



THE American Surveyor

A FOOT IN THE PAST... AN EYE TO THE FUTURE

Jan/Feb 2006

Surveying Hawaii

E-Docs Asset GIS

Iowa GIS benefits surveyors

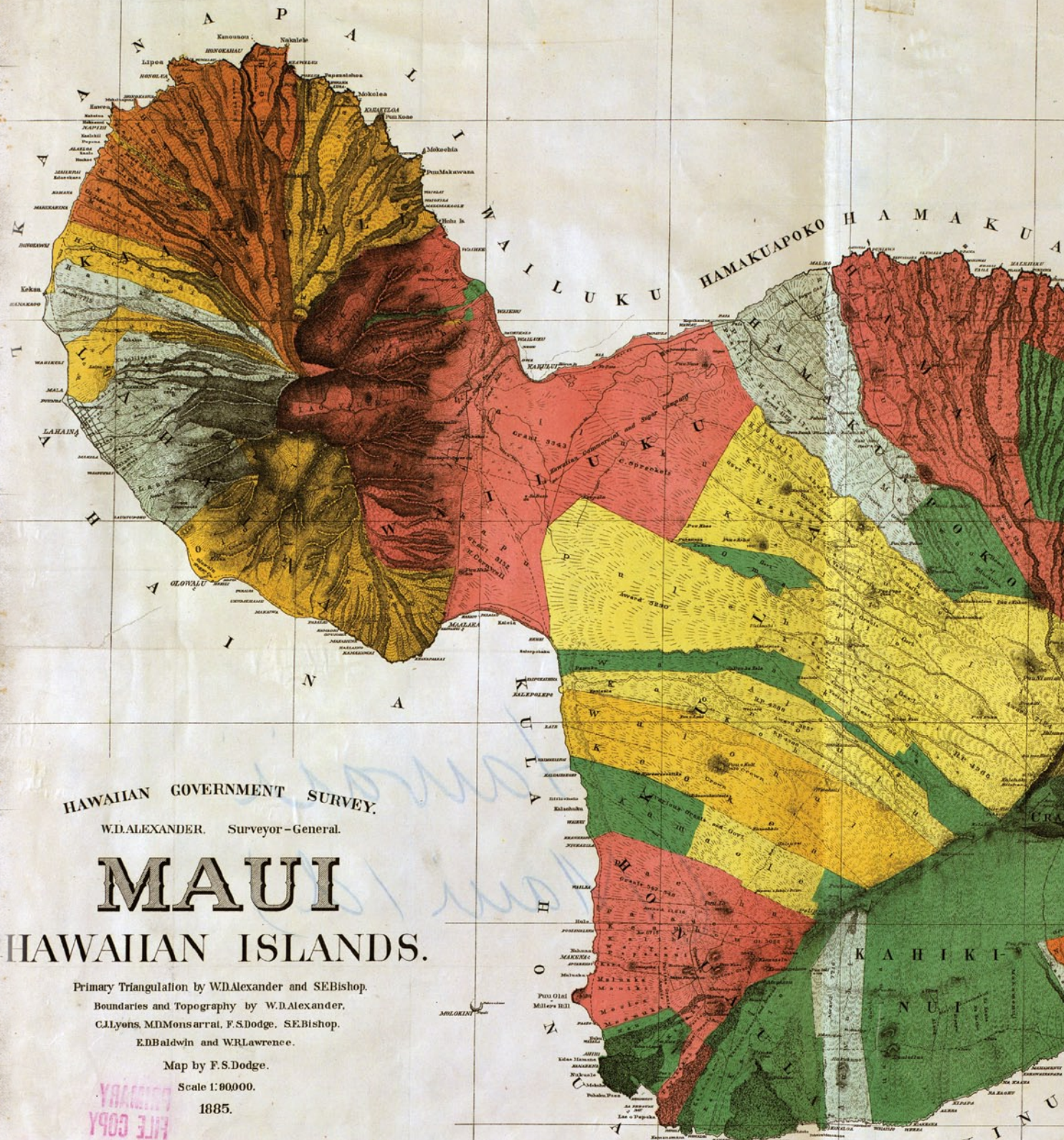
Fencing with Words

When is a fence a fence?

USGS Scans New Orleans

Rapid response aids levee rebuilding

\$4.95



HAWAIIAN GOVERNMENT SURVEY.

W.D.ALEXANDER. Surveyor-General.

MAUI

HAWAIIAN ISLANDS.

Primary Triangulation by W.D.Alexander and SEBishop.

Boundaries and Topography by W.D.Alexander.

C.J.Lyons, M.D.Monsarrat, F.S.Dodge, SEBishop.

EDBaldwin and WRLawrence.

Map by F.S.Dodge.

Scale 1:90000.

1885.

FILE COPY

The lands comprising the public domain are now classed as public lands. Formerly, they were of two classes, (1) the Crown lands, being those reserved by Kamehameha III for his private use in the great division of 1819, and which have been transferred by descent, conveyance and legislation to be a part of the public domain, and (2) Government lands, the revenues from which were to be used for the maintenance of the government. The Crown lands are colored yellow and the Government lands are green. The boundaries are the same as were designated in the division of 1819. In general these lands have Land Commission Awards, Grants, etc., throughout the choice sections owned by private parties.

A series that focuses on unique
wrinkles in our survey heritage.

Notes.
Δ - Triangulation Station.
Gt-Grant or Sale of Govt Land.
Aw-Land Commission Award.
Figures in Red give Elevations
above Mean Tide.
For fuller information regarding
Land Titles etc. see District
Maps in Office of Govt Survey.



