

## 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.

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 biggest lake is Halalii, on Niihau, 841 acres; 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: 39 major beaches surveyed in 1981 were found to have fecal coliform levels per 100 ml. ranging from 2.0 to 219.3, and all but one were within EPA standards. More than 1,100 species, subspecies, and varieties of native flora were endangered, threatened, or extinct, according to a 1977 survey. 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 92°F. Normal precipitation, however, ranges from 5.7 inches near Kawaihae, South Kohala, to 451 inches atop Waialeale. The longest volcanic eruption in Island history lasted 867 days, the worst earthquake attained 7.5 on the Richter scale, and the highest tsunami wave reached 56 feet. Water withdrawn for use in 1975 averaged 2.8 billion gallons per day, compared with 2.7 billion in 1970 and 2.0 billion in 1965. Among 21 neighborhoods on Oahu, median noise levels in 1981-1982 ranged from 40.9 decibels (in Kaneohe) to 57.1 decibels (in Pawaa).

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, published by the University Press of Hawaii in 1973, and Hawai'i, the Natural Environment, issued by the Department of Planning and Economic Development in 1974. National data are reported in Statistical Abstract of the United States: 1981, Section 7.

Table 114.-- GREAT CIRCLE DISTANCES BETWEEN HONOLULU INTERNATIONAL AIRPORT AND SPECIFIED PLACES

Place	Distance from Honolulu	
	Statute miles	Kilometers
Hawaiian Islands:		
Cape Kumukahi, Hawaii .....	236	380
Hilo, Hawaii .....	214	344
Ka Lae (South Cape), Hawaii .....	221	356
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
Trust Territory of the Pacific Islands:		
Majuro, Marshall Islands .....	2,271	3,654
Kwajalein, Marshall Islands .....	2,443	3,931
Kolonia, Ponape, E.C.I. ....	3,087	4,967
Saipan, Mariana Islands .....	3,704	5,960
Koror, Palau, W.C.I. ....	4,593	7,390
Other Pacific locations:		
Apra Harbor, Guam .....	3,806	6,124
Auckland, New Zealand .....	4,393	7,068
Avarua, Rarotonga .....	2,950	4,750
Funafuti, Tuvalu .....	2,550	4,106
Hong Kong .....	5,541	8,915
Johnston Island .....	820	1,319
Kingman Reef .....	1,073	1,726
Manila, Philippines .....	5,293	8,516
Nuku'alofa, Tongatapu .....	3,165	5,096
Nuku Hiva, Marquesas Islands .....	2,400	3,864
Pago Pago, American Samoa .....	2,606	4,193

Continued on next page.

Table 114.-- GREAT CIRCLE DISTANCES BETWEEN HONOLULU INTERNATIONAL AIRPORT AND SPECIFIED PLACES -- Con.

Place	Distance from Honolulu	
	Statute miles	Kilometers
Other Pacific locations, con.:		
Palmyra Island .....	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 America:		
Anchorage, Alaska .....	2,781	4,475
Cape Horn, Chile .....	7,457	11,998
Chicago, Illinois .....	4,179	6,724
Cristobal, Canal Zone .....	5,214	8,389
Lima, Peru .....	5,950	9,580
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
Victoria, B.C. ....	2,668	4,293
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 <sup>1/</sup> .....	12,417	19,979
Equator, due south of Honolulu .....	1,470	2,367
North Pole .....	4,740	7,631
South Pole .....	7,660	12,333

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

Source follows next table.

Table 115.-- GREAT CIRCLE DISTANCES FROM HILO AND KURE ATOLL

Places	Great circle distance	
	Statute miles	Kilometers
Hilo to --		
Honolulu, Oahu .....	214	344
Los Angeles, California .....	2,447	3,937
San Francisco, California .....	2,315	3,725
Kure Atoll to --		
Cape Kumukahi, Puna, Hawaii <u>1/</u> .....	1,523	2,451
Honolulu, Oahu .....	1,367	2,200
Log Point, Elliot Key, Florida <u>2/</u> .....	5,852	9,416
Tokyo, Japan .....	2,486	4,000
West Quoddy Head, Maine .....	5,788	9,313

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

2/ 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 116.-- WIDTHS AND DEPTHS OF CHANNELS

Channel <u>1/</u>	Width <u>2/</u>		Depth <u>3/</u>		
	Statute miles	Kilometers	Fathoms	Feet	Meters
Alenuihaha .....	29.6	47.6	1,135	6,810	2,076
Alalakeiki .....	6.7	10.8	137	822	251
Kealaikahiki .....	17.8	28.6	181	1,086	331
Auau .....	9.5	15.3	42	252	77
Kalohi .....	9.2	14.8	90	540	165
Pailolo .....	8.8	14.2	141	846	258
Kaiwi .....	25.8	41.5	367	2,202	671
Kauai .....	72.1	116.0	1,815	10,890	3,319
Kaulakahi .....	17.2	27.7	595	3,570	1,088
Niihau-Kaula .....	21.5	34.6	894	5,364	1,635
Niihau-Nihoa .....	133.9	215.5	2,425	14,550	4,435
Nihoa-Necker I. ....	179.6	289.0	2,100	12,600	3,840
Necker I.-French Frigate Shoals .....	100.3	161.4	2,130	12,780	3,895
French Frigate Shoals- Gardner Pinnacles .....	137.0	220.5	1,908	11,448	3,489
Gardner Pinnacles-Marø Reef	155.5	250.3	2,050	12,300	3,749
Marø Reef-Laysan I. ....	65.9	106.1	1,380	8,280	2,524
Laysan I.-Lisianski I. ....	137.4	221.1	2,805	16,830	5,130
Lisianski I.-Pearl and Hermes Atoll .....	162.6	261.7	2,900	17,400	5,304
Pearl and Hermes Atoll- Midway Islands .....	86.9	139.9	2,640	15,840	4,828
Midway Islands-Kure Atoll .	57.1	91.9	2,160	12,960	3,950

Footnotes and source on next page.

