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# Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve

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A Report to the  
Governor  
and the  
Legislature of  
the State of  
Hawai`i

Report No. 98-6  
February 1998



**THE AUDITOR**  
STATE OF HAWAII

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The missions of the Office of the Auditor are assigned by the Hawai`i State Constitution (Article VII, Section 10). The primary mission is to conduct post audits of the transactions, accounts, programs, and performance of public agencies. A supplemental mission is to conduct such other investigations and prepare such additional reports as may be directed by the Legislature.

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# OVERVIEW

THE AUDITOR  
STATE OF HAWAII

## Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve

### Summary

Over the past thirty years, the University of Hawaii and the Department of Land and Natural Resources have managed the Mauna Kea summit and the Mauna Kea Science Reserve primarily for the development of astronomy facilities. With growing concerns over the protection of Mauna Kea's natural environment, the 1997 Hawaii State Legislature, through Senate Concurrent Resolution No. 109, requested the State Auditor to conduct an audit of the management of Mauna Kea and the Mauna Kea Science Reserve.

The development of astronomy facilities on Mauna Kea has a long history. While interest can be traced back to the early 1900s, increased federal funding during the 1960s allowed the University of Hawaii to explore Mauna Kea as a site for astronomical facilities. In 1968, the Board of Land and Natural Resources recognized the university's interest in astronomy and approved a 65-year lease for lands above the 12,000-foot level of Mauna Kea. In 1969, the university established the Institute for Astronomy and began to actively develop telescopes on the summit. Thirteen separate telescopes and one antenna have been built or are under construction on Mauna Kea. An estimated \$600 million was spent to construct these facilities.

We found that the University of Hawaii's management of the Mauna Kea Science Reserve is inadequate to ensure the protection of natural resources. The university focused primarily on the development of Mauna Kea and tied the benefits gained to its research program. Controls were outlined in the management plans that were often late and weakly implemented. The university's control over public access was weak and its efforts to protect natural resources were piecemeal. The university neglected historic preservation, and the cultural value of Mauna Kea was largely unrecognized. Efforts to gather information on the Weiku bug came after damage had already been done. Trash from construction was cleaned up only after concerns were raised by the public. Old testing equipment constructed in the early years of development has not been removed as required by the lease agreement.

We found that new technology requires the university to change its approach to future development within the Mauna Kea Science Reserve. While recent development of interferometers was not part of the original master plan, interferometers serve as an important component to astronomical research. Interferometers, however, have multiple antennas that spread out over a much



wider land area than traditional telescopes. The development of these types of instruments, as well as other new technology, requires the university to reassess its methodology for managing future telescope development.

We found that the Department of Land and Natural Resources needs to improve its protection of Mauna Kea's natural resources. The Conservation District permitting process could be strengthened by ensuring the setting of specific conditions relating to the Environmental Impact Statement's mitigating measures and implementation of management plans. We also found that permit conditions, requirements, and regulations were not always enforced. Finally, administrative requirements were frequently overlooked or not completed in a timely manner.

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## Recommendations and Response

We recommend that the university ensure that the Institute for Astronomy begin the planning process for the next master plan. In doing so, the university should seek input from DLNR and the general public early in the planning process. The master plan and attending environmental impact statement should clearly identify areas suitable for astronomical development; critical habitats of plants, invertebrates, and other rare or endangered species; and areas where no development should be planned. We also recommend that the university develop rules and regulations; hire rangers/guards; require the public to register at the visitor station; conduct periodic inspections for trash; remove old equipment; and develop a forum for continuous community input.

We recommend that the university develop a new methodology to measure the impact of future development on Mauna Kea. The new method should assess the impact of each project, as well as the impact on the total development. In addition, this new methodology should be approved by the Board of Land and Natural Resources.

Finally, we recommend that DLNR do the following: (1) review and rewrite applicable environmental impact statement mitigating measures as specific Conservation District Use Permit conditions; (2) include permit conditions (and time frames) that require the implementation of management plans that are approved by its board; (3) establish controls to ensure the timely completion of administrative requirements; (4) ensure that enforcement of rules not related to the department clearly rest with the university; (5) complete and implement the Historic Preservation plan; and (6) adopt rules for the Historic Preservation Program, Chapter 6E, HRS.

The university and the department generally agreed with our findings. Some of the additional information provided by both agencies was incorporated in the final report.

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## Foreword

This report on our audit of the management of Mauna Kea and the Mauna Kea Science Reserve was conducted pursuant to Senate Concurrent Resolution 109, Regular Session 1997.

We wish to express our appreciation for the cooperation and assistance extended by the administration and staff of the University of Hawaii and the Department of Land and Natural Resources.

Marion M. Higa  
State Auditor

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# Chapter 1

## Introduction

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Mauna Kea, located on the island of Hawaii, is the highest peak in the Pacific Basin and a distinctive state landmark. At 13,796 feet, Mauna Kea's summit is a unique and fragile environment that houses a number of rare or endemic species. Mauna Kea is also distinguished as having one of the best viewing conditions in the world for astronomical studies. Its dry air, high elevation, and small seasonal variations make it ideal to house some of the most powerful astronomical instruments in the world. Over the past thirty years, the Department of Land and Natural Resources and the University of Hawaii have attempted to balance the needs of protecting the mountain's natural environment with those of developing the mountain's terrain for astronomical studies.

This audit examines the efforts of the Department of Land and Natural Resources and the University of Hawaii at managing Mauna Kea and the Mauna Kea Science Reserve in light of development in astronomical facilities. This audit was conducted pursuant to Senate Concurrent Resolution No. 109, Regular Session 1997, that requested the State Auditor to conduct an audit of the management of Mauna Kea and the Mauna Kea Science Reserve.

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### **Development and Preservation of Mauna Kea**

Background information on the development and preservation of Mauna Kea helps to shed light on the current situation today. National interest in a good "observing" site, the state's interest in developing the local economy through astronomy related activities, and the university's desire to develop a world-class astronomy program all played a role in the development of Mauna Kea.

#### ***Mauna Kea's early history***

Early astronomical interest and environmental concerns began at the turn of the century. During this time, astronomer Frank Lowell recognized the superior environmental conditions of Mauna Kea as a site for astronomical studies in the United States. However, due to Hawaii's distance from the U.S. mainland, Lowell instead chose a site in Arizona. About the same time, in 1909, then governor of Hawaii Walter F. Frear established the Mauna Kea Forest Reserve, which included the slopes and summit of Mauna Kea. Later, this and other forest reserves were given protection through the Department of Land and Natural Resources.

In the 1950s, Dr. Walter Steiger from the University of Hawaii's Department of Physics tested the quality of the sky at Maui's Haleakala summit and found it to be greatly superior to any other site tested in the

United States. Dr. Steiger and his colleagues at the University of Hawaii submitted a proposal to the National Science Foundation to establish the Hawaii Institute of Geophysics. The foundation, in turn, provided funding for university buildings and equipment to support a broad-based program in solar astronomy, oceanography, and geophysics.

During the 1960s, increased federal funding allowed more extensive tests to be carried out to locate the best sites for observation facilities. In 1963, the late Dr. Gerald P. Kuiper of the University of Arizona initiated a study of “seeing” conditions on Haleakala for the National Aeronautics and Space Administration (NASA). Haleakala served as the first testing site because it was accessible. Later, Dr. Kuiper convinced the late Governor John Burns to provide funding to build an access trail to the summit of Mauna Kea. In 1964, Dr. Kuiper and several colleagues tested conditions on the Mauna Kea summit and concluded that it was an exceptional site for an astronomical observatory. In that same year, the State Land Use Commission established the boundaries of a Conservation District that encompassed Mauna Kea. As a Conservation District, Mauna Kea’s lands fell under the direct purview of the State Board of Land and Natural Resources.

***Increasing interest in astronomy***

Between 1965 and 1966, the University of Hawaii tested and confirmed Dr. Kuiper’s findings. The university conducted the tests as part of a contract with the National Aeronautics and Space Administration (NASA) to undertake the design, fabrication, and construction of a 2.24 meter (88-inch) telescope. In June 1968, the Board of Land and Natural Resources, recognizing the university’s interest in astronomy, approved a 65 year lease (from January 1, 1968 to December 31, 2033) with the university for all lands above the 12,000 foot level of Mauna Kea. The lease referred to the lands as the Mauna Kea Science Reserve and noted that the reserve was established as “a scientific complex, including without limitations 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.” In 1969, the anticipated development of the 88-inch telescope, additional equipment given to the university, and increased professional interest led to the establishment of the Institute for Astronomy, a separate research unit from the Hawaii Institute of Geophysics.

***Telescopes are developed on Mauna Kea***

From the late 1960s through the 1990s, 13 separate telescopes and one antenna have been built or are under construction, on the summit of Mauna Kea. Each telescope has its own unique origin and purpose. Exhibit 1.1 presents some general information about the different instruments.

## Exhibit 1.1 Instruments on the Summit of Mauna Kea

No.	Year Completed	Telescope Name	Project Cost (est.)	Construction Funding Source	Operating Agency
1	1968	UH 0.6 meter telescope	\$300,000	Air Force - 100%	University of Hawaii
2*	1969	UH 0.6 meter telescope	\$300,000	NASA - 100%	University of Hawaii
3	1970	UH 2.2 meter telescope	\$5,000,000	UH - 40% NASA - 60%	University of Hawaii
4	1979	Canada-France-Hawaii telescope (CFHT)	\$30,000,000	Canada - 50% France - 50%	Canada-France-Hawaii Telescope Corporation
5	1979	United Kingdom Infrared telescope (UKIRT)	\$5,000,000	United Kingdom - 100%	Joint Astronomy Centre (United Kingdom)
6	1979	NASA Infrared telescope facility (IRTF)	\$10,000,000	NASA - 100%	University of Hawaii
7	1987	Caltech Submillimeter Observatory (CSO)	\$10,000,000	Caltech (with funds through the National Science Foundation) - 100%	California Institute of Technology
8	1987	James Clerk Maxwell telescope (JCMT)	\$32,000,000	United Kingdom - 55% Canada - 25% Netherlands - 20%	Joint Astronomy Centre
9	1992	W.M. Keck Observatory (Keck I)	\$107,000,000	Caltech - 30% W.M. Keck Foundation - 70%	California Association for Research in Astronomy
10**	1992	Very Long Baseline Array (VLBA)	\$7,000,000	National Radio Astronomy Observatory (with funding from the National Science Foundation) - 100%	National Radio Astronomy Observatory
11	1996	W.M. Keck Observatory (Keck II)	\$91,000,000	Caltech - 30% W.M. Keck Foundation - 70%	California Association for Research in Astronomy
12	1999	Japan National Large telescope (JNLT) - Subaru	\$170,000,000	National Astronomical Observatory of Japan - 100%	National Astronomical Observatory of Japan
13	1999	Gemini Northern 8 meter telescope	\$92,000,000	USA (National Science Foundation) - 50% Canada - 15% Argentina - 2.5% Brazil - 2.5% Other - 5%	Association of Universities for Astronomy
14	1999	Submillimeter Array	\$48,000,000	Smithsonian - 85% Taiwan - 15%	Smithsonian Institute

\* removed in 1994

\*\* VLBA is an antenna

The operations and management of each facility depend on the agreements formed during negotiations and development of the facility. The Institute for Astronomy keeps abreast of the various facilities through a director's meeting and also through the Mauna Kea User's Committee. The locations of the various instruments are noted in Exhibit 1.2.

### ***Initial concerns over the management of Mauna Kea***

In 1974, three telescopes were already in operation, and three others were being planned. Concerns were raised by local groups, including hunters and conservationists, who formed a loose coalition to challenge the increasing development of the summit. These concerns led to efforts to better control and plan for the development of the summit. The state government proceeded to plan and designate Mauna Kea's use for recreational and scientific purposes and the university proceeded with its own research and development plans.

### **The State's Mauna Kea Plan**

In November 1974, then Governor George Ariyoshi issued a memorandum expressing concern over the increasing recreational and scientific use of Mauna Kea. In the memorandum, Governor Ariyoshi directed the Department of Land and Natural Resources to develop "a master plan for all of Mauna Kea above the Saddle Road." From this directive, the department developed the Mauna Kea Plan, issued in May 1977. The purpose of the Mauna Kea Plan was to serve as "a policy framework for the management of Mauna Kea." The plan divided Mauna Kea into five management areas and described acceptable use and management controls for each area. The plan did not directly address the mid-level facility development named Hale Pohaku. It did, however, recognize the need to manage the mid-level facility.