Surveying in the Former Kingdom of **HAWAII**

A Brief History

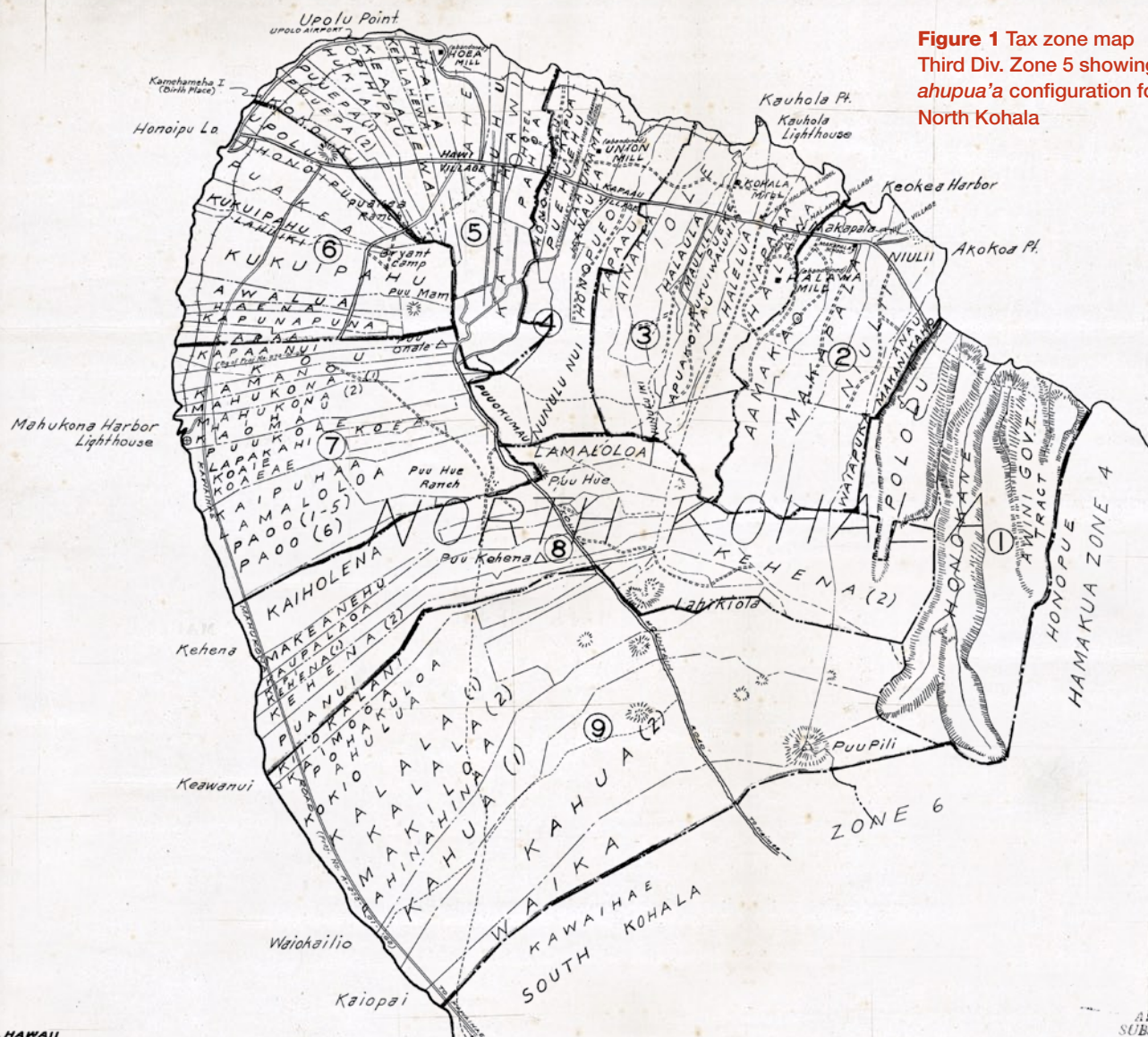
What is now the 50th State was once the Kingdom of Hawaii. Archaeological studies reveal that the Hawaiian islands have been inhabited since about 400 A.D., having been populated by migrating Polynesians from the western Pacific Ocean. After centuries of isolation, history attributes discovery of these islands to the famous British explorer Captain James Cook who arrived in Hawaii in 1778.

Along with a sophisticated social structure, there was a system of land tenure and resource management in place at the time of Cook's arrival. *Alii'aimoku* or kings were the highest ranking individuals controlling the islands. Their territorial control was dependent on military success and could include portions of islands or entire islands. It was not until the end of the 18th century that the entire Kingdom was united under a single individual sovereign, King Kamehameha I, often referred to as Kamehameha the Great. His legacy was passed down to six more kings and a queen before the ancient system was overthrown and a western styled Republic of Hawaii was formed in 1893. By an Act of the United States Congress on August 12, 1898, Hawaii was annexed to the United States of America and became the Territory of Hawaii. It was in 1959 that Hawaii's citizens chose statehood and Hawaii was welcomed into the Union as the 50th State.

Maui, Hawaiian Islands. Primary triangulation by W.D. Alexander and S.E. Bishop; topography and boundaries by W.D. Alexander, C.J. Lyons, M.D. Monsarrat, et al; map by F.S. Dodge. Created and published by the Hawaiian Government Survey, 1885. Courtesy The Library of Congress

>> By Patrick M. Cummins, LS
and Mary M. Cummins, LS

Figure 1 Tax zone map
Third Div. Zone 5 showing
ahupua'a configuration for
North Kohala



Ancient Land Tenure

The ancient Hawaiians developed a complex system of managing their land and natural resources. The basic land entities were the *moku*, the *ahupua'a*, and the *ili kupono*. *Moku* translates into English as “to cut” and in Hawaiian land terms it means an island, cut off by the surrounding ocean. An *ahupua'a* is often described in various books as typically being a pie-shaped strip of land running from the top of a mountain range to the sea. It is a self-contained community with a forest area with its products, running streams, flat land for crop growing and the beach area for houses and for the sea’s bounty. In reality, however, few are pie shaped and many do not reach either the sea or the mountain tops. An *ili kupono* is similar in stature to the *ahupua'a*, but rather than being a contiguous strip of land, it

consists of sections of land unified under a single chief and containing among its scattered sections, called *lele*, all of the necessary resources that *ahupua'a* have. (Figure 1)