Table 116.-- WIDTHS AND DEPTHS OF CHANNELS -- Con.

1/ Listed in geographic order, from east to west. The channels 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;  
Niihau-Kaula: Leahi, Niihau, to Kaula;  
Niihau-Nihoa: Kuakamoku, Niihau, to Nihoa;  
Nihoa-Necker Island: Nihoa to Necker Island;  
Necker Island-French Frigate Shoals: Necker Island to La Perouse Pinnacle, French Frigate Shoals;  
French Frigate Shoals-Gardner Pinnacles: La Perouse Pinnacle, French Frigate Shoals, to Gardner Pinnacles;  
Gardner Pinnacles-Marø Reef: Gardner Pinnacles to eastern end of Marø Reef;  
Marø Reef-Laysan Island: Western end of Marø Reef to Laysan Island;  
Laysan Island-Lisianski Island: Laysan Island to Lisianski Island;  
Lisianski Island-Pearl and Hermes Atoll: Lisianski Island to Southeast Island, Pearl and Hermes Atoll;  
Pearl and Hermes Atoll-Midway Islands: Western extremity of Pearl and Hermes Atoll to Eastern Island, Midway Islands;  
Midway Islands-Kure Atoll: Sand Island, Midway Islands, to Green Island, Kure Atoll.

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, Pacific Scientific Information Center, Bernice P. Bishop Museum, in November 1980.

Table 117.-- 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 <u>4/</u> .....	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>5/</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>6/</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/ Among the States and Territories, Hawaii ranks fourth in general coastline and seventeenth in tidal shoreline.

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

6/ 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 Oceanic and Atmospheric Administration, National Ocean Survey, The Coastline of the United States (1975) and letters dated October 24, 1961, July 5, 1972, and May 6, 1982.

Table 118.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS

County or island	Square miles			Square kilometers <u>1/</u>		Acres <u>1/</u>	
	Total area	Land area <u>2/</u>	Inland water <u>3/</u>	Total area	Land area <u>2/</u>	Total area	Land area <u>2/</u>
State total .....	6,450.4	6,425.4	25.0	16,706.5	16,641.7	4,128,256	4,112,256
Counties:							
Hawaii .....	4,038.0	4,037.0	1.0	10,458.4	10,455.8	2,584,320	2,583,680
Maui .....	1,161.1	1,160.3	0.8	3,007.2	3,005.2	743,104	742,592
Kalawao .....	13.3	13.3	-	34.4	34.4	8,512	8,512
Honolulu .....	610.9	595.7	15.2	1,582.2	1,542.9	390,976	381,248
Kauai .....	627.1	619.1	8.0	1,624.2	1,603.5	401,344	396,224
Islands:							
Hawaii .....	4,038.0	4,037.0	1.0	10,458.4	10,455.8	2,584,320	2,583,680
Maui .....	728.8	728.2	0.6	1,887.6	1,886.0	466,432	466,048
Kahoolawe .....	45.0	45.0	-	116.5	116.5	28,800	28,800
Molokini <u>4/</u> .....	0.0	0.0	-	0.1	0.1	19	19
Lanai .....	139.5	139.5	-	361.3	361.3	89,280	89,280
Molokai .....	261.1	260.9	0.2	676.2	675.7	167,104	166,976
Oahu .....	607.7	592.7	15.0	1,573.9	1,535.1	388,928	379,328
Kauai .....	553.3	548.7	4.6	1,433.0	1,421.1	354,112	351,168
Niihau .....	73.0	69.6	3.4	189.1	180.3	46,720	44,544
Lehua .....	0.4	0.4	-	1.0	1.0	243	243
Kaula .....	0.4	0.4	-	1.1	1.1	280	280
Northwestern Hawaiian Islands <u>5/</u>	3.2	3.0	0.2	8.2	7.7	2,036	1,895

Footnotes and source on next page.



Table 118.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS -- Con.

1/ Areas in square kilometers and acres were calculated directly from the figures shown for square miles (except for Molokini, Lehua, Kaula, and the Northwestern Hawaiian Islands, for which square miles calculated to three decimal places were used); these equivalents were independently rounded, and hence may not add exactly to the indicated totals and subtotals. 1 sq. mi. = 640 A. = 2.58999 sq. km.

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.

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 of a 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 one nautical mile of water; and islands having less than 40 acres of area.

4/ More exactly, the area of Molokini is 18.6 acres (equivalent to 0.03 square miles or 0.075 square kilometers).

5/ Exclusive of the Midway Islands, which are part of the Hawaiian Archipelago but not legally part of the State of Hawaii. Islands included in the State and their land areas in square miles are: Nihoa, 0.298; Necker Island, 0.091; French Frigate Shoals, 0.088; Gardner Pinnacles, 0.004; Maro Reef, awash; Laysan Island, 1.312 (plus 0.220 of inland water, for a total area of 1.533); Lisianski Island, 0.675; Pearl and Hermes Atoll, 0.122; and Kure Atoll, 0.371.

Source: Data from U.S. Bureau of the Census, Geography Division, cited in the Hawaii State Department of Planning and Economic Development, Hawai'i the Natural Environment (1974), pp. 9 and 10.

