

AUG 1979
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY • NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1001
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1.5 HAWAII

SEE STATION OHALE (HGS)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: 3314 USGS OBS BY CGS
 STATE: HAWAII YEAR: 1949 SECOND ORDER

SOURCE: G-16241
 NO. OF OBSERVATION CHECK ON THIS POSITION

GEODETIC LATITUDE:	19 21 13.61278	ELEVATION:	1010.1 METERS
GEODETIC LONGITUDE:	155 16 45.23472		3314 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR $\Delta \theta$ ANGLE*
HI 1	5101	576,099.49	189,041.45	+ 0°04'23"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR $\Delta \theta$ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979
 THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1002
 HAWAII
 LATITUDE 19 00' TO 19 30'
 LONGITUDE 155 00' TO 155 30'
 DIAGRAM NE 5-1.5 HAWAII

SEE STATION KEAKAPULU

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: 4059 USGS OBS BY CGS
 STATE: HAWAII YEAR: 1947 SECOND ORDER

SOURCE: 0-16241

GEODETIC LATITUDE:	19 22 05.88415	ELEVATION:	1246.90 METERS
GEODETIC LONGITUDE:	155 25 25.23151		4090.8 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	Bearing or Angle *
HII 1	5101	526,306.95	194,271.48	+ 0 01' 31"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE $\sin^2 \theta$ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH *	CODE
<p>THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979 THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975 LEVELING BY CGS</p>			

JUN 1978
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191552 STATION 1003
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-15 HAWAII

Aa (Hawaii Island, United States Geological Survey, 1920).—In southeast Hawaii, 3¼ miles southwest of Halemaumau, and 1½ miles southeast of Kau road, in the highest part of an old sand-covered ridge of "aa" lava. Mark, a bronze tablet set in solid rock on top of a rock mound.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **AA**
 ESTABLISHED BY: **U.S.G.S.** YEAR: **1920** STATE: **Hawaii** BENCH MARK(S) ALSO
 RECOVERED BY: **D.M. Whipp** YEAR: **1967** COUNTY: **Hawaii**
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: **Island, Hawaii**

R

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station mark was recovered in good condition. A complete description follows:

Station is located about 3-1/4 miles southwest of Halemaumau Crater, 5-1/2 miles southwest of Kilauea Military Camp, 1-1/3 miles southeast of State Highway 11, and 1400 feet northwest of the Kau Desert Trail, at 3349 feet elevation, on a low, flat, sandy hill with lava outcrops, that is the highest point in the vicinity. It is on a rock mound that is the highest point of the hill.

To reach station from the Hawaii Volcanoes National Park Headquarters, go west on the Crater Rim Road for 1.8 miles; turn right and go 0.1 mile to State Highway 11; turn left and go southwest on State Highway 11 for 4.5 miles to end of truck travel at power-line pole 66 and telephone pole 795 on the left. Walk southeast across rough lava land about 1-1/2 miles to station.

Station mark is a U.S.G.S. disk, stamped "AA", cemented in a drill hole in top of rock mound. It is about 100 feet southeast of a smooth, brown, lava dome which is the only smooth lava formation on the hill.

FORM CG5-526 (1-65)
 USCOM-DC 18509-P65

U. S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION **AA**
 STATE **HAWAII** YEAR **1920** THIRD ORDER

SOURCE **G-SP156**

GEODETIC LATITUDE	19 23 00.342	ELEVATION	1020.73 METERS
GEODETIC LONGITUDE	155 19 46.670		3348.6 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	H OR Δ θ ANGLE*
HI 1	5101	558,716.24	199,788.02	+ 0 03' 24"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE $\theta = \arctan \frac{\Delta}{\Delta}$ FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1005
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1,5 HAWAII

DESCRIPTION

TRIANGULATION STATION

NAME OF STATION: ALII USGS
 ESTABLISHED BY: L.A. Critchlow YEAR: 1977 STATE: Hawaii BENCH MARK ALSO
 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 12 miles south of Hilo
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION				
OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
KULANI MGS 1091	S	70.04	21.349	00 00 00.0
RM 2	S	80.36	24.492	163 16 44
RM 1	S			249 14 18

The station is located on the southwest slope of Mauna Loa in the Puna District, about 10 miles southwest of Mountain View, 4 miles east of Volcano Post Office, in the Alii Subdivision and on the north side of Mokuna Street, on a small lava blister.

To reach the station from the post office in Mountain View, go southwest along State Highway 11 for 9.6 miles to paved road left (Alii Aiele Street) turn left and go east 0.35 mile to crossroad. Turn right and go southwest along Mokuna Street 0.15 mile to a small lava blister on the right and the station site.

The station is a USGS disk stamped "ALII 1961", cemented in a drill hole in pahoehoe lava rock, 27 feet north of the centerline of the street and about 5 feet higher.

Reference mark 1 is a USGS reference mark disk stamped "NO. 1 1961", cemented in a drill hole in pahoehoe lava rock, 28 feet east of the centerline of the street and 5 feet lower than the station mark.

Reference mark 2 is a USGS reference mark disk stamped "NO. 2 1961", cemented in a drill hole in pahoehoe lava rock, 29 feet east of the centerline of the street and 5 feet lower than the station mark.

* Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 SUPERSEDES CGS FORM 826A WHICH MAY BE USED.
 (11-72)

U. S. DEPARTMENT OF COMMERCE
 NOAA
 U. S. GOVERNMENT PRINTING OFFICE: 1978-845-647/1220 Region 6

ADJUSTED HORIZONTAL CONTROL DATA

ADJUSTMENT BY NGS

NAME OF STATION: ALII USGS OBS BY NGS
 STATE: Hawaii YEAR: 1977 FIRST -ORDER

SOURCE: S-18241

GEODETIC LATITUDE: 19 26 50.23117	ELEVATION: 968.1 METERS
GEODETIC LONGITUDE: 155 12 02.98756	3176 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ OR ANGLE
HI 1	5101	605,066.18	223,038.57	+ 0 05 59 "

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ OR FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
KULANI MGS	128 °32 '45.7	128 °26 '46 "	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1006
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1.5 HAWAII

DAA FORM 75-39
 2-70
 FORMERLY C&GS FORM 52B

U.S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL GEODETIC SURVEY

TRaverse
 DESCRIPTION OF TRAVELING STATION

NAME OF STATION: BENCH MARK 1855 USGS STATE: Hawaii COUNTY: Hawaii
 NEAREST TOWN: Pahala QUADRANGLE NO.: YEAR: 1977
 CHIEF OF PARTY: L. A. Critchlow DESCRIBED BY: L.A.C.

NOTE*	HEIGHT OF TELESCOPE ABOVE STATION MARK 1 METERS, † HEIGHT OF LIGHT ABOVE STATION MARK 1 METERS.		DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION			
	SURFACE-STATION MARK	UNDERGROUND-STATION MARK	BEARING	DISTANCE		DIRECTION‡
				FEET	METERS	

The station is located on a low lava mound about 5 miles northeast of Pahala, about 1/4 mile northwest of State Highway 11, on the northwest side of the old Volcano Road, and at a road fork.

To reach the station from the junction of State Highway 11 and Kamani Street at Pahala go northeast on State Highway 11 for 5.4 miles to a side road on the left. Turn left, pass through a gate, and go northwest on a gravelled road 0.1 mile to a T-road. Turn left onto a paved road (the old Volcano Road) and go southwest 0.4 mile to a road fork and the station on the right.

The station mark is a USGS disk stamped HAWAII 1855 cemented in a drill hole in outcropping lava rock that is about 9 feet higher than and 67 feet north of the center of the road fork and is 22 feet northwest of the centerline of the paved road.

Detailed description:

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: BENCH MARK 1855 USGS OBS BY NGS
 STATE: HAWAII YEAR: 1977 SECOND ORDER

SOURCE: G-16241

GEODETTIC LATITUDE:	19 16 05.21742	ELEVATION:	566.52 METERS
GEODETTIC LONGITUDE:	155 26 33.56143		1858.6 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	B ORDER Δ ANGLE
H1 1	5101	519,796.19	157,887.29	+ 0° 01' 08"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE $\theta = \theta' \Delta \Delta \theta'$ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETTIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
KAPAPALA RM 1	14 17 31.5	14 16 23	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

LEVELING BY NGS

3M 015

* Refers to notes in manuals of triangulation and state publications of triangulation. † Direction-angle measured clockwise, referred to initial station.
 ‡ To nearest meter only, when no trigonometric leveling is being done.
 ☆ U. S. GOVERNMENT PRINTING OFFICE 1972; 790-819

AUG 1979
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY & NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1007
 HAWAII
 LATITUDE 19 00' TO 19 30'
 LONGITUDE 155 00' TO 155 30'
 DIAGRAM NE S-1.5 HAWAII

SEE STATION PUU HULUHULU (HGS)

ADJUSTED HORIZONTAL CONTROL DATA ADJUSTMENT BY NGS

NAME OF STATION: BENCH MARK 3440 USGS OBS BY CGS
 STATE: HAWAII YEAR: 1949 SECOND ORDER

S-16241
 TO OBSERVATION CHECK ON THIS POSITION

GEODETIC LATITUDE:	19 22 28.14350	ELEVATION:	1048.0 METERS
GEODETIC LONGITUDE:	155 12 29.42077		3438 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	ϕ OR Δ ϕ ANGLE *
HI 1	5101	600,581.36	196,596.04	+ 0 05 49

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE ϕ OR Δ ϕ FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH * (From south)	CODE

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979
 THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

3M 011

JUN 1978
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191552 STATION 1008
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

SEE STATION KEAKAPULU

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: BENCH MK GS NR KEAKAPULU

STATE: HAWAII

YEAR: 1949

SECOND ORDER

SOURCE: G- 9279
 NO OBSERVATION CHECK ON THIS POSITION

GEODETIC LATITUDE:	19° 22' 05.894	ELEVATION:	1246.90 METERS
GEODETIC LONGITUDE:	155 25 25.238		4050.8 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	β OR Δ OR ANGLE*
HI 1	5101	526,306.33	194,272.47	+ 0 01 31

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE β OR Δ OR β FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
POSITION DETERMINED BY TRAVERSE FROM STATION KEAKAPULU			
QE 267			

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM.

QUAD 191552 STATION 1009
 HAWAII
 LATITUDE 19 00' TO 19 30'
 LONGITUDE 155 00' TO 155 30'
 DIAGRAM NE 5-1.5 HAWAII

~~RECOVERY NOTE~~
 DESCRIPTION
 TRIANGULATION STATION

NAME OF STATION: BM HVO 80 USGS
 ESTABLISHED BY: L.A. Critchlow YEAR: 1978 STATE: Hawaii COUNTY: Hawaii BENCH MARK ALSO
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 8 miles southwest of Kalapana Village
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION					
OBJECT	BEARING	DISTANCE		DIRECTION	
		FEET	METERS		
LAEAPUKI 1914 Geod. dist.	ENE	3302.49	1006.601	00 00 00.0	
KAENA PT USGS Geod. dist.	SW	10437.31	3181.298	170 22 59.69	

The station is located about 8 miles southwest of Kalapana Village and is in the Volcano National Park.
 To reach the station from the two churches at Kalapana Village, go southwest on State Highway 13 for 2.8 miles to a guardrail at end of the state highway. Continue southwest on the paved road for 4.7 miles to station Laeapuki turn-off; continue southwest on the paved road for 0.55 mile to the station on the right.
 The station mark is a USGS disk stamped HVO 80 1965, cemented in a drill hole in an outcropping of lava rock that projects about 1-1/2 feet above the surface of the ground. It is 20 feet northwest of the center of the paved road, 4 feet southwest of a 2 foot cairn, 11 feet southeast of the southeast edge of an 8 foot high lava mound and is about 1 foot higher than the paved road.

* Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 (11-72) SUPERSEDES CGS FORM 326A WHICH MAY BE USED.

U.S. DEPARTMENT OF COMMERCE
 NOAA
 © U.S. GO: 1976-645-641/1220 Region 6

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: BM HVO 80 USGS OBS BY NGS
 STATE: HAWAII YEAR: 1978 SECOND ORDER

SOURCE: G-16241

GEODETIC LATITUDE: 19 17 57.33501	ELEVATION: 19.29 METERS
GEODETIC LONGITUDE: 155 05 54.55343	63.3 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	§ 108 Δ § 1 ANGLE *
HI 1	5101	638,449.35	169,353.98	+ 0°07'58"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE § 108 Δ § 1 FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH * (From south)	CODE
LAEAPUKI	247 59 47.6	247 51 50 "	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979
 LEVELING BY NGS

JUN 1978
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191552 STATION 1010
 HAWAII
 LATITUDE 15 ° 00' TO 15 ° 30'
 LONGITUDE 155 ° 00' TO 155 ° 30'
 DIAGRAM NE 5-1.5 HAWAII

SEE STATION PUU HULUHULU

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION BENCH MK NR PUU HULUHULU
 STATE HAWAII YEAR 1949 SECOND ORDER

SOURCE G- 9279
 NO OBSERVATION CHECK ON THIS POSITION

GEODETTIC LATITUDE	15 22 28.214	ELEVATION	1048.0 METERS
GEODETTIC LONGITUDE	155 12 29.428		3438 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	β HOR Δ UT ANGLE*
HI 1	5101	600,580.65	196,603.14	+ 0 05 45"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE β HOR Δ ϕ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETTIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
POSITION DETERMINED BY TRAVERSE FROM STATION PUU HULUHULU			
QE 269			

JUN 1978
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191552 STATION 1011
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1.5 HAWAII

SEE STATION OHALE

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: BENCH MARK USGS NR OHALE
 STATE: HAWAII YEAR: 1949 SECOND ORDER

SOURCE: G- 9279
 NO OBSERVATION CHECK ON THIS POSITION

GEODETIC LATITUDE:	19 °21' 13.795	ELEVATION:	1010.1 METERS
GEODETIC LONGITUDE:	155 16 45.311		3314 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	P OR Δ OR ANGLE *
HI 1	5101	576,092.16	189,059.82	+ 0 04 23

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE P OR Δ OR ANGLE FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH * (From south)	CODE

POSITION DETERMINED BY TRAVERSE FROM STATION OHALE

QE 268

JUN 1978
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191552 STATION 1012
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

Cone Peak (Hawaii Island, United States Geological Survey, 1920).—In southeast Hawaii, 4 miles southwest of Volcano House, on highest point of rock ridge. Old mark of iron spike driven in lava rock replaced by bronze tablet stamped "3653", and covered by mound of rock.

RECOVERY NOTE, TRIANGULATION STATION

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **CONE PEAK**
 ESTABLISHED BY: **U.S.G.S.** YEAR: **1920** STATE: **Hawaii** BENCH MARK(S) ALSO
 RECOVERED BY: **D.M. Whipp** YEAR: **1967** COUNTY: **Hawaii**
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: **Island: Hawaii**

R

NAME OF STATION: **CONE PEAK**
 STATE: **HAWAII** YEAR: **1920** **THIRD** ORDER

SOURCE: **G-SP156**

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station was recovered in good condition. A complete description follows:

Station is located in the Hawaii Volcanoes National Park, about 4 miles southwest of the Park Headquarters Building, 1.1 miles southwest of the Crater Rim Road, and 1700 feet southeast of the Kau Desert Trail, at about 3653 feet elevation, on the highest point of the rocky rims around some old volcanic cones.

To reach station from the Hawaii Volcanoes National Park Headquarters Building, go west and southwest on the Crater Rim Road for 3.7 miles to end of truck travel where the Crater Rim Road reaches it's westernmost point before turning back to southeast. Walk northwest about 100 yards to top of low ridge and the Kau Desert Trail. Go left, southwest, on the well-marked trail for about 1-1/4 miles, then leave trail and go southeast, across lava area, to station.
 Station mark is a U.S. Geological Survey disk stamped "CONE PEAK", cemented in a drill hole in bedrock.

U. S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

GEODETIC LATITUDE:	19 23 41.437	ELEVATION:	1113.33 METERS
GEODETIC LONGITUDE:	155 18 34.695		3652.6 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ (IN Δ) ANGLE
HI 1	5101	565,602.10	203,940.66	+ 0 03 48

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ (IN Δ) θ FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE

QJ 304

AUG 1979
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY • NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1014
 HAWAII
 LATITUDE 19 00' TO 19 30'
 LONGITUDE 155 00' TO 155 30'
 DIAGRAM NE 5-1.5 HAWAII

SEE STATION UWEKAHUNA (HGS)

ADJUSTED HORIZONTAL CONTROL DATA ADJUSTMENT BY NGS

NAME OF STATION: HVU 113 USGS OBS BY NGS
 STATE: HAWAII YEAR: 1977 SECOND ORDER
 SOURCE: 0-16241

GEODETIC LATITUDE:	19 25 26.81080	ELEVATION SCALED	1244	METERS
GEODETIC LONGITUDE:	155 17 22.43017			FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	ϕ OR Δ OR ANGLE *
HI 1	5101	572,506.07	214,579.08	+ 0°04'12"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE ϕ OR Δ OR FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH * (From south)	CODE
THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979			
3M 050			

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1015
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1.5 HAWAII

DESCRIPTION TRIANGULATION STATION

NAME OF STATION: HVO 119 USGS
 ESTABLISHED BY: L.A. Critchlow YEAR: 1977 STATE: Hawaii BENCH MARK ALSO
 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 2 miles south of the National Volcano Observatory
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
UPEKAHUNA HGS 1896				00 00' 00.0"
RM 1	SE	29.94	9.126	120 59' 27"
SAND HILL USGS	E	3.80	1.157	258 08"
RM 2	N	33.725	10.280	347 38' 01"
RM 1 to RM 2		58.49	17.828	

The station is located about 2 miles south of the National Volcano Observatory, 1/2 mile south of the south rim of the Kilauea Crater and on property owned by the Hawaii Volcanoes National Park.

To reach the station from the entrance to the National Volcano Observatory (which is on the west rim of Kilauea Crater), go south and east on a surfaced road for 2.05 miles to a track road right at a high-way curve sign. Turn right and go south-southwest on the track road for about 200 feet to the top of a low ridge and a rock cairn on the left. Turn left and go southeast on a track road for 0.05 mile to a fork. Take the left fork and continue southeast on the track road for 0.25 mile to a track road right. Turn right and go southwest on the track road for 0.05 mile to the top of a cinder ridge and station as described.