There were two main classes of people: the *alii*, or chiefs, and the *maka'ainana*, or commoners. The kings, generals and landlords were all of the *alii* class. All land was under the control of the *alii'aimoku* who was thought to be godlike and the holder of all land and its products in trust for all of the people. The king distributed the *ahupua'a* and *ili kupono* under his control to his loyal chiefs to manage and to provide, in return, tribute in the form of labor, food and other products of the land and sea. These lesser chiefs were known as *konohiki*, or landlords, and they parceled out portions of the *ahupua'a* to the *maka'ainana* who were the commoners

and tenants of the land. It was the *maka'ainana* who grew the crops, caught the fish, raised pigs, cut trees and built canoes, etc. In return for the use of plots of land, they, like the landlord above them, provided labor and tribute in the form of products of their work to the *konohiki*. In addition to managing the tenants use of the land, the *konohiki* also oversaw the use and distribution of water throughout the lands in their charge and designated certain fish to be reserved for the landlord or for the king. After a battle in which a king acquired additional territory, there was a redistribution of the lands among the king’s loyal generals.

Oral tradition tells us that the names and boundaries of all of the lands in Hawaii were established about 600 years ago. Each *ahupua'a* had an expert or *kahuna* whose responsibility was to

know and to preserve the boundaries of the *ahupuaa*. The boundary *kahuna* not only preserved knowledge of the *ahupua'a* boundaries, but passed this information on to a successor. In all, there are approximately 1,800 lands, 1,300 *ahupua'a* and 500 *ili kupono*. *Ahupua'a* and *Ili kupono* boundaries often follow natural monuments such as streams, and ridge lines or manmade monuments such as rock walls. Where there were no specific monuments to run along in ancient times, corners and angle points were marked with stone heaps called *ahu* in Hawaiian. These *ahu*, approximately three to five feet in both height and diameter, are still found in many parts of the islands. In later years, *ahu*, were placed atop chiseled “+”s cut in the smooth *pahoehoe* lava for ease of locating them in future surveys.

Transition to a Western Style of Land Tenure

Kamehameha I died in 1819 and his son, Lihiliho, became King Kamehameha II. Kamehameha II started a series of historical events which led up to the end of the ancient system of land tenure and the advent of a western system of fee simple ownership. The young king and his royal guardian, High Chiefess

Kaahumanu, decreed the end of the old religion and the *kapu* (taboo) system of restrictions on food and behavior that guided the chiefs and commoners in their daily lives. Old temples and stone idols were destroyed.

This event was followed by the arrival of missionaries from America in April of 1820. A shipload of Calvinists sent by the American Board of Commissioners for Foreign Missions arrived from New England and quickly set about to convert the native population, including many of the highest ranking chiefs and chiefesses. The missionaries were asked by the *alii* to start a school for the chiefs' children so that they might be taught about the world outside of Hawaii and to teach them to learn the basic skills of reading, writing and arithmetic. Up until the arrival of the missionaries, the Hawaiian culture had no written language. All historical information was handed down from generation to generation by word of mouth. At the Chief's Children's School in Honolulu and at Lahainaluna Seminary, another missionary school at Lahaina, Maui, native children were taught basic knowledge and skills including geography and map making.

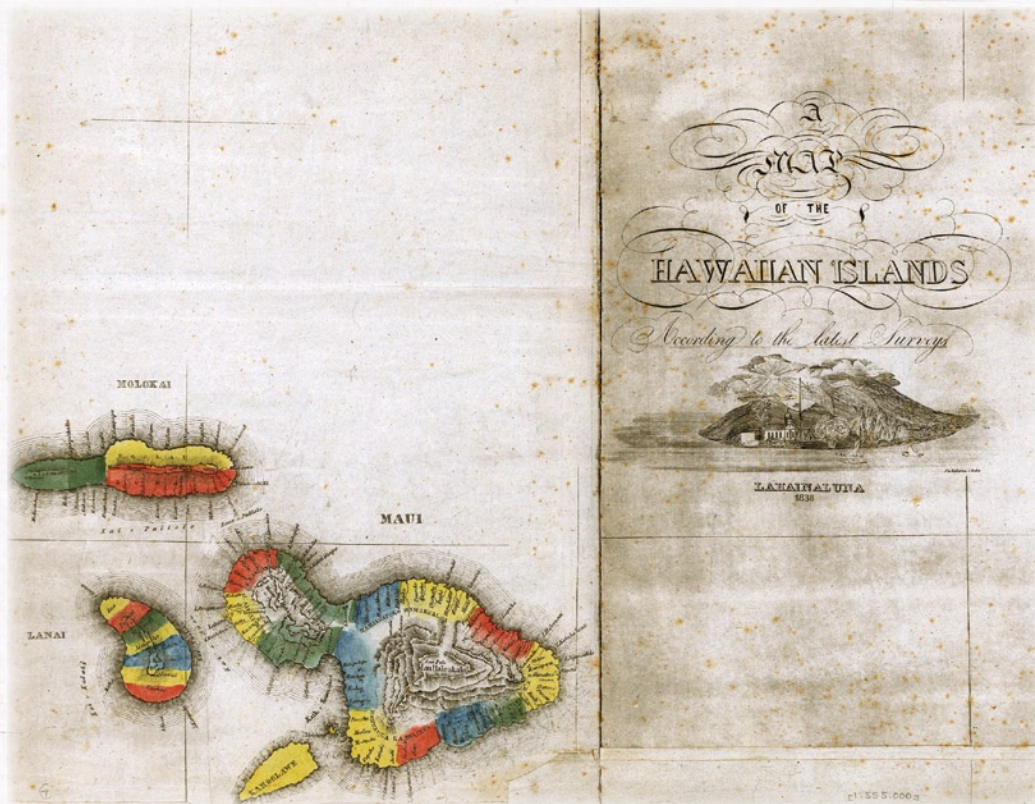
In 1839, King Kamehameha III declared a Bill of Rights which stated

that nothing could be taken from any individual, including land, except by express provision of the law. In 1840, the King presented the first Constitution creating a Monarchical form of government with a bicameral legislature consisting of a house of Nobles appointed by the King and a House of Representatives elected by the people. In December of 1845, a law was passed entitled “An Act to Reorganize the Executive Branch of Government.” This act created a Board of Commissioners to Quiet Land Titles (Land Commission) whose purpose was to receive and adjudicate claims for land. Successful claims were given Land Commission Awards of fee simple title. By the demise of the Land Commission on March 31, 1855, it had dealt with more than 13,000 claims.

