

5/31/69

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HAWAIIAN ISLANDS

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HAWAIIAN ISLANDS - 1

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

TIDAL BENCH MARKS

Hilo (Kuhio Bay), Hawaii Island
Lat. 19° 44'.0; Long. 155° 03'.5

BENCH MARK D 2 (1926) is a standard disk, stamped "D 2 1926", set in extreme northeast corner of concrete deck of Pier 2, near intersection of Piers 1 and 2. It is about $1\frac{1}{2}$ feet from north face and $1\frac{1}{2}$ feet from east end of Pier 2. Elevation: 9.27 feet above mean lower low water

BENCH MARK E 2 (1926) is a standard disk, stamped "E 2 1926", set in 10-inch square steel box with cover flush with asphalt, $12\frac{1}{2}$ feet north of south end of straight section of Pier 1, $2\frac{1}{2}$ feet west of southern most Bollard on Pier 1 and $1\frac{1}{2}$ feet east of pier face. Elevation: 8.77 feet above mean lower low water.

BENCH MARK F 2 (1926) is a standard disk, stamped "F 2 1926", set in 10-inch square steel box with cover flush with asphalt, 8 feet west of northwest corner of transit shed on Pier 1. Elevation: 8.5₀ feet above mean lower low water.

BENCH MARK PIER 1 (USE) (1946) is a standard triangulation station disk, stamped "PIER 1", set in 12-inch square steel box with cover flush with asphalt, 123 feet south of northwest corner of Pier 1, $21\frac{1}{2}$ feet south of Junction line between old and new sections of Pier 1 and 5 feet east of west face of Pier 1. Elevation: 8.4₀ feet above mean lower low water.

BENCH MARK PIER 3 (USE) (1946) is a standard triangulation station disk, stamped "PIER 3", set flush with concrete deck of Piers 2-3, about 20 feet from northwest end of pier. It is $8\frac{1}{2}$ feet south from north face of Pier 2 and 10 feet from southwest face of Pier 3. Elevation: 9.33 feet above mean lower low water.

BENCH MARK 4 (1951) is a standard disk, stamped "NO 4 1951", set in top of east corner of northern most concrete foundation which rests on solid rock, for elevated water tank on State Port of Hilo property. It is about 63 yards west of centerline of main gate and about 160 yards south of foot of Pier 1. Elevation: 11.77 feet above mean lower low water.

(OVER)

USCOMM-CGS-DC

Hilo (Kuhio Bay), (Cont'd)

BENCH MARK 5 (1959) is a standard triangulation station disk, unstamped set flush in concrete deck of Pier 3, 50½ feet northwest of southeast (inshore) end of Pier 3 and 1 foot northeast of southwest face of pier. Elevation: 9.26 feet above mean lower low water.

BENCH MARK F (USE) (1964) is a USE standard triangulation station disk, stamped, "F" set flush in concrete deck of Pier 149½ feet northwest of southeast inshore end of Pier 3. It is 1 foot southwest of a 2½-foot by 4-foot steel cover plate set flush with the pier, 1 foot northeast of southwest face of Pier, and 99 feet northwest of BM 5. Elevation: 9.25 feet above mean lower low water.

Mean lower low water at Hilo (Kuhio Bay), Hawaii Island, is based on 13 years of records, 1947 - 1959, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	Feet
Highest tide observed (Aug. 25, 1961)	3.8
Mean higher high water	2.40
Mean high water	1.90
Mean tide level	1.10
Mean low water	0.30
Mean lower low water	0.00
Lowest tide observed (Dec. 26, 1928)	-1.6

4/20/51

HAWAIIAN ISLANDS - 2

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Honuapo, Hawaii Island
Lat. 19° 05'.4; Long. 155° 33'.1

BENCH MARK 1 (1929) is a standard disk set in top of concrete and stone landing pier at old landing, near north-east corner of pier. Elevation: 6.57 feet above mean lower low water.

BENCH MARK 2 (1929) is a standard disk set in outcropping ledge of rock at foot of bluff north-northwest from old landing, 30 feet north of railway and roadway and 50 feet eastward from storehouse. Elevation: 17.87 feet above mean lower low water.

BENCH MARK 3 (1929) is a standard disk set in top of lava flow 200 feet southeastward from the landing, 50 feet south-westward from a shack, and between the reef and fish pond. Elevation: 7.46 feet above mean lower low water.

Mean lower low water at Honuapo is based on 161 high waters and 161 low waters, August 1 - October 23, 1929, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	4.0
Mean higher high water	2.50
Mean high water	2.00
Half tide level	1.15
Mean low water	0.30
Mean lower low water	0.00
Lowest tide (estimated)	-1.5

Hawaiian Islands - 4

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

TIDAL BENCH MARKS

Kailua, Kailua Bay, Hawaii Island
Lat. 19° 38'.6; Long. 156° 00'.0

BENCH MARK 1 (U.S.G.S.) (1921) is a U.S. Geological Survey disk, stamped "8", cemented in the top of the seawall about 5 feet from the west end, near the northeast corner of the wharf at Kailua Landing. It is 49 feet northeast of the wharf entrance gate, 28 feet north of a wire mesh fence and 12 feet southwest of a power pole, 2 feet northeast from the southwest end of the seawall and 2 feet above the street. Elevation: 7.75 feet above mean lower low water.

BENCH MARK 4 (U.S.G.S.) (1958) is a standard aluminum disk, stamped "4 YY1958", set in a concrete slab on the seawall. It is at the northwest corner of the harbor at the junction of State Highway 19 and 182, across from Tanaguchi Market. The mark is 112 feet northeast of the wharf entrance gate, 48 feet southwest of the highway intersection, 4 feet east of a brass plug marker in the seawall and 3 feet above the sidewalk. Elevation: 9.36 feet above mean lower low water.

BENCH MARK 6 (1971) is a standard disk, stamped "No 6 1971" set in the top of the northeast edge of a large concrete platform on the northeast side of Kailua Pier. It is about 200 feet southeast of the southeast corner of the harbor attendant's office. The mark is $5\frac{1}{2}$ feet northeast of the northeast edge of the pier, $2\frac{1}{2}$ feet north-northwest of the southerly edge of the platform and about 3 inches above deck level. Elevation: 6.10 feet above mean lower low water.

BENCH MARK 7 (1971) is a standard disk, stamped "No 7 1971" set in the northeast corner of a concrete base for a metal post on the south side of the circular entrance driveway to the King Kamehameha Hotel. It is $83\frac{1}{2}$ feet west of the center of the northwest side of a 6 foot high stone monument commemorating King Kamehameha. It is in the grassy area between the hotel and the entrance road to Kailua Pier. Elevation: 6.83 feet above mean lower low water.

BENCH MARK 8 is a standard disk, stamped "No 8 1971", set in the concrete curb on the east side of the entrance driveway to the Kona Hukilau Hotel. It is 42 feet east south-east of the southeast corner of the Hukilau Hotel Restaurant, $34\frac{1}{2}$ feet north of the centerline of an asphalt road that parallels a seawall and 8 inches above the level of the driveway. Elevation: 7.82 feet above mean lower low water.

Mean lower low water at Kailua is based on 1 month of record, October 1971, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	2.10
Mean high water	1.60
Mean tide level	0.90
Mean low water	0.20
Mean lower low water	0.00

The estimated highest water level to the nearest half foot is $3\frac{1}{2}$ feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

8/21/70

HAWAIIAN ISLANDS - 5

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

TIDAL BENCH MARKS

Kawaihae, Hawaii Island
Lat. $20^{\circ} 02'.3$; Long. $155^{\circ} 49'.8$

BENCH MARK 3 (1928) is a standard disk, stamped "1", set in a bedrock ledge that projects 1 foot above ground, at base of stone wall near small boat basin, 3 feet east of northeast corner of 20-foot x 40-foot warehouse and old post office building. It is 31 feet west-northwest of west end of old post office, 128 feet northeast of power pole by boat basin, 44 feet north-northeast of centerline of macadam road, 70 feet northwest of northwest corner of a corral and 105 feet east-northeast of Bench Mark 1 (USGS). Elevation: 7.78 feet above mean lower low water.

BENCH MARK 1 RESET (1967) is a standard disk, stamped "1 RESET 1967", set in top of prominent bedrock ledge projecting 2 feet above ground and 2 feet out from base of stone wall, in front of a corral at base of a stone wall. It is 22 feet northeast of centerline of macadam road, 119 feet northeast of east corner of a small boat basin, 231 feet southeast of Bench Mark 3 and 77 feet southeast of a corral loading ramp. Elevation: 8.37 feet above mean lower low water.

BENCH MARK 5 (1968) is a standard disk, stamped "BM 5 1968", set near the sugar loading dock at Kawaihae Harbor. It is about 180 feet east of the northeast corner of the dock and 30 feet north of the adjacent rock breakwater on a 4-foot x 6-foot bollard foundation. Elevation: 7.64 feet above mean lower low water.

BENCH MARK 6 (1968) is a standard disk, stamped "BM 6 1968", set in the concrete sugar loading dock. It is about 45 feet north of the southeast corner of the dock and 1 1/2 feet from its east edge. Elevation: 7.99 feet above mean lower low water.

(OVER)

Kawaihae, Hawaii Island (Cont'd)

BENCH MARK 7 (1968) is a standard disk, stamped "BM 7 1968", set on the foundation of the sugar processing and storage warehouse. It is about 200 yards northwest of the sugar loading dock and is at the base of the 4th concrete abutment from the southeast corner of the warehouse. Elevation: 15.02 feet above mean lower low water.

Mean lower low water at Kawaihae is based on 66 high waters and 66 low waters, November 8 - December 12, 1968 and 86 high waters and 85 low waters, March 12 - April 25, 1969, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	2.00
Mean high water	1.50
Mean tide level	0.85
Mean low water	0.20
Mean lower low water	0.00

The estimated highest water level to the nearest half foot is $3\frac{1}{2}$ feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

4/24/51

HAWAIIAN ISLANDS - 6

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Mahukona, Hawaii Island
Lat. 20° 11'.2; Long. 155° 54'.2

BENCH MARK 1 (1910) is the top of cement on northwest corner of southern wall on south side of harbor. Level rod was held just north of and alongside iron pipe which projects about 8 inches above top of wall and is located about one foot from either face of wall. Elevation: 17.77 feet above mean lower low water.

BENCH MARK 2 (1910) is a horizontal line cut in west face of rock at corner of wall near Bench Mark 1. Line is in top rock and is about one foot from top of wall and about one foot from south corner. (NOTE: This bench mark now may be lost by lamppost being built over it.) Elevation: 16.65 feet above mean lower low water.

BENCH MARK 3 (1910) is on west side of cement-covered rock walk and as close to wall as level rod could be held. Level rod was held alongside of hinge plates of iron gate. Walk in which bench mark is located extends northerly from wall referred to above and is between the wall and warehouse and railroad siding. Elevation: 13.59 feet above mean lower low water.