Station mark, stamped HVO 119, is a USGS Bench Mark: disk set in an irregular mass of concrete about 2 by 3 feet in size and projects about 3 inches above the ground surface. It is 5 feet northeast of a rock cairn and a metal post driven into the ground. (Note desc.)

Reference mark 1, stamped HVO 119 HO 1 1977, is a NGS reference mark: disk cemented in a drill hole in a boulder which has an exposed surface about 12 by 14 inches and is flush with the ground surface. It is 32.5 feet east-southeast of the rock cairn and metal post. (Note 12c)

Reference mark 2, stamped HVO 119 HO 2 1977, is a NGS reference mark: disk cemented in a drill hole in a boulder which has an exposed surface about 14 by 18 inches and projects about 2 inches above the ground surface. It is 36 feet north of the rock cairn and metal post. (Note 12c)

SAND HILL, stamped HAWAII SAND HILL, is a USGS Bench Mark: disk set in an irregular mass of concrete which is about 1 foot in diameter and about 3 inches below the ground surface. It is 2 feet north of the rock cairn and metal post. (Note desc.)

* Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 SUPERSEDES CGS FORM 926A WHICH MAY BE USED.
 (11-72)

U.S. GPO: 1976-645-661/1220 Region 6

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: HVO 119 USGS OBS BY NGS
 STATE: HAWAII YEAR: 1977 SECOND ORDER

SOURCE: 0-16241

GEODETIC LATITUDE: 19 23 45.39 7"	ELEVATION: 1128.4 METERS
GEODETIC LONGITUDE: 155 17 37.17277	3702 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ OR ANGLE °
HI 1	5101	570,916.61	204,345.60	+ 0°04'06"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ FORMULA, NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
UPEKAHUNA HGS	188 55' 38.7"	188 51' 33"	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

3M 051

AUG 1979
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY & NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1016
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1.5 HAWAII

SEE STATION KAKAKAIA (HTS)

ADJUSTED HORIZONTAL CONTROL DATA ADJUSTMENT BY NGS

NAME OF STATION HVO 120 USGS OBS BY NGS
 STATE HAWAII YEAR 1977 FIRST ORDER

SOURCE C-16241

GEODETIC LATITUDE	19 28 14.37037	ELEVATION	803.4 METERS
GEODETIC LONGITUDE	155 22 26.57140		2636 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ OR ANGLE
HI 1	5101	543,429.29	170,927.84	+ 0 02' 30"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ OR θ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979			
JM 052			

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1017
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1.5 HAWAII

DESCRIPTION

TRIANGULATION STATION

NAME OF STATION: KAENA PT USGS
 ESTABLISHED BY: L.A. Critchlow YEAR: 1977 STATE: Hawaii BENCH MARK ALSO
 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 11 miles southwest of Kalapana
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
PANAU 1914				00 00 00.0
TM PVO 80 USGS	Good. Dist.	10437.31	3181.298	37 15 33.00
RM 1	S	66.41	20.455	54 23 10
RM 2	N	54.90	16.738	537 30 48
RM 1 to RM 2		75.82	23.112	

The station is located about 74 miles east-northeast of Pahala, 15 miles southeast of Volcano, 11 miles southwest of Kalapana, 7 mile north-east of Kaena Point, 700 yards south of State Highway 13 at curve, 750 yards north of the coastline and on a small pahoehoe lava mound.

To reach the station from the junction of State Highways 13 and 22 at the east edge of Pahoa, go southwesterly on Highway 13 for 9.1 miles to road fork. Take the right fork and continue southwesterly on Highway 13 for 5.5 miles to Volcano National Park Headquarters. Continue southwesterly on Highway 13 for 7.3 miles to a right hand curve. Pack south across pahoehoe lava to the station site. A four wheel drive vehicle can be driven to the station site.

The station mark is a USGS disk stamped, "KAENA PT 1961", cemented in a drill hole in the top of a mound of pahoehoe lava.

Reference mark 1, stamped "NO. 1 1961", is a USGS disk cemented in a drill hole in pahoehoe lava about four feet lower than the station.

Reference mark 2, stamped "NO. 2 1961", is a USGS disk cemented in a drill hole in pahoehoe lava about three feet lower than the station.

This station is located on National Park property.

* Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 SUPERSEDES CGS FORM 828A WHICH MAY BE USED.
 (1-72)

U.S. DEPARTMENT OF COMMERCE
 NO.

U.S. GPO: 1976-645-661/1270 Page 10

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KAENA POINT USGS OBS BY NGS
 STATE: HAWAII YEAR: 1977 FIRST -ORDER

SOURCE: S-16241

GEODETIC LATITUDE: 19 17 03.09299	ELEVATION: 23.9 METERS
GEODETIC LONGITUDE: 155 07 27.33366	78 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	ϕ OR Δ OR ANGLE
HI 1	5101	629,574.33	163,861.40	+ 0 07 27

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE ϕ OR Δ OR FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
PANAU	201 03 46.3	200 06 19	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

JUN 1978
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191552 STATION 1018
 HAWAII
 LATITUDE 19 ° 00' TO 19 ° 30'
 LONGITUDE 155 ° 00' TO 155 ° 30'
 DIAGRAM NE 5-1.5 HAWAII

NO TEXT

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION KAMAKA IA
 STATE HAWAII YEAR 1897 THIRD ORDER

SOURCE G-SP15b

GEODETIC LATITUDE	19 18 15.354	ELEVATION	METERS
GEODETIC LONGITUDE	155 22 26.825		FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ OR ANGLE *
HI 1	5101	543,404.93	171,027.05	+ 0 02 30

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ OR θ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH * (From south)	CODE

QD 298

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191552 STATION 1019
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1,5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 535
 Rev. Aug. 1965

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **KAMAKAIA (HTS)** STATE: **Hawaii** COUNTY: **Hawaii**

CHIEF OF PARTY: L. C. Wilder YEAR: 1949		Described by: C. J. Hoepfel	
NOTE*	HEIGHT OF TELESCOPE ABOVE STATION MARK 1.11 METERS.	HEIGHT OF LIGHT ABOVE STATION MARK METERS.	
	Surface-station mark, Underground-station mark	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION	
	OBJECT	BEARING	DIRECTION
			Feet Meters
	PUU ULAULA (KAU) (HTS) ✓		00 00 00 =
120°	R. M. 2 =	NW = 35.056 =	100 53 14 =
120°	R. M. 1 =	E = 18.244 =	248 20 15 =

Detailed description:

The station is located on the summit of the most westerly of three volcanic cones which lie in the Kau Desert about 11 miles southwest of the Hawaiian National Park Headquarters, about 11 miles northeast of Pahala, about 6 miles northwest of the sea, about 3 miles southeast of the highway which runs between Hilo and Naalehu and about 0.3 mile south of a well marked trail which leads southwest from the Kilauea Volcano area.

To reach from the post office at Naalehu; go northeast, on the road which leads toward Hilo, for 18.5 miles to a point where a dirt road leads north toward the Kapapala Ranch; continue northeasterly, toward Hilo, for 4.7 miles to several sheds on the left hand side of the highway; turn right and go across country, southeast, for about 1 mile

to a wire fence and the end of truck travel. From this point, cross over the fence and pack southeast for about 2 miles to the westerly cinder cone and the station.

The station is the center of a 1 1/2 inch iron bar which projects about 2 1/2 feet from the top of a triangular slab of concrete which is about flush with the surrounding rock.

Reference mark number 1 is a standard disk, stamped **KAMAKAIA NO 1 1949**, set into a drill hole in a boulder which is flush with the surface of the ground and is about 3 feet lower than the station.

Reference mark number 2 is a standard disk, stamped **KAMAKAIA NO 2 1949**, set into a drill hole in a boulder which is flush with the surface of the ground and is about 4 feet lower than the station.

This station was monumented in 1938, with a concrete instrument platform and metal pole and target. At that time they recovered a drill hole in a triangle cut in a set stone, surrounded by three marked stones each 32 inches away, and a large stone cairn. The 1 1/2 inch iron bar mentioned in the above description was centered over the drill hole. 1938 recovery was by the Hawaii Territory Survey. No information is available as to how the original station was marked.

* Refer to notes in manuals of triangulation and state publications of triangulation. † Direction-angle measured clockwise, referred to initial station.
 † To nearest meter only, when no trigonometric leveling is being done. 16-52205-1 U. S. GOVERNMENT PRINTING OFFICE

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **KAMAKAIA HTS** OBS BY **CGS**
 STATE: **HAWAII** YEAR: **1949** **FIRST** ORDER
 SOURCE: **G-16241**

GEODETIC LATITUDE: 19 18 14.36250	ELEVATION: 803.4 METERS
GEODETIC LONGITUDE: 155 22 26.57912	2636 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	∠ OR Δ OR ∠
HI 1	5101	543,428.56	170,927.05	+ 0°02'30"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE ∠ OR Δ OR ∠ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
KAKAPULU	143 47 09.9	143 44 40	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

34 073

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1019

LATITUDE 0' TO 0'
 LONGITUDE 0' TO 0'
 DIAGRAM

KAMAKAIA (HTS) (continued)

FORM 526a
 (6-18-60)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KAMAKAIA (HTS)
 ESTABLISHED BY: L.C. Wilder YEAR: 1949 STATE: Hawaii
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 Island: Hawaii

HEIGHT OF TELESCOPE ABOVE STATION MARK 1.65 METERS, HEIGHT OF LIGHT ABOVE STATION MARK METERS.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
KOAE (HTS) -----1949 DISTANCE	and DIRECTION			00 00 00.0
RM No. 1	E	18.244	5.555	58 01 36
RM No. 2	NW	35.056	10.685	270 34 35
KOAE (HTS) 1949 ---1967 DISTANCE	and DIRECTION			00 00 00.0
RM No. 1	E	18.276	5.571	58 08 56
RM No. 2	NW	34.917	10.643	270 34 34

Station was recovered and all marks found in good condition. Discrepancies were noted in the distances to reference marks; they were checked and the 1967 distances are correct. A complete description follows:

Station is located about 11 miles southwest of the Hawaii Volcanoes National Park Headquarters, 10 miles northeast of Pahala, 2-3/4 miles southeast of State Highway 11, and 1/2 mile southeast of the Kau Desert Trail, in the Kamakaila Hills on the most southwesterly and lower 1 of 3 volcanic cones, at about 2633 feet elevation.

To reach station from the headquarters building at the Hawaii Volcanoes National Park, go westerly on Crater Rim Road for 1.8 miles; turn right and go 0.1 mile; turn left on State Highway 11 and go southwest for 10.4 miles to highway milepost No. 41. Continue on the highway for 0.75 mile to a board gate on left, just beyond power pole 119 and across road from a metal gate. Go left, through the board gate, and follow dirt road southeast across rough lava area for 0.7 mile to fence line and end of truck travel. Pack southeast on a direct course towards station hill, which can be seen from here, for about 2-1/2 miles to station. About 2 hours required to pack to station.

Station is marked by a 3-inch-diameter hole in the center of a triangular, concrete platform that is 7 feet on each side and is flush with rocks. A 2-inch steel shaft was formerly mounted vertically over center of hole but the 3 iron legs that supported it have rusted off. The words "KAMAKAIA HTS" are inscribed in the platform.

Reference mark number one is a standard disk stamped "KAMAKAIA RM NO 1 1949", cemented in a drill hole in a bedrock outcrop on southeast point of hilltop, 2 feet lower than station mark.

Reference mark number two is a standard disk stamped "KAMAKAIA RM NO 2 1949", cemented in a drill hole in an outcrop of bedrock 2 feet in diameter and projecting 1 foot above ground. It is 3.3 feet lower than station mark.

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

NOTE - One of these forms must be used for every station recovered.

USCOMM-DC 27178-P99

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KAMAKAIA HTS
 ESTABLISHED BY: L.C. Wilder YEAR: 1949 STATE: Hawaii BENCH MARK ALSO
 RECOVERED BY: J.A. Critchlow YEAR: 1977 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: About 10 miles northeast of Pahala
 HEIGHT OF TELESCOPE ABOVE STATION MARK 5 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 5 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
KAKAPULU 1949				00 00 00.0
RM 1	E	19.51	5.945	134 23 55
RM 2	NW	35.34	10.710	347 16 50
HVO 123 USGS	NE	1.085	0.330	76 21

The station mark was a 3-inch diameter hole and was recovered. At this time a station mark disk was cemented in the center of the hole. Reference marks 1 and 2 were recovered in poor condition due to the loose cinder around them and no suitable place was found to reset them. A difference was noted in distance and direction to reference marks 1 and 2, the distance was compared to the 1967 data and the direction was compared to the 1949 data. The difference to reference mark 1 being 0.374 meters longer and 17 minutes, 03 seconds. The difference to reference mark 2 being 0.037 meters longer and 02 minutes, 43 seconds. The station was reached by helicopter at this time and except for the following changes was recovered as described in 1967.

The station mark is a NGS disk stamped KAMAKAIA HTS 1949 1977, cemented in the center of a triangular shaped concrete platform that projects about 1/4 inches on each side from the rest of the rock surface that surrounds it.

HVO 123 is a USGS disk stamped HVO 123 GEODINETER REFERENCED POINT, cemented in the triangular shaped concrete platform that the station mark is in and just northeast of the station mark disk.

*Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 SUPERSEDES CGS FORM 526A WHICH MAY BE USED.
 (1-72)

U.S. DEPARTMENT OF COMMERCE

U.S. GPO: 1976-645-641/1220 Anglen 6

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 151552 STATION 1021
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1.5 HAWAII

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **KAMAKAMAKA (HTS)** State: **Hawaii** COUNTY: **Hawaii**

CHIEF OF PARTY: **L.G. Wilder** YEAR: **1949** Described by: **G.B.G.**

NOTE*	HEIGHT OF TELESCOPE ABOVE STATION MARK METERS.1	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION		HEIGHT OF LIGHT ABOVE STATION MARK METERS.	
		OBJECT	BEARING		DISTANCE feet meters
12a		R.M. No.1	NE	24.570 7.489	0 00 00 275 59 52.6

Detailed description:
 An old Hawaii Territory Survey station located in the district of Kau, in the southeast part of Hawaii, about 1 1/4 miles above the main government road around the island and about 4 1/2 miles north of Pahala village. The old station as recovered by the H.T.S. in 1938 was a 2 inch pipe in triangular shaped concrete monument 2 1/2 feet high marked KAMAKAMAKA 1904-E. In 1938 the station was marked by the H.T.S. with a triangular concrete monument six feet on each side. Over the old mark a 2 1/2 inch pipe with three steel legs was cemented in the concrete monument and centered over the old mark. In this 2 1/2 inch pipe was placed a 10 foot two inch pipe with metal target at the top. When visited and observed in 1949 the station was the same as built in 1938.

Reference mark No.1 is a standard disk cemented in drill hole in solid rock outcrop northeast of the station and about the same elevation. To reach the station from Pahala: proceed northerly along the main road to Wood Valley a distance of about 4.8 miles to a point where road turns sharply to left and continues into Wood Valley. At this sharp turn in the road take a side road leading to the right and go 0.2 miles, turn right through a gate and go easterly on bladed road for 0.3 miles, turn sharp right and follow dim track road south for 0.3 miles. Here turn left and pick way east across country for 0.2 miles to station.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **KAMAKAMAKA (HTS)**
 ESTABLISHED BY: **L.C. Wilder** YEAR: **1949** STATE: **Hawaii** BENCH MARK(S) ALSO
 RECOVERED BY: **D.M. Whipp** YEAR: **1967** COUNTY: **Hawaii**
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: **Island: Hawaii**

R

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station was recovered and both marks found in good condition. The area is now covered with a heavy growth of Silk Oak trees up to 40 feet tall. A complete description follows:

Station is located about 4 miles north of Pahala, 1-1/4 miles west-northwest of State Highway 11 and 3/4 mile southeast of a plantation camp; on a low rise in timber, 0.6 mile south-southeast of a fence corner and 80 yards east-southeast of a bulldozed strip running along the east side of a woven-wire fence.

To reach station from the post office in Pahala, go northeast on Pikake St., and continue on the macadam road through cane fields, for 4.6 miles to fork. Take right fork, graveled road, and go 0.2 mile to fork. Take right fork and go 0.3 mile to very dim side road right. Go right for 0.2 mile to wire gate at fence corner. Pass through gate and follow bulldozed strip southwest for 0.6 mile to end of truck travel where road passes over small rise. Walk left up gradual rise through trees for about 80 yards to station. (NOTE: The bulldozed strip continues southwest and comes out by station KAPOHO (HTS) 1949).

FORM CGS-526 (1-55)
 USCOM-DC 1800-PE6

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEOD. SURV.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **KAMAKAMAKA HTS**

STATE: **HAWAII**

YEAR: **1949**

SECOND

ORDER

SOURCE: **G- 9279**

GEODETIC LATITUDE	19 15 30.987	ELEVATION	568.5 METERS
GEODETIC LONGITUDE	155 27 56.133		1865 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ or ANGLE
HI 1	5101	511,867.21	154,432.28	+ 0 00 41

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ or FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From north)	PLANE AZIMUTH* (From north)	CODE
KAPAPALA	320 10 49.4	320 10 08	5101

JUN 1978
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 191552 STATION 1021
LATITUDE ° ' TO ° '
LONGITUDE ° ' TO ° '
DIAGRAM

KAMAKAMAKA (HTS) (continued)

Station mark is the center of a 2-1/4-inch iron pipe in the center of a triangular, concrete platform about 7 feet on each side and projecting 8 inches. A 2-inch steel shaft about 2 feet long is centered vertically over the pipe and supports a red and white metal target 8 feet tall.

Reference mark number one is a standard disk stamped "KAMAKAMAKA NO 1 1949", cemented in a drill hole in the top of a sloping lava slab about 12 feet long. It is at about same elevation as station platform.

NOTE: A discrepancy in the horizontal distance to the reference mark was noted and checked, and the 1967 distance is correct. It is believed that the 1949 distance is slope distance from top of steel shaft as the present slope distance coincides with it.