First Surveys

One of the requirements for obtaining a Land Commission Award was a survey of the claimed parcel. Since the *konohiki* awards were for *ahupua'a* and *ili kupono*, the survey requirement presented a problem right at the beginning of the process. *Ahupua'a* varied in size from 184,000 acres in the case of the land of Kahuku on the island of Hawaii to 4 acres for the *ahupua'a* of Uhao in Lahaina on

Figure 2 Portion of 8 panel 1838 map by S.P. Kalama showing *ahupua'a*. Source: Library of Congress



Maui. On Oahu, the largest *ahupua'a* is Honouliuli with approximately 43,000 acres and the smallest is Kapano with 40 acres. With approximately 1,800 of these *konohiki* lands to survey and several thousand tenant claims, the Land Commission was in a dilemma since there were few qualified individuals available to perform the surveys. In 1852, the legislature passed an act to allow the Land Commission to issue Land Commission Awards to *konohiki* land claims by their land names and ancient boundaries without surveys.

The claims of the *maka'ainana* known as *kuleana* claims consisted of several parts. The average tenant claim had three parts: a house lot limited to 1/4 acre by law, and two other patches limited to what was actually being improved or cultivated. While three parts is the average, some claims had as many as 14 pieces. These were usually a *kalo* (the staple food of the Hawaiians) patch and a patch for dry land crops such as sugar

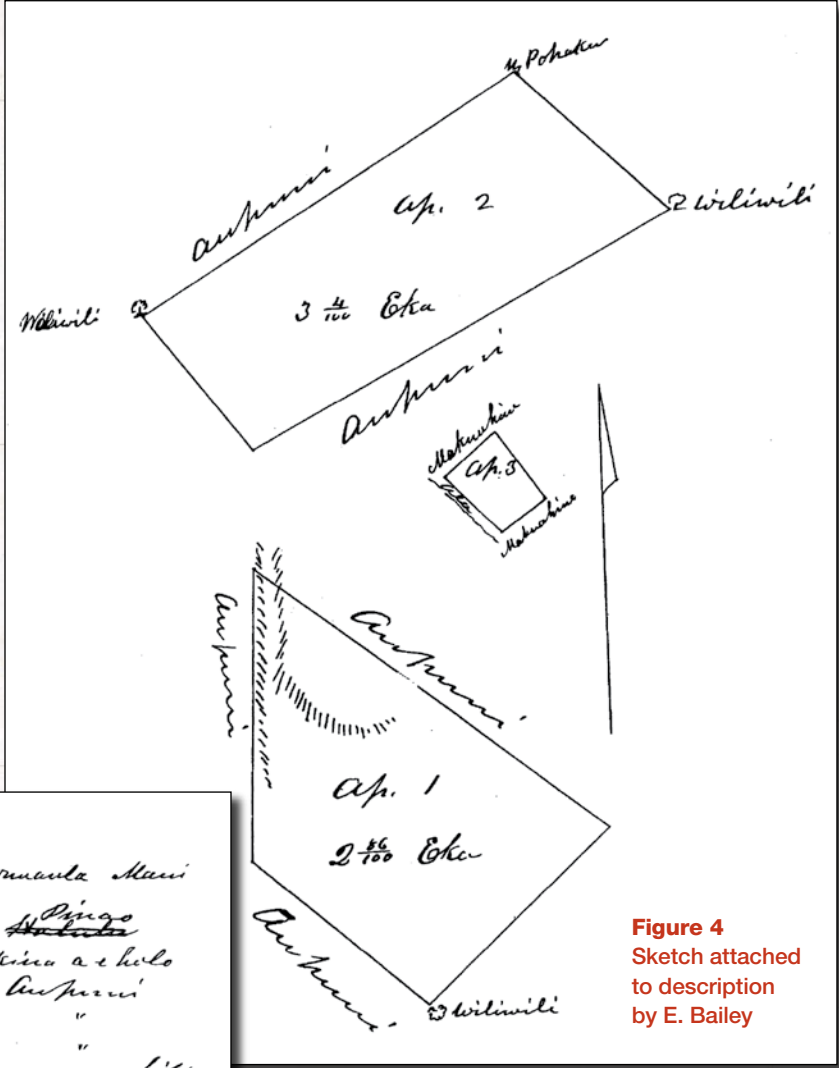


Figure 4 Sketch attached to description by E. Bailey

5472 & 9942 Luaha
Kauakou, Koumaka Maui

Apuna 1 Kula ma ka ili o ~~Halulu~~ ^{Piigo}
 E hoouaka ma ke kiki Okaia a e holo
 Ak. 46 1/2 No. 3.87 Ak. ma ke Aupuni
 Ak. 58 No. 8.40 " " "
 Ak. 37 No. 3.30 " " "
 Ak. 61 1/2 No. 9.05 " " a kiki
 ma ke kiki mua = 3 4/100 Eka

Apuna 2 Kula ma ka ili o Halulu
 E hoouaka ma ke kiki Okaia a e holo
 Ak. 2 No. 5.67 Ak. ma ke Aupuni
 Ak. 48 1/2 No. 4.27 " " "
 Ak. 46 1/2 No. 4.80 " " "
 Ak. 57 1/2 No. 9.30 " " "
 a kiki ma ke kiki mua = 2 4/100 Eka

E. Bailey
 Mahele Mei 8, 1854 (Mahele Aiea)

Apuna 3 Pahale ma ka ili o Paia
 E hoouaka ma ke kiki Okaia a e holo
 Ak. 35 No. 1.57 Ak. ma ke Aupuni
 Ak. 52 1/2 No. 1.04 " Makua
 Ak. 48 1/2 No. 1.57 " Lela
 Ak. 50 No. 2.28 " Makua
 a kiki ma ke kiki mua = 1/100 Eka

306
 14
 216
 6.88

NOTES OF SURVEY (LCA 5472 & 9942 TO LUAHA)

cane, sweet potatoes or melons or for pasturing animals. With around 10,000 of these claims, there were at least 30,000 individual surveys to be made.

