever used more than the first 16 miles of it, to Clark Valley (Robertson 1986: 78). By 1890, three spurs radiated south from Clark Valley up Elk Meadows, Lake Mary Draw, and Howard Draw (Figure 2). By 1893, the CARy stopped paying taxes on all but the first 12 miles near Flagstaff and abandoned the rest of the line (Trennert 1970: 354; Robertson 1986: 78). Following the financial panic of 1893, the CARy pulled its southern 24 miles of rail and sold them to the Santa Fe, Prescott, and Phoenix Railroad (Riordan 1893). Shortly after the turn of the century, the CARy pulled the 12 miles of trackage near Flagstaff (Trennert 1970: 354), plus spurs, and used this material to build a main line and spurs between Flagstaff and Rogers Lake.

Rogers Lake South

Although the Arizona Lumber Company began logging the area southwest of Flagstaff circa 1890, there is no strong evidence that this company or the AL & T built a logging railroad there before the twentieth century (Northern Arizona Pioneers Historical Society nd). Trackage used for the Rogers Lake line was 56 pound rail that had come from the Clark Valley line near Flagstaff. Construction of the line to Rogers Lake was likely begun in 1902 (Ashworth 1991: 86). In July of 1906, Coconino County made the following assessment:

> "Franchise and right-of-way, and 15 miles of main track, and roadbed, with side track, ties, fishplates, bolts and any and all materials used in the construction and maintenance of said track and road bed, together with the bridges and culverts running from Flagstaff in a southerly and westerly direction to Rogers Lake, 4 light log engines, 79 light logging cars, 2 hand cars, 2 log loaders, shovels, etc. $30,000.00" (*Coconino Sun*, October 6, 1906).

The Rogers Lake line ran from Flagstaff in a south-southwesterly direction for approximately five miles to what is now Fort Tuthill. From there it proceeded in a west-northwesterly direction for approximately five miles until it reached the northeastern shores of Rogers Lake.

After 1906 the Rogers Lake railroad logging network was vastly expanded (Figure 3). From 1907 to 1916 the CARy was extended down the east side of the lake so that the AL & T could access a large timber tract south and southwest of Rogers Lake. The first lines were due south of Rogers Lake. They extended to Harding Point and Howard Pocket, areas cut between 1909 and 1911. Later lines stretched southwest of Rogers Lake to Mooney Mountain and Red Hill, areas cut during the period 1912 to 1915. The Rogers Lake south operation ended in 1915.

In the late 1910s, the AL & T withdrew from the Rogers Lake area and focused more attention on the area surrounding its Greenlaw mill. The AL & T would return to the Rogers Lake area in the mid 1920s, but not before it had cut vast tracts of timber northeast and east of Flagstaff.

Greenlaw North

In the early twentieth century, the AL & T began cutting the area around its Greenlaw mill, three miles east of Flagstaff at the Cliffs siding (Schuppert 1985). Again using the CARy as its tool for accessing timber, the AL & T first extended the line eastward from Cliffs toward Turkey Hills, cut in 1908 and 1909. By 1908 the CARy extended as far north as Doney Park (Robertson 1986: 78). Soon main line and spurs skirted the north and east edges of Doney Park, accessing the east side of Black Bill Park (cut in 1910) and reaching T22N R9E (cut in 1911, 1912, and 1913).

Railroad building and timber cutting were shifted north and west in the late 1910s (Figure 4). In 1913 and 1914, logging railroads were being used to transport logs cut in an area extending

from Little Elden Spring to the west side of Black Bill Park. Steel rail was pushed farther north past Lenox Park (cut in 1915 and 1916) to the southern slopes of Robinson Mountain and Lenox Crater (cut in 1916 and 1917).

Greenlaw South

In the late 1910s, the AL & T started cutting the area south of the Greenlaw mill (Figure 5). The earliest area of cutting was near Log Cabin Tank (cut in 1918). By 1920 the railroad system had been further extended to harvest timber in the area now occupied by Flagstaff Fairfield. By 1922-1923 the CARy approached the north side of Walnut Canyon, terminating at Fisher Point.

With cutting concluded in the vicinity of its Greenlaw mill, the AL & T closed the facility in 1923 and refocused its energies on Rogers Lake.

Rogers Lake North

In the mid 1920s, the AL & T harvested timber from the area north and northwest of Rogers Lake and south of the Atchison, Topeka, and Santa Fe Railroad (Figure 6). It is not known whether trackage to Rogers Lake had been left in place when the company turned to the Greenlaw area, or whether the rails to the lake were taken up and relaid again in the 1920s. The latter alternative would seem more plausible, in view of the rail shortage faced by the CARy (and other railroads) during World War I.

By 1924, the Rogers Lake line had been extended along the northern shore of the lake to Volunteer Mountain. This area is now the site of the Navajo Army Depot. The World War II-era installation would use some of the CARy roadbed when it built its own railroad through the post in the 1940s. Pushing south, the Rogers Lake line reached Volunteer Canyon, cut circa 1926.

While the AL & T harvested the Rogers Lake unit, a major competitor worked only a short distance to the west. In the mid 1920s, the Saginaw and Manistee approached Volunteer and Mooney mountains during its cutting of the Hull Springs area. Accessing these areas via Garland Prairie, the Saginaw and Manistee line stretched its spurs as far east as LO Spring and the western portions of the Navajo Army Depot area. So intensive was railroad construction by the AL & T and the Saginaw and Manistee in the Volunteer and Mooney mountain areas that it is often difficult to tell, from the ground or from timber sale control atlases, which roadbed belonged to which company. On forest atlases, the Saginaw and Manistee and CARy lines appear to link at Volunteer Canyon.

In 1926 the AL & T completed cutting the area north and west of Rogers Lake and moved to Woody Ridge and Munds Park.

Woody Ridge

In 1926 the AL & T engaged in cutting timber near Woody Ridge and Fry Canyon (Figure 7). To access these areas, the AL & T used the Rogers Lake line to what is now Fort Tuthill, extended the line one mile to the south, then shot the line west past Griffiths and London Springs. From London Spring, approximately six miles of main line were laid to the south to reach Woody Ridge and then Fry Canyon. Today the roadbed of this line can be seen crossing and recrossing US 89A south of Flagstaff. The cutting of this area was completed in 1926 or 1927.

Munds Park and Howard Spring

In the late 1920s and early 1930s, cutting activities of the AL & T centered south of Flagstaff near Munds Park and Howard Spring (Figure 8). From the Rogers Lake line at Fort Tuthill, the Woody Ridge line was followed a mile south, then a new main line was built in a southerly direction. This main line continued through what is now Mountainaire (cut circa 1927). At a sink one mile south of Mountainaire, the line split into two forks. The west fork accessed Newman Park, Willard Spring, and Munds Park (areas cut between 1929 and 1931) and terminated just north of what is now Odell Lake. The east fork traveled through East Newman Park to Coyote Park and terminated at Howard Spring, cut circa 1929-1930. A spur eastward off this line accessed the west side of Coulter Ridge.

The Munds Park-Howard Spring operation witnessed the transition from spur logging to truck logging. Circa 1931-1932, some of the logs cut by the Gibson brothers, AL & T's contractor, were hauled to Newman Park by the Gibsons' trucks, then transported to Flagstaff by the AL & T/CARy train. The Gibsons continued to cut the area along the Mogollon Rim into the mid 1940s.

The Howard Spring branch of this line witnessed a rebirth in 1941 when it was leased by the Saginaw and Manistee. At that time, the branch was expanded in a southeasterly direction from Howard Spring past Horse, Bert Lee, and Long Parks to Allan Lake. Virtually no spurs came off this branch, as all logs were hauled to it by truck. In 1953 the line and timbering along it were taken over by Southwest Lumber Mills (later called Southwest Forest Industries), which continued to operate the train until 1966. This line was the last logging railroad in the study area.

THE SAGINAW (SAGINAW AND MANISTEE) LUMBER COMPANY AND ITS LOGGING RAILROADS

The AL & T gained a formidable competitor when the Saginaw Lumber Company of Saginaw, Michigan, began operating in northern Arizona. The Michigan company expanded to the study area in 1893 when company president and general manager J. C. Brown purchased timber rights to thousands of acres of former Atlantic and Pacific Railroad land from Dr. Edward B. Perrin (Matheny 1975: 135-136). By June of 1893 Brown had the Williams mill in production and was

constructing one at Chalender, several miles east (Matheny 1975: 137). The Williams mill burned in July of 1896, and when its upscale replacement went on-line a year later, the Chalender mill was closed.

