

U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

*Descriptions, Photographs and Positions for Global Positioning System (GPS)
Bench Marks in the Vicinity of Lassen Peak, California*

BY

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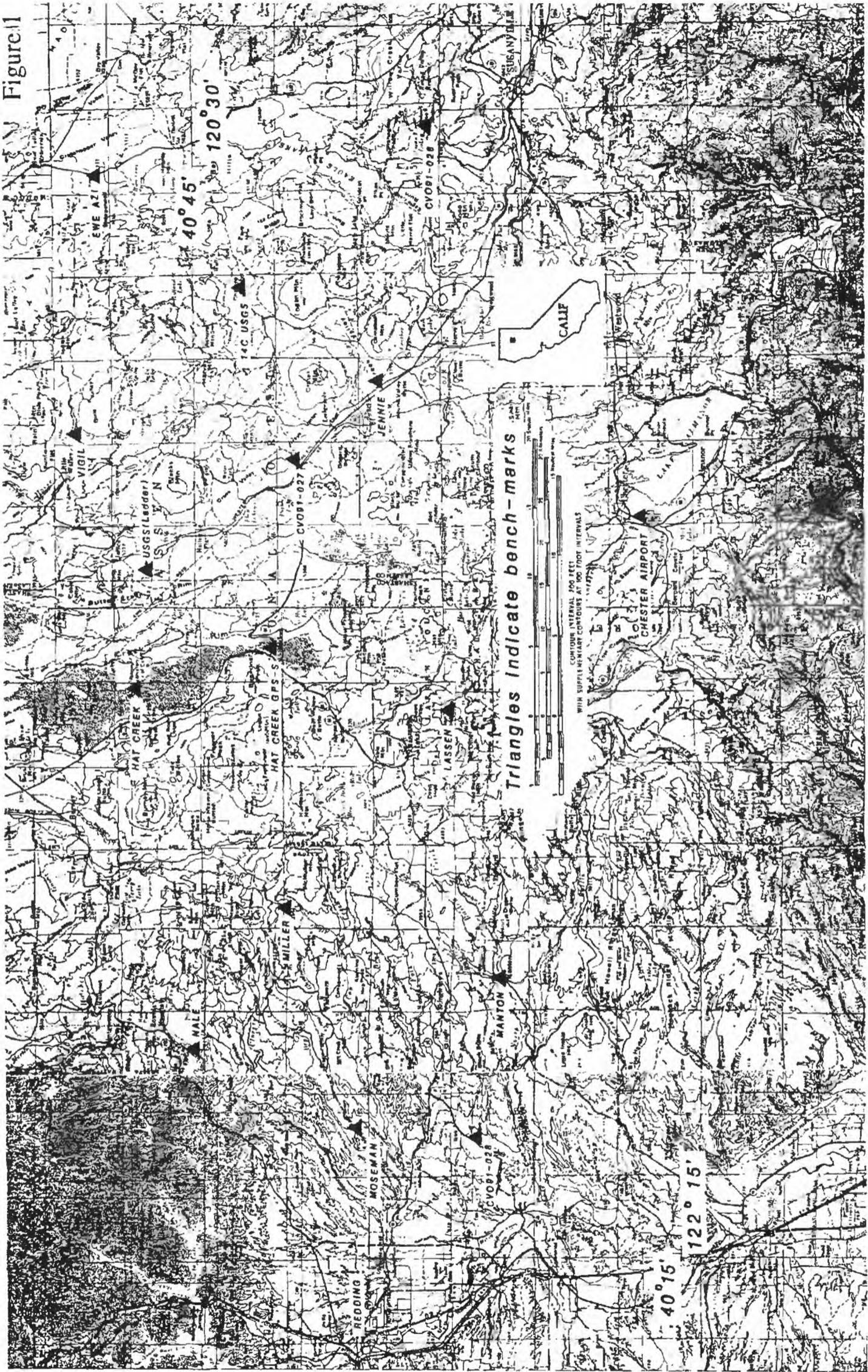
INTRODUCTION

In August 1991 staff from the David A. Johnston Cascades Volcano Observatory (CVO) in Vancouver, Washington, established an approximately 50 km by 100 km GPS network in the Lassen Peak area (figure 1) of Northern California using 12-channel dual-frequency Ashtech® (Ashtech Inc., Sunnyvale, Calif.) LD-XII receivers.

The purpose of the GPS survey, funded by the U.S. Geological Survey's Volcano Hazards and Geothermal Studies Program, was to establish baseline measurements to detect crustal deformation that might be related to tectonic or volcanic processes. By establishing baseline measurements we hope to detect future crustal deformation that might lead to a better understand of the mechanism that creates subduction zone volcanism and tectonism in this portion of northern California and to assess the potential for future eruptions in the Cascade Range of the western United States.

The purpose of this report is to provide a field guide for future researchers who may have a need to re-occupy the listed sites. It contains photographs and descriptions of the bench marks. The network consists of 16 stations (figure 1) located between the towns of Redding, Calif. to the west, Susanville, Calif. to the east, MacArthur, Calif. to the north, and Chester, Calif. to the south. All of the stations were occupied for two consecutive days with each day's session consisting of 6 hours of observation. Station HAT CREEK, a "Very Long Baseline Interferometer" (VLBI) station, was occupied each day, and was used as a fiducial site. The data were initially processed using broadcast orbits and Ashtech's GPS Post Processing System (GPPS) software. We intend to process all the data using geodetic grade software (BERNESE), precise orbits, and tracking data for greater accuracy.

Figure 1



14 C USGS

Proceed 5.3 km (3.3 mi) northwest along highway 36 from the intersection of Highway 139 (Ash Way) and Highway 36 (Main Street) in Susanville Calif., to the intersection with Lassen County Road A1 (Eagle Lake Road). Turn right and continue northwest on County Road A1 for 37.3 km (23.2 mi) to the intersection with Forest Service (FS) road 33N94 on the left with a sign "Champs Flat 7, Prison Springs 2". Turn left and continue northwest along FS road 33N94 for 0.56 km (0.35 mi) to a "Y" intersection with FS road 33N93. Take the right fork towards Champs Flat on FS road 33N93 and continue for 0.2 km (0.1 mi) to a "Y" intersection on the left. Take the sharp left fork and continue for 6.3 km (3.9 mi) to another "Y" intersection at a sign, "Champs Flat 2". Take the left fork, staying on FS road 33N93, and continue for 3.1 km (1.9 mi) to the intersection with Lassen County Road 105. Turn left and continue west on Lassen County Road 105 for 1.6 km (1.0 mi) to an intersection of a fence line on the south side of the road.

The bench mark is cemented in the top of a 0.3 m x 0.6 m (1 x 2 ft) embedded boulder, about 275 m (900 ft) west of a dilapidated barn, 12 m (40 ft) west of a fence line perpendicular to the road, 9 m (30 ft) south of a fence line parallel to the road, 13 m (43 ft) south of the road center, and 0.25 m (8 in) above the ground level (see figure 2a, 2b).

The bench mark is a U. S. Geological Survey brass tablet stamped "14 C 1933 5500".

Note: The driving time from Susanville, Calif., is about 1 hour.

Figure 2a



14C USGS

View looking southeast

Figure 2b



14C USGS

View looking southwest

CHESTER AIRPORT

24 hours prior to visiting this site, call John Coffelt the Airport manager at (916) 258-3616.

The Airport is located at the west of Chester, Calif. Leave Highway 36, turn south on the main road into Chester Airport and proceed south along the airport access road for about 0.5 km (0.3 mi) to the farthest hanger and a pair of gas pumps. Stop at the hanger and inform the Airport manager of your purpose. Proceed westerly along the front of the hanger toward the red revolving light beacon in the middle of an open field.

The bench mark is cemented in the top of a concrete post at ground level, about 76 m (250 ft) east-southeast of the paved runway, and about 30 m (100 ft) west-northwest of the red beacon light (see figure 3a, 3b).

The bench mark is a U. S. Coast and Geodetic brass tablet stamped "Chester Airport 1948".

Note: The driving time from Chester, Calif., is 5 minutes.

Figure 3a



Chester Airport

View looking southwest

Figure 3b



Chester Airport

View looking southwest

CVO91-026

Call Dan Paulson at the California Department of Forestry (CDF) at (916) 257-3778 to make arrangements for the gate key to the lookout tower. The CDF is located at 697-395 highway 36, about 1.6 km (1.0 mi) northwest of the town of Susanville, Calif.