Most field surveys were made with compass and chain, independent of any network of survey controls or comprehensive maps of the kingdom. These were the first boundary surveys to be made in Hawaii. Up until this time, the only maps were those made primarily by the ships of discovery for the purpose of charting safe harbors and for general topography. In 1838, S.P. Kalama, a native Hawaiian trained at the missionary school at Lahainaluna made a map in eight panels showing the Hawaiian Islands (Figure 2). It is quite amazing in its scale and orientation given

Figure 3 Original metes & bounds description prepared by Land Commission surveyor E. Bailey.



W.D. Alexander,
Surveyor General,
at Lake Waiau
base camp near
the summit of
Maunakea, Hawaii,
elevation 13,020
feet (circa 1882).
Source: Hawaiian
Historical Society

the sparse survey information available at the time. It is also the first map to show the names of *ahupua'a* in their respective locations.

Because these original surveys were independent of each other, no coordinated effort was made to relate one to another, no standard for performing surveys was made by the Land Commission and very few corners were marked, retracing these surveys remains a challenge to surveyors today. It was soon discovered that some of the compasses used had been out of adjustment. Also, declinations had to be determined in each locale due to the varying influences of the metal contents of the lava which affected the compass readings. Additional challenges included problems arising from the inexperience of many of the ship captains and untrained volunteers performing the ground surveys.

A simple explanation of the process involved in the original surveys and awards for all of the *kuleana* lands of Hawaii is as follows: 1) written claim letters were sent to the Land Commission by February 14, 1848 with a general description of the claim and the location; 2) testimony was taken from witnesses to support claim; 3) copies of claim letter

and testimony were sent to surveyors in the field; 4) surveyors met on the ground with the claimant, witnesses and representatives of the *konohiki* of the *ahupua'a* in which the *kuleana* lay and when an agreement was reached, the survey was made; 5) the surveyor prepared "Original Notes of Survey" consisting of a metes and bounds description and a sketch to scale; 6) Land Commission made final determination and issued a Certificate of Award; 7) Claimant was provided with the Award upon payment of costs including the survey, copies, notices and processing fees.

Konohiki claims did not require testimony, or surveys if by name only. The only proof needed of their claim was their name in the Mahele Book which will be discussed below under ORIGINAL LAND TITLES. In addition, *konohiki* were required to pay a commutation to the government for their *ahupua'a* and *ili kupono* to extinguished any remaining government interest in the lands. This allowed *konohiki* awardees to obtain Royal Patents from the Minister of Interior for their awarded claims. With the exception of awards for houselots and other lands in the districts of Honolulu, Lahaina and Hilo, *kuleana* awardees were exempt by law

from paying this commutation and were issued Royal Patents by simply applying for them.

Surveyors of the Land Commission came from all walks of life and included American ship captains, natives trained by the missionaries and European residents. One such individual was Rudolph Wilhelm Meyer, an engineer educated in Germany that stayed in Hawaii on his way to the California gold rush.

The "Original Notes of Survey" prepared by the Land Commission Surveyors was based on a format originating in the New England states. It consisted of a title, usually the Claim Number, the land name, district and island, a piece number for claims with multiple parts, a descriptive call as to the type of parcel, such as house lot or taro patch, a point of beginning and courses listed by compass bearing, distance in chains, links or decimal of chains, and a call for adjoining claimant or monument or both, closing statement and area. The sketches accompanying the description are typical of this era. This description format survives to the present (Figures 3 & 4). Award and Grant documents were in the Hawaiian language if the recipient was a native and in English if it was a foreigner.

PALAPALA HOOKO.

Ua ae aku i keia la ka poe hoona kumu kuleana
 aia ia Luahea 3 Apuna ana
 nona ke kuleana Helu 5472 & 9942. Kauhuna Annua
 he kuleana kona ma KE ANO ALODIO.

O keia pa'apala ke homaopopo i kona kuleana ma
 ke Ano Aلودio i ka aina ana i hoopi mai ai, i hoaka-
 kaia ma ka palapala ana aia a C. Bailey
 ma kona mau pa-
 tena, ke hooakaia na mea lilo no na dala he \$ 6.00
Con

A i ole e hooakaia ua mau dala la, aole e lilo
 keia palapala i kuleana maopopo nona.

HALE HOONA,

Nov 27 1854.

J. I. Nailiili
 Kakaulelo.

Loaa mai ia'u ua dala e like ma ka olelo malua.

Keena Hoona.

