

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 191543 STATION 1001
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 154 °30' TO 155 °00'
 DIAGRAM NE 5-15 HAWAII

DESCRIPTION
~~RECOVERY NOTE~~ TRIANGULATION STATION

ADJUSTED HORIZONTAL CONTROL DATA
 ADJUSTMENT BY NGS

NAME OF STATION: BM YY 153 (USGS)
 ESTABLISHED BY: L.A. Critchlow YEAR: 1977 STATE: Hawaii BENCH MARK ALSO
 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: About 5-1/2 miles east of Pahoia
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

NAME OF STATION: BM YY 153 USGS OBS BY NGS
 STATE: HAWAII YEAR: 1977 SECOND ORDER
 SOURCE: 6-16241

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
KAPOHO HGS 1896 Geodetic Distance	NE	10384.00	3165.050	00 00 00.0
KAPOHO HGS h.M. 1 Geodetic Distance	NE	10388.64	3166.465	00 04 49.0

GEODETIC LATITUDE: 19 29 37.03191	ELEVATION: 116.77 METERS
GEODETIC LONGITUDE: 154 52 15.49191	383.1 FEET

The station is located about 5-1/2 miles east of Pahoia, 4 miles west-southwest of Cape Kumukahi Lighthouse and is on state highway right-of-way.

To reach the station from the junction of State Highways 13 and 132 at Pahoia, go east on highway 132 for 2.6 miles to a fork, take the left fork and continue east on highway 132 for 2.1 miles to the station on the left.

The station is a USGS bench mark disk stamped 383 YY 153, cemented in the top of an 8-inch square concrete post that projects about 8 inches above the ground surface. It is 145 feet northeast of a power line pole and 27 feet northwest of the center of State Highway 132.

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	ϕ OR Δ OR ANGLE
41	5101	716,550.59	240,171.52	+ 0°12'35"

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

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
KAPOHO HGS	256°16'40.6"	256°04'05"	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979
 LEVELING BY NGS

3M 014

* 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 C&GS FORM 526A WHICH MAY BE USED.
 (1-72)

U.S. DEPARTMENT OF COMMERCE
 NOAA

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HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191545 STATION 1002
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 154° 30' TO 155° 00'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

ADJUSTED HORIZONTAL CONTROL DATA

DEPARTMENT OF COMMERCE
 U. S. OCEAN AND GEODETIC SURVEY
 FORM NO. 502

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: **Maluma (HTS)** STATE: **Hawaii** COUNTY: **Hawaii**
 ESTABLISHED BY: **Haw. Terr. Survey Year 1091** LOCALITY: **Kalapana, Puna, Hawaii**
 RECOVERED BY: **Haw. Terr. Survey Year 1038**

Detailed statement as to the fitness of the original description:

The original mark, a Δ on rock, was located. This mark is located on top of a prominent bluff at the westerly end of Kalapana Village about 700 feet south of the government road leading to Kapaahu Village. A Type D-1 concrete monument with metal target has been placed over the old mark and is plainly visible from the government road.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: **HAKUMA (HTS)** YEAR: **1891** STATE: **Hawaii** BENCH MARK(S) ALSO
 ESTABLISHED BY: **HTS** YEAR: **1967** COUNTY: **Hawaii**
 RECOVERED BY: **D.M. Whipp** 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 as described in 1938. Located along southeast coast of the island, about 1800 feet southwest of the 2 churches at Kalapana, 650 feet southeast of State Highway 13, and 450 feet northwest of sea, on top of northwest rim of the prominent bluff between highway and sea, about 75 yards northeast of some graves and about 380 feet northwest of station HAKUMA 1914, a station established by the USC and GS in 1914.

To reach station from the junction of State Highways 132 and 13 at Pahoia, go south on State Highway 13 for 10.8 miles to the 2 churches at Kalapana. Continue on the highway for 0.3 mile; turn left through gate in stone wall, into yard of a home and end of truck travel. Walk southeast on trail through trees about 200 yards to graves on slope. Go north-east up along rocky face of bluff about 75 yards to station.

Station is marked by a Type D-1 signal, a triangular, concrete platform about 7 feet on each side, with a red and white metal target extending about 8 feet from the center.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: **HAKUMA HTS** YEAR: **1891** STATE: **Hawaii** BENCH MARK ALSO
 ESTABLISHED BY: **HTS** YEAR: **1977** COUNTY: **Hawaii**
 RECOVERED BY: **L.H. Critchlow** AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: **1/4 mile southwest of Kalapana Village**
 HEIGHT OF TELESCOPE ABOVE STATION MARK FEET. HEIGHT OF LIGHT ABOVE STATION MARK 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	

The station was recovered as described in 1967. No observations was made at this time.

NAME OF STATION: **HAKUMA HTS** OBS BY **CGS**
 STATE: **HAWAII** YEAR: **1891** SECOND ORDER

SOURCE: **S-16241**

GEODETIC LATITUDE	19 21 00.05394	ELEVATION	20.9 METERS
GEODETIC LONGITUDE	154 53 55.63642		69 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	β HOR Δ θ ANGLE °
HI 1	5101	678,424.40	187,892.17	+ 0°10'17"

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE β HOR Δ 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
 THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

3M 029

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191543 STATION 1003
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 154° 30' TO 155° 00'
 DIAGRAM NE 5-1.5 HAWAII

Hakuma (Hawaii Island, E. R. Hand, 1914).—On east coast of Hawaii, on Hakuma Point, ½ mile south of the village of Kalapana. On a flat grassy meadow, about 7 meters from the cliff edge to the southeast and about 3 meters southwest of a stone wall which runs inshore from the cliff edge; part of wall has been removed. Station marked by a survey tablet set in smooth lava outcrop, and surrounded by a circular patch of cement. It is surrounded by a large hollow cairn, 12 feet in diameter and 6 feet high, whitewashed. Reference mark is a cairn inshore and at highest point of meadow; it is near edge of lava cliff which faces inshore and probably marks a Territorial Survey station; it is distant 135 meters, bearing N. 33° W. The spire of the protestant church at Kalapana bears N. 12° E., 655 meters.