KAPAPALA	-----1949	DISTANCE and DIRECTION-----	00	00	00.0
R.M. No. 1	NE	24.570 ft. 7.489 m	275	59	52.6
	-----1967	DISTANCE-----			
RM No. 1	NE	24.381 ft. 7.432 m			

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: KAMAKAMAKA (HTS) STATE: Hawaii BENCH MARK(S) ALSO
ESTABLISHED BY: L.C. Wilder YEAR: 1949 COUNTY: Hawaii
RECOVERED BY: J.M. Collom YEAR: 1969
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN:

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station recovered in good condition. 1967 description adequate.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 151552 STATION 1022
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

Kamehame (Hawaii Island, Hawaiian Government Survey, 1897; E. R. Hand, 1914).—On the southern coast of Hawaii, in southern Ka-u, in the land of Moaula, on the summit of the first cinder cone, Kamehame Hill, on the shore east-northeast of Punaluu and distant therefrom 2½ miles. Originally marked by a triangle cut in the rock. In 1914 a standard bronze disk was set inside this triangle. A cairn at the station is 14 feet through at base and 12 feet high, with terraced sides. It is but 4 or 5 feet from the eroding edge of the cliff. A reference mark was accordingly set in 1914, a very large boulder was placed in a pit on crest of the hill and marked with drill hole and crows foot; the drill hole is 10.9 meters (36 feet) from the station in azimuth 170° 42.9'. Cairn was whitewashed.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM NO. 508

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **KAMEHAME** STATE: **Hawaii** COUNTY: **Hawaii**.
 ESTABLISHED BY: **Hawaiian Gov. Survey** YEAR: **1897** LOCALITY: **Southern Coast of Hawaii**.
 RECOVERED BY: **K. T. Adams** YEAR: **1929**.

Detailed statement as to the fitness of the original description:

Station found as described, except that it is now "about 2 feet from the eroding edge of the cliff".

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM NO. 508

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **KAMEHAME**
 ESTABLISHED BY: **Haw. Govt. Survey** YEAR: **1897** STATE: **HAWAII**
 RECOVERED BY: **L. O. Wilder** YEAR: **1949** COUNTY: **HAWAII**

Detailed statement as to the fitness of the original description:

The 1914 station was recovered in good condition and the distance to the reference mark was checked. This station was originally established by the Hawaiian Government Survey in 1897 and was marked by a triangle carved into a rock. In 1914 E. R. Hand of the U. S. Coast and Geodetic Survey recovered the original station and set a standard disk in the center of the carved triangle but made note of the fact that the disk was only 4 or 5 feet from the eroding edge of a bluff and in order to preserve the position of this station he established a reference mark in a large boulder. The reference mark is a drill hole and crows foot and is 10.9 meters from the station disk in azimuth 170-42.9'. In 1938 the Hawaiian Territory Survey established a new station 41.5 feet northwest of the original station which they named **KAMEHAME NEW** and it was this station which was used in the 1949 survey. The original station is now about 6 inches from the edge of the bluff.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **KAMEHAME**
 ESTABLISHED BY: **HGS** YEAR: **1897** STATE: **Hawaii** BENCH MARK(S) ALSO
 RECOVERED BY: **D.M. Whipp** YEAR: **1967** COUNTY: **Hawaii**
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: **Island: Hawaii**

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station is gone. The edge of the bluff has eroded away until it is now about 2 feet beyond where station was located.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **KAMEHAME**

STATE: **HAWAII**

YEAR: **1897**

SECOND

ORDER

SOURCE: **G- 9279**

NO OBSERVATION CHECK ON THIS POSITION

GEODETIC LATITUDE:	19° 08' 51.978	ELEVATION:	17.0 METERS
GEODETIC LONGITUDE:	155 28 07.461		56 FEET

STATE COORDINATES (Feet)

STATE & ZONE	CODE	X	Y	PLANE AZIMUTH ANGLE °
HI 1	5101	510,789.14	114,183.22	+ 0 00 37

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE PLANE AZIMUTH FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From north)	PLANE AZIMUTH * (From north)	CODE
POSITION DETERMINED BY TRAVERSE FROM STATION KAMEHAME NEW			

QE 265

JUN 1978

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the

NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 191552

STATION 1023

LATITUDE ° ' TO ° '
LONGITUDE ° ' TO ° '
DIAGRAM

KAMEHAME NEW (HTS) (continued)

FORM 526a
(2-18-69)U.S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: KAMEHAME NEW (HTS)
ESTABLISHED BY: L.C. Wilder YEAR: 1949 STATE: Hawaii
RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
Island: HawaiiHEIGHT OF TELESCOPE ABOVE STATION MARK 1.2 METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.
DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
PUNALUU -----1949 DISTANCE AND				
RM No. 1	E	12.828	3.910	00 00 00.0 178 16 21
Honuapo Stack	SW	7 miles		318 45 44.5
PUNALUU 1949 -----1967 DISTANCE AND				
RM No. 1	E	12.748	3.886	00 00 00.0 178 16 30
Honuapo, Hutchinson Sugar Plan- tation Mill, stack, 1949	SW			318 45 36.8

Station mark and reference mark number one were recovered in good condition. Old station KAMEHAME (HGS) 1897 is gone due to erosion of edge of bluff. A complete description follows:

Station is located along southern east of the island, about 3-1/2 miles south of Pahala and 2-1/2 miles east-northeast of Punaluu, on a cinder hill of about 53 feet elevation that has low brush on it and is easily identified because of its green color when seen from up on State Highway 11. The hill terminates in a sheer bluff on the south side and

overlooks the first black sand beach along the coast eastward from Punaluu.

To reach station from the post office in Pahala, go southeast on Pi-kake St. for 0.2 mile; turn right on State Highway 15 and go 0.85 mile; turn right and go southwest on State Highway 11 for 3.8 miles; turn left on the Punaluu road and go southeast downgrade for 0.75 mile; turn left onto old railroad grade and go 0.35 mile to end of road at old concrete foundations. Walk easterly on beach trail for about 2-1/2 miles to station; packing time about 2 hours.

Station mark is the center of a 2-1/2-inch iron pipe that projects 16 inches from the center of a triangular, concrete platform that is 7 feet on each side and projects 6 inches above ground. The words "KAMEHAME NEW HTS" are inscribed in the concrete platform. Station is now 40 feet northwest of edge of bluff.

Reference mark number one is a standard disk stamped "KAMEHAME NO 1 1949", cemented in a drill hole in a 3 x 4-foot, square boulder that projects 20 inches above ground, and is about 1-1/2 feet lower than top of station pipe. NOTE: the reference mark is in the same rock as the "drill hole and crows foot" reference mark established by E.R. Hand in 1914, and is 8 inches east of that mark.

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

NOTE - One of these forms must be used for every station recovered.

USCOMM-DC 37179-P88

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: KAMEHAME NEW HTS
ESTABLISHED BY: L.C. Wilder YEAR: 1949 STATE: Hawaii
RECOVERED BY: L.A. Critchlow YEAR: 1977 COUNTY: Hawaii
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN:
HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.BENCH MARK ALSO

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
PUU ULAULA HTS 1914				
RM 1	E	12.75	3.886	00 00 00.0 05 16 23
PAHALA MAU SUGAR CO. STACK	NE	3 miles		219 50 56.9
RM 3	N	16.14	4.919	333 56 14
RM 1 to RM 3		20.80	6.342	

The station and reference mark 1 were recovered in good condition. The distances and directions measured on this date compare favorably with the 1949 and 1967 measurements. A new reference mark 3 was established. The 1967 recovery note is adequate with the following additions.

To reach the station from the intersection of Pi-kake and Kamani Streets, just north of the Pahala Post Office, go east on Kamani Street 0.4 mile to the intersection of State Highway 11. Turn right and go southwest along highway 11 for 0.75 mile to side road left and metal gate. Turn left through gate and follow dirt road toward city dump for 0.5 mile to fork. Take right fork and go south 0.4 mile to a locked gate. Pass through gate and turn right, go south 0.3 mile to wooden gates. Turn left and follow along north side of fence 0.15 miles to metal gate. Pass through gate and continue 2.05 miles to road fork. Turn right and follow road along beach 0.15 miles. Pack southwest along beach for 0.5 mile to small hill and the station site. The station is located on Parker Ranch property.

Reference mark 3 is a NGS disk stamped, KAMEHAME NEW 1949 NO 3 1978, cemented in a rock outcrop flush with the ground and about 2 feet lower than the station.

*Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 SUPERSEDES CGS FORM 526A WHICH MAY BE USED.
(1-72)

U.S. DEPARTMENT OF COMMERCE
NOAA
1976-563-641/1270 Rev 10/6

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191552 STATION 1023
 HAWAII
 LATITUDE 19 ° 00' TO 19 ° 30'
 LONGITUDE 155 ° 00' TO 155 ° 30'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 583
 Rev. Aug. 1968

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: KAMEHAME NEW (HTS) State: HAWAII COUNTY: HAWAII KAU DISTRICT HAWAII

CHIEF OF PARTY: L. C. WILDER YEAR: 1949 Described by: G. J. HOEPEL

NOTE*	HEIGHT OF TELESCOPE ABOVE STATION MARK METERS.	HEIGHT OF LIGHT ABOVE STATION MARK METERS.	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION			
			BEARING	DISTANCE		DIRECTION:
	Surface-station mark, Underground-station mark			feet	meters	
12c						00 00 00
						13 31 38.1
						233 02 15
						292 19 39
	OBJECT					
	KIPAEPAE (metal target)	SW	7 miles			
	Honuapo Stack	E	12.828	3.910		
	R. M. 1	SE	41.53	12.661		
	KAMEHAME					

The station is located on the summit of a prominent cinder hill which lies about 4 miles south of Pahala, about 2 1/2 miles east northeast of Punaluu, 2 1/2 miles southeast of the road which runs between Hilo and Naalehu, about 75 feet northwest of the sea and 42 feet northwest of the edge of a steep bluff.

To reach from the post office at Naalehu; go northeast, on the road which leads toward Hilo, for 3.5 miles; pass the sugar mill in the village of Honuapo and go northeasterly, toward Hilo, for 5.0 miles; turn right, as per the sign reading Punaluu, and go southeast for 0.75 mile; turn left, onto an old railroad grade, and go southeast for 0.35 mile to the end of the road at the site of an old warehouse. From this point pack east southeast, along the beach, for about 2 1/2 miles to the station.

The station is the center of a 2 1/2 inch pipe which projects about 2 feet from the top of a triangular slab of concrete which is about 6 feet on each side and is about 6 inches higher than the ground.

Reference mark number 1 is a standard disk, stamped KAMEHAME NO 1 1949, set into a drill hole in a boulder which is about five feet in diameter and projects about 2 feet. It is located about the same elevation as the station.

KAMEHAME is a standard disk, unstamped, set into a drill hole in a flat boulder which is flush with the surface of the ground and is about 1 foot higher than the station. It lies about 6 inches northwest of the edge of the sea bluff.

* Refer to notes in manuals of triangulation and state publications of triangulation. † Direction-angle measured clockwise, referred to initial station.
 ‡ To nearest meter only, when no trigonometric leveling is being done.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KAMEHAME NEW HTS OBS BY CGS
 STATE: HAWAII YEAR: 1949 FIRST ORDER

SOURCE: G- 9279

GEODETIC LATITUDE: 19 08 52.34900	ELEVATION: 16.5 METERS
GEODETIC LONGITUDE: 155 28 07.64900	54 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ ± ANGL °
HI 1	5101	510,771.11	114,220.64	+ 0°00'37"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ ± FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
PJU ULAULA HTS	209 ° 40' 16.4	209 ° 39' 39"	5101

THESE DATA ARE OBTAINED FROM ADJUSTMENT OF 1951

3M 074

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 151552 STATION 1024
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 533
 Rev. Aug. 1963

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **KAPAPALA** STATE: **Hawaii** COUNTY: **Hawaii**

CHIEF OF PARTY: **L. C. Wilder** YEAR: **1949** Described by: **C. J. Hoepfel**

NOTE: HEIGHT OF TELESCOPE ABOVE STATION MARK **1.69** METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.

NOTE	OBJECT	BEARING	DISTANCE		DIRECTION
			feet	meters	
	KAHAHA 2 =				00 00 00 =
12a	R. M. No. 1 =	NE =	52.471 =	15.994 =	91 59 10 =
12a	R. M. No. 2 =	WSW =	40.572 =	12.368 =	318 22 09 =
	KOPOHO (HTS) = 1 mile =	W =			335 42 19.8 =
	Azimuth mark - 500 feet =	W =			340 51 20.5 =

The station is located in rocky pasture land about 5 1/2 miles northwest of Kapoo Point, about 3 miles northeast of Pahala, about 2 1/2 miles south of the Kapapala Ranch, about 150 yards south of the road which runs between Naalehu and Hilo and on the summit of a low lava mound. To reach from the post office at Naalehu; go northeast, on the road which leads toward Hilo, for 12.3 miles; continue straight ahead, on the road toward Hilo, for 3.3 miles; cross over a dry wash and continue toward Hilo for 0.9 mile to the end of truck travel at the side of the road. From this point, cross over the wire fence and pack southeasterly for about 150 yards to the station.

The station is a standard disk, stamped KAPAPALA 1949, set into a drill hole in lava bedrock which projects about 5 feet.

Reference mark number 1 is a standard disk, stamped KAPAPALA NO 1 1949, set into a drill hole in lava bedrock which projects about 8 feet and is about the same elevation as the station.

Reference mark number 2 is a standard disk, stamped KAPAPALA NO 2 1949, set into a drill hole in lava bedrock which projects about 3 feet and is about the same elevation as the station.

The azimuth mark is a standard disk, stamped KAPAPALA 1949, set into a drill hole in bedrock which projects about 8 feet. It is located about 500 feet west of the station, 51 feet west of the center line of the highway and 11 feet west of a wire fence.

* Refers to notes in manuals of triangulation and state publications of triangulation. † Direction-angle measured clockwise, referred to initial station.
 ‡ To nearest meter only, when no trigonometric leveling is being done.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **KAPAPALA** OBS BY **CGS**
 STATE: **HAWAII** YEAR: **1949** **FIRST** ORDER
 SOURCE: **9279**

GEODETIC LATITUDE	19 14 25.91700	ELEVATION	473.0
GEODETIC LONGITUDE	155 26 59.89700	METERS	1552
		FEET	

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ OR ANGLE
HI 1	5101	517,256.83	147,970.69	+ 0° 00' 59"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ OR FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
KAPAPALA AZ MK	101 02 29.7	101 01 30 "	5101

THESE DATA ARE OBTAINED FROM ADJUSTMENT OF 1951

3M 077

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1024
 LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

KAPAPALA (continued)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KAPAPALA
 ESTABLISHED BY: L.C. Wilder YEAR: 1949 STATE: Hawaii
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 Island: Hawaii

R

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
PUU ULAULA (HTS) 1914	WSW	40.572	12.368	00 00 00.0
RM No. 2	W	500	Feet	103 18 41
Azimuth mark	NE	52.471	15.994	125 47 52.5
RM No. 1	WSW	40.524	12.352	00 00 00.0
PUU ULAULA (HTS) 1914	WSW	40.524	12.352	103 19 53
RM No. 2	WNW	about 175	yards	125 47 53.3
Azimuth mark	NE	52.385	15.967	236 55 25
RM No. 1				

Station was recovered and all marks found in good condition. A complete description follows:

Station is located about 3 miles north-northeast of Pahala and 2-1/2 miles south of the Kapapala Ranch headquarters, at about 1546 feet elevation, on a mound about 8 feet higher than surrounding area, in the brushy land along the southeast side of State Highway 11. It is about 150 yards southeast of the highway and pole No. 191, and 200 yards north-

east of a highway sign "ELEV. 1500 FT".

To reach station from the post office in Pahala, go south on Pikake St. for 0.2 mile to crossroad. Turn left on State Highway 15 and go 0.5 mile to junction with State Highway 11. Turn left and go northeast on State Highway 11 for 3.1 miles to top of long grade and power pole No. 191 on the right. From here walk southeast about 150 yards to station.

Station mark is a standard disk stamped "KAPAPALA 1949", cemented in a drill hole in lava bedrock, 11 feet southeast of a white witness post. Reference mark number one is a standard disk stamped "KAPAPALA NO 1 1949", cemented in a drill hole in bedrock near the top of a large, sloping bedrock slab on side of mound northeast of station. It is about 8 inches higher than station mark.

Reference mark number two is a standard disk stamped "KAPAPALA NO 2 1949", cemented in a drill hole in bedrock on a ledge extending west from station mound. It is .72 foot lower than station mark.

Azimuth mark is a standard disk stamped "KAPAPALA 1949", cemented in a drill hole in the top of a black lava mound about 7 feet high, along the northwest side of the highway, 11.5 feet northwest of fence line, 51 feet northwest of center line of highway, and 250 feet southwest of power pole No. 191.

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

NOTE - One of these forms must be used for every station recovered.

USCOMA-DC 27173-P89

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: KAPAPALA
 ESTABLISHED BY: L.C.W. YEAR: 1949 STATE: Hawaii BENCH MARK ALSO
 RECOVERED BY: L. A. Critchlow YEAR: 1977 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 3 miles NNE of Pahala
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
PUU ULAULA HTS 1914	SSW	About 3 miles		00 00 00.0
PAHALA KAU SUGAR CO STACK	SW	40.53	12.351	58 52 14.4
RM 2	W	0.25	mile	103 19 27
Azimuth Mark	N	10236.91	3120.217	125 48 02.2
EM 1855 USGS	NE	52.40	15.973	219 08 16.40
RM 1		85.53	26.071	236 55 31
RM 1 to RM 2				

The station mark, azimuth mark, and reference marks 1 and 2 were recovered in good condition. The directions to the reference marks measured on this date compared favorably with the 1949 and 1967 measurements. The direction to the azimuth mark differed by about 10 seconds from the 1949 and 1967 measurements. The distances to the reference marks measured on this date differed from the 1949 measurements by a small amount but compared favorably with the 1967 measurements. The 1967 recovery note is adequate.

Office Note: EM 1855 USGS is EM USGS positioned by NGS in 1977.

*Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 SUPERSEDES CGS FORM 826A WHICH MAY BE USED (1-72)

U.S. DEPARTMENT OF COMMERCE
 NOAA

U.S. GPO: 1976-665-641/1720 Page 4

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191552 STATION 1025
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 535 D

DESCRIPTION OF TRIANGULATION INTERSECTION STATION

NAME OF STATION: KAPOHO (HTS) YEAR: 1949 STATE: Hawaii COUNTY: Hawaii

CHIEF OF PARTY: L. C. Wilder

Description, including sketch of object: The station is the center of the steel target at triangulation station KAPOHO which was established by the Hawaiian Territory Survey.

The station is located about 3 miles north north-east of Pahala; about 2.5 miles south southwest of the Kapapala Ranch and just east of a line of trees;

To reach from the post office at Pahala; go easterly for 0.5 mile; turn left and go northeast, on the road which leads toward Hilo, for 2.2 miles; turn left, pass through a board gate, and follow the old highway, northeasterly for 0.4 mile; turn left, pass through a board gate and go across country, through open pasture land for 0.8 mile in a westerly direction, to the station.

