CENTRAL PACIFIC TRANSCONTINENTAL RAILROAD
(Southern Pacific Overland Route)
(Southern Pacific Donner Pass Route)
Southern Pacific Donner Pass Route Tunnels
Sacramento to the CA/NV State Line
Sacramento
Sacramento County
California

HAER No. CA-196

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENCINEERINC RECORD
National Park Service
Western Region
Department of the Interior
San Francisco, CA 94107

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HISTORIC AMERICAN ENGINEERING RECORD

CENTRAL PACIFIC TRANSCONTINENTAL RAILROAD
(Southern Pacific Overland Route)
(Southern Pacific Donner Pass Route)

HAER No. CA-196

Location:

From Sacramento, Sacramento County, to the California/Nevada State Line, passing through Roseville, Placer County; Rocklin, Placer County; Loomis, Placer County; Newcastle, Placer County; Auburn, Placer County; Applegate, Placer County; New England Mills, Placer County; Colfax, Placer County; Gold Run, Placer County; Dutch Flat, Placer County; Alta, Placer County; Blue Cañon, Placer County; Emigrant Gap, Placer County; Cisco, Placer County; Soda Springs, Nevada County; Norden, Nevada County; Truckee, Nevada County; Floriston, Nevada County, and crossing the California/Nevada state line from Sierra County, California to Washoe County, Nevada.

NOTE: All UTM references are given for station locations, principal grade crossings, or indicated geological features.

UTM: 10-630270-4271525
Quad: Sacramento West, Calif. 7.5', 1967 (photorevised 1980)
(Sacramento)

UTM: 10-649335-4290500
Quad: Roseville, Calif. 7.5', 1967 (photorevsed 1981)
(Roseville)

UTM: 10-653180-4294910
Quad: Rocklin, Calif. 7.5', 1967 (photorevised 1981)
(Rocklin)

UTM: 10-656860-4298225
Quad: Rocklin, Calif. 7.5', 1967 (photorevised 1981)
(Loomis)

UTM: 10-661900-4304480
Quad: Gold Hill, Calif. 7.5', 1954 (photorevised 1973)
(Newcastle)

UTM: 10-667840-4307520
Quad: Auburn, Calif. 7.5', 1953 (photorevised 1981)
(Auburn)

UTM: 10-673960-4318795
Quad: Colfax, Calif. 7.5', 1949 (photorevised 1973)
(Applegate)

UTM: 10-675730-4323250
Quad: Colfax, Calif. 7.5', 1949 (photorevised 1973)
(New England Mills)

UTM: 10-677020-4329460
Quad: Colfax, Calif. 7.5', 1949 (photorevised 1973)
(Colfax)

UTM: 10-685240-4338835
Quad: Dutch Flat, Calif. 7.5', 1950 (photorevised 1979)
(Gold Run)

UTM: 10-687250-4340780
Quad: Dutch Flat, Calif. 7.5', 1950 (photorevised 1979)
(Dutch Flat)

UTM: 10-689070-4341785
Quad: Dutch Flat, Calif. 7.5', 1950 (photorevised 1979)
(Alta)

UTM: 10-697580-4347615
Quad: Blue Canyon, Calif. 7.5', 1955 (photorevised 1979)
(Blue Cañon)

UTM: 10-700610-4351600
Quad: Blue Canyon, Calif. 7.5', 1955 (photorevised 1979)
(Emigrant Gap)

UTM: 10-707000-4355220
Quad: Cisco Grove, Calif. 7.5', 1955 (photorevised 1979)
(Yuba Pass)

UTM: 10-711580-4352910
Quad: Cisco Grove, Calif. 7.5', 1955 (photorevised 1979)
(Cisco)

UTM: 10-726055-4355645
Quad: Soda Springs, Calif. 7.5', 1955 (photorevised 1979)
(Soda Springs)

UTM: 10-728000-4355070
Quad: Norden, Calif. 7.5', 1955 (photorevised 1979)
(Norden)

UTM: 10-742730-4356700
Quad: Truckee, Calif. 7.5', 1992
(Truckee)

UTM: 10-756400-4364660
Quad: Boca, Calif.-Nev. 7.5', 1955 (photorevised 1969, photoinspected 1973)
(Floriston)

UTM: 10-757950-4372640
Quad: Boca, Calif.-Nev. 7.5', 1955 (photorevised 1969, photoinspected 1973)
(California-Nevada State Line)

Date of Construction: 1863-1869, 1906-1925.

Engineer: Theodore Judah and Central Pacific Railroad Engineering Department (1863-1869); Southern Pacific Railroad Engineering Department (1906-1925).

Present Owner: Union Pacific Railroad, 1416 Dodge Street, Omaha NE 68101

Present Use: Railroad.

Significance: The Central Pacific First Transcontinental Railroad is a segment of the western half of the first transcontinental railroad, built from Sacramento, California to Promontory Summit, Utah between 1863 and 1869, where it joined the Union Pacific Railroad which had built west from Omaha. For the purpose of the current project, the first transcontinental railroad was found likely to be eligible for the National Register of Historic Places at the national level of significance under Criterion A for its significance in transportation history, in uniting the East and the West, and in the development of the West. The railroad's period of significance is 1869 to 1945, from the line's completion in 1869, through the years of its role in the settlement and development of the West, to the conclusion of the railroad's achievements in World War II.

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I. DESCRIPTION

Presently owned and operated by the Union Pacific Railroad, the former Central Pacific Transcontinental Railroad is a standard-gauge (four feet, eight and one-half inches between railheads) railroad extending between Sacramento, California and Ogden, Utah.

Originally a single-track line with passing sidings, the line today is both single- and double-tracked, with shops, freight yards, locomotive servicing facilities, depots, and appurtenant structures, including bridges, tunnels, and snowsheds, along the route. A comprehensive inventory of all contributive elements is beyond the scope of this documentation, which is aimed at recording certain of the tunnels. Technological changes in the 130 years since completion of the railroad have left few extant remnants from that period, chiefly the original alignment and roadbed, a few tunnels, and some stone masonry retaining walls. Early timber trestles were quickly filled over with earth wherever possible.

Improvements early in the 20th century brought construction of a second track over much of the length of the line; this second track is also considered a contributive element of the historic property, and beyond the alignment and roadbed of this line, many of the extant track-related structures on both lines date from this period. These elements include: tunnels, both those newly constructed and older tunnels enlarged and improved; truss, deck girder, steel trestle, timber pile trestle, and concrete bridges; "searchlight" type automatic block signals (many now converted to solar power). Earlier semaphore-type signals had been removed by the 1970s, and some of the single-lens searchlight signals were replaced by three-light signals following the 1980s merger of the Southern Pacific Railroad with the Denver and Rio Grande Railroad. By the 1980s improved snow-fighting equipment had greatly lessened the need for snowsheds on the portion of the line over Donner Summit in the Sierra Nevada, and in those areas where the need remained, reinforced concrete snowsheds had replaced the fire-prone, maintenance-intensive timber snowsheds that had been a hallmark of this railroad line since its inception [by the 1920s the Southern Pacific had spent three million dollars building the snowsheds, which had a useful life of about 27 years, and was spending $150,000 per year maintaining the snowsheds, not including the cost of maintaining fire lookouts both within the sheds and on adjacent peaks, nor the cost of four special fire trains and their crews, always on duty]. Finally, while the basic technology of rails fastened to ties is the same as originally constructed, today's steel rails are much heavier than the original iron rails, and concrete and steel crossties have replaced wood ties on some portions of the line.

The present owner operates the railroad as a freight railroad, but AMTRAK provides passenger service over the line, with its *California Zephyr* linking Oakland, California and Chicago, Illinois.

II. HISTORICAL INFORMATION

A. The Nineteenth Century

(The following quoted background discussion of the planning and development of the transcontinental railroad was taken verbatim from the National Register of Historic Places

Registration Form for the Transcontinental Railroad Grade, Box Elder County, Utah, prepared by Gail VanMoorleghem for the Bureau of Land Management, Salt Lake City District Office, May 1994.)

"The history of the Pacific Railroad (as it was originally called) development and construction began in the 1820s, about the time the first network of canals was completed in the eastern United States. During this period railroads began to spread throughout the East. By the 1850s they had spread into the Midwest and Mississippi River. The desire to continue the expansion and to eventually span the continent with a Pacific Railroad grew and eventually became a great public debate.

"The desire was not all grounded in the desire to connect the two parts of the country, rather promoters of such a railroad were primarily interested in and vocal about its commercial importance, even beyond this continent. As historian Robert Utley notes:

> The settlement of the Oregon question in 1846, the discovery of gold in California in 1848, and the admission of California to statehood in 1850 swelled the population of the Pacific Coast. With commerce almost wholly dependent upon the long, slow journey around Cape Horn or across the Isthmus of Panama, both East and West foresaw a large and lucrative trade speeding by rail across the continent.

"The proponents saw the potential for diverting much of the Europe to Asia trade from ship to rail, but the most coveted objective was trade with China, Japan, and other Asian areas.

"For the United States government these reasons were good, but most important in its final decision to actively promote and financially support this project were its potential effects upon domestic political and economic matters. From the government's perspective the railroad had the potential to more quickly end hostility with the American Indians and significantly reduce the expense and speed up transportation of mail and government supplies. In addition, the outbreak of the Civil War in 1861 made it clear that the bonds between California and the Union needed to be strengthened. Also, the Trent Affair, which almost caused another war between the United States and England, revealed the defenseless condition of the Pacific Coast. Though the construction of the Suez Canal in 1869 destroyed the potential value of the U.S. as a rail bridge for trade between Europe and Asia, the railroad was to fulfill all of its other expectations and more.

"The real efforts to initiate construction began in the 1840s with promotion by a New York merchant in the China trade named Asa Whitney. His obsession with this project led him to write articles, lecture and talk with influential politicians. By the 1850s most nationally prominent politicians were in favor of such a plan with a measure of federal aid. But agreement could never be reached on an eastern terminus, a problem which was compounded by the lack of information about the merits of the different possible routes that could be used. This led to a series of fairly comprehensive Pacific Railroad surveys carried out by the Army Engineers between 1853 and 1855. The results of these surveys (two northern and two southern routes) were politically objectionable to both the Northerners and the Southerners. Thus, the issue remained unresolved. It took the Civil War, which removed the southern objections to a northern route, strong lobbying by Theodore Judah, a California railroad engineer, and many eastern

promoters to convince a beleaguered Congress to pass a bill in 1862 throwing the support of the United States government behind the effort. President Lincoln supported the effort and signed the bill into law on July 1, 1862. This act authorized the Central Pacific Railroad and Union Pacific Railroad and Telegraph Company to build the railroad from Omaha to Sacramento.

"Construction of the railroad began in Sacramento on January 8, 1863 and in Omaha on December 2, 1863. The initial construction efforts were pathetic. The Civil War sent supply rates soaring and limited available labor in addition to drying up capital investment potential. By February 1864 only 18 miles of rail had been laid in California and none were laid out in Omaha until the spring of 1865. The adverse conditions of the time forced the railroads to ask for further assistance from the government, a request which was granted in the form of the Act of 1864. This act virtually doubled the resources available to the companies and ensured the project's completion.

"Between the years of 1864 and 1869 a total of 1,775 miles of rail were laid to complete the railroad link across the continent. This effort was perhaps the largest single construction project ever undertaken within the country. The task laid before both railroads was enormous, both logistically and financially....

"Despite the fact that the U.S. government offered lucrative subsidies, these covered only half of the necessary capital needed to build the railroad. As a result, private investment was critical for both the Union Pacific and Central Pacific railroads. Both companies devised the means to solve this dilemma by creating a number of indirectly held companies which carried out the construction work, but were not legally controlled by the federal legislation that directed the efforts of the two main railroad companies.

"Construction of the transcontinental line was fraught with exceptionally difficult obstacles that sorely taxed the technological capabilities of the day. The Central Pacific spent four years surmounting the Sierra Nevada Mountains. The company faced the necessity of putting in deep fills and rock cuts, bridging deep canyons with trestles, and cutting through solid granite for 15 separate tunnels. The Central Pacific did not reach Reno, Nevada until June 19, 1868. Reno lay 154 miles from the beginning of the track in Sacramento. The 536 mile distance from there to Promontory Summit in northern Utah, however, was completed in less than 11 months."

On April 3, 1868 the Central Pacific finished the line through to Truckee, 119 miles from Sacramento. California Historical Landmark No. 780-6, located in Truckee, notes the feat as follows:

> While construction on Sierra tunnels delayed Central Pacific, advance forces at Truckee began building 40 miles of track east and west of Truckee, moving supplies by wagon and sled, and Summit Tunnel [Note: not to be confused with the present 1925-built Summit Tunnel, Tunnel 41, HAER CA-215] was opened in December 1867. The line reached Truckee April 3, 1868; the Sierra was conquered. Rails reached Reno June 19, and construction advanced eastward toward the meeting with Union Pacific at the rate of one mile daily. On May 10, 1869, the rails met at Promontory (Utah) to complete the first transcontinental railroad.

The largely-Chinese construction crews of the Central Pacific had succeeded in surmounting the Sierra and crossing the desert, a tremendous engineering and human achievement, whose cost was not only monetary, but also represented an unknown number injuries and the loss of workers' lives. Some writers have termed the construction of the first transcontinental railroad the greatest engineering accomplishment of its era.

In crossing the Sierra Nevada, the Central Pacific had built fifteen tunnels between 1864 and 1869. In 1865 Central Pacific's Chief Engineer, J.H. Strobridge established an advance construction camp at Cisco, 92 miles from Sacramento, and used this location for the next three years as his advance camp for the arduous tunnel and mountain construction required to reach and overcome the summit of the Sierra. By August 1 of that year he had established camps at all the tunnel sites and heavy construction points from there to the summit, and had begun work at both ends of the summit tunnel while other crews labored to sink a vertical shaft at the tunnel's mid-point.

While crews had achieved rapid construction during the spring, summer, and fall of 1866, the winter that followed slowed progress considerably. One massive snowslide wiped out an entire camp of men at Strong's Canyon (Camp 4), who had been working on Tunnels 11 and 12. Still, Central Pacific issued a printed report in October 1866, stating that construction was progressing on the 1,600-foot summit tunnel and another 800-foot tunnel seven miles east of the summit. The report stated that work was underway on all other tunnels, and that crews were constructing these tunnels wide enough for the double track which the builders confidently expected to be needed within a few years. They could not know that nearly a half-century would pass before a second track would be added, by which time the original tunnels would require enlarging just to continue to service a single track.

Tunnels 1 and 2, known as Grizzly Hill Tunnel and Emigrant Gap Tunnel respectively, were located well west of Cisco. Crews completed both by September 1866. Tunnel 1, completed during the summer, was one mile west of Blue Canyon and 77 miles east of Sacramento. As-built it was Its 498 feet long, 232 feet of which were timber lined. Tunnel 2, just east of Emigrant Gap and 84 miles from Sacramento, was completed in September 1866, and was 271 feet long and completely lined in timber.

At the Summit Tunnel (originally Tunnel 6) time was of the essence and so crews used heavier powder charges than were perhaps necessary. The resulting "frequent and heavy blasting made it very difficult to keep the work to correct lines." Undoubtedly adding to that problem was the fact that crews were working on four separate faces within the tunnel in days long before boring machines or laser transits. Crews completed a vertical shaft at the center and worked outward in both directions, while other crews worked inward at both ends. It took workers almost a year to dig the shaft deep enough and another year to complete the tunnel. Work on the summit tunnel, begun in August 1865, had to be abandoned when the winter season came. The heavy snows forced the railroad to suspend grading between Summit and Truckee during that winter, and to move the crews east of Truckee. During the following summer, part of the work force moved back to complete the job while the rest remained east of Truckee to continue grading toward Nevada. Central Pacific had hauled steel rails and two locomotives over the snows of the summit to Truckee using ox teams and sledges, and laid track from Truckee east so that several miles of

track were had been completed east of Truckee when the connection was finally made in early 1868 between the summit and Truckee.

These delays of the first winter at the summit later led to round-the-clock work on the summit tunnel. By the time winter snow storms came the next year, the work was all underground. The only time the snow interfered with work was when heavy storms or avalanches would close up the end of a tunnel or wipe out laborers' shanties. Though crews were prosecuting the work from four faces within the tunnel, the headquarters for this work was at the east end of Donner Pass. With winter at its height, men initially used Canadian (webbed) snow shoes to get around, later changing to the Norwegian kind--what we would know today as cross-country skis, later made famous by "Snowshoe" Thompson in delivering mail during the Sierra winters.

When construction near the summit reached its apex, crews were using 500 or more kegs of black powder each day. The cost ran anywhere from $2.50 to $15.00 per keg, not surprisingly proving most expensive whenever more was required. Near Cisco the rock proved so hard that it was nearly impossible to drill a sufficient depth for blasting, resulting in many shots blown upwards out of the drill holes rather than shattering the rock. Central Pacific established a nitroglycerin factory near the summit tunnel, hauling glycerin, nitric and sulfuric acids from Cisco by teams. Crews used some nitroglycerin on the Summit tunnel and the two tunnels to the east, but after a "disastrous explosion" Strobridge ordered a cessation to all use of the material. Interestingly, although dynamite was invented this same summer of 1866, it was never used on the initial construction of the Central Pacific.

In its December 31, 1866 edition, the Sacramento *Union* the completion of the Central Pacific from Sacramento to Cisco, a total of 92 miles. The newspaper noted that twelve tunnels ranging from 800 to 1650 ft long were still under construction along the "snow belt" from the summit to Truckee river. Readers were informed that work on the tunnels was progressing 24 hours a day, with three shifts of men working eight hours each, and that the railroad expected completion by the spring of 1867; the sole exception was the 1,650-foot summit tunnel, expected to be ready to receive track by September 1867. To open the Sierra summit, readers noted, required the construction of Tunnels 3 -13 in the "20 mile stretch between Cisco and Lake Ridge just west of Cold Stream Valley on the eastern slope." Fully seven of these tunnels were located within a two-mile stretch east of Donner Pass.

Ranging in length from eighty-five feet to 1,650 feet, the early Sierra tunnels were, due to their construction through solid rock, largely unlined (extant examples are Tunnel 3, HAER CA-212, and Tunnel 4, HAER CA-214); those that were lined were timbered in whole (Tunnels 2 and 13) or in part (Tunnels 1, 11 and 12) In 1873 the Central Pacific added Tunnel "0" (HAER CA-199) at Milepost 132.6 between Clipper Gap and Applegate; this was an masonry-lined, inverted horseshoe-shaped bore with dressed stone masonry portals. Fully thirty-seven miles of the railroad over the Sierras were within timber snowsheds.

When the California State Park Commission approved the listing of the transcontinental railroad as a State Historical Landmark in 1962, the landmark application stated:

> The historical significance of the First Transcontinental Railroad can hardly be over-estimated. Our nation was for the first time united with bands of steel. As a result, California

> and the West were developed economically, politically and socially at a pace not made possible by earlier means of transportation.

The National Register nomination for a segment of the transcontinental railroad in Utah, listed on the National Register in 1994, further delineated the railroad's significance:

> The completion of the Transcontinental Railroad on May 10, 1869 is one of the nation's greatest accomplishments that effected one of the most monumental impacts on America's development. ...The construction of the Transcontinental Railroad is one of the most written about sagas in American history. A feat of such magnitude was unimaginable at the time, but it was a vital effort needed to physically bind the still-young nation together and permanently solidify its territory.

The driving of the last spike touched off a national celebration, but left the Central Pacific's Leland Stanford, Mark Hopkins, Collis P. Huntington, and Charles Crocker--the so-called Big Four--little time to relax. As a group they were in debt, and the expected demand for railroad services failed to quickly materialize. The far-distant Suez Canal, completed the same year as the transcontinental railroad, drew off expected trade from the Far East; business in and with the state of Nevada decreased as the silver mines played out; and perhaps most importantly, California's population was not yet large enough or prosperous enough to provide a terminal market for the railroad. The Big Four had built ahead of the frontier, and so reverted instead to using the railroad to open the West to settlement in order to build their own markets.

Over the ensuing decades the Central Pacific both built new lines and bought already-existing lines. In 1870, the Central Pacific took control of the Southern Pacific (originally incorporated to build south from a connection at San Jose with the pioneer San Francisco and San Jose Rail Road--itself already acquired by the Central Pacific). By the late nineteenth century the two company names were largely interchangeable. The company was finally reorganized as the Southern Pacific. Within California, Southern Pacific lines joined the state's new communities to the transcontinental railroad, and through it to the rest of the nation. Land grants received for railroad construction had left the Southern Pacific with vast tracts of land in California and other western states, and it built new towns on those lands. Using a huge public relations campaign, the Southern Pacific promoted settlement of the West in general and California in particular. In the Southern Pacific's program, newcomers could ride the transcontinental railroad to California, buy a plot of land in a town laid out by the railroad, and begin a business that would receive its materials and ship its products on the Southern Pacific.

The National Register nomination for a branch of the Union Pacific in Utah described how western railroads affected settlement and population growth:

> The influence of the railroad in encouraging settlement to the west cannot be understated [sic]. The remarkable expansion in the 1880s is shown in the comparison of census population maps of 1880 and 1890. In 1880 the frontier was still seen in definite form. By 1890 the strips of settlement united the east with the west. Railroads also encouraged immigration. Completion of the transcontinental lines was paralleled by the building of an immense number of smaller lines and feeders in the 1880s. Railroad mileage increased over 40,000 miles in the 1880s, more than what had been in existence prior to that time. "The

whole significance of the eighties in western railroad history was their importance as a period of transition from pioneer conditions to those of the present day."

Two major settlement and development patterns resulted from railroad expansion. First, the extension of a rail line to an existing settlement brought population growth that expanded villages into towns and towns into cities. Production of coal, iron ore, lead, bauxite, grains, cattle, or timber increased dramatically because the railroad could ship larger volumes faster and at lower cost. Cities and towns that became rail hubs became the equivalent of inland ports. Second, new towns quickly developed along the rail because of the availability of efficient shipping. No longer dependent on the arbitrary location of rivers, these new communities could be built wherever a rail line existed or was feasible. Railroads became so important to the development of the nation that the railroad companies often came to have greater than did local and state governments, a fact that was all too often true of the Central Pacific/Southern Pacific in California.

The Reader's Encyclopedia of the American West began its entry on railroads with the following unequivocal statement regarding their significance:

> Railroads were the most important factor in the rapid settlement of North America. Still the most efficient and versatile of all forms of inland transportation, the railroad was indispensable in the settlement of most of the West.

The Southern Pacific promoted California agriculture, provided teaching of better farming methods for farmers, and sent display trains around the country both to attract farmers westward as well as to create more demand for western agricultural and manufactured products. Southern Pacific's *Sunset* magazine attracted both tourists and settlers with promotional articles featuring California's attractions. In order to build California as a desired destination and increase its own markets, the railroad built luxury hotels along its lines for wealthy tourists, and supported creation of Yosemite National Park.

By 1896 the Southern Pacific controlled 7,300 miles of railroad line in California as well as 3,500 miles of water-borne shipping, giving it a near-monopoly of California's rail (and to some extent, river and ocean). In this guise the railroad became notorious as "The Octopus," exerting political control over state government from both Sacramento and from Washington, D.C.

> California, like so many of her sister commonwealths at the turn of the century, had only the shadow of representative government, while the real substance of power resided largely in the Southern Pacific Railroad Company. To a degree perhaps unparalleled in the nation, the Southern Pacific and a web of associated economic interests ruled the state.

B. The Twentieth Century

In 1900 Collis P. Huntington, last survivor of the Big Four, died, closing a period of penurious management of the railroad that had seen the physical plant decline under lack of maintenance or improvement. Edward Henry Harriman had assumed chairmanship of the Union Pacific by May 1898, bringing an end to years of failures and receiverships. Under Harriman control, the Union Pacific board spent approximately twenty-five million dollars to rehabilitate the railroad,

acquired the Oregon Railroad & Navigation Company, and re-acquired the Oregon Short Line, increasing Union Pacific mileage from 2,848 to 5,391 miles. Harriman had also early on recognized the value of the Southern Pacific and had tried continually to convince Huntington to sell him his interest. Huntington resisted until his death, at which time his interests passed to his wife and nephew, Henry. Harriman had previously ordered the Union Pacific to buy Southern Pacific stock, but he still needed the stock Huntington had left his family in order to take control of the Southern Pacific. Finally, in 1901, Edwin Hawley, who had been a close business associate of Huntington, endorsed the sale of Southern Pacific stock to the Union Pacific and vowed to sell his own. Acquiring just 38 percent of Southern Pacific stock, Harriman was thus able to gain control of the Southern Pacific, and eventually increased Union Pacific's holdings of Southern Pacific stock to forty-six percent.

Harriman succeeded Huntington as President of the Southern Pacific in September 1901. The merger had given Harriman and the Union Pacific control of 9,500 miles of railroad between New Orleans and San Francisco (the Southern Pacific Sunset Route) and between San Francisco and Ogden (the Southern Pacific Overland Route), and a virtual gridiron of lines in California and Texas. Harriman, with an eye toward increasing the profitability of his new acquisition, immediately initiated a system-wide program of improvement and modernization of the Southern Pacific and its equipment. These efforts, budgeted at between $30 million and $40 million, included:

> Double-tracking the original Central Pacific line over the Sierra and bypassing or enlarging original tunnels to improve alignments and allow the use of larger modern locomotives and cars. Harriman contemplated electrifying the Sierra line (this never progressed beyond the planning stage), and planned the Summit Tunnel that was not to be built until 16 years after his death;
>
> Lengthening sidings over the Sierra, allowing the dispatching of longer trains. Half of the sidings were inside the 30 miles of snowsheds that largely enclosed the railroad between Blue Cañon and Truckee; extending the snowsheds required seven million board feet of lumber;
>
> Centralization and expansion of new shop and yard facilities in Roseville, California and Sparks, Nevada, largely replacing the more numerous smaller shops along the early transcontinental line, and expansion of Pacific Fruit Express icing facilities system-wide;
>
> Replacement of early bridges system-wide with modern, standardized designs;
>
> Initiating construction of the Natron Cutoff in Northern California and Southern Oregon to replace the arduous line over the Siskiyou Mountains, and including enlarging shops at Dunsmuir, California;
> Installation of automatic block signal systems for faster, safer dispatching of trains;
>
> Building of the Lucin Cutoff across the Great Salt Lake in Utah to eliminate the circuitous route along the north shore of the Lake;

Construction of the Bay Shore Cutoff, whose tunnels and double-track main line between San Francisco and San Bruno shortened both distance and operating times between San Francisco and San Jose;

Construction of the Dumbarton Cutoff across the south end of San Francisco Bay;

Extension, in a joint effort with the Santa Fe, of the Northwestern Pacific Railroad from Willits to Eureka, California;

Construction of powerhouses and electrification of suburban commuter lines in the Oakland area, with the intention of electrification of all main lines around San Francisco Bay (this latter never occurred);

Controlling, after the efforts of all others had failed, a break in the banks of the Colorado River that threatened to permanently inundate the Imperial Valley in California;

Building of a new headquarters office building, and massive company hospital, in San Francisco;

Purchasing or building modern, heavier locomotives, heavy articulated locomotives purchased specifically to conquer the grades of Donner Summit;

Construction of new steel passenger cars in the company's own Sacramento Shops;

Construction of large new depots, and remodeling and modernization of older depots, system-wide, many in California in the Mission Revival style to symbolize the state and promote tourism;

Promotion of colonization of Southern Pacific owned or served irrigated lands in Arizona, California, and Oregon;

Construction of new lines into Mexico, and extension of existing lines within Mexico;

Standardization of everything from track spikes to locomotives among the many railroads under his ownership or direct control.

Harriman aimed to make the Central Pacific (which still existed as a separate corporate entity within the Southern Pacific) capable of handling as much freight between Ogden and San Francisco as the Union Pacific could handle between Ogden and Council Bluffs. His main focus was on the portion of the line between Reno and Ogden "where the road was burdened by excessive curvature and intolerable grades. In Nevada alone, 221 of [Central Pacific's] 433 miles of main track were relocated to one degree or another to reduce grades and curvature. For the entire route, 321 miles of new main track were built." Harriman began the Great Salt Lake Cut-off on August 21, 1902, with re-grading from Lucin to Ogden.

In a contrast to the penny-pinching years under Huntington's control, Harriman pledged to spend whatever money necessary achieve the full potential of the Southern Pacific lines. His initial

plans centered around the Central Pacific line from Roseville to Ogden--the original transcontinental route. Harriman authorized an astonishing $18,000,000 for improvement of this portion of the line, obviously intending for the most impressive changes to take place on the "Overland Route." The improvements were to include double-tracking of a substantial portion of the route. Harriman's announced intentions included reducing the running time between San Francisco and New York to three and one-half days within three years. Local papers spoke of a six-mile-long tunnel under the Sierra summit aimed at cutting 1,500 feet of elevation, eliminating thirty-three miles of snowsheds, and eliminating many curves and grades. Even minor towns received attention, with Colfax receiving a new station building serving both the Southern Pacific and the Nevada County Narrow Guage Railroad.

Harriman gave serious study to all available alternatives for double-tracking the Donner line, though his primary interest initially lay in building a completely new line. The existing line had severe limitations. Between Rocklin and Colfax, eastbound trains faced a 2.2% maximum compensated grade, which increased to 2.4% between Colfax and Donner Summit, though the rise leveled out somewhat above Emigrant Gap. Westbound trains had to deal with a 1.0% grade from Sparks, Nevada to Truckee, then 2.0% between Truckee and the summit. Some fifty miles of the line lay in "deep snow country."

In order to gain improvements in distance, the proposed new track would have to deviate widely from the existing alignment. Harriman also initially proposed to bore a 27,480 ft tunnel (5.2+ miles) from a point near Spruce to near Lakeview, at an elevation of 6,306 feet. The new line would then go around the north side of Donner Lake, through two short tunnels, rejoining the original alignment just west of Truckee.

