STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
Honolulu, Hawaii

180-Day Exp. Date: April 5, 2010

February 25, 2011

Board of Land and
Natural Resources
State of Hawaii
Honolulu, Hawaii

REGARDING: **Conservation District Use Application HA-3568**
Thirty Meter Telescope

APPLICANT: University of Hawai`i at Hilo

AGENT: Dr. Donald Straney, Chancellor; 200 W. Kāwili Street, Hilo, HI 96720

LANDOWNER: State of Hawai`i; leased to the University of Hawai`i under General Lease S-4191, with management delegated to the Office of Mauna Kea Management (OMKM)

LOCATION: Mauna Kea Science Reserve, Ka`ohe Mauka, Hāmakua District, Hawai`i
Observatory: 13-N Site, "Area E," North Plateau, elevation
Access Way: Mauna Kea Loop Road to 13-N
Batch Plant Staging Area: Access Road, below Pu`u Wēkiu
HELCO Substation: near Hale Pōhaku, @ 7 miles down road

TMK: (3) 4-4-015:009

ARE OF PARCEL: approximately 11,288 acres (Mauna Kea Science Reserve)

AREA OF USE: **Observatory:** approximately 4.9 acres
Access Way: approximately 3.6 acres / 3400 linear feet
Batch Plant Staging Area: approximately 4 acres; temporary
HELCO Substation: No change in footprint

SUBZONE: Resource

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EXHIBITS

DESCRIPTION OF AREA AND CURRENT USE

The proposed 30-Meter Telescope (TMT) will involve four geographic locations at the summit of Mauna Kea: The observatory itself on approximately 5 acres of land on the north plateau; a 3400-foot long Access Way to connect the observatory with existing roads; a Batch Plant Staging Area on a 4-acre site where the Mauna Kea Access Road forks near the summit; and upgrades to the Hawaiian Electric and Light Company (HELCO) substation near Hale Pōhaku.

The project site is in the Mauna Kea Science Reserve. The Reserve encompasses 11,288 acres of State land leased to the University of Hawai`i (UH) under General Lease S-4191. It contains most land within a 2.5 mile radius of the site of the UH 2.2-m telescope – in effect, all land above 3700 meters in elevation with the exception of a pie-shaped wedge set aside as the Mauna Kea Ice Age Natural Reserve. The Science Reserve is located within the Resource subzone of the State Conservation District.

Kepā Maly, in his 1997 review of the historical records of the Mauna Kea ahupua`a of Humu`ula and Ka`ohe[1], discusses the tradition of Kamiki, which identified the following environmental zones associated with the mountain:

Ke kuahiwi – the mountain summit[2]
Ke kualono – below the kuahiwi, the place of silence, or of hearing
Ke kuamauna – the mountain top
Ke ku(a)hea – the region of mists; the area of stunted trees
Ke kaolo – the region of paths and trails

Below the *kuahea* are the *wao*, the inhabited places; these include the *wao kele* (regions of rain), *wao akua*[3] (remote areas inhabited by gods and spirits), *wao lā`au* (forested region), and *wao kānaka* (region of people). The environmental zones identified in this tradition extended seaward, from *ka po`ina nalu* (place washed by waves) and *ke kai kohola* (the shallow seas) to *ke kai pōpolohua a Kāne a Tahiti* (the deep purplish black sea of Kāne at Tahiti).

Mauna Kea rises from these deep seas, his base resting approximately 6000 meters below the surface, and his summit reaching 4205 meters above mean sea level (AMS).

OCCL staff have observed that the term "summit" and "summit region" are not used with much precision in the discussions on Mauna Kea. While there is disagreement in the literature on how to apply the zones in the Kamiki tradition to specific areas on Mauna Kea, we find that the underlying concepts would be useful in our analysis. In line with

[1] Kepā Maly, *Mauna Kea – Kuahiwi ku ha`o i ka mālie, A Report on Archival and Historical Documentary Research*, prepared for the Native Lands Institute, 1997. These zones were taught in the story of a riddling contest between the hero Kamiki and Pīna`au, the foremost riddler of Hilo Palikū. The Kamiki tradition was collected in *Ka Hōkū o Hawai`i, 1914-1917*.
[2] Other traditions use these or similar terms, but with slightly different connotations
[3] Other sources place the *wao akua* as the entire region above the clouds

this, and in order to speak with more specificity, we will use the following terms for the summit region in this report:

The ***Wēkiu summit cone,*** for the highest point on the mountain. This cinder cone is commonly known as Pu`u Wēkiu, although some sources identify it as Pu`u Kūkahau`ula. The cone rises 4205 meters AMS (13796 feet AMS).

The ***Kūkahau`ula summit,*** for the cluster of cones and ridgelines that are above 4080 meters AMS (13,400 feet[4]): Pu`u Wēkiu, Pu`u Kea, and Pu`u Hau`oki. Some sources present these three cones as part of one unit, Pu`u Kūkahau`ula. The State Historic Preservation Division identifies Kūkahau`ula as a *Traditional Cultural Property*. This area has a strong association in traditional Hawaiian culture with both *piko* ceremonies and burial practices.

The nearby Pu`u Poli`ahu and Pu`u Hau Kea also rise above 4000 meters AMS.

The ***summit plateau***, for the alpine desert ecosystem above 3900 meters AMS (12800 feet). The slope shifts abruptly here, from approximately 27% downslope to less than 10% on the plateau. Geological evidence indicates that this broad, circular region was formed by remnant lava flows in the former caldera, and subsequently sculpted by glaciers. The plateau itself varies only approximately 100 meters in elevation, but it is dotted with hundreds of cinder cones that rise 30 to 180 meters above. Other significant geological features are the outcrops of hawaiite, an olivine basalt formed via the interaction of glacial ice and hot lava, and prized for adze making; the alpine Lake Waiau; and the glacial till that blankets most of the upper summit above 3353 meters AMS.

The ***north plateau*** is the portion of the plateau to the north of the summit, identified as the Great Rocky Table Summit in an 1891 government survey. This is the location of ***Area E***, and the site of the proposed observatory.

The ***lower summit region***, for the alpine shrub and grassland ecosystem above the tree line at 2900 meters AMS (9500 feet). OCCL notes that the record indicates that the tree line has shifted down-slope since the introduction of cattle.

The University of Hawai`i also identifies a 525-acre "astronomy precinct" that encompasses the summit the northern portion of the summit and a good percentage of the northern plateau. This precinct is shown as a blue dotted line on many of the maps attached to this report.

As stated before, the Mauna Kea Science Reserve covers most of the land above 3700 meters AMS (12,100 feet), thus encompassing the entire summit plateau and a portion of the lower summit region.

[4] Imperial conversions will be rounded to the nearest 100 for ease of reading.

The name "Mauna Kea" itself is traced back to the earliest written cartographic sources for Hawai`i. Some sources translate the name directly as "White Mountain," while other sources identify Kea as a shortened form of Wākea. Both traditions identify Mauna Kea as the first-born offspring of Papa Hānau Moku and Wākea. Mauna Kea is the ancestor of the *ali`i* class and elder brother to Hāloa, the ancestor of the Hawaiian people.

Poli`ahu, goddess of the snows of Mauna Kea, is the deity most often associated in the literature with the summit. Some early writings refer to the mountain as *mauna o Poli`ahu*, although it is not clear if this is intended as a descriptive term or as a proper name. Other significant gods and supernatural beings associated with the mountain include Poli`ahu's sister Līlīnoe, the goddess of mists; Kūkahau`ula, *Kū of the Red Snow*, an incarnation of Kū and the lover of Poli`ahu; Waiau, a chiefess-goddess companion of Poli`ahu; and Kahoupokāne, another close companion of Poli`ahu.

The summit plateau lies in the moku of Hāmākua and the ahupua`a of Ka`ohe. The land divisions for the island of Hawai`i appear to have been formally set in the early 1600's, in the reign of `Umialīloa. In 1862 the Kingdom of Hawai`i established the Commission on Boundaries to legally set the boundaries of the ahupua`a. Public testimony during the Commission hearings indicated that the traditional ahupua`a of Ka`ohe ran from the summit of Mauna Loa to the summit of Mauna Kea, there was a wide divergence of opinion on how much of Mauna Kea was included in the ahupua`a.

The Commission would eventually set the ahupua`a boundary to encompass the entire mountain summit and a good proportion of the highlands around it. Curtis Lyons, an early surveyor of the Hawaiian kingdom, wrote in 1875 that *the whole main body of Mauna Kea belongs to one land from Hamakua, viz., Kaohe, to whose owners belonged the sole privilege of capturing the ua`u, a mountain-inhabiting but sea-fishing bird*.[5]

The Boundary Commission hearings provide an important record of native practices that occurred on the mountain in the 18th and 19th Century. The practices included, but were not limited to, the collection of birds, collection of material for canoes, adze quarrying and making, *piko* ceremonies, and funerary practices.

Ongoing traditional cultural practices in the summit region include pilgrimage, prayer, shrine construction, offerings, collection of water from Lake Waiau, *piko* ceremonies, scattering of cremation ashes, and burial blessings. Many of these activities were *kapu* for non- ali`i during the Historic period; however, the abolishment of the kapu system and the elimination of castes opened up cultural practices to all Hawaiians.

OCCL also heard public testimony, from both supporters and opponents of the project, that Mauna Kea was associated with *nā mea kilo hōkū*, those who study the stars. However, specific accounts of kilo hōkū and Mauna Kea appear to be absent from the historical literature.

[5] as cited in Maly

Modern recreational activities in the summit region include hiking, star gazing, skiing and sledding in winter, meditation, and touring. There are no established trails near the proposed project site or the Access Way, nor is either area conducive to snow play. A modern trail is close to the Batch Plant Staging area, and this area is near an area popular for sledding and skiing.

Flora and fauna is scarce in the alpine desert above 3900 meters AMS. There are 21 known species of lichen, with ten being found in Area E. There are also 12 species of moss, which occur in deeply shaded rock overhangs. Two species were found in Area E. None of the lichen or moss species are unique to Hawai`i.

The few vascular plants in Area E occur in low densities. These include the endemic `oāli`i (maidenhair spleenwort, *Asplenium trichomanes* subsp. *densum*) and Douglas' bladderfern (Cystopteris douglasii). The `oāli`i is locally abundant in full sunlight and open lava fields. The bladderfern is a USFWS species of concern, but occurs at multiple locations in the islands.

The only fauna in the alpine stone desert are arthropods. Ten indigenous species have been noted in the summit plateau, including wēkiu bugs (*Nysius wekiuicola)*, lycosid wolf spiders (*Lycosa* sp.), two sheetweb spiders (genus *Erigone*), two mites (Family *Aystidae* and Family *Eupodidae,* species unknown), two springtails (Family *Entomobryidae*, species unknown), a centipede (*Lithobius* sp.), and a noctuid moth (*Agrotis* sp.). Other non-indigenous arthropod species are thought to inhabit the summit's cinder cones.

The wēkiu is proposed as a candidate for Federal Listing under the Endangered Species Act. The bug lives in loose cinder above 3570 meters AMS, and feeds on lower-elevation insects that are blown up to the summit. They tend to be concentrated on the cinder cones. Area E does not contain the loose cinder that the wēkiu habit.

No federally or state listed threatened or endangered species are known to occur at Kūkahau`ula or in the project area.

According to the University of Hawaii, Institute for Astronomy (UHIfA), about 0.36 percent (40.5 acres) of the lease area is currently being used by observatories and related development. There are currently thirteen working telescopes on the mountain. Nine are for optical and infrared astronomy, three for submillimeter wavelength astronomy, and one for radio astronomy.

Although none of the telescopes are on Pu`u Wēkiu cone itself, eight lie on the Kūkahau`ula summit: the Subaru telescope, the twin telescopes of the W. M. Keck Observatory (the world's second largest optical telescope), the NASA Infrared Telescope (IRTF), the Canada-France-Hawai`i Telescope (CFHT), the Gemini Northern Telescope, the University of Hawai`i 2.2m Telescope, the United Kingdom Infrared Telescope (UKIRT, the world's largest dedicated infrared telescope), and the University of Hawai`i 0.9m Telescope.

Two additional telescopes lie in the saddle between Kūkahau`ula and neighboring Pu`u Poli`ahu: the Caltech Submillimeter Telescope (CDO) and the James Clerk Maxwell Telescope (JCMT, the world's largest submillimeter telescope). Northwest of these, in an area dubbed "submillimeter valley", are the eight 6-meter telescopes of the Submillimeter Array (SMA).

A further two miles down slope is The National Radio Astronomy Observatory's Very Long Baseline Array. When used in conjunction with the nine other VLBA sites worldwide, it comprises the world's largest dedicated, full-time astronomical instrument.