The station target is set in the center of a triangular slab of concrete which is about 6 feet on each side. Top of the target is 8.95 feet higher than the concrete platform.

This station was recovered in 1938 by the Hawaii Territory Survey and a concrete instrument platform, metal pole and target built. At that time they recovered a 2-inch pipe in a triangular monument with KAPOHO 1904 E. marked in the concrete.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KAPOHO (HTS)
 ESTABLISHED BY: L.C. Wilder YEAR: 1949 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: Island: Hawaii

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station was recovered in good condition. A complete description follows: Station is located about 3 miles north-northeast of Pahala and 1 mile northwest of State Highway 11, on a low rise in a brush-covered area, about 45 yards southwest of the edge of a cleared area planted in macadamia bushes, and 150 yards southeast of a stone wall at the northwest end of the cleared area.

To reach station from the post office in Pahala, go south on Pikake St. 0.2 mile to crossroad. Turn left on State Highway 15 and go 0.5 mile to junction with State Highway 11. Turn left and go northeast on State Highway 11 for 2.1 miles to board gate on left, just before reaching power pole No. 200. Pass through gate and follow old, narrow, macadam road for 0.5 mile to a gate on the left. Pass through gate, go 30 yards, then take right fork and follow track road across macadamia field for 0.5 mile to a fork by fence corner on right. Take left fork and go 0.3 mile to T-junction of track roads by stone wall. Go left 25 yards, then take left fork on a 45° angle away from stone wall, and go 0.1 mile into brush, and station in right curve of the track road.

Station is marked by a 2-1/4-inch iron pipe projecting 2 inches from the center of a triangular, concrete platform, 7 feet on each side and projecting 1 foot above ground. A 2-inch, steel shaft, 2 feet long, is centered vertically over the pipe, supported by 3 iron legs embedded in the concrete platform, and supports a removable, red and white target 8 feet tall. Station is 100 feet northwest of the northwest 1 of 2 large Silk Oak trees.

KAMAKAIA (HTS) 1949 00° 00' 00.0 "
 KAPAPALA 1949 40 11 48.2
 PUU ULAULA (HTS) 1914 81 12 03.3

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KAPOHO HTS

STATE: HAWAII

YEAR: 1949

THIRD

ORDER

SOURCE: G- 9279

GEODETIC LATITUDE	19° 14' 33.55	ELEVATION	500.0 METERS
GEODETIC LONGITUDE	155 28 37.65		1640 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	PLON Δ ANGLE *
HI 1	5101	510,764.85	148,638.26	+ 0 00' 37"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE PLON Δ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE

QE 195

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1026
 HAWAII
 LATITUDE 19 00' TO 19 30'
 LONGITUDE 155 00' TO 155 30'
 DIAGRAM NE 5-15 HAWAII

DESCRIPTION TRIANGULATION STATION

NAME OF STATION: KAU (HGS)
 ESTABLISHED BY: L.A. Critchlow YEAR: 1977 STATE: Hawaii COUNTY: Hawaii BENCH MARK ALSO
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: In Pahala.
 HEIGHT OF TELESCOPE ABOVE STATION MARK $\frac{1}{2}$ FEET. HEIGHT OF LIGHT ABOVE STATION MARK $\frac{1}{2}$ FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
		FROM THE GROUND AT THE STATION		
PUU ULAULA MTS 1914	SE	79.035	24.037	00 00 00.0
M 2	N	24.18	7.371	27 18 17
M 1		97.86	29.829	251 19 49
M 1 to M 2				

The station is located in the west edge of Pahala, 0.1 mile west of the junction of Pihake and Kamani Streets and in the center of Kamani Street.

To reach the station from the post office in Pahala, go north on Pihake Street for 0.1 mile to the junction of Kamani Street. Turn left and go west on Kamani Street for 0.1 mile to the station.

Station mark, stamped KAU 1977, is a State of Hawaii Survey disk set in a round concrete monument which is about 1 1/2 inches in diameter and flush with the surface of the street. It is 23 feet southeast of a power pole and 20.7 feet west of a T-road north (Puahala Street). There is an underground disk with the same stamping as the surface disk set in an irregular mass of concrete about 3 feet below the street surface. (Note desc)

Reference mark 1, stamped 1, is a railroad spike with a punch hole marking the center cemented in a drill hole in a 2 by 3 foot concrete base of a telephone booth. It is 2 feet north of a telephone pole, 23 feet north of center of Kamani Street and 35 feet southeast of the center of Puahala Street. (Note desc) (about 1.4 feet higher than station)

Reference mark 2, stamped 2, is a railroad spike with a punch hole marking the center cemented in a drill hole in a 5 foot diameter concrete base of an emergency warning system pole. It is about 0.6 feet southeast of the emergency warning system pole, 6.6 feet east of a fence line, 35 feet south of center of Kamani Street and about 2 feet lower than the station. (Note desc)

* Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 SUPERSEDES CGS FORM 520A WHICH MAY BE USED.
 (1-72)

U.S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL GEODETIC SURVEY

U.S. GPO: 1976-865-661/1220 Register 6

ADJUSTED HORIZONTAL CONTROL DATA

ADJUSTMENT BY NGS

NAME OF STATION: KAU HGS OBS BY NGS
 STATE: HAWAII YEAR: 1977 SECOND ORDER

SOURCE: G-16241

GEODETTIC LATITUDE:	19 32 19.95280	ELEVATION:	282.1 METERS
GEODETTIC LONGITUDE:	155 28 51.15409		926 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	9 HOR Δ 91 ANGLE °
HI 1	5101	506,597.97	135,161.40	+ 0 00 23 "

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE 9 HOR Δ 91 FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETTIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
PUU ULAJLA MTS	268 24 11.2	268 23 49 "	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

SM 081

JUN 1973
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

191552 STATION 1028
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-15 HAWAII

Kauhao (Hawaii Island, E. R. Hand, 1914).—In southern part of Hawaii, about 4 miles north by west from Pahala, and at a point where a well-known and conspicuous ridge, very narrow and steep, and trending about southeast and northwest, joins the main slope at right angles. This locality is called Ipuu. Reached by taking the homestead road which leaves the main road at Pahala, and proceeding north about 4 miles, when the ridge will be seen on the left distant about 1/2 or 3/4 mile. Proceed along the top of this ridge, crossing a slight saddle, and when this very narrow ridge begins to merge with the main slope, the station will be seen about 400 or 500 feet back in the same general direction as the line of the ridge. Marked by a truncated pyramid of concrete, with short iron pipe; pyramid is white, about 2 1/2 feet at base, and rests on a foundation of concrete and rock.

RECOVERY NOTE, TRIANGULATION STATION

R

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 585
 (REV. FEB. 1953)

NAME OF STATION: KAUAHO
 ESTABLISHED BY: E.R.Hand YEAR: 1914 STATE: Hawaii
 RECOVERED BY: L.C.Wilder YEAR: 1949 COUNTY: Hawaii

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station recovered as described in 1914. It was cut in only from station KAHAHA 2. No measurement was taken to it or cut in from any other station.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: KAUAHO
 ESTABLISHED BY: E.R. Hand YEAR: 1914 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: R.C. Munson YEAR: 1968 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: Island; Hawaii

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station mark was recovered in good condition. Located about 5 miles north-northwest of Pahala and 2-3/4 miles west-southwest of the Kapapala Ranch, at about 3480 feet elevation, on the timbered ridge on the south-west side of Wood Valley, about 300 yards east of a good trail and about 500 yards northeast of a water tunnel.

To reach station from the post office in Pahala, go northeast on Pikeake Street and Highway 151 for 2.4 miles to gravel road left, at power pole 87, just across bridge. Turn left and go 0.65 mile; take left fork and go 0.65 mile to fork; take right fork and go 0.55 mile to side road right. Turn right and go 0.25 mile to fork. Take left fork and go 0.5 mile to fork. Take left fork and go 0.05 mile; take right fork and go northeast along top edge of cane field for 0.35 mile to a point where metal flume on left is only 20 yards from road, and end of truck travel. Pack northeast along flume, keeping the right fork at each of 3 forks of flume, for about 1 mile to where flume enters tunnel. Go left uphill for 45 yards, turn right, and follow good trail around point for about 200 yards to an open, bowl-like gully on right (at mid-point along edge of bowl you are about on the azimuth from KAHAHA 2 to KAUAHO, but station is out of sight just beyond the point of ridge across bowl). Continue on trail about 100 yards to beginning of ridge on right. Leave trail and go southeast down along fern-covered ridge about 900 feet to station.

Station is marked by a 2-1/2-inch, iron pipe projecting 8 inches from the top of a truncated, 3-sided, concrete pyramid which is 3 feet on each side at the base and 10 inches at the top, and 26 inches high. It has "KAUAHO 1904 E" inscribed in the concrete on the southeast side of the pyramid. Station is on a slight point on the sloping, fern-covered ridge top, which also has a sparse covering of slender ohia trees.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KAUAHO
 STATE: HAWAII YEAR: 1914 THIRD ORDER
 SOURCE: G-92184

GEODETIC LATITUDE	19° 16' 10.577	ELEVATION	1061 METERS
GEODETIC LONGITUDE	155° 29' 49.219	SCALED	FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ 10R Δ 01 ANGLE
HI 1	5101	501,052.81	158,424.67	+ 0° 00' 04"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ 10R Δ 01 FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE

QF 085

JUN 1978
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191552 STATION 1029
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1,5 HAWAII

Keaiwa cairn (Hawaii Island, E. R. Hand, 1914).—In southern part of Hawaii, near the edge of the low cliffs at a small point $2\frac{1}{4}$ miles below Puu Ulaula (hill), which bears N. 72° W. (mag.) from the station. Marked by a large cairn, whitewashed.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KEAIIWA CAIRN

STATE: HAWAII

YEAR: 1914

THIRD

ORDER

SOURCE: G-92184

NO OBSERVATION CHECK ON THIS POSITION

GEODETIC LATITUDE:	19 11 28.99	ELEVATION:	METERS FEET
GEODETIC LONGITUDE:	155 24 09.10		

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ HOR Δ α ANGLE*
HI 1	5101	533,632.05	130,029.72	+ 0 01 55"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ HOR Δ α FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE

QF 087

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 151552 STATION 1030
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 535
 Rev. Aug. 1965

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: KEAKAPULU STATE: Hawaii COUNTY: Hawaii

CHIEF OF PARTY: L. C. Wilder YEAR: 1949 Described by: C. J. Hoepfel

NOTE*	HEIGHT OF TELESCOPE ABOVE STATION MARK METERS.†	HEIGHT OF LIGHT ABOVE STATION MARK METERS.†	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION			
			BEARING	DISTANCE		DIRECTION‡
	Surface-station mark, Underground-station mark					
	UWEKAHUNA (USGS)				00 00 00 -	
	B. M. (USGS)				141 29 -	
12a	R. M. 1	SSW -	01.144 -	0.350 =	204 39 06 -	
12a	R. M. 2	W -	15.406 -	4.697 =	315 56 06 -	
		NE -	23.490 =	7.161 =		

The station is located near the southernly edge of Keakapulu Flats at about a 4000 foot elevation. It is about 12 miles west southwest of The Hawaiian National Park Headquarters, about 7 miles north northeast of The Kapapala Ranch, about 3 miles northwest of the highway which runs between Hilo and Naalehu, about 0.7 mile north of Ainapo, about 100 yards east of the Ainapo Trail and 107 feet east of a large Koa tree.

To reach from the post office at Naalehu; go east and north, on the road which leads toward Hilo, for 18.5 miles to a point where a dirt road leads northwest, toward the Kapapala Ranch; continue straight ahead, toward Hilo, for 4.7 miles; pass shed and buildings to the left hand side of the road and continue northeast, on highway, for 0.1 mile;

turn left, pass through a board gate, and go northerly, on a dim track road for 1.5 miles; take the right hand fork and go northerly, up grade for 0.4 mile; pass through a board gate in a fence corner, bare right, and follow a dim track road northerly for about 1.5 miles to a ranch house at Ainapo; pass to the left hand side of dwellings and pick up the old Ainapo trail to the northeast of rock enclosure; follow the trail, which is marked by 2 inch pipes driven into the ground, northerly, for 0.9 mile to the edge of the bench land; turn right and go easterly, across country, for about 100 yards to the station.

The station is a standard disk, stamped KEAKAPULU 1949, set into a drill hole in bedrock which is flush with the surface of the surrounding rock.

Reference mark number 1 is a standard disk, stamped KEAKAPULU NO 1 1949, set into a drill hole in bedrock which is flush with the surface of the ground and is about the same elevation as the station.

Reference mark number 2 is a standard disk, stamped KEAKAPULU NO 2 1949, set into a drill hole in bedrock which is flush with the surface of the surrounding rock and is about the same elevation as the station.

The Bench Mark is a U.S. Geological Survey bronze disk set into a drill hole in bedrock which is flush with the surface of the surrounding rock and is the same elevation as the station. It is stamped 4089.

* Refer to notes in manuals of triangulation and state publications of triangulation. † To nearest meter only, when no trigonometric leveling is being done. ‡ Direction-angle measured clockwise, referred to initial station.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KEAKAPULU OBS BY CGS
 STATE: HAWAII YEAR: 1949 FIRST ORDER

SOURCE: 5-16241

GEODETIC LATITUDE	19 22 05.89401	ELEVATION:	1247.6 METERS
GEODETIC LONGITUDE	155 25 25.22516		4093 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	ϕ OR Δ OR ANGLE*
Hil 1	5101	526,307.47	194,272.48	+ 0° 01' 31"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE ϕ OR Δ OR FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
KAMAKAIA HTS	323° 46' 10.7"	323° 44' 40"	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979
 THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

SM 086

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1030
 LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

KEAKAPULU (continued)

FORM 526a
 (6-18-69)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

R

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KEAKAPULU
 ESTABLISHED BY: L.C. Wilder YEAR: 1949 STATE: Hawaii
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 Island: Hawaii

HEIGHT OF TELESCOPE ABOVE STATION MARK 1.62 METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION				
OHALE (HGS) 1897-----1949 DISTANCE and DIRECTION				00 00 00.0
B.M. (USGS)	SSW	1.144	0.350	111 48
R.M. 1	W	15.406	4.697	174 57 49
R.M. 2	NE	23.490	7.161	286 14 49
OHALE (HGS) 1897 -----1967 DISTANCE and DIRECTION				00 00 00.0
EM 4089 (USGS)	SSW	1.118	0.341	111 58 32
RM No. 1	W	14.950	4.557	174 56 58
RM No. 2	NNE	23.480	7.157	286 14 10

Station was recovered and all marks found in good condition. A complete description follows:

Station is located about 12 miles west-southwest of the Hawaii Volcanoes National Park Headquarters, 2-1/4 miles northwest of State Highway 11, 3/4-mile north of old house, 0.1 mile east of Ainapo Trail, and 700 feet southeast of a fence line, in brushy pasture, along the southeast edge of bench-land, where it begins to drop down to southeast.

To reach station from the Hawaii Volcanoes National Park Headquarters building, go west on Crater Rim Road 1.8 miles; turn right and go 0.1 mile; turn left and go southwest on State Highway 11 for 10.2 miles to metal gate on right. Pass through gate and go 0.1 mile; turn left and follow old macadam road southwest 1.1 miles to metal gate on right. Pass through gate and follow track road 1.8 miles to wooden gate at fence corner. Pass through gate and continue on road for 1.0 mile to old green house in trees. Pass to left of house and follow jeep road northerly for 0.75 mile. Leave road and go right, east through brush, for 0.1 mile to station.

Station mark is a standard disk stamped "KEAKAPULU 1949", cemented in a drill hole in bedrock flush with ground. It is 3.5 feet south-southeast of a white witness post, 107 feet east of a large, low, sprawling, koa tree, and at about 4091 feet elevation. A large cairn is built over station.

Reference mark number one is a standard disk stamped "KEAKAPULU NO 1 1949", cemented in a drill hole in bedrock in open area, at about same elevation as station mark.

Reference mark number two is a standard disk stamped "KEAKAPULU NO 2 1949", cemented in a drill hole in bedrock that projects 6 inches. It is 0.4 foot lower than station mark.

USGS Bench Mark is a standard USGS disk stamped "4089", cemented in a drill hole in bedrock at same elevation as station mark.

NOTE: A 4-wheel-drive vehicle is required to reach station. Key for locked gates was obtained at the Hawaiian Ranch Co. Office in Maalehu.

A discrepancy in distance to RM No. 1 was noted and checked; the 1967 distance is correct.

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

NOTE - One of these forms must be used for every station recovered.

27173-P89

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: KEAKAPULU
 ESTABLISHED BY: L.C. Wilder YEAR: 1949 STATE: Hawaii BENCH MARK ALSO
 RECOVERED BY: L.A. Critchlow YEAR: 1977 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 12 miles north of Pahala
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION				
MANAWAIA MTS 1949				00 00 00"
4089 USGS	SSW	1.12	0.341	63 28
RM 1	SW	15.40	4.694	127 10 24
RM 2	NE	23.48	7.159	238 26 44
RM 1 to RM 2		32.42	9.883	

The station mark, 4089 USGS, and reference marks 1 and 2 were recovered in good condition. The distance to reference mark 1 was found to be 0.137 m. longer than the 1967 measurement but compared favorably with the 1949 measurement. The distances to reference mark 2 and 4089 USGS and the directions to the reference marks and 4089 USGS measured on this date compared favorably with the 1949 and 1967 measurements. The 1967 recovery note is adequate with the addition of the following new to-reach description:

To reach the station from the junction of state highways 11 and 19 in Hilo, go south on State Highway 11 for 40.2 miles (about 12 miles south of Volcano National Park Headquarters) to a locked metal gate on the right. Pass through the gate and go northwest 0.1 mile to a T-road. Turn left and follow an old paved road southwest 1.1 miles to a metal gate on the right. Pass through the gate and follow a track road northwest 1.8 miles to a wooden gate at a fence corner. Pass through the gate and bear right on a dim track road 1.15 miles to a drain crossing just north of an old green house in a grove of trees. Continue north along the track road 0.55 mile to a side road on the right and a triangular-blazed tree on the left. Turn right and go northeast 0.15 mile to the end of the road at the station site. The station is located on Parker Ranch property.

*Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 15152 STATION 1031
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 533
 Rev. Aug. 1963

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: KEANAKAKOI ✓ STATE: Hawaii COUNTY: Hawaii

CHIEF OF PARTY: C.T. Husemeyer ✓ YEAR: 1949 ✓ Described by: G.B.G. ✓
 HEIGHT OF TELESCOPE ABOVE STATION MARK 1.66 METERS.1 HEIGHT OF LIGHT ABOVE STATION MARK 1.33 METERS.

NOTE	HEIGHT OF TELESCOPE ABOVE STATION MARK	HEIGHT OF LIGHT ABOVE STATION MARK	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION		
			OBJECT	BEARING	DIRECTION
7(a)	Surface-station mark				
7(a)	Underground-station mark				
			feet	meters	
					0° 00' 00" ✓
			2 miles ✓		64 36 08.7 ✓
					89 26 57.9 ✓
			22.39 ✓	.6.823 ✓	209 09 22.8 ✓
			36.15 ✓	11.019 ✓	286 30 56.7 ✓

Located in open country about 2.5 miles south of the National Park Headquarters, on the west rim of the Halemaumau Crater, about 100 yards west of the Chain of Craters road and 8 feet west of a sheer cliff about 50 feet high.

Station is a standard disk set in a square topped concrete post that projects four inches above the ground. Stamped KEANAKAKOI 1949.

The underground mark is a standard disk set in a square block of concrete three feet below the surface. Stamped KEANAKAKOI 1949.

Reference Mark No.1 is cemented in a drill hole in the top of a large buried lava boulder that is about 2 feet above the elevation of the station and projects about 1 foot above the ground. A standard disk stamped KEANAKAKOI NO 1 1949.

Reference Mark No.2 is cemented in a drill hole in the top of a buried lava boulder, about the same elevation as the station. A standard disk stamped KEANAKAKOI NO 2 1949.

To reach from the National Park Headquarters: go south on Government road for 2.2 miles to a cross road, turn left on Chain of Craters road and go 4.2 miles, take right fork on dim bladed road, make U turn and go 0.8 miles then turn right across country for 0.1 miles to edge of cliff and station.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KEANAKAKOI OBS BY CGS
 STATE: HAWAII YEAR: 1949 SECOND ORDER

SOURCE: S-16241

GEODETIC LATITUDE: 19 24 00.24312	ELEVATION: 1125.03 METERS
GEODETIC LONGITUDE: 155 16 29.31884	3691.0 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ ± ANGLE °
HI 1	5101	577,601.73	205,852.18	+ 0 04' 29"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ ± FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH * (From south)	CODE
UWERAHUNA HGS	149 49 11.6	149 44 42 "	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979
 THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975
 LEVELLING BY CGS

3M 088

* Refers to notes in manuals of triangulation and state publications of triangulation. † Direction-angle measured clockwise, referred to initial station.
 ‡ To nearest second only, when no trigonometric leveling is being done.

(continued on next page)

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1031
 LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

KEANAKAKOI (continued)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY
RECOVERY NOTE, TRIANGULATION STATION

R

RECOVERY NOTE, TRIANGULATION STATION

R

FORM 526a
 (9-19-69)

NAME OF STATION: **KEANAKAKOI**
 ESTABLISHED BY: **C.T. Husemeyer** YEAR: **1949** STATE: **Hawaii**
 RECOVERED BY: **D.M. Whipp** YEAR: **1967** COUNTY: **Hawaii**
 Island: **Hawaii**

NAME OF STATION: **KEANAKAKOI** BENCH MARK ALSO
 ESTABLISHED BY: **C.T. Husemeyer** YEAR: **1949** STATE: **Hawaii**
 RECOVERED BY: **L.A. Critchlow** YEAR: **1977** COUNTY: **Hawaii**
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: **2.5 miles S of Kilauea Military Camp**
 HEIGHT OF TELESCOPE ABOVE STATION MARK **4** FEET. HEIGHT OF LIGHT ABOVE STATION MARK **4** FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
UWEKAHUNA (HGS) 1896 ----1949				00 00 00.0
RM No. 1		22.39	6.823	171 53 33
RM No. 2		36.15	11.019	249 15 07
UWEKAHUNA (HGS) 1896 ----1967				00 00 00.0
RM No. 1	SE	22.381	6.822	171 51 06
RM No. 2	SW	36.137	11.015	249 13 30

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
UWEKAHUNA HGS 1896				00 00 00.0
RM 1	SE	22.42	6.833	171 45 16
RM 2	SW	36.14	11.014	249 08 17
RM 1 to RM 2		38.13	11.624	

Station was recovered and all marks found in good condition. A complete description follows:

Station is located in the Hawaii Volcanoes National Park, about 2-1/4 miles southwest of the Park Headquarters and 2-1/2 miles due south, across Kilauea Crater, from Kilauea Military Camp, on the south rim of Kilauea Crater, about 450 feet south of the Crater Rim Road and at about 3691 feet elevation.

To reach station from the Park Headquarters building, go west and south on Crater Rim Road for 5.3 miles to the large parking area at Hale-

maumu Crater observation point; continue on the road for 0.7 mile to dim side road right, at left curve of main road, and end of truck travel, below rim and station. Walk south about 450 feet to station up on rim.

Station mark is a standard disk stamped "KEANAKAKOI 1949", set in the top of a 10-inch-square, concrete monument projecting 6 inches. It is 20 feet south from edge of cliff and 3 feet southwest of a cairn.

Reference mark number one is a standard disk stamped "KEANAKAKOI NO 1 1949", cemented in a drill hole in a 2 x 3-foot rock projecting 14 inches, and is about 2 feet higher than station mark.

Reference mark number two is a standard disk stamped "KEANAKAKOI NO 2 1949", cemented in a drill hole in a 12-inch-diameter rock projecting 6 inches, and is at about same elevation as station mark.

NOTE: It is possible to drive to station with a 4-wheel-drive vehicle by proceeding east on Crater Rim Road from end of truck travel for 0.3 mile, then turn right, off of highway, and follow dim track road east for 0.2 mile to edge of a small crater; go right, around hairpin turn, and then go west 0.55 mile across flat area to station.

The station mark and reference marks 1 and 2 were recovered in good condition. The directions to the reference marks measured on this date were about 5 minutes less than the 1967 directions. The distance to reference mark 1 measured on this date was 0.011 meter longer than the 1967 measurement. The distance to reference mark 2 measured on this date compared favorably to the 1949 and 1967 measurements. The 1967 recovery note is adequate.

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

NOTE - One of these forms must be used for every station recovered.

USCOMMA-DC 37178-P89

*Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 (1-72) SUPERSEDES CGS FORM 526A WHICH MAY BE USED.

U.S. DEPARTMENT OF COMMERCE
 NOAA
 U.S. GPO: 1976-665-661/1220 Region 6

JUN 1978
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191552 STATION 1032
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

RECOVERY NOTE, TRIANGULATION STATION
 INTERSECTION

NAME OF STATION: Kilauea Military Camp, flagpole
 ESTABLISHED BY: L.C.W. YEAR: 1949 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: Island:Hawaii

R

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KILAUEA MILITARY CAMP FLAGPOLE
 STATE: HAWAII YEAR: 1949 THIRD ORDER

SOURCE: G- 9275

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station was recovered. Located in the Hawaii Volcanoes National Park, 1 mile west along the Crater Rim Road from the Park Headquarters Building. A white, metal flagpole about 50 feet tall, with brass ball on top, set in front of the Military Camp Office on a circular, raised grass area, about 100 feet north of the Crater Rim Road.

GEODETIC LATITUDE:	19° 26' 07.093	ELEVATION:	METERS
GEODETIC LONGITUDE:	155 16 36.014		FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	# OR Δ OR ANGLE*
HI 1	5101	576,544.07	218,647.33	+ 0 04 28

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE $\theta \sin \Delta \theta$ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE

FORM CG63-526 (11-65)
 USCOMWDC 13308-P43

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

QE 224

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191552 STATION 1033
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

U. S. DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 535
 REV. MAR. 1965

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: KOAE (USGS) STATE: Hawaii COUNTY: Hawaii

CHIEF OF PARTY: C.T. Husemeyer YEAR: 1949 Described by: G.B.G.
 [NOTE:] HEIGHT OF TELESCOPE ABOVE STATION MARK 1.61 METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.

Located in southeast Hawaii, in Kau District, about 7 miles southeast of the Volcano post office and about 3.5 miles east of the Government Highway on the west and highest point of a volcano cone named Koae.

Marked by a Hawaii Territory Survey monument, which is a triangular concrete platform, seven feet on each side, with a 2.5 inch iron pipe mounted on three iron legs in the center of the platform, which in turn supports an iron target. The center of the pipe was used as station. This station is near if not at the same spot as the flag pole and cairn observed by E.R. Hand in 1912. Original station, a 1/2 inch pipe 2 feet long was recovered by the Territory Survey and metal target placed over it. True plumbing of target was accepted as correct.

To reach from the National Park Headquarters: go southwest on government highway for 2.2 miles to a cross road, turn left on Chain of Craters Road and go 2.8 miles, turn right at Park Service sign, "Restricted Area Do Not Enter" and follow dry wash 1.5 miles, turn left out of wash, over ridge, cross same wash and continue south over a low ridge. From here station is visible on right, the most prominent cone in the vicinity. Pick way through lava beds and sand for about five miles to station.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KOAE (USGS) ESTABLISHED BY: C.T. Husemeyer YEAR: 1949 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: Island: Hawaii

Detailed statement as to the fitness of the original description, including marks found, stampings, changes made, and other pertinent facts:

Station was recovered and both marks found in good condition. A complete description follows:

Station is located in the Hawaii Volcanoes National Park area, about 7 miles airline southwest of the Park Headquarters, 1.4 miles east of the junction of the Kau Desert Trail and Footprints Trail, and about 500 feet south of the Footprints Trail, at 3250 feet elevation, on the southwest rim of Puu Koae, a prominent volcanic cone.

To reach station from the Hawaii Volcanoes National Park Headquarters, go southeast on the Crater Rim Road, past east end of the Volcano House Hotel, and go 3.8 miles to crossroad; turn left on Chain of Craters Road and go 2.2 miles; take side road right, at sign "HILINA PALI PARK ROAD", and go 4.0 miles to end of truck travel at a hairpin left curve and sign on right "FOOTPRINTS TRAIL". Walk west on good trail for about 4 miles to station.

Station is marked by a 3/4-inch iron pipe projecting 2 inches from the center of a triangular, concrete platform, about 7 feet on each side, on highest point of crater rim. A 2-1/2-inch iron pipe target, supported by 3 iron legs embedded in the concrete platform, is centered over station pipe and extends about 8 feet above platform. The word "KOAE" is inscribed in the concrete.

Reference mark is a U.S.G.S. reference disk, unstamped, cemented in a drill hole in the top of a small lava rock hump at southwest base of station hill, in azimuth from station 57° 09'. Slope distance to the reference mark is 172.37 feet, and it is about 100 feet lower than station.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KOAE USGS OBS BY CGS
 STATE: HAWAII YEAR: 1949 FIRST ORDER

SOURCE: G-16, 41

GEODETIC LATITUDE:	19 21 30.25785	ELEVATION:	991.2 METERS
GEODETIC LONGITUDE:	155 19 30.70227		3252 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	B OR Δ G. ANGLE
HI 1	5101	560,254.08	190,702.38	+ 0 03 '29"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE B OR Δ G. FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979
 THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

3M 092

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1034
 HAWAII
 LATITUDE 19 00' TO 19 30'
 LONGITUDE 155 00' TO 155 30'
 DIAGRAM NE 5-1.5 HAWAII

DESCRIPTION RESETEDEC 1975 TRIANGULATION STATION

NAME OF STATION: **KOAE 2**
 ESTABLISHED BY: **L.A. Critchlow** YEAR: **1977** STATE: **Hawaii** BENCH MARK ALSO
 COUNTY: **Hawaii**
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: **About 7 miles SW of Volcanoes Nat. Park Hdq**
 HEIGHT OF TELESCOPE ABOVE STATION MARK **5** FEET. HEIGHT OF LIGHT ABOVE STATION MARK **5** FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
UWEKAHUNA HGS 1896	NE	112.664	34.340	00 00 00:0
R.M. No. 3	NW	183.35	55884	31 36 39
R.M. No. 4		177.37	54.064	322 40 27
R.M. No. 3 to R.M. No. 4				

The station is located in the Volcanoes National Park on the south rim of a prominent volcanic cone known as Puu Koae, and in an area known as the Kau Desert.

The station mark is a 1 inch rebar rod driven into the cinder cone, surrounded by a mass of concrete, with a PK nail in the center of the top of the rod with an aluminum tag attached and stamped PUU KOAE RESETE DEC 1975. It is set on the rim of the crater on the south side and about 5 feet lower than a cinder mass to the east and about 4 feet lower than a cinder mass to the west.

To reach the station from the USGS Volcano Observatory, go southerly on paved park road for 1.9 miles to a track road right.* Turn right on the track road go for about 200 feet to the top of the ridge. Keep left on track road and go southeast for 0.15 mile to a fork. Take the right fork and continue on the track road keeping right forks all the way for 4.0 miles to the cone and the station on the left.

Reference mark 3 is a 1 inch rebar rod driven into the cinders and surrounded by concrete. The rod projects 2 inches and is located on the east side of the crater.

Reference mark 4 is a 1 inch rebar rod driven into the cinders and surrounded by concrete. The rod projects 3 inches and is located on the northwest side of the crater.

* From this point a 4 wheel drive vehicle is needed and there are small rock cairns along the trail to follow.

* Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 75-96 SUPersedes CGS FORM 928A WHICH MAY BE USED.
 (1-72)

U.S. DEPARTMENT OF COMMERCE
 NOAA
 U.S. GPO: 1976-665-661/1220 Region 4

ADJUSTED HORIZONTAL CONTROL DATA

ADJUSTMENT BY NGS

NAME OF STATION: **KOAE 2** OBS BY **NGS**
 STATE: **HAWAII** YEAR: **1977** FIRST ORDER
 SOURCE: **15241**

GEODETTIC LATITUDE: 19 21 30.25876	ELEVATION: 988.5 METERS
GEODETTIC LONGITUDE: 155 19 30.69269	3243 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ (ON Δ) ANGL °
HI 1	5101	500,254.71	190,702.47	+ 0°03'29"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ (ON Δ) FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETTIC AZIMUTH (From south)	PLANE AZIMUTH * (From south)	CODE
UWEKAHUNA HGS	207 13 54.4	207 10 26 "	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

SM 093

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 151552 STATION 1035
 HAWAII
 LATITUDE 15° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1,5 HAWAII

Kupapau (Hawaii Island, E. R. Hand, 1914).—On east coast of Hawaii, on Kupapau Point, 3 miles southwest along the coast from the village of Kalapana. Station is up in the line of large rocks which have been thrown back by storm surf; it is about 22 meters from the sea, and 160 meters from the sharp point to the northeast where the shore turns abruptly in, to form bay. Marked by a survey tablet set in a rock which is roughly 3 by 3 by 2½ feet, and which is cemented firmly to rocks below.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KUPAPAU OBS BY CGS
 STATE: HAWAII YEAR: 1914 FIRST ORDER

(9-18-59)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: KUPAPAU
 ESTABLISHED BY: E.R. Hand YEAR: 1914 STATE: Hawaii
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 Island: Hawaii

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
HEIHEIAHULU 1914				
RM No. 1	NE	26.603	8.109	00 00 00.0
RM No. 2	SE	21.951	6.690	134 30 56

SOURCE: G-16241

GEODETIC LATITUDE: 19 19 54.93526	ELEVATION: 7.39 METERS
GEODETIC LONGITUDE: 155 01 10.90990	24.2 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	β OR Δ OR ANGLE*
HI 1	5101	665,585.17	181,286.13	+ 0° 09' 32"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE β OR Δ OR FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
LAEAPUKI	66° 13' 20.3"	66° 03' 48"	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979
 THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975
 LEVELING BY CGS

3M 100

Station mark was recovered in good condition. Two new reference marks were established. A complete description follows:

Station is located about 3 miles southwest of Kalapana village, at Kupapau Point, about 1800 feet southeast of the highway and 600 feet southwest of the sharp point where the shoreline turns in to northwest to form the cove. It is along the top of a prominent row of large, jumbled rocks above the smooth lava beach, 39 feet southwest from the southwest 1 of a row of pandanus trees visible from the highway, and about 175 feet southwest from the end of a large stone wall from which a fence

line runs northwest.

To reach station from the junction of State Highways 132 and 13 at Pahoa, go south on State Highway 13 for 11.0 miles to the churches at Kalapana. Continue westerly on the highway for 3.25 miles to cattleguard; continue on the highway 0.05 mile; turn left on dim track road by cattleguard sign, and go southeast 0.25 mile to end of road about 50 yards from a lone coconut tree (the one nearest the highway). Walk southeast from the coconut palm on a line towards the pandanus trees, about 350 yards to station.

Station mark is a standard disk stamped "KUPAPAU 1914", cemented in a drill hole in the top of a 4-foot-square boulder, secured with concrete onto the rocks on which it sets, and is the highest point of the row of jumbled rocks. It is 145 feet northwest of the extreme rock tip at water edge, and about 8 feet higher than the smooth lava beach ledge.

Reference mark number one is a standard disk stamped "KUPAPAU 1914 NO 1 1967", cemented in a drill hole in a large rock at the north edge of the row of jumbled rocks. It is 12 feet southwest of the base of the southwest pandanus tree, projects 2 feet above ground, and is about 14 inches lower than station mark.

Reference mark number two is a standard disk stamped "KUPAPAU 1914 NO 2 1967", cemented in a drill hole in the smooth lava beach ledge, 125 feet north of the extreme south tip of the ledge and about 7.4 feet lower than station mark.

*Name of chief of party should be stated here. The officer who actually recovered the recovery note.

NOTE - One of these forms must be used for every station recovered.

USCOMM-DC 27173-P59

(continued on next page)

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1035

LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

KUPAPAU (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: KUPAPAU
 ESTABLISHED BY: E.D.H. YEAR: 1914 STATE: Hawaii BENCH MARK ALSO
 RECOVERED BY: L.A. Critchlow YEAR: 1977 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 3 miles southwest of Malapena.
 HEIGHT OF TELESCOPE ABOVE STATION MARK 0 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 0 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
LATAPUNI 1914				00 00 00.0
RM 1	NE	26.61	6.109	150 10 38
RM 2	SE	21.95	6.693	263 12 17

The station mark and reference marks 1 and 2 were recovered in good condition. The distance to reference mark 1 checked flat against the 1967 recovery note and the direction was found smaller by 01 minute 26 seconds. The distance to reference mark 2 was found longer by 0.003 meter and the direction was found smaller by 09 seconds. A complete new description follows.