ADJUSTED HORIZONTAL CONTROL DATA

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

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: HAKUMA
 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	15.974	4.869	00 00 00.0 33 09 23
KUPAPAU 1914 RM No. 2	SW WNW	27.417	8.357	252 17 43.8 304 46 40

Station mark was re-covered in good condition. Two new reference marks were established.
 NOTE: This is not the same station as HAKUMA (HTS) 1891.

A complete description follows:
 Station is located in southeast part of the island, about 1/3-mile southwest of Kalapana village and 1100 feet southeast of State Highway 13, at about 62 feet elevation, on the highest part of the long, open, flat-topped ridge, or mesa along the sea-coast, and about 1500 feet southwest from end of ridge.

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 village. Continue on the highway for 0.25 mile; turn left through gate into yard, and end of truck travel at house. Walk south on trail through trees about 200 yards to some graves on hillside. Go left up onto ridge top about 75 yards to station HAKUMA (HTS) 1891, then follow dim trail southerly through brush about 450 feet to station near edge of cliff.

Station mark is a standard disk, unstamped, cemented in a drill hole in a 4-foot-square bedrock outcrop, with slightly rounded top, projecting 6 inches. It is about 200 yards southwest of a prominent, large, lone ironwood tree, 70 feet southwest of the center of a large rock pile, and 24 feet northwest from edge of cliff.

Reference mark number one is a standard disk stamped "HAKUMA 1914 NO 1 1967", cemented in a drill hole in lava bedrock flush with ground. It is 3 feet south from brush line and at same elevation as station mark.

Reference mark number two is a standard disk stamped "HAKUMA 1914 NO 2 1967", cemented in a drill hole in a 5 x 16-foot, open, bedrock area surrounded by brush. It is flush with ground and about 6 inches lower than station mark.

(Continued on next page)

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

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

USCOMM-DC 27179-P89

GEODETIC LATITUDE: 19 20 56.10873	ELEVATION: 18.81 METERS
GEODETIC LONGITUDE: 154 08 54.85601	61.7 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ HOR Δ θ ANGLE
HI 1	5101	678,596.07	187,494.70	+ 0° 10' 18"

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

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
HEIHEIAHULU	172° 22' 12.7"	172° 11' 55"	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

LEVELING BY CGS

SM 030

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 191543 STATION 1003
 LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

HAKUMA (Continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: HAKUMA BENCH MARK ALSO
 ESTABLISHED BY: S. S. Hand YEAR: 1914 STATE: Hawaii
 RECOVERED BY: L. A. Critchlow YEAR: 1977 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 1/3 mile southwest of Kalapana Village
 HEIGHT OF TELESCOPE ABOVE STATION MARK 5 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 5 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
KUPAPAU 1914	WNW	27.43	8.361	00 00 00.0
RM 2	WNW	(432.96)	131.965	52 29 41
HAKUMA HTS 1891	ENE	15.99	4.874	92 08 55.6
RM 1	NNE	31.35	9.557	140 50 59
RM 1 to RM 2				

The station and reference marks 1 and 2 were recovered in good condition. The distance and direction to reference marks 1 and 2 compared favorable to the 1967 data. The difference to reference mark 1 being 0.005 meters longer and 46 seconds. The difference to reference mark 2 being 0.004 meters longer and 40 seconds. A measurement was made between reference marks 1 and 2 at this time and due to changes a new description follows.

The station is located about 1/3 mile southwest of Kalapana Village and about 1100 feet southeast of State Highway 13 and is on state property.

To reach the station from the junction of State Highways 137 and 13 at the northeast edge 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. Turn left just south of the church on the left and go east for 0.1 mile to the waters edge and end of truck travel. Pack southwest and east going through water for about 0.1 mile, then northeast uphill for about 0.1 mile to some wooden steps; go up the steps then turn right and pack southwest along the top of a bluff for about 1/4 mile to the station.

The station mark is a C&GS disk, unstamped, cemented in a drill hole in lava rock and projects about 3 inches above the ground surface. It is 25 feet northwest of the ocean cliff.

Reference mark 1 is a C&GS disk stamped HAKUMA 1914 NO 1 1967, cemented in a drill hole in lava rock and is flush with the ground surface. It is 44 feet northwest of the ocean cliff and is about the same elevation as the station mark.

Reference mark 2 is a C&GS disk stamped HAKUMA 1914 NO 2 1967, cemented in a drill hole in lava rock and is flush with the ground surface. It is 41 feet northwest of the ocean cliff and is about 6 inches lower than the station mark.

HAKUMA HTS is a 2-1/2 inch metal shaft with a punch hole in the center, projecting 3 feet from the center of a triangular shaped concrete platform, with a metal target mounted vertically on the shaft that projects about 3 feet. The letters HAKUMA HTS 7-1-38 are inscribed in the concrete base. It is 9 feet southeast of the edge of a bluff.