Another alternative, a proposed 28.5-mile line change between Fulda and Truckee would have included a double-track tunnel a staggering 18.5 miles in length, with a total estimated cost nearly $31.4 million. The railroad engineers electrification would be absolutely necessary for successful operation through this mighty tunnel.

Work on a new line between Rocklin and Colfax, with a ruling grade of 1.5%, began in the summer of 1909. Engineers originally intended that this line would eventually be carried all the way over the summit. The contract for the first twenty miles from Rocklin to Clipper Gap went to Erickson & Petterson of San Francisco, with the final eleven miles between Clipper Gap and Colfax going to Utah Construction Company of Ogden. Within this reach, the original line was 31.6 miles long and had a maximum 2.2% grade for eastbound trains and maximum curvature of ten degrees. The new line would be 30.8 miles in length, with a maximum 1.5% grade and maximum curvature of four degrees. It would require seventeen tunnels and two major bridges to achieve this reduction in grade and curvature.

East of Rocklin the original line was moved 6,000 ft so that the new grade could pass over it. Between this separation of the two lines and Newcastle to the east, the new line diverged widely to the north, and required three new bores, Tunnels Number 15, 1,896 feet long, 16, 769 feet long, and 17, 1,639 feet long. (Tunnel numbering resumed where the numbering of the original tunnels had left off.)

Near Newcastle it proved necessary to relocate nearly two miles of the original track in order to keep it south of the new line. The two tracks then passed through the new double-track Tunnel 18 (HAER CA-197) and then diverged again with the original line at a higher elevation. The new line spanned Auburn Ravine on a 540-foot steel trestle that towered ninety feet about the ground, and then continued through three more new tunnels: Tunnel 19, 368 feet long, Tunnel 20, 1,239 feet long, and Tunnel 21, 1,200 feet.

The difference in track levels between the two lines meant that the contractors had to build four more tunnels between Bowman and Applegate; simple double-tracking on the same alignment was impossible. These were Tunnel 22, 1024 feet long, Tunnel 23 (HAER CA-198), 843 feet long, Tunnel 24 (HAER CA-200), 292 feet long, and Tunnel 25 (HAER CA-201), 763 feet long.

The new line crossed under the original line at Applegate in a concrete subway designated Tunnel 26 (HAER CA-202). Then, crews built six more tunnels between there and Colfax; the longest of these was Tunnel 28 (HAER CA-204), at 3,200 feet. In the two miles between Tunnel 32, near Lander, and Colfax, the original line crossed the alignment of the new second track so often that it was simply abandoned, and a new double-track line was built anew.

Crews completed this initial portion of the double-tracking project in early 1912, including major improvements to the Colfax yards. Automatic block signals now controlled train movements. First use of the new line came on March 31, 1912, and the first passenger train crossed eastbound on April 7. The railroad designated the original mainline as Track No. 1, and used it exclusively for westbound traffic, while the new track became Track No. 2, for use by eastbound trains.

While work on the double-track of the Overland Route had begun in 1906, it ground to a halt in 1914 due to the anti-trust suit brought by the federal government against Union Pacific and subsequently against Southern Pacific. By the end of 1912, 167 miles were finished and another 112 miles were at various stages of completion. There was, however, no for the remaining 505 miles, and none would be forthcoming until a decision was reached concerning the unmerger. The suit for unmerger brought by the government against Southern Pacific concerning its ownership of the Central Pacific stalled many of Harriman's primary projects on the Southern Pacific, as management and investors alike awaited the outcome of the case. Among the stalled projects were the Natron Cut-off in Oregon, and the double-track program on the Overland Route. When the case was finally decided in the railroad's favor, the Southern Pacific started these projects anew with a fervor. Crews completed 112 more miles of second-track on the Overland Route until, combined with an arrangement by which the Western Pacific and Southern Pacific shared parallel routes through Nevada, by the end of the 1920s the Southern Pacific was operating nearly 600 miles of double track on the 782-mile route between Oakland to Ogden.

Unfortunately, Harriman's premature death in 1909 meant that he never saw most of these efforts reach fruition. It also meant that he was not subjected to watching his empire dismembered.

Ultimately, in an effort that began during his life but that ended after his death, the federal government ended Harriman's merger of the two giant railroads with its dissolution as a violation of the Sherman Anti-Trust Act. Working under the provisions of the Hepburn Act of 1906, in January 1907 the Interstate Commerce Commission began to investigate the relations

among the western railroads. On the basis of the evidence discovered, on February 1, 1908 the federal government filed a suit in equity in the United States Circuit Court, Eighth District, against the Union Pacific Railroad and its auxiliaries, as well as against the Southern Pacific Railroad, Northern Pacific Railroad, Great Northern Railway, the Atchison, Topeka and Santa Fe Railroad, the San Pedro, Los Angeles & Salt Lake Railway, the Farmers' Loan & Trust Company, Jacob H. Schiff, Otto Kahn, James Stillman, Henry H. Rogers, Henry C. Frick, William A. Clark and, not coincidentally, against Edward H. Harriman who had control of, interests in, or relationships with, all of the foregoing.

The government's basic allegation was that the individuals named conspired to effect a virtual consolidation of the Union Pacific and other transcontinental lines with the intent to unlawfully restrain transcontinental commerce. The government asked the court find this conspiracy a violation of the Sherman Anti-Trust Act, and to "perpetually enjoin Union Pacific, and its auxiliaries from purchasing, acquiring, receiving, holding, voting, or in any manner acting as owner of any shares of the Southern Pacific, Northern Pacific, Great Northern, Atchison, or Salt Lake line." The government contended that under independent control, ten percent of the total Union Pacific and Southern Pacific traffic would be competitive. That ten percent, they pointed out, included California traffic.

In their turn the defendants argued that Union Pacific was not a competitor for California traffic. Lawyers for the railroad asserted that it its line to Portland and boats to San Francisco gave it no control over such traffic, pointing out that this route consumed several days more time than Southern Pacific routes, and could not operate at lower rates without prompting Southern Pacific to retaliate by turning a richer eastbound business over to Union Pacific's competitor Denver and Rio Grande at Ogden. For this reason, they stated, the Southern Pacific absolutely controlled California traffic before the merger. Surely, then, "purchase of a substantial holding of Southern Pacific stock by Union Pacific amounted, therefore, to mere advancement of Southern Pacific's gateway from Ogden to Omaha, and in no wise altered competitive conditions."

Initially, it appeared that the courts would uphold the merger. In early 1911, using the United States Supreme Court's "rule of reason," the Eighth Circuit Court found that the merger of the Union Pacific and the Southern Pacific did *not* violate the Sherman anti-trust law. The court concluded that the Union Pacific could not reach California without either building a new line or acquiring the Central Pacific (which by this time was wholly owned by the Southern Pacific) which had the line extending to San Francisco from its junction with the Union Pacific at Ogden, Utah. Since, the court reasoned, the acquisition of the Central Pacific could not be achieved without the acquisition of the Southern Pacific as a whole, the merger was allowable. The court found that the merger was chiefly one of connecting rather than competing lines. Though attorneys for the federal government brought out the fact that Union Pacific and Southern Pacific both reached Portland on their own rails and asserted that the merger would serve to stifle competition to and from Portland, and to and from San Francisco, the court found for the defense that competition between the two railroads for San Francisco was "largely mythical." It found that there was no increase of rates or deterioration of service evident due to the merger, and thus could not find that the merger was an "unreasonable' restraint of trade." The railroads had won the first battle, and the industry felt that the merger of the Harriman Lines was safe from dissolution. But this was but the first battle in what was to become a virtual war.

The federal govemment never faltered in the wake of this decision, and continued to press its suit through the court system. By 1913, trade journals reported a different story. Bowing to government pressure and legal reverses, the Union Pacific and Southern Pacific proposed to dissolve their merger, with each retaining a part of the Central Pacific. Union Pacific's possession of its portion of the transcontincntal linc would reach San Francisco and as far south as Fresno. Union Pacific also proposed to retain half of San Pedro, Los Angeles & Salt Lake, which would give it a line from Salt Lake to Los Angeles. Further, Union Pacific would retain control of both the Oregon Short Line and the Oregon-Washington Railroad & Navigation Company, by which it could reach throughout the Northwest, to Portland, Tacoma, Spokane, and Scattlc. Southern Pacific, for its part, would retain a 99-year lease to that portion of Central Pacific that constituted part of its line from Portland to San Francisco. Southern Pacific would also enjoy trackage rights over Northern Pacific's line from Portland north to Puget Sound, and its steamship lines would ply bctwccn Los Angclcs, San Francisco and the north Pacific coast. Union Pacific ultimately was denied any possession of the former Central Pacific when the so-called "unmerger" took place. Even this was not enough to satisfy the government, which then bcgan to press to forcc thc Southern Pacific to give up the Central Pacific. Other govemment suits sought to forcc the return to the govcmment of lands granted to the Southem Pacific in Oregon and Washington, with the claim that Southem Pacific's timher, mineral, and land sales violated thc terms of the grant.

The years continued to grind by as the suits wound their way through the court system. Then, in March 1917, the U.S. District Court of Utah decided in favor of the Southern Pacific, denying the govemmcnt's pctition to separate thc Central Pacific from thc Southern Pacific. In its decision thc court opined that it was highly doubtful that thc Sherman Anti-Trust Act could bc applied to consolidations that had been formed prior to its passage, pointing out that consolidation of the Central Pacific and Southern Pacific had begun in 1870! The court also pointed out that there was no cvidence that operation of thc Central Pacific as part of the Southern Pacific had had any "injurious" effect on shippers. The court concluded that although the two constituent roads had separatc corporate organizations, they had been built by the same interests, had always bccn opcratcd as a singlc system, and both would be disastrously crippled if separated. A month later, however, the United States Supreme Court upheld a decision by the U.S. District Court of Orcgon, enjoining Southern Pacific from selling timber and minerals from lands granted to the Oregon and California Railroad during its construction in the 1870s. The Supremc Court further found in favor of the forfeiture of two million acres of railroad land in Oregon and Washington to thc government, providing for government sale of land, timher, and minerals.

In California, the Progressives under Hiram Johnson had takcn office; they took up the question of railroad regulation, and undertook the task of "kicking the SP out of politics." Though the Southern Pacific continued to have great influence in the state, the early years of the twentieth century saw it lose the political dominance it had prcviously cnjoyed. "The Octopus" was losing its all-encompassing grip.

Reeling from the cost of the Harriman improvements and the government-ordered dissolution, Southern Pacific saw its profits cut sharply first by the opening of the Panama Canal which cut shipping time between the coasts, and then hy the outbreak of World War I in 1914; however wartime traffic and industry brought increased revenues. These were offset by increased traffic to

the two sumptuous fairs held in California in 1915, the Panama-Pacific International Exposition in San Francisco, and the Panama-California Exposition in San Diego, as well as by the U.S. entry into the war in 1917. This latter, however, brought federal control of the nation's railroads under the United States Railroad Administration in late 1917 in order to coordinate the heavy wartime rail traffic.

Government control of the railroads was regionalized, with government-appointed administrators drawn from railroad management professionals in charge of each region. In the West, the Central Western Region came under the control of Southern Pacific President, William Sproule, appointed District Director of the lines west of Ogden, Salt Lake City, Albuquerque and El Paso, and south of Ashland, Oregon. During his tenure, Sproule directed that the Southern Pacific and peacetime competitor Western Pacific operate their parallel lines in Nevada as a double-track railroad, with the S.P. handling westbound trains and the W.P. handling eastbound traffic. The joint operation covered roughly 186 miles between Wells and Winnemucca where the two railroads were never more than five miles apart. The two railroads continued to use their own train crews, however. They also pooled their facilities in the San Francisco Bay area.

The end of the war did not bring an immediate end of government control, however. In fact the U.S.R.A. held control of the railroads until President Wilson finally announced in February 1920 that the railroads would revert to private control on March 1, 1920. When this occurred, Southern Pacific resumed its planned improvements system-wide, including those interrupted on Donner Summit. The 1920s saw S.P. finally complete the Harriman-generated improvements over Donner, further modernize its equipment, build new steamships to enlarge its fleet, and deal with the deferred maintenance of the U.S.R.A. years.

After finally prevailing against the federal government's unmerger suit in 1923, Southern Pacific laid out plans for major improvement projects throughout the system. These plans included completion of the double-track over Donner Pass in the forty-mile gap between Blue Cañon and Truckee. Compared to previous double-tracking projects, this was a comparatively simple effort involving laying new track adjacent to the old, and the railroad completed it in just two and one-half.

The first phase involved double-tracking from Blue Cañon and Emigrant Gap. Work on this 5.3-mile section began on March 6, 1923 and was completed on August 15, including new longer sidings at both end points, and a new eighty-foot covered turntable at Emigrant Gap. The Emigrant Gap fire train, stationed to protect the vulnerable snowsheds from fire, was used during this work to haul water to the steam shovels and donkey engines building the project.

The railroad next completed 6.5 miles of second track on the east side of the summit between Truckee and Andover. Construction began April 10, 1923 and was completed on August 5.

This left a 28.4-mile gap between Emigrant Gap and Andover. Work began in November 1923 on the most difficult portion of the Sierra double-tracking. Lack of working room on the extremely precipitous side-hill locations made difficult the storing of materials and erection of construction camps. Most of the right-of-way outside the actual tunnels was covered by snowsheds. These had to be removed for construction and then replaced again before heavy snow began, requiring no fewer that twenty gangs of twenty-five men each. The project often

saw as many as twenty steam shovels working. As had been the case with the initial double-tracking between Rocklin and Colfax, crews construction tracks that crossed the mainline tracks frequently, requiring train protection by electric interlockings. Donkey engines hauling narrow-gauge dump cars moved material from cuts. Mainline train traffic averaged one train every 23 minutes during summer and fall, thoroughly complicating the construction process.

In addition to the seven new tunnels and the snowshed work, this also included four steel viaducts, each approximately 400 ft long, over Butte Canon, Upper and Lower Cascade Creeks, and the Yuba River, new sidings, and a new eighty-foot turntable at Cisco

The crowning achievement of the new line 5.36 mile line was a new summit tunnel (Tunnel 41, HAER CA-215) almost 2 miles long; this was "holed through" on August 25, 1925. Track laying on the new line was complete and first traffic rolling on it by September 19, 1925. While this was not the 5.2-mile tunnel initially proposed during Harriman's years, still this 10,322 ft tunnel was the third longest in the continental United States. Crews laid a 6,000-foot siding for use from both second and mainline tracks on the west side of this summit tunnel. In addition, the complex at the west end of the summit tunnel included support trackage and a new 100-foot covered. Named Norden, this new installation was completely covered by snowsheds and a concrete station was built here which assumed all of Summit's previous functions on Mar 10, 1926; Summit was abandoned soon thereafter.

Completion of the final section of double-track made for an almost continuous run of double-track from Oakland Pier to Sparks, Nevada, a distance of 242 miles. Completion of the double-track also decreased snowshed mileage. During construction, 9.4 miles of the original 29.3 miles of sheds were removed; however, sheds built over the new double-track brought total snowshed mileage back up to 22.9.

Most railroads, Southern Pacific included, had not fully recovered by the time they entered the Great Depression. Still, the lessons of World War I and the lean years of the Great Depression which saw the railroads making do with less prepared them for exemplary service in World War II. While remaining in private control, the railroads became virtual arms of the military, hauling 90% of the military's freight and 97% of the troop movements. The Southern Pacific's original transcontinental line over Donner Summit carried much of the materiel and troops destined for the Pacific Theater. In contrast to the financial losses of World War I under government control, the railroads' World War II efforts garnered nearly three million dollars a day in income tax revenues for the federal government.

In 1944, *Railroads at War* told of the historic contributions of the railroads, from initially uniting the nation with construction of the transcontinental railroads to the then-present movement of freight and troops in wartime:

> America's railroads made the union of the states a physical fact, a practical reality. Today they are the great inner lifelines of that union's survival in the holocaust of world war: an indispensable base behind the tremendous charges under which the tyrant attackers across both oceans are now crumbling.

> Farseeing Americans in the early days of the republic, looking from the westward side of the Alleghenies only as far as the Mississippi, thought it might take five or ten centuries to settle those vast stretches. Railroads brought population and statehood all the way to the Pacific in a matter of decades.
>
> World War II loaded our railways with a job whose hugeness and complexity almost baffles imagination. Failure could have been fatal. They have succeeded magnificently.

Even allowing for wartime rhetoric, the railroads accomplished remarkable feats. The Southern Pacific alone eliminated 27 pre-war passenger trains and rapidly converted to handle military needs, building new bridges, lengthening passing sidings, and laying hundreds of miles of heavier rail, all to increase its capacity to serve the growing volume and weight of military traffic. With the induction of much of the younger labor force into military service, Southern Pacific soon faced a severe labor shortage as nearly 20,000 employees left for military service just as the railroad's workload burgeoned. The railroad lowered minimum and raised maximum ages for its workers, lengthened working days, canceled vacations, imported workers from Mexico, and hired women for jobs previously restricted to men, all to compensate for the shortage.

As mentioned previously the original Central Pacific route, the first transcontinental railroad line, proved crucial to the railroad's war effort, and carried an enormous amount of traffic that would have astounded its original builders. In 1943, a traffic count revealed no fewer than 73 trains and helper engines passing through Colfax daily. "Ton miles" of freight carried over the Sierra increased from an already-record high of 545.5 million in to a stupendous 1.6 billion in 1944. The Southern Pacific found itself handling trains for the Civilian Conservation Corps and the Coast Guard, as well as hospital trains with war wounded. In addition to moving troops and war supplies, the Southern Pacific also moved 125 "alien specials," transporting trainloads of Japanese Americans to internment camps in the interior, where they were incarcerated. Nevertheless, Southern Pacific's substantial accomplishments in World War II service far overshadowed its use in this unforgettable demonstration of war hysteria and racism. At the end of the war, the railroad received commendations for what was termed its "finest hour."

The Southern Pacific's Overland Route, the original transcontinental Central Pacific line, remained the keystone of the system. Over the years, however, the transcontinental railroad line has undergone a number of changes. The Harriman improvements of the early twentieth century resulted in realignments such as the 1904 Lucin Cut-off in Utah shortening the route. Heavier steel rails and heavier bridges replaced the originals and tunnels were enlarged as the line was improved to handle the more massive modern rolling stock, and much of the route was double-tracked. The Harriman improvements reduced the thirty-seven miles of original snowsheds (small wonder that one old-time engineer is said to have quit, muttering that he wasn't about to go railroading in a barn) to twenty-one miles by 1925; by 1940 only eight miles remained, and today virtually all of the timber sheds have been replaced by sheds of prefabricated reinforced concrete panels.

C. The Donner Pass Tunnels

It was during the 1909-1925 period that the improvements to the Donner Pass line, planned prior to Harriman's death, were made. On the west side of Donner Summit, the railroad built an entirely new second line on a 1.5 percent grade between Rocklin and Colfax. This line, which was finished in mid-1911, required the construction of eighteen new tunnels, originally numbered 1-17 (this seeming contradiction was due to one short tunnel being numbered 4½); today these tunnels are numbered 15-32, with Tunnel 19 (old Tunnel 4½) and Tunnel 21 (old Tunnel 6) no longer extant. This group of tunnels includes Tunnel 18 (HAER CA-197), Tunnel 23 (HAER CA-198), Tunnel 24 (HAER CA-200), Tunnel 25 (HAER CA-201), Tunnel 26 (HAER CA-202), Tunnel 27 (HAER CA-203), Tunnel 28 (HAER CA-204), and Tunnel 29 (HAER CA-205). In addition to constructing the new line, the railroad's contractors also made improvements to the original line, enlarging some tunnels and bypassing others, and reducing track curvature to facilitate the use of longer locomotives and cars.

Numerous irrigation ditches and natural streams complicated construction, requiring changing of channels. The biggest headache, however, stemmed from the fact that heavy rail traffic on the existing line precluded its use by construction trains. This meant that expensive construction track had to be built. At the location of a number of cuts and tunnels far enough distant from the original line that no spur could reasonably be built, the contractors had to haul all construction equipment overland, up to two and one-half miles. At Auburn they hauled locomotives, cars, and steam shovels a mile and a half through town, laying track ahead and pulling it up behind as the equipment moved forward. The work force was comprised of Italian, Swedish, and some American laborers earning $2.25 to $2.50 per day, with tunnel men earning $3.50 per day. Though the area was rich in timber, the local pine proved unusable for railroad construction, with the result that the railroad had to bring timber in from San Francisco.

Utah Construction Company of Ogden received the general contract for the eleven miles between Clipper Gap and Colfax. While the contractor used its own forces for tunnel work, it subcontracted work on cuts and fills, much of which was accomplished with steam shovels. The tunnels were all Southern Pacific Common Standard designs, with dressed granite portals and fitted granite rubble slope protection adjacent to the portals. As required by the plans, the contractor lined the tunnels with concrete for a distance of fifty feet in from each portal, with the remainder redwood-lined. Utah Construction bored the tunnels by driving two parallel drifts at the spring line of the arch and then excavating the bench--the material above to the top of the tunnel. With this completed, they then drove a single drift at the grade line, roofed it with loose timbers, and blasted out the bench remaining above, dropping the material down into dump cars through openings in the roof timbers. Construction crews drove Tunnel 27 (HAER CA-203), Tunnel 28 (HAER CA-204), Tunnel 29 (HAER CA-205), Tunnel 30, Tunnel 31, and Tunnel 32 (old Tunnels 12-17) from both ends simultaneously. Dependent on tunnel length, and soil and rock types encountered, completion of the tunnels took from five to fifteen months. Crews had electric power to illuminate the tunnel work; at one tunnel site, Utah Construction built their own power plant to supply electricity.

At Tunnel 26 (HAER CA-202; originally called the Applegate Crossing) the original line, on an embankment, crossed above the new line. Crews put in a temporary timber trestle under the old

line, built the new line beneath in a reinforced concrete subway roofed with I-beams to carry the old line, then filled in around the trestle.

Erickson & Petterson of San Francisco had the contract for the twenty miles of new line between Rocklin and Clipper Gap. This firm used a slightly different tunneling method, driving just a single drift centered at the level of the spring line, then following up with one or two drifts at grade level. There was only one double-track tunnel among the seventeen being built--Tunnel 18 (HAER CA-197; originally Tunnel 4) at Newcastle, in the reach being built by Erickson & Petterson. This firm also faced a large number of heavy cuts and fills, averaging between 40,000 and 183,000 cubic yards. Using materials supplied by American Bridge Company, they also built the 540-foot steel trestle across Auburn Ravine at Auburn, the structure which now carries the railroad above Interstate 80. As with the work undertaken by Utah Construction, this segment also saw some relocation of the old line as well.

But construction difficulties were not the only problems facing Erickson & Petterson. This firm was also engaged in work on the Southern Pacific's Natron Cutoff between Weed, California and Eugene, Oregon. On December 22, 1908 authorities arrested Gustav Petterson at Dorris, California on a charge of extortion. The firm, which had some 600 men at work on this job, was working a scheme by which they paid their work force in "time checks," checks drawn on a Portland, Oregon bank and dated one to two months hence. Then the company would ask the men if they wanted their money "now." Almost without exception the answer was, not surprisingly, in the affirmative. Erickson & Petterson then paid the men with checks that discounted their pay by ten percent for the privilege of available funds. The men often had to further discount the check when cashing them at local banks or businesses, largely because Erickson & Petterson had the reputation of holding up payment. The firm was reportedly profiting nearly three thousand dollars each month by this means, more than their profit on the construction contract (except for tunnel work). The firm also gouged its workers on prices for goods from its commissary department (from which the workers had little choice but to buy), and charged a monthly hospital fee while providing no sick care. The charge was ultimately reduced to a misdemeanor in order to avoid having to take Petterson to the distant county seat, and in order to settle the case and avoid construction delays.

The enormity of the undertaking can be gauged from the average daily size and makeup of the construction crews:

Utah Construction Company

Grading Force: 40 Foremen; 332 Laborers; 8 cranemen; 8 firemen; 115 drillers; 25 two-horse teams with drivers; 4 four-horse teams with drivers; 1 six-horse team with driver; 4 horses; 61 dump cars; 4 four-horse plows; 4 six-horse plows; 2 eight-horse plows; 24 two-horse scrapers; 18.5 four-horse Fresno scrapers; 2 two-horse slips with driver; 4 two-horse Fresno scrapers with drivers; 4 three-horse snatches with drivers; 8 steam shovels with engineers; 34 pitmen; 10 watchmen; 12 one-horse carts with drivers; 2 car repairers; 8 dinkeys (small industrial locomotives), each with engineer and brakeman; 4 blacksmiths; 4 blacksmith's helpers; 5 powdermen; 4 drills; 4 drillers; 4 helpers; 4 boilers; 4 firemen.

General Force: 10 timekeepers; 18 cooks; 35 waiters; 17 blacksmiths; 12 blacksmith's helpers; 6 carpenters; 6 carpenter's helpers; 11 saddle horses; 7 foremen; 3 machinists; 3 watchmen; 3 driving horses; 7 two-horse supply teams; 6 four-horse supply teams; 1 six-horse supply team; 5 camp hosses; 26 laborers; 6 clerks.

Tunnel Force: 15.5 foremen; 78 headingmen; 26 breastmen; 184 laborers; 8 cornermen; 12 benchmen; 2 boilers; 2 boiler firemen; 4 carpenters; 2 carpenter's helpers; 10 blacksmiths; 9 blacksmith's helpers; 5 dumpmen; 1 four-horse team with driver; 3.5 six-horse teams with drivers; 4 drills; 11 drillers; 8 driller's helpers; 1 one-horse cart. For unloading and hauling lumber, 12 laborers, 3 two-horse teams with drivers, and 3 four-horse teams with drivers. For dump car work, 30 cars, 20 horses, and 2 drivers.

Masonry Force: 14 foremen; 44 mixers; 17 tampers; 94 laborers; 19 carpenters; 8 carpenter's helpers; 8 two-horse teams with drivers; 30 four-horse teams with drivers; 5 engineers.

Erickson & Petterson

Grading Force: 20 foremen; 213 laborers; 2 two-horse teams with drivers; 2 four-horse teams with drivers; 1 six-horse team with driver; 29 drillers; 73 dump cars with 12 horses and 8 drivers; 4 steam shovels; 4 engineers; 4 firemen; 4 cranemen; 15 pitmen; 4 watchmen; 8 dinkeys, each with engineer and brakeman; 3 carpenters; 5 carpenter's helpers; 3 powdermen; 4 2-horse scrapers with drivers; 6 four-horse Fresno scrapers with drivers; 9 four-horse plows; 3 six-horse plows; 1 hoist engine, with hoist engineman and signalman.

General Force: 10 foremen; 8 timekeepers; 14 cooks; 23 waiters; 2 blacksmiths; 2 blacksmith's helpers; 2 carpenters; 1 carpenter's helper; 7 two-horse supply teams; 5 four-horse supply teams; 1 six-horse supply team; 3 clerks; 1 camp boss; 11 laborers; 2 machinists; 3 corral bosses.

Tunnel Force: 14 foremen; 24 headingmen; 14 breastmen; 82 laborers; 3 pumps; 2 compressors; 2 compressormen; 1 electrician; 1 fireman; 2 boilers; 1 sawmill; 1 sawmill operator; 6 carpenters; 2 carpenter's helpers; 6 blacksmiths; 2 blacksmith's helpers; 1 fan; 8 drills; 32 drillers; 8 driller's helpers; 4 hoists; 1 steam shovel with engineer and craneman; 2 dinkeys, each with engineer and brakeman. For unloading and hauling lumber, 2 foremen, 12 laborers, 1 two-horse team with driver, 5 four-horse teams with drivers. For dump car work, 31 dump cars using 7 horses and 7 drivers.

Masonry Force: 4 foremen; 15 mixers; 5 tampers; 6 hod carriers; 30 laborers; 4 carpenters; 6 carpenter's helpers; 6 four-horse teams with drivers; 3 two-horse teams with drivers; 1 mixer; 1 gasolene [sic] engine; 1 engineman.

The railroad completed the next extension of the second track beyond Colfax to Blue Cañon on December 10, 1914, a reach that required two more tunnels at Cape Horn, as well as the enlargement of Tunnel 1 (HAER CA-207) to accommodate the second track. These tunnels were slightly different in appearance from the earlier tunnels west of Colfax. Where the earlier tunnels had utilized portals constructed entirely in stone masonry, the tunnels between Colfax and Blue Cañon had reinforced concrete portals with stone masonry elements confined to the voussoirs surrounding the opening itself, to lines of coping atop the portal, and to the flanking wingwalls.

Like the earlier tunnels, these were concrete-lined for a distance of fifty feet in from each portal, and with the balance timber-lined. Tunnels constructed in this reach included Tunnel 34 (HAER CA-206). This stretch of track also included impressive vistas of the American River Canyon far below, and the railroad built a trackside observation platform at a siding named "American"; here it would halt passenger trains so that the passengers could step off the train and wonder at the view. In May 1915, in conjunction with the work between Colfax and Blue Cañon, the Southern Pacific also opened a new second track on the east slope of the Sierra between Truckee and Lawton, Nevada, eliminating old Tunnel 15. By this time the railroad had spent more than twelve million dollars on the double-tracking of the Donner line, and still had some of the most difficult terrain and construction ahead: the reach from Blue Cañon to Truckee over Donner Summit lay through almost solid granite and was--as it had been for the builders of the Central Pacific some fifty years earlier--subject to some of the most severe winter conditions imaginable.