The station is located about 3 1/2 miles southwest of Malapena, 1/2 mile east of State Highway 13 and the entrance to the Hawaii Volcanoes National Park, along the shore line at Mupapau Point and on property owned by Hawaii Volcanoes National Park.

To reach the station from the Star of the Sea (painted) Church in Malapena, go southwest on State Highway 13 for 3.3 miles to a cattle guard and the entrance to the Hawaii Volcanoes National Park. Continue on highway 13 for 0.05 mile to a track road left and a gate on the left. Turn left and pass through the gate and go easterly on the track road for 0.45 mile to where a wire fence and a rock wall joins together on the left and the end of track travel (the fence line is the National Park Boundary). From here pack along the top of the rock wall to the end at the waters edge. Turn left and pack along the shore line for about 200 feet to the station on the right in a jumbled pile of rocks.

Station mark, stamped KUPAPAU 1914, is a C&GS disk cemented in a drill hole in a 4 by 4 foot boulder which projects higher than other boulders around it and is about 8 feet higher than the smooth lava along the waters edge. It is 203 feet southwest of the east end of the rock wall. (Note 4)

Reference mark 1, stamped KUPAPAU 1914 NO 1 1967, is a C&GS disk cemented in a drill hole in a boulder which is about 2 feet lower than the station. It is 183 feet southwest of the east end of the rock wall. (Note 12c)

Reference mark 2, stamped KUPAPAU 1914 NO 2 1967, is a C&GS disk cemented in a drill hole in smooth lava rock which is about 8 feet lower than the station. It is 203 feet southwest of the east end of the rock wall. (Note 12a)

(R.B.M., 1978)--The station and reference marks were recovered in good condition.
 *Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

191552 STATION 1036
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

Laeapuki (Hawaii Island, E. R. Hand, 1914).—On eastern coast of Hawaii, about 8 miles southwest along coast from Kalapana, and 1½ miles southwest from the coconut grove and grass house (the last grove southwest of Kalapana) at Laeapuki. Station is directly below and S. 33° E. from the isolated house situated high up on slope (house of Pea, a native). It is on a mound rising from the smooth barren lava, near the point seen from Laeapuki, is 55 meters from the sea on the east, and 170 meters from the point which bears S. 17° W. Marked by survey tablet set in mound, and covered by a small cairn, painted.

FORM 5700
 (8-18-69)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: LAEAPUKI
 ESTABLISHED BY: E.R. Hand YEAR: 1914 STATE: Hawaii
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 Island: Hawaii

HEIGHT OF TELESCOPE ABOVE STATION MARK 1.51 METERS, HEIGHT OF LIGHT ABOVE STATION MARK METERS.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
PULAMA 1914				0 00 00.0
RM No. 1	S	22.129	6.745	138 20 33
RM No. 2	W	19.199	5.852	241 42 15
iron pin	NNE	652.0		344 15 33

Station mark was recovered in good condition. Two reference marks were established. A complete description follows:
 Station is located along southeast coast of the island, about 8 miles west-southwest of Kalapana, 2 miles northeast of where State Highway 13 leaves the coast and bears inland, and 1-3/4 miles southwest of a small coconut grove which is the last one southwest along highway from Kalapana. It is in the rough lava area between highway and sea, on a round lava hump about 25 by 15 feet in size and projecting about 6 feet above general ground level.

To reach station from the junction of State Highways 13 and 132 at Pahoa, go south on State Highway 13 for 11.0 miles to the churches at

Kalapana. Continue on the highway, southwest, for 7.0 miles to the last coconut grove on left; continue on the highway for 1.75 miles to end of truck travel. Walk southeast across lava area about 500 feet to station.

Station mark is a standard disk stamped "LAEAPUKI 1914", cemented in a drill hole in bedrock on highest point of the lava mound. It is 530 feet south-southeast of center line of highway and 150 feet north-northwest of water line.

Reference mark number one is a standard disk stamped "LAEAPUKI 1914 NO 1 1967", cemented in a drill hole in lava bedrock that projects 1 foot and is about 4-1/2 feet lower than station mark.

Reference mark number two is a standard disk stamped "LAEAPUKI 1914 NO 2 1967", cemented in a drill hole in lava bedrock on a small lava ridge that is an extension of the station hump. It is 1.8 feet lower than station mark.

Iron pin is a 3/4-inch iron pin wedged in a crevasse in bedrock on the top of a lava hump similar to the station hump. It is in the center of a painted white square.

Name of chief of party of the recovery note.

Entered here. The officer who actually visited the station should sign his name at the end

NOTE - On-

not be used for every station recovered.

USCOMA-DC 27179-P88

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LAEAPUKI OBS BY CGS
 STATE: HAWAII YEAR: 1914 FIRST ORDER

SOURCE: G-16241

GEODETIC LATITUDE: 19 18 07.59989	ELEVATION: 16.6 METERS
GEODETIC LONGITUDE: 155 05 22.58025	54 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ & ANGLE*
HI 1	5101	641,508.38	170,598.37	+ 0°08'08"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ #1 FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
KAENA POINT USGS	60 41 24.5	60 33 16 "	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1036
 LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

LAEPUKI (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: LAEPUKI
 ESTABLISHED BY: E.P.H.
 RECOVERED BY: L.A. Critchlow
 YEAR: 1914 STATE: Hawaii BENCH MARK ALSO
 YEAR: 1977 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 3 miles west-southwest of Kalapana
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION				
OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
MAENA PT USGS	WNW	19.21	5.854	00 00 00.0 40 52 23
RM 2	NE	about 640	feet	143 26 05.6
IRON PIN	S	22.14	6.749	297 31 33
RM 1		32.47	9.896	
RM 1 to RM 2				

The station mark, reference marks 1 and 2 and the iron pin were recovered in good condition with the exception the iron pin has about rusted away at the base. The distance to reference mark 1 was found shorter by 0.004 meter and the direction was found larger by 03 seconds. The distance to reference mark 2 was found shorter by 0.002 meter and the direction was found smaller by 49 seconds. The direction to the iron pin was found smaller by 23 seconds. A complete new description follows.

The station is about 3 miles west-southwest of Kalapana, just southeast of State Highway 13, between the road and the shore line, on a small lava hump about 150 feet north-northwest of the shore line and on property owned by the Hawaii Volcanoes National Park.

To reach the station from the Star of the Sea (painted) Church in the village of Kalapana, go south on State Highway 13 for 4.25 miles to the District Park Ranger Headquarter's building on the left (Hawaii Volcanoes National Park). Continue south on highway 13 for 2.75 miles to a sign "Laepuki View". Continue south on highway 13 for 1.5 miles to the station on the left about 500 feet south-southeast of the highway.

Station mark, stamped LAEPUKI 1914, is a C&GS disk cemented in a drill hole in bedrock on highest point of a lava mound which is about 6 feet higher than the general area. It is 530 feet south-southeast of the center line of highway 13 (1967 measurement) and 150 feet west-northwest of the water line. (Note 2)

Reference mark 1, stamped LAEPUKI 1914 NO 1 1967, is a C&GS disk cemented in a drill hole in bedrock which is about 4 feet lower than the station. (Note 12a)

Reference mark 2, stamped LAEPUKI 1914 NO 2 1967, is a C&GS disk cemented in a drill hole in bedrock which is about 2 feet lower than the station. (Note 12a)

Iron Pin, is a 3/4-inch iron pin wedged in a crevice in bedrock on top of a lava hump similar to the one the station is on.

* Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191552 STATION 1038
 HAWAII
 LATITUDE 19 ° 00' TO 19 ° 30'
 LONGITUDE 155 ° 00' TO 155 ° 30'
 DIAGRAM NE S-1,5 HAWAII

Nose (Hawaii Island, United States Geological Survey, 1920).—In southeast Hawaii, 2 miles southwest of Halemaumau, about in line with and halfway between Halemaumau and Puu Koaie, at the lower end of a low ridge of "pahohoe" lava on top of a small rocky knob. Mark, a bronze tablet cemented in solid rock.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: NOSE
 ESTABLISHED BY: U.S.G.S. YEAR: 1920 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: Island: Hawaii

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station mark was recovered in good condition. A complete description follows:

Station is located about 2 miles southwest of the large parking area at Halemaumau Crater and 1 mile southeast of the Kau Desert Trail, at 3551 feet elevation, on a rock point on a low, sloping ridge in pahohoe lava badlands cut by dry washes.

To reach station from the Hawaii Volcanoes National Park Headquarters, go west on Crater Rim Road for 4.8 miles to dirt road fork right, at bottom of grade. Take right fork and go 0.5 mile to quarry on left; continue ahead for 0.9 mile to point of ridge on right. Turn sharp right and go up-grade along edge of bluff 0.75 mile; take dim left fork down sloping ridge for 0.2 mile, then continue ahead, down sandy draw, for 0.7 mile. Turn right, leaving draw, and go west across rough lava area for 0.4 mile to large wash. From here walk west about 1/2 mile to station.

Station mark is a U.S.G.S. disk, stamped "NOSE", cemented in a drill hole in a sloping, bedrock ledge projecting 3 feet. It is 3 feet east of a 3-foot cairn and 60 yards west of 4 electric cables strung on the ground.

NOTE: 4-wheel-drive vehicle required.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: NOSE
 STATE: HAWAII YEAR: 1920 THIRD ORDER

SOURCE G-SP15c

GEODETIC LATITUDE	19 23 13.215	ELEVATION	1082.25 METERS
GEODETIC LONGITUDE	155 18 16.722		3550.6 FEET

STATE COORDINATES (feet)				
STATE & ZONE	CODE	X	Y	B OR Δ OR ANGLE *
HI 1	5101	567,325.85	201,095.70	+ 0 03 54

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE B OR Δ OR FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From north)	PLANE AZIMUTH (From north)	CODE

JUN 1978
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

191552 STATION 1039
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1.5 HAWAII

Observatory (Hawaii Island, United States Geological Survey, 1920).—In southeast Hawaii, at the Hawaiian Volcano Observatory, Kilauea Volcano, in the center of the top of the concrete pier projecting up through the floor of the front porch of the observatory building. Mark, a bronze tablet cemented in the concrete.

RECOVERY NOTE, TRIANGULATION STATION

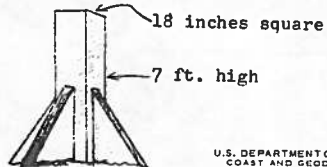
NAME OF STATION: **OBSERVATORY**
 ESTABLISHED BY: **USGS** YEAR: **1920** STATE: **Hawaii** BENCH MARK(S) ALSO
 RECOVERED BY: **D.M. Whipp** YEAR: **1967** COUNTY: **Hawaii**
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: **Island: Hawaii**

R

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station mentioned in original description has been removed and the station now sets in lawn area on west side of the Volcano House Hotel, about 500 feet southwest of the park headquarters building.

Station mark is a U.S. Geological Survey disk, stamped "3979", set in the top of an 18-inch-square concrete monument 7 feet tall and with 4 vanes at the bottom. It is 27 feet southwest of the hotel wall, opposite the point where a glassed-in walkway begins, and is at the base of a lawn terrace.



FORM C&GS-526 (11-65)
 USCOMM-DC 18509-P65

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **OBSERVATORY**
 STATE: **HAWAII** YEAR: **1920** **THIRD** ORDER
 SOURCE: **G-SP156**

GEODETIC LATITUDE	19 25 55.838	ELEVATION	1212.98 METERS
GEODETIC LONGITUDE	155 15 41.092		3979.5 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	B CH Δ RI ANGLE
HI 1	5101	582,201.88	217,519.03	+ 0 04 46

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE $\theta = \alpha \Delta H$ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE

90 300

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1040
 LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

OHAIKEA (HTS) (continued)

FORM 526a
 (6-18-69)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY
RECOVERY NOTE, TRIANGULATION STATION

R

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: OHAIKEA (HTS)
 ESTABLISHED BY: C.T. Husemeyer YEAR: 1949 STATE: Hawaii
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 Island: Hawaii

NAME OF STATION: OHAIKEA HTS
 ESTABLISHED BY: C.T. Husemeyer YEAR: 1949 STATE: Hawaii BENCH MARK ALSO
 RECOVERED BY: L.A. Critchlow YEAR: 1977 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: about 18 miles NE of Pahala
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
UWEKAHUNA (HGS) 1896	SSW	25.740	7.847	00 00 00.0 111 14 36
RM No. 2				
UWEKAHUNA (HGS) 1896	SW	25.739	7.845	00 00 00.0 111 15 13
RM No. 2	WNW	29.865	9.103	204 38 31
RM No. 3				

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
UWEKAHUNA HGS 1896	NW	29.88	9.107	00 00' 00" 204 37 54
RM 3	NE	67.075	20.445	307 35 33
RM 4				

Station mark and reference mark number two were recovered in good condition. Reference mark number one was found destroyed. A new reference mark was established. A complete description follows:

Station is located about 5-1/2 miles west of the Hawaii Volcanoes National Park Headquarters and 1-1/2 miles northwest of State Highway 11, at about 4288 feet elevation, on grassy slope with scattered trees, on south side of a wooden water tank. When seen from down on the highway the station appears to be on the high point of a ridge.

To reach station from the Hawaii Volcanoes National Park Headquarters, go west on Crater Rim Road 1.8 miles; turn right and go 0.1 mile; turn left and go southwest on State Highway 11 for 3.5 miles to side road right, 0.5 mile past milepost 35. Take side road and go 1.0 mile to locked gate. Pass through gate and go 0.1 mile to pump station at corrals. Turn sharp right and go upgrade 0.1 mile to metal gate. Pass through gate and follow field road for 1.1 miles to second gate. Pass through gate and go 0.5 mile; take left fork, northwest, upgrade, for 0.8 mile to gate in fence-corner. Pass through gate, then left through gate in fence on left, and go 80 yards to station.

Station is marked by a 2-1/2-inch hole in the center of a triangular, concrete platform about 7 feet on each side and projecting 8 inches. A 2-inch, steel shaft 2 feet long is centered vertically over the hole and holds a red and white metal target. Station is 34.5 feet southeast of edge of water tank, 4.5 feet east of a 1-1/2-inch pipeline and about 250 feet south-southwest of the T-fence corner.

Reference mark number two is a standard disk stamped "OHAIKEA NO 2 1949", cemented in the top of a 2-inch iron pipe projecting 4 inches. It is 9.5 feet west of the pipeline and 4 feet lower than station platform.

Reference mark number three is a standard disk stamped "OHAIKEA HTS 1949 NO 3 1967", cemented in a drill hole in bedrock area projecting 3 inches. It is 18 feet south of edge of water tank and at same elevation as station platform.

NOTE: A 4-wheel-drive vehicle is required.
 Key for locked gate was obtained at the Hawaiian Ranch Co. office in Naalehu.

The station and reference mark 3 were recovered in good condition. The distances and directions measured on this date compare favorably with the 1967 measurements. A new reference mark 4 was established. The 1967 recovery note is adequate with the following additions.

To reach the station from the junction of State Highways 11 and 19 in Hilo, go southwest on Highway 11 for 34 miles to Milepost 34. Continue on the highway for 100 feet to track road on the right. Turn right and go west-southwest on a track road 0.95 mile to locked gate. Continue ahead on track road to some water tanks and a corral. Turn right and go northerly up hill on dim road for 0.5 mile to gate. Pass through gate and continue up grade to a road fork. Take left fork and go 0.15 mile to fence corner on the left. Continue on up hill on dim road for 1.2 miles to water tank and the station site.

Reference mark 4, stamped OHAIKEA 1949 NO 4 1977, is a NGS tablet cemented in a drill hole in a rock outcrop projecting 0.2 feet above the ground, 57 feet north-northeast of a wooden water tank and 19 feet east of a steel water pipeline.

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

NOTE - One of these forms must be used for every station recovered.

USCOMM-DC 27173-P89

*Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 SUPERSEDES C&G FORM 526A WHICH MAY BE USED. (1-72)

U.S. DEPARTMENT OF COMMERCE
 NOAA

U.S. GPO: 1976-665-641/1270 20g/1m 6

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 151552 STATION 1041
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-15 HAWAII

NO ORIGINAL TEXT

Ohale (HGS) (Hawaii County, Hawaii, HGS, 1897; United States Geological Survey, 1920).—In southeast Hawaii, on a rock hill about 4 miles south of Halemaumau. Marked by a flagpole in the center of a large terraced cairn of rock. A bench mark southeast of the station is 18.7 feet from the station in azimuth 49° 42'.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: OHALE HGS

OBS BY CGS

STATE: HAWAII

YEAR: 1897

FIRST

ORDER

SOURCE: U-10241

RECOVERY DESCRIPTION OF TRIANGULATION STATION

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 535
 Rev. Aug. 1966

NAME OF STATION: OHALE (HGS) STATE: Hawaii County: Hawaii

Established By: Hawaiian Gov. Survey, 1897

CHIEF OF PARTY: L. C. Wilder YEAR: 1949

Described by: C. J. Hoepfel

NOTE: HEIGHT OF TELESCOPE ABOVE STATION MARK 1.28 METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.
 Surface-station mark, DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION
 Underground-station mark

OBJECT	BEARING	DISTANCE		DIRECTION
		feet	meters	
KAKAKAIA S (HTS) - R. M. 1, B. M. (USGS) =	SW =	18.743 =	5.713 =	00 00 00 - 348 23 38 -

The station is located on the summit of a low lava mound which lies about 6 miles south of the Hawaiian National Park Headquarters; about 6 miles north of the sea and about 0.5 mile north of the graded road which leads toward the Hilina Pali.

To reach from the Hawaiian National Park Headquarters; go westerly, on the road which leads toward Haaalehu, for 2.1 miles; turn left, onto the Crater Rim Road, and go south and east for 5.3 miles to the intersection of the Chain of Craters Road; turn right and go southeast for 2.3 miles; turn right, onto a graded road, as per the sign reading Kipuka Nene Picnic Grounds, and go westerly for 2.8 miles to the end of truck travel. From this point pack northwest for about 0.5 mile to the high ground and the station.

The station is the center of a 2 1/2 inch iron pipe which projects about 3 feet from the top of a triangular slab of concrete which is about 6 feet on each side and about flush with the surrounding rock.