Four of these telescopes were designed in a brief period:

There are no current developments in the main part of the North Plateau. Approximately ten percent of the 13N Site in Area E has been previously disturbed; approximately 1/3 of the existing Access Right of Way has been previously graded; and the Batch Plant site was initially graded as part of the road paving project and was used as a staging area during the construction of several observatories.

These telescopes, and other associated and related infrastructure, were approved under the following Conservation District Use Permits and Site Plan Approvals:

1973:	HA-442	Electric conduit
1974:	HA-527	Canada France Hawai`i Telescope
1975:	HA-640	Temporary (one year) Portable Infrared Telescope
	HA-653	UKIRT
1976:	HA-954	After the Fact for the Air Force/UH 0.6m telescope; 24 inch Planetary Patrol Telescope; UH 2.2m telescope (all built between 1968-1970)
1977:	HA-955	Interim power plant expansion
1978:	HA-1009	Tsunami Warning System improvements
1981:	HA-1210	UH Observation Station (temporary; three years)
1982:	HA-1492	Cal Tech Submillimeter Observatory
1983:	HA-1515	James Clark Maxwell Telescope
1986:	HA-1819	Midlevel Facilities at Hale Pōhaku
1989:	HA-2174	Very Long Baseline Array
1991:	HA-2462	Subaru
1992:	HA-2509	Keck 2
1994:	HA-2691	Gemini North
1995:	HA-2728	Smithsonian Submillimeter Array
2004:	HA-3065	New Keck Telescope (to Contested Case HA-02-04)
2005:	HA-3225	Site Testing

MANAGEMENT PLANS

The State-owned Mauna Kea Science Reserve is leased by the University of Hawai`i, with day-to-day management delegated by the Board of Regents to the Office of Mauna Kea Management (OMKM). The University also controls approximately 19 acres of Land and at Hale Pōhaku, the site of the mid-elevation support facilities. A third management area is the Summit Access Road that extends from Hale Pōhaku to the boundary of the Science Reserve. This includes a 400-yard corridor on either side of the road, excluding those areas within the adjacent Mauna Kea Ice Age Natural Area Reserve.

Comprehensive Management Plan

The Board of Land and Natural Resources approved a Comprehensive Management Plan for the Mauna Kea Science Reserve on April 9, 2009. The CMP built on pre-existing management plans, including the 1995 Management Plan for UH Management Areas and the 2000 Mauna Kea Master Plan[6].

A Comprehensive Management Plan (CMP) differs from the standard Management Plan referred to in Hawai`i Administrative Rules (HAR) §13-5 Exhibit 3, MANAGEMENT PLAN REQUIREMENTS. The standard Management Plans discussed in Exhibit 3 are intended for projects with a specific, limited use (e.g. forestry, or aquaculture). A CMP, by contrast, is needed for larger parcels with multiple significant land uses. The CMP provides a framework and guidelines for each use, and identifies areas of joint or shared responsibility.

It should be noted that any land use proposal for Mauna Kea would still need to go through the complete environmental review process; the CMP is corollary to the review process, and provide an additional framework for project development.

The Mauna Kea CMP contained 103 management actions and associated reporting requirements that would govern the future of Mauna Kea. A condition of BLNR approval was that the University develop a *Project Development and Management Framework* and four resource sub-plans *Natural Resources Management Plan; Cultural Resource Management Plan; Public Access Plan;* and *Decommissioning Plan*. The BLNR action also required UH to submit an annual status report on the development of each sub plan and a status report on the development of each management action.

Project Development Implementation Framework

BLNR approved the Project Development Implementation Framework on February 18, 2010. The framework was based in large part on the 2000 Mauna Kea Science Reserve Master Plan. The plan aimed to improve management by replacing the top-down decision making process of the past with a community-oriented process under the University of

[6] Unlike the Comprehensive Plan and Subplans, these plans were not reviewed by BLNR.

Hawai`i at Hilo (UHH), while still keeping final decision making with the UH President and Board of Regents.

The new management structure consists of:

- **The Office of Mauna Kea Management:** The office is charged with the day-to-day management of the Mauna Kea Science Reserve as prescribed in the Master Plan, and reports directly to the UHH Chancellor.

- **Mauna Kea Management Board:** An advisory body comprised of seven members of the community who are nominated by the UH Hilo Chancellor and approved by the UH Board of Regents.

- **Kahu Kū Mauna Council:** A nine-member Native Hawaiian council appointed by the Board, and that advises the Board and Chancellor on cultural matters and issues

The University of Hawaii Board of Regents (BOR) is the entity ultimately responsible for the implementation of the Management Plan.

Resource Subplans

The 103 management actions were elaborated on in the four resource sub-plans, which the BLNR approved on March 25, 2010. The complete list of management actions is included in the exhibits. Significant elements of the sub-plans are

Natural Resources Management Plan (NRMP)

The is the first plan to focus on the protection and preservation of natural resources in the UH Management Areas. The plan offers specific management actions to reduce the identified threats to natural resources and to guide adaptive responses to future threats.

The NRMP has been further divided into five component plans:

Natural Resource Inventory, Monitoring and Research Component Plan: identifies data gaps and information needs for the natural resources found within UH Management Areas.

Threat Prevention and Control Component Plan: reviews current and potential threats to natural resources, and presents management actions to deal with identified threats.

Natural Resources Preservation, Enhancement, and Restoration Component Plan: describes and prioritizes preservation, enhancement, or restoration management activities to protect native plant and animal communities and their habitats.

Education and Outreach Component Plan: describes the continued development of OMKM's educational and outreach efforts and provides recommended education and outreach activities to improve understanding of the unique natural resources found within UH Management Areas to provide visitors and users with the information they need to understand and protect the natural resources.

Information Management Component Plan: describes the activities needed to successfully manage information on natural resources to inform management decisions. Recommendations include establishment of a geographic information system (GIS) at OMKM, maintaining data, and continued support and improvement of the OMKM library.

Cultural Resources Management Plan (CRMP)

The major objectives of the CRMP include promoting a greater understanding of the rich cultural heritage of Mauna Kea; preserving and managing cultural resources in a sustainable manner; maintaining opportunities for Native Hawaiians to engage in cultural and religious practices; and preserving the cultural landscape for the benefit of cultural practitioners, researchers, recreationalists, and other users.

CRMP is further divided into three parts: (1) general management issues; (2) specific public and commercial uses, and (3) long-term management programs, plans, strategies and other needs.

It also identifies two priority management actions: the preparation of a Burial Treatment Plan, and the preparation and implementation of a final Archaeological Monitoring Plan.

An archaeological inventory survey for the Science Reserve was approved in Spring 2010, and OMKM is in the process of developing proposals for these two mitigation plans.

Public Access Plan

The Public Access Plan was formulated with six key tenets in mind: (1) The UH Management Areas on Mauna Kea are public lands held in trust for Native Hawaiians and the general public by the State and UH; (2) Protection of public health and safety is of paramount importance when managing these public lands; (3) An informed public is best prepared to make good decisions and act responsibly while on Mauna Kea; (4) Native Hawaiian traditional and customary rights are legally and constitutionally protected and can be accommodated and reasonably regulated in the interest of public health and safety and protection of natural and cultural resources; (5) Management decisions and actions should be guided by reliable data; and (6) UH has the responsibility to establish rules to govern public activities.

The sub-plan provides a range of recommendations for new or improved access guidelines for commercial and non-commercial visitors. These include maintaining interpretive and enforcement personnel to educate visitors and to provide deterrents for inappropriate behavior; improving signage to encourage visitors to stop at the visitor station; and providing alternatives to visitors at the midlevel facilities to reduce visitors in the summit area.

The CMP specifically identifies the following as being among those rights for which access will be maintained insofar as is consistent with those other requirements:

- Access for traditional and customary practices, including the gathering of cultural resources, including but not limited to mamake, ko`oko`olau, māmane, `awa, and ōwī;
- Access for families to visit *na iwi kupuna;*
- Access to scatter *`ohana* ashes;
- Access through the trails located within the UH Management Areas for subsistence gathering and hunting;
- Access for families to continue to deposit their *`ohana piko*.
- Access for traditional and customary practices, including religious and spiritual observances;
- Pilgrimage, offerings, and prayers; and
- Access for families to gather water from Lake Waiau for religious and spiritual purposes.

For safety reasons, the TMT project would restrict access to construction areas. Such restrictions would be temporary in nature and limited to the immediate vicinity of the construction work. After completion of construction, access to the interior of the TMT Observatory would be restricted for safety considerations. These restrictions would not prevent or preclude access to any resources available within the UH Management Areas of Mauna Kea for the practice of traditional and customary Native Hawaiian rights.

Decommissioning Plan

The Decommissioning Plan describes the process for decommissioning observatories on Mauna Kea, including financial planning. It outlines expectations for both existing and future observatories on Mauna Kea and describes the roles of DLNR (land owner and lessor), UH (lessee), and the observatories (sublessses).

The plan defines decommissioning as a process that results in the *partial or total* removal of all structures associated with an observatory facility and the restoration of the site, to the *greatest extent possible*, to its pre-construction condition.

Provisions for financial planning for decommissioning are included to ensure that adequate funds are available to pay for the costs of deconstruction and site restoration at the end of the life of the observatory.

CDUPs may be required as part of the decommissioning process when the observatory is demolished and provide the opportunity for BLNR to impose additional conditions.

The Plan notes that the Caltech Submillimeter Observatory (CSO) is scheduled to be decommissioned and removed between 2016 and 2018. The Institute for Astronomy also predicts that UKIRT, the 3.8m United Kingdom Infrared Telescope, will be removed from the Kūkahau`ula Summit by the end of the current lease in 2033, along with one more radio telescopes from the saddle between Kūkahau`ula and Pu`u Poli`ahu, and the Very Long Baseline Array from the southeastern portion of the summit plateau.

If the TMT is approved and built, and three telescopes decommissioned by 2033 as predicted, then eight telescopes will remain on the Kūkahau`ula Summit (currently: nine), and two on the summit plateau, for a total of ten telescopes on the mountain (currently: thirteen).

The Office of Mauna Kea Management has stated that they have the long term goal of migrating off Kūkahau'ula and onto the plateau.

The Decommissioning Plan does not address specific timelines or dates for decommissioning observatories, except that all decommissioning activities shall be completed by the end of the master lease, nor does it address the process of renegotiation of a new master lease or sublease agreements. It should be recognized that if no new lease is granted, the observatories will need to be removed and the site restored no later than the end of the master lease.

PROPOSED USE

The University of Hawai`i is seeking the Conservation District Use Permit (CDUP) for the Thirty Meter Telescope (TMT), a "next-generation" Giant Segmented Mirror Telescope (GSMT). The University is seeking the permit on behalf of the non-profit TMT Observatory Corporation[7]. The Corporation was founded in 2003 by the California Institute of Technology, the University of California, and the Association of Canadian Universities for Research in Astronomy. The National Astronomical Observatory of Japan (NAOJ) joined as a Collaborating Institution in 2008; the National Astronomical Observatories of the Chinese Academy of Sciences joined as an Observer in 2009; and India joined as an Observer in June 2010.

Next Generation Telescopes

In August 2010 the National Academy of Sciences released Astro2010: The Astronomy and Astrophysics Decadal Survey (*New Worlds, New Horizons in Astronomy and Astrophysics*). The report laid out a plan for sustaining the current level of scientific progress over the coming decade, and identified three core science objectives: the exploration of the origin of the universe, the search for habitable planets outside our solar system, and the use of astronomical observation to investigate fundamental physics.

In support of these objectives, and noting that the greatest strides in astronomical understanding have been the result of bold research initiatives, Astro2010 identified four large-scale space-based initiatives and four large-scale ground-based initiatives. One of the four priority ground-based recommendations is for a "next generation" Giant Segmented Mirror Telescope (GSMT) which, per the report, will be *a large optical and near-infrared telescope that will revolutionize astronomy and provide a spectroscopic complement to the James Webb Space Telescope, the Atacama Large Millimeter/submillimeter Array, and the Large Synoptic Survey Telescope.*

The James Webb Telescope, a 6.5m infrared-optimized space telescope, is scheduled for launch in 2014. Webb will reside in an orbit about 1.5 million km (1 million miles) from the Earth. It is designed to study the first phase of the early Universe through four main science themes: *The End of the Dark Ages: First Light and Reionization*; *The Assembly of Galaxies*; *The Birth of Stars and Protoplanetary Systems*; and *Planetary Systems and the Origins of Life*.

The Large Synoptic Survey Telescope (LSST) is an optical survey telescope currently in its design and development phase, and will achieve first light four years after construction starts. Full science operations for the ten-year survey will begin two years after that, toward the end of the decade. It will be located on the El Peñón peak of Cerro Pachón, a 2682 meter AMS mountain in northern Chile alongside the existing Gemini South and Southern Astrophysical Research Telescopes. LSST will image the entire visible sky every few nights for ten years, creating a 3-D map of the universe, and capturing changes and opening up the time-domain window to the observable universe.