BENCH MARK 4 (1910) is the top of rock on east side of southern one of two $\frac{1}{2}$ -inch drill holes in rock at east end of southern wall referred to in Bench Mark 3. These holes are about $\frac{1}{2}$ foot north of wall. Elevation: 17.54 feet above mean lower low water.

BENCH MARK 5 (1910) is a cross cut on west side of large boulder just east of cut at south end of warehouse. It is located north-easterly from Bench Mark 4. Elevation: 22.40 feet above mean lower low water.

BENCH MARK 6 (1910) is a cross cut on sea wall just northwest of most northern one of bolts used as anchor bolts for wall. It is about 150 feet around wall northerly from corner at landing. Elevation: 12.44 feet above mean lower low water.

Mean lower low water at Mahukona is based on 56 high waters and 56 low waters, February 11 - March 11, 1910.. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.5
Mean higher high water	2.10
Mean high water	1.60
Half tide level	0.90
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

5/7/63

HAWAIIAN ISLANDS - 7

U.S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Hana, Hana Bay, Maui Island
Lat. 20° 45'.7; Long. 155° 59'.2

BENCH MARK 1(1962) is a standard disk, stamped "NO 1 1962", set flush in northwest corner of concrete pier at Hana. It is $5\frac{1}{2}$ feet south of north face of pier, $1\frac{1}{2}$ feet east of west edge and 3 feet south-southwest of corner mooring bit. Elevation: 10.00 feet above mean lower low water.

BENCH MARK 2(1962) is a standard disk stamped "NO 2 1962", set in top of boulder about $3\frac{1}{2}$ feet above ground along south side of trail to Kauiki Lighthouse, which leads east from road to pier. It is about 150 feet south of beginning of pier, 113 feet east of junction of road and trail and 4 feet south of center line of trail. Elevation: 17.76 feet above mean lower low water.

BENCH MARK 3(1962) is a standard disk, stamped "NO 3 1962", set flush in top of south end of sea wall which runs northwest-southeast. It is 21 feet northwest of south end of the wall, 38 feet north of center line of road leading to Hana Pier and about 100 feet east of three large fuel storage tanks. Elevation: 11.63 feet above mean lower low water.

BENCH MARK 4(1962) is a standard disk, stamped "NO 4 1962", set flush in concrete in top of sea wall running northwest-southeast and just north of break in wall used for beach access. It is 68 feet east of center line of the road and 110 feet southeast of southeast corner of building known as Helene Hall. Elevation: 11.65 feet above mean lower low water.

Mean lower low water at Hana, Hana Bay is based on 25 high waters and 24 low waters, September 26 - October 10, 1962, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	Feet
Mean higher high water	2.40
Mean high water	2.00
Mean tide level	1.15
Mean low water	0.30
Mean lower low water	0.00

(OVER)

USCOMM-CGS-DC

The estimated highest water level to the nearest half foot is $3\frac{1}{2}$ feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

NOTE: The above elevations are preliminary and are subject to revision when the results from a longer tide series become available.

3/4/64

HAWAIIAN ISLANDS - 7A

U. S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

La Perouse Bay, Maui Island
Lat. 20° 36'.2; Long. 156° 25'.4

BENCH MARK 1 (1963) is a standard disk, stamped "NO 1 1963," set in a ledge outcrop about 1 1/2 feet above the ground at the northwest corner of La Perouse Bay about 2.8 miles east of FAA Radio Range Station at Makena. It is on property owned by Mr. George Carter, 80 feet south - southwest of the home of Mr. Aikale, 48 feet north of high water line, and 12 feet south of a 14-inch Keave tree. Elevation: 7.16 feet above mean lower low water.

BENCH MARK 2 (1963) is a standard disk, stamped "NO 2 1963," set in ledge outcrop about 1/2 foot above ground, due north of rock groin forming the west side of a small boat landing. It is 63 feet west of Mr. Aikale's house and 10 feet north of a 30-inch Keave tree. Elevation: 9.78 feet above mean lower low water.

BENCH MARK 3 (1963) is a standard disk, stamped "NO 3 1963," set in a prominent ledge outcrop about 5 feet above a gravel beach, in same general area as Bench Mark 1. It is west of a gravel beach, and 75 feet northwest of a small boat landing. Elevation: 6.39 feet above mean lower low water.

BENCH MARK 4 (1964) is a standard disk, stamped "NO 4 1964," set in ledge outcrop 1/2 foot above ground level, 41 feet southwest of center line of macadam road. It is 12 feet south of 20-foot Keave tree, 47 feet southeast of lava wall where it meets two Keave trees, 96 feet southwest of edge of concrete water well, and 150 feet north of house of Mr. Aikale. Elevation: 11.96 feet above mean lower low water.

Mean lower low water at La Perouse Bay, Maui Island, is based on 2 months of records, March-April 1963, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	Feet
Mean higher high water	2.20
Mean high water	1.70
Mean tide level	1.00
Mean low water	0.30
Mean lower low water	0.00

(OVER)

USCOMM-CGS-DC

The estimated highest water level to the nearest half foot is 3 1/2 feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

8/5/64

HAWAIIAN ISLANDS - 8

U. S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Makena, Maui Island
Lat. 20 39'.4; Long. 156 26'.7

BENCH MARK 2 (1931) is a standard disk, stamped "NO 2 1931," set on sharp point of lava outcrop which projects about 3 feet, about 15 feet west of southwest corner of old Makena slip (dock). Elevation: 12.68 feet above mean lower low water.

BENCH MARK 3 (1961) is a standard disk, stamped "NO 3 1961" set in top of south rock concrete quay of the old Makena Dock. It is about 35 feet east of east corner of a small house, 21 feet northeast of east end of a rock concrete earth retaining wall and 57 feet southeast of the west end of south quay. Elevation: 4.00 feet above mean lower low water.

BENCH MARK 4 (1961) is a standard disk, stamped "NO 4 1961" set in lava rock, 16 feet southwest of Bench Mark 2, 28 feet south of east corner of a small house, and 26 feet southeast of south concrete corner of the house. Elevation: 12.38 feet above mean lower low water.

Mean lower low water at Makena is based on 50 high waters and 50 low waters, April 26-May 21, 1962, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	1.80
Mean high water	1.40
Mean tide level	0.80
Mean low water	0.20
Mean lower low water	0.00

The estimated highest water level to the nearest half foot is 3 feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

USCOMM-CGS-DC

4/24/51

HAWAIIAN ISLANDS - 9

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Olowalu, Maui Island
Lat. $20^{\circ} 48' .7$; Long. $156^{\circ} 37' .6$

BENCH MARK 1 (1925) is a standard disk, stamped "1 1925", set flush with top of concrete landing face (wall) of rock-filled wharf, near northerly derrick post at village of Olowalu. Elevation: 5.82 feet above mean lower low water. NOTE: It was reported in November 1950 that stamping on disk was not legible owing to mutilation of same. Bench mark was recovered in good condition.

Mean lower low water at Olowalu is based on 5 high waters and 5 low waters, April 27-30, 1925, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.5
Mean higher high water	2.30
Mean high water	1.80
Half tide level	1.00
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

4/24/51

HAWAIIAN ISLANDS - 10

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Lahaina (Lighthouse Wharf), Maui Island
Lat. $20^{\circ} 52'.5$; Long. $156^{\circ} 40'.9$

BENCH MARK 1 (1900) is the center of shallow cross cut in concrete sill of north cellar window in post office building at Lahaina. Bench mark is near outer edge of northern end of sill. Elevation: 8.93 feet above mean lower low water.

BENCH MARK 2 (1900) is the center of cross cut in foundation of flagpole in front of post office building at Lahaina. Flagpole is in center of concrete block with two steps and bench mark is on west face near south end of lower step. Two large cannons have been mounted on slab of concrete but are far enough removed to permit passage of level rod. Elevation: 7.97 feet above mean lower low water.

BENCH MARK 4 (1923) is a standard disk, unstamped, set in southeast corner of base of Lahaina Lighthouse. Elevation: 9.20 feet above mean lower low water.

BENCH MARK 5 (1923) is a cross cut in top of 6-inch square concrete post that is part of Lahaina Lighthouse and stands close to and projects 3 feet from southeast corner of concrete base of lighthouse. Elevation: 9.71 feet above mean lower low water.

Mean lower low water at Lahaina (Lighthouse Wharf) is based on 26 high waters and 17 low waters, October 12 - November 28, 1923, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.0
Mean higher high water	2.00
Mean high water	1.50
Half tide level	0.85
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

8/5/64

HAWAIIAN ISLANDS - 11

U. S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Lahaina (Mala Wharf), Maui Island
Lat. 20 53'.4; Long. 156 41'.4

BENCH MARK 1 (1931) is a standard disk, unstamped, set near outer northern corner of dock, just east of corner of mooring bitt. Mala Wharf is about 1 mile northwest of Lighthouse Wharf at Lahaina. Elevation: 9.70 feet above mean lower low water.

BENCH MARK 2 (1931) is a standard disk, unstamped, set in concrete near southeast corner of dock, where it joins main road. It is in middle of narrow walk, which runs parallel to dock and is slightly higher than road leading to dock. Narrow walk runs along southwest side of road which leads to dock. Elevation: 10.40 feet above mean lower low water.

BENCH MARK 3 (1931) is a standard disk, unstamped, set at southwest corner of foundation of wire fence which surrounds Standard Oil Company tank farm. This corner is also corner of rock sea wall which ends at road and is directly opposite northeast corner of dock. Elevation: 10.87 feet above mean lower low water.

BENCH MARK 4 (1961) is a standard disk, stamped "LAHAINA NO 4, 1961" set in center of 4 1/2-inch bolts in deck of Mala Wharf. It is 1 foot from edge of south side of wharf and 49 feet south of southwest corner of a stairway. Elevation: 9.87 feet above mean lower low water.

Mean lower low water at Lahaina (Mala Wharf) is based on 132 high waters and 133 low waters, May 3-June 11, 1961 and April 26-May 25, 1962, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	2.20
Mean high water	1.70
Mean tide level	1.00
Mean low water	0.30
Mean lower low water	0.00

(OVER)

USCOMM-CGS-DC

(Lahaina (Mala Wharf), Maui Island Cont'd)

-2-

The estimated highest water level to the nearest half foot is $3 \frac{1}{2}$ feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

3/14/69

HAWAIIAN ISLANDS - 12

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

TIDAL BENCH MARKS

Kahului (Kahului Harbor), Maui Island
Lat. 20°53'.9; Long. 156°28'.22

BENCH MARK 2 (1929) is a standard disk, stamped "2 1929", set in concrete deck floor, at northeast corner of warehouse at shore end of pier 2. Elevation: 9.31 feet above mean lower low water.

BENCH MARK 4 (1950) is a standard disk, stamped "NO 4 1950", set 4½ inches below asphalt surface of concrete pier, and under a 5-inch diameter, slotted brass hand hole cover stamped "PERFECTO MAR". It is 64 feet toward row of light posts (northwesterly) from the northwest corner of warehouse (transit shed) at shore end of pier 2 and 34 feet from light post. Elevation: 9.05 feet above mean lower low water.