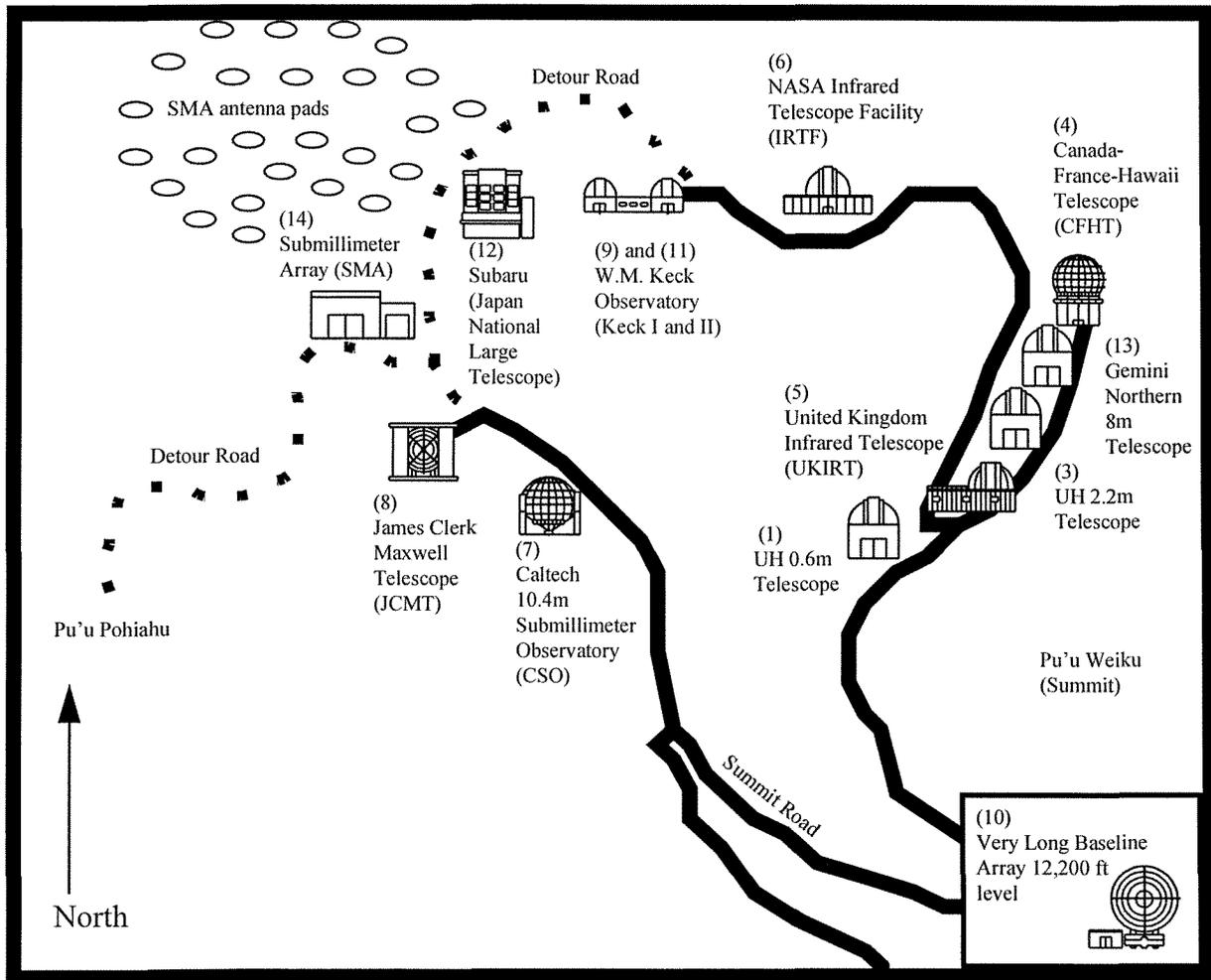
In 1980, the Department of Land and Natural Resources prepared the Hale Pohaku Master Plan to address this need. However, the plan was never officially adopted by the department's board. It instead served as a guide to the university in the design and construction of the astronomy mid-level facility. The plan incorporated the needs of the six telescopes then in operation, as well as an information station outlined in the Mauna Kea Plan. The plan also allocated space for public recreation and set controls for future expansion.

### **Designation of Mauna Kea as a Natural Area Reserve**

In 1981, seven years after directing the Department of Land and Natural Resources to develop a master plan, Governor Ariyoshi designated certain sections of Mauna Kea to be the Mauna Kea Ice Age Natural Reserve Area. Under this designation, the specified areas came under

**Exhibit 1.2**

**Locations of 12 Telescope and Very Long Baseline Array Antenna Facilities**



\* Not drawn to scale.

Note: (2) UH 0.6m telescope removed in 1994. Replaced by (13), Gemini Northern Telescope

the control of the Natural Area Reserves System Commission, an entity administratively attached to the Board of Land and Natural Resources. Exhibit 1.3 below provides a graphic depiction of the Mauna Kea Conservation District area.

### **The University of Hawaii research development plan**

In an effort to control the development of its Mauna Kea facilities, the University of Hawaii developed its own research development plan for the Mauna Kea Science Reserve and its mid-level station at Hale Pohaku. The Board of Regents approved the plan in January 1982. The university envisioned this plan to serve as “the programmatic master plan for the continued development of the Mauna Kea Science Reserve.” The plan included tasks to be undertaken, procedures for the university’s review and assessment of applications for new facilities on Mauna Kea, and types of agreements to be required of all new users of the summit area.

### **The second development plan for the Mauna Kea Science Reserve**

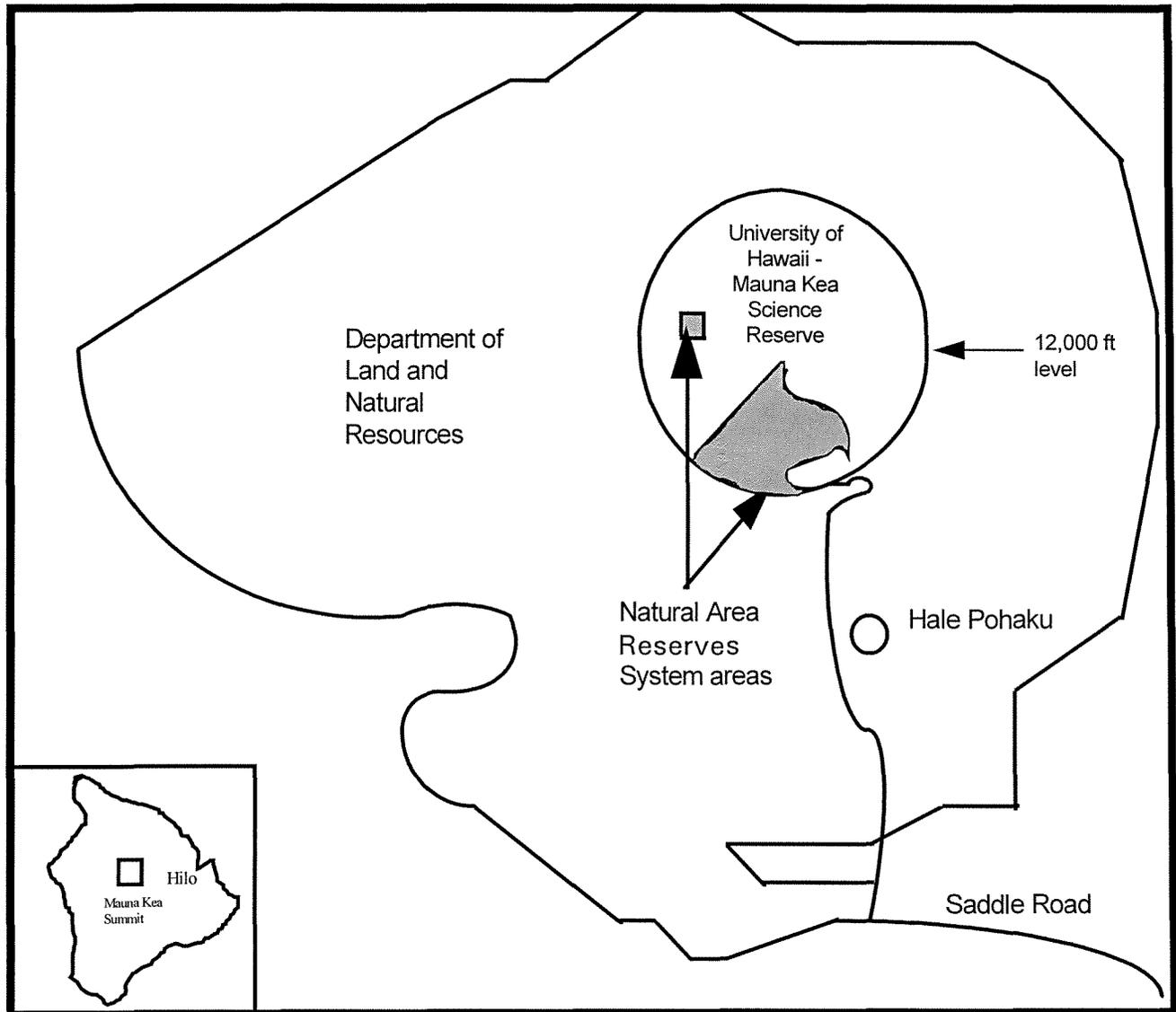
The university developed a second plan, the Mauna Kea Science Reserve Complex Development Plan, to facilitate the implementation of the specific research facilities identified in the Research Development Plan. This plan consisted of two major components: 1) the complex development plan (CDP) and 2) the final environmental impact statement (EIS).

The complex development plan was developed to provide “the physical planning framework to implement the UH Research Development Plan.” The primary objective of this document was to guide and control development in order to preserve the scientific, physical, and environmental integrity of the mountain. A proposal for managing the mountain’s resources and monitoring and controlling visitors to the area was incorporated in this document. The plan made the university responsible for managing and monitoring its specified management areas.

The other component of the university’s Mauna Kea Science Reserve Complex Development Plan is a final environmental impact statement. The (EIS) evaluates the general impact of implementing the actions proposed in the complex development plan and proposes mitigating actions for potential negative impacts. This EIS was to serve as a “master EIS” for future developments outlined in the complex development plan.

The Mauna Kea Science Reserve Complex Development Plan was originally completed in February 1983 by the university. However, the

**Exhibit 1.3**  
**Mauna Kea Conservation District Area of Responsibility**



section of the plan that covered management was amended in 1985 to address concerns from the Department of Land and Natural Resources and the public. The Board of Land and Natural Resources accepted this plan, but noted that it still lacked components to manage commercial use. The plan was amended again in 1987 to address the development of a Very Long Baseline Array (VLBA) antenna but not commercial use.

### **Concerns over the management of commercial use on Mauna Kea**

In an effort to improve management over commercial use, the Board of Land and Natural Resources approved the Revised Management Plan for the UH areas on Mauna Kea in March 1995. This plan superseded and replaced the Management Plan approved by the board in February 1985. Revisions to the plan include: 1) assignment of the management and enforcement responsibilities of public and commercial use to the Department of Land and Natural Resources, 2) incorporation of commercial use and management controls, and 3) modification and addition of new controls to reflect the university's experience over the past ten years.

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## **Management of Mauna Kea: Roles and Responsibilities**

As noted in the previous section, a number of entities play a role in the management of the resources at Mauna Kea. These entities—the Department of Land and Natural Resources, the University of Hawaii, and the Natural Area Reserves System Commission—all have distinct missions and functions that form the basis of the entities' efforts to manage Mauna Kea.

### ***University of Hawaii***

The University of Hawaii is responsible for the land area above the 12,000 foot level known as the Mauna Kea Science Reserve. The university's three major missions are: 1) instruction, 2) service, and 3) research. It is widely recognized for its strength in a number of disciplines, including astronomy. It offers masters and doctorate-level degree programs in astronomy. The university also offers an undergraduate preparation program under the physics and astronomy department in the College of Natural Sciences.

### **Institute for Astronomy**

In order to facilitate research and education on astronomy, the university established the Institute for Astronomy (IFA) in 1969. The institute's primary missions include producing high quality astronomical research; providing world leadership in developing ground-and space-based instruments; developing and being steward of Mauna Kea and Haleakala

Science Reserves; and providing facilities and professional guidance to graduate students of astronomy to enable them to meet curriculum requirements and to gain hands-on experience in current astronomical research techniques. The general organizational structure, applicable to this audit, is shown in Exhibit 1.4.

Within this structure, the Office of the Director of the institute has the overall responsibility to fulfill the institute's mission. The institute's Executive Committee advises the director and assists in developing policies, long-range plans, and programs. The committee is comprised of division and facility heads. The Mauna Kea-Haleakala Development Office oversees the growth of the rapidly increasing number of facilities on Mauna Kea. The office ensures that growth proceeds in an orderly way and provides maximum long-term benefits to the university and the state. The Office of the Assistant Director for Program Support provides program support to the institute's operations (administrative, fiscal, logistical, and project management). The office also monitors all capital improvement projects for Manoa and Mauna Kea and is responsible for the institute's participation in the University of Hawaii's revenue bond issues that finance certain improvements at Mauna Kea. Mauna Kea Support Services (MKSS), an organization operated through the Research Corporation of the University of Hawaii (RCUH), falls under the responsibility of the Office of the Assistant Director for Program Support. Mauna Kea Support Services provides maintenance and logistical services to all the Mauna Kea Observatory facilities and the new Ellison Onizuka Visitors Center on Mauna Kea.