Reference mark number 1 is a U. S. Geological Survey bronze, bench mark, stamped 3314, set into a drill hole in a bed rock outcrop which projects about 10 feet on the southeast side. It is located 4.85 feet lower than the station.

This station was monumented in 1938 by the Hawaii Territory Survey, with concrete instrument platform, metal pole and target. At that time they recovered a copper bolt driven in a drill hole in pahoehoe and their installation including the 2 1/2 inch pipe mentioned, over the mark found. Distance to R.M. No. 1 B.M. (USGS) checks.

GEODETIC LATITUDE:	19 21 15.73521	ELEVATION:	1010.5
GEODETIC LONGITUDE:	155 16 45.00534		3315 METERS FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	PLANE ANGLE
HI 1	5101	576,113.73	189,053.61	+ 0° 04' 23"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE $\beta + \Delta \alpha$ FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
UNEKAHUNA HGS	172° 02' 26.3"	171° 58' 03"	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

3M 120

* Refer to notes in manuals of triangulation and state publications of triangulation. (Direction-angle measured clockwise, referred to initial.)
 (To nearest meter only, when no trigonometric leveling is being done.)

(continued on next page)

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1041
 LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

OHALE (HGS) (continued)

FORM 526a
 (8-16-69)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY
RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: **OHALE (HGS)**
 ESTABLISHED BY: **HGS** YEAR: **1897** STATE: **Hawaii**
 RECOVERED BY: **D.M. Whipp** YEAR: **1967** COUNTY: **Hawaii**
 Island: **Hawaii**

HEIGHT OF TELESCOPE ABOVE STATION MARK **1.65** METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS
 DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
PUU HULUHULU (HGS) 1891 ---1949		DISTANCE and DIRECTION---		00 00 00.0
BM (USGS), R.M. 1	SW	18.743	5.713	156 28 43
PUU HULUHULU (HGS) 1891 ---1967		DISTANCE and DIRECTION---		00 00 00.0
BM 3314 (USGS) (RM No. 1)	SW	18.706	5.702	156 40 50
RM No. 2	NE	11.561	3.525	328 37 39

Station mark and USGS Bench Mark used for RM No. 1 were recovered in good condition. A new reference mark, number two, was established. A complete description follows:

Station is located in the Kau Desert area of Hawaii Volcanoes National Park, about 5-3/4 miles south-southwest of the Park Headquarters, 4 miles south of Halemaumau Crater, and 1/2-mile north of the hairpin curve in the Hilina Pali Park Road, from which point the Footprints Trail runs westward. It is on the summit of a lava mound about 25 feet higher than surrounding area and at 3318 feet elevation.

To reach station from the Park Headquarters, go south, passing to left of the Volcano House Hotel, and follow the Crater Rim Road southerly for 4.1 miles to crossroad. Turn left and go 2.5 miles on the Chain of Craters Road; turn right on Hilina Pali Park Road and go 3.8 miles; leave paved road about 100 yards before reaching the hairpin curve, and go northerly cross-country for 0.3 mile to end of truck travel. Pack northerly about 1/4-mile to station on highest point in vicinity.

Station is marked by a 3-inch hole in the center of a triangular concrete platform that is 7 feet on each side and flush with surrounding rock. A 2-1/2-inch iron pipe, 2 feet long, is mounted vertically over the hole, supported by 3 iron legs embedded in the concrete platform, and supports an 8-foot, red and white metal target.

USGS Bench Mark 3314 (reference mark number one) is a U.S. Geological Survey disk stamped "3314", cemented in a drill hole in the square-edged lava rock ledge southwest of station. It is 1 foot north of south edge of ledge, projects 3-1/2 feet above ground and is 2.8 feet lower than station platform.

Reference mark number two is a standard disk stamped "OHALE HGS 1897 NO 2 1967", cemented in a drill hole in bedrock in the northeast end of the station mound, 0.4 foot lower than station platform.

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.

NOTE - One of these forms must be used for every station recovered.

USCOMM-DC 27173-P89

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: **OHALE HGS**
 ESTABLISHED BY: **HGS** YEAR: **1897** STATE: **Hawaii** BENCH MARK ALSO
 RECOVERED BY: **L.A. Critchlow** YEAR: **1977** COUNTY: **Hawaii**
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: **5-3/4 miles SSW of Park Headquarters**
 HEIGHT OF TELESCOPE ABOVE STATION MARK **4** FEET. HEIGHT OF LIGHT ABOVE STATION MARK **4** FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
UWĒKAHUNA HGS 1896				00 00 00"
RM 2	NE	11.57	3.528	49 32 37
RM 1	SW	18.72	5.709	237 31 15

The station mark, 3314 USGS (reference mark 1), and reference mark 2 were recovered in good condition and the distances and directions to the marks measured on this date compared favorably with the 1967 measurements. The 1967 recovery note is adequate.

*Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 SUPERSEDES CGS FORM 526A WHICH MAY BE USED.
 (1-72)

U.S. DEPARTMENT OF COMMERCE
 U.S. GPO: 1976-645-611/1270 Reg (en 6)

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191552 STATION 1043
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 535
 Rev. Aug. 1965

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **PAHALA** STATE: **HAWAII** COUNTY: **KAU DISTRICT**
WEST BASE (HTS)

CHIEF OF PARTY: **L. G. WILDER** YEAR: **1949** Described by: **G. J. HOEPEL**
 HEIGHT OF TELESCOPE ABOVE STATION MARK **1.9** METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.

NOTE*	Surface-station mark, Underground-station mark	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION			
		BEARING	DISTANCE		DIRECTION
	OBJECT		feet	meters	° ' "
12a	KAHAHA 2				00 00 00
	R M 1	S	18.939	5.773	189 27 08
12a	R M 2	NW	20.059	6.115	317 23 59
	PUU ULAULA (metal target)				55 53 23.9

The station is located on open pasture land about 2 1/2 miles south southwest of Pahala, about 2 miles northeast of Punaluu, about 1.7 miles north of the ocean, about 1 mile southeast of the road which runs between Naalehu and Hilo, about 300 yards southeast of a wooden water tank about 200 yards north of a small stream and about 100 yards southeast of a wire fence.

To reach from the post office at Naalehu; go easterly, on the road which leads toward Hilo, for 3.5 miles; pass the sugar mill, in the village of Honuapo, and continue northeasterly, toward Hilo, for 6.7 miles; turn sharp right, onto the old highway, and go southerly for 0.1 mile; turn left, pass through a board gate, and go southeast, across the pasture, for 1.2 miles to a wire fence and the end of truck travel. From this point peak southeasterly for about 100 yards to the station.

The station is the center of a 2 inch hole in the top of a concrete pyramid which has a base of about 2 1/2 feet and is about 2 feet in height.

Reference mark number 1 is a standard disk, stamped WEST BASE NO 1 1949, set into a drill hole in bedrock which projects about 6 inches and is located about 2 feet lower than the station.

Reference mark number 2 is a standard disk, stamped WEST BASE NO 2 1949, set into a drill hole in bedrock which projects about 1 foot and is about the same elevation as the station.

* Refer to notes in manuals of triangulation and state publications of triangulation. 1) Direction-angle measured clockwise, referred to initial station.
 † To nearest meter only, when no trigonometric leveling is being done.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **PAHALA WEST BASE HTS**
 STATE: **HAWAII** YEAR: **1949** SECOND ORDER

SOURCE G- 9279

GEODETIC LATITUDE: 19 09 44.611	ELEVATION: 36.7 METERS
GEODETIC LONGITUDE: 155 29 23.104	120 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	PLON Δ R ANGLE
HI 1	5101	503,536.92	119,491.53	+ 0 00 12

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE P OR Δ R1 FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH * (From south)	CODE
PUNALUU	67 24 50.8	67 24 39	5101

QE 161

(continued on next page)

JUN 1978
 U. S. DEPARTMENT OF COMMERCE
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
 NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 151552 STATION 1044
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1.5 HAWAII

SEE STATION PAHALA WEST BASE (HTS)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION PAHALA WEST BASE RM 3
 STATE HAWAII YEAR 1949 SECOND ORDER

SOURCE G- 9279

GEODETIC LATITUDE	19 09' 46.169	ELEVATION	40.5 METERS
GEODETIC LONGITUDE	155 29' 28.207		134 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	$\rho \cos \Delta \phi$ ANGLE*
HI 1	51J1	503,047.72	119,648.66	+ 0 00' 10"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE $\rho \cos \Delta \phi$ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (True north)	PLANE AZIMUTH* (True north)	CODE

POSITION DETERMINED BY TRAVERSE FROM STATION PAHALA W BASE
 AND CHECKED BY ADDITIONAL OBSERVATIONS

QE 166

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 151552 STATION 1045
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE 5-1,5 HAWAII

Pali (Hawaii Island, United States Geological Survey, 1920).—In southeast Hawaii, 1¼ miles west of Halemauau, at the place where the "pali" running southwest from Uwekahuna gradually disappears into a low rounded ridge. Station is on low knob of "pahohoe" lava. Mark, a bronze tablet cemented in solid rock.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: **PALI**
 ESTABLISHED BY: **U.S.G.S.** YEAR: **1920** STATE: **Hawaii** BENCH MARK(S) ALSO
 RECOVERED BY: **D.M. Whipp** YEAR: **1967** COUNTY: **Hawaii**
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: **Island: Hawaii**

Detailed statement as to the fitness of the original description, including marks found, stampings, changes made, and other pertinent facts:

Station was recovered in good condition. A complete description follows:

Station is located in the Hawaii Volcanoes National Park, about 3-1/2 miles southwest of the Park Headquarters Building, 1/2-mile southwest of the Crater Rim Road, and 600 feet southeast of the Kau Desert Trail, at about 3747 feet elevation, on a low mound which is the highest point in the vicinity, on the high ground running southwest between the Kau Desert Trail and a large, sandy draw to southeast.

To reach station from the Hawaii Volcanoes National Park Headquarters Building, go west and southwest on the Crater Rim Road for 3.7 miles to end of truck travel where the Crater Rim Road reaches it's westernmost point before turning back to southeast. Walk northwest about 100 yards to top of low ridge and the Kau Desert Trail. Go left, southwest, along the well-marked trail for about 0.6 mile, then leave trail and go left southeast, about 600 feet to station.

Station mark is a U.S. Geological Survey disk, stamped "PALI", cemented in a drill hole in a 3-foot rock, 6 feet northeast of a cairn.

FORM C&G-526 (1-65)
 USCOMM-DC 16509-705

DEPARTMENT OF COMMERCE

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **PALI**
 STATE: **HAWAII** YEAR: **1920** THIRD ORDER

SOURCE **G-SP15c**

GEODETIC LATITUDE	19 24 18.657	ELEVATION	1142.20 METERS
GEODETIC LONGITUDE	155 18 19.979		3747.5 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	β OR Δ OR ANGLE *
HI 1	5101	567,006.55	207,656.79	+ 0 03 53

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE β OR Δ OR θ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE

QD 306

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191552 STATION 1046
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

Panau (Hawaii Island, E. R. Hand, 1914).—On the east coast of Hawaii, in the area known locally as Panau, up on the high shoulder seen southwest along the coast from the village of Kalapana, and 9 miles distant. The land around the station is smooth lava, grass covered, with a very few ohia trees; it slopes gently toward the sea for a few hundred feet, then drops abruptly to the flat lava behind the coast line. To reach station go to the house of Pea, a native, 50 meters above the old Volcano-Kalapana trail; from this house the station bears S. 29° W., 1,120 meters. Marked by a survey tablet set in cement on top of a prominent lava mound, about 10 feet above the general level. A tall tree stump is on mound, between station and reference mark, which is a tablet set in the mound, 4.45 meters (14.6 feet) from the station, bearing N. 30° W.

RECOVERY NOTE, TRIANGULATION STATION

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PANAU OBS BY CGS
 STATE: HAWAII YEAR: 1914 FIRST ORDER
 SOURCE: G-16241

NAME OF STATION: PANAU
 ESTABLISHED BY: E.R. Hand YEAR: 1914 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: Island:Hawaii

R

GEODETIC LATITUDE: 19 19 21.25900	ELEVATION: 339.7 METERS
GEODETIC LONGITUDE: 155 06 31.28185	1114 FEET

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station mark and reference mark were recovered in good condition. A complete description follows:
 Station is located about 9 miles west-southwest of Kalapana, 1-3/4 miles northwest of the coastline, 1/2-mile south of the Kalapana Trail and 1-1/2 miles east of a hairpin curve in the highway. It is along the open, grassy benchland, about 1/4-mile back from cliff edge, on a large prominent lava mound on a slight rise. There are a very few scattered ohia trees in the vicinity of the station.
 To reach station from the Volcano National Park Headquarters, go south on Crater Rim Road for 4.1 miles to crossroad. Turn left and follow the Chain of Craters Road for 13.7 miles to hairpin curve in highway, at 1250 feet elevation, and end of truck travel. Pack easterly along open area, keeping about 1/4-mile back from cliff edge and maintaining same elevation, for about 1-1/2 miles to station, at about 1114 feet elevation.
 Station mark is a standard disk, unstamped, cemented in a drill hole in bedrock in the highest part of the lava mound, which is about 25 feet in diameter and extends about 10 feet above general ground level. There is a small, stone hut with corrugated metal roof about 75 yards southeast of station.
 Reference mark number one is a standard disk, unstamped, cemented in a drill hole in the northwest side of top of mound, at about same elevation as station mark. It is 4.413 meters, (14.478 feet), from station in azimuth 150°.

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	β OR Δ OR ANGLE *
HI 1	5101	654,912.23	177,811.78	+ 0°07'46"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE β OR Δ OR FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH * (From south)	CODE
PULAMA	242°03'40.2	241°55'54"	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979
 THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

(continued on next page)

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1046

LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

PANAU (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: PANAU
 ESTABLISHED BY: T.R. Hood YEAR: 1914 STATE: Hawaii BENCH MARK ALSO
 RECOVERED BY: J.A. Crichtlow YEAR: 1977 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 9 miles west-southwest of Kalapana
 HEIGHT OF TELESCOPE ABOVE STATION MARK 1 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
PULANA 1914	S	33.71	10.277	00 00 00
RM 1	RM	14.53	4.427	277 11 54

The station and reference mark 1 were recovered in good condition. A difference was noted in the distance to reference mark 1, being 0.014 meters longer compared to the 1967 data. No data was available for a comparison in the direction to reference mark 1. Reference mark 2 was not set at this time and due to changes a new description follows.

The station is located about 9 miles west-southwest of Kalapana Village, 1-3/4 miles northwest of the coastline, 1/2 mile south of the Kalapana trail and 1-1/2 miles east of a hairpin curve in the highway. It is along the open grassy benchland about 1/4 mile back from a cliff edge, on a large prominent lava mound that is on a slight rise. There are a very few scattered ohia trees in the vicinity of the station and it is in the Hawaii Volcano National Park.

The station was reached by helicopter, but the 1967 description to the station should be adequate.

The station mark is a CGGS disk, unstamped, cemented in a drill hole in lava rock in the highest part of the lava mound which is about 25 feet in diameter and extends about 10 feet above general ground level. It is 3 feet west of the southeast edge of the lava mound and 3 feet southeast from the edge of a hole formed by the lava.

Reference mark 1 is a CGGS disk, unstamped, cemented in a drill hole in lava rock in the northwest edge of the lava mound. It is 4.3 feet northwest of the hole formed by the lava and is about the same elevation as the station mark.

Reference mark 2 is a MGS disk stamped PANAU 1914 NO 2 1977, cemented in a drill hole in lava rock that projects about 1 foot above the surrounding rock. It is 17 feet west of the edge of a drop-off and about 5 feet lower than the station mark.

* Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191552 STATION 1048
 HAWAII
 LATITUDE 19 ° 00' TO 19 ° 30'
 LONGITUDE 155 ° 00' TO 155 ° 30'
 DIAGRAM NE 5-1.5 HAWAII

Pulama (Hawaii Island, E. R. Hand, 1914).—On eastern coast of Hawaii, 4 miles west from Kalapana, 2¼ miles northwest from Kupapau Point, up on the steep slope, 50 meters below timber line. A black lava flow is between the station and Kupapau Point. Position of station may be determined as follows: There is an isolated house belonging to Joe Canario above the trail, and 330 meters to southwest in the lava flow is a grave with a galvanized iron roof. From the station the northeast part of Kupapau Point will be seen between the house and grave; and the coconut grove at Laeapuki will bear S. 20° W. Also from the station the house will be on range with a small lagoon in the bay just above Kupapau Point. Marked by a survey tablet set in a patch of cement down in a fissure in a natural rock pile some 4 feet high. Reference mark is a tablet set in highest part of above rock pile; it is 1.2 feet higher than the station, and is 0.54 meters (1.8 feet) therefrom, bearing S. 34° W.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PULAMA
 ESTABLISHED BY: E.R. Hand YEAR: 1914 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: Island: Hawaii

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:

Station mark and reference mark were recovered and found in good condition. Distance to reference mark was checked and found correct. There is now a subdivision in the flat land to southeast of station. A complete description follows:

Station is located about 4 miles west of Kalapana and 2 miles northwest of State Highway 13 at about 660 feet elevation, along a ridge line running down from the higher country above. It is slightly left of a line extended north from the west boundary road of the new subdivision.

To reach station from the post office in Pahoa, go east 0.4 mile; take right fork and go south on State Highway 13 for 9.7 miles to junction with State Highway 137. Continue on State Highway 13 for 1.3 miles to the churches in Kalapana; continue west on the highway for 3.0 miles; turn right 20 yards then go left for 0.5 mile; take T-road right and go north 1.0 mile to northeast corner of subdivision. Turn left and go west 0.7 mile to northwest corner of subdivision and end of truck travel at 200 feet elevation. Pack northerly, clearing trail up along ridge about 0.3 mile to station. About 1-1/2 hours required to clear trail.

Station mark is a standard disk, unstamped, cemented in rock 1-1/2 feet down inside a narrow depression in the top of a large rock pile about 8 feet in diameter and projecting about 5 feet above general ground line. It is on a small flat part of the sloping ridge line and 60 feet south of the first ohia tree on the ridge (about 40 feet tall). The more dense ohia growth is uphill about 200 yards and a few are scattered down station ridge.

