

Table
Number **Table Name**

(Click on the table number to go to corresponding table)

Narrative

| | |
|-----------------------|--|
| 05.01 | Great Circle Distance Between Specified Places |
| 05.02 | Latitude and Longitude of Selected Places |
| 05.03 | Time Difference Between Honolulu and Selected Cities |
| 05.04 | Width and Depth of Channels |
| 05.05 | General Coastline and Tidal Shoreline of Counties and Islands |
| 05.06 | Hawaiian Coastal Waters, by Island: 2006 to 2020 |
| 05.07 | Land and Water Area within the Fishery Conservation Zone |
| 05.08 | Hawaiian Perennial Streams, by Island: 2006 to 2020 |
| 05.09 | Land Area, by County: 2010 |
| 05.10 | Land Area, by Island: 2010 |
| 05.11 | Major and Minor Islands in the Hawaiian Archipelago |
| 05.12 | Area and Depth of Selected Craters |
| 05.13 | Elevation of Major Summits |
| 05.14 | Major Named Waterfalls, by Island |
| 05.15 | Major Streams, by Island |
| 05.16 | Lakes and Lake-Like Waters, by Island |
| 05.17 | Length and Width of Selected Beaches |
| 05.18 | Miscellaneous Geographic Statistics, by Island |
| 05.19 | Volcanic Eruptions: Mauna Loa 1950 to 1984, Kilauea 1969 to 2020 |
| 05.20 | Earthquakes of Magnitude 6.2 or Greater: 1823 to 2019 |
| 05.21 | Earthquakes with Intensities of V or Greater on Oahu: 1859 to 2019 |
| 05.22 | Tsunamis with Run-up of 2 Meters (6.6 feet) or More: 1812 to 2020 |
| 05.23 | Major Dams as of December 31, 2020 |
| 05.24 | Fresh Water Use, by Type and by County: 2015 |
| 05.25 | Water Services and Consumption, for County Waterworks: 2018 to 2020 |
| 05.26 | Water Withdrawals by Source and Major Use, for Hawaii and the United States: 2015 |
| 05.27 | Top 25 Water Users on Oahu: 2019 |
| 05.28 | Top 25 Water Users on Oahu: 2020 |
| 05.29 | Wastewater Treatment Plant Operation and Compliance: 1994 to 2020 |
| 05.30 | Wastewater Recycled: 1994 to 2020 |
| 05.31 | Hazardous Waste Sites, Threats and Contaminants on Oahu: 2021 |
| 05.32 | Hazardous Waste Generated, Shipped, and Received in 2017 and Toxic Chemical Releases in 2018 |
| 05.33 | Solid Waste Recycled in Hawaii: 2001 to 2020 |
| 05.34 | Deposit Beverage Container Redemption Rate: 2006 to 2020 |
| 05.35 | Water Quality at Public Beaches, by Island: 2019 to 2020 |
| 05.36 | Water Quality at Selected Public Beaches: 2019 to 2020 |

Table
Number **Table Name**

(Click on the table number to go to corresponding table)

| | |
|-----------------------|--|
| 05.37 | Total Days per Year of Shoreline Postings: 2006 to 2020 |
| 05.38 | Refuse and Sewage Statistics for Oahu: 2006 to 2020 |
| 05.39 | Air Quality in Downtown Honolulu: 1988 to 2020 |
| 05.40 | Air Quality at Specified Locations: 2020 |
| 05.41 | Release of Toxics: 1999 to 2019 |
| 05.42 | Toxic Release Inventory Chemical Releases: 1988 to 2019 |
| 05.43 | Release of Persistent, Bioaccumulative and Toxic (PBT) Chemicals: 2002 to 2019 |
| 05.44 | Oil and Chemical Releases: 2006 to 2020 |
| 05.45 | Atmospheric Carbon Dioxide Measurements at Mauna Loa: 1958 to 2020 |
| 05.46 | Temperatures and Precipitation for Selected Places: 2018 |
| 05.47 | Temperatures and Precipitation for Selected Places: 2019 |
| 05.48 | Temperatures and Precipitation for Selected Places: 2020 |
| 05.49 | Climatic Normals, Means, and Extremes for Hilo, Kahului, Honolulu, and Lihue Airports: 2020 |
| 05.50 | Monthly and Annual Climatic Data for Daniel K. Inouye International Airport: 2020 |
| 05.51 | Average Temperature, Percent of Possible Sunshine, and Precipitation, for Daniel K. Inouye International Airport: 1970 to 2020 |
| 05.52 | Average Daily Temperature and Days with Maximum of 90° or Higher, for Daniel K. Inouye International Airport: 1971 to 2020 |
| 05.53 | Climatic Data for Daniel K. Inouye International Airport: 2008 to 2020 |
| 05.54 | Climatic Data for the Period of Record |
| 05.55 | Rainfall at Specified Locations: 2003 to 2020 |
| 05.56 | Major Hurricanes: 1950 to 2020 |
| 05.57 | Trade Winds, High Surf, and Temperatures in Hawaiian Waters, by Month: 1995 |
| 05.58 | Sunrise, Sunset, and Hours of Daylight at Selected Locations, at Beginning of Each Season: 2021 |
| 05.59 | Sunrise, Sunset, and Hours of Daylight at Selected Locations, at Beginning of Each Season: 2022 |
| 05.60 | Hawaii Audubon Society Bird Counts of Selected Species in the Honolulu Area: 2016 to 2020 |
| 05.61 | Hawaii Audubon Society Bird Counts in the Honolulu Area, by Type of |
| 05.62 | Bird Species of Hawaii |
| 05.63 | Trees Along Streets or in Parks Under the Jurisdiction of the City and County of Honolulu: 2015 to 2020 |
| 05.64 | Threatened and Endangered Species, for Hawaii and the United States: 2021 |

Section 5

GEOGRAPHY AND ENVIRONMENT

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

Important sources of data include the U.S. Geological Survey, the National Ocean Survey, the National Climatic Data Center, the Division of Water Resource Management of the Hawaii State Department of Land and Natural Resources, the Hawaii State Department of Health, and the University of Hawaii at Manoa, School of Ocean and Earth Science and Technology, Department of Atmospheric Science. Detailed information is given in *Atlas of Hawaii*, 3rd edition, published by the University of Hawaii Press in 1998.

Table 5.01-- GREAT CIRCLE DISTANCE BETWEEN SPECIFIED PLACES

| Places | Statute miles | Nautical miles | Kilometers |
|---|----------------------|-----------------------|-------------------|
| Distances from Daniel K. Inouye International Airport | | | |
| Hawaiian Islands locations | | | |
| Hilo, Hawaii | 214 | 186 | 344 |
| Kailua-Kona, Hawaii | 168 | 146 | 270 |
| Kahului, Maui | 98 | 85 | 158 |
| Lanai Airport | 72 | 63 | 116 |
| Molokai Airport | 54 | 47 | 87 |
| Lihue, Kauai | 103 | 90 | 166 |
| Puuwai, Niihau | 152 | 132 | 245 |
| Nihoa | 283 | 246 | 455 |
| Necker Island | 520 | 452 | 837 |
| French Frigate Shoals | 556 | 483 | 895 |
| Gardner Pinnacles | 688 | 598 | 1,107 |
| Maro Reef | 851 | 739 | 1,369 |
| Laysan Island | 936 | 813 | 1,506 |
| Lisianski Island | 1,065 | 925 | 1,714 |
| Pearl and Hermes Atoll | 1,208 | 1,050 | 1,944 |
| Midway Islands | 1,309 | 1,137 | 2,106 |
| Kure Atoll | 1,367 | 1,188 | 2,200 |
| Other Pacific locations | | | |
| Apra Harbor, Guam | 3,806 | 3,307 | 6,124 |
| Auckland, New Zealand | 4,393 | 3,817 | 7,068 |
| Baker Island | 1,900 | 1,649 | 3,058 |
| Hong Kong | 5,541 | 4,815 | 8,915 |
| Howland Island | 1,900 | 1,649 | 3,058 |
| Jarvis Island | 1,560 | 1,354 | 2,511 |
| Johnston Atoll | 820 | 713 | 1,319 |
| Kingman Reef | 1,073 | 932 | 1,726 |
| Kiritimati (Christmas Island), Kiribati | 1,344 | 1,168 | 2,163 |
| Majuro, Marshall Islands | 2,271 | 1,973 | 3,654 |
| Manila, Philippines | 5,293 | 4,599 | 8,516 |
| Nuku Hiva, Marquesas Islands | 2,400 | 2,086 | 3,864 |
| Pago Pago, American Samoa | 2,606 | 2,265 | 4,193 |
| Palmyra Atoll | 1,101 | 957 | 1,772 |
| Papeete, Tahiti | 2,741 | 2,382 | 4,410 |
| Suva, Fiji | 3,159 | 2,745 | 5,083 |
| Sydney (Port Jackson), Australia | 5,070 | 4,406 | 8,158 |
| Tokyo, Japan | 3,847 | 3,343 | 6,190 |
| Wake Island | 2,294 | 1,993 | 3,691 |

Continued on next page.

Table 5.01-- GREAT CIRCLE DISTANCE BETWEEN SPECIFIED PLACES -- Con.

| Places | Statute miles | Nautical miles | Kilometers |
|---|---------------|----------------|------------|
| Distances from Daniel K. Inouye International Airport -- Con. | | | |
| North and South American locations | | | |
| Anchorage, Alaska | 2,781 | 2,417 | 4,475 |
| Cape Horn, Chile | 7,457 | 6,480 | 11,998 |
| Chicago, Illinois | 4,179 | 3,631 | 6,724 |
| Cristobal, Canal Zone | 5,214 | 4,531 | 8,389 |
| Los Angeles, California | 2,557 | 2,222 | 4,114 |
| Miami, Florida | 4,856 | 4,220 | 7,813 |
| New York, New York | 4,959 | 4,309 | 7,979 |
| Portland, Oregon | 2,595 | 2,255 | 4,175 |
| San Diego, California | 2,610 | 2,268 | 4,199 |
| San Francisco, California | 2,397 | 2,083 | 3,857 |
| Seattle, Washington | 2,679 | 2,328 | 4,311 |
| Vancouver, B.C. | 2,709 | 2,354 | 4,359 |
| Tijuana, Mexico | 2,616 | 2,273 | 4,209 |
| Washington, D.C. | 4,829 | 4,196 | 7,770 |
| London, England | 7,226 | 6,279 | 11,627 |
| Bombay, India | 8,010 | 6,960 | 12,888 |
| Ghanzi, Botswana 1/ | 12,417 | 10,790 | 19,979 |
| Equator, due south of Honolulu | 1,470 | 1,277 | 2,367 |
| North Pole | 4,740 | 4,119 | 7,631 |
| Other distances | | | |
| Hilo to -- | | | |
| Los Angeles, California | 2,447 | 2,126 | 3,937 |
| San Francisco, California | 2,315 | 2,012 | 3,725 |
| Kure Atoll to -- | | | |
| Cape Kumukahi, Puna, Hawaii 2/ | 1,523 | 1,323 | 2,451 |
| Log Point, Elliot Key, Florida 3/ | 5,852 | 5,085 | 9,416 |
| Tokyo, Japan | 2,486 | 2,160 | 4,000 |
| West Quoddy Head, Maine | 5,788 | 5,030 | 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 50 states.

Source: U.S. Geological Survey, *Elevations and Distances in the United States* (1980), pp. 22-23, and records; and E. H. Bryan, Jr., *American Polynesia and the Hawaiian Chain* (1942), pp. 38, 42, and 134.

Table 5.02-- LATITUDE AND LONGITUDE OF SELECTED PLACES

| Island and place | Latitude (North) | Longitude (West) |
|--|---------------------|---------------------|
| Hawaii | | |
| Hilo International Airport | 19°43' | 155°04' |
| Cape Kumukahi | 19°31' | 154°49' |
| Ka Lae | 18°56' | 155°41' |
| Keahole Point | 19°44' | 156°04' |
| Upolu Point | 20°16' | 155°51' |
| Geographic center of State (off Maui) | 20°15' | 156°20' |
| Maui | | |
| Wailuku | 20°53' | 156°30' |
| Kahului Airport | 20°54' | 156°26' |
| Hana | 20°45' | 155°59' |
| Cape Hanamanioa | 20°35' | 156°25' |
| Lahaina | 20°52' | 156°41' |
| Kahoolawe | | |
| Puu Moaulanui | 20°34' | 156°34' |
| Lanai | | |
| Lanai Airport | 20°48' | 156°57' |
| Molokai | | |
| Kaunakakai | 21°05' | 157°02' |
| Laaupoint | 21°06' | 157°19' |
| Cape Halawa | 21°10' | 156°43' |
| Oahu | | |
| Daniel K. Inouye International Airport | 21°20' | 157°55' |
| Aloha Tower | 21°19' | 157°52' |
| Kaena Point | 21°35' | 158°17' |
| Kahuku Point | 21°43' | 157°59' |
| Makapuu Point | 21°19' | 157°39' |
| Diamond Head | 21°16' | 157°49' |
| Kauai | | |
| Lihue Airport | 21°59' | 159°21' |
| Mana | 22°02' | 159°46' |
| Kilauea Point | 22°14' | 159°24' |
| Niihau | | |
| Puuwai | 21°54' | 160°12' |
| Kure Atoll | 28°25' | 178°22' |

Source: U.S. Board on Geographic Names, *Gazetteer No. 24, Hawaiian Islands* (1956); U.S. Geological Survey, *Elevations and Distances in the United States* (1980), pp. 17 and 22-23; 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; Bernice P. Bishop Museum, records; and Hawaii State Department of Accounting and General Services, Survey Division and records.

Table 5.03-- TIME DIFFERENCE BETWEEN HONOLULU AND SELECTED CITIES

[Standard time]

| City | Country | Day | Hour | Time difference |
|---------------|----------------|------|------------|-----------------|
| Honolulu | United States | Same | 9:00 a.m. | - |
| Anchorage | United States | Same | 10:00 a.m. | +1 |
| Vancouver | Canada | Same | 11:00 a.m. | +2 |
| Los Angeles | United States | Same | 11:00 a.m. | +2 |
| Las Vegas | United States | Same | 11:00 a.m. | +2 |
| Denver | United States | Same | 12:00 p.m. | +3 |
| Houston | United States | Same | 1:00 p.m. | +4 |
| Winnipeg | Canada | Same | 1:00 p.m. | +4 |
| Chicago | United States | Same | 1:00 p.m. | +4 |
| Atlanta | United States | Same | 2:00 p.m. | +5 |
| Miami | United States | Same | 2:00 p.m. | +5 |
| Toronto | Canada | Same | 2:00 p.m. | +5 |
| Lima | Peru | Same | 2:00 p.m. | +5 |
| New York City | United States | Same | 2:00 p.m. | +5 |
| Santiago | Chile | Same | 3:00 p.m. | +6 |
| Buenos Aires | Argentina | Same | 4:00 p.m. | +7 |
| Sao Paulo | Brazil | Same | 4:00 p.m. | +7 |
| London | United Kingdom | Same | 7:00 p.m. | +10 |
| Madrid | Spain | Same | 8:00 p.m. | +11 |
| Paris | France | Same | 8:00 p.m. | +11 |
| Frankfurt | Germany | Same | 8:00 p.m. | +11 |
| Rome | Italy | Same | 8:00 p.m. | +11 |
| Johannesburg | South Africa | Same | 9:00 p.m. | +12 |
| Jerusalem | Israel | Same | 9:00 p.m. | +12 |
| Moscow | Russia | Same | 10:00 p.m. | +13 |
| Baghdad | Iraq | Same | 10:00 p.m. | +13 |
| Kabul | Afghanistan | Same | 11:30 p.m. | +14.5 |
| Calcutta | India | Next | 12:30 a.m. | +15.5 |
| Bangkok | Thailand | Next | 2:00 a.m. | +17 |
| Singapore | Singapore | Next | 3:00 a.m. | +18 |
| Hong Kong | China | Next | 3:00 a.m. | +18 |
| Beijing | China | Next | 3:00 a.m. | +18 |
| Manila | Philippines | Next | 3:00 a.m. | +18 |
| Taipei | Taiwan | Next | 3:00 a.m. | +18 |
| Seoul | Korea | Next | 4:00 a.m. | +19 |
| Tokyo | Japan | Next | 4:00 a.m. | +19 |
| Sydney | Australia | Next | 5:00 a.m. | +20 |
| Auckland | New Zealand | Next | 7:00 a.m. | +22 |

Source: 2009 HYP Media Finance LLC., *The Official Hawaiian Telcom White Pages O'ahu 2009*, pp. 20-23, and "Time Zone Converter" at <<https://savvytime.com/converter/>> accessed June 25, 2021.

Table 5.04-- WIDTH AND DEPTH OF CHANNELS

| Channel 1/ | Width 2/ | | Depth 3/ | |
|---|---------------|------------|----------|--------|
| | 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-Marø Reef | 155.5 | 250.3 | 12,300 | 3,749 |
| Marø 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; and
- 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 5.05-- GENERAL COASTLINE AND TIDAL SHORELINE OF COUNTY AND ISLANDS

| County and island | General coastline 1/ | | Tidal shoreline 3/ | |
|----------------------------------|----------------------|---------------|--------------------|---------------|
| | Statute miles | Kilometers 2/ | Statute miles | Kilometers 2/ |
| State total | 750 | 1,207 | 1,052 | 1,693 |
| County | | | | |
| Hawaii | 266 | 428 | 313 | 504 |
| Maui, including Kalawao | 210 | 338 | 343 | 552 |
| Honolulu | 137 | 220 | 234 | 377 |
| Kauai | 137 | 220 | 162 | 261 |
| Island 4/ | | | | |
| 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 5/ | 25 | 40 | 25 | 40 |
| Niihau | 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/ 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.

3/ 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.

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 5.06-- HAWAIIAN COASTAL WATERS, BY ISLAND: 2006 TO 2020

[Coastal waters means all waters surrounding the islands of the State from the coast of any island to a point three miles seaward from the coast, and in the case of streams, rivers, and drainage ditches, to a point three miles seaward from their point of discharge into the sea and includes those brackish waters, freshwaters and saltwaters that are subject to the ebb and flow of the tide. (HAR §11-54-1 & HRS §342D-1). Hawaii State Department of Health, Clean Water Branch assessed coastal waters for the following conventional pollutants: enterococci, total nitrogen, nitrates+nitrite, ammonia, total phosphorus, turbidity, and chlorophylla]

| Island | Number of coastal waters 1/ | Number of impaired 2/ | Percentage of total impaired coastal waters | Island percentage of total impaired coastal waters |
|-------------|-----------------------------|-----------------------|---|--|
| 2006 | | | | |
| State total | 522 | 210 | 40.2 | 100.0 |
| Kauai | 81 | 28 | 34.6 | 13.3 |
| Oahu | 176 | 68 | 38.6 | 32.4 |
| Molokai | 37 | 3 | 8.1 | 1.4 |
| Lanai | 17 | 6 | 35.3 | 2.9 |
| Maui | 122 | 72 | 59.0 | 34.3 |
| Hawaii | 89 | 33 | 37.1 | 15.7 |
| 2008-2010 | | | | |
| State total | 522 | 207 | 39.7 | 100.0 |
| Kauai | 81 | 26 | 32.1 | 12.6 |
| Oahu | 176 | 65 | 36.9 | 31.4 |
| Molokai | 37 | 3 | 8.1 | 1.4 |
| Lanai | 17 | 8 | 47.1 | 3.9 |
| Maui | 122 | 72 | 59.0 | 34.8 |
| Hawaii | 89 | 33 | 37.1 | 15.9 |
| 2012 | | | | |
| State total | 575 | 228 | 39.7 | 100.0 |
| Kauai | 88 | 26 | 29.5 | 11.4 |
| Oahu | 194 | 73 | 37.6 | 32.0 |
| Molokai | 36 | 3 | 8.3 | 1.3 |
| Lanai | 17 | 7 | 41.2 | 3.1 |
| Maui | 130 | 76 | 58.5 | 33.3 |
| Hawaii | 110 | 43 | 39.1 | 18.9 |

Continued on next page.