BENCH MARK 5 (1950) is a standard disk, stamped "NO 5 1950", set 0.3 foot from inside south corner in bottom of concrete drainage gutter at southwest corner of warehouse on pier 2. Elevation: 7.22 feet above mean lower low water.

BENCH MARK 6 (1950) is a standard disk, stamped "NO 6 1950", set 4 inches below asphalt surface of concrete deck of pier 2, under a 4-inch diameter slotted brass hand hole cover, cast "PERFECTO RICHMOND", stamped "UPC DET". It is 12 feet southeast (shoreward) of a light post, 54½ feet northwest of northwest corner of a corrugated storage shed and 330 feet northwest of the northwest corner of the transit shed at shore end of pier. Elevation: 9.06 feet above mean lower low water.

BENCH MARK 8 (1966) is a standard disk, stamped "NO 8 1966", set in concrete on the inside corner of an L-shaped extension on the northwest corner of pier 2. It is about 11 feet northeast of waters edge, 21½ feet northeast of the northeast corner of tide house 43 feet southeast of the northwest face of pier 2, 3 feet north of southwest face of pier and about 55 feet east from extreme northwest corner of pier. Elevation: 10.31 feet above mean lower low water.

(OVER)

USCOMM-CGS-DC

Kahului (Kahului Harbor), Maui Island - (Cont'd.)

BENCH MARK 9 (1966) is a standard disk, stamped "NO 9 1966", set in concrete on pier 2 in the base of the first light pole southeast of the northwest end of pier 2. It is 93 feet southeast of Bench Mark 8 (1966), 12 feet northeast of waters edge, $7\frac{1}{2}$ feet northeast of the southwest face of pier, and 135 feet southeast of the northwest face of the pier. Elevation: 9.58 feet above mean lower low water.

Mean lower low water at Kahului (Kahului Harbor), Maui Island is based on 9 years of records, 1951-1959, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide observed (November 12, 1958) (June 20, 1959)	3.6
Mean higher high water	2.30
Mean high water	1.90
Mean tide level	1.15
Mean low water	0.40
Mean lower low water	0.00
Lowest tide observed (June 19-20, 1955)	-1.2

HAWAIIAN ISLANDS - 14

U. S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Kuheia Bay, Kahoolawe Island
Lat. 20° 35'.7; Long. 156° 36'.4

BENCH MARK 1 (1904) is the upper flat projecting face of a copper bolt, stamped "B.M. USC&GS," set horizontally into lava cliff bounding northerly side of bay, about 5 feet above sand beach, and 5 feet west of a stone fence that joins the cliff perpendicularly. Elevation: 13.55 feet above mean lower low water.

BENCH MARK 2 (1904) is the upper flat projecting face of a copper bolt, set horizontally into a lava cliff bounding the northeast side of Kuheia Bay. It is located 30 feet east of Bench Mark 1, about 6 feet above the beach and midway between the junctions of two sections of stone fence with the cliff, which together form a triangular shape enclosed area in which a number of large Keawe brush are growing. Elevation: 14.45 feet above mean lower low water.

Mean lower low water at Kuheia Bay is based on 158 high waters and 157 low waters, November 7, 1904 - March 1, 1905. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	2.10
Mean high water	1.70
Mean tide level	0.95
Mean low water	0.20
Mean lower low water	0.00

The estimated highest water level to the nearest half foot is 3 1/2 feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

USCOMM-CGS-DC

4/24/51

HAWAIIAN ISLANDS - 15

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Manele Bay, Lanai Island
Lat. $20^{\circ} 44'.6$; Long. $156^{\circ} 53'.3$

BENCH MARK 1 (1931) is a standard disk set in lava rock at north side of mooring ring about 35 feet north of stock-loading platform and 10 feet east of cliff. Elevation: 6.88 feet above mean lower low water.

BENCH MARK 2 (1921) is a standard disk set in south face of middle pier of stock-loading platform. Elevation: 7.71 feet above mean lower low water.

BENCH MARK 3 (1931) is a standard disk set in lava rock on first prominent rise about 60 feet south of stock-loading platform. Elevation: 12.59 feet above mean lower low water.

Mean lower low water at Manele Bay is based on 4 high waters and 3 low waters, March 11-13, 1931, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.0
Mean higher high water	1.80
Mean high water	1.40
Half tide level	0.80
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

3/26/65

HAWAIIAN ISLANDS - 16

U. S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Kaumalapau, Kaumalapau Harbor, Lanai Island
Lat. $20^{\circ}47'.4$; Long. $156^{\circ}59'.7$

BENCH MARK 1 (1927) is a standard disk, stamped "NO 1 1927," set vertically in concrete block located in masonry wall that extends along seaward side of highway and harbor parking lot at intersection of breakwater and masonry wall. Elevation: 11.57 feet above mean lower low water.

BENCH MARK 2 (1927) is a standard disk, stamped "NO 2 1927," set at northeastern corner (inshore end) of concrete wharf, about 35 feet seaward of rock bluff. Elevation: 12.47 feet above mean lower low water.

BENCH MARK 3 (1927) is a standard disk, stamped "NO 3 1927," set on top of masonry pier which is foundation block for large iron bitt above wharf. Elevation: 23.83 feet above mean lower low water.

BENCH MARK 4 = 17 M (U.S.G.S.) (1923) is a standard U.S. Geological Survey disk, stamped "17 M 1923," in Kaumalapau Harbor. Elevation: 174.89 feet above mean lower low water.

BENCH MARK 5 is a bronze spike with "33.51," inscribed in concrete, set in top of northeast end of masonry wall on west side of road, northeast of Bench Mark 1. Elevation: 33.84 feet above mean lower low water.

BENCH MARK HAWAII TERRITORY is a standard disk, stamped "HAWAII TERRITORY SURVEY," set in southwest end of masonry wall and about $4\frac{1}{2}$ feet above the parking area. It is $3\frac{1}{2}$ feet north of Bench Mark 1 and 27 feet north of telephone pole at southwest corner of parking lot. Elevation: 15.48 feet above mean lower low water.

(OVER)

USCOMM-CGS-DC

Kaumalapau, Kaumalapau Harbor,
Lanai Island (Cont'd)

-2-

Mean lower low water at Kaumalapau, Kaumalapau Harbor is based on 103 high waters and 101 low waters, December 8, 1931 - February 22, 1932, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	2.20
Mean high water	1.70
Mean tide level	0.95
Mean low water	0.20
Mean lower low water	0.00

The estimated highest water level to the nearest half foot is $3\frac{1}{2}$ feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

7/31/69

HAWAIIAN ISLANDS

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

TIDAL BENCH MARKS

Kalaupapa, Molokai
Lat. $21^{\circ} 12' 4''$; Long. $156^{\circ} 59' 1.5''$

BENCH MARK 1 (1967) is a standard disk, stamped "BM 1 1967" set in concrete seawall about $1\frac{1}{2}$ feet from shore side of breakwater and 2 feet seaward of the wharf. Elevation: 10.23 feet above mean lower low water.

BENCH MARK 2 (1967) is a standard disk stamped "BM 2 1967" set 12 feet north of eye on seawall used to secure winch block and 12 feet southeast of winch base on edge of wharf. Elevation: 15.81 feet above mean lower low water.

BENCH MARK 3 (1967) is a standard disk stamped "BM 3 1967", set in seaward porch of meat storage building, 2 feet south and 1 foot east of northwest corner. Elevation: 19.56 feet above mean lower low water.

BENCH MARK 10 (U.S.G.S) is a standard disk stamped "USGS IN COOPERATION WITH THE TERRITORY OF HAWAII", set in north side of wharf near winch house, 8 feet seaward of seawall along the shore and 8 feet north of old steps under the wharf. Elevation: 10.08 feet above mean lower low water.

Mean lower low water at Kalaupapa, Molokai is based on 104 high waters and 103 low waters, November 1 - December 15, 1967 and August - September 1968, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	2.00
Mean tide level	1.00
Mean Lower low water	0.00

The estimated highest water level to the nearest half foot is $3\frac{1}{2}$ feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

Note: The tides at this locality are chiefly diurnal.

4/24/51

HAWAIIAN ISLANDS - 17

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Pukoo, Pukoo Harbor, Molokai Island
Lat. 21° 04'3; Long. 156° 48'.0

BENCH MARK 1 (1925) is a standard disk, stamped "1 1925", set in concrete base of shore end of what was formerly wharf. Bench mark is on west side where it joined shore. Only few piles of old wharf remain. Elevation: 4.98 feet above mean lower low water.

BENCH MARK 2 (1925) is a standard disk, stamped "2 1925", set in solid rock just above level of and on north side of main road, where it joins road from ruined wharf. Bench mark is 10 feet southeast of southeast corner of Molokai Soda Works. Elevation: 6.54 feet above mean lower low water.

BENCH MARK 3 (1925) is a standard disk, stamped "3 1925", set vertically, flush with large rock in stone wall about 400 yards airline from shore end of ruined wharf. Bench mark is about 50 yards northeast of northwest corner of Pukoo Fish Pond, on north side of main road, about 15 feet west of point where stone property wall joins stone highway wall and about 1 foot above ground. Elevation: 8.98 feet above mean lower low water.

Mean lower low water at Pukoo is based on 6 high waters and 7 low waters, April 6-9, 1925, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.5
Mean higher high water	2.10
Mean high water	1.60
Half tide level	0.90
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

5/27/65

HAWAIIAN ISLANDS - 18

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

TIDAL BENCH MARKS

Kamalo, Kamalo Harbor, Molokai Island
Lat. 21°02'.9; Long. 156°52'.6

BENCH MARK 1 (1925) is a standard disk, stamped "1 1925," set flush in top center of south end of most southerly one of two concrete culverts inshore from old wharf at Kamalo Harbor. Elevation: 4.28 feet above mean lower low water.

BENCH MARK 3 (1925) is a standard disk, stamped "3 1925," set vertically near top of concrete block in south wall of concrete platform-scale base, just across State Highway 45 from its intersection with dirt road to old Kamalo Wharf. Elevation: 5.89 feet above mean lower low water.

BENCH MARK 5 (1965) is a standard disk, stamped "BM 5 1965," set in one of the concrete pilings of the old wharf at Kamalo Harbor. The piling is in the third row of pilings north of the offshore edge of the wharf and about midway between east and west ends of the wharf. There is no deck to the wharf in the vicinity of this bench mark. Elevation: 2.66 feet above mean lower low water.

BENCH MARK 6 (1965) is a standard disk, stamped "BM 6 1965," set in top of concrete monument flush with ground at southwest corner of intersection of State Highway 45 and dirt road leading to Kamalo Wharf. Elevation: 5.48 feet above mean lower low water.