* 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 76-76 SUPERSEDES CGS FORM 522A WHICH MAY BE USED.
 (1-72)

U.S. DEPARTMENT OF COMMERCE

U.S. GPO: 1976-645-641/1270 Reprint 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 191543 STATION 1004
HAWAII
LATITUDE 19° 00' TO 19° 30'
LONGITUDE 154° 30' TO 155° 00'
DIAGRAM NE 5-1.5 HAWAII

NO TEXT

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: HANAE
STATE: HAWAII YEAR: 1891 THIRD ORDER

SOURCE: G-SP156

GEODETIC LATITUDE	19° 22' 32.578"	ELEVATION	METERS
GEODETIC LONGITUDE	154° 57' 12.999"		FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	β OR Δ OR ANGLE *
HI 1	5101	688,318.81	197,256.29	+ 0 10 53

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

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

QD 312

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 191543 STATION 1005
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 154 °30' TO 155 °00'
 DIAGRAM NE 5-1,5 HAWAII

ADJUSTED HORIZONTAL CONTROL DATA

NO TEXT

NAME OF STATION HEIHEI AHULU
 STATE HAWAII YEAR 1896 THIRD ORDER

SOURCE G-SP156

GEODETIC LATITUDE	19 °25'39.024	ELEVATION	METERS
GEODETIC LONGITUDE	154 °59'34.680		FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	ϕ OR Δ OR ANGLE *
HI 1	5101	674,698.82	216,023.09	+ 0 °10'07"

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

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

QD 311

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 151543 STATION 1006
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 154° 30' TO 155° 00'
 DIAGRAM NE 5-1.5 HAWAII

Heiheiahulu (Hawaii Island, E. R. Hand, 1914).—In the eastern part of Hawaii, on the east edge of rim of crater on top of Mount Heiheiahulu, 5 miles north by west from Kalapana. This is the highest point of the entire rim; the old station, *West Heiheiahulu* (see description) across the crater is lower, bears N. 63° W., and is distant about 100 meters. Mark is a survey tablet set in a block of concrete, over which is a cairn about 4 feet high.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 500

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: HEIHEIAHULU
 ESTABLISHED BY: E. R. Hand YEAR: 1914 STATE: Hawaii
 RECOVERED BY: C. T. Husemeyer YEAR: 1949 COUNTY: Hawaii

Detailed statement as to the fitness of the original description:

The station was recovered as described and in good condition. In 1930 the Hawaiian Territory Survey surrounded this station with a square block of concrete which is about 7 1/2 feet on each side but left the station mark open to view. A new description follows--

The station is located on the easterly rim of an extinct volcanic cone which lies about 13.5 miles west southwest of Cape Kumukahi, about 5.5 miles southwest of Pahoa, about 5 miles north of Kalapana and 25 feet east of the rim of the deep crater.

To reach from the post office at Pahoa; go southerly for 0.4 mile; turn right, as per the sign reading Kalapana; and go southwest for 5.1 miles; turn right, onto a track road and go westerly for 1.0 mile; pass to the right hand side of a small shack and continue westerly, on an overgrown track road, for 0.5 mile to the end of truck travel at the side of the road. From this point pack west northwest, thru the ferns and jungle, for about 2 miles to the summit of the low cone and the station. This is about a 3 hour pack over a cleared trail. No water available along the route.

The station is a standard disk, unstamped, set into concrete which is about flush with the surface of the ground.

Reference mark number 1 is a standard disk, stamped HEIHEIAHULU NO 1 1949, set into a drill hole in ledge rock. It is located 6 feet south east of the rim of the crater and about 4 feet lower than the station. Reference mark number 2 is a standard disk, stamped HEIHEIAHULU NO 2 1949, set into a drill hole in ledge rock which is flush with the surface of the surrounding soil. It is located 3 feet southeast of the edge of the crater and about 2 feet lower than the station.

NOTE	OBJECT	BEARING	FEET	METERS	DIRECTION
12a	PUU HULUHULU (HTS)				00 00 00 =
12a	R M No. 2	WNW =	26.359	8.035	21 43 41 =
12a	R M No. 1	NNE =	25.452	7.758	120 45 33 =
	Kapoho Lighthouse (Cape Kumukahi)	ENE =	13.5 miles		165 58 07.4 =

ADJUSTED HORIZONTAL CONTROL DATA

ADJUSTMENT BY HGS

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

SOURCE: G-16241

GEODETIC LATITUDE:	19 25 37.94340	ELEVATION	521.2	METERS
GEODETIC LONGITUDE:	154 59 34.64610		1710	FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	β OR Δ or ANGLE °
HI	5101	674,702.20	215,914.10	+ 0° 10' 07"

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

TO STATION OR OBJECT	GEODETIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
KAPOHO HGS	242° 54' 26.4"	242° 44' 19"	5101

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

SM 037

(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 GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 191543 STATION 1006

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

HEIHEIAHULU (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: HEIHEIAHULU
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 was recovered and all marks found in good condition. The distance to the reference marks was checked and found correct. A complete description follows:

Station is located about 5-3/4 miles southwest of Pahoa and 5-1/4 miles north-northwest of Kalapana, at about 1711 feet elevation, on the highest point on the southeast rim of Heiheiiahulu Crater, which is covered with dense brush and small trees.

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 5.8 miles. Take side road right and go 0.15 mile; turn left by house and go southwest 0.55 mile; turn right and go 0.6 mile to T-junction. Turn left and go 0.25 mile to track road right. Turn right and go northwest 0.7 mile to house on left. Continue for 0.55 mile to end of road. Walk northwest up grassy strip about 300 yards to end. Clear trail through trees and brush on a bearing of 291° for about 3/4-mile (airline) to station. About 2 hours required to clear trail to station. NOTE: A 4-wheel-drive truck is needed to reach end of truck travel.

Station mark is a standard disk, unstamped, cemented in a drill hole in a rock flush with ground. A Type B-1 signal, built by the Hawaii Territorial Survey, is centered over the mark, with the 6-foot-square, conical crete platform projecting 6 inches above ground and a concrete pedestal in the center extending 30 inches above the platform and supporting a red and white metal target 7 feet tall. A 7 x 30-inch depression is in center of platform and the station mark can be seen in the bottom of it.

Reference mark number 1 is a standard disk stamped "HEIHEIAHULU NO 1 1949", cemented in a drill hole in the edge of a bedrock ledge 1 foot southeast of the steep drop into crater and about 1-1/2 feet lower than station mark.