Washington Aug. 2. 1854 C. Bailey

CERTIFICATE OF AWARD (LCA 5472 & 9942 TO LUAHA)

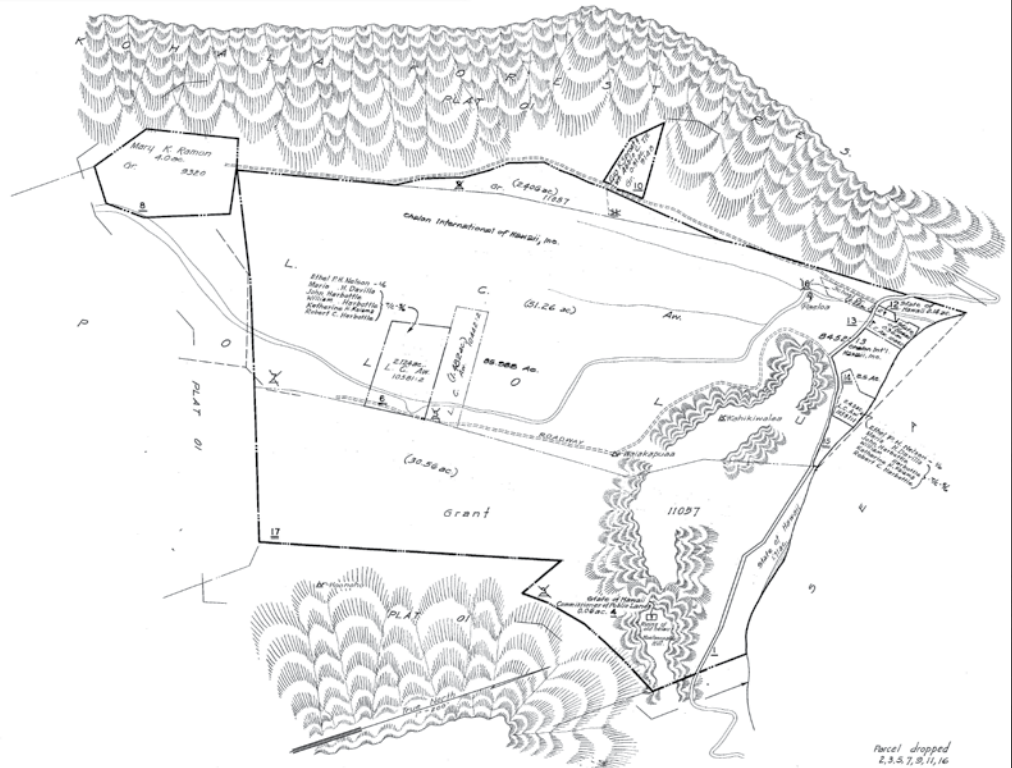
When the original Notes of Survey were received by the Land Commission, they were copied into large volumes or copy books. Those that had been prepared in English were translated into Hawaiian by clerks in the Land Office, depending on the nationality of the awardee or grantee as explained above.

Original Land Titles

Before the Land Commission could begin adjudicating land claims, it had to determine who had an interest in the land. It determined that the King should retain all of his private lands as his own personal property. One third of the remaining lands should be set aside as the property of the Hawaiian Government, one third to the chiefs and *konoiki* and the remaining third to the tenants. The first step taken to separate these interests was called the Great

Figure 5 Original Land Commission Certificate of Award document

Figure 6 Tax parcel map Third Div. 5-1-02 showing Land Commission Awards and Government Grants based on Hawaiian Government Survey data



Parcel dropped
2, 3, 5, 7, 9, 11, 16

ADVANCE SHEET
SUBJECT TO CHANGE

THIRD	DIVISION
ZONE	SEC. PLAT.
5	1 02
CONTAINING 15 PARCELS	
SCALE 1 in = 200 ft.	