The combination of World War I, the federalization of the nation's railroads, and the ongoing federal anti-trust litigation then delayed further work on the second track for nearly a decade, until 1923. Then, between 1923 and 1925 the railroad accomplished the final push of the second track from Blue Cañon to, and over, the summit to Truckee. This last construction required eight more tunnels including construction of a two-mile long summit tunnel. These included Tunnel 35 (HAER CA-208), Tunnel 36 (HAER CA-209), Tunnel 37 (HAER CA-210), Tunnel 38 (HAER CA-211), Tunnel 39 (HAER CA-213), and the Summit Tunnel, Tunnel 41 (HAER CA-215). By this time the tunnels utilized reinforced concrete throughout; gone were all the labor-intensive stone masonry elements. Those who built these tunnels also benefited from technological developments on the Southern Pacific in the intervening years. In 1918 the railroad had developed a system of shotcreting for use in tunnels, utilizing it initially on a project to enlarge tunnels on its line of Tehachapi Summit. The 1923-25 tunnels on between Blue Cañon and Truckee emerged with plain concrete portals, and with wingwalls notched to carry the supporting beams for adjacent snowsheds. At this point, the railroad still had more than seven miles of its line in tunnels, and another twenty-one within snowsheds.

D. Epilogue

The new line had been intended to carry eastbound traffic, while westbound traffic was to move over the old track, south of the eastbound line. In fact, the grade of the new line on the west side of the summit proved too steep for eastbound trains, with the result that train movements were opposite that plan: eastbound over the original Central Pacific alignment, westbound over the new line. The two tracks are closely parallel throughout their length, but in some areas the new line was constructed on a different level in an attempt to improve gradients. In a number of locations the original line was relocated, either temporarily or permanently, to accommodate the new line. The Southern Pacific began the double-tracking over the Sierra in 1906, finally completing the effort in 1925.

Though the double-tracking was enormously expensive and was completed just in time for the traffic decline of the Great Depression, it proved its worth during World War II. By 1944, 581 miles of the 780-mile Central Pacific line between Oakland, California, and Ogden, Utah were double-tracked, enabling the railroad to handle the exponentially-increasing traffic of the war years. The double-tracking proved most beneficial over Donner Summit, where the heavy winter snows complicate the normal difficulties of mountain railroad operation.

Today, virtually all of the timber snowsheds are gone. Improvements in snow-fighting equipment have allowed the railroad to remove most, and replace those still needed with prefabricated reinforced concrete sheds. All of the original Central Pacific tunnels still in service have been enlarged. Original Tunnel 7 has been daylighted (replaced by an open cut) and replaced with a concrete snowshed, while Tunnel 40 was simply daylighted. Tunnels 9 and 10 were widened in the 1970s (Tunnel 10 had previously been enlarged and concreted in the 1930s).

In recent years, rail traffic on the original transcontinental line decreased sharply, with a 50 percent or more drop between the 1980s and 1990s. In a move reminiscent of robbing Peter to pay Paul, the cash-strapped Southern Pacific, viewing the Donner Summit line as having excess capacity, removed the rails and ties on segments of the original Central Pacific alignment to reduce maintenance costs and allow reuse of the rails at other locations on the system. The railroad also considered a proposal to remove the second track through the Truckee River Canyon and return that section of the line to single-track operation. Ironically, following the Union Pacific/Southern Pacific merger in 1996, system-wide traffic increases have the new owners contemplating re-laying the removed tracks over the Sierra, including through the remaining original Central Pacific tunnels, for much the same reason as the original double-tracking.

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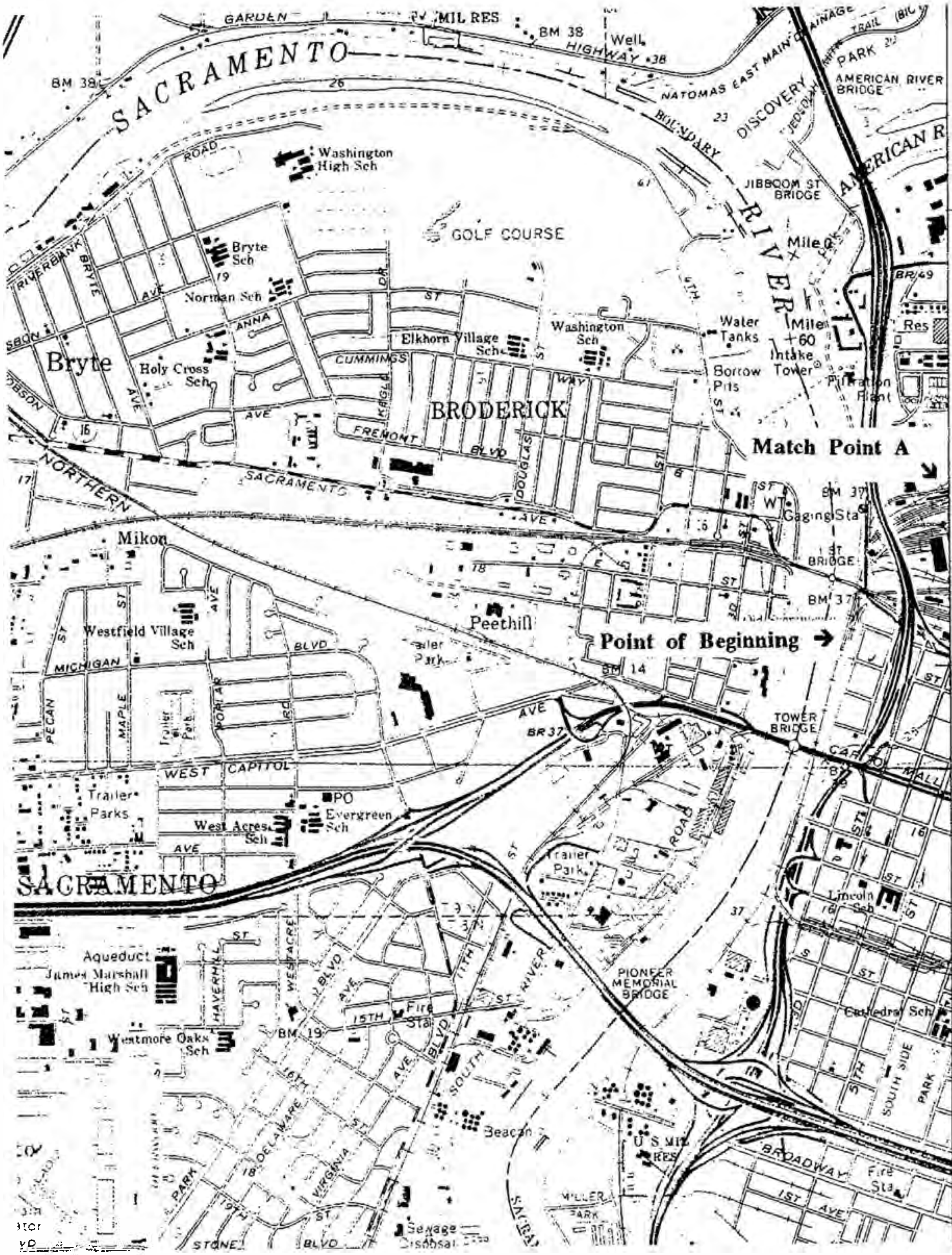
IV. PROJECT INFORMATION

As a result of the 1996 merger of the Union Pacific and Southern Pacific Railroads, a federal undertaking under the jurisdiction of the Surface Transportation Board of the U.S. Department of Transportation, and in order to accommodate freight trains utilizing longer and taller cars and loads--tri-level auto rack cars and cars carrying double-stacked containers--the Union Pacific will need to increase tunnel clearances on the former Southern Pacific Donner Pass Route. The tunnels, built between 1868 and 1925, are contributing elements of the National Register-eligible Southern Pacific Donner Pass Route Tunnels Historic District. All tunnels have been laser-measured and the railroad will determine clearance needs on a tunnel-by-tunnel basis. Some, because of curved alignment, will require interior work to allow for longer cars such as tri-level auto rack cars; others will require both interior and portal work to provide sufficient vertical clearance for "double-stack" container cars. The latter work may impact the character-defining tunnel portals if crown mining of the tunnels (as opposed to lowering the tunnel floors) is selected. Inasmuch as this would cause an adverse effect to the tunnels, Union Pacific, in

consultation with the California SHPO, has elected to record the tunnels for the Historic American Engineering Record. Documentation was carried out by P.S. Preservation Services, John Snyder Field Director and Historian, and Ed Andersen, Photographer. Photos were made in August and October 1997, and research was carried out from August 1997 through March 1998.

ROUTE MAP
SACRAMENTO TO RENO

IMAGE WITHDRAWN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Washington Sch
Water Tanks
Mile 0
Mile +60
Intake Tower
Filtration Plant
Borrow Pits
Bryte
Holy Cross Sch
BRODERICK
Match Point A
Mikon
Gaging Sta
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BM 37
Westfield Village Sch
Peethill
Point of Beginning
TOWER BRIDGE
WEST CAPITOL
Trailer Parks
Evergreen Sch
West Acres Sch
SACRAMENTO
Trailer Park
Lincoln Sch
Aqueduct
James Marshall High Sch
PIONEER MEMORIAL BRIDGE
Cathedral Sch
Westmore Oaks Sch
Beacon
U S MIL RES
BROADWAY
Fire Sta
Sewage Disposal
NORTHERN
GARDEN
HIGHWAY
NATOMAS EAST MAIN DRAINAGE
DISCOVERY
BOUNDARY
AMERICAN R
MICHIGAN
PECAN
MAPLE
FREMONT
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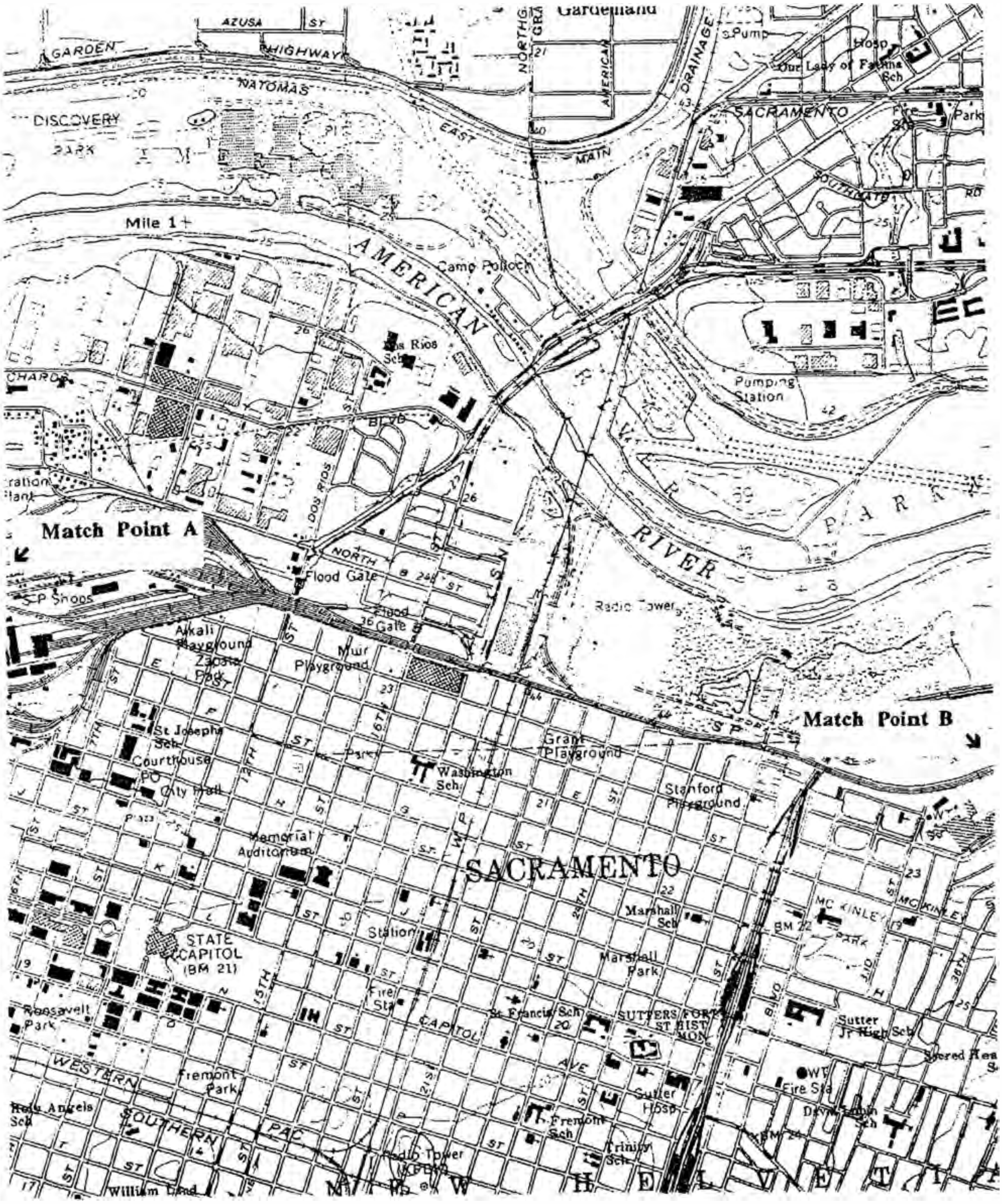
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DISCOVERY PARK
SACRAMENTO
STATE CAPITOL (BM 21)
SP Shops
Flood Gate
Camp Pollock
Pumping Station
Radio Tower
Alkali Playground
Muir Playground
Grant Playground
Stanford Playground
Washington Sch
Courthouse
City Hall
Memorial Auditorium
Marshall Park
Marshall Sch
Sutters Fort St Hist Mon
Sutter Hosp
Fremont Park
Roosevelt Park
Fremont Sch
Trinity Sch
Sutter Jr High Sch
McKinley Park
WESTERN
SOUTHERN PAC
William Land
NEW HELVETIA


Break Point
Match Point B
Richardson Village Park
La Palmas Jr. High Sch
Haggin Wood Sch
Ben Ali
Northwood Sch
Ben Ali Sch
Bellview Park
St Philomena Sch
Dyer Kelly Sch
Howe Ave Sch
Babcock Sch
Dixieland Park
Vista Nueva High Sch
North Sacramento
Radio Tower
Drive-in Theater
Swanston
Woodlake Sch
PC
Vista Jr High Sch
Arden Fair Shopping Center
Howe Community Park
Santa Park
(KXOA) Radio Towers
EXPOSITION BLVD
CALIFORNIA STATE EXPOSITION
Sewage Disposal
DEL PASO
ARDEN
NORTHERN
SOUTHERN PACIFIC
AUBURN
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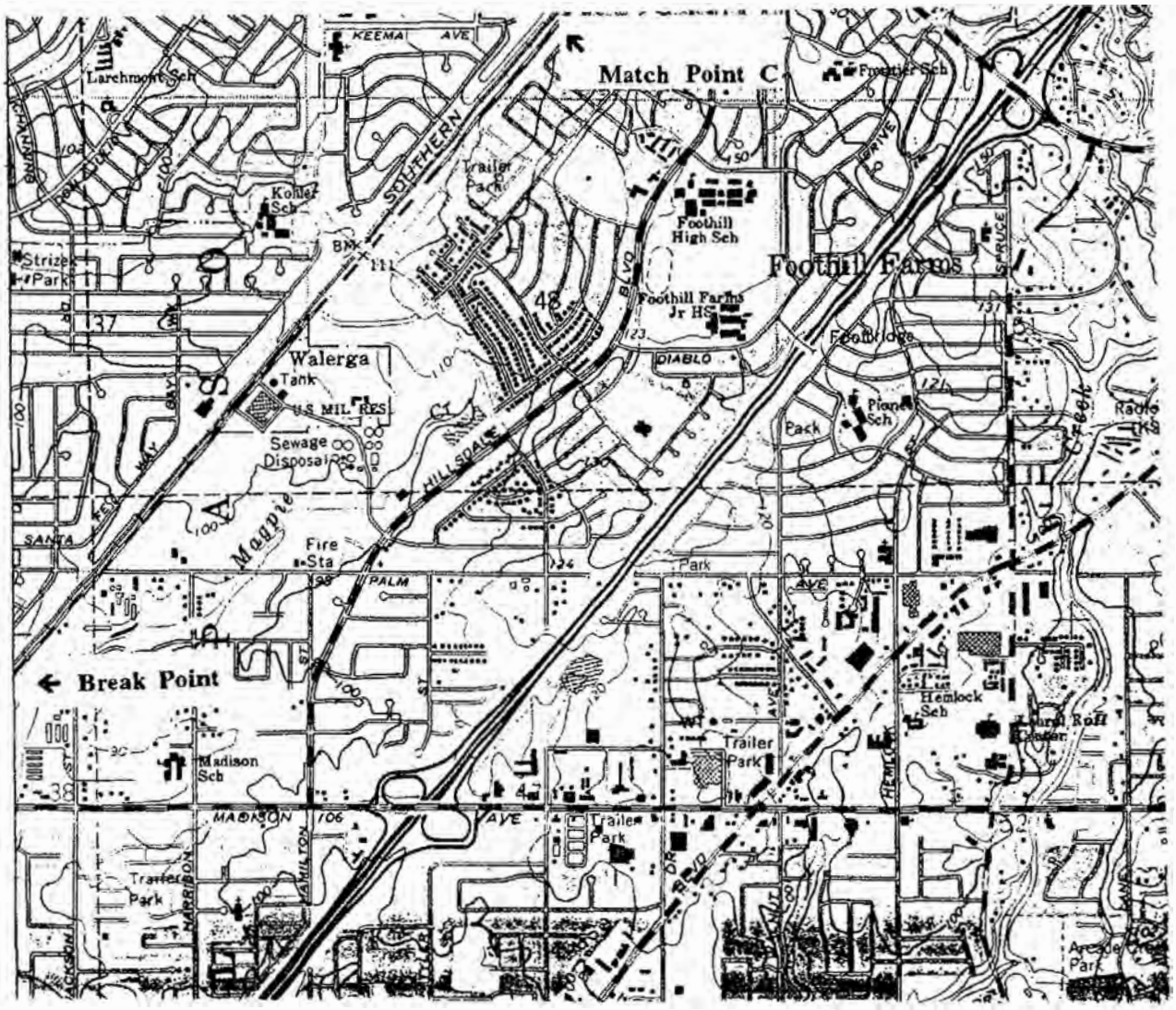
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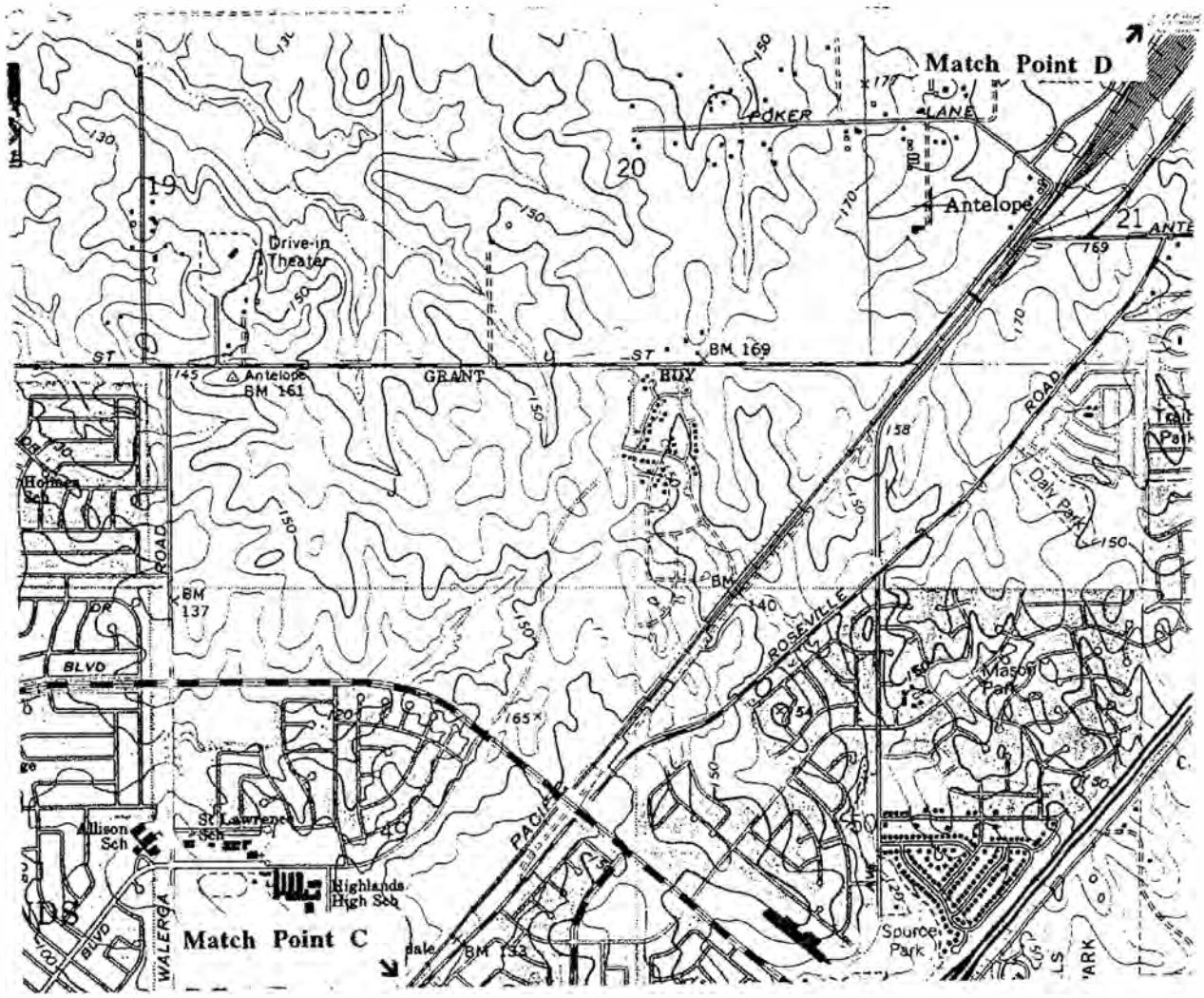
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BLVD
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Allison Sch
St Lawrence Sch
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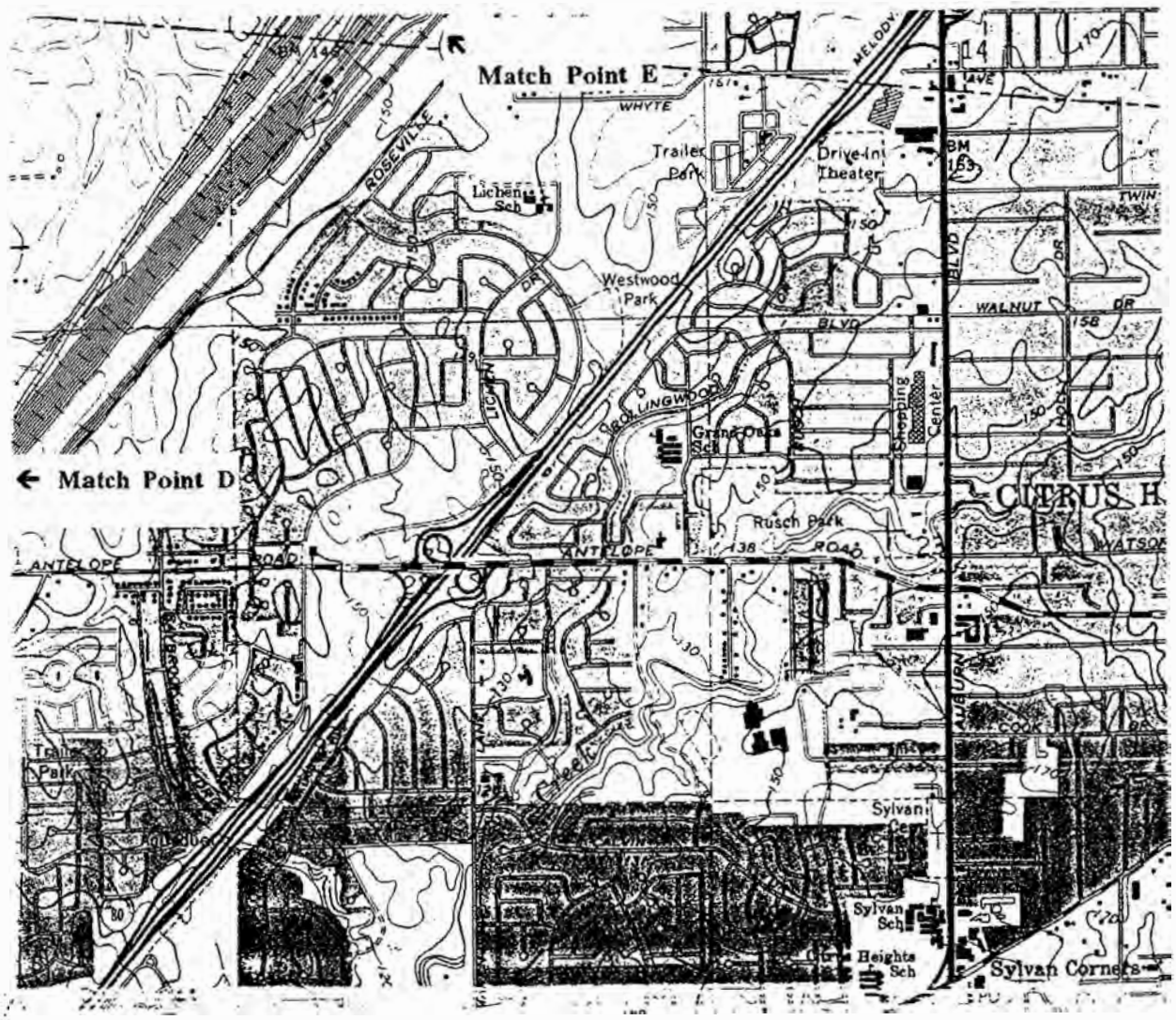
WALERGA
ROSEVILLE
Mason Park
Source Park
Dahl Park
BM 133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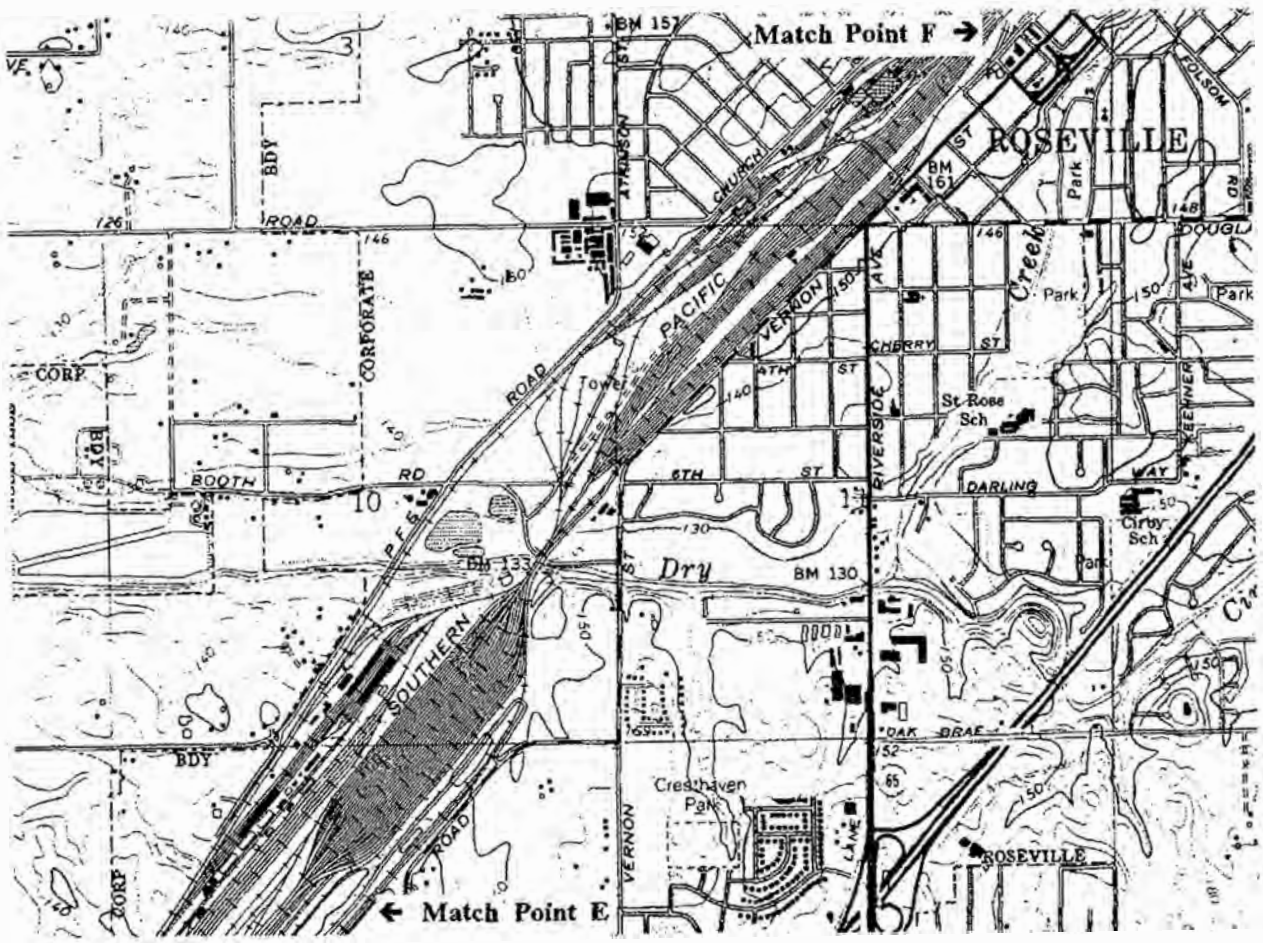
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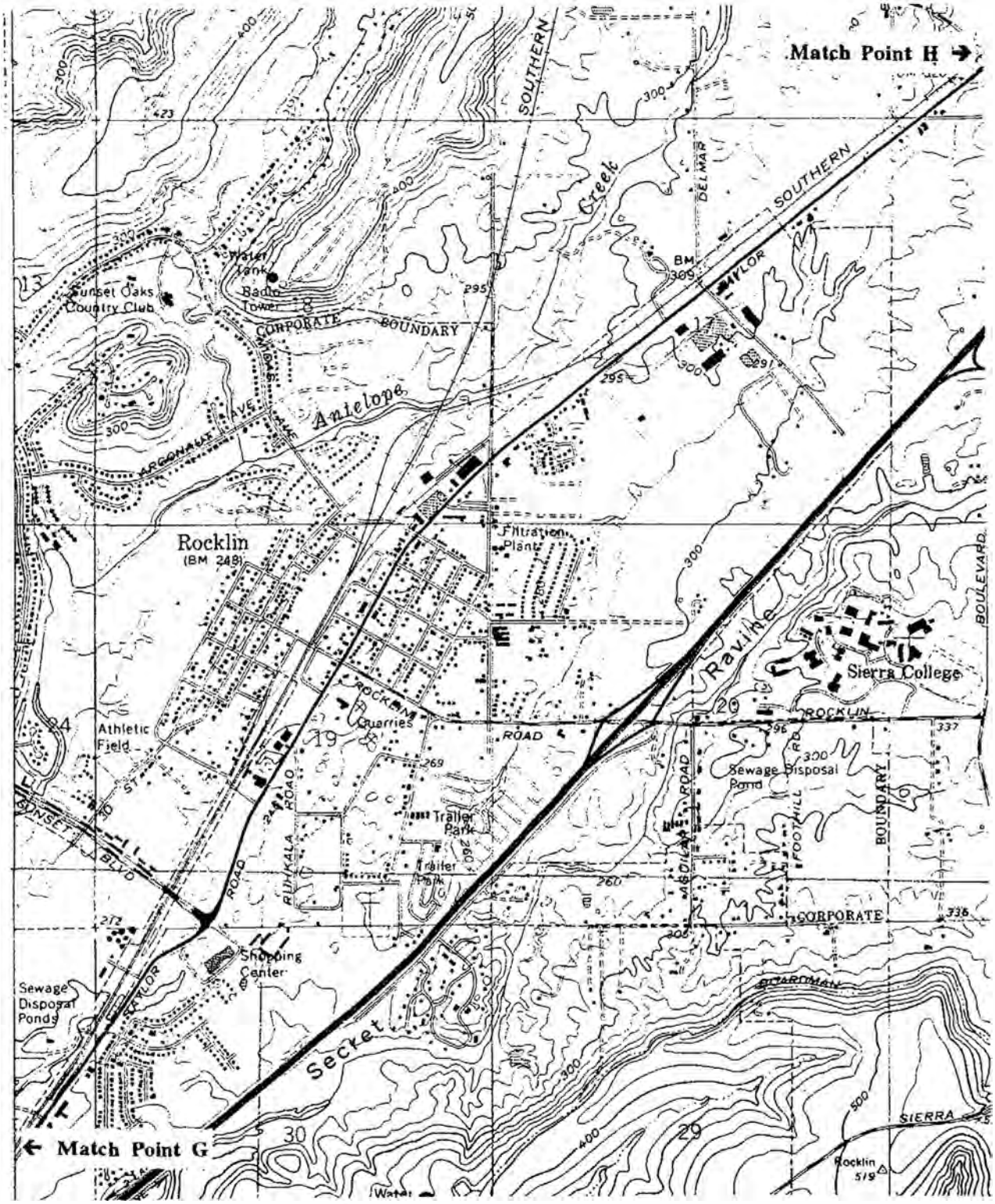
ROAD
BOOTH RD
6TH ST
DARLING WAY
OAK BRAE
VERNON
RIVERSIDE AVE
CHERRY ST
FOLSOM
CHURCH
ATKINSON ST
CORPORATE
BDY
CORP
Park
Tower