BENCH MARK 7 (1965) is a standard triangulation station disk, stamped "RAY KAMA 1961," set in top of concrete monument flush with ground, 50 feet north of inshore end of rock groin which leads to old Kamalo Wharf and on west side of dirt road 10 feet north of Kamalo Wharf. Elevation: 3.43 feet above mean lower low water.

Mean lower low water at Kamalo, Kamalo Harbor is based on 14 high waters and 14 low waters, April 9-16, 1965, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

(OVER)

USCOMM-CGS-DC

Kamalo, Kamalo Harbor, Molokai Island (cont'd)

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	<u>Feet</u>
Mean higher high water	2.10
Mean high water	1.60
Mean tide level	0.90
Mean low water	0.20
Mean lower low water	0.00

The estimated highest water level to the nearest half foot is $3\frac{1}{2}$ feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

4/25/51

HAWAIIAN ISLANDS - 20

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Kolo, Kolo Harbor, Molokai Island

Lat. $21^{\circ} 05'.6$; Long. $157^{\circ} 11'.8$

BENCH MARK 1 (1925) is a standard disk, stamped "1 1925", set flush with top of 12-inch square wooden wharf stringer projecting 2 feet east from shore end of wharf. Elevation: 7.84 feet above mean lower low water.

BENCH MARK 2 (1925) is a standard disk, stamped "2 1925", set in top of a 4-foot boulder, largest in group of boulders lying among algarroba trees, 500 feet east of wharf and 45 feet south of center of road. Elevation: 13.97 feet above mean lower low water.

BENCH MARK 3 (1925) is a standard disk, stamped "3 1925", set in rock outcrop along northerly edge of road, about 3 feet higher than road level. Bench mark is 120 feet east of Bench Mark 2 and 150 feet west from cove east of wharf. Elevation: 17.73 feet above mean lower low water.

BENCH MARK 4, established by the U. S. Geological Survey, is a bronze nail set in rock outcrop on northerly edge of road, about 150 feet east of Bench Mark 3. Elevation: 9.29 feet above mean lower low water.

BENCH MARK A (1926) is a standard disk, stamped "A 1926", set in vertical face of rock, about 65 feet north of east side of wharf. Elevation: 17.10 feet above mean lower low water.

BENCH MARK B (1926) is a standard disk, stamped "B 1926", set in east concrete foundation of tank meter box located about 70 yards north along road from wharf, and about 8 feet north of center of road. Elevation: 18.64 feet above mean lower low water.

BENCH MARK C (1926) is a standard disk, stamped "C 1926", set in vertical face of large rock, 60 feet west of shack which is about 135 yards north along road from wharf, and about 35 feet north of center of road. Elevation: 19.41 feet above mean lower low water.

(OVER)

Mean lower low water at Kolo is based on 6 high waters and 6 low waters, May 27-30, 1925; 13 high waters and 14 low waters, February 17-23, 1926 and 58 high waters and 59 low waters, November 22 - December 15, 1930, the results from each tide series being reduced to mean values. Elevations of other tide planes, referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.0
Mean higher high water	2.00
Mean high water	1.50
Half tide level	0.85
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

10/31/56

HAWAIIAN ISLANDS - 21

U. S. DEPARTMENT OF COMMERCE

COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Laiemaloo, Oahu Island
Lat. 21° 38'.2; Long. 157° 55'.3

BENCH MARK 1 (1933) is a standard disk, stamped "LIEA 1 1933", set in concrete post 11 inches square on top and projecting 6 inches above ground, in well kept lawn on property of Una C. Walker, about 285 yards northeast of Laiemaloo concrete bridge, 46 feet south of guest house and 96 feet north of residence. Elevation: 23.19 feet above mean lower low water.

BENCH MARK 2 (1933) is a standard disk, stamped "LIEA 2 1933", set at northeast corner of Laiemaloo concrete bridge, on cap of abutment outside of guard rail. Elevation: 11.25 feet above mean lower low water.

BENCH MARK 3 (1933) is a standard disk, stamped "LIEA 3 1933", set about 2 feet above sand in lava outflow which forms prominent headland, about 330 yards south of Laiemaloo concrete bridge, at end of sand beach and about 200 feet east of Kamehameha Highway (paved). Elevation: 14.75 feet above mean lower low water.

Mean lower low water at Laiemaloo is based on 10 high waters and 10 low waters, August 21-26, 1933, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.5
Mean higher high water	2.20
Mean high water	1.60
Half tide level	0.95
Mean low water	0.30
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

10/31/56

HAWAIIAN ISLANDS - 22

U. S. DEPARTMENT OF COMMERCE

COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Waikane, Kaneohe Bay, Oahu Island
Lat. $21^{\circ} 29'.8$; Long. $157^{\circ} 50'.9$

BENCH MARK 1 (1932) is a standard disk, stamped "WAIKANE NO 1", set in top of concrete post, 69 feet north of center of World War II sentry box, 5 feet southeast of a concrete pipe outlet, about 169 feet south of center line of inshore end of pier and about 600 yards southeast of the Waikane Churches. Elevation: 4.60 feet above mean lower low water.

BENCH MARK 2 (1932) is a standard disk, stamped "WAIKANE NO 2", set in top of concrete post 15 feet southeast of center line of inshore end of pier, $7\frac{1}{2}$ feet west of northwest corner of shack, 1 foot inshore of edge of rock cribbing and about 550 yards southeast of Waikane Churches. Elevation: 5.33 feet above mean lower low water.

Mean lower low water at Waikane is based on 7 months of records, November 1932 - May 1933, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.5
Mean higher high water	2.20
Mean high water	1.80
Half tide level	1.10
Mean low water	0.40
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

11/1/56

HAWAIIAN ISLANDS - 23

U. S. DEPARTMENT OF COMMERCE

COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS .

Heeia, Kaneohe Bay, Oahu Island
Lat. 21° 25' .8; Long. 157° 48' .2

BENCH MARK 1 (1927) is a standard disk, stamped "1 1927", set near northeast corner of inshore one of three concrete blocks formerly used as guy wire anchors for radio tower. Bench mark is about 35 feet from shore and about $\frac{1}{4}$ mile northwest of Kaneohe Yacht Club pier. Elevation: 4.79 feet above mean lower low water.

BENCH MARK 2 (1927) is a standard disk, stamped "2 1927", set near southwest corner of middle one of three concrete blocks referred to in description of Bench Mark 1 (1927). Bench mark is about 80 feet from shore. Elevation: 4.87 feet above mean lower low water.

BENCH MARK 3 (1927) is a standard disk, stamped "3 1927", set near southwest corner of easterly (largest) one of three concrete blocks referred to in description of Bench Mark 1 (1927). Elevation: 5.22 feet above mean lower low water.

BENCH MARK 1 (1933) is a standard disk stamped "1" set in concrete retaining wall at corner where it turns west, about 80 feet northwest of shore end of Kaneohe Yacht Club pier. Elevation: 4.05 feet above mean lower low water.

BENCH MARK 2 (1933) is a standard disk stamped "2", set in concrete foundation near door of outbuilding on property of Mr. Kiyono, about 175 feet southeast of Kaneohe Yacht Club pier, and just west of first house No. 46-040 D. Elevation: 14.21 feet above mean lower low water.

BENCH MARK 3 (1933) is a standard disk stamped "3", set in concrete floor of lanai on east side of second house No. 46-0-040 C. Bench mark is about 185 feet east of Bench Mark 2 and about 120 yards southeast of Kaneohe Yacht Club pier. Elevation: 12.10 feet above mean lower low water.

(OVER)

Mean lower low water at Heeia is based on 4 high waters and 4 low waters, June 26-28, 1933, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.5
Mean higher high water	2.10
Mean high water	1.70
Half tide level	1.00
Mean low water	0.30
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

7/10/69

HAWAIIAN ISLANDS - 23A

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

TIDAL BENCH MARKS

Mokuoloe Island, Kaneohe Bay, Oahu Island
Lat. 21° 26'.1 N; Long. 157° 47'.5 W

BENCH MARK 1 (1957) is a standard disk, stamped "NO 1 1957", set in top of concrete wall forming part of west end of "Long Pond", (A fish experiment pond). It is ~~17 feet south of tide gage location~~, 20 feet northeast of east end of small concrete arch bridge and at junction of two concrete pond walls. Elevation: 3.70 feet above mean lower low water.

BENCH MARK 2 (1957) is a standard disk, stamped "NO 2 1957", set at intersection of concrete bulkheads of the sluice gate on south side of west of three smaller fish ponds to the south of "Long Pond". It is 75 feet east of the southwest corner of the pond area and 5 feet north of the north side of the small boat basin. Elevation: 3.94 feet above mean lower low water.

BENCH MARK 3 (1957) is a standard disk, stamped "NO 3 1957", set in concrete driveway to an old concrete pier near the southeast corner of fish experiment ponds. It is 54 feet northeast from the northwest corner of the boathouse, 41 feet north of the northeast corner of a three phase concrete block above ground transformer vault, 38 feet west from the north end of a reinforced concrete offset in the bulkhead wall along the east side of the Island's perimeter road and 1 foot north of the south edge of the driveway. Elevation: 6.84 feet above mean lower low water.

BENCH MARK 4 (1959) is a standard disk, stamped "4 1959", set in top of abutment of west pond wall of "Long Pond", at the northwest corner of the pond. It is ~~16 1/2 feet north of north wall of tide gage shelter~~, 3 1/2 feet south from north side of pond and 1 foot north of most northerly opening in the wall. Elevation: 3.65 feet above mean lower low water.

(OVER)

Mokuoloe Island (Cont'd)

BENCH MARK 5 (1967) is a standard disk, stamped "NO 5 1967", set in top of a concrete filled 8 inch pipe bollard which projects 1 foot at the east end of the small boat basin. It is near the Marine railway, 57 feet south from the south roof edge of the boat shed, $51\frac{1}{2}$ feet north of the northwest corner of the workshop building and 1 foot east of the edge of the boat basin bulkhead. Elevation: 5.16 feet above mean lower low water.

BENCH MARK 6 (1967) is a standard disk, stamped "NO 6 1967", set in top of concrete curb at the southeast corner of workshop building which is near the southeast corner of the small boat basin, adjacent and east of the marine railway. It is $2\frac{1}{2}$ feet east of the corner of the wood building and 1 foot above ground level. Elevation: 6.54 feet above mean lower low water.

BENCH MARK 7 (1968) is a standard disk, stamped "NO 7 1968", set in concrete walk $1\frac{1}{2}$ feet west of the southwest corner of the Institute of Marine Biology Building, Elevation: 5.92 feet above mean lower low water.

BENCH MARK 8 (1968) is a standard disk, stamped "NO 8 1968", set in the concrete walk in front of the south entrance on the west side of the National Science Foundation (NSF) Building on the east side of the Island. It is 32 feet north of the southwest corner of the building and $4\frac{1}{2}$ feet west of the west wall. Elevation: 6.30 feet above mean lower low water.

