

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191553 STATION 1051
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-15 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 535
 Rev. Aug. 1968

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **KEEI SOUTH BASE** STATE: **HAWAII** COUNTY: **SOUTH KONA DISTRICT, HAWAII**

CHIEF OF PARTY: **L. C. WILDER** YEAR: **1948** Described by: **G. J. HOEPEL**

| NOTE* | HEIGHT OF TELESCOPE 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 | | HEIGHT OF LIGHT ABOVE STATION MARK METERS. | | |
|-------|---|--|----------|--|------------|--|
| | | BEARING | DISTANCE | | DIRECTION‡ | |
| | | | feet | meters | | |
| 2 | Surface-station mark, Underground-station mark | | | | | |
| | PALEMANO Sub Station A | | | | 00 00 00 | |
| 12a | R M 1 | NE | 29.918 | 9.120 | 04 00 00 | |
| 12a | R M 2 | S | 19.696 | 6.004 | 207 55 55 | |
| | Boundary Monument | | | 33.375 | 342 52 | |

The station is located on a flat lava bed about 1 mile north of Honaunau Bay, about 0.4 mile east of the beach, 70 feet southeast of the center of a cattle guard, 69 feet south of a rock wall, 17.3 feet east of the centerline of the highway which runs between Napoopoo and Honaunau Bay and about 3 feet higher than the highway.

To reach from the post office at Napoopoo, go south on the road which leads to Honaunau Bay for miles to the station on the left hand side of the road.

The station is a standard disk, stamped **KEEI S BASE 1948**, set into a drill hole in flat lava bedrock.

Reference mark number 1 is a standard disk, stamped **KEEI S BASE NO 1 1948**, set into a drill hole in flat lava bedrock. It is located 44.7 feet east of the centerline of the highway and is about the same elevation as the station.

Reference mark number 2 is a standard disk, stamped **KEEI S BASE NO 2 1948**, set into a drill hole in flat lava bedrock. It is located 14 feet east of the centerline of the highway and is about 2 feet lower than the station.

Substitute Station 'A' is the center of the intersections of the highway and the cattle guard. It is 1.33 meters lower than the station.

The boundary monument is a 1 inch iron pipe which projects about 1 foot from the top of a square concrete post. The concrete post is stamped **J B M KEAME 1920**. It is located on the south side of a rock wall, 27.4 feet west of the centerline of the highway and is about 2 feet lower than the station. This mark is believed to be a boundary marker for the Bishop Estate.

* 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. 16-58882-1 U. S. GOVERNMENT PRINTING OFFICE

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **KEEI SOUTH BASE**

STATE: **HAWAII**

YEAR: **1948**

SECOND ORDER

SOURCE **G- 9275**

| | |
|--|-------------------------------|
| GEODETIC LATITUDE: 19 26 14.852 | ELEVATION: 42.7 METERS |
| GEODETIC LONGITUDE: 155 55 03.085 | 140 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-----------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ θ ANGLE* |
| HI 1 | 5101 | 556,151.26 | 219,554.54 | - 0 08 20 |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|-------------------------------|-----------------------------|------|
| KALAPA | 293 43 51.2 | 293 52 11 | 5101 |

QE 002

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 191553

STATION 1051

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

KEEI SOUTH BASE (continued)

FORM 526a
(2-18-59)

U.S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

R

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: KEEI SOUTH BASE
ESTABLISHED BY: L.C. Wilder YEAR: 1948 STATE: Hawaii
RECOVERED BY: R.C. Munson YEAR: 1968 COUNTY: Hawaii
 Island: Hawaii

HEIGHT OF TELESCOPE ABOVE STATION MARK 1.64 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 | | | |
| KALAPA R.M. No. 2 Boundary Monument R.M. No. 1 | -----1948 S NE | 19.696 | 6.004 | 00 | 00 | 00.0 |
| KALAPA (HGS) 1884 R.M. No. 2 Keawe (JEM) 1920 Napoopoo Light 1928 R.M. No. 1 | -----1968 S WNW NW NE | 19.682 | 6.000 | 00 | 00 | 00.0 |
| | | 76.547 | 23.332 | 202 | 34 | 12.2 |
| | | 29.933 | 9.124 | 221 | 27 | 12.1 |
| | | | | 302 | 46 | 50 |

Station was recovered and all marks found in good condition, however a discrepancy of 10.043 meters was noted in the distance to Keawe (JEM) 1920; it was double-checked and the 1968 distance is correct. A complete description follows:

Station is located about 2-1/2 miles west-southwest of Honaunau, 2-3/4 miles south of Napoopoo Bay and 1 mile north of the City of Refuge

National Park, along east side of the macadam road leading to Napoopoo Bay.

To reach station from the post office in Honaunau, go south on State Highway 11 for 1.7 miles to junction; turn sharp right and go downhill on State Highway 16 for 3.5 miles to road junction at the City of Refuge. Continue ahead, northerly, on macadam road for 0.8 mile to station on right, at cattleguard and stone fence.

Station mark is a standard disk stamped "KEEI S BASE 1948", cemented in a drill hole in lava bedrock on low mound about 3 feet higher than road. It is 17 feet east of center line of road and 71 feet south-south-east of center of cattleguard.

Reference mark number one is a standard disk stamped "KEEI S BASE NO 1 1948", cemented in a drill hole in bedrock at same elevation as station mark and 4 feet northeast of the base of a clump of large thorn brush.

Reference mark number two is a standard disk stamped "KEEI S BASE NO 2 1948", cemented in a drill hole in the south end of the same lava rise the station is on. It is 14 feet east of center line of road and about 1 foot lower than station mark.

Keawe (JEM) 1920 is a 1-inch iron pipe, projecting 14 inches from a 10 x 10-inch concrete block with "KEAWE.S JEM 1920", inscribed in it. It is 16 inches south of stone wall, 9 feet north of a metal gate, 27 feet west of center line of road, and at same elevation as station mark.

*Name of ch. try should be inserted here. The officer who actually visited the station should sign his name at the end
of the recove.

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

USCOMM-DC 27179-P59

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191553 STATION 1052
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1,5 HAWAII

Keokea (Hawaii Island, E. R. Hand, 1928).—On western coast of Hawaii, in the district of Keokea, Kona, by the sea, about 1 mile south of Honaunau Bay (City of Refuge), at the head of an indentation sometimes known as Pukakio Bay, 150 meters east-northeast from the point where the ancient but well-marked trail climbs the low cliff on the way south from the City of Refuge, and 50 meters back southeast from the same cliff that trends north and south. Station is on top of a prominent lava bubble which rises abruptly from the surrounding flat to an elevation of 120 feet. Marked by a standard disk station mark.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **KEOKEA**
 ESTABLISHED BY: **E.R. Hand** YEAR: **1928** 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

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 2-1/2 miles southwest of the post office at Honaunau and 3/4-mile southeast of Honaunau Bay and the City of Refuge, above the cliff at Alahaka Bay and about 600 feet east of the sea, at about 125 feet elevation, on a broken-up lava mound about 10 feet higher than surrounding area.

To reach station from the City of Refuge Headquarters Building, go southerly on track road along beach for 0.3 mile to end of road at stone fences. Pack southeast along good trail for about 1/4-mile to where trail goes up onto south end of cliff. Leave trail and go northeast along rim about 150 yards, then go right about 50 yards to station.

Station mark is a standard disk, unstamped, cemented in a drill hole at southwest side of the lava mound, about 40 feet from highest point.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **KEOKEA**
 STATE: **HAWAII** YEAR: **1928** THIRD ORDER

SOURCE: **G-SP156**

| | |
|--|-----------------------------|
| GEODETIC LATITUDE: 19 25 02.645 | ELEVATION: 43 METERS |
| GEODETIC LONGITUDE: 155 54 26.478 | SCALED FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|------------------|
| STATE & ZONE | CODE | X | Y | # OR Δ or ANGLE* |
| HI 1 | 5101 | 359,637.27 | 212,262.56 | - 0° 08' 08" |

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

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

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191553 STATION 1053
 HAWAII
 LATITUDE 19° 00' TO 19° 50'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 532
 REV. AUG. 1968

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **KEOPIKA** STATE: **HAWAII** COUNTY: **SOUTH KONA DISTRICT HAWAII**

CHIEF OF PARTY: **L. C. WILDER** YEAR: **1948** Described by: **C. 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 | | | |
|-------|---|--|--|---------|----------|--------------|
| | | | OBJECT | BEARING | DISTANCE | |
| | | | | feet | meters | 0 1 2 |
| 2 | Surface-station mark, Under-ground-station mark | | | | | |
| 12a | PUU OHAU | | | | | 00 00 00 |
| | R. M. 1 | | N | 15.835 | 4.828 | 23 27 26 |
| | KEAWEKAHEKA 0.2 mile | | SSE | | | 162 38 04.12 |
| 12a | R. M. 2 | | SSE | 42.049 | 12.817 | 169 07 13 |

The station is located on the summit of a low lava mound about 2.5 miles south of Keikiwaha Point, about 2.5 miles west northwest of Napoopoo, about 2 miles south of the North and South Kona boundary line and about 300 feet east of the westernmost edge of Keawekeheka Point.

The station is best reached, by boat, from Napoopoo. A calm landing can be made at the Captain Cook Monument. From the monument pack westerly along the beach for about 1.5 miles, then northerly for about 0.2 mile to the station. Four trees are in a small depression about 0.1 mile north of the station. The last water is at a house near the Captain Cook Landing.

The station is a standard disk, stamped KEOPIKA 1948, set into a drill hole in bedrock which projects about 7 feet.

Reference mark number 1 is a standard disk, stamped KEOPIKA 1 1948, set into a drill hole in bedrock which projects about 6 feet. It is located about 1 foot lower than the station.

Reference mark number 2 is a standard disk, stamped KEOPIKA 2 1948, set into a drill hole in flat bedrock. It is located 7.46 feet lower than the station.

* 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: **KEOPJKA**
 STATE: **HAWAII** YEAR: **1948** ORDER: **SECOND**

SOURCE: **G- 9279**

| | |
|-----------------------------------|------------------------|
| GEODETIC LATITUDE: 19 25 25.746 | ELEVATION: 42.8 METERS |
| GEODETIC LONGITUDE: 155 57 09.162 | 42 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-------------------------------|
| STATE & ZONE | CODE | X | Y | β OR Δ OR ANGLE* |
| HI 1 | 5101 | 544,135.68 | 238,841.92 | - 0 09 04 |

* 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 |
|----------------------|-------------------------------|-----------------------------|------|
| PUU OHAU | 172 43 31.4 | 172 52 35 | 5101 |

QE 057

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191555 STATION 1054
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °30' TO 156 °00'
 DIAGRAM NE 5-1,5 HAWAII

NO ORIGINAL TEXT

Kipaepae (Hawaii Island, Hawaiian Government Survey, 1898; E. R. Hand, 1914).—On the southern coast of Hawaii, on southern Ka-u, on the slope, 3½ miles south by west from Honuapo Wharf, 780 meters in from the edge of the 180-foot cliffs, and 1,450 meters N. 17° E. from the point where these cliffs turn inshore, north of a lava flat, and about 90 meters north of a stone wall on the upper or mauka side of a pasture. Marked by a cross cut in the solid rock, over which is a 10-foot cairn with 12-foot base, terraced, and painted white.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Kipaepae COUNTY: Hawaii
 ESTABLISHED BY: H.G.S. YEAR: 1898 LOCALITY: Kau, Hawaii
 RECOVERED BY: Chas.L.Murray YEAR: 1938

R

Detailed statement as to the fitness of the original description:

Location of station: In the southern part of Hawaii about 3 1/2 miles southwest of Honuapo wharf and about 2 miles below or southeast from Naalehu Village. Best approach is by taking the road that goes down from the plantation store and theatre. This road stops at a point about 1/2 mile from the station.

Old mark found: Drill hole in + cut in pahoehoe in terraced stonepile 10-foot high.

New station mark: 10-foot 2 1/2" pipe set in concrete over mark with standard metal target. The stonepile was rebuilt as follows: First terrace 16 feet in diameter about 4 feet high; Second terrace, 8 feet in diameter and about 5 feet high completely plastered with mortar and concrete platform on top.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 533
 RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **KIPAEPAE**
 ESTABLISHED BY: Hawaiian Govt. YEAR: 1898 STATE: HAWAII
 RECOVERED BY: L. C. Wilder YEAR: 1948 COUNTY: HAWAII

R

Detailed statement as to the fitness of the original description: In 1939 the original station was reported to have been recovered by the Territory Survey Department. Also in 1939 a 2 1/2 inch pipe was reported to have been centered over the original station and the cairn was plastered with mortar and a concrete platform was built on top. The center of this pipe was used as the 1949 station. A new description follows—

The station is located about 4 miles south southwest of Honuapo, about 2 miles south southeast of Naalehu, about 0.7 mile north of the sea, about 100 yards west of a rock wall and at the end of a dim track road. Higher ground is to the north.

To reach from the post office at Naalehu; go south, on the paved road, for 0.15 mile to the end of the pavement; continue straight ahead, on a dirt road, for 0.05 mile; pass through a board gate and follow the dirt road southerly, passing through the village dump, for 1.7 miles; pass to the left hand side of a large wooden tank and continue southerly, on a dim track road, for 0.2 mile; pass to the left hand side of a steel boiler and continue southerly for 0.4 mile to the end of the road and the station.

The station is the center of a 2 1/2 inch pipe which projects about 2 feet from the top of a circular stone and concrete platform which is about 7.5 feet in height and about 8 feet in diameter. The stone and concrete platform rests on a circular base of stones which is about 16 feet in diameter and about 3 feet high.

| Object | Direction | Distance |
|------------------------------|----------------|----------|
| KAMILO (metal target) | 00 00 00 BSW | |
| AKIHI (metal target) | 93 30 59.8 NW | |
| KANEHAME 1939 (metal target) | 196 47 12.3 NE | |

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: KIPAEPAE

STATE: HAWAII

YEAR: 1898

SECOND

ORDER

SOURCE: G- 9279

| | | | |
|--------------------|---------------|-----------|--------------|
| GEODETIC LATITUDE | 19 02 16.754 | ELEVATION | 441.7 METERS |
| GEODETIC LONGITUDE | 155 34 20.973 | | 465 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|-----------|-------------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ OR ANGLE * |
| HI 1 | 5101 | 474,963.93 | 74,324.90 | - 0 01 25 |

* 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 |
|----------------------|----------------------------------|-------------------------------|------|
| KAMILO | 25 05 53.6 | 25 07 19 | 5101 |

CE 052

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191553

STATION 1054

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

KIPAEPAE (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: **KIPAEPAE**
 ESTABLISHED BY: **HGS** YEAR: **1898** 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:

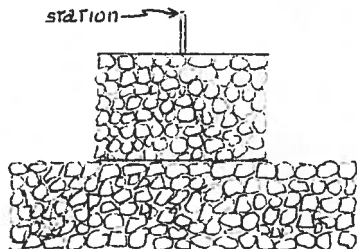
Station was recovered in good condition. A complete description follows:

Station is located in the southern part of the island, about 2 miles south-southeast of Naalehu and 1/2-mile northwest from coast-line, at about 465 feet elevation, in brushy pasture land.

To reach station from the post office in Naalehu, go east on State Highway 11 for 0.1 mile; turn right, go 50 yards, then take left fork and go 0.15 mile to fork. Take left fork and go 0.5 mile to locked gate after passing dump. Pass through gate and continue for 0.25 mile; take left fork and go 0.4 mile to board gate. Pass through gate and go 0.5 mile to board gate on right fork. Pass through gate and continue, on right side of stone wall, for 0.55 mile to dim left fork. Take left fork and go 0.2 mile to board gate. Pass through gate, turn right, along fence, and go 0.1 mile to station.

Station is the center of a 2-1/2-inch iron pipe that projects 2 feet from the center of a circular, stone and concrete platform 8 feet in diameter and extending 5 feet above a larger stone and concrete base that is 16 feet in diameter and extends 4 feet above ground. A removable, red and white metal target 8 feet tall sets in the station pipe. Station is 30 feet southwest of track road, 400 feet southwest of a stone wall and 60 yards southeast of a fence line.

NOTE: Key for locked gate was obtained at the Hawaiian Ranch Co. office in Naalehu.



U.S. DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 FORM 9-1165
 (Rev. 12-74)

REPORT ON PERMANENT SURVEY MARK AREA OFFICE

STATE Hawaii COUNTY Hawaii QUADRANGLE 3
 QUOTE PRIMARY REFERENCE Station is located about 4 mi S. SW. of Honuapo
(Direction and distance)

DESIGNATION { LISTED KIPAEPAE TYPE OF MARK: BM TT TRIANG. X
 STAMPED

| | | |
|-------------------------------|------------------------------------|--|
| Lat. <u>19° 02' 16.794"</u> | CONDITION | ESTABLISHED BY |
| Long. <u>155° 34' 20.973"</u> | Disturbed <input type="checkbox"/> | USGS <input type="checkbox"/> USBR <input type="checkbox"/> |
| Elev. <u>465</u> feet | Destroyed <input type="checkbox"/> | USC&GS <input checked="" type="checkbox"/> State GS <input type="checkbox"/> |
| | Not Found <input type="checkbox"/> | USNFS <input type="checkbox"/> USNFS <input type="checkbox"/> |
| | | USGLO <input type="checkbox"/> USGLO <input type="checkbox"/> |
| | | USBLM <input type="checkbox"/> USBLM <input type="checkbox"/> |

REMARKS OR REVISED DESCRIPTION:

The station was recovered in good condition. All description adequate. This is part of the Parker Ranch.

SUBMITTED BY Yukio Yamamoto DATE 1/26/78
 TITLE Catalographer
 AGENCY USGS

Marks found in good condition need not be reported.

FILL IN ALL AVAILABLE INFORMATION

Please prepare in triplicate.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 Old Hawaiian Datum

QUAD 191553 STATION 1056
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NOAA FORM 76-39
 (12-70)
 (FORMERLY C&GS FORM 525)

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

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: KUKU STATE: Hawaii COUNTY: Hawaii
 NEAREST TOWN: Kealia QUADRANGLE NO.: 191553
 CHIEF OF PARTY: GBH YEAR: 1972 DESCRIBED BY: RDB

| NOTE* | HEIGHT OF TELESCOPE ABOVE STATION MARK METERS.† | | HEIGHT OF LIGHT ABOVE STATION MARK METERS. | | DIRECTION‡ |
|-------|---|--------------------------|--|--------|------------|
| | SURFACE-STATION MARK | UNDERGROUND-STATION MARK | FEET | METERS | |
| | OBJECT | BEARING | DISTANCE | | |
| | | | FEET | METERS | |
| | RM NO. 1 | WSW | 16.69' | 5.088' | |
| | RM NO. 2 | SE | 8.08' | 2.464' | |

Station is located in a lava flow on the western coast of Hawaii Island about 11.5 miles south Kealakekua Bay and 6.5 miles south of the town of Kealia.

To reach station from Kealia, travel south on State Highway 11 to Alae School, continue south for about 1.1 miles to the Pebble Beach Estates road on the right. Turn right and travel down the paved sideroad to the beach and the end of truck travel. Pack southerly across the end of a small bay and continue along the shoreline for approximately 1/2 mile to a point west of twin lava protrusions rising about 3 feet above the surrounding lava flow and 200 feet inshore to the sea bluff. Pack easterly to the lava protrusions and the station.

Station is a standard traverse disk stamped "KUKU 1972" cemented in a drill hole atop the western lava protrusion, and is surrounded on the south and east by low brush. Reference mark No. 1 is a standard disk stamped "NO. 1 1972" cemented in a drill hole in lava rock approximately four feet lower than the station.

Reference mark No. 2 is a standard disk stamped "NO. 2 1972" cemented in a drill hole atop the eastern lava protrusion at about the same elevation as the station.

This station was located by intersection from stations HOOKENA, PUIWA, AND WAIKAKUU 4.

Detailed description:

ADJUSTED HORIZONTAL CONTROL DATA

ADJUSTMENT BY NGS

NAME OF STATION: KUKU OBS BY NGS
 STATE: HAWAII YEAR: 1972 SECOND ORDER

SOURCE: G=14950

| | |
|--------------------------------------|---------------------|
| GEODETIC LATITUDE: 19° 18' 34".12009 | ELEVATION: 1 METERS |
| GEODETIC LONGITUDE: 155 53 24.20427 | SCALED FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|--------------|
| STATE & ZONE | CODE | X | Y | RIGHT ANGLE* |
| HI 1 | 5101 | 365,509.36 | 173,055.66 | - 0 07 44" |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH (From south) | CODE |
|---|----------------------------------|-------------------------------|------|
| THESE DATA OBTAINED FROM ADJUSTMENT OF SEP 1979 | | | |
| RL 185 | | | |

*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: 1971-760-03

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191553 STATION 1058
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1,5 HAWAII

NO ORIGINAL TEXT

Lae Loa (Hawaii Island, Hawaiian Government Survey, 1884; E. R. Hand, 1913).—On west coast of Hawaii, Kona District, on the outermost part of the great rounding point 1½ miles south of Honaunau Bay, 1½ miles northwest from Hookena, and about 25 meters from waters edge on west. Marked by an iron bolt driven into a crack in the rock, and surrounded by four equidistant crosses, the lines connecting these crosses diagonally intersecting at the station. A large cairn was erected over the station and painted white.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 536
RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **LAE LOA**
 ESTABLISHED BY: **Hawaiian Govt.** YEAR: **1884** STATE: **HAWAII**
 RECOVERED BY: **L. C. Wilder** YEAR: **1948** COUNTY: **HAWAII**

Detailed statement as to the fitness of the original description: The original station, consisting of an iron bolt driven into a crack in the rock, was not recovered. The station which was found is a badly rusted iron pipe projecting from the top of a mound of concrete and rock. A new description follows—

The station is located near the outermost point of a great, rounding, point which lies about 2 miles south of Honaunau Bay, about 1.5 miles northwest of Hookena and about 75 feet east of the beach. Area to the west of the station is solid rock while the area to the east is brush and rock.