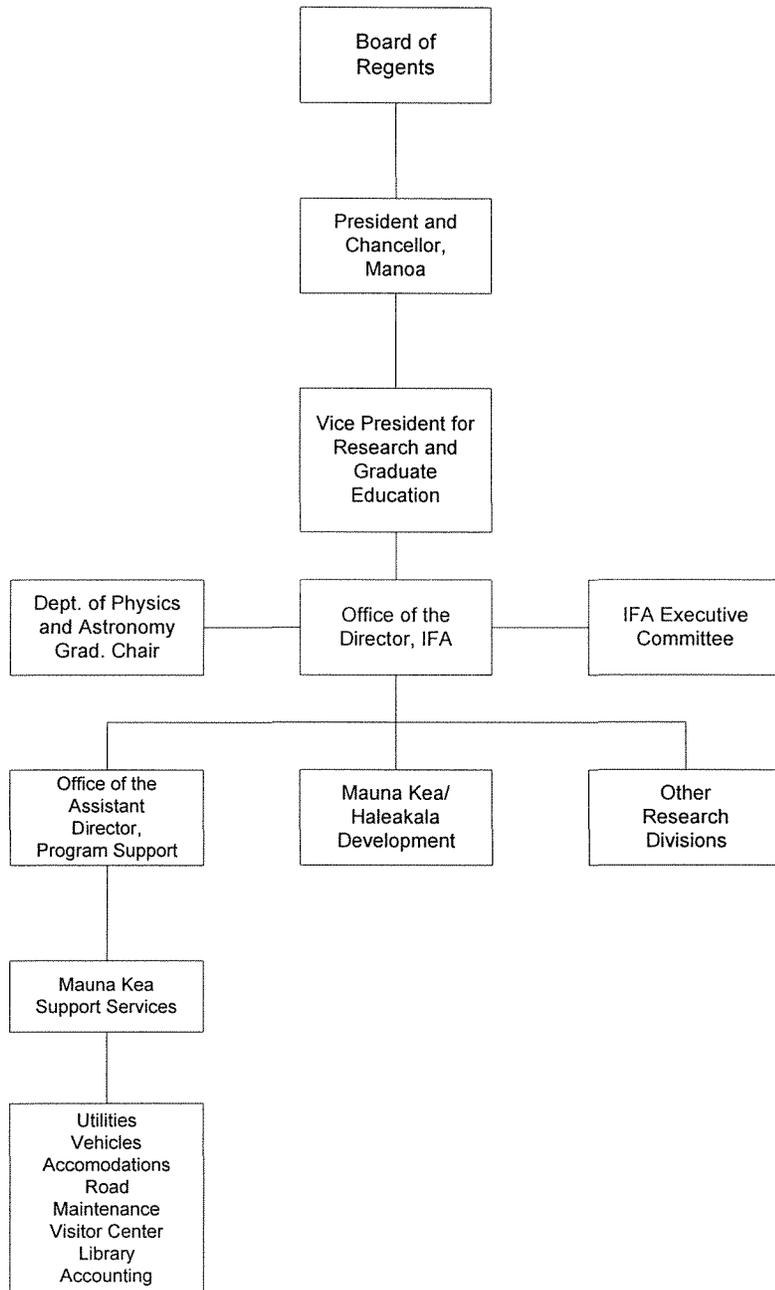
### ***Department of Land and Natural Resources***

The Department of Land and Natural Resources is responsible for managing, administering, and controlling public lands and waterways and the disposition of these lands. The department also manages and administers state parks; historical sites; forests and forest reserves; aquatic life, aquaculture programs, and aquatic life sanctuaries; public fishing areas; boating, ocean recreation, and coastal programs; wildlife and wildlife sanctuaries; game management and public hunting areas; natural area reserves; and other functions assigned by law. The department's organizational structure, applicable to this audit, is presented in Exhibit 1.5.

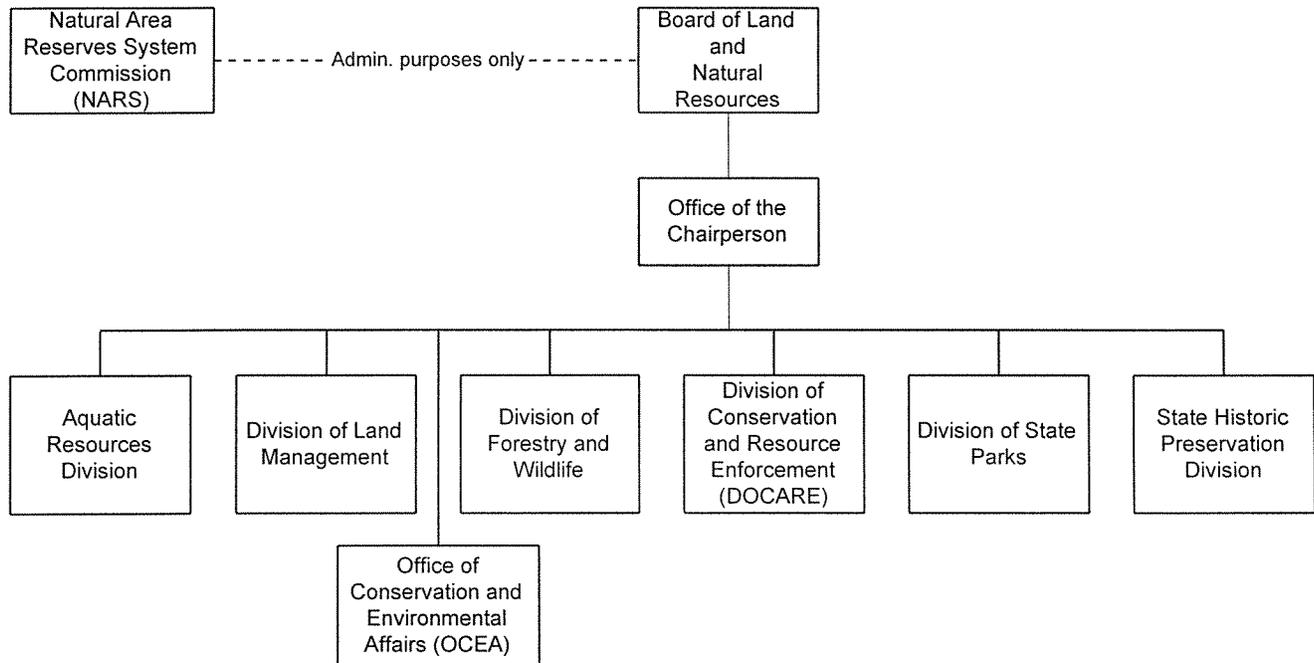
### **Board of Land and Natural Resources**

The Board of Land and Natural Resources is the managing authority for the department. Its numerous responsibilities include: establishing administrative procedures, policies, rules and regulations; approving plans; authorizing and controlling the disposition of state and public lands; administering Conservation Districts; and administering the Natural Area Reserves System. The board also approves all Conservation District Use applications.

### Exhibit 1.4 Organizational Structure of the Institute for Astronomy (IFA)



## Exhibit 1.5 Organization of the Department of Land and Natural Resources



### Natural Area Reserves System Commission

The Natural Area Reserves System (NARS) Commission is administratively attached to the department. It establishes the criteria that are used in determining whether an area should be included in the Natural Area Reserves System. It establishes policies and criteria for the management, protection, and permitted uses of the reserves system. Any land use within the established system area requires a special use permit issued by the Board of Land and Natural Resources, with the approval of the Natural Area Reserves System Commission.

### Division of Land Management

The Division of Land Management is responsible for the planning, development, and management of public lands and other lands under executive order and for administering the land acquisition and disposition program. In the past, this division coordinated with the Office of Conservation and Environmental Affairs (OCEA) in processing Conservation District Use applications for state and private lands. It reviewed and commented on land use proposals received from the office. A proposed reorganization will move the office's functions into the Land Management Division.

### **Office of Conservation and Environmental Affairs**

In the past, the Office of Conservation and Environmental Affairs under the direction of the department's chair, administered all Conservation District Land Use activities. It initiated and coordinated departmental positions on the environmental effects on conservation lands of proposed projects from public and the private sectors. As mentioned earlier, the functions of this office would fall under the Land Management Division under the proposed reorganization.

### **Division of Conservation and Resource Enforcement**

The Division of Conservation and Resources Enforcement is the department's enforcement agency. It investigates complaints, gathers evidence, conducts investigations, and conducts such field observations and inspections as required or assigned. Act 188, Session Laws Hawaii, (SLH) 1977, requires the division to enforce the laws, rules and regulations relating to recreational, historic, scenic and open space resources in coastal zones. Act 226, SLH 1981, expanded these powers to give the division full police powers to enforce all state laws and rules and county ordinances within all state lands, shorewaters, shores, and county parks.

### **Other Department of Land and Natural Resources divisions**

The four divisions, Forestry and Wildlife, Aquatic Resources, State Parks, and Historic Preservation, implement statewide programs for the management, development, maintenance, research, and propagation of the resources within their specific areas of concern. These divisions comment on proposed Conservation District Use applications from the perspective of their specific areas of concern.

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## **Objectives of the Audit**

1. Identify and describe the roles and responsibilities of agencies involved in the management of Mauna Kea and the Mauna Kea Science Reserve.
2. Assess whether management controls are in place to protect the natural resources of the state in the development of Mauna Kea and the Mauna Kea Science Reserve.
3. Make recommendations as appropriate.

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## Scope and Methodology

This audit examined the management practices at both the Department of Land and Natural Resources and the University of Hawaii as they pertain to Mauna Kea and the Mauna Kea Science Reserve. We reviewed files, records, plans, Conservation District Use applications, and other related documents at the Department of Land and Natural Resources to determine the effectiveness of the department's management of the entire mountain, as well as the Mauna Kea Science Reserve area. Our review included testing to assure that the department adhered to applicable statutes and rules. We also examined the files, records, applications, correspondence, and other applicable documents at the University of Hawaii, Institute for Astronomy, to determine the extent to which the institute has complied with Board of Land and Natural Resources' conditions and other criteria set out in the various management plans and Conservation District Use applications. The time period examined was from July 21, 1968 to the present. Our work also included interviews with staff and administrators at the Department of Land and Natural Resources and the University of Hawaii. We also interviewed members and representatives of various community groups.

Our work was performed from May 1997 to November 1997 in accordance with generally accepted government auditing standards.

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# Chapter 2

## Management of Mauna Kea Fails to Adequately Ensure Protection of Our Natural Resources

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Over the past thirty years, the University of Hawaii and the Department of Land and Natural Resources have managed the Mauna Kea Science Reserve and adjacent lands in acknowledgment of the competing needs: astronomy development versus environmental protection. However, both the university and the department failed to develop and implement adequate controls to balance the environmental concerns with astronomy development.

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### Summary of Findings

1. The University of Hawaii’s management of the Mauna Kea Science Reserve is inadequate to ensure that natural resources are protected.
2. Implementation of new technology has impacted development within the Mauna Kea Science Reserve.
3. The Department of Land and Natural Resources’ efforts to protect Mauna Kea’s natural resources need improvement.

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### The University of Hawaii’s Management of the Mauna Kea Science Reserve is Inadequate to Ensure the Protection of Our Natural Resources

The University of Hawaii’s management of the Mauna Kea Science Reserve is inadequate to ensure the protection of the natural resources within the reserve. The State of Hawaii, through the Department of Land and Natural Resources, leased these lands to the university for scientific research. The conditions of the lease, the plan(s) developed, and the Conservation District Use Application (CDUA) process were all designed to allow the university’s use of the lands without causing excessive damage to the fragile environment. However, the university’s focus on pursuing its own interests has led to conditions and practices that have countered or weakened these processes.

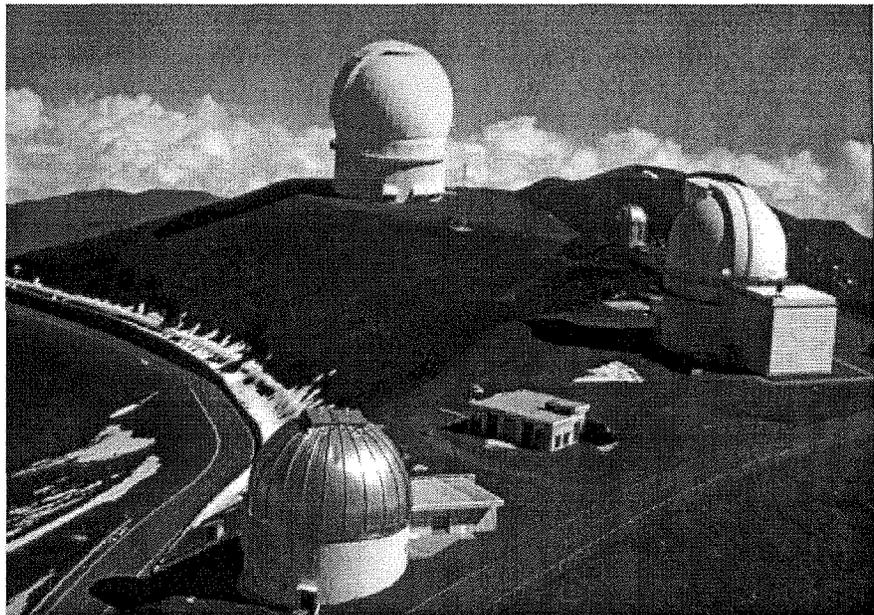
#### *The University of Hawaii focused on development and research benefits*

Because the university focused on developing Mauna Kea, it did not allocate sufficient resources to protect other natural resources on the summit. Since 1967, the university focused on developing the summit for astronomical research, resulting in the construction of some of the most powerful astronomical instruments in the world. These telescopes enhanced the university’s prestige and that of its astronomy program. However, this focus and effort overshadowed the university’s commitment to provide reasonable assurance of protection for the summit’s natural resources.