Table 119.-- MAJOR SUMMITS

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

Island and mountain	Elevation	
	Feet	Meters
Hawaii:		
Mauna Kea <u>1</u> / .....	13,796	4,205
Mauna Loa <u>1</u> / .....	13,677	4,169
Hualalai .....	8,271	2,521
Kohala .....	5,480	1,670
Kilauea (Uwekahuna) .....	4,093	1,248
Kilauea (Halemaumau Rim) .....	3,660	1,116
Kahoolawe:		
Lua Makika .....	1,477	450
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 .....	4,970	1,515
Olokui .....	4,602	1,403
Kaunuohua .....	4,535	1,382
Kalaupapa Lookout .....	1,600	488
Puu Nana .....	1,381	421
Oahu:		
Kaala .....	4,020	1,225
Puu Kalena .....	3,504	1,068
Konahuanui <u>2</u> / .....	3,150	960
Tantalus .....	2,013	614
Olomana .....	1,643	501
Koko Crater (Kohelepelepe) ...	1,208	368
Nuuanu Pali Lookout .....	1,186	361
Diamond Head .....	760	232
Punchbowl .....	500	152
Koko Head .....	642	196

Continued on next page.

Table 119.-- MAJOR SUMMITS -- Con.

Island and mountain	Elevation	
	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
Hole-in-the-Mountain (Puu Konanae) .....	1,433	437
Sleeping Giant (Nonou) .....	1,241	378
Niihau:		
Paniau .....	1,281	390
Lehua .....	702	214
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 <u>3/</u> .....	12	4
Kure Atoll .....	20	6
Kingman Reef <u>3/</u> .....	3	1
Palmyra Island <u>3/</u> .....	6	2
Johnston Atoll: <u>3/</u>		
Sand Island .....	15	5

Footnotes and source on next page.

Table 119.-- MAJOR SUMMITS -- Con.

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 30,477 feet above their submarine bases as calculated from average depths, and respectively 32,066 and 31,497 feet above as calculated from maximum depths. So measured, Mauna Kea and Mauna Loa are the world's tallest mountains.

2/ Two distinct peaks. The lower one has an elevation of 3,105 feet.

3/ Not part of the State of Hawaii.

Source: U.S. Geological Survey data cited in the Hawaii State Department of Planning and Economic Development, Elevations of Major Mountains in Hawaii (Statistical Report 52, November 7, 1967), as revised by U.S. National Cartographic Information Center, October 11, 1978; U.S. Geological Survey topographic maps; E. D. Baldwin, 1883 Molokini figure on Hawaiian Government Survey Reg. Map No. 1276; U.S.S. Tanager survey, 1923 (for Pearl and Hermes Atoll); A. B. Amerson, Jr., and P. C. Shelton, The Natural History of Johnston Atoll, Atoll Research Bull. No. 192 (The Smithsonian Institution, Dec. 1976). Data compiled with assistance of Lee S. Motteler, Pacific Scientific Information Center, Bernice P. Bishop Museum.

Table 120.-- LAND AND WATER AREA WITHIN THE FISHERY CONSERVATION ZONE

[Land and water area within the 200 nautical mile Fishery Conservation Zone surrounding the Hawaiian Archipelago.]

Category	Square nautical miles	Square statute miles	Square kilometers
Total .....	634,023	839,623	2,174,626
Land area .....	4,852	6,425	16,641
Water area .....	629,171	833,198	2,157,985

Source: Charles E. Harrington, Chief Geographer, Marine Surveys and Maps, National Ocean Survey, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, information supplied September 15, 1978

Table 121.-- 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): <sup>1/</sup>		
Hawaii .....	Wailuku River .....	22.7
Maui .....	Palikeya 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 .....	184.0
Maui .....	Iao Stream .....	54.1
Molokai .....	Pulena Stream .....	22.1
Oahu .....	Waikele Stream .....	25.7
Kauai .....	Hanalei River .....	151.0

<sup>1/</sup> 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 (2), 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: Hawaii State Department of Planning and Economic Development, Hawai'i, the Natural Environment (1974), p. 15; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data supplied May 27, 1977 and April 19, 1982.

Table 122.-- MAJOR NAMED WATERFALLS IN HAWAII, BY ISLANDS

Island	Waterfall <u>1/</u>	Height (feet)		Horizontal distance (feet)	Average discharge (million gal./day)
		Sheer drop	Cascade		
Hawaii ..	Kaluahine .....	...	620	400	...
	Akaka .....	442	...	...	...
	Waiilikahi .....	320	...	...	6.6
	Hiilawe (3 falls) ....	...	300	200	...
	Rainbow .....	80	...	...	303.5
Maui ....	Honokohau .....	...	1,120	500	25.2
	Waihiimalu .....	...	400	150	...
	Waimoku .....	...	40	50	37.1
Molokai .	Kahiwa .....	...	1,750	1,000	...
	Papalaua .....	...	1,200	500	...
	Wailele .....	...	500	150	...
	Haloku .....	...	500	200	...
	Hipuapua .....	...	500	300	...
	Olupena .....	...	300	150	...
	Moaula .....	...	250	200	19.7
Oahu ....	Kaliuwaa (Sacred) <u>2/</u> .	80	1,520	3,000	...
	Waihee (Waimea) .....	40	...	...	6.8
	Manoa .....	...	200	250	2.4
Kauai ...	Waipoo (2 falls) .....	...	800	600	...
	Awini .....	...	480	500	...
	Hinalele .....	280	...	...	...
	Kapakanui .....	280	...	...	...
	Manawaiopuna .....	280	...	...	...
	Wailua .....	80	...	...	...
	Opaekaa .....	40	...	...	...
	Puwainui .....	20	...	...	90.9

1/ Includes the largest named waterfall on each major island, either in height or average discharge; all other named falls 250 feet high or over; and well-known smaller falls. Many unnamed falls have sheer drops of 200 feet or more.