[7] More information on the TMT Corporation can be found at www.tmt.org

The Atacama Large Millimeter/submillimeter Array will be the largest astronomical project in existence. It comprises an array of 66 12-meter and 7-meter diameter radio telescopes being built on a 5000-meter AMS plateau in the Atacama desert in northern Chile. It is scheduled to be fully operational by the end of 2012. It will be a complete astronomical imaging and spectroscopic instrument for the millimeter/submillimeter regime, providing scientists with capabilities and wavelength coverage that complement those of other research facilities. It is expected to provide insight on star birth during the early universe and detailed imaging of local star and planet formation.

TMT will be integrated with these by using an angular resolution matched to the Atacama Array, by having sensitivity sufficient to characterize the faintest sources imaged by the space telescope, and by utilizing a combination of field of view and collecting area matched to efficient study of the first emerging large-scale structures in the distant universe.

Light collection increases with the square of the diameter of the mirror; TMT will thus have ten times the light-collecting area of each of the twin Keck Telescopes, which are currently the world's largest. Additionally, sensitivity increases with the diameter to the fourth power. Consequently, a thirty-meter telescope will be 80 times more powerful than a ten meter telescope, and will be 12 times sharper than Hubble.

There are currently three active international partnerships pursuing the development of, and in competition for funding for, an "Extremely Large Telescope (ELT)". Only two are likely to reach first light. Two of these have major participation by US institutions: Carnegie's Giant Magellan Telescope and the TMT. The third is the European Southern Observatory ELT. TMT is the only project under consideration for the Northern Hemisphere; the other two being considered for sites in Chile.

The Thirty Meter Telescope

Elements of the TMT proposal include:

- **The 30-Meter Telescope (TMT).**
  The core of the project is a 30-meter in diameter aperture telescope composed of 492 individual mirror segments, secondary and tertiary mirrors directing the gathered light, and a network of interchangeable sensors and instruments that will collect and process the light. TMT will be located on the north plateau, approximately ½ mile from the Kūkahau`ula Summit, at an approximate elevation between 4008m and 4015m AMS (13150 to 13175 feet).

- **The TMT Access Way.** The 3400-foot long Access Way will consist of an improved road and underground utilities connecting the Observatory with existing roads and utilities. For the most part the Access Way will follow an existing 4-wheel drive road and the wider roads that serve the SMA facility. Only 200 feet

will not follow existing roads. The Access Way will be single lane where it crosses Pu`u Hau`oki, then two lanes for the remainder.

- **The Batch Plant Staging Area.** The Staging Area is a 4-acre site northwest of where the Mauna Kea Access Road forks near the summit. It will be partially restored, and used for storing bulk materials and a concrete Batch Plant. This is a the same use the area was put to during prior construction activities on the mountain.

- **Hawaiian Electric and Light Company (HELCO) Upgrades.** The proposal calls for the repair and upgrades of electrical transformers and related equipment at the substation near Hale Pōhaku. The operation and maintenance of the existing utility lines was authorized under CDUP HA-1573. The substation is located approximately 2000 feet southwest of the main headquarters, and about 1000 feet from Mauna Kea Access Road. The new transformers will replace the existing ones on a 1:1 basis, and the fenced compound will not be expanded.

Due to the challenges encountered when undertaking high-altitude construction, the applicant is requesting that the period allowed for the start of construction if a CDUP is granted by two years, and that the total time allowed for construction be ten years.

If a CDUP is issued the building and operation of the TMT Observatory will require a sublease from UH, which leases the lands from DLNR. The sublease would be subject to approval by the UH Board of Regents and the TMT Board, followed by approval by BLNR. The current UH lease expires in 2033, and the TMT Observatory will be required to either decommission and restore the site at that time or obtain a new lease from BLNR.

TMT Observatory

The core of the project is the 30-meter aperture telescope. The dome housing the telescope The primary "eye" will be comprised of 492 individual mirror segments. Secondary and tertiary mirrors will direct light into different instruments for analysis. Interchangeable instruments and sensors will be mounted to the side of the mirror to collect and process light from an array of wavelengths.

The telescope will be the first large optical/infrared observatory to integrate Adaptive Optics into its design. The system will project up to eight lasers into the sky to create an asterism of guide stars, that can be used to measure and correct for atmospheric distortion.

The dome will be a Calotte-type enclosure. Calotte domes feature a circular shutter and two planes of rotation, as compared to the rectangular shutter and single plan of standard domes. This allows for a tighter fit between dome and telescope. In Keck, the dome is three times the size of the telescope; the TMT will be designed so that the dome hugs significantly closer to the telescope.

The total dome height will be 184 feet above finished grade, with an exterior radius of 108 feet. The dome shutter will be 102.5 feet in diameter, and will retract inside the dome when opened. The dome base, cap, and shutter structures will appear rounded and smooth, and have a reflective aluminum-like exterior coating.

The fixed cylindrical structure below the rotating base will enclose 34,304 square feet, and extend 26.5 feet above grade. This part of the structure will be lava colored.

A support building attached to the dome will have a roof area of approximately 21,000 square feet, and a gross interior area of 18,736 square feet. It will be flat-roofed and lava colored. The building will include a mirror coating and staging area, laboratory and shop spaces, utility spaces, and administration spaces.

There will be a 6000 square foot external equipment area on the north side of the building. This area will contain two electrical transformers; three 5000 gallon underground storage tanks (one for water, one for domestic waste storage, and one double-walled tank for chemical waste storage); two 25,000 gallon water tank for fire suppression; and one double-walled 2000 gallon tank for diesel.

A tunnel will be built to function as an exhaust duct for heating, ventilation, and air-conditioning (HVAC) equipment.

An unpaved parking area will be placed just outside the support facility.

An atmospheric turbulence monitor will be mounted on a 30-foot tower on the north side of the graded area.

The entire footprint of these structures will be approximately five acres.

TMT Access Way

The proposed Access Way will start at the intersection of the Mauna Kea Loop Road and the Submillimeter Array (SMA) roadway. The majority of the Access Way will follow either the existing 4-wheel drive roads or the wider roads that serve SMA. The existing single-lane road was built in the 1960's. Only 200 feet of the 3400 foot long route will deviate from the existing route.

The proposal calls for a single lane road over the southern portion of the Access Way, where the route crosses beneath Pu`u Hau`oki in the Kūkahau`ula TCP. The remainder will be two lanes.

The switch boxes needed to extend electricity and communications to TMT will be placed above ground next to the existing ones across from the SMA building.

The total area of disturbance for the Access Way will be 3.6 acres; of this 1.9 acres will be in an area that has been previously disturbed.

Batch Plant Staging Area

The Batch Plant staging area is approximately four aces northwest of where the Mauna Kea Access Road forks near the summit. This area will be used for storing bulk materials, and for a concrete batch plant. It has been used for similar purposes during the construction of other observatories.

HELCO Upgrades

HELCO will upgrade two transformers within the existing Hale Pōhaku Substation, which is located approximately 2000 feet from the main headquarters building at Hale Pōhaku. The compound will not be expanded.

Work will also be needed on the existing electrical conduit from Hale Pōhaku to the SMA building. The current wire conductors will be replaced with higher capacity conductors within the existing conduits. The majority of the route parallels Mauna Kea Access Road. One portion of the lower alignment follows the former Access Road, which is now part of the Ice Age Natural Area Reserve. There are existing pull boxes every 300 feet, and so no new ground disturbance will be needed to pull the cable.

TMT Lifecycle

There will be four major stages to the TMT lifecycle: planning and design; construction and testing; operation; and decommissioning.

This application, and the Board's decision, marks the end of the first stage. If the Board approves the permit in the first quarter of 2011, the anticipated project schedule is as follows:

Planning and Design	
Construction Plans	Second Quarter 2011
Construction and Testing	
Grading and Foundation	2011-2012
Observatory Erection	2012-2016
Observatory Finish	2016-2017
First Light	***September 2018***
Operation	2018 – to be determined
Decommissioning	To be determined

TMT Observatory Corporation estimates that construction activities will take place 12 to 15 hours per day, seven days per week. Special operations and construction phases might require longer work days, while winter weather conditions will interrupt other work days until the dome is complete.

After First Light the telescope will be occupied and used continuously. Most staff will not need to visit the telescope on a daily basis, and the majority of operations and administration staff will work out of the headquarters at the University of Hawai`i, Hilo campus. Most of the daytime activities at the observatory will be associated with maintaining the facilities and setting up observational experiments. At night the observatory will be staffed by a small crew of six system operators.

A Notice of Intent to decommission the telescope must be given five years before the expiration of the lease, or the desired decommissioning date. This will be followed by environmental due diligence review and decommissioning and restoration planning. TMT will document the site prior to construction in order to provide a guideline for site restoration. A Decommissioning Review Process will be established to guide the activities; reviewers will include OMKM, Kahu Kū Mauna, and the Environment Committee. TMT will manage the process with oversight by OMKM.

IMPACTS AND PROPOSED MITIGATION MEASURES

The Mauna Kea Science Reserve Master Plan (2000) and the Mauna Kea Comprehensive Management Plan (2009) contain mitigative and management measures that address the overall impacts of the Science Reserve on the mountain's resources. TMT will need to be in compliance with the Comprehensive Management Plan, and mitigative measures required by the plan will be assumed to be conditions of any permit TMT Corporation is granted.

The applicant also proposes the following project-level mitigation measures:

Cultural Beliefs and Practices; Historic Resources:

- Kahu Kū Mauna, a nine-member council selected on the basis of their awareness of Hawaiian cultural practices, traditions, will take the lead on advising OMKM and UH on cultural matters related to Mauna Kea.
- TMT is proposed for the 13N Site, where it will be removed from the culturally sensitive locations of Kūkahau`ula, Lake Waiau, or Pu`u Līlīnoe.
- The Access Way was designed to limit impact on cultural resources by limiting it to one lane in places, following the same alignment as the existing 4WD road on the flank of Pu`u Hau`oki, and coloring the pavement to blend with the surroundings.
- Employees will attend mandatory cultural and natural resources training.
- The facilities will be furnished with items to provide a sense of place.
- Daytime activities at TMT will be minimized on up to four days per year, as identified by Kahu Kū Mauna.
- Outreach staff will work with the `Imiloa Astronomy Center and OMKM to develop information exhibits for visitors regarding the natural, cultural and archaeological resources of Mauna Kea.
- TMT will fund the re-naturalization of the closed Access Road on Poli`ahu, partially re-naturalize the Batch Plant Staging Area after construction, and camouflage the utility pull boxes in certain locations to reduce the visual impact from the summit area.

Biological Resources:

- The Access Way has been designed to limit its effect on wēkiu bug habitat.
- An invasive species control program will be implemented.
- A ride-sharing program will be implemented to reduce traffic, dust, and noise.
- Arthropod monitoring will be performed prior to, during, and for two years following construction in the area of the Access Way on the alpine cinder cone habitat.
- The applicant will work with OMKM to develop and implement a habitat restoration study.

Visual and Aesthetic Resources:

- The preferred site location is north of and below the summit.
- The dome has been designed to fit tightly around the telescope.
- The coating of the dome will be a reflective aluminum-like coating which will reflect the sky during the day, reducing visibility.

Other Resources:

- Wastewater will be collected and transported down the mountain for treatment as part of a "Zero Waste Management" policy.
- Employment opportunities will be filled locally to the greatest extent possible.
- TMT will dedicate funds to workforce development programs, including curriculum and program development.
- Employees traveling beyond Hale Pōhaku will take part in a mandatory ride-sharing program using project vehicles.
- Energy savings devices will include solar hot water systems, photovoltaic power systems, energy efficient light fixtures, and the use of Energy Star rated appliances.
- The project will place HVAC (Heating, Ventilating, and Air Conditioning) units indoors to reduce noise. Façade acoustical louvers and duct silencers will be used to further reduce noise.
- TMT will provide $1 million annually, adjusted for inflation, for "Community Benefits Package" which will commence with construction and continue through the term of the sublease. The package will be administered via The Hawai`i Island New Knowledge (THINK) Fund Board of Advisors.
- TMT's outreach office will work with OMKM and `Imiloa to support the development of exhibits regarding cultural, natural, and historic resources for the Visitor's Center, TMT facility, and other appropriate locations.
- TMT will partner with other institutions to implement a Workforce Pipeline Program, headed by at least one full-time position through the Community Outreach office, to prepare local residents for jobs in science, engineering, and technical fields.
- There will be set minimum observation times for UH researchers; the amount will be negotiated as part of the sublease.
- The EIS has committed TMT to paying a "substantial" amount for sublease rent. The rent would be deposited into the Mauna Kea Land Fund, and only used for management of Mauna Kea.