### **Development increased under the Institute for Astronomy**

Development of astronomical facilities increased under the direction of the Institute for Astronomy. Prior to the institute's leadership, the university's administration directed the management and use of the lands on Mauna Kea's summit. Before 1986, the vice president of administration directly handled development of the summit. When the university reorganized in 1985, it decentralized its decision making process. As a result, the institute's director gained significant authority and the institute has taken the lead role in developing Mauna Kea.

Under the institute's management, development of the summit increased significantly. During the eighteen year period from 1968 to 1986, the university built eight telescopes or about one telescope every 2.25 years. Within the ten year period from 1987 to 1997, the institute added another five telescopes and the Very Long Baseline Array (VLBA) antenna. This averages to about one major project every 1.6 years or a 24 percent decrease in time between major construction. In all, the university added a total of 13 telescopes and one antenna facility within the Science Reserve. The university supported the development of these instruments as components of its mission.



Telescopes on Mauna Kea

### **Land use consideration was tied to research benefits**

The university was granted lands to meet its research needs, but it did not fulfill its obligations as a responsible leaseholder of conservation lands. Over the years, more than \$600 million was spent to construct the 13 telescopes and the antenna on Mauna Kea. Another \$50 million per year is spent by agencies involved in the operation of telescopes. A small percentage of these substantial amounts could reasonably have been used for environmental protection and to provide basic services to the public. However, this is not the case. The university claims that it lacks the funds and the positions to implement the protection controls outlined in its management plans. We found that this is largely the university's own fault. It took active steps to ensure that the development benefits would not be lost to other needs.

The university was more concerned about the benefits to its research program than about monetary consideration for the state. The university granted land use agreements to operators in exchange for viewing time on the instrument and a one time contribution. All subleases to operators were gratis or for a token \$1.00. The university used the operating and site development agreements with the various operating agencies to spell out the compensation in viewing time. The university noted that its policy is to seek scientific opportunities in kind as consideration for the land to be used for telescopes on Mauna Kea. This approach will benefit both Hawaii and the other telescope projects. If the consideration were written into the sublease, the document would be subject to review by other State agencies, and the University of Hawaii would run the risk that these agencies would insist on cash payment or some other consideration which might not directly benefit the university's astronomy program or the Mauna Kea astronomical community. This policy meant that operators pay little or no rent but compensate the university in kind through viewing time on the telescopes.

The university does receive some funding from the operating organizations in the form of a one-time infrastructure contribution based on telescope size. Part of these contributions have been used to meet environmental needs such as aerial reconnaissance and arthropod studies. The organizations also make periodic contributions for shared costs such as supplies, lodging, the visitor information station, and road maintenance. However, there is no provision to dedicate significant amounts of funding for on-going environmental protection. There are provisions to increase the operators' contribution to the visitor's center or for more infrastructure contribution, but the only feasible approach to get significant funding is to allow construction of another telescope. Overall, this current arrangement allows the university to receive research benefits despite budget cuts or redirection of funds to competing priorities such as resource protection.

***Protection controls were established through plans but were poorly implemented***

The university developed plans that outlined protection controls designed to limit access; provide for public safety; and protect the cultural, historic, and natural resources. However, many of these plans were submitted late and were weakly implemented. In addition, the university's lack of commitment and the Department of Land and Natural Resources' failure to enforce the plans compounded the problem of inadequate environmental protection.

**Plans were often late**

Over the 30 year period we reviewed, the university produced a number of plans and studies required by the Department of Land and Natural Resources. However, in many instances these plans were submitted late. Sometimes submission was only a few months late. For example, the 1974 department requirement for a master plan for the development of Mauna Kea was submitted six months late. In 1984, the department approved the university's Mauna Kea Science Reserve Complex Development Plan under the condition that several issues be addressed. A revised version was to be submitted within 180 days. This plan, approved February 1985, was also six months late.

In another case, over a decade passed before a plan was produced. In 1985, the department noted that the Mauna Kea complex plan lacked a component that addressed commercial use. The commercial use plan was finally approved in 1995, ten years later. During the interval, the department administered an interim permitting process to address commercial use. Another example of a late plan is the Historic Management Plan, discussed later in this section.

**Comprehensive management plan is developed but is poorly implemented**

The Department of Land and Natural Resources identified the need for a comprehensive management plan in the mid-1970s. However, plans that were subsequently developed were poorly implemented. In the early development phase of Mauna Kea, each telescope project required a separate Conservation District Use Application (CDUA) and a related environmental assessment or impact statement. Several projects were initially approved with brief environmental assessments that stated that no impact statement was necessary. These assessments conformed with the then-current regulation and were reviewed by the appropriate agencies. Each project was assessed individually. However, the cumulative impact of developing the entire complex was undetermined. Recognizing this problem, the department required the university to develop a "master" plan and environmental impact statement. In exchange for allowing the university to pave the summit road, the department required that certain controls be included to protect the

department's various interests, including controls over public access. These controls and requirements were often shortened, neglected, or ignored.

### **The plan was weakly implemented**

The 1984 management plan identified several resources that were to be protected: 1) astronomy related resources, 2) flora, 3) fauna, 4) cultural, historic, and natural history sites, and 5) users. The plan was comprehensive, but it was only partially implemented.

The primary means of controlling the visiting public was through the Visitor Information Station and security personnel. Sightseers, hikers, commercial users, and other visitors were to stop at this station to get information and register themselves. The university was to draft rules and regulations regarding access and use of the Science Reserve area. Phase II of the plan called for funding of security personnel to patrol, provide information, enforce regulations, and help ensure visitor safety. In addition, a small telescope was to be available to the public at Hale Pohaku and a shuttle system to the summit was proposed in the event that visitor count became high. The plan noted that the protection of historic sites would be accomplished by not calling public attention to those sites.

Review of this initial plan and subsequent actions shows a lack of the university's commitment. For example, the Visitor Information Station was to be open during "heavy traffic or seven days a week." The university initially opened the visitor center mainly on weekends. Yet all visitors were expected to stop, register, and get information regarding permitted use and safety. This meant that visitors during the weekdays went up without this information. The university has improved over time by incrementally increasing the days and hours of operation of the Visitor Information Station. However, this control over public access remains only partially implemented.

Under the management plan, the university was to develop rules and regulations and eventually employ security personnel to enforce the rules and regulations. In 1985, the university developed draft rules and regulations for parking and permitted use in the summit area. However, the university noted that in order to implement these rules, the lands would have to be withdrawn from the Forest Reserve. In 1985, the Board of Land and Natural Resources approved the withdrawal of the land. However, the department's delay in preparing the appropriate documentation was delayed over 11 years. During this time, the university's actions related to the parking and permitted use were mostly passive.

Delays also occurred in enforcement areas. The management plan called for security personnel to help enforce rules and regulations for the summit area. However, these positions were to be funded “as necessary.” Without rules and regulations to enforce, the university had no reason to fund the positions. During FY1992-93, the university requested and received three ranger positions. However, these positions were reallocated by the university to meet other administrative control and compliance requirements. Since the lands were technically under the Department of Land and Natural Resources’ control, the university has attempted to secure the services of the department’s Division of Conservation and Resource Enforcement (DOCARE) personnel to enforce the department’s regulations on the summit.

The final component of the management plan was the formation of a management committee to review controls and make necessary changes as concerns arose. However, there is no evidence to show that this committee was ever formed, who the members were, or what was discussed. Evidence shows that some work was done on the commercial use plan, but most of this effort occurred near the end of the ten year period (from 1985 to 1995).

**The current plan shifts enforcement responsibility back to the Department of Land and Natural Resources**

The original intent of the management plan was to control access and public use. In 1995, the university and the Department of Land and Natural Resources adopted a revised management plan to improve control over commercial use in the summit area. While this plan does address commercial use, it is also a step backward from the university’s earlier efforts at establishing controls over public access.

The plan essentially transfers most university management responsibilities back to the department. The plan’s justification is that the university is not structured to manage, control, or enforce public recreational use and areas or process commercial permits. As such, all management responsibilities, except those related directly to the astronomical facilities or the summit road, are transferred back to the department.

In earlier plans, there appeared to be some effort to control public access. But under the recent 1995 plan, the university’s approach to managing public access is weak. The plan says that the Visitor Information Station is “usually” open only on weekends and visitors are “encouraged” to go there for information. The plan mentions that the university is “attempting” to get funding for ranger positions. Once this is accomplished, visitors will be asked to stop at the station before proceeding forward to the summit. This has yet to be accomplished.

The 1995 plan does not mention any rules or regulations to be developed by the university. Instead the plan focuses on current Department of Land and Natural Resources rules as the basis of enforcement. According to the plan, most enforcement activities are handled by the department's enforcement officers. The university merely acts as "monitor," reporting any infractions to the department. The department's enforcement division (DOCARE) handles all enforcement requirements. Its activities are diverse, including monitoring of state parks, assisting in marijuana eradication on state lands, monitoring boat harbors, and enforcing fish and game regulations. Staff allocation is based on an assessment of where the most violations would occur. The university, as the leaseholder of the land, controls the day-to-day activities on the summit. It appears that the university refuses to assume responsibility for protecting the resources and transferred these functions to the department.

***Piecemeal efforts provide no protection and possibly violates the general lease***

The Institute for Astronomy's focus on telescope construction on Mauna Kea's summit propelled the site into a premier location for astronomical research. However, this emphasis was at the expense of neglecting the site's natural resources. The university's Environmental Impact Statement failed to adequately disclose the "cumulative" impact of development, as it was supposed to. Even though this impact statement was accepted, it was based on a limited area within the reserve and based on assumptions without actual data on the potential facilities. Resource protection efforts amounted to ignoring historic sites and limiting data collection on flora and fauna to the acceptable minimum. Very little effort was made to recognize the cultural significance of the mountain. Many of the subsequent problems stem from this limited approach to protection.

### **Historic preservation is neglected**

Historic preservation has been a concern since the signing of the 1968 general lease. The lease states that the university "shall not damage, remove, excavate, disfigure, deface, or destroy any object of antiquity, prehistoric ruin, or monument of historic value." While the concern for preservation previously existed, it was not addressed until the 1983 complex development master plan. However, the plan did not adequately address preservation. It simply noted that public attention would not be called to the historic sites. If people are tampering with the sites, they will be educated, warned, and cited if they persist. In terms of construction, a surveyor in 1982 recommended that an intensive archaeological survey be conducted prior to any construction.

### **Historic sites were damaged**

The development of the Hale Pohaku substation led to some damage to historic sites. In a report, *Survey and Test Excavation of the Pu'u Kalepeamoia Site, Mauna Kea, Hawaii*, dated November 1991, the surveyor reported that there "have been a number of incidents that have adversely affected the integrity and future research potential of this site...determined eligible for inclusion on the National Register of Historic Places." The "damage" included five pits that were dug during the substation's construction near a lithic scatter site. A lithic scatter site refers to all the remains of stone tool manufacturing that have been intentionally left or redeposited by natural means in a particular place. Also, a large number of pipes were placed on two other lithic scatter sites. The report also describes another lithic scatter site that was damaged due to soil erosion. The water causing the erosion was channeled from Hale Pohaku. The report noted that a premature survey of the powerline corridor, the subsequent selection of a final corridor and soil testing prior to conducting an archaeological survey caused the damage.

The university contracted archeologists to "data recover" the site. Data recovery involves the excavation and collection of historically relevant data to ensure that the research potential of the site is maximized. It involves the excavation and removal of parts of the site which destroys the site. While the university took the appropriate corrective action, the damage should not have occurred in the first place.

### **The historic preservation plan is over ten years late**

The historic preservation plan that represents the university's good faith effort to protect historic resources on Mauna Kea is over ten years late. In early 1986, the Department of Land and Natural Resources made an effort to place historic sites on Mauna Kea's summit on the State and National Registers of Historic Places. Concerned that control of development would be transferred from the State to the federal level and would threaten astronomic development on the summit, the university requested that the proposal be reconsidered. The university pointed out that the current master plan, the rules to be promulgated under the plan, and the security personnel empowered under these rules, would provide sufficient protection. As noted earlier, however, these rules were never promulgated and no security personnel have been hired.

The university, at the insistence of the Department of Land and Natural Resources, eventually agreed to develop a historic preservation plan. While an agreement was evident from staff analysis, correspondence, and other documents, no formal agreement was actually developed. Documents indicate that the university agreed to develop the plan in 1986. However, between 1986 and 1991, the university did very little work. Documents refer to "discussions" between the university and the department. After 1991, the department's Historic Preservation Division

actively pursued the need for a historic preservation plan as shown by comments submitted during the Conservation District Use application process for Japan's Subaru telescope project. As part of the staff recommendation for the use application, the university was required to develop a scope of work for a historic preservation plan and have it approved by the Historic Preservation Division. However, this requirement was later removed as a condition, per the university request. The scope of work was finally completed and approved in 1993 and actual fieldwork for the historic preservation plan began in 1995 and is still being conducted.

