

Section 5

GEOGRAPHY AND ENVIRONMENT

This section relates to land and water areas, physical geography, climate, air and water quality, noise, and other geographic and environmental measurements of Hawaii. Most statistics on land use and ownership, however, appear in Section 6.

The State consists of eight major islands and 124 minor islands with a total land area of 6,425 square miles and a general coastline of 750 miles. Honolulu is 214 miles from Hilo, 1,367 miles from Kure Atoll (the westernmost end of the State), 2,397 miles from San Francisco, and 4,829 miles from Washington, D.C. The highest peak in the State is Mauna Kea, 13,796 feet above sea level; the longest stream is Kaukonahua Stream, Oahu, 33 miles in length; the deepest lake is Kauhako, on Molokai, 814 feet; and the highest named waterfall is Kahiwa, Molokai, a 1,750-foot cascade. Various measures of air pollution, such as suspended particulate matter, indicate that Honolulu is one of the cleanest cities in the nation. There is also relatively little water pollution: the 34 major beaches surveyed in 1984 were found to have fecal coliform levels per 100 ml. ranging from 2.3 to 109.7, and all 34 were within EPA standards. More than 1,200 species, subspecies, and varieties of native fauna and flora have been proposed or accepted for inclusion on lists of endangered, threatened, or extinct organisms. Climatically, Hawaii is marked by remarkably balmy temperatures and wide variations in rainfall. The all-time temperature range at Honolulu International Airport, for example, was from 53° to 94°F. Average precipitation, however, ranges from less than nine inches at Kawaihae to 451 inches atop Waialeale. The largest volcanic eruptions in Island history (1859 and 1950) each produced 600 million cubic yards of lava, the worst earthquake attained 7.5 on the Richter scale, the highest tsunami wave reached 56 feet, and the most destructive hurricane (Iwa, in 1982) gusted to 117 miles per hour. Water withdrawn for use in 1980 averaged 2.9 billion gallons per day, compared with 2.8 billion in 1975 and 2.7 billion in 1970. Among 31 neighborhoods on Oahu, median noise levels in 1981-1982 ranged from 37 decibels (in Mililani) to 57 decibels (in Pawa).

Important sources of data include the U.S. Geological Survey, National Ocean Survey, National Weather Service, U.S. Bureau of the Census Geography Division, the Division of Water and Land Development of the State Department of Land and Natural Resources, the State Department of Health, and the University of Hawaii Institute of Geophysics. Detailed information is given in Atlas of Hawaii, 2nd edition, published by the University of Hawaii Press in 1983. National data are reported in Statistical Abstract of the United States: 1985, Section 7.

Table 135.-- GREAT CIRCLE DISTANCES BETWEEN SPECIFIED PLACES

Place	Statute miles	Kilometers
DISTANCES FROM HONOLULU INTERNATIONAL AIRPORT		
Hawaiian Islands locations:		
Hilo, Hawaii	214	344
Kailua, Kona, Hawaii	168	270
Kahului, Maui	98	158
Lanai Airport	72	116
Molokai Airport	54	87
Lihue, Kauai	103	166
Puuwai, Niihau	152	245
Nihoa	283	455
Necker Island	520	837
French Frigate Shoals	556	895
Gardner Pinnacles	688	1,107
Maro Reef	851	1,369
Laysan Island	936	1,506
Lisianski Island	1,065	1,714
Pearl and Hermes Atoll	1,208	1,944
Midway Islands	1,309	2,106
Kure Atoll	1,367	2,200
Other Pacific locations:		
Apra Harbor, Guam	3,806	6,124
Auckland, New Zealand	4,393	7,068
Hong Kong	5,541	8,915
Johnston Atoll	820	1,319
Kingman Reef	1,073	1,726
Kiritimati (Christmas Island), Kiribati	1,344	2,163
Majuro, Marshall Islands	2,271	3,654
Manila, Philippines	5,293	8,516
Nuku Hiva, Marquesas Islands	2,400	3,864
Pago Pago, American Samoa	2,606	4,193
Palmyra Atoll	1,101	1,772
Papeete, Tahiti	2,741	4,410
Suva, Fiji	3,159	5,083
Sydney (Port Jackson), Australia	5,070	8,158
Tokyo, Japan	3,847	6,190
Wake Island	2,294	3,691
North and South American locations:		
Anchorage, Alaska	2,781	4,475
Cape Horn, Chile	7,457	11,998

Continued on next page.

Table 135.-- GREAT CIRCLE DISTANCES BETWEEN SPECIFIED PLACES -- Con.

Place	Statute miles	Kilometers
DISTANCES FROM HONOLULU INT. AIRPORT--Con.		
North and South American locations, con.:		
Chicago, Illinois	4,179	6,724
Cristobal, Canal Zone	5,214	8,389
Los Angeles, California	2,557	4,114
Miami, Florida	4,856	7,813
New York, New York	4,959	7,979
Portland, Oregon	2,595	4,175
San Diego, California	2,610	4,199
San Francisco, California	2,397	3,857
Seattle, Washington	2,679	4,311
Vancouver, B.C.	2,709	4,359
Tijuana, Mexico	2,616	4,209
Washington, D.C.	4,829	7,770
London, England	7,226	11,627
Bombay, India	8,010	12,888
Ghanzi, Botswana 1/	12,417	19,979
Equator, due south of Honolulu	1,470	2,367
North Pole	4,740	7,631
OTHER DISTANCES		
Hilo to --		
Los Angeles, California	2,447	3,937
San Francisco, California	2,315	3,725
Kure Atoll to --		
Cape Kumukahi, Puna, Hawaii 2/	1,523	2,451
Log Point, Elliot Key, Florida 3/	5,852	9,416
Tokyo, Japan	2,486	4,000
West Quoddy Head, Maine	5,788	9,313

1/ Ghanzi, Botswana, is Honolulu's antipode, that is, the point precisely opposite to it on the globe.

2/ Cape Kumukahi and Kure Atoll are the points farthest apart in the Hawaiian Archipelago and State of Hawaii.

3/ Log Point and Kure Atoll are the points farthest apart in the fifty states.

Source: U. S. Department of the Interior, Geological Survey, Elevations and Distances in the United States (1970), and distance computations prepared for the Department of Planning and Economic Development.

Table 136.-- WIDTHS AND DEPTHS OF CHANNELS

Channel <u>1/</u>	Width <u>2/</u>		Depth <u>3/</u>	
	Statute miles	Kilometers	Feet	Meters
Alenuihaha (Hawaii-Maui)	29.6	47.6	6,810	2,076
Alalakeiki (Kahoolawe-Maui)	6.7	10.8	822	251
Kealaikahiki (Kahoolawe-Lanai)	17.8	28.6	1,086	331
Auau (Lanai-Maui)	9.5	15.3	252	77
Kalohi (Lanai-Molokai)	9.2	14.8	540	165
Pailolo (Maui-Molokai)	8.8	14.2	846	258
Kaiwi (Molokai-Oahu)	25.8	41.5	2,202	671
Kauai (Oahu-Kauai)	72.1	116.0	10,890	3,319
Kaulakahi (Kauai-Niihau)	17.2	27.7	3,570	1,088
Niihau-Kaula	21.5	34.6	5,364	1,635
Niihau-Nihoa	133.9	215.5	14,550	4,435
Nihoa-Necker I.	179.6	289.0	12,600	3,840
Necker I.-French Frigate Shoals	100.3	161.4	12,780	3,895
French Frigate Shoals-Gardner Pinnacles ..	137.0	220.5	11,448	3,489
Gardner Pinnacles-Marou Reef	155.5	250.3	12,300	3,749
Marou Reef-Laysan I.	65.9	106.1	8,280	2,524
Laysan I.-Lisianski I.	137.4	221.1	16,830	5,130
Lisianski I.-Pearl and Hermes Atoll	162.6	261.7	17,400	5,304
Pearl and Hermes Atoll-Midway Islands	86.9	139.9	15,840	4,828
Midway Islands-Kure Atoll	57.1	91.9	12,960	3,950

1/ Listed in geographic order, from east to west. The channels between major islands were measured between the following points:

- Alenuihaha: Upolu Pt., Hawaii, to Puhilele Pt., Maui;
- Alalakeiki: Lae o ka Ule, Kahoolawe, to Nukuele Pt., Maui;
- Kealaikahiki: Makaalae, Kahoolawe, to Kamaiki Pt., Lanai;
- Auau: Kikoa Pt., Lanai, to Lahaina, Maui;
- Kalohi: Wahie Pt., Lanai, to Kamalo, Molokai;
- Pailolo: Lipoa Pt., Maui, to Pohakuloa, Molokai;
- Kaiwi: Ilio Pt., Molokai, to Makapuu Pt., Oahu;
- Kauai: Kaena Pt., Oahu, to Kamilo Pt., Kauai;
- Kaulakahi: Mana Pt., Kauai, to Kaunuopou, Niihau.