TMT also proposes to implement the following project-level programs mitigation plans:

- A Cultural and Archaeological Monitoring Plan.
- An Invasive Species and Control Program.
- A Construction Best Management Practices (BMP) Plan.
- A Cultural and Natural Resources Training Plan for employees.

- A Materials Storage / Waste Management Plan, including a Spill Prevention and Response Plan.
- A Waste Minimization Plan, which will include the use of water-efficient fixtures, and incorporate audits of potable water use.

A complete list of proposed mitigation measures is included in the exhibits.

SUMMARY OF COMMENTS

Comments were received from the following agencies:

The Office of Conservation and Coastal Lands referred the application to the following agencies and offices for review and comment:: DLNR – Land Division, Historic Preservation, DOFAW, Engineering; DBEDT – Energy, Resources, & Technology Division, Planning Office; Department of Education; Office of Hawaiian Affairs; University of Hawai`i - Institute for Astronomy, Hawaiian Studies, Environmental Center; US Fish and Wildlife Service; County of Hawai'i Planning Department; Hawaii State Public Libraries – State Library, Hilo, Kailua-Kona, Thelma Parker (Kamuela); Bishop Museum; US Senator Daniel Akaka; US Rep. Mazie Hirono; State Senators Kokubun, Takamine, Green.

A notice of the application was placed in the October 23, 2010 edition of the Office of Environmental Quality Control's *Environmental Notice*.

In addition, copies of the application were available for review at the Hawai`i State Library and the Kailua-Kona and Thelma Parker Public Libraries. Additional copies of the application were published on OCCL's website.

Public Hearings were held at Hilo on December 2, 2010, and at Kailua-Kona on December 3, 2010. Approximately 125 members of the public attended the Hilo meeting, with 51 persons providing oral testimony. Approximately 75 members of the public attended the Kailua-Kona meeting, with 33 members providing public testimony.

The exhibits contain both a complete copy of all written comments and the University's response. OCCL notes that many of the comments arrived in our office after we had forwarded the already-collected comments to the University for response. We will address the remaining comments in our discussion and analysis of the project.

Following is a summary of the written comments:

Office of Hawaiian Affairs

OHA recognizes that the BLNR approved a Comprehensive Management Plan and four subplans, and that therefore a broad mitigation and management framework are in place to address the impacts of development on the mountain.

OHA believes that, when viewed in totality, the project has the potential to contribute to developing a new paradigm for the extremely sensitive nature of development on Mauna Kea, and looks forward to seeing this potential fully achieved.

DLNR – Division of Forestry and Wildlife (DOFAW)

DOFAW notes that the previously approved easement corridor for the power line has been surveyed and recorded. Not knowing the actual alignment makes it difficult to

assess the potential impacts of the project, although the power line will pass through the Mauna Kea Ice Age Natural Area Reserve in some locations.

DOFAW also notes that the corridor has not witnessed any significant work in 20 years, and that erosion and settling have occurred. Access to the pill boxes will require improvements that might not fall within the 20-foot access corridor, and movement of heavy equipment over unstable terrain. DOFAW has the following recommendations:

- The formal land survey of the power line corridor must be completed; draft and final maps should be provided to DOFAW for comments and record keeping;
- Surveys for Wēkiu bugs and other invertebrates should be conducted along the easement corridor prior to any construction disturbance;
- HELCO and other contractors must be held to the same project construction mitigation measures outlined in the CDUA;
- Prior to construction, the Mauna Kea Ice Age NAR Archaeological Survey Report should be reviewed. Construction monitors, including one with archaeological expertise, should be provided;
- Improvements to the power lines should use construction practices that minimize potential disturbance to the corridor, such as using cranes on the Access Road to access pill boxes;
- The power line corridor should be restored back to its current condition after work;
- If access and line improvements prove to be too difficult on the existing corridors then the applicant should consider re-routing it.

DOFAW also notes that Wēkiu bug monitoring, general arthropod monitoring, and invasive species monitoring should occur across the affected environment.

Applicant's Response

The University will ensure that the survey of the power line corridor easement will comply with DLNR -Land Division and Department of Accounting and General Services' standards and in accordance with the conditions contained in the grant of easement (including the Mauna Kea Ice Age Natural Area Reserve) that was approved by the BLNR in August 1985. The University will provide copies to DOFAW as requested.

OMKM will consult with the U.S. Fish and Wildlife Service and experts who are advising OMKM, including representatives from the DLNR, on surveys of the wēkiu bug and invertebrates regarding surveys along the utility corridor, including Pu'u Hau Kea and the pu'u west of the Parking Area 1.

The University will ensure applicable mitigation measures described in Section 4.2 of the CDUA will be implemented.

The archaeological consultants surveyed this area for the Natural Area Reserves System. Based on their survey, they have concluded that there are no inventoried historic properties within 100 feet of the HELCO easement in the Mauna Kea Ice Age NAR.

The University will review proposed construction practices, including the possible use of a crane to ensure minimal disturbance to the power line corridor.

The construction contractor will be required to minimize the visual changes to land within the utility line right-of-way during utility upgrades. Any disturbance outside of the easement area will be restored to the extent possible. However, continuing maintenance access will be needed in order for the easement to function as a utility corridor and some evidence of the facilities, such as manholes or utility boxes, will remain.

It is unlikely that the line improvements will prove too difficult along the existing corridor, but should this be the case, the University will consider re-routing as suggested if the additional (i.e., new) disturbance that re-routing would entail is acceptable to the Board of Land and Natural Resources.

The Invasive Species Prevention and Control Program calls for the type of monitoring for and eradication of invasive species that this comment suggests. The Office of Mauna Kea Management conducts annual surveys of the wēkiu bug and arthropods at Hale Pōhaku, summit batch plant and summit ridges, locations determined by scientists advising OMKM on wēkiu bug and arthropod matters.

As outlined in Chapter 5 of the TMT Management Plan, the TMT Management Plan will be updated every 5 years, as necessary, based on (a) updates to the Mauna Kea CMP; (b) based on strengths or weaknesses revealed through the monitoring and reporting program; (c) relevant new or modified laws, regulations, and policies; and (d) modifications to the operation of the TMT Observatory.

The existing Invasive Species Prevention and Control Program calls for the type of monitoring for and eradication of invasive species that this comment suggests. The Office of Mauna Kea Management conducts annual surveys of the wēkiu bug and arthropods at Hale Pōhaku, summit batch plant, and summit ridges, locations determined by scientists advising OMKM on wēkiu bug and arthropod matters.

DLNR – State Parks
No comments

DLNR – Land Division
No comments

DLNR – Engineering
The applicant should provide the water demands and calculations to Engineering so it can be included in the State Water Projects Plan Update

Applicant's Response
The TMT Corporation estimates that the proposed TMT Observatory and Hilo Headquarters will consume approximately 480 gallons per day and 1,600 gallons per day, respectively. It will provide updated estimates of the Project's water demand to the

DLNR Engineering Division, as requested, upon the Project obtaining a CDUP and completing any design modifications related to CDUP conditions that might affect water demand by the Project.

DLNR – Historic Preservation Division (HPD)
Project specific archeological reports were reviewed by HPD in 2009, and HPD believes that the information provided in the application is complete and accurate.

HPD notes that the application addresses the significance of the Kūkahau`ula TCP, which had not been fully recognized previously in the draft EIS. The proposed mitigation measures address the project-specific and cumulative impacts of TMT.

HPD will recommend that the Historic Preservation Mitigation Plan be specifically referenced by the Board as any condition of approval of the permit.

HPD appreciates that OMKM has been in contact with their office during the project development phase. HPD has no further comments, but assumes that the project will follow the Historic Preservation Mitigation Plan as well as other planning documents associated with the Science Reserve such as the Cultural Resources Management Plan.

HPD looks forward to receiving an Archaeological Monitoring Plan for review and approval prior to the onset of construction.

Department of Health Clean Water Branch (CWB)

CWB notes that the project will need to be compliant with the criteria set out in the Antidegredation Policy (HAR §11-54-1.1) and Designated Uses (HAR §11-54-3) regarding impacts on State waters.

The applicant will need to secure a National Pollution Discharge Elimination System (NPDES) permit for discharges of storm water associated with construction activities, and construction dewatering effluent. An NPDES individual permit might also be needed for other types of wastewater.

Additionally, all discharges must comply with State Water Quality Standards.

Applicant's Response

The applicant and the University understand that the proposed TMT Project is subject to other regulations as well, and it is the applicant's intention to comply with all federal, state, and county rules and regulations, including those cited. The Project will be applying for a NPDES general construction permit prior to performing any construction activities within the Conservation District, or elsewhere.

County of Hawai`i Planning Department
The Department has no objections to the proposed use.

Mauna Kea `Anaina Hou, The Royal Order of Kamehameha, Sierra Club, and Clarence Kukauakahi Ching

The above hui opposes TMT as "there is no legal justification for more development on Mauna Kea, (and) therefore there is no legal justification for considering this CDUA." They ask that the BLNR deny the permit until the Intermediate Court of Appeals renders a decision on the Comprehensive Management Plan, as "submitting a CDUA … burdens and prejudices the public and parties defending their case in the ICA."

Other points the letter raises include:

The TMT staff do not have the expertise to make such claims that TMT will not desecrate Mauna Kea. Mauna Kea is considered the Temple of the Supreme Being. It is the home of Na Akua (the Divine Deities), Na 'Aumakua (the Divine Ancestors), and the meeting place of Papa (Earth Mother) and Wakea (sky Father). The ceremonies and practices on Mauna Kea are practiced nowhere else, and formed the basis of the navigational knowledge that allowed Hawaiians to navigate over ten million square miles of the Pacific. Building TMT there is a desecration.

Mauna Kea is also home to some of the most unique, rare and fragile plant and animal species in the world. These include the `u`au (dark rumped petrel), palila bird, wēkiu hug, and silversword.

Mauna Kea is the principle aquifer for the island of Hawai'i. lf these waters are contaminated, they can no longer be used for ceremonies, healing, and/or for drinking.

The letter also raises a number of quasi-legal issues. In brief: Unlike the summit district and the practices related to it, construction of astronomy facilities is not mentioned in any state statute or the constitution. It is not a protected public trust activity. TMT is not in compliance with State or Federal law. BLNR has not fulfilled court orders issued by Judge Hara. BLNR needs to comply with Hawai`i Supreme Court orders.

The group also objects to any project that will continue beyond the end of the current lease in 2033.

Applicant's Response:

The applicant does note that the ICA case referenced in the comment is a challenge of the Board's decision to deny the request for a contested case.

Beliefs, and the feelings that accompany them, are highly personal and subjective in nature. The EIS and CDUA for the Project disclose that the summit region of Mauna Kea is a spiritual and sacred place for Native Hawaiians, relying on qualified sources for this opinion. By consulting with the holders of a broad variety of opinions about the Project and incorporating their feedback into its management of its leased land on

Mauna Kea, UH believes the ongoing activities it has proposed will be beneficial to the mountain.

TMT Corporation has proposed on-site mitigation measures meant to reduce the effects of the TMT observatory construction. Examples of these include locating the observatory off the summit ridge (which is considered the most sacred area on Mauna Kea) and away from known historic properties and designing its Access Way so as to require a minimum of ground disturbance and alteration. It has also committed to additional measures (e.g., restoring the access road on Pu'u Poli'ahu).

Plans for the TMT Project include measures designed to avoid, minimize, and mitigate potential effects on the biological and environmental resources.

As a general point, the West Mauna Kea Aquifer that underlies the Project area is not the island's principal aquifer. In fact, the State Commission on Water Resource Management (CWRM) estimates that it accounts for only 1 percent of the total groundwater recharge that occurs on the island. Virtually none of the recharge to that West Mauna Kea Aquifer that does occur is in areas affected by the proposed Project. Instead, it takes place at lower elevations (especially in the 2,000' to 5,000' range) where rainfall is much higher.

As it stands the presence (or absence) of observatories is a matter that will be decided by the State in accordance with applicable laws and regulations.

It is not within the scope of this CDUA to speculate on the nature or outcome of those future lease negotiations, which would include a master lease negotiation between DLNR and UH and the subsequent sublease negotiation between UH and TMT. The Board of Land and Natural Resources must review and approve all new leases for State Land, including areas that will be needed for the proposed Project.