To reach the station from the stone wharf in the village of Hookena; go north, on the graded road for 0.1 mile; turn left and go west for 0.1 mile; turn right and follow beach road for 0.1 mile; pass old stone church and continue northerly for about 0.5 mile to an old rock wall and the end of truck travel. From this point pack northerly, along the rocky coast line for about 1.0 mile to the station.

The station is the center of a rusted pipe which projects about 1 foot from the top of a mound of concrete and rock which is about 2 feet high.

Reference mark number 1 is a standard disk, stamped LAE LOA NO 1 1948, set into a drill hole in solid, lava, bedrock which is flush with the surrounding rock. It is located about 50 feet east of the sea and is 4.29 feet lower than the station.

The Azimuth Mark is a standard disk, stamped LAE LOA 1948, set into a drill hole in solid bedrock which is flush with the surrounding rock. It is located about 0.25 mile south of the station, about 80 feet east of the sea and about 50 feet west of the edge of the brush.

| Object | Distance | Direction |
|-------------------------|--------------------|-------------|
| FUU OHAU (metal target) | | 00 00 00 |
| Napooopoo Lighthouse | About 6 miles NNW | 02 34 56.1 |
| Azimuth mark | About 0.25 mile S | 179 53 06.6 |
| R. M. 1 SW | 14.998 m 49.206 ft | 259 53 46 |

An early recovery note reports; In 1923 J.B. Mann recovered the bolt undisturbed and remarked the station with a 2 inch pipe set in concrete.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **LAE LOA**
 STATE: **HAWAII** YEAR: **1884** SECOND ORDER

SOURCE: **G- 9279**

| | | | |
|---------------------|---------------|------------|------------|
| GEODETIC LATITUDE: | 19 24 03.665 | ELEVATION: | 8.2 METERS |
| GEODETIC LONGITUDE: | 155 54 47.264 | | 27 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-----------------|
| STATE & ZONE | CODE | X | Y | B FOR Δ φ ANGLE |
| HI 1 | 5101 | 357,653.47 | 206,517.20 | - 0 08 14 |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH (From south) | CODE |
|----------------------|----------------------------------|-------------------------------|------|
| AZIMUTH MARK | 340 16 50.1 | 340 25 04 | 5101 |

QE 065

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191553 STATION 1058
 LATITUDE 0' TO 0'
 LONGITUDE 0' TO 0'
 DIAGRAM

LAE LOA (continued)

FORM 526e
 (6-18-69)

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

R

NAME OF STATION: LAE LOA
 ESTABLISHED BY: HGS YEAR: 1884 STATE: Hawaii
 RECOVERED BY: R.C. Munson YEAR: 1968 COUNTY: Hawaii
 Island; Hawaii

HEIGHT OF TELESCOPE ABOVE STATION MARK 1.21 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 OHAU (HGS) 1883 | -----1948 | DISTANCE and direction----- | | 00 00 00.0 |
| Napoopoo Light, 1928 | NNW | 02 | 34 | 56.4 |
| Azimuth Mark | S | about 0.25 mi. | 179 | 53 08.0 |
| R.M. No. 1 | SW | 49.206 | 14.998 | 259 53 46 |
| PUU OHAU (HGS) 1883 | -----1968 | DISTANCE and DIRECTION----- | | 00 00 00.0 |
| Napoopoo Light, 1928 | NNW | 02 | 34 | 54.0 |
| RM No. 2 | NNW | 40.014 | 12.197 | 13 48 54 |
| Azimuth Mark | SSE | about 1/4-mile | 179 | 53 22.9 |
| RM No. 1 | WSW | 49.191 | 14.994 | 259 52 49 |

Station was recovered; RM No. 1 and the azimuth mark were found in good condition, but the stone and concrete dome in which the station pipe was set was found to be cracked, although still solid. It was repaired and re-enforced with additional stones and concrete, and a station disk was set in the center of the pipe. The angle to the azimuth mark failed to check by 15 seconds. A complete description follows:

Station is located about 3-1/2 miles southwest of the post office at Honaunau, 1-1/2 miles south of the City of Refuge and 1-1/2 miles northwest of Hookena village, near the sea, on a low rock mound on Loa Point, at west edge of brush line.

To reach station from the post office at Honaunau, go south on State Highway 11 for 3.9 miles to Hookema School; continue on the highway for 0.4 mile to fork and sign "HOOKENA". Take right fork and go 2.25 miles to track crossroad, just before reaching Hookena. Turn right and go through trees and along beach road for 0.35 mile to board gate at house, and end of truck travel. Pack northerly along seacoast about 1-1/4 miles to station. (NOTE: A key may be obtained for the gate from Mc Candless Ranch, however the old road shown on maps is overgrown with large brush, and station is best reached by following coast and avoiding brush.)

Station mark is a standard disk stamped "LAE LOA HGS 1884 1968", set in concrete in top of the original 2-1/2-inch iron pipe, in the top of a 3-foot-diameter, stone and concrete mound that projects 2 feet above ground. It is about 125 feet east of sea bluff, at edge of brush, and about 27 feet above sea level.

Reference mark number one is a standard disk, unstamped, cemented in a drill hole in smooth lava, about 75 feet east of sea and 6 feet lower than station mark.

Reference mark number two is a standard disk stamped "LAE LOA HGS 1884 NO 2 1968", cemented in a drill hole in bedrock, 3 feet lower than station mark.

Azimuth mark is a standard disk, unstamped, cemented in a drill hole in bedrock, 80 feet east of sea and 50 feet west of edge of brush.

*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.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: LAE LOA
 ESTABLISHED BY: HGS YEAR: 1884 STATE: Hawaii BENCH MARK ALSO
 RECOVERED BY: GEH YEAR: 1972 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 2.2 NM SW of Honaunau
 HEIGHT OF TELESCOPE ABOVE STATION MARK Tripod FEET. HEIGHT OF LIGHT ABOVE STATION MARK FEET.

| OBJECT | BEARING | DISTANCE | | DIRECTION |
|---------------|---------|----------|--------|-------------|
| | | FEET | METERS | |
| Azimuth Mark | | | | 00 00 00.0 |
| LAE MAMO 1972 | | | | 1 07 26.8 |
| RM 1 | | 49.55 | 15.104 | 79 57 40.2 |
| RM 2 | | 40.19 | 12.251 | 193 55 33.2 |

The station, Reference Marks 1 and 2, and the Azimuth Mark were recovered as described by R.C. Munson in 1968. All marks were in good condition.

U.S. DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 FORM 9-1105
 (Rev. 12-74)
REPORT ON PERMANENT SURVEY MARK AREA OFFICE

STATE Hawaii COUNTY Hawaii QUADRANGLE 31
 QUOTE PRIMARY REFERENCE near the outermost point 2 mi S. of Honaunau Bay
 (Direction and distance)

DESIGNATION { LISTED LAE LOA
 STAMPED _____ TYPE OF MARK: BM _____ TT _____ TRIANG. X _____
 CONDITION
 Lat. 19° 24' 03.665" Disturbed USGS USBR
 Long. 155° 54' 47.264" Destroyed USC&GS State GS
 Elev. 27 feet Not Found USNPS USNFS
 USGLO USBLM (Other)

REMARKS OR REVISED DESCRIPTION:

Station mark and RM's were recovered in good condition. The 1968 recovery description by R. C. Munson is good.

SUBMITTED BY Yukio Yamamoto
 TITLE Cartographer DATE 1/26/78
 AGENCY USGS

Marks found in good condition need not be reported.
 FILL IN ALL AVAILABLE INFORMATION

gpo 16-54232-6

*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.

FORM CGCS-526e (11-69)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

DEC 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 191553 STATION 1059
HAWAII
LATITUDE 19° 00' TO 19° 30'
LONGITUDE 155° 30' TO 156° 00'
DIAGRAM NE 5-1.5 HAWAII

NOAA FORM 76-39
12-701
FORMERLY CG 03 FORM 928

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

DESCRIPTION OF TRAVERSE STATION

NAME OF STATION: LAE MAMO STATE: Hawaii COUNTY: Hawaii
NEAREST TOWN: Kealia QUADRANGLE NO.: 191553
CHIEF OF PARTY: GEH YEAR: 1972 DESCRIBED BY: JRF

| OBJECT | BEARING | DISTANCE | | DIRECTION |
|--------------|---------|----------|--------|-------------|
| | | FEET | METERS | |
| HOOKENA 1972 | | | | 00 00 00.0 |
| RM 1 | N | 23.48 | 7.156 | 207 51 06.2 |
| RM 2 | ENE | 40.48 | 12.338 | 293 10 18.4 |

Station is located approximately 1.8 miles south of the City of Refuge and 1.2 miles NNW of the town of Hookena on the Kona Coast of Hawaii Island. Station is atop a low lava bluff approximately 17 feet above sea level and approximately 15 feet east of the edge of the bluff.

To reach station from post office at Honanau, travel south on State Hwy 11 for 3.9 miles to Hookena School; continue on Highway 11 for 0.4 mile to fork and sign "Hookena"; take right fork and go 2.25 miles along paved road to gravel track road, just before reaching Hookena Beach; turn right and travel through trees and along beach for 0.35 mile to iron gate and house at end of truck travel. Pack northerly along the beach for 0.8 mile and the station.

Station mark is a standard disk stamped LAE MAMO 1972 set in a drill hole atop the lava bluff. Station is on Hoopalakamaia Point, approximately 0.3 mile northwest of Lae Mamo and is located about 10 feet inshore of a solitary large lava boulder near the edge of the bluff.

Reference mark 1 is a standard disk stamped NO. 1 1972, approximately 2 feet north of a crevasse separating it from the station.

Reference mark 2 is a standard disk stamped NO. 2 1972, on the lava bluff inshore of and at the same elevation as the station.

* 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: 1971-760-031

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LAE MAMO OBS BY NGS
STATE: HAWAII YEAR: 1972 SECOND ORDER

SOURCE: G-14950

| | |
|-------------------------------------|-----------------------|
| GEODETIC LATITUDE: 19° 23' 46.09202 | ELEVATION: 5.0 METERS |
| GEODETIC LONGITUDE: 155 54 41.03592 | 16 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|----------------|
| STATE & ZONE | CODE | X | Y | PERCENT ANGLE* |
| HI 1 | 5101 | 358,225.43 | 204,543.08 | - 0 08' 12" |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|----------------------------------|--------------------------------|------|
| HOOKENA | 327° 19' 22".4 | 327° 27' 34" | 5101 |

THESE DATA OBTAINED FROM ADJUSTMENT OF SEP 1979

RL 177

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191553 STATION 1060
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 30'
 DIAGRAM NE 5-1,5 HAWAII

Lae o Heku (Hawaii Island, Hawaiian Government Survey; E. R. Hand, 1913).—On west coast of Hawaii, Kona District, on Heku Point, about 4 1/4 miles north of Hoopuloa, and 1/2 mile southwest from the former shipping point called Kaapuna. Kaapuna may be recognized from offshore by the large 2-story house, unpainted, and the great piles of corded firewood, and behind, on the slope, the traces of the slide by which the wood was brought down. Marked by a copper triangle in the loose "aa" (lava) clinkers 1/2 foot below the surface, with four beach-worn stones placed around it at distances of 2 feet. It is 25 feet from the edge of the "pali." In 1913 the stones were recovered; triangle not dug for. A cairn was placed over the station; it shows above a wall which was built around it, the wall being nearly circular with vertical sides, 2 1/2 feet high and 11 feet across.

RECOVERY NOTE, TRIANGULATION STATION

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION LAE O HEKU
 STATE HAWAII YEAR 1913 THIRD ORDER
 SOURCE G-SP15c

R

NAME OF STATION LAE O HEKU
 ESTABLISHED BY: E.R. Hand YEAR: 1913 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 was recovered and found to be marked with a rusted iron pin, set in the center of 4 smooth, rounded stones set on a 4 x 4-foot square. Located about 13 miles south of Honaunau and 5 miles north of Milolii, on Lae O heku Point, about 1/4-mile south of the south edge of the Kaapuna Lava Flow of 1950, at edge of sea bluff, on a low knoll about 100 yards south of a slightly higher and more prominent boulder-covered knoll. To reach station from the post office in Honaunau, go south on State Highway 11 for 9.6 miles to power pole No. 142, at north edge of the 1950 lava flow. Turn right and follow bulldozed road along right side of lava flow for 1.6 miles to end of road at sea. Walk south over rough lava along coast for about 1-1/4 miles to station. Station mark is a 1/2-inch iron pin set 6 inches below ground level, in the center of 4 smooth, rounded stones. A 4-foot cairn is built over the mark and a 12-foot-diameter stone wall about 3 feet high surrounds station.

| | | | |
|--------------------|---------------|-----------|-----------|
| GEODETIC LATITUDE | 19 15 36.085 | ELEVATION | 15 METERS |
| GEODETIC LONGITUDE | 155 54 05.246 | SCALED | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-------------------------------|
| STATE & ZONE | CODE | X | Y | β OR Δ OR ANGLE* |
| HI 1 | 5101 | 361,537.03 | 153,205.89 | - 0 07 57 |

* 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 |
|----------------------|----------------------------------|--------------------------------|------|
| | | | |

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191553 STATION 1061
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °30' TO 156 °00'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

Lae o Kanoni (Hawaii Island, Hawaiian Government Survey, 1884; E. R. Hand, 1928)—On the west coast of Hawaii, South Kona District, north of Honaunau Bay, 1,200 meters north-northwest from the "City of Refuge" which is on the south side of the bay, and 330 meters from the water on the west. A bolt referred to in original description as being 4 meters southwest of station was not found in 1913. At that time the station was marked by a drill hole and triangle cut in the solid rock and surrounded by four crosses equidistant from it. The whole surmounted by a large cairn, painted white. In 1928 the cairn had been removed, and the mark consisted of a 2½-inch pipe set in a concrete dome rising about two feet above base of original cairn. Name of station is marked in the concrete.

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

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: LAE O KANONI
 ESTABLISHED BY: Hawaiian Govt. YEAR: 1884 STATE: HAWAII
 RECOVERED BY: L. C. Wilder YEAR: 1948 COUNTY: HAWAII

Detailed statement as to the fitness of the original description: The original station was not recovered. The station is now the center of a 2 inch iron pipe which projects about 3 inches above the rock. The station used for this survey is the center of a 2 1/2 inch pipe which projects from the top of a concrete platform which has been erected over the lower pipe. A new description follows—

The station is located on the summit of a low lava mound about 3 miles south of Napoopoo, about 0.8 mile north of Honaunau Bay, about 0.2 mile east of the beach and about 0.2 mile west of the highway which runs between Napoopoo and Honaunau.

To reach from the post office at Napoopoo, go south, on the road which leads toward Honaunau, for 3.1 miles to a point where the straight road makes a turn to the left at a small highway cut and the end of truck travel. From this point pack westerly for about 0.2 mile to the summit of a low lava mound and the station.

The station is the center of a 2 1/2 inch pipe which projects about 4 inches from the top of a square concrete platform which is about 6 feet on each side and is about 4 feet high.

Reference mark number 1 is a standar disk, stamped KANONI 1 1948, set into a drill hole in lava bedrock which is about level with the surrounding rock. It is in a small depression 6.69 feet lower than the station.

| Object | Distance | Direction |
|---------------------|----------------------|------------|
| KAWAKAHEKA | | 00 00 00 |
| Napoopoo Lighthouse | WNW 4 miles | 08 01 49.1 |
| Napoopoo Spire | N 3 miles | 31 19 11.5 |
| R. M. No. 1 | E 44.291 ft 13.500 m | 128 56 05 |

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION LAE O KANONI
 STATE HAWAII YEAR 1884 SECOND ORDER

SOURCE G- 5275

| | | | |
|--------------------|---------------|-----------|-------------|
| GEODETIC LATITUDE | 19 26 03.091 | ELEVATION | 35.7 METERS |
| GEODETIC LONGITUDE | 155 55 11.517 | | 117 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-------------------|
| STATE & ZONE | CODE | X | Y | # ON Δ 01 ANGLE * |
| HI 1 | 5101 | 555,341.20 | 218,370.09 | - 0 06 23 " |

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE # ON Δ 01 FORMULA NEGLECTING THE SECOND TERM

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From mark) | PLANE AZIMUTH * | CODE |
|----------------------|---------------------------------|-----------------|------|
| PALEMANO | 160 16 29.2 | 160 24 52 " | 5101 |

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 151553 STATION 1062
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °30' TO 156 °00'
 DIAGRAM NE 5-1,5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 525

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **LUU** STATE: **Hawaii** COUNTY: **Hawaii.**
 CHIEF OF PARTY: **K. T. Adams** YEAR: **1929** LOCALITY: **Southeast Coast of Hawaii.**
 Surface-station mark, Note,* **4.**
 Underground-station mark, Note,*
 Reference mark, No. 1, Note,* **12c.**
 Reference mark, No. 2, Note,* **12c.**
 Witness mark, Note,*
 Witness mark, Note,*
 Height of signal above station mark **6** meters.
 Height of telescope above station mark **1.8** meters.

| DISTANCES AND DIRECTIONS TO REFERENCE MARKS AND PROMINENT OBJECTS | | | |
|---|--------------------|-------------|---------|
| OBJECT | DISTANCE Meters | DIRECTION | AZIMUTH |
| Hill | | 00 00 00 | |
| R. M. No. 1. | 18.3 | 210 30 12.5 | |
| R. M. No. 2. | 15.9 | 305 56 12.5 | |

Detailed description:

Standard bronze disc set in the top of a large lava boulder about 200 feet inland from a long, narrow bight. Boulder in which mark is set is about 6 feet above the general level of the lava field. A small foot path runs to the station. The station is in the midst of a rough lava field. Station is about 1520 meters S. 30½ W. (true) from the dock at Funalua, Hawaii.

R. M. No. 1 is in the top of a large lava boulder.
 R. M. No. 2 is in the top of a large lava boulder.

NOTE.—The initial direction must be to a main scheme station.

* Refer to pages 48 and 49, Special Publication No. 26. G P O 11-5791

ADJUSTED HORIZONTAL CONTROL DATA

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

| | |
|-----------------------------------|------------------------|
| GEODETIC LATITUDE: 19 07 36.455 | ELEVATION: 15.0 METERS |
| GEODETIC LONGITUDE: 155 30 48.100 | 45 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-------------------|
| STATE & ZONE | CODE | X | Y | # OR Δ BY ANGLE * |
| HI 1 | 5101 | 495,387.48 | 106,504.33 | - 0°00'16" |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH * (From south) | CODE |
|----------------------|----------------------------------|---------------------------------|------|
| HILL-PUEHUE | 171 24 19.0 | 171 24 35 | 5101 |

WF 034

(continued on next page)

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191553 STATION 1062

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

LUU (continued)

FORM 526a
 (2-12-55)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

R

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: LUU
 ESTABLISHED BY: K.T. Adams YEAR: 1929 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 | |
| HILL (PUEHU) -----1929 | DISTANCE and | DIRECTION----- | | 00 00 00.0 |
| R.M. No. 1 | | 18.3 | 210 30 | 12.5 |
| R.M. No. 2 | | 15.9 | 305 56 | 12.5 |
| HILL (PUEHU HTS) 1914 -1967 | DISTANCE and | DIRECTION----- | | 00 00 00.0 |
| Punaluu, Hokuloa Church Spire, 1967 | NNE | about 3/4 mile | | 26 27 07.2 |
| RM No. 1 | SSW | 59.795 | 18.226 | 210 29 10 |
| RM No. 2 | WNW | 52.129 | 15.889 | 305 59 08 |

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

Station is located along the south coast of the island, about 1 mile southwest of Punaluu Village, on Kohaahu Point, about 100 feet west, inland, from the end of a narrow channel, on top of a large rock which is on the highest and most prominent point in the vicinity, and is at about 49 feet elevation.

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 to junction with State Highway 11. Turn right and go southwest on State Highway 11 for 3.8 miles; turn left on the Punaluu Road and go southeast 1.1 miles to Punaluu Black Sand Beach. Follow track road southwest along power line for 0.7 mile to end of road. Walk south on old roadway up along beach bluff for about 200 yards to where roadway bears right, away from beach. From here follow trail across rock area about 1/4-mile to station.

Station mark is a standard disk stamped "LUU 1929", cemented in a drill hole in the top of a large chunk of rock about 7 feet high and 10 feet in diameter at the base.

