Puu Ka Pele
The most prominent hill in the valley below ***Ahumoa***, it's top being very visible from the station in the direction of the S.W. base of Mauna Loa. The marks are as follows, viz: they are all above ground. The signal being set into a hole drilled in rock "in situ," said hole being in the centre of a raised triangle… A very small "*ahu*" erected.

Napuukulua
A small hill in the same valley, as ***Puu Ka Pele*** and about one mile and a half to the S.E. of it. The point marks are above ground and resemble those at ***Puu Ka Pele***. [254:119]

Keamuku
Is on a small eminence to the N.W. of the Keamuku *āā* flow and said to be on the boundary line between the districts of Kona and Kohala. The underground point marks consist of a section of copper bolt driven into a large rock "in situ," and projecting about an inch. It is surrounded by numerous tin cans and a few bottles. [254:121]

September 23, 1885
J.S. Emerson, to W.D. Alexander
(Regarding Surveys of the Lands Around Mauna Loa and Mauna Kea; location of "Naohuleelua" and the old Trail to Mauna Kea and Neighboring lands from Kona):
…Monday I spent in hunting up a couple of suitable men to go with me into the mountains, in which I finally succeeded… We expect to go thence to Mr. Greenwell's ranch at Kanahaha, from which place as a base of supplies etc. to set signals to command the following points, viz.

Jack's Goat pen at head of Lehuula
Ana o Kiha at head of Lehuula
Kikiaeae at head of Hokukano
Aahuwela cave at head of Hokukano
Ahu on Umi Road, head of Kealakekua
Kanekii water hole, head of Kealakekua
Wahapele crater, head of Kahauloa 2.

To do this will occupy some little time, as the great difficulty is to find some of the points. They all say that the only *kamaaina*, who really was posted, was Keakaikawai (Jack i ka wai) and he is dead!

I spent last Thursday night with your bro. James at Kealapuali (Charles Wall's old place). Though he has, like myself been somewhat ill he is pushing the work at the head of Kaumalumalu and was to ascend Hualalai last Monday…with a humbug of a guide, we started Aug 26 up the ***Judd road*** & camped successfully at ***Kealapuali, Ahu o Umi & Halelaau***, where we established a base of supplies. Sat Aug 29 our old guide led us a day's journey over the *pahoehoe* rock in search of ***Naohuleelua***, which I am satisfied he knows very little about… Aug 31 we started for the summit of M. Loa and after many trials with a foolish guide, who got lost in the woods…we reached a point near the summit Thursday evening, Sept 3.

Friday Sept 4…with one brave native, your bro. & I pushed boldly into the fog…to the very summit… We set a huge signal a great distance down the mountain to command the southern part of Keauhou… Another equally fine signal we set on the summit ridge of the crater commanding (1) a large portion of the interior & base of the crater, (2) the opposite side of the crater, (3) ***M. Kea***, (4) ***Ahu Moa***, (5) ***Puu ka Pele***, (6) Puu Waawaa, (7) W. Hualalai, (8) Puu Laalaau, (9) Keahuolu. Thus the problem of locating the crater will be solved…

On Wed. Sept. 9 with a boy I started for Puu Anahulu to find another guide to show us ***Naohuleelua***. We slept in a cave on the way, and on reaching Iakopa's the next day found that he was the man to go with us, but Mr. Spencer could not spare him until Tuesday Sept. 15. While waiting for him, I set signals at Ana o Maui & Puu Huluhulu & reset that at Puu Waawaa…

Sept. 15 we started with our guide & spent the night in a cave. The next day Iakopa showed us a large tomb like ahu on the old road from ***Waimea*** *to the* ***Ahu o Umi*** *which he says is the real* ***Naohuleelua Ahu****. It is at least a mile north of the flow of 1859 and still further from the point which our first guide showed us. In conclusion I do not think the man can be found to show me a point to answer Hitchcock's description of* ***Naohuleelua****…*

I am told by Iakopa that ***Kaohe*** *was surveyed by the "haole lolo," Wiltze. When at Puu Waawaa with Perryman I sighted Iakopa's flag for Naohuleelua. Mr. Lyons thought it was too near Puu Ka Pele. But if that is not the point, where is it?*

…There is much to be said about the wonderful crater, Mokuaweoweo, and the grand scenery from M. Loa, but I must close… [HSA – HGS DAGS 6 Box 2]

December 8, 1885
J.S. Emerson, to W.D. Alexander
(regarding survey of Naohuleelua, Keamuku and Ahumoa vicinity):
…I have to report that my effort to settle the location of the much talked of ***Naohuleelua Ahu****, of Keakaikawai & D.H. Hitchcock has been, as I believe, successfully accomplished. I have located an ahu 18 feet long, 7 feet wide & 4 feet high on the East side of the well known* ***Alanui Kui*** *leading across the ancient aa from the flow of 1859 to* ***Puu Ka Pele & Waimea****. The direction of the road, as far as visible is N. 20 E. magnetic. About 40 feet South of the ahu is the edge of the aa bank. At about 90 feet is another similar descent of say 7 or 8 feet.*

From that point the road going South crosses a "*kipuka*" or open land (ancient *pahoehoe*), covered with shrubbery & weeds for say 250 feet before reaching the barren, black *pahoehoe* flow of 1859. The ancient *aa* about this *ahu* is covered as far as visible with small trees, *ohia, aalii*, etc. Magnetic bearing to ***Puu Ka Pele*** 229º 15'. *At Waimea I saw the aged Kahakauwila, brother-in-law of John Parker, who assures me that the two bald headed men, for whom the ahu is named, met on this road, one coming from Waimea & one from Kona. There is no other road above this one on which they would have crossed the aa. This is the road and the only road and all agree that the point was somewhere on this road.* The point selected by Hitchcock was on the *aa* bank on the North side of the flow of 1859. These considerations lead to the adoption of the above *ahu* as the one which Mr. Hitchcock fixed upon & attempted to locate.

I think that the difference of bearing in our observations of ***Puu Ka Pele*** need not cause any anxiety.

Some local or personal attraction may have deflected his needle the trifling amount of 24º. I went to the point on the N. Bank of the flow of 1859 whence ***Puu Ka Pele*** bore in the direction indicated in his notes. I spent one day most carefully searching for an *ahu* somewhere near the edge of the flow, going a good distance above and a greater distance below the point indicated. I stimulated my men by the offer of a reward for finding it & am satisfied that no such *ahu* exists. After all the testimony which I have gathered on this subject, it seems that there is little chance of any other point being found to claim the title of ***Naohuleelua***. *I occupied* ***Puu Ka Pele*** *and* ***Ahu Moa*** *two days each and left large cloth covered ahus and puloulous at each place*. The air was full of dust and I failed to see Puu Ouo in spite of its huge signal, but did good work in other respects.

The terminus of the Judd Road among the other points is carefully located. No expedition which I have ever conducted has caused me such anxiety and has been attended with such loss as this. It was a frightful trip, the remembrance of which haunts me. The water holes were dry and the country parched with drought. At Waimea we encountered a cold storm of wind and rain. At ***Keamuku*** *the animals drank too freely of bad water. Used up with hunger, thirst, cold and improper drink, they fell by the way.* Though I did my best to save them, I lost my poor old horse at Waimea and left the old Waawaaikinaauao to die on the flow of 1859 along with a mule belonging to my man… *The rumor which reached you that the tank at Keamuku was locked up and that I went to Waimea for the key was a mistake…* [HSA – HGS DAGS 6 Box 2]

Surveys of Mauna Kea and the Hilo Region
Mountain Lands by E.D. Baldwin (1889-1891)

In 1889, E.D. Baldwin conducted a detailed survey of the Hilo Mountain Lands. His trip and results of the survey were documented in an article he published in 1890 (cited earlier in this study), and in letters as the one cited below:

Hilo, Hawaii
August 18, 1889
E.D. Baldwin; to W.D. Alexander
(Reporting on Mauna Kea and vicinity survey trip):

…I am just back from our ***Mauna Kea*** trip. We left Hilo Aug. 6th at 8 A.M.; with three pack animals. Mr. Burt, Levi and Ernest Lyman went along with us. *We took the Hitchcock road, up through the woods and then over the 1855 flow to their camp* ***Halealoha****, about 20 miles from Hilo, which camp we reached at 8 P.M.* – the moon assisting us to find the trail the latter part of the way. *The bark house at* ***Halealoha*** *is partly rotted away, but gave us good shelter for the night. Next morning we made a start for* ***Puakala*** *or Hitchcocks house near* ***Ahuwela****.*

Mr. Burt and I went on ahead with our rifles and shot two young bullocks, from which we got enough meat to last us several days. Arrived at ***Puakala*** about 5 P.M. *Here the Hitchcocks have a fine large house, made of koa, - which was sawed out by hand.* They had kindly given us the keys of the house, so that we made it our headquarters. The rest of the week was spent getting out poles for ***Ahuwela*** sta. We had to go a mile below Puakala house to find straight – enough poles, which we hewed out and then dragged up to the hill. (Mr. Lowenstein and I saw the poles clearly this morning, from Hilo.) Both Morris Chamberlain and my native boy were taken down sick Monday. We intended to make a start for the top of the mountain any way, and got up at 4 A.M. for that purpose, but found some of the horses gone, which were not found until near noon, so we gave up the trip for that day. Next morning, Tuesday, we started at 7 A.M. The party consisting of Mr. Burt, Levi & Ernest Lyman and myself. Morris and the native boy (David) being left behind, as they were not well enough. *Mr. Burt was the only one, in the party who had been to the top of* ***Mauna Kea****. There is no regular trail going up, we followed the main cattle trails until those disappeared, and then clambered over the clinkers, picking our way as best we could*. One of our pack mules began to act rather stubborn about going up the mountain so I packed my horse, and rode the mule, and by means of considerable spurring got him about a mile further, or about three miles from the top when he refused to go at all, so we tied him, with a feed of oats near by and left him. I walked part of the way, when Mr. Burt kindly urged me to ride his horse, which I did for a ways, (as I had quite a headache) r*eaching on the top plateau we pushed on some two miles further, trying to find the lake.* I tramped the last two miles on foot, and was taken down very sick, with mountain sickness. We concluded to camp while *Mr. Burt went in search for the lake, which he found quite aways above us among the central cones*. The animals were very

uneasy during the night; clawing up the dust, and breaking and chewing up their ropes. One mule persisted in breaking away and hanging around the tent; barking all of our wood, tearing an animal cloth and one of our blankets all to pieces. Levi Lyman and I were the only sick ones. Mr. Burt and Ernest standing the trip first rate. Next morning we packed up; *visited the lake on the way down, which is about 200 feet by 150 feet; and set our pole on the summit cone*. We struck the right cone the first time. I rode up on my horse, carrying the pole and 4 inch instrument up with me. The climb was a hard one, but by zigzagging and taking it slowly the horse managed to get up, a mile north of us I could see Lyon's pole lying on the ground. Our cone over topped considerably all the others. The day was fairly clear, but I was feeling rather under the weather to appreciate the grand scenery from the top, so we made for lower regions. Found our plaid out mule had also concluded he would seek a lower altitude; as he had broken loose and gone. It fogged in, about half way down, so thickly that we could see only a few hundred feet before us. We kept on steadily going down, crossing the trail to the house, without knowing it just at dusk, and fetched up against the *makai* end of a fence which we recognized, and followed up about a mile until we struck *the main trail near the corner of the fence. Here we started one of the mules ahead on the trail and trusted that he would keep the trail and carry us to the house (as it was intensely dark – with the thick fog); which the mule did nicely, getting us there about 8 P.M.*

Mr. Burt, Levi and Ernest Lyman started for Hilo Thursday noon, and I concluded to start for Hilo Friday morning, (reaching Hilo at 8 P.M.) and sent another pack animal up to Morris. On the way down here I found the mule, which had given out going up the mountain… [HSA – ID Survey, 1889]

In 1891, Baldwin again returned to Humu'ula and vicinity, furthering the survey work initiated in earlier years, and to finalize the surveys of the Boundary Commission. Baldwins' letters and sketches from his field books, provide us with descriptions and views of the mountain landscape at the time. On April 27th, 1891, Baldwin reported back to W.D. Alexander:

…I arrived in Hilo last Saturday night from ***Puakala***. We have had fairly good success at ***Aahuwela***, having measured the angle between ***Alala*** and Kulani also nearly finished the angle between Halai and Kulani also Alala and Halai. The 8 inch is a very slow instrument to work with, there being a great deal of lost motion in setting. But by a great deal of care in setting, I believe we have managed to do very fair work with it. The measurements of the Alala-Halai angle so far close the triangle within 4".

We had a very rough trip up the mountain; it raining steady all of the three days on our way to ***Puakala***. Thrum started the day before I did and reached ***Hale-Loulu*** just at dusk; and was unable to start a fire, everything was so wet. He had a great deal of trouble with the pack animals in the woods. Two of our animals were completely used up by the trip, and I am afraid will be unfit for use any more.

I will start back early tomorrow morning. I send down any April accounts; the laborers pay roll, I will send down next month… [HSA – ID Survey, 1891]

In May, Baldwin reported:

Hilo, Hawaii
May 30, 1891
E.D. Baldwin; to W.D. Alexander:
(Reporting on survey trip along Humu'ula slopes of Mauna Kea):
…We are having a very tedious time of it upon the mountain; the weather has been very fair below, but the fog and clouds hang just over ***Aahuwela***, so that for the last three weeks we have done almost nothing.

I have given up the idea of trying to see Kapoho or the other Puna stations from Aahuwela as they are always covered with a cloud, and I am afraid we will have to wait until doomsday to see them. I am going to send a heliotrope to Kaloli point – a short ways beyond Keaau, and devote myself to the large quadrilateral ***Aahuwela***, Alala, Kulani and Kaloli, and work on through Puna from the base, Kulani to Kaloli which will form good triangles with my other Puna stations.

We hope to finish with Aahuwela soon if the weather permits, at any rate I am going to finish the topographical work around the base of the mountain to ***Kalaieha*** and a little beyond, and leave Thrum to watch at ***Aahuwela***. We have been on Aahuwela for the last four weeks, every morning at day light, and then gone up before noon, and remained until there was no hopes of its clearing, without accomplishing any thing on the Hilo station with the exception of Kulani and Puu Ulaula which are always clear in the morning.

Kulani is just below the almost perpetual cloud line, so that I think it will not take us long there.

I have no suitable map tin to send the Hilo map down in; and think rather than run any risk of damaging the map, I will bring it down with me, as I intend to go to Honolulu on June 22nd and attend the Punahou Jubilee.

I send part of my accounts for the month of May, that is all but the labor items. Can you please turn over to H. Chamberlain $72.00 on my account.

We need all the animals we can get, but they must be strong and in fairly good condition to stand our hard trips. If the Molokai horses are in good condition, I think we had better have them up here… [HSA – ID Survey, 1891]

Entries in Baldwins' Field Book No. 323 (viewed in the collection of the State Survey Division), from June 1891 include sketches depicting various localities on Humu‘ula, Ka‘ohe, and neighboring lands. Among the features identified are Pu‘u ‘Ō‘ō survey points and the location of the original ranch house; fence and paddock lines; trails to Mauna Kea, Kīpuka‘āhina, and the mountain road; named *pu‘u* from the forest line to the mountain slope, and on the Pōhakuloa flat lands—several of the names are no longer found on maps; the location of "Waihu" spring; the extent and range of the forests; and the Haneberg facility at Kalai‘eha (*Figures 46a, 46b, 47, 48, 49, and 50*).

Figure 51, taken from Baldwins' entry in the field book for June 16th, 1891, depicts the scene from Pu‘u Huluhulu across the table lands to the Kalai‘eha Station, and up to the summit of Mauna Kea—"*Puu o Kukahauula*." Baldwin includes the main station paddock fences, a depiction of the station buildings, and names several prominent features on the Mauna Kea landscape.

On Wednesday, June 17th, 1891, Baldwin recorded the occurrence of piles of stones on the summit cones of Mauna Kea, and on the cones of Kaupakuhale and Omahulua. A note in the field book entry for the summit cone (Pu‘u o Kūkahau‘ula) recorded:

Pile of rocks on Highest peak. 151º 16' 30" Pile of stones on highest point of Mauna Kea as sighted from Puu Huluhulu & Lepeamoa, where E.D.B. set flag. [Field Book 315:58; in collection of State Survey Division]

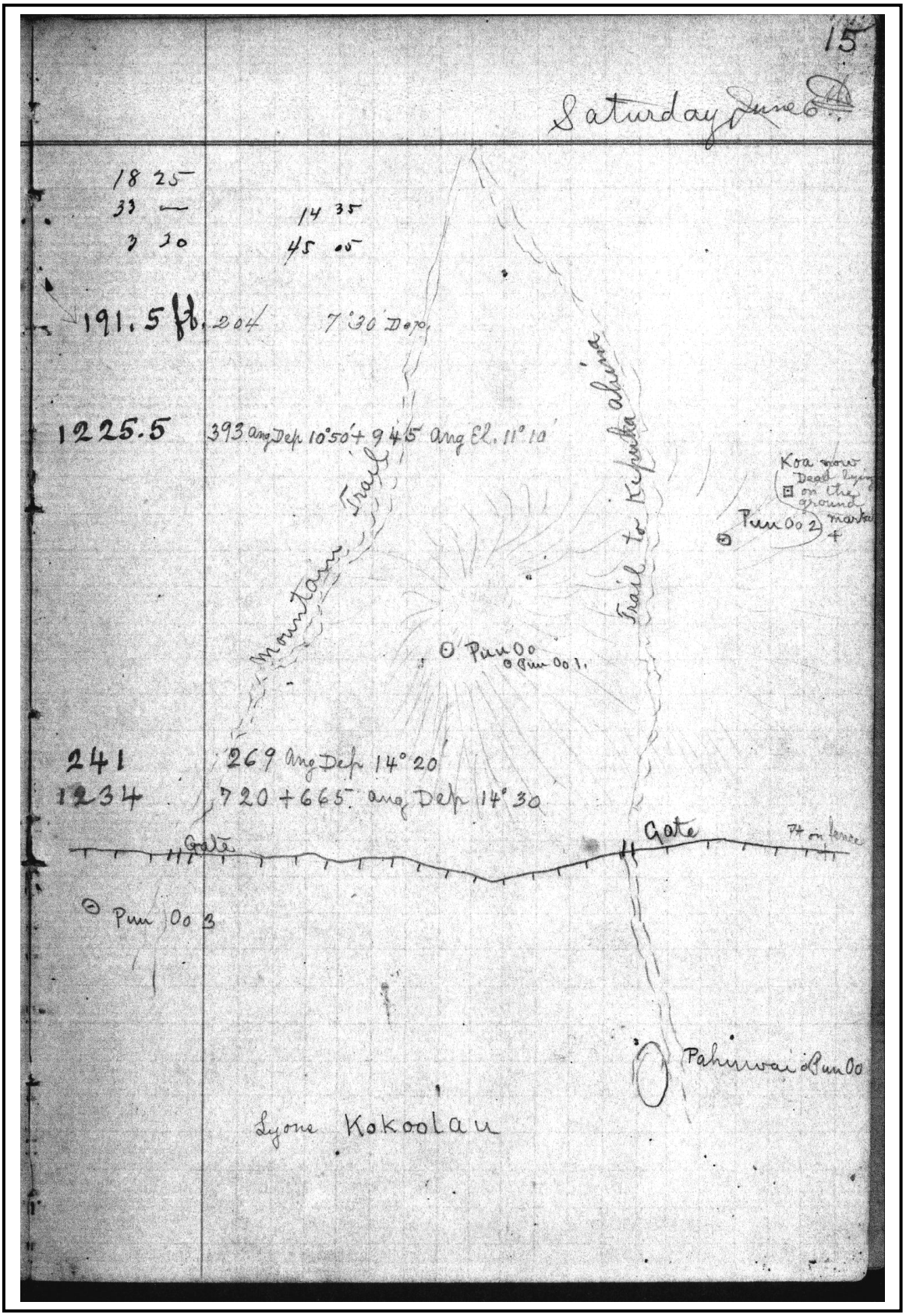


Figure 46a. Pu'u 'Ō'ō Vicinity Trails and Fence Line (E.D. Baldwin, Field Book No. 323:15; June 6th, 1891)

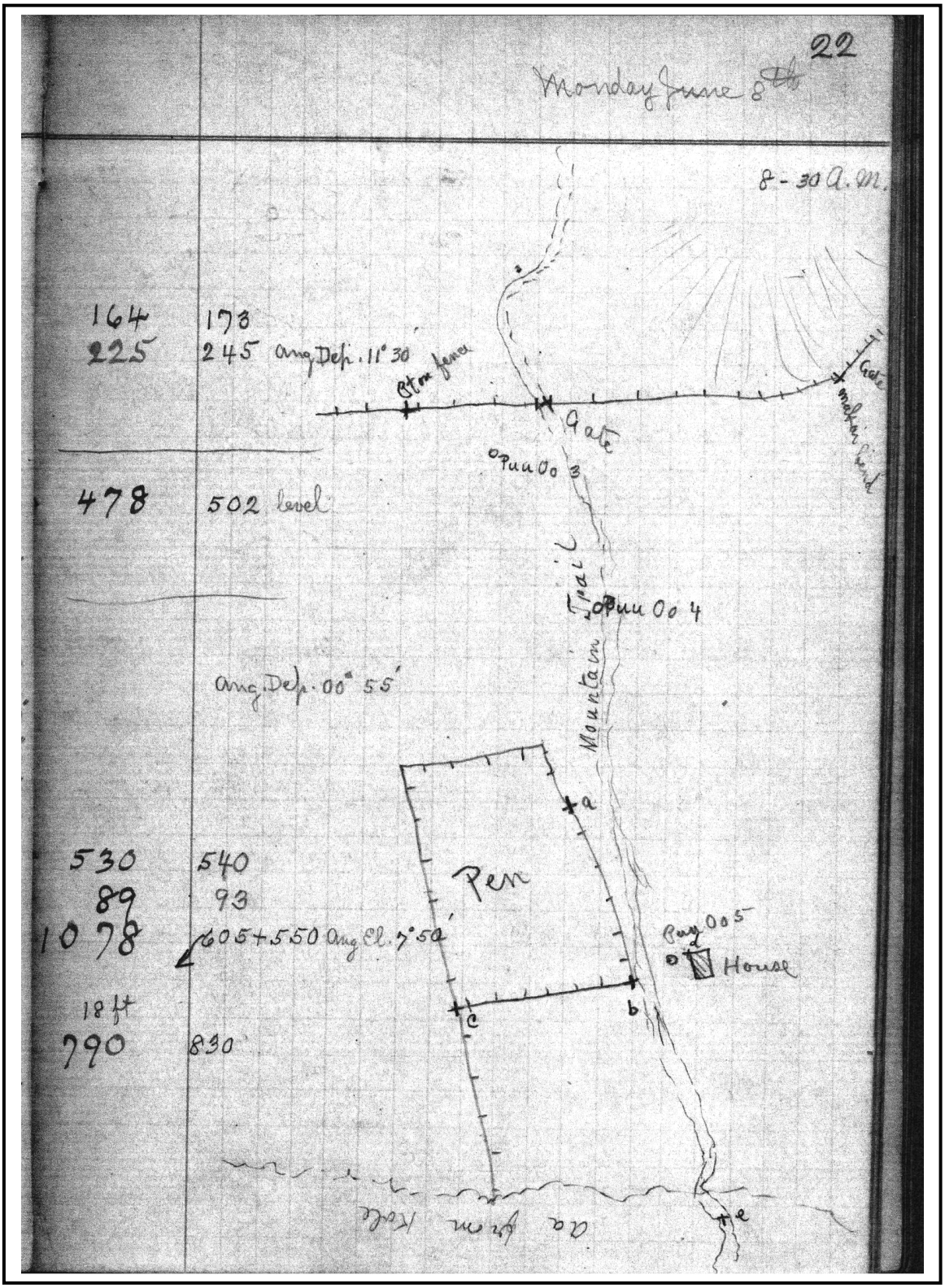


Figure 46b. Lower Pu'u 'Ō'ō Vicinity Trails, Paddocks and House (E.D. Baldwin, Field Book No. 323:22; June 8th, 1891)

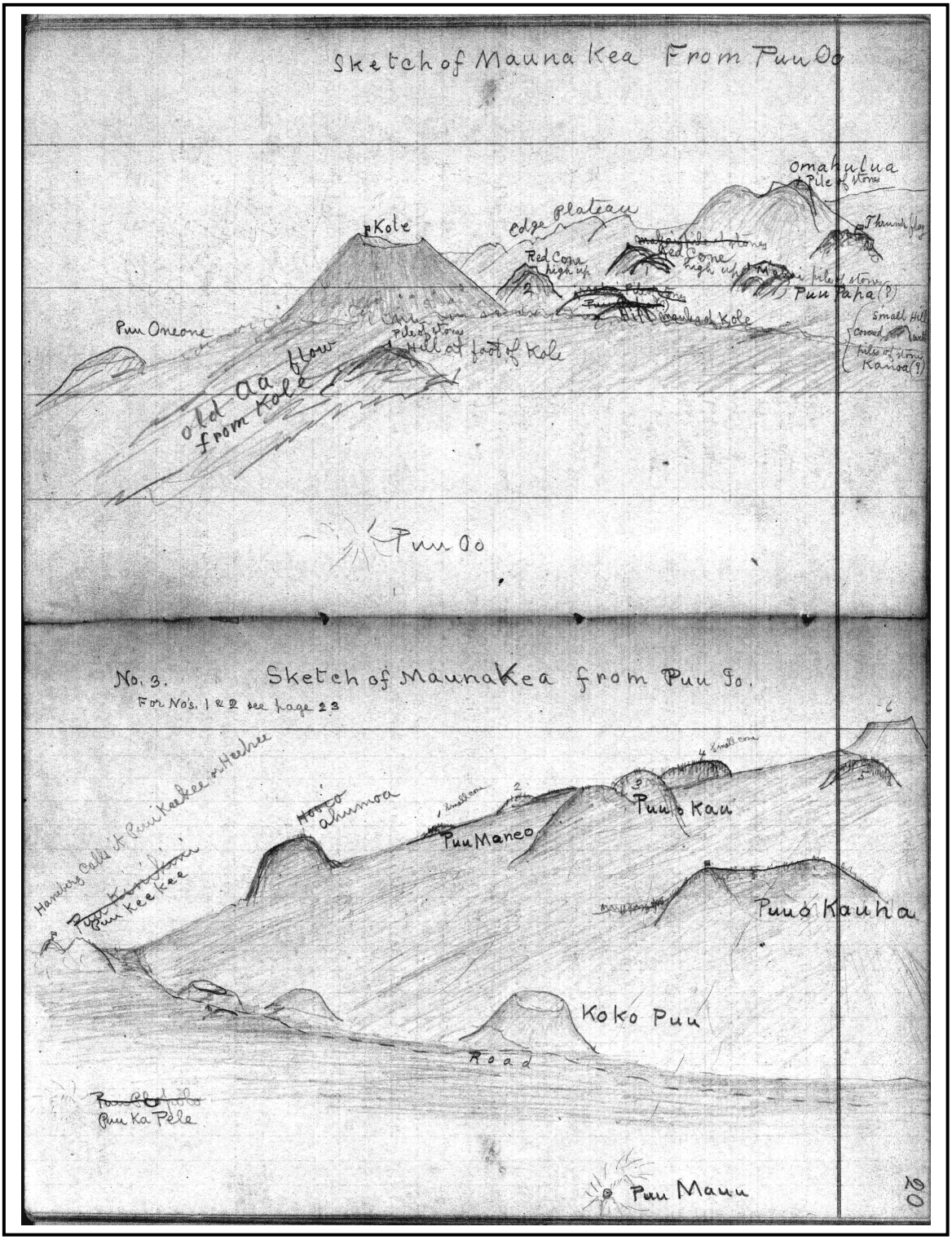


Figure 47. Sketch of Mauna Kea from Puu Oo, Depicting named Puu; & Sketch of Mauna Kea from Puu Io, Depicting Puu Koko (with Road), Puu Keekee, Puu o Kauha, and Named Pu'u of Kaohe (E.D. Baldwin, Field Book No. 323:19-20; June 7th, 1891)

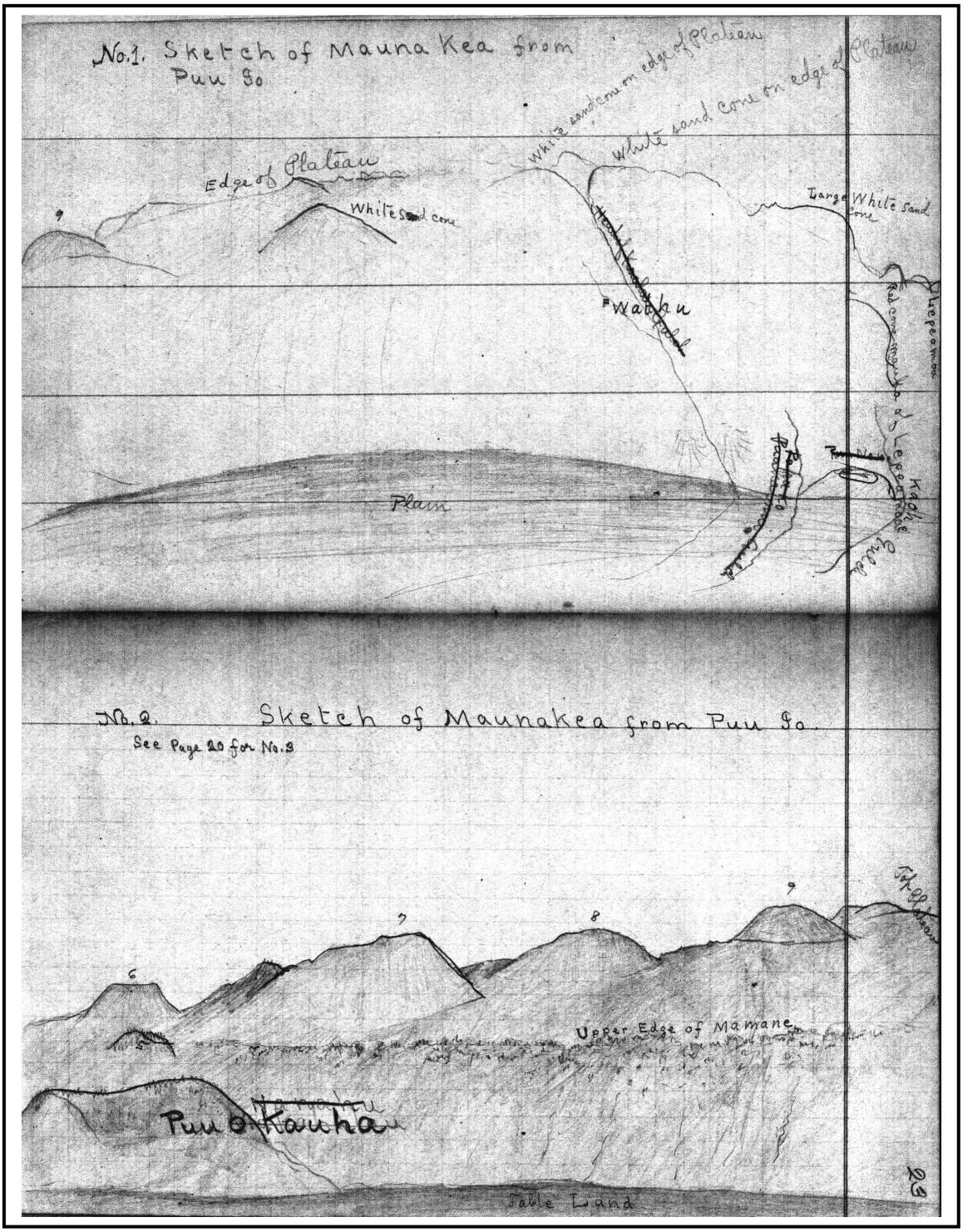


Figure 48. No. 1. Sketch of Mauna Kea from Puu Io (locating Waihu); and No. 2. Sketch of Mauna Kea from Puu Io (locating Upper Edge of Mamane and Puu) (E.D. Baldwin, Field Book No. 323:22-23; June 9th, 1891)

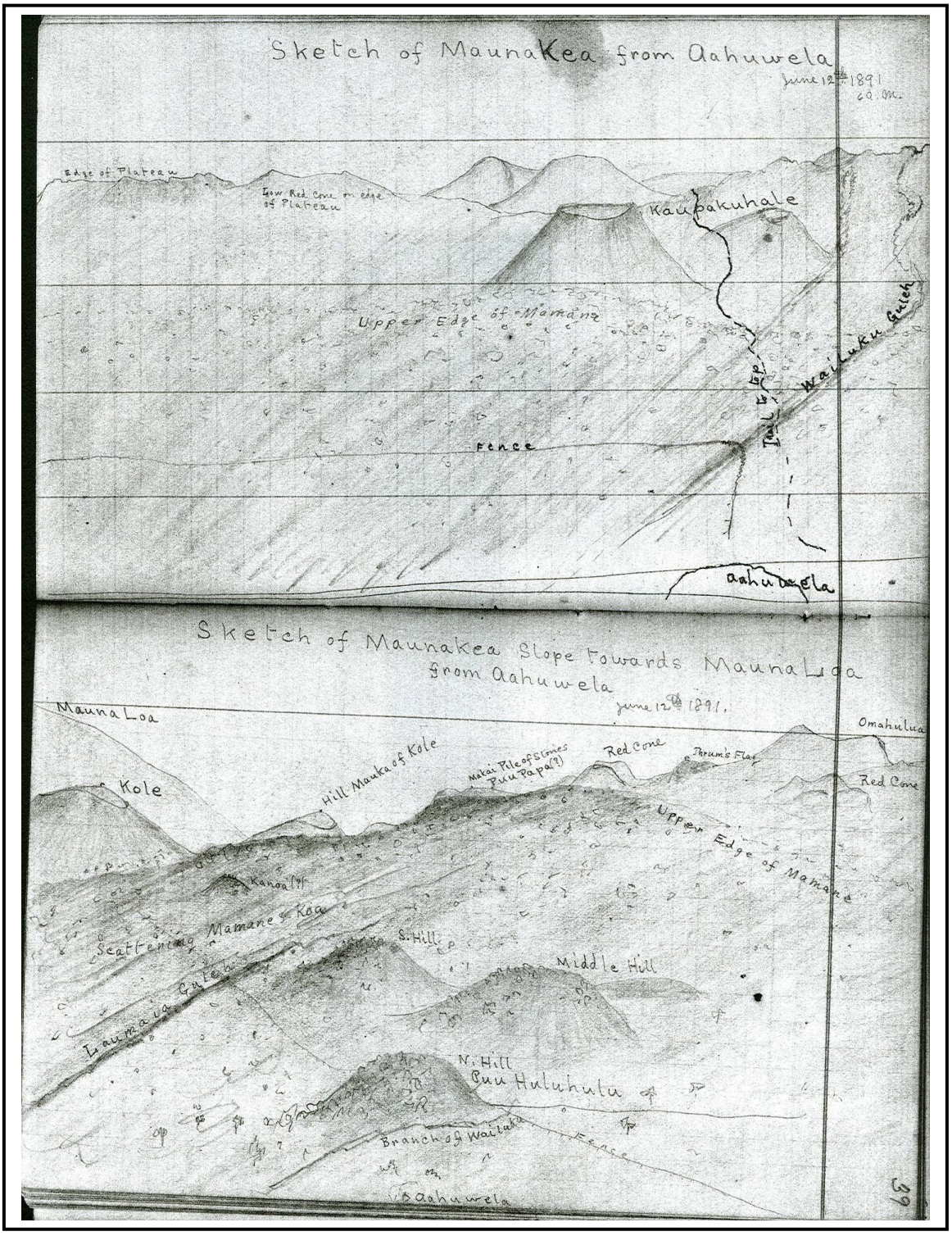


Figure 49. Humu'ula and Mauna Kea from 'A'ahuwela; Depicting Named Pu'u and Gulches, Fence Lines, and Forest Lands (E.D. Baldwin, Field Book No. 323:38-39; June 12th, 1891)

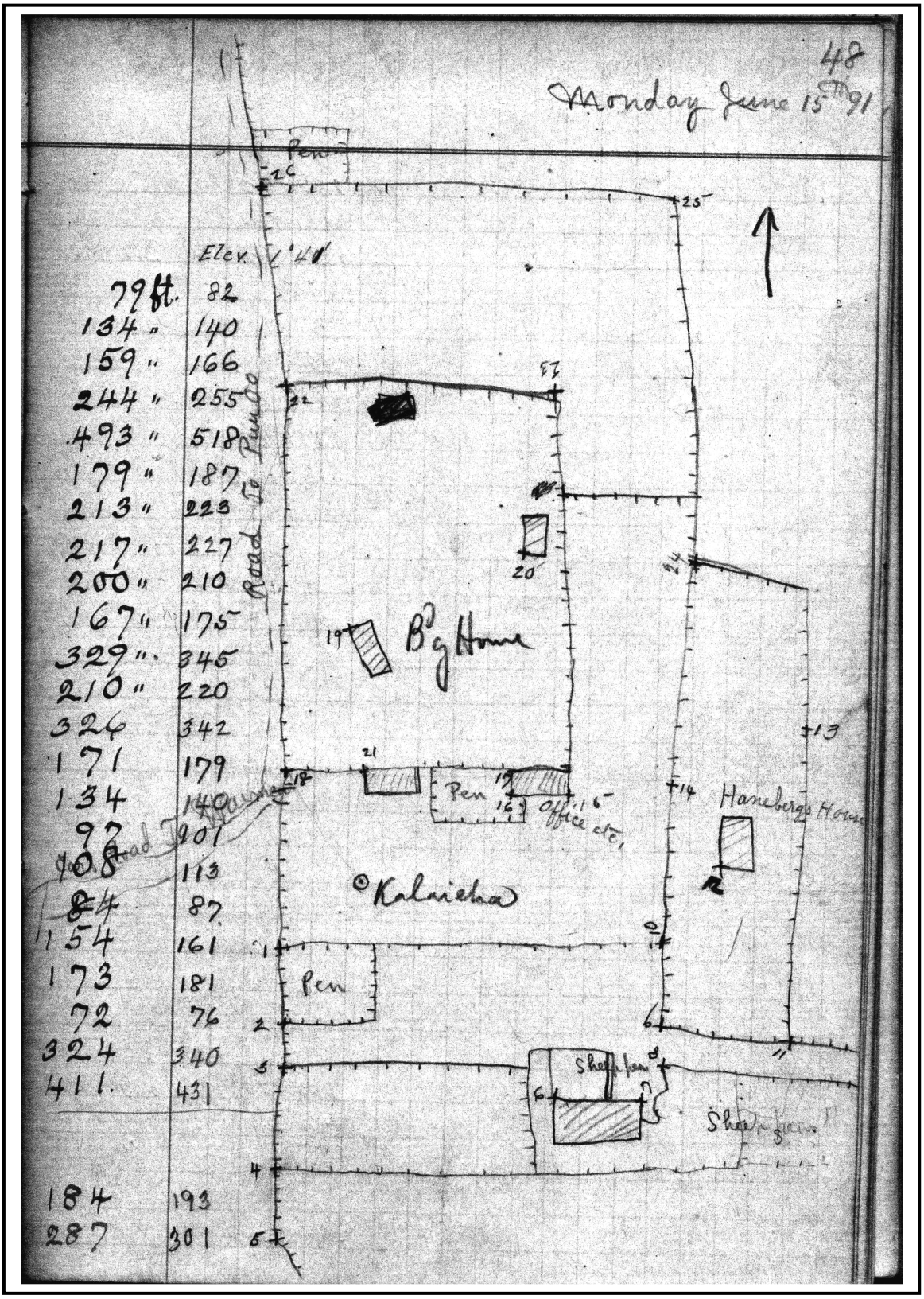


Figure 50. The Kalai'eha Station, Buildings and Pens (E.D. Baldwin, Field Book No. 323:48; June 15th, 1891)

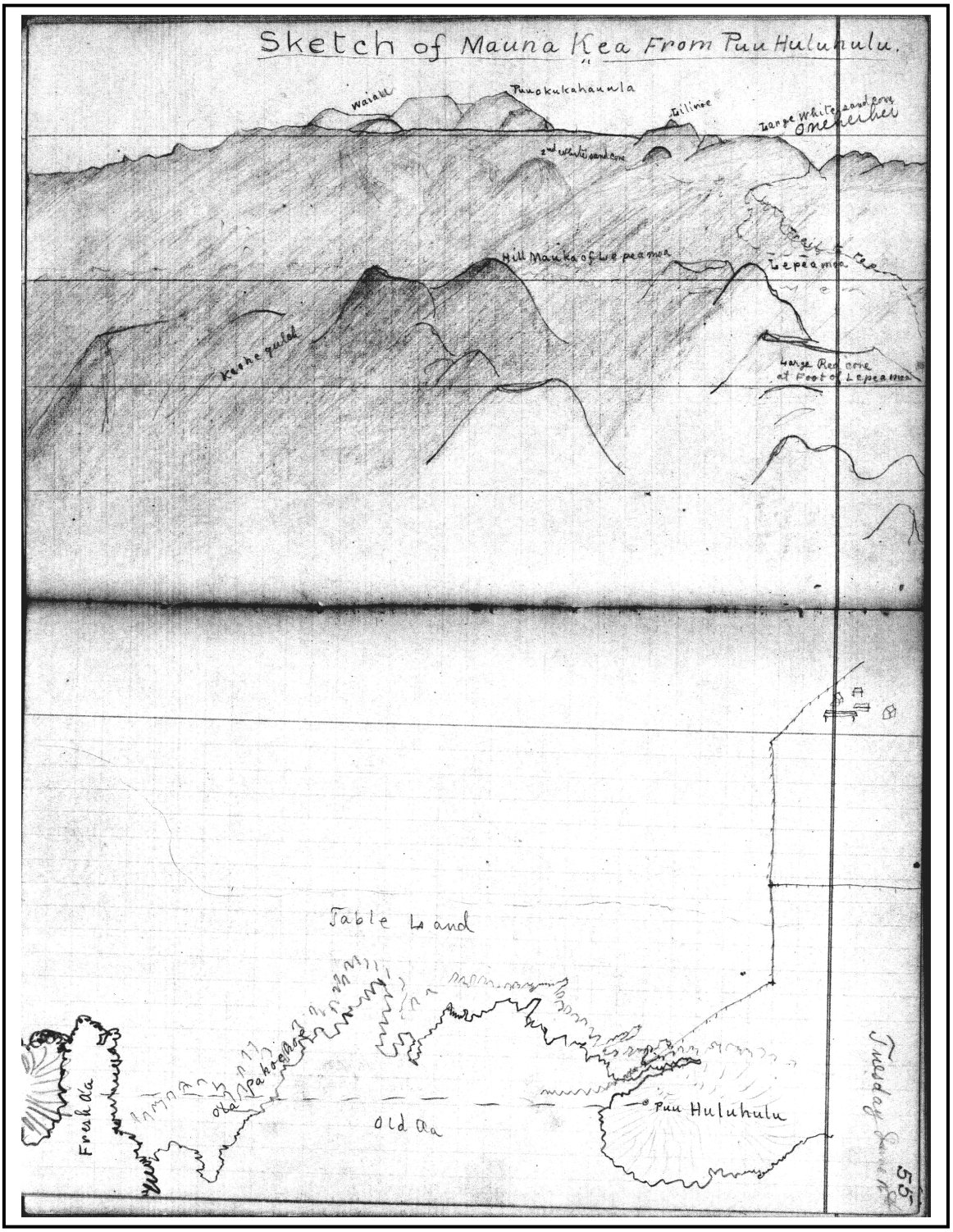


Figure 51. The Kalaiʻeha Station and Mauna Kea (Locating - Puu o Kukahauula, Waiau, Lilinoe and Trail to summit), viewed from Puʻu Huluhulu (E.D. Baldwin, Field Book No. 323:54-55; June 16th, 1891)

Mauna Kea Survey Notes (1891-1894)

Honolulu, Oahu
August 27, 1891
C.J. Lyons; to W.D. Alexander
(Requests survey of Kaohe, in preparation of issuance of lease):
…The Interior Office will very soon want the notes of survey of ***Kaohe*** *for lease, and I expect to be called upon for them.*

It was with reference to this that I wished the positions of ***Kole A; Lepe a Moa, Omaokoili, and Pohaku Hanalei***, as fixed by triangulation by Mr. Baldwin, and requested them of him through yourself about a month since. I should like to respect fully inquire why they have not been finished, as it is now a long time since the measurements were made… [HSA – ID Survey, 1891]

Hilo, Hawaii
September 2, 1891
E.D. Baldwin; to Professor W.D. Alexander:
…Thrum and Chamberlain arrived this evening from the mountain. I wrote to Thrum to give up locating any points below Lydgates ***Mawai*** [Mawae] on the 1855 flow, so that we might push on to Kulani. We will make a start for Kulani next Monday. In regard to the location of those five points – I understood that you wished the notes of survey from ***Kaupakuhale on to Pohaku o Hanalei***, and as I supposed that Lyon's had located ***Kaupakuhale*** I did not relocate it again; and after receiving your letter a month ago; wrote by return steamer for Lyon's location of ***Kaupakuhale***, so that I could get the distance and bearing from ***Kaupakuhale to Kole*** from my map. Lyon's has not as yet sent me the location of ***Kaupakuhale***; but wrote by last steamer that he would like the coordinates of four of the points referred to ***Aahuwela***, which I have sent him by this steamer.

We have been making up a lot of oil-skin clothes and bags, also we made a fly and tarpoling for our small tent, which accounts for the large amount of canvas duck we have been buying.

Our large tent and fly are nearly all to pieces. Can you please send us up another large tent and fly. Also I would like a lot of blank vouchers and a large calculation book.

Can you please pass H. Chamberlains pay over to W. Frear $79.85. And deposit $300.00 in the Postal savings Bank for me, and please send the balance to me… [HSA – ID Survey, 1891]

Hilo, Sept. 11th, 1891
E.D. Baldwin; to W.D. Alexander
(Regarding survey and map (No. 1718) of Central Hawaii):
…We are having beautiful weather up here now; ***Mauna Kea*** has been clear twice nearly all day, and it seems a pity to give up the field work just now.

Horace [Chamberlain] is the best boy I ever had to work with me. He is a rusher, and not a bit afraid of work. He shod all the animals on the way down from ***Mauna Kea***, and I was about to get him a saddlers out-fit so that he could do all our saddle mending, which amounts to quite an item, in a wet climate like this – where every thing rots so quickly. I am afraid he will be very much disappointed, unless he can get some-thing to do…

Please send me some definite instructions in regard to Thrum and Chamberlain, so that I can dispose of them as soon as we return from Kulani; also I have over $600.00 worth of animals and saddles of my own on my hands, and 3 Gov't. Survey horses. My own

animals are pretty well plaid out by ***Mauna Kea*** trip and packing into Kulani, and if sold now will fetch less than half of their value, and if put out to pasture, will soon eat up their value…

I will finish as soon as possible the Central Hawaii map. Also will take up the Hilo Town 50 ft. to the inch maps… [HSA – ID Survey, Hawaii, 1891]

July 23, 1892
Field Book No. 429, W.D. Alexander
Mauna Kea Survey Trip Notes
Records of former parties who visited Peak A & left them in a tin box
[See Figure 12 – for Peak A (Poliahu)]

I. Sep. 9th, 1885. Dr. E. Arning, F.W. Glade, R. Sneyd Rynnersley, H. Purvis & Deverill.
II. Aug. 8th, 1875. S. Berggren, Naaekauna, Ahueau, Onohi.
III. Sec. 9th, 1875. Commander Lon R.N., Leiut Noel R.N. H.B.M.S. "Fantome."
IV. July 26th, 1875. E. Wetmore, D.H. Hitchcock, Hattie A. Castle, Danny Wetmore, Ella Hitchcock, Carrie Castle, Katie Wetmore, Clare Shipman, Cora Hitchcock & Lucy Wetmore.
V. Sep. 24, 1870. Howard Hitchcock, Haalelea & Kahale Kai. Plenty of snow around.

Capt. Long remarks that it is not the highest pt., which bears N.W. from it. [Field Book 429:25; in Collection of State Survey Division]

Hilo, Hawaii
September 20th, 1894
E.D. Baldwin; to W.D. Alexander
…You will find the elevation of ***Omaokoili*** in my calculation book, which I turned over to Lyons. I do not remember calculating the elevation of ***Huikau***, but believe I have some angles of elevations on ***Huikau***, which you can find in my ***Mauna Kea*** field book, which has also been turned over to Lyons.

I learn that Pres. Dole and Mr. Iaukea are coming up here next steamer, and can you kindly loan me the little pamphlet on New Zealand lands, as I would like to discuss the matter with Mr. Iaukea… [HSA – ID Survey, 1894]

Mauna Kea Survey Records in Collection of U.S. Coast and Geodetic Survey (1876-1892)

As a result of work conducted by E.D. Preston on Mauna Kea, in partnership with the Survey Division of the Kingdom of Hawai'i, a record and description of primary triangulation stations on Mauna Kea were furnished to the Coast and Geodetic Survey. These records, now a part of the National Archives and Records Administration (NARA) collection series RG-23, record survey coordinates compiled by W.D. Alexander and C.J. Lyons from 1876 to 1892. They include the following records for Mauna Kea and vicinity:

Description of Primary Triangulation Stations, Hawaii

Papalekoki
Station mark a tremendous *ahu* on North brow of hill with a flag pole in its centre. Perhaps a brass [triangle] or tube.

Altitude 11,429 feet.

Reference Objects:

Puu lo
Nohonaohae
Kihe
Punohu
Koholalele
Paauhau
Anuenue
Apakuie
Kaluamakani
Kuilei. [pages 34-35]

Mauna Kea [Figure 52]
Station mark an iron pin & an *ahu* of light stones & the bones of a defunct cow on the peak 1689 feet Northerly from the summit. This peak is visible from Hamakua.

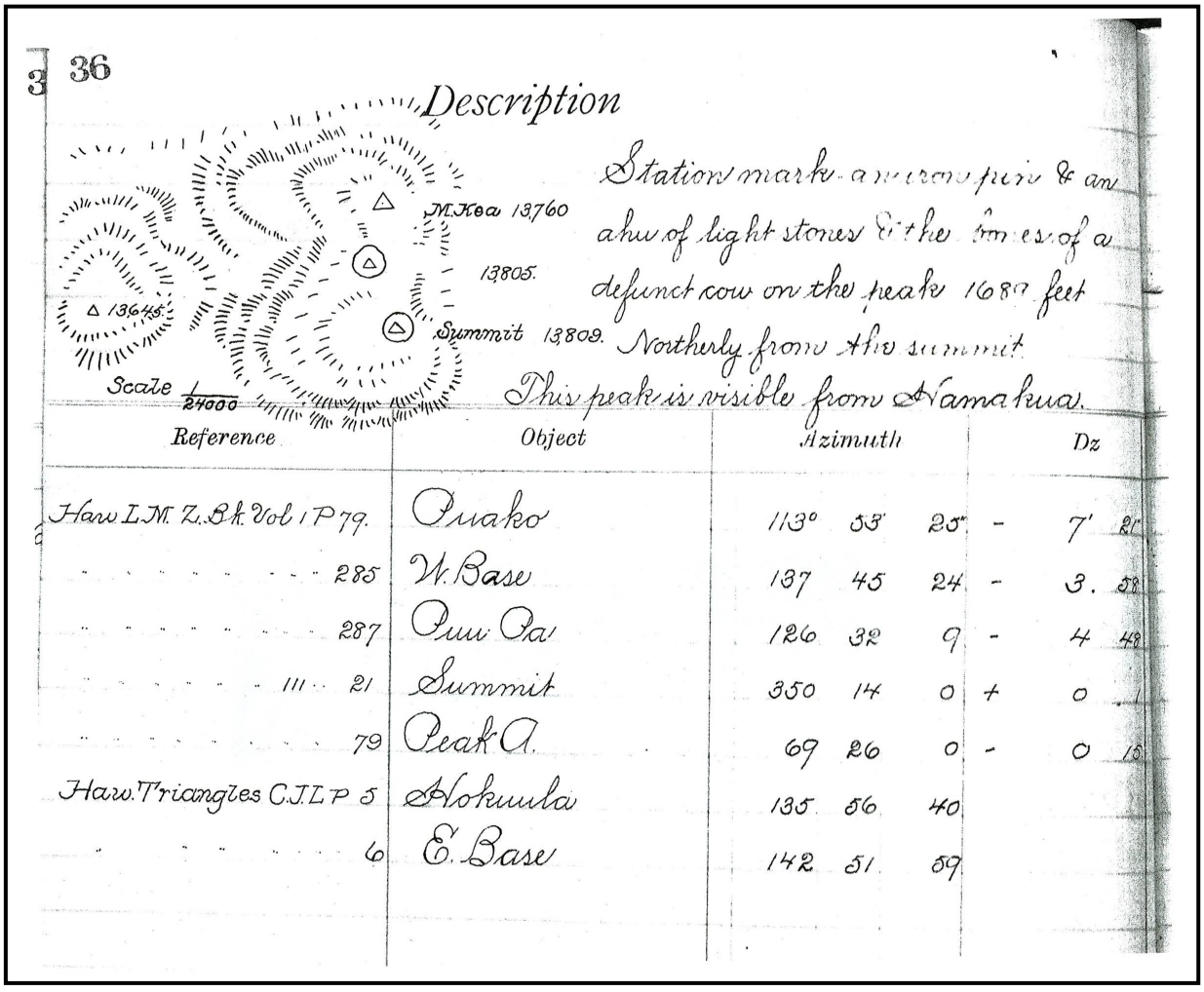


Figure 52. Mauna Kea Triangulation Signal; NARA Collection, Series RG-23 (page 36)

Altitude 13760.0 feet

Reference Objects:
Puako
W. Base
Puu Pa
Summit
Peak A.
Hokuula
E. Base. [pages 36-37]
Summit = ***Kukahaula*** [Kukahauula]
Station mark a wooden flag pole & a stone *ahu*, no other mark.