2/ Width measured in statute miles between designated points on National Ocean Survey and Coast and Geodetic Survey charts. Width in kilometers calculated from miles (1 mile = 1.60934 km.).

3/ Depths given are the deepest soundings noted at or near the line joining the two designated points, on National Ocean Survey and Coast and Geodetic Survey charts. Depths measured in fathoms and converted to feet and meters (1 fathom = 6 feet = 1.8288 meters).

Source: Compiled by Lee S. Motteler, Geography and Map Division, Bernice P. Bishop Museum, in November 1980.

Table 137.-- GENERAL COASTLINE AND TIDAL SHORELINE OF COUNTIES AND ISLANDS

County and island	General coastline <u>1/</u>		Tidal shoreline <u>2/</u>	
	Statute miles	Kilo-meters <u>3/</u>	Statute miles	Kilo-meters <u>3/</u>
State total	750	1,207	1,052	1,693
Counties:				
Hawaii	266	428	313	504
Maui, including Kalawao	210	338	343	552
Honolulu	137	220	234	377
Kauai	137	220	162	261
Islands: <u>4/</u>				
Hawaii	266	428	313	504
Maui	120	193	149	240
Kahoolawe	29	47	36	58
Lanai	47	76	52	84
Molokai	88	142	106	171
Oahu	112	180	209	336
Kauai	90	145	110	177
Niihau	45	72	50	80
Kaula	2	3	2	3
Northwestern Hawaiian Islands <u>5/</u> ..	25	40	25	40
Nihoa	3	5	3	5
Necker Island	2	3	2	3
French Frigate Shoals	6	10	6	10
Laysan Island	6	10	6	10
Lisianski Island	3	5	3	5
Kure Atoll	5	8	5	8

1/ Figures are lengths of general outline of seacoast. Data for the four islands of Maui County are not consistent with the reported county total.

2/ Shoreline of outer coast, offshore islands, bays, rivers, and creeks is included to the head of tidewater or to a point where tidal waters narrow to a width of 100 feet.

3/ Derived from data expressed in statute miles; independently rounded and accordingly may not add exactly to indicated totals and subtotals.
1 mi. = 1.609 km.

4/ Data are not available for five minor islands: Molokini, Lehua, Gardner Pinnacles, Maro Reef, and Pearl and Hermes Atoll.

5/ Excludes the Midway Islands, which are part of the Hawaiian Archipelago but not legally part of the State of Hawaii. Midway has a general coastline of 20 miles and a tidal shoreline of 33 miles.

Source: U.S. Department of Commerce, National Ocean Survey, The Coastline of the United States (1975) and records.

Table 138.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS: 1982

[See maps on page 6]

County or island	Square miles		
	Total	Land <u>2/</u>	Inland water <u>3/</u>
State total	6,470.8	6,425.2	45.6
Counties: <u>4/</u>			
Hawaii	4,035.2	4,034.2	1.0
Maui	1,171.0	1,161.6	9.4
Kalawao	14.3	13.3	1.0
Honolulu <u>5/</u>	620.5	596.3	24.2
Kauai <u>5/</u>	629.8	619.8	10.0
Islands: <u>4/</u>			
Hawaii	4,035.2	4,034.2	1.0
Maui <u>6/</u>	734.5	728.6	5.9
Kahoolawe	45.9	45.0	0.9
Lanai	141.2	140.4	0.8
Molokai	263.7	260.9	2.8
Oahu	617.6	593.6	24.0
Kauai	558.2	549.4	8.8
Niihau <u>7/</u>	71.1	70.0	1.1
Kaula	0.4	0.4	-
Northwestern Hawaiian Islands <u>8/</u>	2.910	2.690	0.220
Nihoa	0.238	0.238	-
Necker Island	0.105	0.105	-
French Frigate Shoals	0.081	0.081	-
Gardner Pinnacles	0.011	0.011	-
Maro Reef	Awash	Awash	Awash
Laysan Island	1.454	1.234	0.220
Lisianski Island	0.586	0.586	-
Pearl and Hermes Atoll	0.106	0.106	-
Kure Atoll	0.329	0.329	-

Continued on next page.

Table 138.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS: 1982 -- Con.

County or island	Square kilometers <u>1/</u>		Acres <u>1/</u>	
	Total	Land <u>2/</u>	Total	Land <u>2/</u>
State total	16,759.3	16,641.2	4,141,312	4,112,128
Counties: <u>4/</u>				
Hawaii	10,451.1	10,448.5	2,582,528	2,581,888
Mau i	3,032.9	3,008.5	749,440	743,424
Kalawao	37.0	34.4	9,152	8,512
Honolulu <u>5/</u>	1,607.1	1,544.4	397,120	381,632
Kauai <u>5/</u>	1,631.2	1,605.3	403,072	396,672
Islands: <u>4/</u>				
Hawaii	10,451.1	10,448.5	2,582,528	2,581,888
Mau i <u>6/</u>	1,902.3	1,887.1	470,080	466,304
Kahoolawe	118.9	116.5	29,376	28,800
Lanai	365.7	363.6	90,368	89,856
Molokai	683.0	675.7	168,768	166,976
Oahu	1,599.6	1,537.4	395,264	379,904
Kauai	1,445.7	1,422.9	357,248	351,616
Niihau <u>7/</u>	184.1	181.3	45,504	44,800
Kaula	1.0	1.0	256	256
Northwestern Hawaiian Islands <u>8/</u>	7.5	7.0	1,862	1,722
Nihoa	0.6	0.6	152	152
Necker Island	0.3	0.3	67	67
French Frigate Shoals	0.2	0.2	52	52
Gardner Pinnacles	0.0	0.0	7	7
Maro Reef	Awash	Awash	Awash	Awash
Laysan Island	3.8	3.2	931	790
Lisianski Island	1.5	1.5	375	375
Pearl and Hermes Atoll	0.3	0.3	68	68
Kure Atoll	0.9	0.9	211	211

1/ Areas in square kilometers and acres were calculated directly from the figures shown for square miles; these equivalents were independently rounded, and hence may not add exactly to the indicated totals and subtotals. 1 square mile = 640 acres = 2.58999 square kilometers.

2/ Dry land and land temporarily or partially covered by water, as marshland, swamps, etc.; streams and canals under one-eighth statute mile wide; and lakes, reservoirs, and ponds under 40 acres of area.

Continued on next page.

Table 138.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS: 1982 -- Con.

3/ Permanent inland water surface, such as lakes, reservoirs, and ponds having 40 acres or more of area; streams, sloughs, estuaries, and canals one-eighth statute mile or more in width; deeply indented embayments and sounds, and other coastal waters behind or sheltered by headlands or islands separated by less than 1 nautical mile of water, and islands having less than 40 acres of area.

4/ Because of rounding, island figures may not add to county figures.

5/ Kaula, included here with Kauai County, has also been claimed by the City and County of Honolulu.

6/ Molokini, offshore of Maui, not measured; other sources give the area of MoTokini as 18.6 acres (0.03 square miles or 0.075 square kilometers).

7/ Includes Lehua, previously reported as 243 acres (0.38 square miles or 0.98 square kilometers).

8/ Exclusive of the Midway Islands, which are part of the Hawaiian Archipelago but not legally part of the State of Hawaii.

Source: Unpublished data supplied by the Geography Division, U.S. Bureau of the Census, May 5, 1983; cited in the Hawaii State Department of Planning and Economic Development, Remeasurements of the Area of Hawaii, 1982 (Statistical Memorandum 83-6, May 18, 1983).

Table 139.-- MAJOR AND MINOR ISLANDS IN THE HAWAIIAN ARCHIPELAGO

Classification	Number of islands		Land area (square miles)
	Total	Inhabited, 1980 <u>1/</u>	
All named islands	137	15	6,427.0
Major islands	8	7	6,419.4
Named minor islands <u>2/</u>	129	8	7.6
Offshore of major islands	96	4	2.6
Northwestern Hawaiian Islands <u>3/</u>	33	4	4.9
Part of State	28	3	2.9
Not part of State (Midway Islands)	5	1	2.0

1/ For populations, see present volume, table 5.

2/ For individual data, see DPED Report GN-6, pp. 3-7.

3/ The 33 islets are in 10 clusters.

Source: Hawaii State Department of Planning and Economic Development, Geographic Names Approved, Second Quarter 1969 (Report GN-6, July 8, 1969), p. 8; data for Midway Islands supplied by Lee S. Motteler, Bishop Museum.