Table 5.06-- HAWAIIAN COASTAL WATERS, BY ISLAND: 2006 TO 2020-- Con.

| Island | Number of coastal waters 1/ | Number of impaired 2/ | Percentage of total impaired coastal waters | Island percentage of total impaired coastal waters |
|-------------|-----------------------------|-----------------------|---|--|
| 2014 | | | | |
| State total | 577 | 266 | 46.1 | 100.0 |
| Kauai | 88 | 39 | 44.3 | 14.7 |
| Oahu | 196 | 78 | 39.8 | 29.3 |
| Molokai | 36 | 3 | 8.3 | 1.1 |
| Lanai | 17 | 7 | 41.2 | 2.6 |
| Maui | 130 | 77 | 59.2 | 28.9 |
| Hawaii | 110 | 62 | 56.4 | 23.3 |
| 2016 | | | | |
| State total | 577 | 258 | 44.7 | 100.0 |
| Kauai | 88 | 39 | 44.3 | 15.1 |
| Oahu | 196 | 75 | 38.3 | 29.1 |
| Molokai | 36 | 3 | 8.3 | 1.2 |
| Lanai | 17 | 5 | 29.4 | 1.9 |
| Maui | 130 | 77 | 59.2 | 29.8 |
| Hawaii | 110 | 59 | 53.6 | 22.9 |
| 2018 | | | | |
| State total | 559 | 264 | 47.2 | 100.0 |
| Kauai | 82 | 40 | 48.8 | 15.2 |
| Oahu | 188 | 78 | 41.5 | 29.5 |
| Molokai | 36 | 3 | 8.3 | 1.1 |
| Lanai | 17 | 6 | 35.3 | 2.3 |
| Maui | 128 | 78 | 60.9 | 29.5 |
| Hawaii | 108 | 59 | 54.6 | 22.3 |

Continued on next page.

Table 5.06-- HAWAIIAN COASTAL WATERS, BY ISLAND: 2006 TO 2020-- Con.

| Island | Number of coastal waters 1/ | Number of impaired 2/ | Percentage of total impaired coastal waters | Island percentage of total impaired coastal waters |
|-------------|-----------------------------|-----------------------|---|--|
| 2020 | | | | |
| State total | 565 | 301 | 53.3 | 100.0 |
| Kauai | 82 | 41 | 50.0 | 13.6 |
| Oahu | 192 | 99 | 51.6 | 32.9 |
| Molokai | 36 | 3 | 8.3 | 1.0 |
| Lanai | 17 | 6 | 35.3 | 2.0 |
| Maui | 129 | 89 | 69.0 | 29.6 |
| Hawaii | 109 | 63 | 57.8 | 20.9 |

1/ Number of coastal waters is based on the total number of scopes of assessments in the integrated reports.

2/ Impaired coastal waters for one of more conventional pollutants.

Source: Hawaii State Department of Health, Clean Water Branch, records.

Table 5.07-- 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]

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

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

Table 5.08-- HAWAIIAN PERENNIAL STREAMS, BY ISLAND: 2006 TO 2020

[Perennial means fresh waters flowing year-round in all or part of natural channels, portions of which may be modified by humans. Flow in perennial streams may vary seasonally. Perennial streams may be subdivided into longitudinal zones, based on elevation and gradient: (1) headwater zone (elevation above 800 m (2600 ft) or gradient above 30 percent or both); (2) mid-zone (elevation between 50-800 m (165-2600 ft), or gradient between 5 and and 30 percent or both); and (3) terminal zone (elevation below 50 m (165 ft) or gradient below 5 percent or both). Perennial streams may be either continuous or interrupted. Continuous perennial streams discharge continuously to the ocean in their natural state, and contain water in the entire length of the stream channel year-round. Interrupted perennial streams usually flow perennially in their upper reaches but only seasonally in parts of their middle or lower reaches, due to either downward seepage of surface flow (naturally interrupted) or to man-made water diversions (artificially interrupted) (HAR §11-54-1)]

| Island | Total number of streams 1/ | Number of impaired streams 2/ | Percentage of total impaired streams | Island percentage of total impaired streams |
|---------------|-----------------------------------|--------------------------------------|---|--|
| 2006 | | | | |
| State total | 168 | 91 | 54.2 | 100.0 |
| Kauai | 29 | 20 | 69.0 | 22.0 |
| Oahu | 50 | 44 | 88.0 | 48.4 |
| Molokai | 6 | 1 | 16.7 | 1.1 |
| Lanai | - | - | 0.0 | 0.0 |
| Maui | 48 | 10 | 20.8 | 11.0 |
| Hawaii | 35 | 16 | 45.7 | 17.6 |
| 2008-2010 | | | | |
| State total | 168 | 92 | 54.8 | 100.0 |
| Kauai | 29 | 20 | 69.0 | 21.7 |
| Oahu | 50 | 44 | 88.0 | 47.8 |
| Molokai | 6 | 1 | 16.7 | 1.1 |
| Lanai | - | - | 0.0 | 0.0 |
| Maui | 48 | 11 | 22.9 | 12.0 |
| Hawaii | 35 | 16 | 45.7 | 17.4 |

Continued on next page.

**Table 5.08-- HAWAIIAN PERENNIAL STREAMS, BY ISLAND:
2006 TO 2020 -- Con.**

| Island | Total number of streams 1/ | Number of impaired streams 2/ | Percentage of total impaired streams | Island percentage of total impaired streams |
|-------------|----------------------------|-------------------------------|--------------------------------------|---|
| 2012 | | | | |
| State total | 168 | 91 | 54.2 | 100.0 |
| Kauai | 29 | 20 | 69.0 | 22.0 |
| Oahu | 50 | 43 | 86.0 | 47.3 |
| Molokai | 6 | 1 | 16.7 | 1.1 |
| Lanai | - | - | 0.0 | 0.0 |
| Maui | 48 | 11 | 22.9 | 12.1 |
| Hawaii | 35 | 16 | 45.7 | 17.6 |
| 2014 | | | | |
| State total | 169 | 92 | 54.4 | 100.0 |
| Kauai | 30 | 21 | 70.0 | 22.8 |
| Oahu | 50 | 43 | 86.0 | 46.7 |
| Molokai | 6 | 1 | 16.7 | 1.1 |
| Lanai | - | - | 0.0 | 0.0 |
| Maui | 48 | 11 | 22.9 | 12.0 |
| Hawaii | 35 | 16 | 45.7 | 17.4 |
| 2016 | | | | |
| State total | 169 | 91 | 53.8 | 100.0 |
| Kauai | 30 | 22 | 73.3 | 24.2 |
| Oahu | 50 | 41 | 82.0 | 45.1 |
| Molokai | 6 | 1 | 16.7 | 1.1 |
| Lanai | - | - | 0.0 | 0.0 |
| Maui | 48 | 11 | 22.9 | 12.1 |
| Hawaii | 35 | 16 | 45.7 | 17.6 |

Continued on next page.

**Table 5.08-- HAWAIIAN PERENNIAL STREAMS, BY ISLAND:
2006 TO 2020 -- Con.**

| Island | Total number of streams 1/ | Number of impaired streams 2/ | Percentage of total impaired streams | Island percentage of total impaired streams |
|-------------|----------------------------|-------------------------------|--------------------------------------|---|
| 2018 | | | | |
| State total | 169 | 92 | 54.4 | 100.0 |
| Kauai | 30 | 23 | 76.7 | 25.0 |
| Oahu | 50 | 41 | 82.0 | 44.6 |
| Molokai | 6 | 1 | 16.7 | 1.1 |
| Lanai | - | - | 0.0 | 0.0 |
| Maui | 48 | 11 | 22.9 | 12.0 |
| Hawaii | 35 | 16 | 45.7 | 17.4 |
| 2020 | | | | |
| State total | 169 | 92 | 54.4 | 100.0 |
| Kauai | 30 | 23 | 76.7 | 25.0 |
| Oahu | 50 | 41 | 82.0 | 44.6 |
| Molokai | 6 | 1 | 16.7 | 1.1 |
| Lanai | - | - | 0.0 | 0.0 |
| Maui | 48 | 11 | 22.9 | 12.0 |
| Hawaii | 35 | 16 | 45.7 | 17.4 |

1/ Number of streams is based on individual streams, not wet/dry season.

2/ Impaired streams for one of more conventional pollutants. Hawaii State Department of Health Clean Water Branch assessed coastal waters for the following conventional pollutants: enterococci, total nitrogen, nitrate+ nitrite, ammonia, total phosphorus, turbidity, and chlorophyll a.

Source: Hawaii State Department of Health, Clean Water Branch, records.

Table 5.09-- LAND AREA, BY COUNTY: 2010

| Measurement unit | State total | Hawaii | Maui | Kalawao | Honolulu | Kauai |
|-------------------------|--------------------|---------------|-------------|----------------|-----------------|--------------|
| Square miles | 6,422.6 | 4,028.4 | 1,161.5 | 12.0 | 600.7 | 620.0 |
| Square kilometers | 16,634.5 | 10,433.6 | 3,008.3 | 31.1 | 1,555.9 | 1,605.7 |

Source: U.S. Census Bureau, 2010 Census Redistricting Data (Public Law 94-171) Summary File (February 2011); and calculations by the Hawaii State Department of Business, Economic Development & Tourism.

Table 5.10-- LAND AREA, BY ISLAND: 2010

| Island | Square miles | Square kilometers |
|----------------------------------|--------------|-------------------|
| State total | 6,422.63 | 16,634.53 |
| Hawaii | 4,028.42 | 10,433.55 |
| Maui | 771.99 | 1,999.45 |
| Molokini | 0.036 | 0.093 |
| Kahoolawe | 44.6 | 115.5 |
| Lanai | 141.07 | 365.36 |
| Molokai | 260.46 | 674.58 |
| Oahu | 597.64 | 1,547.88 |
| Kauai | 552.35 | 1,430.59 |
| Niihau | 67.60 | 175.09 |
| Lehua | 0.444 | 1.149 |
| Kaula | 0.247 | 0.640 |
| Northwestern Hawaiian Islands 1/ | 3.100 | 8.030 |
| Niihau | 0.271 | 0.701 |
| Necker Island | 0.071 | 0.183 |
| French Frigate Shoals | 0.096 | 0.249 |
| Gardner Pinnacles | 0.009 | 0.024 |
| Maro Reef | Awash | Awash |
| Laysan Island | 1.588 | 4.114 |
| Lisianski Island | 0.601 | 1.556 |
| Pearl and Hermes Atoll | 0.139 | 0.359 |
| Kure Atoll | 0.333 | 0.862 |

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

Source: U.S. Census Bureau, 2010 Census Redistricting Data (P.L. 94-171) Summary File (February 2011), and calculations by the Hawaii State Department of Business, Economic Development & Tourism, Office of Planning and the Hawaii State Data Center, and unpublished records.

Table 5.11-- MAJOR AND MINOR ISLANDS IN THE HAWAIIAN ARCHIPELAGO

| Classification | Number of islands | | Land area (square miles) |
|------------------------------------|-------------------|-----------------------|-----------------------------|
| | Total | Inhabited, 1990 1/ | |
| All named islands | 137 | 12 | 6,427.0 |
| Major islands | 8 | 7 | 6,419.4 |
| Named minor islands 2/ | 129 | 5 | 7.6 |
| Offshore of major islands | 96 | 3 | 2.6 |
| Northwestern Hawaiian Islands 3/ | 33 | 2 | 4.9 |
| Part of State | 28 | 1 | 2.9 |
| Not part of State (Midway Islands) | 5 | 1 | 2.0 |

1/ For populations, see present volume, table 1.05.

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

3/ Includes individual islets in the 10 Northwestern Hawaiian Islands.

Source: Hawaii State Department of Planning and Economic Development, *Geographic Names Approved, Second Quarter 1969* (Report GN-6, July 8, 1969), p. 8; *Data Book 1986*, table 152.

Table 5.12-- AREA AND DEPTH OF SELECTED CRATERS

| Island and crater | Area (acres) | Maximum depth (feet) |
|-----------------------------|-----------------|-------------------------|
| Hawaii Kilauea Caldera | 2,319 | 476 |
| Mokuaweoweo Crater 1/ | 2,221 | 572 |
| Maui Haleakala Crater 2/ | 12,575 | 3,028 |
| Oahu Diamond Head Crater | 255 | 562 |
| Koko Crater | 133 | 968 |
| Punchbowl Crater | 62 | 140 |

1/ Data exclude North and South Pits.

2/ Data exclude Koolau and Kaupo Gaps.

Source: Measured from U.S. Geological Survey maps by the Hawaii State Department of Business, Economic Development & Tourism.

Table 5.13-- ELEVATION OF MAJOR SUMMITS

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

| Island and summit | Feet | Meters |
|----------------------------|--------|--------|
| Hawaii | | |
| Mauna Kea 1/ | 13,796 | 4,205 |
| Mauna Loa | 13,679 | 4,169 |
| Hualalai | 8,271 | 2,521 |
| Kaumu o Kaleihoohe | 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 | 3,366 | 1,026 |
| Molokai | | |
| Kamakou | 4,961 | 1,512 |
| Olokui | 4,606 | 1,404 |
| Kalaupapa Lookout | 1,600 | 488 |
| Mauna Loa (Kukui) | 1,430 | 436 |
| Oahu | | |
| Kaala | 4,003 | 1,220 |
| Puu Kalena | 3,504 | 1,068 |
| Konahuanui | 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 |
| Koko Head | 642 | 196 |
| Punchbowl | 500 | 152 |

Continued on next page.

Table 5.13-- ELEVATION OF MAJOR SUMMITS -- Con.

| Island and summit | Feet | Meters |
|------------------------|-------|--------|
| Kauai | | |
| Kawaikini | 5,243 | 1,598 |
| Waialeale | 5,148 | 1,569 |
| Kalalau Lookout | 4,120 | 1,256 |
| Haupu | 2,297 | 700 |
| Sleeping Giant (Nonou) | 1,241 | 378 |
| Niihau | | |
| Paniau | 1,250 | 381 |
| Lehua | 699 | 213 |
| Kaula | 548 | 167 |
| Nihoa | | |
| Millers Peak | 903 | 275 |
| Necker Island | | |
| Summit Hill | 276 | 84 |
| French Frigate Shoals | | |
| La Perouse Pinnacles | 120 | 37 |
| Gardner Pinnacles | 190 | 58 |
| Maro Reef | Awash | Awash |
| Laysan Island | 40 | 12 |
| Lisianski Island | 40 | 12 |
| Pearl and Hermes Atoll | 10 | 3 |
| Midway Islands | 12 | 4 |
| Kure Atoll | 20 | 6 |

1/ According to the *1995 Guinness Book of Records* (p. 147), "The world's tallest mountain measured from its submarine base (3,280 fathoms) in the Hawaiian Trough to its peak is Mauna Kea... with a combined height of 33,480 ft., of which 13,796 ft. are above sea level."

Source: Hawaii State Department of Accounting and General Services, Survey Division, data provided April 21, 1992; U.S. National Cartographic Information Center, data provided October 11, 1978; U.S. Geological Survey topographic maps, 1981-1984; Hawaiian Government Survey (for Nihoa and Molokini); and U.S.S. Tanager survey, 1923 (for Necker Island, French Frigate Shoals, Laysan, Lisianski, Pearl and Hermes Atoll and Kure Atoll).

Table 5.14-- MAJOR NAMED WATERFALLS, BY ISLAND

| Island | Waterfall | Height (feet) | | Horizontal distance (feet) |
|---------|-------------------|---------------|---------|----------------------------|
| | | Sheer drop | Cascade | |
| Hawaii | Kaluahine | (NA) | 620 | 400 |
| | Akaka | 442 | (NA) | (NA) |
| | Waiilikahi | 320 | (NA) | 6 |
| Maui | Honokohau | (NA) | 1,120 | 500 |
| | Waihiumalu | (NA) | 400 | 150 |
| Molokai | Kahiwa | (NA) | 1,750 | 1,000 |
| | Papalaua | (NA) | 1,200 | 500 |
| | Waialele | (NA) | 500 | 150 |
| Oahu | Kaliuwaa (Sacred) | 1/ 80 | 1,520 | 3,000 |
| Kauai | Waipoo (2 falls) | (NA) | 800 | 600 |
| | Awini | (NA) | 480 | 500 |
| | Hinalele | 280 | (NA) | (NA) |
| | Wailua | 200 | (NA) | (NA) |

NA Not available.

1/ Refers to the northernmost fall of a cascade of six falls.

Source: U.S. Geological Survey, records; Hawaii State Department of Land and Natural Resources, Commission on Water Resource Management, records; and "Tall Falls", *The Honolulu Advertiser*, June 25, 1995, pp. A17 and A20.

Table 5.15-- MAJOR STREAMS, BY ISLAND

| Island | Feature or stream | Length or average 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) 1/ | | |
| 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 | 180 |
| Maui | Waihee River | 50 |
| Molokai | Wailau Stream | 30 |
| Oahu | Waikele Stream | 2/ 26 |
| Kauai | Hanalei River | 129 |

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.

2/ Most of discharge is from nearby groundwater outflow.

Source: U.S. Geological Survey, records; and other data from Hawaii State Department of Land and Natural Resources, Commission on Water Resource Management, records.

Table 5.16-- LAKES AND LAKE-LIKE WATERS, BY ISLAND

| Island and lake | Type | Elevation (feet) | Area 1/ (acres) | Maximum depth (feet) |
|--------------------|---------------|------------------|-----------------|----------------------|
| Hawaii | | | | |
| Green Lake | Lake | 3 | 2 | 20 |
| Lake Waiau 2/ | Lake | 13,020 | 2 | 10 |
| Waiakea Pond | Tidal pond | (3/) | 27 | 7 |
| Maui | | | | |
| Kanaha Pond | Marsh | (3/) | 41 | 3 |
| Kealia Pond | Marsh | (3/) | 500 | (NA) |
| Waieleele | Pond | 6,690 | 0.5 | 21 |
| Molokai | | | | |
| Kauhako | Pool | (3/) | 0.9 | 814 |
| Kualapuu Reservoir | Reservoir | 821 | 100 | 50 |
| Meyer Lake | Impoundment | 2,021 | 6-10 | 5 |
| Oahu | | | | |
| Hoomaluhia | Reservoir | 202 | 90 | 90 |
| Kaelepulu Pond | Lake | (3/) | 198 | (NA) |
| Kawainui Marsh | Marsh | (3/) | 1,000 | (NA) |
| Wahiawa Reservoir | Reservoir | 842 | 302 | 85 |
| Kauai | | | | |
| Nomilu Fishpond | Pond | (3/) | 20 | 66 |
| Waita Reservoir | Reservoir | 241 | 424 | 23 |
| Niihau | | | | |
| Halalii Lake | Playa | (3/) | 841-865 | (NA) |
| Halulu Lake | Playa | (3/) | 182-371 | (NA) |
| Laysan | | | | |
| Laysan Lagoon | Closed lagoon | (3/) | 161 | 16 |

NA Not available.

1/ Ranges shown for Meyer Lake, Halalii Lake, and Halulu Lake reflect differences in estimates between sources.

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

3/ Sea level.

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); and Hawaii State Department of Land and Natural Resources, Commission on Water Resource Management, May 18, 1994.

Table 5.17-- LENGTH AND WIDTH OF SELECTED BEACHES

[Includes the longest white sand beach on each inhabited island, plus other important beaches]

| Island and beach | Length (miles) | Width 1/ (feet) |
|--------------------|----------------|-----------------|
| Hawaii | | |
| Hapuna | 0.5+ | 200+ |
| Maui | | |
| Spreckelsville | 2+ | (NA) |
| Kaanapali | 1.5 | 60-80 |
| Lanai | | |
| Polihua | 1.5+ | (NA) |
| Molokai | | |
| Papohaku | 2+ | 300 |
| Oahu | | |
| Waikiki | 2 | (NA) |
| Waimanalo | 3.5-4.5 | (NA) |
| Sunset | 2-3+ | 200 |
| Kauai | | |
| Polihale to Kekaha | 15 | 300 |
| Polihale | 3 | 300 |
| Niihau | | |
| Keawanui | 3.5 | 175 |

NA Not available.

1/ Summer averages. Many beaches in Hawaii are seasonally reduced in width by winter storms.

Source: Hawaii State Department of Planning and Economic Development, *Hawaii's Shoreline* (1965), pp. 33, 47, 55, 62, 68, and 100; John R. K. Clark, *Beaches of the Big Island* (1985), p. 132, *The Beaches of Maui County* (1980), pp. 10, 62, 84-85, and 114, *The Beaches of O'ahu* (1977), pp. 45, 125, and 177, and *Beaches of Kaua'i and Ni'ihau* (1990), pp. 48-49 and 84.

Table 5.18-- MISCELLANEOUS GEOGRAPHIC STATISTICS, BY ISLAND

| 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 |
|-------------|--------------------------------|-----------------------|---|---------------------------------------|---|
| State total | (X) | (X) | 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 | 65.0 |
| Niihau | 8 | 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 |
| State total | 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 | 0.0 | 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 | 0.0 | 530 | 68.0 | 12.5 |

X Not applicable.

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 Records* (1995 edition, p. 154) as "the highest sea cliffs in the world."