Altitude 13810.0 Feet

Reference Objects:
M. Kea
Lilinoe
Peak A
Peak B [pages 38-39]

Peak A (Poliahu)
Station mark, a flag pole & a tall stone *ahu* with a tin box containing records of 6 parties from '85 down; no other mark – on the most striking but not the highest peak of the mountain.

Altitude 13646.5 feet

Reference Objects:
Lilinoe
Mauna Kea
Waiau Aston. Sta.
Summit
Peak B
Waiau Crater Sta.
Lilinoe [pages 40-41]

Waiau Aston. Sta.
Station mark, a pier about 3x2 ½ ft. & 3 ft. high, built up of stone & cement with a + cut in stone on top situated on a slight rise, about 35 or 40 feet from the S.E. edge of ***Waiau*** pond.

Reference Objects:
Peak A
Peak B [pages 44-45]

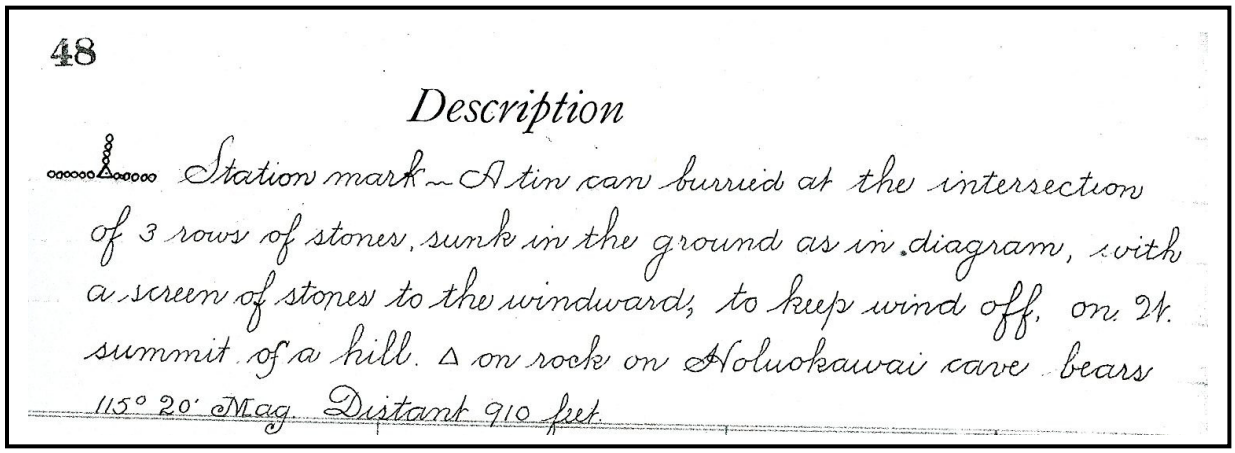
Red Hill
Station mark a large stone *ahu* visible from Volcano house and a small N.W. pole on the most prominent part of ***Kaupo*** peak as seen from Hamakua & Hilo. Probably a copper [triangle] under the pole.

Altitude 11873.2

Reference Objects:
Kihe
Humuula
Kawailahilahi
Papaaloa
Puu Ohai
Haiku
Honohina
Kauku
Halai
Kalepa
A. Kaala
Kaloaloa [pages 46-47]

Apakuie [Figure 53]
Station mark — A tin can buried at the intersection of 3 rows of stones, sunk in the ground as in diagram, with a screen of stones to the windward, to keep wind off; on W. summit of a hill [triangle] on rock on ***Holuokawai*** cave bears 115º 20' Mag. Distant 910 feet. Altitude 5848 feet.

Reference Objects:
Kihe
Papalekoki
Laumaia B.
Kaluamakani
Punohu [pages 48-49]


48

Description

Station mark ~ A tin can buried at the intersection of 3 rows of stones, sunk in the ground as in diagram, with a screen of stones to the windward, to keep wind off, on W. summit of a hill. △ on rock on Holuokawai cave bears 115° 20' Mag. Distant 910 feet.

Figure 53. Apakuie Triangulation Signal; NARA Collection, Series RG-23 (page 48)

Kihe
Station mark a *mamane* post in the centre of a platform of stones about five feet high & 8 feet on a side. With an az. of 38º Mag. and Dist. 96 feet from the Sta. is a X on a stone in situ on the W.N.W. side of crater. Altitude 7822 feet.

Reference Objects:
Papalekoki
Punohu
Koholalele

Kaholo
Humuula
Red Hill
Apakuie
Laumaia B
Poopuaa
Kaluamakani
Kalepa
A. Kaala [pages 50-51]

Kaloaloa [Figure 54]
Station mark a buried copper [triangle] & a *mamane* post set up over it in 1879. As. 76º 45', 545 feet to highest point of a magnetic rock marked [triangle]. An Az. 70º 35' 87 feet to a small marked rock. Az. Red Hill 113º 0' 33" Az. M. Kea Sta. 95º 11" Station situated in map. Altitude 66637 feet.

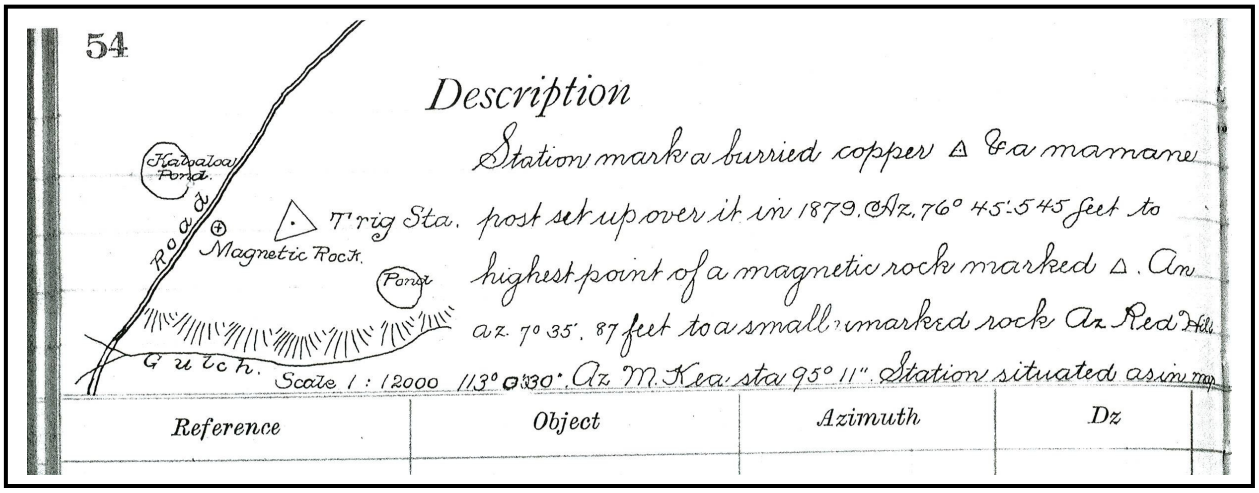


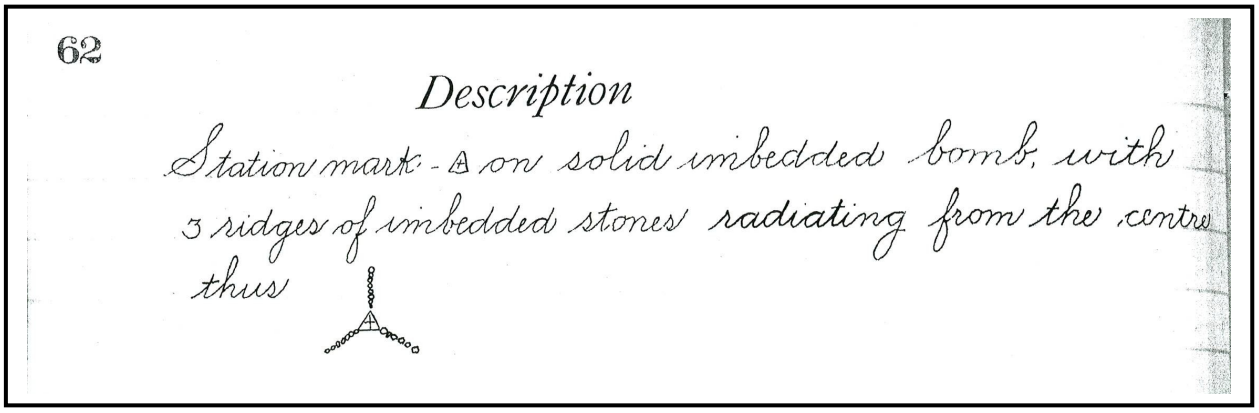
Figure 54. Kaloaloa Triangulation Signal; NARA Collection, Series RG-23 (page 54)

Reference Objects:
Red Hill
Kalepa [pages 54-55]

Omaokoili
Station mark [triangle] on solid imbedded bomb, with 3 ridges of imbedded stones radiating from the centre thus [*Figure 55*].

Altitude 7090 feet.

Reference Objects:
Lilinoe
Waiau Crater
Kalaieha N. Base
Lepeamoa
Kalaieha Puu
Huikau [pages 62-63]



62

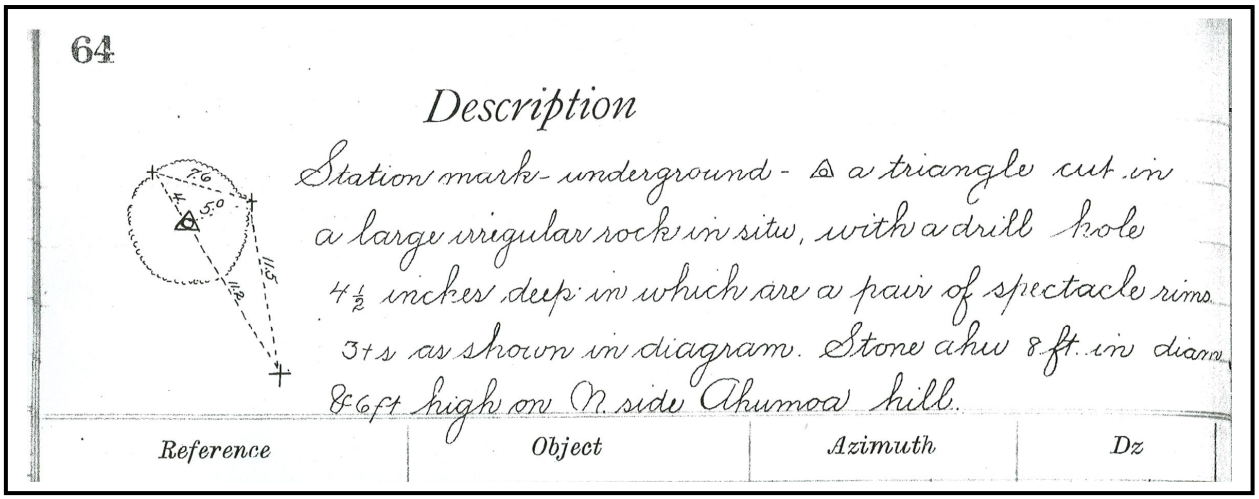
Description

Station mark - △ on solid imbedded bomb, with 3 ridges of imbedded stones radiating from the centre thus

Figure 55. Omaokoili Triangulation Signal; NARA Collection, Series RG-23 (page 62)

Ahumoa [Figure 56]
Station mark underground a triangle cut in a large irregular rock in situ, with a drill hole 4 ½ inches deep in which are a pair of spectacle rims. 3 + s as shown in diagram. Stone *ahu* 8 ft. in diam. & 6 ft. high on N. side ***Ahumoa*** hill.

Altitude 7033.6 feet.



64

Description

Station mark - underground - △ a triangle cut in a large irregular rock in situ, with a drill hole 4½ inches deep in which are a pair of spectacle rims 3+s as shown in diagram. Stone ahu 8 ft. in diam. & 6 ft high on N. side Ahumoa hill.

Reference	Object	Azimuth	Dz

Figure 56. Ahumoa Triangulation Signal; NARA Collection, Series RG-23 (page 64)

Reference Objects:
Nohonaohae
Keamuku
Puako
Anahulu
W. Hualalai
Waawaa
Puu ka Pele
Napukulua
S. Hualalai
M. Loa
Puu Ouo
Kaunuoku
Poikahi
Jacob's No.2
Anaehoomalu
E. Hualalai

Puu Lehua
N. Bank [pages 64-65]

Keamuku
Station mark underground copper bolt driven into a large rock in situ, projecting 1 inch, also 4 + s on stones as in diagram [*Figure 57*] on a small eminence to the N.W. of the Keamuku *aa* flow.

Altitude 3078.5 feet

Reference Objects:
Puako
Nohonaohae
Ahumoa
Puu ka Pele
Waawaa [pages 66-67]

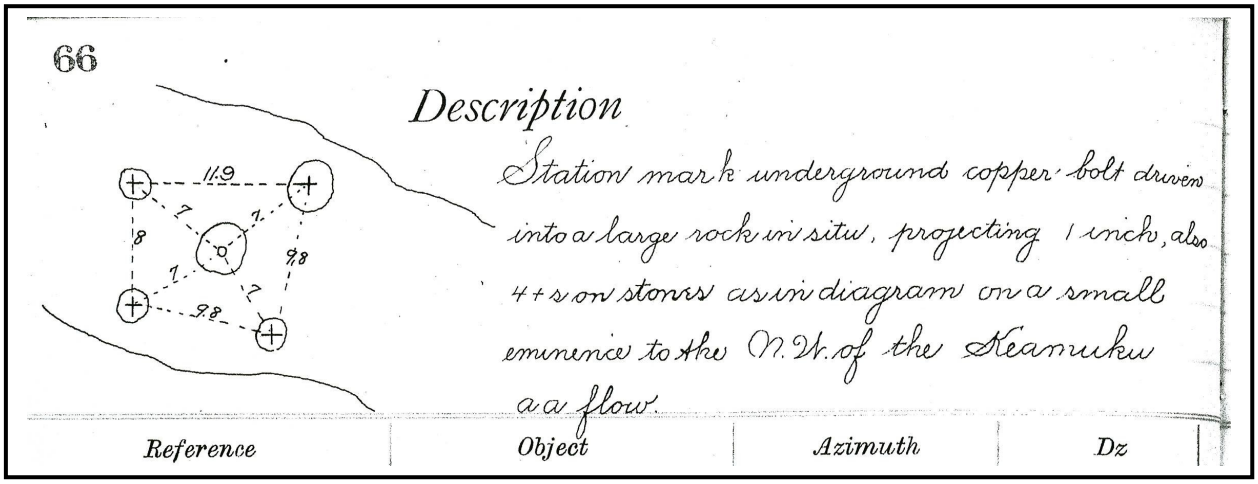


Figure 57. Keamuku Triangulation Signal; NARA Collection, Series RG-23 (page 66)

Additional records of surveys of Mauna Kea and the neighboring mountain lands were recorded between 1905 to 1937, as a part of the development of the Territorial Forest Reserve program, and follow in the next section of this study.

THE HILO AND MAUNA KEA FOREST RESERVES: RANGE LANDS WITHDRAWN FROM GRAZING USES

As noted in preceding sections of the study, by the early 1800s, concerns regarding the retreat of forest lands before the increasing populations of livestock were being voiced. On Hawai'i, lands around Mauna Kea and the Kohala Mountains were of particular concern. Though leases on Crown and Government lands included provisions for fencing and protection of forests, the destruction continued. So significant was the threat of wild animals to the Hawaiian landscape, that on September 19, 1876, King David Kalākaua signed into law an "Act for the Protection and Preservation of Woods and Forests." By that Act, the Minister of the Interior was authorized to set apart and protect from "damage by trespass of animals or otherwise, such woods and forest lands, the property of government…best suited for the protection of water resources…" (Hawaii Laws Chapter XXX:39). The Minister of the Interior was authorized to appoint a superintendent of woods and forests:

> …who shall, under the direction of said Minister, enforce such rules and regulations as may be established to protect and preserve such reserved woods and forest lands from trespass. Said superintendent shall have charge of the construction of fences and barriers required to protect the said woods and forest lands, and shall be responsible for their being kept in good condition… (ibid.).

The above Act was further defined by an Act of the Legislature of the Hawaiian Kingdom, approved by Queen Lili'uokalani on January 4, 1893, which established the Bureau of Agriculture and Forestry. Among the Bureau's goals was the "preservation of forests" (Hawaii State Archives – Com 2, Box 11). In 1893, J. Marsden, Commissioner of Forestry, wrote to J.A. King, President of the Bureau of Forestry and Agriculture, regarding the deforestation of Ka'ohe and the larger Hāmākua-Waimea lands:

> …Within the past (20) twenty years, the land of the Hamakua District extending from Ookala to Waipio gulch, along the sea coast, and inland as far back as Waimea were covered with a dense forest impassible except by trails out through the brush and undergrowth. While in this condition the district had an abundant rainfall, some of the roads being known for their perpetual muddy condition. Within the same period of twenty years, the lands adjoining the sea coast have been gradually cleared for cane, and Agricultural purposes without seriously affecting the rainfall. *Also during this same period of time the Ranching industry in the neighborhood of Waimea has been largely increased. The cattle in grazing around Waimea, and in the adjoining mountains have gradually caused the destruction of the underbrush and finally the large trees throughout that section of the District*.
>
> *The areas of land affected was at first small, but year by year it has steadily increased until now there are probably 100,000 acres entirely cleared, except for an occasional dead stump still standing. As the above area has increased so the rainfall has diminished, so that now there are two causes, lack of moisture, and the damaging effects of the cattle, for the rapid denudation of all the Forest land in this District… The ranching industry extensively carried on between the Hamakua and Kohala Districts, is also seriously threatened from the reduced feed and water supplies*… [HSA – Interior Department Box 2 Agriculture & Forestry; May 29, 1893]

On June 14, 1900, the members and functions of the Bureau were absorbed by the Board of Commissioners of Agriculture and Forestry (Hawaii State Archives – Com 2, Box 11). The Board set about the task of establishing forest reserves on all the islands. In 1904, the Board of Agriculture and Forestry proposed development of the Hilo Forest Reserve, which was needed to "protect the

headwaters of the streams, which play so important a part in the success of the various plantations" (Wm. Hall 1904:277; in Hawaiian Forester and Agricultrualist, 1909). On August 9, 1904, the Commissioners approved the recommendation that "all government and other lands in the district of Hilo, Island of Hawaii, lying above a line approximately 1750 feet above the sea, be set apart as a forestry reservation" (Hall, ibid:282). The lands extended from Laupāhoehoe to Piʻihonua.

Leasehold interests in the Government land of Kaʻohe, which in 1891 had been divided into several parcels, and included the entire summit region of Mauna Kea, were modified during this time. The lands generally above the 7,500 to 9,500 foot elevation were removed from the leases. Parker Ranch, Kukaiau Ranch and the Humuʻula Sheep Station Company had also been required to fence their boundaries between pasture lands and mountain lands. This was done in part, to keep ranch herds separate from the remaining wild herds on the mountain. Among the interesting features associated with fencing and boundaries on the mountain lands are the stone walls north of ʻŌmaʻokoili and ʻŌmaʻokanihae Hills and the Humuʻula Sheep Station Company, and those walls and fences along the on the Waiākea-Piʻihonua-Humuʻula boundaries. As documented in Haneberg's journals, the walls were constructed primarily by Japanese labor in 1891 to 1892. The Puʻu Huluhulu section walls were under construction by October 5, 1891, and the boundary between Kaʻohe and Humuʻula was being laid out on June 29, 1892 (Haneberg Journals, 1891:122 – 1892:201).

By 1909, the summit of Mauna Kea had been removed from the leases, and Territorial Governor, W.F. Frear, approved the boundaries for the proposed Mauna Kea Forest Reserve. The following communications describe the thoughts behind the Hilo and Mauna Kea Forest Reserves, and some of the early actions on lands adjoining them (Register Map No. 2682, depicts the Hilo Forest Reserve Lands; HTS Plat No. 613, depicts the Mauna Kea Forest Reserve Boundaries and Fence Line).

In 1904, the Board of Commissioners of Agriculture and Forestry, met on several occasions to discuss proposals to establish the Hilo Forest Reserve. The proposed reserve would extend from Kaūmana-Piʻihonua (the 1881 lava flow) to Humuʻula, taking in the important forests and watershed lands. In 1904, the Hawaiian Forester and Agriculturalist (HFA) reported that the Board of Commissioners had formalized its' proposal, and identified considerations for establishment of the reserve; the reports also deliberated on the lower boundary line of the reserve:

Proposal and Description of Lands in the Hilo Forest Reserve

At the meeting of the Board of Agriculture and Forestry held on August 17, 1904, the following reports and recommendations were made public:

REPORT OF THE COMMITTEE ON FORESTRY.
Honolulu, August 16, 1904.

To The Board of Agriculture and Forestry.

Gentlemen: Your Committee on Forestry have had under consideration the subject of a permanent forestry reserve line in [page 275] the Hilo district, and also the petition of certain persons for homesteading certain Government land in Honomu, Hilo, Hawaii, now in forest.

The members of the committee are personally familiar with the general conditions existing in the Hilo district and the Superintendent of Forestry has visited and examined the localities in question, in detail, and presented to the committee full reports and recommendations.

These reports accompany this report, and we recommend their adoption.

In brief, the report of the Superintendent of Forestry is in favor of establishing a forest reserve line at approximately the 1750 foot level above the sea, varying to meet local conditions, as set forth in detail in his report. All above this line to be made a forestry reserve under the law of 1903. The upper boundary to be fixed later.

As to the ***Honomu*** homestead proposition, your committee is in doubt as to whether the establishment of homesteads in this locality is economically practicable or not. The land is over three miles from the government road. *The only road to it is a dirt one constructed by the Honomu plantation*. In the normal rainy weather of Hilo teaming is impracticable over such roads, and packing on animals is difficult and expensive. A macadamized road only is of use. This is costly to construct, and by reason of the steep grades, costly to keep in repair.

The available road funds have heretofore been scarcely sufficient to keep the one main road through the district in repair. It is questionable whether under existing financial conditions a macadamized road can be built or kept in repair, if built. A further consideration is, that the Hilo district is cut at such frequent intervals by ravines of such extreme depth that is impracticable to build an upper road above the plantations and parallel to the coast, as has been done in Kona.

A separate road must be built *mauka* on every ridge, or approximately every half mile or so. By reason of this fact the area opened by each road would be comparatively small—so small as not to warrant the cost of the road.

There are questions which, to some extent, lap over into the consideration which this Board must give every proposition to take forest land for homestead purposes. The main points upon which the committee bases its approval of the homesteading of [page 276] this land are: First, that the land itself is fair arable land, and, second, that deforestation under the restrictions recommended by the Superintendent, will not radically injure the purposes for which the forest reserve is sought to be established. The Board is not the responsible authority to decide upon the economical availability of the land for homesteads, or concerning roads to get to them. That rests with the Land Department and the Legislature. The sole scope of this report is therefore, that so far as this Board is concerned, it does not object to utilization of the land in question for homestead purposes.

Respectfully submitted,

L.A. THURSTON,
A.W. CARTER,
W.M. GIFFARD.

REPORT OF THE SUPERINTENDENT OF FORESTRY.
Honolulu, T.H., August 9, 1904.

The Committee on Forestry, Board of Agriculture and Forestry.

Gentlemen:

I have the honor to submit herewith a report with recommendations on the proposed forest reserve, in the Hilo district, on the Island of Hawaii.

This report deals with the lower line of the proposed reserve and is the result of a visit to the district, covering the period from July 6th to July 23rd, 1904. During this time I, personally, went over the ground, following as closely as possible the lower edge of the

existing forest, from the ***Laupahoehoe*** *gulch to the 1881 lava flow, back of* ***Hilo town***. The examination was made in company with the managers of the several sugar plantations along the way; each manager accompanying me over his own land. Other gentlemen, also, were interviewed and much information in regard to local conditions, throughout the district, was obtained.

OBJECT OF HILO RESERVE

The reserve in the Hilo district is needed primarily to protect the headwaters of the streams, which play so important a part in the success of the various plantations. From ***Laupahoehoe*** to Hilo are many running streams, which thanks to the heavy and nearly continuous rainfall in the forests above, may be regarded as permanent, although of course subject to fluctuation. On these streams the plantations depend for water with which to flume their cane to the mill. Their importance is consequently [page 277] very great and the necessity of safeguarding them is apparent.

From its location and topography, the Hilo district is fortunately situated to receive an ample supply of water. The trade winds bring the moisture-laden clouds and pile them up against the slope of ***Mauna Kea***, in a great bank, from which the precipitation is heavy and very nearly continuous. *This cloud stratum covers a belt, extending from an elevation of approximately 2000 feet to one of about 6000 feet*; these limits, of course, varying on different days and with the slight changes in the direction of the trade winds. The lower edge probably fluctuates more than the upper, as the cloud mass frequently creeps down the slope, causing heavy precipitation as far as the sea. But the greater part of the moisture from the clouds is dropped higher up—somewhere between the elevations of 2500 and 4000 feet.

The precipitation is heaviest at the eastern end of the district and gradually diminishes to the westward, until in the Hamakua district, permanently running streams are no longer found. The Hilo-Hamakua boundary is in this way a natural as well as an artificial line. The reason for this change of conditions is that beyond the northern end of the Hilo district, the bulk of ***Mauna Kea*** no longer stands in the path of the trade winds, which accordingly go over the shoulder of the mountain carrying their clouds to the lands beyond.

From quite another cause the 1881 lava flow marks the limit of flowing streams to the eastward, for beyond this point toward Puna, the porous character of the rock and soil allows all the water to sink immediately into the ground, to appear again only near the coast.

At the western end of the Hilo district, the land rises much more abruptly from the sea than at the eastern—the same elevation being reached about four miles back of ***Laupahoehoe***, which, back of Hilo, lies ten miles from the shore.

Whatever may be the influence of the forest on precipitation elsewhere in the islands, the question in the Hilo district is solely one of the conservation and utilization of the water, which reaches the ground. There is naturally great fluctuation in the size of the streams, and during times of drought, the beds of many of them are almost, if not entirely, dry. The presence of the forest tends to regulate and maintain the flow, and to make available for later use, the water which would quickly run away from denuded slopes. [page 278]

While the heaviest precipitation, as has been said, occurs somewhere above the 2000 foot contour line, the beneficial effect of the forest extends much lower down the slope. But after a time, other factors come into the case, making it necessary to establish a limit above which the land should remain in forest and below which it may be cleared for the various industries, without detriment to the general welfare of all concerned.

In deciding upon the location of the lines of a permanent forest reserve it is necessary to consider future as well as present needs. A number of considerations have thus to be taken into account, among which are the benefits to be derived and the uses to which the land would be put if cleared. The former have already been discussed. Of the latter, in the Hilo district there are practically only two; the further extension of the cane fields and the opening of tracts for settlement.

At present, with the exception of what is raised on the homestead clearings, cane is the only crop grown systematically at the higher elevations. The upper line of the cane fields varies with each plantation. At the western end of the district, owing to the steeper grade, the cane runs up to about 1800 feet. On the plantations in the center of the district the highest cane ranges from 1300 to 1600 feet. While back of Hilo on the more gently sloping lands of ***Kaumana and Piihonua*** it runs up to 1800 and 2000 feet. The following table compiled from aneroid measurements, checked in part by known elevations, gives approximately the highest points on each plantation in the district. These points are, as well, the lower edge of the existing forest.

EVALUATIONS OF THE HIGHEST CANE FIELDS, HILO DISTRICT, HAWAII.

Plantation Name	*Approximate Elevation Feet*
Laupahoehoe	1800
Hakalau	1500
Honomu	1400
Pepeekeo	1600
Onomea	1500
Hilo Sugar Co—	
Fee lands	1500
Homestead lands	1800
Hawaiian Mill Company	2000 [page 279]

The elevation at which the highest cane now stands practically marks in each case the limit of profitable cultivation under present prices and conditions. Some of the managers expressed the opinion that with a higher price for sugar it would pay to go farther up, while others felt that the full limit had, for them, already been reached. Most of the managers, however, wanted a strip left above their present fields, on their fee lands, so that if later it were found advisable to extend the cane further *mauka*, there would be room to do so. Seventeen hundred and fifty feet was considered by all of them as being sufficiently high, and this elevation was agreed to by practically all as the best line for the permanent forest boundary.

The other main factor in the case is the demand for land for settlement and homestead purposes which will inevitably follow the development of the Island of Hawaii, through the building of the projected Kohala-Hilo Railroad and the improvement of Hilo harbor—both of which must eventually come. Indeed, because of its location and natural advantages, there are already applicants for all the land now available in the Hilo district.

As a basis on which to work in determining the location of the line, the report to Ex-Governor Dole, made by Mr. George Ross, consulting forester for the North Hilo district, was used. In this report, which embodied the concensus [sic] of opinion of the managers of the various plantations in the district, it is recommended that the lower boundary of the reserve be drawn approximately on the seventeen hundred and fifty foot contour line. In

this recommendation I am ready, on the whole, to concur, because I believe that a line so drawn would sufficiently protect the forest and safeguard the water supply of the district, while at the same time making available all the land which can reasonably be expected will be utilized within a considerable period of years.

RESERVE LINE RECOMMENDED.

In the absence of a good topographic map, it is difficult to discuss the location of this line except in a general way. For this reason the seventeen hundred and fifty foot contour has been adopted, although the line as actually laid out will vary more or less from it. At either end of the district, owing to the fact that the land has already been cleared, or partitioned off into homestead tracts, it will be necessary to go somewhat higher. When the time comes for running the line out on the ground it [page 280] should be drawn between prominent points—such as hills, junctions of ridges or ravines, pronounced angles in streams, etc.—and such points should be permanently marked.

Based upon the topographic data now in hand, I therefore recommend as the lower boundary of the proposed forest reserve in the Hilo district, the following line. *Starting at the **Laupahoehoe** homestead tract, and following the upper boundary of the same to its eastern mauka corner, thence across to, and along the upper boundary of the **Maulua** homestead tract, thence to the top of the **Kamaee** tract, thence across the lands of **Hakalau** and **Kaiwiki** to the upper line of the proposed **Honomu** homestead tracts, as recommended in my report upon that land; thence through the mauka corners of the lands of **Kawainui** and **Puumoi** to the upper corner of the land of **Kikala**, on the boundary of the Kaiwiki homesteads; thence from the eastern boundary of this tract, at about the same elevation, the line should cross to the **Awehi** stream, above the cane fields of the Hilo Sugar Company; and thence across the land of **Piihonua**, around the top of the existing cane, to the 1881 lava flow.*

Such a line would, I believe, meet the requirements of future growth and be above practically all the land best suited for agriculture.

Above seventeen hundred feet the land rises more steeply than at lower elevations and the soil is thinner. This fact combined with the greater rainfall and the consequently greater erosion makes these upper lands less desirable for agriculture. Furthermore, as many of the gulches split up at this elevation into ravines and gullies, the fields in themselves are smaller and less easily managed.

It is an axiom on Hawaii that success in the matter of homesteads is very largely a question of transportation. In a wet district like Hilo it is next to impossible to get the crop grown on the land to market without roads—unless like cane, it can be flumed. This is not the place to discuss the road question, nor whether homestead roads should be built by the government or by the settlers themselves. It is enough to say that even under the most favorable conditions, it will be a long time before there will be money enough to build roads to the higher elevations in the Hilo district, or before such roads can be considered as a paying investment. [page 281]

The foregoing observations apply, of course, only to the Government lands, but on the privately owned lands the line chosen has the advantage of allowing the plantations the leeway which many of them desire for possible future growth.

It is not the intention of this report to convey the idea that the land up to the proposed line should at once be cleared. On the contrary, the forest because of its beneficial influence, should be allowed to remain intact as long as possible, but if the time does come when the land is more needed for other purposes than for forest, it is believed that the forest

below the line may then be cleared without detriment to the best interests of all concerned.

If these recommendations be approved by the Board I recommend that the Governor be requested to set aside, as soon as practicable, all the government lands lying above the proposed line and extending up to an upper line, the location of which is to be determined in the near future.

I further recommend that the owners of private lands within this reserve be encouraged to turn them over to the Government under the terms of Act 44…
Ralph S. Hosmer,
Superintendent of Forestry.

HILO FOREST RESERVE.
The following resolution was adopted by the Commissioners of the Board of Agriculture and Forestry:

Resolved, That the Board of Agriculture and Forestry approves and recommends that all government and other lands in the district of Hilo, Island of Hawaii, lying above a line approximately 1750 feet above the sea, be set apart as a forestry reservation, subject to such change in detail of said location as is recommended by the Superintendent of Forestry in his report upon this subject, dated August 9, 1904, and on file in the records of the Board;

Resolved, That the Superintendent of Forestry be and he hereby is instructed and directed to secure as speedily as practicable a detailed description and map of the said boundary line of said forest reservation; in order that the same may be referred to the Governor for his approval in accordance with the terms of section 6 or Act 44 of the Session Laws of 1903… [HFA, 1904:282]

In October 1904, R. Hosmer, Superintendent of Forestry reported back to the Commissioners on the recommendations for the upper boundary of the Hilo Forest Reserve. As a part of the research, field visits through Humuʻula, Piʻihonua and other affected lands, and interviews with individuals knowledgeable about the landscape were conducted. Hosmers' report described the main plants of the forest, and lay of the land:

October 14th, 1904.
Committee on Forestry
…I have the honor to submit herewith a report, with recommendations, on the upper boundary of the proposed forest reserve in the Hilo District, Island of Hawaii.

During the last week of August *I made a careful examination of the upper edge of the forest from the 1881 lava flow to the Hamakua boundary, going over the ground in person and supplementing the information so gained by interviews with various persons familiar with the locality, and the conditions existing therein.*

In this connection I would acknowledge my obligation to the managers of the several plantations in the Hilo District, to Mr. A.B. Lobenstein of Hilo, and especially to Mr. W.H. Shipman, for information in regard to this question and for other assistance given me.

The general reasons which underlie the establishment of the Hilo Forest Reserve have already been discussed in my report on the lower boundary. In brief they are, that this reserve is needed to protect the water sheds of the streams throughout the district, on which the plantations, and to some extent the other industries, present and prospective,

along the coast, depend for their most satisfactory development. This protection can be best afforded by the setting apart of the belt of forest along the slope of ***Mauna Kea***, which receives the heavy rainfall, and in which the streams head. The object of the reserve is to prevent [page 313] excessive run-off, equalize the flow in the streams and protect the slopes against erosion.

It was pointed out in my former report that the trade winds bring in a bank of moisture-laden clouds, which pile up against the side of ***Mauna Kea*** between the elevations of approximately 2000 and 6000 feet. From the evidence available it appears that the precipitation is heaviest between the elevations of 3000 and 4500 feet, and that from the latter point up to an elevation of about 6500 feet there are only light rains and scattering showers. Higher than this on the slope and in the saddle between Mauna Loa and ***Mauna Kea***, the trade winds die out, much as they do in Kau, just beyond the Volcano House. The point is somewhere between ***Puu Oo and Kalaieha***—the latter place seldom having rain from trade wind clouds, while conversely, during the times of Kona winds, the rains that fall at ***Kalaieha*** do not reach ***Puu Oo***.

On the main slope of ***Mauna Kea***, above approximately the 6500 foot level, the rains are said to come principally with northerly winds. The storms are usually short ones, but precipitation is very heavy while it lasts, rapidly filling the ordinarily dry stream beds so that the fords become impassable. When the rain is over, however, the streams fall just as quickly, the water rushing down the mountain and swelling the volume of the permanent streams below. When more rainfall and stream-flow records come to be kept it will be interesting to see how much and for how long the lower parts of the streams are influenced by these sudden down pours far up on the mountain.

Under existing conditions little can be done to regulate the flow of the torrents resulting from the storms just described. The open *Mamane* (*Sophora chrysophylla*) forest now growing on the steep, upper slopes, has no appreciable effect on the run-off, while the establishment of a cover of vegetation sufficiently dense to make any material difference in the discharge of the streams is practically out of the question. The chief interest in water conservation thus centers in the lower forest.

The upper line of permanent running water in the streams seems to be near the upper edge of the belt of heavy precipitation, although the dense forest above must exercise a considerable influence in absorbing the light rains and helping to feed the springs from which the upper brooks come.

The dense forest now extends up to an elevation of a little [page 314] over 6000 feet. *Koa* (*Acacia koa*) and *Ohia Lehua* (*Metrosideros polymorpha*) are the predominating trees. With them are associated *Koolea* (*Myrsine lessertiana*), *Pilo* (*Coprosma cymosa*), *Olapa* (*Cheirodendron gaudichaudii*), *Naio* (*Myoporum sandwicense*), and some other trees of minor importance, and the dense mass of ferns, bracken, and other undergrowth characteristic of the Hawaiian forest.

Between the upper edge of the dense forest and the boundary of the land of ***Humuula*** *there is, on the lands from* ***Piihonua to Honohina****, a strip of land on which the forest has been wholly or in part destroyed, through fire, grazing, and insect injuries. While most of this damage has occurred in recent years, it is probable that the dense forest never extended much above the boundary of* ***Humuula****. At this point the Koa and Ohia are replaced by Mamane, which, forming an open stand, extends practically to the upper boundary of* ***Humuula****, and all along the slope of Mauna Kea.*

Beyond Honohina the dense forest of Ohia and Koa comes up to the ***Humuula*** *line. From here on to the Hamakua boundary, the proportion of Koa is larger and the forest is of greater potential commercial value.*

The lands within the limits of the proposed Hilo Forest Reserve, which extend through the forest, are from south to north as follows: ***Piihonua, Paukaa, Papaikou, Makahanaloa, Hakalau, Honohina, Piha, Maulua, Laupahoehoe, Waipunalei, and a part of Humuula****. Of these lands* ***Piihonua****, Piha,* ***Humuula*** *and* ***Laupahoehoe*** *are owned by the Government and are, with the exception of the last named, under lease for various terms.*

A portion of ***Laupahoehoe*** is under lease also, but a large part of the land bearing this name on the official maps is included in the tract known as Papaaloa Forest, which is still in the hands of the Government. The remaining lands in the list are owned in fee by plantations or individuals.

The upper part of ***Piihonua*** *is sublet to Mr. W.H. Shipman, the boundary being a line run across the land from the center of Reed's Island, in the 1855 lava flow. Mr. Shipman has just completed a fence across* ***Piihonua*** *somewhat over a mile mauka*[*] [page 315] *of his lower boundary. Hereafter all of his cattle will be kept above this line. The fence starts on the rough aa of the 1855 flow above* ***Halealoha****, runs north to the trail, then eastward to the opening in the woods about north of* ***Halealoha****, and thence in a fairly straight line across* ***Piihonua*** *to a point on the* ***Paukaa*** *boundary, two miles from the* ***Humuula*** *line. There are one or two jogs in the fence line which may later be eliminated, but this straightening would not materially alter the direction of the line.*

Through an arrangement with Brewer & Co., Mr. Shipman has continued the fence across the lands of ***Paukaa, Papaikou and Makahanaloa****, at a slightly higher elevation than that across* ***Piihonua****. The fence corners on these lands are one and one-half, instead of two miles makai of the* ***Humuula*** *boundary. The average elevation of the fence across these lands is little over 6000 feet. Its location is practically at the upper edge of the dense forest.*

Below the line of the fence is a considerable band of wild cattle, which has been estimated to consist of over 500 head. Formerly these cattle ranged all the way from ***Laupahoehoe*** *to the 1855 flow, but constant hunting at the northern end of the district has now driven the greater part towards* ***Piihonua****.* By the terms of his agreement with Brewer & Co., Mr. Shipman leases the land, builds and keeps in repair the fence, and agrees to exterminate the wild cattle in the forest below. This work is now going on with systematic driving and shooting, which will be continued as long as there are any wild cattle left.

If a similar arrangement could be made with Irwin and Company, Mr. Shipman would be glad to continue the fence across the lands of Hakalau and Honohina.

There exist division fences between ***Humuula*** *and the lower lying lands as far north as Hakalau. Beyond this the lands are unfenced and are open to cattle or sheep from above. As a matter of fact the sheep are not allowed to get far into the forest, because of the difficulty in herding them in the underbrush. Wild pigs abound in the forest. No estimate can be made of their number.*

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[*] The convenient Hawaiian terms *mauka*, signifying "inland," hence "toward the mountain," and *makai*, "toward the sea," represent the two leading directions throughout the Territory, and are in general use among all classes.

The fence erected by Mr. Shipman meets so many of the requirements of the upper boundary of the proposed Hilo Forest Reserve, that it seems to me wise to adopt it, from the 1855 flow to the land of Hakalau, and the line desired. From there on I recommend that the boundary follow the edge of the forest across Hakalau and Honohina. (This coincides with the location de- [page 316] sired by Mr. Shipman for the extension of his fence.) From the corner of Honohina, Piha and ***Humuula***, the reserve line should follow the lower boundary of ***Humuula***, as far as the north *mauka* corner of Waipunalei, thence across ***Humuula*** to a point on the Hilo-Hamakua boundary, to be determined later in connection with the Hamakua reserve.

My reasons for recommending this line are as follows: A belt of at least two miles of forest above the upper limit of the heavy rain belt and the head of the permanently running streams is thus reserved.

The line is far enough *mauka* to include practically all of the area subject to the showers and light rains occurring above the belt of heavy precipitation.

The reservation as recommended will, I believe, insure the objects for which it is made. While the forest could undoubtedly be extended further *mauka*, I think the land above the proposed line can be used for other purposes than forest, without detriment to the best interests of the reserve.

By adopting the line recommended, the question of fencing a considerable portion of the boundary is obviated. As the objects of the plantations in their agreement with Mr. Shipman are identical with those of the reserve, in so far as they relate to fencing and to the extermination of wild cattle, they can well be taken advantage of, by c*o-o*perating with the parties to the agreement.

There remains one more point to be considered; the southern boundary of the reserve. This seems to be naturally fixed by the lava flows of 1855 and 1881, beyond which to the south and east, the whole character of the country changes. But it is urged by some that there is agricultural land on ***Piihonua*** between the 1855 flow and the Wailuku river, which under certain conditions, could be opened to settlement without detriment to the reserve. This is a question for future study. At present the section is unexplored. *No trails penetrate the forest and its outer edge only is accessible.*

Should the projected road from Hilo, known as the "One County Road," be built, the area in question would be brought into touch with markets. If it were then found that land suitable for agriculture existed, and that it could be opened for settlement without endangering the sources of the ***Wailuku****, I should be in favor of so doing. But until there is a more definite prospect* [page 317] *of the road being built, I believe the land is better in a forest reserve. I therefore recommend that the southern boundary of the Hilo Forest Reserve be the lava flow of 1855.*

If the recommendations in this report are approved by the Board, I suggest that the Governor be requested to set aside, as soon as practicable, all the Government land not now under lease within the limits of the Hilo Forest Reserve. I further suggest that the Board make known its willingness to consider propositions looking to the turning over to the Government, under the terms of Act 44 of the Session of 1903, of privately owned lands within this reserve… [HFA, 1904:313-318]

The Board of Commissioners subsequently met, to further discuss the boundaries and elevational range of the forest lands, being considered as a part of the Hilo Forest Reserve. A.B. Loebenstein was authorized to survey the boundaries of the reserve. The Board focused on the upper boundary of the

reserve, with discussion as to whether or not Humu'ula—lands leased as a part of the Sheep Station Company—should be included in the reserve. Excerpts from the minutes of the meeting on November 23rd, 1904, provide the following documentation:

November 23, 1904
Discussion on the Upper Boundary of the Hilo Forest Reserve:
…Mr. Brown moved that Mr. Loebenstein place the lower line of the proposed Hilo Forest Reserve on the map, and furnish as close a description of such line as can, at the present time, be given. Motion seconded by Mr. Carter and carried…

…Mr. Hosmer said that there was one more point to be considered in regard to the Hilo Forest Reserve; that of getting a description made of the upper line. He said that Mr. Loebenstein had been requested to make a map and prepare a description of this line, and that he now has the matter under consideration. This map would be much smaller than that of the lower boundary.

Mr. Loebenstein suggested that the ***Kalaieha*** section be included in the map. He said that this could be put in from data now on file in his office and that it would be as well to include it.

*Mr. Thurston asked if **Kalaieha** was included in the reserve, to which the Superintendent of Forestry replied that the reserve does not touch Kalaieha. The upper line (pointing to the map) and Kalaieha are several miles apart.*

Mr. Thurston asked if ***Piihonua*** runs over as far as ***Kalaieha***, to which Mr. Brown replied that it does, adjoining the land of ***Waiakea***.

Mr. Loebenstein stated that Waiakea was on the Mauna Loa side.

Mr. Loebenstein said that he would like to give the Board a map which would be complete in every detail.

Mr. Thurston asked the name of the forest that is below and near ***Kalaieha***, to which Mr. Hosmer replied that it is the upper extension of the ***Waiakea*** forest.

Mr. Loebenstein stated that he did not know just how far up the forest extended, but would like to have the map show some of the ***Mauna Kea*** slope. *He suggested an elevation of about 8000 feet, as the vegetation extends up to about that point.*

*Mr. Hosmer said that this line would take in practically all of the existing in forest, as the Mamani does not go much above the upper **Humuula** boundary. The upper **Humuula** boundary above **Papaikou** and **Hakalau** (Pointing to the Government map) is about 9500 feet. The contour lines are approximately correct.*

*Mr. Hosmer said that there is a section above the present Mamani forest which he thought might profitably be planted with spruces and pines, between the elevations of 8000 and 10,000 feet. This area is practically all on the land of **Kaohe**. Most of the land hereabout is good grazing land.*

Mr. Hosmer said that he thought that the only government land which is not now under lease within the limits of the proposed reserve, is the upper section of ***Laupahoehoe***. The names are somewhat uncertain but on the list of leases which Mr. Pratt has made up this section is known as ***Papaaloa*** Forest. This is the only land which the Board can ask the Governor to set aside. Asked if he was referring to the lower line, replied to both lines. Mr.

Thurston said that the Governor could set aside other than government lands by the consent of the owners.

Mr. Hosmer said that the upper line was concerned in the Papaaloa Forest.

Mr. Loebenstein was asked when he could furnish a map and description of the upper line, to which he replied that he could not have it ready before the beginning of January.

Mr. Hosmer asked Mr. Loebenstein if he could furnish a general description of the upper line, to be followed later by an exact description, to which Mr. Loebenstein replied that a general description could be given.

Mr. Thurston stated that the two propositions could be acted upon entirely independently, one of the other.

Mr. Carter asked how reserves were going to be set apart, before the boundary lines were determined upon.

Mr. Brown also said that the reserves could not be set aside until an upper line is made. Then all the land located within the reserve can be set apart.

Mr. Loebenstein said that there are very few government lands remaining unleased.

Mr. Giffard said that private owners could not make any propositions until the boundaries are fixed he also said he did not think this matter could be placed before the Governor until both of the boundaries could be given him.

Mr. Carter said that the Board could not deal with private owners until a line had been fixed.

Mr. Hosmer said that the boundary on the north side is the Hamakua District line and on the south side the 1855 lava flow.

Mr. Brown asked if it was the intention of the Board to make the land of ***Humuula*** *a forest reserve, to which Mr. Hosmer replied in the negative.*

Mr. Holloway asked what the objections were of following the lower line of ***Humuula*** *to which Mr. Hosmer replied that there is a strip of land here which could be used for grazing without detriment to the forest below. There is a sufficient extent of forest reserve below to safe guard all the streams. The upper land is good for grazing. Further north the dense forest comes up much closer to the* ***Humuula*** *line, and there is also a great deal of Koa timber which the Government should reserve, and later utilize.*

Mr. Thurston stated that it seemed that the Board was not in a position to make recommendation to the Governor until the upper line was fixed, and shown on the map. He asked Mr. Loebenstein how long it would take to make such a map and prepare a description.

Mr. Loebenstein replied that he would prefer to return to Hilo and prepare a map and description in his own office. By so doing he could furnish information that would stand any reasonable test. He thought that he could give this to the Board about the end of the year.

The president then called for any other forestry matters which were to be presented… [HSA, Com 2-8, Minutes]

Land and Resources of Ka‘ohe IV and Mauna Kea Described (1905)

Further deliberations by the Board of Commissioners pertaining to the mountain lands of Mauna Kea and Mauna Loa occurred. In 1905, the Hawaiian Forester and Agriculturalist published the proceedings of meetings conducted in late 1904. The deliberations set the foundation for the removal of the upper regions of Mauna Kea—the lands of Ka‘ohe and Humu‘ula—from leases to ranchers:

> ***New Points in The Forest Policy of the Territory.***
> The adoption by the Board of Commissioners of Agriculture and Forestry of the following four reports establishes certain points in its forest policy. As the action taken on the recommendations of the Superintendent of Forestry in these reports will probably serve as precedents in other cases where the conditions are similar and as the points involved are of general interest, the reports are given in full.
>
> The report on the land of ***Kaohe 4, Hamakua***, Hawaii, brings out the position of the Board on the question of the disposition of the so-called “waste land” above the area of good grazing country on the higher mountains in the Territory. The Board believes that land of this character should not be included with the better land as has been the custom in the past, but that it should be retained by the Government against such time as it may be utilized for some now unforeseen industry, or until it can be planted with forest trees from the temperate zone… [HFA, 1905:124]

During the meeting of December 3rd, 1904, R.S. Hosmer presented a detailed report on the Ka‘ohe IV Tract, covering Pōhakuloa and vicinity. The communication was considered as a part of the Hilo Forest Reserve proceedings, though not included, though later, in 1909, a portion of the parcel was incorporated into the Mauna Kea Forest Reserve. The communication includes several important references to the nature and uses of the land, the make up of the forest, and development of the springs (though not named) at Houpo Kāne (Hopukani) and Waihū. Hosmer wrote:

> …I beg to hand you herewith a written statement of my opinion in regard to that portion of the land of ***Kaohe***, Hawaii, which come under discussion at the meeting of the Board on Wednesday last.
>
> What is said below refers only to that part of the great land of ***Kaohe***, known as ***Kaohe*** 4, which lies on the southwest side of ***Mauna Kea***, above the lava flows of 1843 and of ***Keamuku***, and between the lands of ***Humuula***, on the east, and ***Waikaloa*** and ***Kaohe 3*** on the west. The remainder of ***Kaohe*** will be reported upon later.
>
> *The section in question is now used by the **Humuula** Sheep Station as grazing land for stock other than sheep. The eastern part is fenced in and used as a horse paddock. The lease on the land runs out in about two years.*
>
> Applications have been received for the lease of the land above described, up to a *mauka* line drawn at about the 7500 foot contour, as shown on the government map of Hawaii; or to be more exact, between the bases of puus (Unnamed on the map) near the intersections of the 7500 foot contour line, as shown, with respectively, the ***Humuula*** *line and a straight line drawn from the base of **Puu ka Pele** to the summit of **Mauna Kea*** – the latter being the boundary between ***Kaohe 3 and 4***.
>
> *The land in question is essentially grazing land. It is said by those who know the section, to be much better adapted for cattle and horses than for sheep. Springs on the slope above yield a* [page 125] *rather limited supply of water which is piped down to troughs near the road. With the lease of the grazing land goes the right to further develop this water.*

Over a considerable part of the land, especially on that mauka of the road, there is a fairly dense growth of Mamani (Sophra chrysophylla). Making a practically pure stand, which extends up the mountain to above the point when the good grasses are no longer found.

On the trip around ***Mauna Kea***, made last winter in company with Governor Carter, I crossed *Koa*. During the summer I again had an opportunity to see something of the tract from hills on adjoining lands, so that while I have not gone over the area in detail, I have a good general idea of the conditions thereon.

In common with a belt on the eastern slope of ***Mauna Kea***, Above the level of the *Koa* and *Ohia* forest, this part of ***Kaohe*** is primarily valuable for grazing. Although there is a considerable stand of *Mamani* on ***Kaohe*** 4, this in itself does not make it necessary that the land be set apart as a forest reserve. On the contrary, on this particular land, the value of the *Mamani* lies, to my mind, chiefly in the fact that it increases the worth of the land for grazing.

My reasons for this are:

(1) The main use of the Mamani forest at this elevation, on the leeward side of Mauna Kea, is from its being a source of posts and fuel and because it affords protection for stock, on a dry and exposed range. This value is sufficiently great to cause any intelligent stockman to take a lively interest in perpetuating the forest.

(2) The porous nature of this soil on this slope of ***Mauna Kea*** makes running streams out of the question. There is, therefore, no call for a protection forest.

(3) Unless land on which the *Mamani* grows is subjected to heavy over-stocking with cattle, the trees appear not to be affected, nor is the reproduction seriously interfered with. With sheep the damage is greater. On the land in question the limited water supply practically insures against over-stocking. If therefore, only cattle and horses are grazed there is little to fear for the *Mamani*. And, as has been stated above, the land is said not to be suited for sheep grazing.