### **Cultural preservation is unrecognized**

The cultural value of Mauna Kea is largely unrecognized. The 1983 master environmental impact statement noted that the large concentration of ancient Hawaiian shrines on the northern slope can be used as the basis for postulating the existence of other unrecorded historic sites in this area. The report also notes that the actual and potential significance of this cultural/natural resource warrants further investigation and a determination of eligibility for inclusion on both the state and national historic places registers. The report recommended that a cultural resource management plan be developed as part of the Mauna Kea Science Reserve Complex Development Plan. Neither the university nor the Department of Land and Natural Resources ever developed such a plan as part of the complex development plan. The department noted that this plan is essentially the historic management plan discussed above.

Currently, there is community concern for the lack of recognition for cultural or religious sites on Mauna Kea. Community activist groups, including Ka Lahui, the Mauna Kea Coalition, and Sierra Club, have raised this concern. Currently, individual Hawaiians may practice their native religion but must first go to the Institute for Astronomy for permission to access land, and then go to the Department of Land and Natural Resources and submit a Conservation District Use Application to use the land for religious practices. This process seems excessive and onerous. A cultural management plan could address this issue by identifying specific areas for Native Hawaiians to practice their religion. The plan, included as part of a Conservation District Use Application, could apply to all individual users and specify controls for protecting designated areas. Controls could prohibit commercial user access, limit public access, and require public education on the significance of the area(s) at the Visitor Information Station. Such a plan would help preserve historic shrines and identify specific areas for the building of "modern" shrines.

### **Arthropod study done after the fact**

In 1982, the university conducted an arthropod (e.g., insects) study as part of the requirement for the master environmental impact statement. The EIS identified the Nysius, or Weiku bug, a unique species known to live only on the summit of Mauna Kea. In addition, the study also named a number of different endemic species unique to the summit. As part of the mitigative measures, the report recommended that a biologist visit the site during construction and conduct a survey after construction to assess the relative impact on endemic species. The study also called for limiting construction to the smallest area possible and minimizing disturbance in sensitive areas such as the interior slopes of Pu'u Weiku and Pu'u Hau Oki. These and other measures would help mitigate the damage done during construction. While these EIS mitigating measures are not mandatory, the purpose of these measures are to minimize impact. These measures were not always followed.

In May 1996, Dr. Fred Stone, one of the specialists who conducted the 1983 survey, discovered that during the construction of the Subaru telescope, workers filled and cut in the Pu'u Hau Oki crater walls. According to Dr. Stone, this damaged one of the two most important habitats of the rare Weiku arthropod. The university responded that the construction was done according to the grading plan submitted to the Board of Land and Natural Resources. The university further responded that the reason the crater was filled was to limit construction disturbance to the surface area as required by the impact statement. The Department of Land and Natural Resources later stated that it erred in approving the grading plan since the university failed to comply with the minimum destruction of habitat requirement as stated in the EIS. The university, in an attempt to make amends, commissioned an arthropod study to determine the impact of the damage and to collect more information about arthropods for the next iteration of planning and construction. However, this study comes only after damage has already been done.

### **Trash from construction and the public is a concern**

The summit area of Mauna Kea is a pristine and fragile environment and concerns for maintaining its purity are stated in the 1968 general lease. The lease states that the university needs to keep "the demised [leased] premises and improvements in a clean, sanitary, and orderly condition." Subsequent Conservation District Use Applications included specific conditions that required the university to control trash in the specific construction area and in the general summit area. This lease requirement would entail monitoring construction activity on a regular basis to ensure that contractors are taking measures to prevent construction related trash from spreading over the landscape.

In 1995, the Sierra Club complained about the amount of trash on the summit area. The university found that the Subaru and to some extent the Keck construction projects were generating trash. The university also found that public users of the area were also at fault. The university notified the respective project managers of the problem, but subsequently spent approximately \$20,000 for a helicopter to airlift the trash from the summit. The work was conducted by both the university and community group volunteers. While this effort solved part of the problem, the larger problem is the university's failure to monitor construction and to check for the proliferation of trash.

### **Old equipment is not removed**

The university has yet to remove remnants of old testing equipment from the summit area. In order to prevent remnants of facilities from being left on the summit, the general lease requires that items be removed before the lease termination or be abandoned with prior approval from the Board of Land and Natural Resources. In addition, the 1977 Mauna Kea Plan required an adequate security deposit to ensure that items are removed. During the early years of telescope development, the university erected temporary equipment on the summit to study the conditions of the areas. Remnants of this early period testing still exist, including two concrete slabs located on the Poliahu site and a weather tower on the northeast shield.

The university explained that removing the slabs requires heavy equipment that would damage the environment. However, the university needs to eventually remove these remnants, or seek Board of Land and Natural Resources' approval to abandon them. These remnants were not part of the original landscape and allowing them to remain sets a precedent for other construction to remain. If the university fails to take action, the board may have to require security deposits for all existing telescope structures to assure that those structures and facilities will eventually be removed and the summit restored to its pristine condition.

### ***New plan provides opportunity to improve environmental protection***

The university needs to change its focus and approach as it continues to develop Mauna Kea. Past practices of focusing on astronomy development have served the university and the state economy well, however, changes in the political climate, environmental regulations, and increasing public opposition make it necessary for the university to reconsider its focus. During the 1997 legislative session, a moratorium on any further development of Mauna Kea was considered. Such a moratorium would prevent any further changes on the summit facilities, including new telescopes or improvements to existing facilities. Another consideration is the possible court action by community groups. Litigation could delay and hinder the university's efforts. Public and community groups will continue to remonstrate until their concerns are met.

Within two years, in the year 2000, the 1983 Mauna Kea Science Reserve Complex Development Plan and its related EIS will expire. This presents an opportunity for the university and the Department of Land and Natural Resources to work on issues that have been neglected. The process has partly begun. The arthropod study, the historic site survey and preservation plan, and lessons from the past 14 years serve as the basis for developing a new plan to address all these concerns. However, the university needs to involve the public and the department in the early planning stages. The university also needs to watch deadlines, develop milestones, and establish other controls to ensure that the plan is developed within a reasonable timeframe. The new master plan should identify key areas suitable for astronomical development; general locations of historic sites; critical habitats of plants, invertebrates, and other species; areas for cultural practices; and areas designated as “no build” zones due to the terrain or the natural resources within that area.

The plan should also establish specific controls, including timelines for developing rules and regulations for permissible activities in the summit and Hale Pohaku areas. The university needs to implement the plan by hiring ranger/guides to staff the Hale Pohaku Visitor center seven days a week, and control public access by requiring the public to sign in and receive educational and safety information.

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## **Implementation of New Technology Requires Changes in the Approach to Managing Development Within the Mauna Kea Science Reserve**

***Developing interferometers was not part of the original plan***

Community groups have expressed concern that the summit of Mauna Kea has been developed beyond the limits set forth in the development master plan. Much of the concern stems from the master plan’s description and limits on telescope development. The master plan limits development to 13 telescopes. However, development of a different type of telescope has led to concerns that the limit has been violated and that the summit is over-developed.

In 1982, the university’s Board of Regents adopted the University of Hawaii Research Development Plan for the Mauna Kea Science Reserve. This document provided a conceptual framework for the development of Mauna Kea and outlined the various types of telescopes that could be built in the Science Reserve area. The plan recognized the existence of interferometers, but noted that such telescopes were not projected to be built. The subsequent Mauna Kea Science Reserve Complex Development Plan also did not mention building any interferometers.

Interferometers are a type of telescope that have numerous antennae. The signals from these antennae are collected and mixed to get a better picture. The original telescope limit was based on the assumption that interferometers and their numerous antennae were not going to be built on the summit. This assumption was incorrect.

In 1983, interferometers were not a concern. Controlling development of the summit was simply a matter of limiting the number of telescopes as their impacts were relatively similar. Interferometers, however, changed the situation. Radio interferometers, for example, require several dish-type antennas arranged in straight north-south and east-west lines with a characteristic length of each arm of about a half-mile. This means that the total area needed could be as large as half a square mile or more. The amount of area impacted and the nature of the impact of interferometers are significantly different from that of a single dish facility.

***Questions raised  
regarding the number of  
telescopes on Mauna  
Kea***

Since 1967, 13 self-contained telescopes and one antenna were built on Mauna Kea. In 1994, one telescope was removed to make room for another, leaving 12 telescopes. While this inventory seems clear, the development of interferometers makes these simple facts less clear.

**Development of interferometers began with the Very Long Baseline Array**

Development of interferometers on Mauna Kea began with the construction of the Very Long Baseline Array (VLBA) antenna. In 1988, Hawaii was chosen as a site for this antenna. Mauna Kea's VLBA antenna is one of ten antennas in an array that spans over half the world, ranging from the Virgin Islands in the east to Hawaii in the west.

In order to build this antenna, a supplemental EIS was developed and amendments to the master plan were made. A supplemental EIS was needed because federal funding was involved. The Very Long Baseline Array antenna is technically not a complete (self-contained) instrument and was built outside the area considered for development under the master plan. The university recognized that the size, nature, and proposed location of the instrument made it necessary to amend the master plan.

The Very Long Baseline Array antenna was completed in 1992. At approximately 95 feet high, it is equivalent to an eight to nine story building. The antenna has a dish that is 82 feet in diameter. The control building is a single story 1,350 square foot facility. While the university is technically correct in not recognizing the Very Long Baseline Array as a telescope, its size makes it comparable to other telescopes on Mauna Kea.

### **Submillimeter Array antennas counted as a single telescope**

In 1995, the university began constructing the Smithsonian Submillimeter Array (referred to as the Submillimeter Array or SMA). The university submitted a Conservation District Use Application for the project and no objections were raised. The project called for the building of 24 antenna pads and a control facility. Six to eight removable antennas, 20 feet in diameter, will be positioned in various configurations on the pads. These antennas will move by a specially designed carrier.

As mentioned earlier, the original master plan did not call for the development of interferometers such as the Very Long Baseline Array and the Submillimeter Array. But unlike the Very Long Baseline Array, the entire Submillimeter Array instrument is located wholly on the summit, therefore, it is a complete “telescope” and counted under the current limit. However, the footprint of this “telescope” is much different from that of previous telescopes. The facilities for the instrument include a two-story 4,000 square foot control building and a 2,500 square foot maintenance building. In addition, 24 antenna pads — 10 feet each in diameter, will be scattered over an area approximately a quarter mile wide and just under one-third of a mile long. The antennas, once in place, will be about 30 feet high — about the height of a three story building. The Submillimeter Array will have 6 to 8 of these antennas or an equivalent of 6 to 8 three story buildings. In addition, the university is looking at adding up to 16 more antennas in the next iteration of development. The numerous pads and large antennae are cause for greater scrutiny.

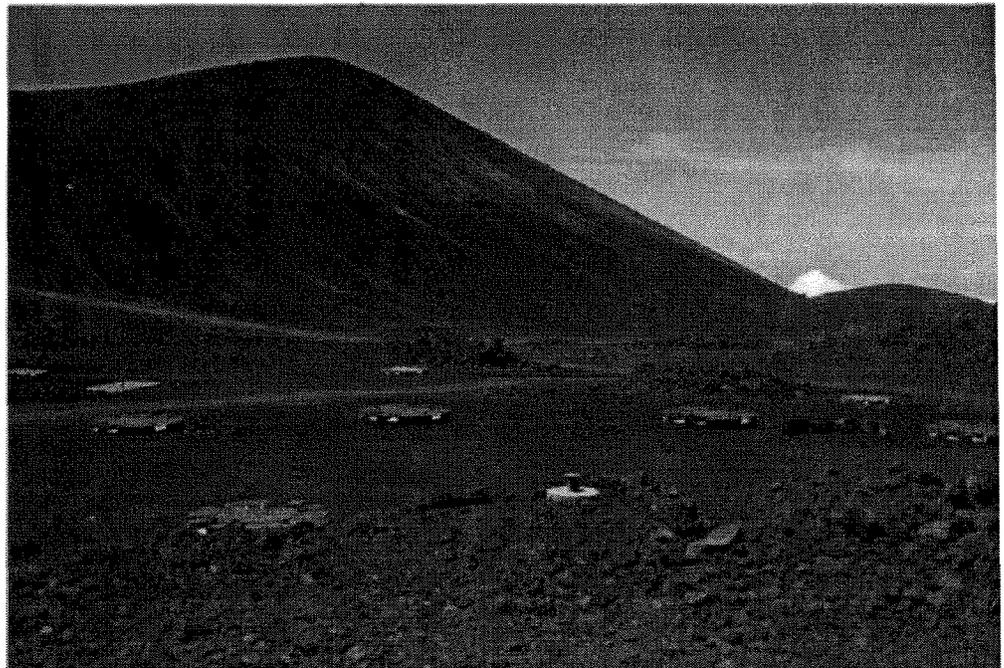
Public knowledge about this type of instrument was limited or non-existent at that time. Once the Submillimeter Array project began, community groups such as Sierra Club and Ka Lahui learned of the project and began raising questions as to the actual number of telescopes on the summit. They argued that each antenna is a receiving instrument and therefore constitutes a “telescope.” The university, however, defines a telescope as not needing to be located in a single facility or limited to a single receiving component — much like a stereo that has eight speakers is still not eight stereos. The university, however, recognizes that there can be a significant difference in size between a single antenna telescope and an interferometer.