KAHEA, The Hawaiian-Environmental Alliance

KAHEA opposes the proposal. The complete eight-page letter and the applicant's response are contained in the Exhibits, page . The main points KAHEA makes is that

1. TMT contributes to the substantial, adverse, and significant impact of telescopes
2. Substantial, adverse impacts are not permitted in the conservation district.
3. TMT is offensive
4. Flawed processes and conflicts of interest plague summit management
   - Management Plan and Subplans not Finalized
   - TMT agrees management plan is not comprehensive
   - The University serves conflicting interests
5. Significant questions remain unanswered
   - Why is UH submitting an application on behalf of TMT?
   - How does the University rationalize serving the conflicting roles of "applicant" and "manager?"
   - What is the carrying capacity for the summit?
   - How many telescopes are currently on the summit?

- How big is the TMT?
- Why did Kahu Kū Mauna only get four days (for cultural practice)?
- What is the overall noise level, in dBA, of the TMT?
- Where is the "approved landfill" for waste located?
- Where would the TMT dispose of the toxic chemical wash?
- How does the TMT manage not to cause substantial adverse impact?
- How can the TMT be built and … natural beauty and open space characteristics be approved upon?
- If the University holds a lease for "one observatory how can it be that more than 13 subleases have been issued?
- How can TMT ensure that it will not be materially detrimental to the public health, safety, and welfare?
- What is the decommissioning plan for the TMT? Did the TMT commit to begin decommissioning by 2028? Did the TMT commit to fully restore the northern plateau by 2033? Does the TMT hope to stay pass (sic) the expiration date of the lease in 2033?

Applicant's Response:

The applicant's complete response can be found in the Exhibits. Many of the questions posed by KAHEA are restatements of the Conservation Criteria contained in HAR §13-5; these were answered by the applicant in their application and will be reviewed by OCCL later in this report.

1. *The EIS and CDUA indicate that the existing cumulative impact to certain resources is already adverse and significant but conclude that the Thirty Meter Telescope Project, when considered in conjunction with other foreseeable actions, would not significantly increase or reduce the existing level of cumulative impact.*
2. *KAHEA's assertion that the Department cannot legally grant the TMT a permit to build in the Conservation District, no matter how well it mitigates its negative impacts, is incorrect.*
3. *KAHEA's belief is acknowledged. UH and the TMT Corporation believe that the construction and operation of the TMT, and the associated management activities, will have a net benefit to the Conservation District.*
4. *Neither the CMP nor the subplans are "currently undergoing legal review." All have been approved by BLNR. BLNR denied certain individuals a contested case request on the management plans, a decision which as upheld by the Circuit Court of the Third Circuit on January 27, 2010.*
   - *The second assertion is completely incorrect, and suggests that the commenter does not understand the scope of the CMP.*
   - *The proposal does not seek to advance University interests at the expense of other important values. All fees including sublease payments are to be deposited into the Mauna Kea special land fund and are to be used for managing Mauna Kea lands.*
5. *UH was the proposing agency because it holds the lease on the lands under consideration. TMT Observatory Corporation applied to UH through the*

Master Plan project review process, which included public input and review. UH approved the TMT Project through that process.

- *The University, through OMKM, takes its role as manager of its managed lands on Mauna Kea seriously. This role is subject to oversight by the Board of Regents and ultimately the BLNR.*
- *The carrying capacity of Mauna Kea for observatory development is large but difficult to define precisely.*
- *There are eleven observatories and one radio telescope on Mauna Kea.*
- *The University is requesting permission for long-term use on 8.6 acres, and temporary use on 4 acres.*
- *SHPD suggested four days as an appropriate amount to set aside. These are days that TMT will minimize its activities; cultural practices will not be restricted on other days.*
- *The HVAC system exhaust might reach 55 dBA. Figure 3-36 of the FEIS shows noise impacts.*
- *The County of Hawai`i operates two landfills, one in South Hilo and one in Pu`uanahulu.*
- *Wastewater from existing observatories is treated at Hilo Wastewater Treatment Plant. It is possible that different options will be available when the first* wastewater is generated.
- *The lease that the University holds does not limit astronomy use to "one observatory."*
- *Decommissioning is discussed in Section 4.5.2 of the TMT Management Plan. Steps will include preparation of a Site Decommissioning Plan (SDP), a Notice of Intent (NOI), Environmental Due Diligence Review, a Site Deconstruction and Removal Plan (SDRP), and a Site Restoration Plan (SRP). It is not within the scope of this CDUA to speculate on the nature or outcome of future lease negotiations, which would likely include both a master lease negotiation between DLNR and UH and the subsequent sublease negotiation between UH and TMT.*

E. Kalani Flores (Assistant Professor, Hawai`i Community College), B. Pualani Flores (`Ike Hawai`i Resource Teacher)

The Flores `ohana opposes TMT for the following reasons:

- The TMT FEIS is incomplete as it does not consider or disclose the impacts of the project on the ancestral akua. The process of consultation with those recognized as the ancestral akua and spirits of Mauna a Wākea has not been done by the applicant. The Flores offered testimony from Mo`oinanea, the guardian of Lake Waiau, who offered her concerns via an individual who has the ability to interact and communicate with ancestral akua. The goddess stated that the project will obstruct the *piko* on top of the mountain and block the *piko*/portal to connect with Akua (Creator) and `Aumākua (Ancestors). This is a major portal for life forces that flow into the island, and blocking it will bring much change, none of it positive.

The Flores' recommended that BLNR conduct a site visit to the mountain, and that the applicant erect a temporary framework of pvc pipe or similar materials to provide a realistic perspective.

Applicant's Response

We must respectfully disagree with your statement that the TMT Final Environmental Impact Statement (FEIS) is an incomplete document. The Governor of the State of Hawai'i accepted the document on May 19, 2010, and the time for legal challenge has passed.

While we cannot evaluate the statements attributed here to the akua, we would note that the FEIS and CDUA provide extensive consideration of the spiritual, religious, and cultural importance of Mauna Kea to a number of groups who have carried out traditional practices in the summit region. For example, an extensive Cultural Impact Assessment (CIA) can be found at Appendix 0 of the FEIS. In addition, the Executive Summary and Section 3 of Volume I of the FEIS contain detailed presentations on these topics as well as interviews with modem-day practitioners and other persons who have identified Mauna Kea as a locus for activities important to their cultural beliefs and practices.

Cliff Souza

Mr. Souza opposes TMT. He notes that 4 men died during a fire ten years ago at Subaru, and that the fire engines could not reach the scene as no access was provided. No construction should start until fire engine access and water supplies are provided.

Applicant's Response

Fire trucks and personnel have unrestricted access to the Mauna Kea summit region. The roads, including the new TMT Access Way, allow for fire truck access to all developed areas in the Mauna Kea summit region. The response time for the County Fire Department is likely well over an hour due to the distance and road conditions. Therefore, UH and the observatories also have an agreement with the U.S. Army that allows its fire-fighting crew at the Pōhakuloa Training Area (PTA) to assist with fire emergencies.

Unfortunately, even the crew from PTA would likely take 45 minutes to reach the summit region. That is why additional fire-detection/fire-suppression measures are discussed in the Project EIS and incorporated into the TMT Observatory's design.

Matt Binder

Mr. Binder supports the project. As a science teacher he is thrilled at the opportunity for breakthrough research occurring here. He notes that all the telescopes combined make

up a tiny fraction of the summit area, and cannot be blamed for any troubles the wēkiu are having.

Tom Peek

Mr. Peek was a guide for Mauna Kea observatories from ten years, starting in 1988. He opposes TMT, and questions whether OCCL staff are experiencing undue pressure from UH Officials, DLNR superiors, influential Land Board members, Hawai`i's Congressional delegation or other political elites, or the construction industry[8].

Mr. Peek states that the DLNR approved a fundamentally flawed and inadequate comprehensive management plan, and that DLNR failed to require that TMT submit a Federal EIS.

Mr. Peek also quotes a 2005 Audit, writing "To reverse this "lax attitude", the Auditor urged the department to write its own comprehensive management plan for the mountaintop: "The Department is required to prepare a comprehensive management plan for areas in the reserves system and is empowered to enforce the laws, rules and regulations applying to the reserves." (p.32)

Applicant's Response

The statement by the State Auditor, found under the heading "A comprehensive management plan for the Mauna Kea Ice Age Natural Area Reserve has yet to be developed", clearly refers to the lack of a comprehensive management plan for the Ice Age Natural Areas Reserve (NAR). It does not refer to the Mauna Kea Science Reserve (MKSR), which is not part of the NAR.

Fred D. Stone, Ph.D.

Mr. Stone opposes TMT for the following reasons:

- The public hearings held in Hilo and Kailua-Kona do not replace the public hearing required by the BLNR when it considers TMT.
- It is a violation of State Administrative Rules for BLNR to consider TMT as the required CMP is still under litigation.
- The UH CMP is referred to as the "Mauna Kea CMP" when in fact it only covers land leased to UH on Mauna Kea and not the whole mountain.
- Telescope construction is not included in the CMP in a comprehensive manner.
- There has been no Federal EIS or EA.
- This plan surpasses the limits set on telescopes.
- The Lease ends in 2033.

[8] OCCL staff would like to state unequivocally that the assessments in this report are his own, and that he experienced no pressure from his superiors, the University, members of Congress, Land Board members, contractors, nor any "political elites" in reaching any of the conclusions found herein (- Michael Cain, January 22, 2011).

- Baseline inventories need to be done at Hale Pōhaku, the road corridors, the staging sites, and the telescope site itself.

Applicant's Response

At no point does the CDUA state or imply that the University can make commitments for land (e.g., the Natural Area Reserves) outside its control.

The other concerns have been addressed previously.

Deborah Ward

"OMKM had convened a wēkiu bug committee, which included Fred Stone and Frank Howarth, two of the scientists who recorded multiple thousands of the organisms unique to the Mauna Kea summit, in 1982, while conducting studies that led to an EIS, and subsequently to the recommendations in the Mauna Kea Science Reserve Complex management Plan.... After a precipitous decline in observed wēkiu numbers, the wēkiu bug was considered for listing as an Endangered Species, and had been Category 1 (highest eligibility for listing). Negotiations between OMKM and USFWS have led to a downlisting of the wēkiu bug status, but recovery efforts are ill-defined. "

Applicant's Response

The University shares Ms. Ward's continuing interest in the status of wēkiu bug populations. UH would like to clarify a few points mentioned in her comments.

The U.S. Fish and Wildlife Service determined that the wēkiu bug is a candidate for federal protection. Candidates are not categorized as either threatened or endangered. They are only categorized by priority. The wēkiu bug priority is an 8; low in priority. The determination of endangered or threatened is made when the species is listed.

"Category 1" is a term that has not been used by the USFWS for over 10 years; when it was used it did not mean "highest eligibility for listing." What it meant is that there was not enough information to consider the species for listing. Thus, there has not been a down listing of the wēkiu bug status because it was never listed. The USFWS has set the priority for listing at 8 due to the relatively low magnitude of the threats and the fact that threats did not occur throughout the species range. All candidate priority numbers are based on this type of threat assessment, not on negotiations.

Dr. Stone and Dr. Howarth participated in the 1982 survey of the wēkiu bug. During that survey multiple thousands of wēkiu bugs were not only recorded, but captured. In a subsequent survey there appeared to be many fewer wēkiu bugs. However, it is not certain whether this resulted from differences in natural environmental factors such as the amount of snow fall, the development of observatories, the trapping and removal of significantly large number of wēkiu bugs during the surveys, or a combination of these and other factors.

The TMT Project will not have a negative impact on the wēkiu bug, and TMT has agreed to work with OMKM on the development and implementation of a habitat restoration study.

Additional comments came in after the public comment period ended on December 3; OCCL will address the concerns raised in our analysis.

Sierra Club Moku Loa Group (Nelson Ho, Chair)

Sierra Club opposed the TMT for the following reasons:

- The CDUA is legally deficient, and contains insufficient information to allow BLNR to make an informed decision.
- There is an unresolved issue of how long the proposed facility will stay on Mauna Kea.
- There is insufficient disclosure of a major, new policy change in the management of Mauna Kea.
- The BLNR should not allow UH to front for the TMT with this CDUA.
- Without a Board discussion on the lease options … the discussion on monetary requirements and 'community benefits package' are merely anomalous[9] handouts.
- DLNR has its own procedures and rules to insure that Hawaiian cultural rights are preserved on state land. SC is concerned that you will be violating them if you approve this CDUA. Who is the Kahu Kū Mauna and can they determine the cultural rights and practices for all Hawaiians AND the public on Mauna Kea?

Kona-Kohala Chamber of Commerce (KKCC)

KKCC represents over 540 business members, and expresses full support for TMT. It will create exciting educational opportunities for our children, and support the local economy with high paying jobs.

The Pacific Resource Partnership (PRP)

PRP represents 240 union signatory contactors and the Hawaii Carpenters Union. PRP supports TMT, and feels that the Construction Plan is well thought out and will serve as a strong guide in complying with mitigation measures.