Proceed 5.3 km (3.3 mi) northwest along Highway 36 from the intersection of Highway 139 (Ash Way) and Highway 36 (Main street), in Susanville Calif., to Lassen County Road A1 (Eagle Lake Road). Turn right and continue northwest along Lassen County Road A1 for 12.9 km (8.0 mi) to a large paved turnout with several dirt roads leaving it. Take the one farthest to the left (which parallels the A1 road) for 0.3 km (0.2 mi) until an intersection is reached after 1.6 km (1.0 mi). Turn right and continue along this road for 0.8 km (0.5 mi) to an intersection on the left. Make a hard left and continue along this road for 1.4 km (0.9 mi), passing Coleman Lake. Continue another 0.2 km (0.1 mi) to a "Y" intersection, take the right fork and continue for 2.1 km (1.3 mi) to another "Y" intersection. Take the left fork and continue for 0.8 km (0.5 mi) to the Forest Service lookout tower on Logan Mountain (no photographs were taken of this station).

The bench mark is cemented in the top of a 1.8 x 2.1 m (6 x 7 ft) boulder, 0.9 m (3 ft) above the road level, 2.5 m (8 ft) above the ground level, about 30 m (100 ft) southeast of the southeast corner of the Lookout tower, 10.7 m (35 ft) southeast of the southeast corner of a garage, 6 m (18 ft) east of the road center, and 0.6 m (2 ft) northeast of a sign, "Artisans Crossing".

The bench mark is a U. S. Geological Survey brass tablet stamped "CVO91-026".

Note: The driving time from Susanville, Calif., is about 1 hour.

CVO91-027

If approaching the station from the south, go 9.8 km (6.1 mi) northwest along Highway 36 from the intersection of Highway 139 (Ash Way) and Highway 36 (Main Street) in Susanville Calif., to the intersection with highway 44. Turn right and continue northwest along Highway 44 for 45.9 km (28.5 mi) to the sign, "Pittville 33 mi, 53 km" and a dirt road to the right*. Turn right onto the dirt road (later the dirt road is signed, "Lassen County Road 111"), and continue north along County Road 111 for 0.3 km (0.2 mi) to a junction with a sign, "Harvey Valley 7, Champs Flat 14, Harvey MTN LO 17". Turn right and head east along FS road 33N11 for 0.6 km (0.4 mi) to a "Y" intersection. Take the right fork on FS road 32N83Y and continue east for 0.2 km (0.1 mi).

The bench mark is cemented in the top of a 0.9 x 1.2 m (3 x 4) embedded boulder about 150 m (500 ft) south of the road, and in the middle of a cluster of three larger boulder (see figure 4a, 4b).

The bench mark is a U. S. Geological Survey brass tablet stamped "CVO91-027".

If approaching this station from the north, from the intersection of highway 89 and highway 44, just northeast of Old Station, Calif., proceed south on highway 44 for 28.1 km (17.5 mi) to an intersection on the left. Leave highway 44 and turn left onto the dirt road (Lassen County Road 111).

*Follow description as previously described.

Note: The driving time from Susanville or Chester, Calif., is about 45 minutes.

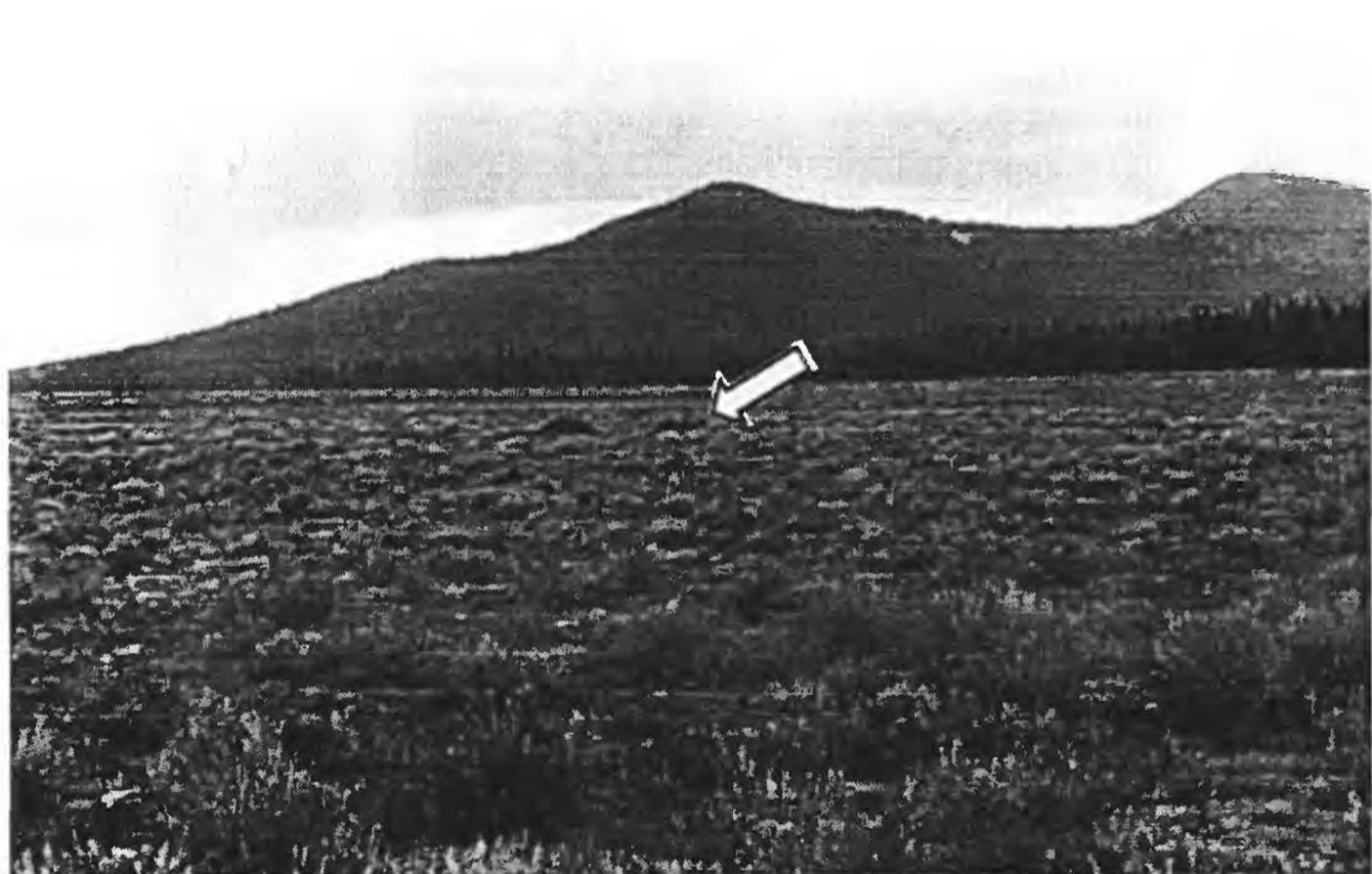
Figure 4a



CVO91-027

View looking southeast

Figure 4b



CVO92-027

View looking south

CVO91-028

Proceed 0.8 km (0.5 mi) west along highway 36 from the intersection of Paynes Creek Ln. and Highway 36, from the town of Paynes Creek, to the intersection with Lanes Valley Ln. to the north. Turn left and continue north along Lanes Valley Ln. for 11.1 km (6.9 mi) to the intersection with Tehema County Road A6 (also called Manton road). Turn right on Tehema County Road A6 and continue northeast for 1.0 km (0.6 mi) to the intersection with Wildcat Rd. on the left with a sign, "Dahhara Springs Fish Hatchery". Turn left and continue north on Wildcat Rd. for 8.9 km (5.55 mi) to a "Y" intersection with a sign, "Balls Ferry 12". Continue west along the left fork for 7.7 km (4.8 mi) passing a weather beaten barn. There is a mobile home about 91 m (300 ft) south of the bench mark.

The bench mark is cemented flush with the ground in a small outcrop of bedrock, about 91 m (300 ft) southeast of a "30 MPH road curve" sign, about 15 m (50 ft) south of the centerline of the road, 15.5 m (25 ft) north of a fence, and 0.9 m (3 ft) west of a witness post (see figure 5a, 5b).