Mean lower low water at Mokuoloe Island, Kaneohe Bay, is based on 5 years of records, 1958-62, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide observed (Jan. 7, 1962)	3.3
Mean higher high water	2.00
Mean high water	1.60
Mean tide level	1.00
Mean low water	0.40
Mean lower low water	0.00

The estimated lowest water level to the nearest half foot is 1 foot below low water.

11/1/56

HAWAIIAN ISLANDS - 24

U. S. DEPARTMENT OF COMMERCE

COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Waimanalo Landing, Waimanalo Bay, Oahu Island
Lat. 21° 20'.1; Long. 157° 41'.6

BENCH MARK 5 (1938) is a standard hydrographic station disk, unstamped, set in top surface of concrete retaining wall, about 165 feet northwest of beach house of S. N. Castle which is about one mile south of Waimanalo Landing, and near a small group of Australian pine trees. Elevation: 10.49 feet above mean lower low water.

BENCH MARK 6 (1938) is a standard hydrographic station disk, unstamped, set in top surface of south end of concrete retaining wall, on west side of exit of a large culvert that passes underneath the Kalaniana'ole Highway, and about 100 feet southeast of beach house of S. N. Castle. Elevation: 7.59 feet above mean lower low water.

Mean lower low water at Waimanalo Landing is based on 12 months of records, August 1938 - September 1939, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.0
Mean higher high water	1.80
Mean high water	1.40
Half tide level	0.85
Mean low water	0.30
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

11/1/56

HAWAIIAN ISLANDS - 25

U. S. DEPARTMENT OF COMMERCE

COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Hanauma Bay, Koko Head, Oahu Island
Lat. 21° 16'.5; Long. 157° 41'.8

BENCH MARK 1 (1931) is a standard disk stamped "1" set in solid rock ledge on northeast side of Hanauma Bay, 10 feet northeast of small arch in buttress of cliff. Elevation: 5.92 feet above mean lower low water.

BENCH MARK 2 (1931) is a standard disk stamped "2", set in depression in rock outcrop on northeast side of Hanauma Bay, about 79 feet north of Bench Mark 1, about 20 feet east of first large black rock southeast of sand beach at head of bay and 3 feet southwest of edge of a large bush. Elevation: 7.06 feet above mean lower low water.

BENCH MARK 3 (1931) is a standard disk, stamped "3", set in solid rock ledge on northeast side of Hanauma Bay, about 135 yards northwest of Bench Mark 2, 75 feet southeast of small algarroba tree, 28 feet from water's edge and about 7 feet from cliff. Elevation: 5.85 feet above mean lower low water.

Mean lower low water at Hanauma Bay is based on 6 months of records, December 1931 - May 1932, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.0
Mean higher high water	1.90
Mean high water	1.50
Half tide level	0.85
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.05

10/15/69

HAWAIIAN ISLANDS - 26

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

TIDAL BENCH MARKS

Honolulu, Oahu Island
Lat. 21° 18'.4; Long. 157° 52'.0

BENCH MARK 2 (1872) is the Hawaiian Government "Standard City Bench Mark", unstamped and is the horizontal surface at the foot of the first pilaster on the southeast side of the entrance to the State of Hawaii Judiciary Building (Aliionlani Halo). It is at the south corner of the intersection of King and Mililani Streets and is about $4\frac{1}{2}$ feet above the entrance floor of building. Elevation: 17.15 feet above mean lower low water.

BENCH MARK 8 (1913) is a U.S.G.S. disk, stamped "B.M. ELV. 8.06 FEET", set in top of the southeast end of concrete bulkhead on the southwest side of Ala Moana Boulevard. It is across from the Hawaiian Electric Company's "Leslie A. Hicks Power Plant", at the northeast end of the waterway between Pier 7 and the ruins of Pier 6 about 2 feet northwest of the southeast end of bulkhead and 2 feet above the sidewalk. Elevation: 8.59 feet above mean lower low water.

BENCH MARK 10 (1925) is a standard disk, stamped "NO. 10 1925", set in an 8 inch square depression on top of a concrete bulkhead on the southwest side of Ala Moana Boulevard across from the Leslie A. Hicks Power Plant. It is at the northeast end of the waterway midway between Pier 7 and ruins of Pier 6, about 120 feet southeast of the northwest end of the bulkhead wall, $98\frac{1}{2}$ feet northwest of Bench Mark 8, 51 feet southeast of extended centerline of entrance between the two power plants and $2\frac{1}{2}$ feet above sidewalk. Elevation: 8.63 feet above mean lower low water.

BENCH MARK 11 (1925) is a standard disk, stamped "NO. 11 1925", set vertically in the southwest face at the south corner of the concrete foundation of the northern one of two Power Company plants at the corner of Ala Moana Boulevard and Alakea Street. It is about 36 feet northwest of the centerline of the Alakea Street entrance between the two plant buildings about 2 inches above the end of the curved concrete curb. Elevation: 6.15 feet above mean lower low water.

BENCH MARK 12 (1925) is a standard disk, stamped "NO. 12 1925", set in floor of peristyle of Federal Office Building, on the Merchant Street (Northeast) side. It is at the middle of the center one of nine arches, 1 foot southwest from edge of floor and directly under the word "CUSTOM" of the inscription "UNITED STATES POST OFFICE, CUSTOM HOUSE AND COURT HOUSE." Elevation: 13.24 feet above mean lower low water.

(OVER)

USCOMM-CGS-DC

Honolulu, Oahu Island (Cont'd)

BENCH MARK 13 (1925) is a standard disk, stamped "NO. 13 1925", set in the floor of the Library of Hawaii, King Street entrance. It is about 4 inches southwest of the most northwest of eight concrete pillars and on range with the outside of the wall running northwest. Elevation: 20.03 feet above mean lower low water.

BENCH MARK 14 (1925) is a standard disk, stamped "NO. 14 1925", set in top of concrete bannister wall on the northwest side of the King Street entrance to Iolani Palace. It is about 2 feet above the sidewalk and at the northeast side of a light standard. Elevation: 18.16 feet above mean lower low water.

BENCH MARK 15 (1925) is a standard disk, stamped "NO. 15 1925", set vertically in the Bishop Street side of the corner of the Alexander Young Hotel. It is at the south corner of Bishop and Hotel Streets about $\frac{1}{2}$ foot above the sidewalk. Elevation: 19.14 feet above mean lower low water.

BENCH MARK 19 (1925) is a plain brass disk, stamped "1" with a chiseled cross in center, set in concrete sidewalk at the east corner of Halekaunila and Mililani Streets. It is about 8 feet back from both street curb lines and 7 feet west of the westerly corner of the U.S. Army Recruiting Office. Elevation: 7.04 feet above mean lower low water.

BENCH MARK 20 (1960) is a standard disk, stamped "NO. 20 1960", set in the northwest corner of the concrete deck of pier 4. It is 1 foot east of the west end and 4 feet south of the north face of the pier. Elevation: 6.33 feet above mean lower low water.

BENCH MARK 21 (1964) is a standard disk, stamped "NO. 21 1964", set in top of concrete bulkhead on west side of Ala Moana Boulevard at the east end of the waterway between pier 4 and the ruins of pier 5A. It is about 139 feet north of the face of pier 4, 2 feet south of the north end of the raised bulkhead and 2 feet above the sidewalk. Elevation: 7.72 feet above mean lower low water.

Mean lower low water at Honolulu is based on 19 years of records, 1941-59. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide observed (Feb. 14, 1967)	3.5
Mean higher high water	1.90
Mean high water	1.40
Mean tide level	0.80
Mean low water	0.20
Mean lower low water	0.00
Lowest tide observed (Apr. 30, 1911)	-1.3

5/20/57

HAWAIIAN ISLANDS - 26A

U. S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Fort Kamehameha (Pearl Harbor Entrance), Oahu
Lat. $21^{\circ} 19'.7$; Long. $157^{\circ} 58'.1$

BENCH MARK 2 (1925) is a standard disk, stamped "NO 2 1925", set in coping on north side of old condemned Quarter-master Dock, 5 feet southwest of and about 10 feet above a concrete curbing set at the high water line. Elevation: 7.34 feet above mean lower low water.

BENCH MARK 3 (1925) is a standard disk, stamped "NO 3 1925", set in top of south corner of 5-foot square concrete block, about 4 feet above ground and in which is located an old sewer vent. It is 135 feet north-northwest of northeast corner of an old concrete foundation and just south of an old wooden warehouse. Elevation: 8.15 feet above mean lower water.

Mean lower low water at Fort Kamehameha (Pearl Harbor Entrance) is based on 30 high waters and 30 low waters, March 9 - July 23, 1925, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.0
Mean higher high water	2.00
Mean high water	1.50
Half tide level	0.80
Mean low water	0.10
Mean lower low water	0.00
Lowest tide (estimated)	-1.05

2/6/62

HAWAIIAN ISLANDS - 26B

U. S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Pearl Harbor (Dock Baker 21), Oahu Island
Lat. $21^{\circ} 21'.5$; Long. $157^{\circ} 57'.4$

BENCH MARK 1 (1950) is a chiseled cross on fourth step from bottom, leading to Officer's Boat Landing on Dock Baker 21, 1 foot from south end of step and near Berth B22. Elevation: 5.53 feet above mean lower low water.

BENCH MARK MON 180 (1950) is a brass disk in well under circular steel cover about 7 inches in diameter, at intersection of center lines of Eighth Street and Avenue A. Elevation: 10.50 feet above mean lower low water.

BENCH MARK 2 (1950) is a standard disk, stamped "NO 2 1950", set $106\frac{1}{2}$ feet south of northwest corner of Dock Baker 21, one foot east of edge of dock at Berth B21, $\frac{1}{2}$ foot north of north edge of large single iron mooring bitt and 128 feet north of northwest corner of Building No. 72. Elevation: 12.83 feet above mean lower low water.

BENCH MARK 3 (1950) is a standard disk, stamped "NO 3 1950", set in concrete manhole cover, 9 feet east of northwest corner of Building No. 72 and about one foot north of building. Elevation: 11.97 feet above mean lower low water.

BENCH MARK 4 (1950) is a standard disk, stamped "NO 4 1950", set in concrete footing of Building No. 179 at Eighth Street and Avenue A, $\frac{1}{2}$ foot from southeast corner of building, $1\frac{1}{2}$ feet from south edge of footing and $2\frac{1}{2}$ feet from east edge of footing. Elevation: 12.04 feet above mean lower low water.

Mean lower low water at Pearl Harbor (Dock Baker 21), Oahu Island is based on 4 years of records, 1951-1954, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	Feet
Mean higher high water	2.00
Mean high water	1.50
Mean tide level	0.85
Mean low water	0.20
Mean lower low water	0.00

The estimated highest water level to the nearest half foot is 3 feet above mean lower low water. The estimated lowest water level to the nearest half foot is $1\frac{1}{2}$ foot below mean lower low water.