### ***Further development of interferometers is likely***

The growing interest in interferometers means that continued development of interferometers is likely. The university needs to develop a new method of measuring the impact of these types of facilities on Mauna Kea’s reserve area. For example, interferometer projects other than the Submillimeter Array (SMA), have or are being



Very Long Baseline Array antenna stands approximately 95 feet high.



Submillimeter Array antenna pads--10 feet each in diameter, scattered over an area of about a quarter mile wide.

considered. Millimeter telescopes can be divided into two types of instruments: those that can measure submillimeter wave, and those that measure millimeter wave. The Submillimeter Array measures only the submillimeter wave. In 1995, an organization expressed interest in Mauna Kea as a possible site for building a 40 antenna millimeter array. The university stated that it is not likely that the organization proposing this particular project will select Hawaii, but another millimeter project is still possible.

Another type of telescope is the optic/infrared telescope. This type of telescope measures waves in the visible and infrared (IR) regions. The W. M. Keck Group is currently working on developing an interferometer that collects waves in these regions. A preliminary proposal calls for building “outriggers” to the existing Keck telescopes. These outriggers are described as 1.5 - 2.0 -meter class telescopes which is only slightly smaller than the largest University of Hawaii telescope. The Keck outrigger project calls for the building of five of these telescopes.

***Method developed should address new direction of telescope development and their attending impact***

Initial documents for the university’s master plan for the year 2000 and beyond indicate that the university plans to pursue the Keck project. The university will be requesting modifications to existing telescopes, increasing the number of antennas currently used by the SMA, developing another interferometer, and building a high altitude lab facility as potential projects within the 20 year period — years 2000 to 2020. The current method of limiting development by number of telescopes is insufficient to address the impact that these proposed projects will have on Mauna Kea.

For example, the high altitude laboratory being considered is not, by definition, a telescope. Yet it will have an impact on the area. Community groups and the public are concerned with the overall development of the summit, be it telescopes or other auxiliary facilities. Yet this laboratory facility, and others not defined as telescopes, could be built and not be “counted” within the development ceiling. The master plan should reflect all types of construction requirements that will impact Mauna Kea. The university should revise its method of controlling development from merely counting telescopes to one that is able to measure the impact of all of astronomy’s needs and the attending impacts of construction.

For example, another development loophole is the combination of existing facilities. The Keck project is currently working to combine the signals of the two Keck telescopes. The Department of Land and Natural Resources accepts the Submillimeter Array as only one telescope since it has only one control room. The university can theoretically combine the two Keck telescopes by removing one of the control rooms.

The replacement of existing facilities with new facilities is also of concern. Under the current method, existing facilities can be replaced with new, larger facilities. This includes replacing a current single dish/mirror facility with an interferometer and its auxiliary antennae if necessary. Theoretically, all 13 facilities on Mauna Kea could be replaced with interferometers of varying sizes. The impact of interferometers will be much more significant than the impact of the current facilities because of the inherent larger land area needed for interferometers.

The master plan needs to clearly define modification/renovation work. For example, a major modification or upgrade of existing facilities could become the construction of a new telescope. Establishing a clear definition of modification will help alleviate future misinterpretations or construction loopholes.

The master plan should incorporate a new way to measure and control development on the summit. In developing the new master plan, the university should solicit input from community groups and seek approval from the Board of Land and Natural Resources. The university's method should apply to all forms of university development, and not be limited to the Science Reserve and certain types of facilities (telescopes). Modification should be clearly defined. Impact on the natural resources and historic sites should be addressed. For example, construction within a critical Weiku habitat area or an area with a high number of historic sites should be classified and treated differently from other areas of no known endangerment. The university should identify in its master plan the total carrying capacity of the mountain, the space available, the types of facilities to be built, and presence or absence of natural flora and fauna and historic and culturally significant sites.

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## **The Department of Land and Natural Resources Should Improve Its Protection of Mauna Kea's Natural Resources**

***The Conservation District permitting process can be stronger***

The Department of Land and Natural Resources needs to improve its efforts at protecting Mauna Kea's natural resources. As a Conservation District, Mauna Kea has special protection through the department's permitting and other administrative processes. The permitting process allows both the department and the Board of Land and Natural Resources to review proposed land use for compliance with conservation zoning and subzoning requirements. However, failure to sufficiently enforce requirements and lack of action has resulted in the inadequate protection of state resources.

The Conservation District permitting process should be strengthened. It is the primary method that the department and board use to control use and development of lands under its jurisdiction. However, the permit

conditions placed on the university are often broad, general, and difficult to enforce. These permit conditions should be more specific to address concerns and should be related to individual projects.

### **Specific permit conditions for mitigating measures are lacking**

Specific permit conditions relating to the Environmental Impact Statement (EIS) should be developed and included. The Environmental Impact Statement discloses potential impacts to the environment from the proposed development. The Environmental Impact Statement includes mitigating measures that are designed to minimize the impact of development. However, the department does not require implementation or enforcement of these mitigating measures.

In a 1991 audit, *Review of Regulation of Residential Construction in the Conservation District*, Report No. 91-1, we found the department accepting inadequate environmental assessments. The Office of Environmental Quality Control, in its 1996 internal audit, found that mitigating measures not listed as permit conditions are usually not implemented. It recommended that permitting agencies rewrite mitigating measures for implementation, monitoring, and enforcement. The department's current practice is to simply state that "all mitigative measures proposed in the EIS that included descriptions of this project shall be incorporated as conditions of approval." This practice is insufficient and has no force or effect.

### **Permit conditions do not ensure implementation of management plans**

Permit conditions do not require the implementation of the management plan and subsequent amendments. The Department of Land and Natural Resources required that the university develop a management plan to outline its intent in managing various aspects of the leased land. However, the department failed to develop controls to ensure implementation. Specific timeframes were not established. The university was allowed to continue development without completing prior tasks outlined in management plans. The department, as the state land manager, was remiss and overly liberal in its landlord relations with its tenant, the university.

### **Permit conditions, requirements, and regulations are not always enforced**

In addition to the weakness of the permit conditions, the department does not enforce these conditions. We found numerous cases of unenforced permits and regulations due to the department's laissez-faire attitude.

Between 1967 and 1970, the first three telescopes were built by the National Aeronautics and Space Administration, the Air Force, and the university. However, the university failed to submit a Conservation District Use Application for these three telescopes. Not until 1976 or almost six years later did the university notice this error and submit the required Conservation District Use Application. The department took no punitive action. Again in 1976, the department found that one of the contractors had violated the land use regulation by erecting an unauthorized structure on the summit. The Board of Land and Natural Resources accepted the staff recommendation of fining the contractor about \$85,500. However, when we asked about the situation, the department stated that it appears this fine was never collected.

In December 1982, the department approved the Conservation District Use Application for the Caltech telescope. One of the permit conditions was that “no further commitment of land use involving major improvements within the Mauna Kea Science Reserve be considered until such time as the University’s Mauna Kea Science Reserve Development Plan is completed.” Little more than two months later, the department’s board approved the United Kingdom/Netherlands telescope despite staff recommendations to deny the permit because the reserve development plan was incomplete and such was a permit condition in the Caltech permit. The reserve development plan was later but preliminarily adopted in 1984, and finally adopted in 1985.

In 1995, problems involving trash on the summit area were brought to the attention of the department. Again, the department took no punitive action. In 1996, the department discovered that critical habitat of the Weiku bug had been destroyed by the university. The department shared fault and agreed to allow the university to continue development in exchange for commissioning an arthropod study.

In 1997, the university requested retroactive approval for four subleases. The department simply looked at this as “house-cleaning.” Other examples of university plans submitted late or not at all testify to the department’s less than active oversight of its conservation district tenant.

***Administrative requirements are overlooked or incomplete***

The department has failed to complete administrative requirements in a timely manner. The administrative duties that are linked to the management of Mauna Kea require timely completion for both the university and the department to adequately manage Mauna Kea. Failure to establish adequate controls, staff shortages, and other administrative problems have resulted in a number of these requirements being overlooked or not completed in a timely manner.

### **Historic Preservation Program has no administrative rules**

In 1976, the Legislature passed Act 104, requiring the department to establish a historic preservation program. The act required the department to employ sufficient professional and technical staff to carry out the act and to promulgate rules to support the program. However, department officials stated that staff shortage was a major problem in the earlier years. This shortage meant that certain priorities took precedence over drafting rules and staff time was allocated accordingly. The department was finally able to develop draft rules in 1987, but these rules have yet to be adopted.

### **Leases and other land management issues not completed in a timely manner**

Some land management issues also were not dealt with in a timely manner. In 1986, the Board of Land and Natural Resources approved the removal of the Science Reserve from the Mauna Kea Forest Reserve. However, the governor did not sign the actual withdrawal approval until August 1997. This long delay affected the university's ability to complete implementation of rules it drafted in 1985.

A similar situation exists for the protracted approval of the Hale Pohaku lease — the site being built outside the Science Reserve area. The university was granted a right-of-entry and permit to build the mid-level facility outside the reserve. In February 1986, the board approved a 55 year lease for the Hale Pohaku area. However, the lease was never issued. Mid-1997 documents indicate that the department is beginning to address these issues.

### ***The department has begun administrative improvements***

The department is making efforts at improving its operations and controls of land management processes. The department is developing operation manuals that describe procedures. In order to ensure that these manuals address the problems noted above, we recommend that manuals include reasonable time frames and deadlines for administrative review and approval. These deadlines will provide motivation to complete lease documents and serve to identify weak areas that slow the process. The department can target those weaknesses for improvement.

---

## **Conclusion**

Over thirty years have passed since construction of the first telescope on Mauna Kea. During this period, little was done to protect its natural resources. The university, as the leaseholder, should have provided sufficient protection to the natural resources and controlled public access and use. These requirements have not been adequately met. The

Department of Land and Natural Resources, in its role as landlord, should have overseen the university's activities and enforced permit conditions and regulations in protecting the State's interests. Neither state agency has been proactive in maintaining the conservation district.

---

## Recommendations

In order to improve the current management of Mauna Kea and the Mauna Kea Science Reserve, we recommend the following:

1. The University of Hawaii should ensure that the Institute for Astronomy carries out the following responsibilities in a timely manner:
  - a. Begin the master planning process for the next iteration immediately. In doing so, the Institute for Astronomy should specifically:
    - 1) include the Department of Land and Natural Resources in the early planning process;
    - 2) solicit public input early in the process;
    - 3) develop milestones, specific timeframes to complete and implement the plan, and other controls to ensure that the plan is implemented; and
    - 4) ensure that the plan addresses cultural and historic issues.
  - b. Ensure that the new master plan and environmental impact statement specifically identify on maps:
    - 1) areas suitable for types of astronomical developments;
    - 2) critical habitats of plants, invertebrates, and other rare or endangered species; and
    - 3) areas where no development should be planned (no-build zones).
  - c. Establish controls, including, but not limited to:
    - 1) development and implementation of rules and regulations for development and public access in the summit and Hale Pohaku area;

- 2) hiring of ranger/guides to staff the Hale Pohaku Visitor Information Station on a daily basis;
  - 3) at a minimum, registering of public visitors to receive education and safety information; and
  - 4) periodic inspections and documenting of inspections to control trash.
- d. Remove remnants of old equipment or seek Board of Land and Natural Resources' approval to abandon remains.
  - e. Develop a forum for continuous community input.
2. As a part of the new master plan, the Institute for Astronomy should develop a new method of measuring the impact of future development on Mauna Kea and present this method to the Board of Land and Natural Resources for approval. The new method should assess the impact of each project, as well as the impact of total development. The university should use this methodology to state a specific carrying capacity. It should also address facilities other than telescopes and areas not necessarily in the Science Reserve. The method used should include methodology that distinguishes and gauges the impact on land area, biota/fauna, and sites of historic/cultural significance.
  3. The Department of Land and Natural Resources should:
    - a. Review and rewrite applicable Environmental Impact Statement mitigating measures as specific Conservation District Use Permit conditions. These measures should be enforceable.
    - b. Include conditions that require implementation of management plans. Projected implementation timeframes should be included.
    - c. Establish controls to ensure that future administrative requirements are met in a timely manner. This would include, but not be limited to:
      - 1) Permit conditions requiring that subleases be approved before beginning construction.
      - 2) Specific internal deadlines to ensure that leases and land withdrawals are handled before and not after the fact.

- d. Clarify and ensure that the responsibility for monitoring violations and enforcing rules not related to the Department of Land and Natural Resources rests with the university.
- e. Complete the Historic Preservation plan and ensure implementation.
- f. Adopt rules for Chapter 6E, Historic Preservation Program.

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## Responses of the Affected Agencies

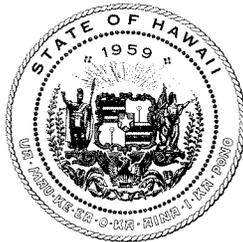
### Comments on Agency Responses

We transmitted drafts of this report to the University of Hawaii and the Department of Land and Natural Resources on January 15, 1998. A copy of the transmittal letter to the university is included as Attachment 1. A similar letter was sent to the Department of Land and Natural Resources. The responses from the university and the department are included as Attachment 2 and 3, respectively.