The bench mark is a U. S. Geological Survey brass tablet stamped "CVO91-028".

Note: The driving time from Redding, Calif., is about 1 hour.

Figure 5a



CVO91-028

View looking southeast

Figure 5b



CVO91-028

View looking south

EWE AZI

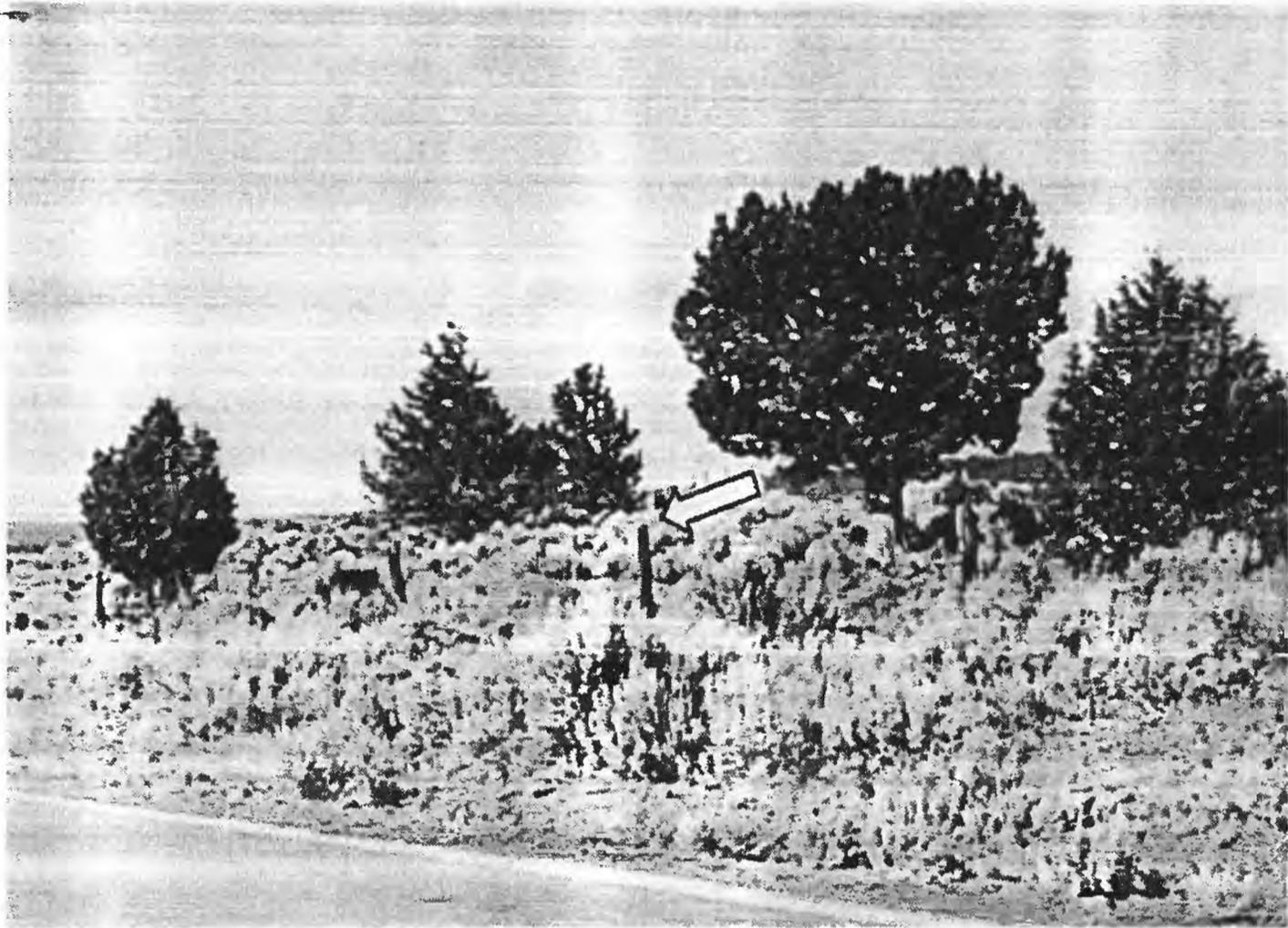
Proceed 54.3 km (33.75 mi) northeast along Highway 139 from the intersection of Highway 36 (Main street), and Highway 139 (Ash Way) in Susanville, Calif. to the California Department of Forestry, Grasshopper Fire Station. Continue another 10.2 km (6.35 mi) to a ridge on the west side of highway 139.

The bench mark is cemented in the top of a 0.6 x 0.6 m (2 x 2 ft) embedded boulder, about 61 m (200 ft) south of a track road with a gate, 40 m (132 ft) west of the centerline of the highway, about 18 m (60 ft) north of a fence line, 0.6 m (2 ft) east of a metal post with a 0.3 x 0.5 m (1 x 1.5 ft) orange metal California Division of Highways witness post, and 2.4 m (8 ft) above the road level (see figure 6a, 6b).

The bench mark is a California Division of highways brass tablet stamped "USC&GS EWE AZI MK."

Note: The driving time from Susanville, Calif., is about 45 minutes.

Figure 6a



EWE AZI

View looking west

Figure 6b



EWE AZI

View looking west-northwest

HALE

Barbara Hale, the property owner, lives across the street from the station. Contact Ms. Hale by calling (916) 472-3595 or (916) 337-6299) before occupying this station.

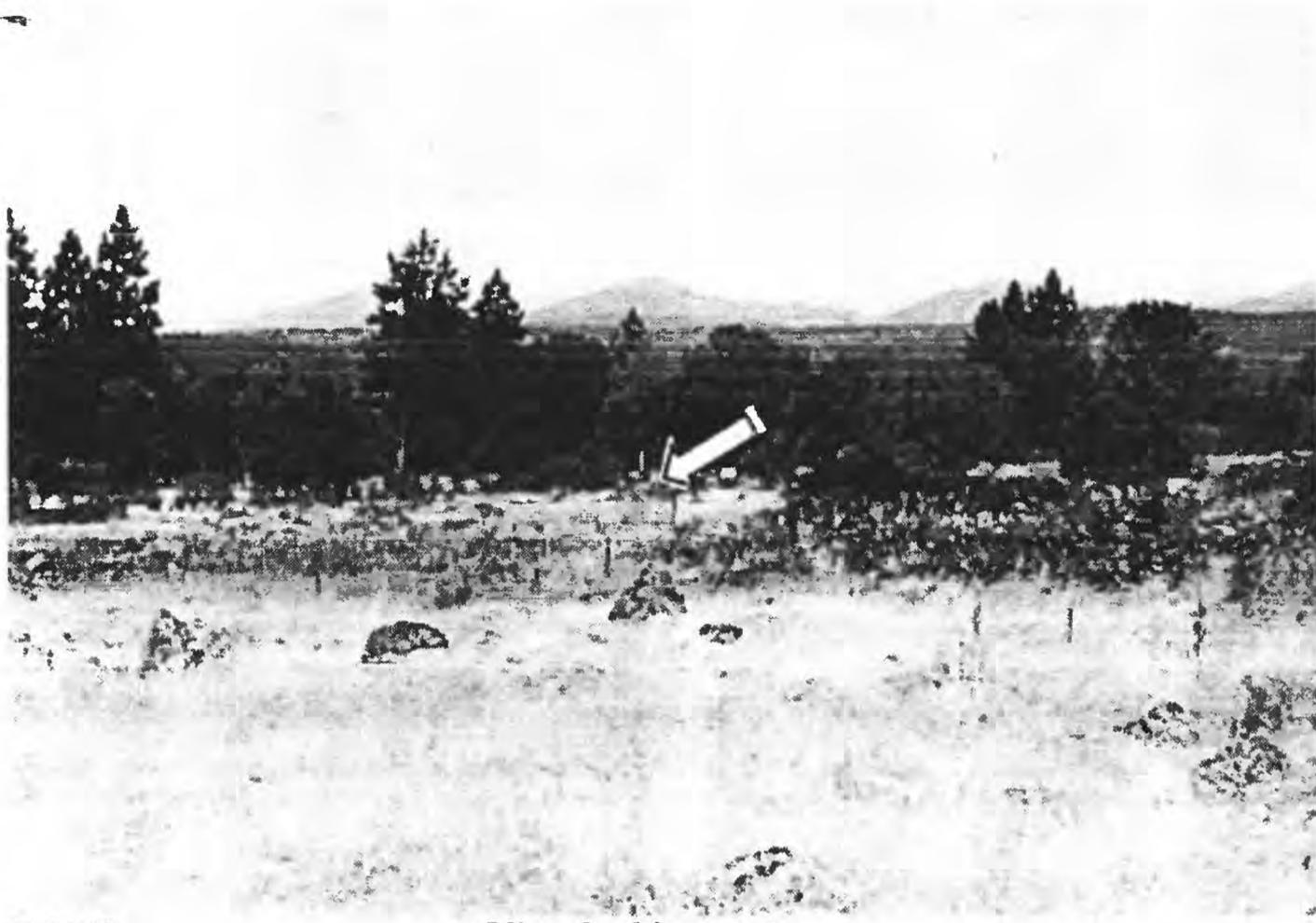
Proceed 5.8 km (3.6 mi) west along Highway 299 from the east end of the bridge over Montgomery Creek, 1.3 km (0.8 mi) west of the General Store in Round Mountain, Calif., to a "T" intersection on the left and a sign, "Buzzard Roost Rd". Turn left and continue southwest along Buzzard Rooster Rd. for 3.9 km (2.4 mi) to a house on the left side of the road with a sign, "Hale", and an address "16259".