2/ Sheer drop refers to northermost fall of a cascade of six falls.

Source: Hawaii State Department of Planning and Economic Development, Hawai'i, the Natural Environment (1974), table 13, as revised by the Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, June 15, 1982.

Table 123.-- LAKES

[Data shown for the largest natural or man-made lake on each island, and other lakes of interest. Excludes shoreline fish ponds and areas filled only during floods. The largest intermittent lake in the State is Halalii Lake, Niihau, with a maximum area of 840.7 acres.)

Island	Name	Cate- gory <u>1/</u>	Maximum depth (feet)	Elevation (feet)	Area (acres)	Shoreline (miles)
Hawaii ..	Waiakea Pond ....	Natural	(NA)	Sea Level	27	2
	Lake Waiiau <u>2/</u> ...	Natural	10	13,020	1.5	0.2
Maui ....	Kanaha Pond .....	Natural	(NA)	Sea Level	41	2
	Violet Lake .....	Natural	(NA)	5,020	3.0	(NA)
Kahoolawe	None					
Lanai ...	None					
Molokai .	Meyer Lake .....	Natural	5	2,021	6	1
Oahu ....	Wahiawa Reservoir	Man-made	85	842	302	11
	Salt Lake <u>3/</u> ....	Natural	(NA)	Sea Level	273	2
Kauai ...	Waita Reservoir .	Man-made	23	241	424	3
Niihau ..	Halulu Lake .....	Natural	(NA)	Sea Level	182	3

NA Not available.

1/ At the present time there are no natural lakes on Kahoolawe, Lanai, Oahu, or Kauai.

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

3/ Data refer to 1964. Since that time, Salt Lake has been mostly filled and is no longer considered a lake.

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

Table 124.-- MISCELLANEOUS GEOGRAPHIC STATISTICS, BY ISLANDS

Island	Extreme length (miles)	Extreme width (miles)	Miles of sea cliffs with heights 1,000 ft. or more <sup>1/</sup>	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

<sup>1/</sup> According to Lee S. Motteler, Pacific Scientific Information Center, 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 (1982 edition, p. 157) 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 125.-- VOLCANIC ERUPTIONS: 1969 TO 1982

[Complete through February 24, 1982. 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 <sup>1/</sup>	Elevation (feet)	Area (square miles)	Volume (1,000 cubic yards)
Mauna Loa:						
1975: July 5 ....	300	< 1	S	13,000-12,100	5.2	39,200
Kilauea:						
1969: Feb. 22 ...	4.0	6	ER	3,100-2,900	2.3	22,000
May 24 ....	2.0	867	ER	3,150	19.3	242,000
1971: Aug. 14 ...	-	< 1	C	3,660-3,600	0.8	12,400
Sept. 24 ..	-	5	C, SWR	3,740-2,730	1.5	10,500
1972: Feb. 4 ....	4.3	645	ER	3,150	13.7	167,000
1973: May 5 .....	-	< 1	ER	3,340-3,250	0.1	1,600
Nov. 10 ...	-	30	ER	3,250-2,900	0.4	3,700
Dec. 12 ...	0.1	203	ER	3,150	3.1	39,300
1974: July 19 ...	-	3	C, ER	3,600-3,520	1.2	9,000
Sept. 19 ..	2.0	< 1	C	3,680	0.4	14,000
Dec. 31 ...	3.4	< 1	C	3,600	2.9	19,600
1975: Nov. 29 ...	11.0	< 1	C	3,600	0.05	330
1977: Sept. 13 ..	21.5	18	ER	1,600-2,080	3.0	45,000
1979: Nov. 16 ...	26.3	1	ER	3,270-3,200	0.1	800

<sup>1/</sup> C, caldera; ER, east rift; S, summit; SWR, southwest rift.

Source: Gordon A. Macdonald and Douglass H. Hubbard, Volcanoes of the National Parks in Hawaii, 7th edition (Hawaii Natural History Association, December 1974), pp. 14 and 29, as corrected by Dr. Macdonald, May 5, 1976, and updated by the staff of the Hawaiian Volcano Observatory through February 24, 1982.

Table 126.-- EARTHQUAKES OF MAGNITUDE 5 OR GREATER: 1972 TO 1982

[Complete to March 15, 1982.]

Date	Location	Magnitude (Richter Scale)
1972: Dec. 23 .....	W. of Kona .....	5
1973: Apr. 26 .....	Hawaii .....	6.2
Oct. 9 .....	Hawaii .....	4.8-5
1974: Nov. 30 .....	Hawaii .....	5.5-6
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

Source: Augustine S. Furumoto, N. Norby Nielsen, and William R. Phillips, A Study of Past Earthquakes, Isoseismic Zones of Intensity and Recommended Zones for Structural Design for Hawaii (University of Hawaii, Center for Engineering Research, June 15, 1972), pp. 16-19; 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.

Table 127.-- TSUNAMIS WITH RUN-UP OF 2 METERS (6.6 FEET) OR MORE:  
1946 TO 1982

[Correct to March 15, 1982.]

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; Hawaii Institute of Geophysics, records; 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).

Table 128.-- MAJOR DAMS: 1981

Name <sup>1/</sup>	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

<sup>1/</sup> Listed by volume of water impounded.

Source: Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, information supplied February 11, 1981.

Table 129.-- WATER USE, BY ISLANDS: 1975

[In millions of gallons per day.]