Table 140.-- ELEVATIONS OF MAJOR SUMMITS

[Elevation of the highest point on each island
and other important peaks]

Island and mountain	Feet	Meters
Hawaii:		
Mauna Kea 1/	13,796	4,205
Mauna Loa 1/	13,679	4,169
Hualalai	8,271	2,521
Kaumu o Kaleihohie	5,480	1,670
Kilauea (Uwekahuna)	4,093	1,248
Kilauea (Halemaumau Rim)	3,660	1,116
Kahoolawe:		
Puu Moaulanui	1,483	452
Puu Moaulaiki	1,434	437
Molokini	160	49
Maui:		
Haleakala (Red Hill)	10,023	3,055
Haleakala (Kaupo Gap)	8,201	2,500
Puu Kukui	5,788	1,764
Iao Needle	2,250	686
Lanai:		
Lanaihale	3,370	1,027
Molokai:		
Kamakou	4,961	1,512
Olokui	4,606	1,404
Kaunuohua	4,535	1,382
Kalaupapa Lookout	1,600	488
Mauna Loa (Kukui)	1,430	436
Oahu:		
Kaala	4,017	1,224
Puu Kalena	3,504	1,068
Konahuanui	3,150	960
Tantalus	2,013	614
Olomana	1,643	501
Koko Crater (Kohalepelepe)	1,208	368
Nuuanu Pali Lookout	1,186	361
Diamond Head	760	232
Koko Head	642	196
Punchbowl	500	152

Continued on next page.

Table 140.-- ELEVATIONS OF MAJOR SUMMITS -- Con.

Island and mountain	Feet	Meters
Kauai:		
Kawaikini	5,243	1,598
Waialeale	5,148	1,569
Namolokama Mountain	4,421	1,348
Kalalau Lookout	4,120	1,256
Hauptu	2,297	700
Sleeping Giant (Nonou)	1,241	378
Niihau:		
Paniau	1,281	390
Lehua	699	213
Kaula	550	168
Nihoa:		
Millers Peak	910	277
Necker Island:		
Summit Hill	277	84
French Frigate Shoals:		
La Perouse Pinnacles	135	41
Gardner Pinnacles	190	58
Maro Reef	Awash	Awash
Laysan Island	35	11
Lisianski Island	20	6
Pearl and Hermes Atoll	10	3
Midway Islands	12	4
Kure Atoll	20	6

1/ The adjacent ocean floor has an average depth of 2,800 fathoms and a maximum depth of 3,045 fathoms. Thus, Mauna Kea and Mauna Loa rise respectively 30,596 feet and 30,479 feet above their submarine bases as calculated from average depths, and respectively 32,066 and 31,499 feet above as calculated from maximum depths. So measured, Mauna Kea and Mauna Loa are the world's tallest mountains.

Source: U.S. National Cartographic Information Center, data provided October 11, 1978; U.S. Geological Survey topographic maps; E. D. Baldwin, 1883 Molokini figure on Hawaiian Government Survey Reg. Map No. 1276; National Geodetic Survey 1969 figure for Kaala, provided by U.S. Geological Survey, Honolulu office, July 23, 1984; U.S.S. Tanager survey, 1923 (for Pearl and Hermes Atoll). Data compiled with assistance of Lee S. Motteler, Bernice P. Bishop Museum.

Table 141.-- MAJOR STREAMS, BY ISLANDS

Island	Feature or stream	Length or ave. discharge
Longest water feature (miles):		
Hawaii	Wailuku River	32.0
Maui	Kalialinui-Waiale Gulch	18.0
Kahoolawe	Ahupu Gulch	4.0
Lanai	Maunalei-Waialala Gulch	12.9
Molokai	Wailau-Pulena Stream	6.5
Oahu	Kaukonahua Stream (So. Fork)	33.0
Kauai	Waimea River-Poomau Stream .	19.5
Niihau	Keanaulii-Puniopo Valley ...	5.9
Largest perennial stream (miles): <u>1/</u>		
Hawaii	Wailuku River	22.7
Maui	Palikea Stream	7.8
Molokai	Wailau-Pulena Stream	6.5
Oahu	Kaukonahua Stream	30.0
Kauai	Waimea River	19.7
Streams with greatest average discharge (million gal./day):		
Hawaii	Wailuku River	185
Maui	Iao Stream	54
Molokai	Wailau Stream	30
Oahu	Waikele Stream	25
Kauai	Hanalei River	140

1/ Estimated on basis of drainage area rather than stream runoff. Other major streams include Wailoa River, Hawaii (1/2-mile long); Honokohau Stream (9.4 miles long) and Iao Stream (5), both on Maui; Halawa Stream (6.4), Waikolu Stream (4.7), and Pelekunu (2.3), all on Molokai; Waikele Stream (15.3), Kipapa Stream (12.8), Waiakakalaua Stream (11.8), Nuuanu Stream (4), and Ala Wai Canal (1.9), all on Oahu; and the Makaweli River (15.1), Wainiha River (13.8), Hanapepe River (13.3), and Wailua River (11.8), all on Kauai.

Source: Longest water feature from U.S. Geological Survey, records; other data from Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, records.

Table 142.-- LAKES AND LAKE-LIKE WATERS, BY ISLANDS: 1985

Island and lake	Elevation (feet)	Area 1/ (acres)	Maximum depth (feet)	Type
Hawaii:				
'Aimakapa	(SL)	15	(NA)	Coastal pool .
Green Lake	3	2	20	Lake
Lake Waiau 2/	13,020	2	10	Lake
Waiakea Pond	(SL)	27	7	Tidal Pond ...
Maui:				
Kanaha Pond	(SL)	41	<3	Marsh
Kealia Pond	(SL)	500	(NA)	Marsh
Violet Lake	5,020	0.02-1	(NA)	Bog Pool
Wai 'Anapanapa	6,790	0.2	(NA)	Pond
Wai'ele'ele	6,690	0.5	21	Pond
Molokai:				
Kauhako	(SL)	0.9	814	Pool
Kualapu'u Reservoir .	821	100	50	Reservoir
Meyer Lake	2,021	6-10	5	Impoundment ..
Oahu:				
Ka'elepulu Pond	(SL)	198	(NA)	Lake
Kawainui Marsh	(SL)	1,000	(NA)	Marsh
Salt Lake	(SL)	49	2	Lake
Wahiawa Reservoir ...	842	302	85	Reservoir
Kauai:				
Nomilu Fishpond	(SL)	20	66	Pond
Waita Reservoir	241	424	23	Reservoir
Niihau:				
Halali'i Lake	(SL)	841-865	(NA)	Playa
Halulu Lake	(SL)	182-371	(NA)	Playa
Laysan:				
Unnamed closed lagoon	(SL)	161	16	Closed Lagoon

Footnotes and source on next page.

Table 142.-- LAKES AND LAKE-LIKE WATERS, BY ISLANDS: 1985 - Con.

NA Not available.

SL Sea level.

1/ Ranges shown for Violet Lake, Meyer Lake, Halali'i Lake, and Halulu Lake reflect differences in estimates between DOWALD and Maciolek.

2/ Highest lake in the State and third highest in the United States.

Source: J.A. Maciolek, Lakes and Lake-like Waters of the Hawaiian Archipelago (Bernice P. Bishop Museum, Occasional Papers, Vol. XXV, No. 1, April 30, 1982; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data provided June 12, 1985; Hawaii State Department of Planning and Economic Development, Resource Management Plan for Kawainui Marsh (March 1983); William H. Meyer, U.S. Fish and Wildlife Service, transmittal letter (to DPED, Coastal Zone Management Program), for Kealia Pond National Wildlife Refuge, Maui, Hawaii, Final EIS (EIS No. 116, August 1981).

Table 143.-- MAJOR NAMED WATERFALLS, BY ISLANDS

Island	Waterfall	Height (feet)		Horizontal distance (feet)
		Sheer drop	Cascade	
Hawaii ..	Kaluahine .....	...	620	400
	Akaka	442	...	...
Maui	Honokohau .....	...	1,120	500
Molokai .	Kahiwa .....	...	1,750	1,000
	Papalaua .....	...	1,200	500
Oahu	Kaliuwaa (Sacred) 1/ .	80	1,520	3,000
Kauai ...	Waipoo (2 falls) .....	...	800	600
	Awini .....	...	480	500

1/ Sheer drop refers to northernmost fall of a cascade of six falls.

Source: U.S. Geological Survey, records; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, records.