Rocklin
Sewage Disposal Ponds
ROSEVILLE CORPORATE BOUNDARY
Match Point G →
Diamond Oaks Municipal Golf Course
SIERRA VIEW COUNTRY CLUB
Roseville Cem
Antelope
Secret Ravine
SOUTHERN PACIFIC
Miners Ravine
Woodbridge Park
Woodbridge Sch
ROSEVILLE
Gravel Pit
ATLANTIC STREET
← Match Point F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BM 309
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Radio Tower
Sunset Oaks Country Club
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Antelope
ARGONAUT AVE
Rocklin
(BM 248)
Filtration Plant
Ravine
BOULEVARD
Sierra College
ROCKLIN ROAD
Athletic Field
ROCKLIN Quarries
Sewage Disposal Pond
FOOTHILL RD
BOUNDARY
SUNSET BLVD
RUHKALA ROAD
Trailer Park
ABOLAN ROAD
CORPORATE
Shopping Center
Sewage Disposal Ponds
TAYLOR
Secret
RICHARDSON
SIERRA
Rocklin
519
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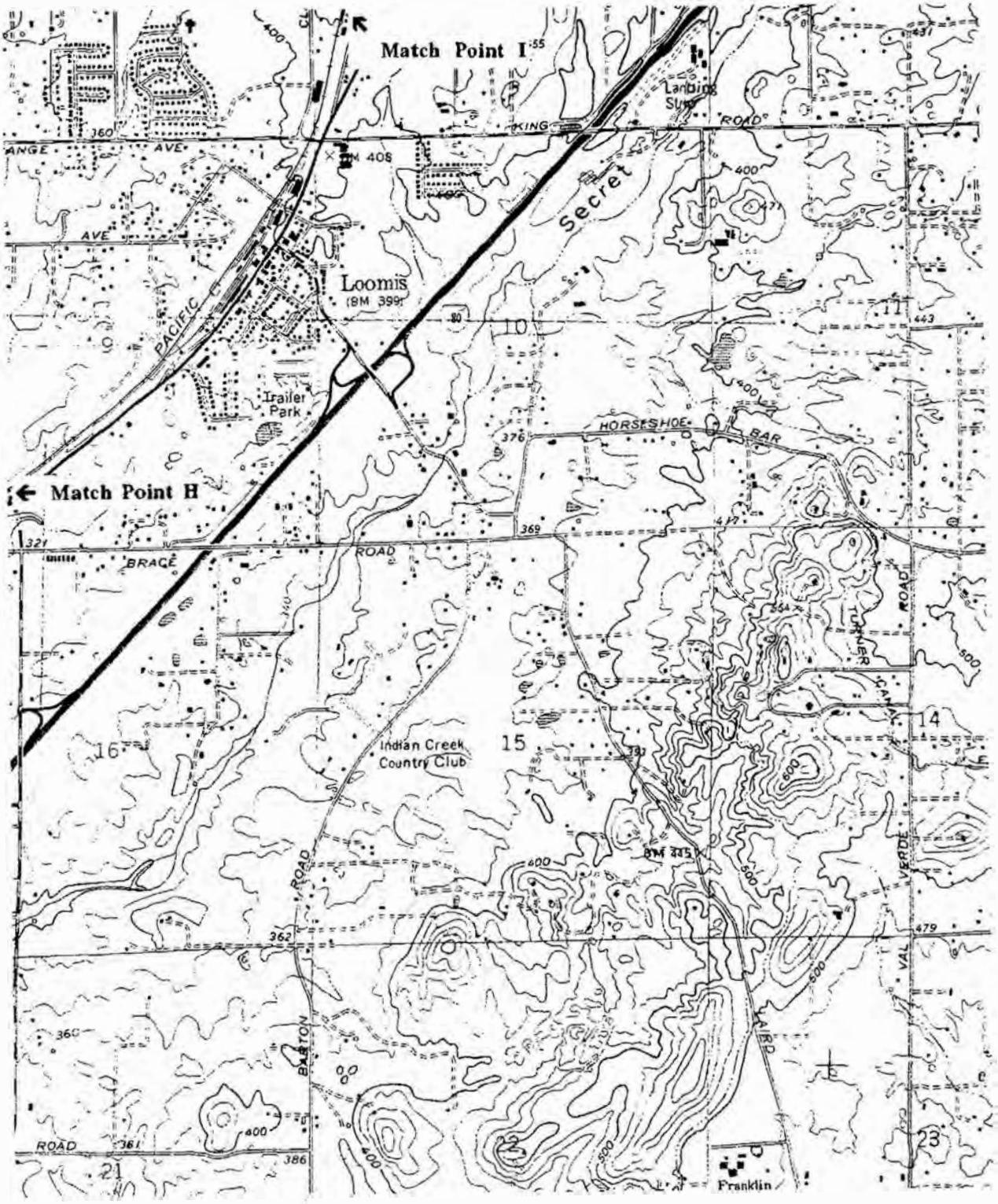
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Match Point H
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(BM 399)
Secret
Trailer Park
Indian Creek Country Club
Franklin
PACIFIC
HORSESHOE BAR
BRACE
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KING
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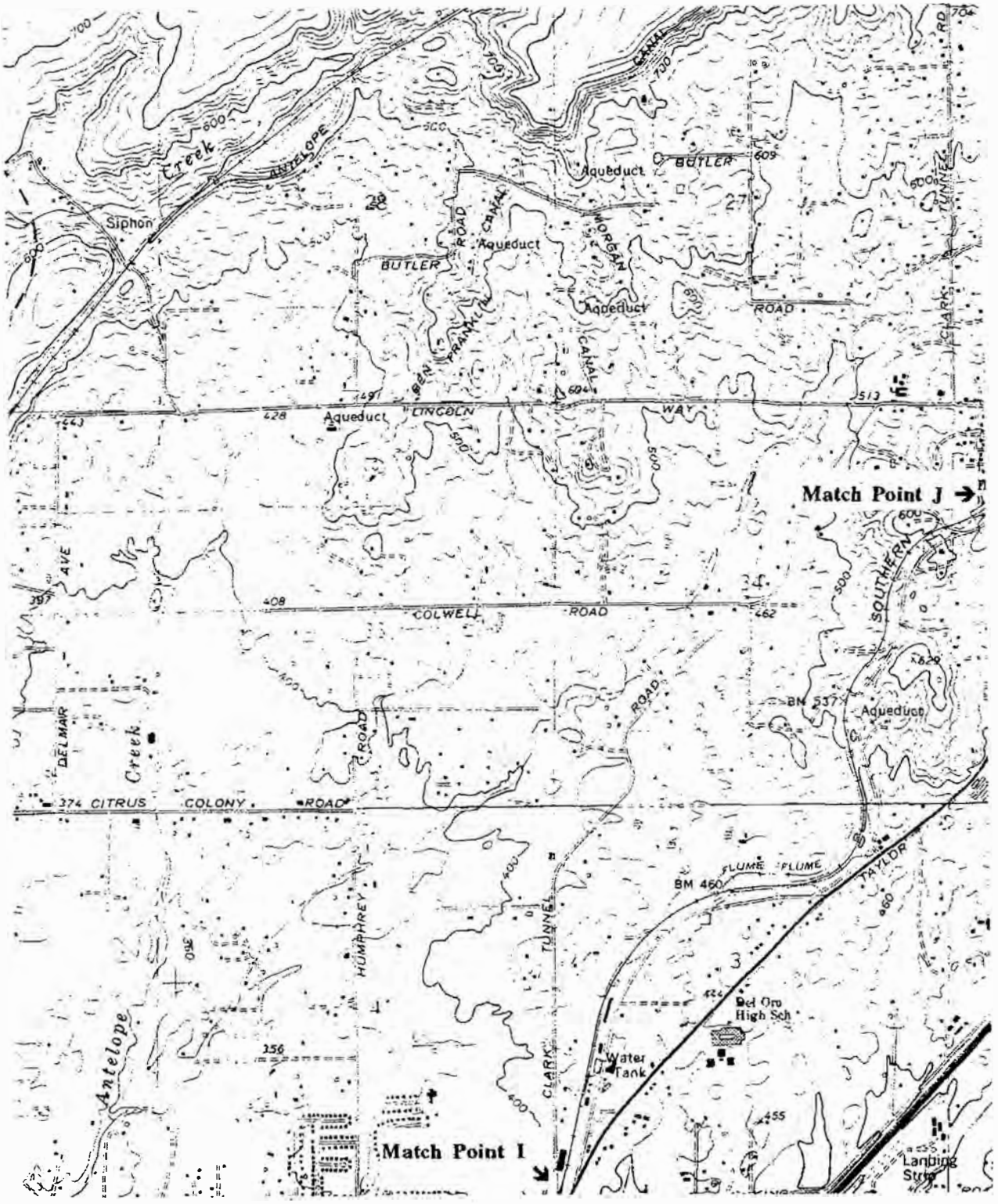
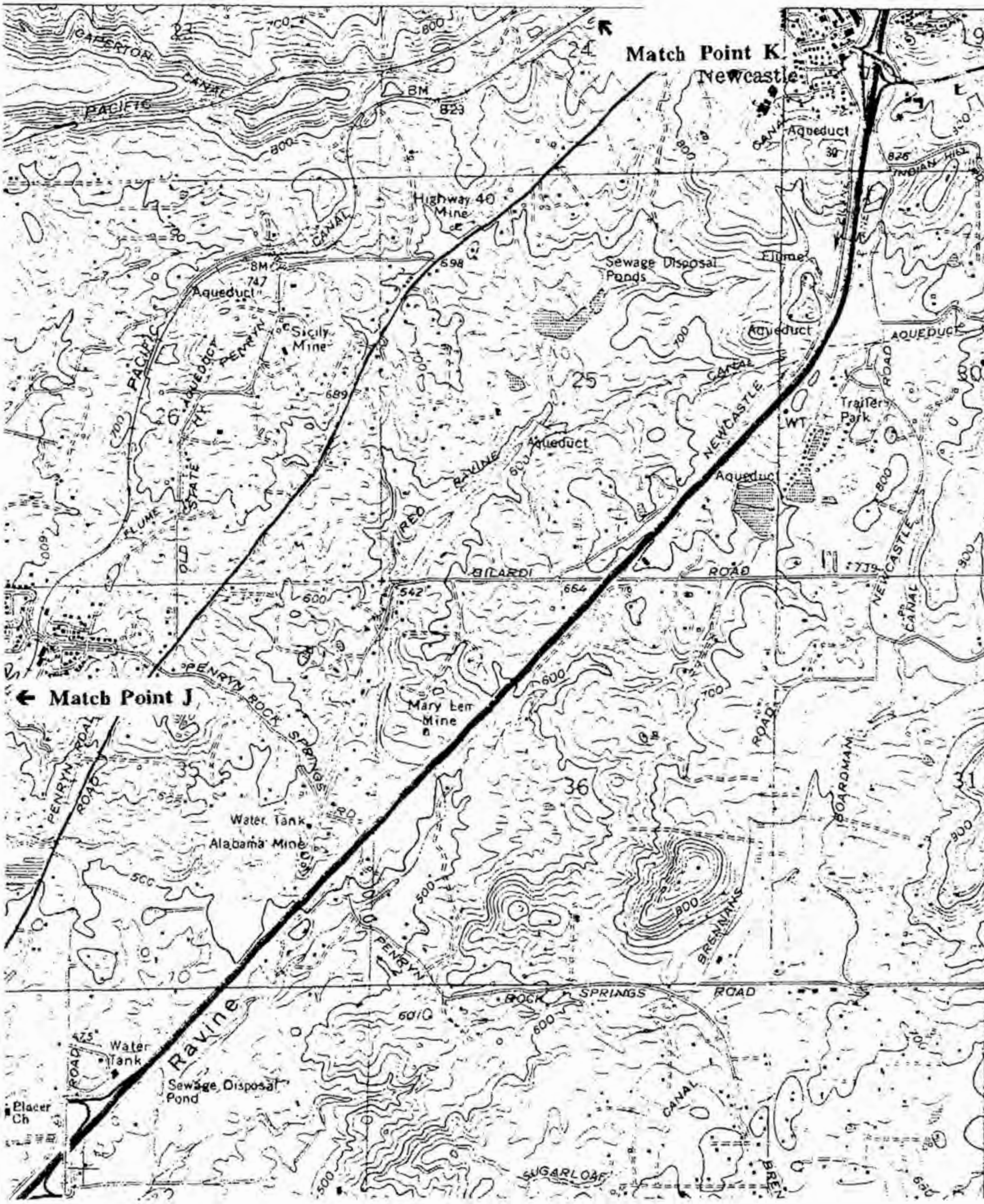
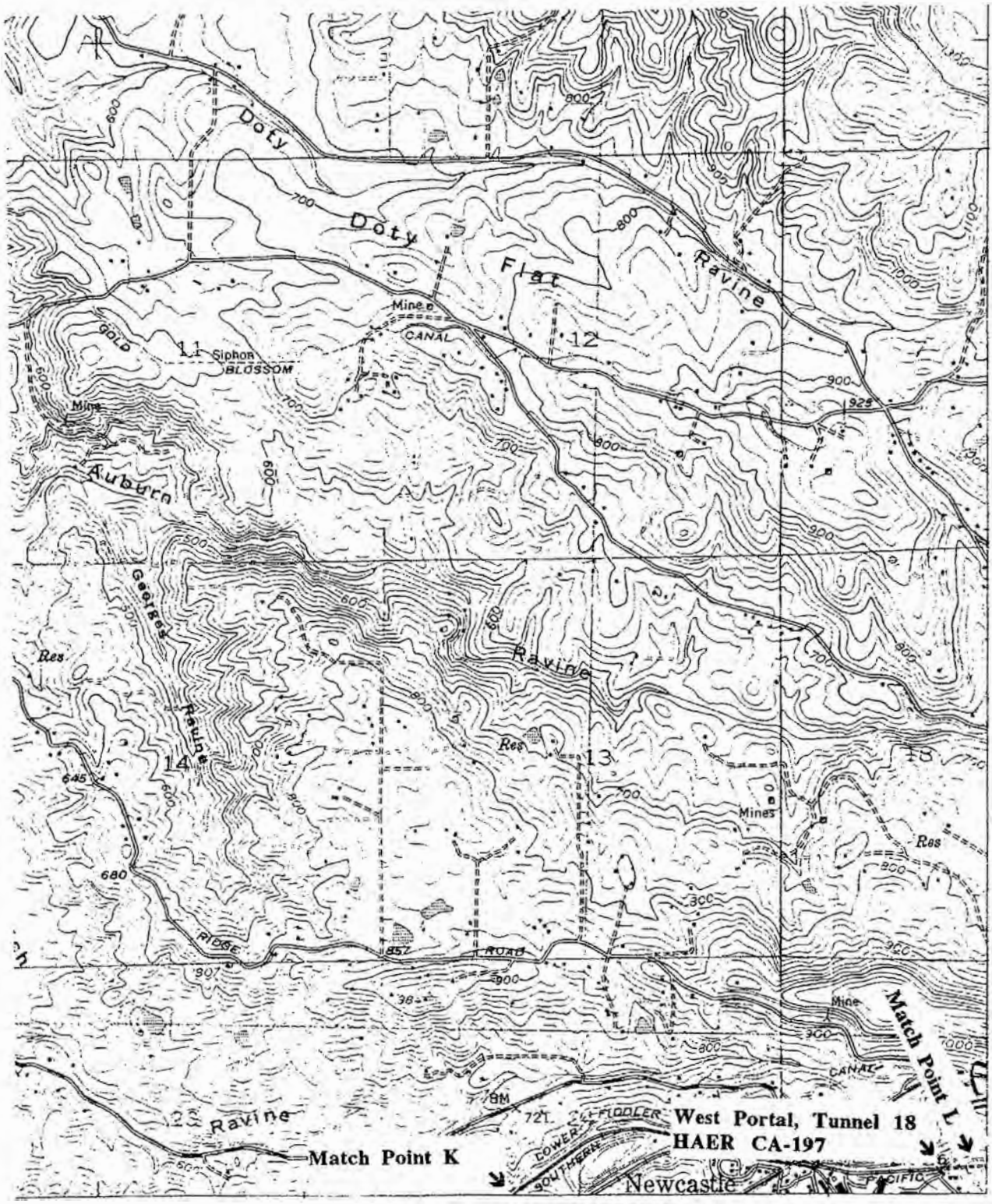
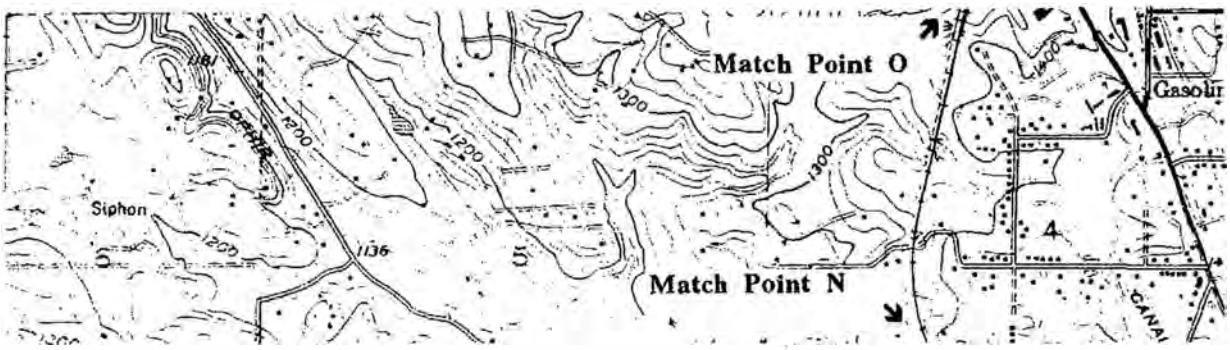
BARTON
ROAD
TURNER
ROAD
VERDE
VAL
BM 408
BM 445
10
15
16
14
23
21


Match Point J
Match Point I
Antelope Creek
Siphon
Aqueduct
BUTLER
ROAD
CANAL
MORGAN
BEN FRANKLIN
LINCOLN WAY
COLWELL ROAD
SOUTHERN
TAYLOR
HUMPHREY
CLARK
TUNNEL
DELMAR
374 CITRUS COLONY ROAD
FLUME
BM 460
BM 537
Del Oro High Sch
Water Tank
Landing Strip

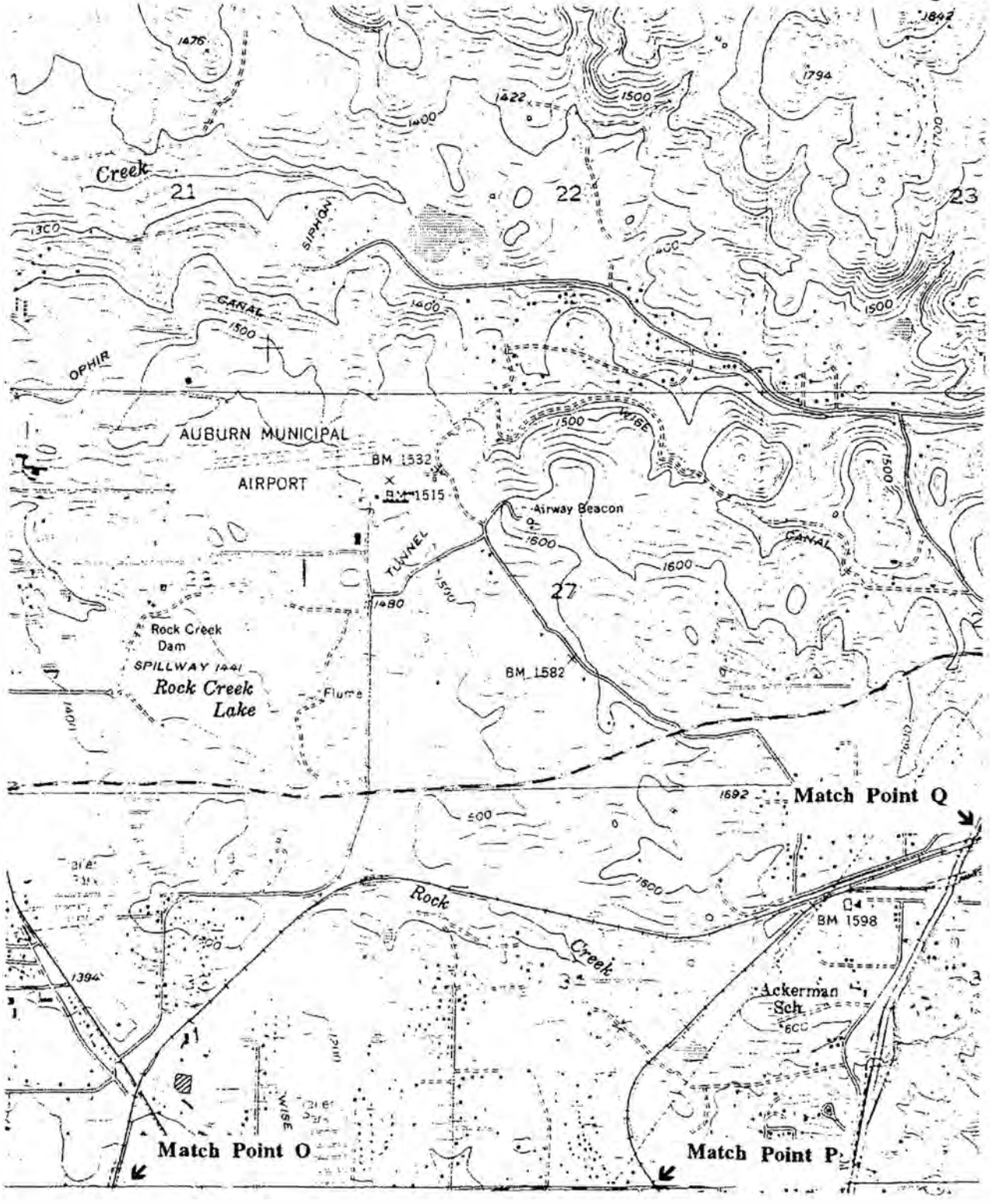

Match Point K
Newcastle
← Match Point J
Highway 40 Mine
Sicily Mine
Sewage Disposal Ponds
Aqueduct
Flume
Trailer Park
Mary Lee Mine
Water Tank
Alabama Mine
Sewage Disposal Pond
Ravine
Red Ravine
Penryn Rock Springs Rd
Rock Springs Road
Bicardi Road
Newcastle Road
Boardman Canal
Brennans
Sugarloaf
Penryn Road
Old State Hy
Pacific Canal
Caperton Canal
Indian Hill
Placer Ch

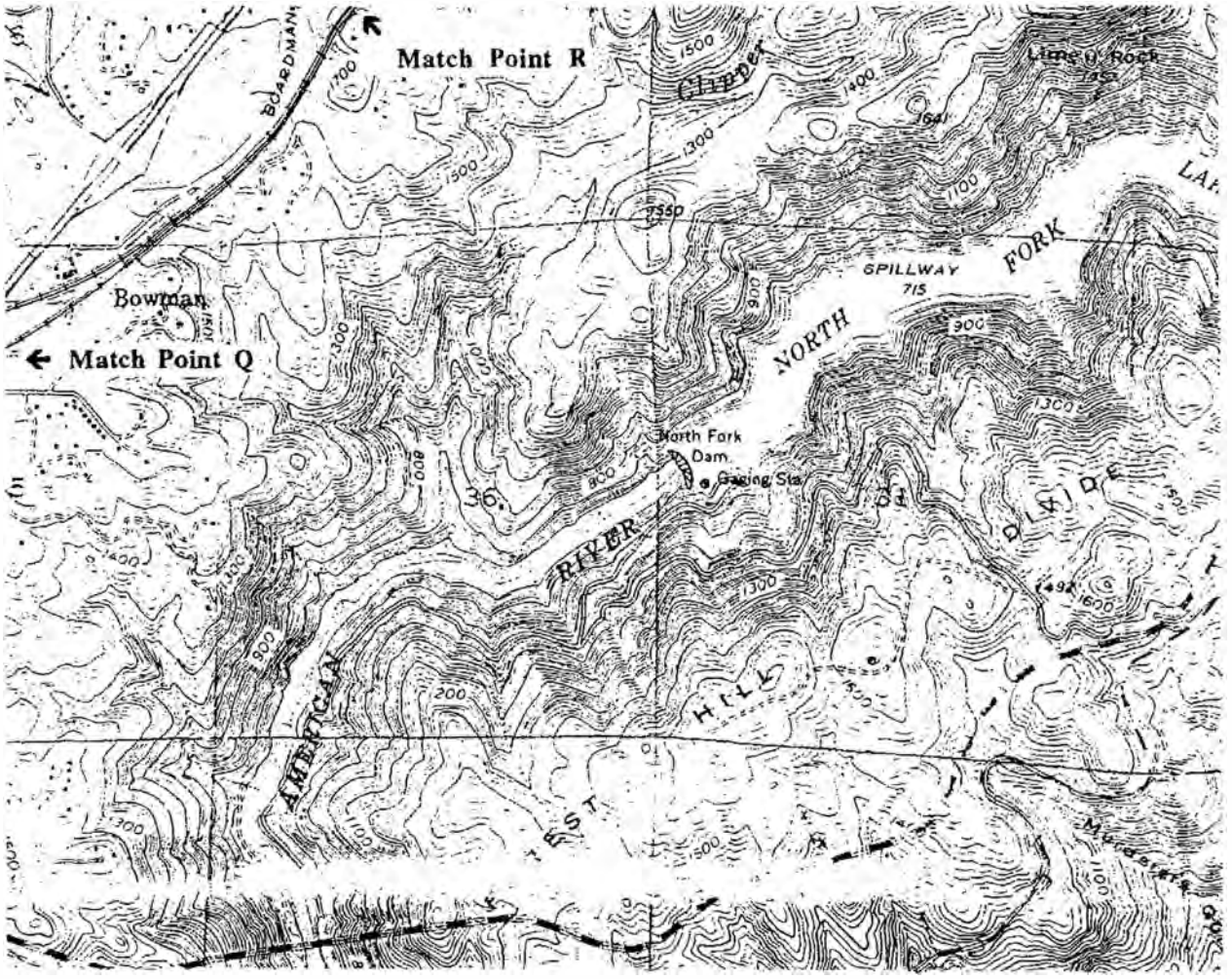

Doty
Doty Flat
Ravine
Mine
CANAL
GOLD
Siphon
BLOSSOM
Auburn
Georges
Ravine
Res
Ravine
Mines
Res
RIDGE
ROAD
Mine
CANAL
Match Point L
Ravine
Match Point K
West Portal, Tunnel 18
HAER CA-197
Newcastle
11
12
13
14
18