Island	All uses		Municipal	Agricultural <sup>1/</sup>
	Including seawater	Fresh only		
State total .....	2,808	1,775	234	971
Hawaii .....	283	278	18	17
Maui .....	606	564	18	410
Lanai .....	2	2	1	1
Molokai .....	5	5	1	4
Oahu .....	1,430	471	183	238
Kauai .....	482	455	13	301
Niihau .....	(z)	(z)	(z)	(z)
	Industrial			
	Thermoelectric		Hydroelectric	Other <sup>2/</sup>
Island	Fresh	Seawater		
State total .....	137	1,033	204	232
Hawaii .....	79	5	70	95
Maui .....	25	42	47	66
Lanai .....	-	-	-	-
Molokai .....	(z)	-	-	(z)
Oahu .....	16	959	-	34
Kauai .....	17	27	87	37
Niihau .....	-	-	-	-

z Less than 0.5 mgd.

<sup>1/</sup> Maui, Oahu, and Kauai data include recycled water.<sup>2/</sup> Hawaii, Maui, and Kauai data include recycled water.Source: Hawaii State Department of Land and Natural Resources, State Water Resources Development Plan and Technical Reference Document (September 1980), p. III-20.

Table 130.-- WATER QUALITY AT SPECIFIED PUBLIC BEACHES: 1978 TO 1981

Island and beach	Number of samples, 1981	Fecal coliform density $\bar{1}$ / (geometric mean, MPN/100 ml)			
		1978	1979	1980	1981
Hawaii (Hilo side):					
Exit of Ice Pond .....	10	84.0	42.3	41.6	178.3
Leileiwi Beach Park .....	10	63.1	93.5	195.5	219.3
Onekahakaha .....	10	6.0	6.8	13.5	8.2
Puhi Bay No. 3 .....	10	10.8	6.9	9.1	30.4
Hawaii (Kona side):					
Hapuna Beach .....	11	3.1	6.1	16.2	19.5
Kahaluu Beach .....	10	3.5	2.7	2.5	2.0
Kealakekua Bay (off curio stand) .	11	2.3	2.6	2.5	2.3
Kealakekua Bay (off canoe landing)	11	2.4	3.0	2.8	2.4
Magic Sands Beach .....	11	21.5	3.2	3.6	2.4
Puako Beach Lots (middle) .....	11	14.9	13.8	16.7	9.0
Puako Beach Lots (far end) .....	11	48.6	17.4	35.8	18.6
Spencer Beach Park .....	11	9.1	9.3	7.8	29.5
Maui:					
Hukilau Hotel shoreline .....	12	8.3	5.6	3.3	2.0
Kahului Breakwater .....	12	32.4	7.6	2.1	2.0
Wailuku Breakwater .....	12	387.7	5.5	4.2	2.8
Oahu:					
Ala Moana Park (ewa) .....	26	5.0	5.6	5.1	5.6
Ala Moana Park (center) .....	10	3.2	3.7	3.1	4.1
Ala Moana Park (diamond head) ....	11	3.9	6.8	7.9	5.4
Elks Club Beach .....	12	5.0	15.8	5.9	4.0
Ewa Beach .....	12	6.2	4.5	4.3	6.3
Ft. DeRussy Beach .....	12	4.2	18.5	7.2	5.2
Gray's Beach .....	24	6.6	6.9	5.7	5.7
Hanauma Bay .....	12	2.4	10.0	5.1	8.1
Kahana Park Beach .....	12	49.5	42.9	35.9	43.6
Kahanamoku Beach .....	11	4.2	17.3	8.9	4.5
Kahanamoku Lagoon (diamond head) .	25	84.9	94.8	127.3	79.8
Kailua Bay outfall shoreline .....	12	2.3	2.5	8.8	2.3
Kailua Beach Park .....	12	6.7	17.8	13.2	3.7
Kokokahi Pier .....	12	30.3	45.6	60.6	25.6
Kuhio Beach .....	18	10.6	17.9	37.3	5.2
Public Bath Beach .....	18	3.6	4.3	4.6	3.6
Tavern Beach .....	12	10.1	8.9	17.9	3.5
Sand Island Pt. #1 .....	12	28.2	13.9	3.6	2.0
Sand Island Pt. #2 .....	12	21.5	33.2	3.9	15.1
Sand Island Pt. #3 .....	12	24.7	89.6	8.9	4.4
Sand Island Pt. #4 .....	12	15.2	19.6	17.3	7.7

Continued on next page.

Table 130.-- WATER QUALITY AT SPECIFIED PUBLIC BEACHES: 1978 TO 1981 - Con.

Island and beach	Number of samples, 1981	Fecal coliform density <sup>1/</sup> (geometric mean, MPN/100 ml)			
		1978	1979	1980	1981
Kauai:					
Brennecke Beach .....	4	3.6	2.9	2.7	2.0
Hanalei Bay Landing .....	4	64.4	25.5	30.6	16.7
Poipu Beach .....	4	9.0	3.7	2.3	2.7

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

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied June 4, 1982.

Table 131.-- WATER SERVICES AND CONSUMPTION, FOR COUNTY WATERWORKS: 1980 AND 1981

Geographic area	Number of services, June 30		Consumption <sup>1/</sup> (millions of gallons)	
	1980	1981	1980	1981
State total .....	175,382	178,250	55,610	58,574
City and County of Honolulu ..	124,752	125,903	42,519	44,216
Honolulu <sup>2/</sup> .....	58,082	58,349	24,168	25,086
Rest of Oahu .....	66,670	67,554	18,351	19,130
Hawaii County .....	22,446	23,215	4,433	4,664
Kauai County .....	10,169	10,632	2,745	2,780
Maui County .....	18,015	18,500	5,913	6,914
Maui .....	16,892	17,376	5,649	6,620
Molokai .....	1,123	1,124	265	294

<sup>1/</sup> Year ended June 30.