To expand operations and purchase additional timber rights, the Saginaw Lumber Company merged with the Manistee Lumber Company on October 24, 1899 to form the Saginaw and Manistee Lumber Company. A key individual in the new organization was William F. Baker of Baker & Fentress, a Chicago bank. Baker & Fentress, trustees for timber lands that had been part of the Arizona Cattle Company, agreed to sell 132,000 acres to the Saginaw & Manistee for $139,547. This transaction launched a period of rapid expansion for the company (Matheny 1975: 160). By 1905, the Williams mill had grown to be "twice as large" as the AL & T one and "the largest in the entire Southwest" (*Williams News* cited in Matheny 1975: 161).

A major reorganization of the Saginaw and Manistee occurred in 1920 when it was purchased by Baker and Fentress (Saginaw & Manistee 1923a: 4). E. J. Wilder was named manager, replacing R. A. Nickerson, and corporate headquarters were moved to Williams (Saginaw & Manistee 1923a: 4; Robertson 1986: 99). The company struggled through the timber slump of the 1920s and the Depression of the 1930s better than its local competitors, although survival did necessitate a move by the early 1940s. In 1941 the company leased the AL & T facilities at Flagstaff in order to efficiently harvest the woodland south of Mormon Lake (Fuchs 1953: 144). It closed its Williams mill during the following year. In 1952 the AL & T lease was taken over by Southwest Lumber Mills. The Saginaw and Manistee was dissolved as a corporation on February 11, 1954.

Except for a five-year period near the end of the Depression (Glover 1988: 4), logging railroads were a vital part of the Saginaw/Saginaw and Manistee throughout its history. The company first used a logging railroad in 1894, when a line was extended south from the Chalender mill for a distance of approximately five miles (or ten miles: see Putt 1991: 96) (Figure 9). It is unclear whether the lumber company or the Atlantic and Pacific Railroad constructed and operated this railroad; Glover (1988: 1) believes it was more likely the A & P. From 1898 to the 1940s, the Saginaw & Manistee built and operated railroads to access timberland south of Williams (1898 to 1903), north of Chalender (1902 to 1906), north of Bellemont (1904 to 1926), south of Garland Prairie (1924 to 1928), south of the Grand Canyon (1929 to 1935), and south of Mormon Lake (1941 to 1952).

Saginaw Southern Railroad

In late 1897, following the closure of its sawmill in Chalender and the opening of its reconstructed facility at Williams, the Saginaw Lumber Company intensified efforts to harvest timber south of the latter settlement. The lumber company contracted with the J. M. Dennis Lumber Company of New Mexico to cut the timber (Fuchs 1953: 62), and then set about building a railroad to haul logs to the mill. The Saginaw Southern Railroad was formed on September 22, 1898 by John C. Brown, George G. Wharton, Williams Claude Brown, William P. Cutty, Max

Salzman, Charles F. Roberts, and Edward Doe (Arizona Lumber and Timber 1921a). Perhaps because its owners anticipated problems with local landowners, the Saginaw Southern was incorporated as a common carrier, giving it the right to adjudication in the case of right-of-way disputes. This decision proved wise, as landowner Elizabeth Owens Hull immediately objected to the railroad's plans. The case was settled in favor of the company by a court decision of April 13, 1899 (Arizona Lumber and Timber 1921a).

Grading began in the fall of 1898. By November 18, three miles had been constructed, and by January of the following year eleven miles had been laid with 60 pound rail. By June 30, 1899, 16 miles were owned and in use (Figure 10). The trackage was reduced to 12 miles in 1900 and extended to 18 in 1901 and 1902. Rails were pulled to within six miles of Williams in 1903, and the line was abandoned by the summer of 1904 (*The Railway Age*, cited in Robertson 1986: 99). Although it was the railroad's intention to build as far south as Jerome (Arizona Lumber and Timber 1921a), the line never reached farther south than Section 29 in T20N, R2E (Glover 1965).

The Saginaw Southern main line and spurs included steep grades through rugged terrain (*The Railway Age*, cited in Robertson 1986: 99; Glover 1988: 2). An engineer who visited the abandoned roadbed in 1921 stated that its grade presented the old Saginaw Lumber Company with "a losing game...[that] could bankrupt anyone" (Arizona and Lumber 1921b). A Saginaw and Manistee official later reported that the company had followed the path of least resistance and abandoned the hazardous and expensive grade because "financial conditions at that time necessitated moving the logging operations to better timber in another district" (Arizona Lumber and Timber 1921a).

Saginaw and Manistee Chalender Line

From 1902 to 1904, the Saginaw & Manistee built and operated a railroad that accessed timber north of Chalender (Figure 11). Little is known about this line, depicted on a 1909 forest atlas, a 1912 Tusayan National Forest map, and subsequent timber sale control maps. From Chalender, the line passed through Pitman Valley and then wound along the west and north sides of Sitgreaves Mountain. The main line was approximately 15 miles long, with spurs at Hardy Hill, Little Squaw Mountain, Squaw Mountain, and Spring Valley. The timber sale control atlas for the Kaibab National Forest suggests that the easternmost part of this line was later incorporated into the westernmost part of the Bellemont line, discussed below.

Bellemont Line

In 1903 the Saginaw & Manistee began to construct a line north of Bellemont (Figure 12). August Lindstrom, placed in charge of construction (Matheny 1975: 161), built 18 miles of main line and spur line during the first year (Glover 1988: 3). By 1909 the railroad had accessed Brannigan Park and Walker and Klostermeyer Hills. The line was extended north and northeast (around the west and north base of the San Francisco Peaks) after the Saginaw & Manistee's 1913

purchase of 24,000,000 board feet of timber from the Forest Service (Matheny 1975: 161). This increased the company's timber holdings to about 200,000,000 board feet, exceeding those of the AL & T.

The Bellemont line reached Fern Mountain by 1913, Kendrick Park by 1917, Howard Seep by 1920, and Deadman Wash by 1922. After 1922, cutting activity focused on the Fort Valley/Wing Mountain area, and a network of lines and spurs were constructed to harvest the timber there.

It was during its Bellemont logging operation that the Saginaw and Manistee began to use rail-borne logging camps:

> "In addition to small shanties that could be loaded on standard railroad flat or log cars, the camps included a number of oversize camp cars rolling on their own wheels. The entire camp could be loaded up and moved to a new site in a matter of days. All of the camp functions from cook shack to saw filer were contained in the portable buildings. All that was required to start up was to light the fires in the stoves and lay down some boardwalks between the buildings" (Glover 1988: 4).

During its Bellemont period, the Saginaw & Manistee began a new numbering sequence for its camps, a sequence it continued to use during later operations at Hull Spring and Tusayan. Once assigned a number, a camp retained that number even if its location was changed. When the Saginaw and Manistee completed cutting the Tusayan unit in 1936, 38 camps had been assigned numbers from this sequence (there were not 38 camps in the Tusayan unit alone, as Richmond [1989: 113] implies). Camps 1 and 2, located near Bellemont, housed predominantly track construction crews and railroad operators and repairmen (Saginaw and Manistee 1923b). Other camps, located farther out on the main line and spurs, housed predominantly loggers.

The Bellemont line operated longer than any other line of the Saginaw and Manistee. It was also the most extensive railroad system of that company. At its maximum extent (circa 1922, when it reached Deadman Wash), it included approximately 29 miles of main line and an indeterminate number of miles of spur line. A 1925 assessment stated that the track was of 45-pound rail with a maximum 6 percent grade (Robertson 1986: 99).

The lumber company experienced problems with the Atchison, Topeka, and Santa Fe Railroad during the Bellemont campaign. The larger carrier, which served the lumber company by hauling logs from Bellemont to Williams and hauling water from Williams to Bellemont, raised its freight rates to levels considered unacceptable by the Saginaw & Manistee. A lawsuit brought by the Saginaw and Manistee and the AL & T resulted in a court-ordered reduction of freight rates by 28 percent (Putt 1991: 100). The reduced rates took effect in 1910 and were to remain in effect for at least two years (Matheny 1975: 168). As rates continued to rise during its final years at Bellemont, the Saginaw & Manistee looked for ways to by-pass the Santa Fe during its next cutting operation, south of Garland Prairie.