Table 144.-- MISCELLANEOUS GEOGRAPHIC STATISTICS, BY ISLANDS

Island	Extreme length (miles)	Extreme width (miles)	Miles of sea cliffs with heights 1,000 ft. or more ^{1/}	Miles from coast of most remote point	Percent of area within 5 miles of coast
The State ..	...	...	33	28.5	48.6
Hawaii	93	76	4	28.5	30.0
Maui	48	26	-	10.6	76.1
Kahoolawe	11	6	-	2.4	100.0
Lanai	18	13	1	5.2	100.0
Molokai	38	10	14	3.9	100.0
Oahu	44	30	-	10.6	79.0
Kauai	33	25	11	10.8	67.0
Niihau	18	6	3	2.4	100.0
Island	Percent of area with elevation --		Approximate mean altitude (feet)	Percent of area with slope --	
	Less than 500 feet	2,000 feet or more		Less than 10 percent	20 percent or more
The State ..	20.8	50.9	3,030	63.5	17.0
Hawaii	12.0	68.4	3,950	76.0	4.0
Maui	24.9	41.4	2,390	38.5	36.0
Kahoolawe	38.9	0	600	60.0	9.0
Lanai	24.8	6.3	1,140	61.0	16.0
Molokai	37.3	17.8	1,150	53.0	26.0
Oahu	45.3	4.6	860	42.5	45.5
Kauai	35.6	24.0	1,380	33.5	50.5
Niihau	78.2	0	530	68.0	12.5

^{1/} According to Lee S. Motteler, Geography and Map Division, Bernice P. Bishop Museum, the sea cliffs along the northeastern coast of Molokai between Umilehi Point and Puukaoku Point drop 3,250 feet at an average slope of 58 degrees. These cliffs have been described by the Guinness Book of World Records (1984 edition, p. 108) as "the highest sea cliffs yet pinpointed anywhere in the world."

Source: Hawaii State Department of Planning and Economic Development, Hawai'i, the Natural Environment (1974), p. 19; U.S. Geological Survey, Elevations and Distances in the United States (1978), pp. 4-5.

Table 145.-- VOLCANIC ERUPTIONS: 1975 TO 1985

[Complete through May 31, 1985. Four volcanoes have erupted in historical times: Haleakala, last active around 1790; Hualalai, last active in 1800-1801; and Kilauea and Mauna Loa, both active during the past decade and included in this table]

Volcano and date of outbreak	Repose period since previous eruption (months)	Duration (days)	Location	Elevation (feet)	Area (square miles)	Volume (1,000 cubic yards)
Mauna Loa:						
1975: July 5	301	<1	Summit	13,000	5.2	35,000
1984: March 25 ..	104	22	Summit, east rift	13,200-9,400	11±	230,000
Kilauea:						
1975: Nov. 29 ...	11.0	<1	Caldera	3,600-3,520	0.1	300
1977: Sept. 13 ..	21.5	18	East rift	2,080-1,600	3.0	45,000
1979: Nov. 16 ...	26.3	1	East rift	3,270-3,200	0.1	800
1982: April 30 ..	29.5	<1	Caldera	3,630	0.1	260
Sept. 25 ..	4.9	<1	Caldera	3,620	0.3	3,900
1983: Jan. 3	3.3	879	East rift	2,560-2,120	15.3	376,000

Source: Gordon A. Macdonald and Douglass H. Hubbard, Volcanoes of the National Parks in Hawaii, 8th edition (Hawaii Natural History Association, 1982), pp. 10, 19, 34, and 58, as updated by the staff of the Hawaiian Volcano Observatory through May 31, 1985.

Table 146.-- EARTHQUAKES OF MAGNITUDE 5 OR GREATER: 1975 TO 1985

[Complete to March 31, 1985]

Date	Location	Magnitude (Richter Scale)
1975: Jan. 1, 2:41 AM ...	Near Pahala, Hawaii	5.1
Jan. 1, 3:20 AM ...	Mauna Loa, Hawaii	5.1
Jan. 2	Near Pahala, Hawaii	5.6
Jan. 5	Mauna Loa, Hawaii	5.1
Nov. 29, 3:35 AM ..	Puna, Hawaii	5.7
Nov. 29, 4:47 AM ..	Puna, Hawaii	7.2
1977: Jan. 22	100 miles S. of Kauai	5.0
1979: March 29	40 miles S.W. of Oahu	5.5
Sept. 21	Puna, Hawaii	5.5
1981: March 5	Molokai area	5.0
Nov. 10	Kilauea, Hawaii	5.3
1982: Jan. 21, 11:52 AM .	Mauna Loa, Hawaii	5.5
Jan. 21, 12:29 PM .	Mauna Loa, Hawaii	5.5
May 14	Off Kawaihae, Hawaii	5.0
1983: Nov. 16	S.E. flank of Mauna Loa ..	6.3-6.6

Source: Hawaii Institute of Geophysics, records; U.S. Geological Survey, National Earthquake Information Service. Data provided by Professor Augustine S. Furumoto, Hawaii Institute of Geophysics, University of Hawaii, May 28, 1985.

Table 147.-- TSUNAMIS WITH RUN-UP OF 2 METERS (6.6 FEET) OR MORE:
1946 TO 1985

[Correct to March 31, 1985]

Date	Maximum height in Hawaii		Deaths in Hawaii	Damage in Hawaii (dollars)
	Meters	Feet		
1946: April 1	17.0	55.8	159	26,000,000
1952: Nov. 4	6.1	20.0	-	1,000,000
1957: March 9	16.0	52.5	-	5,000,000
1960: May 22	10.5	34.5	61	23,000,000
1964: March 27	4.8	15.7	-	67,590
1975: Nov. 29	14.6	48.0	2	1,500,000

Source: George Pararas-Carayannis, Catalog of Tsunamis in the Hawaiian Islands (U.S. Coast and Geodetic Survey, May 1969); Robert C. Schmitt, "Catastrophic Mortality in Hawaii," The Hawaiian Journal of History, Vol. III (1969), pp. 66-86; Harold G. Loomis, The Tsunami of November 29, 1975 in Hawaii (Hawaii Institute of Geophysics, December 1975), pp. 1 and 10; D.C. Cox and J. Morgan, Local Tsunamis and Possible Local Tsunamis in Hawaii (Hawaii Institute of Geophysics, Report HIG 77-14, November 1977); Hawaii Institute of Geophysics, records.

Table 148.-- MAJOR DAMS: 1985

Name	Location	Height (ft.)	Length (ft.)	Volume of water impounded (acre ft.)
Wahiawa Dam ...	Wahiawa, Oahu	98	460	7,671
Waita	Koloa, Kauai	28	3,250	6,500
Kualapuu	Kualapuu, Molokai .	58	7,100	4,265
Alexander Dam .	Kalaheo, Kauai	119	600	2,500
Nuuanu No. 4 ..	Honolulu, Oahu	73	1,730	1,420

Source: Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, records.

Table 149.-- WATER USE, BY TYPE, BY ISLANDS: 1980

[Millions of gallons per year]

Type of water and use	State total	Hawaii	Maui	Lanai	Molokai	Oahu	Kauai	Niihau
Agricultural:								
Ground water	136,510	1,720	47,300	330	140	70,360	16,650	10
Surface water	237,950	3,630	129,130	-	990	16,170	88,030	-
Recycled water	32,970	50	9,730	-	-	3,350	19,840	-
Commercial:								
Ground water	2,770	1,470	-	-	-	410	890	-
Domestic:								
Ground water	71,770	2,280	3,830	140	270	63,250	1,990	10
Surface water	3,880	130	3,500	-	80	-	170	-
Hydroelectric:								
Surface water	74,190	22,840	14,620	-	-	-	36,730	-
Industrial, thermoelectric:								
Ground water	31,520	24,740	-	-	10	4,880	1,890	-
Surface water	2,170	-	-	-	-	-	2,170	-
Seawater ^{1/}	447,810	3,140	14,820	-	-	425,900	3,950	-
Industrial, other uses:								
Ground water	18,680	2,030	2,810	-	-	7,340	6,500	-
Surface water	11,220	4,080	2,910	-	30	-	4,200	-
Recycled water	4,130	1,900	160	-	-	200	1,870	-

^{1/} Includes water from wells near the seacoast.

Source: Data compiled by U.S. Geological Survey, cited in Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, Water Use in Hawaii, 1980 (Report No. R-79, 1984).

Table 150.-- POLLUTION ABATEMENT COSTS AND EXPENDITURES: 1983

[Unless otherwise specified, in millions of dollars. Statistics cover manufacturing establishments with 20 employees or more]

Subject	State total	Food and kindred products
Total pollution abatement capital expenditures	1.1	(NA)
Gross annual cost of pollution abatement	13.6	10.8
Payments to government units	1.3	1.3
Operating costs	12.4	9.6
Air	2.9	1.6
Water	5.4	4.0
Solid waste	4.1	4.0
Quantities of pollutants removed (1,000 short tons):		
Air:		
Particulates	(D)	27.9
Sulfur dioxides	(D)	-
Water:		
Total suspended solid	1,109.3	-
Biochemical oxygen demand	(Z)	(Z)
Other water pollutants	-	-
Solid waste	2,004.7	1,999.5

D Withheld to avoid disclosing operations of individual companies.