<sup>2/</sup> Maunalua to Moanalua.

Source: Honolulu Board of Water Supply, Annual Report and Statistical Summary for 1979-1980 and 1980-1981; Hawaii Department of Water Supply, Annual Report for 1979-1980 and 1980-81; Kauai Department of Water, records; Maui Department of Water Supply, Annual Report for the Fiscal Year Ended June 30, 1981.

Table 132.-- AIR QUALITY IN DOWNTOWN HONOLULU:  
1971 TO 1981

[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 (ug/m <sup>3</sup> )	
	Total suspended particulates	Sulfur oxides
1971 .....	45	11
1972 .....	41	11
1973 .....	34	7
1974 .....	35	10
1975 .....	40	9
1976 .....	34	23
1977 .....	31	17
1978 .....	29	18
1979 .....	32	22
1980 .....	37	18
1981 .....	40	19
Standards: <u>1/</u>		
Primary .....	75	80
Secondary .....	60	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 June 4, 1982.

Table 133.-- SOURCES OF AIR POLLUTANT EMISSIONS, BY COUNTIES:  
1981

[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	Maui
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)
Ag. fuel .....	6.5	15.1	2.0	13.7	12.9
Industrial process losses ..	14.6	7.1	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 & 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 June 4, 1982.



Table 134.-- AIR QUALITY AT SPECIFIED LOCATIONS: 1981

[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 ...	26	188	51	< 5	40	< 5
Downtown Honolulu	23	75	40	< 5	44	19
Kalihi Kai .....	32	93	53	< 5	8	< 5
Pearl City .....	19	71	34	< 5	< 5	< 5
Waikiki .....	18	78	36	< 5	< 5	< 5
Waimanalo .....	14	78	28	...	...	...
Maui:						
Kahului .....	28	180	76	< 5	337	74
Kihei .....	17	137	50	...	...	...
Hawaii:						
Hilo .....	10	46	19	< 5	11	< 5
Honokaa .....	12	66	24	...	...	...
Kauai:						
Lihue .....	18	83	37	< 5	< 5	< 5

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied June 4, 1982.

Table 135.-- NOISE LEVELS IN SPECIFIED NEIGHBORHOODS ON OAHU:  
1981-1982

[Data collected during the latter part of 1981 and early 1982, during daylight hours only. Data were obtained from both manual sampling, utilizing on-site noise-level readouts, and automatic sampling, utilizing a community noise analyzer. Differences in noise levels as measured by the two types of sampling result from the inclusion in the automatic samplings of such sources as vehicles traveling near the microphone, barking dogs, or other instantaneous sounds. With manual samplings, these sources are eliminated from the recorded data. The 1981-1982 surveys were concentrated in Honolulu and Windward Oahu; future surveys will be conducted in Leeward Oahu and along the North Shore.]

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
HONOLULU						
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
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
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
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
REST OF OAHU						
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
Wahiawa .....	47.1	44.7	42.4	51.8	47.3	43.9
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, data provided June 8, 1982.

Table 136.-- GOVERNMENT EXPENDITURE FOR ENVIRONMENTAL QUALITY CONTROL: 1977 TO 1979

[In thousands of dollars. For years ended June 30.]

Unit of government and year	Type of environmental quality control				
	Total	Water	Land	Air	Other
STATE OF HAWAII					
1977 .....	14,590	13,077	852	370	291
1978 .....	5,164	3,636	851	340	337
1979 .....	3,993	2,403	766	307	517
CITY AND COUNTY OF HONOLULU					
1977 .....	56,850	42,413	14,303	-	134
1978 .....	69,290	57,318	11,873	-	99
1979 .....	40,874	30,194	10,591	-	89

Source: U.S. Department of Commerce, Bureau of the Census, Environmental Quality Control--Government Finances, State and Local Government Special Studies (annual).

Table 137.-- AVERAGE WATER TEMPERATURES AT WAIKIKI BEACH

[°F.]

Month	Morning	Afternoon
March .....	75	77
August .....	77	82

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, Hawaii, 1981.

Table 138.-- CLIMATIC DATA FOR SELECTED PLACES

Island and station	Ground elevation (feet)	Average temperature (°F.)		Extreme temperature of record (°F.)		Average annual precipitation (inches)	Average annual possible sunshine (percent)
		Coolest month	Warmest month	Lowest	Highest		
Hawaii:							
Hilo Airport .....	26	71.0	75.9	53	94	133.57	40
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 <u>1/</u> .....	10	73.1	79.8	52	98	9.47	...
Waimea (Kamuela) .....	2,670	62.3	66.8	34	90	40.05	...
Mauna Kea summit <u>2/</u> .....	13,796	31.1	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 <u>3/</u> .....	90	70.9	78.4	49	98	13.79	...
Kahului Airport .....	48	71.6	78.8	48	96	18.43	70
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	72.3	80.7	53	93	22.90	68
Honolulu Federal Bldg. <u>4/</u> .....	12	72.0	78.6	57	88	25.35	65
Waikiki <u>5/</u> .....	10	71.9	80.6	51	93	27.32	...
Manoa (HSPA) .....	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 138.-- CLIMATIC DATA FOR SELECTED PLACES -- Con.