The University of Hawaii and the Department of Land and Natural Resources generally agreed with our findings. Both agencies provided additional information regarding the areas of concerns addressed in the report. The university noted that complex jurisdictional issues also played a role in problems that plagued the management of Mauna Kea. The university agreed with our recommendations and cited several corrective steps taken or planned. The Department of Land and Natural Resources provided additional information regarding historic and cultural preservation. However, it did not specifically comment on our recommendations. Some of the additional information provided by the University of Hawaii and the Department of Land and Natural Resources were incorporated in the final report.

ATTACHMENT 1

STATE OF HAWAII  
OFFICE OF THE AUDITOR  
465 S. King Street, Room 500  
Honolulu, Hawaii 96813-2917



MARION M. HIGA  
State Auditor  
(808) 587-0800  
FAX: (808) 587-0830

January 15, 1998

*COPY*

The Honorable Kenneth P. Mortimer  
President and Chancellor  
University of Hawaii  
2444 Dole Street  
Honolulu, Hawaii 96822

Dear Dr. Mortimer:

Enclosed for your information are three copies, numbered 6 to 8 of our draft report, *Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve*. We ask that you telephone us by Tuesday, January 20, 1998, on whether or not you intend to comment on our recommendations. If you wish your comments to be included in the report, please submit them no later than Monday, January 26, 1998.

The Department of Land and Natural Resources, Governor, and presiding officers of the two houses of the Legislature have also been provided copies of this draft report.

Since this report is not in final form and changes may be made to it, access to the report should be restricted to those assisting you in preparing your response. Public release of the report will be made solely by our office and only after the report is published in its final form.

Sincerely,

Marion M. Higa  
State Auditor

Enclosures




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**UNIVERSITY OF HAWAII**

PRESIDENT, UNIVERSITY OF HAWAII  
AND CHANCELLOR, UNIVERSITY OF HAWAII AT MĀNOA

January 26, 1998

Ms. Marion Higa  
State Auditor  
Office of the Auditor  
465 S. King Street, Room 500  
Honolulu, HI 96813-2917

RECEIVED  
Jan 26 4 25 PM '98  
OFF. OF THE AUDITOR  
STATE OF HAWAII

Dear Ms. Higa:

Thank you for the opportunity to review your draft report *Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve*. We appreciate the thoroughness of your review and the work and effort of your staff in preparing the report. Enclosed please find a brief response addressing the recommendations presented in the draft report and clarification of a few points mentioned in the report itself.

Please do not hesitate to contact me personally or Alan H. Teramura, Interim Senior Vice President for Research and Interim Dean of the Graduate Division, if you have any further questions or concerns.

Sincerely,

Kenneth P. Mortimer  
President, University of Hawai'i and  
Chancellor, University of Hawai'i at Mānoa

Enclosure

c: Senior Vice President Alan H. Teramura

**AUDIT OF THE  
MANAGEMENT OF MAUNA KEA  
AND THE MAUNA KEA SCIENCE RESERVE**

Response by the University of Hawai'i  
January 26, 1998

**The Role of the University**

Over the past 30 years, under the leadership of the University of Hawai'i , the Mauna Kea Observatories have grown into the world's largest astronomical observatory complex. This remarkable development is one example of the State's policy to promote clean, high-tech enterprises, particularly on the neighbor islands. Telescope construction on Mauna Kea has helped the Big Island economy through lean times, and telescope operations are becoming a major factor in Big Island employment. Over and above the basic economics, astronomy provides Hawai'i 's people the opportunity to pursue rewarding careers in science and technology without leaving the State.

From the outset, the State adopted the policy that if world-class astronomy were to come to Hawai'i, then the people of Hawai'i, through their University, would be full participants in the scientific endeavor and not simply bystanders and landlords. This basic philosophy led to the creation of the Institute for Astronomy and to the creation of the Mauna Kea Science Reserve. The non-UH telescopes on Mauna Kea do not pay land rent. Rather they give the University a guaranteed share of the observing time. As a result of this guaranteed access, the Institute for Astronomy has developed into one of the world's pre-eminent centers for astronomical research, with the ability to attract the best faculty and best students from around the world. At the same time, the growing quality of the Institute and its enthusiasm for Mauna Kea were major factors in attracting the world's premier new telescopes to Hawai'i . The Canada-France-Hawai'i Telescope would have gone to either Mexico or the Canary Islands if the Institute's founding director had not convinced Canadian and French astronomers that Mauna Kea, although far from Toronto or Paris, was clearly superior to closer sites. Similarly, the United Kingdom Infrared Telescope and the James Clerk Maxwell Telescope would have been built in the Canaries without the strong encouragement that British scientists received from their Institute colleagues. More recently, both the U.S. national 8-meter telescope (ultimately Gemini) and the Submillimeter Array had plans to locate in Arizona until strong and scientifically persuasive intervention by the Institute's second director won the day for Hawai'i . It is this symbiotic relationship between the unique qualities of the Mauna Kea site and the scientific excellence of the Institute for Astronomy which has produced the remarkable astronomy development on Mauna Kea. Without such a relationship, the development initiative started by Big Island residents in the early 1960's might well have failed, and even if it had proceeded, it would have been controlled by out-of-State interests.

## Protection of Natural Resources

The report's principal finding concerning the University is that its management of the Mauna Kea Science Reserve is inadequate to ensure that natural resources are protected. In support of this finding, the report cites three specific occurrences of environmental problems: disturbance of an historic site (lithic scatter) at Hale Pohaku; unnecessary disturbance of wekiu habitat at the Subaru site; and trash. Related to this finding, the report faults the University for lax controls on public access. We address each of these issues in turn.

### **Historic Sites.**

An archeological survey of the summit area down to the 13,000-foot contour was conducted in 1982 by the Bishop Museum as part of the Mauna Kea Science Reserve Complex Development Plan EIS. Twenty-two sites (mostly rock shrines) were recorded. Subsequent surveys have added about two dozen additional sites at lower elevations. Almost all of these sites are far away from any area of activity. In addition to the broad-area surveys, intensive local surveys were done for all locations in which telescope development was to take place. In the few cases where there are shrines in the vicinity of a telescope project, adequate protection was provided. An example is the Submillimeter Array, where a temporary fence was erected to protect two small shrines which were within ~500 feet of one of the pads. *No historic site in the summit area has ever been damaged or threatened by telescope development.* To protect sites from pilferage and vandalism, the University has maintained a policy of not listing or drawing attention to them. These measures, taken by the University to protect historic sites within the Science Reserve, have been remarkably successful. The recent field work for the Historic Preservation Management Plan has confirmed that none of ~50 sites known has been disturbed.

The only damage to an historic site has occurred at Hale Pohaku, outside the Science Reserve, where construction of an electrical substation and erosion has disturbed several lithic scatters. The lithic scatters were discovered in 1984-85 as part of the EIS work for a new construction camp; an earlier survey of the Hale Pohaku area in 1979 had found no archeological remains. Also, a survey of the overhead transmission line corridor, which ends at the substation, in early 1986 had found no remains. Unfortunately, the substation work did begin before a thorough enough archeological survey had been completed. The University did attempt to minimize the damage by commissioning a "data recovery" project at the site. In 1992, the State Historic Preservation Division (HPD) formally accepted the report on this project, describing it in their acceptance letter as "one of the best that we have received over the last several years." Data recovery was also accomplished at the eroded scatter site and drainage improvements were added to limit the erosion.

The University is working closely with HPD staff to complete the Historic Preservation Management Plan. The field work is essentially complete. Accurate locations for each of

the known sites in the Science Reserve have been recorded on a new topographic map, using GPS and aerial photography techniques. The Historic Preservation Plan will be a key component of our new master plan.

### **Disturbance of Wekiu Habitat.**

The Puu Hau Oki cinder cone was identified in the Complex Development Plan (CDP) as one of the prime sites for telescope construction; both the CDP and the EIS indicated that some loss of habitat for the wekiu arthropod would result. The Conservation District Use Application (CDUA) for the Subaru Telescope clearly showed that some of the construction would occur on the inside of the crater. In the CDUA it was stated that excess fill would be distributed more or less uniformly at various places around the site; including on the inside surfaces of the crater. Later, however, it was decided that it would be better mitigation to concentrate the fill in the center of the crater, so as to minimize the surface area disturbed. As a result, the grading plan approved by DLNR differed somewhat from the preliminary site plan in the CDUA. The actual grading was in accordance with the approved plan. From this experience, the University has learned that the details of cut, fill and grading must be addressed at the CDUA stage and not left to the plan submittal stage. Nonetheless, in the case of Subaru, even if all of the excess material had been trucked away, the reduction in disturbed area would have been only about 20 percent.

Furthermore, it should be kept in mind that relatively little is known about the wekiu at the present time. We do not know how widespread it is on Mauna Kea, nor do we know for certain what impact site disturbance, such as that at Subaru, has on the local population. These questions are being addressed in the new arthropod study now underway. This study will provide important data for the new master plan.

### **Trash.**

Windblown trash from construction and from the general public has been a problem in the past, but is now under control. Construction projects are required to control trash on site and to immediately collect any which does escape. The projects are inspected regularly to ensure compliance. Organized sweeps of the summit area to collect accumulated trash, including that left by the general public, are made several times each year.

### **Public Access Controls and Enforcement.**

The draft report also faults the University for not doing enough to control access and public use. This is a sensitive issue, especially with Big Island residents. Over the years, we have learned that there is a very wide range of opinion on what level of control is appropriate or even acceptable. Partly because of this fact, and partly because of funding and jurisdictional problems (see below), the University has concentrated on educating visitors rather than regulating them. The focus of this activity is the Visitor Information

Station at Hale Pohaku, which is currently open Friday through Tuesday with two guides present on Saturdays and Sundays. We anticipate adding new personnel in the near future which will allow us to open seven days per week, ensuring added public visitor safety, increased trash control, and help with preserving Native Hawaiian sites. At the station, visitors learn how to have a Mauna Kea visit which is both safe for them and friendly to the environment. They also learn about the unique geological and biological features of the mountain and about the world's largest astronomy complex at its summit. Guided tours of the summit, including a visit to one of the observatories, are held every Saturday and Sunday afternoon. The most popular Visitor Station program is the evening stargazing on Thursday through Sunday evenings, which now attracts over 1,000 participants per month. All Visitor Station programs are free of charge. A sign directs all visitors to check in at the station prior to proceeding further up the mountain. Even when there is no one there to greet them, basic safety advice is available on a large sign. Additional signage all along the access road warns visitors about driving hazards, directs them not to drive off-road, and not to disturb the landscape.

In its discussion of control and enforcement, the audit report makes no mention of the complex jurisdictional issues which come into play. For example, in the lease to the University for the Science Reserve, the State reserves to itself "all hunting and recreation rights". Thus it would appear that the lease does not give the University either the authority or the responsibility to regulate these activities--rather this resides with DLNR. Nonetheless, the University of Hawai'i recognizes that it has the principal responsibility as the lessee of the Science Reserve to supervise future astronomy development, to properly monitor the cultural and historical Native Hawaiian sites, and to provide for appropriate visitor safety. The Ice Age Natural Area Reserve (NAR), which is adjacent to the Science Reserve, presents additional jurisdictional problems. Some of the most sensitive environmental features on the mountain are located within the NAR, including the adze quarry and Lake Waiau. Presently, the University has no jurisdiction to regulate activities in the NAR. Commercial activities are another example. The majority of opinion is that commercial operations within the Science Reserve should be managed by DLNR, not by the University. The problems with defining jurisdiction and allocating responsibility between DLNR and UH were the principal reasons that the management plans and commercial plan took so long to finalize. The 1995 revision to the management plan was a joint effort by DLNR and UH to address these problems. It attempted to resolve the enforcement issue by assigning to DLNR enforcement responsibility for public and commercial activities. The plan was reviewed by the various DLNR divisions, in particular DOCARE, who stated that they would respond to problems on Mauna Kea on an "as needed" basis. After hearing the arguments in favor of the revised management plan as presented by DLNR and UH, as well as the objections raised by the Sierra Club and Ka Lahui Hawai'i, the Land Board approved the revision in March 1995. It should be pointed out that the revised plan specifically allows cultural activities. Special permission is required only for night activities.

## Impact of New Technology on Development

The report's second finding concerning the University is that the advent of interferometers requires changes in the way that astronomy development in the Science Reserve is managed. This finding results from concerns expressed about two projects in particular: the Very Long Baseline Array Antenna (VLBA) and the Submillimeter Array.

The VLBA was not anticipated in the 1983 Mauna Kea Science Reserve Complex Development Plan. In particular, its location on the south flank at an elevation of 12,300 feet was not within the areas designated for telescope development in that plan. As mentioned in the audit report, the plan was amended in 1989 by the UH Board of Regents to add this new siting area and the antenna facility. At the same time, a supplemental EIS was completed, not because federal funds were involved as stated in the report, but because the VLBA siting area had not been assessed in the 1983 EIS. The VLBA went through the full public approval process including a Conservation District Use Permit.