USCOMM-CGS-DC

11/2/56

HAWAIIAN ISLANDS - 27

U. S. DEPARTMENT OF COMMERCE

COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Waianae, Pokai Bay, Oahu Island
Lat. $21^{\circ} 26' .7$; Long. $158^{\circ} 11' .5$

BENCH MARK 1 (1924) is a standard disk, stamped "1", set in second prominent lava rock point at southeast end of Pokai Beach Park sandy beach, 43 feet inshore from end of point and 20 feet west of center line of Waianae Valley Road extended. Elevation: 8.06 feet above mean lower low water.

BENCH MARK 2 (1924) is a standard disk, stamped "2", set in top of lava outcrop, on first prominent point at southeast corner of Pokai Beach Park sandy beach, 60 feet west of center line of Waianae Valley Road extended and 25 feet inshore from lava rock point. Elevation: 8.86 feet above mean lower low water.

BENCH MARK 4 (1948) is a standard disk, stamped "4 1948", set in lava outcrop on first point north of breakwater, about 20 feet inshore from east-west shoreline and nearly in line with intersection of main telephone line and its spur. Bench mark is about 400 feet southwest of Bench Mark 1. Elevation: 8.55 feet above mean lower low water.

BENCH MARK 5 (1948) is a standard disk, stamped "5 1948", set in lava outcrop, 3 feet inshore from edge of 10-foot cliff and 69 feet southwest of center line of breakwater. Bench mark is in line with intersection of main telephone line and its spur, and about 280 feet southwest of Bench Mark 4. Elevation: 9.76 feet above mean lower low water.

Mean lower low water at Waianae is based on 12 high waters and 12 low waters, March 17-22, 1924 and 1 month of records, May 1926, the results from both tide series being reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.0
Mean higher high water	1.80
Mean high water	1.40
Half tide level	0.80
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

11/2/56

HAWAIIAN ISLANDS - 28

U. S. DEPARTMENT OF COMMERCE

COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Haleiwa, Waialua Bay, Oahu Island
Lat. $21^{\circ} 35' .9$; Long. $158^{\circ} 06' .5$

BENCH MARK 1 (1924) is a standard disk, stamped "1", set in exact center of flat rock peninsula that juts out on east side of mouth of Anahulu River, where it enters into Waialua Bay. Bench mark is at west end of Haleiwa Beach. Elevation: 9.73 feet above mean lower low water.

BENCH MARK C 3 (1927) is a standard disk, stamped "C 3 1927", set in top of concrete post, 23 feet east of telephone pole No. 22T, $17\frac{1}{2}$ feet east of center line of an old dirt road, $15\frac{1}{2}$ feet west of northwest corner of an apartment building and 4 feet west of edge of a palm tree. It is about 300 feet north along Kamehameha highway from bridge across stream flowing out of Eke Ea, 105 feet north of Crustacean Inn and $50\frac{1}{2}$ feet east of center line of highway. Elevation: 9.60 feet above mean lower low water.

Mean lower low water at Haleiwa is based on 3 months of records, July - September 1932, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.0
Mean higher high water	1.60
Half tide level	0.80
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

The tide at this station is largely diurnal.

7/20/65

HAWAIIAN ISLANDS - 23

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

TIDAL BENCH MARKS

Hanamaulu Bay (Ahukini Landing), Kauai Island
Lat. $21^{\circ} 59'.7$; Long. $159^{\circ} 20'.1$

BENCH MARK 1 (1927) is a standard disk, stamped "NO 1 1927", set in southwest end of inshore one of concrete beams that parallel the shore at the abandoned wharf at Hanamaulu Bay. It is 50 feet southeast of a small, concrete house on the wharf, 20 feet southwest from edge of plank decking, 17 feet northwest from west corner of a low concrete wall foundation at extreme end of macadamized approach ramp and 1 foot southwest of a 16 inch diameter inclined conveyor pipeline. Elevation: 10.49 feet above mean lower low water.

BENCH MARK 3 (1927) is a standard disk, stamped "NO 3 1927", set in north corner of a flat concrete block that is northeast and lower 1 of 3 similar blocks located about 8 feet apart along wide, winding stone and concrete stairway leading up through trees to old buildings on bluff above abandoned wharf. It is 52 feet south of Bench Mark 1, 30 feet northeast of 16 inch diameter-inclined conveyor pipeline, $34\frac{1}{2}$ feet southwest of corner of black stone bulkhead hidden in trees, 3 feet south of large, gnarled, ironwood tree setting on edge of bluff, and 13 feet above macadamized approach ramp of pier. Elevation: 25.37 feet above mean lower low water.

Mean lower low water at Hanamaulu Bay is based on $3\frac{1}{2}$ months of records, May 19 - September 9, 1927, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	1.80
Mean high water	1.40
Mean tide level	0.80
Mean low water	0.20
Mean lower low water	0.00

The estimated highest water level to the nearest half foot is 3 feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

3/30/70

HAWAIIAN ISLANDS 30

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

TIDAL BENCH MARKS

Nawiliwili, Nawiliwili Bay, Kauai Island
Lat. $21^{\circ}57'.5$; Long. $159^{\circ}21'.4$

BENCH MARK 2 (1927) is a standard disk, stamped "NO 2 1927", set in the southwest corner of the concrete abutment at outside of concrete rail at southwest corner of old 2-lane divided bridge over Nawiliwili Stream. It is about 270 feet south of a side road leading to Kauai Surf Hotel, 42 feet east of east side of main Highway 51 bridge, and 2 feet north-east of south end of bridge. A 6-inch iron water pipe which uses the bridge for support in crossing stream lays directly upon the mark. Elevation: 9.20 feet above mean lower low water.

BENCH MARK 3 (1927) is a standard disk, stamped "NO 3 1927", set in concrete abutment at southeast corner of old 2-lane divided bridge over Nawiliwili Stream. It is about 200 feet south of side road leading to Kauai Surf Hotel, 68 feet east of east side of present Highway 51 bridge, and 2 feet northeast of south end of bridge. Elevation: 9.14 feet above mean lower low water.

BENCH MARK 5 (1954) is a standard disk, stamped "NO 5 1954", set in concrete walk leading to abandoned U.S. Coast Guard Boat Station Pier, about $\frac{1}{2}$ foot from west end of concrete walk, 10 feet west of west side of Coast Guard Building, and about 138 feet south of wharf face line of Pier 1. Elevation: 5.28 feet above mean lower low water.

BENCH MARK 6 (USE) is a chiseled cross with the inscription "3.990 USED 1932", inscribed in concrete deck of small boat landing at the east end of wharf (pier 1), 1 foot west of east end of platform. It is 144 feet east of wharf transit shed, at extreme east end of old wharf, 96 feet west of east end of the new wharf extension on northeast corner of an $8\frac{1}{2}$ x 36-foot section which is $5\frac{1}{2}$ feet lower than the main wharf. Elevation: 3.86 feet above mean lower low water.

(OVER)

USCOMM-CGS-DC

Nawiliwili, Nawiliwili Bay, Kauai Island (Cont'd)

BENCH MARK 8 (USE) is top of 2-inch brass pipe which projects 2 inches, set in $1\frac{1}{2}$ -foot square concrete monument with inscription, "BASE B", $1\frac{1}{2}$ feet below ground level, protected by a 12-inch diameter handhole, at northeast corner of small boat basin. It is about 52 feet north of extreme southeast corner of Pier 1, 40 feet west of centerline of road leading to end of jetty, and 19 feet southeast of the southeast corner of cement block building at east end of pier. Elevation: 6.64 feet above mean lower low water.

BENCH MARK 10 (1964) is a standard disk, stamped "NO 10 1964", set in center of 4-foot square mooring cleat foundation. It is south-southeast of abandoned Coast Guard Office, 31 feet west of centerline of road leading to end of jetty, and $58\frac{1}{2}$ feet southeast of Bench Mark 5. Elevation: 5.92 feet above mean lower low water.

BENCH MARK 11 (1967) is a standard disk, stamped "NO 11 1967", set in the southwest corner abutment of Highway 51 bridge over Nawiliwili Stream. It is $12\frac{1}{2}$ feet north of the south end of abutment, $2\frac{1}{2}$ feet west of the west side of bridge, and $\frac{1}{2}$ foot from the northwest corner of abutment. Elevation: 12.49 feet above mean lower low water.

BENCH MARK 12 (1969) is a standard disk, stamped "NO 12 1969", set on the extended centerline of State Highway 58 in the top of center of a $2\frac{1}{2}$ -foot wide seawall. It is about 150 yards east of the intersection of Highways 58 and 51, 174 feet south of the first drain through the seawall south of the north end of wall, and 132 feet north of the second drain south of the north end of the wall. Elevation: 8.89 feet above mean lower low water.

Mean lower low water at Nawiliwili, Nawiliwili Bay is based on 8 years of records, 1955-62, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	Feet
Highest tide observed (Dec. 18-20, 1968)	3.1
Mean higher high water	1.80
Mean high water	1.30
Mean tide level	0.75
Mean low water	0.20
Mean lower low water	0.00

The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

7/20/05

HAWAIIAN ISLANDS - 31

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

TIDAL BENCH MARKS

Koloa Landing, Kauai Island
Lat. 21° 53'.0; Long. 159° 28'.3

BENCH MARK 1 (1926) is a standard disk, stamped "1 1926", set in south side of a 4x4 foot concrete slab that projects 1 foot and is surrounded by large boulders, 150 feet east of Mouth of Waikomo Stream at Old Koloa Landing. It is on east side of small boat launching ramp, 75 feet south of ramp head, 12½ feet east of south end of brick and concrete bulkhead and 12 feet south of an 8x8 foot stone and concrete slab. Elevation: 6.52 feet above mean lower low water.

BENCH MARK 2 (1926) is a standard disk, stamped "2 1926", set in top of 3x5 foot black rack projecting 2 feet above general rock line, 150 feet west and 225 feet north of Bench Mark 1. It is across stream from houses on high bluff, 230 feet north from the point at east side of mouth of stream, 168 feet north from point opposite north end of small boat dock at Seven Seas Hotel, 45 feet south from north end of prominent rock channel of stream and 20 feet east of edge of stream. Elevation: 5.45 feet above mean lower low water.

BENCH MARK 3 (1926) is a standard disk, stamped "3 1926", set in a 4x8 foot, red bedrock outcrop about 1 foot above water level 176 feet north, upstream, from Bench Mark 2 at east edge of stream. It is 405 feet north of Old Koloa Landing along east side of Waikomo Stream, directly across from large black house on bluff which has a high stone retaining wall facing stream and 40 feet east-southeast across stream from stone and concrete fence corner. The mark is in stream flow at moderately high water and is hidden by trees. Elevation: 11.46 feet above mean lower low water.