Reference mark number one is a standard disk stamped "1 1929", cemented in a drill hole in a 10 x 14-foot chunk of rock that projects 4 feet above the general level of rocks. It is 9.9 feet lower than station mark.

Reference mark number two is a standard disk stamped "2 1929", cemented in a drill hole in a large, round, lava chunk 14 feet in diameter. It projects 5 feet above general level of rocks and is 8.7 feet lower than station mark.

Punaluu, Hokuloa Church Spire 1967 is a sharp, copper spire 4 feet long, mounted on top of a square, red cupola on small, stone church 12 x 15 feet in size.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: LUU
 ESTABLISHED BY: K. T. ADAMS YEAR: 1929 STATE: HAWAII BENCH MARK(S) ALSO
 RECOVERED BY: R. B. MELBY YEAR: 1978 COUNTY: HAWAII
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 1 MILE SOUTHWEST OF PUNALUU

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

THE STATION, REFERENCE MARKS AND THE PUNALUU, HOKULOA CHURCH SPIRE WERE RECOVERED IN GOOD CONDITION. THE DISKS ARE ALL STAMPED WITH THE 1929 DATE.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

191553 STATION 1063
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1,5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 883
 Rev. Aug. 1968

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **MAKANAO 2 (HSSD)** STATE: **HAWAII** COUNTY: **HAWAII**

KAU DISTRICT

CHIEF OF PARTY: **L. G. WILDER** YEAR: **1949**

Described by: **G. J. HOEPEL**

NOTE: HEIGHT OF TELESCOPE ABOVE STATION MARK **3.2** 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 | | | |
| pipe | KAMEHAME NEW 1939 | | | | 00 | 00 | 00 |
| | R M 1 | SE | 18.266 | 5.567 | 46 | 15 | 58 |
| | Honuapo Stack | S | 4 miles | | 85 | 42 | 06.8 |
| | R M 2 | NW | 48.740 | 14.856 | 234 | 10 | 02 |

The station is located on a rock pile on the summit of a rounded hill, planted in cane, which lies about 5 miles north of Honuapo, about 3 miles northwest of Punaluu, about 2 miles northwest of Hilea, about 200 yards west of a graded road and 40 feet southeast of the corner of a rock wall.

To reach from the post office in Naalehu; go north and east on a good cinder road for 6.6 miles; cross over a small creek and continue east for about 200 feet; take the left hand fork and go easterly for about 150 feet; pass through a board gate and follow the steep road east and north for 0.6 mile to a point where the road, after passing around the east side of the hill, starts to break away to the west and the end of truck travel. From this point pack westerly, through the cane field, for about 200 yards to the high ground and the station. A slightly higher hill, which is brush covered, lies about 0.7 mile northwest of the station.

The station is the center of a 1 1/2 inch iron pipe which projects about 5 inches from the top of a triangular stone and concrete platform which is about 5 feet above ground and about level with the rock pile.

Reference mark number 1 is a standard disk, stamped MAKANAO 2 NO 1 1949, set in the top of a 3 inch pipe which projects about 8 inches above the ground and is about the same elevation as the station.

Reference mark number 2 is a standard disk, stamped MAKANAO 2 NO 2 1949, set in the top of a 3 inch pipe which projects about 7 inches above the ground and is about the same elevation as the station.

This station was established by the Hutchinson Sugar Company Survey Department after they could not locate the old H.T.S. station MAKANAO.

* 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. 16-64302-1 U. S. GOVERNMENT PRINTING OFFICE

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **MAKANAO 2 HSSD**

STATE: **HAWAII**

YEAR: **1949**

SECOND ORDER

SOURCE: **G- 5275**

| | |
|-----------------------------------|-------------------------|
| GEODETIC LATITUDE: 19 09 03.204 | ELEVATION: 500.2 METERS |
| GEODETIC LONGITUDE: 155 33 13.934 | 1838 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|--------------|
| STATE & ZONE | CODE | X | Y | PLANE ANGLE* |
| HI 1 | 5101 | 481,407.85 | 115,323.56 | - 0 01 04 |

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE $\theta = \Delta \theta + \frac{1}{R} \Delta x \Delta y$ FORMULA NEGLECTING THE SECOND TERM

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|----------------------------------|--------------------------------|------|
| KAMEHAME NEW | 272 08 00.0 | 272 09 04 | 5101 |

QE 164

HORIZONTAL CONTROL DATA

by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 191553 STATION 1063

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

MAKANAO 2 HSSD (continued)

FORM 526a
(9-18-66)

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

R

NAME OF STATION: MAKANAO 2 (HSSD)
ESTABLISHED BY: L.C. Wilder YEAR: 1949 STATE: Hawaii
RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
Island: Hawaii

| OBJECT | BEARING | DISTANCE | | DIRECTION |
|---|---------|----------|--------|------------|
| | | FEET | METERS | |
| KAMEHAME NEW 1914 | | | | 00 00 00.0 |
| Honuapo, Hutchinson Sugar Co. Mill, stack | S | | | 85 35 42.7 |
| RM No. 3 | SW | 10.443 | 3.184 | 150 39 20 |
| RM No. 4 | NW | 57.005 | 17.375 | 233 14 30 |

Station pipe was recovered in good condition. Both reference marks have been destroyed. Two new reference marks, numbers 3 and 4, were established and the station was marked with a standard disk set in the pipe. A complete description follows:

Station is located about 6 miles north-northeast of Naalehu and 5 miles north of Honuapo, at about 1838 feet elevation, on the south end of a prominent hill with nearly sheer sides that rises above the surrounding cane fields. The top of the hill is planted in sugar cane and station is at west edge of field and about 50 yards north of a clump of large trees. To reach station from the post office in Naalehu, go northeast on

State Highway 11 for 3.4 miles to fork 0.1 mile before sugar mill at Honuapo. Take left fork and go upgrade 3.0 miles; take right fork and go 0.55 mile; take right fork and go 0.15 mile to fork just after crossing cattle-guard. Take right fork and go 0.1 mile; take the center 1 of 3 forks and go up along steep side of hill for 0.45 mile to top of grade; continue through cane fields for 0.3 mile; take dim left fork and go 0.15 mile to hairpin curve on top of hill; go sharp left, south, along top of hill for 0.2 mile to station on right.

Station mark is a standard disk stamped "MAKANAO 2 HSC 1949 1967", cemented in the top of a 1-1/2-inch iron pipe projecting 3 inches from a stone and mortar platform which is the squared-up, and re-enforced, southeast end of a very large stone wall about 6 feet high. 15 yards northwest of the station the wall curves off to right and becomes smaller.

Reference mark number 3 is a standard disk stamped "MAKANAO 2 NO 3 1949 1967", set in concrete in a depression boulders on top of the stone wall, 3 feet northeast of edge of wall and at same elevation as station.

Reference mark number four is a standard disk stamped "MAKANAO 2 NO 4 1949 1967", set in the top of a concrete-filled, 3-inch, iron pipe that is set in the stone wall and re-enforced with concrete. It projects 6 inches from top of wall, is 0.5 foot higher than station, and is hidden by sugar cane.

*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 37173-P89

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 191553 STATION 1066

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

MANUKA (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: **MANUKA**
ESTABLISHED BY: **L.C. Wilder** YEAR: **1948** 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 was recovered and all marks found in good condition. Distance to reference marks was checked and found correct. A complete description follows:

Station is located about 9 miles southeast of Milolii, 1-1/2 miles east-southeast of Manuka State Park, 1450 feet south-southwest of State Highway 11, and across highway from the southwest corner of the Hawaiian Ocean View Estates, in heavily-wooded area, about 180 feet southeast of a track road, and at the south end of a clearing through the timber between station and azimuth mark.

To reach station from the post office at Honaunau, go south on State Highway 11 for 24.5 miles to Manuka State Park on left; continue for 1.6 miles to power pole 345 on left, telephone pole 301 on right, and a track road going back sharp right, 0.2 mile before reaching Aloha Blvd. Turn right and follow track road into forest for 0.25 mile to azimuth mark on left. Continue southwest on the track road for 0.1 mile to end of truck travel. Pack southerly, slightly downgrade, for about 80 yards to end of cleared strip and station.

Station mark is a standard disk, unstamped, set in concrete at about same elevation as ground. There is a large, 7-foot-diameter cairn, 4 feet high, centered over the mark. Station elevation is 1835 feet, and the azimuth mark is considerably higher than station.

Reference mark number one is a standard disk stamped "MANUKA 1 1948", cemented in a drill hole in an 8-foot-diameter lava knob that projects 4 feet above ground. It is about 7 feet higher than station mark.

Reference mark number two is a standard disk stamped "MANUKA 2 1948", cemented in a drill hole in a bedrock ledge that projects 3 feet above ground. It is in the middle of the cleared strip to azimuth mark, and is about 6 feet higher than station mark.

Azimuth mark is a standard disk, stamped "MANUKA 1948", cemented in a drill hole in the top of a knob on a bedrock ledge. It is 5-1/2 feet southeast of the southeast track of the road, 2-1/2 feet east of a white witness post and about 3 feet higher than the road. The clearing to the station is very noticeable, bearing off to left on a 20° angle from the road.

NOTE: The remains of an old pole tower are scattered around station.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191553 STATION 1067
 HAWAII
 LATITUDE 15° 00' TO 15° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5:1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 Form 525
 Rev. Aug. 1964

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **MCCANDLESS** STATE: **HAWAII** COUNTY: **HAWAII** SOUTH KONA DISTRICT

CHIEF OF PARTY: **L. C. WILDER** YEAR: **1948** Described by: **G. J. HOEPPPEL**
 NOTE: HEIGHT OF TELESCOPE ABOVE STATION MARK **1.6** 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 | |
| | | | | feet | meters | ° ' " |
| 4 | Surface-station mark, Underground-station mark | | | | | |
| 12c | LAE LOA | | | | | 00 00 00 |
| | R M 1 | NE | 21.918 | 6.681 | 143 | 17 14 |
| | Sub Station 'A' | | | 16.37 | 169 | 36 01.2 |
| | Hookena Spire | W | | 3 miles | 335 | 58 27.1 |

The station is located in the front yard of an abandoned shack on property belonging to the McCandless Ranch. It is about 4 miles south-east of Honanau Bay, about 3 miles northeast of Hookena, about 1 mile east of the highway which runs between Captain Cook and Waiohinu, 38.3 feet south of the center of a graded road, 33.3 feet southeast of a fence corner, 16.3 feet west of the northwest corner of an old shack and 12.7 feet east of a fence.

To reach from the post office at Kai Malino; go south on the road toward Waiohinu for 0.15 mile; turn left, onto a track road, and go easterly, up grade, for 1.15 miles to the old shack and the station on the right hand side of the road.

The station is a standard disk, stamped MCCANDLESS 1948, set into a drill hole in a boulder which projects about 1 foot.

Reference mark number 1 is a standard disk, stamped NO 1 1948, set into a drill hole in a boulder which projects about 10 inches. It is located 34.3 feet east of a wire fence, 26.5 feet south of the center of a graded road, 11.5 feet north of the northwest corner of an old shack and is about the same elevation as the station.

Substitute station 'A' is the northwest corner and base of an old shack. It is 0.24 meter higher than the station.

* 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.) 16-56289-1 U. S. GOVERNMENT PRINTING OFFICE

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **MC CANDLESS**

STATE: **HAWAII**

YEAR: **1948**

SECOND ORDER

SOURCE: **G- 5279**

| | |
|-----------------------------------|-------------------------|
| GEODETIC LATITUDE: 15 23 41.773 | ELEVATION: 525.7 METERS |
| GEODETIC LONGITUDE: 155 52 02.704 | 1725 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-----------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ θ1 ANGLE |
| HI 1 | 5101 | 575,581.25 | 204,075.18 | - 0 07 19 |

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ θ1 FORMULA NEGLECTING THE SECOND TERM.

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|-------------------------------|-----------------------------|------|
| KEEI SOUTH BASE | 131 49 04.2 | 131 56 23 | 5101 |

QE 068

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191555 STATION 1069
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 535
 Rev. Aug. 1968

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **MOUNTAIN** STATE: **HAWAII** COUNTY: **SOUTH KONA HAWAII**

CHIEF OF PARTY: **L. G. WILDER** YEAR: **1948** Described by: **C. L. MURRAY**

| 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 | | | |
| 4 | Surface-station mark, Underground-station mark | BEARING | DISTANCE | | DIRECTION‡ |
| | | | feet | meters | |
| 12a | R. M. No. 1 | | 40.07 | 12.215 | Magnetic Bearings N 15 E |
| 12a | R. M. No. 2 | | 25.42 | 7.748 | S 60 E |
| | Nail in a cross on ohia tree | | 19.33 | 5.89 | S 75 E |
| | Nail in a cross on ohia tree | | 5.36 | 1.634 | S 45 E |

The station is located in the land of Pahoehoe in the South Kona District, in dense forest about four miles above the Government road and about two miles northwest of the Kahe Ranch House.
 The station is located on a high rise of land that breaks steeply to the southwest and northwest. The station mark is a standard disk cemented in drill hole in a boulder set in the ground 25 feet northwest of and about four feet lower than the highest ground nearby. It is about 60 feet directly below the top of a large ohia tree denuded of its branches. A small pile of stones covers the station mark.

To reach the station proceed east and up the hard surfaced track road leading to the Ohia and Koa Mills south of the Alika Lava flow of 1919. This road commences at the Government main road, about 1/4 mile south of the Alika lava flow and is marked by a chained gateway with a cattle guard. After reaching the Koa Mill about 5 miles above the main road, turn north along a rough road which crosses the many branches of the Alika lava flow. Keep to the right at first fork in the road, a little north of the Koa Mill. From this point on take left forks of all junctions. This road ends at Kahe Ranch House about 10 miles beyond the Koa Mill. Continue along a trail that runs northwest 1/4 mile through a narrow corral, thence due north along trail through forest a little over a mile, following near the west side of a fence, to high ground about 300 feet west of the fence at which point the trail turns northwest. Continue a distance of about 3/4 mile. From this point go west through dense forest for 1/4 mile to station. Without a guide the station is difficult to locate. The location of the station was first located by going due west 4300 feet from the paddock corner 1 1/2 miles north of Kahe Ranch House.

R. M. No. 1 is a disk in drill hole in solid rock 5 feet east of an uprooted ohia tree NNE of station.

R. M. No. 2 is a disk in drill hole in solid rock 3' x 1.5' by 1' high SE of station, on highest ground nearby.

A 20 penny nail in cross in north face of ohia tree bears SSE.

A 20 penny nail in cross in west face of ohia tree bears ESE.

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

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **MOUNTAIN**

STATE: **HAWAII**

YEAR: **1948**

SECOND ORDER

SOURCE: **G- 9279**

| | | | |
|---------------------|-----------------|------------|---------------|
| GEODETIC LATITUDE: | 19° 15' 49.186 | ELEVATION: | 1419.5 METERS |
| GEODETIC LONGITUDE: | 155° 49' 20.090 | | 4657 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-----------------|
| STATE & ZONE | CODE | X | Y | β OR Δ ± ANGLE* |
| HI 1 | 5101 | 388,846.76 | 180,579.55 | - 0 06 24 |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From mark) | PLANE AZIMUTH* (From mark) | CODE |
|----------------------|---------------------------------|-------------------------------|------|
| | | | |

QE 066

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191553 STATION 1070
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

Na Puu a Pele (Hawaii Island, Hawaiian Government Survey, 1891; E. R. Hand, 1914).—On southwest coast of Hawaii, in the extreme southwest part of Ka-u District, in Manuka, on the largest and most westerly of a chain of cinder cones on the coast, and about 12 miles west-northwest from Ka lae, the south point of Hawaii. Marked by a cross cut in a beach-worn stone buried 1 foot below the surface of the ground. Above it is placed a similar stone marked with a triangle, and above all a large stone cairn.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 PHOTO 838

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: NA PUU a PELE
 ESTABLISHED BY: Hawaiian Govt. YEAR: 1891 STATE: HAWAII
 RECOVERED BY: L. G. Wilder YEAR: 1949 COUNTY: HAWAII

Detailed statement as to the fitness of the original description: The station was recovered, as described, in good condition. A standard station disk was set into the original drill hole and two reference marks were established. A new description follows—

The station is located on the summit of the higher of several rounded, cinder cones which lie along the coast east of Awili Point. The station is about 4 miles west northwest of Pohue Bay, about 2 miles east southeast of Kauna Point Lighthouse and about 300 yards east of the beach.

The station is best reached, by boat, from the village of Milolii. A landing can be made in a small cove at the foot of the station hill.

Station can also be reached, by trail, from the highway which runs between Naalehu and Captain Cook. The trail starts 14.7 miles northwest of the school house and church in the village of Waiohinu. This is about a 9 mile pack and horses can be obtained at the Kahuku Ranch. No water is obtainable after leaving truck.

The station is a standard disk, stamped NA PUU a PELE 1948, set in the center of a triangle which is carved into a flat rock which is flush with the surface of the ground.

A rock cairn was built over the station.

Reference mark number 1 is a standard disk, stamped NA PUU a PELE 1 1948, 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 NA PUU a PELE 2 1948, set into a drill hole in a boulder which projects about 4 inches and is about 4 feet lower than the station.

| Object | Distance | Direction |
|----------------|-------------------|-----------|
| KAUNA PT LIGHT | | |
| R. M. No. 2 N | 27.083 ft 8.255 m | 00 00 00 |
| R. M. No. 1 SE | 16.869 ft 5.142 m | 79 01 32 |
| | | 225 49 11 |

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: NA PUU A PELE
 STATE: HAWAII YEAR: 1891 SECOND ORDER

SOURCE: G- 5275

| | | | |
|---------------------|---------------|------------|-------------|
| GEODETIC LATITUDE: | 19 01 48.274 | ELEVATION: | 74.7 METERS |
| GEODETIC LONGITUDE: | 155 51 21.266 | | 245 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|-----------|-----------------|
| STATE & ZONE | CODE | X | Y | Bearing Angle ° |
| HI 1 | 5101 | 277,377.19 | 71,567.40 | - 0 06 58 |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH (From south) | CODE |
|----------------------|----------------------------------|-------------------------------|------|
| PUU KI HGS | 291 11 54.6 | 291 18 53 | 5101 |

QE 079

(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 191555 STATION 1071
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NO TEXT

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: NAMAUIKEHAU
 STATE: HAWAII YEAR: 1890 ORDER: THIRD

SOURCE: G-SPI56

| | | | |
|---------------------|---------------|------------|--------|
| GEODETIC LATITUDE: | 19 12 44.830 | ELEVATION: | METERS |
| GEODETIC LONGITUDE: | 155 46 21.256 | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|---------------------------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ OR ANGLE * |
| HI 1 | 5101 | 405,965.12 | 137,744.06 | - 0 05 23 " |

* 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 |
|----------------------|----------------------------------|---------------------------------|------|
| | | | |

QC 286

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191553 STATION 1073
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

NAPOOPOO KAHIKOLU CHURCH SPIRE
 (Hawaii Island, E. R. Hand, 1913; E. R. Hand, 1928).—On western coast of Hawaii, Kona District, at Napoopoo, the steeple of the large stone church. It is high up on a rise, faces the sea, and shows up white; very prominent.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: NAPOOPOO KAHIKOLU CHURCH SPIRE
 STATE: HAWAII YEAR: 1915 THIRD ORDER
 SOURCE: G- 9279

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 535
 Rev. Aug. 1968

RECOVERY DESCRIPTION OF TRIANGULATION STATION

KAHIKOLU CHURCH, SOUTH KONA DISTRICT
 NAME OF STATION: NAPOOPOO SPIRE STATE: HAWAII COUNTY: HAWAII
 Established By: E. R. Hand, 1913
 CHIEF OF PARTY: L. C. WILDER YEAR: 1948 Described by: G. J. HOEPEL

| NOTE* | HEIGHT OF TELESCOPE ABOVE STATION MARK 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 | feet | meters |
| | | OBJECT BEARING DISTANCE DIRECTION | | |
| | This is an intersection station. | | | |

| | | | |
|--------------------|-----------------|-----------|--------|
| GEODETIC LATITUDE | 19° 28' 21.182 | ELEVATION | METERS |
| GEODETIC LONGITUDE | 155° 55' 05.795 | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|------------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ or ANGLE* |
| HI 1 | 5101 | 355,922.70 | 252,298.95 | - 0 08 22 |

* 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 |
|----------------------|----------------------------------|-------------------------------|------|
| | | | |

The station is the top of the spire on the summit of the steeple of the Kahikolu Church in the village of Napoopoo.

The church is constructed of stone and concrete and faces to the west. The steeple is on the west end of the structure and is about 40 feet in height.

The church lies about 0.5 mile east of the beach.

RECOVERY NOTE, TRIANGULATION STATION INTERSECTION

NAME OF STATION: Napoopoo, Kahikolu Church, spire
 ESTABLISHED BY: E. R. Hand YEAR: 1913 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

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

Station was recovered; the church has been abandoned for a long time but is still in good condition.

Located about 1/4-mile southeast of Napoopoo Bay and 1100 feet east of the macadam road leading south to the City of Refuge, on the kiawe-covered slopes.