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

Table 5.19-- VOLCANIC ERUPTIONS: MAUNA LOA 1950 TO 1984, KILAUEA 1969 TO 2020

[As of June 30, 2021. Four volcanoes have erupted in historical times: Haleakala, last active in 1460; Hualalai, last active in 1801; Mauna Loa, last active in 1984; Kilauea, last active in 2020]

| Volcano and date of outbreak | Duration (days) | Location 1/ | Elevation of main vent (meters) | Area covered by lava flows (km ²) | Volume of lava and/or ash erupted (km ³) |
|------------------------------|-----------------|-------------|---------------------------------|---|--|
| Mauna Loa | | | | | |
| 1950: June 1 | 23 | S, SWR | 3,840-2,380 | 112.0 | 0.3760 |
| 1975: July 5 | <1 | S | 3,900 | 13.5 | 0.0300 |
| 1984: March 25 | 22 | S, NER | 4,030-2,870 | 48.0 | 0.2200 |
| Kilauea | | | | | |
| 1969: Feb. 22 | 6 | ER | 930-870 | 6.0 | 0.0161 |
| May 24 | 874 | ER | 940 | 50.0 | 0.1850 |
| 1971: Aug. 14 | <1 | C | 1,100-1,080 | 3.1 | 0.0091 |
| Sept. 24 | 5 | C, SWR | 1,120-820 | 3.9 | 0.0077 |
| 1972: Feb. 3 | 900 | ER | 940 | 46.0 | 0.1620 |
| 1973: May 5 | <1 | ER | 1,000-980 | 0.3 | 0.0012 |
| Nov. 10 | 30 | ER | 980-870 | 1.0 | 0.0027 |
| 1974: July 19 | 3 | C, ER | 1,080-980 | 3.1 | 0.0066 |
| Sept. 19 | <1 | C | 1,100 | 1.0 | 0.0102 |
| Dec. 31 | <1 | SWR | 1,080 | 7.5 | 0.0143 |
| 1975: Nov. 29 | <1 | C | 1,080-1,060 | 0.3 | 0.0002 |
| 1977: Sept. 13 | 18 | ER | 620-480 | 7.8 | 0.0329 |
| 1979: Nov. 16 | 1 | ER | 980-960 | 0.3 | 0.0006 |
| 1982: April 30 | <1 | C | 1,080 | 0.3 | 0.0005 |
| Sept. 25 | <1 | C | 1,080 | 0.8 | 0.0030 |
| 1983: Jan. 3 | 12,893 | ER | 900 | 272.8 | 4.4000 |
| 2008: March 19 | 3,710 | C | 1,035 | 0.4 | (2/) |
| 2018: May 3 | 126 | LER | 200 | 35.5 | 1.0550 |
| 2020: Dec. 20 | 3/ 143 | C | 715 | 0.5 | 0.0410 |

1/ C, summit caldera; ER, east rift zone; NER, northeast rift zone; S, summit area; SWR, southwest rift LER, lower east rift zone. All historic Mauna Loa eruptions began as summit eruptions, and then either zone; remained in the summit or migrated down one of the rift zones.

2/ Halemaumau Overlook Crater contained a lava lake with an area of 41,000 square meters, and total erupted mass of ash ejecta was 2.9×10^6 kg.

3/ Preliminary results. Eruption considered paused in July 2021.

Source: Gordon A. Macdonald, Agatin T. Abbott, and Frank L. Peterson, *Volcanoes in the Sea: The Geology of Hawaii*, 2nd ed. (1986), pp. 80-81; U.S. Geological Survey, Hawaiian Volcano Observatory <<http://hvo.wr.usgs.gov/kilauea/history/historytable.html>> and USGS records.

Table 5.20-- EARTHQUAKES OF MAGNITUDE 6.2 OR GREATER: 1823 TO 2019

[As of December 31, 2019. Includes all earthquakes with magnitudes of 6.2 or greater]

| Date and time (HST) | | Location | Magnitude |
|---------------------|------------|----------------------------------|-----------|
| 1823: June 1 | 10:00 PM | Kaimu, Hawaii | 7.0 |
| 1825: January 6 | 11:30 PM | Kona, Hawaii | 6.2 |
| 1832: January 10 | 6:00 PM | Kilauea, south flank, Hawaii | 6.2 |
| 1841: April 7 | 11:45 PM | Kilauea, south flank, Hawaii | 6.5 |
| 1849: July 15 | 4:05 AM | Hilea, Hawaii | 6.2 |
| 1852: March 31 | 4:15 PM | Kaoiki, Hawaii | 6.2 |
| 1865: March 3 | 12:45 AM | West Hawaii, deep | 6.5 |
| 1868: March 28 | 1:28 PM | Hilea, Hawaii | 7.0 |
| | April 2 | Hilea, Hawaii | 7.9 |
| | April 3 | Hilea, Hawaii | 6.2 |
| | April 4 | West Hawaii, deep | 6.5 |
| | May 24 | Kilauea, south flank, Hawaii | 6.2 |
| 1870: March 21 | 8:30 PM | South Hawaii | 6.2 |
| | August 7 | Molokai | 6.4 |
| 1871: February 19 | 10:15 PM | Lanai | 6.8 |
| 1877: May 31 | 4:20 AM | Kilauea, caldera deep, Hawaii | 6.3 |
| 1880: September 23 | 3:15 PM | Kaoiki, Hawaii | 6.6 |
| 1881: September 30 | 4:53 AM | Mauna Kea, deep, Hawaii | 6.4 |
| 1887: January 23 | 11:30 PM | Hilea, Hawaii | 6.5 |
| 1890: August 6 | 11:10 PM | Kilauea, south flank, Hawaii | 6.5 |
| 1894: December 3 | 3:30 AM | Molokai, deep | 6.4 |
| 1895: January 22 | 10:00 PM | Molokai | 6.5 |
| | December 8 | Kona offshore, Hawaii | 6.8 |
| 1896: September 13 | 4:59 AM | East Maui | 6.6 |
| 1905: May 3 | 4:07 PM | Kilauea, south flank, Hawaii | 6.2 |
| 1908: September 20 | 8:15 PM | Kilauea, south flank, Hawaii | 6.7 |
| 1915: March 28 | 8:26 AM | Kaoiki, Hawaii | 6.4 |
| 1918: November 1 | 11:33 PM | Kaoiki, Hawaii | 6.4 |
| 1927: March 20 | 4:52 AM | Mauna Kea, offshore deep, Hawaii | 6.8 |
| 1929: September 25 | 6:20 PM | Hualalai, Hawaii | 6.2 |
| | October 5 | Hualalai, Hawaii | 6.5 |
| 1938: January 22 | 10:03 PM | Maui | 6.8 |
| 1950: May 29 | 3:17 PM | Kona, Hawaii | 6.3 |
| 1951: April 22 | 2:52 PM | Kilauea, caldera deep, Hawaii | 6.2 |
| | August 21 | Kona, Hawaii | 6.9 |
| 1952: March 29 | 11:59 PM | Kilauea, south flank, Hawaii | 6.2 |
| 1954: March 30 | 8:42 AM | Kalapana, Hawaii | 6.5 |
| 1962: June 27 | 6:27 PM | Kaoiki, Hawaii | 6.2 |
| 1973: April 26 | 10:26 AM | Honomu, Hawaii | 6.2 |

Continued on next page.

**Table 5.20-- EARTHQUAKES OF MAGNITUDE 6.2 OR GREATER:
1823 TO 2019 -- Con.**

| Date and time (HST) | | Location | Magnitude |
|---------------------|----------|--------------------|-----------|
| 1975: November 29 | 4:47 AM | Kalapana, Hawaii | 7.7 |
| 1983: November 16 | 6:13 AM | Kaoiki, Hawaii | 6.7 |
| 1989: June 25 | 5:27 PM | Kalapana, Hawaii | 6.2 |
| 2006: October 15 | 7:07 AM | Kiholo Bay, Hawaii | 6.7 |
| 2018: May 4 | 12:32 PM | Kalapana, Hawaii | 6.9 |

Source: Klein, F.C. and T.L. Wright (2000), "Catalog of Hawaiian Earthquakes, 1823-1959", U.S. Geological Survey Professional Paper 1623, 98 pp; Klein, F.C., et al. (2001), *Seismic Hazard in Hawaii: High Rate of Large Earthquakes and Probabilistic Ground-Motion Maps*, Bulletin of the Seismological Society of America, Vol. 91, No. 3, pp. 479-498; Wyss, M. and R.Y. Koyanagi (1992), *Isoseismal maps, macroseismic epicenters, and estimated magnitudes of historical earthquakes in the Hawaiian Islands*, U.S. Geological Survey Bulletin 2006, 93 pp; U.S. Geological Survey, Hawaiian Volcano Observatory, Seismic Catalog; <<https://earthquake.usgs.gov/earthquakes/>>; and records.

Table 5.21-- EARTHQUAKES WITH INTENSITIES OF V OR GREATER ON OAHU: 1859 TO 2019

[As of December 31, 2019]

| Date (HST) | Epicentral location | Magnitude | Oahu average intensity (Modified Mercalli Scale 1/) |
|-------------------|----------------------------|------------------|--|
| 1861: Dec. 5 | Molokai-Lanai vicinity (?) | 5.9 | Mid V |
| Dec. 15 | Molokai-Lanai vicinity (?) | 5.6 | Lower V - mid V |
| 1868: Apr. 2 | SE coast of Hawaii | 7.9 | Upper IV - lower V |
| Apr. 4 | Maui group vicinity (?) | 6.5 | Lower V |
| 1870: Aug. 7 | Near Molokai | 6.4 | V |
| 1871: Feb. 19 | S coast of Lanai | 6.8 | Upper VI - lower VII |
| 1881: Sep. 30 | Maui vicinity | 6.4 | IV - V |
| 1887: Jan. 13 | Oahu vicinity | 5.3 | V |
| 1895: Dec. 8 | Oahu vicinity (?) | 6.8 | Mid V |
| 1896: Sep. 13 | Maui vicinity (?) | 6.6 | IV - V |
| 1926: Mar. 19 | N of Kohala, Hawaii | 5.5 | Upper IV - lower V |
| 1929: Oct. 5 | Hualalei | 6.5 | Lower V |
| 1938: Jan. 22 | N of Maui | 6.8 | Upper V - lower VI |
| 1940: June 16 | N of Hawaii | 6.0 | IV - V |
| 1948: June 28 | S coast of Oahu | 5.2 | Mid VI |
| 1973: Apr. 26 | Honomu, Hawaii | 6.2 | Mid V |
| 1975: Nov. 29 | Kalapana, Hawaii | 7.2 | V |
| 1981: Mar. 5 | Kalohi Channel | 5.0 | Mid V |
| 2006: Oct.15 | Kiholo Bay, Hawaii | 6.7 | V |

1/ Modified Mercalli Scale of 1931, 1956 abridged version further simplified. This scale, which extends from I to XII, reads in part:

IV. Hanging objects swing. Vibration like passing of heavy trucks or sensation of a jolt. Standing autos rock. Windows, dishes, doors rattle. Crockery clashes. In the upper part of range wooden construction creaks.

V. Felt outdoors; direction estimated. Sleepers wakened. Liquids distributed, some spilled. Small unstable objects displaced or upset. Doors, shutters, pictures swing. Pendulum clocks stop.

VI. Felt by all. Many frightened, run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books thrown off shelves, pictures off walls. Furniture moved, overturned. Weak plaster and masonry cracked. Small bells ring. Trees, bushes noticeably shaken.

VII. Difficulty in standing. Noticed by drivers of autos. Hanging objects quiver. Furniture broken. Damage to weak masonry. Weak chimneys broken at roof line. Fall of plaster, loose bricks, etc. Some cracks in ordinary masonry. Waves on ponds. Small slides on sand and gravel banks. Large bells ring. Irrigation ditches damaged.

Source: Cox, D.C. (1986a), *Earthquakes Felt on Oahu, Hawaii and Their Intensities*, Environmental Center Special Report, Vol. 38, University of Hawaii, 120 pp.; Cox, D.C. (1986b), *The Oahu Earthquake of June 1948, Associated Shocks, and the Hypothetical Diamond Head Fault*, Environmental Center Special Report, Vol. 36, University of Hawaii, 32 pp.; Cox, D.C. (1987), *Earthquake Experience in Honolulu*, Hawaiian Journal of History, Vol. 21, pp 98-109; Klein, F.C. and T.L. Wright (2000), *Catalog of Hawaiian Earthquakes, 1823-1959*, U.S. Geological Survey Professional Paper 1623, 98 pp.; Wyss, M. and R.Y. Koyanagi (1992), *Isoseismal maps, macroseismic epicenters, and estimated magnitudes of historical earthquakes in the Hawaiian Islands*, U.S. Geological Survey Bulletin 2006, 93 pp.; U.S. Geological Survey, Hawaiian Volcano Observatory, Seismic Catalog; and U.S. Geological Survey, National Earthquake Information Center, ShakeMap; and records.

Table 5.22-- TSUNAMIS WITH RUN-UP OF 2 METERS (6.6 FEET) OR MORE: 1812 TO 2020

[Two dates were removed from the previous *Data Book* due to updated classification]

| Date | Place of observation | Source | Maximum height in Hawaii | | Deaths in Hawaii | Damage in Hawaii |
|------------------|-------------------------|------------------|--------------------------|------|------------------|--------------------------------------|
| | | | Meters | Feet | | |
| 1812: Dec. 21 1/ | Hookena, Hawaii | California | 3.0 | 10 | - | Hut flooded |
| 1819: April 12 | W. Hawaii | Chile | 2.0 | 7 | - | Houses destroyed |
| 1837: Nov. 7 | Hilo, Hawaii | Chile | 6.0 | 20 | 16 | 100 houses destroyed |
| 1841: May 17 | Hilo, Hawaii | Kamchatka | 4.6 | 15 | - | Unknown |
| 1854: Jan. 27 | Hilo, Hawaii | Alaska | 2.4 | 8 | - | (NA) |
| 1868: April 2 | Keauhou Landing, Hawaii | Ka'u | 13.7 | 45 | 47 | Severe in Puna and Ka'u |
| 1868: Aug. 13 | Hilo, Hawaii | Chile | 4.5 | 15 | - | Houses, bridges destroyed |
| 1869: Aug. 24 2/ | S.E. Puna | S. Pacific | 8.2 | 27 | - | Houses destroyed, roads washed out |
| 1877: May 10 | Hilo, Hawaii | Chile | 4.8 | 16 | 5 | Severe in Hilo |
| 1878: Jan. 10 | Maliko Bay, Maui | Alaska | 3.6 | 12 | - | Scattered flooding, N. Maui, N. Oahu |
| 1896: June 15 | Keauhou, Hawaii | Japan | 5.5 | 18 | - | Houses, wharfs, stores destroyed |
| 1906: Aug. 17 | Maalaea, Maui | Chile | 3.5 | 12 | - | Piers damaged |
| 1919: Oct. 2 | Hoopuloa, Hawaii | S. Kona | 4.3 | 14 | - | Wharf damaged, car swept away |
| 1922: Nov. 11 | Hilo, Hawaii | Chile | 2.1 | 7 | - | Fishing boats swept away |
| 1923: Feb. 3 | Hilo, Hawaii | Kamchatka | 6.1 | 20 | 1 | \$1,500,000 |
| 1933: March 2 | Keauhou, Hawaii | Japan | 3.3 | 11 | - | Boathouses, walls destroyed in Kona |
| 1946: April 4 3/ | Waikolu Valley, Molokai | Aleutian Islands | 16.5 | 54 | 158 | \$26,000,000 |
| 1952: March 17 | Kalapana, Hawaii | Hawaii | 3.0 | 10 | - | no damage |
| 1952: Nov. 4 | Kaena, Oahu | Kamchatka | 10.4 | 34 | - | \$1,000,000 |
| 1957: March 9 | Wainiha Bay, Kauai | Aleutian Islands | 16.2 | 53 | - | \$5,000,000 |
| 1960: May 22 | Hilo, Hawaii | Chile | 10.7 | 35 | 61 | \$23,000,000 |
| 1964: March 27 | Waimea Bay, Oahu | Alaska | 4.9 | 16 | - | \$68,000 |
| 1975: Nov. 29 | Keauhou Landing, Hawaii | S. Puna | 14.3 | 47 | 2 | \$1,500,000 |
| 2011: March 11 | Kealakekua Bay, Hawaii | Japan | 5.4 | 18 | - | (NA) |

Continued on next page.

Table 5.22-- TSUNAMIS WITH RUN-UP OF 2 METERS (6.6 FEET) OR MORE: 1812 TO 2020-- Con.

NA Not available.

1/ Earliest tsunami for which definite information exists.

2/ Probable source.

3/ Revised from previous *Data Book*.

Source: George Pararas-Carayannis, "Catalog of Tsunamis in the Hawaiian Islands" (U.S. Coast and Geodetic Survey, May 1969); 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); Doak C. Cox, "Tsunami Casualties and Mortality in Hawaii" (University of Hawaii, Environment Center, June 1987), p. 39; James F. Lander and Patricia A. Lockridge, *United States Tsunamis (Including United States Possessions) 1690-1988*, Publication 41-2, National Geophysical Data Center, August 1989, pp.17-77; U.S. Geological Survey, Hawaiian Volcano Observatory, records; Pacific Tsunami Warning Center, records; and National Oceanic and Atmospheric Administration, National Geophysical Data Center, Tsunami Runup database <<https://www.ngdc.noaa.gov/hazel/view/hazards/tsunami/runup-search>> accessed February 26, 2020.

Table 5.23-- MAJOR DAMS AS OF DECEMBER 31, 2020

[Includes all dams whose maximum storage equals or exceeds 600 acre-ft.]

| Dam name | Nearest city | Purpose | Year completed | Height (ft.) | Length (ft.) | Drainage area (sq. miles) | Maximum storage (acre-ft.) |
|--------------------------|-------------------|-----------------------------|----------------|--------------|--------------|---------------------------|----------------------------|
| Waita Reservoir | Koloa, Kauai | Irrigation | 1906 | 23 | 3,250 | 3.36 | 9,900 |
| Wahiawa Dam | Wahiawa, Oahu | Irrigation | 1906 | 88 | 660 | 16.70 | 9,200 |
| Kualapuu Reservoir | Kualapuu, Molokai | Irrigation, water supply | 1969 | 57 | 7,100 | 0.21 | 5,082 |
| Kaneohe Dam | Kaneohe, Oahu | Flood control, recreation | 1980 | 83 | 2,200 | 2.45 | 4,500 |
| Nuuanu Dam No. 4 | Honolulu, Oahu | Flood control, recreation | 1910 | 66 | 2,120 | 1.40 | 3,600 |
| Alexander | Kalaheo, Kauai | Hydroelectric, irrigation | 1931 | 112 | 600 | 2.86 | 2,540 |
| Puukapu Dam | Waimea, Hawaii | Flood control | 1965 | 12 | 4,340 | 3.05 | 1,450 |
| Kaloko Reservoir | Kilauea, Kauai | Irrigation | 1890 | 27 | 915 | 0.12 | 1,400 |
| Wailua Reservoir | Wailua, Kauai | Irrigation | 1920 | 40 | 1,080 | 0.88 | 1,223 |
| Kapaia Reservoir | Kapaia, Kauai | Irrigation | 1910 | 50 | 1,050 | 2.51 | 1,114 |
| Ku Tree Reservoir | Wahiawa, Oahu | Other | 1925 | 98 | 550 | 0.83 | 1,085 |
| Papuaa Reservoir | Omao, Kauai | Irrigation | 1914 | 43 | 2,000 | 1.75 | 921 |
| Puu Lua Reservoir | Kekaha, Kauai | Fish & wildlife pond, other | 1925 | 105 | 640 | 0.08 | 888 |
| Upper Helemano Reservoir | Waialua, Oahu | Irrigation | 1912 | 46 | 530 | 0.45 | 700 |
| Aepoeha Reservoir | Kukuila, Kauai | Irrigation | 1913 | 42 | 600 | 0.81 | 670 |

Source: Hawaii State Department of Land & Natural Resources, Engineering Division, Flood Control & Dam Safety Section, records and Hawaii State Department of Land & Natural Resources, Dam Inventory System <<http://dams.hawaii.gov/Default.aspx>> accessed on February 22, 2021.

Table 5.24-- FRESH WATER USE, BY TYPE AND BY COUNTY: 2015

[Million gallons per day]

| Use | State total | Hawaii | Honolulu | Kalawao | Kauai | Maui |
|----------------|-------------|--------|----------|---------|-------|--------|
| Total | 682.95 | 89.89 | 258.11 | 0.01 | 43.35 | 291.59 |
| Ground water | 338.47 | 60.09 | 186.38 | 0.01 | 16.71 | 75.28 |
| Public supply | 252.31 | 37.38 | 168.78 | 0.01 | 13.67 | 32.47 |
| Domestic | 0.66 | - | - | - | 0.54 | 0.12 |
| Industrial | 0.24 | 0.21 | - | - | 0.03 | - |
| Irrigation | 73.80 | 14.47 | 15.09 | - | 1.88 | 42.36 |
| Livestock | 0.51 | - | 0.11 | - | 0.20 | 0.20 |
| Aquaculture | 8.58 | 6.21 | 1.92 | - | 0.34 | 0.11 |
| Mining | 0.89 | 0.34 | 0.48 | - | 0.05 | 0.02 |
| Thermoelectric | 1.48 | 1.48 | - | - | - | - |
| Surface water | 344.48 | 29.80 | 71.73 | - | 26.64 | 216.31 |
| Public supply | 14.61 | 2.32 | - | - | 2.67 | 9.62 |
| Domestic | 7.44 | 7.44 | - | - | - | - |
| Industrial | - | - | - | - | - | - |
| Irrigation | 311.26 | 12.19 | 68.65 | - | 23.97 | 206.45 |
| Livestock | 1.10 | 1.10 | - | - | - | - |
| Aquaculture | 10.04 | 6.75 | 3.08 | - | - | 0.21 |
| Mining | 0.03 | - | - | - | - | 0.03 |
| Thermoelectric | - | - | - | - | - | - |

Source: U.S. Geological Survey, Water Resources, *Water Use in the United States, Estimated Use of Water in the United States County-Level Data for 2015* <<https://www.sciencebase.gov/catalog/item/5af3311be4b0da30c1b245d8>> accessed April 24, 2020.