Reference mark number two is a standard disk stamped "HEIHEIAHULU HTS 1949", cemented in a drill hole in bedrock 2 inches beneath ground level. It is 3 feet south of edge of steep drop into crater and about 2 feet lower than station mark.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: HEIHEIAHULU
ESTABLISHED BY: E.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: 5 miles N of Kalapana
HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION		
		FEET	METERS	°	'	"
KAPOHO HGS 1896	WNW	26.45	8.062	00	00	00
RM 2	NNE	25.44	7.757	214	23	38
RM 1		39.48	12.034	313	28	08
RM 1 to RM 2						

The station mark and reference marks 1 and 2 were recovered in good condition. The direction to reference 1 measured on this date was about 4 minutes larger than the 1949 measurement. The direction to reference mark 2 measured on this date was about 1 1/2 minutes larger than the 1949 measurement. The distance to reference mark 2 measured on this date was 0.027 meter longer than the 1949 measurement. The distance to reference mark 1 measured on this date compared favorably to the 1949 measurement. The 1949 and 1967 recovery notes are adequate with the addition of the following new to reach description. To reach the station from the junction of State Highways 13 and 132 near the east edge of Pahoa, go south on Highway 13 for 5.4 miles to road intersection on the right at the south edge of a lava flow. Turn right and follow main travelled gravel road westerly 1.8 miles to road-T right. Turn right (pass through locked gate) and go 1.5 miles on main road to the end of the road which is the end of travel by vehicle. Pack westerly along trail about 3/4 mile to the top of the hill and the station site.

* 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

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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 191543 STATION 1008
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 154 °30' TO 155 °00'
 DIAGRAM NE 5-1.5 HAWAII

Honuaula (Hawaii Island, E. R. Hand, 1914).—Near eastern point of Hawaii, on the rim of Honuaula Crater, which lies a little south of west from Cape Kumukahi, and in the forks where the road from Pahoa branches to Pohoiki and Kapoho. The station is the more northerly and seaward of two wooded tits of almost equal height on the rim of the crater. These twin tits are very conspicuous from the sea on all sides.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: HONUULA
 STATE: HAWAII YEAR: 1914 ORDER: THIRD

SOURCE: G-SP156

GEODETIC LATITUDE	19 29 02.14	ELEVATION:	METERS
GEODETIC LONGITUDE	154 53 22.36		FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	ϕ OR Δ ANGLE*
HI 1	5101	710,261.30	236,628.90	+ 0 12 13

* 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

QD 320

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191543 STATION 1009
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 154 °30' TO 155 °00'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 Form 525
 Rev. Aug. 1968

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: HONUAULA (HTS) STATE: Hawaii COUNTY: Hawaii

CHIEF OF PARTY: CT. Husemeyer YEAR: 1949 Described by: C. J. Hoepfel

NOTE*	HEIGHT OF TELESCOPE ABOVE STATION MARK	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.
	METERS.	OBJECT	BEARING	DISTANCE	DIRECTION:
	Surface-station mark, Underground-station mark			feet	meters
	This station was located by 16 position intersection.				

The station is located on the summit of a prominent, brush covered, hill which lies about 8 miles southwest of Cape Kumukahi, about 4 miles east southeast of Pahoa, about 3.5 miles southwest of Kapoho and about 0.5 mile northeast of the Pahoa-Pohoiki road.

The station is the center of a 1 1/2 inch iron pipe which is set in concrete. Set over this station is a pipe tripod about 10 feet in height which supports a target pole.

The station is best reached from the southeast side of the hill.

Detailed description

ADJUSTED HORIZONTAL CONTROL DATA

ADJUSTMENT BY NGS

NAME OF STATION: HONUAULA HTS

OBS BY CGS

STATE: HAWAII

YEAR: 1949

FIRST

ORDER

SOURCE: G-16241

GEODETTIC LATITUDE:	19 28 59.70722	ELEVATION:	258.6
GEODETTIC LONGITUDE:	154 33 29.78231		848
			METERS FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	# OR Δ ° ANGLE °
HI 1	5101	709,647.69	236,381.30	+ 0 12' 11"

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

TO STATION OR OBJECT	GEODETTIC AZIMUTH (From south)	PLANE AZIMUTH* (From south)	CODE
KALIU HGS	46 °06' 06.2	45 °53' 55 "	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

3M 049

(continued on next page)

JUN 1978

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

HONUAULA HTS (continued)

HORIZONTAL CONTROL DATA

by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 191543

STATION 1009

LATITUDE ° ' TO ° '
LONGITUDE ° ' TO ° '
DIAGRAMFORM 326a
(1-1967)U.S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: HONUAULA (HTS)
ESTABLISHED BY: C.T. Husemeyer YEAR: 1949 STATE: Hawaii
RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
Island: HawaiiHEIGHT OF TELESCOPE ABOVE STATION MARK 1.29 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	
KAPOHO (HGS) 1896				84 26 14
RM No. 1	SE	32.097	9.784	161 44 07
RM No. 2	SW	7.905	2.410	354 00 58.6
Cape Kumukahi Lighthouse, 1949	NE			

Station mark was recovered in good condition. A 1958 U.S. Geological Survey description states that at that time it was found in only fair condition and was re-enforced by USGS personnel. Two new reference marks were established. A complete description follows:

Station is located about 4 miles east-southeast of Pahoa and 6 miles southwest of Cape Kumukahi, which is the easternmost point of the island; on the summit of Puu Honuaula, a brush and tree-covered crater rim of about 850 feet elevation. When seen from Hilo this hill appears to have a large notch on it's west end.