The Carpenters Union, Local 645, testify that 69% of their Hilo members and 91% of their Kona members are unemployed. Construction jobs have been the hardest hit in the on-going economic downturn. The TMT project will cost over $1 billion dollars, most of which will be federal money infused into the State and County. Material and equipment will be bought locally. Jobs will be created for construction workers, administrative and financial workers, mechanical engineers, software and IT engineers, steelworkers,

[9] Anomalous (adjective) - deviating from or inconsistent with the common order, form, or rule; irregular; abnormal: *Advanced forms of life may be anomalous in the universe*. (from dictionary.com)

electricians, plumbers, heavy equipment operators, laborers, trucking and shipping service workers, paramedics, security personnel, and vehicle mechanics.

Construction crew personnel are expected to receive union wages.

Hugh Y. Ono

Mr. Ono supports the project.

Roberta Chu

Ms. Chu believes that there has been a paradigmatic shift in how development is handled on Mauna Kea, and supports the project.

Cory Harden

Mr. Harden states that the project is "about making the illegal occupier of Hawai`i, the United States, world astronomy's top dog." He opposed TMT.

Richard Ha

Mr. Ha testifies that "we have a unique opportunity for change, where we can utilize these gifts so the economy can give, give, give and the culture can receive, receive, receive." He offers that TMT represents a patch to a brighter tomorrow, and supports the proposal.

Kukauakahi (Clarence Ching)

"The relationships acquiesced to by this CDUP could create dangerous hurdles for BLNR/DLNR, and has an odoriferous smell." Mr. Ching's complete testimony on privity, liability, credit and finance, banking feasibility, and fiduciary responsibilities can be found on page X of the Exhibits. He opposes TMT.

Hawaii Island Chamber of Commerce

The Chamber represents 300 member businesses comprising more than 700 individual members. They estimate that 300 construction jobs will be created during the eight to ten years of the project's construction, and 140 full-time employees. They believe that TMT will contribute to diversifying the Hawaiian economy, and support the project.

Nimr Tamimi

Mr. Tamimi believes that TMT is committed to proper environmental stewardship and the concept of sustainability planning, and supports the proposal.

Roxanne Kapuaimohalaikalani Stewart

"As a practitioner of Kanaloa and of Laka, of Ku and of Hina, and as educator of young Hawaiians," Ms. Stewart charges the Board to deny the proposal. She points out that "Once two stories of `aina has (sic) been unearthed and thousands of feet of sacred grounds has been demolished, there is no un-doing of these actions. The mountain is changed forever, the alignments are lost forever, the watershed is altered forever"

Gene Leslie, VP Hawaiian Civic Clubs, President Hawaii Land Council

"Because of open and transparent dialogue, we trust TMT in their commitment to be good stewards on Mauna Kea."

Gene Barber

Mr. Barber is a volunteer at Imiloa, and feels that TMT is a most desirable project for Mauna Kea, a win-win situation for Hilo and Hawai`i.

Vaughn G. T. Cook

Mr. Cook is pleased to see the progress that has been made and is confident that TMT will be a good steward of the mountain. He has come to know people involved in the project, and testifies that they are "capable and reasonable people of the highest integrity who have the best interest of the entire community at heart."

Jerry Chang, State Representative, 2nd District

Rep. Chang writes that "this is Hawaii's opportunity to show the world that we can, at once, support the advancement of science while preserving and respecting the host culture." He supports TMT.

Hawaii Island Chamber of Commerce

The Chamber has supported TMT from the very beginning due to the tremendous economic impact the project will have on the island for generations to come.

James Albertini, Maui `Aina Center for Non-violent Education & Action

The current state of Mauna Kea represents a microcosm of our planet heading off the cliff of Global Warming due to over-development. It is shameful that we disregard the host culture out of concern for science, prestige, and money. It is sinful. "The irony is that looking into the heavens will be our downfall because we have not shown respect."

Sara Peck

Ms. Peck testifies that CEO's of tech companies don't want to locate to Hawai`i because we don't have the educational capacity to provide employees for high tech industries. She

feels that TMT, and their support for the schools, could help change this. She supports TMT.

Andrew Chun

Mr. Chun believes that Hawaiians are open to change, and always have been, and that the ancestors would be supportive. He believes that we can be better stewards as we move forward, and supports TMT.

Newton Chu

Mr. Chu supports TMT. He would like to see astronomy move forward, and for our children to have jobs that would allow them to stay.

Stephen Yee

In this time of economic need, the opportunities TMT provides to the community cannot be missed.

David A. Byrne

Mr. Byrne believes that traditional culture, environmental concerns, and astronomy can coexist on Mauna Kea. He supports TMT.

Inge Heyer, Chair of Mauna Kea Observatories Outreach Committee

Ms. Heyer is impressed that the TMT team has been active in local outreach, and been an integral part of the community, from when they first arrived. She supports TMT.

Jacqui Hoover

Ms. Hoover's family hails from Waipi`o Valley; their oral history includes references to Mauna Kea and Poli`ahu. She writes, "My kupuna always thought and strategized in future tense – looking many generations forward. It is in keeping with this tradition, my education and training, and with the greatest respect for Mauna Kea and my kupuna that I support this conservation district use application."

Contested Case requests were part of the testimony from Mauna Kea `Anaina Hou, Fred Stone, KAHEA Environmental Alliance, Clarence Kukauakahi Ching, and Sierra Club.

PUBLIC TESTIMONY

Public Hearings were held at Hilo on December 2, 2010, and at Kailua-Kona on December 3, 2010. The Hearings were noted in the paper of record. Approximately 125 members of the public attended the Hilo meeting, with 51 persons providing oral testimony. Approximately 75 members of the public attended the Kailua-Kona meeting, with 33 members providing public testimony. There was a small amount of overlap between speakers at the two meetings.

Below is a brief summary of who spoke, and their position. It is not possible to give a complete accounting for each person; our hope here is to show the breadth and variety of views on the proposal. OCCL recorded the meetings, and the tapes will be part of the permanent file.

Hilo

Ross Wilson. Supports TMT. Believes that they have established a new paradigm with their listening sessions, support for the community, and willingness to care for the mountain's resources.

Roberta Chu. Supports. Notes that lease negotiations will be open and transparent.

Mike Kaleikini (for Jackie Hoover). Supports. TMT is a modern way for *mo`opuna*[10] to carry on ancient traditions. This allows us to carry on traditions that we begun centuries ago. Perhaps one day wayfaring will extend out towards the skies.

Skylark Rossetti (Mahi Lineage). Supports, but make sure things are done pono. Kupuna in the district have no problem, and are more concerned with the future of the mo`opuna.

David Byrne. Supports. Traditional culture, environmental protection, and science can coexist on the mountain with proper management and appropriate mitigation.

Frank Commendader. Supports. Children and grandchildren moved 'cause no more work.

Samuel Kaleiliki (Kingdom of Hawai`i). Opposes TMT. Prayed to Jesus in the House of Nobles. Doesn't support anything America puts before us. This gathering is run by immigrants. People need to go back to the dirt and start planting.

Mike Gleason (Hawai`i Island Chamber of Commerce). Supported this from the beginning.

Miles Yoshioka (for State Rep. Jerry Chang). Supports. Submitted written testimony.

[10] grandchildren, descendants; descendants two generations on.

Deborah Ward. Opposes. Asks for a Contested Case (OCCL presumes this request is on behalf of Sierra Club). Project ignores due process, CDUA is not applicable, the project isn't funded, TMT doesn't comply with NEPA, she's on the Environment Committee but OMKM ignores her suggestions.

Cory Harden. Opposes. This is about making the illegal occupier of Hawai`i the top dog internationally. UH violates laws for public trust land. This should discuss decommissioning in 2033 when the current lease ends.

Fred Stone. Opposes. Wants to know what the relationship is between Master Plan 2000 and CMP. Master Plan never went through the BLNR approval process, but CDUA is relying heavily on the plan. TMT also needs a federal EIS as there are federal funds involved, and this is grounds for a lawsuit.

Inge Heyer. Supports. TMT has volunteered to help many vital scientific education and literacy projects to survive. Their actions have shown beyond a doubt that they have a commitment to education on the island, and looks forward to the discoveries TMT might make.

Tom Peek. Opposes. Telescope limits have been sidestepped, there are inadequacies in management, the Department has not embraced its role as landowner.

Catherine Robbins. Opposes. There are twenty telescopes and the mountain is legally overbuilt.

Jon Miyata (Hawai`i Chamber of Commerce). Supports. Project will lead to 300+ direct and ancillary jobs.

Wallace Ishibashi (Poliahu Lineage). Supports. We must continue our search for knowledge, and he is proud that Hawai`i has the opportunity to do this.

Sally Miller. Opposes. This is not needed. This is a sacred mountain. There are environmental safety issues regarding digging into the soil. This mars the beauty of the mountain. It only provides jobs for scientists. Let people be farmers, and let them weave.

Galen Kelly. Opposes. Other kupuna are misguided. We are violated by the desecration of the sacred mountain, which is symbolic of the violation of the people. We should be able to go up and talk to god, to see god. There are also access issues.

Kini Burke. Opposes. Enough is enough.

Bob Lindsay (OHA Trustee). Supports. The framework for the protection of the mountain is now in place, and he wants to see its potential achieved.

Jim Albertini (Malu `Āina). Opposes. This type of industrial development is an environmental disaster. There is no study on carrying capacity. The host culture says the mountain is sacred. Science is all about prestige and money.

Nelson Ho (Sierra Club). Opposes. CDUA has insufficient information. There are unresolved issues of how long construction and lifetime of project will be. This represents a heavy industrial use forever. Says Hawaiian cultural rights must be preserved, and wonders who Kahu Kū Mauna is, and how they can represent Hawaiians.

Kealoha Pisciotta (Mauna Kea `Anaina Hou). Opposes. These proceedings violate due process and prejudice us as plaintiffs. Deny TMT for three reasons: There are legal issues involved, there is no federal EIS, the users are the parties who define desecration, and this cannot meet the 8 Conservation Criteria in HAR §13-5. "Creating jobs" is not a conservation criteria. You keep cutting up the culture, but where is the integrity for the sacred?

Jim Kennedy. Supports. TMT sets new standards of excellence.

Nimr Tamimi. Supports. Notes that there are cumulative impacts from hikers and skiers, yet these activities are allowed. Notes that there are numerous monitoring and environmental protection activities proposed.

Hanalei Fergestrom. Opposes. This is the Temple of Lono. We should spend more time correcting the known problems. The State of Hawai`i does not own the land; people of Hawai`i are only trustees and they don't have the right to give it away. "Mitigate means after I screw you, we'll figure out how to compensate." So you can rape a child and twenty years later pay him and say it's alright, because you compensated him? How can you sleep with this?

Ronald Fujiyoshi. Opposes. This is a monstrosity; Mauna Kea is a temple under siege.

David Deluke. Supports. There have been wrongs in the past, there will be mistakes in the future; the best we can do is learn from our past and attempt to apply that for the future. Is glad that there is dialogue. Feels that, at this point and time, TMT is needed.

Mahina Patterson. Opposes. Asks how to integrate science and culture. Telescopes have a direct cultural impact; the view of the telescopes on the mountain marred her understanding of her relationship with the akua and herself. This is not integration, this is desecration.

Jessie Cleghorn. Opposes. Utterly ashamed of what her government and her school have allowed to happen. The complete dominance of an externally focused industry on the most sacred lands Hawaiian have is ultimate environmental racism and injustice. Our world view as Hawaiians is based on the indigenous, scientific, and spiritual scientific understanding of the importance of unaltered undeveloped land.

Kaleo Lum. Opposes. This strikes at our heart. There is a fine line between traditional rights and modernization. You need to respect the native people of this land. A people that have been ignored for centuries are asserting their rights.

Dean Au (Hawaiian Carpenters' Union). Supports. We need this work.

Nancy Cabral. Opposes. She rode Mauna Kea Road on horseback, and understands its value.

Roxanne Stewart. Opposes. As a science teacher, she knows how these projects leave nothing but decimation in their wake. Any decision but denial would destroy a precious resource.

Randy Kurohara (Japanese Chamber of Commerce). Supports. TMT provides economic opportunities that we direly need. Tourism is not a sustainable driving economic device.

Keo Van Gogh (Mauna Kea `Anaina Hou). Opposes. If somebody submits a CDUA then the top tier thing would be to see if they meet the 8 criteria; then we wouldn't need to spend tax payer money fighting this and UH wouldn't need expensive lawyers.

Kihei Soli Niheu (NFIP). Opposes. When haole say "aloha" they don't mean it, because they don't live it. People misuse the term Hawaiian. You are American if you support the US Constitution, but you are not Hawaiian just because you have the koko. Don't say "indigenous" because that means "without soul" in Latin. Hopes young people carry on their beliefs. Struggle for independence is a long road.