Table 5.25-- WATER SERVICES AND CONSUMPTION, FOR COUNTY WATERWORKS: 2018 TO 2020

[Services as of June 30; consumption during the year ending June 30]

| Geographic area | Number of services | | | Consumption (million gallons) | | |
|-----------------------------|--------------------|---------|---------|-------------------------------|--------|--------|
| | 2018 | 2019 | 2020 | 2018 | 2019 | 2020 |
| State total | 273,969 | 275,498 | 277,772 | 72,193 | 72,369 | 70,942 |
| City and County of Honolulu | 172,156 | 172,872 | 173,347 | 47,494 | 47,515 | 46,256 |
| Honolulu District 1/ | 63,496 | 63,612 | 63,667 | 28,478 | 28,001 | 27,633 |
| Rest of Oahu | 108,660 | 109,260 | 109,680 | 19,016 | 19,514 | 18,622 |
| Hawaii County | 43,391 | 43,711 | 45,000 | 8,935 | 9,259 | 8,805 |
| Kauai County | 21,807 | 22,196 | 22,356 | 4,015 | 3,921 | 3,767 |
| Maui County | 36,615 | 36,719 | 37,069 | 11,749 | 11,674 | 12,114 |
| Maui | 34,933 | 35,028 | 35,374 | 11,508 | 11,449 | 11,849 |
| Molokai | 1,682 | 1,691 | 1,695 | 241 | 225 | 265 |

1/ Maunaloa to Moanalua.

Source: City and County of Honolulu Board of Water Supply, County of Hawaii Department of Water Supply, County of Kauai Department of Water, and Maui County Department of Water Supply records.

**Table 5.26-- WATER WITHDRAWALS BY SOURCE AND MAJOR USE,
FOR HAWAII AND THE UNITED STATES: 2015**

[Withdrawal signifies water physically withdrawn from a source. Includes fresh and saline water]

| Subject | Hawaii | U.S. 1/ |
|--|--------|---------|
| Water withdrawals, total (millions of gallons per day) | 1,060 | 322,000 |
| Source (percent) | | |
| Ground water | 33.8 | 26.3 |
| Surface water | 66.2 | 73.7 |
| Selected major uses (percent) | | |
| Public supply | 25.2 | 12.1 |
| Domestic | 0.8 | 1.0 |
| Irrigation | 36.3 | 36.7 |
| Livestock | 0.2 | 0.6 |
| Aquaculture | 1.8 | 2.3 |
| Industrial | 0.0 | 4.6 |
| Mining | 0.1 | 1.2 |
| Thermoelectric power | 35.7 | 41.3 |

1/ Includes Puerto Rico and the Virgin Islands.

Source: U.S. Geological Survey, *Estimated Use of Water in the United States in 2015*, Circular 1441 table 1 and table 2A <<https://pubs.usgs.gov/circ/1441/circ1441.pdf>> accessed May 24, 2019 and calculations by Hawaii State Department of Business, Economic Development & Tourism.

Table 5.27-- TOP 25 WATER USERS ON OAHU: 2019

[Estimated monthly average. Annual dates were revised to a fiscal year timeline ending June 30.
 Previous *Data Book* tables used a timeline of April through May]

| Rank | User | Gallons (1,000) |
|------|--|--------------------|
| 1 | Department of Environmental Services - R1 Honolulu TP | 70,506 |
| 2 | Commanding General | 69,419 |
| 3 | Prince Waikiki Golf Club | 26,700 |
| 4 | Hilton Hawaiian Village Lessee LLC | 23,658 |
| 5 | Island Energy Services LLC | 17,831 |
| 6 | Ewa Village Golf Course | 14,770 |
| 7 | Coral Creek Golf Course | 14,686 |
| 8 | Department of Environmental Services - 1614 Sand Island Parkway | 14,217 |
| 9 | Airport Maintenance - 530 Paiea Street | 13,403 |
| 10 | Ewa Beach Golf Club | 12,101 |
| 11 | Disney Vacation Resort & Spa - Ko Olina | 11,776 |
| 12 | Airport Maintenance - 2980 Aolele Street | 11,655 |
| 13 | Hoakalei Country Club | 11,625 |
| 14 | Kalaeloa Partners LP | 11,223 |
| 15 | Tesoro Hawaii Corporation | 11,030 |
| 16 | Airport Maintenance - 463 Lagoon Drive | 10,999 |
| 17 | Sheraton Hotels Hawaii | 10,712 |
| 18 | West Loch Golf Course | 10,645 |
| 19 | United Laundry Services | 9,947 |
| 20 | University of Hawaii - 2566 Dole Street | 9,753 |
| 21 | MWR Barbers Point Golf Course | 8,604 |
| 22 | Department of Enterprise Services | 8,583 |
| 23 | Division of Park Maintenance & Recreation - Central Oahu Regional Park | 8,567 |
| 24 | University of Hawaii - 2444 Dole Street | 7,829 |
| 25 | Marriott International Inc. | 7,212 |

Source: Honolulu Board of Water Supply, records.

Table 5.28-- TOP 25 WATER USERS ON OAHU: 2020

[Fiscal year ending June 30. Estimated monthly average]

| Rank | User | Gallons (1,000) |
|-------------|--|----------------------------|
| 1 | Department of Environmental Services - R1 Honolulu TP | 73,582 |
| 2 | Commanding General | 67,177 |
| 3 | Prince Waikiki Golf Club | 27,389 |
| 4 | Hilton Hawaiian Village Lessee LLC | 20,667 |
| 5 | Ewa Village Golf Course | 15,114 |
| 6 | Hoakalei Country Club | 14,715 |
| 7 | Airport Maintenance - 530 Paiea Street | 14,079 |
| 8 | West Loch Golf Course | 13,702 |
| 9 | Coral Creek Golf Course | 13,400 |
| 10 | Kalaeloa Partners LP | 12,143 |
| 11 | Ewa Beach Golf Club | 11,987 |
| 12 | Tesoro Hawaii Corporation | 10,977 |
| 13 | GGP Ala Moana LLC | 10,945 |
| 14 | Par Hawaii Refining LLC | 10,764 |
| 15 | Airport Maintenance - 463 Lagoon Drive | 10,114 |
| 16 | Division of Park Maintenance & Recreation - Central Oahu Regional Park | 9,604 |
| 17 | Disney Vacation Resort & Spa - Ko Olina | 9,339 |
| 18 | University of Hawaii - 2444 Dole Street | 9,113 |
| 19 | Sheraton Hotels Hawaii | 8,425 |
| 20 | Department of Enterprise Services | 8,264 |
| 21 | Department of Environmental Services - 1614 Sand Island Parkway | 8,236 |
| 22 | MWR Barbers Point Golf Course | 8,178 |
| 23 | Hawaiian Cement | 8,134 |
| 24 | A E S Hawaii Inc. | 8,062 |
| 25 | Division of Park Maintenance & Recreation - Haleiwa Beach Park | 7,985 |

Source: Honolulu Board of Water Supply, records.

Table 5.29-- WASTEWATER TREATMENT PLANT OPERATION AND COMPLIANCE: 1994 TO 2020

| Year | Total plants | Plants inspected | Plants rated unsatisfactory | In compliance (percent) |
|------|--------------|------------------|-----------------------------|-------------------------|
| 1994 | (NA) | 135 | 33 | (NA) |
| 1995 | (NA) | 163 | 35 | (NA) |
| 1996 | (NA) | 103 | 23 | (NA) |
| 1997 | (NA) | 176 | 45 | (NA) |
| 1998 | (NA) | 169 | 41 | (NA) |
| 1999 | (NA) | 164 | 35 | (NA) |
| 2000 | (NA) | 113 | 38 | (NA) |
| 2001 | (NA) | 144 | 35 | (NA) |
| 2002 | (NA) | 106 | 29 | (NA) |
| 2003 | (NA) | 100 | 20 | (NA) |
| 2004 | (NA) | 57 | 17 | (NA) |
| 2005 | (NA) | 41 | 8 | (NA) |
| 2006 | 180 | 93 | 14 | 92 |
| 2007 | 180 | 102 | 33 | 82 |
| 2008 | 180 | 34 | 15 | 92 |
| 2009 | 180 | 119 | 38 | 79 |
| 2010 | 180 | 114 | 13 | 93 |
| 2011 | 180 | 62 | 17 | 91 |
| 2012 | 190 | 58 | 13 | 93 |
| 2013 | 190 | 58 | 16 | 92 |
| 2014 | 190 | 82 | 30 | 84 |
| 2015 | 191 | 71 | 35 | 82 |
| 2016 | 214 | 51 | 23 | 55 |
| 2017 | 214 | 61 | 29 | 52 |
| 2018 | 214 | 81 | 32 | 60 |
| 2019 | 214 | 75 | 30 | 60 |
| 2020 | 220 | 82 | 31 | 62 |

NA Not available.

Source: Hawaii State Department of Health, *Indicators of Environmental Quality Report* (annual); Hawaii State Department of Health, *Environmental Health Management Report* (annual); and Hawaii State Department of Health, Wastewater Branch, records.

Table 5.30-- WASTEWATER RECYCLED: 1994 TO 2020

[In million gallons per day. Reuse amount for 2015 onward is based on operator reports which provide more accurate figures because they account for declines in use due to rainy periods, off-spec water, and equipment malfunctions]

| Year | Total wastewater treated | Wastewater reused | Percent reused |
|---------|--------------------------|-------------------|----------------|
| 1994 | 150 | 10.50 | 7.00 |
| 1995 | 150 | 11.10 | 7.40 |
| 1996 | 150 | 12.30 | 8.19 |
| 1997 | 150 | 15.60 | 10.40 |
| 1998 | 150 | 17.00 | 11.33 |
| 1999 | 150 | 19.50 | 13.00 |
| 2000 | 150 | 20.20 | 13.47 |
| 2001 | 150 | 19.90 | 13.27 |
| 2002 | 150 | 24.00 | 16.00 |
| 2003 | 150 | 23.50 | 15.67 |
| 2004 | 150 | 23.50 | 15.67 |
| 2005 | 150 | 23.50 | 15.67 |
| 2006 | 150 | 24.60 | 16.40 |
| 2007 | 150 | 24.40 | 16.27 |
| 2008 | 150 | 23.91 | 15.94 |
| 2009 | 150 | 23.91 | 15.94 |
| 2010 | 145 | 22.98 | 15.85 |
| 2011 | 141 | 19.64 | 13.93 |
| 2012 | 141 | 21.14 | 14.99 |
| 2013 | 133 | 21.12 | 15.88 |
| 2014 | 134 | 22.00 | 16.42 |
| 2015 | 134 | 1/ 18.10 | 12.10 |
| 2016 1/ | 134 | 18.90 | 12.80 |
| 2017 | 134 | 19.50 | 14.55 |
| 2018 | 134 | 19.20 | 14.33 |
| 2019 | 134 | 18.20 | 13.58 |
| 2020 | 134 | 19.00 | 14.18 |

1/ Revised from previous *Data Book*.

Source: Hawaii State Department of Health, *Indicators of Environmental Quality Report* (annual); Hawaii State Department of Health, *Environmental Health Management Report* (annual); and Hawaii State Department of Health, Wastewater Branch, records.

Table 5.31-- HAZARDOUS WASTE SITES, THREATS AND CONTAMINANTS ON OAHU: 2021

[Sites on the national priorities list for the superfund program]

| Sites with threats and contaminants | Location | Final listing 1/ | Deletion year | Sitewide ready for anticipated use 2/ |
|--|--------------|------------------|---------------|---------------------------------------|
| Del Monte Corp. (Oahu Plantation) 3/ Naval Computer & | Kunia | 12/16/94 | (4/) | Yes |
| Telecommunications Area 5/ | Wahiawa | 5/31/94 | (NA) | No |
| Pearl Harbor Naval Complex 6/ | Pearl Harbor | 10/14/92 | (NA) | No |
| Schofield Barracks (U.S. Army) 7/ | Schofield | Deleted | 2000 | Yes |

NA Not available.

1/ After the proposed listing, site was added on this date to the National Priorities List (NPL).

2/ "Yes" means all cleanup goals affecting current and reasonably anticipated future land uses of the entire site have been achieved, so there are no unacceptable risks. All required land-use restrictions or other controls have been put in place and the site has achieved "Construction Complete Status."

3/ "Yes" means soil and shallow groundwater at the site have been contaminated with the fumigants EDB, DBCP and DCP, the solvents TCP and benzene and the pesticide Lindane. Deep groundwater is contaminated with EDB, DBCP and TCP. People who touch or ingest contaminated groundwater or soil could be at risk.

4/ Partial deletion, EPA delisted the Poamoho section of the site from NPL list on January 13, 2004.

5/ The Navy's Installation Restoration Program (IRP) is addressing the sites at NCTAMS EASTPAC. The sites are primarily land disposal areas that are no longer in use and PCB transformer sites. Soil contamination depends on the site but generally the chemicals of concern are PCBs, volatile organics, semi-volatile organics and metals. The Navy selected remedies for several sites and has begun cleanup activities.

6/ Soil, groundwater and sediment are contaminated with metals, organic compounds and petroleum hydrocarbons. Site investigations and cleanup activities are ongoing. Site investigations indicate that there are no immediate threats to human health or the environment at the site.

7/ Industrial operations at the site contaminated groundwater with volatile organic compounds (VOCs), including trichloroethene (TCE). Following cleanup, EPA took the site off the Superfund program's (NPL) in 2000.

Source: U.S. Environmental Protection Agency, *National Priorities List Sites in Hawaii*
<<https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#HI>> accessed May 13, 2020.

Table 5.32-- HAZARDOUS WASTE GENERATED, SHIPPED, AND RECEIVED IN 2017 AND TOXIC CHEMICAL RELEASES IN 2018

| Category | Unit |
|--|-----------|
| Hazardous waste generators, shippers, and receivers, 2017 | |
| Number of generators | 108 |
| Number of shippers | 107 |
| Number of receivers | 1 |
| Hazardous waste generated, shipped, and received 2/ | |
| Generated | 499,156 |
| Shipped | 675 |
| Received | 30 |
| Number of Toxic Release Inventory facilities in Hawaii, 2018 | |
| | 31 |
| Toxic chemical releases 1/ | |
| On-site releases | 2,943,092 |
| Air emissions | 2,720,735 |
| Water emissions | 1,826,598 |
| Land emissions | 749,919 |
| Off-site releases, transfers to disposal | 144,218 |
| | 222,357 |

1/ In pounds.

2/ In tons. Covers hazardous wastes regulated under the Resource Conservation and Recovery Act (RCRA) of 1976 as amended.

Source: United States Environmental Protection Agency, Toxic Release Inventory Program, *TRI Explorer Fact Sheet, Summary of TRI Information for Hawaii* <http://iaspub.epa.gov/triexplorer/tri_factsheet_search.searchfactsheet> accessed May 29, 2020; United States Environmental Protection Agency, *The National Biennial RCRA Hazardous Waste Report: 2017 Edition* <<https://rcrainfo.epa.gov/rcrainfoweb/action/modules/br/summary/view>> accessed May 29, 2020.

Table 5.33-- SOLID WASTE RECYCLED IN HAWAII: 2001 TO 2020

[Fiscal year ending June 30. In tons]

| Year | Generated | Disposed | Diverted | Percent diverted |
|------|--------------|--------------|--------------|------------------|
| 2001 | 1,794,496 | 1,441,000 | 353,496 | 19.7 |
| 2002 | 1,971,336 | 1,478,668 | 492,668 | 25.0 |
| 2003 | 2,115,313 | 1,489,974 | 625,339 | 29.6 |
| 2004 | 2,140,648 | 1,517,915 | 622,733 | 29.1 |
| 2005 | 2,116,724 | 1,427,904 | 688,820 | 32.5 |
| 2006 | 2,227,124 | 1,425,752 | 801,373 | 36.0 |
| 2007 | 2,526,134 | 1,733,889 | 792,245 | 31.4 |
| 2008 | 2,617,350 | 1,778,009 | 839,341 | 32.1 |
| 2009 | 2,532,370 | 1,629,397 | 902,973 | 35.7 |
| 2010 | 1,636,298 | 988,444 | 647,854 | 39.6 |
| 2011 | 1,786,343 | 1,159,027 | 627,316 | 35.1 |
| 2012 | 1/ 1,593,887 | 1,147,194 | 1/ 608,857 | 1/ 34.7 |
| 2013 | 2,471,320 | 1,566,642 | 904,678 | 38.1 |
| 2014 | 2,300,696 | 1/ 1,455,078 | 1/ 845,618 | 1/ 36.8 |
| 2015 | 2,417,650 | 1,377,611 | 2/ 1,040,039 | 1/ 43.0 |
| 2016 | 2,235,962 | 1,503,061 | 732,900 | 32.8 |
| 2017 | 2,334,183 | 1,634,347 | 699,836 | 30.0 |
| 2018 | 2,396,089 | 1,828,297 | 567,792 | 23.7 |
| 2019 | 2,275,398 | 1,833,711 | 441,687 | 19.4 |
| 2020 | 2,153,205 | 1,605,580 | 547,625 | 25.4 |

1/ Incomplete or unavailable data for Maui County.

2/ Incomplete data for both Maui and Hawaii counties.

Source: Hawaii State Department of Health, *Environmental Health Management Plan* (annual); and Hawaii State Department of Health, Solid & Hazardous Waste Branch, records.

**Table 5.34-- DEPOSIT BEVERAGE CONTAINER REDEMPTION
RATE: 2006 TO 2020**

[Fiscal year ending June 30. In millions of beverage containers]

| Year | Beverage container sold | Beverage container redeemed | Redemption rate (percent) |
|------|-------------------------|-----------------------------|---------------------------|
| 2006 | 930 | 629 | 67.6 |
| 2007 | 936 | 633 | 67.6 |
| 2008 | 948 | 682 | 71.9 |
| 2009 | 896 | 705 | 78.7 |
| 2010 | 902 | 686 | 76.1 |
| 2011 | 907 | 687 | 75.7 |
| 2012 | 907 | 697 | 76.8 |
| 2013 | 912 | 684 | 75.0 |
| 2014 | 934 | 678 | 72.6 |
| 2015 | 959 | 648 | 67.6 |
| 2016 | 949 | 635 | 66.9 |
| 2017 | 958 | 665 | 69.4 |
| 2018 | 940 | 659 | 70.1 |
| 2019 | 968 | 640 | 66.1 |
| 2020 | 982 | 616 | 62.3 |

Source: Hawaii State Department of Health, *Environmental Health Management Report* (annual); and Hawaii State Department of Health, Solid & Hazardous Waste Branch, records.

Table 5.35-- WATER QUALITY AT PUBLIC BEACHES, BY ISLAND: 2019 TO 2020

[Starting in the 2019 Data Book, only includes data from regularly monitored beaches and stations with 10 or more sampling events. Therefore, data from previous editions of the Data Book are not comparable]

| Island | Number of locations | Number of samples | Enterococci density 1/ | | | |
|----------------|---------------------|-------------------|------------------------|------------|----------------|---------|
| | | | Lowest 2/ | Highest 3/ | Number over 4/ | Mean 5/ |
| 2019 | | | | | | |
| State total | 53 | 2,279 | 2.4 | 9.9 | - | 3.8 |
| Hawaii | 10 | 408 | 2.9 | 9.5 | - | 4.4 |
| Hilo shoreline | 5 | 157 | 3.6 | 9.5 | - | 6.5 |
| Kona shoreline | 5 | 251 | 2.9 | 4.4 | - | 3.4 |
| Maui | 16 | 506 | 2.4 | 8.2 | - | 3.5 |
| Lanai | - | - | (X) | (X) | (X) | (X) |
| Molokai | - | - | (X) | (X) | (X) | (X) |
| Oahu | 22 | 1,120 | 2.4 | 6.9 | - | 3.7 |
| Kauai | 5 | 245 | 2.8 | 9.9 | - | 4.9 |
| 2020 | | | | | | |
| State total | 60 | 2,004 | 2.3 | 16.8 | - | 3.0 |
| Hawaii | 10 | 372 | 3.0 | 5.3 | - | 4.2 |
| Hilo shoreline | 5 | 151 | 3.0 | 7.7 | - | 5.1 |
| Kona shoreline | 5 | 221 | 3.0 | 5.3 | - | 3.6 |
| Maui | 14 | 375 | 2.4 | 7.8 | - | 3.5 |
| Lanai | - | - | (X) | (X) | (X) | (X) |
| Molokai | - | - | (X) | (X) | (X) | (X) |
| Oahu | 25 | 832 | 2.3 | 4.5 | - | 3.0 |
| Kauai | 11 | 425 | 2.7 | 16.8 | - | 4.4 |

X Not applicable.