Garland Prairie and Hull Spring Line

In the early 1920s the Saginaw & Manistee owned rights to 790,000 board feet of timber south of Garland Prairie (Putt 1991: 111). The line built to access this timber was the subject of more forethought than perhaps any other logging railroad in the study area. Three years of survey and planning were undertaken before construction began in 1924. The Saginaw & Manistee sought to bypass the Santa Fe Railroad and its rising freight rates, and was willing to spend an unprecedented amount of time devising a plan that would do so.

In 1921 a logging railroad engineer for the Saginaw and Manistee was given instructions to survey a roadbed that would connect the Williams mill directly with the area to be logged. In September of that year, the engineer enthusiastically reported (Arizona Lumber and Timber 1921a) on a right-of-way he had staked for this purpose. From the Williams mill the right-of-way would run directly south along the course of the old Saginaw Southern. To avoid the more perilous grades of the Saginaw Southern, the new right-of-way would depart from the older one at Sevier Flat in Sec. 15 in T21N R2E, turn northeast and follow Dogtown Wash to Sec. 7 in T21N R3E, and then proceed in a southeasterly direction to Hull Spring. Impressed with the results of the survey, the Saginaw and Manistee approached the Arizona Corporation Commission with the intent to revive the old right-of-way of the Saginaw Southern (Arizona Lumber and Timber 1921b).

The following summer, the same engineer changed his recommendation. He was now "unreservedly in favor of" a line that would use the Santa Fe rather than avoid it; the right-of-way would connect with the Santa Fe at Garland Prairie, proceed southward along the west side of the prairie, and branch east and west near Dow and LO Springs (Arizona Lumber and Timber 1922). Unlike the right-of-way surveyed the previous summer, the new one would not exceed a grade of 1 1/2 percent for its entirety:

> "Your first logging camp would be built on Sec. 3, T20N, R4E, and when logging was completed there part of that outfit should be left as a sort of headquarters RR camp and the locomotives kept there. Were I given my way I would not build the Williams road [surveyed in 1921] but the Garland Prairie one instead. The latter is so much easier...I believe that a rate over the Santa Fe of about half that now in effect could be obtained...There are many disadvantages in working with the Santa Fe but...they are hauling our logs 24 miles for a great deal less (less than half) than what it costs us to deliver our logs to Bellemont and the distance is practically the same" (Arizona Lumber and Timber 1922).

The Saginaw & Manistee followed the 1922 recommendation and chose the Garland Prairie route (Figure 13). The line, which accessed Volunteer Canyon, the head of Sycamore Canyon, the west side of Mooney Mountain, and the western portions of what is now the Navajo Army Depot, remained in use until 1928.

Tusayan Line

By the late 1920s, the Saginaw and Manistee had cut nearly all of the timber near its Williams mill and was forced to consider stands in more remote areas. In 1927 the company succeeded in negotiating a contract to harvest 142 million board feet of government timber in the Anita-Moqui (now the Tusayan) District, south of the Grand Canyon (Putt 1991: 112) and 52 miles north of Williams (Figure 14). The acreage would be accessed by a railroad constructed from the Apex Siding on the Grand Canyon Railway, a common carrier constructed between 1898 and 1901 with Saginaw/Saginaw & Manistee assistance (Richmond 1989: 1-22).

The Saginaw & Manistee quickly modernized for the new timber campaign ahead. It replaced its Big Wheels with powered vehicles. It converted its sawmill from steam to electricity, building a power plant that also supplied electricity to the community of Williams (Fuchs 1953: 121). In August of 1928, the lumber company contracted with the Atchison, Topeka, and Santa Fe Railroad for the grading of tracks and sidings at Apex and for the rental of 56-pound rail. A wye at Apex soon fed into 26 miles of main line and spurs stretching from the siding to the south boundary of Grand Canyon National Park (Richmond 1989: 105-106). A settlement with school was started at Apex (one mile east of the siding of that name), and timber cutting was commenced in 1930.

An interesting feature of the Tusayan unit was that the areas most distant from Apex were cut first. Timber sale control maps indicate that the eastern areas of the unit were cut in 1930 and 1931. Cutting operations then moved westward, terminating near Apex and Tusayan in 1936 Richmond's (1989: 113) contention that cutting operations moved from west to east, rather than from east to west, is in conflict with cut dates recorded in timber sale control atlases.

Thanks to the Tusayan operation and conservative management practices, the Saginaw & Manistee survived the Depression better than its Flagstaff counterparts (Matheny 1975: 357). Still, by 1933 company officials voiced concerns that its timber supply would be exhausted by 1942. Immediately following the close of the Tusayan campaign in 1936, the company logged small, isolated pockets of timber scattered throughout the forest. Trucks provided the only economical means of harvesting these stands. The Saginaw & Manistee operated no logging railroads from 1936 until 1941 (Glover 1988: 4).

Allan Lake

In the late 1930s, the Saginaw & Manistee maneuvered to gain access to rich stands of timber that lay south of Mormon Lake. When appeals to the Forest Service were denied, the company negotiated with the AL & T to lease that company's Flagstaff mill, railroad, and timber operations. The Saginaw's offer was timely, for AL & T manager Joe Dolan was by then disheartened with the state of the industry and sought a release from his cutting agreements. Negotiations between the two companies were completed on March 1, 1941.

For the first year of its lease, the Saginaw & Manistee attempted to run some of the operation from its Williams mill. When it found that it could not do so cost-effectively, it closed the Williams facility in 1942 (Fuchs 1953: 144). All of its operations were then conducted from the Flagstaff plant.

To access the timber south of Mormon Lake, the Saginaw & Manistee upgraded the line that the AL & T had built to Howard Spring 12 years before. More importantly, the Saginaw extended the line another 14 miles to the southeast, terminating the line at Allan Lake (Figure 15). The extension contained occasional wyes and sidings (Glover 1965) but only one spur: a function of the fact that trucks were used to bring logs to the railhead.

The Allan Lake extension served the Saginaw and Manistee well. The timber it accessed enabled the lumber company to supply the defense industry during World War II. Saginaw lumber from the Flagstaff area was used to build March Air Force Base in California as well as Luke and Williams Air Force Bases in Arizona (Kuhn 1981: 101).

Southwest Lumber Mills took control of the AL & T (and the Saginaw's lease) in 1952 and 1953. Southwest Lumber and its successor, Southwest Forest Industries, continued to operate the Allan Lake extension until March of 1966 (*Arizona Daily Sun*, March 31, 1966). In 1967, Southwest Forest pulled the iron, thus ending the era of railroad logging on the Coconino and Kaibab National Forests.

THE FLAGSTAFF LUMBER MANUFACTURING COMPANY (FLAGSTAFF LUMBER COMPANY) AND THE FLAGSTAFF AND SOUTHERN RAILROAD

Following its purchase of the Greenlaw Lumber Company in 1897, the AL & T held a virtual monopoly of the forest northeast, southeast, and southwest of Flagstaff. That situation changed in 1909 when Ed McGonigle, general superintendent of the AL & T's Flagstaff mill, independently bid $3.50 per thousand feet on 75,000,000 feet of timber owned by the USDA Forest Service on land southeast of Flagstaff (Trennert 1967-1968: 69). When the Forest Service accepted his offer, McGonigle and associates formed the Flagstaff Lumber Manufacturing Company (FLM). McGonigle was named president and general manager, with John G. Verkamp as vice-president and treasurer and Jesse L. Boyce as secretary (*Coconino Sun*, October 29, 1909).

In December of 1909, the new lumber company announced plans to build a mill with a capacity of 100,000 board feet per day. The site chosen for the mill was one-half mile southeast of Flagstaff, the location now occupied by Stone Forest Industries. At the same time, the company announced plans to construct a railroad that would carry logs and not operate as a common carrier (*Coconino Sun*, December 3, 1909). The railroad was named the Flagstaff and Southern, but unofficially it came to be known as the "Flim-Flam" (Trennert 1967-1968: 70). The trackage built by the Flim-Flam used 110 pound rail (Robertson 1986: 106).

On November 30, 1910, the FLM began operating the mill and railroad. By that date the railroad was five miles long and had reached Clark Valley, where over a million board feet of logs already awaited transport back to Flagstaff (*Coconino Sun*, December 9, 1910). The new company represented a tremendous boost to the town; its nearly 1,000 employees and dependents increased the population of Flagstaff by nearly 20 percent (Trennert 1967-1968: 69).