Station is the sharp, rust-colored spire, with a ball and wind vane on top, located on the west end of the large, rectangular, stone and mortar church building, which has a rust-colored, corrugated metal roof. Top of spire is about 60 feet above ground.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Napoopoo, Kahikolu Church, Spire
 ESTABLISHED BY: E. R. Hand YEAR: 1913 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: G. E. Haraden YEAR: 1972 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: In Napoopoo

R

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

Station was viewed from sea and no changes were noted from the recovery note by R. C. Munson dated 1968.

QE 214

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191553 STATION 1074
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

Napoopoo Light (Hawaii Island, E. R. Hand, 1928).—On western coast of Hawaii, north side of Kealakekua Bay, the usual type of unwatched light; a square structure, tapering, and painted white. There is a small railed platform about the lamp. Height about 33 feet. Must not be confused with old light, which was on a pole, determined in 1913. New light is 18 feet true south from position of old light.

RECOVERY NOTE, TRIANGULATION STATION
 INTERSECTION

R

NAME OF STATION: Napoopoo Light
 ESTABLISHED BY: E.R. Hand YEAR: 1928 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 was recovered. Located about 2-1/4 miles southwest of Kealakekua and 1 mile west-northwest of Napoopoo dock, on west side of Cook Point, about 1300 feet southwest from Captain Cook's Monument. Station is the center of the light tower, a square, white, concrete structure, 4-1/2 feet square at the base, tapering to 2 feet square at the top, supporting a 5-foot-square platform with the white light extending above it. The light is about 22 feet above ground. The point occupied by the old light is 18 feet north from center of tower, and is marked by a small brass pipe set in concrete block.

INTERSECTION
 RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: Napoopoo Light
 ESTABLISHED BY: E.R. Hand YEAR: 1928 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: GEH YEAR: 1972 COUNTY: Hawaii
 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 was recovered as described by R.C.Munson (1968) in good condition.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: NAOOPOO LIGHT
 STATE: HAWAII YEAR: 1928 THIRD ORDER
 SOURCE: G- 9279

| | | | |
|--------------------|---------------|-----------|--------|
| GEODETIC LATITUDE | 19 28 55.877 | ELEVATION | METERS |
| GEODETIC LONGITUDE | 155 56 21.592 | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|--------------------------------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ OR ϕ ANGLE |
| HI 1 | 5101 | 348,679.14 | 235,816.99 | - 0 08 48 |

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE θ OR Δ OR ϕ 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

Q 191553 STATION 1075
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °30' TO 156 °00'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

Napoopoo School Flagpole

(Hawaii Island, E. R. Hand, 1913; E. R. Hand, 1928).—On western coast of Hawaii, Kona District, 1¼ miles east of wharf at Napoopoo, on the public school, a 1-story building, originally a dark red color, with galvanized roof. Building conspicuous because of large number of windows. In 1928 building no longer red but brown, and roof no longer shows up bright. Building no longer conspicuous because of color, painted roof, and numerous other buildings about. Station is flagpole on east side of building, midway between ends, and may be seen from the shore, showing over the roof. On school days a flag will be flying.

RECOVERY NOTE, TRIANGULATION STATION INTERSECTION

NAME OF STATION: **Napoopoo School, Flagpole**
 ESTABLISHED BY: E.R. Hand YEAR: 1913 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

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

Station was recovered. It is a slender pipe flagpole about 25 feet tall, set in a mass of concrete, at east side of abandoned school building, midway between ends.

Located about 2 miles southeast of Captain Cook and 1-1/4 miles east of Napoopoo, along west side of old macadam road leading down to Napoopoo from State Highway 11.

NOTE: Since school is abandoned a flag no longer flies, and large trees block view of the flagpole.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: NAPOOPOO SCHOOL FLAGPOLE

STATE: HAWAII

YEAR: 1913

THIRD

ORDER

SOURCE: G-SP156

| | | | |
|---------------------|---------------|------------|--------|
| GEODETIC LATITUDE: | 19 28 25.050 | ELEVATION: | METERS |
| GEODETIC LONGITUDE: | 155 54 07.324 | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|------------------|
| STATE & ZONE | CODE | X | Y | θ HOR Δ θ ANGLE* |
| HI 1 | 5101 | 361,518.30 | 232,675.79 | - 0° 08' 03" |

* 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 |
|----------------------|----------------------------------|--------------------------------|------|
| | | | |

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 151553 STATION 1076
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 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: NIUOU STATE: HAWAII COUNTY: SOUTH KONA DISTRICT HAWAII

CHIEF OF PARTY: L. C. WILDER YEAR: 1948 Described by: G. J. HOEPEL

| NOTE* | HEIGHT OF TELESCOPE ABOVE STATION MARK METERS.1 | 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 | | | |
|-------|---|--|--|----------|------------|-------------|
| | Surface-station mark | Underground-station mark | BEARING | DISTANCE | DIRECTION: | |
| | | | | feet | meters | ° ' " |
| | HANAMALO 2 | | | | | 00 00 00 |
| | Cairn 8 1 mile | | | | | 166 44 57.4 |
| 12e | R M 1 | | S | 33.172 | 10.111 | 186 41 51 |
| 12e | R M 2 | | W | 23.579 | 7.187 | 262 38 05 |

The station is located about 4.5 miles south of Milolii, about 2.5 miles south of Hanamalo Point, 0.6 mile north of Kanewaa Point, about 0.2 mile north of Niouou Coconut Grove, about 100 feet east of the sea, about 100 feet west of a trail and on the summit of a low lava knoll.

The station is best reached, by boat, from the village of Milolii. A landing can be made on the rocky point about 100 feet west of the station. In rough weather the station can be reached from Milolii by packing southerly, on the good trail, for about 4.5 miles to the station on the right hand side of the trail.

The station is a standard disk, unstamped, set into a drill hole in a boulder which is about 1 foot in diameter.

Reference mark number 1 is a standard disk, unstamped, set into a drill hole in a boulder which projects about 3 feet and is located 1.53 meters lower than the station.

Reference mark number 2 is a standard disk, unstamped, set into a drill hole in a boulder which is about 10 feet long, 5 feet wide and projects about 8 feet from the surrounding rock. It is located 1.65 meters lower than the station.

A 2 1/2 x 2 1/2 black and white pole has been plumbed over this station and a cairn of rocks built around the pole.

FORM 533
 (11-8-55)

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

R

NAME OF STATION: NIUOU
 ESTABLISHED BY: L. C. W. YEAR: 1948 STATE: Hawaii
 RECOVERED BY: U. S. G. S. YEAR: 1958 COUNTY: Hawaii

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

Station recovered.

To reach from the Hookena School; proceed southerly along main road for 17.2 miles to the main ranch buildings at Honomolino Ranch; turn right going past houses for 0.1 mile; take left fork thru gate for 1.8 miles to wire corral; turn into corral and continue out gate on west side of corral and continue down grade for 2.3 miles to coastline; take left fork and go southerly across lava along jeep trail for 1.0 mile to end of truck travel, from here pack southerly along good trail for about 0.5 miles to station on right hand side of trail.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: NIUOU

STATE: HAWAII

YEAR: 1948

SECOND

ORDER

SOURCE: G- 9279

| | | | |
|--------------------|---------------|-----------|-------------|
| GEODETIC LATITUDE | 19 07 49.156 | ELEVATION | 10.5 METERS |
| GEODETIC LONGITUDE | 155 55 08.988 | | 34 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|------------------|
| STATE & ZONE | CODE | X | Y | ρ OR Δ ρ1 ANGLE* |
| HI 1 | 5101 | 355,316.65 | 108,018.76 | - 0 08 15 |

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE ρ OR Δ ρ1 FORMULA NEGLECTING THE SECOND TERM.

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|----------------------------------|--------------------------------|------|
| HANAMALO 2 | 182 11 03.2 | 182 19 18 | 5101 |

QE 075

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 191553

STATION 1076

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

NIUOU (continued)

RECOVERY NOTE, TRIANGULATION STATION

FORM 526a
 (2-18-69)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: NIUOU
 ESTABLISHED BY: L. C. Wilder YEAR: 1948 STATE: Hawaii
 RECOVERED BY: R. C. Munson YEAR: 1968 COUNTY: Hawaii
 Island: Hawaii

NAME OF STATION: NIUOU
 ESTABLISHED BY: L. C. Wilder YEAR: 1948 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: C. A. Burroughs YEAR: 1973 COUNTY: Hawaii
 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:

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 | |
| HANAMALO 2 -----1948 DISTANCE and DIRECTION----- | | | | 00 00 00.0 |
| OHEPUUPUU (HGS) 1890 | | | | 28 34 43.0 |
| R.M. No. 1 | S | 33.172 | 10.111 | 186 41 51 |
| R.M. No. 2 | W | 23.579 | 7.187 | 262 38 05 |
| HANAMALO 2 (HGS) 1890 ---1968 DISTANCE and DIRECTION----- | | | | 00 00 00.0 |
| OHEPUUPUU (HGS) 1890 | | | | 28 34 42.2 |
| R.M. No. 1 | S | 33.131 | 10.099 | 186 43 12 |
| R.M. No. 2 | W | 23.562 | 7.182 | 262 41 43 |

Station was recovered and all marks found in good condition. It is now possible to drive to within 1/2-mile of station with 4-wheel drive vehicle. A complete description follows:

Station is located about 4-1/4 miles south of Mjollii, 4 miles southwest of the Honomalino Agriculture Co. Office, and 3400 feet southwest of the old Hoha Slide, along the coast, southeast across a small cove from Niuou Point, about 250 yards north of a kiawe grove (there is no longer a coconut grove in the area), at about 34 feet ele-

vation, on a slight knoll in rough lava area, and 100 feet west of an old Hawaiian trail.

To reach station from the post office at Honaunau, go south on State Highway 11 for 19.7 miles to the Honomalino Agriculture Co. Office on right. From office go south on narrow macadam road for 0.25 mile to a dim road right. Turn right and go down through orchard for 1.1 miles to locked gate (key was obtained at the Honomalino office). Pass through gate and go 0.4 mile to T-junction. Turn left and go 0.8 mile; take right fork, inside wire corral, and go down through pasture land for 2.6 miles to T-junction at beach. Turn left and follow beach road south for 0.95 mile to end of road. Pack south on old trail about 1/2 mile to station on right.

Station mark is a standard disk, unstamped, cemented in a drill hole in rock flush with ground, about 175 feet north of the inner end of a narrow inlet. There is a large cairn with signal in center, over the mark.

Reference mark number one is a standard disk, unstamped, cemented in a drill hole in a 4-foot-diameter boulder projecting 3 feet above ground. It is 4.9 feet lower than station mark.

Reference mark number two is a standard disk, unstamped, cemented in a drill hole in a 9-foot-diameter lava rock that projects 6 feet above ground. It is 5.3 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.

USCOMMA-DC 27179-P89

FORM C&GS-526 (5-66)
 USCOMMA-DC 38490-P88

U.S. DEPARTMENT OF COMMERCE
 ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
 COAST AND GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191553 STATION 1077
 HAWAII
 LATITUDE 15° 00' TO 15° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

Ohepuupuu (Hawaii Island, Hawaiian Government Survey, 1890; E. R. Hand, 1914).—On southwest coast of Hawaii, in South Kona, land of Kapua, ¼ mile south of the shacks at Kapua Bay, which is just south of Okoe Bay, and 430 meters east of the shingle beach cove which is on the north side of the great point. It is near the shore, south of Aholo cocoanut grove, 32 feet southwest of trail leading over the "aa" (lava), and 600 or 700 feet southeast of the ancient "holua" (slide) of Heeia. Marked by a triangle cut in a large stone on top of an ancient grave on highest point of the "aa." In 1914 a large cairn was erected over the station and painted white.

RECOVERY NOTE, TRIANGULATION STATION

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 519

NAME OF STATION: OHEPUUPUU
 ESTABLISHED BY: Hawaiian Govt. Year: 1890 STATE: HAWAII
 RECOVERED BY: L. C. Wilder Year: 1948 COUNTY: HAWAII

Detailed statement as to the fitness of the original description:

The station was recovered as described. A standard station disk and two reference marks were established. A new description follows—

The station is located about 3.5 miles south of Milolii, about 1 mile northeast of the Niou Cocoanut Grove, about 0.3 mile east of the beach, about 200 feet north of a well marked trail and about 50 feet south and west of a well marked side trail. The station is on the summit of a prominent lava knoll which projects about 20 feet above the surrounding lava.

The station is best reached, by boat, from the village of Milolii. A landing can be made in a small cove which lies about 500 feet south of the ancient Hawaiian slide. In rough weather the station can be reached by a good foot trail from the village of Milolii.

The station is a standard disk, unstamped, set into a drill hole in a boulder which is flush with the surface of the ground.

Reference mark number 1 is a standard disk, unstamped, set in a drill hole in a boulder which is about 25 feet long, 15 feet wide, and projects about 6 feet. It is located to the north of a trail and is 2.51 meters lower than the station.

Reference mark number 2 is a standard disk, unstamped, set into a drill hole in a boulder which is about 7 feet long, 4 feet wide and projects about 3 feet. It is located about 2 feet east of a trail and 1.43 meters lower than the station.

| Object | Distance | Direction |
|-----------------------|--------------------|-------------|
| HANAMALO 2 | | |
| R. M. 1 NE | 65.162 ft 19.862 m | 00 00 00 |
| R. M. 2 ESE | 47.546 ft 14.492 m | 57 38 11 |
| Cairn SSE | 2 miles | 116 02 30 |
| Boundary Monument 4 W | 0.3 mile | 196 11 06.4 |
| | | 284 52 55.1 |

Boundary monument number 4 is a 1 inch pipe which projects about 6 inches above a square slab of concrete. It is located about 0.3 mile west of the station, about 100 feet east of the sea and just north of a number of scrub trees. It is the most northeasterly of four pipes.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: OHEPUUPUU
 STATE: HAWAII YEAR: 1890 SECOND ORDER

SOURCE: G- 9279

| | | | |
|--------------------|---------------|-----------|-------------|
| GEODETIC LATITUDE | 15 08 15.590 | ELEVATION | 51.0 METERS |
| GEODETIC LONGITUDE | 155 54 52.420 | | 102 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-------------------------------|
| STATE & ZONE | CODE | X | Y | β OR Δ OR ANGLE* |
| HI 1 | 5101 | 356,910.79 | 110,682.27 | - 0 08 05 |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|----------------------------------|--------------------------------|------|
| HANAMALO 2 | 171 22 59.7 | 171 31 09 | 5101 |

QE 077

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191553 STATION 1077

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

OHEPUUPUU (continued)

FORM 5260
 (8-15-65)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: OHEPUUPUU
 ESTABLISHED BY: HGS YEAR: 1890 STATE: Hawaii
 RECOVERED BY: R.C. Munson YEAR: 1968 COUNTY: Hawaii
 Island: Hawaii

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: OHEPUUPUU
 ESTABLISHED BY: HGS YEAR: 1890 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: C. A. Burroughs YEAR: 1973 COUNTY: Hawaii
 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:

| OBJECT | BEARING | DISTANCE | | DIRECTION |
|--------------------------------|----------|--------------------|--------|-------------|
| | | FEET | METERS | |
| HANAMALO 2 -----1948 | DISTANCE | and DIRECTION----- | | 00 00 00.0 |
| R.M. 1 | NE | 65.162 | 19.862 | 57 38 11 |
| R.M. 2 | ESE | 47.546 | 14.492 | 116 02 30 |
| Cairn | SSE | 2 | miles | 196 11 06.4 |
| Boundary Monument 4 | W | 0.3 | mile | 284 52 55.1 |
| HANAMALO 2 (HGS) 1891 ----1968 | DISTANCE | and DIRECTION----- | | 00 00 00.0 |
| R.M. No. 1 | NE | 65.154 | 19.859 | 57 38 43 |
| R.M. No. 2 | ESE | 47.530 | 14.488 | 116 03 08 |
| Cairn, 1948 | S | | | 196 11 20.6 |
| Boundary Monument 4, 1948 | W | | | 284 52 53.9 |

Station was recovered in good condition. It is now possible to drive within 1/4-mile of station. A complete description follows:

Station is located about 3-1/2 miles south of Milolii, 1500 feet east of Kaupo Bay, 800 feet southeast of Holua Slide, an old Hawaiian slide built of stones, and 32 feet southwest of an old stone trail, on a knoll of about 102 feet elevation in rough lava land.

To reach station from the post office at Honaunau, go south on State Highway 11 for 19.7 miles to the Honomalino Agriculture Co. Office on right. From the office go south on narrow macadam road for 0.25 mile to dim road right. Turn right and go down through orchard for 1.1 miles to locked gate (key was obtained at the Honomalino office). Pass through gate and go 0.4 mile to T-junction. Turn left and go 0.8 mile; take right fork, inside wire corral, and go down through pasture land for 2.6 miles to T-junction at beach. Turn left and follow beach road for 0.8 mile to old slide on left. Pack southeast along stone trail about 400 yards to station.

Station mark is a standard disk, unstamped, cemented in a drill hole in a boulder flush with ground.

Reference mark number one is a standard disk, unstamped, cemented in a drill hole in the west end of a large rounded lava formation projecting 6 feet above ground, and is 8.3 feet lower than station mark.

Reference mark number two is a standard disk, unstamped, cemented in a drill hole in a 4-foot boulder, 4 feet east of the trail and 4.8 feet lower than station mark.

FORM CGS-526 (8-65)
 USCOMM-DC 36496-P68

U.S. DEPARTMENT OF COMMERCE
 ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
 COAST AND GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191553 STATION 1079
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

ADJUSTED HORIZONTAL CONTROL DATA

DEPARTMENT OF COMMERCE
 U. S. OCEANIC AND GEODETIC SURVEY
 FORM 538

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: Olokuana STATE: Hawaii COUNTY: Hawaii
 ESTABLISHED BY: H.G.S. YEAR: 1914 LOCALITY: Kau, Hawaii
 RECOVERED BY: Chas. L. Murray YEAR: 1938

Detailed statement as to the fitness of the original description:

Location of station: On a prominent grassy hill surrounded by lava flows about 0.6 mile above the Waiohinu-Kona road and roughly about 5 miles from Waiohinu

Old station mark found: Drill-hole in + cut in rock set in ground and stone-pile.

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 STATION: OLOKUANA

STATE: HAWAII

YEAR: 1914

THIRD

ORDER

SOURCE: G-SP156

| | | | |
|--------------------|---------------|-----------|--------|
| GEODETIC LATITUDE | 19 04 13.430 | ELEVATION | METERS |
| GEODETIC LONGITUDE | 155 40 56.359 | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|-----------|-------------------------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ OR ANGLE |
| HI 1 | 5101 | 437,045.31 | 86,117.57 | - 0 03 35 |

* 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 |
|----------------------|----------------------------------|-------------------------------|------|
| | | | |

* 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.

U. S. GOVERNMENT PRINTING OFFICE

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

11-7008

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191553 STATION 1081
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

Palemano (Hawaii Island, E. R. Hand, 1928).—On western coast of Hawaii, on Palemano Point, south side of Kealakekua Bay, south of the low, flat extent of rock which forms this feature, and about 20 meters from the sea on the west. Point is almost as level as a floor, composed of "pahoehoe" or smooth lava, and is awash at storm high water, and is therefore free of all loose stones. Thirty meters true east from the station are the remains of an ancient "heiau" or temple. Marked by a prominent dome of concrete built up from the smooth lava to a height of 2 feet, with a 2-inch gas pipe protruding from its top. This is an old Territorial survey station.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 598

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: **PALEMANO**
 ESTABLISHED BY: **E. R. Hand** YEAR: **1928** STATE: **HAWAII**
 RECOVERED BY: **L. C. Wilder** YEAR: **1948** COUNTY: **HAWAII**

Detailed statement as to the fitness of the original description: The station, as described in the 1928 survey, was recovered in good condition. A standard disk was set in the center of the 2 inch pipe and two reference marks were established. A new description follows—

The station is located on Palemano Point about 3 miles north of Honaunau Bay, about 1.3 miles southwest of Napoopoo, about 300 feet east of the westernmost point of Palemano Point, 96 feet southwest of a concrete slab which formed the foundation for the old lighthouse and on the top of a mound of concrete which is awash during stormy weather.

To reach from the post office at Napoopoo; go south on the road which leads toward Honaunau for 0.6 mile; turn right, onto a graded road, and go west and south for 0.5 mile; pass through the settlement at Keel and continue southerly for 0.2 mile; pass through a board gate into the grounds of the Kona Maluhia Camp; turn right and go westerly for 0.3 mile to the station.

The station is a standard disk, stamped **PALEMANO RESET 1948**, set in the top of a mound of concrete which projects about 2 feet. Reference mark number 1 is a standard disk, stamped **PALEMANO NO 1 1948**, set into a drill hole in bedrock which is flush with the surrounding rock. It is located 34 feet southwest of the foundation of an old lighthouse and is about 2 feet lower than the station.

Reference mark number 2 is a standard disk, stamped **PALEMANO NO 2 1948**, set into a drill hole in flat bedrock. It is located about 3 feet lower than the station.