Kukauakahi. Objects to the Hearings. Under the Hawaiian Kingdom this is not a valid process, so he submits his testimony under protest.

Kimo Lee. Supports. These hearings shouldn't divide people. If the children can participate it will make him happy.

Kristine Kubat. Opposes. This is like geothermal, where "people like me, haole from the mainland, had to back up the Hawaiians. We took it to the line. Bring it on – your telescope will not be built."

Paul Neves (Royal Order of Kamehameha). Opposes. This project does not meet the 8 Conservation Criteria in HAR §13-5. Demands that DLNR does their job. DLNR are supposed to be our *konohiki*. They would have been fired or killed back in the Kingdom.

Chad Kalepa. Supports. Hawaiians shaped the land – look at adze quarries, or fishponds, or lo`i. There is a change in the way things are being done on Mauna Kea. He believes we should be advocates for good stewardship. He is part of Kahu Kū Mauna, and they don't rubber stamp projects, and he invites the young people to be part of the process.

Isaac Kawika. Opposes. As a soldier in Afghanistan he learned to win the hearts and minds of the people by manipulating their greed and then stealing their land. It is the same thing that TMT is doing here. He came back to Hilo to find a war going on at home.

Denise Reggetti. Opposes. End the military occupation of Hawai`i now.

Kyle Kimura. Supports. Has been at `Imiloa for ten years. Testifies that TMT has done things differently.

Cristal. Opposes. The voices for the land speak from the heart, not from a script. TMT is a piece of crap.

Pete Lindsey (Local 3). Supports.

Kona

E. Kalani Flores, B. Pualani Case, Kapulei Flores, Hāwane Rios. Oppose. Submitted written testimony. The cumulative impacts are substantial, significant, and adverse. The FEIS is incomplete as it there is no consultation with the akua or any ancestors, directly or indirectly. The summit of Mauna Kea is the piko of the island, and if it is blocked then the reaction will be manifested in the elements.

Mike Kido (Pacific Resources Partnership). Supports. Has reviewed the Construction Plans.

Bob Trubell (Small Farmer). Supports. Society deserves the best science possible. TMT is good, but must follow the proper protocols.

Bob Meierdiercks (Hawaii Carpenters' Union). Supports. 90% of their workforce is unemployed, over 200 have been unemployed over 2 years. All ethnicities in Hawai`i have worked on the mountain on the other telescopes. TMT will benefit all.

Jacqui Hoover. Supports. TMT is fully consistent with purposes of Conservation District. Family is from Waipi`o Valley & believe in respecting tradition and remaining relevant in the 21st Century.

Greg Chun. Supports. This is about our relationship with the mountain. This was a use by our kupuna. Every important activity always occurred in the most sacred of places. They can coexist.

Vivian Landstrom. Supports. Bring high tech jobs back to Hawai`i. Our children can come home.

Richard Ha. Supports. Those on the lowest rungs of the economic ladder will be the first to suffer when the economy is hard, many of these are Hawaiian. TMT will benefit all.

Gene Leslie. Supports. 35 years with the Civic Club. After many years of open dialogue they trust TMT to be respectful stewards.

Bob Lindsey (OHA). Supports. TMT affords us the opportunity to continue to create a new paradigm for sensitive development on Mauna Kea.

Dennis Rattinger. Supports. He has no outside agenda and represents no group. Feels that if the past Polynesian navigators were here they would support TMT.

Marni Herkes. Supports. Sometimes we are guilty of not setting high enough expectations for our young people. They can achieve high standards if given the chance. Supporting educational opportunities like TMT is a step in developing upstream programs that will provide downstream benefits.

Sarah Peck. Supports. Her passion is education, and the educational system will benefit from TMT.

Cindy Armer. Supports. We need to increase educational opportunities on island.

David B. Gomes. Partially supports. The Universe is a sentient being. We are responsible for our part in the universe, and everything we do. The TMT is not necessary. It will not open the third eye, but it does improve our scientific and religious knowledge. Mauna Kea is sacred and part of the ley lines. Science and religion are not different. The government also hides knowledge of the E.T.s around us. We should work together.

Anne E. Field-Gomes. Supports. Thinks these opportunities are wonderful, and is amazed to think that today's children could help discover things unknown to us.

Russ Robinson. Supports. The host culture takes *mana* from the sky, and we could do the same. The glaciers came and went. The ocean dropped 300 feet and rose again. Asteroids destroyed life. The earth survived. And Mauna Kea survived.

Alfredo Gormozano. Opposes. Spent days and nights on the mountain asking for guidance in his prayers. Wondered how many planners have done this. Can planners see that there is a lot outside of science? We don't need more destruction to create jobs. Jobs will come and go, but the telescopes will stay. If we're going to develop, we need to connect first.

Donna Worden (Kohala Health Library). Opposes. Was educated in biophysics. People on the mountain now don't pay fair rent, and they don't take care of the place. The photos in the papers never show the whole mountain. This project might give five people a job for a couple years. We need to grow more food, but not put up more telescopes.

Kihei Soli Niheu. Continued testimony from previous evening. He was the founder of Hawaiian Studies program This history of America was built on slavery thievery rape and incest. It was built on lies, so when the government comes in they lie. Wants to know what the probity is between UH and TMT. Sang a song he had written, *Kukae Blues*.

Mahi (?) The mountain top is gone, so he can't fish. Fresh water comes from Waiau.

Kealoha Pisciotta. Continued testimony from previous evening. States the Batch Plant will be placed in the adze quarry, that the CMP was written by a public relations firm,

that not a single astronomer has gotten up to support the project, and that TMT is a "test bed" for a 100 meter or 200 meter telescope. Also notes that "we keep getting accused of misrepresenting projects."

Chad Baybayan. Supports. We can start to remove telescopes that are less optimal, and start migrating off the summit ridge and onto the plateau. Also notes that TMT will pay higher rent than the existing facilities, and that people "complain about the one dollar but shoot down the million dollars."

Josephine Keliipio. Opposes.

Deborah Ward. Opposes. Continued testimony from previous evening. Written testimony attached.

Kukauakahi. Opposes. Continued testimony from previous evening. Written testimony attached.

ANALYSIS

OCCL notified the applicant on October 14, 2010 that:

1. The project is an identified land use pursuant to HAR §13-5-22, Identified Land Uses in the Resource Subzone, R-3 ASTRONOMY FACILITIES, (D-1) *Astronomy facilities under an approved management plan.* This land use requires a permit from the Board of Land and Natural Resources (BLNR). The Board has the final authority to grant, modify, or deny any permit application.

   The BLNR approved the Mauna Kea Comprehensive Management Plan on April 9, 2009. The BLNR required the University to submit four sub-plans: a Natural Resources Management Plan, a Cultural Resources Management Plan, a Public Access Plan, and a Decommissioning Plan. The BLNR approved the four sub-plans on March 25, 2010.

2. The Chair of the Board of Land and Natural Resources authorized OCCL to conduct a Public Hearing pursuant to HAR §13-5-40 HEARINGS (a) *Public hearings shall be held* (4) *On all applications determined by the chairperson that the scope of proposed use, or the public interest requires a public hearing on the application.*

   Public Hearings were held at Hilo on December 2, 2010, and at Kailua-Kona on December 3, 2010. The Hearing was noted in the paper of record. Approximately 125 members of the public attended the Hilo meeting, with 51 persons providing oral testimony. Approximately 75 members of the public attended the Kailua-Kona meeting, with 33 members providing public testimony.

3. Pursuant to HAR §13-5-31 (4) *Permit applications,* the permit required an environmental impact statement (EIS).

   The Final EIS and associated ancillary documents were prepared under the supervision of the University of Hawai`i at Hilo, and were published in the May 8, 2010 edition of the *Environmental Notice*.

Notice of CDUA HA-3568 was published in the October 23, 2010 issue of the *Environmental Notice.*

CONSERVATION CRITERIA

The following discussion evaluates the merits of the proposed land use by applying the criteria established in HAR §13-5-30.

1. *The proposed land use is consistent with the purpose of the Conservation District.*

The objective of the Conservation District is to conserve, protect and preserve the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety, and welfare.

As discussed earlier, BLNR has approved the Comprehensive Management Plan and four associated resource sub plans to serve as a management framework for development in the Mauna Kea Science Reserve. All land uses and activities that take place within UH managed areas will be evaluated according to these plans and processes, subject to future modifications based on an adaptive management framework.

OCCL believes that astronomy is both an environmentally and economically sustainable use. In terms of the environment, it does not extract resources, nor consume significant resources once constructed. The TMT will have significant power requirements, but will not be a major contributor of greenhouse gasses in and of itself. The observatory will not be built in critical habitat for any species of concern, nor in an ecologically vulnerable area. It has a decommissioning plan associated with it which calls for the area to be restored to its existing condition once the observatory's lifecycle is complete.

Economically, the observatory will bring significant funds to Hawai`i and will provide needed blue-collar and professional jobs.

In addition, the financial and other resources that TMT will bring will improve the University's ability to implement many of the management plan actions.

OCCL has heard no credible testimony that the project would be a threat to the public health, safety, or welfare.

As the proposal will occur under a strong management framework, and represents a sustainable use of resources, OCCL concludes that it is consistent with this objective.

2. The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur.

The objective of the Resource Subzone, pursuant to HAR 3-5-13, is *to develop, with proper management, areas to ensure sustained use of the natural resources of those areas.*

The proposed use is an identified land use in the Resource subzone of the Conservation District, pursuant to HAR §13-5-24, R-3 ASTRONOMY FACILITIES, (D-1) *Astronomy facilities under an approved management plan.*

In April 2010 OMKM submitted their first yearly report to the BLNR on the status of the Comprehensive Management Plan's management actions. According to their information, 24 actions are on-going, 24 are implemented on an as-needed basis, and 4 are completed. OMKM also submitted an implementation schedule for the remaining 51 actions.

Following is a summary of the as-needed actions most relevant to the TMT proposal:

Complete an archaeological survey of the portions of the Access Road corridor.
Develop a geo-spatial database of all known natural resources.
Recommend that BLNR include CMP conditions as conditions of any CDUP.
Encourage existing facilities to use sustainable technologies
Require an independent construction monitor who has oversight and authority to insure that all aspects of ground-based work comply with protocols and requirements.
Develop, prior to construction, a rock movement plan.
Conduct required archaeological monitoring during construction projects
Require future observatories to consider site restoration in project planning, and to include provisions in subleases for full restoration.
Catalogue initial site conditions for use in restoration
Require use of close-contained zero-discharge waste systems.

OMKM's first yearly report to the Board is included in the exhibits. In addition, they contain a full summary of management plan actions that are relevant to TMT.

In addition to these, TMT has developed its own project-specific management plan, which includes:

A Historic Preservation Mitigation Plan (draft)
A Construction Plan
A Historical and Archaeological Site Plan
A Maintenance Plan, and
An Arthropod Monitoring Plan.

These plans contain numerous internal linkages to other plans and strategies, including the reporting plan, safety and accident prevention plan, cultural and natural resources training program, invasive species prevention and control program, waste minimization

plan, ride sharing program, fire prevention and response plan, and rock movement plan – such that contractors, scientists, and project managers should all be equally aware of the important protocols governing activities in the Science Reserve.

The TMT Management Plan will be updated every 5 years, as necessary, based on updates to the Mauna Kea CMP; the strengths or weaknesses revealed through the monitoring and reporting program; relevant new or modified laws, regulations, and policies; and modifications to the operation of the TMT Observatory.

OCCL has concluded that these integrated and overlapping management plans satisfy the objectives of the subzone.

3. The proposed land use complies with provisions and guidelines contained in Chapter 205, HRS, entitled* Coastal Zone Management*, where applicable.

The goals of the CZM program are to address issues from an integrated ecosystem perspective. In Hawai`i the entire State is considered to be in the Coastal Zone.

Many of the objectives of the CZM program outlined in HRS 205A – protection of historic resources, scenic and open space resources, and recreational resources – parallel the objectives of the Conservation District.

There are additional 205 A objectives specific to coastal ecosystems, and the impact of upland areas on coastal ecosystems. These are *to promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.*

Potential impacts could occur from the paving of new, impermeable surfaces. Beyond this, TMT has committed to a policy of Zero Waste Management. All wastewater will be collected and transported down the mountain for disposal. No wastewater will be released into the substrate. Water efficient fixtures will be used when feasible.

TMT will also implement a Materials Storage / Waste Management Plan, including a Spill Prevention and Response Plan.

OCCL received testimony from KAHEA that TMT planned to "haul chemical wastewater and hazardous waste down to the county dump." OCCL has not been able to confirm this, and notes that the application calls for waste to be transported to a waste treatment and disposal facility.