NA Not available.

Z Less than 500 short tons.

Source: U.S. Bureau of the Census, "Pollution Abatement Costs and Expenditures, 1983," Current Industrial Reports, MA-200(83)-1 (April 1985), pp. 16, 32, 46, and 68.

Table 151.-- WATER QUALITY AT SPECIFIED PUBLIC BEACHES: 1981 TO 1984

Island and beach	Number of samples, 1984	Fecal coliform density $\bar{1}$ / (geometric mean, MPN/100 ml)			
		1981	1982	1983	1984
Hawaii (Hilo side):					
Exit of Ice Pond	12	178.3	27.3	27.5	15.6
Leileiwi Beach Park	12	219.3	222.6	121.1	109.7
Onekahakaha	12	8.2	17.3	6.4	5.6
Puhi Bay No. 3	12	30.4	18.1	12.6	12.9
Hawaii (Kona side):					
Hapuna Beach	12	19.5	33.0	15.2	5.3
Kahaluu Beach	12	2.0	2.3	6.4	2.6
Kealahakua Bay (curio stand)	12	2.3	2.3	3.9	3.3
Kealahakua Bay (canoe landing)	12	2.4	2.3	4.4	4.4
Magic Sands Beach	12	2.4	8.0	3.4	5.4
Puako Beach Lots (middle)	12	9.0	29.6	21.4	9.5
Puako Beach Lots (south end)	12	18.6	74.0	21.2	46.2
Spencer Beach Park	12	29.5	14.6	4.7	9.8
Maui:					
Hukilau Hotel shoreline	11	2.0	2.9	3.3	3.0
Kahului Breakwater	-	2.0	3.1	...	...
Wailuku Breakwater	-	2.8	3.4	...	...
Maui Sheraton <u>2</u> /	12	2.0	2.7	2.3	...
Oahu:					
Ala Moana Park (ewa)	22	5.6	11.0	6.8	5.7
Ala Moana Park (center)	12	4.1	4.9	2.0	2.7
Ala Moana Park (diamond head)	12	5.4	5.8	6.2	3.1
Elks Club Beach	12	4.0	4.9	4.0	5.4
Ewa Beach	10	6.3	5.5	4.4	4.8
Ft. DeRussy Beach	12	5.2	18.5	5.6	6.8
Gray's Beach	21	5.7	6.0	5.7	5.4
Hanauma Bay	12	8.1	13.0	6.8	9.5
Kahana Park Beach	12	43.6	62.2	24.0	58.2
Kahanamoku Beach	11	4.5	3.3	3.4	2.4
Kahanamoku Lagoon (diamond head)	23	79.8	38.5	23.3	16.8
Kailua Bay outfall shoreline	12	2.3	5.3	2.0	3.8
Kailua Beach Park	12	3.7	5.7	3.1	2.5
Kokokahi Pier	12	25.6	48.5	29.8	12.1
Kuhio Beach	12	5.2	23.9	9.7	8.4
Public Bath Beach	21	3.6	3.3	2.5	3.3
Tavern Beach	12	3.5	7.3	4.4	6.1
Sand Island, Pt. No. 3	12	4.4	2.7	2.9	2.3

Continued on next page.

Table 151.-- WATER QUALITY AT SPECIFIED PUBLIC BEACHES: 1981 TO 1984 - Con.

Island and beach	Number of samples, 1984	Fecal coliform density 1/ (geometric mean, MPN/100 ml)			
		1981	1982	1983	1984
Kauai:					
Brennecke Beach	4	2.0	2.0	4.1	2.5
Hanalei Bay Landing	3	16.7	60.1	86.0	42.8
Poipu Beach	4	2.7	2.5	2.0	4.4

MPN Most probable number.

1/ The geometric mean standard for fecal coliform density is 200 MPN per 100 ml.

2/ Site discontinued January 1, 1984.

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied April 30, 1985.

Table 152.-- AVERAGE WATER TEMPERATURES AT WAIKIKI BEACH

[In Fahrenheit degrees]

Month	Morning	Afternoon
March	75	77
August	77	82

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, Hawaii, 1983.

Table 153.-- WATER SERVICES AND CONSUMPTION, FOR COUNTY WATERWORKS:
1980 TO 1984

Subject and geographic area	1980	1981	1982	1983	1984
NUMBER OF SERVICES, JUNE 30					
State total	175,382	178,250	179,648	181,980	185,044
City and County of Honolulu .	124,752	125,903	126,400	127,540	129,080
Honolulu 1/	58,082	58,349	58,159	58,173	58,462
Rest of Oahu	66,670	67,554	68,241	69,367	70,618
Hawaii County	22,446	23,215	23,682	24,218	24,834
Kauai County	10,169	10,632	10,823	11,049	11,501
Maui County	18,015	18,500	18,743	19,173	19,629
Maui	16,892	17,376	17,607	18,007	18,413
Molokai	1,123	1,124	1,136	1,166	1,216
CONSUMPTION 2/ (MILLION GALLONS)					
State total	55,610	58,574	56,719	59,724	63,670
City and County of Honolulu .	42,519	44,216	42,646	44,535	47,389
Honolulu 1/	24,168	25,086	24,317	25,658	26,636
Rest of Oahu	18,351	19,130	18,329	18,877	20,753
Hawaii County	4,433	4,664	4,753	5,066	5,409
Kauai County	2,745	2,780	2,805	3,240	3,492
Maui County	5,913	6,914	6,515	6,883	7,380
Maui	5,649	6,620	6,235	6,592	7,073
Molokai	265	294	280	292	307

1/ Maunaloa to Moanalua.

2/ Year ended June 30.

Source: Data compiled by Hawaii State Department of Planning and Economic Development from Honolulu Board of Water Supply, Hawaii County Department of Water Supply, Kauai Department of Water, and Maui Department of Water Supply.

Table 154.-- AIR QUALITY IN DOWNTOWN HONOLULU:
1974 TO 1984

[Sampling is conducted approximately 46 ft. above ground on the roof of the State Health Department building, 1250 Punchbowl Street, Honolulu, Hawaii]

Year	Annual arithmetic means ($\mu\text{g}/\text{m}^3$)	
	Total suspended particulates	Sulfur oxides
1974	35	10
1975	40	9
1976	34	23
1977	31	17
1978	29	18
1979	32	22
1980	37	18
1981	40	19
1982	29	11
1983	26	<5
1984	25	<5
Standards: 1/		
Primary	75	80
Secondary	60	...

1/ Primary and secondary National Ambient air quality standards have been promulgated by the Federal government. Primary standards are designed to prevent adverse effects on public health, while secondary standards are designed to prevent adverse effects on public welfare, including the effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials.

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied April 23, 1985.

Table 155.-- AIR QUALITY AT SPECIFIED LOCATIONS: 1984

[24-hour sampling, in micrograms per cubic meter]

Sampling station	Total suspended particulates			Sulfur dioxide		
	Annual range		Arith- metic average	Annual range		Arith- metic average
	Minimum	Maximum		Minimum	Maximum	
Oahu:						
Barbers Point ...	17	112	54	<5	<5	<5
Downtown Honolulu	11	48	25	<5	<5	<5
Kalihi Kai <u>1/</u> ...	...	...	...	...	...	...
Liliha <u>2/</u>	18	56	33	...	...	...
Pearl City <u>3/</u> ...	15	45	28	<5	<5	<5
Waikiki <u>1/</u> .....	...	...	...	...	...	...
Waimanalo	9	60	25	...	...	...
Maui:						
Kahului	24	121	64	<5	62	7.8
Kihei	15	83	44	...	...	...
Hawaii:						
Hilo	7	27	15	<5	5	<5
Kauai:						
Lihue <u>3/</u>	13	91	35	<5	<5	<5

1/ Site discontinued January 1, 1984.

2/ New site established at Kauluwela Elementary School, January 19, 1984.

3/ Based on 11 months of data. SO_x sampling discontinued December 1, 1984.

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied April 23, 1985.