The bench mark is in a pasture across from the Hale residence, cemented on top of a 0.9 x 0.9 m (3 x 3 ft) embedded boulder about 75 m (250 ft) southwest of the paved road, about 7.7 m (25 ft) northwest of a Seep, 6 m (20 ft) south of a young 3 m (10 ft) tall oak tree, 1.1 m (3.5 ft) south of a witness post, and 0.2 m (0.6 ft) above the ground level (see figure 7a, 7b).

The bench mark is a U. S. Geological Survey brass tablet stamped "HALE".

Note: The driving time from Burney, Calif., is about 30 minutes.

Figure 7a



HALE

View looking west

Figure 7b



HALE

View looking west

HAT CREEK

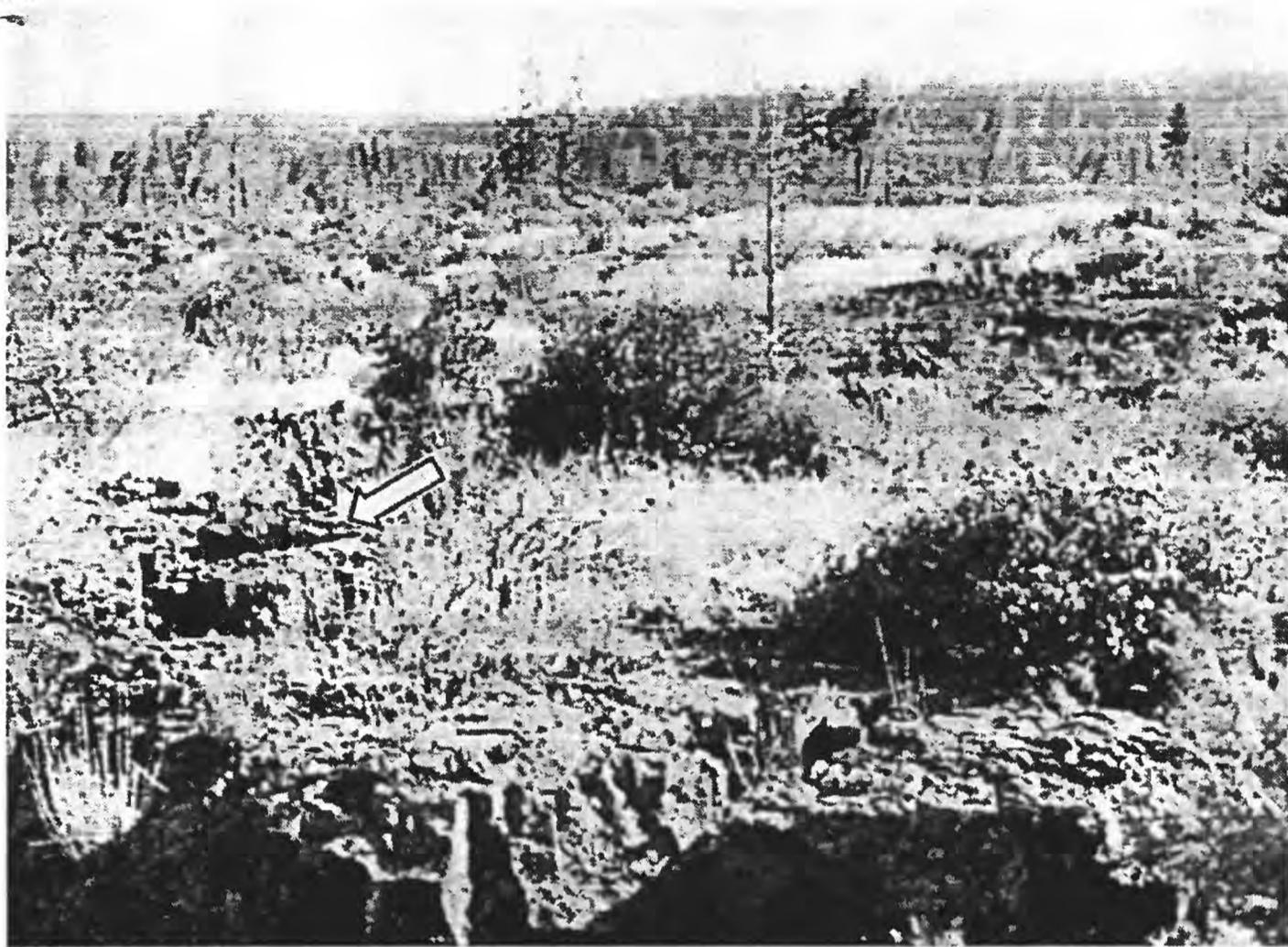
Proceed 14.6 km (9.05 mi) south along Highway 89 from the intersection of Highway 299 and Highway 89 to the MAAHCOOATCH store. Continue south for 0.08 km (0.05 mi) to the intersection with Doty Road. Turn left and continue east along Doty Road for 2.1 km (1.3 mi) to a "T" intersection with Bidwell Rd and a sign, "University of California Radio Astronomy Hat Creek". Turn left and continue east along Bidwell Road to an intersection on the right and a pipe gate. Turn right and continue through the gate for 1.2 km (0.75 mi) to a complex of building with a sign, "Stop Authorized Vehicles Only Beyond This Point". Turn left and continue to the parking lot of a building with a full glass front. Permission to enter the grounds can be obtained there.

To reach the bench mark, go back to the "Stop Authorized Vehicles...." sign and continue west to a large radio antenna and a white building.

The bench mark is cemented in the top of a 2 m (7 ft) high lava flow, located about 30 m west of the white building, 3 m (10 ft) southwest of the northwest edge of the flow edge, 3 m (10 ft) northeast of a 0.9 m (3 ft) wide fissure, and on a bearing of 120° from the large radio antenna next to the white building (see figure 8a, 8b).

Note: The driving time from Burney, Calif., is about 15 minutes.