In 1916 the FLM shortened its name to the Flagstaff Lumber Company, to "cut expenses", ribbed the local newspaper (*Coconino Sun*, October 20, 1916). At the time of the change, Joe C. Dolan had replaced McGonigle as general manager. A more extensive change occurred early in 1924, when the Flagstaff Lumber Company was purchased by the W. M. Cady Lumber Company of McNary, Louisiana. The new owner modernized and expanded the Flagstaff mill but retained the name of the company. W. M. Cady, Jr. was placed in charge of the operation (Trennert 1967-1968: 82-83). The Flagstaff Lumber Company permanently ceased operations in October of 1927. By the time the company folded, its railroad had been used to access timber stands at Howard Mountain (1910-1917), atop Anderson Mesa (1917-1922), and on Mormon Mountain (1923-1927). The latter two areas were expensive and difficult to access, a factor that contributed to the company's demise.

Clark Valley to Howard Mountain

During its earliest years of operation, the Flagstaff Lumber Manufacturing Company focused cutting efforts on the Howard Mountain area. Its main logging camp, called Camp No. 1, was located northeast of the mountain, at the watering spot known as Lake No. 1. When the Flagstaff and Southern reached Howard Mountain in 1911, 18 miles of main line were on the company's ledgers. A network of spur lines radiated out from the main line to access Thomas Spring, Seruchos Tank, and the eastern side of Coulter Ridge (Figure 16). These areas were cut between 1911 and 1917.

No fewer than four catastrophies befell the FLM while logging this area. In June of 1913, brakeman Fred Lewellen was killed when a log fell from a loaded railcar and crushed him (*Coconino Sun*, June 27, 1913). In November of that year, two locomotives (one of which was "practically new") were badly damaged and the engine house destroyed when oil dripped from one of the engines and started a fire (*Coconino Sun*, November 28, 1913). The year 1916 was also a bad one for the FLM. In January, heavy flooding inundated Camp No. 1 and almost reached the fire box of a locomotive as it crossed Lake Mary (*Coconino Sun*, January 21, 1916). Two months later the FLM's logging engine went off the track at the same lake and overturned in nine feet of water. This accident was caused by an unusually wet winter that softened the roadbed (*Coconino Sun*, March 17, 1916).

Equipment considered "high-tech" for its time was popular with the FLM during its Howard Mountain and later operations. When the terrain was too steep for rails and too hazardous for draft animals, Dolbeer donkey engines were used to snake logs from the woods to the railhead (Trennert

1967-1968: 70). In late 1916, the FLM purchased a steam loader that was used to load logs from Big-Wheels onto logging cars (*Coconino Sun*, October 20, 1916). The FLM had previously used a steam loader, with great success, at its mill to unload logs. However, it was not until the Anderson Mesa operation that the FLM (by then, the Flagstaff Lumber Company) faced its biggest logging challenge and attempted its most ambitious technological solution: an incline.

Anderson Mesa

By 1917, the Howard Mountain area was nearly logged out, and the Flagstaff Lumber Company (FLC) looked for an area in which to expand its operations. From its 1909 timber purchase from the Forest Service, the company still had rights to virgin stands atop Anderson Mesa. Accessing the mesa would be extremely difficult, for Walnut Creek/Walnut Canyon cut off all approaches from Flagstaff. After several months of surveying, the FLC decided to build a new railroad down the north and east sides of Lake Mary and to build an incline up the 500 foot high mesa.

An incline was "simply a railroad laid straight up the side of a mountain by which cars and locomotives went up and down at the end of a wire rope controlled by a donkey engine" (Labbe and Goe 1961: 29). An incline was the pride and glory of many a western logger; "in this period [1910s and 1920s] a logger felt himself a failure if he didn't own an incline" (Adams 1961: 58).

Using "a goodly appropriation" (*Coconino Sun*, February 16, 1917), the Flagstaff Lumber Company constructed the new road and the incline in the winter of 1916-1917 (Figure 17). The incline was a sight to behold. It was a mile long and tackled a 30 percent grade. A steam donkey located at the top lowered cars and engines to the bottom by cable.

The incline had a short and dramatic career. In November of 1917, a Shay locomotive taking on water near the top of the mesa strayed onto the incline and shot down its grade. There were no injuries, but the locomotive was completely wrecked. Approximately a year after its debut, the incline was replaced by a series of switchbacks. A flume or chute was also used to carry logs from Anderson Mesa to the railroad below (Trennert 1965: 13). Although photographs exist of the chute, its precise located is not indicated in historical records, and remains of the structure have not been found.

Mormon Mountain

In 1923, the Flagstaff Lumber Company started construction of an extension of the Lake Mary (Anderson Mesa) line, south to Mormon Lake (Figure 18). The line was built to access the Mormon Lake and Sawmill Springs timber units, purchased that year from the USDA Forest Service at a price of $2.25 per thousand feet. The unit included 80,000,000 board feet and covered 28,000 acres (*Coconino Sun*, August 3, 1923).

The extension followed the course of the Arizona Mineral Belt Railroad of the 1880s. From Clark Valley, it ran along the west side of Walnut Creek and then skirted the west side of Mormon Lake, terminating at Coyote Basin. The Mormon Lake extension was viewed with great anticipation by the locals, who believed that rail service would open Mormon Lake as a tourist destination. Although it was never the FLC's intent to be a common carrier, it sometimes found itself with as many as 300 passengers on a weekend (Trennert 1967-1968: 81-82). The use of Mormon Lake as a recreational area began in this era.

Shortly after W. M. Cady purchased Flagstaff Lumber in 1924, the new owners experienced two major accidents. In June, Charles McGonigle, a long-time FLC employee, was killed when the wire of a skidder snapped and slashed him. One month later a log carrier with a wide load knocked out the southern span of the Lake Mary bridge. Three log cars were dumped into the canyon, a gondola car was left suspended over the bridge, and the bridge, a metal structure that had been purchased from the Arizona Eastern Railroad for $25,000, was ruined. With its lifeline decommissioned, the sawmill soon ran out of logs and had to close temporarily (*Coconino Sun*, August 1, 1924; Trennert 1967-1968: 83-84) .

To expedite the delivery of logs to the mill, the FLC contracted with D. H. Cooper in 1924 to assume all logging and train operations. Cooper served in this capacity until 1926, when the FLC underwent reorganization. As a result of reorganization, W. M. Cady's business was purchased by a Chicago group and became known as the Cady Lumber Corporation of Delaware. This formed the nucleus of what later became Southwest Lumber Mills (Southwest Lumber Mills 1950; Trennert 1967-1968: 84). New officers included T. C. Hawkins, president, and Frank Quatters, vice-president.

The reorganized company completed its cutting of the Fulton Canyon and Coyote Basin areas in 1926 and 1927. It had saved the worst until last, and now faced the difficult task of accessing timber on Mormon Mountain. Moving north from Fulton Canyon, the company built a seven-mile branch to the summit of the peak. The line had a steep grade and no turning facility at the top, so locomotives were forced to use the hazardous expedient of heading up and backing down (Trennert 1967-1968: 84). Because of the expense and danger involved, the lumber company exhibited little enthusiasm for logging the mountain, but the Forest Service made it clear that it would negotiate no new sales with the company until it had completed timber harvesting there.

Mormon Mountain became the company's Waterloo. A slump in the lumber industry, coupled with the expense of the Mormon Mountain operation, caused the company to close its Flagstaff operation in October of 1927. However, the company did continue to run its operation in the White Mountains. The Flim Flam's 40 miles of main line plus spurs were pulled in 1938 (Trennert 1967-1968: 89).

PROPERTY TYPES

The boundaries of the area associated with the context "Railroad Logging on the Coconino and Kaibab National Forests, 1887 to 1966" can be accurately defined on the basis of historical maps and primary and secondary sources of data (for boundary descriptions, please see Section C, above). The study area, which includes more than 1,400,000 acres, has not been completely surveyed for historic properties. Survey coverage ranges from 0 percent in some areas to 100 percent in others. Overall, probably no more than 30 to 40 percent of the study area has been intensively examined. Therefore, not all logging railroad resources present within the study area have been found. It is probably also true that not all property types associated with railroad logging there have been defined.