Table 156.-- SOURCES OF AIR POLLUTANT EMISSIONS, BY COUNTIES: 1980

[Percent distributions for the sums of weights of sulfur oxides, particulate matter, carbon monoxide, hydrocarbons, and nitrogen oxide emissions]

Source	State total	Hawaii	Honolulu	Kauai	Mauai
All sources	100.0	100.0	100.0	100.0	100.0
Transportation	43.0	38.1	47.4	40.6	35.8
Motor vehicles	40.1	36.2	43.9	35.7	33.1
Aircraft	2.3	1.1	2.9	2.3	1.6
Vessels	0.6	0.8	0.6	2.6	1.1
Fuel combustion in					
stationary sources	29.7	34.9	26.7	32.2	35.3
Steam electric	23.1	19.8	24.6	18.5	22.4
Gas utilities	0.1	(N)	0.1	(N)	(N)
Agricultural fuel	6.5	15.1	2.0	13.7	12.9
Industrial process losses ..	14.6	7.7	20.3	3.2	3.5
Refinery	4.8	(N)	6.5	(N)	(N)
Petroleum storage	0.7	1.1	0.8	(N)	0.5
Metalurgical	0.1	(N)	0.1	(N)	(N)
Mineral products	6.9	3.9	10.8	0.9	1.1
Off-highway const., farms and industries	2.1	2.7	2.1	2.3	1.9
Municipal incinerator	0.9	(N)	1.3	(N)	(N)
Agricultural burning	11.7	19.3	4.3	24.2	25.4

N Less than 0.05 percent.

Source: Hawaii State Department of Health, Environmental Permits Branch, information provided May 7, 1985.

Table 157.-- NOISE LEVELS DURING DAYLIGHT HOURS IN SPECIFIED NEIGHBORHOODS
ON OAHU: 1981-1982

Neighborhood	Noise levels (in decibels) exceeded --					
	Manual sampling			Automatic sampling		
	10 percent of time	50 percent of time	90 percent of time	10 percent of time	50 percent of time	90 percent of time
Aina Haina	45.6	42.1	39.5	53.5	46.2	43.2
Aina Koa	48.1	43.1	40.1	52.9	45.8	42.5
Downtown	57	55	54	60	57	55
Hawaii Kai	46.5	41.6	38.9	53.5	46.9	42.9
Kahala	48.0	44.5	42.4	-	-	-
Kaimuki	51.8	44.6	41.7	57.2	47.6	43.3
Kalihi	53.5	49.6	47.4	-	-	-
Kapahulu	47.2	45.0	42.0	-	-	-
Kapalama-Liliha	46.4	45.1	42.5	-	-	-
Kuliouou	48.6	45.9	43.4	52.5	47.9	45.4
Liliha	46	45	43	-	-	-
Makiki	52.7	46.9	45.3	56.5	50.5	48.6
Manoa	45.4	42.6	40.7	51.5	46.0	43.4
Moiliili	53.7	50.2	46.9	60.0	53.4	48.9
Nuuanu	46.6	43.6	40.8	-	-	-
Palolo	49.3	44.6	41.6	65.0	52.4	45.4
Pawaa	59.8	57.1	55.2	60.8	57.1	54.7
Salt Lake	56	52	49	-	56	51
Waikiki	57.8	55.4	54.1	61.6	57.5	55.3
Waialae Iki ...	46.4	43.1	40.6	54.6	44.8	41.7
Aiea	58	54	52	59	56	54
Halawa	52	46	44	55	50	47
Hauula	53	48	45	56	51	47
Kailua	49.2	45.5	42.9	54.9	49.6	45.2
Kaneohe	43.8	40.9	38.9	49.7	43.5	40.9
Mililani	44	37	34	53	46	41
Nanakuli	54	50	47	58	52	48
Pearl City	51	47	45	55	50	48
Wahiawa	47.1	44.7	42.4	51.8	47.3	43.9
Waimanalo	53	50	48	55	51	49
Waipahu	54.1	50.5	47.4	58.8	53.6	50.4

Source: Hawaii State Department of Health, Environmental Protection and Health Services Division, Noise and Radiation Branch, records.

Table 158.-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES

Island and station	Ground elevation (feet)	Average temperature (°F.)		Extreme temperature of record (°F.)		Average annual precipitation (inches)
		Coollest month	Warmest month	Lowest	Highest	
Hawaii:						
Hilo Airport	27	71.2	75.8	53	94	126.76
Hawaii Volcanoes Nat. Park Hdq. .	3,971	57.6	63.2	37	85	102.81
Kailua	30	72.1	77.3	54	93	25.22
Puako 1/	10	73.1	79.8	52	98	9.47
Waimea (Kamuela)	2,670	62.3	66.8	34	90	40.05
Mauna Kea summit 2/	13,796	31.3	42.5	11	66	8.08
Maui:						
Hana	120	71.3	76.8	50	90	70.65
Haleakala summit	9,960	42.6	50.0	14	73	50.69
Kihei 3/	90	70.9	78.4	49	98	13.79
Kahului Airport	48	71.7	79.0	48	96	18.63
Lahaina	45	71.5	78.0	52	93	15.51
Molokai:						
Kaunakakai	12	...	...	...	...	14.08
Molokai Airport	450	70.2	77.6	48	90	29.21
Lanai:						
Lanai City	1,620	65.8	72.8	46	88	38.44
Oahu:						
Honolulu International Airport ..	7	72.6	80.2	53	94	22.68
Waikiki (Honolulu Zoo)	10	71.9	80.6	51	93	27.32
Manoa (Lyon Arboretum)	500	69.4	75.2	...	...	158.41
Kaneohe MCAS	10	72.9	79.1	58	90	43.88
Kahuku	25	71.6	78.8	49	95	41.10
Wheeler AFB	826	68.2	75.5	52	89	39.85
Waianae	20	72.1	79.7	45	96	20.31

Continued on next page.

Table 158.-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES -- Con.

Island and station	Ground elevation (feet)	Average temperature (°F.)		Extreme temperature of record (°F.)		Average annual precipitation (inches)
		Coollest month	Warmest month	Lowest	Highest	
Kauai:						
Kilauea (town)	315	68.7	75.6	49	94	68.03
Lihue Airport	103	70.2	78.0	50	90	43.51
Poipu (Makahuena Pt.)	52	72.4	79.4	50	93	36.39
Kokee (Kanalohuluhulu)	3,600	54.9	65.5	31	83	72.25
Waialeale	5,075	...	...	...	...	451.00
Northwestern Hawaiian Islands:						
Midway	10	65.0	78.6	52	89	43.60

1/ Temperature data are for Mahukona.

2/ Based on incomplete and non-continuous data for 1966-1972.

3/ Temperature data refer to Puunene Airport.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Pacific Region, data supplied March 17, 1976 and May 2, 1977, and National Climatic Data Center, Local Climatological Data, Annual Summary With Comparative Data, 1984 for Hilo, Kahului, Honolulu, and Lihue; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data supplied August 5, 1985.

Table 159.-- MONTHLY AND ANNUAL CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT

Month	Normal temperature (°F)			Extreme temperature (°F) <u>1/</u>		Precipitation (inches)			
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest	Normal total	Maximum monthly	Minimum monthly	Maximum in 24 hours
Jan. .	79.9	65.3	72.6	87	53	3.79	14.74	0.21	6.72
Feb. .	80.4	65.3	72.8	88	53	2.72	13.68	0.06	6.88
Mar. .	81.4	67.3	74.3	88	55	3.48	20.79	0.01	17.07
Apr. .	82.7	68.7	75.7	89	59	1.49	8.92	0.01	4.21
May ..	84.8	70.2	77.5	90	62	1.21	7.23	0.05	3.44
June .	86.2	71.9	79.1	91	65	0.49	2.46	T	2.28
July .	87.1	73.1	80.1	91	67	0.54	2.01	0.03	1.03
Aug. .	88.3	73.6	81.0	93	67	0.60	3.08	T	2.35
Sept.	88.2	72.9	80.6	93	66	0.62	2.74	0.05	1.40
Oct. .	86.7	72.2	79.5	94	64	1.88	11.15	0.11	7.57
Nov. .	83.9	69.2	76.6	90	58	3.22	14.72	0.03	9.15
Dec. .	81.4	66.5	74.0	89	54	3.43	12.09	0.06	8.14
Ann. .	84.2	69.7	77.0	94	53	23.47	20.79	T	17.07

Continued on next page.

Table 159.-- MONTHLY AND ANNUAL CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT -- Con.

Month	Relative humidity (percent) <u>2/</u>		Wind (miles/hour)		Percent of possible sunshine	Mean sky cover, sunrise to sunset <u>3/</u>	Mean number of days		
	8 A.M.	2 P.M.	Mean speed	Fastest mile			Sunrise to sunset		Precip. .01 inch or more
							Clear	Cloudy	
Jan. ...	82	63	9.8	67	62	5.5	9.1	8.9	10.1
Feb. ...	78	59	10.5	63	64	5.7	7.5	8.1	9.4
Mar. ...	73	58	11.5	59	68	5.9	7.3	9.6	9.0
Apr. ...	70	57	12.1	40	66	6.2	5.5	10.6	9.4
May	67	54	12.1	35	68	6.0	6.5	9.4	7.3
June ...	67	53	12.8	39	70	5.7	5.5	7.1	6.0
July ...	68	52	13.5	34	73	5.3	7.5	5.4	7.5
Aug	68	53	13.2	52	75	5.3	8.0	6.4	6.5
Sept. ..	68	52	11.6	36	75	5.2	8.2	5.9	7.0
Oct. ...	69	55	10.8	40	68	5.6	7.5	8.4	8.9
Nov. ...	74	59	10.9	65	61	5.7	7.1	9.2	9.2
Dec. ...	79	61	10.7	59	58	5.6	8.2	9.6	10.2
Ann. ...	72	56	11.6	67	67	5.6	87.8	98.5	100.5

T Trace amount.