The possible influence on precipitation of the *Mamani* [page 126] forest on this land may, I think, be neglected, especially as the existing cover is not likely to be much altered.

Higher up on the slope of ***Mauna Kea***, above the existing forest and far above any good grazing land is a region which is now of no real value to any one, but which I believe could some time be profitably plated with pines, spruces, firs, or other temperate zone timber trees. Before such work is undertaken many experiments as to kinds of trees and as to methods, must be tried, so that it will be some time before any extensive planting could be done. But this high lying land both on ***Mauna Kea*** and on Mauna Loa should, I think, be held out from all new leases, as waste land. And if, in later years, it is found that it can be made to grow forests, it should then be so used. To exclude land of this sort will work no hardship on any one now and it may, later, be of distinct advantage to the government.

In keeping with the general forest policy of the administration and in view of the possible future use of the upper slopes for forest, I advise that a fencing clause be inserted in the lease of ***Kaohe*** 4, providing that a fence be built and maintained across the *mauka* portion of the area leased. I further suggest that it be stipulated that this fence be completed within five years from the date of the lease. As the lessee would in any event probably fence on or below his *mauka* boundary, such a clause could not be considered a hardship.

In view of the above, I recommend that the Committee report favorably to the Board on the question of leasing for grazing the part of ***Kaohe*** 4 desired, with the suggestion that a fencing clause be included… [HFA 1905:127]

Proclamation of the Hilo Forest Reserve (1905)

On July 24th, 1905, Acting Governor A.L. Atkinson issued the proclamation establishing the Hilo Forest Reserve. The description of the lands and notes of survey are given below:

THE HILO FOREST RESERVE.

It is with a feeling of no small satisfaction that we are able this month to chronicle the creation of the Hilo Forest Reserve on the Island of Hawaii.

Based upon reports and recommendations made by the Superintendent of Forestry and approved by the Committee on Forestry,* the Board of Commissioners of Agriculture and Forestry, at a meeting held on June 30, 1905, unanimously adopted the following resolution:

"RESOLVED, that the Forest Reserve in the Hilo District, lying between the 1881 Lava Flow, back of Hilo Town, and the Hamakua District line, in the Hilo District, Island of Hawaii, as recommended by the Committee on Forestry, based upon the reports of the Superintendent of Forestry, dated August 9th, 1904, October 14th, 1904, and June 28th, 1905, and on maps and a description of the boundary prepared by Mr. A.B. Loebenstein and by the Survey Office, now on file in the office of this Board, a copy of which description is hereto attached and forms a part of this resolution, be approved.

RESOLVED, that the Board recommends to the Governor that the Government lands within the boundaries of the Proposed Forest Reserve, be set apart by him after the hearing required by Law. [page 181]

RESOLVED FURTHER, that the Board recommends to the Governor, that all the land within the said described boundaries be set apart as a Forest Reserve, subject to all private rights and titles, and that all owners of private lands lying within said boundaries be requested to co-operate with the Board of Agriculture and Forestry in reserving all of said lands for forestry purposes, in accordance with the terms of Chapter 28 of the Revised Laws of Hawaii."

On July 19, Acting Governor Atkinson and the Board of Commissioners of Agriculture and Forestry held the Public Hearing required by Law. No opposition to the Reserve developing, Acting Governor Atkinson declared the Hilo Forest Reserve to be created, and on July 24th, signed the formal proclamation, describing the boundaries and setting apart the unleased Government lands lying within them. *The total area of the Reserve is 110,000 acres, more or less; the Government lands actually set apart 12,771 acres, more or less.* The proclamation issued by Acting Governor Atkinson will appear in the August issue of the Forester.

It may perhaps be well to explain the relation of the lands set apart to the remainder of the area embraced within the limits of the Reserve. By officially recognizing the larger area the Governor and the Board of Agriculture and Forestry go on record as to the section which they believe it is to the advantage of the Territory to devote to forest purposes. The Government then shows its good faith by setting apart the unleased Government lands lying within the limits of the Reserve and requests private owners to follow its example

* These reports appeared in the October and November (1904) issues of the Forester, Vol. 1, pp. 275 to 282 and 313 to 318.

and co-operate under the Law to carry out the plan and secure the objects for which the Reserve is made.

In the case of the Hilo Forest Reserve, from one-third to one-half of the land within the boundaries is owned by private individuals or corporations. The remainder is Government land, for the most part lease. *The Government sets aside at this time the two Government lands not now under lease, viz: the mauka portion of* ***Honomu****, 926 acres, more or less, and the section above* ***Laupahoehoe****, known as the Papaaloa Forest, 11,845 acres, more or less.* As the leases on other Government lands run out the Board of Agriculture and Forestry will recommend that the portions within the Reserve be also set apart. [page 182]

Except as the owners of private land or the lessees of Government land c*o-o*perate with the Board of Agriculture and Forestry as provided by Law, the Government can exercise no authority over the other lands within the Reserve boundary.

But, as the Reserve is established primarily to maintain favorable conditions of water-shed protection on which the plantations and the other large owners so much depend, it is clearly in the interest of these corporations to c*o-o*perate with the Government by setting apart the lands belonging to them until all of the area within the boundaries of the Reserve is devoted to the purposes of forestry.

As an example of the interest of the private owners within its boundaries in the creation of the Hilo Forest Reserve, the action of the Bishop Estate is significant. At the Public Hearing Mr. F.S. Dodge, Superintendent of the Bishop Estate, stated that the Estate was heartily in favor of the Reserve and proposed to c*o-o*perate with the Government in making it effective. The Estate has for some years maintained certain of its lands in the Hilo District as Forest Reserve, both within and extending *makai* of the boundaries adopted. It is expected that other large interests will follow the lead of the Bishop Estate. [page 183]

BY AUTHORITY.
PROCLAMATION OF FOREST RESERVE, HILO DISTRICT, ISLAND OF HAWAII.
Under and by virtue of the authority vested in me by the provisions of Chapter 28 of the Revised Laws of the Territory of Hawaii, enacted April 25, 1903, and amended by Act 65 of the Session Laws of the Legislature of 1905, and of every other power me hereunto enabling, I, A.L. C. ATKINSON, Acting Governor of the Territory of Hawaii, having duly given the notice and held the hearing as in said Acts provided, *do hereby approve as a Forest Reserve the lands lying between the 1881 Lava Flow back of Hilo Town and the Hilo-Hamakua District line, and between a line drawn approximately parallel to the coast (having an elevation of about 1750 ft. at the South end and an elevation of about 2000 ft. at the North end) and a line approximately along the top of the woods, in the District of Hilo, Island of Hawaii*, Territory of Hawaii, more particularly described as follows, viz:

LOWER LINE.
"Beginning at a point on the extreme lower end of the ***Laumaia*** Branch of the Lava Flow of 1881, this point being on the boundary line between the lands of Punahoa 1st and 2nd. Its c*o-o*rdinates referred to the Halai Survey Reference Station, being 8669 feet South, 24,934 feet West, the boundary runs by the true meridian:

1. N. one degree 41 minutes E. 4555 ft. crossing the various subdivisions of the land of ***Punahoa*** and to a point on the boundary line of Punahoa and with the land of ***Piihonua*** (Government), the c*o-o*rdinates of the said point referred to the Halai Survey Reference Station, being 4432 ft. South, 24,809 ft. West; thence crossing the land of ***Piihonua***;

2. N. 21 degrees 32 minutes E. 4247 ft. to junction of the ***Hookelekele Stream*** with a branch from the North, the c*o-o*rdinates referred to the Halai Survey Reference Station, being 480 ft. South, 23,250 ft. W.; thence following up the middle of said branch which forms the present South boundary of the Hawaii Mill Company's Plantation to the South-west angle of the same, the direct bearing and distance to said point being;

3. N. 62 degrees 9 minutes W. 6165 ft., the c*o-o*rdinates referred to the Halai Survey Reference Station, being 2400 ft. North, 28,700 ft. West, thence across the lands of ***Piihonua and Waiau*** (Government);

4. N. 27 degrees 47 minutes E. 8538 ft. to a point in the ***Awehi Stream***, the c*o-o*rdinates referred to the Halai Survey Reference Station, being 9950 ft. North, 24,720 ft. West, thence down the middle of the *Awehi, also called the* ***Waiau*** *Stream*, to the junction of same with the ***Alae Stream***, the direct bearing and distance being;

5. S. 59 degrees 08 minutes E. 5964 ft., the c*o-o*rdinates referred to the Halai Survey Reference Station, being 6890 ft. North, 19,600 ft. West, thence across the lands of Pueo [***Puueo***] (Hilo Sugar Co.), ***Kalalau and Alae*** (Estate B. Pauahi Bishop). [page 245]

6. N. 4 degrees 36 minutes E. 6545 ft. to the Southwest angle of ***Kawaiki*** Homestead, Lot No. 40, at the junction of the ***Maili and Pahoa Streams***, the c*o-o*rdinates referred to the Halai Survey Reference Station, being 13,405 ft. North, 19,075 ft. West, thence following up the middle of the Maili Stream and gulley forming the South boundary of the Kaiwiki Homestead Tract, the direct bearing and distance being;

7. N. 81 degree 10 minutes W. 18,130 ft. to the Southwest angle of Kaiwiki Homestead, Lot No. 73, the c*o-o*rdinates referred to the Halai Survey Reference Station, being 16,189 ft. West, thence along West boundary of Kaiwiki Homestead, Lot No. 73;

8. N. 5 degrees 58 minutes W. 2168 ft. to Northwest angle of Kaiwiki Homestead, lot No. 73, at a point on the South *Pali* of the ***Honolii Stream*** *called* ***Waikee*** the c*o-o*rdinates referred to the Halai Survey Reference Station, being 18,345 ft. North, 37,226 ft. West, thence along North line of Kaiwiki Homestead Tract to the Northeast angle of Kaiwiki Homestead Lot No. 51, the direct bearing and distance being;

9. S. 34 degrees 10 minutes E 15,166 ft. to said Northeast angle the c*o-o*rdinates being referred to the Halai Survey Reference Station being 16,768 ft. North, 22,125 ft. West, thence across the land of ***Kikala*** (Estate B.P. Bishop).

10. N. 18 degrees 58 minutes E. 986 ft. to junction of the ***Honolii*** and the ***Pohakupaa*** Streams, thence across the land of ***Paukaa*** (Onomea Sugar Company);

11. N. 1 degree 10 minutes 30 seconds 3145 ft. to a point on the boundary line between ***Paukaa and Pahoehoe*** (Estate B.P. Bishop), thence across the land of *Pahoehoe*;

12. N. 1 degree 10 minutes 30 seconds 3605 ft. to a point in the middle of the *Pahoehoe* stream the c*o-o*rdinates referred to the Halai Survey Reference Station being 24,460 ft. North, 21,671 ft. West, thence to and across the land of ***Papaikou*** (Onomea Sugar Co).

13. N. 2 degrees 29 minutes E. 6615 ft. to a point in the ***Alakahi Stream*** marking the West angle of the land of ***Puumoi*** (Onomea Sugar Co), this point being distant

1964 ft., bearing South 86 degrees 43 minutes E (True) from an x cut in the rock at the Waiemi Falls, the c*o-o*rdinates referred to the ***Kauku*** Survey Reference Station being 11,271 ft. North, 1080 ft. West, thence across the lands of Alakahi, ***Mokuoneki*** and ***Kahalii*** (Onomea Sugar Co.);

14. North 4491 ft. to a point on the boundary of ***Kahalii*** and ***Onomea*** (Onomea Sugar Co.) the c*o-o*rdinates referred to the Kauku Survey Reference Station being 6780 ft. South, 1085 ft. West, thence across the land of Onomea.

15. N. 14 degrees 23 minutes W. 3251 ft. to head of the land of ***Kawainui*** (Government) the c*o-o*rdinates referred to the Kauku Survey Reference Station, 3632 ft. South, 1893 ft. West, thence across the land of ***Makahanaloa*** (Pepeekeo Sugar Co.) to and along the upper limits of the ***Honomu*** Homestead Lots as shown on Government Survey Registered Map No. 2296 to the South *Pali* of ***Kolekole Stream*** and up said *Pali* to a point, the co-ordinates of which referred to the Kauku Trig. Station [page 246] are 5250 ft. North and 5000 ft. West, the direct bearing and distance between the initial and final points, being N. 19 degrees 17 minutes W. 9409 ft, thence across the lands of ***Kaiwiki*** and ***Hakalauiki*** (Government), ***Hakalaunui*** (Hakalau Sugar Co.) ***Kamaee*** (Government), ***Umauma*** (Estate B.P. Bishop), ***Opea*** (Government), ***Honohina*** (Liliuokalani) and ***Nanue*** (Hakalau Sugar Co.);

16. N. 22 degrees 14 minutes W. 22,361 ft. to the South angle of the ***Kahuku*** Homestead Lot No. 16 the co-ordinates referred to the ***Puuohai*** Survey Reference Station being 13,710 ft. South, 1884 ft. West, thence across the land of ***Piha*** (Government);

17. N. 58 degrees 19 minutes W. 1519 ft to a point in the ***Waikaumalu Stream*** the c*o-o*rdinates referred to the ***Puuohai*** Survey Reference Station being 12,912 ft. South, 3177 ft. West, thence up the Waikaumalu Stream which forms the East boundary of the ***Maulua*** Gehr Settlement Association Tract to the Southeast angle of Lot No. 67 of said Tract, the direct bearing and distance being;

18. S. 67 degrees 58 minutes W. 10,260 ft. to aforesaid point, the c*o-o*rdinates referred to the Puuohai Survey Reference Station being 16,761 ft. South, 12,687 ft. West, thence along top of Gehr Settlement Association Lots No. 67, 68, 69 and 70;

19. N. 34 degrees 55 minutes W. 2233 ft to Southwest angle of Lot No. 70 the c*o-o*rdinates referred to the Puuohai Survey Reference Station being 14,931 ft. South, 13,965 ft. West, thence along the boundary of ***Mauluanui*** (Mrs. Robertson);

20. N. 37 degrees 37 minutes E. 5852 ft. to a natural divide or fork in the ***Pohakupuka Stream*** called ***Kepaniwai*** the c*o-o*rdinates referred to the Puuohai Survey Reference Station being 10,306 ft. South, 10,403 ft. West, thence along the boundary of Maulua and Gehr Settlement Association Lots.

21. N. 2 degrees 20 minutes W. 3062 ft. to a point in the Makaliiloa Stream 150 ft. above the ***Hauwanawana Falls***, the c*o-o*rdinates referred to the Puuohai Survey Reference Station being 6347 ft. South, 10,564 ft. West, thence across ***Maulua***;

22. N. 29 degrees 14 minutes W. 4632 ft. to a point on boundary of ***Mauluanui*** and ***Weloka*** (Government), this point being distant 700 ft. and bearing South 39 degrees 16 minutes West (True) from an *Ohia* tree marked

L

at edge of old water ditch, the c*o-o*rdinates referred to the Puuohai Survey Reference Station being 2306 ft. South, 12,826 ft. West, thence across the lands of Weloka, ***Keaalau***, and ***Kapehu*** (Government);

23. N. 64 degrees 35 minutes W. 3371 ft. to Southeast angle of ***Laupahoehoe*** Homestead, Lot No. 39, the c*o-o*rdinates referred to the Papaloa Survey Reference Station being 10,155 ft. South, 2480 ft. West, thence along South line of ***Laupahoehoe*** Homestead Tract; [page 247]

24. N. 61 degrees 25 minutes W. 11,631 ft. to Southwest angle of ***Laupahoehoe*** Homestead, Lot No. 7, the c*o-o*rdinates referred to the Papaloa Survey Reference Station being 4413 ft. South, 13,019 ft. West, thence across the lands of ***Puualaea, Kiilau and Laupahoehoe 1st and 2nd*** (Government);

25. N. 58 degrees 00 minutes W. 5097 ft. to a point on the boundary of ***Waipunalei*** (S. Parker), the c*o-o*rdinates referred to the Papaloa Survey Reference Station, being 1712 ft. South, 17,335 ft. West, thence across the land of Waipunalei.

26. N. 86 degrees 16 minutes W. 1997 ft. to the Southeast angle of Section 13 ***Kahooahuna***, the c*o-o*rdinates referred to the Papaloa Survey Reference Station being 1582 ft. South, 19,331 ft. West, thence across top of Section 13 Kahooahuna to point in middle of ***Mauiana*** gulch on boundary of Humuula;

27. N. 46 degrees 24 minutes W. 1786 ft. to the Southwest angle of Section 13, thence down middle of the ***Mauiana gulch*** and boundary of ***Humuula*** (Government);

28. N. 27 degrees 25 minutes E. 2986 ft. to a point in the ***Mauiana*** gulch, the c*o-o*rdinates referred to the Humuula Survey Reference Station, being 8777 ft. South, 2470 ft. West, thence across the lands of ***Humuula and Ookala***.

29. N. 61 degrees 35 minutes W. 4661 ft. to a pool at foot of Falls in the ***Kaula gulch*** called ***Paeoopu***, said point forming the Southwest angle of the land of ***Ookala*** and on the boundary between the Hilo and the Hamakua Districts, the c*o-o*rdinates referred to the ***Humuula*** Survey Reference Station being 6559 ft. South, 6507 ft. West, *thence up along said boundary between the Hilo and Hamakua Districts to an* ***X*** *cut in the rock ledge near the middle of the Kaula gulch at the old* ***Keanakolu-Waimea trail*** *crossing, the said gulch* at this point being the boundary of the Hilo and Hamakua Districts, the c*o-o*rdinates of the said point being North 13,204.9 ft., East 3,301.4 ft., referred to the "***Puukalepa***" Terr. Survey Station.

UPPER LINE.

30. Beginning again at the initial point the boundary runs in a general westerly direction up and along the northern edge of the various lava flows to the point described in Bd. Cert. No. 53, **Piihonua**, as **Mawae**, the mark being a large monument of stones erected on the top of bank of the main *Aa* lava channel of the 1855 Lava Flow, situated a little above the bend of the trail over the lava, where it leaves the *Pahoehoe* crossing the *Aa* channel, and about 700 ft. South of the entrance of the trail into the **Halealoha** opening the co-ordinates being South 40,908 ft., East 6350.0 ft. referred to the "Aahuwela" Survey Reference Station, thence by true azimuths.

31. 195 degrees 42 minutes 40,366 across the land of ***Piihonua*** (Territory of Hawaii) to a point on the South boundary line of ***Paukaa*** (Onomea Sugar Co.), the c*o-o*rdinates being South 2040 ft., East 17,273.2 ft. referred to the "Aahuwela" Survey Reference Station. [page 248]

32. 215 degrees 55 minutes 30 seconds 3436.7 ft. across the land of ***Paukaa***, to a point of the South boundary of ***Papaikou*** (Onomea Sugar Co.), the c*o-o*rdinates being North 742.2 ft., East 19,289.7 ft. referred to the "Aahuwela" Terr. Survey Station.

33. 178 degrees 03 minutes 43 seconds 4791.0 ft. across the land of Papaikou to a point on the South boundary of ***Makahanaloa*** (Onomea Sugar Co), the c*o-o*rdinates being North 5983.3 ft., East, 19,135.0 ft. referred to the "Aahuwela" Terr. Survey Station.

34. 168 degrees 01 minutes 55 seconds 4783 ft. across the land of ***Makahanaloa*** to a point on the South boundary of ***Hakalaunui*** (Hakalau Sugar Co.), the c*o-o*rdinates being 250.7 ft. South, 7278.2 ft. East referred to the "***Kaloaloa***" Terr, Survey Station;

35. 179 degrees 26 minutes 56 seconds 9294.0 ft. across the land of Hakalau to a point on the South boundary of ***Honohina*** (Liliuokalani), the c*o-o*rdinates being North 9032.3 ft., East 7188.8 ft. referred to the "Kaloaloa" Terr. Survey Station;

36. 114 degrees 09 minutes 02 second 8695.7 ft. across the land of Honohina to Northwest angle of same, a *Koa* tree blazed ***H*** (old mark) re-marked

    L

    standing on the north bank of the Nahui [***Nauhī***] gully, about 50 ft. East or *makai* of the ***Hopuwai-Keanakolu trail*** *where it leaves the gully*, the c*o-o*rdinates being North 12,590.4 ft., West 745.5 ft., referred to the "***Kaloaloa***" Terr. Survey Station;

37. 183 degrees 19 minutes 4580 ft. along West or *mauka* line of ***Piha*** (Territory of Hawaii) bordering ***Humuula*** (Territory of Hawaii) to Northwest angle of Piha, *at a point on the* ***Hopuwai-Keanakolu trail*** *where it leaves the brush and enters an open flat covered with black sand, in the middle of which has been erected a large mound of stones, called* ***Kahuwai***, the c*o-o*rdinates of the aforesaid Northwest angle of Piha being South 7867.3 ft., East 10,415.5 ft. referred to the "***Puukalepa***" Terr. Survey Station;

38. 109 degrees 23 minutes 6208 ft. along West or *mauka* line of ***Mauluanui*** (Mrs. Sara Robertson) bordering the land of ***Humuula*** to Northwest angle of ***Maulua Nui*** at a *Koa* tree

    L

    surrounded by a mound of stones, a little East of *the* ***Hopuwai-Keanakolu trail****, and at bend of the same into the* ***Kaiaki gully***, the c*o-o*rdinates [page 249] being South 1765.3 ft., East 9271.5 ft. referred to the "***Puukalepa***" Terr. Survey Station.

39. 172 degrees 02 minutes 12 seconds 4125 ft. along West or *mauka* boundary of ***Laupahoehoe*** (Territory of Hawaii) bordering the land of ***Humuula***, to the Northwest angle of ***Laupahoehoe*** at the crossing of *the* ***Hopuwai-Keanakolu trail****, over the "****Keahuaai****" or "Douglas Pits" gully*, the c*o-o*rdinates being North 2320.0 ft., East 3700.0 ft. referred to the "***Puukalepa***" Terr. Survey Station.

40. 229 degrees 55 minutes 4638 ft. along the North boundary of ***Laupahoehoe*** bordering Humuula to a *mound of stones by a Koa tree marked "Poloka" at West brink or edge of a pool of water called "****Kalaukahoi****"* [Kulanihakoi] this forming the Southwest angle of the land of ***Waipunalei*** (Samuel Parker), the co-ordinates being North 5306.4 ft., East 12,248.6 ft., referred to the "Puu Kalepa" Terr. Survey Station.

41. 163 degrees 03 minutes 03 seconds 4502.0 ft. along West or *mauka* line of ***Waipunalei*** bordering ***Humuula*** to Northwest angle of Waipunalei at a point in the middle between three *Koa* trees marked ***H***, ***X*** and ***W*** respectively, re-marked.

L

distant 1241 ft., bearing 282 degrees 00 minutes from the post set as a Survey Reference Station on the top of the ***Lahohinu Puu***, the co-ordinates being North 9613.4 ft., East 10,936.0 ft. referred to the "***Puu Kalepa***" Terr. Survey Station;

42. 142 degrees 57 minutes 45 seconds 4374.0 ft. across the land of ***Humuula*** to an ***X*** cut in the rock ledge near the middle of the ***Kaula gulch*** *at the old "****Keanakolu-Waimea" trail*** *crossing*, the said gulch at this point, being the boundary of the Hilo and Hamakua Districts, the c*o-o*rdinates of the said point being North 13,204.9 ft., East 3301.4 ft. referred to the "***Puu Kalepa***" Terr. Survey Station.

Total area 110,000 acres, more or less.

And I do hereby set apart as a Forest Reserve those portions of the Government lands known as the *Ahupuaa* of ***Honomu*** and ***Papaaloa*** Forest section (embracing the Government lands between ***Maulua*** and Waipunalei), lying within the said metes and bounds… [HFA, 1905:250]

Leasehold Interests Modified on the Lands of Ka'ohe and Mauna Kea (1906-1908)

The Commissioners again visited the discussion on the lands of Ka'ohe, in the Hāmākua District, including the summit region of Mauna Kea, thus, the lands lying along the *mauka* boundary of Humu'ula, in 1906 and 1907. The following reports describing the lands, their usage, and resources was published in the Hawaiian Forester and Agriculturalist of 1907:

GOVERNMENT WASTE LAND.

At a meeting of the Board of Agriculture and Forestry, held on December 21, 1906, there was passed a resolution, based on reports submitted by the Superintendent for Forestry and by the Committee on Forestry, that further defines the policy of the Board in regard to the disposition of waste land belonging to the Territorial Government.

Another report on the land of ***Kaohe***, similar in tenor and purport to those given below, was approved by the Board in December, 1904, and appeared in this magazine in the issue of May, 1905, Vol. II, pp. 124-127.

Following are the resolution and reports first mentioned:

RESOLUTION IN REGARD TO THE LAND OF KAOHE, HAMAKUA, HAWAII.

(Adopted by the Board of Agriculture and Forestry on December 21, 1906.)

Resolved, that the Board of Commissioners of Agriculture and Forestry approves the recommendation of the Committee on Forestry in regard to the retention by the Government from sale or lease of the mauka part of the land of ***Kaohe****, District of Hamakua, Island of Hawaii, contained in a report dated Nov. 1st, 1906, based on a report of the Superintendent of Forestry dated Oct. 13th, 1906.*

Resolved, that the Board recommends to the Governor that the portion of ***Kaohe*** lying above a line roughly described as beginning on the boundary between ***Kaohe 4 and 5*** at the end of the *mauka* fence required to be built across ***Kaohe 4*** by a lease sold to Mr. A.M. Brown in December, 1904, and running in a general northwesterly direction, *mauka*

of ***Puu Ahumoa to Puu Laau***, thence northeasterly along the *mauka* boundary of ***Paauhau*** to ***Puu Kemole***, thence *mauka* of ***Puu Kaluamakani*** to a point on the division line between ***Kaohe 3*** and ***Kaohe 5***, thence along said division line to the northwest end of the existing fence across ***Kaohe*** 5, built by the ***Kukaiau*** Plantation Company, thence in a general southeasterly direction across ***Kaohe 5***, following said fence, to the ***Humuula*** boundary, thence following said ***Humuula*** boundary to the south and west around ***Mauna Kea*** to the southeast line of ***Kaohe 4***, thence across ***Kaohe*** 4, following the above described fence to the point of beginning, and also the portion of the land of ***Kaohe*** that lies above the ***Keamuku and the 1843 lava*** flows on the north slope of ***Mauna Loa***, be for the present reserved by the Government from sale or lease and retained by the Land Office as waste land. [HFA, 1907:429]

REPORT OF THE COMMITTEE ON FORESTRY.
Nov. 1, 1906…

…Your Committee has had under consideration the report of the Superintendent of Forestry, dated Oct. 13th, 1906, concerning the land of ***Kaohe***, District of Hamakua, Island of Hawaii.

The upper portion of the said land should, in the judgment of your Committee, be classed as waste land, being unsuited for any economic use now known.

But in order that it may be available in future when it is possible that some use may be found for it, your Committee are in favor of its retention from sale or lease by the Government.

Your Committee therefore recommend that the Board approve the suggestions of the Superintendent of Forestry and that a recommendation embodying them be adopted by the Board and transmitted to the Governor and to the Commissioner of Public Lands… [HFA, 1907:430]

REPORT OF THE SUPERINTENDENT OF FORESTRY.
October 13, 1906…

…I have to submit the following report upon the land of ***Kaohe***, District of Hamakua, Island and County of Hawaii, with the recommendation that certain portions of this tract be reserved from sale or lease, as waste land.

Kaohe *is the largest single land in the Territory, its area being given in the last Land Office List as 218,257 acres. It includes practically all of the upper slopes of* ***Mauna Kea*** *and a good share of the northern slope of* ***Mauna Loa****.* For purposes of classification in the Land Office, ***Kaohe*** is divided into six parts. ***Kaohe 1*** is cane land under a five-year lease, expiring in 1909. ***Kaohe 6*** is open grazing land not under lease. All of the remainder of ***Kaohe*** consists of grazing, open forest and waste land. A portion of ***Kaohe 2*** (1,035.6 acres) is under lease until January 10, 1909. The lease on the remainder of ***Kaohe*** 2, with those on ***Kaohe 3, 4 and 5*** expired on September 9, 1906, but a new 21-year lease [page 430] for a portion of ***Kaohe*** 4 went into effect the next day. This lease was sold to Mr. A.M. Brown during the winter of 1904.

Kaohe 2 and the lower portion of the other three tracts are primarily of value for grazing and should in my judgment be so used, except as hereinafter noted. *Above an elevation of about 5,000 feet there is a fairly dense growth of Mamani (Sophora chrysophylla) making a practically pure stand, which extends up the mountain to an elevation of about*

8,000 feet. Within the last ten years the belt of Mamani has, through natural reproduction, been extended both up and down the mountain and the process is still going on. Just why the *Mamani* should have taken this sudden start is not clearly understood, the usually excepted theory being that prior to about 10 years ago some insect or other pest held the reproduction in check. Unless a paddock is heavily overstocked cattle do not interfere with the growth or reproduction of *Mamani*. In fact over a considerable part of the *Mamani* belt the trees are coming up so thickly as almost to preclude grazing. Obviously no artificial protection is required for this type of forest.

The Mamani forest extends some distance above the area of good grazing land, which is marked by the upper limit of the valuable native and introduced grasses. The section above the Mamani belt being without valuable vegetation is of little account for grazing. It is for the most part now used only by wild cattle and horses. There seems at present no economic use to which it can be put.

In the leases that have just expired this area of waste land was included with the good land below, thrown in as it were as a sort of "*manuahi*," thereby greatly swelling the acreage under lease, but being of little value to the lessee. In my opinion this arrangement serves no good end and should in future be discontinued; the land of value for grazing being leased as such and the remainder held by the Government as waste land.

In a report upon the land of ***Kaohe*** 4 made to the Board under the date of Dec. 3rd, 1904, I made similar recommendations in regard to the *mauka* part of that tract. These were adopted and when the lease was made to Mr. Brown only the good grazing land was included, thus establishing a precedent in regard to waste land. I now recommend that when ***Kaohe*** 3 and 5 are re-leased the portion above the following roughly described line be excluded and retained by the Land Office as waste land:

Beginning on the boundary between ***Kaohe 4 and 5*** at the end of the fence required to be built across ***Kaohe*** 4, the line should run *mauka* of ***Puu Ahuamoa to Puu Laau***, thence along the *mauka* boundary of ***Paauhau to Puu Kemole***, thence *mauka* of ***Puu Kaluamakani*** to a point on the division line between ***Kaohe 3 and Kaohe 5***, thence along said division line to [page 431] the northwest end of the existing fence across ***Kaohe*** 5, built by the ***Kukaiau*** Plantation Company, thence across ***Kaohe*** 5 following said fence to the ***Humuula*** boundary, thence following said ***Humuula*** boundary to the south and west around ***Mauna Kea*** to the southeast end of the fence required to be built across ***Kaohe 4*** and along the same to the initial point.

Mr. A.W. Carter, representing the Parker Ranch, has proposed to lease the grazing land in ***Kaohe*** 3, with a proviso in the lease that a fence be built and maintained across ***Kaohe*** 3 following the line just described. Across ***Kaohe*** 5 a fence built sometime ago by the ***Kukaiau*** Plantation Company (the one mentioned in the above description) marks the division between the good grazing and the waste land.

With the building of the fences on ***Kaohe*** 3 and 4 and the gradual capture of the wild cattle on the mountain, facilitated thereby, stock will be kept off this upper section.

The retention by the Land Office of this area of waste land is directly in line with the policy of the administration to put the government land to its best use and furthermore it leaves what is now an unavailable tract in such shape that if a use is found for it in later years it will then be available for lease or sale. With the introduction of new grasses it is quite possible that the area of good grazing land may in time be extended *mauka*, *while there seems to me no good reason why much of the area on the sides of Mauna Kea, between the elevation of 8,000 and 10,000 feet could not be made to grow forest trees from the*

temperate zones, such as Pines, Firs and Spruces, that in time could be looked to, to supply construction timber. The establishment of such a forest belt would, of course, entail a considerable expense, even though the method of scattered seed spots were adopted, but experiments have been begun to determine what species are best adapted for use in this locality. Funds for more extended work are not now in sight.

Kaohe 2.
On the part of ***Kaohe*** *2, between the mountain road and the upper line of the upper Pohakea homesteads, the forest has been destroyed by one cause and another, the chief among them being fire, until with the exception of a few groves of Koa and a section of the Mamani belt, practically the whole area is open country which could only be reforested by artificial means.* Except for the *Koa* groves already mentioned there are not enough trees left to furnish seed, even were the other factors governing natural reproduction favorable, which is distinctly not the case.

Realizing the importance of the protection which an open [page 432] forest affords stock the ***Kukaiau*** Plantation has proposed to Mr. Pratt that he put up ***Kaohe*** 2 for lease with the requirement that a certain part of the land be planted with Blue gum (*Eucalyptus globulus*) trees; the stock to be kept out until the trees grow large enough to care for themselves. I heartily approve of this plan and am now having prepared by Mr. Haughs, a planting plan under which the work could be done.

If natural reproduction of Blue gum takes place in Hamakua as it has in certain other upland districts of the Territory this section may in time come under a forest cover of this Eucalyptus…

Ralph S. Hosmer… [HFA, 1907:433]

In 1908, Commissioner, L.A. Thurston reported on the lands of Kaʻohe and Humuʻula, and a proposal to set aside such lands for a new reserve, to the Board of Commissioners. This proposal would become the Mauna Kea Forest Reserve, and implement a fencing project across Humuʻula and Kaʻohe, around most of Mauna Kea. The resulting reserve, established in 1909, would become one of the major projects undertaken by the Civilian Conservation Corps (CCC) program in the 1920s-1930s, and one in which several participants in oral history interviews had a hand. The report of the committee, approved January 11th, 1908 reads—

Forestry Reserve on Lands of
Kaohe And Humuula, District of Hamakua and Hilo, Hawaii.
On Wednesday, December 2nd, instant, there was referred to this committee a communication from Land Commissioner Pratt, dated Nov. 29th, in which he states in substance, that the leasing of the lands of ***Kaohe*** and ***Humuula***, Hamakua, Hawaii, is in contemplation, and asks for the views of this Board upon the subject of forest reserves upon said lands.

Kaohe IV *contains approximately 137,000* acres and includes the top of ***Mauna Kea***, the southern slope of that mountain toward ***Mauna Loa***, the table land between the two mountains and a large portion of the northern slope of upper Mauna Loa.

The greater portion of the Mauna Loa portion consists of barren lava flows, with a sparse growth of shrubs and grass.

The tableland between the mountains, at an elevation of about 6,000 feet is dry and sandy, with scattered mamani, naio and other trees which grow on such soil and in such a climate. There is a fair amount of grass, making good grazing for a limited amount of stock.

The steep southern slope of ***Mauna Kea*** *up to the 7,500 foot level has a thick growth of the same kinds of trees, and somewhat less grass.* Above the 7,500 foot contour there is practically no grass, and the trees though thick are scrubby.

Above about the 8,000 foot level there is little vegetation, while the land is rocky and sandy.

The committee is not informed as to the exact conditions on ***Kaohe*** at the north end of ***Mauna Kea***.

Humuula is the land lying below ***Kaohe*** on the east slope of ***Mauna Kea***, and above the forest lands which run to the sea in the Hilo District. It contains 110,000 acres and is largely appropriate for grazing land.

It will be necessary to take more time and study to formulate a definite plan concerning the whole of ***Kaohe and Humuula***. Your committee is informed, however, that the only proposition immediately pending for leasing either of said lands, is an application for a lease of 18,000 acres situate on the table land between ***Mauna Kea*** and Mauna Loa, and extending up to the 7,500 foot level on the south slope of ***Mauna Kea***.

Your Committee are of the opinion that as to this particular area, it is proper land for grazing purposes. There are no running streams. The water available is so limited in amount that but comparatively few animals can run on it at once, obviating the danger of stocking out what trees there are.

Without at present having any definite plans for development of a forest growth on the waste lands of ***Mauna Kea***, as they are valueless for pasturing purposes, it is recommended that they be kept under the control of the Government instead of being included in the leases of the lower grazing lands as has heretofore usually been done.

In order to protect the forest growth already there, we suggest that a proper condition of any lease given of said land should be that the lessee should fence and keep fenced, the upper boundary of the leased land.

We recommend to the Board for adoption the following resolution:

> "Resolved that the Board of Commissioners of Agriculture and Forestry are of the opinion that it is not necessary to reserve for forestry purposes that portion of the land of Kaohe, District of Hamakua, Island of Hawaii, lying on the southerly slope of ***Mauna Kea***, below the 7,500 foot contour line; and that portion lying on the table land between ***Mauna Kea*** and Mauna Loa.
>
> That if the Land Commissioner sees fit to lease or otherwise dispose of the indicated portion of Kaohe, this Board respectfully recommends to him that a condition of such disposition be that the lessee or purchaser fence and keep fenced the upper boundary of said land."

Your committee requests further time in which to consider the subject of forest reserves in connection with the remainder of ***Kaohe*** and the land of ***Humuula***.

Your committee transmit herewith the report of Forest Hosmer upon this subject… …L. A. Thurston… …The above resolution was adopted by the Board of Agriculture and Forestry, at the meeting held Jan. 11th, 1908.

Ralph S. Hosmer, Superintendent of Forestry…

The Pi‘ihonua Forest and Watershed (1907)

During 1907, the Commissioners also discussed the Pi‘ihonua Watershed. The reports in the Hawaiian Forester and Agriculturalist provide us with descriptions of the forest; the leasehold interests of J.T. Baker and W.H. Shipman—Pu‘u ‘Ō‘ō Ranch; and ranching and forestry issues. The reports were in part generated by an investigation into the possibility of developing a lumbering venture on Pi‘ihonua; an idea which superintendent of Forestry, R.S. Hosmer, considered inappropriate—

Honolulu, Hawaii
July 18, 1907
(The land of Piihonua):
…I have the honor to submit the following report on the question of permitting lumbering on the land of ***Piihonua***, District of Hilo, Island of Hawaii:

This report is made in reply to a request received from the Commissioner of Public Lands on June 18, 1907. It is based: (1) on an examination of the land made at the end of June, 1907, during which I saw as much of ***Piihonua*** as can be seen without the cutting of a considerable number of trails through heavy undergrowth and across swamps: (2) on all the other evidence in regard to the character of the land that I could obtain, and I believe I have practically all that is available. I have given the matter most careful consideration from every point of view and I conscientiously believe that I am acting for the best interests of the Territory in making the recommendations that follow.

DESCRIPTION

Piihonua *is a government land, under a crown lease to the Hon. John T. Baker of Hilo. The lease (No. 531) expires on March 21, 1921. The upper part of the tract is sublet to Mr. W.H. Shipman and constitutes the* ***Puu Oo*** *Ranch. The lower line of Mr. Shipman's lease extends almost due north across the tract from the point on the 1855 lava flow, known as Reed's Island, at an elevation of approximately 5,000 feet. The lower portion of the tract is covered by the fields of the Hawaii Mill Company's sugar plantation. The cane lands reach up to an elevation of about 2,000 feet.* [page 253]

The section between the cane fields and a forest fence constructed by Mr. Shipman at some distance above the line of his lease, constitutes a part of the Hilo Forest Reserve, established in July, 1905.

Between the limits named the land is heavily wooded. On the lower and middle sections the forest consists of a mixed stand of *Ohia Lehua* and *Koa* trees, mainly of large size. At an elevation of approximately 4,500 feet is a belt of pure *Ohia* forest. Above this and extending to and above the Shipman fence the forest is again composed of *Koa* and *Ohia*, in mixture. Throughout the forest is a heavy undergrowth consisting of tree-ferns, low shrubs and small trees, and high growing ferns and brakes. In places are tangles of *ie-ie* vine and *uluhi* [*uluhe*]. The soil where exposed is a reddish clay, a foot to eighteen inches or more in depth.

The belt of pure *Ohia* is evidently the point of greatest precipitation from the trade wind clouds; though throughout the forest, from the plantation clearing to the Shipman line, the rainfall is heavy. All over the area are springs, pools and swamps that feed the numerous small tributaries to the ***Wailuku River*** and its several branches. Practically the whole drainage basin of this stream is on ***Piihonua***, for the water that comes from higher up than the section watered by the trade wind clouds is limited to the flow resulting from Kona and other local storms.

Very little is known accurately of the actual sources of the water in the streams, or from which part of the forest they are most largely fed. But the indications are that from one-third to one-half of the water comes from the area of pure Ohia forest, above described, while the remainder is the result of springs and swamps lower down. These springs are dependent for their sustained and equalized flow on the protection afforded by the forest cover.

At present the water from the Wailuku river is used for fluming cane and for turning the power wheels of the Hilo Electric Light Company. For these purposes it is diverted at points near or below the 2,000 foot level.

RECOMMENDATIONS.
Having given the problem thorough and careful study, both on the ground and in its various relations, *I cannot report favorably on the proposition to lumber this tract. My principal reasons for this decision are three in number.*

First: I believe the greatest value of the forest on ***Piihonua*** to be in the influence which it has on the drainage of the Wailuku River and its branches, i.e. on the affect the forest exerts on the water after it reaches the surface, by equalizing the flow and preventing excessive run off. In view of its present use and possible further development for water power, irrigation and even for domestic supply—especially in connection with the growth of [page 254] Hilo town—I regard the Wailuku as one of, if not the, most important stream protected by a forest reserve in the Territory.

It might be possible, if the work were done under careful restrictions, to remove some of the mature trees from the ***Piihonua*** forest without detriment to its water conserving qualities. But to make lumbering profitable the operations would have to be conducted on a large scale. This would inevitably involve the opening up of considerable areas in sections where a complete forest cover is most needed. Such a policy on this particular water shed would be fraught with danger. It is a risk which I do not believe the Territory should take. For the money to be obtained as stumpage would in no way compensate for the injury that would result were the regular flow of the Wailuku River seriously interfered with.

For this reason *I am opposed to lumbering the forest on* ***Piihonua****.*

Second: The forest policy of the Territory has been and is to create a chain of forest reserves that are essentially "protection forests." On the leeward side of the island, where because of the absence of running streams watershed protection does not figure, I am in favor of utilizing the merchantable timber. But on the windward side of Hawaii I believe that the forest in the several established forest reserves should for the most part be kept intact, at any rate for the present.

If this is so in general it is particularly true of the Hilo Forest Reserve; for with the growing importance of Hilo town and the Hilo District, through the construction of the breakwater and the building of the Hilo-Kohala Railroad, the streams coming from the reserve will be needed more than at any time in the past.

Considering the large area of privately owned land in the Hawaiian forest reserves it is essential that a uniform and consistent policy of forest protection be maintained, in order that the owners of this land may be brought to cooperate with the Government in its management. *The granting of logging rights on such a land as* ***Piihonua*** *would, I fear, tend to weaken the public sentiment that supports the reserve work, if indeed it did not react unfavorably on the whole forest policy of the Territory.*

Therefore, on this count also, *I believe the logging of **Piihonua** to be inexpedient.*

Third: My third reason is from a professional standpoint. Forestry rests on a business as well as on a scientific basis. In the consideration of such a problem as the lumbering of the ***Piihonua*** forest, the factor of whether or not it would pay is an essential one.

Even were it desirable that lumbering should be permitted, it would in my judgment be necessary, in order to safeguard the favorable conditions of stream flow that now exist, to load the con- [page 255] tract with stringent regulations as to the area to be logged, the methods to be used and the subsequent treatment of the tract. From the situation of ***Piihonua*** in relation to transportation, the cost of logging would at best be high. When to this were added the necessary restrictions and stumpage at the price which I believe the Territory should demand, I cannot see how there would remain any margin of profit for the contractor undertaking the work.

Looking at the matter in this light I should not be justified from the standpoint of professional ethics, in tacitly recommending the project by approving conditions under which logging might be carried on.

On this third count, then, *I cannot recommend lumbering on **Piihonua**.*

I recommend, if the Board approves this report, that copies be sent to the Governor and to the Commissioner of Public Lands…

Ralph S. Hosmer… [HFA, 1907:256]

The Mauna Kea Forest Reserve (1909)

In 1909, the summit of Mauna Kea was removed from the leases, and Territorial Governor, W.F. Frear, approved the boundaries for the proposed Mauna Kea Forest Reserve (*Figure 58*) . The following communications describe the thinking behind the reserve, and some of the early actions on lands adjoining it (see HTS Plat No. 613, for final boundaries of the reserve and location of fence lines):

Honolulu, Hawaii, March 30, 1909.

…The subject of this report is the proposed setting apart of the upper slopes of ***Mauna Kea*** as a forest reserve.

Unlike most of the Hawaiian forest reserves, this project is not concerned with watershed protection. Its purpose is to facilitate the systematic management of an area that can be used to better advantage for growing forest trees than for any other economic purpose. There is now on Mauna Kea a considerable stand of Mamani [māmane] forest. At the higher elevations there is much land, now unproductive, that could well be planted with commercially valuable exotic trees. By setting apart the area as a forest reserve the existing forest can be made to be of greater service to the people of the Territory, while the afforestation of the upper slopes of the mountain will be facilitated.

Description of the Area.

Mauna Kea, the highest mountain in the Territory of Hawaii, is situated in the District of Hamakua, Island and County of Hawaii. The elevation above the sea of its highest peak is 13,825 feet. The summit and the greater part of the sides of the mountain above the 7,500 foot contour line are included in the government land of ***Kaohe***, an *ahupuaa* containing an immense area of waste land, in that besides the summit and upper slopes of ***Mauna Kea*** it also takes in a considerable portion of the north side of Mauna Loa.

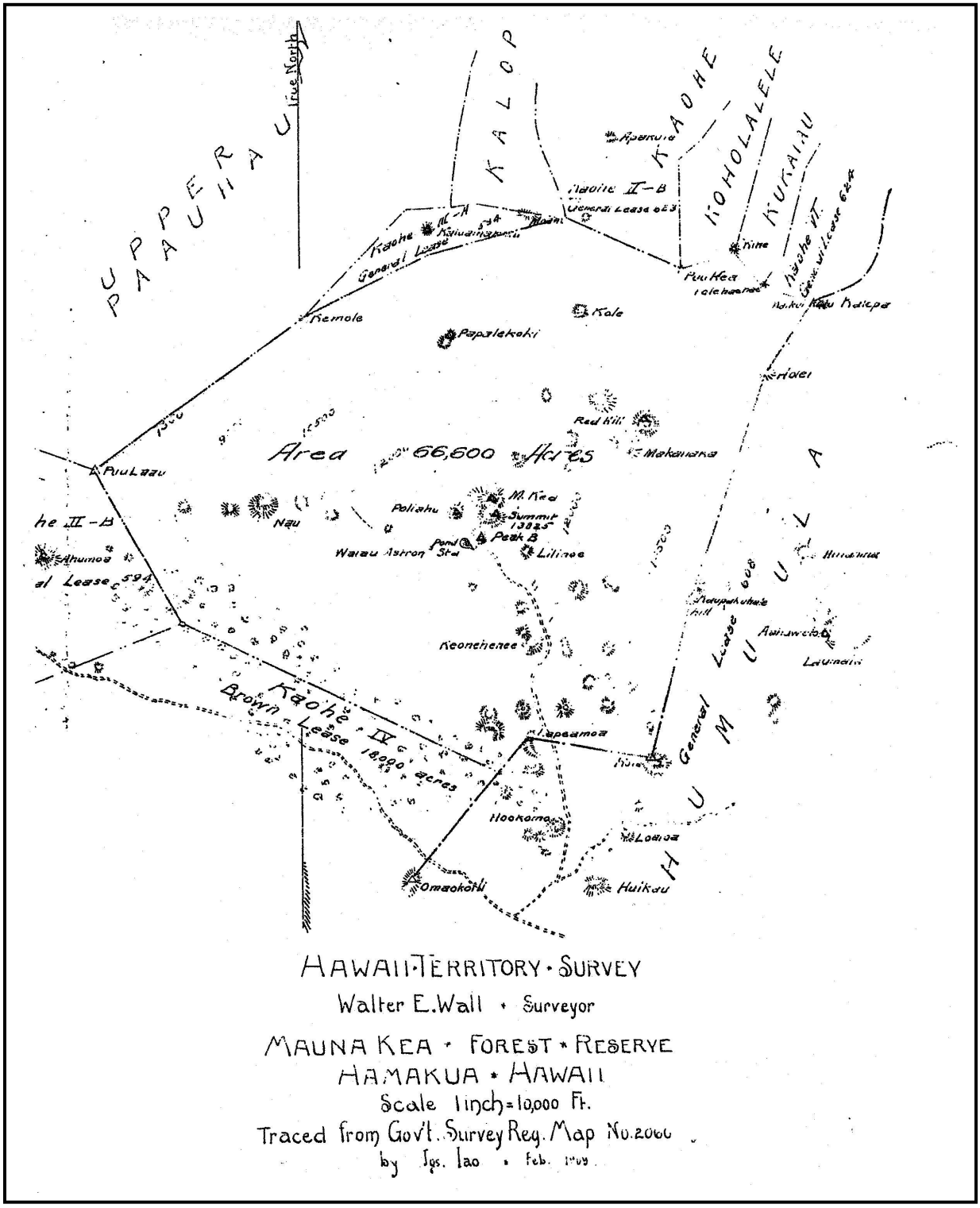

Figure 58. Boundaries of the Mauna Kea Forest Reserve (1909 – traced from Reg. Map No. 2060)

Above a line encircling the mountain at the elevation of approximately 7,500 feet, the slopes of Mauna Kea may be classed as waste land. The herbage is too poor and uncertain to justify grazing and the land has now no other use. This fact, together with the desire to prevent their stock from straying up the mountain to join the bands of wild cattle, led the several ranches controlling the better portions of ***Kaohe*** *and the other adjoining lands to build fences separating their upper paddocks from the area of low value above. Several such fences were built before the old leases expired. In 1907 when the leases on the govern-* [page 229] *ment land of* ***Humuula*** *and the better portions of* ***Kaohe*** *ran out and came to be renewed, provision was made for the extension of these mountain fences and for their up-keep during the term of the new leases. At the present time, with the exception of a stretch on the southwestern side of Mauna Kea, across the portion of* ***Kaohe*** *known as* ***Kaohe*** *4, the mountain is wholly fenced off. It is expected that this stretch also will soon be leased, with a provision that the fence be completed. Further, negotiations are now in progress with the ranches abutting on Mauna Kea looking to a systematic campaign for the rounding up and capture and extermination of the wild cattle on the mountain.*

When the new leases of ***Kaohe*** were made the waste land was retained by the Government, instead of being included as formerly with the productive areas below. This usage has now become a regular part of the land policy of the Territory. It is a step toward putting all the land to the use for which each tract is best adapted. For it leaves the control of land for which there is now no use in the hands of the Government against the time when some, now unforeseen, use may be found.

In the case of ***Kaohe*** it is now proposed that the land be devoted to the purpose of raising trees. The object of this report is to state the reasons that make this use advisable and to show how the setting apart of the area as a forest reserve will help bring about the desired results.

The section included in the proposed reserve may roughly be described as the upper slopes of ***Mauna Kea*** above an elevation of approximately 7,500 feet. The area is 66,600 acres.

Use of Kaohe for Forest Purposes.
The question of using the land of ***Kaohe*** for wood and timber production may be considered under two heads—the existing and the prospective forest.

The Mamane Forest.
Between the good grazing land and the elevation of about 9,000 feet, especially on the northern and western slopes of Mauna Kea, there is a fairly heavy stand of Mamane (Sophora chrysophylla). This forest is increasing through natural reproduction. The reason for the rapid spread of Mamane—which is a matter of the last decade—is not clear, but the fact remains to the advantage of the Territory. Mamane is a wood valuable for posts. Rightly managed there is likelihood that in time this forest can be made a source of revenue. One of the reasons for the setting apart of ***Kaohe*** as a forest reserve is that it will facilitate the proper handling of this forest. [page 230]

Above the *Mamane* belt, between the elevations of from eight to eleven thousand feet, and in sections lower down where the *Mamani* forest is open and broken, there exists an excellent opportunity for the planting of commercially valuable exotic trees. The general conditions of soil, situation and climate at this elevation are sufficiently comparable to those on the mountains of Southern California to make it appear reasonable to expect that the kinds of trees that do well there can also be made to grow and thrive on ***Mauna Kea***.

The planting of pines, spruces and firs on the upper slopes of ***Mauna Kea*** *has been recommended by each of the professional foresters who have visited the islands: Mr. E. M. Griffiths, now State Forester of Wisconsin; Mr. W. L. Hall, of the U. S. Forest Service, and by me.* Favorable conditions for tree planting are also obtained on the upper slopes of Mount Haleakala on Maui, and on Mount Hualalai on Hawaii.

The U. S. Forest Service has shown its belief in the feasibility of the plan by allotting the sum of $2,000 for experimental planting on Mauna Kea and Haleakala, during the present fiscal period. This money is now being expended under my direction as Collaborator in the Forest Service, in the inclosure and planting up of a number of experimental plots on these two mountains, located at varying elevations and having different conditions of aspect and exposure.