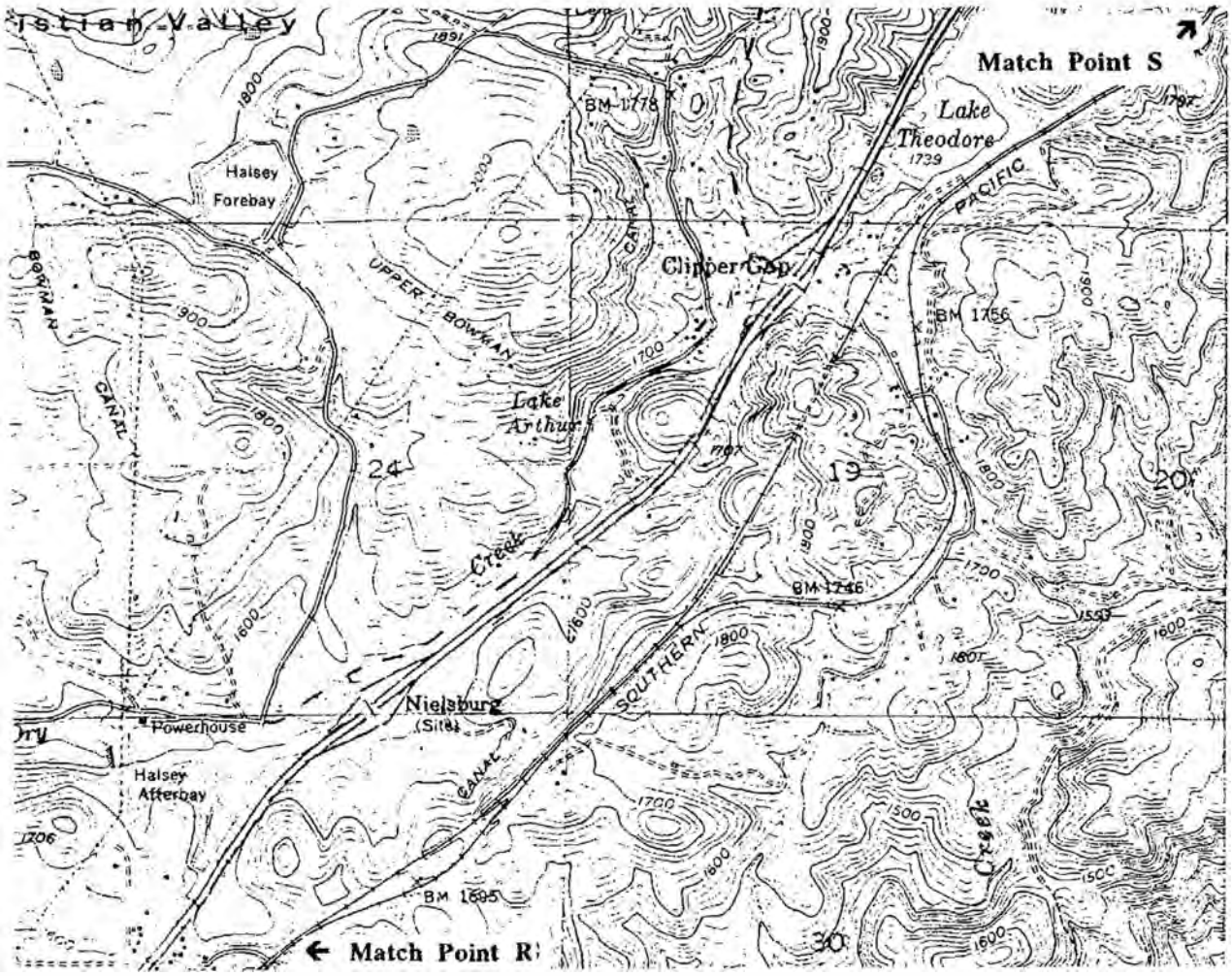

Match Point N
Millertown
(Site)
Wise Forebay
Dudley Canal
Canal
North
Bald Hill
Ravine
Fiddler Green Canal
Wise
Penstock
Substation
Cemetery
Duncan Hill
Sewage disposal
Ophir Sch
Ophir
Auburn Ravine
Ravine
Siphon
Canal
Southern Pacific
Match Point M
Match Point L
South
Southern
Fiddler Green
Ravine
East Portal, Tunnel 18, HAER CA-197

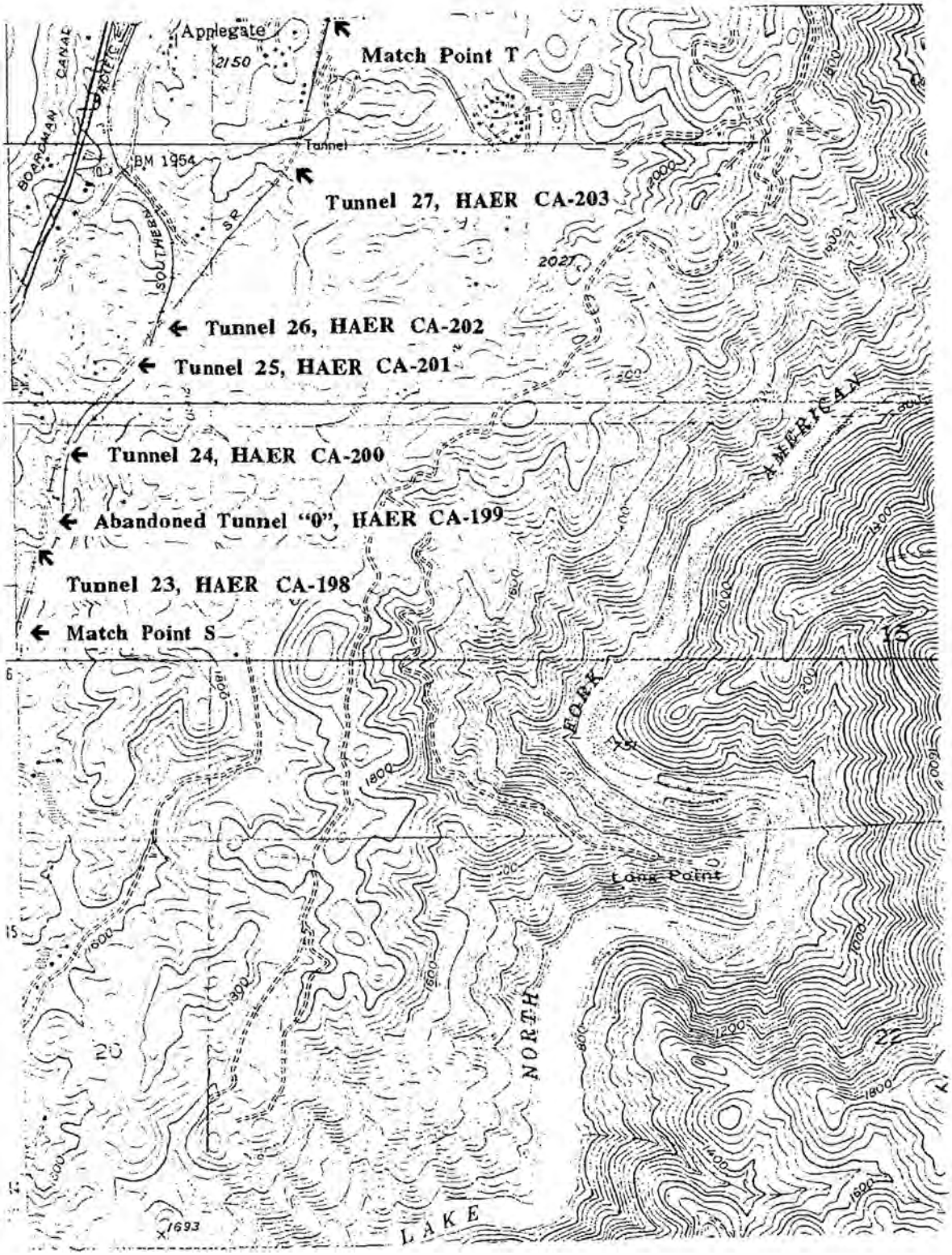

Match Point O
Match Point N
Siphon
1136
1200
1300
1400
4
5

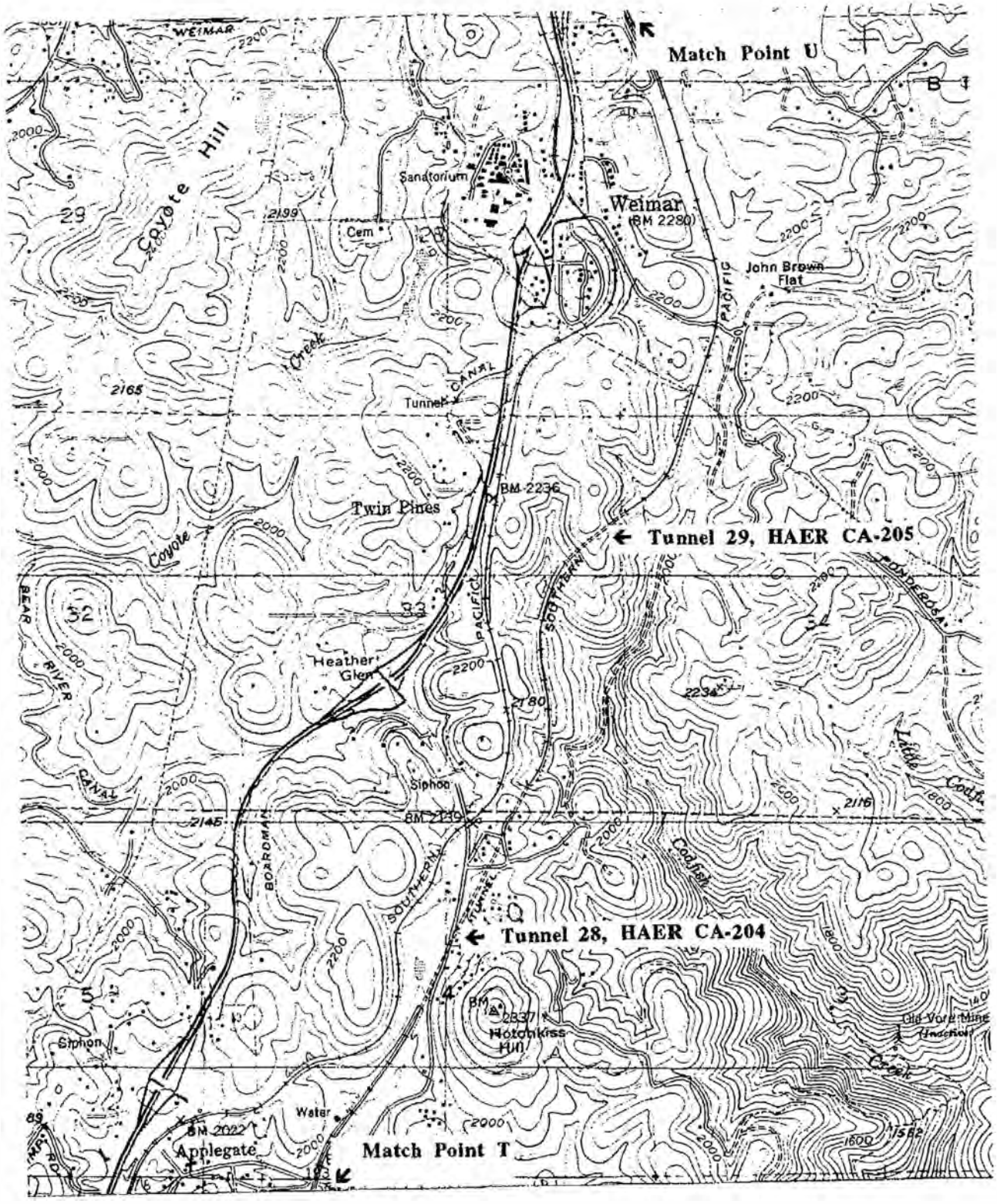

Match Point P
BM 1495
BOARDMAN
Auburn Ravine
Siphon
BM 1396
E V Cain Sch
County Hospital
AUBURN
Sta
BM 1359
BM 1297
Courthouse
Highland Gen Hosp
Jr College
CANAL
FAIRGROUNDS
BM 1307
Flume
SHIRLAND
Match Point M
NORTH
Pointed Rocks
Roble Pt
PLACER CO
EL DORADO CO
Kanaka Bar
Salt

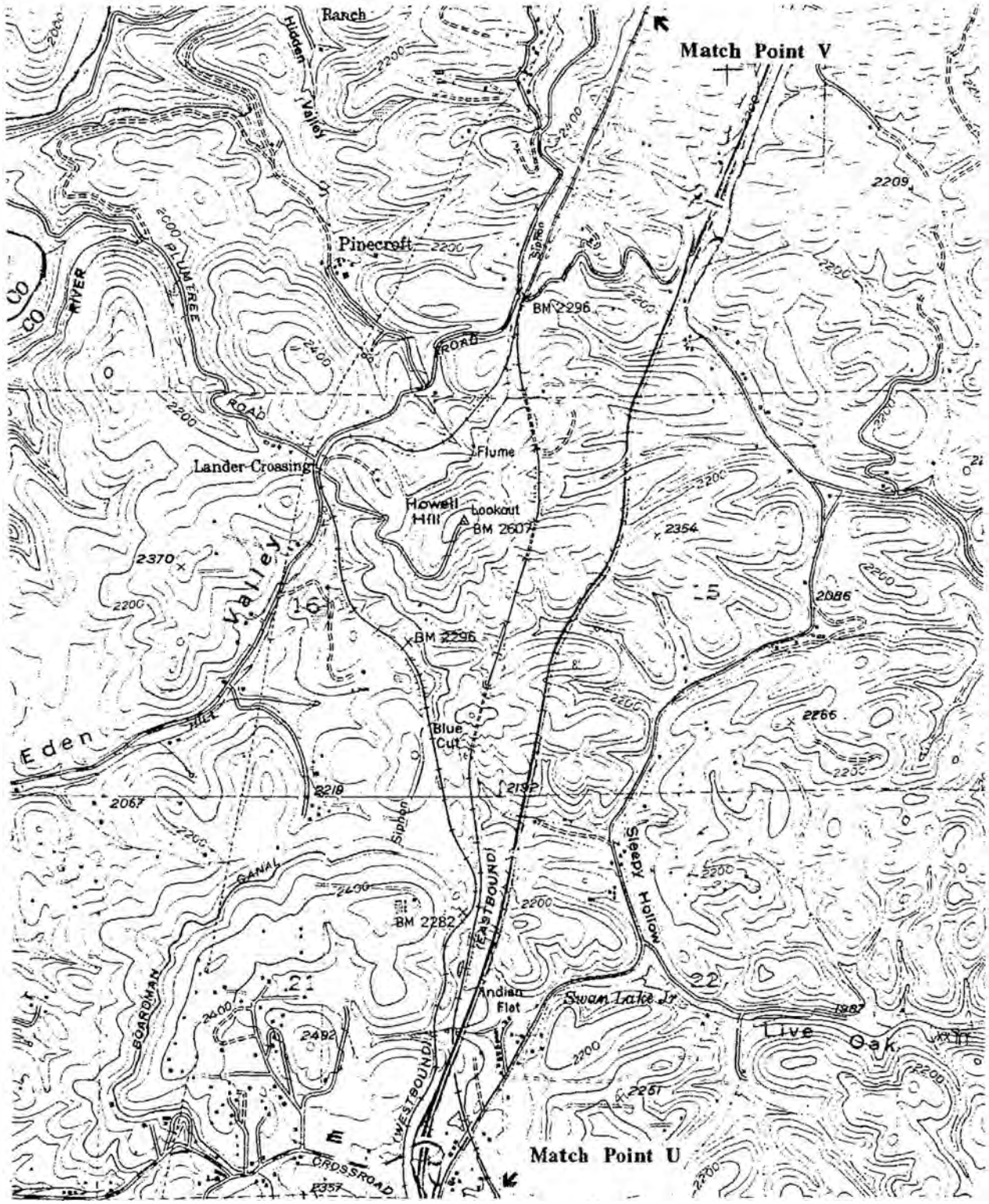

Creek
21
22
23
SIPHON
CANAL
OPHIR
AUBURN MUNICIPAL
AIRPORT
BM 1532
1515
Airway Beacon
WISE
TUNNEL
27
Rock Creek
Dam
SPILLWAY 1441
Rock Creek
Lake
Flume
BM 1582
Match Point Q
Rock
Creek
BM 1598
Ackerman
Sch
Match Point O
Match Point P

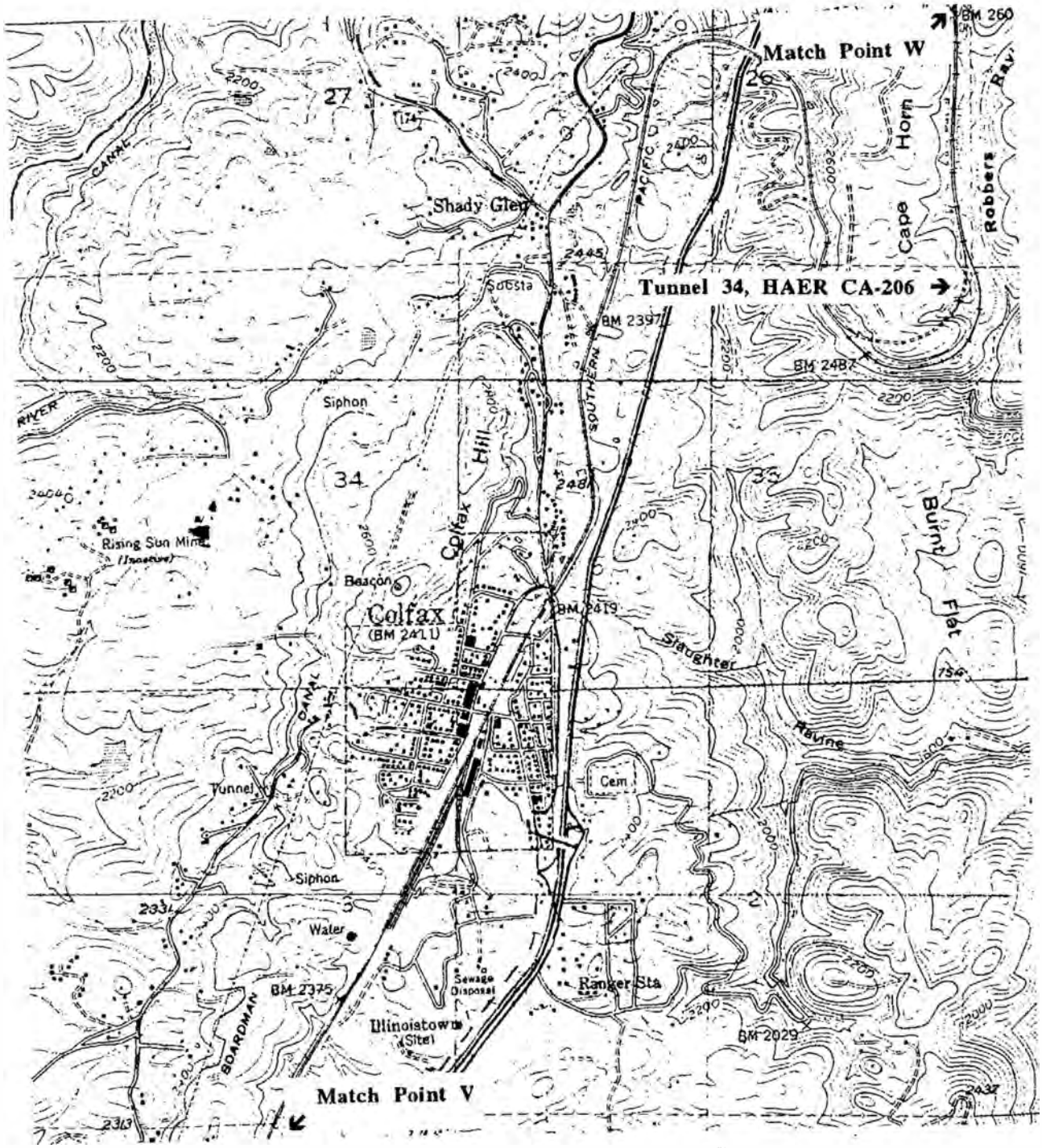

Match Point R
Match Point Q
Bowman
BOARDMAN
Clipper
Lime Q. Rock
SPILLWAY
715
NORTH
FORK
North Fork
Dam
Gaging Sta.
RIVER
AMERICAN
WEST
DIVIDE
HILL
36
1700
1500
1400
1300
1200
1100
1000
900
800
600
500
200
100

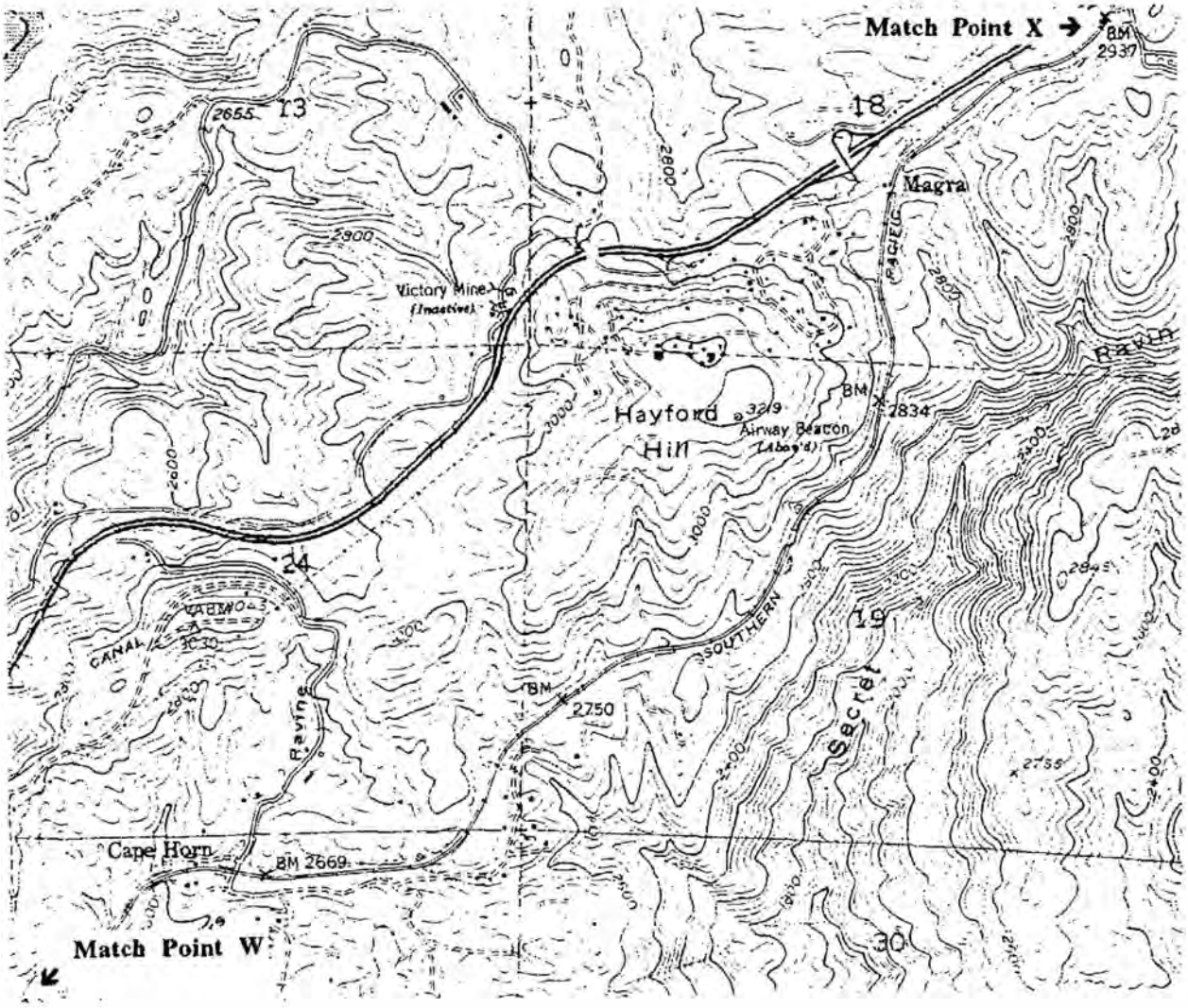

Match Point S
Lake Theodore
1729
BM 1778
Halsey Forebay
Clipper Gap
BM 1756
Lake Arthur
Nielsburg (Site)
Powerhouse
Halsey Afterbay
BM 1695
Match Point R
PACIFIC
SOUTHERN
CANAL
UPPER BOWMAN
BOWMAN
Creek
24
19
20
30

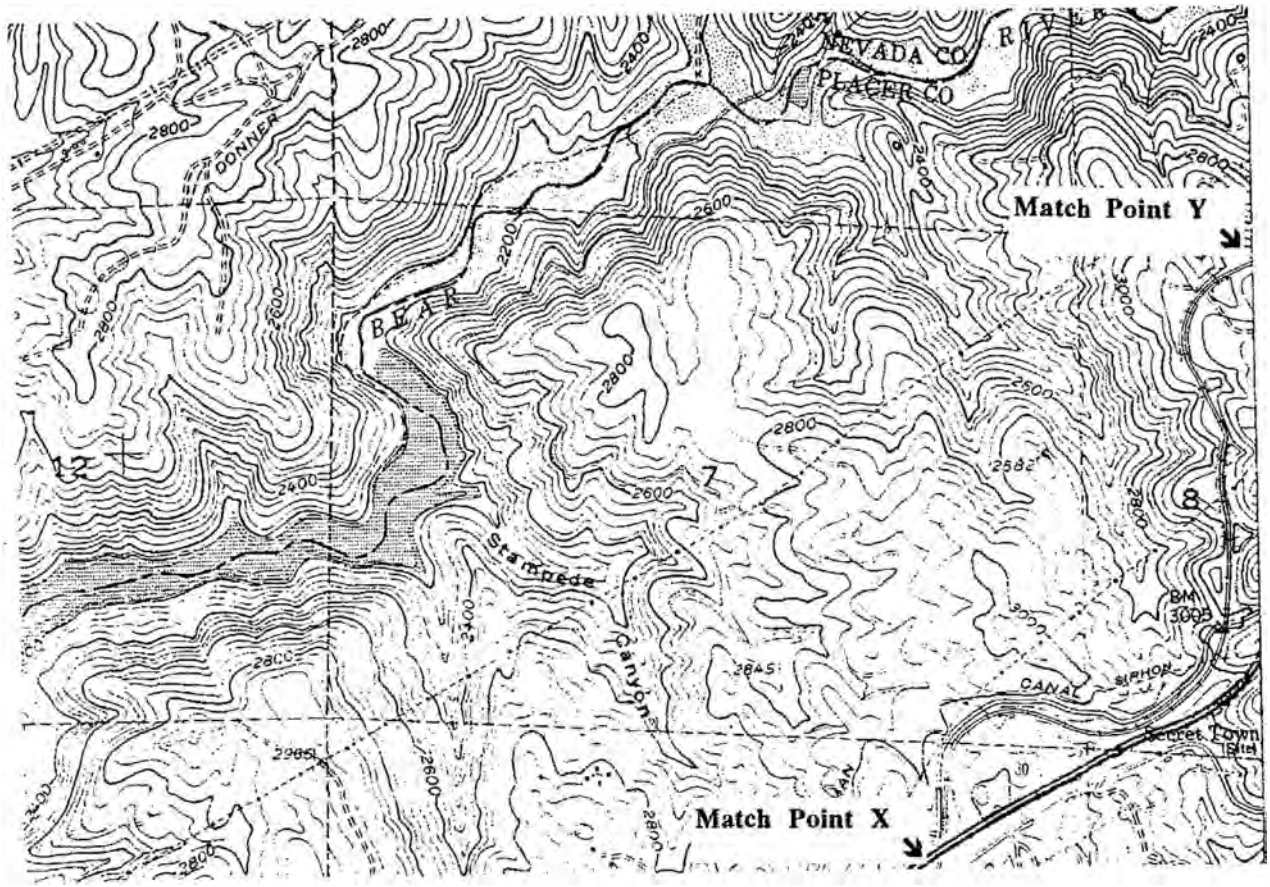

Applegate
2150
Match Point T
BOARDMAN CANAL
SOUTHERN PACIFIC
BM 1954
Tunnel
Tunnel 27, HAER CA-203
SR
2027
Tunnel 26, HAER CA-202
Tunnel 25, HAER CA-201
Tunnel 24, HAER CA-200
Abandoned Tunnel "0", HAER CA-199
Tunnel 23, HAER CA-198
Match Point S
AMERICAN
FORK
Long Point
NORTH
LAKE
1693