1/ For periods October 1962 through December 1964 and September 1971 through December 1984.

2/ Data for 1963, 1964, and 1972-1984.

3/ Sky cover is expressed in a range of 0 for no clouds or obscuring phenomena to 10 for complete sky cover.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, 1984.

Table 160.-- CLIMATIC DATA FOR THE PERIOD OF RECORD

Subject	Date	Place	Magnitude
Long-term averages:			
Lowest monthly average minimum temp. (°F.) ..	February	Mauna Kea summit ..	23.5
Lowest monthly average daily temp. (°F.)	February	Mauna Kea summit ..	31.3
Highest monthly average maximum temp. (°F.) .	September	Kawaihae <u>1/</u>	91.9
Highest monthly average daily temp. (°F.) ...	September	Kawaihae <u>1/</u>	80.8
Lowest average annual rainfall (inches) .....	.....	Kawaihae	8.7
Highest average annual rainfall (inches) ....	.....	Waialeale	451
Single events:			
Lowest temperature of record (°F.)	Jan. 20, 1970 ...	Mauna Kea summit <u>2/</u>	1.4
Highest temperature of record (°F.)	April 27, 1931 ..	Pahala	100
Lowest annual rainfall of record (inches) ...	1953	Kawaihae	0.2
Highest annual rainfall of record (inches) ..	1982	Waialeale	666
Highest wind speed of record (m.p.h.)	Nov. 23, 1982 ...	Makahuena Pt. <u>3/</u> ..	117

1/ Puukohola Heiau National Historical Site, Kawaihae, Hawaii.

2/ Recorded by Dr. Alfred Woodcock 60 meters inside the Mauna Kea summit cone, at 6:50 a.m. The rim at that time had a temperature of 39° F.

3/ Makahuena Point Coast Guard Station, Poipu, Kauai.

Source: U.S. Department of Commerce, National Weather Service, Pacific Region, data supplied March 14, 1973; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data supplied August 5, 1985.

Table 161.-- CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT: ANNUALLY,
1974 TO 1984

Year	Average temperature (°F)			Extreme temp. (°F)		Precipitation (inches)
	Annual	Coolest month	Warmest month	Lowest	Highest	
1974 ...	77.5	74.0	81.2	58	92	24.02
1975 ...	76.2	72.4	80.1	56	90	24.39
1976 ...	76.8	72.0	80.8	53	91	12.90
1977 ...	78.2	73.7	82.2	59	92	12.36
1978 ...	76.8	72.4	80.5	57	91	25.05
1979 ...	77.0	69.9	81.1	57	93	16.93
1980 ...	77.5	71.9	81.6	56	91	26.90
1981 ...	77.1	73.2	80.7	53	90	13.41
1982 ...	76.9	71.7	81.4	56	92	34.92
1983 ...	77.2	71.3	82.4	53	92	5.03
1984 ...	78.1	74.1	81.7	57	94	17.08

Year	Relative humidity (percent)		Wind speed (miles/hour)		Percent of possible sunshine	Days with precipitation .01 inch or more
	8 A.M.	2 P.M.	Annual average	Fastest mile <u>1</u> / hour		
1974 ...	73	58	10.9	34	61	118
1975 ...	72	56	12.2	36	62	82
1976 ...	64	52	11.5	38	60	105
1977 ...	71	55	12.2	37	68	81
1978 ...	74	58	11.9	34	69	90
1979 ...	74	57	11.4	34	68	89
1980 ...	75	59	11.9	35	69	115
1981 ...	76	59	10.7	30	72	97
1982 ...	73	59	10.4	46	56	124
1983 ...	75	52	9.8	23	64	78
1984 ...	72	53	10.2	40	71	81

1/ 1984 figure refers to peak gust.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, Hawaii (annual).

Table 162.-- CLIMATIC NORMALS, MEANS, AND EXTREMES FOR
HILO, KAHULUI, HONOLULU, AND LIHUE AIRPORTS

Subject	Hilo	Kahului	Honolulu	Lihue
Normal temperatures (°F.):				
Daily maximum	81.2	83.8	84.2	81.1
Daily minimum	65.9	67.2	69.7	69.3
Monthly: Coolest month	71.1	71.5	72.6	71.2
Warmest month	75.8	79.2	81.0	79.1
Annual	73.5	75.5	77.0	75.2
Extreme temperatures (°F.):				
Record highest	94	96	94	90
Record lowest	53	48	53	50
Normal degree days, base 65°F.:				
Heating	-	-	-	-
Cooling	3,134	3,851	4,389	3,758
Precipitation (inches):				
Normal	128.15	19.85	23.47	44.02
Maximum monthly	50.82	14.46	20.79	22.91
Minimum monthly	0.28	0.00	T	T
Relative humidity (percent):				
8 A.M.	80	74	72	78
2 P.M.	68	57	56	66
Wind speed (m.p.h.):				
Mean	7.1	12.8	11.6	11.9
Fastest mile <u>1</u> /	29	44	67	65
Percent of possible sunshine	41	69	67	56
Mean number of days:				
Clear	35.4	130.2	87.8	52.7
Partly cloudy	128.5	145.5	178.9	179.5
Cloudy	201.3	89.5	98.5	133.1
Precipitation .01 inch or more .	279.4	96.7	100.5	202.3

T Trace amount.

1/ Hilo and Lihue data refer to fastest observation, 1 minute.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Local Climatological Data, Annual Summary with Comparative Data, 1984 for Hilo, Kahului, Honolulu, and Lihue.

Table 163.-- RAINFALL AT SPECIFIED LOCATIONS: ANNUALLY,
1974 TO 1984

[In inches]

Year	Hawaii			Maui		
	Hilo Airport	Wai-me <u>a</u> <u>l</u> / ¹	Kona Village	Kahului Airport	Kihei	Lahaina
1974 ...	112.92	22.84	8.10	18.68	14.97	13.01
1975 ...	99.93	12.35	15.64	13.74	10.63	12.19
1976 ...	114.67	11.10	7.04	12.83	8.84	8.86
1977 ...	90.38	5.42	3.40	11.50	7.88	8.28
1978 ...	119.09	14.83	8.68	19.15	9.91	11.97
1979 ...	158.77	29.23	16.00	26.82	21.32	20.85
1980 ...	127.74	28.31	16.90	27.87	20.27	22.69
1981 ...	89.91	13.30	7.02	12.85	9.72	8.13
1982 ...	170.36	56.29	26.88	34.04	29.11	34.36
1983 ...	68.09	12.95	8.51	13.05	8.60	9.70
1984 ...	100.08	8.87	8.15	8.56	5.64	6.30

Year	Oahu			Kauai		
	Waikiki	Univ. of Hawaii	Nuuanu Res. 4	Koloa	Lihue Airport	Princeville
1974 ...	24.51	44.62	130.94	86.35	45.60	130.40
1975 ...	25.98	39.25	101.42	49.91	35.52	62.36
1976 ...	13.59	26.83	86.44	62.60	32.83	109.34
1977 ...	15.73	32.83	88.96	52.51	40.34	84.55
1978 ...	27.18	41.56	124.42	70.64	39.11	130.82
1979 ...	26.22	46.74	111.56	55.98	37.09	93.19
1980 ...	28.50	48.52	140.70	78.78	54.64	130.55
1981 ...	19.09	31.71	112.46	66.26	38.14	130.72
1982 ...	39.96	57.98	168.16	96.75	74.40	241.22
1983 ...	9.80	19.77	74.32	50.69	16.40	46.93
1984 ...	19.35	33.13	71.32	48.82	30.12	71.58

¹/ Lalamilo Field Office.

Source: U.S. Department of Commerce, National Climatic Data Center, Local Climatological Data, Annual Summary with Comparative Data, 1984 for Hilo, Kahului, and Lihue and Climatological Data Annual Summary, Hawaii and Pacific (annual); U.S. Department of Commerce, National Weather Service, Pacific Region, records; and Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, records.