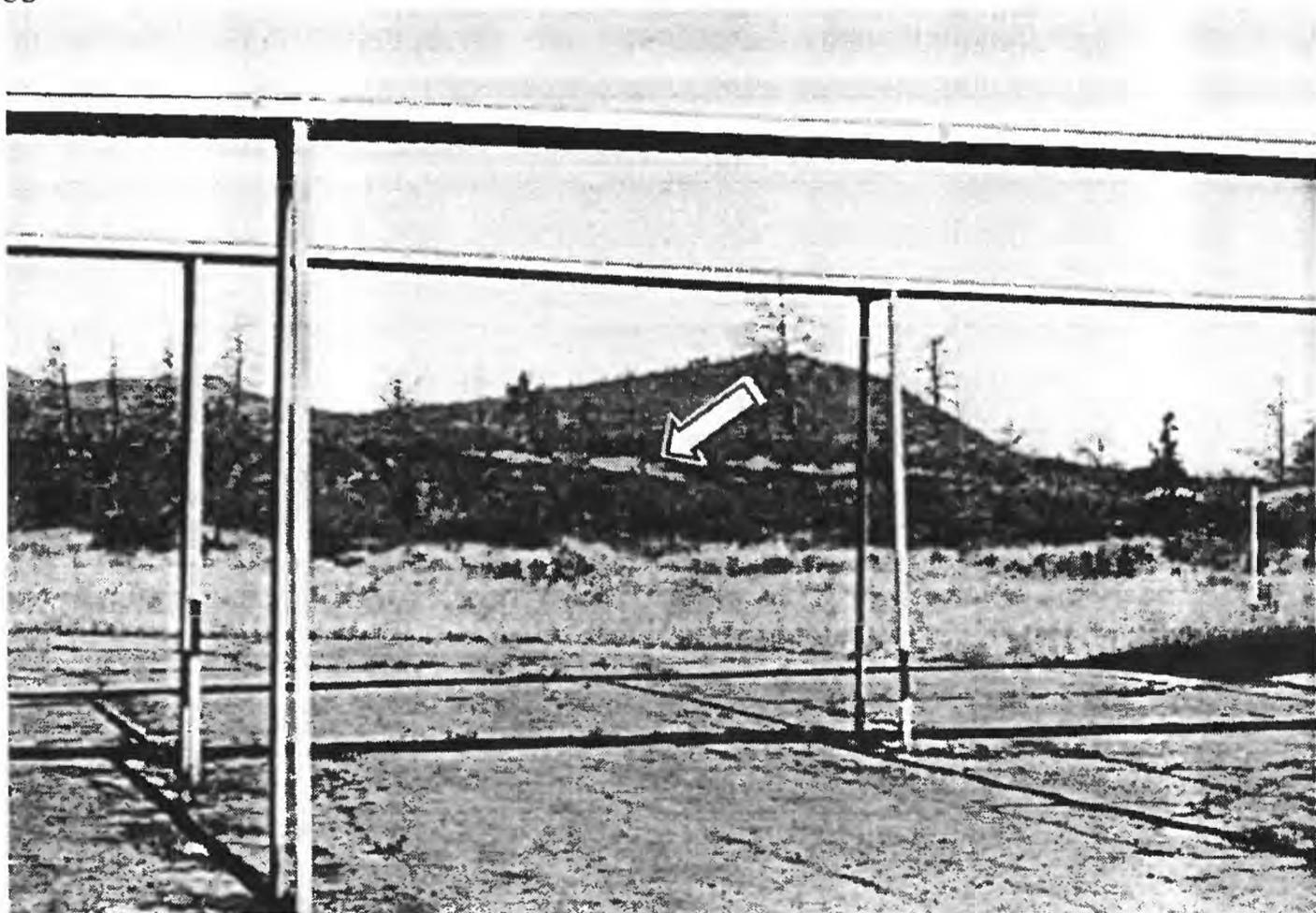
Figure 8a



HATCREEK

View looking west

Figure 8b



HATCREEK

View looking north

HAT CREEK GPS-S

Proceed 0.2 km (0.1 mi) south of the intersection of Highway 44 and Highway 89, about 0.6 km (0.4 mi) north of Old Station, Calif. to a road intersection to the southeast. Turn southeast onto the paved road at the signs, "State of California Department of Transportation, Hat Creek Maintenance Station" and "Not a through street". Continue southeast along the side road for 1.0 km (0.6 mi) to the end of the paved road. Go past the fire station, turn left at the end of the paved road, and continue along the gravel road for 0.6 km (0.35 mi) to the southeast end of the second Helipad.

The bench mark is cemented in a lava outcropping, about 68 m (225 ft) south of the south-most Helipad, about 10.7 m (35 ft) east of the road center, at the apex of a curve in the road, and 0.5 m (1.5 ft) lower than the highest part of the outcropping (see figure 9a, 9b).

The bench mark is a National Aeronautical and Space Administration brass tablet stamped "NASA GSFC Greenbelt Hat Creek CA GPS-S NOV 1990".

Note: The driving time from the Post Office at Old Station, Calif., is about 10 minutes.

Figure 9a



HATCREEK GPS-S

View looking southeast

Figure 9b



HATCREEK GPS-S

View looking northeast

JENNIE

Proceed 9.8 km (6.1 mi) northwest along Highway 36 from the intersection of Highway 139 (Ash Way), and Highway 36 (Main Street) in Susanville Calif., to the intersection with Highway 44. Turn right and continue northwest along Highway 44 for 33.6 km (20.85 mi) to the intersection with FS road 31N26 on the left. Leave highway 44, and turn right onto the dirt road. Continue east along the dirt road for 0.2 km (0.1 mi) to the railroad crossing and continue an additional 0.08 km (0.05 mi) beyond the railroad crossing.

The bench mark is attached to a pipe, about 10.6 m (35 ft) north of the road center, 0.6 m (2 ft) south of a witness post, and 0.1 m (0.3 ft) above ground level (see figure 10a, 10b).

The bench mark is a U. S. Coast and Geodetic Survey brass tablet stamped, "JENNIE 1948".

Note: The driving time from Susanville, Calif., is about 45 minutes.

Figure 10a



JENNIE

View looking east-southeast

Figure 10b



JENNIE

View looking north-northwest

LADDER (USGS)

Proceed 9.8 km (6.1 mi) northwest along Highway 36 from the intersection of Highway 139 (Ash Way) and Highway 36 (Main Street), in Susanville Calif., to the intersection with Highway 44. Turn right and continue northwest along Highway 44 for 45.9 km (28.5 mi) to a sign, "Pittville 33 mi, 53 km", and a dirt road to the right. Turn right onto the dirt road (later the dirt road is signed "Lassen County Road 111") and continue east along County Road 111 for 0.3 km (0.2 mi) to a junction with a sign, "Harvey MTN LO 17". Turn left at the junction and continue northwest for 8.4 km (5.25 mi) to a "Y" intersection with FS road 33N15 on the right with a sign, "Blacks Mtn Experimental Forest". Take the left fork and continue for 10.9 km (6.8 mi) to an intersection with a sign, "Jelly SPR, Jelly Camp". Turn left onto FS road 34N43 and continue northwest along FS road 34N43 for 3.2 km (2.0 mi) to a major intersection with FS road 34N35. Turn right and continue north along FS road 34N35 for 0.7 km (0.45 mi) to a sign, "Negro Camp 5, Ladder Butte Pt. 1". Continue ahead an additional 1.4 km (0.85 mi) to a curve in the road to the west and an intersection to the right with a sign, "Ladder Butte 1". Turn right and continue east along FS road 34N35A for 0.7 km (0.45 mi) to a "Y" intersection. Take the left fork and continue for 0.6 km (0.35 mi) to the top of the hill.

The USGS bench mark is cemented in the top of a 0.9 m (3 ft) high granite boulder at the northeast end of the clearing formerly occupied by a Forest Service lookout tower, about 15 m (50 ft) north of the road, and about 1.8 m (6 ft) higher than the road level (see figure 11a, 11b). There also is a U.S. Coast and Geodetic Survey bench mark "Ladder" RM #1 cemented in the top of a 0.9 m (3 ft) high granite boulder, at the far southeast end of the clearing among the manzanita bushes. Be sure to use the U.S. Geological Survey Brass tablet which is unstamped.

Note: The driving time from Susanville, Calif., is about 1 hour.

Figure 11a



LADDER USGS

View looking northwest

Figure 11b



LADDER USGS

View looking northeast

LASSEN

The station is located on a high point on Lassen Peak, about 17.7 km (11 mi) northeast of the town of Mineral, Calif. and about 21.7 km (13.5 mi) southwest of Old Station, Calif.

Drive into Lassen Volcanic National Park and proceed to the parking lot at the base of Lassen Peak, approximately 0.8 km (0.5 mi) north of Lake Helen. Follow the trail to the summit of Lassen Peak, crossing the lava flow, to a high ridge on the northwest, a few hundred meters south, of the north-most crater. The bench mark is cemented in bedrock on the northern-most point of this ridge (see figures 12a, 12b, 12c, 13).

The bench mark is U.S. Geological Survey Brass tablet stamped "LASSEN".

NOTE: This station requires a substantial hike, about 1.5 hours from the parking lot.