1/ Geometric mean, number per 100 ml. The geometric mean standard for Enterococci density was 35 per 100 ml. in 2019 and 2020.

2/ The lowest reported average value for 2019 was shared by 2 beaches, one of which was Makapuu on the island of Oahu. The lowest reported average value for 2020 was Hanauma Beach Park on the island of Oahu.

3/ The highest average value for 2019 and 2020 was reported by Kalapaki Beach Park on the island of Kauai.

4/ Refers to number of samples over the geometric mean standard for Enterococci density which was 35 per 100 ml. in 2019 and 2020.

5/ Not weighted by number of samples.

Source: Hawaii State Department of Health, Clean Water Branch, records.

**Table 5.36-- WATER QUALITY AT SELECTED PUBLIC BEACHES:
2019 AND 2020**

[Starting in the 2019 *Data Book*, only includes data from regularly monitored beaches and stations with 10 or more sampling events. Therefore, data from previous editions of the *Data Book* are not comparable. Data are categorized by STORET Station ID. STORET (Storage and Retrieval for Water Quality Data) is a repository of ambient Water Quality Data]

| Island and beach 1/ | STORET | Number of samples | | Enterococci density 1/ | |
|-------------------------------------|--------|-------------------|------|------------------------|------|
| | | 2019 | 2020 | 2019 | 2020 |
| Hawaii | | | | | |
| Hilo shoreline | 0011XX | 157 | 151 | 6.5 | 2.7 |
| Hilo Bay (Canoe Beach) | 001138 | 28 | 26 | 7.8 | 5.1 |
| Honolii Cove (Ocean) | 001110 | 27 | 29 | 9.5 | 7.7 |
| Keaukaha Beach - 4 Miles | 001114 | 34 | 32 | 6.9 | 4.6 |
| Onakahakaha Beach County Park | 001126 | 34 | 32 | 3.6 | 3.0 |
| Richardson Ocean Center | 001136 | 34 | 32 | 7.1 | 6.8 |
| Kona shoreline | 0012XX | 251 | 221 | 3.4 | 19.0 |
| Anaehoomalu Bay | 001236 | 50 | 44 | 2.9 | 3.3 |
| Kahaluu Beach County Park | 001203 | 51 | 43 | 4.2 | 3.2 |
| Kailua Bay | 001205 | 50 | 44 | 2.9 | 3.7 |
| Kamakaokahonu | 001208 | 50 | 45 | 4.4 | 5.3 |
| Puako | 001222 | 50 | 45 | 3.0 | 3.0 |
| Maui | | | | | |
| Airport (Kahekili) Beach | 000695 | 37 | 28 | 3.6 | 2.7 |
| Baldwin Park | 000689 | 33 | 25 | 2.9 | 3.2 |
| Cove Park | 000703 | 35 | 31 | 3.6 | 7.8 |
| Fleming Beach (North) | 000674 | 38 | 27 | 3.0 | 2.6 |
| Hanakaoo | 000693 | 43 | 27 | 4.7 | 5.8 |
| Hookipa Beach Park | 000688 | 30 | 28 | 2.5 | 2.9 |
| Hukilau Hotel shoreline | 000654 | 27 | 25 | 2.4 | 4.5 |
| Kamaole Beach 1 | 000681 | 14 | (2/) | 8.2 | (X) |
| Kamaole Beach 2 (Ili'iliholo Beach) | 000682 | 32 | 33 | 3.6 | 2.8 |
| Kamaole Beach 3 | 000683 | 41 | 34 | 3.0 | 2.9 |
| Kanaha Beach County Park | 000677 | 10 | (2/) | 4.3 | (X) |
| Launiupoko | 000694 | 32 | 21 | 3.2 | 3.9 |
| Makena Beach shoreline | 000661 | 27 | 16 | 3.1 | 3.0 |
| Sheraton Kaanapali shoreline | 000666 | 45 | 20 | 2.6 | 2.7 |
| Teen Challenge (Mile 14) | 000697 | 42 | 30 | 3.8 | 4.2 |
| Wailea Beach | 000691 | 40 | 30 | 4.7 | 2.4 |

Continued on next page.

**Table 5.36-- WATER QUALITY AT SELECTED PUBLIC BEACHES:
2019 AND 2020 -- Con.**

| Island and beach 1/ | STORET | Number of samples | | Enterococci density 1/ | |
|----------------------------------|--------|-------------------|------|------------------------|------|
| | | 2019 | 2020 | 2019 | 2020 |
| Oahu | | | | | |
| Ala Moana Lagoon | 000222 | 51 | 23 | 3.2 | 3.7 |
| Ala Moana Beach | | | | | |
| County Park, Center | 000153 | 52 | 23 | 3.4 | 3.2 |
| Ala Moana Beach | | | | | |
| County Park, DH | 000154 | 54 | 23 | 3.1 | 2.8 |
| Chun's Reef | 000218 | 49 | 39 | 3.6 | 2.8 |
| Haleiwa Alii Beach County Park | 000247 | 48 | 40 | 2.9 | 2.7 |
| Hanauma Bay | 000201 | 43 | 21 | 6.9 | 2.3 |
| Ihilani Kohola | 000252 | 49 | 18 | 3.6 | 4.3 |
| Kahanamoku Beach | 000155 | 53 | 29 | 5.6 | 4.5 |
| Kailua Beach County Park | 000193 | 56 | 17 | 4.9 | 4.1 |
| Kuhio Beach Park | 000161 | 56 | 28 | 6.7 | 4.1 |
| Lanikai Beach | 000194 | 55 | 41 | 3.9 | 3.7 |
| Makaha Beach County Park | 000185 | 49 | 41 | 2.6 | 2.6 |
| Makapuu Beach County Park | 000216 | 52 | 42 | 2.4 | 2.6 |
| Moana Beach, Waikiki | 000238 | 51 | 44 | 4.1 | 3.9 |
| Nanakuli Beach County Park | 000187 | 52 | 39 | 2.7 | 2.5 |
| Pokai Bay Beach County Park | 000224 | 53 | 42 | 5.1 | 3.1 |
| Sandy Beach County Park | 000200 | 52 | 40 | 2.6 | 2.4 |
| Sans Souci State Recreation Area | 000228 | 52 | 44 | 3.7 | 3.6 |
| Sunset Beach | 000225 | 45 | 40 | 3.3 | 2.6 |
| Waimanalo Beach County Park | 000197 | 53 | 13 | 2.9 | 3.3 |
| Waimea Beach | 000172 | 45 | 33 | 4.0 | 2.6 |
| White Plains Beach | 000236 | 50 | 39 | 2.8 | 2.5 |
| Kauai | | | | | |
| Hanalei Bay Pavilion | 000805 | 50 | 38 | 4.6 | 3.3 |
| Hanapepe Salt Pond | 000808 | 49 | 41 | 2.8 | 3.2 |
| Kalapaki Beach Park | 000809 | 49 | 44 | 9.9 | 3.7 |
| Lydgate Park | 000825 | 47 | 34 | 4.9 | 5.3 |
| Poipu Beach Pavilion | 000819 | 50 | 41 | 4.4 | 3.0 |

X Not applicable.

1/ Geometric mean, number per 100 ml. The geometric mean standard for Enterococci density was 35 per 100 ml. in 2019 and 2020.

2/ Did not have sufficient sample numbers.

Source: Hawaii State Department of Health, Clean Water Branch, records.

Table 5.37-- TOTAL DAYS PER YEAR OF SHORELINE POSTINGS: 2006 TO 2020

[For fiscal year ending June 30, unless otherwise specified. These numbers represent sign postings for sewage-related events along coastal shorelines, but do not reflect postings of warning signs on streams, lakes and other inland waters, such as the Ala Wai Canal. Other agencies may also post other shoreline warning signs. These numbers exclude 'brown water advisories' which are general media releases anticipating or responding to heavy storm water runoff and are not accompanied by actual sign postings]

| Year | Days 1/ | Year | Days 1/ | Year | Days 1/ |
|---------|---------|------|---------|------|---------|
| 2006 2/ | 368 | 2011 | 529 | 2016 | 68 |
| 2007 2/ | 151 | 2012 | 15 | 2017 | 301 |
| 2008 2/ | 159 | 2013 | 136 | 2018 | 331 |
| 2009 | 310 | 2014 | 48 | 2019 | 37 |
| 2010 | 403 | 2015 | 45 | 2020 | 104 |

1/ Total days may include same-day postings of separate posting events, therefore the total may exceed 365 days.

2/ Data for 2008 and earlier are calendar year data.

Source: Hawaii State Department of Health, Clean Water Branch, records.

Table 5.38-- REFUSE AND SEWAGE STATISTICS FOR OAHU: 2006 TO 2020

[Fiscal year ending June 30]

| Year | Tons of municipal solid waste delivered 1/ | | | Sewage treated 2/ (millions of gallons) |
|------|--|------------------------------------|----------------|--|
| | Total | City and County refuse vehicles | Other vehicles | |
| 2010 | 777,069 | 326,201 | 450,868 | 38,549 |
| 2011 | 778,158 | 306,939 | 471,219 | 38,307 |
| 2012 | 746,368 | 285,153 | 461,215 | 36,517 |
| 2013 | 748,227 | 289,203 | 459,024 | 36,318 |
| 2014 | 764,726 | 302,732 | 461,994 | 38,498 |
| 2015 | 769,183 | 307,069 | 462,114 | 38,448 |
| 2016 | 793,793 | 311,172 | 482,621 | 41,136 |
| 2017 | (NA) | (NA) | (NA) | 42,678 |
| 2018 | (NA) | (NA) | (NA) | 41,593 |
| 2019 | (NA) | (NA) | (NA) | 40,179 |
| 2020 | (NA) | (NA) | (NA) | 39,058 |

| Year | Average wastewater treated per day (millions of gallons) | Miles of sewers 2/ | City and County pump stations | City and County treatment plants |
|------|--|-----------------------|----------------------------------|-------------------------------------|
| 2010 | 105 | 2,105 | 72 | 9 |
| 2011 | 105 | 2,226 | 72 | 9 |
| 2012 | 100 | 2,226 | 72 | 9 |
| 2013 | 100 | 2,016 | 72 | 9 |
| 2014 | 105 | 2,019 | 72 | 9 |
| 2015 | 105 | 2,023 | 72 | 9 |
| 2016 | 113 | 2,024 | 72 | 9 |
| 2017 | 117 | (NA) | (NA) | (NA) |
| 2018 | 114 | (NA) | (NA) | (NA) |
| 2019 | 110 | (NA) | (NA) | (NA) |
| 2020 | 107 | (NA) | (NA) | (NA) |

NA Not available.

1/ Excludes small landfill controlled by armed forces.

2/ Data are limited to a system maintained by the City and County of Honolulu, Department of Environmental Services.

Source: City and County of Honolulu, Department of Environmental Services, records.

Table 5.39-- AIR QUALITY IN DOWNTOWN HONOLULU: 1988 TO 2020

[Annual arithmetic means, in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), for particulate matter 10 microns or less in diameter (PM_{10}) and in parts per million (ppm) for carbon monoxide (CO). Sampling is conducted about 46 feet above ground on the roof of the State Health Department building (Kinau Hale), 1250 Punchbowl Street, Honolulu, Hawaii]

| Year | PM_{10} ($\mu\text{g}/\text{m}^3$) 1/ | CO (ppm) 2/ | Year | PM_{10} ($\mu\text{g}/\text{m}^3$) 1/ | CO (ppm) 2/ |
|------|--|-------------|---------|--|-------------|
| 1988 | - | 1.7 | 2005 3/ | 14 | 0.6 |
| 1989 | - | 1.8 | 2006 4/ | 13 | 0.4 |
| 1990 | - | 1.5 | 2007 | 14 | 0.5 |
| 1991 | - | 1.7 | 2008 | 14 | 0.5 |
| 1992 | - | 1.6 | 2009 | 13 | 0.4 |
| 1993 | 13 | 1.8 | 2010 | 12 | 0.4 |
| 1994 | 14 | 0.8 | 2011 | 12 | 0.4 |
| 1995 | 14 | 0.8 | 2012 | 12 | 0.4 |
| 1996 | 14 | 0.8 | 2013 | 11 | 0.4 |
| 1997 | 8 | 0.8 | 2014 | 13 | 0.4 |
| 1998 | 9 | 0.8 | 2015 | 11 | 0.5 |
| 1999 | 14 | 0.6 | 2016 | 13 | 0.6 |
| 2000 | 14 | 0.7 | 2017 | 11 | 0.5 |
| 2001 | 16 | 0.6 | 2018 | 12 | 0.4 |
| 2002 | 15 | 0.6 | 2019 | 11 | 0.4 |
| 2003 | 15 | 0.6 | 2020 | 11 | 0.3 |
| 2004 | 13 | 0.6 | | | |

1/ The State Ambient Air Standard for PM_{10} annual average is $50 \mu\text{g}/\text{m}^3$. The Federal standard was revoked by the U.S. Environmental Protection Agency effective December 17, 2006.

2/ There is no annual standard for CO.

3/ Represents data until July 14, 2005, when the monitoring station was closed for roof repairs.

4/ Represents data from August 5, 2006, after completion of roof repairs.

Source: Hawaii State Department of Health, Environmental Management Division, Clean Air Branch, records.

Table 5.40-- AIR QUALITY AT SPECIFIED LOCATIONS: 2020

[Data are preliminary]

| Sampling station | PM ₁₀ (µg/m ³) 1/ | | | Sulfur dioxide (ppm) 2/ | | |
|-------------------|--|---------|---------------------------|-------------------------|---------|---------------------------|
| | Annual range 24-hr | | Annual arithmetic average | Annual range 1-hr | | Annual arithmetic average |
| | Minimum | Maximum | | Minimum | Maximum | |
| Oahu | | | | | | |
| Downtown Honolulu | 3 | 22 | 11 | 0.000 | 0.001 | 0.000 |
| Pearl City | 3 | 26 | 12 | (X) | (X) | (X) |
| Kapolei | 2 | 43 | 12 | 0.000 | 0.015 | 0.001 |

X Not applicable.

1/ Particulate matter up to 10 microns in diameter. The State and Federal Ambient Air Standard for 24-hr PM₁₀ is 150 µg/m³.

2/ The State Ambient Air Standard for 24-hr SO₂ is 0.14 ppm. Federal standard for SO₂ is now a 1 hour average not to exceed 75 ppb (0.075 ppm).

Source: Hawaii State Department of Health, Environmental Management Division, Clean Air Branch, records.

Table 5.41-- RELEASE OF TOXICS: 1999 TO 2019

[In pounds. Release is defined as the amount of a toxic chemical released on-site (to air, water, underground injection, landfills, and other land disposal) and the amount transferred off-site for disposal. Data for 2002 through 2018 revised from previous *Data Book*]

| | Total | Air | Water | On-site land | Under-ground injection | Off-site |
|------|--------------|------------|--------------|---------------------|-------------------------------|-----------------|
| 1999 | 1,681,101 | 1,584,809 | 2,721 | 38,163 | 5,070 | 50,338 |
| 2000 | 1,311,611 | 1,057,090 | 1,224 | 31,833 | 7,284 | 214,180 |
| 2001 | 3,108,521 | 2,379,969 | 29,770 | 224,400 | 2,071 | 472,311 |
| 2002 | 3,695,661 | 2,495,255 | 454,684 | 228,634 | 2,241 | 514,846 |
| 2003 | 3,167,753 | 2,131,958 | 364,067 | 249,267 | 2,670 | 419,791 |
| 2004 | 3,170,718 | 2,358,755 | 296,417 | 227,720 | 6,601 | 281,224 |
| 2005 | 3,105,369 | 2,310,746 | 522,217 | 89,734 | 2,736 | 179,935 |
| 2006 | 3,021,488 | 2,253,130 | 358,266 | 174,678 | 4,743 | 230,671 |
| 2007 | 3,015,577 | 2,266,925 | 446,948 | 143,011 | 2,670 | 156,023 |
| 2008 | 3,245,550 | 2,277,988 | 549,838 | 169,076 | 3,471 | 245,176 |
| 2009 | 3,230,824 | 2,512,126 | 222,963 | 147,530 | 4,477 | 343,728 |
| 2010 | 2,777,864 | 2,021,469 | 452,359 | 171,221 | 2,603 | 130,212 |
| 2011 | 2,871,599 | 2,120,060 | 409,370 | 124,224 | 3,722 | 214,223 |
| 2012 | 2,957,277 | 2,140,557 | 435,662 | 181,039 | 4,508 | 195,511 |
| 2013 | 2,843,334 | 1,977,061 | 441,572 | 232,261 | 1,242 | 191,198 |
| 2014 | 2,926,542 | 1,821,690 | 534,190 | 401,495 | 7,036 | 162,131 |
| 2015 | 2,831,202 | 1,810,416 | 621,767 | 224,194 | 6,346 | 168,480 |
| 2016 | 3,215,153 | 2,113,719 | 522,258 | 197,012 | 3,199 | 378,966 |
| 2017 | 3,061,992 | 2,001,955 | 593,620 | 238,073 | 1,338 | 227,006 |
| 2018 | 2,961,904 | 1,826,598 | 749,919 | 160,734 | 2,297 | 222,357 |
| 2019 | 2,910,867 | 1,786,404 | 626,495 | 261,770 | 2,534 | 233,664 |

Source: U.S. Environmental Protection Agency, *Hawaii Report: Toxics Release Inventory* (annual) <https://enviro.epa.gov/triexplorer/tri_factsheet_search.searchfactsheet> accessed October 27, 2020.

Table 5.42-- TOXIC RELEASE INVENTORY CHEMICAL RELEASES: 1988 TO 2019

[In pounds. For all industries and all chemicals]

| Year | Total on-site disposal or other releases | Total off-site disposal or other releases | Total on- and off-site disposal or other releases | Total production-related waste managed |
|---------|--|---|---|--|
| 1988 | 2,225,959 | 164,482 | 2,390,441 | (NA) |
| 1989 | 2,105,585 | 20,458 | 2,126,043 | (NA) |
| 1990 | 844,758 | 7,209 | 851,967 | (NA) |
| 1991 | 916,001 | 12,388 | 928,389 | 8,322,961 |
| 1992 | 873,910 | 163,500 | 1,037,410 | 8,348,939 |
| 1993 | 706,345 | 14,982 | 721,327 | 8,259,575 |
| 1994 | 588,489 | 17,371 | 605,860 | 3,133,045 |
| 1995 | 492,923 | 163,769 | 656,692 | 5,401,395 |
| 1996 | 536,272 | 3,995 | 540,267 | 4,185,584 |
| 1997 | 444,040 | 8,365 | 452,405 | 4,118,506 |
| 1998 | 2,026,357 | 85,903 | 2,112,260 | 5,806,154 |
| 1999 | 1,630,843 | 50,438 | 1,681,281 | 5,221,169 |
| 2000 | 1,097,432 | 176,546 | 1,273,978 | 1,782,121 |
| 2001 | 2,950,196 | 430,325 | 3,380,521 | 4,258,038 |
| 2002 | 3,180,814 | 514,846 | 3,695,661 | 4,620,356 |
| 2003 | 2,747,963 | 419,791 | 3,167,753 | 4,023,425 |
| 2004 | 2,889,493 | 281,224 | 3,170,718 | 3,853,008 |
| 2005 | 2,925,433 | 179,935 | 3,105,369 | 4,009,430 |
| 2006 | 2,790,816 | 230,671 | 3,021,488 | 3,679,473 |
| 2007 | 2,859,554 | 156,023 | 3,015,577 | 3,878,790 |
| 2008 | 3,000,373 | 245,176 | 3,245,550 | 4,393,104 |
| 2009 | 2,603,536 | 343,728 | 2,947,264 | 3,734,894 |
| 2010 1/ | 2,647,652 | 130,212 | 2,777,864 | 3,328,198 |
| 2011 1/ | 2,657,376 | 214,223 | 2,871,599 | 3,556,339 |
| 2012 1/ | 2,761,766 | 195,511 | 2,957,277 | 6,897,551 |
| 2013 1/ | 2,652,135 | 191,198 | 2,843,334 | 5,726,070 |
| 2014 1/ | 2,764,411 | 162,131 | 2,926,542 | 5,932,552 |
| 2015 1/ | 2,662,722 | 168,480 | 2,831,202 | 7,321,061 |
| 2016 1/ | 2,836,188 | 378,966 | 3,215,153 | 6,221,410 |
| 2017 | 2,834,986 | 227,006 | 3,061,992 | 6,572,271 |
| 2018 1/ | 2,739,548 | 222,357 | 2,961,904 | 4,075,002 |
| 2019 | 2,677,202 | 233,664 | 2,910,867 | 4,084,590 |

NA Not available.