Table 164.-- TRADE WINDS, HIGH SURF, AND TEMPERATURES IN HAWAIIAN WATERS,
BY MONTHS

Month	Trade wind frequency ^{1/} (percent)	Expected days of strong trade winds ^{2/}	Highest surf ^{3/} (average number of days)		Water temperature (°F.)	
			Flat or 1 foot	6 feet or more	Mean maximum	Mean minimum
Jan. ...	42	9	1	19	74.7	71.1
Feb. ...	55	7	1	16	75.6	70.3
March ..	61	10	1	12	76.5	71.8
April ..	74	10	3	7	77.7	73.0
May	86	7	8	3	79.5	74.7
June ...	91	7	15	-	81.1	77.7
July ...	95	10	16	-	81.1	78.3
Aug. ...	94	7	15	-	81.9	79.2
Sept. ..	83	4	10	2	81.9	78.4
Oct. ...	71	4	1	12	81.1	77.2
Nov. ...	64	8	-	19	79.3	74.5
Dec. ...	57	9	-	20	75.9	71.4
Ann. ...	65	92	71	110	78.6	74.8

^{1/} Mean monthly frequency of trade winds in Hawaiian waters.

^{2/} Expected number of hazardous days in Hawaiian waters due to strong trade winds.

^{3/} Observations at Sunset Beach, Oahu. Annual averages were: flat or 1 foot, 71 days; 2-5 feet, 184 days; 6-10 feet, 71 days; 11-15 feet, 26 days; 16 feet or higher, 13 days.

^{4/} Observations at Kaneohe, Oahu. The mean ranged from 73.0 in January and February to 80.2 in August. Absolute maximums and minimums were respectively 84 (in July, August, and October) and 68 (December and February).

Source: Paul Haraguchi, Weather in Hawaiian Waters (Honolulu: Pacific Weather, Inc., 1979), pages 14, 22, 56, and 74.

Table 165.-- MAJOR HURRICANES: 1950 TO 1985

[Complete to August 8, 1985]

Hurricane name	Date ^{1/}	Islands most affected	Maximum winds ashore (m.p.h.)		Deaths	Property damage (million dollars)
			Sustained	Gusts		
Hiki	Aug. 12-16, 1950	Kauai	68	(NA)	1	0.200
Della	Sept. 1-17, 1957	French Frig. Shoals	82	109	-	Minor
Nina	Nov. 29-Dec. 7, 1957	Kauai	92	(NA)	4	1.056
Dot	Aug. 1-8, 1959	Kauai	81	103	-	5.5+
Fico	July 17-28, 1978	Hawaii	(NA)	58+	-	0.188
Iwa	Nov. 19-25, 1982	Kauai, Oahu	65	117	-	234

NA Not available.

^{1/} Total duration, including period outside Hawaiian waters.

Source: Samuel L. Shaw, A History of Tropical Cyclones in the Central North Pacific and the Hawaiian Islands, 1832-1979 (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, September 1981); Hawaii State Department of Defense, Civil Defense Division, Catalogue of Natural and Man-Caused Incidents and Disasters in the Hawaiian Islands (December 1978); The Governor's Ad Hoc Committee on the Economic Impact of Hurricane Iwa, Hurricane Iwa's Economic Impact on Hawaii (January 1983); "The History of Hurricanes in Hawaii," Honolulu Star-Bulletin, July 18, 1983, p. A-5; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, letter dated December 5, 1983.

Table 166.-- SUNRISE, SUNSET, AND HOURS OF DAYLIGHT AT HILO, HONOLULU, AND LIHUE, FOR SELECTED DATES

[Hawaiian Standard Time]

Subject	March 21	June 21	Sept. 23	Dec. 22
Sunrise (A.M.):				
Hilo	6:24	5:42	6:09	6:51
Honolulu	6:35	5:50	6:21	7:05
Lihue	6:41	5:55	6:26	7:12
Sunset (P.M.):				
Hilo	6:32	7:02	6:16	5:47
Honolulu	6:43	7:16	6:27	5:55
Lihue	6:49	7:23	6:33	6:00
Hours of daylight:				
Hilo	12:08	13:20	12:07	10:56
Honolulu	12:08	13:26	12:06	10:50
Lihue	12:08	13:28	12:07	10:48

Source: Nautical Almanac Office, U.S. Naval Observatory, Tables of Sunrise and Sunset, No. 1083 and 1084 and records.

Table 167.-- HAWAII AUDUBON SOCIETY BIRD COUNT OF THE HONOLULU AREA, BY TYPE OF SPECIES: DECEMBER 16, 1984

Type of species ^{1/}	Number of species	Number of individuals
All species	46	25,809
Endemic	6	309
Indigenous	6	729
Introduced	26	23,508
Migratory	7	1,700

^{1/} For definitions, see following table, footnote 1.
 Source: Hawaii Audubon Society, "Honolulu Christmas Bird Count, 1984," 'Elepaio, March 1985, pp. 82-85.

Table 168.-- HAWAII AUDUBON SOCIETY BIRD COUNTS OF THE
HONOLULU AREA: 1980 TO 1984

[Counts are made in late December, in a circle, 15 miles
in diameter, centered near Nuuanu Pali]

Species <u>1/</u>	1980 <u>2/</u>	1981 <u>2/</u>	1982	1983	1984
All species:					
Species	44	48	45	46	46
Individual birds ..	20,226	19,427	16,649	22,279	25,809
Endemic species:					
'Apapane	147	153	68	106	96
Hawaiian Coot	28	28	62	135	40
Hawaiian Stilt	115	92	77	110	87
Oahu 'Amakihi	152	159	65	140	59
Indigenous species:					
Great Frigatebird	615	366	24	37	17
Red-footed Booby	1,132	1,063	425	370	624
Introduced species:					
Cattle Egret	1,072	682	331	384	477
Common Myna	3,577	2,917	2,790	3,080	3,611
House Sparrow	1,684	1,604	1,489	2,518	2,169
Japanese White-eye	1,003	970	1,121	1,706	1,235
Red-vented Bulbul	1,174	1,159	1,199	2,195	2,051
Spotted Dove	1,104	1,393	1,052	1,606	2,650
Zebra (Barred) Dove	2,541	3,694	3,442	3,840	7,624
Migratory species:					
Lesser Golden-Plover ...	1,884	1,621	1,402	1,747	1,359
Ruddy Turnstone	397	361	291	269	295

1/ Separate data are shown for endemic birds averaging more than 25 individuals in 1975-1979, indigenous birds more than 200, introduced birds more than 500, and migratory species and stragglers more than 100. Endemic birds are those peculiar to a particular region, in this case Hawaii, and therefore found nowhere else in the world; indigenous birds are those native to a given region, in this case Hawaii, but with a total range of distribution encompassing a much wider area. The classification is that in Andrew J. Berger, *Hawaiian Birdlife* (1972).

2/ Including Moku Manu, excluded after 1981. Moku Manu had 4 species and 913 individuals (including 425 Red-footed Boobies and 460 Great Frigatebirds) in 1982, 4 species and 760 individuals in 1983, and 4 species and 545 individuals in 1984.

Source: Hawaii Audubon Society, *The 'Elepaio* (monthly).

Table 169.-- TREES ALONG STREETS OR IN PARKS UNDER THE JURISDICTION OF THE CITY AND COUNTY OF HONOLULU: 1979 TO 1984

[As of June 30]

Year	Along City and County streets and highways <u>1/</u>	In City and County parks
1979	104,499	95,600
1980	108,202	95,700
1981	110,975	96,250
1982	113,489	96,296
1983	114,875	96,130
1984	117,133	96,873

1/ Excludes Federal, State, and private thoroughfares.

Source: City and County of Honolulu, Department of Parks and Recreation, data provided February 11, 1985.

Table 170.-- THREATENED, ENDANGERED, AND EXTINCT SPECIES OF NATIVE FAUNA AND FLORA: JUNE 1985

Type of fauna or flora	Native species	Candidate	Threatened	Endangered	Extinct <u>1/</u>
Mammals	19	-	-	9	-
Reptiles and amphibians ..	4	-	3	1	-
Birds	87	-	1	29	23
Invertebrates	(2/)	150	-	41	88
Plants	2,734	795	-	11	100

1/ Since 1778.

2/ Not known, but nearly 10,000 native species of insects and more than 1,000 native species of land snails have been estimated.

Source: U.S. Department of the Interior, Fish and Wildlife Service records; P. Q. Tomich, Mammals in Hawaii (1969); Robert L. Pyle, "Checklist of Birds of Hawaii," The 'Elepaio, November 1983; correspondence from W. C. Gagné, Entomology Department, Bishop Museum, July 3, 1985; H. St. John, List and Summary of the Flowering Plants in the Hawaiian Islands (1973), p. 519; University of Hawaii Department of Geography, Atlas of Hawaii (1983), pp. 80 and 83.