Mean lower low water at Koloa Landing is based on 15 high waters and 14 low waters, April 8 - May 26, 1926, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	1.90
Mean high water	1.50
Mean tide level	0.85
Mean low water	0.20
Mean lower low water	0.00

(OVER)

USCOMM-CGS-DC

Koloa Landing, Kauai Island (Cont'd)

-2-

The estimated highest water level to the nearest half foot is 3 feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

7/21/65

HAWAIIAN ISLANDS - 32

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

TIDAL BENCH MARKS

Port Allen, Hanapepe Bay, Kauai Island
Lat. $21^{\circ} 54' .1$: Long. $159^{\circ} 35' .4$

BENCH MARK 1 (1926) is a standard disk, stamped "1 1926", set in concrete foundation for derrick on abandoned loading wharf at southwest end of Eleele, near inshore end on northwest side of breakwater, at east side of Hanapepe Bay, about 400 feet southeast across water from present Port Allen Pier. It is about 135 feet southwest of a stairway leading up to top of small bluff, 96 feet southwest of inshore end of pier, 20 feet southwest of old engine hoist, 4 feet northwest of a concrete stairway leading down to lower level boat landing, 16 inches southwest of edge of foundation and 0.8 inches above wharf level. Elevation: 14.44 feet above mean lower low water.

BENCH MARK 3 (1926) is a standard disk, stamped "3 1926", set in concrete cornerstone at west end of ruins of warehouse foundation wall, on bluff above inshore end of breakwater, 270 feet west-southwest of gas storage tanks. It is located on north edge of cut through which railway passed, $19\frac{1}{2}$ feet southeast of a power pole, $13\frac{1}{2}$ feet east of top step of stairway leading down to old wharf, $1\frac{1}{2}$ feet west of wall foundation, 3 feet lower than it's top and 1 foot southeast of an iron pipe guard rail. Elevation: 31.84 feet above mean lower low water.

BENCH MARK 4 (U.S.G.S.) is a standard disk, stamped "35", set in 1 foot diameter truncated concrete cone extending 1 foot above a 3 foot diameter base which projects 8 inches above ground, on bluff at inshore end of breakwater, 270 feet west-southwest of gas storage tanks. It is $12\frac{1}{2}$ feet west of west one of a row of 7 gas mains, 15 feet west-northwest of right-angle bend in gas mains, 27 feet east-northeast of a power pole and $31\frac{1}{2}$ feet north of Bench Mark 3. Elevation: 35.18 feet above mean lower low water.

Mean lower low water at Port Allen is based on 18 months of records, August 1948 - January 1950, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	1.70
Mean high water	1.30
Mean tide level	0.75
Mean low water	0.20
Mean lower low water	0.00

(OVER)

USCOMM-CGS-DC

Port Allen, Hanapepe Bay, Kauai Island (Cont'd)

-2-

The estimated highest water level to the nearest half foot is 3 feet above mean lower low water. The estimated lowest water level to the nearest half foot is 1 foot below mean lower low water.

4/25/51

HAWAIIAN ISLANDS - 33

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Waimea, Waimea Bay, Kauai Island
Lat. $21^{\circ} 57'.4$; Long. $159^{\circ} 40'.4$

BENCH MARK 1 (1926) is a standard disk set in southeast corner-stone of barn two doors west of Waimea Hotel. Bench mark is about 6 feet inside fence line and about 3 feet west of gateway. Elevation: 14.13 feet above mean lower low water.

BENCH MARK 2 (1926) is a standard disk set flush in top of stone retaining wall off southwest corner of platform scale. This scale is off southwest corner of sugar storehouse located at northern end of Waimea wharf. Elevation: 10.12 feet above mean lower low water.

BENCH MARK 3 (1926) is a standard disk set flush in top of southwest corner of concrete foundation of derrick located on beach at high water line, about 90 feet east of Waimea wharf. Elevation: 6.37 feet above mean lower low water.

BENCH MARK 4 (U.S.G.S.) is a U. S. Geological Survey brass disk, stamped "El. 9.091 feet", set in concrete block at north end of hedge which separates Town Courthouse (Sheriff's Office) grounds from Waimea Valley road. Bench mark is south of rear path to courthouse and one foot west of hedge line. Elevation: 9.85 feet above mean lower low water.

Mean lower low water at Waimea is based on 3 months of automatic gage records, January 14 - February 12, May 19 - June 23, and September 1-30, 1926, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:-----

	<u>Feet</u>
Highest tide (estimated)	3.0
Mean higher high water	1.60
Mean high water	1.20
Half tide level	0.70
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

7/21/55

HAWAIIAN ISLANDS - 34

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

TIDAL BENCH MARKS

Hanalei, Hanalei Bay, Kauai Island
Lat. 22° 12'.9; Long. 159° 30'.1

BENCH MARK 1 (1927) is a standard disk, unstamped, set in top of coping at northeast corner of concrete loading platform directly below northeast corner of metal roof, at outer end of abandoned pier at east side of Hanalei Bay, about 600 feet southwest of mouth of Hanalei River. Elevation: 8.74 feet above mean lower low water.

BENCH MARK 2 (1927) is a standard disk, unstamped, set vertically in south face of 6th concrete piling, westward from inshore end of abandoned pier about 3½ feet above present sand level. Elevation: 6.92 feet above mean lower low water.

BENCH MARK 3 (1927) is a standard disk, unstamped, set in north side of concrete ramp leading to abandoned pier. It is at inshore end of pier, near end of road running north along coast from Hanalei, at east end of concrete curbing, 1½ feet east of iron pipe sign post and across ramp from drinking fountain. Elevation: 7.94 feet above mean lower low water.

Mean lower low water at Hanalei is based on 2½ months of records, June 16 - September 6, 1927, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Mean higher high water	1.80
Mean high water	1.50
Mean tide level	0.85
Mean low water	0.20
Mean lower low water	0.00

The estimated highest water level to the nearest half foot is 3 feet above mean lower low water. The estimated highest water level to the nearest half foot is 1 foot below mean lower low water.

4/25/51

HAWAIIAN ISLANDS - 35

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Nonopapa, Niihau Island
Lat. $21^{\circ} 52'.2$; Long. $160^{\circ} 14'.1$

BENCH MARK 1 (1926) is a standard disk set in 3-foot by 5-foot flat black boulder at water's edge, about 150 feet north of south face of dock. Elevation: 4.77 feet above mean lower low water.

BENCH MARK 2 (1926) is a standard disk set in large rough black boulder about 80 feet northwest of Bench Mark 1, and about 4 feet above high water mark. Elevation: 7.25 feet above mean lower low water.

BENCH MARK 3 (1926) is a standard disk set in depression of large black boulder, partly embedded in sand and projecting about one foot above surface. Boulder is about 250 feet north of landing pier and about 5 feet above high water line. Elevation: 8.36 feet above mean lower low water.

Mean lower low water at Nonopapa is based on $2 \frac{1}{3}$ months of automatic gage records, June 13 - August 31, 1926, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	3.0
Mean higher high water	1.60
Mean high water	1.20
Half tide level	0.70
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

5/1/51

HAWAIIAN ISLANDS - 36

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Necker Island (Shark Bay)
Lat. $23^{\circ} 34'.7$; Long. $164^{\circ} 42'.4$

BENCH MARK 1 (1928) is a standard disk set in flat lava shelf on shoreline on the east side of the island. The bench mark is about 80 feet south of small pool located at east end of narrowest east-west portion near north end of island. Elevation: 5.94 feet above mean lower low water.

BENCH MARK 2 (1928) is a standard disk set in light-colored ledge on shoreline about 115 feet northeast of pool mentioned in description of Bench Mark 1. Elevation: 4.45 feet above mean lower low water.

BENCH MARK 3 (1928) is a standard disk set in flat lava shelf about 35 feet west of pool mentioned in description of Bench Mark 1. Bench mark is near trail leading up hill upon which astronomical station is located. Elevation: 5.49 feet above mean lower low water.

Mean lower low water at Necker Island (Shark Bay) is based on 13 high waters and 13 low waters, June 10-16, 1928, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	2.5
Mean higher high water	1.30
Mean high water	1.00
Half tide level	0.60
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

4/25/51

HAWAIIAN ISLANDS - 37

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

East Island, French Frigate Shoals
Lat. $23^{\circ} 47'.0$; Long. $166^{\circ} 12'.5$

BENCH MARK 1 (1928), which is also reference mark No. 1 for triangulation station SOUTHEAST BASE, is a standard reference mark disk set in mass of concrete with arrow pointing toward triangulation station (Bench Mark 2). Bench mark is at edge of grass line at southeast end of East Island. A 4-foot length of 2-inch iron pipe was driven about 3 feet into ground, and was imbedded in same mass of concrete and constitutes witness mark. Elevation: 5.94 feet above mean lower low water.

BENCH MARK 2 (1928) is a standard triangulation station disk marking station SOUTHEAST BASE and set in concrete at edge of grass line at southeast end of East Island. Elevation: 7.00 feet above mean lower low water.

BENCH MARK 3 (1928), which is also reference mark No. 1 for triangulation station END 2, is a standard reference mark disk set in top of concrete block at northwest end of East Island. Elevation: 8.71 feet above mean lower low water.

BENCH MARK 4 (1928), which is also triangulation station END 2, is a standard triangulation station disk set in top of 10-inch square by 36-inch concrete block projecting about 6 inches above surface of ground, at northwest end of East Island. Elevation: 8.43 feet above mean lower low water.

BENCH MARK 5 (1928), which is also reference mark No. 2 for triangulation station END 2, is a standard reference mark disk set in top of concrete block at northwest end of East Island. Elevation: 5.96 feet above mean lower low water.

Mean lower low water at East Island is based on 58 high waters and 58 low waters, July 11-- September 17, 1928, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	2.5
Mean higher high water	1.40
Mean high water	1.10
Half tide level	0.65
Mean low water	0.20
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

4/26/51

HAWAIIAN ISLANDS - 38

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Laysan Island

Lat. $25^{\circ} 46'$; Long. $171^{\circ} 45'$

BENCH MARK 1 (1930) is a standard disk set in top of 3-inch iron pipe projecting 3 feet above ground. Pipe is set in concrete and is about 250 yards south-southwest of Bench Mark 2. Elevation: 24.67 feet above mean lower low water.

BENCH MARK 2 (1930) = Magnetic Station LAYSAN is a standard disk set in top of 3-inch copper pipe, 9 feet long and projecting about 2 feet above surface of ground. Pipe is set in concrete block which projects 6 inches above ground. Bench mark is located near west-central part of island, due east of small boat harbor formerly used by Pacific Grain and Fertilizer Works and nearly due east of two palm trees about 100 yards away. Elevation: 21.98 feet above mean lower low water.

BENCH MARK 3 (1930), which is also an azimuth station, is a standard reference mark disk set in top of 3-inch iron pipe projecting $2\frac{1}{2}$ feet above ground. Pipe is set in concrete and is about 230 yards north of Bench Mark 2. Elevation: 27.06 feet above mean lower low water.