To date, eight property types associated with railroad logging have been defined in the study area. They are: rolling stock, railroad grades, sawmills (millsites), logging camps, trestles, inclines, rural historic landscapes, and Big Wheels. Each is discussed in Section F of this Multiple Property Documentation Form. Property types that may be present but are not yet recorded in the study area are not included in Section F. Such types include chutes/flumes (an example of which may have existed on the side of Anderson Mesa) and train wrecks (local lore holds that there is a "lost" train wreck south of Rogers Lake). Property types are also not included in Section F if all examples of them have been severely impacted. "Waterworks" fall in this category. Logging companies impounded water by building tanks and reservoirs for their locomotives, sawmills, workers, and livestock. However, all of these features have been extensively modified in modern times.

The eight property types discussed in the following section are register-eligible under criteria A, C, and/or D. None appear to be eligible under B (properties best associated with important individuals). Registration requirements discussed in the following section define the threshholds for determining properties eligible under these criteria. Federal agencies may, at their discretion, choose to manage non-eligible properties, although they are legally required to manage eligible ones.

In addition to meeting the registration requirements set forth below, a logging railroad resource must be at least fifty years old to qualify for the Register. Properties that have not reached the half-century mark -- namely, some of those associated with the Allan Lake line -- may qualify as they achieve that age. None of the resources under fifty years of age appear to possess exceptional significance that would render them currently eligible.

Regarding level of significance, each Register-eligible property in the study area best qualifies for the National Register at the local level because the impact of railroad logging was felt most keenly at that level. An exception may be the Anderson Mesa incline, which currently appears to be the unique example of the property type "incline" in Arizona. It should be noted that the only other logging railroads in Arizona were the Cady lines on the Apache-Sitgreaves National Forests.

Name of Property Type Rolling Stock

Description: Rolling stock is here defined as the wheeled vehicles used on railroad grades. It includes structures such as locomotives and log carrier cars (Photo 1). It does not include vehicles that were used in conjunction with railroad logging but that operated *off* railroad grades, such as Big Wheels (treated in this nomination as a separate property type).

Once a hallmark of railroad logging, locomotives are now extremely rare. Of the approximately 20 engines that operated in the study area, only two are known to have survived to the present (Table 1). One of them, Baldwin #60870, used by Southwest Lumber Mills and later by Southwest Forest Industries, is displayed at the Coconino County Fairgrounds. The other survivor, Baldwin #35938, used by the AL & T and later by the Saginaw and Manistee, may still be viewed on the grounds of Stone Forest Industries in Flagstaff. It is conceivable that future research will locate additional survivors. Some of the locomotives, such as Saginaw and Manistee's numbers 2, 3, and 4, were sold for scrap iron.

Log carrier cars were more plentiful than locomotives, but only three of them are currently known to still exist. All three are attached to the Baldwin locomotive at Stone Forest Industries.

Significance: Locomotives and log carriers embody the distinctive design characteristics of a technology now obsolete. Therefore, they are eligible for the National Register under criterion C. As highly palpable and evocative reminders of an industry that made a significant contribution to local history, they are also eligible for the National Register under criterion A.

Registration Requirements: To be eligible under criterion A and/or C within the context established in this nomination, an item of rolling stock must exhibit the following three characteristics:

(1) The property must have been used in the study area. A piece of rolling stock never used within the study area, yet exhibited there, would not be eligible.

(2) To be eligible under criterion A, the property must still be located in the study area or have been returned to it. A piece of rolling stock that permanently left the study area would be "out of context" and therefore not eligible for the National Register. The property need not be in the exact location where it was used within the study area; integrity of general setting is more important in this case than integrity of exact location.

(3) To be eligible under criterion C, the property must still exhibit the distinctive characteristics of a type, period, and method of construction. A locomotive or log carrier that was extensively modified to adapt it to a purpose other than logging would not be eligible.

Integrity of association (1), setting (2), design (3), and workmanship (3) are sufficient to qualify rolling stock as eligible under criteria A and C.

☒ See continuation sheet

☒ See continuation sheet for additional property types

Table 1
Locomotive Rosters of Logging Railroads Used in the Study Area*

Company: Arizona Lumber & Timber (Central Arizona Railway)/Southwest Forest

No.	Type	Bldr/No	Built	Comments
1	2-8-2	Baldwin 43561	1916	Ex ATSF #2303
2	2-8-0	Brooks 595	1881	
3	4-6-0	Baldwin 7926	1886	Ex A & P #50
4	3T Shay	Lima 2732	1913	Sold 1923 to Saginaw & Manistee
4-2d	4T Shay	Lima 3026	1919	Purchased in 1936
5	3T Shay	Lima 2905	1917	Sold 1941 to Saginaw & Manistee
7	Shay	Lima 585	1899	Ex Saginaw & Manistee #1
25	2-8-0	Baldwin 35938	1911	Preserved at Stone Forest

Company: Saginaw & Manistee

No.	Type	Bldr/No	Built	Comments
1	2T Shay	Lima 585	1899	to AL & T #7
2	2-6-0	Baldwin 23883	1904	
3	2-6-0	Baldwin 32249	1907	
4	3T Shay	Lima 2732	1913	Purchased 1923; ex AL & T #4
4-2d	4T Shay	Lima 3026	1919	Ex Al & T #4-2d
4-3d	2-6-6-2	Baldwin 56738	1923	To Southwest Lumber #4
5	3T Shay	Lima 2905	1917	Purchased 1914; ex AL & T #5
25	2-8-0	Baldwin 35938	1911	Ex AL & T; at Stone Forest

Company: Flagstaff Lumber Manufacturing/Flagstaff Lumber/Cady/Southwest Forest

No.	Type	Bldr/No	Built	Comments
1	2-8-0	Hinkley 1530	1882	Ex A & P #40
1	3T Shay	Lima 3047	1919	
2	2-8-0	Hinkley 1518	1882	Ex ATSF #234; purchased 1910
2	2T Shay	Lima 3192	1922	Ex Aloha Lumber #2
3	2-8-0	Baldwin 37167	1911	
4	3T Shay	Lima 2732	1913	Ex AL & T; to Sag. & Manistee
4	2-6-0	Porter 5532	1914	
5	2-8-0	Baldwin 43573	1916	
12	2-6-6-2T	Baldwin 60870	1929	Displayed at county fairgrounds

* From Trennert 1967-1968 and Robertson 1986

Name of Property Type: Railroad Grade

Description: A railroad grade is here defined as the roadbed foundation that allowed the movement of rolling stock (Photo 2). From the 1880s to the 1940s, lumber companies in the study area built a cumulative total of more than 770 miles of railroad grade, including main lines, spurs, sidings, and wyes. Main lines were the arteries that accessed general cutting areas. Spurs were branches off the main lines that accessed particular cutting units. Sidings were short segments where tracks were doubled to allow one vehicle to pass another, and wyes were Y-shaped trackage that allowed a train to reverse direction by heading up one arm of the Y and backing down the other. From maps and historical sources, it appears that no more than 100 miles of grade were in active use at any given time.

Railroad grades were constructed in a variety of ways. A ballast of crushed rock or earth was often, although not always, deposited to prepare a level and dry base for the ties above. Ties were of ponderosa pine and untreated. They were not expected to last long, and so were commonly left in place when rails were pulled. In instances where a high ballast was needed (over 2 feet high), logs were often laid within and along the sides of the ballast to provide reinforcement. To provide as level a surface as possible, some grades were cut into slopes rather than laid above the natural ground surface.

Also occurring but considerably rarer within the study area were other types of grades, namely pole roads and tram roads. Both were built when steel rail was unavailable. They were built for short distances, and usually within or adjacent to logging camps. Pole roads used debarked logs or poles for rails, while tram roads used milled lumber or long ties for rails.

Several factors have impacted the integrity of railroad grades. Rails were systematically and thoroughly removed, so that today it is extremely rare to find even a single one *in situ*. Many ties were salvaged by local residents and used to build fences, cabins, and landscaping features. Other ties were left in place to rot; decomposed ones yielded rich humus that encouraged new tree growth along some of the grades. Roads for logging trucks were often built over the railroad grades. Although ties may still be found in place, it is common to find them thrown to the sides of grades as logging roads were built over them.

Significance: Railroad grades were not simply main lines (or spurs or sidings) but lifelines that kept mills and towns alive through the steady flow of logs from wilderness to civilization. Grades are still strong visual clues that allow even the casual observer to appreciate the enormity of the railroad logging industry and the niches it exploited. With the exception of rolling stock, no property type is more strongly associated with the historic context of railroad logging than the railroad grade. Therefore, grades are potentially eligible for the National Register under criterion A.