As stated in the report, the Submillimeter Array is the first complete interferometer facility to be located in the Science Reserve. The CDP had anticipated a major millimeter-wave radio facility during the 1990's, but this was expected to be a single antenna in the 25-meter size range. In contrast, the SMA is an array of eight much smaller moveable antennae which can be located on any combination of 24 antenna pads, each only 10 feet in diameter. The University recognizes that Exhibit 1.2 is intended to be schematic and the telescope facilities are not drawn to scale. Nevertheless, the University would like to point out that the SMA pads are depicted as much larger than they actually are. In developing the permit application for the SMA, the University carefully assessed whether the environmental impact of this project would significantly differ from that disclosed in the EIS. While it is true that the SMA is a single telescope facility in the technical sense, this fact was *not* a key factor in assessing impact. The key determinants were: the fact that the SMA was to be located entirely within one of the telescope siting areas identified in the CDP; the fact that the impact on flora, fauna and historic sites was minimal and completely disclosed in the EIS; and the fact that, although there were eight antennae, there was only one control building, one septic tank, one utility connection, one operating organization, etc. At the end of this analysis, the University concluded that the *overall* impact was not significantly different from what had been already disclosed in the EIS, a conclusion which was officially confirmed by the State Office of Environmental Quality Control.

The audit report concludes that the scope and impact of astronomy development on Mauna Kea cannot be properly measured by simply counting telescope facilities. We certainly agree with this and want to point out that this has been the University's philosophy from the beginning. The overall scope of development and its impact are the key issues, not the precise number of telescope facilities.

## The Recommendations

### **Recommendation 1a.**

The University accepts these recommendations and will begin immediately the master planning process for the next iteration of development. The Historic Preservation Management Plan will be a key component of the new master plan. DLNR will be included early in the process, and public input will be sought from the outset. The Senior Vice President for Research, the Chancellor of UH Hilo, and the Director of the Hawaiian Language College at UH Hilo, in consultation with the DLNR, shall establish the Mauna Kea Advisory Committee during the next few months to identify and coordinate matters of concern to the people of the State of Hawai'i relevant to current and future activities within the Mauna Kea Science Reserve and to propose short- and long-term solutions to problems which may be identified. Cultural issues will be addressed through consultation with Native Hawaiian groups via the Advisory Committee. The time frame for completing the plan will be specified, but the time frame for implementing the *astronomy* portion of the plan will have to remain somewhat uncertain. This is because the pace of development is likely to be driven largely by outside forces, such as the availability of funding from government agencies.

### **Recommendation 1b.**

The University accepts these recommendations. As with the 1983 Complex Development Plan, the new master plan will identify areas suitable for astronomy development, habitat areas for the various flora and fauna, and areas where no development will take place. The new arthropod survey, currently underway, will provide key information for this portion of the plan.

### **Recommendation 1c.**

The University will continue to work with DLNR on the contentious issues of control and regulation, trying to strike the best possible balance between open access, safety, and environmental protection. We will seek broad community input with the assistance of the Mauna Kea Advisory Committee to guide us in this area. Our highest immediate priority will be to expand the Visitor Station operation to seven days per week, and to provide staff to patrol the Science Reserve to ensure public visitor safety, to control trash, and to help preserve Native Hawaiian historical sites.

### **Recommendation 1d.**

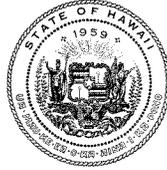
The University accepts this recommendation. We will either remove old equipment or request approval to abandon it in place.

**Recommendation 1e.**

The University accepts this recommendation. One of the roles of the Mauna Kea Advisory Committee will be to provide a forum for continuous community input.

**Recommendation 2.**

The University accepts this recommendation and agrees that simply counting the number of telescope facilities is not a good way to measure the overall scope of development and will be working with the consultants on the new master plan to better estimate the impacts of future development on Mauna Kea.



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES

P.O. BOX 621  
HONOLULU, HAWAII 96809

Ref.PB:SL

AQUACULTURE DEVELOPMENT  
PROGRAM  
AQUATIC RESOURCES  
BOATING AND OCEAN RECREATION  
CONSERVATION AND  
ENVIRONMENTAL AFFAIRS  
CONSERVATION AND  
RESOURCES ENFORCEMENT  
CONVEYANCES  
FORESTRY AND WILDLIFE  
HISTORIC PRESERVATION  
LAND MANAGEMENT  
STATE PARKS  
WATER AND LAND DEVELOPMENT  
WATER RESOURCE MANAGEMENT

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Jan 26 3 21 PM '98

OFF. OF THE AUDITOR  
STATE OF HAWAII

MEMORANDUM:

TO: The Honorable Marion Higa, State Auditor  
Office of the Legislative Auditor

FROM: *for* Michael D. Wilson, Chairperson *Michael D. Wilson*  
Department of Land and Natural Resources

SUBJECT: DLNR's Response to the Audit of the Management of Mauna  
Kea and the Mauna Kea Science Reserve (draft)

We have reviewed the report titled, "Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve" and have the following comments.

We agree with the auditor's finding that the Department of Land and Natural Resources' (DLNR) needs to improve efforts to protect and conserve Mauna Kea's natural resources. In this regard, DLNR will continue to make every effort to protect and conserve these resources for present and future generations. However, we feel that the audit should recognize and highlight the breadth and depth of DLNR's resource management responsibilities coupled with our comparatively low level of program funding. We are surprised that the report does not include a funding item to bolster DLNR's management capabilities. Although DLNR will do its best in the future to manage and regulate land use on Mauna Kea with the resources it has available, it appears that UHfIA must assume a significant degree of resource management responsibility to see significant improvements over the past.

In this regard, DLNR is encouraged by the auditors' findings suggesting that the University of Hawaii, Institute for Astronomy (UHfIA) must do more to protect natural resources on Mauna Kea by actively managing public access and use through the creation of ranger positions and enforceable regulations. In addition, DLNR strongly supports the recommendations regarding future planning by the University and has repeatedly requested that UHfIA work with DLNR during the initial planning phases.

Marion Higa  
State Auditor  
January 22, 1998  
Page 2

In hindsight, what has occurred on Mauna Kea until now has been the fulfillment of prior administrations' policies, decisions and values regarding the use of Mauna Kea and its environs. However, DLNR believes that future management and regulation of Mauna Kea requires a shift in perspective and priorities. The University must assume a greater role in natural resource stewardship since they are the primary users, to better balance summit development with natural resource protection. DLNR will always be there to provide the necessary oversight. The astronomy community has been the biggest beneficiary of Mauna Kea's unique natural resources, so it is logical for astronomy to be Mauna Kea's greatest benefactor by investing more in resource management and conservation. Perhaps this is the real value of the audit.

Clearly, the logic behind DLNR's prior efforts to exert more control over public access and use of Mauna Kea, as evidenced by the 1995 Revised Management Plan for UH Management Areas, needs to be reevaluated in light of the State's current economic problems as well as the opportunities provided by the astronomy industry. A fresh perspective calls for UHfIA and its tenants to provide the necessary funding to deal with issues of public access and use of the mountain, with continued oversight from the DLNR and its respective divisions. Funds are also needed to provide for more detailed resource studies and analysis of acceptable levels of change.

Other:

Page 15, para. 1 (Department failed).

Care should be taken when making general statements such as "The University and the Department failed to develop and implement adequate controls to balance the environmental concerns with astronomy development". Failure is a very strong word which suggests a total lack of plans and controls. Being late with plans, operating under draft rules and plans and failing to meet some management responsibilities does not equate to total failure. It can be shown that DLNR has, in fact, put substantial effort behind the protection of Mauna Kea's natural resources, even with our limited staff and funds. The fact that it took ten years to have an approved Commercial Activities Plan does not mean that this led to resource degradation. In the meantime, DLNR had regulated commercial operators through the issuance of CDUAs. Our ability to ensure compliance with permit conditions and to generally monitor activities on the mountain, is clearly a function of staffing, but this is down played in the report.

Marion Higa  
State Auditor  
January 22, 1998  
Page 3

Furthermore, whether this resulted in an imbalance between resource protection and development is a matter of opinion that is subject to a separate and distinct evaluation which is beyond the scope of this audit.

Page 21, para. 3 (Historic Preservation Neglected).

We would agree that historic preservation concerns were neglected up until about 1985-1987. Yet, since then, each development has been carefully reviewed for historic preservation concerns and the development of an overall management plan has been worked on. You might consider altering your title to state something like, "Historic Preservation concerns were not adequately handled prior to 1985-1987".

This paragraph also says that the complex development master plan "does not address preservation", but the following sentences describe several measures (not calling attention to sites, warning and citing individuals who damage sites) which are preservation measures. This sentence should be rewritten to say measures did exist but are not adequate.

Also, in reference to the last sentence, we would like to note that intensive archaeological surveys (now called inventories) have been done since 1985-1987.

Page 22, para. 3 (The historic preservation plan is ten years late).

The information in sentence 2 is incorrect. The listing of historic sites on the State and National Registers of Historic Places does not convey control of development activities from the State to the Federal government, although this may have been a concern or misconception of UHfIA.

Page 22, para. 1 (Historic Sites were damaged).

The date of the report that was cited is 1991, not 1987. To be more precise, a lithic scatter refers to all of the remains of stone tool manufacturing that have been intentionally left or redeposited by natural means in a particular place.

Marion Higa  
State Auditor  
January 22, 1998  
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Page 22, para. 4 & 23, para. 1

The first sentence states that the University agreed to develop a historic preservation plan with the "encouragement of the department". We believed that our actual role is better portrayed by the phrase "at the insistence". The Historic Preservation Division was actively pursuing the need for the preservation plan before 1991 and the Subaru permits. It should be noted in the last sentence, that whatever the reason for the removal of the condition, the DLNR around this time, wrote the scope itself. Dr. McCoy (the expert on Mauna Kea's historic sites) wrote the plan.

Page 23, para. 2 (Cultural preservation is unrecognized).

Cultural preservation may not be the correct term to use. If you are referring to historic preservation laws, it is not a term that is used. Historic preservation is the term, and sites with cultural significance have long been identified and evaluated under this process. If you are referring to religious freedom or gathering rights, these are other matters. If this section refers to those matters, the title should be clarified with a noting of the specific items addressed to avoid confusion.

The cultural significance of the shrines on Mauna Kea (in the quarry and on the summit) has long been recognized. The archaeological community of the entire Pacific has known of them since the 1970s (the quarry) and the early 1980s (the summit), and our Division published a study on Hamakua in 1994 (with earlier pre-publication ms) which includes the sites, and which was distributed to the public.

A "cultural resource management" plan is not different than a "historic preservation plan". They are the same thing. What was being called a cultural resource management plan in 1983 is now called a historic preservation plan in the legal review process, and in the more recent correspondence. With this in mind, the historic preservation plan has been worked on and is in process (albeit late). The last sentence in paragraph 2 gives the impression that no work on such a plan has occurred, and that the plan was ignored. This is not true.

If there is a desire to discuss natural resources of concern to native Hawaiians (gathering resources) in this paragraph, then a distinction should be made between historic sites or properties which are subject to the historic preservation

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review process and those natural resources that are not historic sites but may be of concern to native Hawaiians. Such broadly distributed natural resources could, hypothetically, include stones that are not part of an archaeological site or plants. These kinds of resources are generally not included in historic preservation compliance documents but should be recognized, where appropriate, in other types of planning documents.

Page 22, para. 3

We are not aware that native Hawaiians wanting to practice their religion must go to UHfIA to access the land and submit a CDUA application. As we understand it, anyone can access these State lands anytime they want without permission. Many kinds of religious observance do not require any ground disturbance or alternation of historic sites and as far as we know, these are not regulated in any way. If such activities will alter the landscape or historic sites a CDUA or some form of regulation seems appropriate and is currently in place to handle these situations. This section should probably be revised to better reflect the complexity of the issues involve and we agree that these issues should be specifically addressed in the historic preservation plan and the Revised Mauna Kea Plan.

Page 24, para. 2 (Department erred).

It is stated that the "Department of Land and Natural Resources later erred in approving the application since the University failed to comply with the minimum destruction of habitat requirement as stated in the EIS." Actually, DLNR did not err in approving the application for the Subaru Telescope, but erred in approving a grading/fill plan that was submitted later in connection with the construction of the Subaru Telescope.

Page 34, para. 1 (Historic Preservation Program has no rules).

Chapter 6E-3, HRS might be mentioned in addition to Act 104 because an HRS citation is generally easier for the public to access than the act number.

Draft rules for the historic preservation review process; for minimal standards for survey, data recovery, monitoring, etc; and for minimal professional standards have been in place since 1987. These have been revised a number of times with

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the most recent draft being dated 1996. Thus, minimal standards have been in place for over a decade, with thousands of cases processed in writing. It is true that the rules are not yet adopted, but how has this affected work on Mauna Kea? Developments were stringently reviewed through the application of the decade old review process steps and minimal standards. If it is thought that the lack of rules have affected the protection of historic properties on the mountain, then this paragraph needs to be amplified.

Page 34, para. 5 (Conclusions)

The statement (in reference to Mauna Kea), that "little was done to protect its natural resources" is misleading. The Department and for that matter, UH have devoted substantial resources to the planning and regulation of development to ensure that natural resources are protected. We could certainly do a better job and it has been acknowledged that some mistakes have been made. We are continually striving to work better with the resource available to us.

Please feel free to contact me at 587-0400 or our Land Division staff at 587-0381, should you have any questions.

cc: Hawaii Board Member  
Hawaii Land Agent  
Historic Preservation Division  
UHfIA