It is the intention at the start to plant in each inclosure a sufficient number of seedling trees—say 100 of each—of some eight kinds of coniferous trees (pines, spruces and firs) likely to do well. Later, it is expected that additional allotments will be secured from the Forest Service to continue the work. Eventually those trees that prove to be adapted to the situation can be more extensively planted, being then set out in such a way that in the end a belt of forest will be secured. Such a result is, of course, only to be expected after a considerable time. This makes the experiment one that is only likely to be undertaken by the Government. That it appears practical and practicable to the Forest Service is evidenced by the allotment already made.

At first it was felt that it would be sufficient if only the areas actually needed for the experimental plots were turned over by the Land Department for this use. But on consultation with the Land Commissioner it appeared that from an administrative standpoint it would be more satisfactory if all of this portion of ***Kaohe*** were transferred to this Board. This proposal met with the approval of the Governor. The present report is the next step in the matter. [page 231]

Recommendation.
For the reasons above outlined—which may be summarized by the statement that the purpose of the reserve is to facilitate the management of the forest, present and prospective, on the upper slopes of ***Mauna Kea***—I do now recommend that the Board of Agriculture and Forestry request the Governor to set apart, in accordance with law, as the "***Mauna Kea Forest Reserve,***" that portion of the non-agricultural, unleased government land of ***Kaohe***, in the district of Hamakua, Island and County of Hawaii, within and above the boundary hereinafter described.

Official Description.
Following is the technical description of the boundary of the proposed ***Mauna Kea*** Forest Reserve, prepared by the Government Survey Department as C. S. F. NO. 2001, and accompanied by Registered Map No. 2060…

Ralph S. Hosmer, Superintendent of Forestry. [HFA, 1909:232]

By Authority
Mauna Kea Forest Reserve.
Proclamation of Forest Reserve in the District of Hamakua,
Island and County of Hawaii.
Under and by virtue of the authority vested in me by the provisions of Chapter 28 of the Revised Laws of Hawaii, as amended by Act 65 of the Session Laws of 1905, and by Act 4 of the Session Laws of 1907, and of every other power me hereunto enabling, I, WALTER F. FREAR, Governor of Hawaii, having held the hearing of which notice has

been duly given as in said acts provided, do hereby SET APART as a Forest Reserve, to be called the "***MAUNA KEA FOREST RESERVE***," that portion of government land in the District of Hamakua, Island of Hawaii, known as ***Kaohe***, embracing and including the upper slopes and summit of ***Mauna Kea***, above the elevation of approximately 7,500 feet, and containing an area of 66,600 acres, more or jess, in the District of Hamakua, Island and County of Hawaii, Territory of Hawaii, more particularly described by and on a map made in February, 1909, by the Government Survey Department, of the Territory of Hawaii, which said map is now on file in the said Survey Department, marked "Registered Map Number 2060" and "***Mauna Kea*** Forest Reserve," and a description accompanying the same, numbered C.S.F. 2001, which said description now on file in the said Survey Department, is as follows:

MAUNA KEA FOREST RESERVE.
Including Portion of the Government Land of ***Kaohe V***, ***Kaohe***, Hamakua, Hawaii. Beginning at Government Survey Trig. Station "***Kole South***" (marked by ____ on set stone and *ahu*) on hill of that name on the South side of ***Mauna Kea*** and on the boundary of ***Humuula*** and ***Kaohe***, the true azimuth and distance to "***Aahuwela***" Trig. Station being 234° 44' 30" 22851.8 feet and to "***Puu Oo***" Trig. Station being 307° 04' 13' 111,139 feet, as shown on Government Survey Registered Map No. 2060, and running by true azimuths:—

1. 99° 56' 58" 13798.5 feet along land of ***Humuula*** to "***Lepeamoa***" Trig. Station (marked by a ┼ on set stone and *ahu*);
2. 39° 58' 42" 4875.8 feet along land of Humuula to the East corner of , ***Kaohe IV*** (Brown Lease, 18,000 acres), from which the true azimuth and distance to "***Omaokoili***" Trig. Station (marked by on solid imbedded bomb) is 39° 58' 42" 15,000.0 feet;
3. 115° 10' 37,700.0 feet along Kaohe IV (Brown Lease) to the East corner of ***Kaohe III-B*** (General Lease 594 to A. W. Carter, Guardian);
4. 1610 10' 19380.0 feet along Kaohe III-B (General Lease 594 to A. W. Carter, Guardian) to "***Puu Laau***" Trig. Station on the boundary of ***Paauhau***, from which the true azimuth and distance to "Nohonaohae" Trig. Station is 135° 24' 50" 43544.0 feet;
5. 234° 10' 27900.0 feet along land, of Paauhau to "***Kemole***" Hill;
6. 244° 35' 15060.0 feet along ***Kaohe III-A*** (General Lease 594 to A. W. Carter, Guardian) to a point directly South of "***Kaluamakani***" Trig. Station;
7. 255° 20' 15700.0 feet along Kaohe III-A (General Lease 594) to the ***Hanaipoe*** Gulch at the Southeast, corner of the land of ***Kalopa***;
8. 293° 45' 13660.0 feet along ***Kaohe II-B*** (General Lease 623 to Kukaiau Plantation Company, Limited), to "***Puu Kea***" Trig. Station at the Southwest corner of the land of ***Koholalele***, from which the true azimuth and distance to" ***Apakuie***" Trig. Station is 154° 02' 40" 6150.0 feet; [page 246]
9. 254° 10' 5800.0 feet along the head of the land of ***Koholalele*** to a waterhole on the *mauka* side of "***Puu o Kihe***" Trig. Station;
10. 319° 00' 5200.0 feet along the head of the land of ***Kukaiau*** to its South corner just *mauka* of ***Iolehaehae***;
11. 286° 50' 5400.0 feet along ***Kaohe VI*** (General Lease 624 to the Kukaiau Plantation Company, Limited) to a place called ***Waikulukulu***, a point in ***Kaula Gulch*** at the West base of the hill ***Puu Kalepa***;

12. 34° 30’ 9000.0 feet along the land of ***Humuula*** to ***Holei***;

13. 19° 42’ 20” 26368.0 feet along land of ***Humuula to Kaupakuhale Hill***;

14. 13° 10’ 17260.0 feet along the land of ***Humuula*** to the point of beginning.

Area 66,600 Acres.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Great Seal of the Territory of Hawaii to be affixed. Done at the Capitol in Honolulu, this 5th day of June, A. D. 1909… W. F. FREAR, Governor of Hawaii. [HFA, 1909:247]

Modifications in Boundaries of the Mauna Kea and Hilo Forest Reserves (1910-1937)

In 1910, Governor Frear, removed tracts of land from leasehold interests, to be included in the Hilo Forest Reserve. The proclamation named the lands and described the acreage as:

> In the Hilo Forest Reserve I do hereby set apart as integral parts of that Reserve those certain portions of the tracts of government land known as ***Humuula****, 3,901 acres*, more or less, ***Kahoahuna***, 46 acres, more or less, ***Waikaumalo-Maulua***, 790 acres, more or less, Opea-Peleau, 230 acres, more or less, Kamaee-Wailua, 930 acres, more or less, Wailea-Kaiwiki, 3,834 acres, more or less, Piha, 3,780 acres, more or less, ***Piihonua****, 33,941 acres*, more or less, that lie within the boundaries of the Hilo Forest Reserve, in the District of Hilo, Island and County of Hawaii, Territory of Hawaii, created and approved by proclamation of Acting Governor A.L.C. Atkinson, under the date of July 24, 1905, which said proclamation gives the metes and bounds of said Hilo Forest Reserve, the same being more particularly described by and on a map now on file in the office of the Territorial Survey Department in Honolulu, marked “Registered Map No. 2060,” and a description accompanying the same, numbered “C.S.F. 1629,” altogether an area of 47,452 acres, more or less… [HFA, 1910:277]

In late 1913, R.S. Hosmer presented a special report to the Commissioners, among the topics discussed was an update on the fencing of the Mauna Kea Forest Reserve. He described the progress in the following letter:

> ***November 18, 1913***
> ***Special Report: Forest Conditions – Hawaii***
> ***R.S. Hosmer; to the Board of Commissioners of Agriculture and Forestry:***
> ***…Mauna Kea Forest Reserve.***
> In passing mention may be made here of the ***Mauna Kea Forest Reserve*** that takes in all the upper slopes of that mountain above approximately the 8000 foot contour, altho’ across ***Humuula*** it is somewhat higher – about 9,500 feet. *For the greater part of the way around the mountain the line is substantially fenced; above* ***Humuula*** *by a fence built about 20 years ago by Mr. Haneberg and now kept in repair, under the terms of its lease, by the* ***Humuula*** *Sheep Station Company; above the* ***Kukaiau*** *ranch by paddock fences, which with other fences on that ranch are now being, or soon will be repaired and put in good shape; above the Parker Ranch, by strong fences built and now maintained by a regular fence rider. These fences are all required to be maintained under Government Leases, respectively Nos. 608, 623, 624, 594. Under Lease 594 it was provided that the Government pay half of the cost of the fence on the boundary between the forest reserve and the fee simple land of Upper* ***Paauhau*** *(Parker Ranch), from* ***Puu Laau to Puu Kemole****. Lease 608 runs ‘til 1930, the others to 1928.*
>
> *The section on the west slope of the Mountain, between* ***Waikii*** *and the boundary of* ***Humuula****, across the Government land known as* ***Kaohe*** *4, is not fenced. This section is not under lease. It was lately the scene of certain litigation over a broken lease, between Mr. A.M. Brown and the Government.*

There are still some wild cattle on Mauna Kea, and a few herds of wild horses, but thru' driving and shooting by men from the neighboring ranches the numbers of these animals have been very much reduced. There are also wild pigs on Mauna Kea, but not, I think, in very great numbers… [HSA – Gov 2-1 Board of Forestry & Agriculture]

In 1921, C.S. Judd, Superintendent of Forestry, conducted an inspection of the Hilo and Mauna Kea Forest Reserves. His report on the inspections, published in the Hawaiian Forester and Agriculturalist, documented the importance of the water resources generated by the Hilo forest lands (identifying primary trees found); the extent of the sugar cultivated on lands fed by the stream systems flowing from the forest; the continuing impacts on the forest by wild cattle and ranching interests; and impacts to the forest from plantation and homestead activities. Judd observed:

THE HILO FOREST RESERVE.

Every stream of any moment on the Island of Hawaii, with the exception of those in the Kohala Mountain region, has its source in the Hilo Forest Reserve. Not only does the town of Hilo depend solely upon the water coming from this forest reserve for its domestic uses, but ten sugar plantations absolutely depend upon this water for fluming their crops to the mills, for use in the manufacture of sugar, and for the domestic use of their laborers. The output of these ten sugar plantations, which comprise almost a solid belt of cane fields from 3 to 5 miles wide and 35 miles long, extending from the Olaa Plantation in Olaa to the Kaiwiki Sugar Company at Ookala, and the existence of which the water from the Hilo Forest Reserve makes possible, during the ten years from 1911 to 1920, amounted to 1,126,376 tons of sugar worth approximately $114,469,455.14.

The Hilo Forest Reserve was the third out of the present total of 47 forest reserves to be set apart and was set aside by a proclamation signed by Acting Governor A.L.C. Atkinson on July 24, 1905. It embraces at present a total area of 110,000 acres, of which 60,223 acres or 55 per cent is unleased land belonging to the Territory, and 49,777 acres or 45 percent is land in private ownership. Owing to the peculiar system of Hawaiian land surveys the private lands and government lands in the reserve are indiscriminately interspersed and usually consist of narrow strips or wedge-shaped pieces of land running from the sea up the slopes of ***Mauna Kea***.

The largest single piece of land in the reserve is ***Piihonua****, embracing 33,941 acres of government land.* This was held under lease by the late John T. Baker until March 21, 1921, when the lease expired and the land reverted to the Territory.

The lowest part of any of the reserve lies at the elevation of 1400 feet above sea level on ***Awehi Stream*** west of the town of Hilo, and the highest part is found at the upper end of ***Piha*** at an elevation of about 6,750 feet. The heaviest rainfall between these limits occurs between the elevations of 2,500 and 4,000 feet above sea level. In general, the reserve consists of a solid belt of almost impenetrable forest, in a region of heavy rainfall, 20 miles long from north to south with an average width of 10 miles lying on the gentle slopes of the huge mountain mass of ***Mauna Kea***. This slope is cut up by innumerable eroded gulches and one may follow along the lower boundary of the reserve and observe more than 100 perpetual waterfalls.

The forest growth consists chiefly of *ohia lehua* with the usual undergrowth of tree ferns and *ieie* vines and a ground cover of countless other ferns, shrubs and vines, an ideal com- [page 170] bination for the conservation of water. On the well drained slopes, especially at the higher elevations, extensive groves of *koa* trees are found, and in the highest portions the *mamani* tree occupies the drier situations. In the wet forest other trees such as the *kopiko, kolea, olapa, pilo,* and *naio* are also found.

The Hilo Forest Reserve would have served a greater usefulness in the way of water conservation if it had been found feasible to include originally a larger area of forest land and to protect all of the forest on this area from the very start.

The work of three agencies has resulted in confining the reserve to its present size. Grazing interests on the west or upper boundary have encroached upon the forest to an undesirable extent and would still like to send their destructive stock even deeper into the forest. This, in fact, is being done on some of the private lands within the recommended forest reserve boundary, and the only way to terminate it will probably be by the purchase of the lands by the government.

On the east or lower boundary, cane cultivation has removed hundreds of acres of heavy forest. This is a proper use of the land when kept in cultivation to cane, but when such land is abandoned, allowed to grow up in Hilo grass, and then pastured without adequate fences on the boundary line, the result is further destructive of forest growth by grazing and a pushing back of the heavy forest.

In the past on some of the government lands homesteads have been surveyed out and opened to settlement on parts of this lower forest without adequate thought as to the best use of the land. Some of these in swampy and rainy country have been abandoned and some have never even been taken up.

In all such matters there is necessarily a give and take depending on the highest use to which the land should be put. Several interests, however, seem to be oblivious of the usefulness of the Hilo Forest Reserve as a whole and would "kill the goose that laid the golden egg" for some temporary gains rather than join in the general scheme of forest protection for the benefit of the leading industry and the community as a whole.

In order to ascertain exact conditions on the ground an intensive field study was begun early in May, 1921, by a party of Territorial officials who are resurveying the lower boundary and reporting on all situations as observed. This work will be completed in a short time and will result in adding about 2,500 acres of unleased government forest land to the reserve along the lower boundary and increasing its size as well as usefulness.

The investigation, which has been made under adverse weather conditions, has resulted in surveying and marking the new forest boundary at the rate of about eight miles per month, and has disclosed such situations as unbuilt or wrongly located fences required by general leases and homestead agreements issued by [page 171] the land office, unlawful grazing, illegal wood cutting, and the presence of wild cattle on the reserve.

Steps have already been taken to correct such situations and it is planned to exterminate all wild stock in the reserve, to complete the fencing of the boundary at the earliest possible date, and to place a competent ranger in charge. Because of various ownerships of land in this important reserve, it is necessary that all parties cooperate with the utmost harmony in order to bring this work to a satisfactory conclusion… [HFA, 1921:172]

…The work of delineating the *makai* boundary and surveying additional areas to be included in the Hilo Forest Reserve continued during the month and resulted in the running of 7.5 miles from ***Pohakupuka Stream to Kaula Gulch*** at the extreme north corner of the reserve. A visit was made to the survey crew and the boundary line was inspected across the lands of ***Piihonua, Waipunalei, Piha, Opea Peleau and Kaiwiki 3***. [page 223]

FENCING REQUIREMENTS.

During the course of my forest inspections the following instances of unfulfilled fencing requirements or of incorrectly located fences came to my attention and were at once reported to the Commissioner of Public Lands with the suggestion that he compel the lessee or homesteader to comply at once with the fencing requirements on the proper lines…:

4. Hilo Forest Reserve. Weloka, general lease 946 to ***Laupahoehoe*** Sugar Co. Supposed to be adjacent to *makai* forest reserve boundary, but upper fence of lease found to be about 700 feet *mauka* in the forest reserve.

5. Hilo Forest Reserve. ***Laupahoehoe***, general lease 926 to M.P. Silva. Very frail fence found to be 1,330 feet at the NW. corner and 342 feet at the SW. corner *mauka* of the correct forest reserve boundary, and as a result about 98 acres of forest reserve land were being illegally grazed and the forest cover thereon destroyed.

6. Hilo Forest Reserve. Adjacent lot 51 of the Hakalau-iki homesteads, held under general lease 984 by Rose de Lima. Inadequate fence on *mauka* line of her lease, which allows cattle to get into the forest.

MAUNA KEA TRIP.

On August 5 and 6, visited the ***Mauna Kea*** Forest Reserve, in company with my assistant and six others, for the purpose of determining upon experimental planting with temperate zone trees and of making scientific observations in this high country. The *mamani* forest between 7,700 and 10,000 feet, the upper timber line, was found to be in good condition. *Two wild cattle and a band of wild sheep were seen, but no wild horses, although a band of the latter are occasionally seen on the mountain.* Six wild sheep were killed on the trip. It is possible that conifers will succeed on the lower slopes of this reserve if planted at times of favorable moisture, but there are not sufficient funds available at present for this work. At ***Waiau Pond***, near the summit at 13,014 feet, where our party experienced a cold night and the temperature was as low as 18 degrees, causing a film of ice to form on the edges of the pond, *it is planned to start a small grove of lodgepole pine trees by seed spotting, so that in time fuel wood will be available for travelers who ascend the mountain. For this purpose an order of 20 pounds of seed has been placed with the Forest Service at Portland, Oregon.* The presence of numerous cinder cones superimposed on glacial drift all over the summit plateau of the mountain was found to be of great interest… [HFA, 1921:224]

Chas. J. Kraebel , Assistant Superintendent of Forestry, reported in August 1921, on the boundary survey, of lands in the Hilo Forest Reserve, and reported on a field trip to Mauna Kea. Kraebel and survey party found that the *mauka* boundaries of many of the homesteads had been pushed too far inland, thus impacting the forests meant to be protected. Kraebel also described the tree planting efforts around the mountain lands, conducted in partnership with A.W. Carter of Parker Ranch:

…I respectfully submit the following routine statement of my work during August, 1921.

BOUNDARY SURVEY.

At the end of the month the survey of the *makai* boundary of the Hilo Forest Reserve had reached the point in ***Kaula Gulch*** called "***Paeoopu***," which is the extreme north corner of the reserve and therefore the end of the *makai* boundary. The distance covered by Mr. Hockley's party during August is approximately 7.5 miles, extending from Pohakupuka Stream at Waikaumalo to Kaula Gulch between the lands of Ookala and Manowaialee. At Waipunalei Mr. Hockley found it necessary to make a complete resurvey of lots 12 and 13 of the ***Kahoahuna*** Homesteads in order to correct an error in the original survey and to

determine the forest boundary in that vicinity. In the course of the month's work several irregularities in the location of fences were disclosed. The *mauka* fence of lot 55, Waikaumalo Homesteads is several hundred feet *mauka* of its correct position, infringing thus upon the Robertson Estate land of ***Mauluanui***. In ***Laupahoehoe***, the *mauka* fence of the government remnant under general lease 946 is approximately 700 feet *mauka* of the true boundary; while on the government remnant under lease 926 the present fence is 342 feet *mauka* at the south end and 1,330 feet *mauka* at the north end of its true location. In Waipunalei, because of the peculiar status of that land at present, I requested the surveyor to carry the line straight across this land from the west corner of the land under lease 926 to the newly established south corner of lot 13, ***Kahoahuna*** Homesteads. The land of Waipunalei cannot be regarded as forest reserve at present, since the upper portion constitutes a paddock of the Parker Ranch and the lower portion is used as a pasture by homesteaders under permit from the ***Laupahoehoe*** Sugar Company. The effect of this use is to separate the forest in the government land of ***Humuula*** from the remainder of the Hilo Reserve, a condition which should be corrected as soon as possible.

At the end of the month the following portions of the boundary survey remained still to be done: From ***Hanawai Stream in Papaikou to Puu Kauku***, a distance of about two miles; the final line of 1.2 miles across ***Piihonua and Waiau from Hookelekele Stream to Alae Stream***; the inclusion of the area of ***Piihonua*** lying between Hookelekele Stream, Wailuku River, and the land of ***Punahoa 2***; determination of the Punahoa2-***Piihonua*** boundary from the Wailuku River to the top of the land of Punahoa 2, approximately 7 miles of straight line.

PARKER RANCH.

On August 1, in company with the Chief Plant Inspector, I drove to Waimea to consult with Mr. Carter on the forestry problems of the Parker Ranch. The ranch is well equipped to raise in its own nursery all the common species of trees for windbreak purposes, but Mr. Carter is anxious to be supplied with the less common introduced species for [page 225] experimental planting. This is an excellent opportunity for experimentation in a thorough manner and on a scale which the Division of Forestry is unable to practice independently. There is almost no limit to the range of climatic conditions which can be found on the Parker Ranch, and Mr. Carter would be at pains to help us find the most favorable site for each species. *The conifer plots established ten years ago on the slopes of Mauna Kea are examples of the excellent results which can be obtained by this sort of cooperation.*

At the time of our visit there were some 300,000 transplants in the ranch nursery, including the genera Eucalyptus, Acacia, Araucaria, Cypressus and Pinus. It is obvious that such vigorous efforts in forestry deserve our most hearty support.

MAUNA KEA EXPEDITION.

During the first week of the month I made the ascent of ***Mauna Kea*** with a party of government officials and scientific men, including the Chief of the U.S. Geological Survey for Hawaii, the Territorial Land Commissioner, the Director of the B.P. Bishop Museum, and the Superintendent of Forestry. The purposes of the expedition were several, centering chiefly about the problem of mapping the mountain, and about the reported evidences of ancient glaciation above the elevation of 11,000 feet, which was Professor Gregory's principal concern. Unmistakable evidences of glaciation were found and a plan for further study was developed by Professor Gregory…

PINE TREES ON MAUNA KEA.

During the fourth week of the month I cooperated with Dr. H.E. Gregory of the Bishop Museum on a trip up the northwest slope of ***Mauna Kea****. Dr. Gregory's object was to*

secure further evidence of glaciation on the mountain, while I went to inspect the conifer plots established in February, 1910, by Mr. Hosmer. Both objects were very gratifyingly realized. Abundant evidences of glaciation were found and numerous photographs of striations, moraines and ice-distributed boulders were obtained [*Figure 59*].

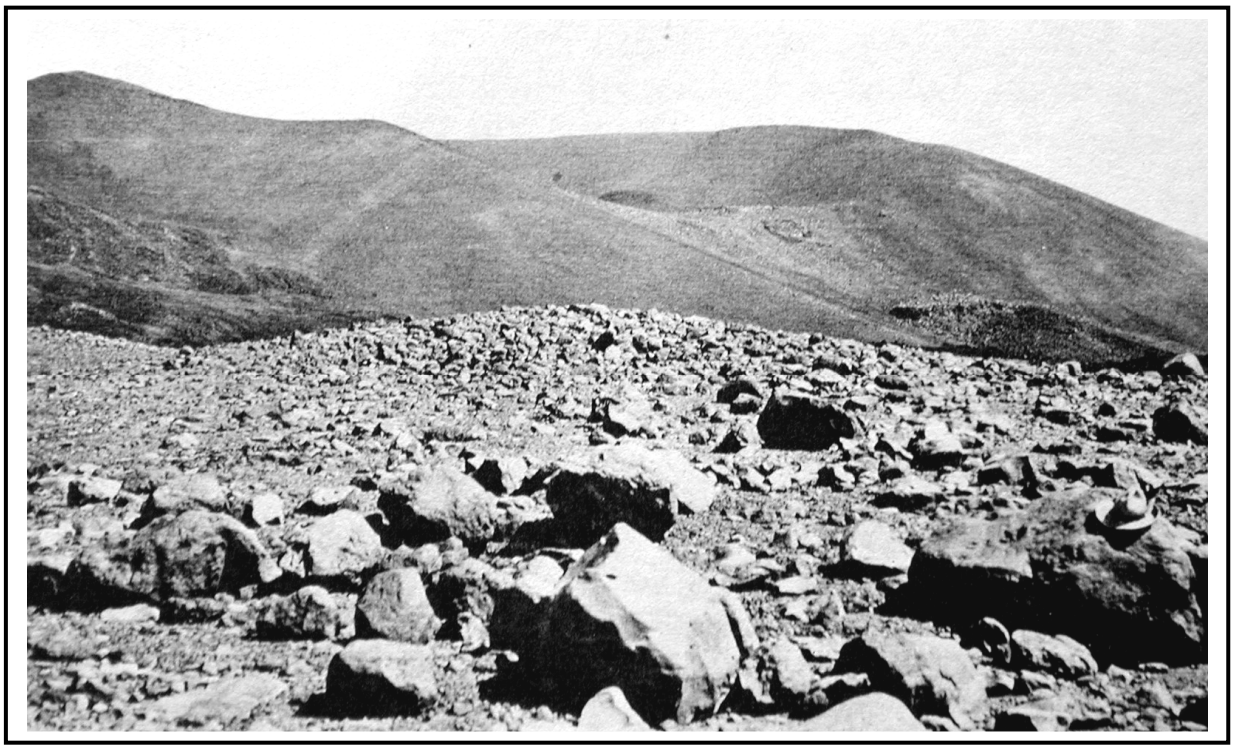

Figure 59. "Summit Cluster, View from north slope of Mauna Kea, at about 12,000 feet altitude. Glaciated terrane (foreground), cinder cones (in the distance)." Photo by C.J. Kraebel (in Gregory and Wentworth, 1937; Plate 3, Figure 2) (Copy Photo, KPA-N871)

> The tree plot at the lowest elevation, 7,000 feet, contained a total of 201 thrifty trees, ranging in size from 6 feet to 20 feet, and including the following species: *Pinus coulteri, Cedrus deodara, Libocedrus decurrens* and *Pinus jeffreyi*, named of their vigor of growth. At 9,000 feet [page 226] Coulter pine again showed the best growth of all species, but the total number of living trees was only 46. At 11,000 feet, the highest plot, only a single stunted tree was found, an incense cedar. Further experimentation at this altitude is therefore inadvisable at present. The results on the whole, however, are very encouraging, since it is demonstrated that lumber-producing trees can be successfully grown at the intermediate altitudes. Numerous photographs were taken at all the plots and specimens of all species were also taken for the office herbarium. An exhibit of these, with explanatory placards in a store window in Hilo and remained there during the recent American Legion Convention in the city… [HFA, 1921:227]

In 1937, the boundaries of the Mauna Kea forest Reserve were modified, to take in additional portions of the lands of Humu'ula, Ka'ohe, and some lands lying *makai* of the two. As a result, more land was removed from the grazing operation of the Humu'ula Sheep Station. Hawaii Territorial Survey Plat Map No. 613 (by notes of survey from C.S.F. 5055, July 20, 1937) depicts the modified boundaries, and the notes of survey record the metes and bounds:

C.S.F. 5055
Maunakea Forest Reserve
(2nd Revision)

Hamakua and North Hilo Districts
Island of Hawaii

Being portions of the government land of ***Kaohe*** and ***Humuula*** and portions of the privately owned lands of ***Koholalele*** (R.P. 4527, *Mahele* Award 26-B to Kailakanoa) and Paauhau (Grant 2869 to J.P. Parker).

Beginning at the South corner of this tract of land at the junction of three fences in the land of ***Humuula***, the true azimuth and distance to said point from Government Survey Trig. Station ***OMAOKOILI*** being 5º 21' 40" 4036.0 feet and the coordinates of said point of beginning referred to Government Survey Trig. Station ***AAHUWELA*** being 30,032.8 feet South and 45,412.7 feet West as shown on Government Survey Registered Map 2789 and running on the ***AAHUWELA*** Meridian by azimuths measured clockwise from true South:–

1. 141º 58' 00" 18880.3 feet along fence along the remaining lands of ***Humuula and Kaohe***;
2. 111º 27' 20" 12426.7 feet along fence along the remaining land of Kaohe;
3. 86º 13' 30" 14380.7 feet along same;
4. 225º 01' 40" 20217.5 feet along same to a ***+*** on set stone;
5. 147º 09' 00" 18695.1 feet along same to a ***+*** on set stone at the foot of hill called "Puu Laau" the true azimuth and distance to Government Survey Trig. Station "Puu Laau 2" being 79º 06' 30" 191.4 feet;
6. 229º 51' 10" 10788.5 feet along fence;
7. 228º 32' 00" 5384.0 feet along same to a ***+*** on set stone southeast of rocky hill called "Nanao" or "Kalepaio", the true azimuth and distance to a ***+*** on set stone on said hill being 158º 19' 86.10 feet;
8. Thence along the fence, the direct azimuth and distance between the two end points being 239º 59' 20" 11724.2 feet;
9. 152º 13' 30" 755.8 feet along fence to Government Survey Trig. Station "***Kemole 2***" marked by __ on set stone, the true azimuth and distance to a U.S.B.M. elevation 7630 feet (marked by ***+*** on bronze tablet) being 169º 35' 18.06 feet;
10. 226º 16' 30" 8903.7 feet along fence, along the remaining portion of the lands of Paauhau (Grant 2769 to J.P. Parker);
11. 235º 40' 50" 7579.1 feet along same along the remaining portion of the land of Kaohe;
12. 256º 24' 00" 3162.6 feet along fence along the remaining portion of the land of Kaohe;
13. 304º 42' 00" 681.0 feet along same, the true azimuth and distance to a ***+*** on stone on the ***Paauhau-Kaohe*** boundary being 207º 15' 30" 777.8 feet;
14. 14º 18' 00" 1120.4 feet along fence West of Kawailiilii Gulch;
15. 29º 45' 30" 782.8 feet along same;
16. 20º 04' 30" 978.4 feet along same;
17. 354º 32' 30" 881.7 feet along same;

18. 277º 10' 00" 5128.2 feet along fence along the remaining portion of the land of Kaohe;

19. 255º 21' 00" 11150.1 feet along same to an angle in fence South of ***Puu Mali*** Hill;

20. 279º 33' 40" 3483.1 feet along fence along the remaining portion of the land of ***Kaohe***;

21. 278º 02' 40" 8751.8 feet along same and along the remaining portion of the land of ***Koholalele*** (*Mahele* Award 26-B to Kailakanoa);

22. 295º 59' 50" 4034.0 feet along the remaining portion of the land of ***Koholalele*** to a pipe in concrete marking the end of Course 76 of Land Court Application 1090, Trustee, Estate of Charles Notley, deceased, applicant;

23. 318º 58' 20" 11083.2 feet along fence along Land Court Application 1090 and remaining portion of the lands of ***Kaohe*** and ***Humuula*** to a ***+*** on set stone, the true azimuth and distance to Government Survey Trig. Station "***Kalepa***" being 217º 54' 30" 3837.5 feet;

24. 348º 03' 20" 12093.5 feet along fence along the remaining portion of the land of ***Humuula***;

25. Thence along the fence, the direct azimuth and distance between the two end points being 7º 02' 40" 13619.0 feet;

26. 57º 41' 40" 8739.6 feet along same;

27. 38º 24' 50" 13989.0 feet along same to a ***+*** on set stone;

28. 357º 23' 00" 5939.0 feet along same;

29. 105º 06' 00" 153.4 feet along same;

30. 59º 42' 00" 1164.5 feet along same;

31. 63º 13' 50' 1593.5 feet along same;

32. 88º 10' 10" 3071.4 feet along same;

33. 95º 02' 20" 2971.8 feet along same;

34. 71º 59' 30" 2061.8 feet along same;

35. 41º 43' 30" 1595.9 feet along same;

36. 68º 28' 10" 13351.0 feet along same;

37. 17º 00' 20" 5039.9 feet along same;

38. 37º 01' 10" 4210.3 feet along same to the point of beginning.

Area 88,108 Acres

Summary of Areas

Lands	*Owner*	*Area*
Kaohe	Territory of Hawaii	79260 Acres
Humuula	Territory of Hawaii	8453 Acres
Koholalele	Hamakua Mill Company	248 Acres
Paauhau	A.W. Carter, Trustee	*147 Acres*

Total Area 88108 Acres

[C.S.F. 5055, State Survey Division]

Humu‘ula and Land Interests of the Department of Hawaiian Home Lands (1920-present)

Being a part of the Crown Land inventory, Humu‘ula and Pi‘ihonua fell into the category of Ceded Lands as a result of the annexation of Hawai‘i to the United States in 1898. Following years of work, Prince Jonah Kūhiō Kalaniana‘ole and associates succeeded in passing legislation enacting the Hawaiian Homes Commission Act of 1920, enacted by the United States Congress on July 9, 1921. The Act established a land base of approximately 200,000 acres, to be set aside for homesteading purposes by Native Hawaiian beneficiaries of the Act (Hawaii Advisory Committee, 1991).

Section ***§*** 203 of the Hawaiian Homes Commission Act of 1920, identified various public lands which would be made available for homesteading purposes. The Act named the lands and available acreage, but also included exemptions to the availability of the lands:

> (a) “all lands within any forest reservation, (b) all cultivated sugar-cane lands, and (c) all public lands held under a certificate of occupation, homestead lease, right of purchase lease, or special homestead agreement… On the island of Hawaii: …*fifty-three thousand acres to be selected by the department from the lands of* ***Humuula Mauka***, in the district of North Hilo… [HHC, Amended, 1964:4]

While a portion of Humu‘ula was designated as one of the lands set aside for Native Hawaiian homesteaders, the land was held under leases by Parker Ranch from 1914 to 2002. No pastoral homesteading lands became available until around 1990—this as a result of efforts on the part of Native Hawaiian applicants on the wait list for pastoral lease lands. The final lease of Parker Ranch on lands of Humu‘ula ended in August, 2002. In the years leading up to the end of the lease, the Department of Hawaiian Home Lands, beneficiaries and applicants initiated dialog to formulate a plan for land stewardship and lessee opportunities on portions of Humu‘ula and Pi‘ihonua. At the time of this writing, *‘Ōiwi Lōkahi o ka Mokupuni o Keawe*, an organization of native Hawaiian beneficiaries and applicants for pastoral leases, in cooperation with the Department of Hawaiian Home Lands, are working on a master plan to accomplish a program of leases and stewardship on Humu‘ula and Pi‘ihonua.

That Hawaiians have long been in favor of, and contemplating such uses by beneficiaries of the Hawaiian Home Lands Trust, is evidenced in the voices of our *kūpuna*, and was given voice in a public forum, as early as December 1920, when efforts to ensure passage of the HHCA were still underway. On December 2nd, 1920, Stephen Desha, Sr., editor of the Hawaiian language newspaper, *Ka Hoku o Hawaii*, published an article, including an interview with an elder Hawaiian rancher, and *kama‘āina* of the Humu‘ula lands. The article, translated by Maly, follows, with the words of William Lindsey, who from his youth, to his old age, traveled and worked Humu‘ula and other lands controlled by Parker Ranch.

While the land resource has been degraded since 1920, much of what the elder Mr. Lindsey expressed, is still held in the hearts and desires of beneficiaries of the Hawaiian Home Lands Trust:

> ***He Mau Aina Waiwai Nui o Humuula ame Kawaihae-uka no na Hawaii***
> ***(The Lands of Humuula and Kawaihae-uka are of great value for the Hawaiians)***
> There are many of us Hawaiians living in these days who do not know the nature of the pastoral lands of ***Humuula*** and Kawaihae-uka, and some of these people today, believe that these are stony and worthless lands, that the Hawaiians cannot live on.
>
> As a result of this confusion, remaining to this day, the writer asked Mr. Wm. M. S. Lindsey of Waimea, if these lands mentioned above, were good lands or perhaps unfit lands? The straight forward answer of this native of the mountain lands, was this, “The lands of ***Humuula*** and Kawaihae-uka are first rate lands, with gold and money to be made.”

The writer asked again: “It is said that these lands are bad, filled with stones, that people cannot live there?”

[Mr. Lindsey responded]
“These are words of deception, words spoken by Makekau at the time of casting ballots, and he is not familiar with the nature of these lands. *I am one who is familiar with every inch of the land of* ***Humuula****. I have gone there to round up cattle from my youth to my adulthood*. This is one of the very best lands of the Parker Ranch in these days.”

Another question: “Do cultivated crops grow at this place?”

Answer:
“At ***Keanakolu*** and ***Laumaia*** are very good lands for planting. Fruit trees such as apples and others grow there, and corn will grow as well. These things will all grow there because the soil is rich. These are places with water, though on the pasture lands of ***Humuula***, there is no water. But, there is much grass growing and the cattle are fat, and the horses as well.

At some places on ***Humuula***, the land below the mountain of ***Maunakea***, are grown the *uwala kahiki* (Irish potatoes) and corn, and feed for fattening the cattle of Parker Ranch.”

Lindsey also said: “That if individuals could get 500 acres of grazing land, they would be well off.

Thus we understand: “You can raise cattle, horses, donkeys, turkeys, chickens and pigs. On these mountain lands, there are many wild pigs, and you can tame them, fatten them, and sell them. These days, the wild pigs from ***Humuula*** are sold for 8 cents a pound, and you can separate out the pigs that you want to sell. Thus money can be made quickly by the ones who have this land.”

“The raising of turkeys and chickens is also a fast way for the stock breeder to earn money. You can raise several thousand turkeys a year, and also chickens, if you know how to care for them. Also, the cattle, horses and donkeys are not burdensome animals to care for, as they roam the pasture lands.”

“Cattle raised on this land are very fat. At the time when calves are born, their weight rises quickly, and dairy cattle of this place produce a yellow cream as a result of the rich grasses of this place.”

Therefore, there is no trouble for a person as he is first beginning, to get food and clothing through the goodness of these animals. With the passing of two years he will be able to sell his cattle, horses and donkeys, as he pleases. A stock breeder can purchase heads of small cattle from other places and bring them back to this land to fatten them, and in the passing of six months, will have two-fold or three-fold the money returned on them. Thus, you shall see the true value of this land for a man if he could get 500 acres of this place…”
[Desha & Lindsey in *Ka Hoku o Hawaii*, December 2, 1920; Maly, translator]

Interestingly, Mauna Kea was not the first choice for the practice of such science. The development of the first astronomy facility on Mauna Kea, occurred after the development of the Weather observatory on Mauna Loa in 1951, and the solar observatory on Haleakalā, Maui, in 1956. While the practice and activities associated with astronomy on Mauna Kea represent the shortest of the period of history and land use described in this study, its forty-one years on Mauna Kea (at the time of this writing), also represent the period of most significant changes in the natural and cultural landscapes in the upper mountain region. The significance of this fact is left to the readers of this study to assess.

The records that follow below, mostly from the Hawaii State Archives (HSA), catalogued by various departments under then Governors Ingram M. Stainback and John A. Burns, represent some of the communications documenting the early development of astronomical facilities on Mauna Kea. The communications are important, as they provide readers, with the background and considerations that were explored as decisions were being made that led to the development of the first observatories on Mauna Kea.

In the preparation of this overview of the development of astronomy on Mauna Kea, we are particularly indebted to Mr. Howard Ellis, Representative Helene H. Hale (formerly Chairman of the Board of Supervisors, County of Hawaii), and Dr. Walter Steiger, individuals who participated in the early days of this history. They shared their personal recollections, and made suggestions of resources that could be researched. In addition to the records from public collections, this section of the study refers to interviews and papers prepared by the afore-named individuals.

Mauna Loa and Mauna Kea, The Birth of Modern Astronomy on the Mountain Lands of Hawai'i

In 1947, the Territory of Hawai'i, prepared for the development of the Kulani Honor Camp, in the upper 'Ōla'a and Waiākea Forest Reserves, on the slopes of Mauna Loa. Establishment of an unmanned weather station at the summit of Mauna Loa, followed two years later, and the Stainback Highway was authorized in 1950. The development of Kulani Camp and its means of access, the Stainback Highway, fell under the management of Tom Vance, Director of Institutions in the Territory. In 1951, members of the East Hawai'i business community approached Vance with a proposal meant to draw visitors to the Island of Hawai'i. The proposal was for the development of the "Gardens of the World Highway." As proposed, the highway would ascend the slopes of Mauna Loa, ending at the summit, near Moku'āweoweo. The idea was enthusiastically adopted by Vance, and supported by Governor Stainback (Hawaii State Archives, Series Gov 9-7). As the Stainback Highway and summit road was being developed, the idea of making a manned weather station on Mauna Loa also emerged, and was dedicated in 1956.

Howard Ellis, who worked at the Mauna Loa Station from 1961 to 1981, befriended Tom Vance, and from him learned details of the Mauna Loa road project. Ellis observed that Vance was particularly protective of Mauna Kea, and so inspired by its form, that he personally traveled the Mauna Loa road, laying out its route, in order to take advantage of the best opportunities to view the beauty of Mauna Kea (see Ellis, 1988, and oral history interview in Volume II). While the "highway" on Mauna Loa was never completed, its route was dozed, and access to the summit region of Mauna Loa was available. This led to the development of the manned Mauna Loa Weather Station in 1956. Around the same time, the Solar Observatory was developed at Haleakalā, on Maui, and eyes were turning towards the high mountains of Hawai'i. According to Howard Ellis and Walter Steiger, Mauna Loa was the "logical" first choice, as the access road to the summit region had been developed. Ellis recalled learning from Vance, that he encouraged the use of Mauna Loa for observatory purposes, specifically advocating for the protection of Mauna Kea, with no development being considered (see interview with Howard Ellis in Volume II).

Indeed, the first visit to the Island of Hawai‘i, by Gerard Kuiper, an internationally known astronomer, was facilitated on the ground, by Howard Ellis, who took him to the Mauna Loa Weather Station in 1963. Ellis and Steiger both recalled that initially, Kuiper pursued an observatory on Mauna Loa—as some level of access to the summit was available—but because of the active volcanism of the mountain, he met opposition in Washington D.C. On his subsequent trips to Hawai‘i in 1963 and 1964, Howard Ellis, was again contacted, asked to meet Dr. Kuiper, and take him to Mauna Kea. Ellis, Kuiper, and his assistant, Alika Herring, traveled to Mauna Kea, conducted their observations on Pu‘u Poli‘ahu, and explored the mountain. By early 1964, Mauna Kea was promoted as the ideal, high mountain observing platform, though early proposals included development on Mauna Loa, and triangulation between facilities on the summit of Mauna Kea, Mauna Loa an d Haleakalā.

Support for astronomy on Mauna Kea, was found in the membership of the Hawaii Island Chamber of Commerce, and in the person of Mitsuo Akiyama. As a result of the 1960 tsunami, economic conditions in East Hawai‘i were dismal. Akiyama and Kuiper hit it off, and Akiyama, in partnership with the County of Hawai‘i, took the initiative for development on Mauna Kea as a serious one (see interview with Helen Hale in Volume II). The County of Hawai‘i, the State and University of Hawai‘i, the National Aeronautics and Space Administration (NASA), and the national scientific communities all worked in this accord, to further Dr. Kuiper’s proposal for an observatory on Mauna Kea. By May 1964, a jeep road had been dozed from the Hale Pohaku vicinity to Pu‘u Poli‘ahu (*Figure 60*), and a terrace leveled for a test observatory facility. In June 1964, a 12 ½ foot dome was installed on Pu‘u Poli‘ahu, and formal observations began to be made (see communications in this study).

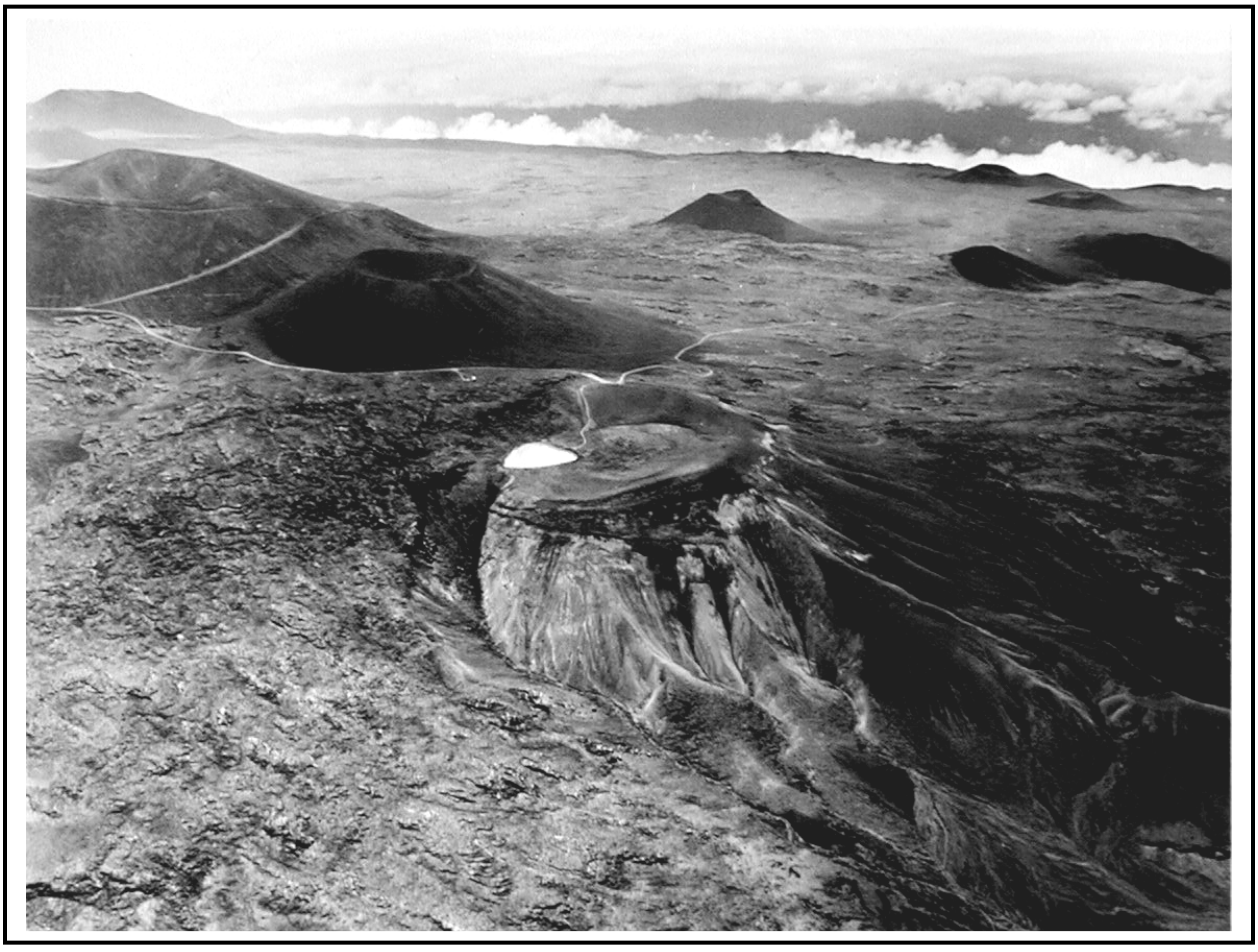

Figure 60. Mauna Kea (ca. 1965), Depicting Pu‘u and Lake Waiau, Pu‘u Lilinoe, Pu‘u o Kūkahau‘ula, and a portion of New Road to Summit (USGS Library, Denver; Copy Photo KPA-N183)

Dr. Kuiper, had been working with NASA, and on projects funded by the agency since 1959—including plans for Lunar and Mars projects. As a result, Dr. Kuiper's efforts were directed towards developing a large observatory facility on Mauna Kea, that would be operational by the time of the 1967 opposition of Mars, allowing for optimum viewing of Mars. Dr. Kuiper and associates detailed their facilities plan, including a history of his efforts in Hawaii, and on Mauna Kea, in a proposal for a 60-inch telescope to be built on Mauna Kea. The proposal of December 1964 (see proposal in this study), outlined the participation of the University and State of Hawaii, University of Arizona, NASA and other parties. Logistics and the time necessary for such a program, led to delays, and by 1965, it was determined that the 1967 date would not be obtainable. As a result of further negotiations between the University of Hawaii and NASA, it was determined that the University would build an 84" telescope on Mauna Kea. This was contingent upon a preserve being set aside on Mauna Kea, and the University of Hawaii overseeing development and management of the facility—including improvements such as the telescope pad, roads, housing, and offices. These responsibilities would fall under the direction of Dr. John Jefferies as the University established the Institute of Astronomy. By July 1966, funding from NASA was released, and plans for construction of the University of Hawaii observatory on Mauna Kea, were underway (see communications in this study).

Communications and Manuscripts Documenting Development of Astronomy Facilities on Mauna Kea

In the records of Governor John A. Burns, housed at the Hawai'i State Archives, are a number of communications between Dr. Kuiper, Mitsuo Akiyama, Governor Burns, and various parties, that provide us with details of the early development of astronomy on Mauna Kea. It is of interest to note, that among the primary factors leading to development of observatories on the high mountains of Hawai'i, was access and an available power source. It is reported that the existence of a good road, is what lead to initial development on Haleakalā in 1956. By 1964, it was determined that Mauna Kea would be the best location for further development of astronomy, but only if a good road could be made to the summit. Initially, the County and people of the Island of Hawai'i were asked to foot the bill for such development, but Governor Burns worked out arrangements for the work to be undertaken as a state project.

Selected records below, document the exploration of sites by Dr. Kuiper, and the efforts of the Hawaii Island Chamber of Commerce, Governor Burns–the State of Hawai'i, the University of Hawai'i, and NASA in development of Mauna Kea.

July 15, 1963
Thomas H. Hamilton, President, University of Hawaii;
to Mr. Mitsuo Akiyama, Executive Secretary, Hawaii Island Chamber of Commerce
(Regarding Interest and Considerations by the University of Hawaii in High Altitude Astronomy on Mauna Loa and Mauna Kea):

> In response to your letter to me of June 19 asking for additional information about (a) applied research on lava for commercial purposes, and (b) *the use of Mauna Loa or Mauna Kea as possible sites for space and astronomical activities*, I am pleased to send you herewith the comments of our most knowledgeable faculty members…
>
> ***B. Astronomical and space projects***
>
> *Dr. Walter Steiger, in charge of our High Altitude Observatory on Haleakala, assures me that it is indeed true that Mauna Kea and Mauna Loa offer unique possibilities for astronomical and space studies. It is now well known that high altitude sites (10,000 ft. and over) in Hawaii offer a large percentage of cloud-free days and nights and an atmosphere that is extremely transparent and free from contamination. As you have pointed out, these qualities are already being exploited by the Weather Bureau's Mauna Loa Observatory at 11,134 ft. and the University's Haleakala Observatory at 10,000 ft.*

In 1956, when the University established the Haleakala site, the decision to do so was based on careful study of the many factors involved. As you have suggested, one of these was the relative ease of access. The excellent road up Haleakala as compared to that up Mauna Loa was an important factor. Equally important was the fact that commercial electric power was available at the summit of Haleakala whereas power at a Mauna Loa site had to be furnished by local generators—an expensive and troublesome procedure, and never quite satisfactory. A third factor that was considered, although related to the road situation, was the livability of the location for employees and their families. At Haleakala the employees can live in the Kula area where there are schools and stores, and can commute daily to the observatory without undue hardships. At Mauna Loa, at least under present conditions, this is not feasible. To have employees with a satisfactory home life is certainly an important consideration.

Studies of the scientific qualities of the Haleakala site showed them to be very good. No such thorough study was carried out at Mauna Loa, but one can judge from the meteorological records and other comparisons that Mauna Loa and presumably Mauna Kea also would be somewhat better than Haleakala, due entirely to the additional altitude that could be gained. In 1956 it was decided that this probable improvement in observing conditions at Mauna Loa was not sufficient to offset the disadvantages of that location.

In the future the situation will almost certainly change due to the expanding needs of astronomical and space research. For some programs the additional altitude that can be gained on Mauna Loa or Mauna Kea may be the determining factor. In other cases it may be that the desirable physical and meteorological conditions necessary can only be found on a Mauna Loa or Mauna Kea site.

Potential programs for the Island of Hawaii is the search by the Lunar and Planetary Laboratory of the University of Arizona for a high quality site for a new lunar and planetary observatory. This search has been extended over the United States and even to Chile. Two series of tests have been carried out at Haleakala, and the Laboratory now wishes to extend the tests to Mauna Loa and Mauna Kea. *Dr. Gerard Kuiper, Director of the Laboratory, was recently in Hawaii and through the courtesy of the Weather Bureau was flown over Mauna Kea and Mauna Loa and driven to the summit of the latter. As a result of this preliminary survey, Dr. Kuiper has decided that Mauna Kea cannot be considered at this time because of the exceedingly difficult access to either Puu Kahinahina or the summit, which seem to be the potentially most promising sites. The Weather Bureau site on Mauna Loa at 11,134 ft. is also not suitable for his program because of the local meteorological conditions. He feels that the summit of Mauna Loa may offer an excellent site, and he is anxious to carry on detailed tests at this site as he has done at Haleakala. However, in order to bring his delicate instruments to the summit, the road must be improved considerably over the last seven miles.* The estimated cost of a minimal road is about $25,000.

We have no doubt that Mauna Loa and Mauna Kea are destined to play an important role in the future of astronomical observing sites. Clearly this role is dependent on the accessibility of such sites. We should like to encourage the people of the Island of Hawaii to do everything possible to help provide access to these sites. Perhaps the answer for the future will not be in roads but in helicopters.