As structures, some grades are still well enough preserved to manifest a type, period, and method of construction. Viewed from this perspective, grades are potentially eligible for the National Register under criterion C.

Registration Requirements: For a grade to be eligible within the context established in this nomination, it must exhibit the following qualities:

(1) The grade must have been part of a logging railroad, and not a railroad used primarily for another purpose. A grade that was part of a transcontinental carrier or a mining railroad would not qualify within this context, although it might qualify within another historic context. All of the railroad systems discussed in this nomination possess integrity of association within this context. The Atlantic and Pacific/Atchison, Topeka, and Santa Fe Railroad and the Grand Canyon Railway would not qualify.

(2) To be eligible under criterion A, the grade must contain sections that still convey a visual sense of a logging lifeline streaming through the forest. *Both the condition of the section and the length of the section must be considered in making this determination.* The section of grade must, minimally, still have a majority of its ties in place or have a majority of its earthwork/ballast bed intact. A section of grade meeting this condition threshhold must provide a line of sight that carries the viewer's eye a substantial distance through the forest.

(3) To be eligible under C, the grade must contain sections that still manifest a method, period, and type of construction. The condition of the section is of critical importance here: the section must be in an exemplary state. It is not necessary that rails be present (that would impose an unrealistically high threshhold for determining eligibility); however, a majority of ties must be in place. Character defining elements of the earthwork/ballast bed (if it had one) must also be substantially intact. If the section was a pole road or a tram road, then a majority of the poles or lumber forming the rails of the road must be *in situ.*

Integrity of association (1), workmanship (2), and feeling (2) are sufficient to qualify a section of grade as eligible under criterion A. Integrity of association (1), workmanship (3), and design (3) are adequate for qualifying a section of grade as eligible under criterion C.

Name of Property Type: Sawmill (Millsite)

Description: Sawmills are defined here as mechanical facilities for reducing logs to lumber (Photo 3). Sawmills associated with railroad logging in the study area were of two general types.

Large, permanent mills were located where the lumber companies connected with the transcontinental railroad. These large installations, with capacities approaching 100,000 board feet per day, milled wood for a wide variety of purposes, depending on economic demand. At times, high-grade lumber for construction was in most demand; at other times, demand was greater for lumber for fruit and vegetable crates (some mill complexes, such as those in Flagstaff and Williams, included box factories). Railroad ties were also produced in great quantities at these plants, depending upon the amount of construction and repair being undertaken by the major carriers. Large mills were of critical importance to lumber companies. A fire in one could cripple an entire operation. Therefore, when one burned (fires were common in these facilities), it was quickly rebuilt, often in the same location. Large mills included the Saginaw and Manistee's mill at Williams, the Ayer Lumber Company's mill at Flagstaff, the Flagstaff Lumber (Cady) mill at Flagstaff, and the Arizona and Lumber Company's mills at Flagstaff and Cliffs (Greenlaw).

In contrast, small sawmills had capacities not exceeding 10,000 board feet per day. They were stationed to accomplish specific tasks and were moved or shut down as these tasks were completed. For example, the Saginaw and Manistee Lumber Company as well as the Arizona Lumber and Timber Company set up small mills to produce ties for logging railroads that were being extended. In this manner, the small mills could be used to make ties on the spot; wood would not have to be hauled to the main mills, converted to ties, and then hauled back to the construction site. Small mills also helped to relieve the burden of larger ones, particularly when the latter burned. Small mills tended to be located in the backwoods where logging railroads were being constructed. The Saginaw's Chalender mill, as well as the AL & T's mill at Riordan, provide exceptions to this generalization.

Virtually all historic sawmills in the study area are now in an archaeological state. As archaeological sites, they possess varying degrees of integrity. Some lack integrity and are not eligible for the National Register. From a preservation standpoint, large mills have fared worse than small ones. A shopping mall covers the site of the old Greenlaw mill. Motels and stores cover the site of the Ayer and AL & T mills. The modern facilities of Stone Forest Industries have replaced the historic facilities of the Flagstaff Lumber/Cady mill. The site of the Saginaw and Manistee mill is now occupied by Williams High School. Archaeological testing or monitoring would be required in order to ascertain if any of these archaeological resources retain integrity. A thorough evaluation of the Greenlaw Mill has been conducted (Pilles 1975), and the millsite has been determined ineligible for the National Register for lack of integrity (Hall 1976). In contrast, some small milling operations are in fine condition from an archaeological perspective. A good example is the site of the Saginaw and Manistee's Chalender mill.

Significance: Some sawmill sites in the study area have the potential to contribute significant information to the field of industrial archaeology. Artifacts and features from sawmill sites could provide a detailed understanding of the material culture of the lumber industry in northern Arizona. Therefore, sawmills are potentially eligible for the National Register under criterion D.

It is not argued here that millsites are potentially eligible under criterion A. To be eligible under A, a resource generally must be recognizable to the people who knew or used the property in historic times. As archaeological resources, sawmills in the study area would probably fail this test. Other property types discussed in this nomination -- such as rolling stock, grades, rural historic landscapes, and Big Wheels -- provide much stronger visual links to the context of railroad logging, and *are* potentially eligible under A.

Registration Requirements: For a millsite to be eligible within the context established in this nomination, it must exhibit the following qualities:

(1) The property must have functioned as part of a logging railroad system. Sawmills that predate or postdate logging railroads are not eligible within the context of this nomination. For example, the Sawmill Springs site or the site of Wilson and Haskell's mill would not be eligible, since both operated and closed prior to the era of railroad logging. If historical documentation is lacking for a particular sawmill site, then association of the site with the context of railroad logging may be established by matching the date of the site's artifacts to the date of a grade in the immediate proximity. If a grade is not present within one-half mile of the site, then an association with the context of railroad logging cannot be safely assumed.

(2) The property must contain surface or subsurface remains capable of yielding significant information about the material culture of the logging industry. The concepts of **visibility** and **focus** are useful for making this evaluation (National Park Service 1991: 12-13). Visibility refers to the sheer quantity of physical remains at a site. Focus refers to the readability (interpretability) of the physical remains and is a direct function of intactness. A site that possesses good visibility and good focus is eligible for the Register under criterion D; it is probably also a good candidate for public interpretation. A site with few physical remains (poor visibility) but good intactness (good focus) is probably also eligible if it can be expected to yield a usable body of data relevant to a carefully framed research question. An artifactually rich (good visibility) site that has been scrambled by post-historic disturbance (poor focus) would likely not be eligible for the Register. A site that lacks both visibility and focus would also not be eligible.

(3) If the surface of the property has been extensively disturbed, then it must contain intact subsurface deposits capable of yielding significant information. Large sawmills in the study area have been so heavily disturbed that intact subsurface deposits may not be present; register eligibility in these cases must be demonstrated, through testing or monitoring, rather than presumed.

Integrity of association (1) and materials (2) and (3) are sufficient to qualify sawmill sites as eligible for the National Register in this nomination. As sites, all sawmills will possess integrity of location; therefore, that quality is not a critical registration requirement.

Name of Property Type: Logging Camp

Description: A logging camp is here defined as a work station for the tending of laborers, livestock, and equipment associated with the logging industry (Photo 4). From site file data, it appears that a total of 34 logging camps have been recorded on the Kaibab National Forest and 68 have been recorded on the Coconino National Forest. All are archaeological sites. There are probably many additional camps that have not yet been recorded.

Logging camps served many functions. They provided food and shelter for workers as well as for horses and mules. They were used for making minor repairs to logging equipment and for shoeing draft animals. They were also used to tend pigs, chickens, and other barnyard animals that augmented the loggers' food supply. The camps were located close to the areas being cut and were occupied just long enough to accomplish the cutting; when the cutting moved to a new unit, so did the logging camp. By the 1920s, all logging companies in the study area were using highly portable camps that could be loaded onto train cars and rapidly moved to new locations. This was facilitated by hooks attached to the corners of the structures so that they could be hoisted onto an awaiting train. The scheduling of occupation was related more to economic climate than to season of year: wood was harvested when timber was needed, regardless of season.

Features found at logging camp sites include the remains of workers' cabins, mess halls, camp kitchens, blacksmiths' forges, scalers' cabins, commissaries, privies, boardwalks, corrals, sleds, Big Wheels, and miscellaneous other features and equipment. Dugouts for storing food or explosives sometimes occur. Depressions and rockpiles of unclear function are also common. The quantity of debris ranges from moderate to abundant. Trash pits and trash mounds also occasionally occur.