The distance between reference mark number 1 and reference mark number 2 is 98.760 feet.

| Object | Distance | Direction |
|---------------------|----------------------|-------------------------|
| KEAWEKAHEKA | | |
| Napoopoo Lighthouse | NNW 2.0 miles | 00 00 00 |
| R. M. No. 2 | N 72.378 ft 22.061 m | 14 48 33.6 |
| Napoopoo Spire | NE 2.0 miles | 23 44 16 |
| R. M. No. 1 | E 63.994 ft 19.505 m | 84 37 48.8 116 16 19 |

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **PALEMANO**
 STATE: **HAWAII** YEAR: **1928** SECOND ORDER

SOURCE G- 9275

| | | | |
|---------------------|---------------|-----------|------------|
| GEODETTIC LATITUDE | 19 27 42.810 | ELEVATION | 2.0 METERS |
| GEODETTIC LONGITUDE | 155 55 49.210 | | 7 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-------------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ OR ANGLE * |
| HI 1 | 5101 | 351,758.92 | 228,438.35 | - 0 08 36 |

* 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 |
|----------------------|-----------------------------------|---------------------------------|------|
| KEAWEKAHEKA | 142 23 24.7 | 142 32 01 | 5101 |

QE 060

(continued on next page)

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191553 STATION 1081
 LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

PALEMANO (continued)

FORM 526a
 (2-16-55)

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

R

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PALEMANO
 ESTABLISHED BY: E.R. Hand YEAR: 1928 STATE: Hawaii
 RECOVERED BY: R.C. Munson YEAR: 1968 COUNTY: Hawaii
 Island: Hawaii

| OBJECT | BEARING | DISTANCE | | DIRECTION |
|------------------------|---------|----------|--------|-------------|
| | | FEET | METERS | |
| KEAWEKAHEKA (HGS) 1891 | N | 72.326 | 22.045 | 00 00 00.0 |
| R.M. No. 2 | E | | | 23 45 27 |
| PALEMANO 2 | E | 63.974 | 19.500 | 106 53 38.6 |
| R.M. No. 1 | E | | | 116 14 20 |

Station was recovered and both reference marks found in good condition; the stone and concrete mound in which the station mark is set is cracking and the soft bedrock ledge on which it is located is being broken up by wave action and it will not last long, so a new station, PALEMANO 2, was established, however the old station was not removed. A complete description follows:

Station is located about 3-1/2 miles west-northwest of the post office at Honaunau, 1 mile southwest of Napoopoo, 1400 feet southwest of Keeli village, and 800 feet west-northwest of Maluhia Boys' Camp, near the sea, on Palemano Point.

To reach station from the post office in Honaunau, go south on State Highway 11 for 1.8 miles to junction with State Highway 16. Turn sharp right and go downhill on State Highway 16 for 3.5 miles to the City of Refuge; continue north on the road to Napoopoo for 3.05 miles to side road left, just past station KEEI NORTH BASE 1948. Turn left and go 0.65 mile to sand beach at end of Keeli village. Follow sandy road right, along beach, for 0.15 mile to end of beach. From here pack southwest across bedrock beach about 125 yards to station.

Station mark is a standard disk stamped PALEMANO RESET 1948, set in a concrete post in the center of a 3-foot-diameter, stone and concrete mound 16 inches high, on the north edge of a 2-foot ledge of soft lava rock.

Reference mark number one is a standard disk stamped "PALEMANO NO 1 1948", cemented in a drill hole in bedrock, 34.3 feet southwest of a large concrete pad (in which PALEMANO 2 is set), and is about 16 inches lower than station mark.

Reference mark number two is a standard disk stamped "PALEMANO NO 2 1948", cemented in a drill hole in flat lava area, 2-1/2 feet lower than station mark.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: PALEMANO
 ESTABLISHED BY: E.R. Hand YEAR: 1928 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: GEH YEAR: 1972 COUNTY: Hawaii

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 mark was recovered as described by R.C. Munson (1968) in fair condition. It appears that the mark has not deteriorated significantly since it was visited in 1968. Reference marks 1 and 2 were recovered as described in good condition.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191553 STATION 1082
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 30'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 Form 882
 Rev. Aug. 1968

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: PALEMANO 2 STATE: Hawaii COUNTY: Hawaii

CHIEF OF PARTY: R. C. Munson YEAR: 1968 Described by: R. F. Hanson

| NOTE | HEIGHT OF TELESCOPE ABOVE STATION MARK Surface-station mark, Underground-station mark | 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 feet meters | DIRECTION |
| | | 1.5 | | | | |
| | | | KEAWEKAHEKA (HGS) 1891 | NW | | 00 00 00.0 |
| | | | Napoopoo Light, 1928 | | | 14 34 21.3 |
| | | | Honaunau, St. Benedict Catholic Church, spire, 1948 | SE | | 160 56 51.8 |
| 12a | | | R.M. No. 1 | SSE | 22.453 6.844 | 199 27 48 |
| 12a | | | R.M. No. 2 (old PALEMANO RM 1) | SW | 34.316 10.459 | 269 42 42 |
| 12a | | | R.M. No. 3 (old PALEMANO RM 2) | ENE | 112.920 (34.418) | 326 49 04 |

Station was established to replace PALEMANO (HTS) 1928 which is being destroyed by wave action.
 Located about 3-1/2 miles west-northwest of the post office at Honaunau, 1 mile southwest of Napoopoo, 1400 feet southwest of Keel village and 700 feet west-northwest of Maluhia Boys' Camp, at Palemano Point, at the east, inshore, end of the large, flat, black rock area, near a higher stone bank and brush-line, at an old concrete pad that was once a foundation for a light mast.

To reach station from the post office at Honaunau, go south on State Highway 11 for 1.8 miles to junction with State Highway 16. Turn sharp

right and go downhill on State Highway 16 for 3.5 miles to the City of Refuge; continue north on the road to Napoopoo for 3.05 miles to side road left, just past station KEEI NORTH BASE 1948. Turn left and go 0.65 mile to sand beach at end of Keel village. Gollow sandy road right, along beach, for 0.15 mile to end of beach. Pack southwest along bedrock for about 100 yards to station.

Station mark is a standard disk stamped "PALEMANO 2 1968", cemented in a drill hole in the middle of an 11-foot-diameter, concrete pad flush with surrounding rock, and surrounded by a 2-foot-diameter ring of rusted bolts projecting 4 inches from the concrete. It is about 300 feet east from tip of point and 25 feet west of base of a long boulder bank that is 6 feet higher than station.

Reference mark number one is a standard disk stamped "PALEMANO 2 NO 1 1968", cemented in a drill hole in bedrock, 25 feet west of the boulder bank and about 6 inches higher than station mark.

Reference mark number two is the original PALEMANO (HTS) 1928 RM NO. 1. It is a standard disk stamped "PALEMANO NO 1 1948", cemented in a drill hole in flat lava bedrock at same elevation as station mark.

Reference mark number three is the original PALEMANO (HTS) 1928 RM NO 2. It is a standard disk stamped "PALEMANO NO 2 1948", cemented in a drill hole in flat lava bedrock at about same elevation as station mark.

NOTE: The arrows on RM 2 and 3 point toward the old station.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PALEMANO 2
 ESTABLISHED BY: R. C. Munson YEAR: 1968 STATE: Hawaii BENCH MARK(S) ALSO
 RECOVERED BY: GEH YEAR: 1972 COUNTY: Hawaii
 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 mark and Reference mark 1 were recovered as described by R. C. Munson in good condition. Reference marks 2 and 3 (old PALEMANO marks) were recovered as described in good condition.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PALEMANO 2
 STATE: HAWAII YEAR: 1968 SECOND ORDER

SOURCE G-12664

| | | | |
|--------------------|---------------|------------------|---------------|
| GEODETIC LATITUDE | 19 27 42.146 | ELEVATION SCALED | 2 METERS FEET |
| GEODETIC LONGITUDE | 155 55 48.273 | | |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|----------------|
| STATE & ZONE | CODE | X | Y | # OR Δ # ANGLE |
| HI I | 5101 | 351,848.67 | 228,472.02 | - 0 08 56 |

* 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 |
|----------------------|----------------------------------|-------------------------------|------|
| KEAWEKAHEKA | 141 56 32.2 | 142 05 08 | 5101 |

R

QF 030

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 151553 STATION 1083
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

Palianihi (Hawaii Island, Hawaiian Government Survey, 1884; E. R. Hand, 1913).—On west coast of Hawaii, South Kona District, at Hookena, about 8 feet back from edge of cliff. Station marked by a square drill hole in rock, surrounded by four crosses cut in rock equidistant from center. The following bearings are from the station: Extreme southeast corner of wharf, 140 meters, S. 36° W.; post office, 175 meters, S. 66° W.; steeple of Pukaana church, 410 meters, N. 69° W. Station is 383 feet south of tomb near government road.

RECOVERY NOTE, TRIANGULATION STATION

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 528

NAME OF STATION: **Palianihi** STATE: **Hawaii** COUNTY: **Hawaii**
 ESTABLISHED BY: **H.G.S.** YEAR: **1884** LOCALITY: **Hookena, S. Kona, Hawaii**
 RECOVERED BY: **Chas. I. Murray** YEAR: **1938**

Detailed statement as to the fitness of the original description:

Location of station: West coast of Hawaii, South Kona on top of and 8-feet away from the perpendicular bluff just back of Hookena village and on the lower side of the road leading down to Hookena.

Old mark found: Drill hole in middle of Δ cut in rock and 4 +s distant 1.2 feet, 0.82 feet, 2.10 feet and 2.67 feet from the station mark.

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).

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 528

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **PALIANIHI** STATE: **HAWAII**
 ESTABLISHED BY: **Haw. Govt. Survey** YEAR: **1884** COUNTY: **HAWAII**
 RECOVERED BY: **L.C. Wilder** YEAR: **1948**

Detailed statement as to the fitness of the original description:

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 "drill hole in middle of triangle and 4 crosses distant 1.2 feet, 0.82 feet, 2.10 feet and 2.67 feet from the station mark". The present pipe and target were installed over the old center 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.

H-2510-2

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **PALIANIHI**

STATE: **HAWAII**

YEAR: **1884**

THIRD

ORDER

SOURCE: **G-SP156**

| | | | | |
|---------------------|---------------|------------|----|--------|
| GEODETIC LATITUDE: | 19 23 00.215 | ELEVATION: | 43 | METERS |
| GEODETIC LONGITUDE: | 155 53 59.923 | SCALED | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|--------------------------------|
| STATE & ZONE | CODE | X | Y | β OR Δ OR ANGLE ° |
| HI 1 | 510i | 502,150.35 | 199,906.33 | - 0 07 58 |

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

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

QO 276

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 191553 STATION 1083
LATITUDE ° ' TO ° '
LONGITUDE ° ' TO ° '
DIAGRAM

PALIANIHI (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: PALIANIHI
ESTABLISHED BY: H.G.S. YEAR: 1884 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 was recovered in good condition. Located about 4-1/2 miles south-southwest of Honaunau, at the east edge of Hookena village, along west side of macadam road, on the edge of the curving cliff about 100 feet high overlooking the sand beach at Kauhako Bay at south side of Hookena village.

To reach station from the post office in Honaunau, go south on State Highway 11 for 3.9 miles to Hookena School; continue for 0.4 mile to fork and sign "HOOKENA". Take right fork and go downgrade for 2.0 miles to station on left, in trees.

Station is marked by a triangular, concrete platform 7 feet on each side, with a 3-1/2-inch hole through the center. A 1-7/8-inch iron shaft, 2 feet long, mounted on 3 iron legs, is centered over the hole, and a punch mark in the top is used for center. Station is 50 yards north-northwest of telephone pole No. 23, 100 yards northwest of telephone pole No. 22, 57 feet west of center of macadam road, and 200 yards southeast, upgrade, from a hairpin left turn.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: PALIANIHI
ESTABLISHED BY: H.G.S. YEAR: 1884 STATE: Hawaii BENCH MARK(S) ALSO
RECOVERED BY: GEN YEAR: 1972 COUNTY: Hawaii
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 mark was recovered as described by R.C.Munson (1968) in good condition.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 Old Hawaiian Datum

QUAD 191553 STATION 1084
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NOAA FORM 76-39
 12-70
 FORMERLY CGS FORM 5251

DESCRIPTION OF TRIANGULATION STATION

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

NAME OF STATION: PAM
 NEAREST TOWN: Kealia
 CHIEF OF PARTY: GEH
 STATE: Hawaii COUNTY: Hawaii
 QUADRANGLE NO.: 191553
 YEAR: 1972 DESCRIBED BY: RDB

| NOTE | HEIGHT OF TELESCOPE ABOVE STATION MARK SURFACE-STATION MARK, UNDERGROUND-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 | | | DIRECTION‡ | |
| | OBJECT | BEARING | DISTANCE | | | | |
| | | | FEET | METERS | | | |
| | HOOKENA 1972 | | | | 00 | 00 | 00.0 |
| | R.M. No. 2 | N | 14.64' | 4.460' | 32 | 16 | 33.4 |
| | R.M. No. 1 | ESE | 20.44' | 6.230' | 154 | 05 | 49.1 |

Detailed description:

Station is located in the Honokua lava flow of 1950, about 10 miles south of Kealahou Bay on the west side of the island of Hawaii.

To reach station, follow State Highway 11 south from the town of Kealia about 3.9 miles, or about 3.2 miles south of Hookena School. Go to the southern side of the Honokua lava flow of 1950 and turn right on an unpaved road which bends back north, parallel to and approximately 150 feet west of Route 11. Follow this road to about middle of lava flow. Station is located on western edge of unpaved road.

Station is a standard disk stamped "PAM 1972" and set in a large boulder.

Reference mark number 1 is a standard disk stamped "NO. 1" set on eastern edge of unpaved road.

Reference mark number 2 is a standard disk stamped "NO. 2" set in lava rock in the flow north of the station.

* 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.

ADJUSTED HORIZONTAL CONTROL DATA

ADJUSTMENT BY NGS

NAME OF STATION: PAM
 STATE: HAWAII
 YEAR: 1972
 OBS BY NGS
 SECOND ORDER

SOURCE: G-14950

| | | | |
|---------------------|-------------------|------------|--------------|
| GEODETIC LATITUDE: | 19° 20' 35.22934 | ELEVATION: | 333.7 METERS |
| GEODETIC LONGITUDE: | 155° 52' 33.17083 | | 1095 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|------------------|
| STATE & ZONE | CODE | X | Y | B OR Δ OR ANGLE* |
| HI 1 | 5101 | 370,423.77 | 185,261.76 | - 0 07 28 |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|----------------------------------|--------------------------------|------|
| HOOKENA | 147° 37' 30.2 | 147° 44' 58 | 5101 |

THESE DATA OBTAINED FROM ADJUSTMENT OF SEP 1979

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191553 STATION 1085
 HAWAII
 LATITUDE 19 ° 00' TO 19 ° 30'
 LONGITUDE 155 ° 30' TO 156 ° 00'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 Form 502
 Rev. Aug. 1968

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **PEAK 2 (HTS)** STATE: **HAWAII** COUNTY: **KAU DISTRICT HAWAII**

CHIEF OF PARTY: **L. G. WILDER** YEAR: **1949** Described by: **G. J. HOEPEL**
 HEIGHT OF TELESCOPE ABOVE STATION MARK **1.7** METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.

| 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 | DISTANCE | | DIRECTION: |
|-------|---|--|----------|--------|-----------------|
| | | | feet | meters | |
| | Surface-station mark, Underground-station mark | | | | |
| | | OBJECT | BEARING | | |
| | | KAMEHAME NEW 1939 | | | 00 00 00 |
| 12a | | R M 1 | N | 21.299 | 251 03 33 |
| 12a | | R M 2 | NE | 31.640 | 354 50 07 |
| | | Steeple, Punaluu | NE | | 351 55 43.8 |

The station is located about 2 miles west of Honuape, about 1.5 miles north northeast of Naalehu, about 0.1 mile south of a road forks, about 100 feet south of a good graded road and on side hill pasture land with higher ground to the north.

To reach from the post office in Naalehu; go north, on the good graded road which leads to the cane fields, for 2.1 miles to the station on the right hand side of the road.

The station is the center of a 2 1/2 inch iron pipe which projects about 2 feet from the top of a triangular slab of concrete which is about 1 foot on each side and projects 1 inch.

Reference mark number 1 is a standard disk, stamped PEAK 2 NO 1 1949, set into a drill hole in bedrock which is flush with the surface of the ground and is about 6 inches higher than the station.

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

This station was originally called PEAK 2 to distinguish it from another station called PEAK 1.

* Refer to notes in manuals of triangulation and state publications. (To nearest corner only, when the trigonometric leveling is being done.) Direction-angle measured clockwise, referred to initial station. 10-58252-1 U. S. GOVERNMENT PRINTING OFFICE

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **PEAK 2 HTS**

STATE: **HAWAII**

YEAR: **1949**

SECOND

ORDER

SOURCE: **G- 9279**

| | |
|--|--------------------------------|
| GEODETIC LATITUDE: 19 ° 05 ' 01.720 | ELEVATION: 399.3 METERS |
| GEODETIC LONGITUDE: 155 34 30.659 | 1310 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|-----------|---------------------------------|
| STATE & ZONE | CODE | X | Y | θ (OR Δ) ANGLE ° |
| HI 1 | 5101 | 474,041.85 | 90,961.46 | - 0 01 29 |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|-------------------------------|-----------------------------|------|
| KIPAEPAE | 356 48 11.2 | 356 49 40 | 5101 |

QE 156

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 Old Hawaiian Datum

QUAD 191553 STATION 1087
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

10AA FORM 76-39
 12-70
 FORMERLY CGS FORM 829

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

TRaverse STATION

DESCRIPTION OF STATION

NAME OF STATION: PUIWA
 NEAREST TOWN: HOOKENA
 CHIEF OF PARTY: GEH
 STATE: HAWAII
 COUNTY: HAWAII
 QUADRANGLE NO.: 191553
 YEAR: 1972
 DESCRIBED BY: SJH

| NOTE | HEIGHT OF TELESCOPE ABOVE STATION MARK 1.36 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 | | |
|------|--|--------------------------|--|--------|-----------|
| | SURFACE-STATION MARK | UNDERGROUND-STATION MARK | DISTANCE | | DIRECTION |
| | OBJECT | BEARING | FEET | METERS | |
| | WAIKAKUU 4, 1951 | SSE | | | 00 00 00 |
| | RM 1 | SE | 7.50 | 2.287 | 348 45 24 |
| | RM 2 | SW | 16.04 | 4.882 | 53 18 11 |

Detailed description:

The station is located 4.1 miles southwest of the post office at Honaunau, 3.3 miles south of the City of Refuge and 1.5 miles southeast of Hookena Village on a prominent bluff, on a flat lava mound, at the west end of a cliff and the brush line. To reach the station from the post office in Honaunau, go south on State Highway 11 for 3.9 miles to Hookena School, continue on the highway for 0.4 mile to a fork in the road and a sign saying Hookena. Take the right fork and go 1.6 miles to a sharp right turn in the road. From there pack 0.2 mile towards the ocean in a southwesterly direction until reaching the edge of a cliff. The station is midway between Lainamala Pt. and Kanekaukii Pt. and sees all of Kauhako Bay and Hookena's beach.

Station mark is a standard disk stamped PUIWA 1972, set in a drill hole in the top of a 5 foot diameter lava mound. It is 8 feet from the cliff's edge near the edge of the brush line and 150 feet above the ocean level.

Reference mark 1 is a standard disk, stamped NO. 1 1972, cemented in a drill hole in a lava mound about 16 feet from the cliff's edge.

Reference mark 2 is a standard disk, stamped NO. 2 1972, cemented in lava bed about 8 feet from the cliff's edge and about 4 feet lower than the station.