We should also like to make a strong recommendation that early action be taken to set aside the summit of Mauna Loa and Puu Kahinahina as a scientific preserve for now and future generations. We would certainly be most willing to cooperate in any such plan… [HSA Gov 13-47]

January 17, 1964
Mitsuo Akiyama, Executive Secretary, Hawaii Island Chamber of Commerce;
to The Honorable John A. Burns, Governor, State of Hawaii
(Regarding Investigation by Dr. Kuiper of sites on Mauna Loa and Mauna Kea):

Enclosed herewith is a photo-copy of a reply we received from President Hamilton of the University of Hawaii which should be of interest to you, especially the subject of our two tall mountains, namely Mauna Kea and Mauna Loa.

Our office has been corresponding with Dr. Gerard Kuiper for several months now in regard to his interest in exploring the sites of our two mountains, and we feel confident that his visit here for the past several days has resulted most favorably in his desire to further explore the use of our mountains, particularly the secondary peak next to the summit of Mauna Kea, if the local community can provide an access road for his project.

Therefore, the Hawaii Island Chamber of Commerce, in our sincere desire to help expand the economy of this island, would be only too willing to assist the State and County governments in everyway possible to expedite the use of our mountains for scientific work as well as to expand the recreational facilities on the two mountains. [HSA Gov 13-47]

January 22, 1964
Gerard P. Kuiper, Director, Lunar and Planetary Laboratory,
The University of Arizona;
to President E.A. Harvill
(Regarding Investigation into Development of Astronomy Site and
Access Road on Mauna Kea; and Interest by NASA in the same):

I should like to acquaint you with the results of my Hawaiian trip made last week in continuation of the search for the most favorable observatory location within the United States boundaries in the interest of the national space program. I am enclosing a copy of a letter to Mr. Oran Nicks, Director of the Office of Lunar and Planetary Sciences of NASA, and also photostats of some Hawaiian newspaper comments. Further enclosed is a copy of my letter to Governor Burns of Hawaii, written at his suggestion, summarizing the reasons for our request for road construction to Mauna Kea.

The tests on Mauna Kea will be carried out largely by our staff member, Mr. Alika Herring, who has previously conducted the three test periods on Haleakala and has made similar studies at two Chilean sites and our own Catalina Station. The Mauna Kea tests are expected to last from 6 to 12 months. There is a good probability that Mauna Kea will be the best observatory site in the world. In view of the enormous expenditures under the national space program, it is essential that in preparation all possible data be obtained from the ground.

It is perhaps too early to consider how the Hawaiian program might be conducted if it is confirmed that the site is truly excellent. *My present feeling is that legal responsibility should rest with the University of Hawaii.* The Lunar and Planetary Laboratory is the only institute that has so far succeeded getting NASA funds for a major telescope and it is unlikely that NASA would find it politically possible to make a second major funding to LPL without incurring a storm of protest. *The Institute of Geophysics of the University of Hawaii of which my friend George Woollard is the director, will provide an excellent medium for accomplishing the national aims,* with LPL and the Geological Survey through Dr. Shoemaker, having associate status.

March 4, 1964
Board of Supervisors, County of Hawaii;
to Governor John A. Burns
Resolution No. 361
(Regarding Development of the Mauna Kea Access Road):

WHEREAS, the National Aeronautic and Space Administration, through its Office of Lunar and Planetary Sciences has authorized a series of tests of the astronomical conditions in the Mauna Kea area of Hawaii in anticipation of locating a high-altitude observatory there at to provide scientific information and engineering data to the national space programs; and

WHEREAS, preliminary studies and surveys of the Mauna Kea area have elicited favorable observations and is deemed possessed of potentialities for further and greater utilization as a site for astronomical activities; and

WHEREAS, the present one-year test program, which will in large measure determine future investment in the Mauna Kea area as an observatory site, is not sufficiently funded to provide costs for access road construction to the area desired to allow transportation of scientific equipment and building materials; and

WHEREAS, it is considered desirable to facilitate and assist the current test program to the fullest;

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF SUPERVISORS in and for the County of Hawaii that it hereby endorses said Mauna Kea observatory test program and respectfully requests the Governor of the State of Hawaii, the President of the Senate and the Speaker of the House of Representatives, State Legislature, and the Senators and Representatives to the United States Congress to use the powers of their office to facilitate the proposed road construction to and use of the Mauna Kea area as an observatory site.

BE IT FURTHER RESOLVED that the County Clerk be and she is hereby directed to forward copies of this resolution to the Honorable Hiram L. Fong, U.S. Senator; the Honorable Daniel K. Inouye, U.S. Senator; the Honorable Thomas P. Gill, Congressman; the Honorable Spark M. Matsunaga, Congressman; the Honorable John A. Burns, Governor, State of Hawaii; the Honorable Nelson K. Doi, President, State Senate; and the Honorable Elmer F. Carvalho, Speaker, State House of Representatives.

Dated at Hilo, Hawaii, this 4th day of March, 1964.

Signed:
Helen Hale, Chairman and Executive Officer, County of Hawaii
Ikuo Hisaoka
Elroy Osorio
Herbert T. Matayoshi
Sherwood R.H. Greenwell
Harold H. Higashihara
Elias P. Yadao.

March 10, 1964
Governor John A. Burns;
to Helene Hale and Members of the Board of Supervisors, County of Hawaii
(Regarding proposed development of the Mauna Kea Access Road):

This is to acknowledge the receipt of your Resolution No. 361 requesting my support for facilitating the construction of the Mauna Kea Road.

I am pleased to report that plans for construction of this road are already underway. Immediately after I received information concerning NASA's desire to use a location on Mauna Kea for a lunar observatory, I caused a review to be made as to the feasibility of the road project and an estimate to be obtained as to the cost. You will be interested to know that the cost has been estimated at about $42,000, not $25,000 as originally suggested.

In line with the policies of this administration the Department of Transportation has been directed to proceed with the construction of this road with the Department of Land and Natural Resources cooperating and furnishing funds. Please be assured that this administration, as a team, is working toward implementing the decision made to give expeditious attention to this project of local and national importance… [HSA Gov 13-47]

March 18, 1964
Gerard P. Kuiper, Director, Lunar and Planetary Laboratory,
The University of Arizona;
to Dr. Fujio Matsuda, Director, State Department of Transportation
(Regarding Development of the Mauna Kea Access Road; Support of NASA for a Test Program on Mauna Kea; and Preference for Development on "Puu Poliahu"):

It has been suggested to me by Professor Walter Steiger, writing for Dr. Woollard, Director of the Institute of Geophysics of the University of Hawaii, that I present to you the present outlook and desired schedule for the NASA-sponsored test program on Mauna Kea. Dr. Steiger and Mr. Mitsuo Akiyama of Hilo have kept me informed on the steps taken by your Office toward the construction of an access road to the summit area.

NASA's decision to support a test program on Mauna Kea for a period of approximately one year was based on my strong recommendations, following our test program on Haleakala from October 1962 to August 1963, jointly sponsored by ARPA (Department of Defense) and NASA. As you undoubtedly know, following our tests, ARPA, through contracts with the University of Michigan and the University of Hawaii, has initiated a $4.3 million construction program on Haleakala involving the installation of three telescopes. The staff of the Lunar and Planetary Laboratory will have guest privileges at this installation upon its completion approximately two years from now.

Our tests on Haleakala made it abundantly clear, however, that a distinctly higher site, in the same general area, than Haleakala would have had very marked advantages. Haleakala is not high enough above the average top of the cloud layer surrounding the Hawaiian Islands with the result that night observations are frequently interrupted; though it is true that during a fair fraction of the nights the conditions on Haleakala are very good.

Mauna Kea was selected in favor of Mauna Loa because of the expected disturbances (seismic and volcanic) on the latter. I have overflown Mauna Kea twice (June 1963, Jan. 1964) and taken many photographs of the approaches and have also traveled the jeep roads with Mr. Lyman Nichols, State Wildlife Biologist at Hilo, to the east and south of the summit (at the 6000 to 9000 ft levels). Mr. Nichols has been good enough recently to climb to the summit area of Mauna Kea and has sent me a set of color slides taken from

the 13,440 ft cone (Peak B) between Lake Waiau and the summit. This is the cone which at first seemed the most suitable for our operations, taking into account the State interests for tourists visiting the snow-covered areas to the north. The Nichols' photographs, however, have convinced me that the nearby peak, ***Puu Poliahu****, at 13,631 ft, would be distinctly preferable from the point of view of atmospheric turbulence.* I am enclosing herewith black and white enlargements of some of Mr. Nichols' photographs taken from Peak B. The legend of each photo on the back. ***Puu Poliahu*** *is better than the other nearby sites because it is a peak from which, during the night, the air cooled by radiation to space will drain off more or less symmetrically, with the observatory left in the undisturbed part of the atmosphere.* The objective of the program is to find a site where a large telescope will give superior images, with resolutions better than 1/10 of a second, and I believe that the chances are very good that the optimum site on ***Mauna Kea*** will give telescopic images better than any site in the world now used for astronomical observation. This belief is based on the general experience in the tropics of excellent image quality, even at lower elevations, coupled with the great altitude of ***Mauna Kea***, which eliminates disturbing effects of the lower and most active part of the atmosphere.

Because of the urgency to the NASA program, it would be much appreciated if the astronomical tests could begin as soon as possible after June 1, 1964. The equipment can be ready for installation, according to present estimates, late in May. It will consist of a 12 ½ ft dome, a 12 ½ inch telescope, and supporting equipment. The principal observer will be Mr. Alika Herring, who has made the three test runs on Haleakala, aided from time to time by other observers, including myself. I know that the staff at NASA Hq. attaches great importance to these tests and I believe that they will be ready to proceed with bigger plans if, as I expect will be the case, our tests during the next year turn out favorably.

Mr. Saul Price of the U.S. Weather Bureau in Honolulu has offered all possible assistance in supplying our station on Mauna Kea with adequate meteorological equipment, and I would not be surprised if they would go further than this.

The most efficient way to determine the best terminal point of the road might be for me to visit Hawaii at the time the flat area between ***Puu Poliahu*** and the ***Mauna Kea*** summit is reached, at which time the top of Puu Poliahu can be explored on foot. Provisionally I would suggest that the approach might be as indicated on the enclosed photocopy. If reaching the summit of ***Puu Poliahu*** would pose insurmountable problems, the tests might be made, by way of substitute, on the round peak just south of ***Lake Waiau***, approximately 13,180 ft elevation, shown on plate 4, left; but I would consider the higher elevation distinctly preferable.

I hope that the above description gives you the necessary background information. [HSA Gov 13-47]

March 18, 1964
Gerard P. Kuiper, Director, Lunar and Planetary Laboratory,
The University of Arizona;
to The Honorable John A. Burns, Governor, State of Hawaii
(Regarding Support for use of the Summit of Mauna Kea as the "Most outstanding observatory site in the world;" Construction of the Summit Road; and use of Mauna Loa as a Lunar Training Field):

My friends at the University of Hawaii and in Hilo have kept me informed of the various administrative steps that have been taken towards the construction of a road to the summit of Mauna Kea, and I have summarized our latest thinking on this problem in a letter to Dr. Matsuda, Director of the State Department of Transportation, as per enclosed copy. I am very grateful to the response which this program has received, and I continue

to feel most optimistic about the scientific and national assets that will accrue from the construction of this road. *I do not hesitate to reaffirm my convictions that the summit area of* ***Mauna Kea*** *may prove to be the most outstanding observatory site in the world.*

I should like to take this opportunity to return to a statement I made to you during the meeting I was privileged to have with you last January. It is that the lava fields and volcanic structures on the slopes of Mauna Loa are unequalled to any similar natural phenomena on the several continents on which I have traveled and are more like typical lunar terrain than any other lava fields I know. I believe that the nature and location of these fields offer the most interesting and instructive training area for prospective astronauts scheduled to make lunar explorations in person; and as a scientist would strongly recommend that steps be taken by NASA to include suitable visits and a training program under the supervision of the geophysicists stationed on the Island. I am aware that a limited program of this nature exists in northern Arizona under the direction of Dr. Eugene Shoemaker, Head of the Astrogeology Branch of the U.S. Geological Survey, in close coordination with the NASA's Manned Space Flight Center at Houston. I believe, however, that the Mauna Loa fields, by their nature, structure, and enormous extent, offer a "lunar training ground" not approached by any areas on the Main Land. I believe that Dr. Shoemaker fully concurs with the exceptional merits of a potential Mauna Loa training program…[HSA Gov 13-47]

March 27, 1964
Mitsuo Akiyama, Executive Secretary, Hawaii Island Chamber of Commerce;
to The Honorable John A. Burns, Governor, State of Hawaii
(Regarding Support for Big Telescope to be Built on Mauna Kea; NASA Participation; and Eliciting Congressional Support):

Thank you for your sincere effort and help to get the necessary road construction up Mauna Kea for Dr. Kuiper's test telescope site.

We noticed in yesterday's Hawaii Tribune Herald that both houses of the Legislature approved similar resolutions requesting your office to set aside a portion of Mauna Kea as a scientific preserve for now and future generations. If you recall, this was highly recommended by President Hamilton in his letter to our office, a copy I sent you for your files.

Perhaps this is a rather premature matter but assuming that the testing of Dr. Kuiper shows extremely favorable results, *I feel that Dr. Kuiper may face a big hurdle of convincing NASA to grant funds for another major telescope for his University, and he has suggested that the University of Hawaii be the logical institution to get the funds*, as per attached photocopy of his report to President Harvill of the University of Arizona after his return from the trip to Hawaii last January.

Furthermore, some concerted effort should be initiated by the local community to encourage NASA that steps should be taken to include suitable visits and a training program on Mauna Loa for prospective astronauts scheduled to make lunar explorations in person, as mentioned in Dr. Kuiper's letter to you, a copy of which was sent to our office and released to the Hawaii Tribune Herald as a feature article in the Sunday's paper with your permission.

We have considered this matter a so-called local problem until now, but the time has come when we may have to alert our Democratic Congressional delegates in our quest to convince NASA and other agencies that we do have the two tall mountains on our island with unique potentialities in furthering the National Space Program.

The Chamber Office has received excellent cooperation from the Congressional delegates on matters we have requested help, such as the stinkbug problem, the Naalehu Flood Control project, Emergency Cattle Feed Rations, and other Big Island problems which required Congressional help.

Therefore, at this time may we ask your advice as to whether it is advisable to inform our Democratic Congressional delegates, perhaps mail them some background information about our Mauna Kea project. We haven't sent them any information yet because, as I said, we have considered the matter a local problem, and through your efforts I know that we'll get the minimum road necessary for the test telescope of Dr. Kuiper.

If you feel that alerting our Congressional delegates at this stage may help, we'll be happy to mail them copies of whatever background material which I think may be helpful in their understanding of the potential projects envisaged for our two mountains.

On the other hand, if you want to write to them yourself requesting cooperation and support in the near future in order that the Democratic administration, both here and our delegates in Washington, can work together to accomplish this project, we'll be happy to give you the privilege and honor to initiate this request so that eventually we should be able to get a big telescope up Mauna Kea for the University of Hawaii.

Further, if you feel that this is too early and premature to mention anything, please advice [advise] and we will sit tight on this matter. [HSA Gov 13-47]

May 4, 1964
Gerard P. Kuiper, Director, Lunar and Planetary Laboratory,
The University of Arizona;
to Dr. G.P. Woollard, Director of Institute of Geophysics,
University of Hawaii
(Regarding Development of Telescope Terrace on Puu Poliahu; Use of Water from Lake Waiau for Facilities; and Proposed Restrictions to be set in Place):

I have just returned from a week's trip to the Hawaiian Islands, during which the road construction to the top of Mauna Kea was essentially completed and a small terrace (90 x 40 ft.) was prepared for the placement of the scientific equipment. On Friday night (May 1) I had the opportunity to make a verbal report to Dr. Steiger and some of his colleagues during a dinner party at his home. The six miles of new road are excellent for the purpose and will allow us to set up over-night accommodations at Hale Pohaku, 9200 ft., a beautifully sheltered area in a grove of oak trees. It will take 20-25 minutes to drive down these 6 or 7 miles and 4400 ft. elevation difference. The dome and telescope are scheduled to arrive in Hilo about May 15 and, if all goes well, we should be able to start our test program about June 1. The six miles of road below Hale Pohaku are still very rough, the original road cover made about 30 years ago having been nearly completely ruined. It is my understanding that the State of Hawaii will attempt to make emergency repairs on the worst 2 miles of this 6-mile section so that scientific equipment can be taken up to Mauna Kea. I have further learned that a broad program of road building and repairs in the Mauna Kea area will follow during the next budget year, $100,000 having been appropriated for this purpose. This is a tremendous development and will open up this excellent site for a broad scientific program. Incidentally, the road to Mauna Kea will be one of the most scenic in the entire United States.

The terrace on Mauna Kea now constructed will be large enough only for the modest equipment planned by our group for the test period. If it should be decided, on the basis of favorable tests, that the installation of larger equipment is warranted (a development which I do anticipate), then the terrace will have to be enlarged, which can be done easily

by road-grading equipment since no large masses of solid rock need to be moved. There are three potential sites for scientific equipment in the immediate vicinity:

Site A which I have described;

Site B about 600 ft. due north and only about 20 ft. or so lower in elevation; and

Site C to the east, about 300 ft., away and perhaps 40 ft. farther down.

Site A is definitely the prime site of the area, and it has an unobstructed horizon in all directions except due east where the summit of Mauna Kea, 160 ft. higher and one mile away, projects less than 2 degrees above the horizon over an arc of less than 20 degrees in azimuth. Northeast of Site A there is a hollow, protected by the higher elevations of Sites A, B, and C and by the summit to the east and north, a mile away, which will be very suitable for any future supporting structures, such as laboratories, darkroom, and possibly even a small dormitory.

I have discussed with Mr. Stanley Hara, Chairman of the Finance Committee of the House of Representatives, some of the potential scientific interests on Mauna Kea. I pointed out that ordinary tourist traffic around the summit to the east will, in no way, interfere with scientific operations on the observatory peak (***Puu Poliahu***) except that we would like to avoid the installation of powerful radio and TV transmitters. Also, it will be desirable to have a gate at the foot of observatory peak with a sign explaining the equipment on it (so that the public be informed and less likely to disturb the installation) and another sign stating "No Trespassing, Government Property," or something similar. *The minimum area that should be reserved for scientific purposes, in my opinion, would be 2000 x 2000 ft., centered on* ***Puu Poliahu****,* with the added requirement that no powerful transmitters be placed in the entire summit area. *There is a further direct interest in* ***Lake Waiau****, 4000 ft., southwest from observatory peak, at the elevation 13,020 ft. This lake is 250 ft. square and contains potable water. Some steps should probably be taken to protect the purity of this water supply which is potentially of enormous importance to future scientific installations on Mauna Kea.*

I do not know what precise steps would be required for securing these protective measures but I am sure that the University of Hawaii Administration would have this information, and I would be most grateful if you would initiate these steps. I would also like to have your suggestions as to what formal organizational steps would be in order to develop the cooperative program between the University of Hawaii and the University of Arizona covering our use of the Mauna Kea area for the astronomical and space-oriented programs. I may be able to return to Hawaii about June 1st and perhaps we could plan on having a formal opening of the test station with representatives of the State Government and the University present… [HSA Gov 13-47]

May 7, 1964
Gerard P. Kuiper, Director, Lunar and Planetary Laboratory,
The University of Arizona;
to The Honorable John A. Burns, Governor, State of Hawaii
(Regarding Completion of the Mauna Kea Access Road, and Preparation of the Telescope Terrace):

Last week I was able to inspect the new road constructed to the top of Mauna Kea. I supervised the preparation of a terrace on the summit for the placement of the dome and test equipment later this month. I was tremendously impressed with the site which is now essentially ready for occupation. I determined the water-vapor content of the overlying atmosphere at noon on May 1 and found it to be only 0.8 mm, which is gratifyingly low and

indicates Mauna Kea will be a site advantageous for infrared observations as well as in the optical range.

I would like to express to you personally my gratitude for your interest in this program. I believe that the opening of Mauna Kea to scientific and space-oriented research marks a major step in American science.

Enclosed herewith is a copy of a letter sent to Professor Woollard, Director of the Institute of Geophysics of the University of Hawaii, which makes reference to future possibilities of cooperation with the University.

I would like to add that all State officials with whom I have dealt in the last few months have been most gracious and helpful… [HSA Gov 13-47]

June 15, 1964
Mitsuo Akiyama, Executive Secretary, Hawaii Island Chamber of Commerce;
to Mr. William R. Norwood, Administrative Director,
Office of the Governor, State of Hawaii
(Regarding Initiation of Test Research on Mauna Kea by Alika Herring; Shipping of the Observatory Dome; Construction of the Cement Platform for the Observatory on Mauna Kea; and Dedication and Proposal that the Mauna Kea Access Road be Named for Governor John Burns):

We're very happy to report that the Chief Observer, Alika Herring, has started his work officially from Saturday night, June 13th, at the Mauna Kea Station of the Lunar & Planetary Laboratory of the University of Arizona, headed by Dr. Kuiper. Mr. Herring will report to Dr. Kuiper tonight via an amateur radio contact pre-arranged by Mr. Gillespie, Assistant to Dr. Kuiper, who was here the past two weeks finalizing plans for the station.

The observatory dome was completed last Thursday, and Mr. Gillespie left Saturday morning. The engineers from Ash Manufacturing Company, Plainfield, Illinois left Friday morning after working 3 full days installing the dome. S.K. Oda, Ltd., of Hilo was given the contract to make the concrete foundation and the wooden platform within the dome was completed by volunteer helpers.

During his two weeks visit here, Mr. Gillespie was in close contact with Dr. Kuiper, and according to Mr. Gillespie, Dr. Kuiper is scheduled to be in Hilo from July 16 to July 23, and Dr. Kuiper has suggested that any date during the week of July 19-25 is okay with him for the dedication program. He did suggest also that the early part of the week be preferred because of the possibility that he may have to rush back to the Mainland for some urgent work the following week.

We would suggest, therefore, that you consult the Governor and select a date convenient for him, because we are very anxious to have him personally present at this auspicious occasion. My personal suggestion would be on Monday, July 20, because it may make it convenient for some people coming from the Mainland. As previously mentioned, Mr. Gillespie said that Dr. Kuiper is very anxious to invite some top officials of NASA's headquarters in Washington, D.C., to visit the station.

Our preliminary planning calls for the dedication program to start about 2:00 p.m. and it should end in about an hour so that the guests who want to return have ample time to come back to Hilo to catch the last HAL plane leaving Hilo at 6:30 p.m. Aloha Airlines has a later flight leaving Hilo at 8:00 p.m. via Kona. The afternoon program should be convenient for everyone, although we may be faced with some logistic of coordinating transportation because it takes about 2 hours to reach the station. Our Public Relations

Committee will arrange transportation of 4-wheel drive vehicles to take all the invited guests.

Also, Mr. Gillespie suggested that we should arrange the program so that if guests are interested in staying late to observe the work of Mr. Herring, we should try to arrange necessary transportation and box lunches for them.

We could proceed on the printing of the invitation cards as soon as we get word from you regarding the convenient date of the Governor. Sunday, July 19 is acceptable if he feels that he cannot come on July 20 or July 21.

In a few days I do hope that I can inform you about the testing results of Mr. Herring. I have been to the site over a dozen times already, and from what little I know about astronomy, I am very optimistic that we may have the best observatory site in the world. As it stands now, we can already boast to the fact that we have the highest telescope observatory in the United States, and possibly the world because the dome in Peru, although higher, is not a planetary station.

We would appreciate a reply at the earliest convenience in order that we can proceed with the planning of the dedication.

P.S. Someone suggested that we dedicate the road as "Burns Highway," similar to the Stainback Highway. Please check if this proposal is acceptable to the Governor… [HSA Gov 13-47]

July 1, 1964
James L. Reid, President, Hawaii Island Chamber of Commerce
(Regarding Invitation and Notice of Dedication of The Mauna Kea Access Road):

Invitation:

You are cordially invited to the
Dedication Ceremonies
of the
Mauna Kea Summit Road
and the
Observatory Station
of the
Lunar and Planetary Laboratory
Monday, July 20, 1964
2 p.m. at the Dome Site
(***Puu Poliahu***)
Program coordinated by Public Relations Committee
of Hawaii Island Chamber of Commerce.

Notice:

Dear Honored Guest:

The Public Relations Committee of the Hawaii Island Chamber of Commerce is coordinating this dedication ceremonies on July 20, 1964, and we cordially welcome you to join us in this breath-taking scenic drive to the observatory site on ***Puu Poliahu*** (elevation 13,612 ft.) atop Mauna Kea.

Transportation of jeep station wagons will be provided from Hilo so we would appreciate an early reply. Deadline is July 17.

Departure time from Hilo is 11:30 A M. at the area in front of the State Land Office at 1665 Kamehameha Avenue (in front of Sure Save Super Market). We suggest that you have your own early lunch because lunch will not be provided. Please bring adequate warm clothing because the temperature has varied recently from 30º to 60º F.

Box lunches (at nominal charges) will be ordered for those who want to remain after the ceremony to observe the early moon after sundown.

Every safety precaution will be taken to insure safety of your health and no hiking will be required. However, oxygen tanks will be made available at all times.

The ceremonies should be over by 3:00 P.M. to allow time for those returning to Hilo (two hour ride) to catch a late flight back to Honolulu…

You will surely enjoy the ride on one of the most scenic roads in the entire United States. Furthermore, the site is now the highest observatory in the entire United States, the second highest dome in the world, and the highest manned lunar observatory on earth… [HSA Gov 13-47]

July 20, 1964
Participants in Dedication Ceremony
For Completion of Mauna Kea Summit Road
and Observatory Dome [Figure 61]

Date: Monday, July 20, 1964. Time & Place: 2:P.M. at Puu Poliahu.

1. Governor John A. Burns
2. Senator Dan Inouye
3. Senator Hiram Fong
4. Congressman Spark Matsunaga
5. Congressman Thomas Gill
6. Chairman Helen Hale
7. Senator Nelson Doi
8. Senator John Ushijima
9. Senator Ben Menor
10. Senator Wm. “Doc” Hill
11. Senator Kazuhisa Abe
12. Rep. Stanley Hara
13. Rep. Toshio Serizawa
14. Rep. Joseph Garcia
15. Rep. Jack Suwa
16. Rep. Yoshito Takamine
17. Rep. Takeo Kudo
18. Rep. Akoni Pule
19. Senator Bernard Kinney
20. Senator Julian Yates

Figure 61.
Governor John Burns Speaking at Hale Pohaku, prior to Ascent to Puʻu Poliʻahu (July 20, 1964); Geo. Woollard in background. Courtesy of Walter Steiger.

21. Supervisor Herbert Matayoshi
22. Supervisor Elias Yadao
23. Supervisor Elroy Osorio
24. Supervisor Ikuo Hisaoka
25. Supervisor Sherwood Greenwell
26. Supervisor Harold Higashihara
27. President Thomas Hamilton, U.H.
28. Dr. George Woollard, Director of Hawaii Geophysics Inst., U.H.
29. Dr. Walter Steiger, Chairman, Dept. of Physics, U.H.
30. Dr. Kaoru Noda, Director UHHC
31. Dr. Harold Loomis, UHHC
32. Howard Ellis, U.S. Weather Bureau, Hilo
33. Saul Price, U.S. Weather Bureau, Honolulu
34. Raymond Busniewski, U.S. Weather Bureau, Hilo Airport
35. Dr. Fujio Matsuda, Director, Dept. of Transportation, State of Hawaii
36. Jim Ferry, Director, Dept. of Land & Natural Resources
37. Charles Schuster, District Highway Engr., Div. of Highways
38. Karl Kami, Div. of Highways, Hilo
39. Hiroshi Tanaka, Land Board Member
40. Lyman Nichols, Fish & Game, Hilo
41. Michio Tanaka, Div. Head, Fish & Game, Honolulu
42. David Woodside, Chief of Branch, Fish & Game, Honolulu
43. Max Landgraf, Div. of Forestry, Hilo
44. Dr. Howard Powers, Geologist in Charge, Volcanoes Observatory
45. Fire Chief Alex Von Arnswaldt
46. Chief of Police Anthony Paul
47. T. Chocolate Nishida, Police Dept. Radio Technician
48. Fred Johnston, Superintendent, Hawaii Volcanoes Nat'l. Park
49. Seisa Kamimura, Div. of Parks, Hilo office
50. Alvin F. Ellman, S. Point Tracking Station Manager, Kau
51. Dr. Gerard Kuiper, University of Arizona
52. William Hartmann, University of Arizona
53. Carl Gillespie, University of Arizona
54. Rev. Gerald Loweth for Dedication Prayer
55. Ray Yuen, Editor Hawaii Tribune Herald
56. George Chaplin, Editor, Honolulu Advertiser
57. William K. Ewing, Editor, Honolulu Star Bulletin
58. Walt Southward, Honolulu Advertiser, Hilo
59. Jack Bryan, Honolulu Star Bulletin, Hilo

60. Lt. Col. John Coleman, Base Commander, Pohakuloa Training Area
61. President James Reid, HICC
62. President Charles Sakaguchi, Japanese Chamber of Commerce
63. President Harold Kuwahara, Hilo Junior Chamber of Commerce
64. R.W. Jaderstrom – KIPA, Hilo
65. Harold Marques – KHBS, Hilo
66. Ernest Yap, Fish & Game Warden, Hilo
67. Yasuo Kuwaye, Kuwaye Brothers
68. Glenn K. Oda, S.K. Oda, Ltd.
69. Akira Sato, Hilo Battery & Glass Shop
70. Atsuo Nishioka, State Highway, Hilo
71. Wm. McKenzie, Manager – HELCO
72. J. Stanley Hodgins, Manager – Hawaiian Telephone Co., Hilo
73. Radcliffe Greenwell, Manager – Parker Ranch
74. Wm. Seymour
75. Raymond Ikeda, County Engineer Office
76. Valentine Taka, County Engineer Office
77. Hajime Tanaka, Chief Engineer, C of H
78. Glenn Mitchell, President of Hunter's Association
79. Marlin Bordner, County ERDC
80. Harold Tanouye Sr. Chairman, ERDC
81. Myron Isherwood, Director – Civil Defense, Hilo
82. Sunao Kido, Deputy Director, Dept. of Land & Natural Resources, Honolulu
83. Robert T. Chuck, Manager-Chief Engineer, Div. of Water & Land Development, Dept. of Land & Natural Resources
84. George Inouye, Veterans Produce
85. Larry Tanimoto, Radio TV Corp.
86. William Thomspson, Manager-Engineer Board of Water Supply, C of H
87. Ralph Kiyosaki, District Superintendent, Hawaii District Schools
88. Dr. Shelley Mark,. Director, Dept. of Planning & Economic Development
89. Floyd M. Cossitt, Acting State Forester
90. Dr. Clarence L. Hodge, Deputy Director, Dept. of Planning & Economic Development
91. John Lenk, Editor, Kona Torch
92. Richard Smart, Parker Ranch
93. Tom Okuyama, 1st Vice President, HICC
94. William Chillingworth, Second Vice President, HICC
95. George Mukai, Treasurer, HICC
96. George McEldowney, Director HICC
97. Herbert Gomes, Director HICC

98. Hamilton Ahlo, Director HICC
99. Don Theriault, Director HICC
100. Warren Whang, Director HICC
101. Kent Bowman, Director HICC
102. Tommy Ishimaru, Director HICC
103. Ernest Kurohara, Director HICC
104. Shigeto Setoda, Member HICC
105. Paul Tallet, Member HICC
106. Mike Cabral, Member HICC
107. William Weber, Member HICC
108. Robert Hashimoto, Member HICC
109. Robert Santos, Member HICC
110. James Runyan, Member HICC
111. Iwao Kitagawa, Member HICC
112. Robert Yamada, Yamada Transfer
113. James Osmun, Regional Director, US Weather Bureau
114. Dr. Robert M. White, Chief US Weather Bureau
115. Thomas Vance, Hilo Hospital
116. Barry Kommel, Communication Systems Inc.
117. Joe Sanders, Dept. Assistant Manager, Pacific Operations, Atomic Energy Commission, Honolulu
118. Edward Butts, Atomic Energy Commission, Honolulu
119. Alika Herring, University of Arizona
120. James Yaeger, Radio Station – KIMO, Hilo
121. Martin Sebastian, Radio Station – KEKO, Kealakekua, Kona
122. Fred Fay, President Kona Chamber of Commerce
123. Kiyoshi Okubo, Editor, Hilo Times
124. Tadayuki Tsugawa, Hawaii Times
125. E. Ochiai, The Hawaii Hochi, Hilo Branch
126. Richard Miyashiro, Cafe 100
127. Irving Robinson, Welding & Ind. Products

128-139. Request of Dr. Kuiper. [HSA Gov 13-47]

July 20, 1964
Dedication Ceremony For Completion Of Mauna Kea Summit Road And Observatory Station

July 20, 1964 – MONDAY
2:00 P.M.
Dome Site at Puu Poliahu (13,612 ft.) Mauna Kea.

PROGRAM

1. MASTER OF CEREMONIES.
2. INVOCATION – The Reverend Gerald P. Loweth of the Church of the Holy Apostles in Hilo.
3. WELCOME ADDRESS IN BEHALF OF HAWAII ISLAND CHAMBER OF COMMERCE: James L. Reid, President.

   a. Announcement: regrets as well as introduction of special guests present.
4. WELCOME FROM COUNTY OF HAWAII: The Honorable Helene H. Hale, Chairman & Executive Officer of County of Hawaii.

   Representatives from the three following organizations to say a few words in behalf of their group:
5. State Senate – The Honorable Nelson K. Doi, President of the Senate.
6. State House of Representative – The Honorable Stanley Hara, Chairman of the House Finance Committee.
7. University of Hawaii – Dr. Thomas Hamilton, President. (A representative to speak in his behalf if he is unable.)
8. Main Speaker – The Honorable John A. Burns, Governor, State of Hawaii.
9. Response – Dr. Gerard P. Kuiper, Director of Lunar & Planetary Laboratory, University of Arizona.
10. Cutting of Leis around dome to officially dedicate completion of observatory station and the summit road… [HSA Gov 13-47]

July 20, 1964
Gerard P. Kuiper, University of Arizona, Lunar and Planetary Laboratory
Address given at Mauna Kea Station Dedication [Figure 62]:

Governor Burns, Madame County Chairman, Senators, Members of the House, Dr. Woollard and Guests from the University of Hawaii, Guests from the U.S. Weather Bureau, Guests and Friends of Hilo—Distinguished Guests!

I do not recall an occasion in my professional career that had the excitement and the promise of this moment. Here we stand on the highest mountain of the Pacific in the clearest and purest air that astronomers have found for making observations in support of the greatest of all human ventures: travel to the moon—hopefully by 1970—and later possibly to Mars.

This peak among the five summit mountains was named for the snow goddess Poliahu—built by tremendous forces of nature now dormant here—but very much alive elsewhere on this beautiful island. Hawaii is probably the best laboratory from which to study the Earth; its forces, its growth, its history, and the chemistry and history of its atmosphere. *This mountain top, our tests have already shown, is probably the best site in the world—I repeat—in the world, from which to study the Moon, the Planets, the Stars.*

The factors which make this so are lasting factors. We are here far away from the sources of industrial soot, smoke, and smog and other air pollution. And this will remain. On the mainland the industrial growth has caused a blanket over the land that all of you that have flown the jets have seen. This cannot happen here! The trade wind brings ever fresh air, cleansed by the rain. But other disturbances are possible: car lights, search light beams, radio and TV transmitters near the Observatory. I would strongly recommend that steps be taken by the Government of this State to prevent such local, man-made interference. This is a simple problem.

As many of you know, the Lunar and Planetary Laboratory staff was brought to these Islands at the invitation of the Department of Defense to test conditions on Haleakala. We found these conditions to be at times extraordinarily good, but it soon became evident that such excellent conditions would be more frequent on Mauna Kea, nearly four thousand feet higher. Because of the tremendous potential importance to the space program, I requested the Space Agency to assist in the discovery of what might prove to be the best observatory site on Earth.

Figure 62.
Dr. Gerard Kuiper Speaking at Hale Pohaku, prior to Ascent to Puʻu Poliʻahu (July 20, 1964). Courtesy of Walter Steiger.

The knotty problem of building a road on State land from federal research fund could be by-passed by the extraordinary cooperation of the citizens and Government of this State.

Governor, Sir, I want to express to you the deep appreciation for your interest and your favorable decisions—not only on behalf of myself and my associates—but, at the request of Dr. Liddel, Chief of Sciences in the Office of Lunar and Planetary Sciences, also on behalf of NASA. I want further to express appreciation to the citizens of Hilo for their tremendous help. In particular, to Mr. Akiyama, who has been our counsel and guide throughout this program. What was attempted here was unprecedented but with Mr. Akiyama's guidance and almost daily participation it was accomplished. Mr. Akiyama also prepared the very interesting pamphlet which you have received, describing the history and the legends of this beautiful Island.

Thanks are extended also to Pacific Division of the U.S. Weather Bureau in Honolulu; the director, Mr. Johnson and the Chief Scientist, Mr. Price; and especially Mr. Howard Ellis, chief of the Mauna Loa Weather Observatory. Their advice gave me some understanding of the causes and trends of the weather on these Islands. *My first good views of Mauna Kea were from a chartered plane as the guest of Mr. Price. The help of the Weather Bureau has been vital. I also want to thank Mr. Lyman Nichols, State wildlife Biologist in Hilo, who taught me about this great mountain from the ground. The selection of the observatory peak was made in consultation with Mr. Nichols, Mr. Akiyama and Mr. Ellis.* Mr. William Seymour has been a good friend of our observers—he gave them a second

home. He freely donated his time and personal resources to provide the radio links Hilo-Mauna Kea and Hilo-Tucson. These links have been invaluable for the personal safety of our staff on their remote and lonely post and for prompt transmission of data to Tucson and NASA Headquarters.

Now the Future: Mr. Governor, as a scientist who has worked in Europe, Java, the Mainland, Chile, and on Haleakala, I want to tell you that, to use the words of Mr. Alika Herring, our first observer, "This mountain is it." It is a jewel! This is the place where the most advanced and powerful observations from this Earth can be made. I believe that as citizens of the U.S., it behooves us to strengthen the scientific position of this country by developing the potentialities of this mountain top. I hope that ways can be found, in collaboration between the University of Hawaii, the U.S. Government Agencies, the Lunar and Planetary Laboratory, and other interested groups, to develop the opportunities now open.

In this development I recommend close association with the various Departments of the State. *I want to stress that recreation, conservation, and science are not rivals; on the contrary, that their interests are parallel.* Most major U.S. observatories are on game preserves, in National Forests or in Parks. The scientists will welcome visitors (naturally in small numbers) and could arrange for "open house," say, once a month.

In order to avoid conflicting efforts or rivalry, I would specifically recommend that the State Government set up a coordinating Committee charged with receiving requests for building space, examining their compatibility and providing coordination generally. This committee might concern itself also with development of roads, electric power, water. In this manner the Mauna Kea High Altitude Research and Recreational facility can be developed.

Tomorrow I shall have a meeting with Dr. Woollard, director of the Hawaii Geophysical Institute to explore common scientific interests.

My closing remark must be one of thanks to the citizens of Hilo who have organized this festive occasion… [HSA Gov 13-47]

Around the time of the dedication of the test telescope on Puʻu Poliʻahu, Alika Herring photographed Dr. Kuiper, Mitsuo Akiyama, Howard Ellis and other participants in the test program at the site on Mauna Kea. *Figure 63*, is reproduced from Mr. Herring's slide, in the collection of the Institute for Astronomy.

Figure 64, an aerial shot of the Puʻu Poliʻahu facility, shortly after development in 1964, was also taken by Alika Herring, and is reproduced here from a slide in the Institute for Astronomy.

Figure 63. Dr. Kuiper (seated, left), Mitsuo Akiyama (standing, left), Howard Ellis (standing, right), and others at the Lunar and Planetary Laboratory – Test Telescope Site on Puʻu Poliʻahu (ca. July 1964). Photo Courtesy of the Institute for Astronomy.

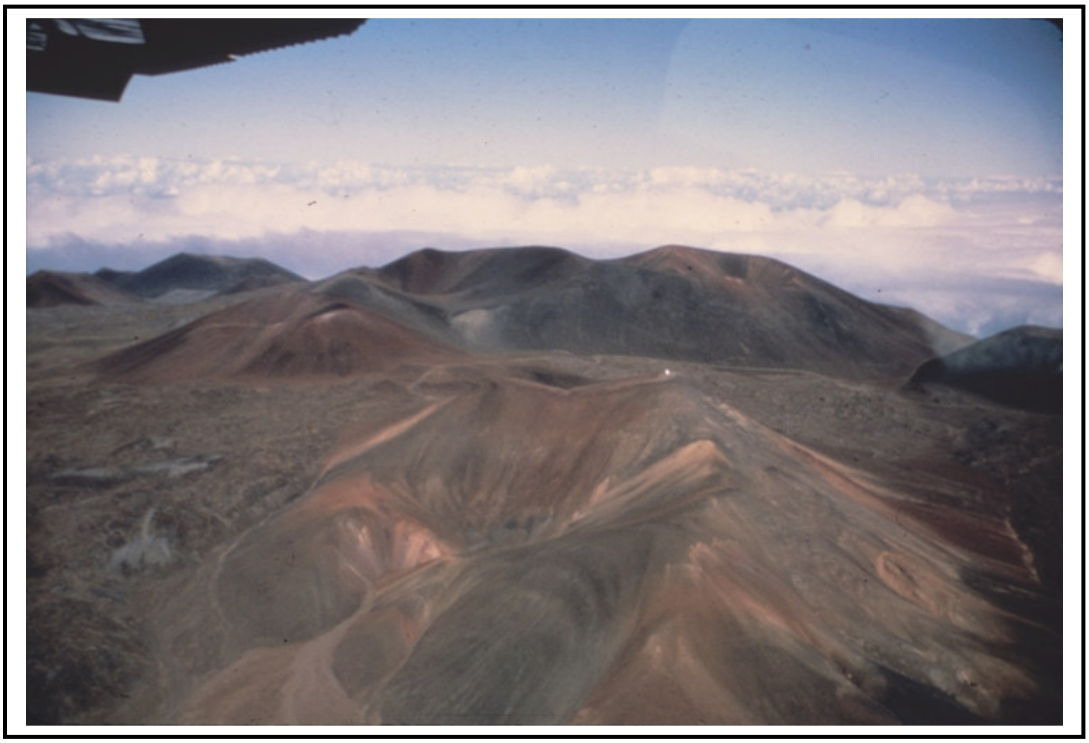

Figure 64. Aerial Photograph of the Puʻu Poliʻahu Lunar and Planetary Laboratory– Test Telescope Site. Alika Herring, Photographer (October 14, 1964). Photo Courtesy of the Institute for Astronomy.

Mauna Kea Pamphlet of the Hawaii Island Chamber of Commerce (July 1964)

As noted in the address above, given by Dr. Kuiper, Mitsuo Akiyama of the Hawaii Island Chamber of Commerce, prepared a pamphlet providing readers with an overview of Mauna Kea. The pamphlet discussed the natural and cultural environments, and considerations in development of the astronomical potential of Mauna Kea. It is notable that the cultural association of Mauna Kea, Puʻu Poliʻahu, the Hawaiian goddess Poliʻahu and her companion gods was brought to the attention of the early participants in the development of Mauna Kea. The pamphlet (July 20, 1964) is reproduced in its entirety here, as a reference point for future readers.

MAUNA KEA
Island of Hawaiʻi

Prepared By:
Hawaii Island Chamber of Commerce
95 Waianuenue Avenue
Hilo, Hawaii
July 20, 1964

FOREWORD

This simple pamphlet was prepared by the office of the Hawaii Island Chamber of Commerce to provide some background information about Mauna Kea ceremonies for the completion of the summit road and the observatory station atop ***Puu Poliahu*** on July 20, 1964.

This is an historical event because the State of Hawaii, through the vigorous leadership of Governor John A. Burns, has finally dared to push through this new summit road to open up a new vista in the development of possibly two major types of activities on this mountain:

1. Scientific and space-oriented research work.

2. Expanded recreational activities such as camping, hunting, skiing and hiking.

This pamphlet is hereby dedicated to Governor John A. Burns, and we urge the people of the Big Island to support the idea of naming the new summit road as the "John A. Burns Highway" similar to the naming of Stainback Highway and other new roads.

Also, at this time we would like to honor the scientists and explorers of the past who have made extensive exploration and research to make it possible for us to reprint and copy many of the valuable information about the mountain—its topography, climate, glacial geology and other features.

Finally, we know that the people of the Big Island wish Dr. Kuiper and the Lunar & Planetary Laboratory continued success in their quest to develop the Nation's space program, and we all hope that Mauna Kea will develop into a Mecca of scientific research someday.

TABLE OF CONTENTS

GENERAL DESCRIPTION OF ISLAND OF HAWAII & MAUNA KEA

Island of Hawaii

The island of Hawaii consists of five volcanoes, namely, ***Mauna Kea*** (13,784 feet), Mauna Loa (13,679 feet), Hualalai (8,251 feet), Kohala (5,505 feet), and Kilauea (4,040 feet).

During the past century Mauna Loa has averaged one outbreak in the caldera for every 3-1/3 years, and has produced a lava flow every 6 years. Kilauea has contained a lava lake for years at a time, but since 1800 has produced only seven flows outside of its caldera. The only recorded eruption of Hualalai was in 1800-1801. ***Mauna Kea*** and Kohala have not erupted in historic times.

Hawaii, except for the windward slope of Kohala is little dissected. The only perennial streams are on the northeastern slopes of ***Mauna Kea*** and Kohala. The high permeability of the fresh lavas forming the surface of Kilauea, Mauna Loa and Hualalai inhibit the development of permanent streams. Large areas on these mountains are covered with black rock and are bare and devoid of vegetation. The southwestern side of Kilauea is a desert.

The lavas of Mauna Loa interfinger with the lavas of Kilauea, Hualalai, and ***Mauna Kea***. The lavas of ***Mauna Kea*** interfinger with the latest lavas of Kohala Mountain. The 25-foot shore line has been found on Mauna Kea but not on Hualalai, Mauna Loa and Kilauea.

Marine conglomerates reach a height of 260 feet and stream terraces, a height of 1,100 feet on Kohala mountain. Thus, Kohala Volcano became extinct before all others on the Island. It is probable, however, that all except Kilauea have been active simultaneously since sometime in the Tertiary. The stratigraphy given in the accompanying table and the distribution of the rock units shown have been recently completed. The mountains are described in order of height.

MAUNA KEA

This mountain is the highest insular peak on the earth. Snow usually remains throughout the year in one place on the summit. The peak rises 13,796 feet above sea level, but the base of the island, and also the peak, is 18,600 feet below sea level. So the entire height of the peak from the ocean floor is more than 32,000 feet.

The lower slopes of the mountain, especially the high plains of Waimea, are blanketed with tan-colored ash deposits. Most of this material is fine-grained fire foundation debris wafted from the numerous cinder cones nearby. Streams have cut narrow gashes in the windward slope and Laupahoehoe Gulch contains an intra canyon flow. At its mouth is a flat of *pahoehoe* so recent that very little soil has formed on it. Obviously ***Mauna Kea*** poured out this lava after a canyon more than 400 feet deep had been cut. [page 1]

The volcanics of ***Mauna Kea*** are divided into two series by G. A. MacDonald. The older or the Hamakua volcanic series forms the major part of the mountain and is chiefly primitive olivine basalts with picrite-basalts carrying olivine and augite phenocrysts and a few andesites in its upper part. It usually carries a blanket of tan-colored vitric Pahala ash 4 to 15 feet thick and is separated from the over-lying Laupahoehoe volcanic series by the presence of the ash blanket and the porphyritic picrite-basalts. Interbedded with the Hamakua lavas near the summit are several beds of lithic-vitric explosion breccias reaching 90 feet in thickness. The Laupahoehoe volcanic series are predominately andesine andesites but olivine basalts are also present. The lavas of this series form a thin veneer over the upper part of the cone, reaching a maximum thickness at the summit.

They are characterized by many short flows and bulky cinder cones. The top of the mountain above 11,000 feet is a plateau that may be caused by the Laupahoehoe volcanic series filling a caldera in the Hamakua volcanic series. Six recent flows, which are all andesites, comprise the upper member of the Laupahoehoe volcanic series. They are mostly black and bare and differ from the lavas in the lower member of the Laupahoehoe series only in their youthful appearance and because those above 10,500 feet overlie glacial drift. They indicate that ***Mauna Kea*** became extinct in recent time.

A glacier about 250 feet thick covered the top of the mountain during the Wisconsin glacial stage as shown by moraines and glaciated areas above 10,500 feet. The glacial evidence was discovered in 1909 and details have been described more recently. Three older drifts have been described, but these have been found to be fanglomerate and explosion deposits. [page 2]

A TOUR OF MAUNA KEA IN 1963.

The 55-mile Saddle Road crosses the broad pass between the slopes of Mauna Loa and ***Mauna Kea*** to connect Hilo with the Waimea-Kohala district, the island's northwest corner. It also gives access to hiking and skiing areas on Mauna Kea's slopes and to Hawaii's best hunting region.

You start from Hilo in land that is forested with *ohia* and ferns, then you reach open plateau country as you get into the saddle. The road cuts through successive lava flows which have occurred over thousands of years, but the most apparent (indicated by Hawaii Visitors Bureau warrior signs) are recent Mauna Loa flows. You'll traverse 9 miles of the 1855 flow, an eruption which lasted 13 months—longer than any other in historic times. Later you'll pass over lava from the 1935 eruption which threatened Hilo's water supply until the flow was successfully diverted by aerial bombing.

Puu Huluhulu cinder cone seems to rise right out of the saddle floor near the ***Humuula*** Sheep Ranch junction. This cone, from Mauna Kea is surrounded by *pahoehoe* lava which flowed from Mauna Loa in 1935.

From the junction you can take a gravel road northeastward along Mauna Kea's slopes. You pass the Humuula Sheep Ranch Station, then drive on through open grazing lands broken here and there by small clumps of trees. At 7,000 feet you are above the Hamakua rain forest and often surrounded by clouds. From the end of the road a jeep trail continues, passing close by a monument in a grove of Douglas firs—a memorial to David Douglas, botanist and explorer who was killed near this spot. The Douglas fir was named for him. About 20 miles farther along, near Mana, the trail becomes a good road again and takes you to the Mamalahoa Highway.

From the sheep ranch station another road leads to cabins and a picnic area at the 10,000-foot level on ***Mauna Kea*** and to the start of the hiking trail to the summit. To drive this road you'll need a key to the gate—pick up the key at the office of the Department of Land and Natural Resources in Hilo, then check in at the sheep station.

The road is very steep all the way, but you can make it in a passenger car if the car is in good condition. It winds through sheep grazing lands among cinder cones up to about 9,000 feet. Scattered around are native trees—*ohia*, *naio*, or false sandalwood, and *mamani*.

At ***Halepohaku Camp*** (elevation about 9,500 feet) are two well-insulated stone houses with barracks-type accommodations for about 30 persons in each. Both houses have fireplaces as night time temperatures are extremely cold even in summer. You can make arrangements to use the cabins by contacting the State Parks Division office in Hilo.

The road ends at ***Kilohana Lookout***, a delightful picnic area about one-half mile beyond the camp. The picnic area is set among several cinder cones and its few trees seem almost out of place at this extreme elevation. [page 3]

A 6-mile trail to Mauna Kea's summit begins at the picnic area. The round trip to the summit is a grueling all-day hike; the air is so thin you can scarcely breathe and your feet will sink into cinders—high shoes are necessary. Along the trail you pass ***Keanakakoi*** *Cave, an old Hawaiian mine where Hawaiians chipped their spear points and other implement out of the hard lava. You can still see a pile of chipped rock and imperfect tools which they left.* You can also see glacial scratches on the lava slopes in this area. At the foot of a cinder cone, at 13,020 feet, is little ***Lake Waiau***, 300 feet across and 8 feet deep.

The trail spirals around the north side of the cluster of summit cones of various hues, but coming back you can plunge right down the soft south slopes and rejoin it below the lake.

From ***Humuula*** junction it's about 7 miles to ***Pohakuloa Camp*** in the heart of some of the finest upland game bird areas in the world. The camp has picnic grounds and cabin and barracks accommodations, and pens housing some rare *nene*, or Hawaiian geese.

The 12 ½ — mile stretch from Pohakuloa to Mamalahoa Highway is through the Parker Ranch. The junction is about 5 miles from Waimea town. [page 4]

GENERAL GEOLOGY OF MAUNA KEA

Mauna Kea, on the island of Hawaii, is the highest peak in the Hawaiian Islands. A large cinder cone at the summit reaches an altitude of 13,784 feet above sea level. On the north the lavas of Mauna Kea are banked against the older and smaller Kohala Volcano and to some extent interbedded with the latest lavas of the Kohala Volcano. On the south they are over-lapped by late lavas of Mauna Loa, but deflection of late flows of Mauna Kea eastward and westward along the depression between the two mountains indicates that the northern slope of Mauna Loa must already have been built nearly to its present position at the time they were erupted. Mauna Kea and Mauna Loa must have grown to a large extent simultaneously, and their lavas must be interfingered at depth. A similar relationship probably existed between the lavas of Mauna Kea and Hualalai.