Reference mark number one is a standard disk, unstamped, cemented in a drill hole in an outcropping part of the top of the rock pile. It is about 1-1/2 feet higher than station mark.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PULAMA OBS BY CGS
 STATE: HAWAII YEAR: 1914 FIRST ORDER
 SOURCE: G-16241

GEODETIC LATITUDE:	19 21 20.28155	ELEVATION:	201.5 METERS
GEODETIC LONGITUDE:	155 02 34.76289		661 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	# OR Δ @ ANGLE *
HI 1	5101	657,532.16	189,873.69	+ 0 09' 05"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE # OR Δ @ FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
HAKUMA	276 ° 35' 42.7"	276 ° 26' 37"	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

SM 134

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1048

LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

PULAMA (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: PULAMA
 ESTABLISHED BY: F.R. Hand YEAR: 1914 STATE: Hawaii BENCH MARK ALSO
 RECOVERED BY: L.A. Critchlow YEAR: 1977 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 4 miles west of Kalapana Village
 HEIGHT OF TELESCOPE ABOVE STATION MARK: 7.3 FEET. HEIGHT OF LIGHT ABOVE STATION MARK: 7.6 FEET.

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION				
OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
HAWAIIA				80 00 00.0
RM 1	S 71	1.78	0.545	139 02
RM 2	N	42.37	13.064	257 52 01
RM 1 to RM 2		43.77	13.340	

The station and reference mark 1 were recovered in good condition, but no data was available for a comparison check to reference mark 1. Reference mark 2 was set at this time and due to changes a new description follows.

The station is located about 4 miles west of Kalapana Village, 2 miles north of highway 13 at about 660 feet elevation and is on property owned by Morone Construction Company, Phone Number 935-1997.

To reach the station from the junction of State Highways 137 and 13 at the northeast side of Kalapana Village, go southwest on highway 13 for 1.2 miles to Kalapana Village and two churches, one on each side of the highway. Continue southwest on highway 13 for 3.1 miles to a side road right. Turn right, then left and continue west on a paved road for 1.1 miles to a side road right; turn right and go north on a paved road for 1.45 miles to a cross road. Turn left and go west on a paved road for 0.15 mile to a cross road; turn right and go north on a paved road for 0.2 mile to a side road left; turn left and go westerly on the paved road for 0.1 mile to a track road on the left; turn left and go southwest on the track road for 0.1 mile to the station on the right.

Station mark is a C&GS disk, unstamped, cemented in a drill hole in rock, 1-1/2 feet down inside a narrow depression in the top of a large rock pile about 8 feet in diameter and projecting about 5 feet above the general ground line. It is 55 feet west of the track road and about 15 feet higher.

Reference mark 1 is a C&GS disk, unstamped, cemented in a drill hole in the rock that surrounds the station mark and is about 1-1/2 feet above the station mark. It is 57 feet west of the track road and about 15 feet higher.

Reference mark 2 is a NGS disk stamped PULAMA 1914 NO 2 1977, cemented in a drill hole in lava rock and is flush with the ground surface. It is 55 feet west of the track road, 23 feet south of a 12-inch ohia tree and is about the same elevation as the station mark.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: PULAMA
 ESTABLISHED BY: E. R. HAND YEAR: 1914 STATE: HAWAII BENCH MARK(S) ALSO
 RECOVERED BY: R. B. MELBY YEAR: 1978 COUNTY: HAWAII
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 4 MILES WEST OF KALAPANA

Detailed statement as to the fitness of the original description; including marks found, stampings, changes made, and other pertinent facts:
 THE STATION AND REFERENCE MARKS WERE RECOVERED IN GOOD CONDITION.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 151552 STATION 1049
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 00' TO 155° 30'
 DIAGRAM NE 5-1.5 HAWAII

COAST AND GEODETIC SURVEY
 FORM 882

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION:	PUN			STATE:	Hawaii County: Hawaii.		
CHIEF OF PARTY:	K. T. Adams			YEAR:	1929 LOCALITY: Southeast Coast of Hawaii.		
Surface-station mark,	Note,*	4.		DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS			
Underground-station mark,	Note,*			OBJECT	DISTANCE	DIRECTION	AZIMUTH
Reference mark,	No. 1	Note,*	120.	Hill		00 00 00	
Reference mark,	No. 2	Note,*	120.	R. M. No. 1.	6.29	61 50 30	
Witness mark,	Note,*			R. M. No. 2.	32.14	339 30 00	
Witness mark,	Note,*						
Height of signal above station mark	6 meters.						
Height of telescope above station mark	1.8 meters.						
Detailed description:							

A bronze disc set flush in the surface of the lava on the first prominent mound of the pahoehoe lava on the seashore east of the town of Punaluu, Hawaii, and one mile E.x E. of the warehouse at Punaluu. The station mark is about 18 meters from the high water line and about 12 or 15 feet above sea level.

R. M. No. 1 is on the same mound.
 R. M. No. 2 is on the lower mound to the westward.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PUN
 ESTABLISHED BY: K.T. Adams YEAR: 1930 STATE: Hawaii
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 Island: Hawaii

HEIGHT OF TELESCOPE ABOVE STATION MARK 1.59 METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.
 DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
KAMEHAME NEW (HTS) 1949	---	1929		DISTANCE and DIRECTION
RM No. 2			32.14	00 00 00.0
RM No. 1			6.29	190 14 12
KAMEHAME NEW (HTS) 1949	---	1967		DISTANCE and DIRECTION
Punaluu, Hokuhoa Church Spire, 1967	WSW		105.354 (32.112)	00 00 00.0
RM No. 2	WSW		20.634	188 13 58.4
RM No. 1	NNW		6.289	190 14 14
				272 33 24

Station was recovered and all marks found in good condition. A complete description follows:

Station is located in the southern part of the island, along the coastline, about 1 mile east of Punaluu village, in rough lava area, on top of a lava mound.

To reach station from the post office in Pahala, go southeast on Pikeke St. for 0.2 mile; turn right on State Highway 15 and go 0.85 mile; turn right and go southwest on State Highway 11 for 3.8 miles; turn left

on the Punaluu Road and go downgrade 0.75 mile; turn left onto old railroad grade and go 0.35 mile to end of road at old dock. Walk easterly on good trail across rock and lava about 1 mile to station.

Station mark is a standard disk stamped "PUN 1929", cemented in a drill hole in lava bedrock 20 feet north of the 8-foot-high, sheer south edge of the mound. It is 5-1/2 feet northeast of a cairn with a 6 x 6-inch timber 9 feet long in the center, and about 100 feet north of water line. An area covered with large, rounded boulders begins at east side of station and runs east about 200 yards.

Reference mark number one is a standard disk stamped "1 1929", cemented in a drill hole in the north part of the station mound, across a large crack from station mark and 6 feet east of another large crack.

Reference mark number two is a standard disk stamped "2 1929", cemented in a drill hole in a lava area across a boulder-strewn draw from station. It is 21 feet north of a bluff edge and about 4 feet lower than station mark.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PUN
 STATE: HAWAII YEAR: 1930 THIRD ORDER
 SOURCE: G- 446

GEODETIC LATITUDE:	19 08 26.595	ELEVATION:	0 METERS
GEODETIC LONGITUDE:	155 29 21.880	SCALED	FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	ϕ OR Δ OR ANGLE
HI 1	5101	503,654.73	111,621.95	+ 0 00 15

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE ϕ OR Δ FORMULA NEGLECTING THE SECOND TERM

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
KAMEHAME NEW	249 56 34.0	249 56 21	5101

QF 035

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191552 STATION 1050
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °00' TO 155 °30'
 DIAGRAM NE S-1,5 HAWAII

NO ORIGINAL TEXT

Puu Huluhulu (HGS) (Hawaii County, Hawaii, HGS, 1891; United States Geological Survey, 1920).—In southeastern part of Hawaii, in southern Puna, about 3 miles southeast of the Volcano House at Kilauea, on the western and highest peak on the sharp rim of the Puu Huluhulu crater. Marked by a triangle cut in a stone set firmly in the ground, and three large stones to support instrument. Also by a stone pyramid 13 feet high.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM NO. 530

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Puu Huluhulu (HGS) STATE: Hawaii COUNTY: Hawaii
 ESTABLISHED BY: H.G.S. YEAR: 1891 LOCALITY: Puna, Hawaii
 RECOVERED BY: Chas.L. Murray YEAR: 1938

R

Detailed statement as to the fitness of the original description:

Location of station: In the S.E. part of Hawaii about 3 miles southeast of the Volcano House on the highest part of the western crater rim of a prominent hill called Puu Huluhulu. It can be reached by taking the chain of Craters Road.

Old station mark found: Drill hole in Δ on rock firmly set in ground with large stonepile over it.

New station mark: H.T.S. Type D-1 monument (Triangular concrete monument 7 1/2 feet on each side with 1 7/8 steel bar 2 feet long set on steel legs over the station mark which is left exposed to view. A standard metal target is set over the steel bar).

*Name of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the recovery note.
 NOTE.—One of these forms must be used for every station recovered.

11-7023

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PUU HULUHULU HGS OBS BY CGS
 STATE: HAWAII YEAR: 1891 FIRST ORDER
 SOURCE: 0-16241

GEODETIC LATITUDE:	19 22 28.20542	ELEVATION:	1049.39 METERS
GEODETIC LONGITUDE:	155 12 27.49206		3442.8 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	∠ OR Δ OR ANGLE *
HI 1	5101	600,574.52	196,602.27	+ 0 °05 '49 "

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE ∠ OR Δ OR FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH * (From south)	CODE
OHALE H.S	72 °56 '47.1 "	72 °50 '59 "	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979
 THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975
 LEVELING BY CGS

3M 136

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191552 STATION 1050

LATITUDE 0 ' TO 0 '
 LONGITUDE 0 ' TO 0 '
 DIAGRAM

PUU HULUHULU (HGS) (continued)

FORM 526a
 (7-18-67)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

R

RECOVERY

RECOVERY NOTE, TRIANGULATION STATION

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 526
 MAY, 1967

NAME OF STATION: PUU HULUHULU (HGS) State: Hawaii COUNTY: Hawaii

Established By: Hawaiian G.S., 1891
 CHIEF OF PARTY: C. T. Husemeyer Year: 1949

Described by: C. J. Hoepfel

HEIGHT OF TELESCOPE ABOVE STATION MARK 0.95 METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.

NOTE*	HEIGHT OF TELESCOPE ABOVE STATION MARK	HEIGHT OF LIGHT ABOVE STATION MARK	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION				
			OBJECT	BEARING	DISTANCE		DIRECTION
					feet	meters	
12c	Surface-station mark, Underground-station mark		OHALE (HGS)	N	32.355	9.862	00 00 00
			R M No. 1	E	9.235	2.816	98 10 27
			B M (USGS)				239 26 47

Detailed description

The original station, consisting of a drill hole in the center of a triangle carved into the rock, was established by the Hawaiian Government Survey in 1891. In 1912 the original station was recovered by the U. S. Geological Survey and a new station, marked by a U. S. Geological Survey disk, was established. In 1938 the Hawaiian Territory Survey recovered the original station, over which they centered a 1 7/8 inch iron bar. Accuracy of centering by the Hawaiian Territory Survey in remarking there is no means of checking the centering of the iron bar exactly over the original station. The center of the iron bar was used as the station for this survey. A new description follows--

The station is located on the western summit of a prominent, wooded, volcanic cone which lies about 8 miles north of the sea, about 5.5 south 43 degrees east of the Hawaiian National Park Headquarters and about 0.5 mile north of the Chain of Craters road.

To reach from the Hawaiian National Park Headquarters; go south and east on the Chain of Craters Road for 9.2 miles to the west side of Aloi Crater and the end of truck travel. From this point pack northerly, along a well marked trail for 0.4 mile; take the right hand fork, as per the sign reading Puu Huluhulu, and pack easterly for 0.3 mile to the summit of the cone and the station.

The station is the center of a 1 7/8 inch iron bar which projects about 2 feet from the top of a triangular slab of concrete which is 7 1/2 feet on each side and projects about 6 inches.

Reference mark number 1 is a standard disk, stamped PUU HULUHULU NO 1 1949, set into a drill hole in a boulder which is about flush with the surface of the ground. It is located on the crest of the rim of the crater and is about the same elevation as the station.

The U. S. Geological Survey Disk, stamped 8440 1912, is set into a drill hole in a boulder which projects about 2 feet. It is located about 2 feet north of the edge of the crater and is about 1 1/2 feet lower than the station.

NAME OF STATION: PUU HULUHULU (HGS) STATE: Hawaii
 ESTABLISHED BY: HGS YEAR: 1891 COUNTY: Hawaii
 RECOVERED BY: D.M. Whipp YEAR: 1967 Island: Hawaii

HEIGHT OF TELESCOPE ABOVE STATION MARK 0.9 METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.

NOTE*	HEIGHT OF TELESCOPE ABOVE STATION MARK	HEIGHT OF LIGHT ABOVE STATION MARK	DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION					
			OBJECT	BEARING	DISTANCE		DIRECTION	
					FEET	METERS		
			OHALE (HGS) 1897	-----	1949	DISTANCE and DIRECTION		00 00 00.0
			RM No. 1	N	32.355	9.862	98 10 27	
			B M (USGS)	E	9.235	2.816	239 25 47	
			OHALE (HGS) 1897	-----	1967	DISTANCE and DIRECTION		00 00 00.0
			RM No. 1	NNW	32.200	9.815	98 13 07	
			EM 3440 (USGS) (RM No. 2)	SE	9.244	2.817	239 30 04	

Station was recovered and all marks found in good condition. A complete description follows:

Station is located in the Hawaii Volcanoes National Park, about 5-1/2 miles southeast of the Park Headquarters building and 1/2 mile north of the Chain of Craters Road, on the west rim of a prominent, wooded volcanic cone.

To reach station from the Hawaii Volcanoes National Park Headquarters building, go south and east on the Crater Rim Road for 3.8 miles to a crossroad. Turn left on the Chain of Craters Road and go 4.8 miles to

end of truck travel at a parking area on left and a signboard describing Puu Huluhulu. Pack northerly on good trail about 0.6 mile to top of cone and station.

Station is marked with a Type D-1 signal built by the Hawaii Territorial Survey; this consists of a triangular, concrete platform about 7 feet on each side and projecting 3 inches. In center of platform is an 8-inch-triangular hole about 7 inches deep. At the bottom of this hole is a 1-inch-diameter hole in rock which is assumed to be station mark. A 2-inch iron shaft, 2 feet long, is mounted vertically over center of hole, supported by 3 iron legs embedded in the platform, and holds a red and white metal target 8 feet high. Station is 7 feet west of the steep drop into crater and about 50 feet north of a stone observation point on crater rim.

Reference mark number one is a standard disk stamped "PUU HULUHULU NO 1 1949", cemented in a drill hole in a 16-inch-diameter bedrock knob projecting 4 inches. It is about 2 feet lower than station mark.

Bench mark 3440 (USGS) serves as reference mark number two. It is a U.S. Geological Survey disk, stamped "3440 1912", cemented in a drill hole in a bedrock ledge at sheer edge of crater rim, about 2 feet lower than station mark.

NOTE: The difference in distance to RM No. 1 was noted and checked and the 1967 distance is correct. It is believed that the 1949 distance is the slope distance from top of iron shaft to the reference mark, as indicated by a check.

* of party should be inserted here. The officer who actually visited the station should sign his name of the note.

NOTE - One of these forms must be used for every station recovered.

USCOM 4-778-P88

* Refer to notes in manuals of triangulation and state publications of triangulation. 1 Direction-angle measured clockwise, referred to initial station.
 10-50002-1 U. S. GOVERNMENT PRINTING OFFICE

(continued on next page)

JUN 1978
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

PUU HULUHULU HGS (continued)

HORIZONTAL CONTROL DATA

by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 191552 STATION 1050

LATITUDE ° ' TO ° '
LONGITUDE ° ' TO ° '
DIAGRAM

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: PUU HULUHULU HGS
ESTABLISHED BY: HGS YEAR: 1891 STATE: Hawaii BENCH MARK ALSO
RECOVERED BY: L.A. Critchlow YEAR: 1977 COUNTY: Hawaii
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 5 1/2 miles SE of Hawaii Volcanoes
HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. National Park Headquarters, FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
OHALE HGS 1897	NNE	6.03	1.836	00 00 00"
RM 3				133 36 47
BM 3440 USGS	SE	9.25	2.819	239 29 35
RM 3 to BM 3440 USGS		12.34	3.759	

The station is located in the Volcanoes National Park, about 5 1/2 miles southeast of the Park Headquarters building and 1/2 mile north of the Chain of Craters Road, on the west rim of a prominent, wooded volcanic cone.

To reach the station from the Hawaii Volcanoes National Park Headquarters, go east for 0.15 mile to side road right. Turn right and go east and southeasterly 0.45 mile to a T-road. Turn left and go east 2.45 miles to crossroad. Turn left and go east for 2.15 miles to side road right. Continue east 1.55 miles to crossroad and a locked gate on the left. Key may be obtained at the Park Headquarters. Turn left and go north 0.55 mile to a track road right at the north end of a lava flow. Turn right and go east on track road 0.15 mile to a lava flow and the end of the road. Pack east on the trail on the lava flow to a fork at a better trail. Bear left and follow this better marked trail to a fork at a signboard at the south side of a grass covered hill. Pack north on trail to top and the station site. It is about a 1/2 hour pack.

The station is marked with a Type D-1 signal built by the Hawaii Territorial Survey; this consists of a triangular, concrete platform about 7 feet on each side and projecting 3 inches. In the center of the platform is an 8 inch triangular hole about 7 inches deep. At the bottom of this hole is a 1 inch diameter hole in rock which is assumed to be the station mark. A 2 inch iron shaft, 2 feet long, is mounted vertically over the center of the hole, supported by 3 iron legs embedded in the platform, and holds a red and white metal target 8 feet high. The station is 7 feet west of the cliff and about 50 feet north of a stone observation point on the crater rim.

Bench Mark 3440 USGS serves as reference mark number 2. It is a USGS disk, stamped 3440 1912, cemented in a drill hole in a bedrock ledge, 1 foot south of the cliff edge, and about level with the station. Measurements made on this date are compatible with the 1967 ones. Reference mark 3, stamped PUU HULUHULU HGS 1891 NO 3 1977, is a NGS tablet cemented in a drill hole in bedrock, about 1 1/2 feet south of the edge of a cliff and about level with the station.

* Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the recovery note.

NOAA FORM 76-96 (11-72) SUPERSEDES CGS FORM 828A WHICH MAY BE USED.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL GEODETIC SURVEY

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