1/ Revised from previous *Data Book*.Source: United States Environmental Protection Agency, Toxic Release Inventory Program, TRI Explorer
<<https://www.epa.gov/toxics-release-inventory-tri-program/tri-data-and-tools>> accessed on May 11, 2021.

Table 5.43 -- RELEASE OF PERSISTENT, BIOACCUMULATIVE AND TOXIC (PBT) CHEMICALS: 2002 TO 2019

[In pounds unless otherwise specified]

| Year | Total on- and off-site disposal or other releases 1/ | | | | |
|------|--|----------|-------------------------------|------------------------|-----------|
| | Lead and lead compounds | PAC's 2/ | Mercury and mercury compounds | Benzo (g,h,i) perylene | Dioxin 3/ |
| 2002 | 91,912 | 1,407 | 317 | 0.95 | 6.330 |
| 2003 | 106,067 | 1,533 | 203 | 1.18 | 5.129 |
| 2004 | 131,952 | 1,786 | 187 | 9.84 | 5.390 |
| 2005 | 46,192 | 1,683 | 211 | 213.00 | 5.100 |
| 2006 | 90,131 | 1,467 | 127 | 7.00 | 5.000 |
| 2007 | 84,110 | 1,271 | 203 | 6.00 | 5.080 |
| 2008 | 91,106 | 1,288 | 293 | 6.00 | 0.010 |
| 2009 | 107,782 | 2,276 | 147 | 16.00 | 4.080 |
| 2010 | 93,115 | 1,328 | 553 | 6.00 | 4.110 |
| 2011 | 74,488 | 1,798 | 236 | 9.00 | 4.233 |
| 2012 | 101,479 | 1,627 | 345 | 33.00 | 3.888 |
| 2013 | 134,234 | 1,361 | 294 | 6.00 | 3.678 |
| 2014 | 214,637 | 915 | 131 | 5.00 | 1.676 |
| 2015 | 110,410 | 520 | 128 | 32.00 | 1.649 |
| 2016 | 104,779 | 493 | 373 | 4.00 | 1.708 |
| 2017 | 120,021 | 669 | 67 | 16.00 | 1.585 |
| 2018 | 70,427 | 703 | 68 | 17.00 | 1.586 |
| 2019 | 76,812 | 1,134 | 70 | 17.00 | 1.440 |

1/ Release is defined as the amount of a toxic chemical released on-site (to air, water, underground injection, landfills, and other land disposal), and the amount transferred off-site for disposal.

2/ Polycyclic aromatic compounds.

3/ Dioxin and dioxin-like compounds in grams.

Source: U.S. Environmental Protection Agency, *Hawaii Report: Toxics Release Inventory* (annual) <<https://www.epa.gov/toxics-release-inventory-tri-program/tri-data-and-tools>> accessed October 27, 2020.

Table 5.44-- OIL AND CHEMICAL RELEASES: 2006 TO 2020

| Year | Total oil & chemical releases | Oil releases | | | Chemical releases | | |
|------|-------------------------------|--------------|---------|----------|-------------------|---------|----------|
| | | Total | To land | To water | Total | To land | To water |
| 2006 | 384 | 206 | (NA) | (NA) | 178 | (NA) | (NA) |
| 2007 | 489 | 289 | (NA) | (NA) | 200 | (NA) | (NA) |
| 2008 | 305 | 198 | (NA) | (NA) | 107 | (NA) | (NA) |
| 2009 | 268 | 143 | 56 | 87 | 125 | 63 | 62 |
| 2010 | 414 | 218 | 126 | 92 | 196 | 131 | 65 |
| 2011 | 371 | 257 | 185 | 72 | 114 | 51 | 63 |
| 2012 | 376 | 268 | 203 | 65 | 108 | 70 | 38 |
| 2013 | 388 | 256 | 178 | 78 | 132 | 83 | 49 |
| 2014 | 366 | 230 | 159 | 71 | 136 | 104 | 32 |
| 2015 | 440 | 283 | 180 | 103 | 157 | 100 | 57 |
| 2016 | 620 | 388 | 219 | 169 | 232 | 135 | 97 |
| 2017 | 565 | 381 | 171 | 210 | 184 | 121 | 63 |
| 2018 | 515 | 308 | 122 | 186 | 207 | 136 | 71 |
| 2019 | 513 | 291 | 161 | 130 | 222 | 142 | 80 |
| 2020 | 458 | 285 | 137 | 148 | 173 | 108 | 65 |

NA Not available.

Source: Hawaii State Department of Health, Hazard Evaluation and Emergency Response Office, records.

Table 5.45-- ATMOSPHERIC CARBON DIOXIDE MEASUREMENTS AT MAUNA LOA: 1958 TO 2020

[Average carbon dioxide mixing ratio, parts per million. Revised from previous *Data Book*]

| Year | Annual average | Year | Annual average | Year | Annual average |
|------|----------------|------|----------------|------|----------------|
| 1958 | 1/ 315.17 | 1979 | 336.84 | 2000 | 369.71 |
| 1959 | 315.98 | 1980 | 338.76 | 2001 | 371.32 |
| 1960 | 316.91 | 1981 | 340.12 | 2002 | 373.45 |
| 1961 | 317.64 | 1982 | 341.48 | 2003 | 375.98 |
| 1962 | 318.45 | 1983 | 343.15 | 2004 | 377.70 |
| 1963 | 318.99 | 1984 | 344.85 | 2005 | 379.98 |
| 1964 | 2/ 319.62 | 1985 | 346.35 | 2006 | 382.09 |
| 1965 | 320.04 | 1986 | 347.61 | 2007 | 384.02 |
| 1966 | 321.37 | 1987 | 349.31 | 2008 | 385.83 |
| 1967 | 322.18 | 1988 | 351.69 | 2009 | 387.64 |
| 1968 | 323.05 | 1989 | 353.20 | 2010 | 390.10 |
| 1969 | 324.62 | 1990 | 354.45 | 2011 | 391.85 |
| 1970 | 325.68 | 1991 | 355.70 | 2012 | 394.06 |
| 1971 | 326.32 | 1992 | 356.54 | 2013 | 396.74 |
| 1972 | 327.46 | 1993 | 357.21 | 2014 | 398.87 |
| 1973 | 329.68 | 1994 | 358.96 | 2015 | 401.01 |
| 1974 | 1/ 330.19 | 1995 | 360.97 | 2016 | 404.41 |
| 1975 | 3/ 331.12 | 1996 | 362.74 | 2017 | 406.76 |
| 1976 | 332.03 | 1997 | 363.88 | 2018 | 408.72 |
| 1977 | 333.84 | 1998 | 366.84 | 2019 | 411.66 |
| 1978 | 335.41 | 1999 | 368.54 | 2020 | 414.24 |

1/ Based on data for 8 months.

2/ Based on data for 9 months.

3/ Based on data for 11 months.

Source: National Weather Service, Pacific Region, Honolulu (for 1958-1991); Mauna Loa Observatory (for 1992-1999); and U.S. Department of Commerce, National Oceanic & Atmospheric Administration (NOAA), Cooperative Global Air Sampling Network, Global Monitoring Division, Earth Systems Research Laboratory (ESRL) <<ftp://aftp.cmdl.noaa.gov/products/trends/co2/>> accessed February 22, 2021 and records.

Table 5.46-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES: 2018

| Island and station | Ground elevation (feet) | Average temperature 1/ (°F) | | Extreme temperature of record (°F) | | Average annual precipitation (inches) |
|---------------------------------|-------------------------|-----------------------------|---------------|------------------------------------|---------|---------------------------------------|
| | | Coollest month | Warmest month | Lowest | Highest | |
| Hawaii: | | | | | | |
| Hilo Airport | 38 | 72.2 | 78.6 | 58 | 91 | 176.44 |
| Hawaii Volcanoes Nat. Park Hdq. | 3,971 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Naalehu | 660 | (NA) | (NA) | (NA) | (NA) | 52.45 |
| Kailua (Kona Airport) | 43 | (NA) | (NA) | 60 | 92 | 12.31 |
| Puako 2/ | 133 | 70.5 | 79.9 | 59 | 96 | 11.36 |
| Waimea (Kamuela) 3/ | 2,615 | 66.2 | 73.5 | 44 | 83 | 8.86 |
| Honokaa | 1,080 | (NA) | (NA) | (NA) | (NA) | 140.67 |
| Mauna Kea summit 4/ | 13,773 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Maui: | | | | | | |
| Hana Airport 5/ | 75 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Haleakala summit 6/ | 6,962 | 49.3 | 59.4 | 35 | 77 | 25.73 |
| Kihei 7/ | 160 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kahului Airport | 51 | 72.3 | 80.8 | 52 | 95 | 22.13 |
| Lahaina 8/ | 40 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Molokai: | | | | | | |
| Kaunakakai | 12 | (NA) | (NA) | (NA) | (NA) | 12.69 |
| Molokai Airport | 443 | (NA) | (NA) | 53 | 93 | 21.12 |
| Lanai: | | | | | | |
| Lanai City 9/ | 1,620 | (NA) | (NA) | (NA) | (NA) | (NA) |

Continued on next page.

Table 5.46-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES: 2018 -- Con.

| Island and station | Ground elevation (feet) | Average temperature 1/ (°F) | | Extreme temperature of record (°F) | | Average annual precipitation (inches) |
|--|-------------------------|-----------------------------|---------------|------------------------------------|---------|---------------------------------------|
| | | Coolest month | Warmest month | Lowest | Highest | |
| Oahu: | | | | | | |
| Daniel K. Inouye International Airport 10/ | 7 | 74.5 | 81.9 | 63 | 92 | 16.95 |
| Waikiki (Honolulu Zoo) | 10 | 67.3 | 78.4 | 51 | 92 | 18.81 |
| Manoa (Lyon Arboretum) | 500 | 68.7 | 74.9 | 58 | 87 | 211.14 |
| Kaneohe (State Hospital) | 68 | (NA) | (NA) | (NA) | (NA) | 105.87 |
| Kahuku | 25 | 69.1 | 77.6 | 59 | 88 | 42.28 |
| Wheeler AFB 11/ | 820 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Upper Wahiawa 12/ | 1,006 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kauai: | | | | | | |
| Kilauea (town) | 259 | (NA) | (NA) | (NA) | (NA) | 96.39 |
| Lihue Airport | 100 | 71.5 | 79.7 | 58 | 88 | 51.96 |
| Poipu (Makahuena Pt.) 6/ | 52 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kekaha 13/ | 10 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kokee (Kanalohuluhulu) | 3,600 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Northwestern Hawaiian Islands: | | | | | | |
| Midway 14/ | 40 | (NA) | (NA) | (NA) | (NA) | (NA) |

Continued on next page.

Table 5.46-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES: 2018 -- Con.

NA Not available.

1/ For some stations, data represent 30-year normals.

2/ Data available through 1976. Temperature data are for Mahukona.

3/ Data available through 1980.

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

5/ Data available through 2005.

6/ Data available through 1976.

7/ Temperature data available through 1982, refer to Keawakapu Beach.

8/ Data available through 2001.

9/ Data available through 2008, then restarted since June 2010.

10/ Formerly known as Honolulu International Airport.

11/ Data available through 1949.

12/ Started on April 1971 used through December 1977, then relocated WSW of Post Office at Wahiawa.

13/ Data available through 2000.

14/ Data available through 1991, not confirmed.

Source: Hawaii State Department of Land and Natural Resources, Commission on Water Resource Management, records; and University of Hawaii at Manoa, School of Ocean and Earth Science and Technology, Department of Atmospheric Science, records.

Table 5.47-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES: 2019

| Island and station | Ground elevation (feet) | Average temperature 1/ (°F) | | Extreme temperature of record (°F) | | Average annual precipitation (inches) |
|---------------------------------|-------------------------|-----------------------------|---------------|------------------------------------|---------|---------------------------------------|
| | | Coollest month | Warmest month | Lowest | Highest | |
| Hawaii | | | | | | |
| Hilo Airport | 38 | 70.3 | 79.9 | 57 | 92 | 100.82 |
| Hawaii Volcanoes Nat. Park Hdq. | 3,971 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Naalehu | 660 | (NA) | (NA) | (NA) | (NA) | 39.80 |
| Kailua (Kona Airport) | 43 | (NA) | (NA) | 59 | 90 | 8.93 |
| Puako 2/ | 133 | 68.6 | 80.1 | 61 | 94 | 7.91 |
| Waimea (Kamuela) 3/ | 2,615 | 65.5 | 75.4 | 39 | 83 | 7.33 |
| Honokaa | 1,080 | (NA) | (NA) | (NA) | (NA) | 13.44 |
| Mauna Kea summit 4/ | 13,773 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Maui | | | | | | |
| Hana Airport 5/ | 75 | 65.6 | 76.7 | 55 | 86 | 66.76 |
| Haleakala summit 6/ | 6,962 | 55.4 | 56.4 | 42 | 68 | 5.48 |
| Kihei 7/ | 160 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kahului Airport | 51 | 72.4 | 82.3 | 54 | 97 | 12.86 |
| Lahaina 8/ | 40 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Molokai | | | | | | |
| Kaunakakai | 12 | (NA) | (NA) | (NA) | (NA) | 11.92 |
| Molokai Airport | 443 | (NA) | (NA) | 55 | 94 | 18.11 |
| Lanai | | | | | | |
| Lanai City 9/ | 1,620 | (NA) | (NA) | (NA) | (NA) | 10.86 |

Continued on next page.

Table 5.47-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES: 2019 -- Con.

| Island and station | Ground elevation (feet) | Average temperature 1/ (°F) | | Extreme temperature of record (°F) | | Average annual precipitation (inches) |
|--|-------------------------|-----------------------------|---------------|------------------------------------|---------|---------------------------------------|
| | | Coollest month | Warmest month | Lowest | Highest | |
| Oahu | | | | | | |
| Daniel K. Inouye International Airport 10/ | 7 | 71.7 | 83.5 | 61 | 95 | 16.61 |
| Waikiki (Honolulu Zoo) | 10 | 70.7 | 81.1 | 34 | 97 | 19.20 |
| Manoa (Lyon Arboretum) | 500 | 65.2 | 76.3 | 52 | 89 | 132.89 |
| Kaneohe (State Hospital) | 68 | (NA) | (NA) | (NA) | (NA) | 60.78 |
| Kahuku | 25 | 69.3 | 79.3 | 56 | 86 | 29.58 |
| Wheeler AFB 11/ | 820 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Upper Wahiawa 12/ | 1,006 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kauai | | | | | | |
| Kilauea (town) | 259 | (NA) | (NA) | (NA) | (NA) | 66.12 |
| Lihue Airport | 100 | 70.2 | 83.0 | 56 | 91 | 38.45 |
| Poipu (Makahuena Pt.) 6/ | 52 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kekaha 13/ | 10 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kokee (Kanalohuluhulu) | 3,600 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Northwestern Hawaiian Islands: | | | | | | |
| Midway 14/ | 40 | (NA) | (NA) | (NA) | (NA) | (NA) |

Continued on next page.

Table 5.47-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES: 2019 -- Con.

NA Not available.

1/ For some stations, data represent 30-year normals.

2/ Data available through 1976. Temperature data are for Mahukona.

3/ Data available through 1980.

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

5/ Data available through 2005.

6/ Data available through 1976.

7/ Temperature data available through 1982, refer to Keawakapu Beach.

8/ Data available through 2001.

9/ Data available through 2008, then restarted since June 2010.

10/ Formerly known as Honolulu International Airport.

11/ Data available through 1949.

12/ Started on April 1971 used through December 1977, then relocated WSW of Post Office at Wahiawa.

13/ Data available through 2000.

14/ Data available through 1991, not confirmed.

Source: Hawaii State Department of Land and Natural Resources, Commission on Water Resource Management, records; and University of Hawaii at Manoa, School of Ocean and Earth Science and Technology (SOEST), Department of Atmospheric Science, Hawaii State Climate Office, records.

Table 5.48-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES: 2020

| Island and station | Ground elevation (feet) | Average temperature 1/ (°F) | | Extreme temperature of record (°F) | | Average annual precipitation (inches) |
|---------------------------------|-------------------------|-----------------------------|---------------|------------------------------------|---------|---------------------------------------|
| | | Coollest month | Warmest month | Lowest | Highest | |
| Hawaii | | | | | | |
| Hilo Airport | 38 | 72.2 | 78.2 | 59 | 93 | 121.40 |
| Hawaii Volcanoes Nat. Park Hdq. | 3,971 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Naalehu | 660 | (NA) | (NA) | (NA) | (NA) | 44.38 |
| Kailua (Kona Airport) | 43 | (NA) | (NA) | 63 | 92 | 11.19 |
| Puako 2/ | 133 | 70.1 | 78.5 | 58 | 92 | 6.92 |
| Waimea (Kamuela) 3/ | 2,615 | 66.7 | 74.0 | 43 | 79 | 1.21 |
| Honokaa | 1,080 | (NA) | (NA) | (NA) | (NA) | 62.22 |
| Mauna Kea summit 4/ | 13,773 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Maui | | | | | | |
| Hana Airport 5/ | 75 | 69.8 | 74.7 | 57 | 86 | 70.91 |
| Haleakala summit 6/ | 6,962 | 55.3 | 55.3 | 39 | 68 | 20.93 |
| Kihei 7/ | 160 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kahului Airport | 51 | 73.2 | 82.5 | 55 | 96 | 11.39 |
| Lahaina 8/ | 40 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Molokai | | | | | | |
| Kaunakakai | 12 | (NA) | (NA) | (NA) | (NA) | 2.37 |
| Molokai Airport | 443 | (NA) | (NA) | 56 | 91 | 13.58 |
| Lanai | | | | | | |
| Lanai City 9/ | 1,620 | (NA) | (NA) | (NA) | (NA) | 13.69 |

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Table 5.48-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES: 2020 -- Con.

| Island and station | Ground elevation (feet) | Average temperature 1/ (°F) | | Extreme temperature of record (°F) | | Average annual precipitation (inches) |
|--|-------------------------|-----------------------------|---------------|------------------------------------|---------|---------------------------------------|
| | | Coollest month | Warmest month | Lowest | Highest | |
| Oahu | | | | | | |
| Daniel K. Inouye International Airport 10/ | 7 | 74.2 | 82.0 | 60 | 93 | 13.61 |
| Waikiki (Honolulu Zoo) | 10 | 70.0 | 71.1 | 58 | 85 | 4.64 |
| Manoa (Lyon Arboretum) | 500 | 68.1 | 73.6 | 56 | 89 | 141.16 |
| Kaneohe (State Hospital) | 68 | (NA) | (NA) | (NA) | (NA) | 44.77 |
| Kahuku | 25 | 69.6 | 78.3 | 55 | 86 | 34.61 |
| Wheeler AFB 11/ | 820 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Upper Wahiawa 12/ | 1,006 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kauai | | | | | | |
| Kilauea (town) | 259 | (NA) | (NA) | (NA) | (NA) | 100.81 |
| Lihue Airport | 100 | 72.8 | 81.3 | 58 | 89 | 41.26 |
| Poipu (Makahuena Pt.) 6/ | 52 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kekaha 13/ | 10 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Kokee (Kanalohuluhulu) | 3,600 | (NA) | (NA) | (NA) | (NA) | (NA) |
| Northwestern Hawaiian Islands: | | | | | | |
| Midway 14/ | 40 | (NA) | (NA) | (NA) | (NA) | (NA) |

Continued on next page.

Table 5.48-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES: 2020 -- Con.

NA Not available.

1/ For some stations, data represent 30-year normals.

2/ Data available through 1976. Temperature data are for Mahukona.

3/ Data available through 1980.

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

5/ Data available through 2005.

6/ Data available through 1976.

7/ Temperature data available through 1982, refer to Keawakapu Beach.

8/ Data available through 2001.

9/ Data available through 2008, then restarted since June 2010.

10/ Formerly known as Honolulu International Airport.

11/ Data available through 1949.

12/ Started on April 1971 used through December 1977, then relocated WSW of Post Office at Wahiawa.

13/ Data available through 2000.

14/ Data available through 1991, not confirmed.

Source: Hawaii State Department of Land and Natural Resources, Commission on Water Resource Management, records; and University of Hawaii at Manoa, School of Ocean and Earth Science and Technology (SOEST), Department of Atmospheric Science, Hawaii State Climate Office, records.