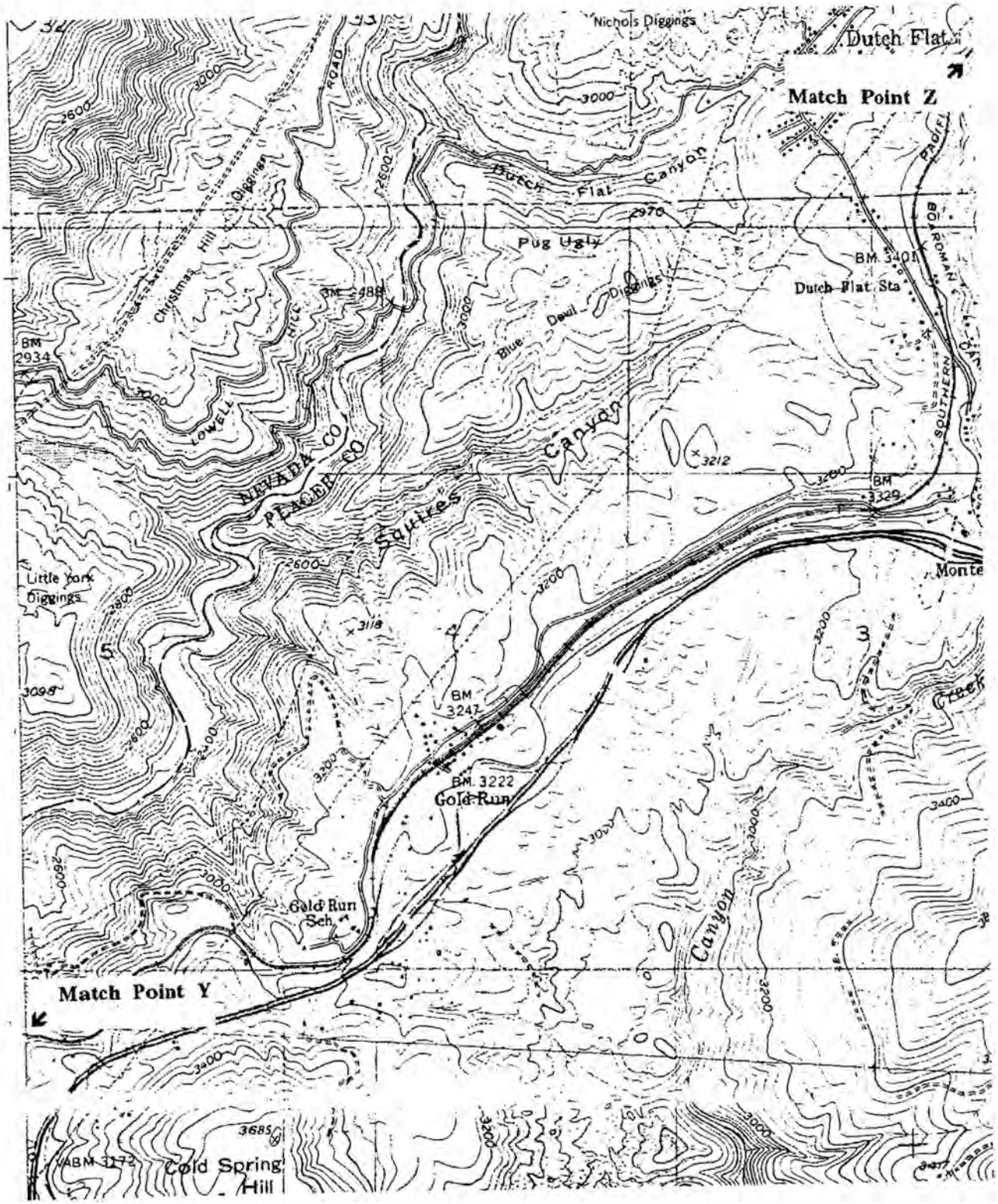

Match Point U
Weimar
(BM 2280)
Sanatorium
Cem
Coyote Hill
Creek
CANAL
Tunnel
BM 2236
Twin Pines
Tunnel 29, HAER CA-205
John Brown Flat
PACIFIC
SOUTHERN
Heather Glen
Siphon
BM 2139
BOARDMAN
Tunnel 28, HAER CA-204
BM 2837
Hotchkiss Hill
Siphon
Water
BM 2022
Applegate
Match Point T
Old Verde Mine
Codfish
Little Codfish
BEAR RIVER
Coyote

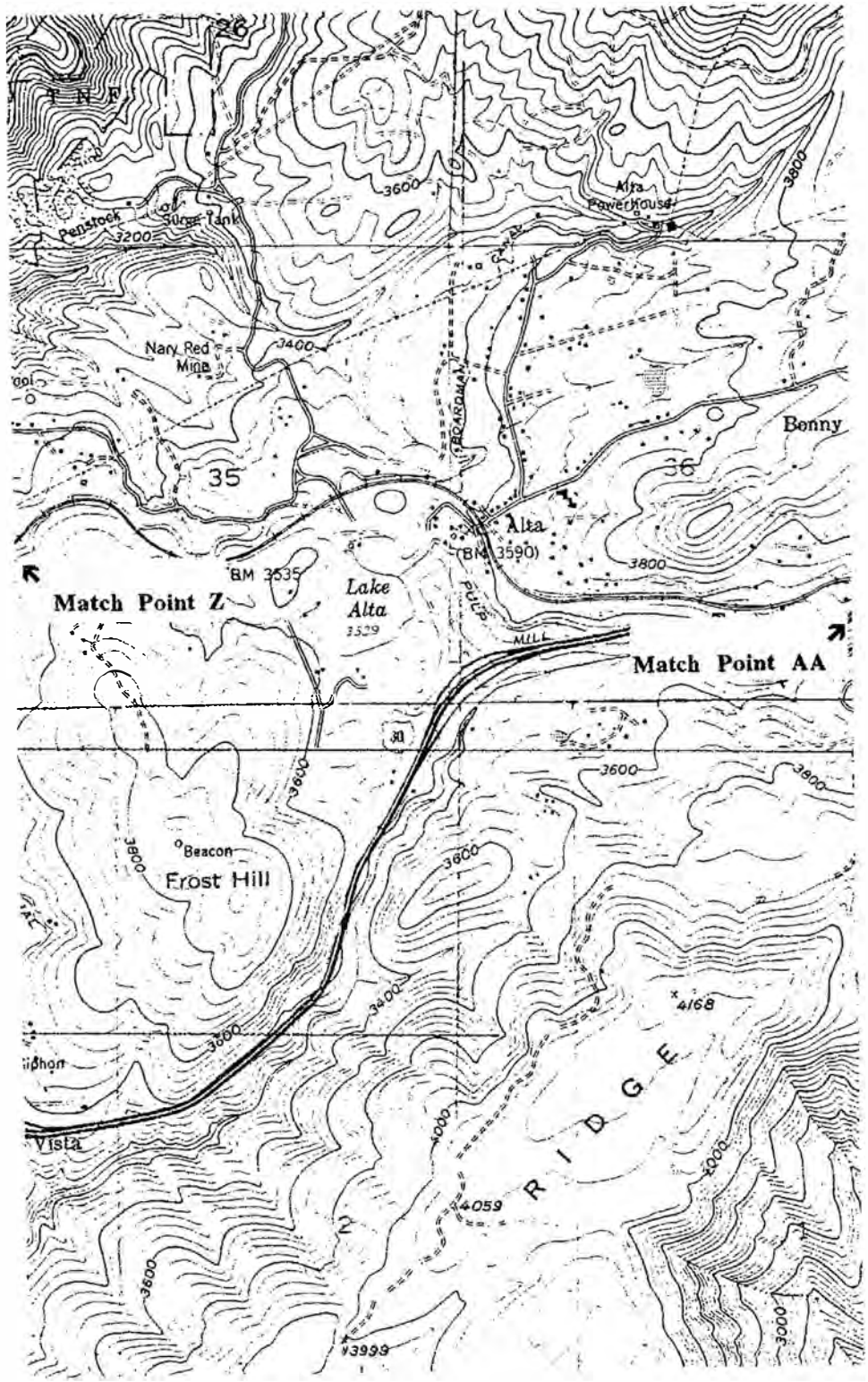

Ranch
Hidden Valley
Match Point V
Pinecroft
PLUMTREE
RIVER
ROAD
BM 2296
Flume
Lander Crossing
Howell Hill
Lookout
BM 2607
Eden Valley
BM 2296
Blue Cut
Siphon
CANAL
BM 2282
EASTBOUND
WESTBOUND
Indian Flat
Sleepy Hollow
Swan Lake Jr
Live Oak
BOARDMAN
CROSSROAD
Match Point U

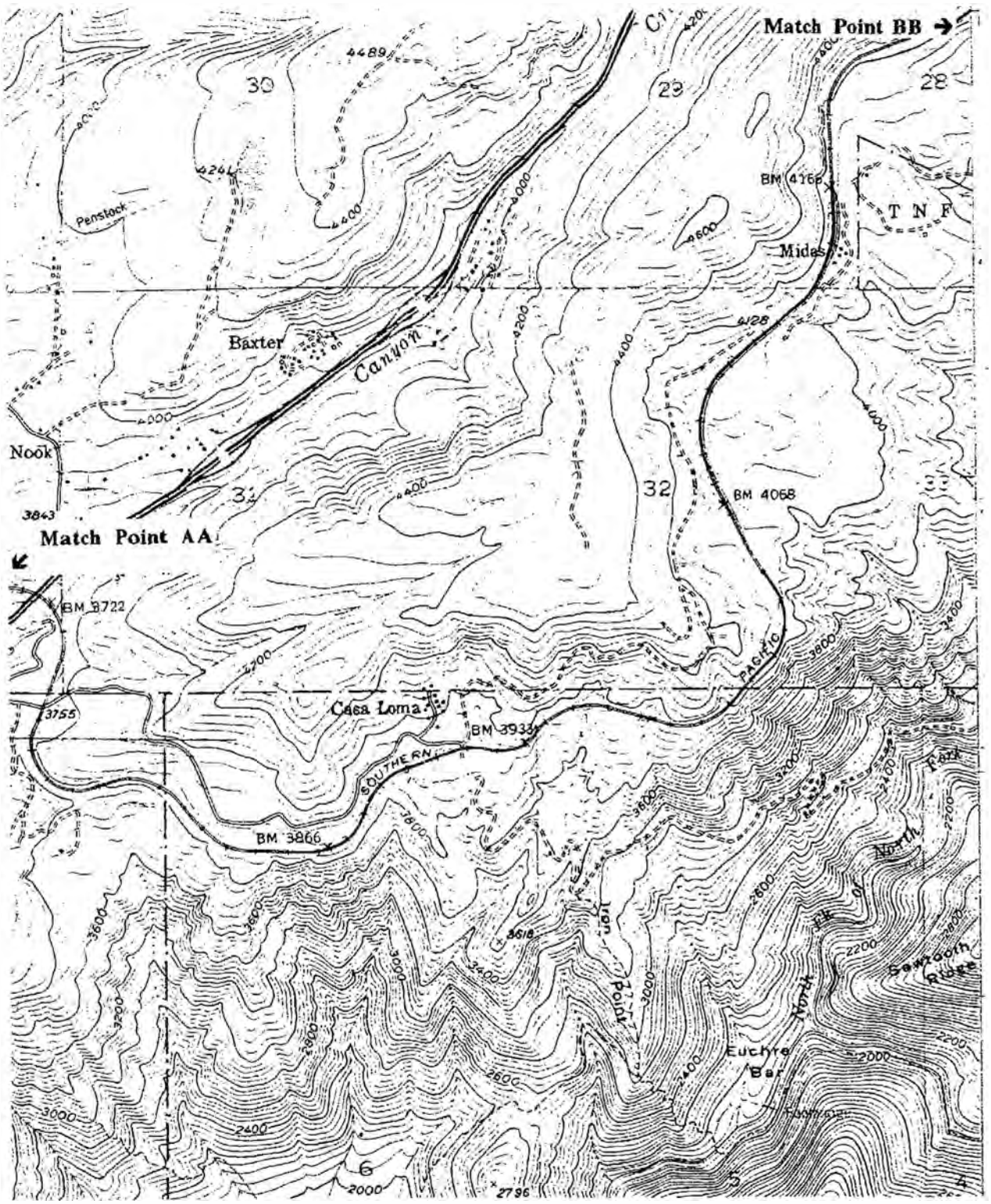

Match Point W
Tunnel 34, HAER CA-206
Match Point V
Colfax
(BM 2410)
Shady Glen
Rising Sun Mine
(Inactive)
Siphon
Tunnel
Water
Sewage Disposal
Ranger Sta
Illinoistown
(Site)
Cape Horn
Robbers
Burnt Flat
Slaughter
Ravine
Cem.
Beacon
Canal
Pacific
Southern
BM 2397
BM 2487
BM 2419
BM 2375
BM 2029
BM 260
Boardman

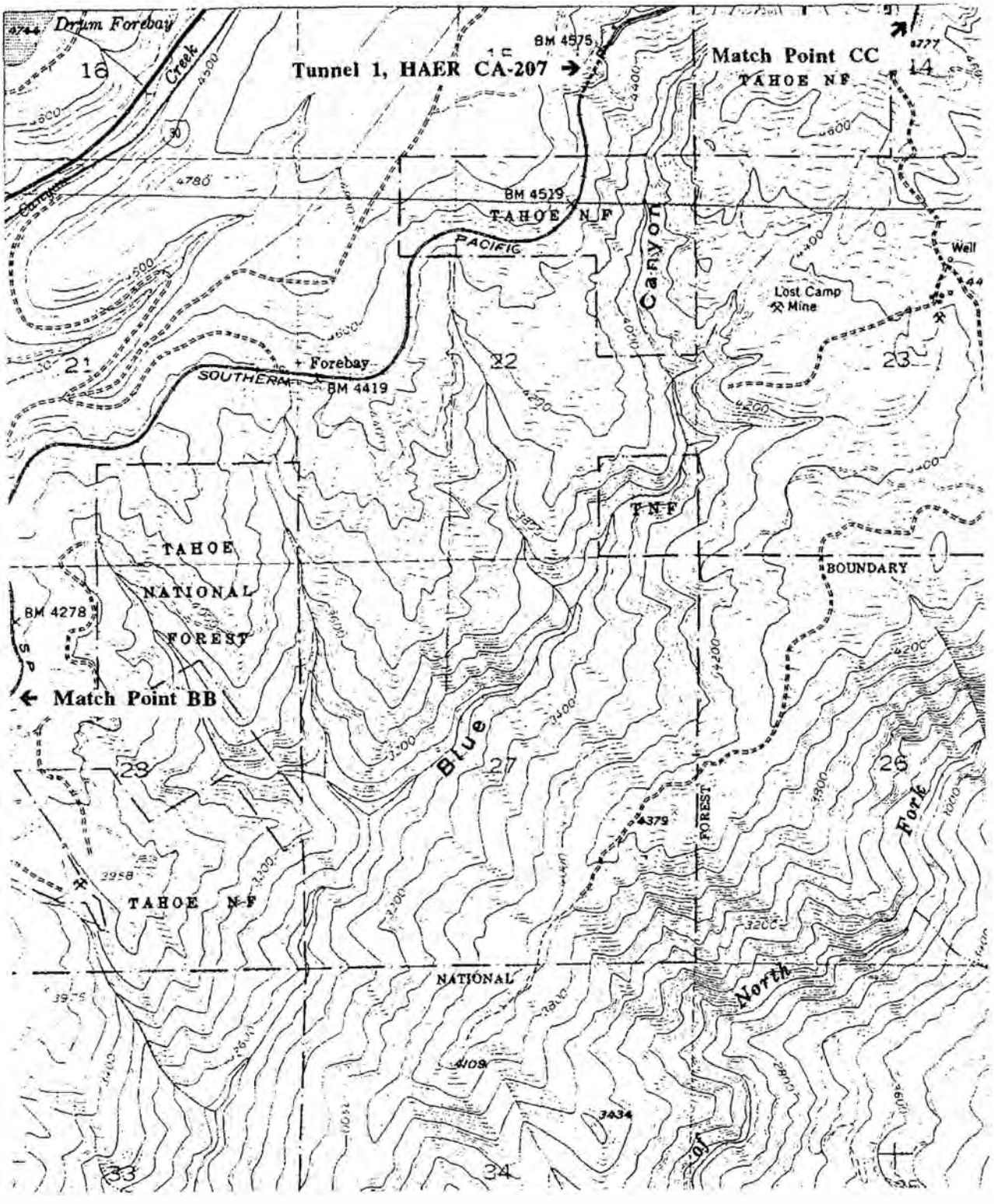

Match Point X
BM 2937
18
Magra
PACIFIC
Victory Mine
(Inactive)
Hayford
Hill
3279
Airway Beacon
(Abandoned)
BM 2834
24
19
SOUTHERN
CANAL
BM 2750
Secret
Ravine
Cape Horn
BM 2669
Match Point W
30

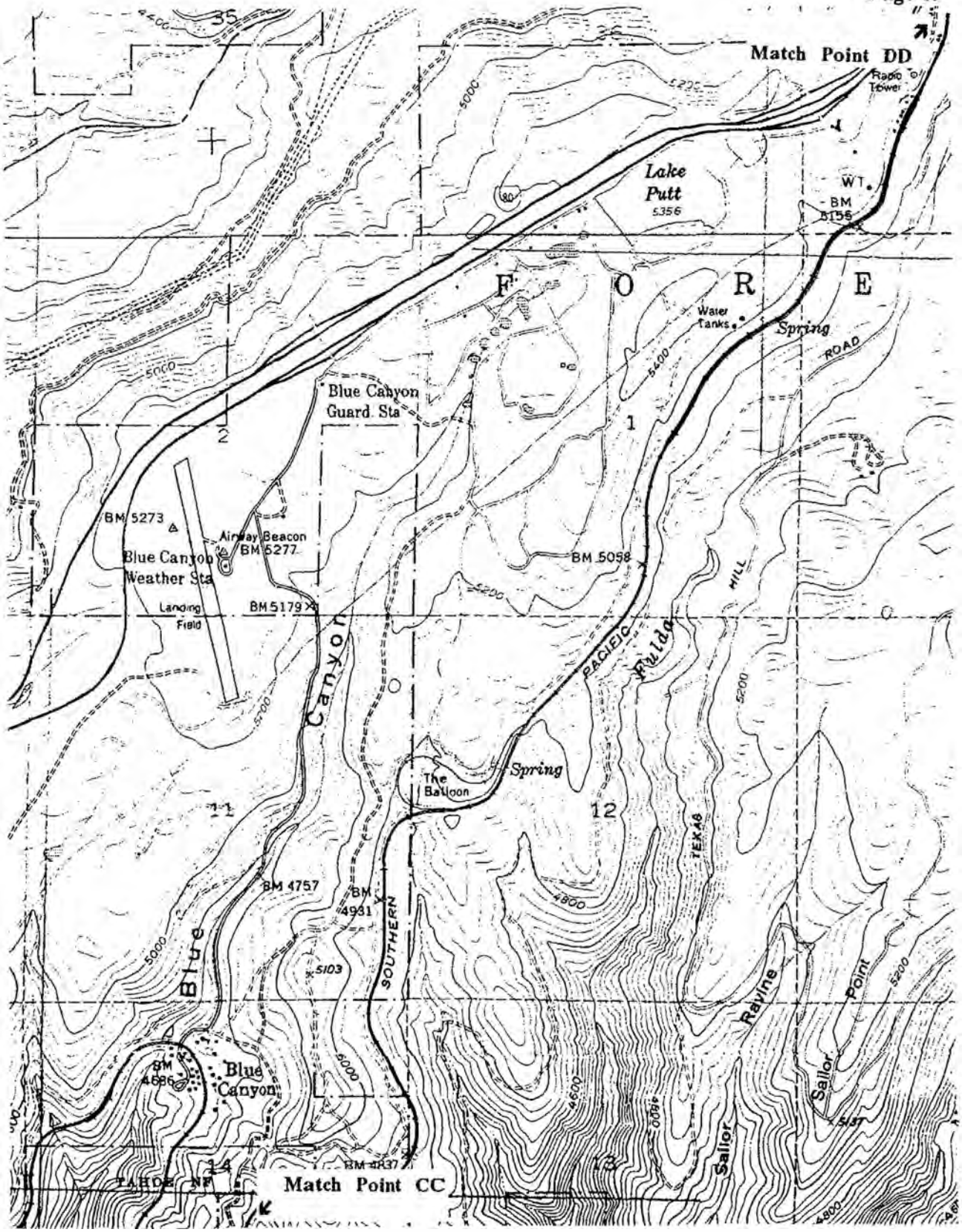

NEVADA CO
PLACER CO
DONNER
BEAR R
Match Point Y
Match Point X
Stampede
Canyon
CANAL
SIPHON
Secret Town
BM 3005
2800
2600
2400
2200
3000

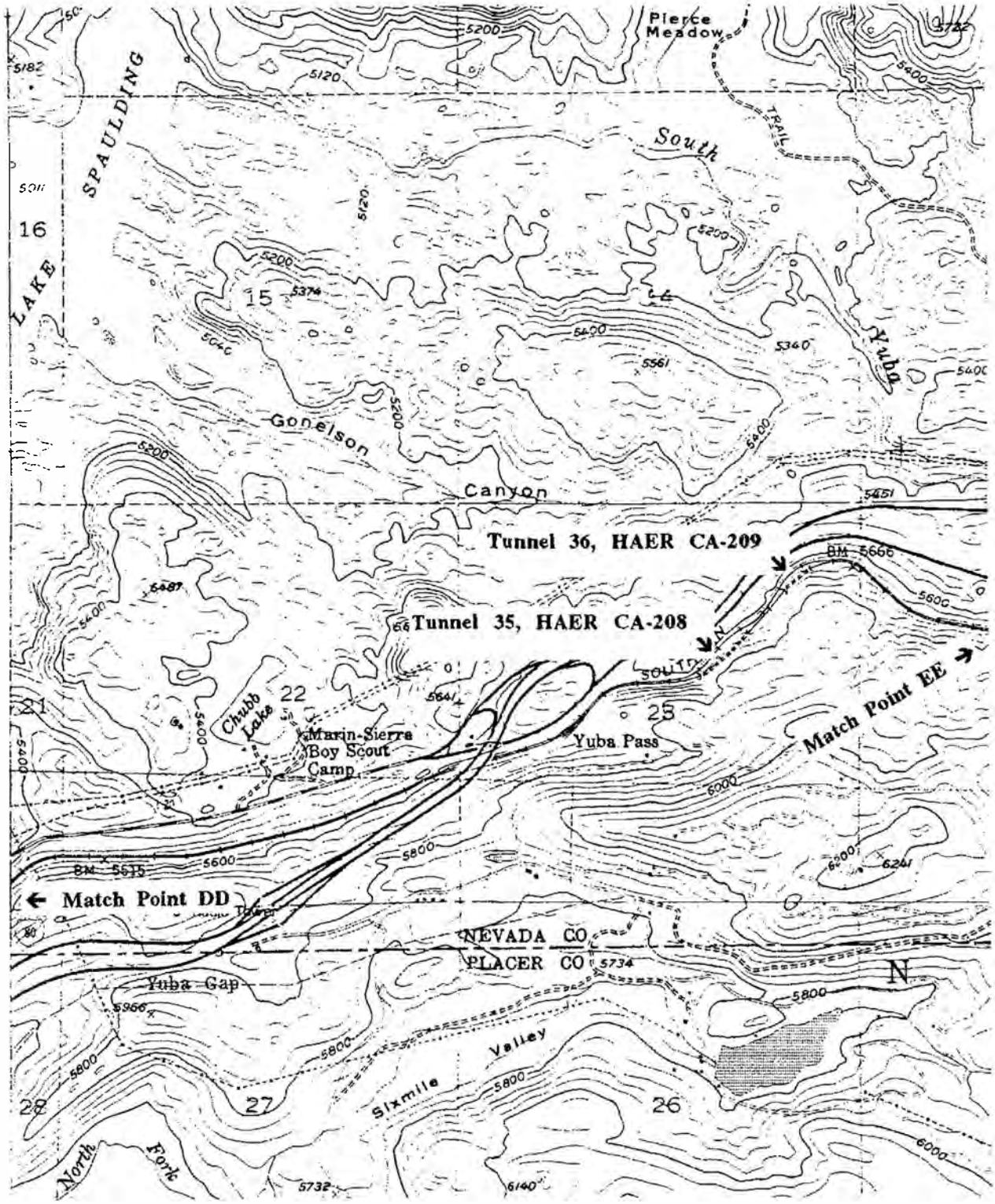

Nichols Diggings
Dutch Flat
Match Point Z
Dutch Flat Canyon
Pug Ugly
Blue Devil Diggings
BM 3401
Dutch Flat Sta
Christmas Hill Diggings
BM 2934
Lowell Hill
BM 3488
NEVADA CO
PLACER CO
Sawtes Canyon
BM 3212
BM 3329
Little York Diggings
Monte
BM 3247
BM 3222
Gold Run
Gold Run Sch
Match Point Y
Cold Spring Hill
BM 3272

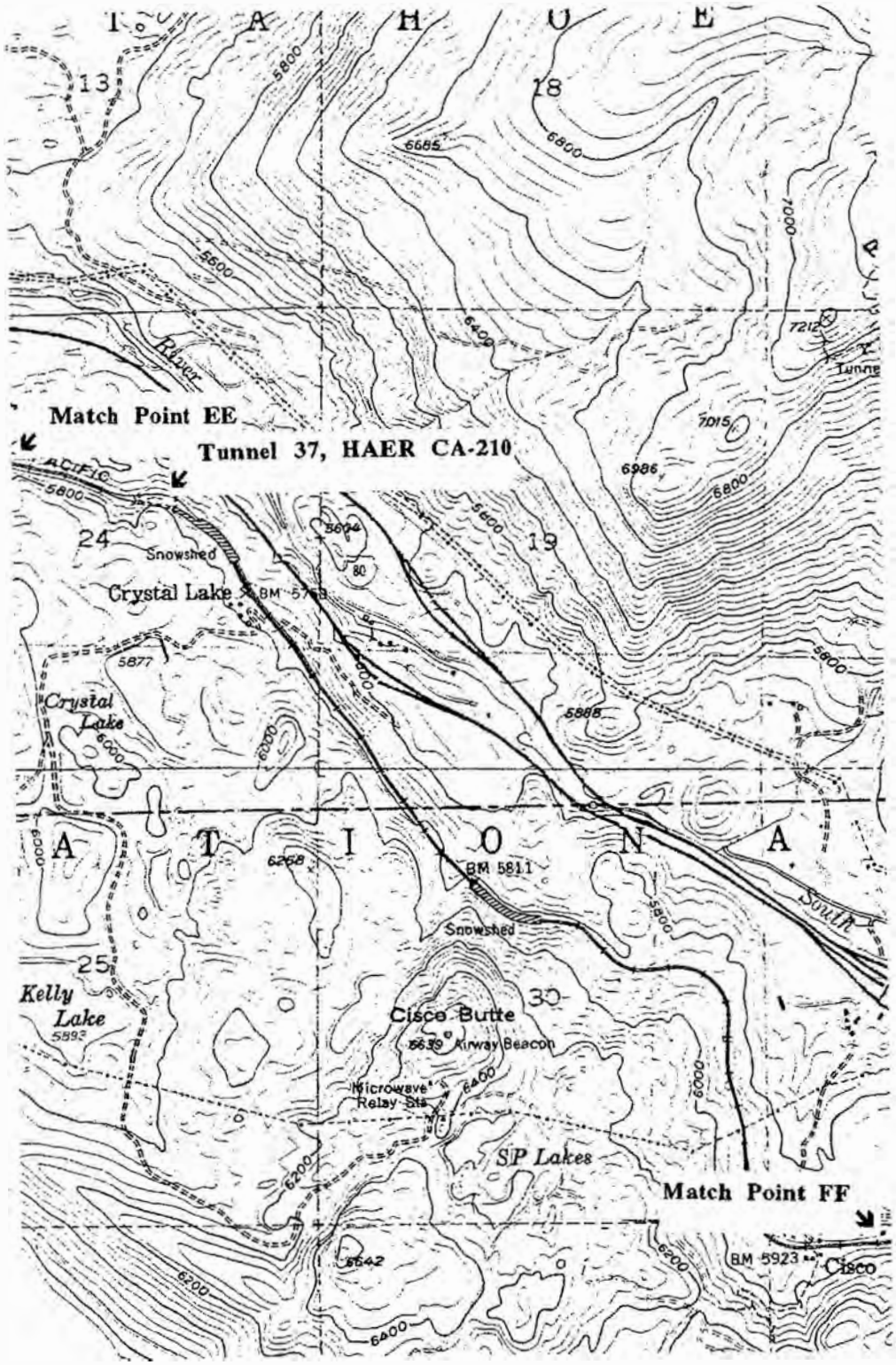

T N F
26
35
36
Penstock
Old Surge Tank
3200
Nary Red Mine
3400
3600
3800
Alta Powerhouse
BROADWAY
Benny
Alta
(BM 3590)
BM 3535
Lake Alta
3529
Match Point Z
Match Point AA
PUMP
MILL
Beacon
Frost Hill
4168
RIDGE
4059
3999
Vista