The volcanic rocks of Mauna Kea are divided into two groups, named respectively the Hamakua and Laupahoehoe volcanic series. The Hamakua volcanic series is named for its exposures along the Hamakua coast, northwest of Hilo, where it is well exposed in sea cliffs and in the walls of large gulches. Its great exposed thickness is 650 feet, but its thickness below sea level is many thousands of feet. The Laupahoehoe volcanic series is named for its exposures at Laupahoehoe peninsula, where a typical andesite flow has built a lava delta. At its type locality lava of the Laupahoehoe volcanic series is separated from the rocks of the older Hamakua volcanic series by a profound erosional unconformity. Erosional unconformities of lesser magnitude separate the two volcanic series at other localities, but in still other places there is no sharp separation. Volcanism was essentially continuous from one to the other. Around the periphery of the mountain many of the lava tongues of the Laupahoehoe volcanic series are only one or two flows in thickness. On the upper flanks of the mountain erosion has in general been too slight to expose the base of the Laupahoehoe volcanic series, but the presence of a large *kipuka* of the Hamakua volcanic series extending up the southern slope to about 10,000 feet altitude indicates that the thickness on the outer slopes of the mountain probably nowhere exceeds a few hundred feet, and in many places may be measurable in tens of feet. However, if a caldera formerly existed, as appears probable, and was filled by the Laupahoehoe volcanic materials, the series may reach a thickness of two or three thousand feet.

The rocks of the Hamakua volcanic series consist largely of olivine basalts, representing the undifferentiated magma of the Hawaiian province. A few thin ash beds are intercalated with the lavas, but for the most part pyroclastic debris forms only a small proportion of the whole. The lavas were erupted in a highly fluid condition, and spread out as thin flows far from their vents, building a broad shield volcano. In the upper part of the Hamakua volcanic series, high on the southern slope of the volcano, there are exposed, however, thick deposits of explosion debris composed of blocks of olivine basalt and picritic basalt in a matrix of vitric-crystal tuff. If such deposits are abundant in the upper part of the cone, below [page 5] the levels revealed by the shallow erosional dissection, they together with the greater abundance of eruptions at and near the central eruptive axis probably account for the steepness of the upper slopes of the cone, which have an average inclination of about 16º in contrast to 5º on the lower slopes.

Gradually, as the frequency of eruption decreased and the magma chamber feeding the volcano cooled, differentiation brought about important changes in the composition of the erupted lavas. Interbedded with the olivine basalts in the upper part of the Hamakua volcanic series there are many flows of picritic basalt and andesite. The picritic basalts are

rich in phenocrysts of olivine and augite, and are believed to have formed by the settling of intratelluric phenocrysts from upper to lower portions of the magma column. The andesites are believed to represent the upper part of the magma column, impoverished in the constituents of the sunken phenocrysts.

The Laupahoehoe volcanic series contrasts with the earlier rocks in consisting very largely of andesites, with less abundant olivine basalts. Pictritic basalts are entirely absent. The andesites in general were erupted in a more viscous condition than the earlier lavas, with the production of greater quantities of pyroclastic material. Locally, small viscous domes were formed by the accumulation of lava around vents.

Except in a small wind-swept area southwest of Waimea, on the northwest side of the mountain, the surface of the lavas of the Hamakua volcanic series in buried beneath a cover of yellow to reddish-brown ash, correlative in age with at least a part of the Pahala ash on Mauna Loa. This ash is 15 feet thick near Hilo, gradually decreasing in thickness northwest ward. Near Kukaiau, 25 miles northwest of Hilo, it is only 5 to 6 feet thick and in the saddle between Mauna Kea and Kohala its greatest depth is 4 to 5 feet. Where not influenced by outside factors, its thickness increases up the mountain. At any locality, the maximum thickness is present only where the accumulation of ash has not been interrupted by lava flows. Its distribution and variation in thickness indicate clearly that most of the ash came from cones on Mauna Kea, although there must have been small additions from such other neighboring sources as the northeast rift zone of Mauna Loa. Far from being a good time marker, the Pahala ash at its places of maximum thickness represents continuous accumulation from late Hamakua time to the present. A smaller amount of ash is present also on many flows of the Laupahoehoe volcanic series, equivalent in age to the upper part of the ash on lavas of the Hamakua volcanic series.

Near the end of its eruptive history, the summit of Mauna Kea was buried beneath glacial ice. A few small lava flows are later than the glacial drift, and other flows at lower altitudes appear to be of about the same age. These late flows have been arbitrarily separated from the rest of the Laupahoehoe volcanic series. All are andesites. [page 6]

TOPOGRAPHY OF MAUNA KEA

The Mauna Kea dome, forming with the Kohala dome the north-eastern third of the island of Hawaii, is next younger than the Kohala dome in age. At least its uppermost lava flows overlap the Kohala dome along a curved boundary which extends from the northeast coast at Kukuihaele to the west coast at Kawaihae. In turn, the Mauna Kea dome is overlapped by Mauna Loa lava flows along a similar curved boundary on the south and southwest sides from Hilo to Puako. The saddle of overlap at the north lies at the elevation of about 2,900 feet; that at the south between Mauna Loa and Mauna Kea at 6,600 feet.

Thus below 6,600 feet, the southern and the western slopes of Mauna Kea are wholly concealed; at the north the Mauna Kea mass is built over and around the Kohala dome and only in the 120-degree sector from N. 20º W. to S. 80º E. are the full slopes accessible from the summit to sea level. Only the upper half of the mountain is involved in this study. Slopes of this party are in general much steeper than those of the exposed northeast lower sector, and the upper half of Mauna Kea has only about one-third the volume of the nearby Mauna Loa above the 7,000-foot contour line. The steepest slopes of the upper half of Mauna Kea on the east are between 9,000 and 10,500 feet, where the gradient is about 1,200 feet a mile. Between 9,000 feet and 6,000 feet, slopes average about 700 feet a mile; below 6,000 feet, less than 500 feet a mile.

On the north side, a maximum gradient of 1,500 feet a mile is found between 7,500 and 10,500 feet, with a gradual reduction to about 500 feet at the 5,000-foot elevation. On the west side there is a pronounced spur around which the contours pass, and down the axis of which the gradient of about 850 feet a mile obtains from 12,00 feet down to 7,000 feet, with a gradual decrease below. In the southwest sector, between 11,000 feet, and 7,000 feet, the general gradient is 1,600 feet, with a few small areas as steep as 2,000 feet, a mile. On the south side, toward Humuula, 1,500-foot slopes are found between 9,000 and 11,000 feet. Up to 7,500 feet north and northwest of Humuula is a gently sloping area with gradients of less than 500 feet a mile. The remainder of the south slope is somewhat irregular, with variable slopes among numerous cinder cones.

Above the zone of marked steepening, around the entire mountain, the slope decreases rather abruptly to form a gently domed summit plateau, whose edge may be placed at 11,000, 11,500 and 12,000 feet in elevation on the east, north, west, and south sides, respectively. Its surface rises to slightly over 13,000 feet somewhat west of the center, and on this portion stand the several large cinder cones forming the summit of the mountain. Above the 7,000-foot level, there are more than 80 pyroclastic cones. ***Puu Makanaka***, the largest isolated cone, exceeds 4,000 feet in diameter at the base, 600 feet in height on two opposite sides, and has a nearly circular rim about 1,500 feet in diameter. [page 7]

DRAINAGE SYSTEM OF MAUNA KEA

Only a very rudimentary drainage system is developed on the higher parts of Mauna Kea. So porous is the material of the cinder cones and of the broad sheets of debris between them that water from falling rain and melting snows is quickly absorbed. The cones are little scarred by runways and most of the valleys on the flatter lands assume definite form only in their lower courses.

At 6,500 feet, a circuit of the mountain reveals about eighty channels of intermittent streams, of which only twenty reach as high as 10,000 feet. Only three continuous channels of intermittent streams and lead down from elevations above 12,000 feet, ***Pohakuloa*** and ***Waikahalulu*** gulches on the southwest and ***Kaula Gulch*** on the northeast. There are no perennial streams above 4,500 feet on any part of the Mauna Kea dome. Headwaters of the Wailuku River flow intermittently from about 11,000 feet on the east-southeast side, and several intermittent streams drain to the coast from about 12,000 feet on the northeast and north. Most of these stream channels are ill-defined trenches ranging up to 50 feet in depth. Waikahalulu gulch is 200 feet deep for a considerable distance below the 10,000 foot level, and Pohakuloa is a still more prominent gorge for about 2 miles down the steep southwestern side of Mauna Kea.

In certain respects the most remarkable drainage feature of the Mauna Kea summit area is ***Lake Waiau***—a perennial body of water in the bowl of the comparatively old Waiau ash cone. As measured in August, presumably its low-water stage, it has an area of approximately 1 ½ acres, a depth of 8 to 15 feet, and lies 6 feet below the lowest sag in its rim. The freshness of its outlet channel suggests that each spring the surplus water from melting snows finds its way to Pohakuloa Gulch. Around the southern half of its shore the beach is moist with seepage water, and a spring hole dug on the southeast side was maintained full to a level of about a foot higher than the lake. The day–time temperature of the lake water in August of three different years was close to 54º F.; in the spring hole about 10 degrees less. At night the margin of the lake was covered with ice. The lake has a yellowish green color derived from organic matter in the water and in the debris which forms its end. Samples of the water and the muck were examined by Lyon with the following result:

"The water from Waiau Lake is a veritable infusion. Bacteria are extremely numerous and probably the chief factor in causing the turbidity of the water. A small ciliate is also present in enormous numbers, while a larger infusorian, *Stylonchia sp.*, is present in large numbers. I also find a few diatoms and numerous dead bodies of a crustacean, Daphnia sp. which are being consumed by a fish mold, Achlya sp. The sample of muck contains several blue-green algai, desmids, diatoms, at least two species of nematodes, hosts of bacteria and many kinds of protozoa, among which are present all of those found in the sample of water." [page 8]

A chemical analysis of the water made by the Dearborn Chemical Company (December 30, 1929) shows total dissolved solids of 6,424 grains. These include silica, 0.233; iron oxide, .070; calcium carbonate, 2.686; magnesium carbonate, 0.789; sodium sulphate, 1.954; sodium chloride, 0.680; sodium nitrate, 0.834. in composition the ratio is much like that from ephemeral Hawaiian streams fed from rain water. As compared with water from the Honolulu artesian basin it is low in silica, sodium, and chlorides and high in iron oxides, aluminum, calcium carbonates, sulphates, and nitrates.

Lake Waiau is one of the few perennial water bodies in Hawaii. Its position in an area of porous rocks at an altitude of 13,000 feet is worthy of special comment.

BASIN OF LAKE WAIAU

Lake Waiau lies in the bowl of Puu Waiau—a cone built chiefly of fine grained and much-weathered cinders and ash. On its north side, the cone is breached and thus forms an outlet for the lake at high water stages. As the average depth of the lake when full of water is about 15 feet and the muck at its bottom as much as 8 feet, the floor of its basin lies 23 feet below the lowest part of its rim. In superficial view, Waiau has the appearance of an ordinary crater lake, but striae directed toward the basin from the northeast, morainal deposits high up on its southern slope, and scour marks on its outlet bar, show that it was occupied by glacial ice. It seems probable that ice to a depth of 100 feet or more was forced into the basin and after a temporary halt was forced out to join the larger ice tongues moving down Pohakuloa Gulch. Scouring by the ice doubtless deepened the original basin, and it may be that some ice remained after the glaciers disappeared. The possibility is suggested that downward seepage of lake water is impeded not only by fine-grained ash and organic material but also by ground ice that probably forms each year. [page 9]

CLIMATE OF MAUNA KEA

Except for the miscellaneous observations by ranchers and a few instrumental measurements made from time to time by scientists who have ascended Mauna Kea, knowledge of the climate at the summit platform is based on records made during the years 1895, 1905-1914, at Humuula Sheep Station and at Lake Waiau during the period August 8-19, 1935. As elaborated by Coulter, these records permit a generalized description of precipitation and temperature characteristic of a subpolar ("tundra") climate.

On the windward (northeast) side of Mauna Kea the zone of maximum rainfall lies between contours 1,800 and 2,000, where annual precipitation may exceed 200 inches. At ***Humuula*** (6,685 feet) it is 32 inches, at ***Puu Kea*** (8,580 feet) 29.03 inches; at ***Lake Waiau*** (13,007 feet) probably less than 15 inches. The rainfall wherever recorded varies widely in amount and distribution—annual, monthly, and daily—and exposure to wind and local topographic features greatly modify the conditions resulting from altitude. On the summit area, precipitation is almost entirely snow and fog.

Above 10,000 feet, snow falls generally during the period October-May and in some years, every month. The repeated snows during the colder seasons may form a thick continuous white cap that remains for several months. The snowfall from most summer storms is light and may rapidly melt. In August, 1926, small snow banks remained in sheltered places; in August, 1935, no snow was found; during a storm in August, 1936, the summit area was covered. During a snow storm in February, 1936, generally regarded as the most severe storm in at least 25 years, the lower limit of snow which remained on the ground around the slopes of Mauna Kea followed approximately the 7,000-foot contour line. Snow to a depth of 2 ½ feet was reported between ***Puu Oo*** and ***Hookomo*** on the south slope. Sleet formed part of a brief storm in August, 1935, and several observers report sleet and ice storms during June, July, August and September.

Fogs are common about the slopes of Mauna Kea especially on the saddle which separates the mountain from Mauna Loa. Humuula during 1895 experienced 177 days of fog. At Laumaia in 1893, 233 foggy days are recorded; "the fogs came during the afternoon" and "remained during the night." On the summit of the mountain, fogs are frequent, at least during the summer season. Those noted at Lake Waiau by the Mauna Kea Expedition came from the west between 11 a.m. and 2 p.m. Other observers report heavy fogs in the late afternoon and at night.

The mean annual temperature at Humuula is 52 degrees: mean maximum, 62.1 degrees: mean minimum, 42 degrees. At Lake Waiau the highest temperature measured during 11 days in August, 1935, was 57.1 degrees, the lowest, 18.9. In January and February, so far as can be deduced from known temperature gradients and airplane observations over Oahu, the general range of mean minima and mean maxima is probably 19 degrees to 41 degrees, with extremes of 10 degrees and 45 degrees, and a mean of perhaps 30 degrees. [page 10]

Freezing temperatures are not uncommon at altitudes as low as 9,000 feet in summer and 6,000 feet in winter. Temperatures above 70 degrees are expected on unclouded days at altitudes below 7,000 feet. At Humuula, the highest temperature recorded is 84 degrees; the lowest, 25 degrees. All observers report that the water in Lake Waiau freezes at night during all seasons of the year. During the summer at least the ice melts during the day. In December 1833, Goodrich found the lake only "about half frozen over."

VEGETATION

Botanically, the alpine zone of Mauna Kea from timberline (9,500 feet) to the summit is a desert, for few species of plants and few individual plants are found. To succeed in the cinders, plants must endure many vicissitudes. Low temperature, short seasons for growth and reproduction, low rainfall, and grazing by sheep and goats combine with high soil porosity and instability of substratum to produce unfavorable conditions. Seeds that drop in the crevices in the lava rocks are the most likely to succeed, and here most of the vegetation is found.

The entire summit area, above 13,000 feet, which bears any vegetation at all is in the pioneer stage. In the alpine zone, 28 species of ferns and flowing [flowering] plants were found, also several kinds of lichens, a few mosses, algae (in Lake Waiau), and micr*o-o*rganisms. No plants were abundant; of the xerophytic flora, only one living silversword has been found. The plants found above timberline have been studied by Hartt and Neal, members of the Mauna Kea Expedition. [page 11]

GENERAL FEATURES AND GLACIAL GEOLOGY OF MAUNA KEA

INTRODUCTION

The four volcanic masses whose coalescing bases form the island of Hawaii are substantially alike in petrographic composition: all of them bear cinder cones on their flanks, and lava flows from all of them have extended far into the sea, and also inland to join their neighbors. As regards their topographic expression, they form two groups, Mauna Loa and Hualalai have remarkably flat, smooth profiles and summit craters; Mauna Kea and Kohala are rugged masses sharply incised by canyons and have no topographic feature to indicate the major source of the materials of which they are constructed. The two giant domes, Mauna Loa and Mauna Kea, reveal these differences clearly.

The profile of Mauna Loa extends from the coast as an almost unbroken curve with a gradient averaging about 600 feet to the mile nearly to the rim of the active crater, Mokuaweoweo, at an altitude of 13,680 feet. Mauna Kea, only 25 miles distant, rises from a base about half as large as that of Mauna Loa and reaches an altitude 104 feet higher (13,784 feet). Its profile is a series of broken, irregularly placed steps which lead to a summit plateau with an area of about 10 square miles, a plateau made uneven by cinder cones rising above its surface and by gorges cut below it. The ascent of Mauna Loa from the hotel at Kilauea involves the traverse of a slope of lava sufficiently fresh to retain its original structure and over a trail which might readily be converted into an automobile road. All routes to the summit of Mauna Kea wind in and out among foothills, follow and cross gorges with alternating stretches of "good going" and "stiff climbs." Up to about 11,500 feet in the valleys, and to about 12,500 feet on the flat divides, the rock where exposed is much weathered and the soil in places is deep. The plateau is covered with red and brown lapilli, partly decomposed blocks and bombs of lava and with ridges and flats of angular, fresh blocks and slabs of dense basalt. Particularly in the valleys and on the flanks of rock-ridges this material is so continuous, so deeply piled, and presents such sharp edges as to make travel on horseback hazardous.

Mauna Loa is an active volcano and any traces of glacial action which may have taken place at its summit during Pleistocene time have, so far as known, been effaced by subsequent lava flows. Mauna Kea, on the contrary, has long been dormant and shows evidence of little post-Wisconsin volcanic activity. Hence it is the only place in Hawaii, and probably in the entire central pacific, where a record of Pleistocene glaciation can be found. The mountain is therefore of peculiar interest to geologists, and to geographers and biologists as well. [page 12]

HISTORICAL SKETCH

That the Hawaiians were familiar with the summit of Mauna Kea is amply demonstrated by adz quarries at ***Keanakakoi*** *(cave of the adz makers), by walls, stone platforms, and burial caves.* The first recorded ascent of the mountain was by Joseph Goodrich in August 1823. In describing a subsequent ascent in December 1832, he speaks of "fragments of granite embedded in lava—specimens of compact lava resembling hornstone—some specimens of granite a foot or more in diameter." He found near the summit a "lake or pond of water—75 rods in circumference, or 25 in diameter—half frozen over—very deep."

James McRae, botanist of the 'Blond,' who spent many uncomfortable hours on top of Mauna Kea, June 15-17, 1825, noted "Lava and sand intermixed with small broken stones about the size of brickbats—large, sharp edged granite stones of several tons weight, which have beyond a doubt been thrown up by some previous convulsion."

David Douglas, who ascended Mauna Kea, January 19, 1834, describes the top of Mauna Kea as a "tableland or platform where spring the great vent holes of the subterranean fire or numerous volcanoes…large blocks of lava of every shape, size and color…in some places the round boulders of lava are so irregularly placed and the sand so washed among them as to give the appearance of a causeway."

Charles Pickering and William D. Brackenridge with a guide, "Dawson, alias Billy-Lilly," ascended Mauna Kea in 1841. They speak of "a plain made desolate by stones, gravel, sand, scoria…resembled the dry bed of some great river over which the water has passed for ages—no appearance of lava streams or clinkers…"

Dutton noted the salient physiographic features of Mauna Kea during a day spent on the upper slopes in 1882. He writes:

"After seven hours of travel without a halt, we reached what may be termed the summit platform, which has an altitude…averaging probably 12,500 feet…Upon this platform stand about a dozen large cinder-cones, from 700 to 1,000 feet in height, carrying the extreme apices of the mountain very nearly 14,000 feet…The aspect of the lavas beneath our feet now becomes somewhat different from those seen lower down the mountain. They are lighter colored and some of them are much more compact…Hard by the noon-day camp is a mass of very light-colored lava which seems at first to have a constitution notably different from the very black almost ultra basalts to which we have thus far been accustomed. It is exceedingly compact and fine grained and has a very light gray color. No signs of any recent volcanic activity are to be seen…How these lava sheets have thus been torn to pieces, as it were, and reduced to piles of moldering ruins I can explain only by suggesting the action of frost and ice filling the cracks and wedging the pieces apart by expansion…A few hundred yards from our noon camp is the head of a ravine which has been scored to a considerable depth by the unmistakable action of running water." [page 13]

Hitchcock, who ascended the mountain in 1886, mentions "many canyons about the base of Mauna Kea" as "criteria of a great age" and states that "there is a sort of plateau upon the higher part of Mauna Kea about the contour of 12,500 feet with an area of from 35 to 40 square miles." The Mauna Kea summit cones are usually "perfect" (not breached)…"cone at the summit is covered by blocks of consolidated lava including many bombs." "A lake about 200 feet long and 150 feet wide occupies a small crater between two sand cones".

Baldwin, while establishing a triangulation station on Mauna Kea in 1889, observed that the "sides of the mountain are made up mostly of disintegrated *aa* flows and sand cones…on top the texture of the scoria is somewhat different being of a light bluish gray color; rings when struck, and splits in regular smooth layers; the feldspars being present in large quantities."

Bryan noted that the deep gulches which furrow the northeast side of Mauna Kea do not extend to the summit, and ascribed the difference to the later extinction of volcanic activity at the summit. He says:

> "Its elliptical summit is rather thickly sprinkled with a number of cinder cones; about two dozen being above the 12,500 foot contour line…one of these cones is occupied by a pond 40 feet deep and several acres in extent."

Though Dutton ascribed the fresh angular blocks of compact basalt to “the action of frost and ice”, and both Dutton and Bryan called attention to the sudden change in profile of the drainage lines, the first record of unmistakable glacial features on Mauna Kea was made by Daly, who ascended the mountain to the edge of its summit platform in 1909. Daly writes:

> “Hawaii itself seems to have borne at least one small glacier, the characteristic traces of which were observed by the writer on Mauna Kea at the 12,000 foot level.”

There have doubtless been many unrecorded visits to the summit of Mauna Kea since Goodrich’s traverse in 1823. Indeed, it is probable that fifty or more years ago, when ranch operations were of relatively greater importance and the old Makahalau-Keanakolu trail was in general use as a route from Kawaihae and Waimea to Hilo, the upper slopes of the mountain were more generally known to the residents of Hawaii than they are today. During the last two decades a number of scientists interested in the natural history of Hawaii have reached the summit on single-day trips. Forestry surveys by the Hawaiian Dept. of Agriculture, topographical surveys by the U.S. Geological Survey (1925-1927), and observations by T.A. Jaggar and his colleagues of the Hawaiian Volcano Research Association have supplied authentic information. In particular, photographs and notes by C. S. Judd and C. J. Kraebel and sketch maps by E. G. Wingate (1927) showing approximately the position of the “new fresh rock” and “old unaltered rock” are contributions of value. [page 14]

Systematic studies of the glaciation, petrography, and structure of Mauna Kea were made by Gregory and by Wentworth at intervals during the years 1921-1935. On these studies the present report is based. In 1921, Gregory spent seven days (August 5-7, 22-25), and in 1926, three days (July 23-25) on the summit and upper slopes. Awaiting the completion of topographical maps (issued 1932), those observations were recorded in preliminary papers.

Wentworth ascended the mountain in 1929, and as leader of the Mauna Kea Expedition of the Hawaiian Academy of Science spent two weeks of August 1935 in a survey of the summit area, with special attention to glaciation. During the course of this survey, the central summit area was studied in some detail, though only a very general examination of parts of the marginal area of glaciation was made. Even with the convenience of a fixed camp at Lake Waiau, field work at 11,000 to nearly 14,000 feet is arduous for a party coming up abruptly from life at sea level in the tropics. Many problems, particularly those of altering volcanic and glacial activity and of multiple glaciation have scarcely been touched and offer a promising field for more detailed studies. [page 15]

MULTIPLE GLACIATION OF MAUNA KEA, HAWAII

Mauna Kea, Hawaii (13,784 feet), was glaciated four times during a period presumably correlative with the ice age elsewhere. Snow mantles Mauna Kea during winter but banks rarely survive the summer. Evidence is abundant not only for the latest glacial stage in the summit area but also for three earlier glacial advances in the zone outside and below the youngest moraine. The four indicated stages have been named, beginning with the latest, the ***Makanaka***, ***Waihu, Pohakuloa***, and pre-Pohakuloa stages.

Distinguishing features of the several drifts are:

1. Stratigraphic position. The three earlier ones lie under successive series of late lava flows.
2. Moderate weathering and surface staining (to brown) of the older drifts. Climate has probably been periglacial throughout Pleistocene and recent time.
3. Litho logic differences due to derivation from different series of surface lavas.
4. Matrices of the older drifts are partly tuffoceaous indicating contemporary volcanism.
5. In places the oldest drifts are well-indurated tillite.
6. The drifts are dominantly boulder beds, much water-washed. Boulders are somewhat faceted but only faintly striated.
7. Striated pavements are known under the older drifts, but glacial erosion was generally feeble.
8. Glaciers in the pre-Pohakuloa stage descended to about 7,000 feet but only to 10,200 feet in the latest stage.
9. Interglacial processes other than extrusive volcanism are little known. Climate is now sub arctic above the timber line; and significant soils probably were never developed.

Four glacial stages on Mauna Kea are indicated by four distinct drifts separated by series of lava flows up to 100 feet in total thickness. Such criteria as progressively greater internal induration, greater surface weathering where broadly exposed, and development of soil and plant cover on the older drifts indicate that true glacial stages are represented. A tentative correlation is indicated with Nebraskan-Gunz, Kansan-Mindel, Illinonian-Riss, and Wisconsin-Wurn stages of north America and Europe. No other known island summit in the Pacific area affords evidence of this sort. It is highly significant that glaciation occurred here on a summit where no permanent snow fields exist today. If Mauna Kea were higher than its [page 16] present 13,784 feet, the snow line today would probably lie between 14,000 and 15,000 feet. During the Pleistocene, general ocean-wide climatic changes led to periodic fall of the snow line below the level of 13,000 feet, the probable approximate height of Mauna Kea early in the Pleistocene. Glaicial advances in some continental areas may be correctly attributed to increases in precipitation, but in Hawaii this explanation seems less plausible than ocean-wide lowering of temperature. Most of the cinder cones on Mauna Kea probably were erupted during the Pleistocene, but their relations to moraines indicate that all but three or four were formed prior to the last glacial stage. Up building of the volcanic dome by lava outflows has been negligible since glaciation, and even since the beginning of the ice age it has not exceeded 100 feet for the whole dome.

EPOCH

Recent	less than 20,000 years ago
Pleistocene	20,000 to 1,000,000 years ago
Pliocene	1,000,000 to 11,000,000 years ago

Correlation with Glacial Stages elsewhere.

Stage no.	Hawaii,	North America,	Alps
4	Makanaka	Wisconsin	Wurn
3	Waihu	Illinoian	Riss
2	Pohakuloa	Kansan	Mindel
1	Pre-Pohakuloa	Nebraskan	Gunz [page 17]

PELE AND THE SNOW-GODDESS

"A LEGEND"

There were four maidens with white mantles in the mythology of the Hawaiians. They were all queens of beauty, full of wit and wisdom, lovers of adventure, and enemies of ***Pele***. They were the goddesses of the snow covered mountains. They embodied the mythical ideas of spirits carrying on eternal warfare between heat and cold, fire and frost, burning lava and stony ice. They ruled the mountains north of Kilauea and dwelt in the cloud-capped summits. They clothed themselves against the bitter cold with snow-mantles. They all had the power of laying aside the white garment and taking in its place clothes made from the golden sunshine. Their stories are nature-myths derived from the power of snow and cold to check volcanic action and sometimes clothe the mountain tops and upper slopes with white, which melted as the maidens came down closer to the sea through lands made fertile by flowing streams and blessed sunshine.

It is easy to see how the story arose of ***Pele and Poliahu***, the snow-goddess of ***Mauna Kea***, but it is not easy to understand the different forms which the legend takes while the legends concerning the other three maidens of the white mantle are very obscure indeed.

Lilinoe was sometimes known as the goddess of the mountain ***Haleakala***. In her hands lay the power to hold in check the eruptions which might break forth through the old cinder cones in the floor of the great crater. She was the goddess of dead fires and desolation. She sometimes clothed the long summit of the mountain with a glorious garment of snow several miles in length. Some legends give her a place as the wife of the great-flood survivor, Nana-Nuu, recorded by Fornander as having a cave-dwelling on the slope of Mauna Kea. Therefore she is also known as one of the goddesses of Mauna Kea.

Waiau was another snow-maiden of Mauna Kea, whose record in the legends has been almost entirely forgotten. There is a beautiful lake glistening in one of the crater-cones on the summit of the mountain. This was sometimes called "The Bottomless Lake," and was supposed to go down deep into the heart of the mountain. It is really forty feet in its greatest depth—deep enough for the bath of the goddess. The name Wai-au means water of sufficient depth to bathe. Somewhere, buried in the memory of some old Hawaiian, is a legend worth exhuming, probably connecting Waiau, the Maiden, with Waiau, the lake.

Kahoupokane was possibly the goddess of the mountain Hualalai, controlling the snows which after long intervals fall on its desolate summits. At present but little more than the name is known about this maiden of the snow-garment.

Poliahu, the best-known among the maidens of the mountains, loved the eastern cliffs of the great island Hawaii,—the precipices which rise from [page 18] the raging surf which beats against the coast known now as the Hamakua district. Here she sported among mortals, meeting the chiefs in their many and curious games of chance and skill. Sometimes she wore a mantle of pure white *kapa* and rested on the ledge of rock overhanging the torrents of water which in various places fell into the sea.

There is a legend of Kauai woven into the fairy-tale of the maiden of the mist—Laieikawai—and in this story Poliahu for a short time visits Kauai as the bride of one of the high chiefs who bore the name Aiwohikupua. The story of the betrothal and marriage suggests the cold of the snow-mantle and shows the inconstancy of human hearts.

Aiwohikupua, passing near the cliffs of Hamakua, saw a beautiful woman resting on the rocks above the sea. She beckoned with most graceful gestures for him to approach the beach. Her white mantle lay on the rocks beside her. He landed and proposed marriage, but she made a betrothal with him by the exchange of the cloaks which they were wearing. Aiwohikupua went away to Kauai, but he soon returned clad in the white cloak and wearing a beautiful helmet of red feathers. A large retinue of canoes attended him, filled with musicians and singers and his intimate companions. The three mountains belonging to the snow-goddesses were clothed with snow almost down to the seashore.

Poliahu and the three other maidens of the white robe came down to meet the guests from Kauai. Cold winds swayed their garments as they drew near to the sea. The blood of the people of Kauai chilled in their veins. Then the maidens threw off their white mantles and called for the sunshine. The snow went back to the mountain tops, and the maidens, in the beauty of their golden sun-garments, gave hearty greeting to their friends. After the days of the marriage festival Poliahu and her chief went to Kauai.

A queen of the island Maui had also a promise given by Aiwohikupua. In her anger she hastened to Kauai and in the midst of the Kauai festivities revealed herself and charged the chief with his perfidy. Poliahu turned against her husband and forsook him.

The chief's friends made reconciliation between the Maui chiefess and Aiwohikupua, but when the day of marriage came the chiefess found herself surrounded by an invisible atmosphere of awful cold. This grew more and more intense as she sought aid from the chief.

At last he called to her: "This cold is the snow mantle of Poliahu. Flee to the place of fire!" But down by the fire the sun-mantle belonging to Poliahu was thrown around her and she cried out, "*He wela e*, *he wela!*" ("The heat! Oh, the heat!") Then the chief answered, "This heat is the anger of Poliahu." So the Maui chiefess hastened away from Kauai to her own home. [page 19]

Then Poliahu and her friends of the white mantle threw their cold-wave over the chief and his friends and, while they shivered and were chilled almost to the verge of death, appeared before all the people standing in their shining robes of snow, glittering in the glory of the sun; then, casting once more their cold breath upon the multitude, disappeared forever from Kauai, returning to their own home on the great mountains of the southern islands.

It may have been before or after this strange legendary courtship that the snow-maiden met Pele, the maiden of volcanic fires. Pele loved the *Holua*-coasting—the race of sleds, long and narrow, down sloping, grassy hillsides. She usually appeared as a woman of wonderfully beautiful countenance and form—a stranger unknown to any of the different companies entering into the sport. The chiefs of the different districts of the various islands had their favorite meeting-places for any sport in which they desired to engage.

There were sheltered places where gambling reigned, or open glades where boxing and spear-throwing could best be practiced, or coasts where the splendid surf made riding the waves on surf-boards a scene of intoxicating delight. There were hillsides where sled-riders had opportunity for the exercises of every atom of skill and strength.

Poliahu and her friends had come down Mauna Kea to a sloping hillside south of Hamakua. Suddenly in their midst appeared a stranger of surpassing beauty. Poliahu welcomed her and the races were continued. Some of the legend-tellers think that Pele was angered by the superiority, real or fancied, of Poliahu. The ground began to grow warm and Poliahu knew her enemy.

Pele threw off all disguise and called for the forces of fire to burst open the doors of the subterranean caverns of Mauna Kea. Up toward the mountain she marshaled her fire-fountains. Poliahu fled toward the summit. The snow-mantle was seized by the outbursting lava and began to burn up. Poliahu grasped the robe, dragging it away and carrying it with her. Soon she regained strength and threw the mantle over the mountain.

There were earthquakes upon earthquakes, shaking the great island from sea to sea. The mountains trembled while the tossing wave of the conflict between fire and snow passed through and over them. Great rock precipices staggered and fell down the sides of the mountains. Clouds gathered over the mountain summit at the call of the snow-goddess. Each cloud was gray with frozen moisture and the snows fell deep and fast on the mountain. Farther and farther down the sides the snow mantle unfolded until it dropped on the very fountains of fire. The lava chilled and hardened and choked the flowing, burning rivers.

Pele's servants became her enemies. The lava, becoming stone, filled up the holes out of which the red melted mass was trying to force itself. Checked and chilled, the lava streams were beaten back into the depths of Mauna Loa and Kilauea. The fire-rivers, already rushing to the sea, were narrowed and driven downward so rapidly that they leaped out from the land, becoming immediately the prey of the remorseless ocean. [page 20]

Thus the ragged mass of Laupahoehoe was formed, and the great ledge of the arch of Onomea, and the different sharp and torn lavas in the edge of the sea which mark the various eruptions of centuries past.

Poliahu in legendary battles has met Pele many times. She has kept the upper part of the mountain desolate under her mantle of snow and ice, but down toward the sea most fertile and luxuriant valleys and hillside slopes attest the gifts of the goddess to the beauty of the island and the welfare of men.

Out of Mauna Loa, Pele has stepped forth again and again, and has hurled eruptions of mighty force and great extent against the maiden of the snow-mantle, but the natives say that in this battle Pele has been and always will be defeated. Pele's kingdom has been limited to the southern half of the island of Hawaii, while the snow-maidens rule the territory to the north.

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July 28, 1964
Dr. George P. Woollard, Director, Institute of Geophysics, University of Hawaii;
to The Honorable John A. Burns, Governor, State of Hawaii
(Regarding Proposed Management Measures and Restricted Access to the Summit of Mauna Kea):

The day after the dedication of the road to the crest of Mauna Kea, Dr. Gerard Kuiper met with Professor Walter Steiger, Professor Jerry Weinberg and myself to discuss the following:

How best to protect the Mauna Kea summit area against problems such as those that have plagued the Mt. Haleakala summit area as an observatory site

How best to get a first-rate observatory established at Mauna Kea

What sort of operations are compatible on Mauna Kea

What sort of programs should be located at Mauna Kea and what sort at Haleakala

In regard to Item (1), it was our unanimous opinion that the entire Mauna Kea summit area above the 12,000 ft. level should be made a restricted area and placed under the jurisdiction of a permanent board that you would appoint representing both the State's needs for scientific activity and conservation of natural resources. Although it was not discussed, I personally would recommend that the same board control the summit area of Mauna Loa as it is probable that both Mauna Kea and Mauna Loa in the future will have considerable scientific and conservation value to the State. For example, I can visualize the use of these two summits plus Mt. Haleakala in triangulation experiments for precisely studying on controlling the orbits of space ships or orbiting astronomical observatories.

This committee need not be large, but it should have representation from the University, conservation interests, federal scientific interests, local representation such as the Hilo Chamber of Commerce and, of course, legislative representation, as well as representation from your office.

In regard to Item (2), it was felt a joint proposal from Dr. Kuiper and myself to NASA submitted through the University of Hawaii would be the best way to try to get a permanent observatory established. This request would include a 60-inch telescope to capitalize to the utmost on the unique capabilities of Mauna Kea. We, however, are handicapped by not having an astronomer on our staff and, although I have added two

people in astrogeophysics out of our new positions of six approved by the Legislature, we can not allocate another one in this field for another year. With nine disciplines of geophysics needing to be developed, I am hung on the horns of a dilemma as to what should be pushed in terms of developing scientific balance, available research support and significance to the economy of the State. This year I am pushing oceanography and astrogeophysics with some help to solid earth geophysics.

In regard to Item (3), it was felt that the mistakes on Mt. Haleakala should not be repeated. There should be no TV, radar or radio installations, and although it was felt that the road should be open to the public, there should be restrictions on night use above the 12,000 ft. level, as car lights could seriously interfere with operations.

In regard to Item (4), it was felt that only those experiments requiring the extraordinary capabilities of Mauna Kea should be located there. These would be experiments requiring minimum water vapor in the atmosphere such as infrared studies, emission spectra and planetary photography. All others could be done equally well at Haleakala and under much easier environmental conditions. This last involves not only temperature, snow, ice, altitude effects and wind force on Mauna Kea, but also the fact that it will not be feasible to establish families much closer than Hilo because of the lack of schools, stores, etc., and the long drive from Hilo to the summit.

I believe that this covers our discussions with Dr. Kuiper, but if you have any questions, please do not hesitate to call on me. [HSA Gov 13-47]

December 1964
Proposal for the Design, Construction, and Installation of a 60-Inch Telescope on Mauna Kea, Hawaii
(Describing the proposed Telescope Project on Mauna Kea, and History of Research on Mauna Kea as an Astronomy Site in 1962-1964):

1. Introduction and Summary

This application for the construction of a 60-inch telescope for a high-altitude observatory on Mauna Kea, Hawaii, follows a test program directed by Dr. G.P. Kuiper which started in October 1962 on Haleakala, Maui, under the sponsorship of ARPA and NASA. The program was continued under NASA sponsorship on Mauna Kea (el. 13,800 ft.) after the construction of a road to the summit by the State of Hawaii, requested in a personal visit to Governor Burns, January 1964, and completed in May 1964. Under the Mauna Kea program a 12-foot dome, housing a 12 ½ inch telescope, was erected on one of the summit peaks (el. 13,630 ft.) in May 1964 and a regular test program was started June 1, 1964. The observatory and Mauna Kea road were dedicated on July 20, 1964, with Governor Burns; Mme. Hale, Chairman of the County Board of Hawaii; Mr. Stanley Hara, Chairman of the State Finance Committee; Dr. G.P. Woollard, Director of the Geophysical Institute of the University of Hawaii; and Dr. Kuiper making formal presentations.

The results of the test program have been extraordinary. No other site on earth has been found which compare with it in quality according to the three principal criteria of excellence of an astronomical observatory site.

A large fraction of absolutely clear (photometric) skies at night;
A large fraction of excellent seeing conditions (sharp images); and
Very low water-vapor content in the overlying atmosphere as determined spectroscopically.

To this may be added other exceptional advantages such as location in the tropics (93% of sky wall observable), location 3 hours west in longitude from principal U.S. observatories, complete freedom from industrial atmospheric contamination, with the trade winds being from the northeast, nearly opposite from the direction of Honolulu; favorable conditions for personal safety of observers, such as health; etc. These various aspects are developed more fully in Section 2 below.

A very important long-range aspect is that Mauna Kea is within the borders of the U.S. We know from personal experience the complexities of shipping equipment across international boundaries, of currency devaluation, and questions of health, language, etc. [page 1]

The Director of the Kitt Peak National Observatory, Dr. M.U. Mayall, has authorized us to state that he regards Mauna Kea as a potential site for a very large telescope ("X-inch") frequently discussed as the ultimate goal during this century for ground-based astronomy. Because of the large cost of a very large telescope (presumably in excess of $100,000,000) a site can only qualify for the X-inch if it has proven its worth with telescopes of smaller aperture.

In selecting the design for the proposed telescope, a decision was needed regarding its aperture and its detailed requirements. The following are the main considerations governing this proposal:

(1) A 60-inch telescope, with accessories, can be produced in two to three years, an 84-inch telescope in about five years. Because of the urgency of the programs to be carried out on Mauna Kea the more modest program is definitely preferred.

(2) The very high altitude of Mauna Kea, one of its great merits, implies certain discomforts for the observers which, however, can be largely overcome by the use of the coude focus which allows the air to be enriched in oxygen (not pressurized, which would entail more difficult and unnecessary technical complications).

Because of these two considerations the design adopted in this proposal is that of the Kitt Peak National Observatory design for the Chile 60-inch telescope which has a coude installation (the 60-inch Catalina telescope does not). The Director of the Kitt Peak National Observatory has stated that he will make available, without charge, the full design drawings of the Chile telescope.

As is stated in greater detail in Section 3, Vice President Hiatt of the University of Hawaii, stated to Dr. Harold Johnson in a conference at that University of November 30, 1964, also attended by Mr. Stanley Hara and Mr. Akiyama (Executive Secretary of the Chamber of Commerce of Hilo), that the University Administration is prepared to submit to the Hawaii State Legislature budget requests for the dome and building on Mauna Kea, estimated to require roughly $300,000; and supporting buildings at Hale Pohaku, the base camp at the foot of the summit area (el. 9,200 ft.), and Hilo, the port of entry and site of a two-year branch of the University of Hawaii; and Mr. Hara agreed during this conference to introduce the necessary legislation. [page 2]

Because of Dr. Johnson's experience with the development of Site II of the Catalina Station and the scientific programs carried out there and also his strong interests to extend these programs to the Southern Hemisphere under the superior conditions of Mauna Kea, it is proposed that he be the principal investigator; with Dr. Kuiper, who has

directed the test program since 1962, and who wishes to extend his lunar and planetary observation program, acting as coinvestigator. It is believed that direct participation with the Department of Astronomy at the University of Hawaii can be effected. We shall also welcome cooperation with other universities interested in the site and will agree to a sharing of observing time after the installation is complete.

Dr. Kuiper has consulted with Dr. Jerome Spar, Director of Research of the U.S. Weather Bureau, about their interest in Mauna Kea. Dr. Spar has stated that he wishes to transfer the Mauna Loa Weather Bureau Observatory (11,100 ft.) to Mauna Kea (13,800 ft.) as soon as possible and is prepared to add a program in atmospheric geochemistry which would be important to Dr. Kuiper's planetary program. It might be pointed out that during the past 2-year test period in Hawaii, the U.S. Weather Bureau, through its Honolulu and Hilo offices, has given much valuable advice and assistance. Attention is further called to the personal interest of Governor Burns in these programs, as may be seen from the two letters from the Governor to Dr, Kuiper, dated October 9 and November 24, 1964, of which photo copies are attached to this application.

The Mauna Kea Observatory would be the highest observatory not merely in the United States but in the world. It would be the first one to be "pressurized" or "oxygen-enriched," with the auxiliary equipment operated by remote control. The types of indirect instrumentation required can serve as prototypes for more difficult space operations to follow. The tropical latitude of the site is a tremendous advantage for lunar and planetary observations because they can be made when the objects are near the zenith. The nearest oppositions of Mars occur when the planet has a declination around –20 degrees, a serious handicap when observations are to be made from the mainland United States. Certain lunar programs also require observations when the moon has a southern latitude (selenodesy, using opposite librations). Similar problems exist with respect to the ring and satellite systems of the Planet Saturn; and the cloud belts of Venus. [page 3]

The proposed telescope is highly automated in setting, guiding and data acquisition. This is called for because of the high altitude of the site and the need for the observer to stay in an oxygen-enriched room if he is to be alert and not to endanger his health. The coude installation further allows the use of large recording equipment and accessories (counters, etc.). The techniques to be used will be intermediate between those common in ground-based astronomy and needed in space research. They will be adaptable to balloon astronomy and programs such as OAO. Because of this Laboratory's existing programs in these related fields the staff has a strong interest in such development and has already considerable experience with remote control balloon instrumentation.

The 60-inch telescope for the Catalina Station and its dome are scheduled for completion January 10, 1965. The optics for this telescope were produced in our optical shop under the direction of Mr. Robert Waland, formerly from St. Andrews University, Scotland, one of the most competent contemporary opticians. It is proposed that the optics of the Mauna Kea telescope also be produced in house which will affect very substantial savings and ensure top quality.

2. The Hawaii Test Program

During the summer of 1962 Dr. Kuiper was approached by the ARPA-University of Michigan group (Dr. Zirkind; Prof. Boggess) on whether the Lunar and Planetary Laboratory was able and interested to provide an observer and a test telescope to examine the astronomical conditions on Haleakala, Maui (10,000 ft.). Having had a long-time interest in the unexplored astronomical potential of the high mountains in Hawaii, he accepted this responsibility on condition that the test program be sponsored jointly by

NASA (Office of Lunar and Planetary Sciences), to stress the Scientific rather than the service interests of this Laboratory. This program was agreed to by the Director of Lunar and Planetary Science of NASA and made possible by the generous assistance and cooperation of Dr. Walter Steiger, Director of the Haleakala Observatory. Dr. Steiger made available the newly constructed 16-foot dome that was to house the cororograph beginning September 1963, and provided lodging for the Arizona observers on Haleakala and the university dormitory at Waiakea (4,000 ft.). Our observer was Mr. Alika Herring, a man of over 20 years of astronomical observing experience and an expert optician. Dr. Kuiper joined Mr. Herring during two of his three runs (Oct-Dec 1962; April-June 1963; Aug 1963) [page 4] for about one week each. He verified that Mr. Herring's seeing scale (0 very poor, 3 fair, 5 good, 7 excellent, 9-10 entirely perfect for many minutes without the slightest interruption) was stable and in agreement with the customary scale used by experienced double-star and planetary observers. The telescope used was Mr. Herring's personal property. It has superb optics showing for a bright star the OV36 stellar diffraction disk surrounded by at least 6 diffraction rings. These rings are extremely sensitive to seeing and give a sharp measure of it. The Haleakala tests showed that while the best conditions were truly superb (seeing 9), they occurred only during a single two-week period in October 1962. Often the trade wind would blow fog, accumulated in the great crater below at around 8,000 ft., over the rim causing the most irregular conditions of seeing and humidity. It was apparent that the much-higher mountains of Hawaii Island would be far better, at least at night.

The first tests on Hawaii Island was made in June 1963 from the Mauna Loa Weather Bureau Observatory, by invitation of the Weather Bureau, with a 6-inch telescope for this purpose shipped in from the mainland by Mr. Saul Price, Chief Scientist, Honolulu Office, U.S. Weather Bureau. He also arranged for a chartered overflight of the large mountains.

It was not possible to implement the desire to test on Mauna Kea, which was inaccessible, except on foot, until the State Government of Hawaii, supported the NASA-Arizona program with the construction of a 14-foot-wide graded and oiled access road to span the last 6 miles to the summit. Governor Burns graciously agreed during Dr. Kuiper's visit in January 1964 to have this road constructed and he honored us with his presence at the dedication of observatory and road on July 20, 1964. *The road construction was completed about May 1, 1964, with Dr. Kuiper personally directing the grading of the upper part of the road and the observatory terrace.*

The site selected was not the summit (13,798 ft.) but ***Puu Poliahu*** *(13,631 ft.) because of its steepness and isolation. However, to view of the steep gradient in the water vapor content and the large area needed for future developments it is proposed that the Mauna Kea Observatory be constructed on the real summit.*

The Mauna Kea test observatory was completed about June 1, 1964. The 12-foot dome is an Ash Dome and the telescope a Cave Telescope, but the optics used was Mr. Herring's excellent mirror. The test program has again been conducted [page 5] by Mr. Herring, assisted by Mr. William Hartmann, for a period in July 1964, and by Dr. Kuiper during short visits in July and October 1964.

The U.S. Weather Bureau installed near the Observatory an anemometer, a maximum and minimum thermometer, and a self-recording thermo-hydrograph. Typical night temperatures in summer are 24 deg. – 36 deg.; typical relative humidities 10-15%, typical wind velocities 0-10 mph and 20-35 mph in almost equal frequencies, with much higher winds (up to 70-80 mph) not experienced but certainly present occasionally on the basis of the Mauna Loa records.

It does not rain on Mauna Kea, but there is occasional snowfall in winter (Mauna Kea = White Mt.), and occasional fog in summer. The weather at night is about 60-70% photometric, as compared to 22% at McDonald Observatory and 33-35% at the Arizona Observatories (figures by Dr. H. Johnson). Girrus occurs about 25% of the time, often very light, not that 90% of the nights or more will allow spectroscopic observation. Cloudy nights account for less than 5% based on Weather Bureau data since 1958. The average seeing was found to be 6-6.5 as compared to 5 for the Catalina Station in summer and fall, 3-4 in winter, and 5 during test periods of five nights each at Cerro Tololo (7,300 ft.) and La Penieta (10,000 ft.), Chile (both during "good" summer weather). Seeing 7 and above occurs often on Mauna Kea.

The atmosphere pressure at Puu Poliahu is 590 mb; the transparency is fantastic to any one familiar with U.S. continental conditions. At present the limit is the Bali volcanic dust at very high altitude (about 70,000 ft.), visible from Mauna Kea much more clearly than elsewhere because of the clear lower atmosphere. This dust will probably settle in a year or two, as did the dust of Krakatao 1883-1885.

A most important consideration is that Mauna Kea will remain in pure air for many decades to come because of the favorable airflow pattern over the ocean; whereas the continental observatories are finding in steadily thickening atmosphere. Photometry and spectroscopy will be possible from Mauna Kea down to 60ºS declination, which covers 93% of the entire sky. No artificial lights trouble the site and aurorae are absent at the latitude, 19º 49' N.

The seismic stability of Mauna Kea at 13,200 ft. level, between the summit cones, is the best in the Hawaiian Islands, according to tests directed by Dr. G.P. Woollard. The cinder cones themselves are composed [page 6] of rather loose material but no different from that on which the 60-inch astronometric telescope of the US Naval Observatory is built near Flagstaff. The foundations will have to be made adequate. Mauna Kea is an extinct volcano, unlike Mauna Loa, with no activity having occurred since the Pleistocene. Dr. Kuiper has reviewed the safety of this mountain with Dr. Gordon McDonald, chief volcanologist of the Islands, at the University of Hawaii, who sees no cause for concern on Mauna Kea.

3. The Proposed Research Telescope and Auxiliaries.

The exceptional observing conditions found on Mauna Kea make it urgent that the site be utilized for astronomical observations in support of the space program. The excellent seeing will make possible higher resolution, visual, photographic and spectroscopic, in lunar and planetary studies. Such higher resolution is essential if we are to obtain more information about the surface of the moon and planets. Because of the high percentage of "photometric" weather and the small amount of precipitable water, Mauna Kea should be the best known observing site for astronomical photometry and spectrometry, in visible, infrared and millimeter wavelengths.

As a first step in the development of the Mauna Kea observatory site, we propose to build a 60-inch telescope, equipped with attachments for making photometric, polarimetric and spectromatric observations over the range of wavelengths from 0.3 u to 13 u; later extensions to 20 u, 300 u and 1 mm may be made. This instrumentation would be suitable for observations of the moon, the planets and the stars. The optical quality of the telescope must be as high as it can be made, in order to take advantage, especially for lunar and planetary observations, of the superior image quality that we have observed on Mauna Kea. Visual and photographic observations would also be provided for.

The great altitude of the summit of Mauna Kea, 13,800 feet, and the resultant [page 7] difficulty of working effectively there, make it important that the installation be such that the observers work in a pressurized (or oxygen-enriched) somewhat-heated room. The telescope and auxiliary instruments must be designed for remote operation, similar to radio telescopes. The Kitt Peak National Observatory has available designs for 60-inch and 84-inch telescopes. The 60-inch telescope is intended for Chile, with the 84-inch has already been put into operation at Kitt Peak, Arizona. Both designs can be used for the remote, automatic operations necessary on Mauna Kea. According to Dr. N.U. Mayall, Director of Kitt Peak National Observatory, the time of duplicating the construction of the 60-inch would be about two years, while it would take five for an 84-inch. We have chosen to copy the 60-inch design, in order to minimize the time required to get into operation.

The auxiliary instruments which we propose to construct would be based upon existing devices already developed and in use at the Lunar and Planetary Laboratory. Our present instruments are not suitable for Mauna Kea because they are not designed for remote operation.

The 60-inch AURA telescope design includes the coude focus, and we propose to carry out observations from the oxygen-enriched coude room. We do not at this time propose a coude spectrograph, although space for one will be provided. Thus, observations would be made either at the coude focus or, remotely, at the cassegrain focus.