Island and station	Ground elevation (feet)	Average temperature (°F.)		Extreme temperature of record (°F.)		Average annual precipitation (inches)	Average annual possible sunshine (percent)
		Coollest month	Warmest month	Lowest	Highest		
Kauai:							
Kilauea .....	315	68.7	75.6	49	94	68.03	...
Kealia .....	9	70.2	78.0	44	93	43.28	...
Lihue Airport .....	103	71.2	79.1	50	90	44.18	56
Poipu (Makahuena Pt.) .....	52	72.4	79.4	50	93	36.39	...
Kokee (Kanalohuluhulu) .....	3,600	54.9	65.5	31	80	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 Mohukona.

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

3/ Temperature data refer to Puunene Airport.

4/ Temperature sensors are 87 feet above the ground.

5/ Located at Honolulu Zoo. Available only from 1965.

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 Center, Local Climatological Data, Annual Summary With Comparative Data, 1981 for Hilo, Kahului, Honolulu, and Lihue; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data supplied July 9, 1982.

Table 139.-- 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. .	79.3	65.3	72.3	87	53	4.40	14.74	0.34	6.72
Feb. .	79.2	65.3	72.3	87	53	2.46	13.68	0.32	6.88
Mar. .	79.7	66.3	73.0	88	55	3.18	20.79	0.01	17.07
Apr. .	81.4	68.1	74.8	89	59	1.36	8.92	0.01	4.21
May ..	83.6	70.2	76.9	90	62	0.96	7.23	0.05	3.44
June .	85.6	72.2	78.9	90	65	0.32	2.46	T	2.28
July .	86.8	73.4	80.1	91	67	0.60	2.01	0.03	1.03
Aug. .	87.4	74.0	80.7	92	67	0.76	3.08	T	2.35
Sept.	87.4	73.4	80.4	92	66	0.67	2.74	0.05	1.40
Oct. .	85.8	72.0	78.9	93	64	1.51	11.15	0.11	7.57
Nov. .	83.2	69.8	76.5	89	58	2.99	14.72	0.03	9.15
Dec. .	80.3	67.1	73.7	89	54	3.69	12.09	0.06	8.14
Ann. .	83.3	69.8	76.6	93	53	22.90	20.79	T	17.07

Continued on next page.

Table 139.-- MONTHLY AND ANNUAL CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT -- Con.

Month	Relative humidity (percent) <u>2/</u>		Wind (miles/hour)		Percent of possible sun- shine	Mean sky cover, sunrise to sun- set <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. ...	81	63	9.9	67	63	5.5	9	9	10
Feb. ...	78	60	10.7	63	63	5.7	7	9	10
Mar. ...	73	58	11.7	59	69	5.9	7	10	9
Apr. ...	70	57	12.1	40	67	6.2	6	11	9
May ....	67	55	12.2	35	69	6.0	6	10	7
June ...	67	54	13.0	39	70	5.7	6	7	6
July ...	66	52	13.7	34	74	5.3	7	5	8
Aug ....	68	54	13.4	52	75	5.3	8	6	6
Sept. ..	67	52	11.7	36	75	5.2	8	6	7
Oct. ...	69	55	10.9	40	68	5.6	7	8	9
Nov. ...	75	59	11.0	65	61	5.7	7	9	9
Dec. ...	79	62	10.9	59	59	5.6	8	10	10
Ann. ...	72	57	11.8	67	68	5.6	86	100	101

T Trace, an amount too small to measure.

1/ For periods October 1962 through December 1964 and September 1971 through December 1981.

2/ Data for 1963, 1964, and 1972-1981.

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, Environmental Data and Information Service, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, 1981.

Table 140.-- CLIMATIC DATA FOR THE PERIOD OF RECORD

Subject	Date	Place	Magnitude
<b>Long-term averages:</b>			
Lowest monthly average minimum temp. (°F.) ..	February .....	Mauna Kea summit ..	23.3
Lowest monthly average daily temp. (°F.) .....	February .....	Mauna Kea summit ..	31.1
Highest monthly average maximum temp. (°F.) .	August .....	Waiawa, Kauai .....	89.7
Highest monthly average daily temp. (°F.) ...	August .....	Puako, Hawaii .....	80.7
Lowest average annual rainfall (inches) .....	.....	N. of Kawaihae ....	5.7
Highest average annual rainfall (inches) .....	.....	Waialeale .....	451.0
<b>Single events:</b>			
Lowest temperature of record (°F.) .....	Feb. 11, 1973 ...	Mauna Kea summit ..	11.
Highest temperature of record (°F.) .....	April 27, 1931 ..	Pahala, Hawaii ....	100.
Lowest annual rainfall of record (inches) ...	1953 .....	Kawaihae, Hawaii ..	0.2
Highest annual rainfall of record (inches) ..	1947-1948 .....	Waialeale .....	624.
Highest wind speed of record (m.p.h.) .....	Jan. 17-18, 1959	Mauna Loa Obser. ..	105+

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 July 9, 1982.



Table 141.-- CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT: ANNUALLY,  
1971 TO 1981

Year	Average temperature (°F.)			Extreme temp. (°F.)		Precipitation (inches)
	Annual	Coolest month	Warmest month	Lowest	Highest	
1971 ...	76.1	71.7	79.5	56	89	26.64
1972 ...	76.2	70.4	81.1	53	90	26.94
1973 ...	77.2	72.6	81.2	55	91	14.24
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

  

Year	Relative humidity (%)		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		
1971 ...	72	57	13.3	34	70	110
1972 ...	72	57	13.2	33	65	93
1973 ...	70	54	12.7	33	63	110
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

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

Table 142.-- RAINFALL AT SPECIFIED LOCATIONS:  
ANNUALLY, 1971 TO 1981

[In inches.]