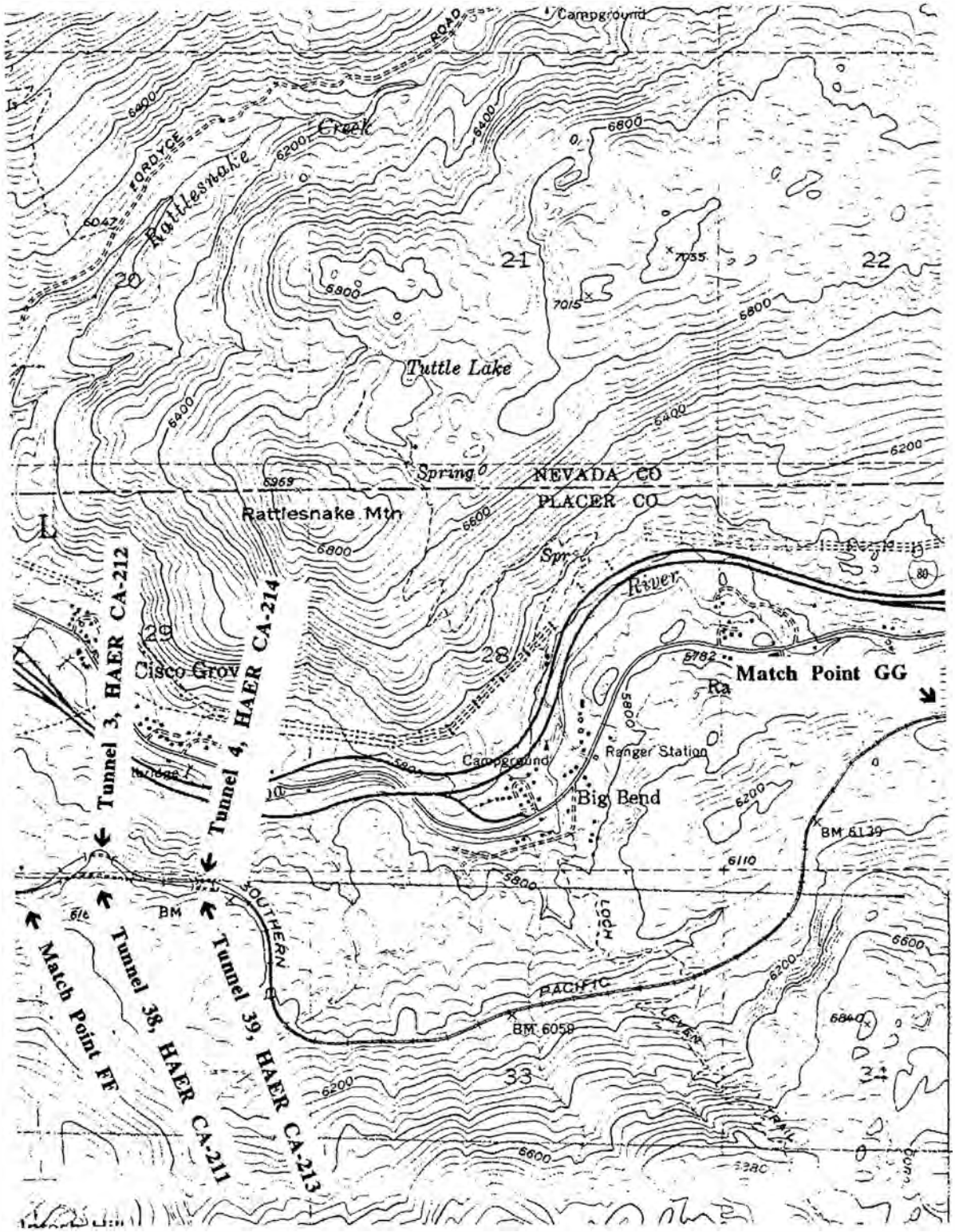

Match Point BB
Match Point AA
Baxter
Canyon
Nook
Penstock
Mides
BM 4168
BM 4068
BM 3722
Casa Loma
BM 3933
BM 3866
SOUTHERN PACIFIC
T N F
Iron Point
Euchre Bar
North Fork
Sawtooth Ridge
30
29
28
32
31
6
5
4
3843
3755
2796

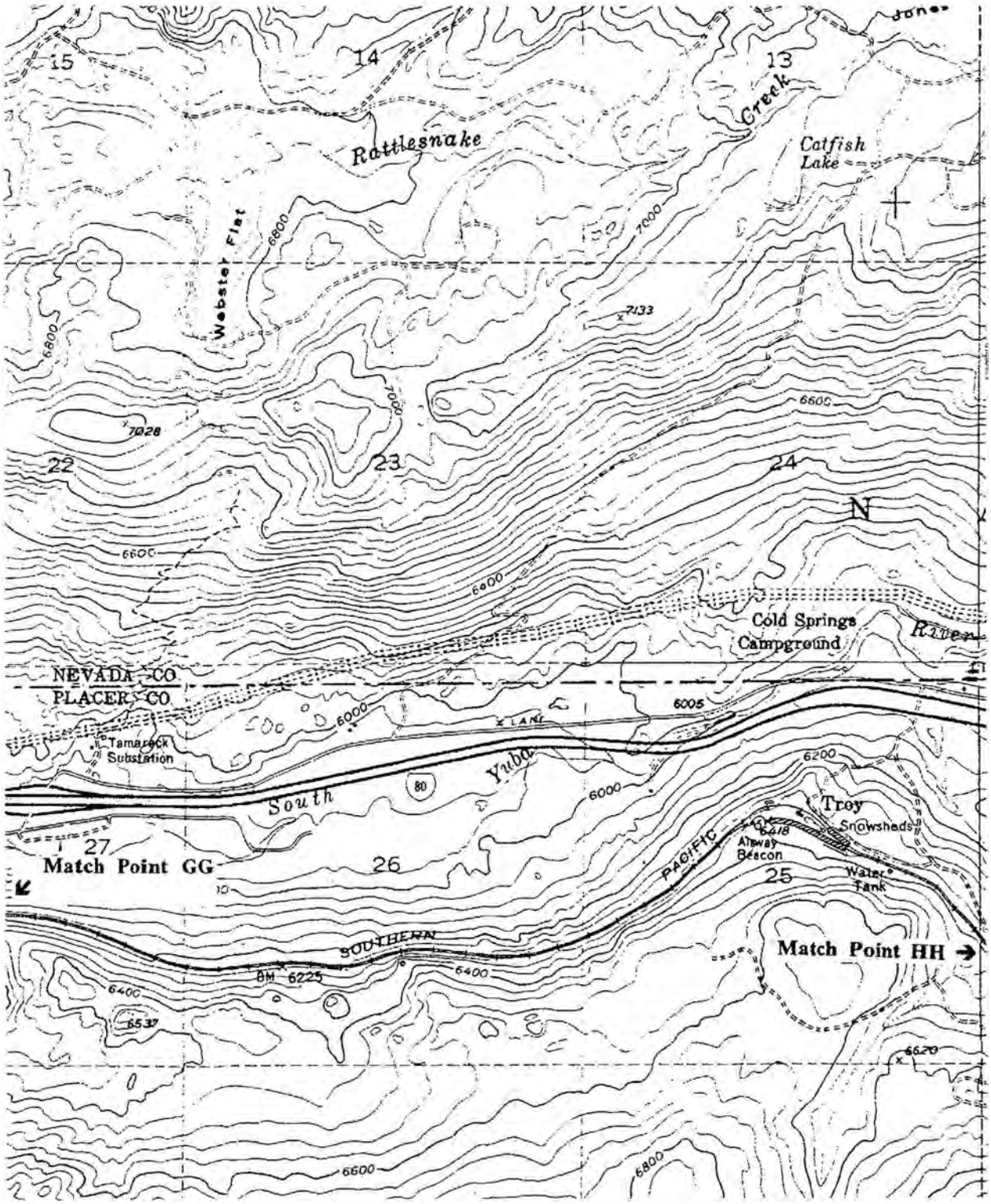

Drum Forebay
Tunnel 1, HAER CA-207
Match Point CC
TAHOE NF
BM 4575
BM 4519
TAHOE N F
PACIFIC
Canyon
Well
Lost Camp
Mine
Forebay
SOUTHERN
BM 4419
TAHOE
NATIONAL
FOREST
BM 4278
Match Point BB
T N F
BOUNDARY
Blue
North
Fork
FOREST
NATIONAL
TAHOE N F
18
21
22
23
27
28
33
34

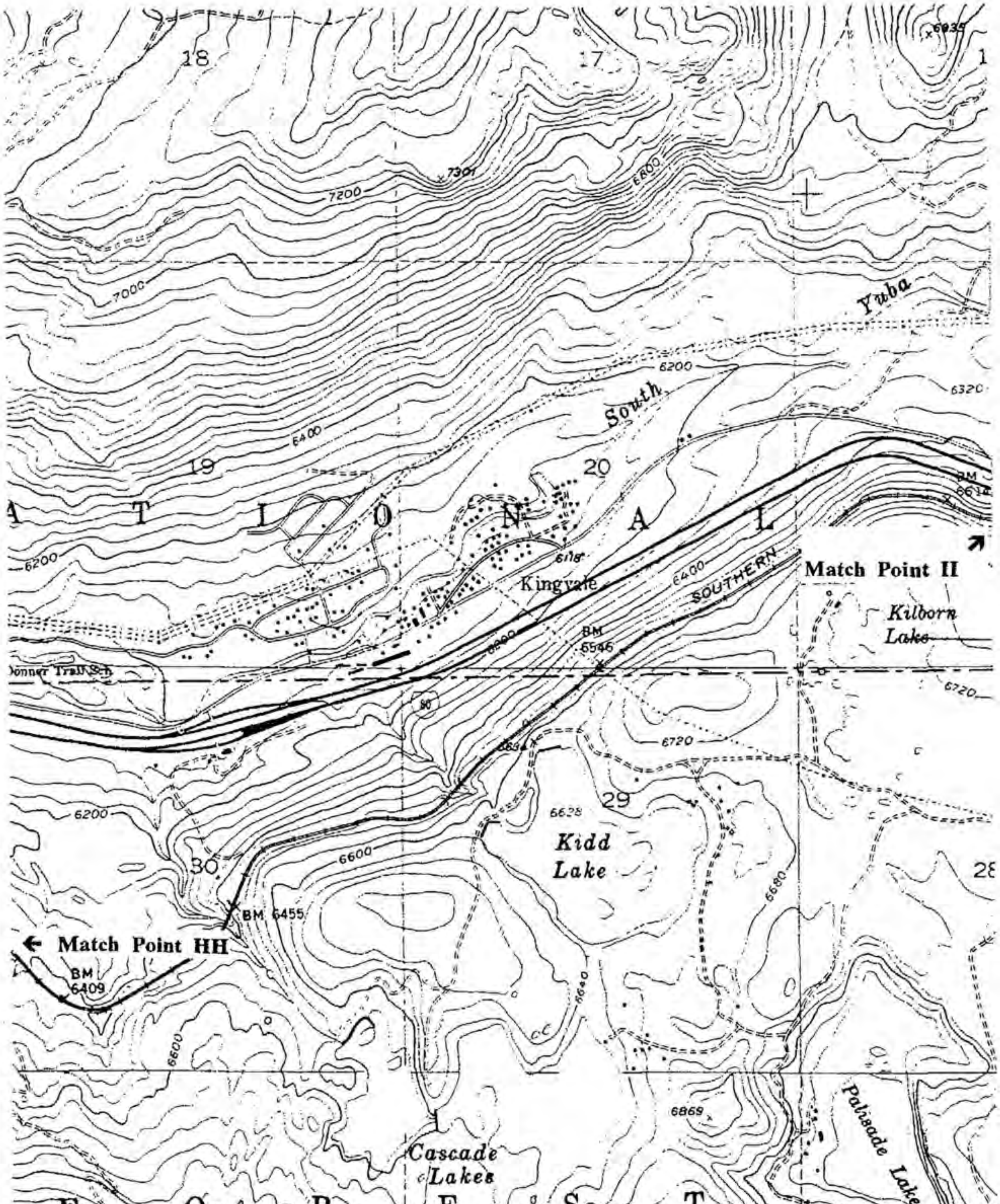

Match Point DD
Radio Tower
Lake Putt
5356
WT.
BM 5156
F O R E
Water Tanks
Spring
ROAD
Blue Canyon Guard Sta
BM 5273
Airway Beacon BM 5277
Blue Canyon Weather Sta
Landing Field
BM 5179
BM 5058
HILL
Canyon
PACIFIC
Fulda
The Balloon
Spring
TEXAS
BM 4757
BM 4931
SOUTHERN
Blue
5103
Ravine
Sailor
Point
BM 4686
Blue Canyon
BM 4837
TAHOE NF
Match Point CC

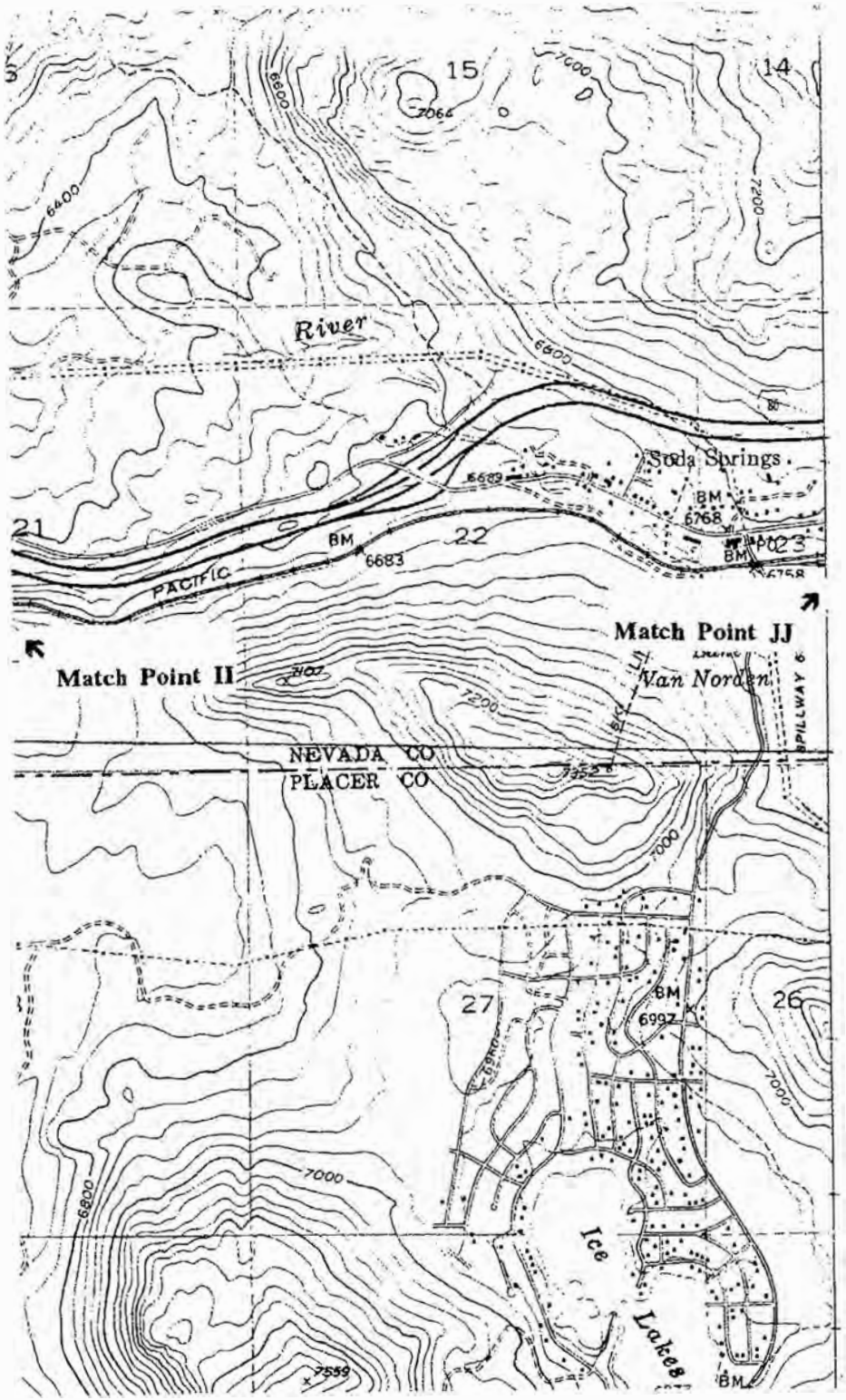

Pierce Meadow
SPAULDING LAKE
South Yuba TRAIL
Gonelson Canyon
Tunnel 36, HAER CA-209
Tunnel 35, HAER CA-208
Chubb Lake
Marin-Sierra Boy Scout Camp
Yuba Pass
Match Point EE
Match Point DD
NEVADA CO
PLACER CO
Yuba Gap
Valley
Slxmile
North Fork
BM 5666
BM 5615
16
15
22
25
27
26
28

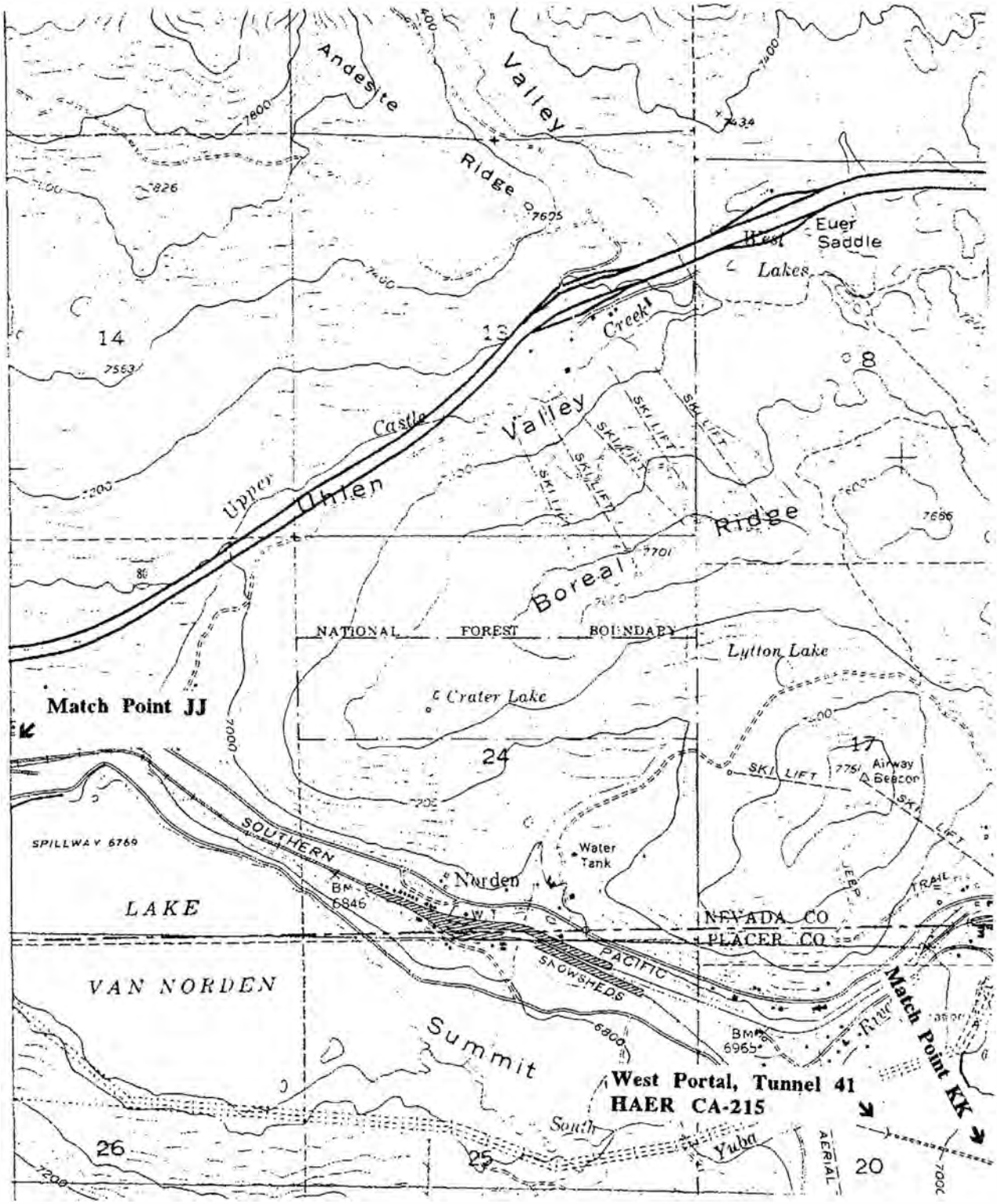

Match Point EE
Tunnel 37, HAER CA-210
Match Point FF
Crystal Lake
Kelly Lake
Cisco Butte
Airway Beacon
Microwave Relay Sta
SP Lakes
Snowshed
Tunnel
BM 5811
BM 5923
Cisco
South
13
18
19
24
25
30

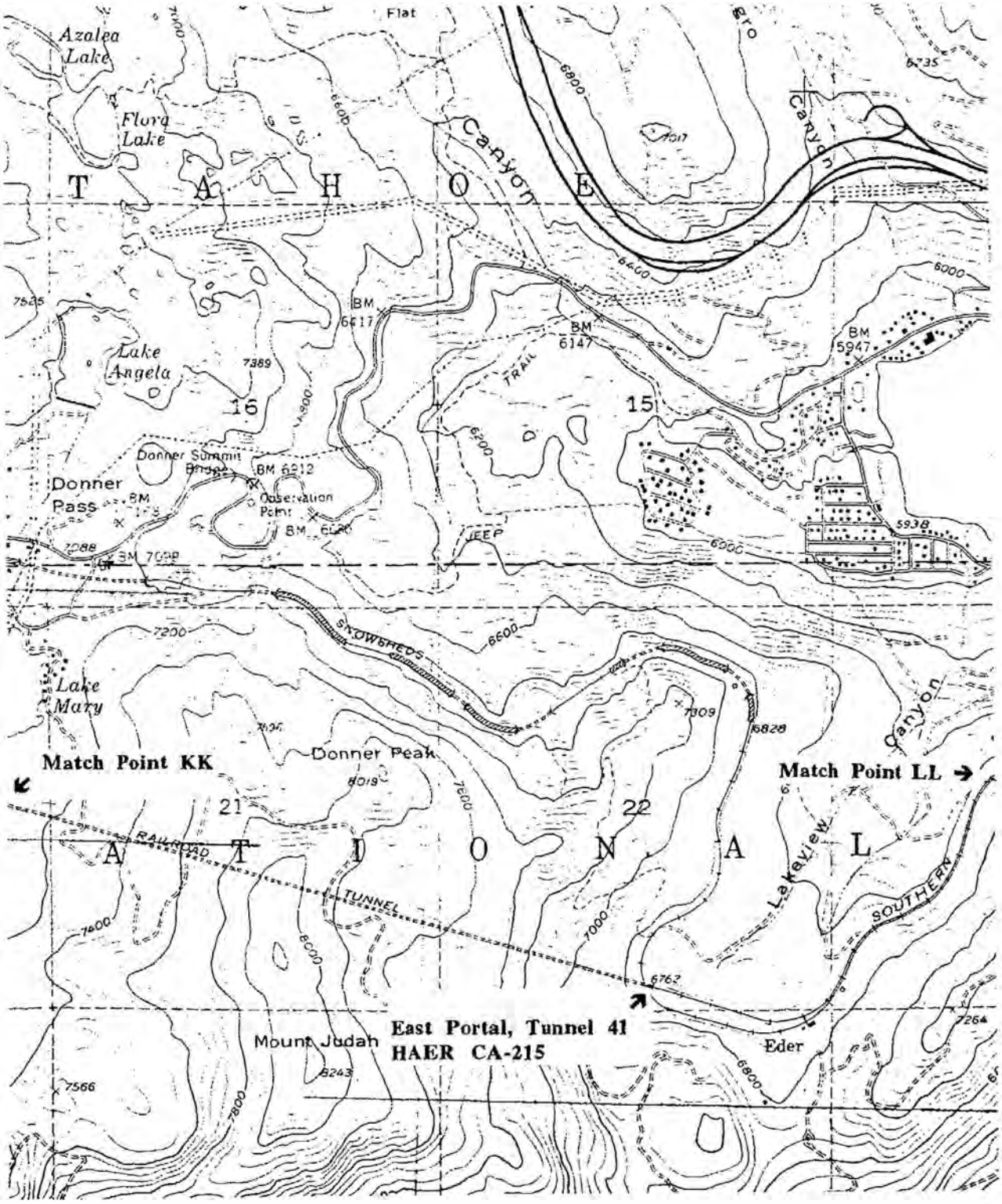

Campground
ROAD
6400
6800
Creek
Rattlesnake
6200
FORDYCE
6047
20
21
22
7035
7015
6800
Tuttle Lake
6400
6200
Spring
NEVADA CO
PLACER CO
6969
Rattlesnake Mtn
6800
Spr
River
80
29
28
Cisco Grov
Tunnel 3, HAER CA-212
Tunnel 4, HAER CA-214
5782
Match Point GG
Ra
5800
Campground
Ranger Station
Big Bend
6200
BM 6139
6110
5800
BM
SOUTHERN
PACIFIC
HIGH
6600
6200
BM 6059
6840
LEVEN
33
34
Match Point FF
Tunnel 38, HAER CA-211
Tunnel 39, HAER CA-213
6200
TRAIL
6600
5280

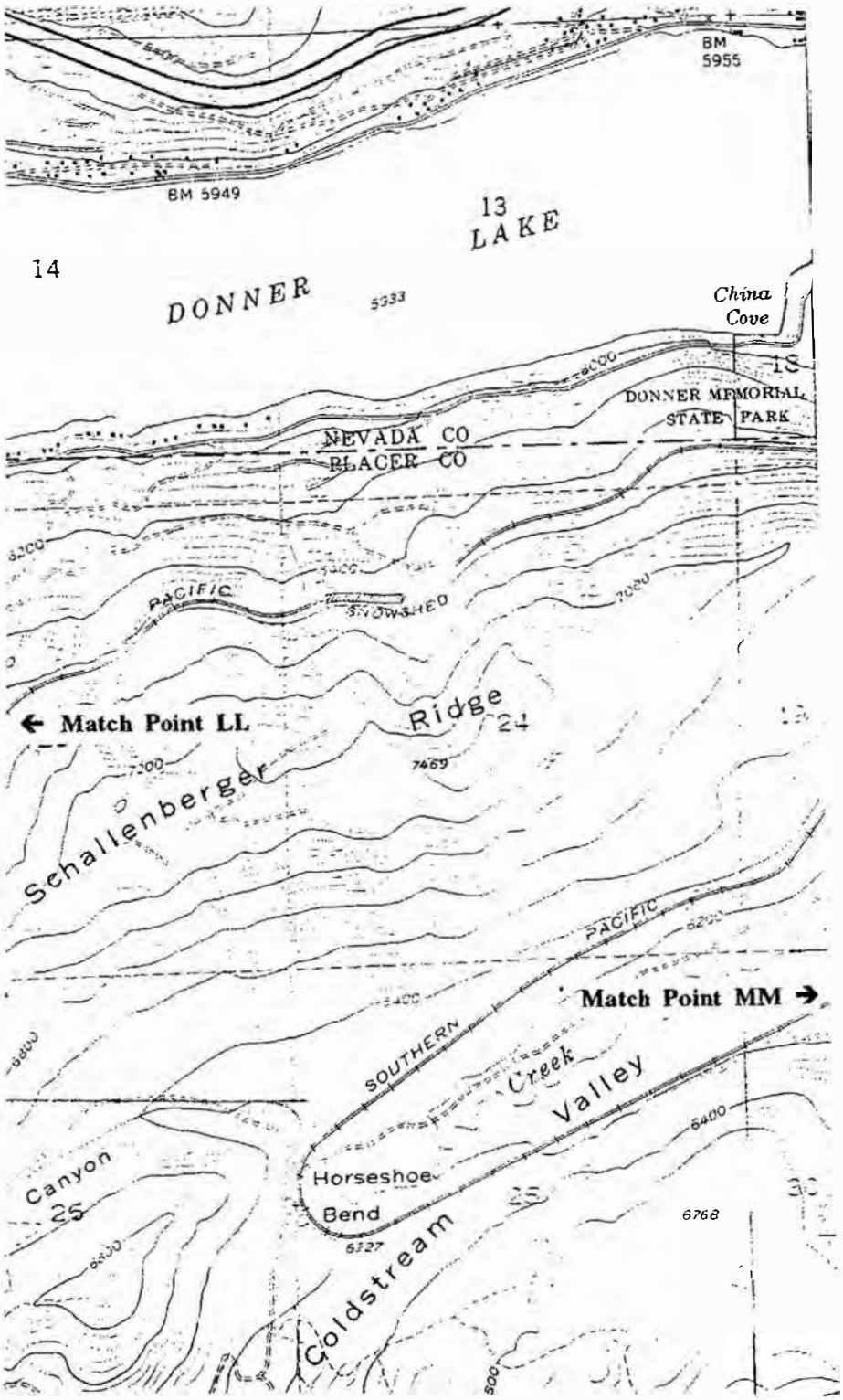

15
14
13
Rattlesnake
Creek
Catfish Lake
Webster Flat
6800
7000
7133
7028
22
23
24
N
6600
6400
Cold Springs Campground
NEVADA CO
PLACER CO
6000
6005
Tamarack Substation
South Yuba
80
6200
Troy
Snowsheds
6418
Airway Beacon
27
Match Point GG
26
25
Water Tank
PACIFIC
SOUTHERN
Match Point HH
BM 6225
6400
6537
6620
6800