Table 5.49-- CLIMATIC NORMALS, MEANS, AND EXTREMES FOR HILO, KAHULUI, HONOLULU, AND LIHUE AIRPORTS: 2020

[Normals are 30-year averages (1981 - 2010)]

| Subject | Hilo | Kahului | Honolulu | Lihue |
|---|----------|----------|----------|----------|
| Temperatures (°F) | | | | |
| Normal daily maximum, annual | 80.9 | 84.3 | 84.4 | 81.2 |
| Highest daily maximum | 94 | 97 | 95 | 91 |
| Month and year of occurrence | Nov 2013 | Sep 2019 | Aug 2019 | Sep 2019 |
| Normal daily minimum, annual | 66.8 | 67.4 | 70.9 | 70.4 |
| Lowest daily minimum | 53 | 22 | 53 | 50 |
| Month and year of occurrence | Feb 1962 | Jan 2004 | Jan 1998 | Jan 1969 |
| Normal dry bulb (temperature of ambient air) | | | | |
| Coolest | 71.2 | 71.8 | 73.1 | 71.6 |
| Month | Feb | Feb | Feb | Feb |
| Warmest | 76.4 | 79.7 | 81.9 | 79.7 |
| Month | Aug | Aug | Aug | Aug |
| Annual | 73.9 | 75.8 | 77.7 | 75.8 |
| Normal no. days with maximum 90°F and above | - | 17.0 | 18.7 | 0.1 |
| Normal relative humidity (percent), annual | | | | |
| 8 a.m. | 80 | 74 | 72 | 77 |
| 2 p.m. | 68 | 58 | 56 | 66 |
| Percent of possible sunshine, annual | 41 | (NA) | 71 | 59 |
| Mean no. days (annual) with | | | | |
| Clear | 35.5 | 130.5 | 90.0 | 55.3 |
| Partly cloudy | 131.3 | 145.2 | 179.8 | 183.2 |
| Cloudy | 195.3 | 89.5 | 92.0 | 123.2 |
| Wind speed (m.p.h.), annual | | | | |
| Mean | 6.7 | 12.8 | 10.3 | 13.2 |
| Maximum 2-minute | 39 | (NA) | 40 | 48 |
| Month and year of occurrence | Aug 2014 | (NA) | Jan 2004 | Dec 2007 |
| Precipitation (inches) | | | | |
| Normal, annual | 126.72 | 17.83 | 17.10 | 37.05 |
| Maximum monthly | 50.82 | 14.46 | 20.79 | 36.13 |
| Month and year of occurrence | Dec 1954 | Jan 1980 | Mar 1951 | Mar 2006 |
| Minimum monthly | 0.13 | - | 0.01 | 0.08 |
| Month and year of occurrence | Jan 1998 | Jun 1957 | Dec 2012 | Dec 2005 |
| Maximum in 24 hours | 27.36 | 7.01 | 17.07 | 40.00 |
| Month and year of occurrence | Nov 2000 | Jan 1980 | Mar 1958 | Aug 2019 |

NA Not available.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, *Local Climatological Data, Annual Summary with Comparative Data, 2020*, "Normals, Means, and Extremes," for Hilo, Kahului, Honolulu, and Lihue (annual)
 <<http://www.ncdc.noaa.gov/IPS/lcd/lcd.html>> accessed May 25, 2021.

Table 5.50-- MONTHLY AND ANNUAL CLIMATIC DATA FOR DANIEL K. INOUE INTERNATIONAL AIRPORT: 2020

[Normals are 30-year averages (1981 - 2010)]

| Month | Normal temperature (°F) | | | Extreme temperature (°F) | | Precipitation (inches) | | | |
|-----------|-------------------------|---------------|--------------------|--------------------------|----------------------|------------------------|-----------------|-----------------|---------------------|
| | Daily maximum | Daily minimum | Normal dry bulb 1/ | Highest daily maximum | Lowest daily minimum | Normal | Maximum monthly | Minimum monthly | Maximum in 24 hours |
| January | 80.1 | 66.3 | 73.2 | 88 | 53 | 2.31 | 14.74 | 0.03 | 6.72 |
| February | 80.2 | 66.1 | 73.1 | 88 | 53 | 1.99 | 13.68 | 0.06 | 6.88 |
| March | 81.2 | 67.7 | 74.5 | 88 | 55 | 2.02 | 20.79 | 0.01 | 17.07 |
| April | 82.7 | 69.4 | 76.1 | 91 | 57 | 0.63 | 8.92 | 0.01 | 4.21 |
| May | 84.6 | 70.9 | 77.8 | 93 | 60 | 0.62 | 7.23 | 0.03 | 3.44 |
| June | 87.0 | 73.4 | 80.2 | 92 | 65 | 0.26 | 5.68 | (2/) | 5.01 |
| July | 87.9 | 74.5 | 81.2 | 94 | 66 | 0.51 | 2.71 | 0.02 | 2.20 |
| August | 88.7 | 75.1 | 81.9 | 95 | 65 | 0.56 | 7.63 | (2/) | 4.42 |
| September | 88.6 | 74.4 | 81.5 | 95 | 64 | 0.70 | 4.48 | 0.05 | 2.25 |
| October | 86.7 | 73.4 | 80.0 | 94 | 58 | 1.84 | 11.15 | 0.07 | 7.57 |
| November | 83.9 | 71.4 | 77.6 | 93 | 57 | 2.42 | 18.79 | 0.03 | 9.15 |
| December | 81.2 | 68.3 | 74.8 | 89 | 54 | 3.24 | 17.29 | 0.01 | 8.25 |
| Annual | 84.4 | 70.9 | 77.7 | 95 | 53 | 17.10 | 20.79 | 0.01 | 17.07 |

Continued on next page.

Table 5.50-- MONTHLY AND ANNUAL CLIMATIC DATA FOR DANIEL K. INOUE INTERNATIONAL AIRPORT: 2020 -- Con.

| Month | Relative humidity (percent) | | Wind (miles/hour) | | Percent of possible sunshine | Number of days | | |
|-----------|--------------------------------|--------|----------------------|------------------------------|------------------------------------|----------------|--------|--------------------------------------|
| | 8 a.m. | 2 p.m. | Mean speed | Maximum 2-minute speed | | Mean | | Normal |
| | | | | | | Clear | Cloudy | Precipitation .01 inch or more |
| January | 81 | 61 | 8.5 | 40 | 65 | 9.5 | 8.5 | 8.5 |
| February | 79 | 59 | 9.1 | 39 | 68 | 8.1 | 7.6 | 7.4 |
| March | 73 | 57 | 10.1 | 39 | 72 | 7.4 | 9.3 | 8.8 |
| April | 70 | 55 | 10.9 | 35 | 70 | 5.9 | 9.6 | 7.5 |
| May | 67 | 54 | 10.5 | 31 | 72 | 6.7 | 8.7 | 5.8 |
| June | 66 | 52 | 11.8 | 30 | 74 | 6.5 | 6.2 | 5.7 |
| July | 68 | 52 | 12.0 | 30 | 76 | 7.4 | 5.1 | 7.1 |
| August | 68 | 52 | 11.7 | 33 | 77 | 8.0 | 5.7 | 5.6 |
| September | 70 | 53 | 10.2 | 30 | 77 | 7.9 | 5.7 | 6.9 |
| October | 71 | 56 | 9.5 | 36 | 71 | 7.5 | 8.1 | 7.6 |
| November | 75 | 59 | 9.7 | 35 | 64 | 7.2 | 8.8 | 8.8 |
| December | 79 | 60 | 9.3 | 39 | 63 | 7.9 | 8.7 | 9.7 |
| Annual | 72 | 56 | 10.3 | 40 | 71 | 90.0 | 92.0 | 89.4 |

1/ Temperature of the ambient air.

2/ Trace precipitation.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, *Local Climatological Data, Annual Summary With Comparative Data, 2020*, "Normals, Means, and Extremes, Honolulu, HI" (annual) <<http://www.ncdc.noaa.gov/IPS/lcd/lcd.html>> accessed May 25, 2021.

Table 5.51-- AVERAGE TEMPERATURE, PERCENT OF POSSIBLE SUNSHINE, AND PRECIPITATION, FOR DANIEL K. INOUE INTERNATIONAL AIRPORT: 1970 TO 2020

[From 1980 on, data taken from the "Normals, Means, and Extremes, Honolulu, HI" table represents a historic average rather than annual data]

| Year | Average temperature (°F) | Percent of possible sunshine | Precipitation (inches) | Year | Average temperature (°F) | Percent of possible sunshine | Precipitation (inches) |
|---------|--------------------------|------------------------------|------------------------|------|--------------------------|------------------------------|------------------------|
| 1970 1/ | 78.2 | 72 | 15.49 | 2000 | 77.6 | 71 | 7.10 |
| 1971 1/ | 76.1 | 70 | 26.64 | 2001 | 78.2 | 71 | 9.14 |
| 1972 | 76.2 | 65 | 26.94 | 2002 | 77.9 | 71 | 12.18 |
| 1973 | 77.2 | 63 | 14.24 | 2003 | 78.5 | 71 | 12.69 |
| 1974 | 77.5 | 61 | 24.02 | 2004 | 78.7 | 71 | 39.01 |
| 1975 | 76.2 | 62 | 24.39 | 2005 | 78.4 | 71 | 15.60 |
| 1976 | 76.8 | 60 | 12.90 | 2006 | 77.1 | 71 | 29.45 |
| 1977 | 78.2 | 68 | 12.36 | 2007 | 78.0 | 71 | 11.99 |
| 1978 | 76.8 | 69 | 25.05 | 2008 | 78.3 | 71 | 14.76 |
| 1979 | 77.0 | 68 | 16.93 | 2009 | (NA) | 71 | 11.55 |
| 1980 | 77.4 | 68 | 26.90 | 2010 | 77.5 | 71 | 17.40 |
| 1981 | 77.1 | 68 | 13.41 | 2011 | 78.3 | 71 | 15.69 |
| 1982 | 76.9 | 67 | 34.92 | 2012 | 77.2 | 71 | 8.58 |
| 1983 | 77.2 | 67 | 5.03 | 2013 | 77.1 | 71 | 16.18 |
| 1984 | 78.1 | 67 | 17.08 | 2014 | 78.2 | 71 | 20.82 |
| 1985 | 76.9 | 67 | 17.38 | 2015 | 78.7 | 71 | 21.04 |
| 1986 | 78.3 | 68 | 13.93 | 2016 | 77.9 | 71 | 13.16 |
| 1987 | 77.9 | 68 | 23.53 | 2017 | 78.2 | 71 | 22.62 |
| 1988 | 78.5 | 68 | 16.47 | 2018 | 78.8 | 71 | 16.95 |
| 1989 | 77.5 | 68 | 27.52 | 2019 | 79.3 | 71 | 16.61 |
| 1990 | 77.6 | 69 | 19.84 | 2020 | 78.9 | 71 | 13.65 |
| 1991 | 77.7 | 69 | 17.94 | | | | |
| 1992 | 77.8 | 69 | 19.00 | | | | |
| 1993 | 77.1 | 69 | 5.84 | | | | |
| 1994 | 78.8 | 70 | 15.59 | | | | |
| 1995 | 79.3 | 70 | 13.60 | | | | |
| 1996 | 78.6 | 70 | 33.12 | | | | |
| 1997 | 77.8 | 71 | 19.99 | | | | |
| 1998 | 77.1 | 71 | 4.52 | | | | |
| 1999 | 76.9 | 71 | 11.99 | | | | |

NA Not available.

1/ Site conditions produced distorted temperature measurements from 1965 to 1971.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, *Local Climatological Data, Annual Summary With Comparative Data 2020*, "Average Temperature (°F), Honolulu, HI", "Normals, Means, and Extremes, Honolulu, HI", "Precipitation (inches), Honolulu, HI" (annual) <<http://www.ncdc.noaa.gov/IPS/lcd/lcd.html>> accessed May 25, 2021.

Table 5.52-- AVERAGE DAILY TEMPERATURE AND DAYS WITH MAXIMUM OF 90° OR HIGHER, FOR DANIEL K. INOUE INTERNATIONAL AIRPORT: 1971 TO 2020

| Year | Average daily maximum (°F) | Days 90° or higher | Year | Average daily maximum (°F) | Days 90° or higher |
|------|----------------------------|--------------------|------|----------------------------|--------------------|
| 1971 | 82.7 | - | 2001 | 84.5 | 19 |
| 1972 | 83.2 | 3 | 2002 | 84.1 | 9 |
| 1973 | 84.4 | 10 | 2003 | 84.8 | 35 |
| 1974 | 85.0 | 25 | 2004 | 84.9 | 53 |
| 1975 | 83.6 | 1 | 2005 | 84.7 | 55 |
| 1976 | 84.1 | 9 | 2006 | 83.1 | 1 |
| 1977 | 85.2 | 16 | 2007 | 84.2 | 11 |
| 1978 | 84.2 | 13 | 2008 | 84.5 | 12 |
| 1979 | 84.7 | 51 | 2009 | (NA) | 31 |
| 1980 | 84.6 | 22 | 2010 | 84.0 | 1 |
| 1981 | 84.6 | 9 | 2011 | 84.6 | 8 |
| 1982 | 83.5 | 27 | 2012 | 83.4 | - |
| 1983 | 85.1 | 44 | 2013 | 83.6 | 3 |
| 1984 | 85.5 | 63 | 2014 | 84.4 | 40 |
| 1985 | 84.6 | 53 | 2015 | 85.0 | 64 |
| 1986 | 86.2 | 64 | 2016 | 84.1 | 4 |
| 1987 | 85.7 | 93 | 2017 | 84.7 | 14 |
| 1988 | 86.1 | 70 | 2018 | 84.7 | 31 |
| 1989 | 85.2 | 34 | 2019 | 86.1 | 95 |
| 1990 | 84.0 | 47 | 2020 | 84.4 | 19 |
| 1991 | 84.9 | 35 | | | |
| 1992 | 85.2 | 28 | | | |
| 1993 | 84.5 | 23 | | | |
| 1994 | 85.5 | 85 | | | |
| 1995 | 86.8 | 116 | | | |
| 1996 | 85.8 | 69 | | | |
| 1997 | 85.1 | 50 | | | |
| 1998 | 83.7 | - | | | |
| 1999 | 83.2 | - | | | |
| 2000 | 84.0 | 4 | | | |

NA Not available.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, *Local Climatological Data, Annual Summary With Comparative Data 2020*, "Meteorological Data, Honolulu" (annual) <<http://www.ncdc.noaa.gov/IPS/lcd/lcd.html>> accessed May 25, 2021.

Table 5.53-- CLIMATIC DATA FOR DANIEL K. INOUE INTERNATIONAL AIRPORT: 2008 TO 2020

| Year | Average temperature (°F) 1/ | | | Extreme temperature (°F) | |
|------|-----------------------------|----------------|---------------|--------------------------|---------|
| | Annual | Coollest month | Warmest month | Lowest | Highest |
| 2008 | 78.3 | 73.6 | 82.2 | 62 | 90 |
| 2009 | (NA) | 72.5 | 82.5 | 58 | 92 |
| 2010 | 77.5 | 73.1 | 80.7 | 61 | 90 |
| 2011 | 78.3 | 73.4 | 81.5 | 59 | 90 |
| 2012 | 77.2 | 73.9 | 80.8 | 60 | 89 |
| 2013 | 77.1 | 72.9 | 81.2 | 59 | 90 |
| 2014 | 78.2 | 72.7 | 82.9 | 60 | 93 |
| 2015 | 78.7 | 72.3 | 83.5 | 57 | 93 |
| 2016 | 77.9 | 74.2 | 81.5 | 59 | 91 |
| 2017 | 78.2 | 73.5 | 81.7 | 58 | 91 |
| 2018 | 78.8 | 75.0 | 82.9 | 63 | 92 |
| 2019 | 79.3 | 72.3 | 84.3 | 61 | 95 |
| 2020 | 78.9 | 74.9 | 83.1 | 60 | 93 |

| Year | Relative humidity (percent) | | Annual average wind speed (miles/hour) | Precipitation | |
|------|-----------------------------|--------|--|-----------------------|----------------------------|
| | 8 a.m. | 2 p.m. | | Annual total (inches) | Days with .01 inch or more |
| 2008 | 62 | 53 | 10.0 | 14.76 | 92 |
| 2009 | 62 | 54 | 10.2 | 11.55 | 74 |
| 2010 | 63 | 53 | 10.1 | 17.40 | 88 |
| 2011 | 66 | 56 | 10.1 | 15.69 | 108 |
| 2012 | 66 | 57 | 10.7 | 8.58 | 51 |
| 2013 | 65 | 56 | 9.4 | 16.18 | 83 |
| 2014 | 65 | 56 | 8.9 | 20.82 | 104 |
| 2015 | 67 | 58 | 9.4 | 21.04 | 122 |
| 2016 | 66 | 57 | 10.2 | 13.16 | 97 |
| 2017 | 64 | 54 | 9.7 | 22.62 | 72 |
| 2018 | 67 | 58 | 10.1 | 16.95 | 98 |
| 2019 | 65 | 54 | 9.6 | 16.61 | 85 |
| 2020 | 64 | 53 | 10.3 | 13.65 | 89 |

NA Not available.

1/ Average dry bulb (temperature of the ambient air).

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, *Local Climatological Data, Annual Summary With Comparative Data, (annual)* "Meteorological Data, Honolulu, HI" (annual) <<http://www.ncdc.noaa.gov/IPS/lcd/lcd.html>> accessed May 25, 2021.

Table 5.54-- 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 1/ | 91.9 |
| Highest monthly average daily temp. (°F) | September | Kawaihae 1/ | 80.8 |
| Lowest average annual rainfall (inches) | ... | Kawaihae | 8.7 |
| Highest average annual rainfall (inches) | ... | Waialeale | 444.0 |
| Single events | | | |
| Lowest temperature of record (°F) | Jan. 20, 1970 | Mauna Kea summit 2/ | 1.4 |
| Highest temperature of record (°F) | April 27, 1931 | Pahala | 100.0 |
| Lowest annual rainfall of record (inches) | 1953 | Kawaihae | 0.2 |
| Highest annual rainfall of record (inches) | 1982 | Waialeale | 666.0 |
| Highest wind speed of record (m.p.h.) | Sept. 11, 1992 | Makahuena Pt. 3/ | 143.0 |

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: Hawaii State Department of Land and Natural Resources, Commission on Water Resource Management, data provided February 14, 1995.

Table 5.55 -- RAINFALL AT SPECIFIED LOCATIONS: 2003 TO 2020

[In inches]

| Year | Hawaii | | | | Maui | | |
|------|--------------|----------|--------------|----------|-----------------|----------|---------|
| | Hilo Airport | Lalamilo | Kona Village | Naalehu | Kahului Airport | Kihei | Lahaina |
| 2003 | 91.38 | 1/ 12.37 | 5.66 | 1/ 25.71 | 13.83 | 11.58 | (NA) |
| 2004 | 137.49 | 29.99 | 19.97 | 2/ 47.56 | 26.17 | 26.38 | (NA) |
| 2005 | 123.32 | 15.58 | 14.90 | 1/ 25.01 | 2/ 15.45 | 10.88 | (NA) |
| 2006 | 122.02 | 10.61 | 9.68 | 1/ 71.26 | 18.65 | 16.49 | (NA) |
| 2007 | 106.75 | 16.39 | 12.45 | 42.46 | 13.06 | 14.61 | (NA) |
| 2008 | 127.53 | 7.43 | 7.74 | 1/ 48.43 | 9.55 | 5.84 | (NA) |
| 2009 | 131.18 | 2/ 9.41 | 6.99 | 3/ 23.20 | 14.07 | 7.33 | (NA) |
| 2010 | 63.29 | 4/ 0.25 | 5.55 | 4/ 0.51 | 9.44 | 4.68 | (NA) |
| 2011 | 97.66 | 4/ 0.36 | 3.29 | 5/ 11.49 | 1/ 10.59 | 7.42 | (NA) |
| 2012 | 90.94 | 6/ 1.04 | 1.50 | 7/ 18.73 | 5.04 | 2.17 | (NA) |
| 2013 | 102.24 | 8/ 0.90 | 3/ 4.29 | 1/ 27.02 | 15.41 | 1/ 06.76 | (NA) |
| 2014 | 115.24 | 7/ 11.83 | 13.64 | 1/ 52.87 | 23.25 | 17.97 | (NA) |
| 2015 | 147.59 | 4/ 1.66 | 9.61 | 43.20 | 29.26 | 1/ 14.22 | (NA) |
| 2016 | 128.43 | 8/ 0.04 | 1/ 14.60 | 41.76 | 19.00 | 1/ 14.22 | 4/ 0.73 |
| 2017 | 105.57 | 1.38 | (NA) | 35.64 | 26.10 | (NA) | (NA) |
| 2018 | 176.44 | 9/ 8.86 | (NA) | 9/ 52.45 | 7/ 22.13 | (NA) | (NA) |
| 2019 | 100.82 | 9/ 7.33 | 9/ 11.88 | 9/ 39.80 | 12.86 | (NA) | (NA) |
| 2020 | 2/ 121.40 | 9/ 1.21 | 12.31 | 9/ 44.38 | 1/ 11.39 | (NA) | (NA) |

Continued on next page.