To reach station from the post office in Pahoa, go east on State

Highway 13 for 0.4 mile; take left fork and go east on State Highway 132 for 2.8 miles to fork just after passing Lava Tree State Park. Take left fork and go 0.7 mile; turn right, onto graveled side road, and go 0.3 mile to fork by garbage dump. Take right fork and go 0.1 mile to fork. Take left fork, up through cane field, up through saddle, and bearing left up onto flat cleared area, for 0.3 mile to end of truck travel at southeast point of hill just below deep crater. Pack north-west up ridge through heavy brush about 250 yards to top and station.

Station mark is a 1-1/2-inch iron pipe that projects 5 inches from the top of a 12-inch-square, concrete monument that projects 7 inches above ground and has "1958" inscribed in the top, as well as some names. It is about 40 yards northwest of a 60-foot ohia tree that is the northernmost one of a group of large, prominent trees. A large, iron-pipe tripod, painted red, is centered over the station, with a 12-inch, triangular iron plate at it's top about 8 feet above station mark.

Reference mark number one is a standard disk stamped "HONUAULA HTS 1901 NO 1 1967", cemented in a drill hole in lava rock outcrop projecting 3 inches. It is along ridge top, 0.8 foot lower than station mark.

Reference mark number two is a standard disk stamped "HONUAULA HTS 1901 NO 2 1967", cemented in a drill hole in lava rock outcrop projecting 2 inches. It is along the southwest side of the hill, about 14 inches lower than station mark.

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

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

END

USCOMM-DC 27179-P88

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: HONUAULA (HTS)
ESTABLISHED BY: C.T. Husemeyer YEAR: 1949 STATE: Hawaii BENCH MARK ALSO
RECOVERED BY: J.A. Critchlow YEAR: 1977 COUNTY: Hawaii
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 4 miles southeast of Pahoa
HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET, HEIGHT OF LIGHT ABOVE STATION MARK FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
KALIN HGS 1891				00 00 00.00
RM 2	SE	7.926	2.416	5 15 22
CAPE KUMUKAHI LIGHTHOUSE 1949	SW	About 5 miles		107 47 31.63
RM 1	S	32.096	9.793	200 12 12
RM 1 to RM 2		31.30	9.541	

The station mark and reference marks 1 and 2 were recovered in good condition. The direction to reference mark 1 compared favorably with the 1967 measurement. The direction to reference mark 2 differs by 15 minutes with the 1967 measurement, although it must be noted that reference mark 2 is very close to the station mark. The distances to the reference marks measured on this date compares 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 226A WHICH MAY BE USED.
(1-75)

JIMMERCE
NOAA
U.S. GPO: 1976-645-641/1220 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

0 191543 STATION 1010
 HAWAII
 LATITUDE 19 ° 00' TO 19 ° 30'
 LONGITUDE 154 ° 30' TO 155 ° 00'
 DIAGRAM NE 5-1.5 HAWAII

KALAPANA CHURCH (Hawaii Island, E. R. Hand, 1914).—On the eastern coast of Hawaii, at Kalapana, the spire of the Protestant Church. The church faces the sea, and the spire is surmounted by a yellow ball. In 1914 it was the largest building in the village.

RECOVERY NOTE, TRIANGULATION STATION INTERSECTION

NAME OF STATION: **Kalapana Church**
 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**

R

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **KALAPANA CHURCH**
 STATE: **HAWAII** YEAR: **1914** THIRD ORDER

SOURCE: **G-52184**
 NO OBSERVATION CHECK ON THIS POSITION

GEODETIC LATITUDE:	19 ° 21' 15.18	ELEVATION	METERS
GEODETIC LONGITUDE:	154 58 46.78		FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	ρ OR Δ OR ANGLE *
HI 1	5101	679,363.62	189,420.87	+ 0 10 21

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

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

FORM C&G-526 (1-68)
 USCOMM-DOC 18209-P68

U. S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

QF 061

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 151543 STATION 1011
 HAWAII
 LATITUDE 15° 00' TO 19° 30'
 LONGITUDE 154° 30' TO 155° 00'
 DIAGRAM NE 5-15 HAWAII

NO ORIGINAL TEXT

KALIU (HGS)

(Hawaii Island, Hawaiian Government Survey, 1891; E. R. Hand, 1914).—In the eastern part of Hawaii, southwest of Cape Kumukahi, on the summit of Kaliu Hill, which is 3 miles inshore (northwest) from Kalepa Point. Hill has grassy top and wooded sides. Station is at highest point of grassy area in a raised square, apparently a natural formation. Station reached by proceeding down old plantation road, turning to the left at a water shed and tanks; the road joins the Kalapana-Pahoa road 4 miles out of Pahoa. Station marked by a cross on a stone set in concrete, a few inches down in the sod.

RECOVERY NOTE, TRIANGULATION STATION

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

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
HEIHEIAHULU 1914 -----1949 DISTANCE and R.M. No. 2	NW	13.711	4.179	00 00 00.0
Kumukahi Cape Lighthouse R.M. No. 1	NE	20.105	6.128	77 40 31.3
HEIHEIAHULU 1914 -----1967 DISTANCE and RM No. 2	NE	13.742	4.189	170 46 26.6
Cape Kumukahi Lighthouse, 1949 RM No. 1	NW	20.111	6.131	180 39 40.0
	ENE			00 00 00.0
				77 48 24
				170 47 32.6
				180 37 59

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

Station is located in the Puna District, about 3-1/2 miles southeast of Pahoa and 3 miles northwest of Opihikao Village, on the summit of Puu Kaliu, a heavily-timbered hill of about 1071 feet elevation. The raised square mentioned in old descriptions, on which station sets, is not noticeable due to the dense fern and brush.