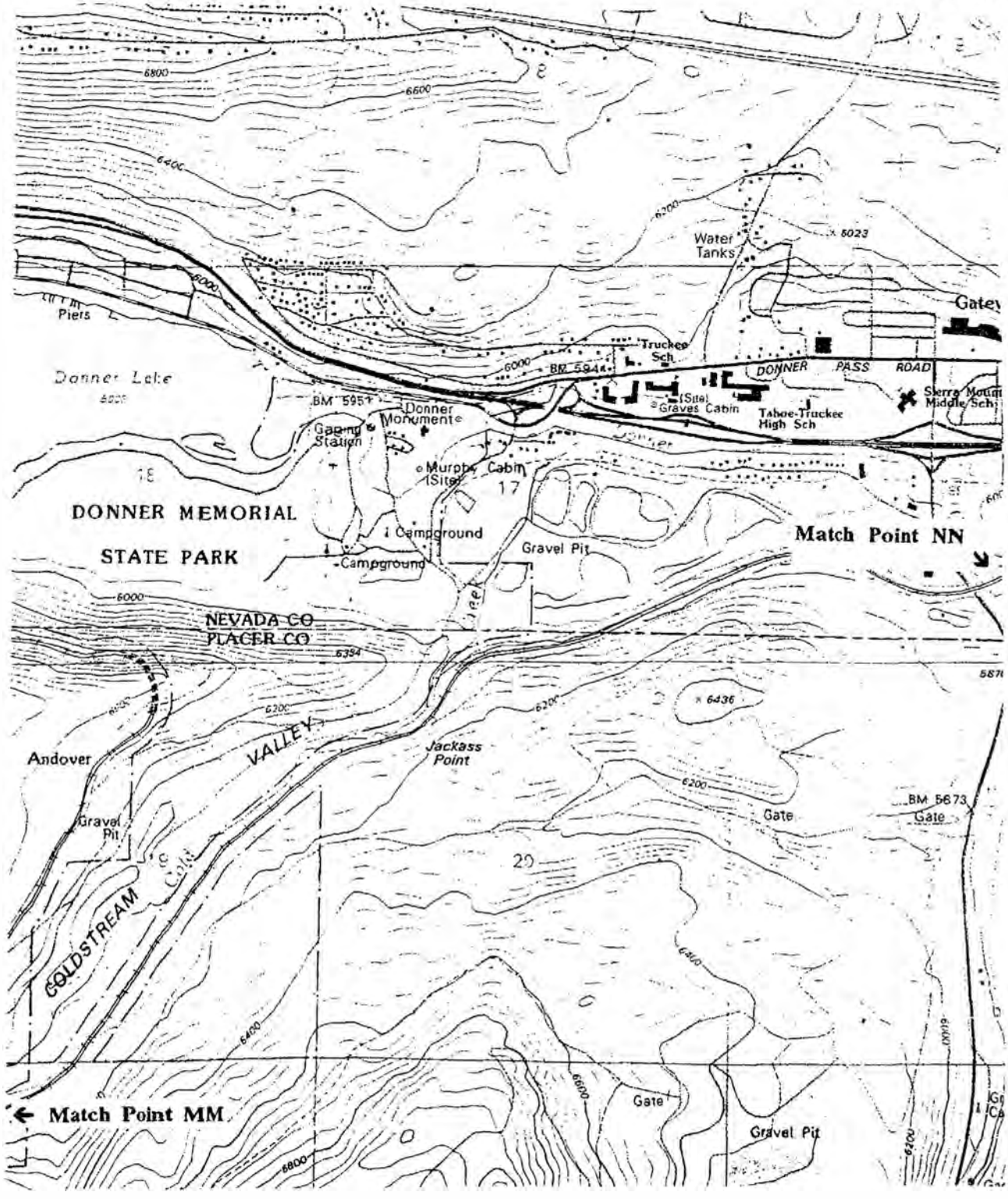

18
17
6935
7301
7200
6800
7000
Yuba
6200
6320
South
6400
19
20
BM
6614
N
A
L
6118
Kingvale
6400
SOUTHERN
Match Point II
Kilborn
Lake
Donner Trail Sch
BM
6546
6720
6720
6200
29
6628
Kidd
Lake
6600
30
6680
28
BM 6455
Match Point HH
BM
6409
6640
6600
6869
Palisade Lake
Cascade
Lakes
F
O
R
E
S
T

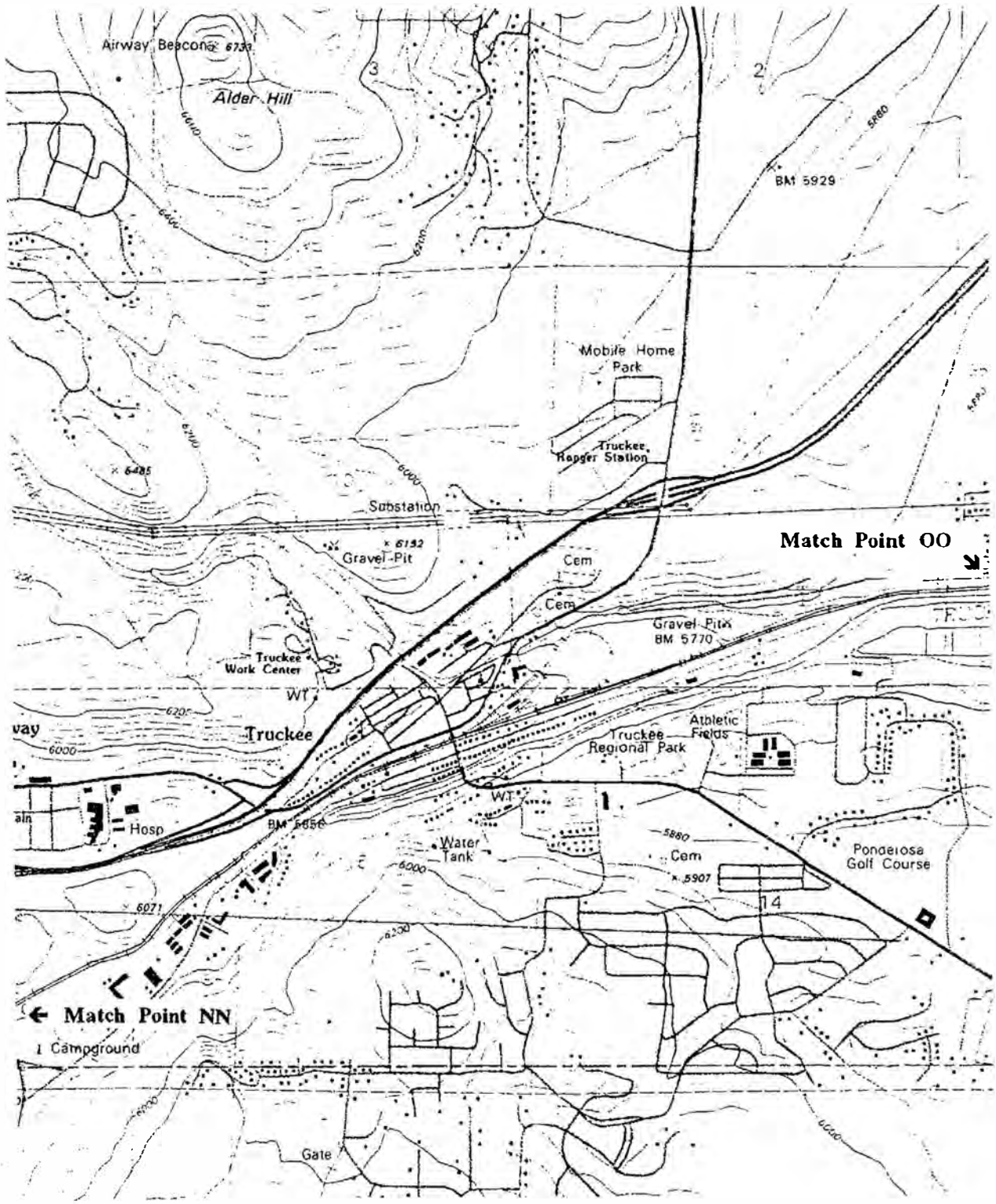

15
14
7000
6600
7066
6400
7200
River
6600
Soda Springs
BM
6768
21
22
BM
6683
PACIFIC
Match Point JJ
Match Point II
Van Norden
7200
NEVADA CO
PLACER CO
7000
27
BM
6997
26
7000
6800
7000
Ice
Lakes
BM
7559

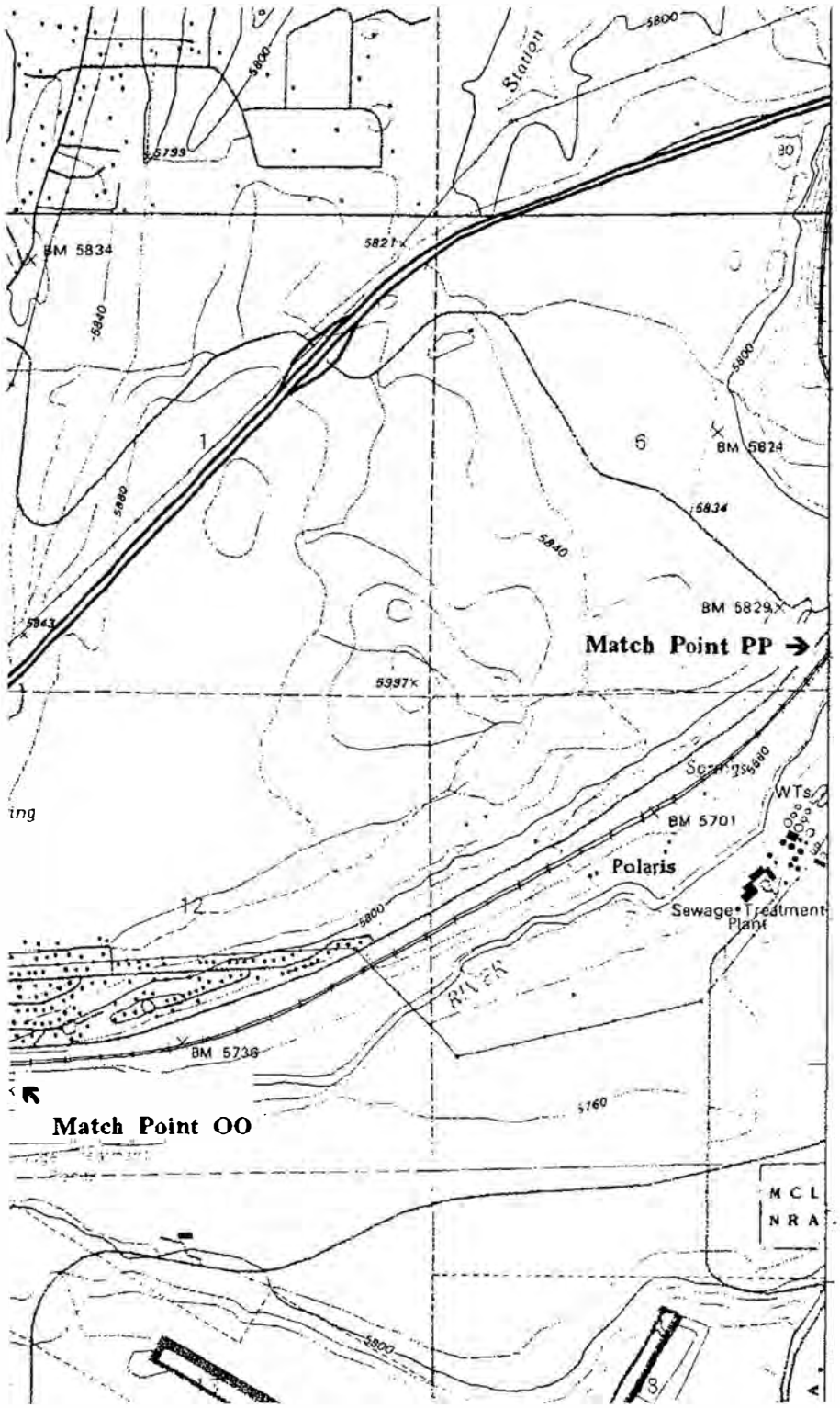

Andesite
Ridge
Valley
Euer Saddle
West Lakes
Creek
Castle Valley
Upper Uhlen
Ridge
Boreal
NATIONAL FOREST BOUNDARY
Lytton Lake
Crater Lake
Match Point JJ
SKI LIFT
Airway Beacon
SPILLWAY 6769
SOUTHERN PACIFIC
Water Tank
Norden
LAKE
BM 6846
NEVADA CO
PLACER CO
SNOWSHEDS
VAN NORDEN
Summit
BM 6965
West Portal, Tunnel 41
HAER CA-215
Match Point KK
South Yuba
AERIAL
14
13
8
24
17
26
25
20

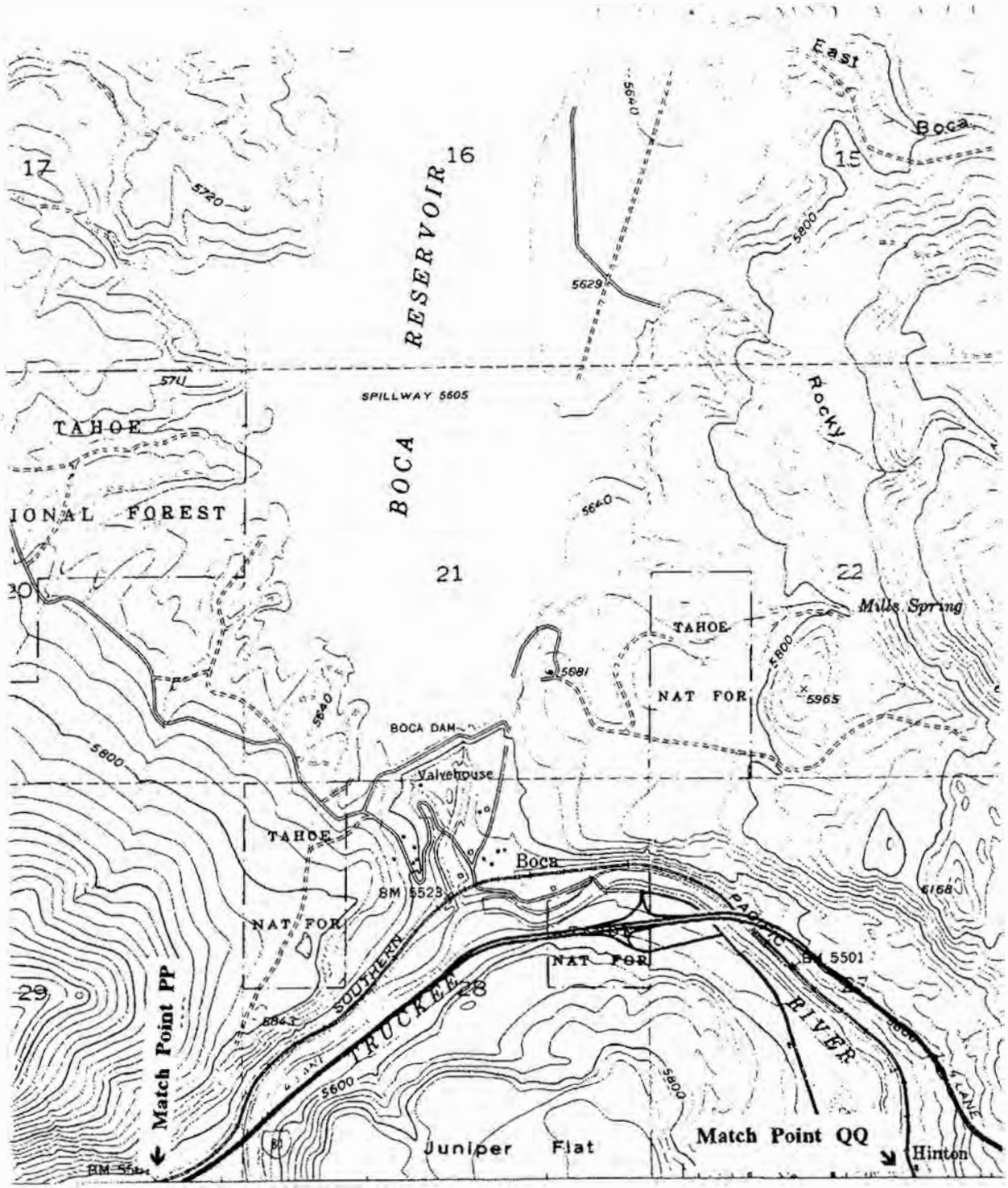

Azalea Lake
Flora Lake
Flat
Canyon
T A H O E
BM 6417
BM 6147
BM 5947
Lake Angela
TRAIL
16
15
Donner Summit
Donner Pass
BM 6812
Observation Point
BM 6180
JEEP
5938
SNOWSHEDS
Lake Mary
Donner Peak
Match Point KK
Match Point LL
21
22
RAILROAD
A T D O N A L
TUNNEL
Lakeview
SOUTHERN
Mount Judah
East Portal, Tunnel 41
HAER CA-215
Eder

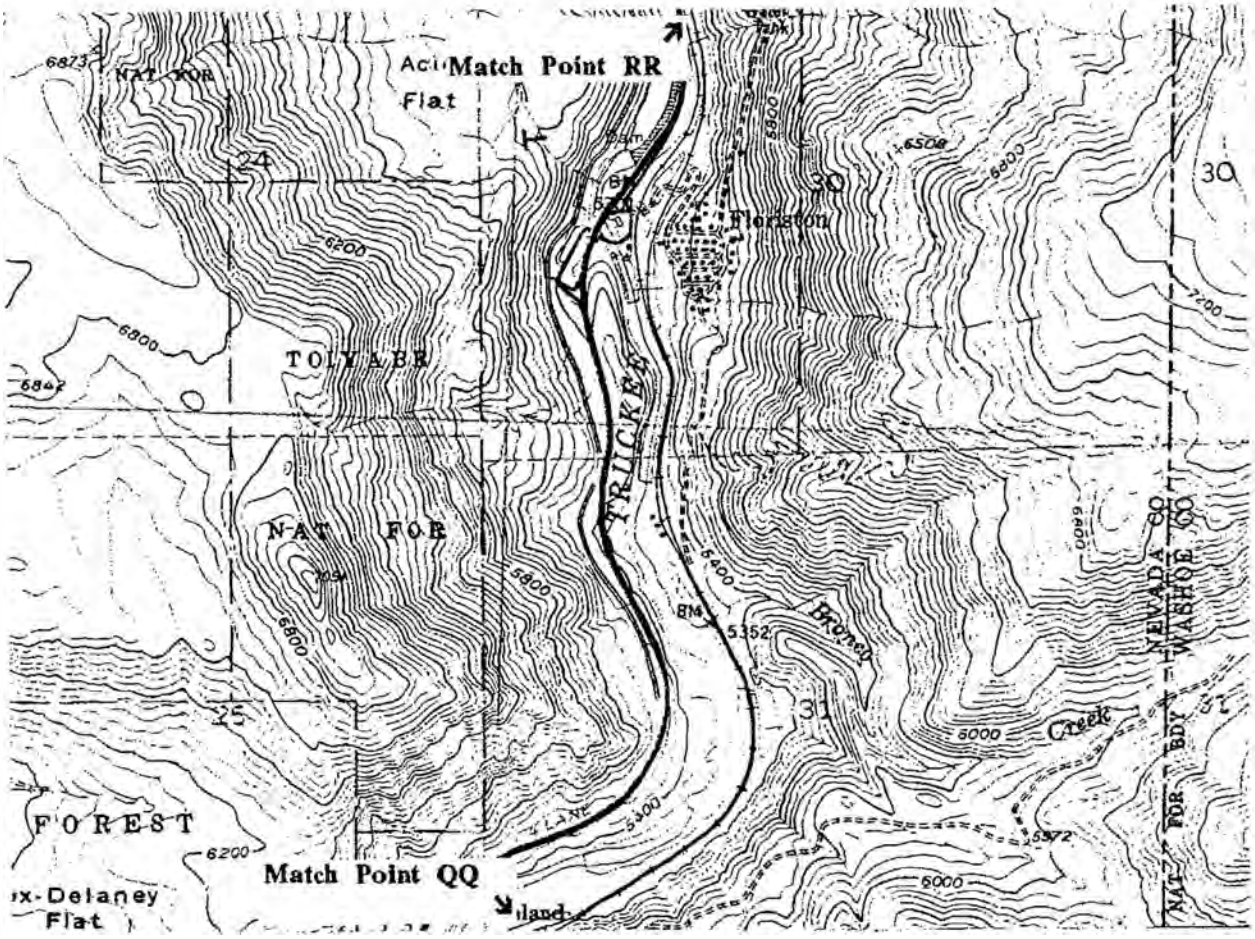

BM 5955
BM 5949
13
LAKE
14
DONNER
5333
China Cove
DONNER MEMORIAL STATE PARK
NEVADA CO
PLACER CO
PACIFIC
SNOWSHED
Match Point LL
Ridge
24
7469
Schallenberger
PACIFIC
Match Point MM
SOUTHERN
Creek
Valley
Canyon
25
Horseshoe
Bend
6327
Goldstream
6768

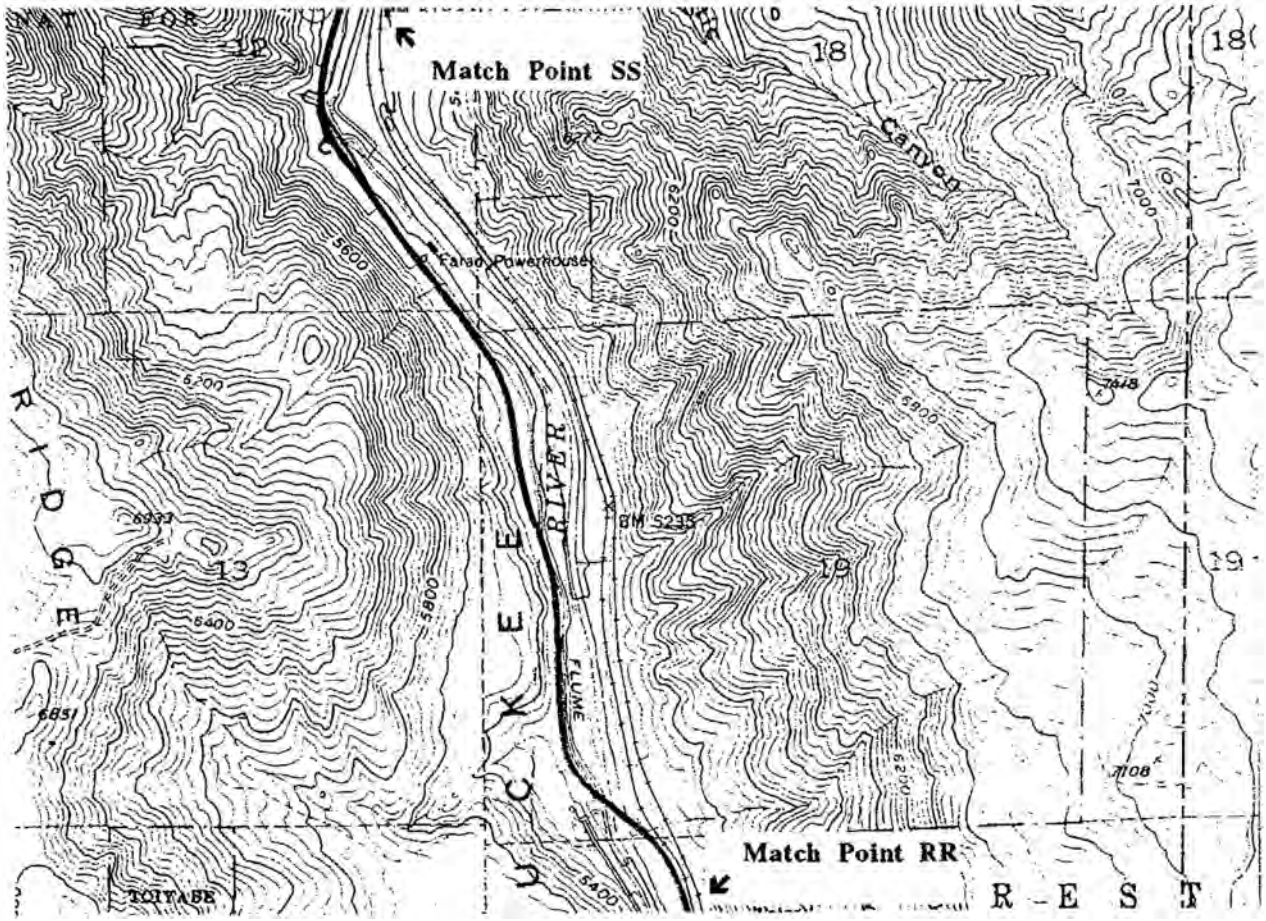

Water Tanks
Piers
Donner Lake
Truckee Sch
DONNER PASS ROAD
BM 5944
BM 5951
Donner Monument
Gaging Station
(Site) Graves Cabin
Taboe-Truckee High Sch
Murphy Cabin (Site)
DONNER MEMORIAL
STATE PARK
Campground
Campground
Gravel Pit
Match Point NN
NEVADA CO
PLACER CO
Andover
VALLEY
Jackass Point
Gravel Pit
COLDSTREAM
Gate
BM 5673
Gate
Gate
Gravel Pit
Match Point MM

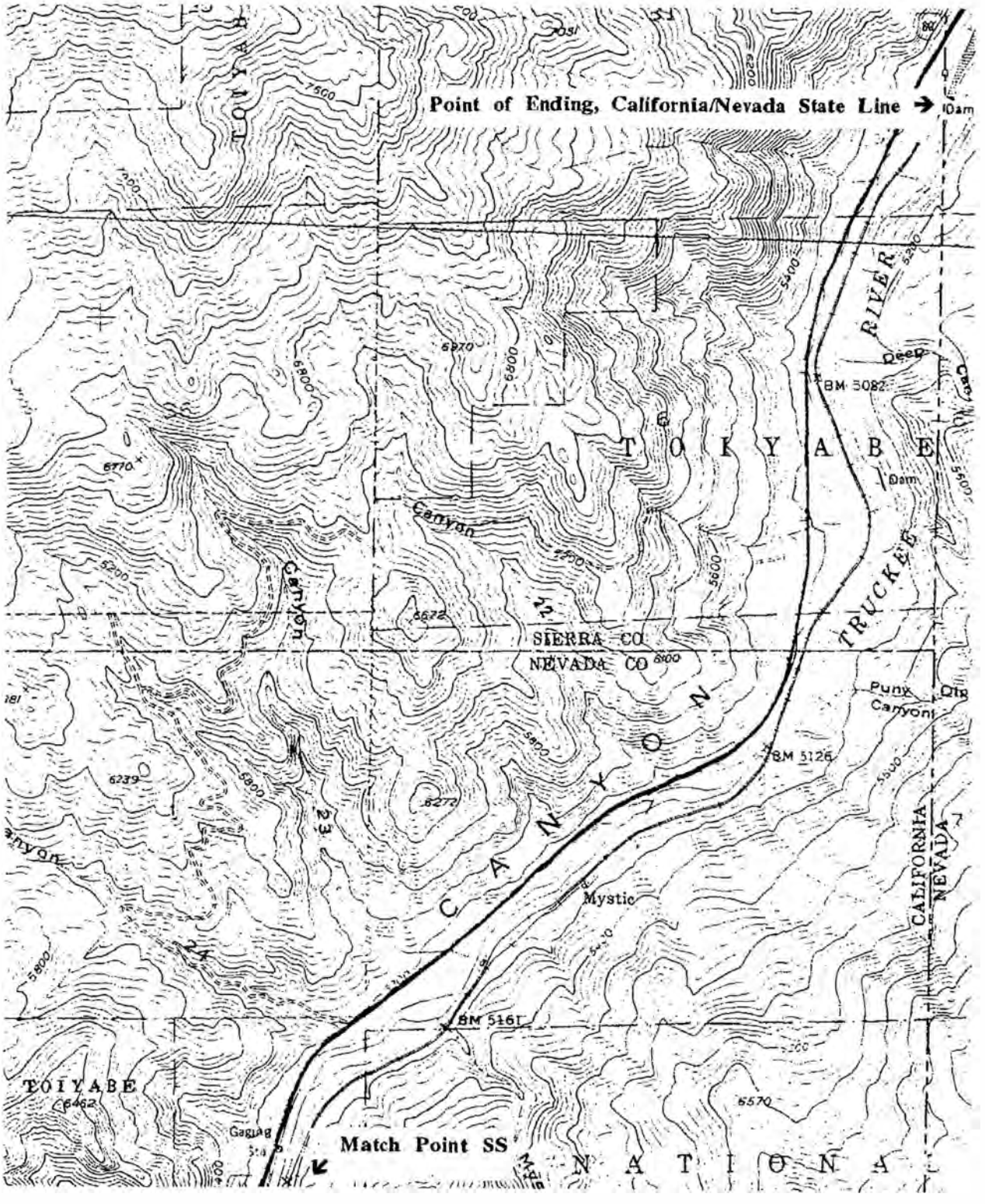

Airway Beacon 6733
Alder Hill
6440
6400
6200
BM 5929
5980
Mobile Home Park
Truckee Ranger Station
6485
6000
Substation
6152
Gravel Pit
Match Point OO
Cem
Cem
Gravel Pits
BM 5770
Truckee Work Center
WT
Truckee
6200
6000
Athletic Fields
Truckee Regional Park
WT
Hosp
BM 5856
Water Tank
6000
5880
Cem
5907
Ponderosa Golf Course
14
6071
6200
Match Point NN
1 Campground
6000
Gate
6000


Station
5800
5799
BM 5834
5821
5840
1
6
BM 5824
5880
5834
5840
BM 5829
5843
Match Point PP
5997
WTs
BM 5701
Polaris
Sewage Treatment Plant
12
5800
RIVER
BM 5736
5760
Match Point OO
M C L
N R A
5800
8


BOCA RESERVOIR
SPILLWAY 5605
East Boca
Rocky
Mills Spring
TAHOE NAT FOR
BOCA DAM
Valvehouse
Boca
BM 5523
SOUTHERN PACIFIC
TRUCKEE RIVER
Juniper Flat
Match Point PP
Match Point QQ
Hinton
16
17
15
21
22
28
29
30
5720
5800
5629
5640
5711
5681
5965
5600
5501


Match Point RR
Flat
NAT FOR
TOLYABR
NAT FOR
FOREST
Match Point QQ
Flat
TRUCKEE
Florsheim
Bronco
Creek
NEVADA CO
WASHOE CO
24
25
30
31
6873
6800
6200
6400
6000
5352
5372
5300


Match Point SS
Canyon
Farad Powerhouse
RIDGE
TRUCKEE RIVER
FLUME
BM 5235
Match Point RR
TOITABE
R - E S T
18
19
13
5600
5800
6400
6000
7000


Point of Ending, California/Nevada State Line
Match Point SS
TOKYABE
SIERRA CO
NEVADA CO
CANYON
RIVER
TRUCKEE
Mystic
BM 5161
BM 5126
BM 5082
CALIFORNIA
NEVADA
NATIONA