Figure 12a



LASSEN

View looking northwest, arrow points to benchmark

Figure 12b



LASSEN

View looking west-northwest, arrow points to benchmark

Figure I2c

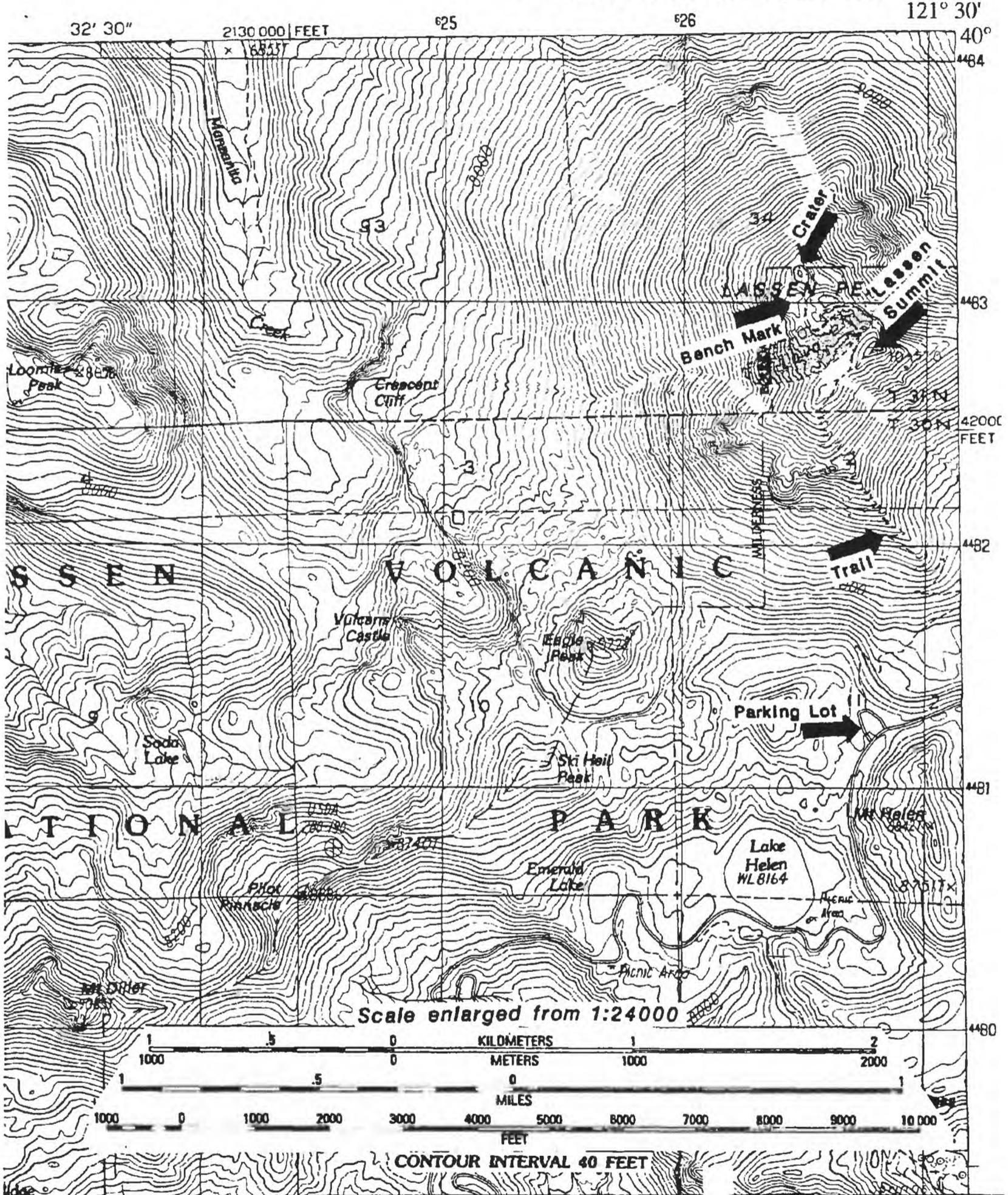


LASSEN

View looking southwest, arrow points to benchmark

Figure 13

LASSEN PEAK QUADRANGLE CALIFORNIA 7.5 MINUTE SERIES (TOPOGRAPHIC)



MANTON

To reach this station from the North:

Proceed 0.08 km (0.05 mi) east of Shingletown, Calif., on Highway 44, to a road intersection to the south. Leave Highway 44, turn right onto the paved side road (later the side road is "signed", "Wilson Hill Road") and continue south for 13.2 km (8.2 mi) to the intersection with Manton Rd (also called Tehema County Road A6), in Manton, Calif. Turn right and continue southwest for 0.08 km (0.05 mi) along Manton road to the intersection with S. Powerhouse Rd. Turn left and continue south on S. Powerhouse road for 1.8 km (1.15 mi) to the intersection with Hazen Rd. The bench mark is cemented in the top of a small exposure of bedrock, about 75 m (250 ft) north of the intersection of S. Powerhouse road and Hazen road, along S. Powerhouse road, 5.2 m (17 ft) east of the road center, 0.9 m (3 ft) west of the fence line, and at ground level (see figure 14a, 14b). The bench mark is U. S. Geological Survey Brass tablet stamped "Manton".

To reach this station from the Southwest:

Proceed 0.8 km (0.5 mi) east along highway 36 from the intersection of Paynes Creek Ln. and Highway 36 north of Paynes Creek, Calif., to the intersection with Lanes Valley Ln.

Turn left and continue north along Lanes Valley Ln. for 11.1 km (6.9 mi) to the intersection with Tehema County Road A6 (also called Manton Rd). Turn right and continue northeast along County road A6 for 11.7 km (7.3 mi) to the intersection with S. Powerhouse Rd across from the Post Office in the town of Manton. Turn right on S. Powerhouse road and continue south for 1.9 km (1.15 mi) to the intersection with Hazen Rd.

The location of the bench mark is described above.

Note: The driving time from Redding, Calif., is about 45 minutes.

Figure 14a



MANTON

View looking south

Figure 14b



MANTON

View looking south

MILLER

To reach this station from the Southeast:

Proceed 28.2 km (17.55 mi) east along Highway 44/89 from the Post Office in Old Station Calif., to the "Christian Youth Camp" in Viola, Calif. Continue east on Highway 44/89 an additional 22.6 km (14.05 mi) to an intersection on the right with a sign, "Inwood 1, Whitmore 13". Turn right and continue for 0.7 km (0.45 mi) to an intersection with Ponderosa Way on the right. Continue ahead for 1.8 km (1.1 mi) to a "Y" intersection with Whitrow Road. Take the left fork on Whitrow Road and continue for 1.0 km (0.6 mi) to the intersection with Ponderosa Way on the right. Turn right and continue along Ponderosa Way for 18.7 km (11.65 mi) to a road intersection with Whitmore Road, and the California Department of Forestry compound northeast of Whitmore, Calif. Turn right and continue east along Whitmore Road for 0.6 km (0.4 mi) to an intersection on the left. Continue ahead an additional 2.4 km (1.5 mi) to a "Y" intersection with a sign, "Tamarack Whitmore 3". Take the left fork and continue for 3.6 km (2.25 mi) to a "Y" intersection with a gravel road with a sign, "Cascade School Rd". Turn left onto the gravel road and continue along the left fork for 5.1 km (3.15 mi) to a track road on the right. Turn right and continue 0.08 km (0.05 mi) to the base of a rocky knoll. The bench mark is at the top of the knoll.

The bench mark is cemented in the top of a 1.8 x 1.8 m (6 x 6 ft) embedded boulder about 11 m (35 ft) south of the highest part of the ridge, and 1.2 m (4 ft) above the ground level (see figure 15a, 15b).

The bench mark is a U. S. Geological Survey brass tablet stamped "MILLER".

To reach station Miller from the Southwest:

Proceed 6.0 km (3.75 mi) northeast along Highway 44 from the freeway overpass at Palo Cedro, Calif., to a sign, "Milleville 1" and the intersection with Old Forty Four Rd on the left in Millville, Calif. Turn left and continue north along Old Forty Four Road for 1.4 km (0.85 mi) to a "T" intersection with Whitmore Road. Turn right and continue easterly along Whitmore Road for 27.8 km (17.3 mi) to the intersection with Ponderosa Way on the right and the California Department of Forestry compound. Continue as described previously.