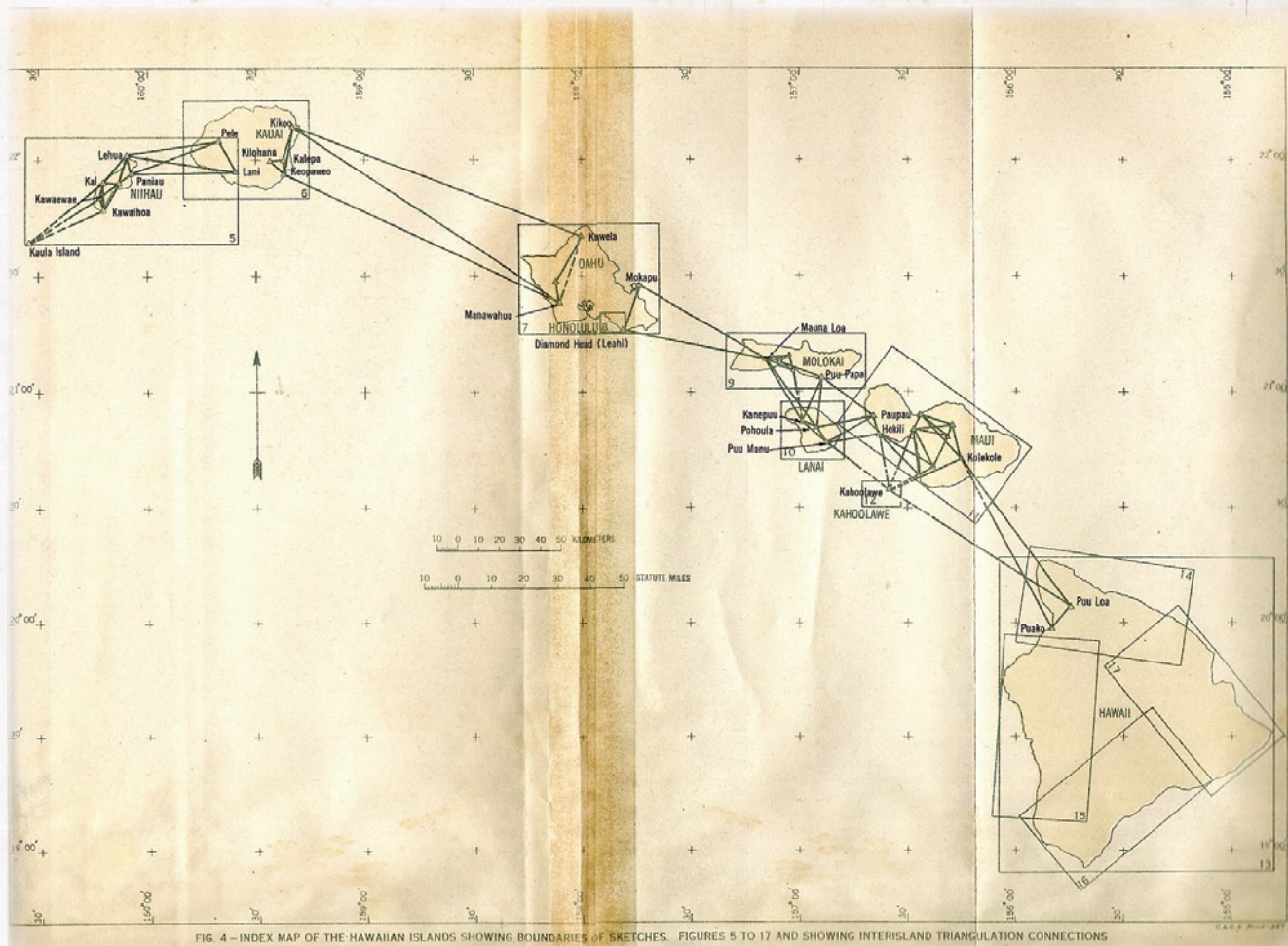


FIG. 4 - INDEX MAP OF THE HAWAIIAN ISLANDS SHOWING BOUNDARIES OF SKETCHES. FIGURES 5 TO 17 AND SHOWING INTERISLAND TRIANGULATION CONNECTIONS

Figure 7 USC&GS triangulation network from U.S. Publication No. 156 dated 1930

Mahele or Division. In early 1848, the King sat down with his chiefs, approximately 240 of them, and redistributed all of the lands of Hawaii. It was the aforementioned S.P. Kalama that assisted the King in the *Mahele*. Each chief came to the table with the lands he or she possessed. The King and chief agreed upon a redistribution, the King taking certain lands from the chiefs list with the remaining lands being left to the chief. These agreed upon redistributions took the form of quit claim deeds and were written into a ledger known as the "*Mahele Book*."

Once this process was completed, the King took the lands he had just obtained from his chiefs and after keeping his personal lands for himself, his heirs and assigns, he gave the vast majority of them to his people in the form of government lands. This act of the King became known as the "Second *Mahele*." The Land Commission could now begin the process of determining claims

for *konohiki* lands. Both of these acts of division by the King were ratified by an act of the legislature on June 7, 1848.

A law passed just four weeks before the Kuleana Act, made it legal for foreign-born residents to own land. The Kuleana Act of 1850 authorized the Land Commission to issue awards for *kuleana* claims and as a result of the "Second *Mahele*," the government now had a list of lands to sell to those that did not otherwise have land and to generate income for the treasury to operate the government. All title to the lands of Hawaii originate with one of the following sources: 1) King Kamehameha Deeds for properties that were sold from the King's personal lands; 2) Land Commission Awards (**Figure 5**); and 3) Government Grants. The government land sales were by Royal Patent Grants. After the overthrow of the monarchy and up to the present, these government conveyances are made by Land Patent Grants.

The Hawaiian Gov't Survey

By 1870, not having any maps of the kingdom and not having any idea where the *kuleana*, *ahupua'a*, and government land sales were located, there was no way for the government to know how much government land remained, if any. The Minister of the Interior petitioned the legislature to fund a survey to map and inventory all of the lands of the kingdom. Known as the Hawaiian Government Survey and using instruments and equipment borrowed from the United States Coast and Geodetic Survey, a comprehensive ground survey began in 1871. The Survey's mission was threefold: 1) to establish a survey control network across the entire island nation; 2) locate topographic features such as roads, shoreline, ridges, streams and evidence of occupation such as walls, fences, houses, and evidence of Land Commission Awards, government grants and *ahupua'a* boundaries; and 3) to plot all of this information on maps

Kauai Island

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance		
						Log (meters)	Meters	Feet
Kauai Island, highest point, 1926.....	21 39 28.83 160 32 38.34	886.1 1,131.1	228 34 32 231 26 48 243 08 35	48 44 25 51 31 20 68 16 06	Lehua..... Kali..... Iloa.....	4.783546 4.686916 4.572288	61,030 48,017 37,695	200,229 154,311 123,671

Oahu Island

Principal points	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance		
						Log (meters)	Meters	Feet
Diamond Head (Leahi), 1872-1927.....	21 16 46.334 157 48 52.184	1,428.0 1,504.5			Diamond Head.....	3.907650	5,082.2	26,516.4
Tantalus (Puu Ohia), 1873-1927.....	21 20 06.929 157 49 03.233	274.6 93.2	357 44 28.5	177 44 32.5	Diamond Head.....	3.907650	5,082.2	26,516.4
Halawa Barrel, 1927.....	21 23 32.967 157 53 29.182	1,013.9 840.6	309 18 11.5 330 54 07.3	129 19 48.4 150 55 48.1	Tantalus..... Diamond Head.....	3.908801 4.216417	9,903.8 16,421.7	32,492.7 53,876.9
Kapuai New, 1927.....	21 22 46.559 158 04 30.621	1,431.9 879.2	205 40 65.2	85 44 58.4	Halawa Barrel.....	4.281125	19,104.0	62,677.0
Waipio Uka, 1873-1927.....	21 27 04.336 158 00 44.078	1,324.4 1,280.2	287 24 29.9 39 27 10.8	117 27 08.8 219 25 48.1	Halawa Barrel..... Kapuai New.....	4.140663 4.011385	14,111.2 10,263.6	46,296.5 33,670.7
Mauna Una, 1874-1927.....	21 28 08.522 158 04 50.678	2,621.2 1,441.7	285 33 41.6 336 44 38.7	105 35 11.7 176 44 45.9	Waipio Uka..... Kapuai New.....	3.866441 3.998421	7,352.6 9,917.0	24,122.7 32,589.0
Station Z, 1927.....	21 31 10.704 157 59 05.194	331.0 147.8	20 36 08.3 60 34 84.3	200 35 32.1 340 32 17.9	Waipio Uka..... Kapuai New..... Mauna Una.....	3.968296 4.238095 4.056975	8,096.5 18,117.4 11,401.8	26,563.3 59,440.3 37,407.4
Schofield west base, 1927.....	21 29 20.774 158 04 11.815	638.9 340.1	805 02 38.3 25 22 03.1	125 03 54.4 206 21 49.0	Waipio Uka..... Mauna Una.....	3.863675 3.394474	7,305.9 2,480.1	23,959.4 8,136.8
Schofield east base, 1927.....	21 29 01.676 158 01 42.350	33.1 1,219.1	334 57 06.7 73 21 31.8 98 01 21.8	154 57 28.1 253 20 23.0 278 00 27.1	Waipio Uka..... Mauna Una..... Schofield west base.....	3.528021 3.751949 3.687991	3,953.0 5,640.8 4,346.014	13,001.9 18,506.5 14,255.27