*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: 1971-760-081

ADJUSTED HORIZONTAL CONTROL DATA

ADJUSTMENT BY NGS

NAME OF STATION: PUIWA
 STATE: HAWAII
 YEAR: 1972
 OBS BY NGS
 SECOND ORDER

SOURCE: G-14950

| | | | |
|---------------------|------------------|------------|-------------|
| GEODETIC LATITUDE: | 19° 22' 40.67068 | ELEVATION: | 31.0 METERS |
| GEODETIC LONGITUDE: | 155 53 52.75145 | | 102 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|------------------|
| STATE & ZONE | CODE | X | Y | ϕ OR Δ OR ANGLE* |
| HI 1 | 5101 | 362,832.38 | 197,932.79 | 0° 07' 55" |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|----------------------------------|--------------------------------|------|
| WAIKAKUU 4 | 343° 55' 40.7 | 344° 03' 36" | 5101 |

THESE DATA OBTAINED FROM ADJUSTMENT OF SEP 1979

RL 179

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191553 STATION 1089
 LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

PUNALUU (continued)

FORM 526a
 (9-18-59)

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

R

RECOVERY NOTE, TRIANGULATION STATION

R

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

NAME OF STATION: PUNALUU
 ESTABLISHED BY: L.C. Wilder YEAR: 1949 STATE: Hawaii BENCH MARK ALSO
 RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii
 AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 5 miles SW 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 | | | | |
| PUU ULAULA (HTS) 1914 | -----1949 | DISTANCE and DIRECTION----- | | 00 00 00.0 |
| RM No. 1 | SE | 14.691 | 4.479 | 74 08 46 |
| HILL (PUEHU HTS) 1914 | SSW | 2804.9 | | 143 28 39.5 |
| RM No. 2 | W | 16.871 | 5.143 | 184 19 54 |
| PUU ULUULA (HTS) 1914 | -----1967 | DISTANCE and DIRECTION----- | | 00 00 00.0 |
| RM No. 1 | SE | 14.683 | 4.476 | 74 05 58 |
| HILL (PUEHU HTS) 1914 | SSW | | | 143 28 41.6 |
| RM No. 2 | SW | 16.880 | 5.146 | 184 20 02 |

| 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 | | | | |
| PUU ULAULA HTS 1914 | | | | 00 00 00.0 |
| RM 1 | SE | 14.69 | 4.480 | 74 07 20 |
| RM 2 | SW | 16.87 | 5.144 | 184 20 01 |
| RM 1 to RM 2 | | 25.94 | 7.908 | |

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

Station is located about 4 miles southwest of Pahala, 1 mile north of Punaluu, and 5 miles northeast of Honuapo, at about 383 feet elevation, on the high point of a small brushy ridge running up northwest from the highway. It is about 75 yards northwest of the highway and 40 feet higher, opposite a large parking area and a State Historical Marker on southeast

side of the highway. To reach station from the post office in Pahala, go south on Pikake St. 0.2 mile to crossroad. Turn right on State Highway 15 and go 0.85 mile to junction with State Highway 11. Turn right and go southwest on State Highway 11 for 3.7 miles to the wide parking area on left, and end of truck travel, 0.15 mile before reaching the Punaluu Road junction. Walk northwest up shallow gully about 75 yards to station.

Station mark is a standard disk stamped "PUNALUU 1949", cemented in a drill hole in a rock flush with ground. There is a large cairn built over station mark, with a long, black and white, 2-1/2-inch-square, target pole in the center.

Reference mark number one is a standard disk stamped "PUNALUU NO 1 1949", cemented in a drill hole in a bedrock ledge on top of ridge line, 10 inches higher than station mark.

Reference mark number two is a standard disk stamped "PUNALUU NO 2 1949", cemented in a drill hole in a bedrock knob outcrop at southwest edge of ridge, where it drops steeply for 8 feet into a gully. It is about 2 feet lower than station mark.

The station mark and reference marks 1 & 2 were recovered in good condition. The direction and distances measured on this date compared favorably with the 1949 & 1967 measurements. The 1967 recovery note is adequate with the addition of the following new to reach description:

To reach the station from the intersection of Pikake and Kamani Streets, just north of 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, 4.3 miles to a parking area on the left. Pack northwest up a shallow gully about 75 yards to the top of a hill and the station site.

*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.

USCGM-DC 27179-P88

*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)

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191555 STATION 1090
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

Puu Ahinui (Hawaii Island, Hawaiian Government Survey, 1890).—In the southern part of Hawaii, in South Kona, on the land of Kaapuna, on Puu Ahinui, in an open space or "kipuka" in the forest, about 7,300 meters from the sea, and about 400 meters south of trail through ohia forest. Marked by a large triangle cut in solid rock, and by a large stone cairn.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 536
RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **PUU AHINUI**
 ESTABLISHED BY: Hawaiian Govt. YEAR: 1890 STATE: HAWAII
 RECOVERED BY: L. C. Wilder YEAR: 1948 COUNTY: HAWAII

Detailed statement as to the fitness of the original description:
 The original station was recovered in good condition. A new description follows—

The station is located on the summit of a low lava knoll which projects about 15 feet above the scrub trees and lies about 7.5 miles north-east of Milolii, about 5 miles east of the sea, about 4.5 miles south south-east of the Kaohae Ranch, about 2 miles northwest of the old Koa Mill, about 0.4 mile south of the 1919 lava flow and about 200 yards south of an old trail which runs between the sea and the Kaapuna Ranch.

To reach from the post office at Honaunau; go south on the road which leads toward Waiohinu for 15.8 miles to the Alika Lava Flow of 1919; continue south for 0.3 mile; turn left, onto an oiled road, and go easterly, up the steep grade for 1.2 miles to the site of an Ohia Mill; turn left and follow the oiled road easterly for 3.45 miles to the site of an old Koa Mill; pass to the eastward of the mill and follow a graded road northerly, across the Aliko Lava Flow, for about 0.4 mile; take the left hand fork and follow the dim track road northerly for about 0.5 mile to an east-west rock wall and the end of truck travel. From this point pack westerly, down grade, keeping to the north side of the rock wall for about 0.5 mile to an old pole corral; here, leave the timber and head southwest for about 0.3 mile to the station.

The station is a 2 inch drill hole surrounded by a triangle carved into the rock.

Reference mark number 1 is a standard disk, unstamped, set into drill hole in a boulder which projects 3 feet and is about 4 feet higher than the station.

| Object | Distance | Direction |
|--------------------------|------------------|------------|
| PUU NAHAHA 2 | | 00 00 00 |
| R. M. 1 E | 1.570 m 5.150 ft | 237 12 * |
| KAPUKAWAA (metal target) | | 19 35 48.4 |

* too close to focus

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

NAME OF STATION: **PUU AHINUI**
 ESTABLISHED BY: Haw. Govt. YEAR: 1890 STATE: Hawaii
 RECOVERED BY: U.S.G.S. YEAR: 1958 COUNTY: Hawaii

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

Station recovered.

To reach from the post office at Honaunau; go south on the road which leads toward Waiohinu for 15.8 miles to the Aliko lava flow of 1919; continue south for 0.3 mile; turn left onto an oiled road and go easterly for 1.2 miles to the site of an old Ohia mill; turn left and follow oiled road easterly for 3.45 miles to the site of an old Koa mill; pass to the eastward of the mill and follow graded road northerly across Aliko lava flow for 2.8 miles to an old corral; take road fork to left on graded road westerly down lava flow for 1.9 miles to a large wooded corral and end of truck travel. From this point pack southerly for about 0.3 mile thru dense brush to the west side of a small densely brushed knoll and station.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **PUU AHINUI**
 STATE: **HAWAII** YEAR: **1890** SECOND ORDER

SOURCE G- 9275

| | | | |
|--------------------|---------------|-----------|---------------|
| GEODETIC LATITUDE | 19 15 04.421 | ELEVATION | 1209.6 METERS |
| GEODETIC LONGITUDE | 155 50 02.875 | | 3908 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|--------------------|
| STATE & ZONE | CODE | X | Y | 8 FIG Δ 41 ANGLE * |
| HI 1 | 5101 | 364,751.10 | 151,862.13 | - 0 36 37 " |

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE 8 FIG Δ 41 FORMULA NEGLECTING THE SECOND TERM.

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|----------------------------------|--------------------------------|------|
| PUU NAHAHA 2 | 30 15 26.9 | 30 22 04 " | 5101 |

QE 071

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 191553 STATION 1090

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

PUU AHINUI (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION PUU AHINUI
ESTABLISHED BY HGS YEAR: 1890 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 and reference mark were recovered in good condition and the distance to the RM was checked. The old trail mentioned in 1948 is gone. The trees and brush in the area are growing and the station knoll no longer projects above the brush, but is camouflaged by it and is difficult to locate.

Station is located about 6-1/2 miles northeast of Milolii, 5 miles southwest of Kaohē Ranch, 2000 feet south of a track road and 2100 feet south-southwest of a corral where a wire fence leads off to east-southeast and a cleared strip runs due east up through large trees. It is at 3968 feet elevation, in a rough lava area that is covered with small ohia trees, brush, and uluhe fern, and is about 200 yards northwest of a prominent clump of very tall trees.

To reach station from the post office at Honaunau, go southerly on State Highway 11 for 13.2 miles to a board gate on left by corral, just south of a quarry at the south edge of the 1950 Kapuna lava flow. Pass through gate and go upgrade on track road for 2.3 miles to a crossroad at 3200 feet elevation. Continue on road, along a finger of the lava flow, for 0.9 mile to a board gate at 3820 feet elevation. Pass through gate and continue for 0.35 mile to corral and end of truck travel at 3980 feet elevation. Pack south-southwest at about same elevation, through very dense brush and fern, for about 2100 feet to station. NOTE: An altimeter is of great help because the brush obstructs the view most of the way.

Station is marked by a 2-inch drill hole in flat bedrock, on west point of the broken-up lava knoll, at west side of a 4-foot-high rock that is the highest point of the knoll. A small cairn with a 3 x 3-inch target is centered over station.

Reference mark number one is a standard disk, unstamped, cemented in a drill hole in the top of the 4-foot-high rock. It is 1.570 m (5.150 ft) from station, in azimuth 267° 27' 27". NOTE: The disk was under a 6-inch layer of moss.

NOTE: At the board gate at 3820 feet elevation a timbered hill may be seen a few hundred yards to south-southeast, and about the same distance beyond it, over its right end, may be seen another timbered hill, which is the station hill.

A 4-wheel-drive vehicle is required after leaving State Highway 11.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191553 STATION 1091
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

Puu Enuhe (Hawaii Island, Hawaiian Government Survey, 1894; E. R. Hand, 1914).—In the southern part of Hawaii, in southern Ka-u, on the summit of Puu Enuhe, a hill northwest of Punaluu Landing. Station is not on highest point of hill, but about 10 feet below it and 114 meters N. 60° E. from a small bushy tree which is almost at the highest part. This hill is roughly a truncated pyramid, its flat top sloping toward the sea, and the position of the station may be approximated, from a distance, as follows: As seen from Punaluu its position is one-fourth the distance along its flat top from its west end. From Honuapo the small lone tree on its summit resembles a cairn, and the station appears about 100 meters east from it along the skyline. Palaha Mill stack is seen over the edge of the hill, across a gully, above the ground, and to the left of the summit, on a bearing N. 57° E. Punaluu warehouse bears S. 50° E. Marked by a standard bronze disk station mark set in center of original mark, a triangle cut in a long stone set in the ground, surrounded by three similar unmarked stones for instrument tripod supports. Spot is further marked by a pile of decayed tree fern logs.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 538

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **Puu Enuhe** STATE: **Hawaii** COUNTY: **Hawaii**
 ESTABLISHED BY: **H.G.S.** YEAR: **1894** LOCALITY: **Kau, Hawaii**
 RECOVERED BY: **PHAS.L. Murray** YEAR: **1938**

Detailed statement as to the fitness of the original description:

Location of station: On a flat-topped, triangular hill, the top of which slopes toward the sea. This hill is located about 2 1/2 miles above Punaluu. It is best reached by taking the plantation road at the Plantation stablew, in Pahala. The station is located near the upper end of the flat top and is difficult to reach due to the heavy growth of fern and brush. Old station mark: U.S.G.S. bronze tablet in buried rock which is buried in a small mound of dirt formed from decomposed fern stumps. New station mark: Two U-shaped steel brackets, bolted together to form a four-legged stand, driven in the ground over the bronze tablet. A 20-foot 1 1/2" pipe with metal target set over the bolt uniting the two brackets and guyed with heavy galvanized wire to three steel plates and eye-bolt anchors form the signal.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **PUU ENUHE** STATE: **Hawaii** COUNTY: **Hawaii**
 ESTABLISHED BY: **HGS** YEAR: **1894** BENCH MARK(S) ALSO
 RECOVERED BY: **D.M. Whipp** YEAR: **1967** LOCALITY: **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, although the wide target constructed by the Hawaii Territorial Survey is now rusted and fallen over. A complete description follows:

Station is located about 4 miles southwest of Pahala and 8-1/2 miles north-northeast of Naalehu, at 2336 feet elevation, on a prominent, timbered, steep-sided hill, or butte, that sets in the canefields, and has a rather flat top which slopes towards the sea.

To reach station from the post office in Pahala, go southwest on Pikake St. for 0.15 mile to crossroad. Turn right on Huapala St. and go 0.5 mile to crossroad. Keep ahead and go upgrade for 0.35 miles; take left fork and follow wide macadam cane road for 2.6 miles to fork just past old houses. Take left fork and go 0.6 mile to crossroad. Keep ahead on main road for 0.75 mile to crossroad; turn right and go 0.6 mile; take side road right and go 0.05 mile to T-junction. Turn left and go downgrade for 0.2 mile to crossroad. Turn right, along drainage, and go 0.05 mile to end of truck travel at dim crossroad. Walk right, west, on trail between base of hill and canefield for about 350 yards to point about below station, then climb

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **PUU ENUHE**

STATE: **HAWAII**

YEAR: **1894**

THIRD

ORDER

SOURCE: **G-92184**

| | | | | |
|--------------------|---------------|-----------|-----|--------|
| GEODETIC LATITUDE | 19 10 45.510 | ELEVATION | 711 | METERS |
| GEODETIC LONGITUDE | 155 32 21.988 | SCALED | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|--------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ ANGLE |
| HI 1 | 5101 | 486,390.15 | 125,635.95 | - 0 00 47 |

* 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 |
|----------------------|----------------------------------|--------------------------------|------|
| | | | |

QF 084

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

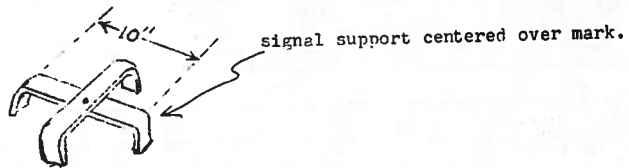
HORIZONTAL CONTROL DATA

by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 191553 STATION 1091
LATITUDE ° ' TO ° '
LONGITUDE ° ' TO ° '
DIAGRAM

PUU ENUHE (continued)

up very steep and slippery hillside about 150 yards to station.
Station mark is a standard disk, unstamped, cemented in a drill hole
in a flat boulder flush with ground. It is located in an open area, on
a slightly rounded point covered with grass and ferns, about 100 yards
east from highest point of hill, 45 feet south of a 10-inch ohia tree
with a triangular blaze and 40 feet southwest of another similar tree with
a triangular blaze. An old target support, made of 2 strap-irons 2 inches
wide and 10 inches long, crossed and bolted in the middle, and projecting
3 inches above ground, is centered over the mark.
NOTE: All lines are now obstructed by trees.



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 151553 STATION 1092
 HAWAII
 LATITUDE 19 ° 00' TO 19 ° 30'
 LONGITUDE 155 ° 30' TO 156 ° 00'
 DIAGRAM NE S-1.5 HAWAII

Puu Hoomaha (Hawaii Island, Hawaiian Government Survey, 1890).—In southern Hawaii, South Kona, land of Kipahoeheo, on the summit of Puu Hoomaha, just above the forest belt, on an old "pahoehoe" flow, and 250 feet north of an "aa" flow. Marked by a large triangle cut in the solid rock.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PUU HOOMAHA

STATE: HAWAII

YEAR: 1850

THIRD

—ORDER

SOURCE: G-SP156

| | | | | |
|---------------------|-------------------|------------|------|--------|
| GEODETIC LATITUDE: | 19 ° 14' 28.755" | ELEVATION: | 2025 | METERS |
| GEODETIC LONGITUDE: | 155 ° 45' 53.379" | SCALED | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|------------------------------|
| STATE & ZONE | CODE | X | Y | ρ OR Δ OR ANGLE* |
| HI 1 | 5101 | 408,650.63 | 148,223.18 | - 0 05 14" |

* 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 |
|----------------------|----------------------------------|--------------------------------|------|
| | | | |

QQ 218

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 151553 STATION 1093
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1,5 HAWAII

PUU KI (HGS)

(Hawaii Island, Hawaiian Government Survey; E. R. Hand, 1914).—On the southwest coast of Hawaii, 8½ miles west-northwest from Ka lae, the south point of the island, in the land of Kahuku, about ¼ mile south of Pohue coconut grove, on the highest point (southeast rim) of the extinct volcano called Puu Ki, the highest hill in the vicinity. Marked by a triangle cut in a rock set even with the surface of the ground in gravel. A small cairn is over the station.

RECOVERY NOTE, TRIANGULATION STATION

R

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 586

NAME OF STATION: **PUU KI (HGS)**
 ESTABLISHED BY: **E. R. Hand** YEAR: **1914** STATE: **Hawaii**
 RECOVERED BY: **L. G. Wilder** YEAR: **1949** COUNTY: **HAWAII**

Detailed statement as to the fitness of the original description:

The station was recovered, as described, and in good condition. A new description follows—

The station is located on the highest point (southeast rim) of an extinct volcanic cone which lies about 10 miles northwest of Kalae (South Point), about 5.5 miles southwest of the road which runs between Naalehu and Captain Cook, about 0.5 mile south of the Pohue Coconut Grove and on the highest point in the immediate vicinity.

To reach from the school house and church in the village of Waiohinu; go west and north, on the road which leads toward Captain Cook, for 11.2 miles to several covered tanks; turn left, pass through a board gate (key for gate may be obtained at the Kahuku Ranch) and follow a cinder road, westerly, for 5.2 miles to the ocean and the end of truck travel. From this point pack southerly for about 0.5 mile to the summit of the low cone and the station.

The station is the center of a 1 inch drill hole, surrounded by a carved triangle, in a flat rock which is flush with the surface of the ground. A rock cairn has been built over the station.

| Object | Direction | Distance |
|-----------------------------|-----------|-------------|
| NA PUU A PELE | NW | 00 00 00 |
| PUU O KAMAQA (metal target) | NNE | 92 22 51.1 |
| UMI'S AHU (metal target) | SE | 178 26 19.3 |

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **PUU KI HGS**

STATE: **HAWAII**

YEAR: **1914**

SECOND

ORDER

SOURCE: **G- 9279**

| | |
|--|-------------------------------|
| GEODETIC LATITUDE: 19 00 28.241 | ELEVATION: 44.1 METERS |
| GEODETIC LONGITUDE: 155 47 44.432 | 145 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|-----------|-------------------------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ OR ANGLE |
| HI 1 | 5101 | 597,866.52 | 63,455.82 | - 0° 05' 47" |

* 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 |
|----------------------|----------------------------------|--------------------------------|------|
| NA PUU A PELE | 111 13 05.3 | 111 18 52 | 5101 |

QE 083

(continued on next page)

HORIZONTAL CONTROL DATA

by the
 NATIONAL GEODETIC SURVEY
 OLD HAWAIIAN DATUM

QUAD 191553 STATION 1093
 LATITUDE ° ' TO ° '
 LONGITUDE ° ' TO ° '
 DIAGRAM

PUU KI (HGS)(continued)

FORM 526a
 (6-18-65)

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

R

NAME OF STATION: PUU KI (HGS)
 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 1.61 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 | |
| NA PUU A PELE (HGS) 1891 RM No. 2 | N | 20.686 | 6.305 | 00 00 00.0 66 44 11 |
| PUU O KAMAOKA (HTS) 1948 RM No. 1 | NNE SE | 34.751 | 10.593 | 92 22 51.2 216 51 45 |

Station was recovered as described. It was re-marked with a standard station disk and two reference marks were established. A complete description follows:

Station is located about 14 miles west-southwest of Naalehu and 10 miles northwest of the southernmost point of the island; on the summit of Puu Ki, a prominent, bare hill of 145 feet elevation that lies about 1/2 mile southeast of Pohue Bay and 300 feet northeast of Keliuli Bay.

To reach station from the post office in Naalehu, go west on State Highway 11 for 7.7 miles to Kahuku Ranch road on left. Continue west on the highway for 5.3 miles to locked board gate on left, between power poles

396 and 397. (Key for gate was obtained at the Kahuku Ranch). Pass through gate and go southerly on track road for 5.6 miles to fork. Take left fork and follow dim road 0.7 mile to top of hill and station. NOTE: A 4-wheel drive vehicle is required.

Station mark is a standard disk stamped "PUU KI HGS 1914 1967", cemented in the original station drill hole in middle of an 8-inch, chiseled triangle in the top of a flat rock flush with ground. It is 30 feet north-west of a large and prominent hydro-signal. A large cairn, with target pole in center, is built over the station mark.

Reference mark number one is a standard disk stamped "PUU KI HGS 1914 NO 1 1967", cemented in a drill hole in a square bedrock outcrop 12 x 20 inches, and projecting 8 inches above ground. It is 4.1 feet lower than station mark.

Reference mark number two is a standard disk stamped "PUU KI HGS 1914 NO 2 1967", cemented in a drill hole in a rough lava bedrock outcrop 4 feet in diameter and projecting 1 foot above ground. It is 4.2 feet lower than station mark.

U.S. DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 FORM 9-1185
 (Rev. 12-74)

REPORT ON PERMANENT SURVEY MARK

AREA OFFICE

STATE Hawaii COUNTY Hawaii QUADRANGLE 5
 QUOTE PRIMARY REFERENCE In southern part of Hawaii in Southern Kau on the south
crater rim of Akihi Hill. (Direction and distance)

DESIGNATION LISTED PUU KI (HGS)
 STAMPED TYPE OF MARK: BM TT TRIANG. X

| | | |
|--|------------------------------------|--|
| Lat. <u>19</u> ° <u>00</u> ' <u>28.241</u> " | CONDITION | ESTABLISHED BY |
| Long. <u>155</u> ° <u>47</u> ' <u>44.432</u> " | Disturbed <input type="checkbox"/> | USGS <input type="checkbox"/> USBR <input type="checkbox"/> |
| Elev. <u>145</u> feet | Destroyed <input type="checkbox"/> | USCAGS <input checked="" type="checkbox"/> State GS <input type="checkbox"/> |
| | Not Found <input type="checkbox"/> | USNPS <input type="checkbox"/> USNFS <input type="checkbox"/> |
| | | USGLO <input type="checkbox"/> (Other) <input type="checkbox"/> |
| | | USBLM <input type="checkbox"/> |

New marks in duplicate.