It is now well-known that in the far infrared the variable "sky" background seriously limits the performance of photometric and spectromatric operations. The recent successful resolution of this problem by Low and Johnson has depended upon the addition to the LPL 28-inch telescope of an offset finder and a telescope "wobbler." The offset finder can be offset, from the pointing direction of the main telescope, by up to +1º and is used for finding objects too faint [page 8] for visual observation, and for offset guiding during observation with the main telescope. The telescope "wobbler" moves the telescope back and forth, star to sky and return, in synchronism with the integration cycle of the automatic photometer and data recorder. We propose to construct, as part of the photometers and spectrometers, as offset devices that can be remotely controlled from the coude-room. This device would be similar to that described by Johnson in Basic Astronomical Data (University of Chicago Press, 1963); it has been quite successful for offset finding and guiding. In addition to the adaptions of this design for remote offset operation and readout, we will substitute for the eyepiece an image orthicon TV-relay system. According to Dr. Livingston of Kitt Peak Observatory, it should be possible to see 18th mag. Stars with such a device. The slow motion controls of the telescope will be modified slightly to make the telescope "wobble" in the manner that has been successful with the 28-inch.

The budget for the construction, installation and testing of the proposed 60-inch telescope and auxiliary operation is given in Sec. 4. It does not provide for a dome and building to house the telescope, nor does it include necessary additional laboratory and office buildings at the lower altitudes. However, during a recent meeting, Vice President Hiatt of the University of Hawaii indicated that when the National Aeronautics and Space Administration decides to go ahead with this part of the project, the University of Hawaii will take steps to request from the Hawaii Legislature the funds for the necessary supporting facilities, such as dome and building for the 60-inch, laboratory and office building, roads, power lines, etc. The Hon. Stanley Hara, Chairman of the Finance Committee of the Hawaii House of Representatives, has indicated his belief that such requests by the University of Hawaii will receive favorable action by the Hawaii Legislature… [page 9; HSA Gov 13-47]

January 5, 1965
Dr. George P. Woollard, Director, Institute of Geophysics, University of Hawaii;
to Major General Edmond H. Leavey, U.S.A. (Ret.), Chairman,
Governor's Advisory Committee on Science and Technology,
Department of Planning and Economic Development
(Regarding Determination of Roles of the University of Hawaii, NASA, Dr. Kuiper, and others in the Development of the Mauna Kea Observatory; and Plans for Lease of the Summit to the University of Hawaii):

As you know, there has been considerable discussion about getting a major telescope installation on Mauna Kea, particularly since Professor Kuiper of the University of Arizona started conducting a site survey in Hawaii for the National Aeronautical and Space Administration in the hope that there would be a superior low latitude location in Hawaii for observing the transit of MARS in 1967. Professor Kuiper's recommendation to NASA on the basis of his studies to date with a small telescope is that Mauna Kea is not only the best site in Hawaii, but also probably the best site in the world for low latitude planetary observations.

NASA is now anxious to go ahead on a telescope on Mauna Kea, but has not reached a decision as to how to best handle the installation and its operation. NASA itself does not have an in-house operational group for this type of project, and has to implement its research program through grants and contracts. In the present case, the contract can be made directly with the University of Hawaii; the University of Hawaii in collaboration with another university; or directly with another university. We are submitting a proposal directly from the University, but also have been identified as a collaborating institution by both Harvard College and the University of Arizona in proposals that have been submitted by these two institutions. The situation is therefore a bit confused, and I think it wise to give you and the Governor's Committee both the background and outlook for the future at this time.

Professor Kuiper last summer approached me on the basis of the University of Hawaii submitting a proposal in collaboration with the University of Arizona, his institution, for setting up and operating a NASA supported telescope on Mauna Kea. As at the time there was no one on the staff of the University of Hawaii who had a background in planetary astronomy, and as I was reluctant to take on the housekeeping operations for such an installation without our taking part in the scientific program, I agreed to collaborate with him on the basis that he would help us find a competent planetary astronomer so that there would be scientific collaboration.

Since that time we have still not been able to find a top-level planetary astronomer, but have added significantly to our staff for work in other phases of astronomy. One of the new men who is now in charge of our astronomical program is Dr. John Jefferies. He was formerly at the National Bureau of Standards High Altitude Observatory at Boulder, Colorado, and is a recognized leader in solar physics and astronomy. In all, there are now nineteen persons in the astronomy-aeronomy group at the Institute, and our program at the Haleakala Observatory in solar physics, zodiacal light and ionization effects is one of the best in these aspects of astronomy.

In October Dr. Jefferies and I had another conference with Professor Kuiper, and again we reiterated our willingness to work with him on the basis of scientific collaboration, but not on the basis of housekeeping. Professor Kuiper appreciated our viewpoint, and in fact, stated that he would not have us even consider any other basis of collaboration.

I stress this background of amicable relations with Professor Kuiper, who incidentally is a personal friend of mine of some 15 years' standing, because it has come to my attention

that “rumor” has it that the University has been dragging its feet on cooperating with Professor Kuiper on the Mauna Kea project and even trying to sabotage it. Nothing can be further from the truth. Any reluctance on my part in collaborating with Professor Kuiper has been only in terms of our not being a scientific partner, and even here I have proceeded on the assumption that this would be resolved as evidenced by: (a) the seismic noise level study I had made of the top of Mauna Kea by our seismologists and the U.S. Coast and Geodetic Survey and which I forwarded to Professor Kuiper for inclusion with his test telescope observations in his report to NASA, and (b) the presentation I made to the U.S. Wildlife and Conservation group on the compatibility of observatory and conservation interests on Mauna Kea.

In November things were brought to a head when Dr. Kuiper announced that he had funds for a 60-inch telescope on Mauna Kea. As we had seen no proposal to NASA from Professor Kuiper for such a telescope, and as we were naturally curious as to what role we had been cast in his proposal, Vice-President Hiatt, who happened to be in Washington, made a point of visiting NASA to find out what commitment, if any, had been made in the name of the University of Hawaii. He found no funds had been given to Professor Kuiper for this telescope, although a tentative decision had been made to support a telescope on Mauna Kea. Professor Hiatt also found there was some aversion to have Professor Kuiper associated with the Mauna Kea project despite the fact that he had been commissioned by NASA to carry out the preliminary test observations. This aversion was not related to Professor Kuiper’s competence as an astronomer, but rather to the fact that since his present NASA supported program is so large, it was felt that he could not do justice to an additional program on Mauna Kea. It was suggested that we might consider some other partner, and NASA further offered to contact several astronomers who it was felt might make a more satisfactory partner than Professor Kuiper.

I wrote Professor Kuiper as to the status of things, and he was naturally upset and wrote the Governor implying that Professor Hiatt had not talked to a responsible official of NASA.

The only way to settle this was to ask for a conference at NASA to go over the whole Mauna Kea situation. Homer Newell, NASA Deputy Director for Science, is a personal friend of mine, and he arranged for all the cognizant officials to meet with Professor Hiatt, Dr. Jefferies and myself on December 10 in Washington. Newell was also able to sit in the latter part of the meeting which was a two-hour conference. It is possibly significant in view of Professor Kuiper’s letter to the Governor that he was not invited to this meeting, although Professor Menzel of Harvard was. All of the points made earlier concerning Professor Kuiper were reiterated, namely he is over-extended. Our position in insisting on scientific collaboration was discussed and endorsed as being both reasonable and sensible, and Professor Menzel presented the basis on which Harvard might collaborate with the University of Hawaii. It was also recognized that our problem in finding an A-1 man in planetary astronomy might well be quickly resolved once word gets out that there would be a major telescope installation on Mauna Kea. Up to this meeting, there was no definite assurance that there would be a telescope on Mauna Kea, and we had nothing really to offer a good man.

Since this meeting, we have received a draft of Professor Menzel’s proposal for a joint operation which allocates the University of Hawaii the role of a housekeeping agency. The Arizona proposal at least hopes that we can give half positions to people on their staff, so that it would be at least officially a joint scientific operation.

Professor Hiatt, Dr. Jefferies and myself had a joint telephone conversation with Dr. Liddel of NASA on December 20, and the upshot was that we were encouraged to put in a proposal of our own for an 84-inch telescope and a Coude interferometer. Dr. Jefferies is now drafting this proposal.

All is not quite clear sailing as we are going to have to depend on the recommendations of an advisory panel of experts such as Professor Kuiper in coming up with the design, and sub-contract the construction. In addition, NASA can not underwrite the cost of the observatory, the paving of a road, bringing up power, or building support facilities as a dormitory at the 10,000 ft. level, or a laboratory on the Hilo Campus of the University. The most we can expect from NASA is the equipment, the foundation for the mount and the dome, and there is some question on the latter. The NASA contribution will be about $2.5 million toward the installation and about $0.3 million towards an annual operation budget. The State will have to put in about $1.7 million or perhaps more, and also give me at least three positions which I do not have at present. *A lease for the entire mountain top above the 12,500 ft. level will also be required from the Board of Land and Natural Resources if this sort of investment is to be justified. We can't gamble on the kind of problems that have developed on Haleakala because of not having the area under our control. I visualize ultimately several observatories on Mauna Kea, but they will have to be compatible with each other, and although the present Land Board is sympathetic and doing all it can to protect the State's natural resources, a change in membership could conceivably wreck the usefulness of the entire project.*

Last week (December 30) I had an opportunity to discuss our plan to submit an independent proposal to NASA with Professor Kuiper in Seattle. He was naturally not too happy about not having a more active role in the development, but in a sense relieved that we were not going to throw in with Harvard. He is anxious to get his 28-inch telescope on Mauna Kea as soon as possible as part of the observatory complex, and is also willing to serve as a consultant on the new telescope which he hopes to be able to use as a visiting scientist.

Our present plans are to: (a) submit a proposal for an 84-inch telescope to NASA; (b) ask NASA for support for two test telescopes in carrying out a site study and for seismic depth measurements to see if any of the cinder cones extending above the 13,500 ft. level can be utilized for a major telescope; (c) if successful, ask the Land Board for a lease of the crest area above the 12,500 ft. level; (d) ask for State support for needed positions, the construction of the observatory and auxiliary facilities, paving of a 12 ft. road, and bringing in power. We shall try to get at least matching funds from NASA and NSF for the construction, but preliminary inquiries are not very encouraging. [HSA Gov 13-47]

February 16, 1965
Homer E. Newell, Associate Administrator for Space Science and Applications;
to Dr. Robert W. Hiatt, Vice President for Academic University of Hawaii
(Reporting on Developing Agreement between the University of Hawaii and NASA for Development of the First Observatory on Mauna Kea):

…It was certainly good to see you and George Woollard again and to continue our discussions of common interest in furthering the observation of the planets. I felt that the meeting was very useful, and I know that all of the NASA people appreciated the very frank discussion that took place. I certainly hope that you felt the same.

It seems to me that a number of important points came out very clearly in the discussion. First of all, there seemed to be no question at all on the part of anyone about the value of moving forward to exploit the exciting potentialities of the Mauna Kea site for astronomical purposes. In this same connection there was agreement around the table that the NASA

interest in strengthening ground based planetary research in support of our Voyager program might be a useful means for initiating the use of the Mauna Kea site.

Another point was clearly made, that the proper development of the Mauna Kea site would require a considerable amount of time. About three years would be a minimum time, considering the necessity to be both wise in the planning of the use of the facility under discussion and thorough in the design and preparation work.

It was also clear that the mutuality of interest between NASA and the State and University of Hawaii was a very basic consideration to the plans being discussed. On NASA's part, it will be important to have from Hawaii assurance of intention to make a substantial investment in and commitment to the proposed astronomical facility. On Hawaii's part, there is need to have assistance from an agency like NASA, and a reasonable commitment to such assistance. It seemed clear from the discussion that this particular point may be a knotty one to come to grips with. Nevertheless, from NASA's point of view, I think that it is important to emphasize that we will want genuine assurances that Hawaii will make substantial investments in the enterprise.

There was, I believe, unanimous agreement that to establish a strong and competent committee to advise the University of Hawaii on the planning for and use of this facility was a good concept. At the same time, there was equally strong feeling that such an advisory committee could not do the job of the detailed planning and shepherding of the project that would be necessary to carry it through to successful completion. Furthermore, the astronomers felt very strongly that a competent director is required in the very earliest stages of planning and construction, and that it was absolutely essential to bring such a director aboard before the firming up of the final proposal for the project. On reviewing this discussion, and on further consideration of NASA's interests, I feel that NASA must agree with this point of view.

We left the discussion, as I recall, with the two major action items. On our part, we were to bring Mr. Webb up to date on these discussions, and obtain his guidance. We have done this, as I conveyed to you in our phone conversation of today, and Mr. Webb is in agreement with the desirability of moving ahead along the general lines we have discussed. NASA's commitment to the project will, however, have to await our review of your specific proposal and our assessment of the total picture at that time.

On your part, you have the action of pulling together the advisory committee, seeking an appropriate director, and drafting the proposal that you wish to have considered by NASA.

My very best regards. I shall be looking forward to hearing from you in the very near future… [HSA Gov 13-47]

February 25, 1965
Robert Hiatt, Vice President for Academic Affairs, University of Hawaii;
to Mr. Mitsuo Akiyama, Executive Secretary,
Hawaii Island Chamber of Commerce
(Update on Agreements Between the University of Hawaii and NASA; it Being Decided that a more Long-term Approach to Development be Undertaken, Instead of the "Crash Program" originally Proposed by Dr. Gerard Kuiper):

This letter concerning the present status of the development of Mauna Kea as an astronomical observatory will bring you up to date on the subject.

Two meetings between University of Hawaii and NASA officials have been held for discussions relating to developments on Mauna Kea. Attached herewith is the most recent

communication from Dr. Homer Newell which followed our last meeting. You will note NASA's interest in moving ahead with the project, but at the same time there are some fundamental matters to be worked out both by us and by NASA.

Foremost among the problems which has now been settled was the nature of the development—a crash program or one fo longer range. All concerned are now agreed that the crash program date for completion (the next opposition of Mars in 1967) is impossible to meet, and that we should now plan for longer range objectives, always keeping in mind that NASA must base its support on their mission—planetary research for the Voyager program.

I should interject here that Harvard College Observatory has submitted a proposal to NASA for support of the same type of program we envisage, but would need the same measure of support from the State of Hawaii as would we. Because we believe that State support should be related to our own State University interests, we feel that NASA has little alternative but to move along with us providing we can carry out the program. We shall ask the cooperation of both Harvard and Arizona, as well as other centers. Dr. Kuiper was at the last NASA meeting and assures us of his continuing interest and cooperation, and will be a member of the consulting committee mentioned below.

As a result of our last NASA meeting we decided to invite several leading astronomers to consult with us (see p. 2 of Newell's letter) and to assist us with two main problems. First, what size and type of instrument should be the first installed on Mauna Kea? A conclusive answer to this question may not be possible until further intensive seeing studies and seismographic and meteorological measurements are conducted on Mauna Kea. The second question which they can help to decide is the nature of professional staffing we need. We do not have men on our staff with extensive experience with large telescopes, but we feel that Dr. Jefferies, a most competent solar physicist on our faculty and in charge of our Haleakala Observatory and astronomy in the Hawaii Institute of Geophysics, is of sufficient stature to direct this expanded program, even though we will want to add a couple of astronomers, perhaps with some lunar and planetary experience. Dr. Jefferies will meet with this committee of consultants and can demonstrate to them his ideas and capabilities. NASA will certainly follow the advice of the committee.

We hope to convene this committee at Tucson, Arizona at our expense in the latter part of March. At this time our proposal to NASA will be completed, and with the backing of the committee NASA will almost certainly approve our program.

You will note that NASA anticipates a substantial State commitment which includes a paved roadway, suitable observatory building, power supply and water supply. Additionally living quarters, either trailers or houses, will have to be provided at about the 9,000-10,000 foot level, with some supporting offices and work rooms on the Hilo Campus. Whether or not federal funds for highway construction might be made available I don't know. Perhaps it can be shown that the opening up of the top of Mauna Kea for space-age developments is in the national interest, and through some means or other federal aid can be gotten. It cannot be obtained through any of the usual granting agencies with whom we deal for research funds.

Our best estimates to cover the road, power, water, buildings, etc. is about $2 million. This wouldn't all have to be appropriated in one year, and could most likely be spread over a three-year period. We do not propose to take this matter before the Governor or the Legislature until we have had the meeting of the consultants, and are assured of the size of the program and intentions of NASA. My personal belief is that should the State make such an investment Mauna Kea will have a sizeable cluster of observatories within ten

years, and may very well become the major astronomical center in the world, if all that we believe to be true now proves to be so.

With best regards… [HSA Gov 13-47]

July 2, 1965
Richard L. Callaghan, Assistant Administrator for Legislative Affairs,
National Aeronautics and Space Administration;
to Honorable John A. Burns Governor of Hawaii
(Notification that Funding from NASA for Development on Mauna Kea had been Obtained):

…The National Aeronautics and Space Administration yesterday signed a contract with the University of Hawaii, Research Corporation in the amount of $475,000 for design, development, fabrication and installation of an 84 inch telescope suitable for lunar, planetary and stellar observations. I thought you would like a few further details inasmuch as the Hawaiian congressional delegation has shown much interest in this project over this past year.

The sum of $475,000 represents expenditures for the first year and it is expected that over a three year period the total government support will amount to $2,995,000.

As of this writing the exact location has not been determined but site surveys are being conducted and a decision should be made soon.

If you have any further questions, I will be glad to keep you informed on this project… [HSA Gov 13-47]

April 29, 1966
Thomas H. Hamilton, President, University of Hawaii;
to The Honorable John A. Burns Governor of Hawaii
(Regarding the Proposed Science Reserve Boundaries on Mauna Kea):

…You may recall that when the National Aeronautics and Space Administration approved the Mauna Kea site for the 84-inch telescope the approval was with the understanding that the University of Hawaii would obtain control of sufficient adjacent land on Mauna Kea to guarantee isolation of the site. In earlier correspondence I indicated that at the very minimum the top of the mountain above the 12,000-foot contour should be isolated for this installation. This contour is marked on the enclosed sketch with a heavy line. At other observatories throughout the world the isolated site encompasses a radius of approximately three miles from the telescope installation.

To comply with NASA's request I have asked that the proposed reserve area be drawn on a contour map. The attached sketch was prepared. Two sites are under intensive study now—marked A and B. The three-mile radius centered on A lies for the most part above the 11,000-foot contour. Site B is also a distinct possibility for the observatory, and it lies much too close to the 12,000-foot contour. [*Figure 65*]

Our astronomers believe the best solution is to use the three-mile radius from point A. The absolute minimum, we feel, would be the 12,000-foot contour to the east and the 11,400-foot contour to the west.

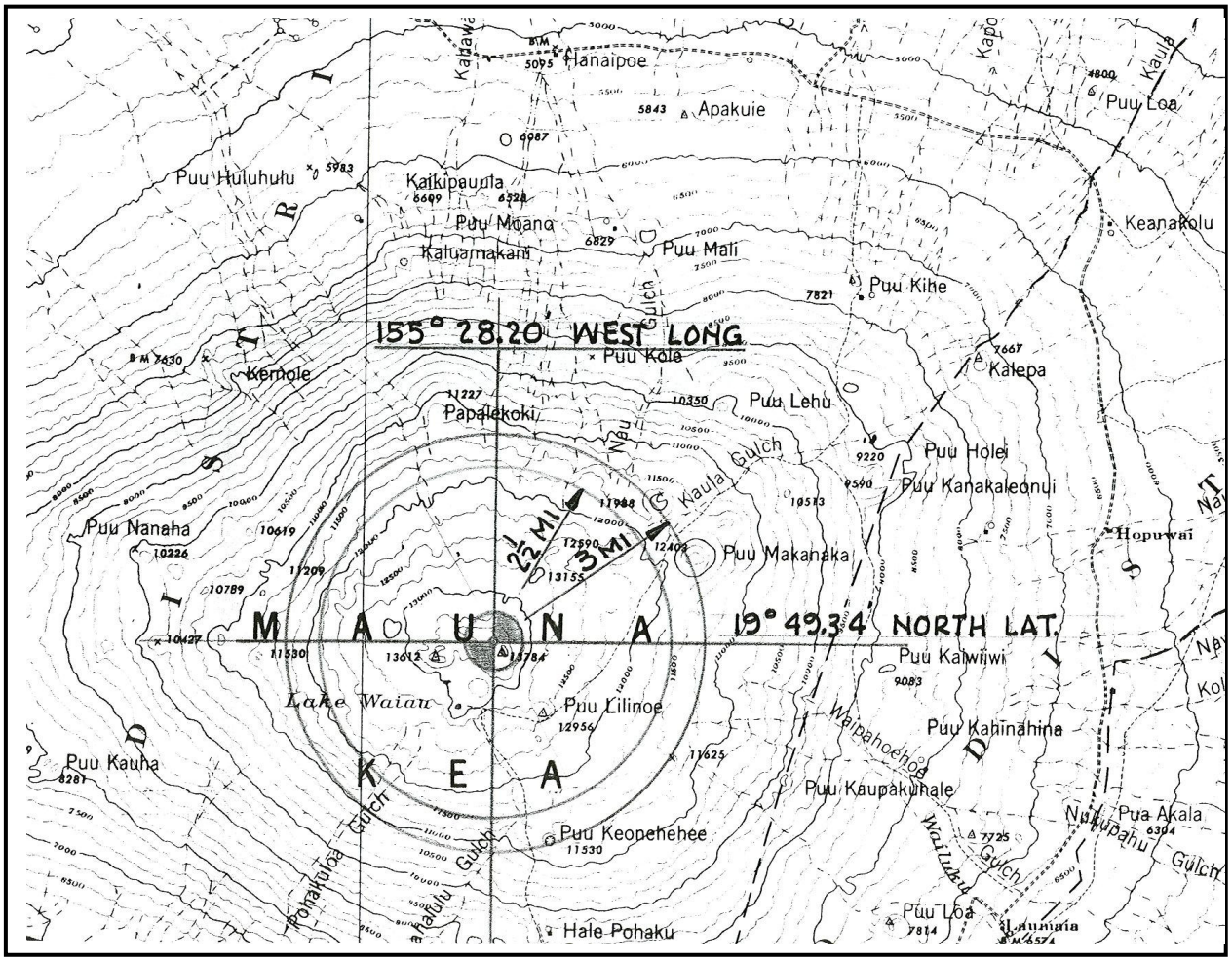

Figure 65. Proposed Boundary Radius of the Mauna Kea Science Reserve.

Because the land surveys and the processing of this request will take considerable time, I should like to have you initiate appropriate action. Should you wish to confer with me on this matter, I am available at your convenience. Dr. Jefferies and his staff are also ready to assist in any way… [HSA Gov 13-47]

July 1, 1966
Robert W. Hiatt, Acting Executive Officer, University of Hawaii; to
The Honorable John A. Burns Governor of Hawaii:

…NASA has just concluded its contract with us for the fabrication of the 84" telescope for Mauna Kea. This brings to mind President Hamilton's earlier correspondence of April 29, 1966 with you, asking that steps be taken to set aside a portion of the summit of Mauna Kea for exclusive control by the University as requested by NASA.

The process of setting aside this land had to be preceded by land surveys, but we have not been contacted nor has any of the astronomers observed anyone at work on the survey project. This is to inquire as to what steps are to be taken and to ask whether or not we can assist in any way in bringing this matter to a successful and early conclusion… [HSA Gov 13-47]

Establishment of the Mauna Kea Science Reserve (1967)

Pursuant to the agreement between the University of Hawaii and NASA, and the communications above, the State Surveyor conducted field work to identify the Mauna Kea Science Reserve Boundaries. Record of survey, C.S.F. 15,343, withdrawing a portion of Mauna Kea Forest Reserve for this purpose was filed on September 22, 1967 (*Figure 66*).

September 22, 1967
C.S.F. No. 15,343
Withdrawal
Portion of Mauna Kea Forest Reserve Governor's Proclamation dated June 5, 1909
Kaohe, Hamakua, Island of Hawaii, Hawaii

Being a portion of the Government Land of Kaohe

Beginning at a point on the south boundary of this parcel of land, the coordinates of said point of beginning referred to Government Survey Triangulation Station "SUMMIT 1955" being 12,325.95 feet South and 471.84 feet West, as shown on Government Survey Registered Map 2789, thence running by azimuths measured clockwise from True South:

1. Along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 135º 00' 18,667.62 feet;
2. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, still on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 225º 00' 18,667.62 feet;
3. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, still on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 281º 18' 04.6" 5173.56 feet;
4. 207º 49' 06.5" 841.83 feet along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;
5. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 1200.00 feet, the chord azimuth and distance being: 297º 49' 06.5" 2400.00 feet; [page 1]
6. 27º 49' 06.5 841.83 feet along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;
7. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 306º 59' 47.4" 1824.16 feet;
8. 227º 29' 00.9" 2805.06 feet along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;
9. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 1500.00 feet, the chord azimuth and distance being: 317º 29' 00.9" 3000.00 feet;
10. 47º 29' 00.9" 2805.06 feet along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;

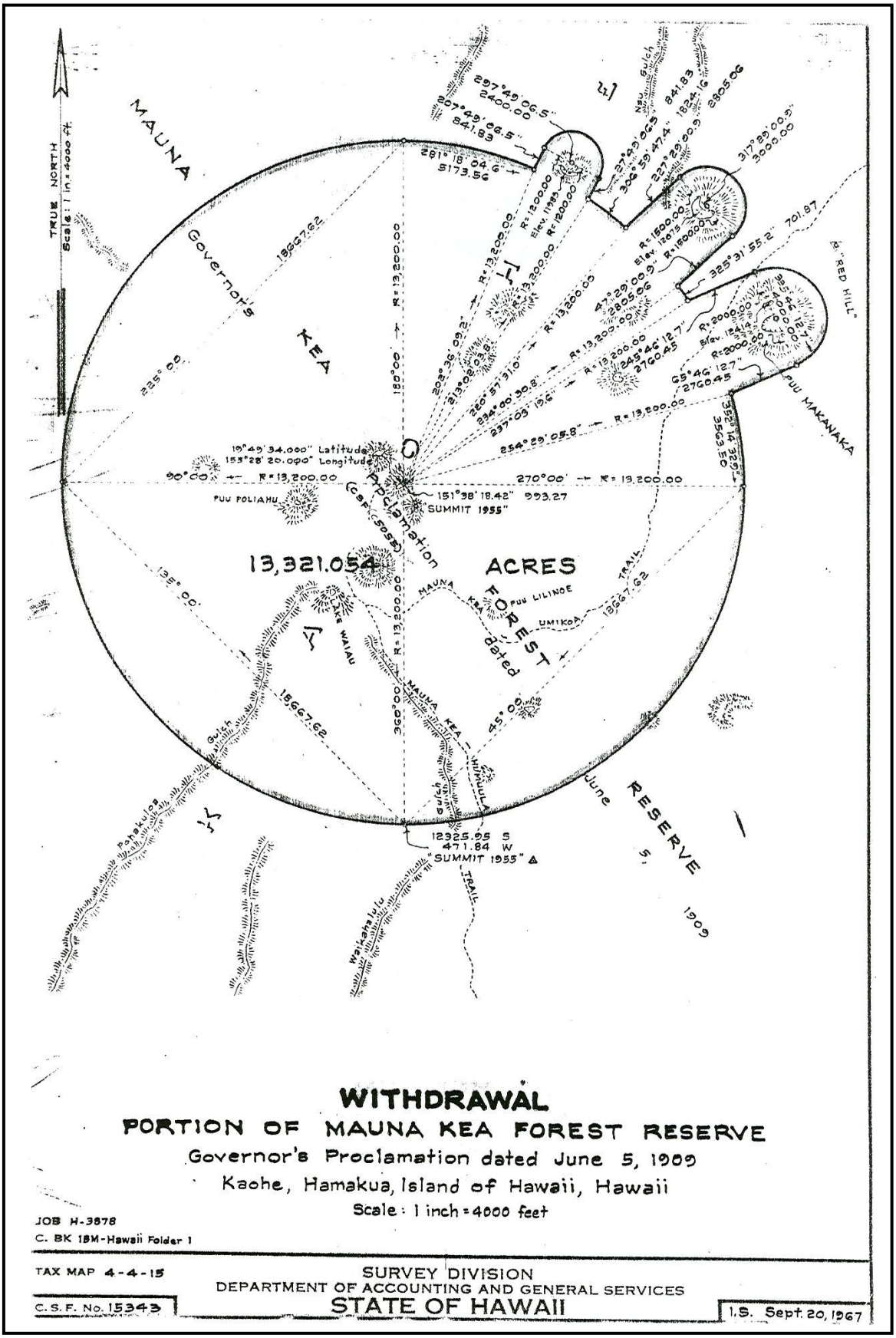

Figure 66. C.S.F. 15,343 - Survey of Mauna Kea Summit, Withdrawn from Mauna Kea Forest Reserve for the Mauna Kea Science Reserve (September 22, 1967)

11. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 325º 31' 55.2" 701.87 feet;
12. 245º 46" 12.7" 2760.45 feet along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;
13. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 2000.00 feet, the chord azimuth and distance being: 335º 46' 12.7" 4000.00 feet;
14. 65º 46' 12.7º 2760.45 feet along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;
15. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 352º 14' 32.9" 3563.50 feet; [page 2]
16. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, still on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 45º 00' 18,667.63 feet to the point of beginning and containing an Area of 13,321.054 Acres… [page 3; State Survey Division]

General Lease S-4191 Issued to the University of Hawaii (1968)

On June 21st, 1968, the Board of Land and Natural Resources granted State General Lease S-4191, to the University of Hawaii, with terms running from January 1, 1968 to December 31, 2033. The area of the lease generally conformed with the area depicted in *Figures 65 and 66*, and took in the entire summit of Mauna Kea, extending from about the 12,000 foot elevation to the summit. Item 4 – "Specified Use" required that:

> *"The land hereby leased shall be used by the Lessee as a scientific reserve being more specifically a buffer zone to prevent the intrusion of activities inimical to said scientific complex."*

It appears that this condition of the general lease, in part attempted to address the concerns raised by Dr. Kuiper in 1964, regarding limited development in order to protect the integrity of the mountain as an observatory platform. Today, the level of development in the reserve—particularly in the Puʻu o Kūkahauʻula, summit cluster of cones—has resulted in a concentration of facilities on the mountain peaks, that was not envisioned by the early planners, nor by the community of Hawaiʻi County (see section below, titled "*Mauna Kea (1980): Community Voices–Agency Debates…*").

A number of conditions regarding cultural and natural resources, protection of Mauna Kea's topography, and use of water from Waiau, were made a part of the lease. General Lease S-4191 reads:

> ***June 21st, 1968***
> ***GENERAL LEASE NO. S-4191***
> THIS INDENTURE OF LEASE, made this 21st day of June, 1968, by and between the STATE OF HAWAII, by its Board of Land and Natural Resources, pursuant to the provisions of Section 103A-90(b), Revised Laws of Hawaii 1955, as amended, hereinafter referred to as the "LESSOR", and the UNIVERSITY OF HAWAII, a body corporate, whose post office address is 2444 Dole Street, Honolulu, City and County of Honolulu, State of Hawaii, hereinafter referred to as the "LESSEE",

WITNESSETH THAT:

FOR and in consideration of the mutual promises and agreements contained herein, the Lessor does hereby demise and lease unto the said Lessee and the said Lessee does hereby rent and lease from the Lessor, all of that certain parcel of land situate at Kaohe, Hamakua, County and Island of Hawaii, State of Hawaii, and more particularly described in Exhibit "A", hereto attached and made a part hereof.

TO HAVE AND TO HOLD, all and singular the said premises, herein mentioned and described, unto the said Lessee, for and during the term of sixty-five (65) years, to commence from the 1st day of January, 1968, and to terminate on the 31st day of December. 2033. [page 1]

RESERVING UNTO THE LESSOR THE FOLLOWING:

1. Water Rights. All surface and ground waters appurtenant to the demised premises, together with the right to enter and to capture, divert or impound water; provided, that the Lessor shall exercise such rights in such manner as not to interfere unreasonably with the Lessee's use of the demised premises; provided, further, that *the Lessee shall have the right to use the waters of Lake Waiau for any purpose necessary or incidental to the use permitted by this lease on the following conditions:*

   a. No drilling or disturbance of Lake Waiau's bottom, banks or areas adjacent thereto shall be permitted;

   b. No activity shall be permitted which will result in the pollution of the waters of Lake Waiau;

   c. Lessee shall not take or divert any of the waters arising from springs which furnish the water supply for Pōhakuloa. and no alterations to said springs shall be made by Lessee.

2. Access. All rights to cross the demised premises for inspection or for any government purposes.

3. Hunting and Recreation Rights. All hunting and recreation rights on the demised lands, to be implemented pursuant to rules and regulations issued by said Board in discharging its fish and game or state parks responsibilities, provided, however, that such hunting and recreation activities shall be coordinated with the activities of the Lessee on the demised lands; and provided, further, that such hunting and recreation activities shall be limited to day-light hours only. [page 2]

4. Right to use Demised Lands. The right for itself, and its successors, lessees, grantees and permittees, to use any portion of the lands demised and the right to grant to others, rights and privileges affecting said land; provided, however, that, except as otherwise provided herein, no such use shall be permitted or rights and privileges granted affecting said lands, except upon mutual determination by the parties hereto that such use or grant will not unreasonably interfere with the Lessee's use of the demised premises; provided, further, that such agreement shall not be arbitrarily or capriciously withheld.

THE LESSEE, IN CONSIDERATION OF THE PREMISES, COVENANTS WITH THE LESSOR AS FOLLOWS:

1. Surrender. *The Lessee shall, at the expiration or sooner termination of this lease, peaceably and quietly surrender and deliver possession of the demised premises to the Lessor in good order and condition, reasonable wear and tear excepted.*

2. Maintenance of the Premises. *The Lessee shall keep the demised premises and improvements in a clean, sanitary and orderly condition.*

3. Waste. *The Lessee shall not make, permit or suffer, any waste, strip, spoil, nuisance or unlawful, improper or offensive use of the demised premises.*

4. Specified Use. *The land hereby leased shall be used by the Lessee as a scientific complex, including without limitation thereof an observatory, and as a scientific reserve being more specifically a buffer zone to prevent the intrusion of activities inimical to said scientific complex.*

   Activities inimical to said scientific complex shall include light and dust interference to observatory operation [page 3] ~~during hours of darkness~~ and certain types of electronic installation on the demised lands, but shall not necessarily be limited to the foregoing.

5. Assignments. The Lessee shall not sublease, sub-rent, assign or transfer this lease or any rights there under without the prior written approval of the Board of Land and Natural Resources.

6. Improvements. *The Lessee shall have the right during the existence of this lease to construct and erect buildings, structures and other improvements upon the demised premises; provided, that plans for construction and plot plans of improvements shall be submitted to the Chairman of the Board of Land and Natural Resources for review and approval prior to commencement of construction. The improvements shall be and remain the property of the Lessee, and shall be removed or disposed of by the Lessee at the expiration or sooner termination of this lease; provided, that with the approval of the Chairman such improvements may be abandoned in place.* The Lessee shall, during the term of this lease, properly maintain, repair and keep all improvements in good condition.

7. Termination by the Lessee. The Lessee may terminate this lease at any time by giving thirty (30) days' notice in writing to the Lessor.

8. Termination by the Lessor. In the event that (1) the Lessee fails to comply with any of the terms and conditions of this lease, or (2) the lessee abandons or fails to use the demised lands for the use specified under paragraph 4 of these covenants for a period of two years, the Lessor may terminate this lease by giving six months' notice in writing to the Lessee.

9. Non-Discrimination. The Lessee covenants that the use and enjoyment of the premises shall not be in support of any [page 4] policy which discriminates against anyone based upon race, creed, color or national origin.

10. General Liability. The Lessee shall at all times, with respect to the demised premises, use due care for safety, and the Lessee shall be liable for any loss, liability, claim or demand for property damage, personal injury or death arising out of any injury, death or damage on the demised premises caused by or resulting from any negligent activities, operations or omissions of the Lessee on or in connection with the demised premises, subject to the laws of the State of Hawaii governing such liability.

11. Laws, Rules and Regulations, etc. The Lessee shall observe and comply with Regulation 4 of the Department of Land and Natural Resources and with all other laws, ordinances, rules and regulations of the federal, state, municipal or county governments affecting the demised lands or improvements.

12. *Objects of Antiquity. The Lessee shall not appropriate, damage, remove, excavate, disfigure, deface or destroy any object of antiquity, prehistoric ruin or monument of historical value.*

13. Undesirable Plants. In order to prevent the introduction of undesirable plant species in the area, the Lessee shall not plant any trees, shrubs, flowers or other plants in the leased area except those approved for such planting by the Chairman.

IN WITNESS WHEREOF, the STATE OF HAWAII, by its Board of Land and Natural Resources, has caused the seal of the Department of Land and Natural Resources to be hereunto affixed and these presents to be duly executed this 21st [page 5] day of June, 1968, and the UNIVERSITY OF HAWAII, by its Acting President and VP for Business Affairs has caused these presents to be duly executed this 12th day of June, 1968, effective as of the day and year first above written.

State of Hawaii
(signed) Sunao Kido
Acting Chairman and Member Board of Land and Natural Resources…

University of Hawaii
(signed) Robert W. Hiatt
Its Acting President… [page 6]

EXHIBIT "A" [Figure 67]
MAUNA KEA SCIENCE RESERVE

Kaohe, Hamakua, Island of Hawaii, Hawaii

Being a portion of the Government Land of Kaohe. Beginning at a point on the south boundary of this parcel of land, the coordinates of said point of beginning referred to Government Survey Triangulation Station "SUMMIT 1955" being 12,325.95 feet South and 471.84 feet West, as shown on Government Survey Registered Map 2789, thence running by azimuths measured clockwise from True South:

1. Along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 135º 00' 18,667.62 feet;

2. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, still on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 225º 00' 18,667.62 feet;

3. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, still on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 281º 18' 04.6" 5173.56 feet;

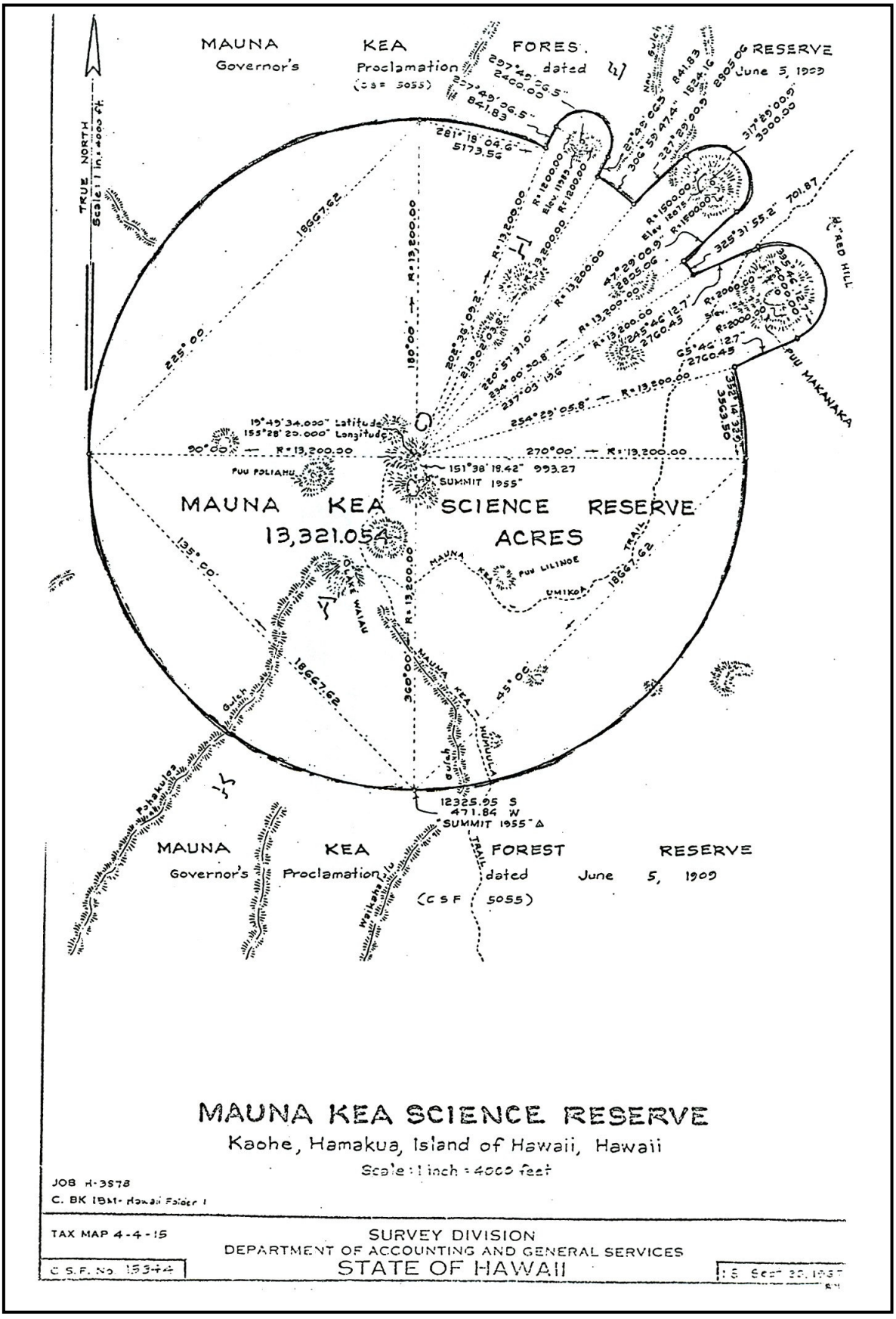

Figure 67. C.S.F. 15,344 – Mauna Kea Science Reserve (September 22, 1967)

4. 207º 49’ 06.5” 841.83 feet along the remainder of Mauna Kea Forest Reserve, Governor’s Proclamation dated June 5, 1909;
5. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 1200.00 feet, the chord azimuth and distance being: 297º 49’ 06.5" 2400.00 feet; [page 1]
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12. 245º 46” 12.7” 2760.45 feet along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;
13. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 2000.00 feet, the chord azimuth and distance being: 335º 46’ 12.7” 4000.00 feet;
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15. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 352º 14’ 32.9” 3563.50 feet; [page 2]
16. Thence along the remainder of Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, still on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 45º 00’ 18,667.63 feet to the point of beginning and containing an Area of 13,321.054 Acres

EXCEPTING and RESERVING to the State of Hawaii and to all others entitled thereto, the Mauna Kea-Humuula and Mauna Kea-Umikoa Trails, and all other existing trails within the above-described parcel of land, together with rights of access over and across said trails.

ALSO, EXCEPTING and RESERVING to the State of Hawaii, its successors and assigns, the waters and all riparian and other rights in and to all the streams within the above-described parcel of land. [page 3; State Land Division]

In 1968, The University of Hawai'i broke ground, and began construction on it's permanent 88-inch telescope, marking the beginning of a multi-million dollar program in development on Mauna Kea (*Figure 68*).

Figure 68. University of Hawaii 88-inch Telescope Project Development, ca. July 1968 (Photo in Collection of University of Hawaii-Institute of Astronomy (Copy Photo, KPA-N950)

Mauna Kea Ice Age Natural Area Reserve– Reduction of the Mauna Kea Science Reserve

While development of observatories was being undertaken in the Mauna Kea Science Reserve, concern for various facets of Mauna Kea's unique natural and cultural landscapes was being raised. It was feared that the unique ecosystems, geology—including glaciation—and cultural resources of Mauna Kea would suffer adversely from uncontrolled development and access on Mauna Kea. In the 1970s, the State of Hawai'i entered into a program of creating a Natural Area Reserve System, that would afford special localities with greater protection, and the opportunity for enhanced awareness by the public. Mauna Kea was one of the localities considered for such a designation. In May 1977, the Department of Land and Natural Resources published "The Mauna Kea Plan" (DLNR, 1977), the result of public hearings and the input of researchers, land managers, and concerned citizens. Subsequently, in August 1977, a formal proposal to establish the Mauna Kea Ice Age Natural Area

Reserve was made, and a draft Environmental Assessment issued by the Department of Land and Natural Resources. The assessment, including an overview of the varied resources of Mauna Kea and the proposed Natural Area Reserve (NAR), follows below:

Draft Environmental Assessment
State of Hawaii – Department of Land and Natural Resources
Natural Area Reserves System Commission
Proposed Mauna Kea Ice Age Natural Area Reserve (August 1977)

INTRODUCTION

The need to protect natural areas, as cultural and scientific assets, against intense population and economic pressures on a limited natural environment was recognized by the 1970 State Legislature in enacting Act 139 (Chapter 195, Hawaii Revised Statutes). The Act authorized the establishment of a Natural Area Reserves System to strengthen the existing conservation programs of preserves, sanctuaries, and refuges. The natural areas selected (primarily from State-owned land) would be irreplaceable examples of all aspects of the unique and varied, original Hawaiian ecological system.

Their undisturbed condition would be perpetuated by protective measures against any exploitive use or encroachment that would modify the dominance of natural processes. To achieve its objectives, the Act created an 11-member Commission, administratively within the Department of Land and Natural Resources (DLNR), to function as an advisory and policy recommending body to the Governor and the Board of DLNR. [page 1]

PROPOSED ACTION AND OBJECTIVES

The Natural Area Reserves System Commission (NARSC) is recommending that a 2,970 acre portion of the 80,000 acre Mauna Kea Forest Reserve (Tax Map No. 4-4-15:1) be established as the Mauna Kea Ice Age Natural Area Reserve (Fig. 1) [*Figure 69*]. The recommended site is at the south slope of the 13,784 foot high volcano between the elevations of 10,400 and 13,200 feet. The Mauna Kea Forest Reserve, which encompasses the volcano from the mid-elevations to the summit, is in the State's Conservation District, under the jurisdiction of the DLNR. [page 2]

The upper half of the proposed Natural Reserve would extend into the summit portion that is leased to the University of Hawaii as the Mauna Kea Science Reserve (Tax Map No. 4-4-15:9). The purpose of the proposed Natural Reserve is to preserve indefinitely some very exceptional geological and archaeological features of Mauna Kea volcano. Its establishment is consistent to the development and management program prescribed in DLNR's Mauna Kea Plan of May 1977.

As much as possible to be maintained so as to allow natural processes to dominate, the Natural Area Reserve would serve to be a viable example of an original heritage for present and future generations. It would serve as a long-term control against which to measure man-introduced stresses in adjacent or similar ecosystems elsewhere. It would provide an environmental and cultural appreciation site for citizens, teachers, and students. It would provide a research site for Hawaiian historians, archaeologists, geologists, and biologists. It would preserve a gene pool of native plant and animal species, particularly of rare and endangered species. [page 4]

In accordance with the requirements of Act 139, the NARSC recommends regulating policies for the protection, control, and use of Natural Reserves. A public review is required of the proposed regulation before it can be officially adopted by the DLNR and there is subsequent declaration of a Natural Reserve by a Governor's Executive Order.

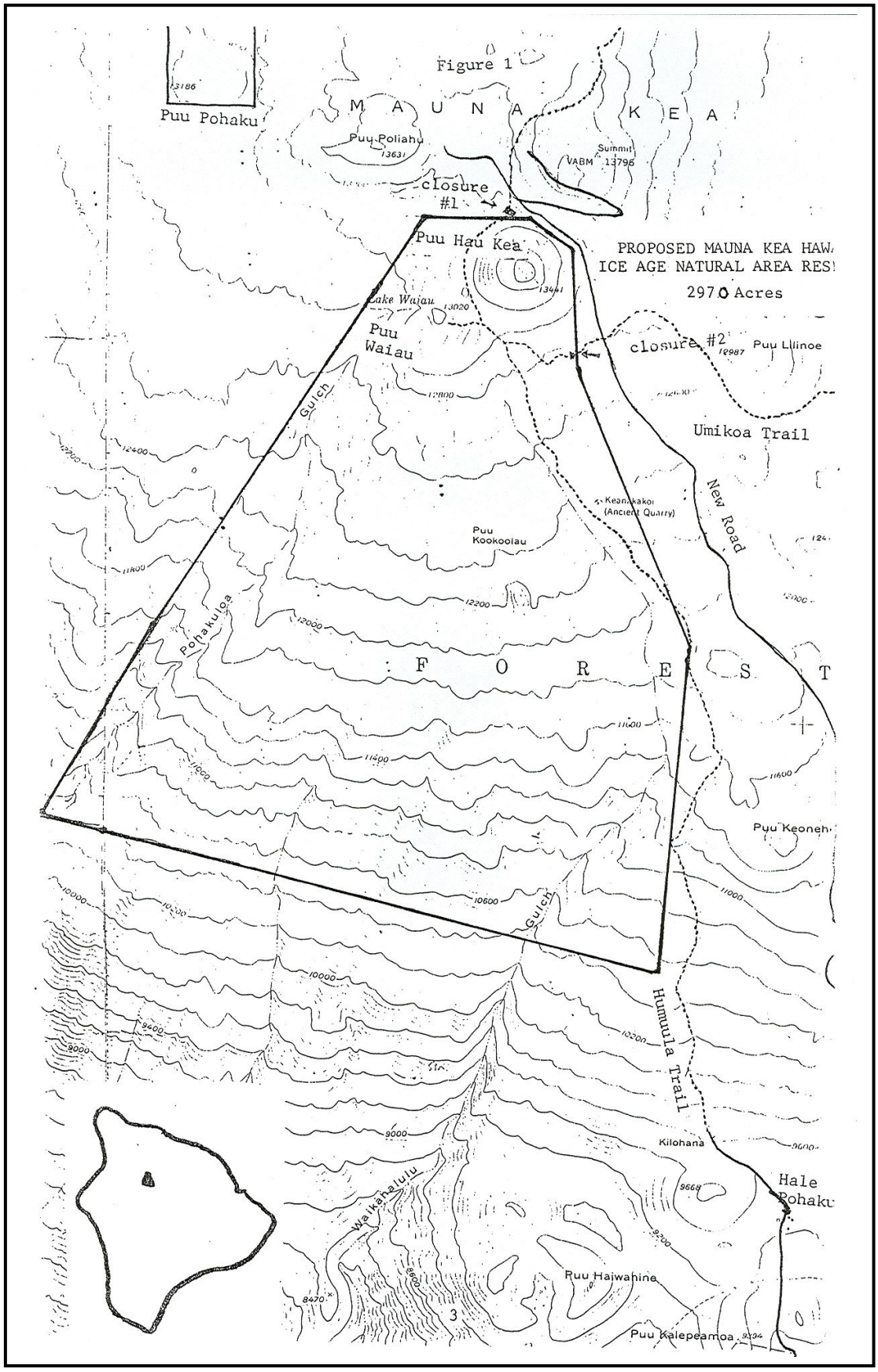

Figure 69. Proposed Mauna Kea Hawaii Ice Age Natural Area Reserve (Figure 1, August 1977:3)

The guiding principle in the formulation of regulations for Natural Reserves is the prevention of unnatural encroachment. Long-term protection of the natural and historical features of a given area can be assured only by imposing restrictive uses. Besides the explicit prohibition of destructive or damaging activities to the biological, physical, and historical elements, proposed Regulation 9 (Appendix 1) forbids camping or the setting of a fire. The only consumptive recreation allowed is hunting, subject to applicable regulations of the Division of Fish and Game.

Opportunities for public appreciation and education would be through interpretative walks explaining the geologic, archaeologic, and biologic attributes of the Natural Reserve. [page 5]

Guided walks would not only be advantageous in providing interpretations, but they would also offer a safer access to the generally unfamiliar high altitude, cold climate, and rough terrain. Existing trails, when compatible, would be improved and new ones established as required.

As indicated in the Mauna Kea Plan, management of the historic and geologic features would be the responsibility of the Division of State Parks, Outdoor Recreation and Historic Sites. Visitor access to the upper slope will likely continue to be controlled from Hale Pohaku. According to the Mauna Kea Plan, this mid-level park facility would be "...a day-use destination point for visitors and [would provide] primitive overnight camping facilities."

Signs stating the regulations for the Natural Reserve would be posted at strategic locations. Unobtrusive signs with interpretive storylines may be placed within the site should it be considered desirable.

DESCRIPTION OF AREA AFFECTED [page 6]

Geology

Mauna Kea, one of five massive shield volcanoes that make up the island of Hawaii, is the highest insular volcano in the world. Although it last erupted some 4500 years ago (Porter 1971), its present size and form was attained by the end of the Pleistocene, or Ice Age, some 15000 years ago (Macdonald and Abbott 1970).

Just as massive glaciers were forming and receding on the continents during the Pleistocene, the summit of Mauna Kea was being covered by ice at coinciding intervals. The Mauna Kea glaciers were relatively tiny averaging 200 feet in thickness and covering some 28 square miles down to the 11,000 foot elevation (Macdonald and Abbott 1970).

The features of erosion and deposition left by the action of four successive glaciers—the last had peaked about 20,000 years ago (Porter et al 1977)—are prime natural assets of the upper slope of Mauna Kea. They are also unique, for Mauna Kea is the only known mountain in the Central Pacific basin to have undergone glaciation. The proposed Natural Reserve [page 7] would protect and preserve such Ice Age features as, ***Pohakuloa Gulch*** (formed by glacial meltwater), glacial moraine and meltwater deposits of fine sediments, and the glacially sculptured features of cinder cones and lava flows.

Permafrost, recently discovered (Woodcock 1974) beneath the crater of ***Puu Wekiu***, the summit cone, could be present in one or more of the cinder cones to be protected by the proposed Natural Reserve. Typical of the subsurface of polar and very frigid temperate areas, permafrost on the relatively warm Mauna Kea summit is an odd and interesting feature.