Table 5.55 -- RAINFALL AT SPECIFIED LOCATIONS: 2003 TO 2020 -- Con.

| Year | Oahu | | | | Kauai | | |
|------|----------|----------------------|---------------|-----------|-----------|---------------|-------------|
| | Waikiki | University of Hawaii | Nuuanu Res. 4 | Kane-ohe | Koloa | Lihue Airport | Princeville |
| 2003 | 23.09 | 1/ 24.36 | 111.33 | 50.75 | 2/ 31.06 | 35.78 | 74.82 |
| 2004 | 40.31 | 61.89 | 146.17 | 81.26 | 64.89 | 49.91 | 93.17 |
| 2005 | 19.26 | 36.45 | 1/ 79.09 | 58.24 | 3/ 22.35 | 27.61 | 79.95 |
| 2006 | 31.84 | 38.90 | 89.54 | 81.28 | 10/ 60.48 | 67.03 | 91.58 |
| 2007 | 27.30 | 1/ 33.81 | 1/ 93.06 | 45.19 | 43.52 | 24.37 | 72.09 |
| 2008 | 15.60 | 33.79 | 103.82 | 41.44 | 57.56 | 40.07 | 78.85 |
| 2009 | 11.56 | 24.22 | 1/ 88.12 | 52.50 | 1/ 30.99 | 26.63 | 82.53 |
| 2010 | 15.60 | 32.76 | 83.33 | 40.91 | 1/ 43.12 | 25.94 | 52.02 |
| 2011 | 23.74 | 1/ 29.87 | 93.76 | 1/ 52.56 | 10/ 39.64 | 42.67 | 83.11 |
| 2012 | 14.25 | 23.01 | 6/ 61.22 | 32.66 | (9/) | 41.12 | 73.40 |
| 2013 | 19.25 | 32.11 | 112.48 | 47.44 | (9/) | 37.15 | 62.28 |
| 2014 | 21.48 | 32.83 | 123.63 | 52.51 | (9/) | 30.94 | 70.73 |
| 2015 | 18.54 | 10/ 33.70 | 130.86 | 1/ 52.45 | (9/) | 30.07 | 71.87 |
| 2016 | 11.97 | 24.80 | 123.67 | 1/ 80.30 | (9/) | 13.39 | 74.53 |
| 2017 | 21.58 | 29.95 | 101.15 | 60.61 | 40.23 | 23.68 | 72.42 |
| 2018 | 9/ 18.81 | 9/ 40.37 | 9/ 120.30 | 9/ 105.87 | 9/ 69.04 | 51.96 | 1/ 137.78 |
| 2019 | 9/ 19.20 | 9/ 32.49 | 9/ 64.25 | 9/ 60.78 | 9/ 53.68 | 38.45 | 1/ 69.97 |
| 2020 | 9/ 4.64 | 9/ 19.28 | 9/ 92.59 | 9/ 44.77 | 9/ 56.34 | 9/ 41.26 | 9/ 88.93 |

NA Not available.

1/ Missing 1 day.

2/ Missing 2 days.

3/ Missing 4 days.

4/ Missing 10 days.

5/ Missing 6 days.

6/ Missing 5 days.

7/ Missing 7 days.

8/ Missing 11 days.

9/ Missing 26 or more days.

10/ Missing 3 days.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, *Climatological Data, Annual Summary, Hawaii and Pacific* (annual); Hawaii State Department of Land and Natural Resources, Commission on Water Resource Management, records; and University of Hawaii at Manoa, School of Ocean and Earth Science and Technology, Department of Atmospheric Science, records; and Hawaii State Climate Office records.

Table 5.56-- MAJOR HURRICANES: 1950 TO 2020

[Updated data source; additional historical hurricanes were added compared to the previous *Data Book*]

| Hurricane name | Date 1/ | Islands most affected | Maximum recorded winds ashore (m.p.h.) | | Deaths | Property damage (\$M) |
|----------------|------------------|-----------------------|--|------------|--------|-----------------------|
| | | | Sustained | Peak gusts | | |
| Hiki | Aug. 15-17, 1950 | Kauai | 68 | (NA) | 1 | 0.2 |
| Della | Sept. 4, 1957 | French Frigate Shoals | 82 | 109 | - | Minor |
| Nina | Dec. 1-2, 1957 | Kauai | (NA) | 92 | 1 | 0.1 |
| Dot | Aug. 6, 1959 | Kauai | 81 | 103 | - | 5.5+ |
| Fico | July 18-20, 1978 | Hawaii | (NA) | 58+ | - | 0.2 |
| Iwa | Nov. 23, 1982 | Kauai, Oahu | 65 | 117 | 1 | 234.0 |
| Estelle | July 22, 1986 | Maui, Hawaii | (NA) | 55 | - | 2.0 |
| Iniki | Sept. 11, 1992 | Kauai, Oahu | 92 | 143 | 8 | 1900.0 |
| Eugene | Jul. 24, 1993 | Hawaii | (NA) | 125 | 1 | (NA) |
| Iselle | Jul. 31, 2014 | Hawaii | (NA) | 140 | 1 | 148.0 |
| Ana | Oct. 17, 2014 | Kauai, Oahu | (NA) | 85 | - | Minor |
| Darby | Jul. 12, 2016 | Hawaii, Kauai, Oahu | (NA) | 120 | - | Minor |
| Olivia | Sep. 9, 2018 | Maui | (NA) | 130 | - | 25.0 |
| Douglas | Jul. 20, 2020 | Maui | (NA) | 130 | - | Minor |

NA Not available.

1/ Period affecting the Hawaiian Islands.

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; "20-Foot Waves Hit Big Isle As Storm Brushes Coastline", *The Honolulu Advertiser*, July 23, 1986, pp. A1, A2; "Hawaii Hurricanes", *Honolulu Star-Bulletin*, August 4, 1988, p. A-8; Hawaii State Department of Land and Natural Resources, Commission on Water Resource Management, records; University of Hawaii at Manoa, School of Ocean and Earth Science and Technology, Department of Atmospheric Science, records; and Hawaii State Climate Office, records; NOAA *Historical Hurricane Tracks* <<https://coast.noaa.gov/hurricanes/#map=4/32/-80>> accessed March 3, 2021.

Table 5.57-- TRADE WINDS, HIGH SURF, AND TEMPERATURES IN HAWAIIAN WATERS, BY MONTH: 1995

| Month | Trade wind frequency 1/ (percent) | Expected days of strong trade winds 2/ | Highest surf 3/ (average number of days) | | Water temperature 4/ (°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 |
| Annual | 73 | 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), pp. 14, 22, 56, and 74; and Hawaii State Department of Land and Natural Resources, Commission on Water Resource Management, data provided February 14, 1995.

**Table 5.58-- SUNRISE, SUNSET, AND HOURS OF DAYLIGHT AT
SELECTED LOCATIONS, AT BEGINNING OF EACH SEASON: 2021**

[Based on Hawaii-Aleutian Standard Time which is 10 hours less than Universal Time Coordinated (UTC), the international standard for civil time]

| Subject | Hilo | Kahului | Honolulu | Lihue |
|---------------------------|--------|---------|----------|-------|
| Sunrise (a.m.) | | | | |
| March 19 | 6:25 | (NA) | 6:36 | (NA) |
| June 20 | 5:42 | (NA) | 5:50 | (NA) |
| September 22 | 6:09 | (NA) | 6:20 | (NA) |
| December 21 | 6:50 | (NA) | 7:05 | (NA) |
| Sunset (p.m.) | | | | |
| March 19 | 6:31 | (NA) | 6:42 | (NA) |
| June 20 | 7:02 | (NA) | 7:16 | (NA) |
| September 22 | 6:16 | (NA) | 6:27 | (NA) |
| December 21 | 5:47 | (NA) | 5:55 | (NA) |
| Daylight (hours, minutes) | | | | |
| March 19 | 12, 06 | (NA) | 12, 06 | (NA) |
| June 20 | 13, 20 | (NA) | 13, 26 | (NA) |
| September 22 | 12, 07 | (NA) | 12, 07 | (NA) |
| December 21 | 10, 57 | (NA) | 10, 50 | (NA) |

NA Not available.

Source: NOAA Global Monitoring Laboratory, "NOAA Solar Calculator for sunrise, sunset, solar noon and solar position for any place on earth." Hilo data based on GML data sites. Honolulu data based on U.S. Cities sites, <<https://www.esrl.noaa.gov/gmd/grad/solcalc/>> accessed May 27, 2021, and calculations by the Hawaii State Department of Business, Economic Development & Tourism.

**Table 5.59-- SUNRISE, SUNSET, AND HOURS OF DAYLIGHT AT
SELECTED LOCATIONS, AT BEGINNING OF EACH SEASON: 2022**

[Based on Hawaii-Aleutian Standard Time which is 10 hours less than Universal Time
Coordinated (UTC), the international standard for civil time]

| Subject | Hilo | Kahului | Honolulu | Lihue |
|---------------------------|-------------|----------------|-----------------|--------------|
| Sunrise (a.m.) | | | | |
| March 19 | 6:25 | (NA) | 6:36 | (NA) |
| June 20 | 5:42 | (NA) | 5:50 | (NA) |
| September 22 | 6:09 | (NA) | 6:20 | (NA) |
| December 21 | 6:50 | (NA) | 7:05 | (NA) |
| Sunset (p.m.) | | | | |
| March 19 | 6:31 | (NA) | 6:42 | (NA) |
| June 20 | 7:02 | (NA) | 7:16 | (NA) |
| September 22 | 6:16 | (NA) | 6:27 | (NA) |
| December 21 | 5:47 | (NA) | 5:55 | (NA) |
| Daylight (hours, minutes) | | | | |
| March 19 | 12, 06 | (NA) | 12, 06 | (NA) |
| June 20 | 13, 20 | (NA) | 13, 26 | (NA) |
| September 22 | 12, 07 | (NA) | 12, 07 | (NA) |
| December 21 | 10, 57 | (NA) | 10, 50 | (NA) |

NA Not available.

Source: NOAA Global Monitoring Laboratory, "NOAA Solar Calculator for sunrise, sunset, solar noon and solar position for any place on earth." Hilo data based on GML data sites. Honolulu data based on U.S. Cities sites, <<https://www.esrl.noaa.gov/gmd/grad/solcalc/>> accessed May 27, 2021, and calculations by the Hawaii State Department of Business, Economic Development & Tourism.

Table 5.60-- HAWAII AUDUBON SOCIETY BIRD COUNTS OF SELECTED SPECIES IN THE HONOLULU AREA: 2016 TO 2020

[Counts are made in late December at various locations between Hawaii Kai and Aiea, and between Waimanalo and Kaneohe. Annual changes reflect differences in numbers of bird counters and counting time in the field, as well as changes in bird populations. Totals by species are also affected by the types of habitats studied]

| Species | 2016 | 2017 | 2018 | 2019 | 2020 |
|---------------------------|-------|-------|-------|-------|-------|
| Endemic species 1/ | | | | | |
| Apapane | 26 | 4 | 4 | 18 | 13 |
| Hawaiian Duck x Mallard | 160 | 279 | 170 | 165 | 133 |
| Hawaiian Coot 2/ | 47 | 83 | 255 | 449 | 128 |
| Hawaiian Moorhen 2/ | 103 | 77 | 26 | 49 | 25 |
| Hawaiian Stilt 2/ | 124 | 117 | 119 | 131 | 20 |
| Oahu Amakihi | 7 | 7 | 6 | 64 | 43 |
| Oahu Elepaio | - | 1 | 2 | - | 6 |
| Indigenous species 3/ | | | | | |
| Black-crowned Night Heron | 39 | 51 | 36 | 41 | 27 |
| Brown Booby | 8 | 8 | - | 6 | 2 |
| Great Frigatebird | 7 | 78 | 57 | 105 | - |
| Red-footed Booby 4/ | 2,050 | 1,775 | 850 | 866 | - |
| White Tern | 48 | 55 | 48 | 31 | 79 |
| Alien species 5/ | | | | | |
| Cattle Egret | 204 | 193 | 206 | 382 | 227 |
| Common Myna | 1,137 | 1,294 | 969 | 1,381 | 1,196 |
| Common Waxbill | 1,414 | 860 | 1,259 | 832 | 918 |
| House Finch | 32 | 89 | 38 | 204 | 193 |
| House Sparrow | 258 | 373 | 126 | 236 | 249 |
| Japanese White-eye | 61 | 104 | 93 | 343 | 289 |
| Java Sparrow | 128 | 262 | 514 | 484 | 504 |
| Northern Cardinal | 22 | 28 | 12 | 81 | 69 |
| Nutmeg Mannikin | 57 | 27 | 114 | 27 | - |
| Red-billed Leiothrix | 42 | 50 | 83 | 163 | 138 |
| Red-crested Cardinal | 228 | 250 | 198 | 373 | 368 |
| Red-vented Bulbul | 289 | 278 | 214 | 350 | 550 |
| Red-whiskered Bulbul | 37 | 24 | 13 | 115 | 106 |
| Rock Dove/Pigeon | 630 | 605 | 215 | 370 | 289 |
| Saffron Finch | 7 | 11 | 7 | 31 | 91 |
| Spotted Dove | 269 | 242 | 164 | 315 | 570 |
| White-rumped Shama | 20 | 55 | 31 | 76 | 96 |
| Yellow-fronted Canary | 190 | 97 | 142 | 121 | 146 |
| Zebra Dove | 1,826 | 2,317 | 1,860 | 1,649 | 1,232 |

Continued on next page.

Table 5.60-- HAWAII AUDUBON SOCIETY BIRD COUNTS OF SELECTED SPECIES IN THE HONOLULU AREA: 2016 TO 2020 -- Con.

| Species | 2016 | 2017 | 2018 | 2019 | 2020 |
|-----------------------|------|------|------|------|------|
| Visitor species 6/ | | | | | |
| Mallard | 104 | 10 | - | 2 | - |
| Pacific Golden-Plover | 313 | 342 | 339 | 485 | 283 |
| Ruddy Turnstone | 186 | 239 | 424 | 285 | 21 |
| Sanderling | 1 | 9 | 13 | 14 | 2 |
| Wandering Tattler | 5 | 15 | 11 | 23 | - |

1/ Birds peculiar to Hawaii, and found nowhere else.

2/ Endangered species.

3/ Native to Hawaii, but also found elsewhere.

4/ In 2020, the Red-footed Booby was still found in Hawaii, but not in the Honolulu area.

5/ Formerly termed "introduced." Includes accidental escapes from captivity.

6/ Formerly termed "migratory." Includes stragglers and seasonal migrants.

Source: Audubon's Christmas Bird Count <<http://netapp.audubon.org/CBCObservation/>> accessed June 2, 2021.

Table 5.61-- HAWAII AUDUBON SOCIETY BIRD COUNTS IN THE HONOLULU AREA, BY TYPE OF SPECIES: 2008 TO 2020

[Counts are made in late December of various locations between Hawaii Kai and Aiea, and between Waimanalo and Kaneohe. Annual changes reflect differences in numbers of bird counters and counting time in the field, as well as changes in bird populations. Totals by species are also affected by the types of habitats studied]

| Year | Type of species | | | | |
|------|-----------------|---------|------------|-------|---------|
| | All species | Endemic | Indigenous | Alien | Visitor |
| 2008 | 40 | 3 | 5 | 22 | 10 |
| 2009 | 51 | 5 | 11 | 28 | 7 |
| 2010 | 46 | 4 | 8 | 27 | 7 |
| 2011 | 60 | 5 | 9 | 33 | 13 |
| 2012 | 54 | 5 | 7 | 28 | 14 |
| 2013 | 50 | 5 | 9 | 27 | 9 |
| 2014 | 56 | 5 | 12 | 28 | 11 |
| 2015 | 51 | 5 | 8 | 27 | 11 |
| 2016 | 48 | 4 | 9 | 28 | 7 |
| 2017 | 50 | 5 | 7 | 30 | 8 |
| 2018 | 46 | 5 | 8 | 26 | 7 |
| 2019 | 1/ 55 | 7 | 5 | 36 | 7 |
| 2020 | 45 | 7 | 3 | 30 | 5 |

| Year | Number of individuals | | | | |
|------|-----------------------|---------|------------|-------|---------|
| | All species | Endemic | Indigenous | Alien | Visitor |
| 2008 | 4,110 | 193 | 553 | 2,587 | 777 |
| 2009 | 6,963 | 149 | 656 | 5,102 | 1,056 |
| 2010 | 5,475 | 304 | 808 | 3,574 | 789 |
| 2011 | 11,807 | 512 | 1,242 | 8,985 | 1,068 |
| 2012 | 9,600 | 403 | 837 | 7,458 | 902 |
| 2013 | 7,847 | 353 | 1,138 | 5,113 | 1,243 |
| 2014 | 8,528 | 271 | 1,733 | 5,977 | 547 |
| 2015 | 7,314 | 302 | 1,860 | 4,640 | 512 |
| 2016 | 10,406 | 240 | 2,381 | 7,260 | 525 |
| 2017 | 10,583 | 374 | 2,161 | 7,430 | 618 |
| 2018 | 9,037 | 437 | 1,150 | 6,640 | 810 |
| 2019 | 10,851 | 877 | 1,049 | 8,060 | 865 |
| 2020 | 8,568 | 368 | 108 | 7,780 | 312 |

Continued on next page.

Table 5.61-- HAWAII AUDUBON SOCIETY BIRD COUNTS IN THE HONOLULU AREA, BY TYPE OF SPECIES: 2008 TO 2020 -- Con.

1/ Reported total was 53, but after summing total number of species it was found to be 55 individual species.

Source: Audubon's Christmas Bird Count <<http://netapp.audubon.org/CBCObservation/>> accessed May 14, 2020; Robert L. Pyle, *Checklist of the Birds of Hawaii* <<http://www.hawaii.audubon.com/checklist/checklist2002.pdf>> accessed on June 22, 2010; Denis Lepage, *Avibase - Bird Checklists of the World* <<https://avibase.bsc-eoc.org/checklist.jsp?region=ushi&list=howardmoore>> accessed on June 2, 2021; and calculations by the Department of Business, Economic Development & Tourism.

Table 5.62-- BIRD SPECIES OF HAWAII

| Type of species | Number |
|---|--------|
| All species | 1/ 338 |
| Resident native: normally does not leave the islands | 34 |
| Alien, introduced: resident, does not leave the islands | 53 |
| Breeding in Hawaii: most individuals leave Hawaii when not breeding | 26 |
| Visitor: breeds elsewhere, occurs in Hawaii when not breeding | 194 |
| Extinct: extinct or almost certainly extinct | 33 |
| Endangered (or threatened): on the federal list of endangered species | 36 |

1/ Does not include double counts for cattle egret and eurasian skylark, which are classified as alien and visitor.

Source: Robert L. Pyle and Peter Pyle, *The Birds of the Hawaiian Islands: Occurrence, History, Distribution, and Status*, Version 2-1 January 2017, Bishop Museum, Hawaii Biological Survey
 <<http://hbs.bishopmuseum.org/birds/rlp-monograph/PrimaryChecklist.htm>> accessed on July 4, 2017 and
 U.S. Fish & Wildlife Service, Environmental Conservation Online System (ECOS)
 <<https://ecos.fws.gov/ecp/species-reports>> accessed May 14, 2020.

Table 5.63-- TREES ALONG STREETS OR IN PARKS UNDER THE JURISDICTION OF THE CITY AND COUNTY OF HONOLULU: 2015 TO 2020

[As of June 30]

| Location | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|-------------|-------------|-------------|-------------|-------------|-------------|
| Along City and County streets and highways 1/ | 143,967 | 145,184 | 145,900 | 146,830 | 147,417 | 148,237 |
| In City and County parks | 95,978 | 96,790 | 97,266 | 97,886 | 98,278 | 88,824 |

1/ Excludes Federal, State, and private thoroughfares.

Source: City and County of Honolulu, Department of Parks and Recreation, Urban Forestry, records.

Table 5.64-- THREATENED AND ENDANGERED SPECIES, FOR HAWAII AND THE UNITED STATES: 2021

[As of July 1, 2021]

| Group | Hawaii | United States |
|---------------------|---------------|----------------------|
| Animal species | 78 | 1,330 |
| Amphibians | - | 44 |
| Arachnids | 1 | 17 |
| Birds | 36 | 335 |
| Clams | - | 93 |
| Corals | - | 24 |
| Crustaceans | 3 | 28 |
| Fishes | - | 161 |
| Insects | 28 | 92 |
| Mammals | 1 | 365 |
| Reptiles | 4 | 118 |
| Snails | 5 | 53 |
| Plant species | 423 | 945 |
| Conifers and cycads | - | 6 |
| Ferns and allies | 23 | 38 |
| Flowering plants | 400 | 899 |
| Lichens | - | 2 |

Source: U.S. Fish & Wildlife Service, Environmental Conservation Online System (ECOS)
 <<https://ecos.fws.gov/ecp/species-reports>> accessed July 1, 2021.