Year	Hawaii			Maui		
	Hilo Airport	Kona Airport	Keahole Airport	Kahului Airport	Kihei	Lahaina
1971 ...	140.69	27.28	...	20.13	21.12	15.93
1972 ...	98.85	28.82	16.25	15.71	13.43	20.21
1973 ...	107.97	12.49	8.37	10.27	5.92	10.13
1974 ...	112.92	35.57	...	18.68	14.97	13.01
1975 ...	99.93	20.28	...	13.74	10.63	12.19
1976 ...	114.67	17.32	...	12.83	8.84	8.86
1977 ...	90.38	14.60	...	11.50	7.88	8.28
1978 ...	119.09	18.93	...	19.15	9.91	11.97
1979 ...	158.77	...	...	26.82	21.32	20.85
1980 ...	127.74	...	...	27.87	20.27	22.69
1981 ...	89.91	...	7.82	12.85	9.72	8.13

  

Year	Oahu			Kauai		
	Waikiki	Hono- lulu <u>1/</u>	Honolulu Airport	Koloa	Lihue Airport	Kilauea Point
1971 ...	26.70	28.61	26.64	75.33	49.62	68.67
1972 ...	24.26	26.72	26.94	66.72	43.54	59.61
1973 ...	18.79	18.66	14.24	66.78	35.27	35.54
1974 ...	24.51	28.24	24.02	86.35	45.60	119.40
1975 ...	25.98	24.63	24.39	49.91	35.52	31.29
1976 ...	13.59	...	12.90	62.60	32.83	40.99
1977 ...	15.73	...	12.36	52.51	40.34	27.82
1978 ...	27.18	25.63	25.05	70.64	39.11	40.45
1979 ...	26.22	24.78	16.93	55.98	37.09	47.21
1980 ...	28.50	27.21	26.90	78.78	54.64	45.82
1981 ...	19.09	...	13.41	66.26	38.14	56.81

1/ Old Federal Building, 335 Merchant Street.  
Observations suspended November 26, 1976 to March 31, 1977,  
and discontinued in May 1981.

Source: U.S. Department of Commerce, National Climatic Center, Local Climatological Data, Annual Summary with Comparative Data, 1981 for Hilo, Kahului, Honolulu, and Lihue; 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 143.-- TRADE WINDS, HIGH SURF, AND TEMPERATURES IN HAWAIIAN WATERS,  
BY MONTHS

Month	Trade wind frequency <u>1/</u> (percent)	Expected days of strong trade winds <u>2/</u>	Highest surf <u>3/</u> (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 144.-- 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 145.-- SHADOWLESS NOONS IN HILO, HONOLULU, AND LIHUE: 1983

[Times when the sun is directly overhead in 1983.]

Location	Sun moving north		Sun moving south	
	Date	Time (P.M.)	Date	Time (P.M.)
Hilo .....	May 19 ....	12:16	July 26 .....	12:26
Honolulu .....	May 28 ....	12:28	July 16-17 ....	12:37
Lihue .....	June 1 ....	12:36	July 12 .....	12:43

Source: Walter R. Steiger, Science Center and Planetarium, Bernice P. Bishop Museum, June 21, 1982.

Table 146.-- HAWAII AUDUBON SOCIETY BIRD COUNTS OF THE  
HONOLULU AREA: 1970 TO 1981

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

Species <sup>1/</sup>	Annual averages		1980	1981
	1970- 1974	1975- 1979		
All species:				
Species .....	49	54	44	48
Individual birds ..	11,614	15,811	20,226	19,427
Endemic species:				
'Apapane .....	35	135	147	153
Hawaiian Coot .....	69	35	28	28
Hawaiian Stilt .....	112	128	115	92
Oahu 'Amakihi .....	42	132	152	159
Indigenous species:				
Great Frigatebird .....	614	597	615	366
Red-footed Booby .....	1,463	1,401	1,132	1,063
Introduced species:				
Barred Dove .....	1,468	2,216	2,541	3,694
Cattle Egret .....	759	1,156	1,072	682
Common Myna .....	2,567	2,241	3,577	2,917
House Sparrow .....	1,373	1,155	1,684	1,604
Japanese White-eye .....	450	1,165	1,003	970
Red-vented Bulbul .....	31	503	1,174	1,159
Spotted Dove .....	586	1,091	1,104	1,393
Migratory species:				
American Golden Plover .	564	1,138	1,884	1,621
Ruddy Turnstone .....	97	165	397	361

<sup>1/</sup> 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).

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

Table 147.-- TREES ALONG STREETS OR IN PARKS UNDER THE JURISDICTION OF THE CITY AND COUNTY OF HONOLULU: 1980 AND 1981

Location	June 30, 1980	June 30, 1981
Along City and County streets and highways <u>1/</u> .....	108,202	110,975
In City and County parks .....	95,700	96,250

1/ Excludes Federal, State, and private thoroughfares.  
Source: City and County of Honolulu, Department of Parks and Recreation, records.

Table 148.-- ENDANGERED, THREATENED, AND EXTINCT SPECIES OF NATIVE HIGHER PLANTS: 1977

Status	Species, subspecies, and varieties	Percent
Total native flora .....	2,200	100.0
Endangered, threatened, or extinct <u>1/</u> ...	1,113	50.6
Endangered .....	646	29.4
Threatened .....	197	8.9
Extinct .....	270	12.3
Not endangered, threatened, or extinct .	1,087	49.4

1/ For the other 49 States, 2,140 (or 10.7 percent) of all 20,000 native higher plants are endangered, threatened, or extinct.

Source: Edward S. Ayensu and Robert A. DeFilipps, Endangered and Threatened Plants of the United States (Smithsonian Institution and the World Wildlife Fund, Inc., 1978), p. xiii.