Note: The driving time from Redding or Old Station, Calif., is about 45 minutes.

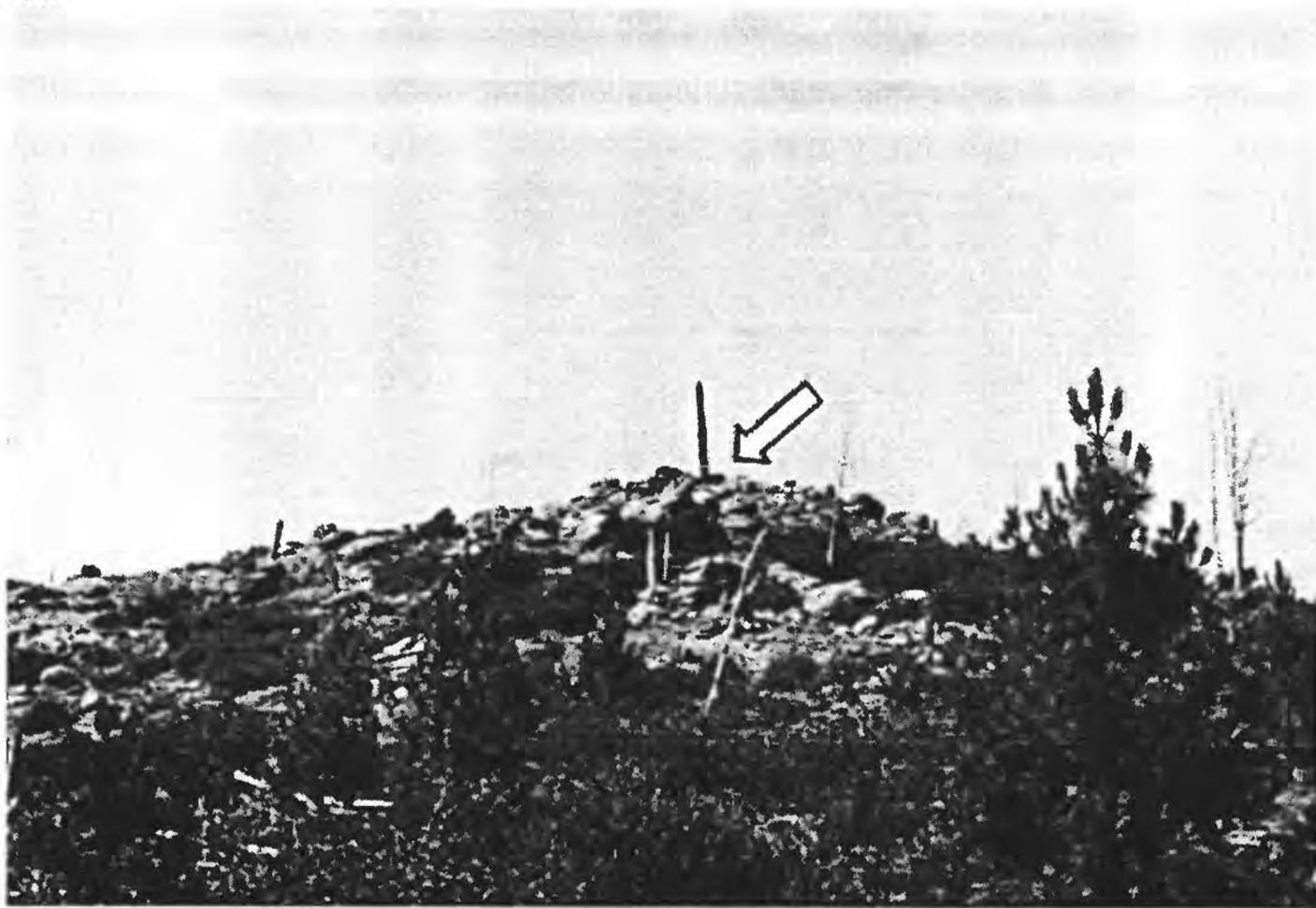
Figure 15a



MILLER

View looking southeast

Figure 15b



MILLER

View looking south

MOSEMAN

Contact Mr. Boyd Benson at (916) 547-4701, 24 hours before entering the property.

Proceed 6.0 km (3.75 mi) west along Highway 44 from the freeway overpass at Palo Cedro, Calif., to a sign, "Milleville 1" and the intersection with Old Forty Four Road on the left in Millville, Calif. Turn left and continue north along Old Forty Four Road for 1.4 km (0.85 mi) to a "T" intersection with Whitmore Road on the right. Turn right and go northeast along Whitmore Road for 5.6 km (3.5 mi) to a large complex of building on the south side of the road and a driveway on the left leading uphill (the ranch owner, Mr. Moseman, resides here but get the key from the ranch foreman). Continue northeast an additional 3.5 km (2.2 mi) along Whitmore Road to a bend in the road and a complex of building on the north. Mr. Boyd Benson the ranch foreman resides here, get the key from him.

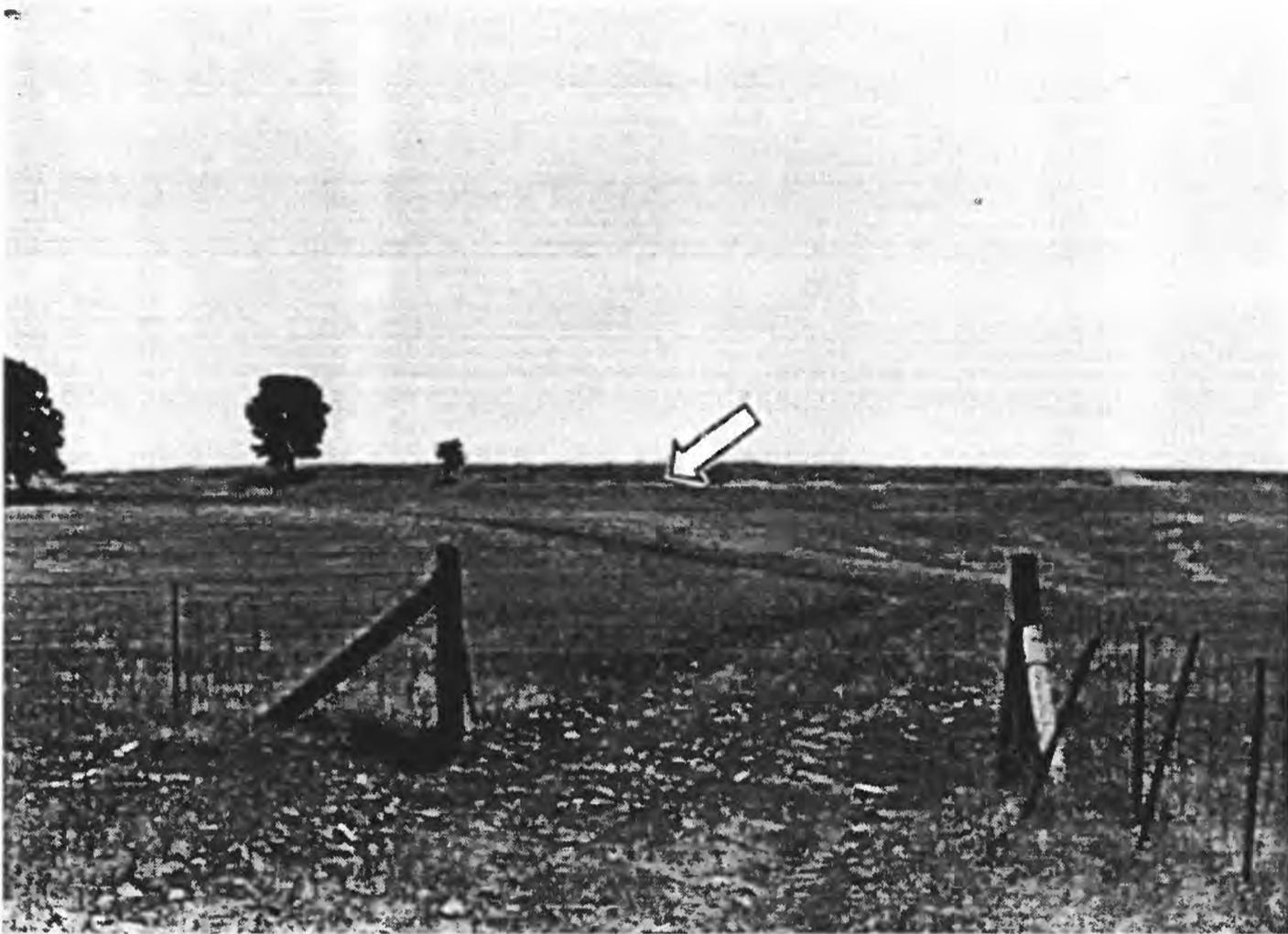
After getting the key, proceed an additional 0.6 km (0.35 mi) northeast on Whitmore Road to a locked gate on the south side of the road. Turn right and drive uphill 0.2 km (0.1 mi) to just before the crest of the hill.