Significance: The archaeological research potential of logging camps in the study area is vast and virtually untapped. Only two camps, Saginaw and Manistee Camps 3 and 18 (AR-03-04-03-592 and AR-03-04-03-46, respectively) have been excavated, and the data from them is currently being analyzed (Morris and others, in preparation). Logging camps could yield information relating to a number of important research issues, some of which are listed below:

(A) Did some camps serve specialized functions? There is some evidence that the Saginaw and Manistee's Camps 1 and 2 on the Bellemont line served mainly railroad builders and operators. Archaeological data could test this notion and could search for clues of specialization at other camps in the study area.

(B) Were the camps segregated? The logging industry drew workers from many ethnic groups. Were different ethnic groups housed at different camps? Were different groups housed in different areas of the same camp? Were they fed separately? Were

they fed the same diet? How did the different logging companies vary in their treatment of minority groups?

(C) When and under what circumstances were families allowed to reside at the logging camps? Were women and children allowed to live at the camps in the era when all logging was done manually and loggers needed massive amounts of food in order to survive? Or were women and children allowed on camps only after mechanized logging was introduced? Did patterns of food consumption change following the introduction of families? Was food still served communally, or was each family responsible for its own meals?

(D) How good or bad were health and sanitation conditions? How quickly and thoroughly was garbage disposed? What diseases and injuries were common, as reflected in medicinal artifacts from the sites?

(E) Viewed as a group, how did logging camps change through time, both physically and socially?

(F) How similar or different were the logging camps of the different logging companies?

Because of their potential to yield information regarding these and other issues, logging camps are potentially eligible for the National Register under criterion D. It is not argued here that logging camps are potentially eligible under criterion A. As archaeological resources, the logging camps would probably not be recognizable to the people who knew or used the properties in historic times. Other property types discussed in this nomination provide much stronger visual links to the context of railroad logging and *are* potentially eligible under criterion A.

Registration Requirements: For a logging camp to be eligible within the context established in this nomination, it must exhibit the following qualities:

(1) The property must have been associated with railroad logging, and not with pre-railroad or post-railroad logging. In the case of logging camps associated with non-spur railroad logging (in which trucks delivered logs to railheads), the property must be at least fifty years old. If historical research or direct observation (close proximity of a camp to a railroad) cannot verify that a property was associated with railroad logging, then the property will not be eligible within the context established in this nomination. Isolated trash (trash that does not occur in association with a logging railroad resource) is not eligible within this context, although it may be eligible within other contexts.

(2) The property must contain surface or subsurface remains capable of yielding significant historical information. The site's **visibility** and **focus** should be considered

for making the evaluation of eligibility (please refer to the discussion of the property type "sawmill"). A site with good visibility and good focus will likely be eligible. One with poor visibility but good focus may also be eligible if it can be expected to yield a usable body of data relevant to a carefully framed research question. Sites with good visibility and poor focus, or that lack both qualities, will rarely be eligible.

Integrity of association (1) and materials (2) are sufficient to qualify logging camp sites as eligible within the context of this nomination. As archaeological sites, all logging camps will possess integrity of location; therefore, that quality is not a critical registration requirement.

Name of Property Type: Trestle

Description: Logging railroads sought the gentlest grade possible. A slope not exceeding 1 1/2 percent was recommended; one exceeding 6 percent was considered hazardous. To minimize roadbed slope, logging companies built trestles, defined here as structures to cross streams, drainages, and depressions (Photo 5).

Trestles in the study area exhibit considerable variety in construction technique. Trestles were devices to fill topographic irregularities, and the material used as fill was most commonly wood, or some combination of wood, rock, and earth. One example comprised almost entirely of stone is also known on the Howard Spring line, and a trestle of rock and concrete exists near Lake Mary. Wooden trestles were most commonly of the type known as cribbed or pigpen trestles (Glover and Hereford 1986: 25), built of logs bucked to a standard length of 16 feet. Sometimes the bases of cribbed trestles consisted of logs joined in log-cabin-like units to form piers. Longitudinal stringers would be laid atop the piers, ties were placed atop the stringers, and finally rails would be placed above the ties. The size of the trestle would commonly be described by the number of stringers (spans) comprising the length of the structure. With 16-foot stringers (that it, stringers comprised of logs bucked to 16 feet), a trestle approximately 48 feet long would be "three-span", one 64 feet long would be "four-span", and so forth. Some cribbed trestles attained a length of several hundred feet. Some were reinforced with rock ballast or longitudinal logs that were added to their lower sides in a buttress-like manner.

Another type of trestle occurred historically in the study area, although examples of it do not appear to have survived to the present. An 1890 photograph taken in the Flagstaff area (see Photo 5) pictures a logging train crossing a milled wooden trestle several hundred feet in length. The milled wood in the photograph forms an exquisite lattice of bents (vertical frames) resembling those in trestles described by Glover (1984: 6, 56, and 57) and Chappell (1971: 71 and 84) in New Mexico and Colorado.

Significance: Trestles were technological solutions to the problems posed by topographic irregularities. They created artificially gentle grades that enabled heavily loaded logging trains to pass safely through naturally rugged terrain. Trestles are significant primarily for their method and type of construction and therefore are potentially eligible for the National Register under criterion C. In localities where adjacent grades have been obliterated, trestles may provide the only clues regarding the former locations of logging railroads; in such instances, the trestles may qualify for the National Register under criterion D, for information potential.

Registration Requirements: To be eligible within the context established in this nomination, a trestle must exhibit the following characteristics:

(1) The property must have been part of a logging railroad, and not a railroad used primarily for another purpose. A trestle that was part of a transcontinental carrier or mining railroad would not qualify within this context, although it might well qualify within another historic context.

(2) To be eligible under criterion C, the trestle must be intact enough to evince its method and type of construction. A burned trestle would qualify if enough of its charred members remained *in situ* to convey a sense of how the structure was built and how it operated. The property must still exhibit intact character and technological representativeness.

(3) To be eligible under criterion D, the trestle must provide the only remaining evidence of the location of a former logging railroad grade.

Integrity of association (1), design (2), workmanship (2), and location (3) are critical for establishing the eligibility of a trestle. Some trestles may not qualify for individual listing under the criteria cited above. In such cases, the trestles should be regarded as features within grades; the grade, with trestle(s), should then be evaluated using the criteria discussed for the property type "Railroad Grades".

Name of Property Type Incline

Description: An incline is defined as a cable operated railroad on the side of a hill (Photo 6). Such structures were built to lower loaded log cars *down* grades too steep for locomotive power. Inclines were the opposite of declines, which were built to hoist loaded cars *up* steep grades (Adams 1961: 141; Labbe and Goe 1961: 258). Inclines (and declines) normally used steam donkey engines as well as a system of cables to move loaded cars and locomotives along the grade. Because the cables received more wear on one end than another, it was necessary to reverse them from time to time (Adams 1961: 59) or to replace them entirely.

Historical sources and archaeological surveys currently indicate that only one incline was built in the study area. The same sources suggest that no declines were ever built there. It is conceivable that additional historical research and survey work will identify more inclines (and perhaps also declines) within the study area.

Inclines tackled some audacious grades. The mightiest of them all was the one built in 1912 by Yosemite Valley Railroad, California, for the Yosemite Lumber Company. It was 8,300 feet long and had a maximum grade of 78 percent (Adams 1961: 57). The example from the study area was modest by comparison. The Anderson Mesa incline was a mile long with a maximum grade of 30 percent. The Anderson Mesa incline was not a particularly successful device. Built in 1917 by the Flagstaff Lumber Company, it was bypassed by switchbacks in 1918 (Trennert 1967-1968: 78-79).

Significance: Inclines represent a technological solution to the harvesting of timber from nearly inaccessible areas. They are significant for their peculiar and highly specialized design characteristics. They are therefore eligible for the National Register under criterion C.

Registration Requirements: The rarity of this resource type in the study area suggests that the registration threshhold for it be set rather low. For an incline to be eligible within the context established in this nomination, it must exhibit the following characteristics:

(1) The property must be known, through archival sources or observation of physical remains, to have been an incline. If archival sources are lacking, then pieces of cable in association with a relatively straight (not switch-backed) grade exceeding 15 percent should be viewed as representing an incline. Rails and ties need not be present for the resource to be considered eligible.

(2) A majority (more than 50 percent) of the incline's slope, from the base to the top of the topographic feature it scales, must be intact, so that the basic design characteristics of the structure are evident.