To reach station from the post office in Pahoa, go east 0.4 mile to highway junction. Take right fork and go south on State Highway 13 for 4.0 miles; take paved side road left, at sign "OPIHIKAO", and go 1.25 miles to building on right; continue on main road, going left, for 1.0 mile; turn left on cinder track road and go upgrade 0.5 mile; take right fork, just below cinder pit, and go 0.3 mile; take dim right fork and go 0.3 mile to open area and end of truck travel. Walk northeast on trail 50 yards, then go left, northwest, on brushy trail about 200 feet. Here leave trail and go right, picking way northeast up through timber and brush about 1/4-mile to top, and station.

Station mark is a faint, 1-inch cross chiseled in the top of a 2 x 3-inch oval rock set in concrete. A Hawaii Territorial Survey, Type B-1 signal is built over the mark; the 6-foot-square, concrete platform projects 6 inches above ground and the station mark is visible in a 7 x 30-inch depression in the middle of the platform. A red and white metal target extends 10 feet above the platform.

Reference mark number one is a standard disk stamped "KALIU NO 1 1949", cemented in the top of a 2-1/2-inch iron pipe that projects 3 inches. It is at about same elevation as station.

Reference mark number two is a standard disk stamped "KALIU NO 2 1949", cemented in the top of a 2-1/2-inch iron pipe that projects 6 inches. It is at same elevation as station. NOTE: A difference of .010 meter was noted in distance to station mark; the 1967 distance is correct.

NOTE: Station becomes completely blocked by large ohia trees. The lines were cleared to HEIHEIAHULU, KALOLI 2, HONUWALA, KAPOHO and Cape Kumukahi Lighthouse at this time.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KALIU HGS

OBS BY CGS

STATE: HAWAII

YEAR: 1891

FIRST

SOURCE: 6-16241

GEODETIC LATITUDE: 19 27 19.89025	ELEVATION: 326.2 METERS
GEODETIC LONGITUDE: 154 55 18.12507	1070 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	# OR Δ & ANGLE °
-1 1	5101	699,219.95	226,275.71	+ 0°11'33"

* 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
HONUWALA HTS	226°05'29.8"	225°53'56"	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

5H 070

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191543 STATION 1011

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

KALIU (HGS) (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: KALIU 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: 3 1/2 miles southeast of Pahoa.
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
HONUAULA 1949	NE	about 8	1 1/2 miles	00 00 00.00
CAPE WUNUVAHI LIGHTHOUSE 1949	NE	20.13	6.138	11 59 02.72
RM 1	NW	13.74	4.188	21 51 18
RM 2		26.80	8.172	278 53 51
RM 1 to RM 2				

The station mark and reference marks 1 and 2 were recovered in good condition. The distance to reference mark 1 was found longer by 0.007 meter and the direction was found larger by 01 minute and 51 seconds. The distance to reference mark 2 was found shorter by 0.001 meter and the direction was found smaller by 01 minute and 02 seconds. The 1967 recovery note is good with the exception a new to reach follows.

To reach the station from the junction of state Highways 13 and 132 in the east edge of Pahoa, go south on highway 13 for 2.45 miles to a side road left. Turn left and go east on a cinder road for 0.6 mile to where the cinder road turns into a paved road. Continue east on the surface road for 0.3 mile to a track road right, at the west edge of a cinder pit just before reaching the junction of Pomaikai Road. Turn right and go south on the track road for 0.05 mile to the end of truck travel and a trail that leads along the west edge of the pit and into the woods (this trail is about 60 feet west of the extended center line of Pomaikai Road). From here follow well marked trail south and southeast uphill to the summit and the station.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: KALIU (HGS)
 ESTABLISHED BY: H.G.S. YEAR: 1891 STATE: HAWAII BENCH MARK(S) ALSO
 RECOVERED BY: R. B. MELBY YEAR: 1978 COUNTY: HAWAII
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 3 1/2 MILES SOUTHEAST OF PAHOA

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

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 191543 STATION 1013
HAWAII
LATITUDE 19 00' TO 19 30'
LONGITUDE 154 03' TO 155 00'
DIAGRAM NE 5-15 HAWAII

DESCRIPTION
~~TRIANGULATION STATION~~ TRIANGULATION STATION

NAME OF STATION: MALAMA KI USGS
ESTABLISHED BY: L.A. Critchlow YEAR: 1978 STATE: Hawaii BENCH MARK ALSO
COUNTY: Hawaii
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: About 2 miles southwest of Pohoiki
HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
HONUOLA 1949				00 00 00.0
RM 1'	SW	18.24	5.562	272 01 36
RM 2'	NW	16.94	5.164	346 59 49
RM 1 to RM 2'		21.44	6.534	

The station is located in a small clearing in the forest, in the Malama KI Forest Reserve and is about 2 miles northeast of the T-intersection of roads at the village of Opihikao, 2 miles southwest of Isaac Hale State Park at the village of Pohoiki and about 100 meters northwest of State Highway 137.

To reach the station from the T-intersection of State Highway 137 and Pahoa Pohoiki Road at Pohoiki go southwest on highway 137 for 2.0 miles to a narrow turn-out on the right 0.1 mile before reaching the entrance to Mackenzie State Park on the left. Pack northwest about 100 meters on a dirt trail to a small clearing and the station site.

The station mark is a USGS disk, unstamped, cemented in a drill hole in pahoehoe lava and projects about 0.2 of a foot above the ground. It is 3.5 feet northeast of a 2-foot cairn in a small clearing. Note, Desc.

Reference mark 1 is a USGS RM disk stamped MALAMA KI NO 1 1958. It is cemented in a drill hole in pahoehoe lava and projects about 0.3 of a foot above the ground. It is 14 feet northeast of a sharp drop-off and is about the same elevation as the station mark. Note, Desc.

Reference mark 2 is a USGS RM disk stamped MALAMA KI NO 2 1958. It is cemented in a drill hole in pahoehoe lava and projects about 0.5 of a foot above the ground and is about the same elevation as the station mark. Note, Desc.