The bench mark is cemented in the top of a 1 x 1 m (3 x 3 ft) embedded boulder, 0.5 m (1.5 ft) southwest of the road center, 12 m (40 ft) northwest of a 2.4 m (8 ft) tall oak tree, 2.4 m (8 ft) lower than the top of the hill, and 0.4 m (18 in) above ground level (see figure 16a, 16b).

The bench mark is a U.S. Geological Survey brass tablet stamped "Moseman".

NOTE: The driving time from Redding, Calif., is about 45 minutes.

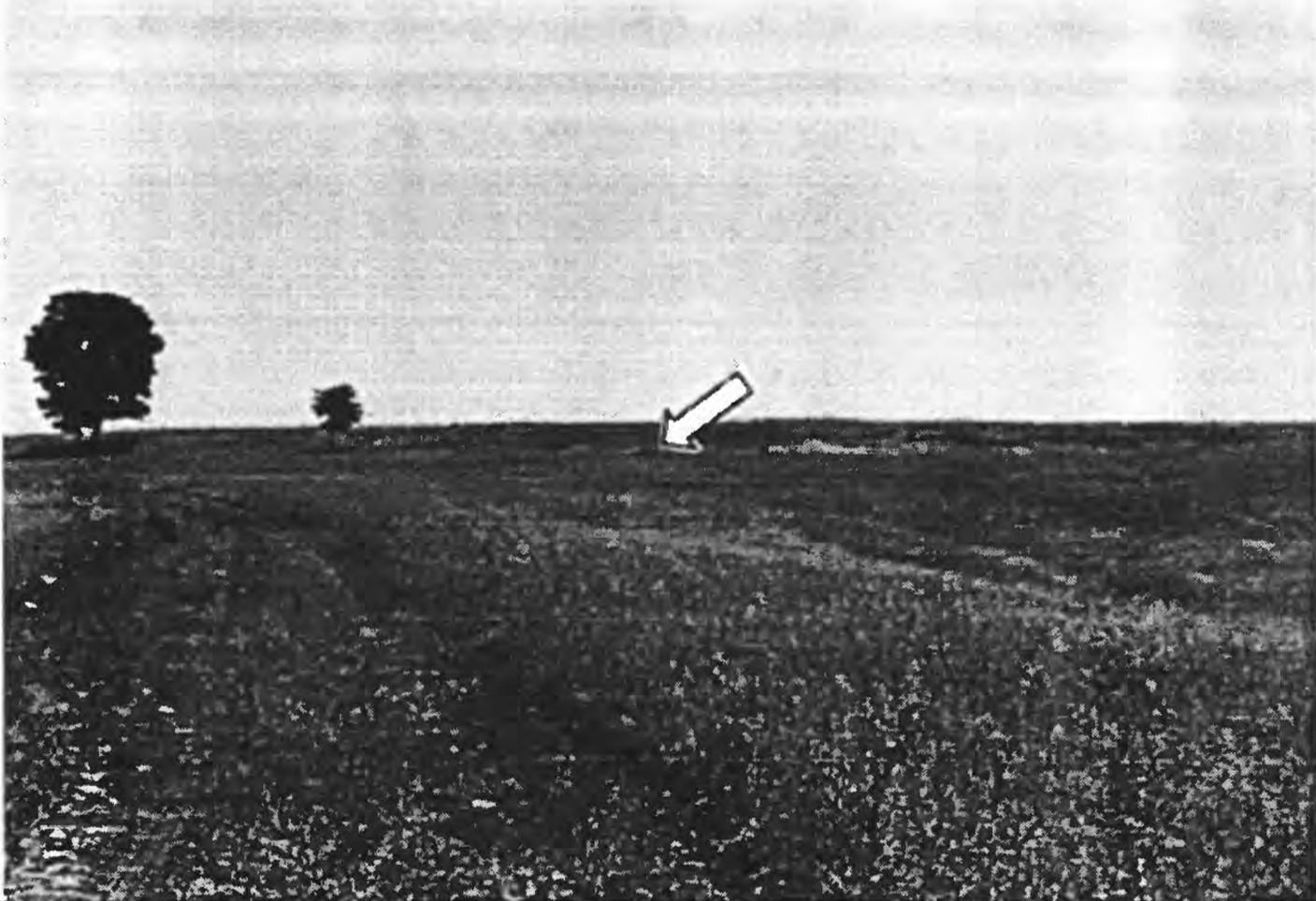
Figure 16a



MOSEMAN

View looking south

Figure 16b



MOSEMAN

View looking south

VIGIL

Contact Mike Vigil, the Ranch foreman at (916) 336-5902, 24 hours prior to visiting this site.

Proceed 1.6 km (1.0 mi) east along Highway 299 from the east end of MacArthur, Calif., to a paved road on the right with a sign, "Pittville, Little Valley". Turn right and continue south for 4.3 km (2.65 mi) to a "Y" intersection. Take the right fork and continue for 1.8 km (1.15 mi) to a "Y" intersection. Take the left fork along the "red road" and continue for 1.6 km (1.0 mi) to another "Y" intersection and take the left fork. Continue along the left fork for 24.0 km (14.9 mi) to a "Y" intersection on the left. Continue down-hill along the left fork for 5.0 km (3.1 mi) to a closed gate. Proceed through the gate and continue an additional 1.8 km (1.1 mi) to a cluster of rocks on the south side of the road.

The bench mark is cemented in a small 0.9 x 1.2 m (3 x 4 ft) outcrop, about 12.8 m (42 ft) south of the road center, 7.6 m (25 ft) north of a 3 m (10 ft) tall juniper tree, 2 m (6.5 ft) northwest of a witness post, and 0.6 m (2 ft) below the road level (see figure 17a, 17b).

The bench mark is a U.S. Geological Survey brass tablet stamped "Vigil".

Note: The driving time from Fall River Mills, Calif., is about 45 minutes.

Figure 17a



VIGIL

View looking south

Figure 17b



VIGIL

View looking southeast

TABLE 1**Latitude and Longitude of GPS stations**

The WGS-84 latitude, longitude and ellipsoidal heights are preliminary and subject to change as the data is re-processed.

Station Name	Latitude	Longitude	Ellipsoidal height (M)
14C USGS	40° 42' 30.6"	120° 55' 16.2"	1657.9
CVO91-026*	40° 30' 24.0"	120° 42' 17.0"	2128.0
CVO91-027	40° 39' 04.1"	121° 09' 43.1"	1679.6
CVO91-028	40° 27' 44.5"	122° 05' 26.4"	262.7
CHESTER AIRPORT	40° 17' 13.6"	121° 14' 27.3"	1360.2
EWE AZI	40° 51' 20.4"	120° 45' 36.3"	1610.5
HALE	40° 45' 36.8"	121° 58' 10.6"	627.5
HAT CREEK	41° 49' 03.9"	121° 28' 16.6"	1001.2
HAT CREEK GPS-S	40° 40' 04.4"	121° 25' 08.9"	1309.8
JENNIE	40° 33' 57.1"	121° 03' 36.6"	1697.1
LADDER (USGS)	40° 48' 38.1"	121° 18' 24.6"	1732.6
LASSEN	40° 29' 23.6"	121° 30' 32.4"	3136.9
MANTON	40° 25' 02.7"	121° 52' 17.5"	605.6
MILLER	40° 39' 45.0"	121° 46' 40.6"	1471.9
MOSEMAN	40° 35' 22.0"	122° 04' 49.3"	297.7
VIGIL	40° 52' 57.7"	121° 07' 16.5"	1295.6

* The receiver on this station malfunctioned; However the latitude and longitude are probably good estimates but the height is probably no better than ± 5 meters.