Integrity of association (1), design (2), and workmanship (2) are sufficient to qualify inclines as eligible for the National Register in this nomination. Because of their nature, all inclines will possess integrity of location; therefore, that is not a critical registration requirement in assessing eligibility.

Name of Property Type: Rural Historic Landscape

Description: In the context of this nomination, a rural historic landscape is defined as a geographical area that has been modified in a patterned manner by human activity. A rural historic landscape reflects the day-to-day occupational activities of people engaged in traditional work, in this case, railroad logging. Unlike *designed* historic landscapes, which are created for visual effect, rural historic landscapes evolve in response to both the forces of nature and the pragmatic need to make a living (National Park Service nd: 1-2).

One form of rural historic landscape has been identified in association with railroad logging (Photo 7). This form consists of timber tracts that were clear-cut. When clear-cutting was allowed, prior to about 1910, felling was done manually rather than by mechanical means, leaving knee-high to waist-high stumps. Lumber companies in the study area switched from manual felling to mechanical felling in the 1910s and 1920s. With power saws, trees could be cut closer to the ground.

Clear-cut areas exhibiting high stumps were once extremely common on the Coconino and Kaibab National Forests. Their numbers have decreased as stumps have rotted and new growth has taken root.

Significance: Clear-cut areas with high stumps represent the intensive cutting practices that helped railroad logging thrive in the study area. When USDA Forest Service regulations and plans took effect following 1910, timber could no longer be harvested intensively. The practice of clear-cutting was replaced by the principle of sustained yield. New policies promoting the selective removal of timber eroded the profitability of logging railroads, and foreshadowed the replacement of railroads by trucks. Clear-cut areas with high stumps evoke memories of the golden age of railroad logging. For their strong association with the context of railroad logging, these historic sites are potentially eligible for the National Register under criterion A.

Registration Requirements: For a rural historic landscape to be eligible within the context established in this nomination, it must exhibit the following qualities:

(1) The property must not predate the era of railroad logging. Clear-cutting was practiced in the study area several years before the first logging railroads. If a railroad grade is not present within one half mile of the property, then an association with the context of railroad logging cannot be safely assumed.

(2) The property must exhibit the character defining elements of a clear-cut area: that is, there must be no tree regeneration within its boundaries. High stumps must be

present to show that the area was not naturally open, but, rather, was cut. The property must also convey a sense of intensive tree harvesting on a large scale.

Integrity of association (1), workmanship (2), setting (2), and feeling (2) are sufficient to qualify rural historic landscapes as eligible within this nomination.

Name of Property Type: Big Wheels

Description: Big Wheels are here defined as two-wheeled, single-axled carts used to skid logs (Photo 8). Until the late 1920s, Big Wheels were the overwhelming tool of choice among local timbermen for the task of skidding logs to railroads. The strong association of the carts with railroad logging justifies their inclusion as a property type within the context established in this nomination.

Big Wheels were clever devices that carried logs by suspending them *beneath* the axle of the cart. By distributing the load in this manner, the wheels, rather than the draft animals pulling the wheels, bore the weight of the logs. This method of weight distribution meant that enormous loads of several thousand pounds could be pulled with a team of only two or four horses (Mackey 1991).

Big Wheels consisted of a heavy wooden or metal axle that supported the wheels, a tongue extending forward from the axle, and a heavy plank (Johnson board) hinged to the tongue and extending as much as eight feet behind the axle. The first step in Big Wheel skidding was to group logs into transportable piles (bunching). After the logs were bunched, the teamster would back the Big Wheels over the pile and unhitch the horses from the tongue. With wheels in position but the team still unhitched, a worker would stand on the rear of the Johnson board, and the weight of the person would be sufficient to begin to raise the tongue and rotate the axle. The team would then be hitched to the board so that it would assist in elevating the tongue as the Johnson board slid along the top of the logs. A chain with a grapple hook was then attached from the bunched logs to the axle. As the team pulled the tongue forward (down), turning the axle, the rotation of the axle would wind the chain, thus lifting the front of the load off the ground. Another chain might then be attached temporarily around the front of the load and tongue to stabilize the load until the team could be rehitched to the tongue.

A safety modification of some Big Wheels was the "slip tongue". Wheels of this nature had a distinctive square hole in their axle through which the slip tongue slid back and forth. Slip tongue Big Wheels required two teams: one that was hitched to the tongue, and another that was hitched to a long lever connected to the load. If the load started to run away, the wheels carrying the load slid forward on the slip tongue, causing the lever pulled by the second team to lower the logs to the ground. The lever would nose into the ground and serve as a braking device (Mackey 1991: 2).

Big Wheels were phased out of use in the study area in the late 1920s. They were gradually replaced by arches hauled by tractors, by cable-hauling systems, and by trucks. Big Wheels in relatively good condition are currently preserved at several locations in the study area: in Flagstaff at the Chamber of Commerce, the First Interstate Bank (South Milton Road Branch), and the Northern Arizona Pioneers' Historical Museum; and in Happy Jack at the Long Valley Ranger Station.

Significance: Big Wheels are symbols of bygone logging practices. They evoke strong memories of the era when Flagstaff and Williams were little more than logging towns and when locomotive whistles could be heard in almost every stand of timber. For their symbolic/associative value, Big Wheels are therefore eligible for the National Register under criterion A. The objects also represent an ingenious technological solution to the problem of hauling massive loads without mechanization. Their clever construction renders them potentially eligible under criterion C.

Registration Requirements: For a Big Wheel cart to be eligible within the context established in this nomination, it must exhibit the following qualities:

(1) The object must have been used within the study area during the era of logging railroads (post 1886). A set of wheels never used in the study area yet exhibited there would not qualify within the context established in this nomination. Similarly, a set of wheels that was decommissioned prior to the advent of logging railroads in the study area (1887) would not qualify, although the vehicle could possible qualify under a different context, such as "Establishment of the Logging Industry on the Coconino and Kaibab National Forests circa 1875 to 1886".

(2) The property must still be located in the study area or have been returned to it. A set of Big Wheels that permanently left the study area would be "out of context" and therefore not eligible within this nomination. The property need not be in the exact location where it was used within the study area; integrity of general setting is more critical than integrity of exact location.

(3) The object must be in good enough condition to convey the sense of how it looked and functioned. Its basic design attributes must still be present, with both of its wheels upright and still attached to an axle. It is not necessary that the tongue/slip tongue and Johnson board still be present for the vehicle to be eligible, although such elements would strengthen the interpretive value of the property. Fragments of Big Wheels (such as the pieces of axles, spokes, and rims occasionally found in the forest) should be regarded and treated as artifacts rather than as individually-eligible properties.

Integrity of association (1), setting (2), and design (3) are critical for establishing the eligibility of Big Wheels.

G. Summary of Identification and Evaluation Methods

Discuss the methods used in developing the multiple property listing.

This study was conducted by reviewing published and unpublished historical sources at: the State Department of Library, Archives, and Public Records (Phoenix); the Arizona Historical Foundation (Tempe); the Department of Archives and Special Collections/Arizona State University (Tempe); the Science Library/Arizona State University (Tempe); the Sharlot Hall Museum (Prescott); the Museum of Northern Arizona (Flagstaff); the Special Collections and Archives Department/Northern Arizona University (Flagstaff); Riordan State Historic Park (Flagstaff); the Region 3 Forest Museum (currently in storage at the Prescott National Forest, Prescott); and the Arizona Pioneers' Historical Museum (Flagstaff). The archives and files of the Coconino National Forest and the Kaibab National Forest were also consulted in assembling this Multiple Property Documentation Form. The Timber Sale Control Map Atlases on file at each Forest, as well as Vernon Glover's maps on file at the Special Collections and Archives Department/Northern Arizona University, were particularly valuable for determining when various timber areas were harvested. No survey work was conducted for this study. However, known (previously recorded) resources representing the range and diversity of property types were visited.

☐ See continuation sheet

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☒ See continuation sheet

Primary location of additional documentation:

☐ State historic preservation office
☐ Other State agency
☒ Federal agency
☐ Local government
☐ University
☐ Other

Specify repository: Kaibab National Forest, Williams
Coconino National Forest, Flagstaff

I. Form Prepared By

name/title Pat Stein, Historic Preservation Division
organization SWCA, Inc. date January 1993
street & number 23 East Fine Avenue telephone (602) 526-1928
city or town Flagstaff state AZ zip code 86001

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