Mean lower low water at Laysan Island is based on 24 high waters and 23 low waters, August 6-17, 1930, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	2.0
Mean higher high water	1.00
Mean high water	0.80
Half tide level	0.45
Mean low water	0.10
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

4/26/51

HAWAIIAN ISLANDS - 39

U. S. COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Lisianski Island

Lat. $26^{\circ} 04'$; Long. $173^{\circ} 58'$

BENCH MARK 1 (1931) is a standard disk, stamped "1 1931", set in top of 1-inch iron pipe driven 6 feet into ground and projecting about 1 foot. Mass of concrete was poured around pipe about 5 feet below surface of ground. Bench mark is about 45 feet from grass line and is back from center of curve in beach between two points a little north of center of west side of island. Just east of bench mark is spot of green weed and all around is grass. Elevation: 6.41 feet above mean lower low water.

BENCH MARK 2 (1931) is a standard triangulation station disk marking station LISIANSKI. Disk is set in top of 3-inch brass pipe, 9 feet long, projecting 3 feet above surface of ground. A 12-inch square concrete block was placed around pipe to depth of 4 feet from surface of ground. Bench mark is located near west-central part of island about 200 yards back from beach. It is on highest point, at north end of prominent sand ridge which extends along west side of island. Area around station is covered with rank grass about 3 feet high. Elevation: 20.93 feet above mean lower low water.

Mean lower low water at Lisianski Island is based on 6 high waters and 5 low waters, August 25-28, 1931, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	<u>Feet</u>
Highest tide (estimated)	2.0
Mean higher high water	0.80
Mean high water	0.60
Half tide level—	0.35
Mean low water	0.10
Mean lower low water	0.00
Lowest tide (estimated)	-1.0

4/16/71

HAWAIIAN ISLANDS - 40

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

TIDAL BENCH MARKS

Sand Island, Midway Islands
Lat. $28^{\circ}12'.8$; Long. $177^{\circ}22'.0$

BENCH MARK 1 (1941) is a standard disk, stamped "NO 1 1941", set vertically in the southeast concrete wall of powerhouse at the center of the building where old and new sections join. It is at the north corner of intersection of Tuttle Way and Brannon Avenue about 63 feet northwest of the centerline of Brannon Avenue and 2 feet above ground. Elevation: 8.69 feet above mean lower low water.

BENCH MARK 2 (1941) is a standard disk, stamped "NO 2 1941", set on top of an old seawall, now filled with land on both sides flush with top. It is about 160 feet southwest of the south end of Nimitz Avenue, and 231 feet southeast of the centerline of Brannon Avenue. The seawall is on the south side of and parallels a taxiway to old SAR hanger and is on the north side of an antenna form. Elevation: 5.98 feet above mean lower low water.

BENCH MARK 3 (1941) is a standard disk, stamped "NO 3 1941", set on top of northeast edge of east concrete pier supporting steel water tank converted to observation tower. Tower is just across Cannon Avenue from large seaplane hangar and about 130 yards northeast of and behind headquarters building at northeast corner of intersection of Cannon and Nimitz Avenues. Elevation: 9.04 feet above mean lower low water.

BENCH MARK 18 (1950) is a standard disk, stamped "NO 18 1950", set in top of rectangular concrete manhole structure at northwest corner of Nimitz Avenue and Halsey Drive. It is 33 feet west of centerline of Nimitz Avenue, 56 feet north of centerline of Halsey Drive, $7\frac{1}{2}$ feet north of south edge and about 2 feet west of east edge of manhole. Elevation: 6.66 feet above mean lower low water.

BENCH MARK 19 (1959) is a standard disk, stamped "19 1959", set flush in top of seawall near northeast corner of Inner Harbor Boat Basin. It is about 15 feet south of corner projected, about 1 foot east of edge of wall and $2\frac{1}{2}$ feet east of tide staff. Elevation: 7.29 feet above mean lower low water.

(OVER)

BENCH MARK 20 (1959) is a standard disk, stamped "20 1959", set flush in top of 3 foot high steel bollard, near northeast corner of Inner Harbor Boat Basin. It is about 19 feet west of corner projected and $7\frac{1}{2}$ feet north of seawall, and $16\frac{1}{2}$ feet west of northeast corner of the basin. Elevation: 10.55 feet above mean lower low water.

BENCH MARK 21 (1959) is a standard disk, stamped "21 1959", set flush in concrete manhole structure $1\frac{1}{2}$ feet south of cover, at northeast corner of Inner Harbor Boat Basin. It is about 46 feet west of east seawall projected and $66\frac{1}{2}$ feet north of north seawall face. Elevation: 7.87 feet above mean lower low water.

BENCH MARK 22 (1965) is a standard disk, stamped "NO 22 1965", set in concrete topping of north seawall at the Inner Harbor Boat Basin. It is about 65 feet southwest of Bench Mark 21, and $60\frac{1}{2}$ feet west of Bench Mark 20 and 4 feet north of seawall face. Elevation: 7.32 feet above mean lower low water.

BENCH MARK 23 (1965) is a standard disk, stamped "NO 23 1965", set in a 15-foot by 52-foot concrete slab used for picnic area, surrounded by numerous ironwood trees. It is about 120 feet north of the north seawall face of the Inner Harbor Boat Basin, 76 feet northwest of Bench Mark 21, and $1\frac{1}{2}$ feet from southeast corner of the slab. Elevation: 10.94 feet above mean lower low water.

BENCH MARK 24 (1969) is a standard disk, stamped "NO 24 1969", set flush in concrete deck at inshore end of pier 6 in the Inner Harbor Boat Basin. It is about 49 feet south of the centerline of Roberts Street, $2\frac{1}{2}$ feet northeast of southwest face of pier and about on centerline of bulkhead cap which extends to the west. Elevation: 7.75 feet above mean lower low water.

BENCH MARK 25 (1969) is a standard disk, stamped "NO 25 1969", set in a 7-foot by 7-foot concrete manhole structure about 2 inches above ground level. It is about 200 feet southwest of the northwest corner of the Inner Harbor Boat Basin, $14\frac{1}{2}$ feet northwest of the west seawall face of the Boat Basin and 3 feet west of the center of the manhole cover. Elevation: 8.89 feet above mean lower low water.

Mean lower low water at Sand Island, Midway Islands, is based on 10 years of records, 1951-60, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

Sand Island, Midway Islands - (Cont'd)

-3-

	<u>Feet</u>
Highest tide observed (Jan. 11, 1958)	4.1
Mean higher high water	1.20
Mean high water	1.00
Mean tide level	0.60
Mean low water	0.20
Mean lower low water	0.00
Lowest tide observed (April 6 & May 5, 1969)	-1.0

3/14/71

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

TIDAL BENCH MARKS

Johnston Island, Hawaiian Islands
Lat. $16^{\circ}44'.7N$; Long. $169^{\circ}31'.0W$

BENCH MARK 6 (USN) is a bronze disk, stamped "S. LINE, STA. 40 + 00.00 ELEV. 7.523", set in concrete post level with surface of ground about 115 feet northwest of northwest line of runway lights. It is about 90 feet southeast and 12 feet southwest of northeast corner of concrete magazine (Building #205) which is 50 feet south of west end of NCO Club (Building #203), $69\frac{1}{2}$ feet northeast of the east corner of the most easterly one of seven large concrete slabs and $6\frac{1}{2}$ feet east of west end of roof of NCO Club. Elevation: 7.27 feet above mean lower low water.

BENCH MARK 12 (1955) is a standard disk, stamped "NO 12 1955", set in west side of concrete seawall which surrounds the Navy Pier. It is about 56 feet south of the south edge of the small concrete pier with tide house and 1 foot south of south edge of wooden ramp leading from Navy Pier to wooden boat pier. Elevation: 7.81 feet above mean lower low water.

BENCH MARK 13 (1955) is a standard disk, stamped "NO 13 1955", set in concrete coping extending along the inshore end of the Navy Pier. It is about $57\frac{1}{2}$ feet north of the northwest corner of Building #100 (Aerospace Supply Warehouse), 39 feet west of a fire hydrant, $14\frac{1}{2}$ feet west of east side of the dock and 1 foot east of east side of a concrete ramp leading to supply warehouse. Elevation: 7.63 feet above mean lower low water.

BENCH MARK 14 (USE) is a standard bench mark disk, stamped "NO 14", set in the top of the concrete seawall which forms the east side of the main boat dock. It is about 255 feet south of the northeast corner of the pier, 195 feet north of the inshore end of east side of pier and $\frac{1}{2}$ -foot west of the east face of the pier. Elevation: 7.65 feet above mean lower low water.

BENCH MARK 18 (1963) is a brass cap stamped, "TRAVERSE MON. NO. 3 ELEV. 7.938 JETTY 62", set in concrete mass flush with dirt road, on northeast end of island at end of jetty. It is about 44 feet east of the southwest corner of bulkhead around the Commanding Officers' house northwest of the Officers Club (Building #4) and 34 feet south of Base Commanders' Quarters on west side of road. Elevation: 7.70 feet above mean lower low water.

(OVER)

Johnston Island, Hawaiian Islands - (Cont'd.)

BENCH MARK 19 (1963) is a brass cap, stamped "62 POL 2 ELEV 6245", set in concrete monument which is protected by an 8-inch iron pipe projecting 3 inches above mark and fitted with a loose cover, located on northeast end of island about 82 feet south-southeast from southeast corner of Power Plant Building No. 45. It is about 131 feet southwest of southwest corner of tank form, Structure No. 50, 63 feet north of northeast corner and 2 feet east of extended east wall of Tire Shop Building No. 47 and $2\frac{1}{2}$ feet west of a 3-foot high red and white striped marker post. Elevation: 6.02 feet above mean lower low water.

BENCH MARK 21 (1964) is a standard disk, stamped "NO 21 1964", set on the northeast part of island in top of 2-foot high concrete wall. It is about 77 feet east from the northwest corner of west wing of Officers Club (Building #4) and 4 feet west from west edge of doorway along north side of building. Elevation: 10.72 feet above mean lower low water.

BENCH MARK 22 (1964) is a brass cap, stamped "TRAVERSE MON STA JENNY", set in concrete about 3 inches below ground level on northeast end of island, on range between Bench Marks 18 and 19. It is about 169 feet north-northwest of the northwest corner of the concrete wall around fuel tank form (Building #50), 149 feet east from southeast corner of guardrail around fuel pumps and 17 feet west of center of asphalt road. Elevation: 6.44 feet above mean lower low water.

BENCH MARK 28 (1964) is a standard disk, stamped "NO 28 1964", set in top of southeast corner of concrete platform at doorway to boiler room on west side of Officers Club (Building #4). It is about 27 feet north of the southwest corner and 24 feet south of northwest corner of building, 1 foot south of the doorway and 1 foot west of the wall. Elevation: 9.35 feet above mean lower low water

Mean lower low water at Johnston Island, Hawaiian Islands, is based on 8 years of records, 1950-51 and 1954-59, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

(OVER)

Johnston Island, Hawaiian Islands - (Cont'd.)

	<u>Feet</u>
Highest tide observed (Jan. 13, 1958)	5.1
Mean higher high water	2.10
Mean high water	1.90
Mean tide level	1.00
Mean low water	0.10
Mean lower low water	0.00
Lowest tide observed (March 23, 24, 25, 1951)	-1.7