ADJUSTED HORIZONTAL CONTROL DATA

ADJUSTED BY NGS

NAME OF STATION: MALAMA KI USGS OBS BY NGS
STATE: HAWAII YEAR: 1978 FIRST ORDER
SOURCE: -16241

GEODETTIC LATITUDE	19 25 38.71740	ELEVATION	29.6 METERS
GEODETTIC LONGITUDE	154 01 59.47514		97 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ OR ANGLE *
HI 1	5101	718,244.94	222,189.18	+ 0 12' 39"

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

TO STATION OR OBJECT	GEODETTIC AZIMUTH (From south)	PLANE AZIMUTH (From south)	CODE
HONUOLA HTS	149 00 16.5	148 47 37	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

3M 112

* 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&GS FORM 520A WHICH MAY BE USED
(1-72)

DEPARTMENT OF COMMERCE
NOAA

U.S. GPO: 1976-645-641/1220 Region 4

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

QUAD 191543 STATION 1014
 HAWAII
 LATITUDE 19 00' TO 19 30'
 LONGITUDE 154 30' TO 155 00'
 DIAGRAM NE 5-1.5 HAWAII

DESCRIPTION
~~XXXXXXXXXX~~ TRIANGULATION STATION

ADJUSTED HORIZONTAL CONTROL DATA
 ADJUSTMENT BY NGS

NAME OF STATION: MOANA HAUAE USGS
 ESTABLISHED BY: L.A. Critchlow YEAR: 1978 STATE: Hawaii COUNTY: Hawaii BENCH MARK ALSO
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 2 miles northeast of Kalapana Village
 HEIGHT OF TELESCOPE ABOVE STATION MARK 4 FEET. HEIGHT OF LIGHT ABOVE STATION MARK 4 FEET.

NAME OF STATION: MOANA HAUAE USGS OBS BY NGS
 STATE: HAWAII YEAR: 1978 FIRST ORDER

SOURCE: G-10241

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	
HAKUMA 1914				00 00 00.0
RM 1	N	21,220	6,470	116 23 48
RM 2	ESE	8,330	2,540	234 35
RM 1 to RM 2		26,210	7,989	

The station is located on a prominent mound of pahoehoe lava, overlooking the pacific ocean to the southeast and is about 6 miles southwest of the I-intersection of roads at the village of Ophikao, 2 miles northeast of the village of Kalapana, about 100 meters northwest of the shoreline and 90 meters southeast of State Highway 137.

To reach the station from the junction of State Highway 13 and 137 about 1 mile northeast of Kalapana go northeast on highway 137 for 1.3 miles to a prominent mound of pahoehoe lava and the station site on the right.

The station mark is a USGS disk, unstamped, cemented in a drill hole in the top of a mound of pahoehoe lava. It is 11 feet northwest of and about 1/2 foot lower than the highest point. Note, Desc.

Reference mark 1 is a USGS RM disk stamped MOANA HAUAE 1958 RM 1, cemented in a drill hole in pahoehoe lava and is about 3 feet lower than the station mark. Note, Desc.

Reference mark 2 is a USGS RM disk stamped MOANA HAUAE 1958 RM 2, cemented in a drill hole in pahoehoe lava and is about 1/2 foot lower than the station mark. Note, Desc.

GEODETIC LATITUDE: 19 22 31.41991	ELEVATION: 22.8 METERS
GEODETIC LONGITUDE: 154 57 12.83944	75 FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ HOR Δ α ANGLE *
HI 1	5191	618,334.45	197,139.51	+ 0 10 53 "

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

TO STATION OR OBJECT	GEODETIC AZIMUTH (From sea level)	PLANE AZIMUTH * (From sea level)	CODE
HAKUMA	45 27 27.9	45 16 35 "	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

3M 115

* 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.

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 191543 STATION 1015
 HAWAII
 LATITUDE 19 ° 00' TO 19 ° 30'
 LONGITUDE 154 ° 30' TO 155 ° 00'
 DIAGRAM NE 5-1,5 HAWAII

PAHOA STACK (Hawaii Island, E. R. Hand, 1914).—In the eastern part of Hawaii, Puna District, town of Paho; the stack on the lumber mill of the Hawaii Hardwood Co.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION **PAHOA STACK**
 STATE **HAWAII** YEAR **1914** ORDER **THIRD**

SOURCE **G-52184**

GEODETIC LATITUDE	19 29' 46.219	ELEVATION	METERS
GEODETIC LONGITUDE	154 56 53.179		FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ OR ANGLE *
HI 1	5101	650,076.18	241,007.29	+ 0 11' 03"

* 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

UF 067

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191543 STATION 1016
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 154° 30' TO 155° 00'
 DIAGRAM NE 5-1.5 HAWAII

Pohoiki (Hawaii Island, F. R. Hand, 1914).—On eastern shore of Hawaii, on a rounding point which is the outermost point to the south as seen from Cape Kumukahi; it is a short distance northeast of the village of Pohoiki. From station the highest point of rim of Kapoho crater bears N. 44° W. Station marked by survey tablet set in a huge block of "pahoehoe" lava (smooth) which is itself flush with top and in center of circular cairn of "aa" lava (rough), 10 feet in diameter. A rim was built up halfway round and the cairn whitewashed. Cairn is about 50 meters from high-water mark and at north edge of old "aa" lava flow.

ADJUSTED HORIZONTAL CONTROL DATA

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

SOURCE: 6-16241

GEODETIC LATITUDE:	19 28 45.32116	ELEVATION:	6.66 METERS
GEODETIC LONGITUDE:	154 49 34.30732		21.9 FEET

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: POHOIKI
 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 1.62 METERS, HEIGHT OF LIGHT ABOVE STATION MARK METERS.