REMARKS OR REVISED DESCRIPTION:
 To reach from the P.O. in Naalehu, go W. on Hwy. 11 for 7.7 mi to Kahuku Ranch on left. New: Continue W. on the Hwy. for 4.9 mi to Kohala Blvd., turn left and go 0.25 mi on Kohala Blvd. to Maile Drive, turn right and go 0.7 mi on Maile to Maikai Blvd., turn left and go 3.4 mi on Blvd. to locked gate (key may be obtained at the Kahuku Ranch), continue on rd. for 2.2 mi to the ocean, turn left and go S. along the coast for 1.5 mi to top of hill and station. Station mk. and Rm. No 1 and No 2 were recovered in good condition.

SUBMITTED BY Yukio Yamamoto
 TITLE Cartographer DATE 1/26/78
 AGENCY USGS

Marks found in good condition need not be reported.

FILL IN ALL AVAILABLE INFORMATION

gpo 16-64222-0

*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.

USCOM-DC 27173-P28

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191553 STATION 1094
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1,5 HAWAII

NO ORIGINAL TEXT

Puu Nahaha (Hawaii Island, Hawaiian Government Survey, 1884; E. R. Hand, 1914).—Near southwest coast of Hawaii, in South Kona, Land of Okoe, east of Hanamalo Point, almost 1½ miles east by north from Okoe Bay, and just to the right of a line from the shed at the bay to the huge barn (station *Barn*) showing conspicuously about 3 miles inside on the same bearing, on a prominent bare rocky shoulder which commands a view in every direction. Marked by a square headed iron bolt let into the rock inside a triangle cut in the rock. Four crosses each 0.46 meter (1.5 feet) from the center were cut in the rock. A huge cairn was erected over the station and painted white.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 528

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **PUU NAHAHA**
 ESTABLISHED BY: **Haw. Govt. Survey** YEAR: **1884** STATE: **HAWAII**
 RECOVERED BY: **L. G. Wilder** YEAR: **1948** COUNTY: **HAWAII**

Detailed statement as to the fitness of the original description:

The original mark, an iron bolt, was recovered in good condition. A standard disk could not be installed vertically above the bolt so it was stamped Puu Nahaha Reset 1948 and set 0.0525 meters from the bolt.

* 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.

M-2518-2

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **PUU NAHAHA**

STATE: **HAWAII**

YEAR: **1884**

SECOND ORDER

SOURCE: **G- 9275**

NO OBSERVATION CHECK ON THIS POSITION

| | | | |
|---------------------|---------------|------------|--------------|
| GEODETIC LATITUDE: | 19 09 25.810 | ELEVATION: | 234.0 METERS |
| GEODETIC LONGITUDE: | 155 53 28.255 | | 768 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|---------------------------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ OR ANGLE * |
| HI 1 | 5101 | 364,997.85 | 118,149.67 | - 0 07 42 " |

* 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 |
|----------------------|----------------------------------|---------------------------------|------|
| | | | |

POSITION DETERMINED BY TRAVERSE FROM STATION PUU NAHAHA 2

QE 261

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191553 STATION 1095
 HAWAII
 LATITUDE 19 °00' TO 19 °30'
 LONGITUDE 155 °30' TO 156 °00'
 DIAGRAM NE 5-15 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 509

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: PUU NAHAHA 2

ESTABLISHED BY:

L. G. Wilder YEAR: 1948

STATE:

COUNTY: HAWAII

HAWAII

Detailed statement as to the fitness of the original description: The station and marks were recovered in good condition. A standard disk station mark was set 0.0525 meters from the old iron bolt and two reference marks were established. A new description follows--

The station is located on the summit of a low lava butte about 3 miles southeast of Milolii, about 3 miles northeast of Kanewaa Point, about 2 miles east of Hanamalo Point, about 2 miles west of the road which runs between Kealakekua and Waiohinu, about 150 yards north of a rock wall which marks the boundary between the Okoa and Kapua tracts and about 100 yards south of a trail which leads to Okoe Bay.

To reach from the post office at Honaunau; go south, on the road which leads toward Waiohinu, for 15.8 miles; cross over the Alike Lava Flow and continue south for 1.55 miles to the junction of the road which leads to Milolii; continue south, toward Waiohinu for 3.45 miles; turn right, onto a dirt road, and go westerly for 0.1 mile; pass through a pole gate and continue westward for 0.2 mile; pass through a pole gate, enter barn yard, turn right and go across country for 0.05 mile; pass through a gate, turn left and follow rock lane, westward, for 0.15 mile; pass through five gates in a stone corral and continue westerly for 0.05 mile; pass through a gate in a fence corner and continue westerly for 0.5 mile to three gates in a fence intersection and the end of truck travel. From this point pack westerly along the trail for about 0.2 mile; cross over two wire fences and follow the trail westerly for about 0.5 mile. From this point leave the trail and head for the low butte which lies about 100 yards south of the trail.

The station is a standard disk, stamped PUU NAHAHA RESET 1948, set into a drill hole in solid rock.

Reference mark number 1 is a standard disk, stamped PUU NAHAHA 1948, set into a drill hole in bedrock which is flush with the surrounding rock. It is located on a rock ledge about 1 foot lower than the station.

Reference mark number 2 is a standard disk, stamped PUU NAHAHA 1948, set into a drill hole in a boulder which projects about 1 foot. It is located 6 feet south of a rock ledge and is about the same elevation as the station.

| Object | Distance | Direction |
|--------------------------|-------------------|-------------|
| HANAKEAUMOE | | 00 00 00 |
| PUU NAHAHA | 0.0525 meter | 123 30 |
| R. M. 1 NE | 3.805 m 12.482 ft | 207 31 45 |
| R. M. 2 SE | 3.160 m 10.364 ft | 289 22 36 |
| KAPUKAWAA (metal target) | | 132 20 14.8 |

R

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PUU NAHAHA 2

STATE: HAWAII

YEAR: 1948

SECOND

ORDER

SOURCE: G- 9279

| | | | |
|--------------------|---------------|-----------|--------------|
| GEODETIC LATITUDE | 19 09 29.805 | ELEVATION | 234.2 METERS |
| GEODETIC LONGITUDE | 155 53 28.254 | | 768 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-------------------|
| STATE & ZONE | CODE | X | Y | B OR Δ OR ANGLE * |
| HI 1 | 5101 | 364,997.98 | 118,149.57 | - 0 07 42 * |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From 1000 ft) | PLANE AZIMUTH * (From 1000 ft) | CODE |
|----------------------|------------------------------------|-----------------------------------|------|
| HANAKEAUMOE | 18 25 36.5 | 18 33 18 | 5101 |

QE 075

(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 191553

STATION 1095

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

PUU NAHAHA 2 (continued)

FORM 524a
(9-18-66)

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

R

NAME OF STATION: PUU NAHAHA 2
ESTABLISHED BY: L.C. Wilder YEAR: 1948 STATE: Hawaii
RECOVERED BY: R.C. Munson YEAR: 1968 COUNTY: Hawaii
Island: Hawaii

| OBJECT | BEARING | DISTANCE | | DIRECTION |
|---------------------------------|----------|-------------------|--------|-------------|
| | | FEET | METERS | |
| HANAKEAUMOE -----1948 | DISTANCE | and DIRECTION---- | | 00 00 00.0 |
| R.M. No. 1 | NE | 12.482 | 3.805 | 207 31 45 |
| R.M. No. 2 | SE | 10.364 | 3.160 | 289 22 36 |
| HANAKEAUMOE (HGS) 1890 ----1968 | DISTANCE | and DIRECTION---- | | 00 00 00.0 |
| KAPUKAWAA (HGS) 1884 | NE | 12.490 | 3.808 | 132 20 18.6 |
| R.M. No. 1 | SE | 10.380 | 3.165 | 207 35 57 |
| R.M. No. 2 | | | | 289 20 31 |

Station was recovered and all marks found in good condition, including the original iron bolt, which can be seen just under the edge of the 1948 disk. A complete description follows:

Station is located about 2-1/2 miles southeast of Milolii and 1-1/2 miles west-southwest of the Honomalino Agriculture Co. Office, at about 768 feet elevation, on the summit of a low, broken-up, lava butte, or ridge about 150 yards long, and 150 yards north of a stone wall.

To reach station from the Honomalino Agriculture Co. Office, which is about 19.7 miles south on State Highway from the post office at Honaunau, go south on old macadam road for 0.2 mile to start of macadamia orchards on both sides of road; continue on the road for 0.1 mile; turn right on dirt track road and go down through orchard and then through pasture, for 1.2 miles to locked metal gate. (Key was obtained at the Honomalino Office). Pass through gate and continue for 0.4 mile to T-junction. Turn right and go 0.05 mile to wire corral; go into corral about 75 feet, then go left, through metal gate, and follow track road down grade for 0.3 mile to end of truck travel where road makes a 90° left turn at 800 feet elevation. Pack northwest across rough lava and pasture area about 600 yards to station. Station mark is a standard disk stamped "PUU NAHAHA RESET 1948", cemented in a drill hole in bedrock flush with ground. It is on a 25-foot diameter, flat-topped, rocky point that rises about 25 feet above the surrounding area. Reference mark number one is a standard disk stamped "PUU NAHAHA 1948", cemented in a drill hole in flat bedrock about 20 inches southwest from edge of cliff, and at same elevation as station mark. Reference mark number two is a standard disk stamped "PUU NAHAHA 1948", cemented in a drill hole in a 16-inch bedrock outcrop that projects 8 inches above ground, and is 0.1 foot higher 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.

USCGM-DC 27178-P88

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 HAWAIIAN DATUM

191553 STATION 1096
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-15 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 833
 Rev. Aug. 1963

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: PUU O KAMAOA (HTS) STATE: HAWAII COUNTY: HAWAII KAU DISTRICT

| | | | |
|------------------------------|--|--|-------------|
| CHIEF OF PARTY: L. C. WILDER | YEAR: 1948 | Described by: G. J. HOEPEL | |
| NOTE: | HEIGHT OF TELESCOPE ABOVE STATION MARK 1.2 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 |
| | KAHUHU SE BASE | ESE | 00 00 00 |
| | UNIT'S AHU (metal target) | SE | 38 07 53.2 |

The station is located about 13 miles southeast of Milolii, about 10 miles west of Waiohinu, about 1 mile west of the lava flow of 1907, about 200 yards east of a shed, 41.4 feet southwest of the center of a road, 30 feet south of telephone pole number 230 and 18 feet southwest of a rock wall.

To reach from the school house in Waiohinu; go northerly on the road which leads toward Captain Cook, for 11.0 miles to the station on the left hand side of the road.

The station is the center of a 2 1/2 inch iron pipe which projects 0.7 meter from the top of a triangular slab of concrete which is about 7 feet on each side and projects about 6 inches above the surrounding rock.

The Hawaii Territory Survey reports the present station, 2 1/2 inch pipe, centered over a rusted iron bolt driven into solid pahoehoe. Station Kahuku SE Base is suitably located for an azimuth.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PUU O KAMAOA (HTS)
 ESTABLISHED BY: L.C. Wilder YEAR: 1948 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 11-1/2 miles west of Naalehu, along the southwest side of State Highway 11, 0.1 mile northwest of the intersection of King Kamehameha Blvd., at about 2005 feet elevation, on an open knoll in pasture land, at top of highway grade.

To reach station from the post office in Naalehu, go west on State Highway 11 for 5.7 miles to the South Point Road. Continue ahead on the highway for 6.6 miles to King Kamehameha Blvd. on right. Continue ahead on highway, upgrade, for 0.1 mile to top of hill and station on left.

Station is the center of a 2-1/2-inch, iron pipe about 2 feet long, mounted vertically on 3 iron legs at the center of a triangular, concrete platform about 7 feet on each side. It is 25 feet southwest of telephone pole 230, 18 feet southwest of stone fence, and 40 feet southwest of the center line of State Highway 11. The words "PUU O KAMAOA" are inscribed in the concrete platform.

FORM CG65-526 (1-63)
 USCGMWDG 18000-703

U.S. DEPARTMENT OF COMMERCE
 COAST AND GEODETIC SURVEY

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PUU O KAMAOA HTS
 STATE: HAWAII YEAR: 1948 SECOND ORDER
 SOURCE: G- 9275

| | |
|-----------------------------------|-------------------------|
| GEODETIC LATITUDE: 19 04 54.833 | ELEVATION: 611.9 METERS |
| GEODETIC LONGITUDE: 155 45 41.936 | 2008 FEET |

| STATE COORDINATES (feet) | | | | |
|--------------------------|------|------------|-----------|----------------|
| STATE & ZONE | CODE | X | Y | PHOR Δ ANGLE * |
| HI 1 | 5101 | 409,660.10 | 90,328.63 | - 0 05 08 |

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE PHOR Δ R FORMULA NEGLECTING THE SECOND TERM

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH * (From south) | CODE |
|----------------------|----------------------------------|---------------------------------|------|
| KAHUHU SE BASE | 289 58 19.5 | 290 03 28 | 5101 |

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

0 191553 STATION 1097
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1,5 HAWAII

Puu o Keokeo (Hawaii Island, Hawaiian Government Survey).—In southern part of Hawaii, in extreme western part of Ka-u District, on Mount Keokeo, on the highest point on the east corner of the mountain, composed of light pumice stone. Marked by a tin can placed underground, and over it a hard stone with a triangle cut in it, and around it three similar stones set as supports for the tripod feet.

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION PUU O KEOKEO
 STATE HAWAII YEAR 1890 THIRD ORDER

SOURCE G-SP156

| | | | | |
|---------------------|----------------|------------|------|--------|
| GEODETIC LATITUDE: | 19° 13' 01.223 | ELEVATION: | 2096 | METERS |
| GEODETIC LONGITUDE: | 155 44 40.315 | SCALED | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|---------------------------------------|
| STATE & ZONE | CODE | X | Y | β HOR Δ θ ANGLE * |
| HI 1 | 5101 | 415,638.99 | 139,383.30 | - 0 04 50 |

* 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 |
|----------------------|----------------------------------|---------------------------------|------|
| | | | |

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 191553 STATION 1099
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NO TEXT

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: S MOWAE
 STATE: HAWAII YEAR: 1913 THIRD ORDER

SOURCE: G-SP156

| | | | |
|---------------------|----------------|------------|--------|
| GEODETIC LATITUDE: | 19° 09' 47.728 | ELEVATION: | METERS |
| GEODETIC LONGITUDE: | 155 52 17.509 | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|--------------------------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ OR ANGLE* |
| HI 1 | 5101 | 371,783.87 | 119,942.31 | - 0° 07' 15" |

* 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 |
|----------------------|----------------------------------|--------------------------------|------|
| | | | |

QO 282

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

191553 STATION 1100
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1,5 HAWAII

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: Stein 2 (HTS) STATE: Hawaii COUNTY: Hawaii
 ESTABLISHED BY: Chas. L. Murray YEAR: 1938 LOCALITY: Naalehu, Kau, Hawaii

Detailed statement as to the fitness of the original description:

Location of station: On a rise of land about 1000 feet back of Naalehu school.

Old mark found: Δ on set stone and stonepile.

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).

RECOVERY OF TRIANGULATION STATION

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 855
 Rev. Aug. 1968

NAME OF STATION: STEIN 2 (HTS) STATE: HAWAII COUNTY: KAU DISTRICT HAWAII
 Established By: C.L. Murray Year: 1938
 Recovered By: L.C. Wilder Year: 1949

Described by: O. J. HOEPEL

| 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 | | | |
|-------|---|------------------------------------|--|----------|-------------------------------------|-----------|
| | | | BEARING | DISTANCE | | DIRECTION |
| | Surface-station mark, Underground-station mark | | feet | meters | | |
| 12a | PEAK 2 R M 1 KAMEHAME 1939 (metal target) | SE | 49.550 | 15.103 | 00 00 00 105 12 39 40 22 52.6 | |

The station is located about 0.5 mile east of Naalehu, about 300 yards south of the road which runs between Naalehu and Honuape, about 200 yards east of the grounds of the Naalehu School, 10 feet south of a rock wall and on the summit of a large stone pile.

To reach from the post office in Naalehu; go south on the road which leads toward the village dump for 0.2 mile; pass through a board gate and continue straight ahead, easterly for 0.15 mile; pass through a board gate and continue easterly, on the dirt track road, for 0.2 mile; pass through a board gate, to the rear of the school grounds, and continue easterly for 0.15 mile to the end of the road. From this point peak north for about 200 feet to the high ground, the rock pile and the station.

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

Reference mark number 1 is a standard disk, stamped STEIN R M NO 1 1949, set into a drill hole in bedrock which projects about 3 inches above the ground and is about 4 feet lower than the station.

There is another station about a mile away called STEIN 1 (HTS).

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: STEIN 2 HTS

STATE: HAWAII

YEAR: 1938

SECOND

ORDER

SOURCE: G- 9279

| | |
|-----------------------------------|-------------------------|
| GEODETIC LATITUDE: 19° 03' 48.898 | ELEVATION: 155.3 METERS |
| GEODETIC LONGITUDE: 155 34 45.337 | 634 FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|-----------|------------------------|
| STATE & ZONE | CODE | X | Y | # OF Δ OR ANGLE |
| HI 1 | 5101 | 472,630.80 | 83,616.48 | - 0 01 33 |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH (From south) | CODE |
|----------------------|----------------------------------|-------------------------------|------|
| PEAK 2 HTS | 190 50 55.7 | 190 52 29 | 5101 |

QE 160

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 191553 STATION 1100
LATITUDE ° ' TO ° '
LONGITUDE ° ' TO ° '
DIAGRAM

STEIN 2 (HTS) (continued)

FORM 526a
(9-18-69)

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

R

NAME OF STATION: STEIN 2 (HTS)
ESTABLISHED BY: C.L. Murray YEAR: 1938 STATE: Hawaii
RECOVERED BY: D.M. Whipp YEAR: 1967 COUNTY: Hawaii

| OBJECT | BEARING | DISTANCE | | DIRECTION |
|---|---------|----------|--------|------------|
| | | FEET | METERS | |
| PEAK 2 -----1949 DISTANCE and DIRECTION----- | | | | 00 00 00.0 |
| RM 1 | SE | 49.550 | 15.103 | 105 12 39 |
| PEAK 2 (HTS) 1949 -----1967 DISTANCE and DIRECTION----- | | | | 00 00 00.0 |
| RM No. 2 | NE | 11.753 | 3.583 | 27 06 46 |
| RM No. 1 | ESE | 49.418 | 15.062 | 105 12 50 |

Station and reference mark were recovered in good condition. One new reference mark, number two, was established. A complete description follows:

Station is located about 1/2-mile east of the center of Naalehu, 800 feet south of State Highway 11, and 1000 feet east-southeast of the Naalehu School, on a low, brushy rise in pastureland, and along the south side of a stone wall.

To reach station from the post office in Naalehu, go east on State Highway 11 for 0.65 mile to side road right, just after passing the

school grounds. Turn right and go south 40 yards to board gate. Pass through gate and continue for 0.15 mile to board gate on rise, and end of truck travel. Walk left, east, along fence and stone wall about 100 yards to station. NOTE: It is possible to drive slightly closer to station by going to left around the corral just ahead of end of truck travel and then driving the short distance along the power line road.

Station is marked by a 3-1/2-inch hole in the center of a triangular, concrete platform about 7 feet on each side and projecting 7 inches. A 2-inch iron shaft is centered vertically over the hole, mounted on 3 iron legs embedded in the platform, and supports a removeable, red and white metal target 8 feet tall. Station is 7 feet south of the stone wall, 125 feet north of a power line, 115 feet north of the power line road, about 125 yards northeast of corral, and set on the top of a raised, flat, bare, rock area about 30 feet in diameter.

Reference mark number one is a standard disk stamped "STEIN RM NO 1 1949", cemented in a drill hole in bedrock about 2 feet in diameter and projecting 3 inches. It is 5.4 feet lower than station platform.

Reference mark number two is a standard disk stamped "STEIN 2 HTS 1949 NO 2 1967", cemented in a drill hole in bedrock flush with ground, at east edge of the flat, rock area, 1 foot south of base of stone wall and about 1 foot lower than station mark.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: STEIN 2 (HTS)
ESTABLISHED BY: C.L. Murray YEAR: 1938 STATE: HAWAII BENCH MARK(S) ALSO
RECOVERED BY: R.B. MELBY YEAR: 1978 COUNTY: HAWAII
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: 1/2 MILE EAST OF NAAHELU

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 AS DESCRIBED.
THE METAL SIGNAL POLE IS STILL STANDING OVER THE STATION.