Another northern latitude phenomenon, but requiring less frigid conditions, is the display of "patterned ground." As discussed by Macdonald and Abbott (1970), the alternating freezing and thawing temperatures on the upper slopes of Mauna Kea fracture the rocks into ever smaller fragments as water that penetrated the rock during the day freezes and expands at night. The fragmented rock pieces produced by [page 8] this mechanical weathering lay in stripes or polygonal patterns designed according to the varying coarseness of the pieces.

No less unusual is the existence of ***Lake Waiau***, another outstanding geological feature that would be protected by the proposed Natural Reserve. As elsewhere in the Hawaiian Islands, the porous basalt substrate precludes standing bodies of water. ***Lake Waiau***, however, has a bottom substrate of fine sediments more than 25 feet thick (Woodcock et al 1966). The sediments, composed of volcanic ash and organic detritus, may have been accumulating at the bottom of the lake since the Pleistocene. At an elevation of 13,020 feet, the lake is one of the highest in the United States. It has a surface area of 1.7 acres and a depth of nearly 10 feet.

Perched water is contained in the interior of ***Puu Waiau*** itself, a few yards from the crater in which ***Lake Waiau*** is located. ***Puu Pohaku*** is also known to contain perched water (Woodcock and Groves 1969).

Archaeology
Scattered, throughout the proposed Natural Reserve is a [page 9] variety of ancient Hawaiian culture remains that date back to about 1400-1600 A.D. (McCoy 1975). They include religious shrines and rock shelters of different types, which were established in conjunction with a series of adz (tool) quarries and workshops that were the largest in Polynesia, and perhaps the world. They are the most complex and best preserved of all those found in the Hawaiian islands. The site is listed in the Hawaii Register of Historic Places. It has been also declared a National Historic Landmark, the boundary of which is expected to approximate that of the proposed Natural Reserve.

During a recent 1976 field survey in his continuing research on the ***Mauna Kea adz quarry****, McCoy (pers. commun.) found the first evidence of Hawaiian rock art on the upper slopes of the volcano. They were pictographs, or rock paintings, which are very rare in Hawaii, and a single panel of petroglyphs.*

The site was without doubt a very important and extensive center of Hawaiian adz manufacturing. The significance of this early enterprise to the cultural, social, and economic environment of the Hawaiian people of that period is being investigated (McCoy 1975). [page 10]

Bioecology
Located at elevations above the present treeline, the proposed Natural Reserve contains little vegetation. Temperature records are scanty, but those of the summit indicate a mean minimum at winter of 23º F and a summer mean maximum of 53º F (Environmental Data Service, US Dept. of Commerce). Together with low precipitation (4-10" annually at the summit) and substrate porosity, the area is an alpine desert (Hartt and Neal 1940).

Occasional patches of mosses, lichens, and grass species, including the native *pili-hale* (*Agrostis sandwicensis*) and *he'u-pueo* or *pili-uka* (*Trisetum glomeratum*), grow in sheltered pockets of the rocky substrate (Hartt and Neal 1940, Mueller Dombois and Krajina 1968). The moist shore of Lake Waiau supports thin growths of native species of grass and fern, and weed species introduced by pack animals (Hartt and Neal 1940). Dwarfed, shrub forms of *pukiawe* (*Styphelia douglasii*) are in widely scattered mats in the

lower region of the proposed Natural Reserve. Here the paucity of vegetation may be due [page 11] in part to past intense grazing by sheep and goats, which presently browse at lower elevations.

The waters of Lake Waiau contain diatoms and desmids (Hartt and Neal 1940), and perhaps other types of planktonic unicellular plants (Maciolek 1969). Several species of blue-green algae and one green algal species grow in dense floating or submerged mats (Hartt and Neal 1940). Only three faunal species, all primary consumers, have been identified (Maciolek 1969).

Existing Uses

A "Mauna Kea Entry Permit" is required to enter the Mauna Kea Forest Reserve and use the gravel road between Hale Pohaku and the summit. The DLNR-issued permit allows only 4-wheel drive vehicles on the road and limits public activities on the upper slope to day-use. The slope is presently being used for such recreational activities as hiking, sightseeing, and winter skiing and sledding. Hunting, perhaps the major activity in the mid and lower slopes, is somewhat marginal at the upper slope where the occasional sheep or goats are likely to be strays or hunter-chased. [page12]

Scientific geological and archaeological investigations are being conducted within the proposed Natural Reserve at various intervals by personnel from the University of Hawaii and the Bernice P. Bishop Museum.

Access

The recently realigned gravel road from Hale Pohaku to the astronomical site at the summit nearly conjoins with a portion of the anticipated northeastern border of the proposed Natural Reserve. At this region the road formerly veered eastward to within 10 feet of Lake Waiau.

Two trails lead to Lake Waiau. The Umikoa Trail, which starts as a jeep trail from Umikoa above the Hamakua Coast, transects the gravel road before it terminates at Lake Waiau. From the road to the lake the trail is 3/4 mile long. The Humuula Trail, originating about ½ mile from Hale Pohaku, enters the proposed Natural Reserve at about the 12,000 foot elevation and ½ mile later passes Keanakakoi, a major ancient quarry site. It continues for about 1 mile to the shore of Lake Waiau. [page 13]

POTENTIAL IMPACTS AND THEIR SIGNIFICANCE

As the purpose of having a Natural Reserve is to protect and preserve the existing natural habitat and all the natural things that occur in it and act upon it, the proposed action would neither degrade nor destruct the quality of the physical and biological environment. This favorable impact on the environment, in turn, affords the equally beneficial impact of retaining an original natural resource that will always be available for such things as heritage appreciation, environmental awareness, scientific study, and education.

The proposed regulation necessary to maintain the Natural Reserve would not adversely alter current public use of the area. Presently a part of the Mauna Kea Forest Reserve, the proposed site has been administered according to conservation measures outlined in Regulation No.1 of the Division of Forestry. Further to that Regulation, special precautionary restrictions, largely for public safety, allow only day-use of the upper slope.

Non-destructive and non-consumptive day utilization [page 14] involving hiking and sightseeing, especially if related to environmental and cultural education, is wholly compatible with the earlier mentioned scope of objectives of a Natural Area Reserves

System. The desired effect of a public educational program would be environmental and cultural heritage understanding. Teacher, student, and citizen appreciation would help to ensure—beyond any legal measure—that the unique qualities of the site would be preserved for future generations.

DETERMINATION AND REASONS THEREOF

This assessment indicates that an environmental impact statement is not required. The proposed action would not entail the loss of an economic or social benefit. Its objective being to preserve natural features, the proposed action would have no adverse effect on the quality of the environment. [page 15]

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Survey of the Mauna Kea Ice Age Natural Area Reserve (1979)

The survey of the proposed Mauna Kea Ice Age NAR was recorded in C.S.F. 18,645, dated May 4, 1979 (*Figure 70*). On May 8th, 1981, the Board of Land and Natural Resources adopted a resolution to establish the Mauna Kea Ice Age Natural Area Reserve, and Governor's Executive Order No. 3101, set aside the land for that purpose, on November 16, 1981. The notes of survey recorded in C.S.F. 18,645 record the following metes and bounds:

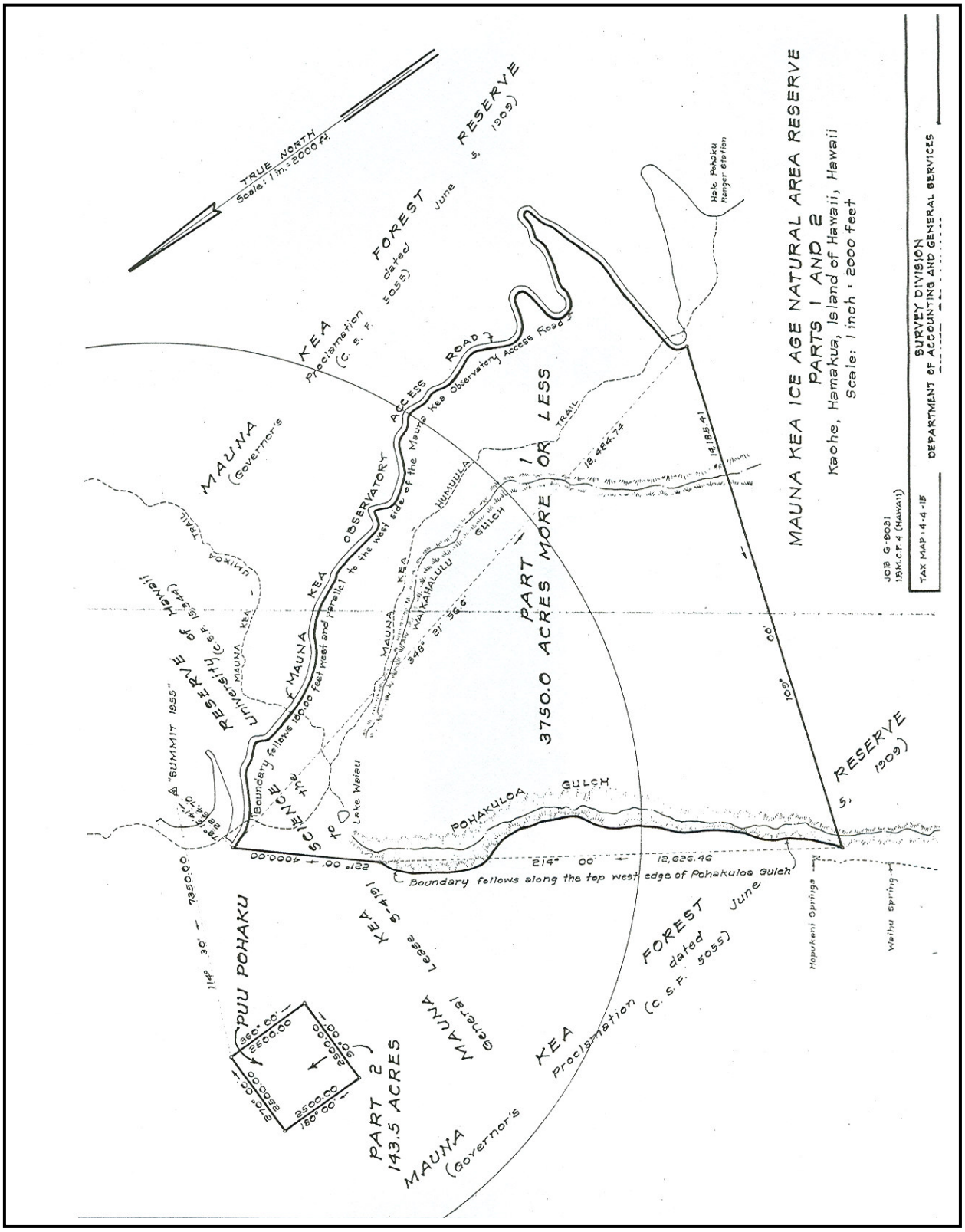

Figure 70. C.S.F. 18,645 - Survey of the Mauna Kea Ice Age Natural Area Reserve Including a Portion of the Mauna Kea Forest Reserve and the Mauna Kea Science Reserve (May 4, 1979)

May 4, 1979
C.S.F. 18,645
PARTS 1 AND 2

Kaohe, Hamakua, Island of Hawaii, Hawaii
Being a portion of the Government Land of Kaohe.

Being also a portion of Mauna Kea Science Reserve covered by General Lease S-4191 to the University of Hawaii.
PART 1:

Beginning at the north corner of this parcel of land, being also 100.00 feet west from the west side of Mauna Kea Observatory Access Road, the direct azimuth end distance from Government Survey Triangulation Station "SUMMIT 1955" being 78º 16' 41" 2264.70 feet, thence running by azimuths measured clockwise from True South:

1. Along the remainder of Mauna Kea Forest Reserve (Governor's Proclamation dated June 5, 1909), the boundary follows 100.00 feet west and parallel to the west side of the Mauna Kea Observatory Access Road, the direct azimuth and distance being: 348º 21' 56.6" 18,484.74 feet;
2. 109º 00' 14,185.41 feet along the remainder of Mauna Kea Forest Reserve (Governor's Proclamation dated June 5, 1909), to the top west edge of Pohakuloa Gulch;
3. Thence along the remainder of Mauna Kea Forest Reserve (Governor's Proclamation dated June 5, 1909), along the top west edge of Pohakuloa Gulch, the direct azimuth and distance being: 214º 00' 12,626.46 feet;
4. 221º 00' 4000.00 feet along the remainder of Mauna Kea Forest Reserve (Governor's Proclamation dated June 5, 1909), to the point of beginning and containing an AREA OF 3750.0 ACRES MORE OR LESS. [page 1]

PART 2:
PUU POHAKU

Beginning at the northeast corner of this parcel of land, the direct azimuth and distance from Government Survey Triangulation Station "SUMMIT 1955" being 114º 30' 7350.00 feet, thence running by azimuths measured clockwise from True South:

1. 360º 00' 2500.00 feet along the remainder of Mauna Kea Forest Reserve (Governor's Proclamation dated June 5, 1909);
2. 90º 00' 2500.00 feet along the remainder of Mauna Kea Forest Reserve (Governor's Proclamation dated June 5, 1909);
3. 180º 00' 2500.00 feet along the remainder of Mauna Kea Forest Reserve (Governor's Proclamation dated June 5, 1909);
4. 270º 00' 2500.00 feet along the remainder of Mauna Kea Forest Reserve (Governor's Proclamation dated June 5, 1909), to point of beginning and containing an Area OF 143.5 ACRES. [page 2; State Survey Division]

Mauna Kea Ice Age Natural Area Reserve – Draft Management Plan (1982)

Following establishment of the Mauna Kea Ice Age NAR, a draft management plan was prepared by the Department of Land and Natural Resources in 1982. The draft remains as a guideline for management and protection of the NAR, and all actions on Mauna Kea, are reviewed by the NAR

program, and enforcement of protection measures in the NAR are coordinated by the DLNR program. The draft management plan provides the following overview of the significance of Mauna Kea and the NAR, in the natural and cultural history of Hawai'i:

> Following the Board of Land and Natural Resources' resolution on May 8, 1981, to establish the Mauna Kea Ice Age Natural Area Reserve, Governor's Executive Order No. 3101, which sets aside the land for that purpose, was issued on November 16, 1981.
>
> The reserve is in the land of Kaohe on the south face of Mauna Kea between the 10,400 and 13,200 ft. elevation (Appendix 1). From about the 11,500 ft. elevation, the reserve is within an area that is leased to the University of Hawaii as a science reserve. The western boundary is the western ridge of Pohakuloa Gulch and the eastern boundary is along the summit road from a 100 ft. distance. The reserve encompasses 3,893.5 acres, of which 143.5 acres is a satellite portion that consists of the cinder cone, Puu Pohaku. It is in the Conservation District and was part of the 82,669 acre Mauna Kea Forest Reserve.
>
> Two trails, both leading to Lake Waiau, are present. The Humuula Trail, which originates about a half mile from Hale Pohaku, enters the reserve at the 10,500 ft. elevation and a half mile later passes Keanakakoi, a major ancient quarry site. It continues for a mile before joining with the Umikoa Trail near lake Waiau, after which it goes over the summit and beyond. [page 1]
>
> The Umikoa Trail, which starts as a jeep trail from Umikoa above the Hamakua Coast, crosses the summit road before it terminates at the lake. This portion of the trail, between the summit road and Lake Waiau, eventually developed into a road. In compliance with the Department's 1977 Mauna Kea Plan, which states that roads not part of the summit road are to be removed and that there will be "only a walking trail" to the lake, vehicular access to the lake has been terminated by rock barriers.
>
> The annual rainfall average is 15-20 inches, which in the high elevations is in the form of snow during most winter months. The mean temperature at the summit region hovers above freezing and at the lower elevations of the reserve it is 40° F. Volcanic ash and cinders amid clinkery *aa* lava cover a slope that generally exceeds 30 percent. The extremely porous substrate prevents surface water accumulation. Situated within this physical environment, Lake Waiau is an exceptional perennial body of water.
>
> Lake Waiau, located on Puu Waiau at the 13,020 ft. elevation, has a bottom substrate of fine sediments more than 25 ft. thick. The lake has a surface area of about 1.7 acres and a maximum depth of about 9 ft. With snow-melt the lake overflows into Pohakuloa Gulch. The thick sedimentary layering of the bottom of Lake Waiau, which may have been occurring since the Pleistocene, is of scientific value in helping to reconstruct Mauna Kea's volcanic history, its climatic history, and the history of the earth's magnetic field. The crater of Puu Pohaku also contains perched water on occasion.
>
> The other significant and exceptional geological feature of the reserve is that just as massive glaciers were forming and receding on the continents during the Pleistocene, or Ice Age, the summit of Mauna Kea was being covered [page 2] by ice at coinciding intervals. The features of erosion and deposition left by the action of four successive glaciers, the last of which peaked about 20,000 years ago, are prime natural assets of the volcano. They are also unique, for Mauna Kea is the only known mountain in the Central Pacific basin to have undergone glaciation. The glaciers were relatively small-sized, averaging 200 ft. in thickness and covering some 28 square miles down to the 11,000 ft. elevation. The main Ice Age features evident today include Pohakuloa Gulch (formed by glacial meltwater), glacial moraine and meltwater deposits of fine sediments (present

down to the 10,500 ft. elevation), and the glacially sculptured features of cinder cones and lava flows.

Along with these outstanding natural geological components, there are a variety of ancient Hawaiian cultural remains dating back to about 1000 A.D. They include religious shrines, rock shelters (with such artifacts as wooden fire ploughs, tapa fragments, braided sennit cordage, and pandanus matting), food remains (such as marine limpets, sea urchins, fish, birds, coconuts, and kukui nuts), pictographs (rock paintings), and a single panel of petroglyphs. These evidences of habitation, which were apparently intermittent and short-term, are associated with a series of adz (tool) quarries and workshops that were the largest in Polynesia, and perhaps the world. Containing the most complex and best preserved archaeological site found in the Hawaiian Islands, the area is listed in the Hawaii Register of Historic Places and has been declared a National Historic Landmark.

Located above the treeline, the area is an alpine desert with occasional patches of mosses, lichens, and grasses, including the *pili-hale (Agrostis)* and *he'u pueo* (*Trisetum*). The lower portion has scattered growths of [page 3] *pūkiawe (Styphelia)* and *kūpaoa (Railliardia)*. Lake Waiau contains diatoms, desmids, blue-green and green algae, and planktonic animal species.

Management Principles

Two basic principles should guide the direction of management of all Natural Area Reserves. As the purpose of establishing the reserve is to preserve and protect the area's irreplaceable naturalness, the first principle is to allow natural processes to dominate and control the natural ecosystem. The second principle is that the indigenous naturalness is a resource, which is to be utilized for its esthetic, heritage, educational, and scientific values.

These two principles provide the conceptual base for the formulation of the management objectives and programs for the Mauna Kea Ice Age Natural Area Reserve… [DLNR, 1982:4]

Mauna Kea (1980): Community Voices–Agency Debates, County of Hawaii Recommends that Development be Limited to Six Observatories

In 1974, concerns about development on Mauna Kea had been brought to the attention of George Ariyoshi (then, acting Governor). As a result, he directed the Board of Land and Natural Resources to investigate, and develop a plan for management of the "priceless qualities" of Mauna Kea. The plan was to address "scientific, recreational and other purposes" that posed a "threat" to the integrity of the mountain landscape. The result of Governor Ariyoshi's direction was the "Mauna Kea Plan" (1977).

The "flurry" of development of observatories on Mauna Kea between 1968 to 1979, was also causing great concern among community members on the island of Hawai'i. The "Mauna Kea Foundation" was organized, and chaired by Helen Hale, in cooperation with community members, the County of Hawaii, the University of Hawaii, and the Mauna Kea users (representing various observatories). The foundation developed an outreach program to collect information pertaining to the history and natural environment of Mauna Kea, and elicit recommendations to further develop the 1977 "Mauna Kea Plan," and ensure protection of the unique natural and cultural resources of Mauna Kea.

On January 27th, 1980, the Hawaii Tribune-Herald published a special section of the paper, titled "*Mauna Kea (Past, Present and Future),*" in which an overview of the topics raised by members of the

community (including the Native Hawaiians [39]); various County and State agencies; and the University of Hawaii and Institute for Astronomy, were described. Notable issues identified, and recommendations included, but were not limited to:

> Based on community input and best planning practices, the County of Hawaii recommended that development on Mauna Kea be limited to six observatories.
>
> - This recommendation was "rejected" by the State Board of Land and Natural Resources, and no limit was placed on development as of 1980.
>
> Definition of jurisdictional responsibilities, as an inter-agency program.
>
> Identification of areas of cultural significance to Native Hawaiians, and designated preservation zones.
>
> Identification of unique biological and geological resources, and designated preservation zones.
>
> "The main thing is we have to treat it (Mauna Kea) with sensitivity."

There follows below, selected articles from the special Mauna Kea insert, published in the Hawaii Tribune-Herald. The articles focus on the background of the Mauna Kea Foundation program, the planning processes of the State and University of Hawai'i, the County of Hawai'i, and comments from the Hawaiian community. In addition to these articles, there were also articles covering archaeological and historical resources; the geology and glaciation of Mauna Kea; the natural resources of the mountain; hunting practices; and development of astronomy.

Mauna Kea (Past, Present and Future)

> The Mauna Kea Project was triggered by the desire of the Mauna Kea Foundation to bring about a sharing of information and concerns about "White Mountain." Many people are aware of their own interests but lack the opportunity to bridge these separate interests in consideration and respect for the total concern of this great natural resource.
>
> Spurred by President Helene Hale, others participating in the initial meeting were Terry Lee, Roger Cayrel, Pierre Bely, Ginger Plaish and Mary Matayoshi. The result was the formation of a Mauna Kea Advisory Committee composed of Tom Krieger, general manager, Mauna Kea Observatory Support Services; Helene Hale; Mary Matayoshi, director of the Center of Continuing Education and Community Services (CCECS); John and Sheila Dobovan representing the video production aspects; and Nahua Maunakea, CCECS program coordinator who was designated project director. They, in turn, have solicited input from the many individuals and groups who have expressed concern about Mauna Kea. Some of these views are contained in this section… [page B-1]

Plans drawn for majestic Mauna Kea

> "Mauna Kea was important to the early Hawaiians. There they quarried its rock, and there lived Poliahu, their Goddess of Snow, rival to Pele. Today, Mauna Kea remains important, although the reasons differ." Northeast Hawaii Community Development Plan, County of Hawaii.
>
> The importance of Mauna Kea as an international astronomical research center was at no time brought into a clearer focus than when a flurry of dedications of observatory projects

[39] A copy of the Hawaii Tribune Herald insert was provided to Maly by *Kupuna* Emma Kauhi in 1997, as part of discussion of Hawaiian traditions and practices associated with Mauna Kea.

took place on top of the lofty mountain last summer and early fall. With six observatories atop the 13,976-1oot summit, and with the possibilities of more observatories to come, Mauna Kea now can unqualifiedly claim its world leadership in astronomical studies.

But Mauna Kea means more to the Big Islanders than a haven for professional star gazers to explore man's last frontier, the universe. It is a natural beauty, it is the habitat of precious Hawaiian birds and plants, and it is a playground for the islanders.

Against this background, both the State and the County of Hawaii planners have been trying to formulate a plan that will protect the mountain's natural resources and, at the same time, allow the scientific development to continue atop the mountain. The task has not been easy.

Mauna Kea, meaning the "White Mountain," extends 16,000 feet from the ocean floor to the sea level before continuing another 13,796 feet, making it the tallest mountain in the world. Commonly, however, the mountain region begins from the 6,000 foot elevation and extends to the summit.

The mountain has two distinctive zones. One covers an area from the 6,000-foot to the 10,000-foot elevation within which lie the fragile ecosystems of rare birds and unique plants, and where hunting of sheep, goats and pigs ranks among popular sporting activities on the Big Island.

The second zone covers from the 10,000-foot elevation to the summit. It is here astronomers have found the finest spot in the world to open up windows in the sky. Winter snow that dons the summit region provides breathtaking scenic beauty and rare recreational opportunities on the mountain slopes towering above the tropical Pacific.

Serious considerations for drafting a master plan for Mauna Kea were triggered in late 1974 by Acting Governor George Ariyoshi in a memorandum to Sunao Kido, chairman of the State Board of Land and Natural Resources. The memorandum stated:

> "I am concerned that social pressures for more intensive uses of Mauna Kea for scientific, recreational and other purposes pose a threat to the priceless qualities of that mountain…
>
> To assure that full consideration is given to all aspects of permitted, controlled and prohibited uses, you are hereby directed to develop and promulgate, as expeditiously as possible, a Master Plan for all of Mauna Kea above the Saddle Road.
>
> Finally, the promulgation of the Master Plan should include its adoption by the Board of Land and Natural Resources following public hearings, and should provide for both the enforcement of the Plan and procedures for its, amendment." [Ariyoshi to Kido, November 1, 1974]

After more than two Years of study, public hearings, conducted by government and private groups, including a Mauna Kea Advisory Group — all not without controversies, "The Mauna Kea Plan" was adopted February 11, 1977 by the Board of Land and Natural Resources at a meeting in Kona.

The Plan is in no way considered a definitive planning work for the mountain. It is a set of broad guidelines to be reviewed and updated from time to time.

The plan "is a policy framework for the management of Mauna Kea." It outlines the jurisdictional responsibilities of various government agencies for specific resources and uses."

The plan spells out five management areas within each of which guidelines, on specific uses of the mountain's resources are laid down:

I. *Mamane* / *Naio* Forest Ecosystem Management Area, which is the region extending from the 6,500-foot elevation to 9,500-foot elevation; where hunting of sheep, goats and pigs take place; and where Hawaii's *Palila* birds depend on the *Mamane* trees for its habitat and food.

II. Science Reserve Management Area, which is a region from the l0,000-foot elevation to the summit and is leased to the University of Hawaii for scientific research, and where snow play and skiing, is permitted during winter months.

III. Special Natural Area and Historic/Archaeological Management Area, which, includes such historic sites as Lake Waiau, Puu Hau Kea, Adz Quarry, and Puu Pohaku.

IV. Silversword Management Area, which includes all lands now fenced off to protect the silversword plants, and which "will be managed as a nursery for supplying plants in interpretive areas or for future reestablishment in other areas of the mountain," when desirable.

V. Military Management Area, which covers the lands within Pohakuloa Military Training Area, managed by the Army under a lease agreement with the State.

In addition to the five management areas, the plan also sets out guidelines on several "special problems" affecting the use of the entire mountain.

One is the development of Hale Pohaku at the 9,200-foot elevation. As State master plan for the area calls for the setting aside of nine acres for the University of Hawaii, Institute for Astronomy for development of mid-level support facilities for the scientists.

Presently, four acres of the proposed site, near the access road to the summit, are occupied by structures temporarily serving as mid-level facilities for the scientists. The master plan for Hale Pohaku proposes to replace the existing temporary buildings with new ones.

The new buildings "will be used for sleeping, eating, lounging, research, support, and minor maintenance functions, directly related to telescope operations at the summit."

About 700 feet down slope from the proposed mid-level support facilities area is an eight-acre area the State proposes for a park development.

Initially, two acres of this proposed park site will be developed with an information and interpretation station, parking area, and 10 picnic sites. Six acres will be reserved for future expansion.

The 8.5-mile access road to the summit from Hale Pohaku poses another special problem. The Mauna Kea Plan forbids paving of the gravel road but calls for road safety devices. Only four-wheel drive vehicles are allowed to go from the picnic area above Hale Pohaku to the summit. The summit access should be maintained by the State Department of Transportation, according to the Plan.

Electricity is produced by on-site generators to supply power to the observatories and support facilities. The Mauna Kea Plan prohibits the installation of overhead power lines to prevent the adverse effect on the visual quality of the slopes. Underground power lines, however, may be allowed.

The Pohakuloa State Park also is a special area which is not included in any of the five management areas. The Mauna Kea Plan calls for no change in the type of recreational use of the park. Any expansion will depend on additional water supply development.

Administration and management of Mauna Kea cuts across the jurisdictional boundaries of several government agencies, although the land mass falls within the conservation district jurisdiction of the State Department of Land and Natural Resources. For instance, the DLNR's Divisions of Forestry, Fish and Game, and Parks, Outdoor Recreation and Historic Sites, are directly involved in the Management of all the mountain's resources.

The University of Hawaii has the responsibility for management and upkeep of Hale Pohaku area where permanent mid-level support facilities will be located. The University also is responsible for the management and upkeep of the ' Mauna Kea Science Reserve at the summit.

The State Department of Transportation is responsible for the maintenance of the access road from the Saddle Road to Hale Pohaku and eventually to the summit.

Although the County of Hawaii has no jurisdiction over the mountain, it nevertheless is responsible for processing permits for building and grading and for site or design reviews. The County's Planning Department also is asked to provide comments and recommendations before the DLNR makes a land use decision affecting Mauna Kea.

In formulating the Mauna Kea Plan, differences between local and State planners developed. Until this day some of the differences still have not been settled while the three-year-old plan is being reviewed by the DLNR for rewriting and refining.

The most noticeable difference is over the limit of the number of observatories that should be allowed atop the mountain. The Mauna Kea Citizen Advisory Committee's recommendation, which is endorsed by the County Administration, was six observatories. The recommendation however was rejected by the Land Board, and at present, no limit on the number of the observatories is placed by the State agency.

Besides its scientific significance, the Big Islanders, both inside and outside of government, are concerned about the natural beauty of the mountain and about its historic and cultural heritage. Sites such as Puu Poliau [Poliahu], home of the Hawaiian [page B-2] Goddess of Snow, and Lake Waiau atop the summit, "regarded by Hawaiians as a sacred place and a cultural tie with the past," should not be obliterated by haphazard development. And, the rarefied atmosphere on the mountain's higher slopes and summit and its surrounding unique Hawaiian ecosystems should not be unreasonably disturbed in the name of progress or scientific development.

How Hale Pohaku should be developed remains unsettled, despite the fact that the State has drafted an environmental impact statement for its proposed development in the area. Hawaii County Planning Director Sidney Fuke, for instance, thinks that until there's agreement on the extent of development in the Science Reserve at the summit, the Plan for Hale Pohaku cannot be finalized.

Whether the summit access roads should remain unpaved is another unsettled problem. There is pressure for paving the 8.5-mile winding, one-lane road, as the traffic between

the observatories and Hale Pohaku is increasing. The University in fact has asked the DLNR to reverse its policy and to allow pavement.

So it is understandable why government officials have been cautious in making comments on the uses of the mountain.

> "Mauna Kea is like our shoreline," says Planning Director Sidney Fuke. "It is a natural beauty, and at the same time, it has economic and boundless recreational potentials.
>
> To assure its balanced and orderly development, a comprehensive plan should be developed. The need for such a plan has been the County's position, a position well-expressed in the Northeast Hawaii Community Development Plan.
>
> This plan would determine the capacity of Mauna Kea and then set some maximum limit to astronomy and its related developments. At the same time, it would look at means to preserve the natural character of the mountain and provide for its diversified use."

Fuke has suggested reactivation of the Mauna Kea Citizen Advisory Committee for updating the Mauna Kea Plan and for developing a more specific management plan.

The University presently is drafting a management plan for the Science Reserve Area on the summit. The plan will set forth specific criteria for the use of the summit area as an international research site.

Chancellor Durward Long, addressing the subject of the place of astronomy in the present and future of the University, has made the following remarks:

In seeking the most effective way to develop programs of international quality, it has been natural for the University to look to these academic areas where the particular geographical, environmental, economic, or sociological characteristics of Hawaii give it a special advantage.

In this way it was recognized early in the 1960s that astronomy had a great potential for development as a first-class research and training program and, at the same time, could bring significant economic and cultural benefits to the Islands.

The wisdom of the choices made by the political and academic leaders of that time has been shown in the dramatic growth of astronomy as an enterprise on Mauna Kea and Haleakala, and the rapid growth in stature of the UH research and training program within the Institute for Astronomy and Department of Physics and Astronomy.

Our aspiration is (and can be) no less than to develop an academic program matching the excellence of our sites; at the same time we recognize the great responsibility we have to serve as a wide and responsible custodian for the international resource represented by our high mountain peaks and especially Mauna Kea.

The astronomy program at the University began 15 years ago and has developed through the dedication of its staff and the constant support of the University and State administration. Today, new programs in the University which show similar promise in fields such as energy development, marine biology, and agriculture, are in the early stages of development. We look forward to seeing their growth to national and international significance as well, following the same kind of development as we see in the astronomy program."

Since the meager beginning 15 years ago, Mauna Kea now has six observatories — a UH observatory with an 88-inch telescope; two 24-inch telescope observatories; a Canada-Hawaii-France observatory with a 140-inch telescope; an 120-inch infrared observatory built by the National Aeronautics and Space Administration; a 155-inch infrared United Kingdom observatory. And, there may be more to come.

Susunu Ono, chairman of the Board of Land and Natural Resources, expects the review of the Mauna Kea Plan to be completed within the next six months.

"There are a number of considerations equally important in making recommendations for land use (affecting Mauna Kea)," said Ono. These considerations include the "need of the scientific community, the role the University plays, the recreational needs of our people on the Big Island, as well as the input we've received from the county in terms of its overall objectives and goals regarding the use of the mountain."

"At present, the ultimate goals for the mountain use are under review by the Department as part of the review of the Mauna Kea Plan," Ono says.

"Hopefully, the results of this review will further specify the kinds of goals that all of us are working to achieve in terms of mountain use."

In reviewing, Ono says his department is listening "very closely" to the University, the County government, as well as the general public.

And, the State chief protector of the natural resources in the Islands promises:

"The main thing is we have to treat it (Mauna Kea) with sensitivity." [Hawaii Tribune Herald, Sunday, January 27, 1980:B-3]

Perspective: reflections of Mauna Kea

(by Mrs. Faith Bean and Mrs. Brenda Duquette)

From the slopes of the Kohala Mountain, members of the Waimea Hawaiian Civic Club are able to view Mauna Kea and introspectively reflect their "*manao*" (or thoughts) about the great "White Mountain." Many members have one time or another used the mountain for the purpose of exploring, hunting, or sightseeing.

In 1971, the club with about 20 four-wheel drive vehicles, took an historical Hawaiian tour of the mountain. Their guide showed them several caves where the ancient Hawaiians carved the adzes for their tools. Some of the members were awed by the sight of the *opihi* shells found in the caves. It was soon explained that the ancient Hawaiians lived by the beaches and in their preparation for their stay on the mountain would probably take *opihi*, dried fish, perhaps some bananas and, of course, *poi*. Hopefully, this food would last them until they had completed the new adzes for their tools. However, all that was left for the modern-day Hawaiians to view were just some adze chips and *opihi* shells.

Later, the group visited Lake Waiʻau, a lake caused by the melting of snow. A member of the club shared her family tradition of putting the umbilical cord of a newborn baby into a bottle and throwing it as far as possible into the middle of the lake. She and her mother and probably her mother's mother had done the same thing. Many of the others in their company agreed with her for all Hawaiians know that the umbilical cord if not properly disposed may alter the destiny of a child's life. For example, if the cord is stolen by a rat, the child could become a thief.

Recently some members mentioned how fortunate Hawaii had been chosen to facilitate the Mauna Kea observatories, our own "White Mountain" above all others in the world. Others said progress is good but "no more building." The mountain should not be "overcrowded;" it may bring more building." The mountain should not be "over crowded;" it may bring more cars, and outsiders who do not have good "mana'o" (thoughts) about preserving the valuable history of the mountain. Then, too, as mentioned by another member, the existing road has been traveled so extensively that by the time the other observatories open, there will be irreversible effects such as full-scale erosion of the mountain itself, not to mention the devastating effect it has on the existing historical sites.

Between the 6,000-foot and 10,000-foot elevations are native Hawaiian ecosystems, including rare plants and birds. Many species are found nowhere else in the world.

Hunting of feral goats, sheep, pigs, and game birds has become a traditional use within (and on the perimeter of) the Mamane/Naio Forest. With this in mind, the Waimea Hawaiian Civic Club introduced a resolution at the 1979 Association of Hawaiian Civic Clubs Convention on Maui, to implement and expedite the Mauna Kea Master Plan. Included in the resolution, was the request to have the entire *Mamane*/*Naio* Forest fenced off, for the purpose of preserving the critical habitat of the threatened and endangered "*Palila* Bird." However, since May 1979 at the Annual Convention, the Waimea Hawaiian Civic Club has received only one reply: that of Susumu Ono in his acknowledgement of our resolution and of his endeavors to act on the Mauna Kea Master Plan.

In short, the members of the Waimea Hawaiian Civic Club continue to hold in awe the magnificence and unique landmark of Mauna Kea. Another historical tour is being planned by the club sometime this year at the 9,000-foot level. They will tour many historical house sites, caves, and perhaps share more *mo'olelo* (stories) of the area by reminiscing members. Our club's motto reflects the overall feeling of our great "White Mountain:" "*Ua Mau Ke Ea O Ka 'Aina Ika Pono.*" "The Life of the Land is Perpetuated in Righteousness." [Hawaii Tribune Herald, Sunday, January 27, 1980:B-8]

Personal Recollections of Mitsuo Akiyama— Mauna Kea and Early Years of Astronomy

Hilo-born, Mitsuo Akiyama[40], is perhaps the individual most responsible for setting the foundational work of developing Mauna Kea into an astronomical platform. Following the *tsunami* of 1960, Hilo was in an economic slump. By 1963, Akiyama settled upon astronomy upon the high mountains—either Mauna Loa or Mauna Kea—as a means of rejuvenating the economy of Hilo. He believed that the science was honorable, and that it would be one by which many local citizens could benefit. As noted in communications cited earlier in this section of the study, Akiyama played a key role in facilitating Dr. Gerard Kuiper's research on Hawai'i, and developing a support base for astronomy on the community, County, State, and National levels.

In 1980, recognizing his role in the development of astronomy on Mauna Kea, the Hawaii County Council issued a resolution, honoring Mitsuo Akiyama, and acknowledging the significant roles of Dr. Gerard Kuiper, and Governor Burns in the process. The resolution reads:

[40] Mitsuo Akiyama was born in 1920, and died on May 28, 2004. Unfortunately, we were unable to interview him as a part of the present study. A number of his letters were located in public collections, and recollections of his efforts shared by other participatns in the oral history program (Volume II). At the time of this writing, arrangements are being made to house Mr. Akiyama's collection of Mauna Kea documents in the library of the Office of Mauna Kea Management.

January 23, 1980
County Council Resolution No. 536

WHEREAS, the developing of an astronomical science base atop Mauna Kea in 1963 began as a dream of Mitsuo Akiyama, then Executive Secretary of the Hawaii Island Chamber of Commerce, who personally south relentlessly for scientists who would help fulfill his dream and thus expand the economic base of the Big Island; and

WHEREAS, in response to Mr. Akiyama's call, Dr. Gerard Kuiper, Director of the Lunar and Space Planetary Laboratory of the University of Arizona, the key advisor to the then burgeoning National Aeronautics and Space Administration, arrive in Hilo in 1964 with a 12 ½ inch astronomical telescope which instrument became the forerunner of the six existing telescopes, atop Mauna Kea; and

WHEREAS, prior to his death six years ago, Dr. Kuiper reverberated his discovery to the scientific world that the Big Island, with its lofty 14,000-foot island mountain, should be developed as the astronomical science base of the world, however, he never lived to see the seed that he planted grow; and

WHEREAS, Mr. Akiyama's dream may not have come true without the support of our late Governor John A. Burns who not only made available $40,000 to build the road to Puu Poliahu, second highest peak where the planetary domes sit, but who was also instrumental in pushing for the expansion of the Institute of Astronomy at the University of Hawaii.

NOW THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE COUNTY OF HAWAII that it congratulate Mr. Mitsuo Akiyama for his untiring efforts in making his dream come true, thus bringing recognition to the Big Island of Hawaii and the scientific community of the world.

BE IT FURTHER RESOLVED that the late Dr. Gerard Kuiper and the late Governor John A. Burns be recognized posthumously for their contribution in fulfilling Mr. Mitsuo Akiyama's dream.

BE IT FURTHER RESOLVED that the Clerk of the County of Hawaii remit true copies of this resolution to Mitsuo Akiyama; to the families of the late Dr. Gerard Kuiper and the late Governor John A. Burns; to the Honorable George R. Ariyoshi, Governor of the State of Hawaii; Director John T. Jefferies, UH Institute of Astronomy; Dr. Terrence Lee, United Kingdom Infrared Telescope; Mr. Claude Berthoud, Canada-France-Hawaii; and to the National Aeronautics and Space Administration.

Dated at Hilo, Hawaii, this 23rd day of January, 1980.

In 1991, The Hawaii Herald published an interview with Mitsuo and Shizue Akiyama, regarding the early days of astronomy on Mauna Kea. Through the interview, and Mr. Akiyama's candid observations, we learn of the events that led to the first "test" telescope on Puʻu Poliʻahu, and efforts to ensure that development of the science complex on the summit of Mauna Kea would occur. In those early years, the "dream" of Mitsuo Akiyama apparently met with no opposition—the economic well-being of Hilo was foremost in the minds of the participants. While the dream did not manifest itself in the manner Akiyama originally envisioned and passionately sought after, the results were the same. Mauna Kea has developed into a "Mecca for scientific research." On June 7, 1991, Bernadette Kagawa, of the Hawaii Herald reported:

Mitsuo Akiyama, Wind Beneath Mauna Kea's Flight to the Stars

If Hawaii was giving out Academy Awards for science, then Mitsuo Akiyama would be a shoo-in for "Best Supporting Actor" for his part in the early astronomical development of Mauna Kea.

No, Akiyama's role was not always glamorous, but he nevertheless carried out his duties very conscientiously—helping others to develop Mauna Kea as the world's premier site for astronomical studies.

Akiyama's adventures all started in June 1964. At the request of Howard Ellis of the U.S. Weather Bureau's Mauna Loa Observatory, Akiyama, then executive secretary of the Hawaii Island Chamber of Commerce, took up the task of finding universities which had astronomy departments and writing to them about possibly doing research atop Mauna Kea or Mauna Loa. He sent word out to such places as the University of Tokyo, the Massachusetts Institute of Technology and Caltech. Several months passed without any serious inquiries.

Then Akiyama's big break came when Dr. Gerard Kuiper entered the scene. You see, Akiyama had finally attracted the attention of a "big gun" in scientific circles. Kuiper, then director of the Lunar and Planetary Laboratory at the University of Arizona, was a Dutch-born scientist who previously headed astronomy departments at the universities of Chicago and Wisconsin. He had made such milestone discoveries as the fifth moon of Uranus and second moon of Neptune. And at the time, he was a key advisor to a then-growing National Aeronautics and Space Administration (NASA).

Kuiper and his staff spent several days inspecting and testing Mauna Kea in January 1964. He liked what he saw so much that he requested a road be built there for scientific-related traffic only.

Such scientific talk came at a time when the Big Island was in an economic slump, and officials were looking for new industries. Science itself was big news back then.

Gov. John Burns supported the road request and the scientific idea itself. After Kuiper discussed his ideas with other officials, the State set aside money to build a road from Hale Pohaku to Puu Poliahu. Kuiper himself chose Puu Poliahu (elevation 13,612 feet) as the site of the observatory.

After about a month and several inspections, the road was completed at a cost of approximately $40,000, and work to build an observatory began. Kuiper got a $25,000 grant from NASA. That wasn't enough, so he asked Akiyama to find people to help build the dome. Akiyama asked some of his friends to help contractors put up the 12 ½ foot dome and test telescope. That was a solid two-week assignment. By June 11, 1964, the foundation, dome and 12 ½ inch telescope were in place.

The University of Hawaii did not even have an astronomy department back in 1964, so Kuiper utilized his resources at the University of Arizona, which boasted a staff of 175.

"We visited Dr. Kuiper at the University of Arizona—a beautiful setting." Akiyama remembers. "He took us to see the 60-inch telescope. Real nice fellow. So I said, 'Gee, by all means, I gotta help this man.' He's such a nice man. He used to write to me every week. He used to telephone me from Tucson, Ariz., every week to tell me about this and that and how about this, check up on this for me, do this for me. And I said 'Sure, anytime.'"

Tests were conducted and on July 20, 1964, the observatory road and dome were dedicated. The establishment of the first observatory atop Mauna Kea—albeit a modest forerunner to today's giant telescopes—was a big push for science and the Big Island.

At the dedication ceremony, attended by about 200 people, Kuiper extolled the attributes of the site as probably the best for astronomical studies in the world—free from industrial pollution. Kuiper also acknowledged the support of Burns, Ellis and others, including Akiyama; "I want . . . to express appreciation to the citizens of Hilo for [page A-1] their tremendous help. In particular to Mr. Akiyama, who has been our counsel and guide throughout this program. What we attempted here was unprecedented—but with Mr. Akiyama's guidance and almost daily participation it was accomplished."

Carl Gillespie, too, had kind words for Akiyama. In an Aug. 8, 1964, Gillespie, Kuiper's assistant at the Luna and Planetary Laboratory, wrote to Akiyama; "I want to take this opportunity to extend my personal thank you and gratitude for the enormous amount of help you have provided the Lunar and Planetary Laboratory. Your personal participation in all aspects of this Mauna Kea development program has saved the taxpayers a very considerable amount of money and the scientists at least six months' time…"

Both Kuiper and Gillespie appreciated Akiyama's thankless, behind-the-scenes efforts; putting together detailed monthly reports for the Board of directors of the Chamber of Commerce; and periodically corresponding with the Hawaii County Council to keep them informed of what officials were saying, as well as recommending certain actions be taken.

Akiyama also scheduled pertinent appointments and made sure Kuiper got to where he was supposed to be. For example, in January 1964, Akiyama and his staff:

- arranged for Kuiper to speak with various officials about the project, including Gov. Burns, UH President Thomas Hamilton, Dr. George Woollard of UH's geophysics department, the State Land Division, State Forestry Division, and Hawaii National Guard;
- transported Kuiper to study and visit the Volcano Observatory;
- have him flown over Mauna Kea and Mauna Loa several times for thorough surveys;
- scheduled a jeep ride to Mauna Kea with state Fish and Game Division officials;
- slotted various dinners; and
- helped to draft a letter for Burns which Akiyama personally delivered to the governor.

Akiyama accompanied Kuiper on many of these excursions, including field tests in the oxygen poor, cold and remote Mauna Kea area, to help him discuss and fill in the blanks with officials, or otherwise provide moral support.

"I'm just another guy that helped Dr. Kuiper," Akiyama said humbly. "I provided the transportation, I ran around with him all over the place…" He accompanied Kuiper when he gave a talk at the University of Kansas, to Hawaii County Council meetings…

"He explained to them about the current setup—trying to get community support. (He) talked to all kinds of people. Everybody's all for it. Even the newspaper backed us. Things looked all right as far as we didn't have any opposition at the time."

Akiyama set up the 1964 dedication program. He invited the Governor here, and put together a special pamphlet recognizing Kuiper's efforts and describing Mauna Kea's geology, topography, drainage system, climate, vegetation and history, including Hawaiian legends and stratigraphic rock units.

"I mentioned in the pamphlet that we should dedicate this thing (the summit road) to Gov. Burns because he was instrumental in getting the money for us to build the road. So we proposed to named the road Burns Highway."

But in a newspaper report, Burns said, "Don't name it after me. I'm still living. Name it (after) this guy Akiyama." The matter sat quietly until it recently resurfaced 25 years later when two County council members introduced such a proposal. Today, the road apparently still has not officially been named.

Kuiper used his clout to spread the word to NASA and others in the scientific community, attracting national attention to Mauna Kea and the state of Hawaii as a whole.

But in spite of his scientific reputation, Akiyama remembers Kuiper as a warm and personable friend. "He took us around one time when we visited him in Tucson, Ariz." Akiyama recalls. "We spent some time at his home. We had him over a couple of times, One time we had a Christmas or New Year's party gathering in Hilo. We invited him and had bingo. To think a guy like him never played bingo in his life! We made him sit down on the floor and play bingo. He won the prize; I laughed. It was a cute thing."

By 1967, however, the blues skies over Mauna Kea had begun to turn gray. Following the testing and establishment of Mauna Kea's first telescope, Kuiper proposed another cooperative venture involving UH. But this time, NASA was not receptive to the idea of his involvement in Mauna Kea activities because he already had a large slice of NASA support at the University of Arizona and a heavy work load. Woollard added that NASA would not support Hawaii's astronomy program on Mauna Kea while Kuiper was a key player.

The University of Hawaii and University of Arizona thus parted ways. Both sent in separate proposals for more telescopes though at the time UH still had no department of astronomy.

NASA funded the UH proposal, and 88-inch, $3-million telescope. From there, the UH Institute fro Astronomy picked up the baton and led scientists in the race to help Mauna Kea grow.

UH kicked off the project with groundbreaking ceremonies in 1967. The dignitaries in attendance included the director of IFA, a Burns assistant, project manager, UH regent, State representative, other UH personnel, and a state accounting official. Akiyama and Kuiper, however, were conspicuously absent. They apparently weren't even invited.

Still, Akiyama does not regret getting involved—except when it comes to Kuiper's role. "I'm happy to see something like this (the Mauna Kea project) happen," he said. "I was fortunate that I was associated with that. Maybe any other person would have done the same thing. But I was one of the lucky guys that helped Dr. Kuiper. Of course Dr. Kuiper toward the end was squeezed out of the whole thing here by University of Hawaii. I guess (there was) a certain amount of professional jealousy. He was left out and University of Hawaii took over the whole thing. Now the whole area is owned by University of Hawaii. All the different countries that want to provide (observatories)—Canada, France, Great Britain, Japan eventually wants to put a big telescope there—have to get permission from University of Hawaii."

Kuiper returned to the University of Arizona in 1967 and continued as a consultant to NASA. He kept very active in trying to develop astronomy facilities until his death in 1973 in Mexico City at age 68.

Akiyama's unhappiness at the treatment those early founders received, especially Kuiper, led him to write to the Honolulu Star-Bulletin in 1972; "As a former active participant and booster of Mauna Kea's potential 'Mecca for scientific research' first envisioned and discovered by the nation's most eminent astronomer, Dr. Gerard Kuiper, I want to share with you some newspaper clippings and other materials I have kept in my voluminous scrapbook of my past undertakings a few years ago when we assisted the pioneer work of Dr. Kuiper.

"I can say without any hesitation that if not for Dr. Kuiper's diligent search to find the so-called 'best site' in the world for NASA, our beautiful Mauna Kea would still be just another site to see when we have some snow.

"Your editorial of March 28 was outstanding, and we are thankful that your newspaper is pursuing the idea first proposed by Dr. Kuiper that the State should set up the Mauna Kea High Altitude Research and Recreational Facility Committee to preserve and protect our great asset."

In 1984, Akiyama tried one last time to garner recognition from the local community to fit the catalytic work Kuiper did to establish the astronomy program in Hawaii. Akiyama wrote to the Hawaii County Council, thanking them for [page A-18] passing Resolution No. 536. He then took it upon himself to inform the various council members of the 20th anniversary of the dedication of Mauna Kea's first observatory project. He reminded them of Kuiper's key role in Mauna Kea's early astronomical development, and enclosed information on more recent events there. He also informed them of a planetary science prize named after Kuiper, the first of which was presented by his widow, Sarah Kuiper Roth, in October 1984, in Kona.

He then suggested that, in order to make Mauna Kea a "Mecca for astronomical development," the Hawaii County Council should support IFA's idea of having the University of Hawaii at Hilo include more technical courses in it's curriculum to be used in training potential Mauna Kea staffers, and have more local residents involved in mauna Kea operations.

Akiyama further believed the Council should go full tilt in helping to establish more telescopes on Mauna Kea. Akiyama sent background information about Mauna Kea's first observatory and dedication ceremony plus pictures, and dispersed copies of his correspondence with the council to UH-Manoa, Mauna Kea, UH-Hilo, the Hawaii Island Chamber of Commerce.

"I think he (Kuiper) got such a raw deal," Akiyama said. To think he did all the investigations, all the hard work for a good six months to a year… It's really a shame. To think that a person like that who more or less dedicated his time trying to find the best site in the world… He said, 'I found this place. I think I have found the best site in the world.' Yet they just give him the good old shaft. It strifes me to no end."

So how did all of this Mauna Kea business affect Akiyama's family? Although he went to Mauna Kea often, his wife Shizue (the former Shizue Ushijima) tried but couldn't stand the altitude. Their son, Alvin apparently fared better.

One night, Mitsuo Akiyama remembers taking Alvin up there when Gillespie was desperately trying to prepare a site because the contractors were coming the next day. At about midnight, they drove up and used their car lights to take various measurements.

Shizue Akiyama added, "He (Mitsuo) feels that Dr. Kuiper doesn't get enough recognition, so his life seems to be dedicated to getting recognition for Dr. Kuiper…

Mitsuo Akiyama reflected, “Gee, I’m happy that something like this happened, because there are over eight observatories up here now, and maybe about 200-300 employees. They don’t make only $10,000-$15,000 pay. They’re all big earning people. Eventually, I hope more high-paying (local) people—niseis and sanseis—will be able to get a job (at Mauna Kea).

“Then of course if local people get training (and) show some interest, you’ll find more local people with jobs up there (which) is a good sign instead of only plenty haoles.”

…Now retired, former 442 RCT veteran Mitsuo Akiyama can take comfort when he steps out of his home in Hilo on a clear day and looks up at Mauna Kea, knowing he worked hard and tried his best. No one can ask for more than that. [The Hawaii Herald, Friday June 7, 1991:A-19]

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