Mali, 1874-1927.....	21 31 20.447 158 05 43.701	903.6 1,317.0	372 49 57.1 313 18 45.0 346 27 21.1	02 52 24.1 133 12 31.6 165 27 41.5	Station Z..... Waipio Uka..... Mauna Una.....	4.062361 4.070985 3.896699	11,644.1 11,623.0 6,983.9	37,874.8 39,031.3 25,944.5
Halemano, 1927.....	21 32 31.685 158 02 32.763	574.5 942.8	292 36 07.1 20 02 02.6 70 59 37.0	112 57 28.3 205 01 12.2 230 58 23.1	Station Z..... Mauna Una..... Mali.....	3.811083 3.811083 3.708974	5,472.7 9,007.0 5,874.5	21,235.8 23,550.5 19,373.3
Puu Iki, 1927.....	21 32 30.317 158 07 31.809	922.4 913.3	209 42 16.5 301 31 15.7	89 44 06.4 121 31 54.7	Halemano..... Mali.....	3.934760 3.538968	8,605.3 3,380.2	28,232.6 11,746.0
O'Reilly, 1927.....	21 33 36.649 158 04 15.829	1,127.1 455.4	303 57 49.5 33 29 20.5 70 07 17.0	123 58 27.4 213 28 47.6 230 05 08.0	Halemano..... Mali..... Puu Iki.....	3.553378 3.871227 3.777917	3,575.8 4,680.6 5,996.8	11,721.6 15,389.1 19,674.5
Waialua 2, 1927.....	21 35 31.891 158 07 17.365	980.8 492.5	394 09 13.9 4 15 28.1	124 10 20.7 184 15 20.8	O'Reilly..... Puu Iki.....	3.800142 3.745173	5,311.6 5,599.8	20,707.3 18,372.0
Dillingham, 1927.....	21 35 02.616 158 10 30.670	80.5 873.4	260 47 18.3 233 45 36.2 308 38 46.3 312 15 56.1	80 48 29.3 103 47 54.9 128 40 30.9 132 20 01.7	Waialua 2..... O'Reilly..... Mali..... Puu Iki.....	3.750394 4.043347 4.020667 3.812380	5,630.3 11,000.6 40,494.6 6,065.5	18,472.1 35,419.2 84,631.0 22,823.1
Pupukoa, 1875-1927.....	21 39 30.887 158 02 54.269	1,134.5 1,060.9	78 13 23.4 57 17 27.8	198 12 20.3 237 14 30.7	Mali..... Dillingham.....	4.196168 4.193134	15,782.2 15,600.3	51,778.8 51,182.0
Lak, 1927.....	21 40 00.482 158 03 13.022	14.8 353.7	31 18 02.1 62 43 03.1	211 16 69.9 342 39 17.9	Mali..... Dillingham.....	4.294805 4.294805	18,391.0 18,391.0	60,337.8 60,337.8

Figure 8 Station data listing from U.S. Publication No. 156

using the abundance of information at their disposal. (Figure 6)

This great effort continued until 1900. When the United States government sent the United States Coast and Geodetic Survey (USC&GS) to its newest Territory, it found that the control network of the Hawaiian Government Survey was well established and of excellent quality. The USC&GS re-monumented most of the existing stations and re-measured the network. The new values were published in U.S. Government Publication No.156 (Figures 7&8). Measuring between islands was a monumental task for both the Hawaiian Government Survey and the USC&GS. As a result of the Hawaiian Government Survey and the USC&GS surveys, boundaries in Hawaii are usually referenced with geodetic coordinates referred to a local trig station. Although the original Land Commission Surveys used bearings, a system of true azimuths measured

clockwise from South was developed during the execution of the Hawaiian Government Survey and the work completed by the USC&GS and is the system used exclusively in Hawaii. This azimuth system is legislated by Hawaii Revised Statutes Chapter 502 pertaining to the filing of surveys of regular system lands and Rule 101 of the Rules of the Land Court when filing surveys of lands registered in the Land Court.

Conclusion

Modern surveys in Hawaii are conducted technically in the same way as in any other of the states. While district and county lines change configurations from time to time, their boundaries are along ancient ahupua'a boundaries. Many of the original ahupua'a were not surveyed and many kuleana remain unsurveyed since the 1850s and will require an understanding of the Hawaiian land tenure system and the methods used during the Land Commission and the

Hawaiian Government Survey to retrace. In addition, while Hawaiian law is United States Common Law, it is subject to Hawaiian custom and usage. A recent Second Circuit Court Decision states "... the common law doctrine of accretion is subject to and overruled by Hawaiian usage and law." Licensed Professional Land Surveyors are not required to speak the Hawaiian language, however, a minimum knowledge of the ancient land tenure system, the ancient customs and traditions pertaining to land, and the ability to work with a Hawaiian dictionary to understand the basic measurements and calls in a Land Commission Award description are necessary to practice land surveying in the 50th state. A

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