OBJECT	BEARING	DISTANCE		DIRECTION
		FEET	METERS	
KAPOHO (HGS) 1896				00 00 00.0
Cape Kumukahi Lighthouse, 1949	NNE			51 07 34.2
RM No. 1	NE	11.011	3.357	99 17 33
RM No. 2	NW	19.749	6.019	337 35 10

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

Station is located about 3 miles south-southwest of Cape Kumukahi, the easternmost point of the island; 1700 feet southwest of an old beach shack that sets on a property line running in to the southeast from the highway, 3/4-mile northeast of the point where State Highway 137 changes from due south to southwest, 1/4-mile south of the end of the Kii Lava Flow of 1955, and near the northeast edge of an old black lava flow, now mostly brushcovered, on a raised, circular, rock platform about 16 feet in diameter which is the highest part of the low rise on which it sets.

To reach station from the post office in Pahoa, go east on the main street 0.4 mile; take left fork and follow State Highway 132 east 2.8 miles to fork just past the Lava Tree State Park. Take left fork and go 5.2 miles to crossroad; turn right and go south on State Highway 137 for 2.0 miles to the Kii Lava Flow of 1955; continue on the highway 0.6 mile to right curve of highway and end of truck travel at old road left. Walk east down old road, and trail, about 150 yards to beach. Go left along rocky beach about 3/4-mile to station. NOTE: A raised, circular, rock platform, similar to the one the station is on, is situated about half-way to the station.

Station mark is a standard disk stamped "POHOIKI 1914", cemented in a drill hole in a boulder flush with surrounding rock, in center of the rock platform. It is 125 yards northwest of water line and 150 feet southwest of northeast edge of the black lava area.

Reference mark number one is a standard disk stamped "POHOIKI 1914 NO 1 1967", cemented in a drill hole in a bedrock ledge just below the station platform. It is about 2 feet lower than station mark.

Reference mark number two is a standard disk stamped "POHOIKI 1914 NO 2 1967", cemented in a drill hole in a large lava chunk, 0.9 foot lower than station mark.

(Continued on next page)

*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

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	θ OR Δ OR ANGLE *
HI 1	5101	752,088.45	234,862.45	+ 0°13'29"

* 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
KAPOHO HGS	145 16 09.4	145 02 40 "	5101

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

THESE DATA SHOULD BE USED FOR ALL SURVEYS AFTER DEC 1975

LEVELING BY CGS

SM 130

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191543 STATION 1016

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

POHOIKI (Continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: POHOIKI
 ESTABLISHED BY: D.P. Rand YEAR: 1974 STATE: Hawaii BENCH MARK ALSO
 RECOVERED BY: L.A. Critchlow YEAR: 1977 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 1/2 miles east of Pahoa
 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	
PAPONO HGS 1896				00 00 00.00
CAPE KUMUKAHI LIGHTHOUSE 1949	NNE	about	3 miles	51 07 24.10
RM 1	NE	11.025	3.350	99 21 24
RM 2	NN	19.740	6.010	337 32 14
RM 1 to RM 2		27.210	8.293	

The station mark and reference marks 1 and 2 were recovered in good condition. The direction to the reference marks measured on this date differed by 4 minutes on reference mark 1 and 3 minutes on reference mark 2. The distances compared favorably with the 1967 measurements. The direction to Cape Kumukahi Lighthouse differs by about 10 seconds from 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.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191543 STATION 1017
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 154 °30' TO 155 °00'
 DIAGRAM NE 5-1,5 HAWAII

NO ORIGINAL TEXT

WEST HEIHEIAHULU (HGS)

(Hawaii Island, Hawaiian Government Survey, 1896; E. R. Hand, 1914).—In the eastern part of Hawaii, on the west edge of the crater on top of Mount Heiheiuhulu, 5 miles north by west from Kalapana; the east edge, nearer the sea, is a few feet higher. On this east edge station *Heiheiuhulu* (see description) was established in 1914; it is S. 63° E., about 100 meters across the crater from station. Station marked by cross cut in a solid beach-worn stone set in cement on a raised foundation of stones, 16½ feet in diameter. Above the station is a conical cairn 8½ feet high.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: WEST HEIHEIAHULU (HGS)
 ESTABLISHED BY: HGS YEAR: 1896 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. Marked by a cross in stone set in cement. A Type B-1 signal, built by the Hawaii Territorial Survey, is centered over the mark. It is about 340 feet northwest across the crater from station HEIHEIAHULU 1914 and slightly lower.

Located about 5-3/4 miles southwest of Pahoa and 5-1/4 miles north-northwest of Kalapana, at about 1700 feet elevation, on the northwest rim of Heiheiuhulu Crater, which is covered with dense brush and small trees.

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 5.8 miles. Take side road right and go 0.15 mile; turn left by house and go southwest 0.55 mile; turn right and go 0.6 mile to T-junction. Turn left and go 0.25 mile to track road right. Turn right and go northwest 0.7 mile to house on left; continue for 0.55 mile to end of road. Walk northwest up grassy strip about 300 yards to end. Clear trail through trees and brush on a bearing of 291° for about 3/4-mile (airline) to station. About 2 hours required to clear trail. NOTE: A 4-wheel-drive truck is needed.

FORM CGS-526 (11-65)
 USCOMM-DC 7508-P88

U.S.
 C

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: WEST HEIHEIAHULU HGS
 STATE: HAWAII YEAR: 1896 THIRD ORDER

SOURCE G-92184

GEODETIC LATITUDE	19 25 59.904	ELEVATION	522	METERS
GEODETIC LONGITUDE	154 59 37.611	SCALED		FEET

STATE COORDINATES (Feet)				
STATE & ZONE	CODE	X	Y	β ON Δ α ANGLE*
HI 1	5101	674,418.03	216,111.04	+ 0 10 06

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

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

QF 055