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 191553 STATION 1101
HAWAII
LATITUDE 19 °00' TO 19 °30'
LONGITUDE 155 °30' TO 156 °00'
DIAGRAM NE 5-1,5 HAWAII

NO TEXT

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: WAHE PELE
STATE: HAWAII YEAR: 1913 THIRD ORDER
SOURCE: G-SP156

| | | | |
|---------------------|---------------|-----------|--------|
| GEODETIC LATITUDE: | 19 13 51.581 | ELEVATION | METERS |
| GEODETIC LONGITUDE: | 155 53 26.461 | | FEET |

| STATE COORDINATES (feet) | | | | |
|--------------------------|------|------------|------------|----------------------------------|
| STATE & ZONE | CODE | X | Y | $\rho \cos \Delta \theta$ ANGLE* |
| HI 1 | 5101 | 365,229.07 | 144,555.12 | - 0 07 45 |

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

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

QJ 266

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 151553 STATION 1102
 HAWAII
 LATITUDE 15° 00' TO 19° 50'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 502
 Rev. Aug. 1968

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **WAIKAKUU 2** STATE: **HAWAII** COUNTY: **SOUTH KONA DISTRICT HAWAII**

CHIEF OF PARTY: **L. O. WILDER** YEAR: **1948** 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 | | | |
|-------|---|--|--|---------|----------|------------|
| | | | OBJECT | BEARING | DISTANCE | |
| | Surface-station mark | | | feet | meters | |
| | Underground-station mark | | | | | |
| 4 | | 1.9 | | | | |
| 12c | LAE LOA | | NNW | 5 miles | | 00 00 00 |
| 12c | Hookena Spire | | N | 9.826 | 2.995 | 02 15 47.4 |
| | R M 1 | | WSW | 17.884 | 5.451 | 07 42 34 |
| | R M 2 | | | | | 282 23 45 |

The station is located on an open hill side about 5 miles south southeast of Hookena, about 1 mile east of the ocean, about 250 feet north of a house, about 200 feet east of the highway which runs between Captain Cook and Waiohinu and about 150 feet southeast of an abandoned shack.

To reach from the post office at Honaunau; go south on the road which leads toward Waiohinu for 1.9 miles to the road forks; continue straight ahead, south, toward Waiohinu, for 1.9 miles to the Hookena School on the right hand side of the road; continue south 1.6 miles to the Hookena Post Office on the left hand side of the road; continue straight ahead, south, for 2.0 miles to a small church on the left hand side of the road; continue south for 0.35 mile; turn left, pass through the most northerly of two gates and go easterly, across country, for 0.05 mile to the station.

The station is a standard disk, stamped WAIKAKUU 2 1948, set into a drill hole in a boulder which projects about 2 inches.

Reference mark number 1 is a standard disk, stamped WAIKAKUU 2 NO 1 1948, set into a drill hole in a boulder which projects about 2 inches and is about the same elevation as the station.

Reference mark number 2 is a standard disk, stamped WAIKAKUU 2 NO 2 1948, set into a drill hole in a boulder which is flush with the ground and is about 2 feet lower than the station.

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 502
 (Rev. Feb. 1968)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **WAIKAKUU 2**
 ESTABLISHED BY: **L. O. WILDER** YEAR: **1948** STATE: **HAWAII**
 RECOVERED BY: **C. L. MURRAY** YEAR: **1951** COUNTY: **HAWAII**

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

WAIKAKUU 2 marker set in concrete was found in a slight depression, the marker being a few inches lower than the surrounding ground. There is no likelihood of same having been disturbed.

R.M. NO. 1 - The rock on which the mark is set appears to be solid. Being about 6 inches higher than the ground, it is possible that same may have been run into by truck wheels and moved westward.

R.M. NO. 2 - Marker was found to be set in solid rock flush with the surrounding ground. No likelihood of same having been disturbed.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **WAIKAKUU 2**

STATE: **HAWAII**

YEAR: **1948**

SECOND

ORDER

SOURCE: G- 9279

| | | | |
|---------------------|-----------------|------------|--------------|
| GEODETIC LATITUDE: | 15° 18' 42.050 | ELEVATION: | 362.2 METERS |
| GEODETIC LONGITUDE: | 155° 52' 36.689 | | 1188 FEET |

| STATE COORDINATES (FWS) | | | | |
|-------------------------|------|------------|------------|--------------------|
| STATE & ZONE | CODE | X | Y | ρ OR Δ ρ † ANGLE † |
| HI 1 | 5101 | 370,033.29 | 173,845.58 | - 0 07' 29" |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH* (From south) | CODE |
|----------------------|-------------------------------|-----------------------------|------|
| LAE LOA | 158 58 30.0 | 159 05 59 | 5101 |

QE 070

HORIZONTAL CONTROL DATA

by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 191553 STATION 1102

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

WAIKAKUU 2 (continued)

Form 526
(11-8-55)

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

R

NAME OF STATION: WAIKAKUU 2
ESTABLISHED BY: L.C.W. YEAR: 1948 STATE: Hawaii
RECOVERED BY: R.E.A. YEAR: 1961 COUNTY: Hawaii

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

The station was recovered and found in good condition.
The station can not be occupied because the home of Mr. Lotgrace is built over the station site leaving about only 18 inches clearance.

A new "To reach" follows:

To reach from the south edge of the middle of three 1950 lava flows on State Highway 11, go south on the State Highway for 0.6 mile to an old church on the left, continue straight ahead for 0.3 mile to a curve to the left and station WAIKAKUU 4 on the right, continue on the highway for about 50 feet to a driveway on the left. Turn left, go up the driveway for about 200 feet to the home of Mr. Lotgrace and the station under the southeast part of the house.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: WAIKAKUU 2
ESTABLISHED BY: L.C. Wilder YEAR: 1948 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 was recovered and all marks found in good condition, however a house, at present abandoned, has been built over the station, covering all 3 marks. The floor is about 3 feet above them and it was possible to check the distance to the RMs, which were found to be correct.
Station is located about 9 miles south of the post office at Honaunau and 1 mile south of the middle 1 of the 3 lava flows of 1950, up on the brushy hillside, 300 feet east of State Highway 11, opposite power pole 99, and under a house.

To reach station from the post office at Honaunau, go south on State Highway 11 for 8.6 miles to the middle lava flow, 1/2-mile past Alae School; continue on the highway for 1.0 mile to side road left, across from power pole 99, go left up driveway for 75 yards to house and station.
Station mark is a standard disk stamped "WAIKAKUU 2 1948", cemented in a drill hole in bedrock, under southeast corner of house.

Reference mark number one is a standard disk stamped "WAIKAKUU 2 NO 2 1948" (mis-stamped 2 instead of 1), cemented in a drill hole in bedrock under northeast angle of house. It projects 3 inches above ground and is at about same elevation as station mark.

Reference mark number two is a standard disk stamped "WAIKAKUU 2 NO 2 1948", cemented in a drill hole in bedrock flush with ground and about 2 feet lower than station mark. It is 2 feet northeast of the second foundation post east from southwest corner of house.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: WAIKAKUU 2
ESTABLISHED BY: LCW YEAR: 1948 STATE: Hawaii BENCH MARK(S) ALSO
RECOVERED BY: GEH YEAR: 1972 COUNTY: Hawaii
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 mark recovered as described by REA in 1961. No search was made for Reference Marks.

FORM CGS-526 (9-66)
USCOMM-DC 28496-P66

U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
COAST AND GEODETIC SURVEY

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

191553 STATION 1103
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-15 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 525
 Rev. Aug. 1963

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: WAIKAKUU 3 STATE: Hawaii COUNTY: Hawaii

CHIEF OF PARTY: C.L. Murray YEAR: 1951 Described by: C.L.M.

| NOTE* | HEIGHT OF TELESCOPE 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 | HEIGHT OF LIGHT ABOVE STATION MARK METERS. | |
|-------|--|---|---|------------|
| | | | feet | meters |
| | Surface-station mark, Underground-station mark | | | |
| | | OBJECT | BEARING | DIRECTION: |
| | | | | ° ' " |
| | | WAIKAKUU 4 | 286.25 | 00 00 00 |
| | | R.M. 3 | 9.02 | 73 32 00 |
| | | R.M. 4 | 13.98 | 337 34 40 |

Sub-surface mark 3/4 inch galvanized pipe set in concrete to top of pipe, 6 inch triangle cut in concrete with pipe in center.
 Surface mark is a USC&GS triangulation disk set in concrete in center of triangular concrete monument 7 feet on each side and flush with ground. The concrete monument is situated on the west end of a fairly prominent rise of land. To eliminate any unsightliness, the owner of the land, in whose front yard the station is located, asked that the station be covered with a thin layer of dirt. This was done but the triangular form of the monument is clearly discernible.
 R.M. 3 - Disk set in cement in drill hole in solid rock flush with ground near west top end of rise on which the station is situated.
 R.M. 4 - Disk set in cement in drill hole on jutting rock on the west slope of the rise on which the station is located.
 Reference marks are standard disks stamped WAIKAKUU 3 RM 3 1951 and WAIKAKUU 3 RM 4 1951.

FORM 525
 (11-8-55)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: WAIKAKUU 3
 ESTABLISHED BY: C.L.M. YEAR: 1951 STATE: Hawaii
 RECOVERED BY: U.S.G.S. YEAR: 1958 COUNTY: Hawaii

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. A house has been constructed on the point of ground and the station mark is located near the southwest corner of the house but it probably could be reoccupied.

FORM 525
 (11-8-55)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: WAIKAKUU 3
 ESTABLISHED BY: C.L.M. YEAR: 1951 STATE: HAWAII
 RECOVERED BY: R.E.A. YEAR: 1961 COUNTY: HAWAII

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

The station was recovered and found in good condition.

A new "To reach" follows:

To reach from the south edge of the middle of three 1950 lava flows on State Highway 11, go south on the State Highway for 0.6 mile to an old church on the left, continue straight for 0.3 mile to a curve to the left and station WAIKAKUU 4 on the right, continue on the Highway for about 50 feet and a driveway on the left, go up the driveway for about 200 feet to Mr. Lotgrace's home and the station by the southwest corner of the house.

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: WAIKAKUU 3

STATE: HAWAII

YEAR: 1951

SECOND

ORDER

SOURCE: G- 9275

NO OBSERVATION CHECK ON THIS POSITION

| | |
|-------------------------------------|-----------------------|
| GEODETIC LATITUDE: 19° 18' 42.020 | ELEVATION: 345 METERS |
| GEODETIC LONGITUDE: 155° 52' 37.270 | SCALED FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|-------------------|
| STATE & ZONE | CODE | X | Y | θ OR Δ OR ANGLE ° |
| HI 1 | 5101 | 370,006.37 | 175,842.61 | - 0 37 25 |

* 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 |
|----------------------|----------------------------------|--------------------------------|------|
| | | | |

POSITION DETERMINED BY TRAVERSE FROM STATION WAIKAKUU 2

QE 51

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 191553

STATION 1103

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

WAIKAKUU 3 (continued)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: WAIKAKUU 3
ESTABLISHED BY: C.L. Murray YEAR: 1951 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 was recovered and all marks found in good condition. Distance to RMs was checked and found correct. All lines are blocked by trees. A complete description follows:

Station is located about 9 miles south of the post office at Honsunau and 1 mile south of the middle one of the 3 lava flows of 1950, up on the brushy hillside, 300 feet east of State Highway 11, opposite power pole 99, and at the southwest corner of a house built by Mr. Lot Grace, but now abandoned.

To reach station from the post office at Honsunau, go south on State Highway 11 for 8.6 miles to the middle lava flow, 1/2-mile past the Alae School; continue on the highway for 1.0 mile to driveway on left, across road from power pole 99; go left up driveway for 75 yards to station.

Station mark is a standard disk stamped "WAIKAKUU 3 1951", set in the center of a triangular, concrete platform 7 feet on each side and flush with ground. It is 2 feet southwest of southwest corner of the house. Station WAIKAKUU 2 1948 is 27.08 feet east-northeast, and under the house.

Reference mark number three is a USC and GS Bench Mark disk, stamped "WAIKAKUU 3 1951 NO 3 TRI REF MARK", cemented in a drill hole in the top of a 10-inch-square, smooth-topped rock flush with ground, 4 feet south of edge of porch, 6 feet southeast of the southwest corner foundation post of the porch and about 1 foot lower than station mark. A cap of cement on top of the rock makes it appear to be a concrete monument.

Reference mark number four is a USC and GS Bench Mark disk, stamped "WAIKAKUU 3 1951 NO 4 TRI REF MARK", cemented in a drill hole in a small bedrock step down on the steep slope, 6 feet lower than station mark and hidden behind dense shrubbery.

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: WAIKAKUU 3
ESTABLISHED BY: CIM YEAR: 1951 STATE: Hawaii BENCH MARK(S) ALSO
RECOVERED BY: GEM YEAR: 1972 COUNTY: Hawaii
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 mark recovered in good condition as described by CIM in 1951. The to-reach as written by REA in 1961 is adequate. No search was made for Reference Marks.

HORIZONTAL CONTROL DATA

by the
 National Ocean Survey
 OLD HAWAIIAN DATUM

Q 191553 STATION 1104
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAPHRAM NE 5-1,5 HAWAII

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 Form 525
 Rev. Aug. 1965

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: **WAIKAKUU 4** STATE: **Hawaii** COUNTY: **Hawaii**

CHIEF OF PARTY: **C.L. Murray** YEAR: **1951** Described by: **C.L.M.**

| NOTE* | HEIGHT OF TELESCOPE ABOVE STATION MARK METERS, I | 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 | DIRECTION I # |
| | Surface-station mark | | | | |
| | Underground-station mark | | | | |
| | | | 286.25 | 00 00 00 | |
| | | | 79.59 | 58 18 30 | |
| | | | 159.55 | 67 13 45 | |
| | | | 56.58 | 302 41 35 | |

The station mark is a 1 inch galvanized pipe set solidly in concrete flush with the ground. Located on the west side of the Government Road right-of-way, 1 foot east of a low stone wall.
 R.M. 1 is set in concrete and marks the line-of-center of the Government main road.
 R.M. 3 is an iron pin set in concrete and marking the center line of the Government main road.
 R.M. 4 is a skip spike in the pavement. It is near the west edge of the pavement and surrounded by 3 galvanized roofing nails in a triangle.

Detailed description

(11-8-55)

RECOVERY NOTE, TRIANGULATION STATION

R

NAME OF STATION: **WAIKAKUU 4**
 ESTABLISHED BY: **C.L.M.** YEAR: **1951** STATE: **Hawaii**
 RECOVERED BY: **R.E.A.** YEAR: **1961** COUNTY: **Hawaii**

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

The station was recovered and found in good condition.

A new "To reach" follows:

To reach from the south edge of the middle of three 1950 lava flows on State Highway 11, go south on the State Highway for 0.6 mile to an old church on the left, continue straight for 0.3 mile to a curve to the left and the station on the right.

* 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.

Comm-DC 34314

(continued on next page)

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **WAIKAKUU 4**

STATE: **HAWAII**

YEAR: **1951**

ORDER: **SECOND**

SOURCE: **G-9279**

NO OBSERVATION CHECK ON THIS POSITION

| | | | | |
|--------------------|-----------------|-----------|-----|--------|
| GEODETIC LATITUDE | 19° 18' 41.704 | ELEVATION | 523 | METERS |
| GEODETIC LONGITUDE | 155° 52' 40.240 | SCALED | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|----------------------|
| STATE & ZONE | CODE | X | Y | PLANE AZIMUTH ANGLE* |
| Hi 1 | 5101 | 369,721.84 | 173,811.35 | - 0 07 30 |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From south) | PLANE AZIMUTH (From north) | CODE |
|----------------------|----------------------------------|-------------------------------|------|
| KAPUKAWAA | 14° 10' 37.2 | 14 18 07 | 5101 |

POSITION DETERMINED BY TRAVERSE FROM STATION WAIKAKUU 2

HORIZONTAL CONTROL DATA

QUAD 191553

STATION 1104

by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

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

WAIKAKUU 4 (continued)

FORM 526a
(6-18-69)

U.S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: WAIKAKUU 4
ESTABLISHED BY: C.L. Murray YEAR: 1951 STATE: Hawaii
RECOVERED BY: R.C. Munson YEAR: 1968 COUNTY: Hawaii
Island: Hawaii

HEIGHT OF TELESCOPE ABOVE STATION MARK 1.69 METERS. HEIGHT OF LIGHT ABOVE STATION MARK METERS.

| OBJECT | BEARING | DISTANCE | | DIRECTION |
|----------------------|-----------|----------------------------|--------|-------------|
| | | FEET | METERS | |
| KAPUKAWAA (HGS) 1884 | -----1951 | DISTANCE and DIRECTION---- | | 00 00 00.0 |
| R.M. No. 1 | | 58.58 | | 192 07 33 |
| R.M. No. 3 | | 79.59 | | 307 44 28 |
| KAPUKAWAA (HGS) 1884 | -----1968 | DISTANCE and DIRECTION---- | | 00 00 00.0 |
| Milolii Point, light | SSW | | | 00 15 26.9 |
| KALAPA (HGS) 1884 | | | | 164 54 28.3 |
| R.M. No. 1 | NE | 56.581 | 17.247 | 192 08 06 |
| WAIKAKUU 3 1951 | | | | 249 25 57.9 |
| R.M. No. 3 | SE | 79.579 | 24.256 | 307 44 11 |

Station was recovered and all marks found in good condition, except RM 4, which was not recovered. The station was re-marked with a standard disk set in the original pipe. A tie was made to stations KAPUKAWAA, LAE LOA and KALAPA. A complete description follows:

Station is located about 9 miles south of the post office at Honaunau and 1 mile south of the middle 1 of the 3 lava flows of 1950, along the

west side of State Highway 11, at the west edge of a wide, grassy shoulder, at a left curve of the highway.

To reach station from the post office at Honaunau, go southerly on State Highway 11 for 8.6 miles to the middle lava flow, 1/2-mile past the Alae School; continue on the highway for 1.0 mile to station on right, by power pole No. 99, 0.3 mile past old church on left.

Station mark is a standard disk stamped "WAIKAKUU 4 1951 1968", cemented in the center of a 1-inch iron pipe set flush in the center of an irregular, concrete pad flush with ground and with "WAIKAKUU 4 1951" inscribed in the concrete. It is at extreme west edge of shoulder, by low rock wall, 30.5 feet west of center line of highway and 39.5 feet north-northwest of power pole No. 99.

Reference mark number one is a highway traverse marker, a 1/2-inch brass plug, stamped "NO 1", set in the top of a 4-inch-square concrete post, flush with highway surface, in the center line stripe, and is 1.8 feet lower than station mark.

Reference mark number two is a highway traverse marker, a 1/2-inch brass plug, stamped "NO 2", set in the top of a 4-inch-square concrete post, flush with highway surface, in the center line stripe, and is 3 feet higher than station mark.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: WAIKAKUU 4
ESTABLISHED BY: C.L. Murray YEAR: 1951 STATE: Hawaii BENCH MARK(S) ALSO
RECOVERED BY: GEH YEAR: 1972 COUNTY: Hawaii
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 mark was recovered as described by R.C. Munson (1968) in good condition. No search was made for the reference marks.

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 191553 STATION 1105
 HAWAII
 LATITUDE 19° 00' TO 19° 30'
 LONGITUDE 155° 30' TO 156° 00'
 DIAGRAM NE 5-1.5 HAWAII

NO ORIGINAL TEXT

DEPARTMENT OF COMMERCE
 U. S. COAST AND GEODETIC SURVEY
 FORM 500
 RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: **WAIKUKUU**
 ESTABLISHED BY: **Haw. Govt. Survey** YEAR: **1884** STATE: **Hawaii**
 RECOVERED BY: **L.C. Wilder** YEAR: **1948** COUNTY: **HAWAII**

Detailed statement as to the fitness of the original description:

This station was established by the Hawaii Government Survey and was originally marked by a brass shotgun shell driven into a drill hole in lava rock with four reference marks, crosses cut in rock, east 2.75 feet, south 3.50 feet, west 4.00 feet and north 8.75 feet from the station.

A tie was calculated from Waikakuu 2 (1948) about 296 feet distant and a thorough search for the station mark as well as the tie marks was made, but none could be found. The vicinity is overgrown with guava, the entangled roots of which make it difficult to find any of the marks. The station should be considered lost unless some survey data from nearby known marks can be found to locate the station.

* 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.
 U. S. GOVERNMENT PRINTING OFFICE Note.—One of these forms must be used for every station recovered. H-2518-2

R

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: **WAIKUKUU**

STATE: **HAWAII**

YEAR: **1684**

THIRD

ORDER

SOURCE: **G-SP15c**

| | | | |
|--------------------|---------------|-----------|--------|
| GEODETIC LATITUDE | 19 18 41.513 | ELEVATION | METERS |
| GEODETIC LONGITUDE | 155 52 33.775 | | FEET |

| STATE COORDINATES (Feet) | | | | |
|--------------------------|------|------------|------------|------------------|
| STATE & ZONE | CODE | X | Y | ± OR Δ ± ANGLE * |
| HI 1 | 5101 | 570,341.00 | 173,790.74 | - 0 07 28 |

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

| TO STATION OR OBJECT | GEODETIC AZIMUTH (From 1901) | PLANE AZIMUTH * (From 1901) | CODE |
|----------------------|---------------------------------|--------------------------------|------|
| | | | |

QQ 263