OCCL received testimony from Sierra Club and others that Mauna Kea is the principle aquifer for the island of Hawai`i, and they expressed concern that "if these waters are contaminated they can no longer be used for ceremonies, healing, and/or for drinking."

OCCL notes that the watershed recharge areas for Mauna Kea occur at lower elevations, where it rains, and not in alpine deserts, where precipitation is minimal. The impact from any waste spill would be negative, intense and localized, but would unlikely have any impact on the island's drinking water. The main anthrogenic threats to the Mauna Kea's aquifer occur at lower elevations in areas of heavier population and use.

OCCL concurs with the applicant that the project's impact on water resources will not be significant, and that the proposal is consistent with the guidelines and objectives contained in HRS 205A.

4. The proposed land use will not cause substantial adverse impacts to existing natural resources within the surrounding area, community, or region.

The Environmental Impact Statement identified the following areas of potential impact:

Cultural Practices and Historic Resources

In *Ka Pa'akai O Ka 'Āina v. Land Use Commission*, 94 Haw. 31 (2000), hereafter, "Ka Pa`akai," the Hawai`i Supreme Court laid out a framework for assessing cultural impacts. An assessment must include:

(1) the identity and scope of "valued cultural, historic, or natural resources" in the area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area;

(2) the extent to which those resources – including traditional and customary native Hawaiian rights – will be affected or impaired by the proposed action; and

(3) the feasible action, if any, to be taken by the (agency) to reasonably protect native Hawaiian rights if they are found to exist.

Cultural practices that occur or have been documented on the Mauna Kea plateau include worship, gathering of stones, burying of human remains, burying of *piko*, and gathering of water from Lake Waiau.

A number of historic trails also led to and crossed the summit plateau. Features found along these trails included religious and commemorative shrines, boundary markers, formal resting places (*o`io`ina*), places where mele were sung, and places where "propitiation would be made to various gods or spirits to insure safe passage of a completion of a task."[11] Historic maps do not show any paths crossing the northern plateau where the TMT is being proposed.

Of these, burial of human remains is currently illegal under state law, although lineal descendants still care for *iwi* that are on the mountain. The other practices continue, or are assumed to be continuing.

The State has identified three Traditional Cultural Properties that are most associated with these practices: Kūkahau`ula, Lake Waiau, or Pu`u Līlīnoe. The project will be located 3400 feet from Kūkahau`ula, and on the other side of the summit from Waiau and Līlīnoe. A portion of the Access Way will traverse the lower portion of Kūkahau`ula.

Historic resources identified by archaeological surveys in the Science Reserve include 141 shrines, 5 confirmed burial sites, 24 possible burial sites, 15 stone markers, 3

[11] Holly McEldowney 1982, taken from the *Mauna Kea Science Reserve Master Plan*

temporary shelters, 2 historic campsites, one historic route, and three sites of unknown function. There are an additional 300 ahu that have been built over the past 35 years.

There are no known burial sites, ahu, or other historic features near the project area. There is one ahu, built in the early 2000's, within 200 feet of the project area. The presence of the TMT will discourage the building of additional ahu on the five acre site. No other cultural practices beyond the building of modern ahu have been documented at the project site.

Access will be limited to the site during construction. OCCL concurs with the applicant that this action is important for public safety. The operation of the facility should have no impact on public access to the summit or the traditional cultural properties there.

Many persons testified that the very presence of a new facility, anywhere on the mountain summit, would be sacrilegious. It would affect the spiritual nature of the mountain as a *wao akua*, or place of the gods, and thus directly affect believer's religious practice.

OCCL also heard testimony from cultural practitioners who believed that modern astronomy and traditional practice are compatible, and that the observatories are a continuation of *kilo hoku*, the study of the stars engaged in by early Hawaiian astronomers, priests and navigators.

TMT has taken steps to minimize the direct and indirect impacts on cultural practice include: selecting a site off of the Kūkahau`ula Summit, and away from known resources and practices; selecting a location that minimizes the impact on view plains from recognized Traditional Cultural Properties; compliance with the actions outlined in the Cultural Resources Management Plan; and engaging in extensive consultation with Kahu Kū Mauna, the community, and cultural practitioners during the project development process.

Following the Ka Pa`akai framework, OCCL concurs with the applicant that the project will have a less than significant affect on the cultural practices, identified traditional cultural properties, and historic resources.

Biological Resources

Potential impacts identified by the applicant include dust generated by vehicle traffic along unpaved, the destruction of 0.2 acres of wēkiu habitat below Pu`u Hau`oki, and the disruption of approximately 6 acres of alpine stone desert. All other project areas have been previously disturbed.

The Access Way has been designed to limit effect on wēkiu cinder cone habitat by using the alignment of existing roads, and by reducing it to a single lane. Arthropod monitoring will be done prior to construction, during construction, and for two years after. A ride-sharing program will be implemented for employees to reduce the impacts from dust

generated by vehicle traffic. TMT will also work with OMKM to develop and implement a habitat restoration study.

The EIS notes that wēkiu were only found in low abundance in the above-mentioned habitat. Some surveys failed to uncover any. The disturbed area is not considered critical, and is relatively small. The larger wēkiu habitat will remain contiguous, which entomologists testified was the most important factor in sustaining healthy populations.

The alpine stone desert at the main project site is not considered critical habitat for any species of lichen, moss, floral, or arthropod species. Those that do occur also occur at higher densities elsewhere on the mountain, in more favorable habitats.

OCCL received testimony from Sierra Club and others that stated that TMT would put endangered species such as `u`au, (Hawaiian petrel, *Pterodroma sandwichensis),* palila (Hawaiian honeycreeper, *Loxioides bailleui*), and `āhinahina (Mauna Kea silversword, *Argyroxiphium sandwicens),* at risk of extinction.

The CMP and NRMP are intended to benefit the recovery of biological resources. and that. While `āhinahina once dominated the Mauna Kea landscape, its population has been decimated by introduced feral ungulates. Federal and state agencies are cooperating to control feral animals and help `āhinahina recover. A new population was discovered in the Science Reserve in 2007. OCCL notes that of the avian species Sierra Club mentions, palila live, breed, and feed in the māmane forest at much lower elevations, and `ua`u have not been observed in the Science Reserve in modern times,

OCCL concurs with the applicant that the impact on biological resources will not be significant.

View Plains

The current observatories are visible from 43 percent of the island's area. With TMT the observatories will be visible from 44.2 percent of the island. TMT itself will be visible from 14 percent of the island's area, and approximately 15.4 percent of the island's population. The impacted areas include portions of Honoka`a, Waimea, and Waikaloa.

The view plain analysis shows that TMT will extend the view plain horizontally. However, as it is located lower on the summit than existing large observatories, it will not impact the view plain vertically. It will also not be visible from the Wēkiu peak of Mauna Kea, nor from the identified Traditional Cultural Properties of Waiau and Līlīnoe.

TMT will be significantly visible from the lower peaks of Kūkahau`ula, where it will be the dominant feature on the landscape looking north. It will also be in the primary view plain of the town of Waimea and viewpoints along Highway 250.

The exhibits contain highlights of the view shed analysis contained in the application.

The location of TMT, off the main Kūkahau`ula Summit, is the primary mitigative action taken. The coating for the dome is a secondary measure; the aluminum-like coating will be less visible than other alternatives during the day, although it will be more visible during sunrise and sunset.

When viewed in context with the other existing observatories, OCCL concurs with the applicant that TMT will not have a significant affect on view plains or aesthetic resources.

Recreational Resources

OCCL notes that the summit region currently receives 200,000 visitors per year. Some do not venture past the visitor center, and OMKM does not have a count of how many continue to the summit. Of those who do, some come to view the telescopes, some for the views, some for recreation, and some for spiritual and cultural matters. Some come for all of these reasons. These numbers should be expected to increase as improvements continue on Saddle Road.

The primary recreational activities on Mauna Kea are hiking, stargazing, and snow play. The observatory is not near any active recreation area. It will not be lit at night, and will not interfere with any stargazing activities. The project should not have an impact on any of these activities during its normal operation.

The Batch Plant Staging Area is in an area used for hikers using the Lake Waiau trail, and for those who come to the mountain on snow days. Construction activities will limit parking here, and OCCL is concerned that visitors might be tempted to park off-road or in undisturbed habitat. We would like to see the applicant present a plan for handling recreational parking during construction.

OCCL also notes that, if the TMT is approved and built, it has the potential to be a significant tourist draw in its own right. OCCL notes that there do not appear to be any visitor facilities at the observatory site, and feels that this might be a missed opportunity for the project developers.

Sierra Club representatives have stated that "TMT could [bring] new restrictions on islanders' access to their beloved mountaintop, including nighttime gate closures and prescreening of all visitors to the summit."[12] OCCL can find no evidence to support this statement.

Water Resources and Wastewater; Solid and Hazardous Waste

These are discussed in the previous section.

Cumulative Impacts

[12] Nelson Ho, editorial Star Advertiser, June 4, 2010. The same quote was used in his letter to the editor of West Hawaii Today, June 18, 2010.

There are currently nine observatories on the Kūkahau`ula Summit three observatories just below the summit, and one two miles down slope. One of these is scheduled for removal.

OCCL heard public testimony stating that the maximum number of telescopes on the summit of Mauna Kea was officially set at 13, and that TMT would surpass this. This limit is not found in any Board-approved Management Plan, and OCCL is not aware of any Carrying Capacity study that would support this figure. We also note that, if TMT is approved, and CSO decommissioned, there would be nine telescopes on the summit, two immediately below the summit, one to the north (TMT), and one to the south – and thus a *reduction* in telescope numbers on and abutting the Kūkahau`ula summit.

The EIS concluded that the existence of observatories on Mauna Kea has had a significant impact on natural and cultural resources. The EIS noted that those impacts that are significant will remain significant with or without TMT, and that those impacts that have been less than significant will continue to be less than significant. In other words, the proposal will not create new significant impacts, nor significantly increase the existing impacts.

OCCL concurs with the EIS that the post construction impacts on Mauna Kea's natural and cultural resources will be less than significant. We have seen no evidence that the project would surpass the summit's carrying capacity, or that the cumulative impacts would be significant. Our conclusion is based on three significant factors: unlike the existing facilities the proposed location is removed from the Kūkahau`ula Summit and other identified culturally significant features, the proposed location is removed from critical habitat for threatened and endangered species, and the proposal will operate under a strong management regime.

5. The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding area, appropriate to the physical conditions and capabilities of the specific parcel or parcels.

Both proponents and opponents of the project testified to the important role that mountain summits and Mauna Kea had for *kilo hoku*, the navigators, astronomers, and priests who studied the heavens. However, the cultural and historical studies have uncovered no known mo`olelo that specifically tie Mauna Kea to traditional astronomy.

Opponents of TMT argue that a facility on the summit violates the sacred nature of the summit, and that any modern observatory is intrinsically not compatible. Others argue that modern observatories do have their place, but that the TMT specifically is not compatible. Finally, proponents argue that modern observatories are a continuation of Hawaiian tradition, and that TMT has been planned and designed with respect to that tradition and that it is compatible.

There is a strong historical association between mountains and the sacred in most world cultures, and there is also a strong association between the sacred and astronomy. The association of modern, scientific astronomy with mountains, however, is more recent. Galileo's observatory at the University of Padua in 1609 was only 12 meters above sea level. It wasn't until 1888 that the first permanently occupied mountaintop observatory was built, the 36-inch Lick Observatory at Mount Hamilton in California, at 1290 AMS.

King David Kalākaua had expressed an interest in bringing modern astronomy to Hawai`i,[13] and visited the construction site for Lick Observatory at the beginning of his world tour in 1881. Although the dome had not been completed, the 12" telescope was set up in the open air for the King to observe through. A telescope was purchased for Punahou School shortly thereafter; it was placed in a dome above the campus in 1884.

Since then telescopes have steadily climbed the summits, coming to Haleakalā in 1940 with the Grote Reber radio antenna, Mauna Loa in 1956 with the Mauna Loa Observatory, and Makapu`u on O`ahu in 1957 with the UH Solar Observatory. The first road to the summit of Mauna Kea was built by NASA in 1964, and the "seeing" tests that established the summit as one of the world's premier modern astronomy sites were conducted later that year by the astronomer, mirror maker, and Hawaiian steel guitarist Alika Herring.

By the mid 1990's a spurt of rapid development led many residents to take a new look at the University's stewardship role on the mountain. Public opposition to development on Mauna Kea begin to coalesce in 1995, when Nelson Ho of the Sierra Club and Mililani Trask became involved in issues regarding ceded lands. Their concerns led to a closer examination of the management regime on Mauna Kea, culminating in a 1998 State

[13] In a 1880 letter to Captain R. S. Floyd, President of Lick Trustees, the King wrote: *I must thank you sincerely for the pamphlet you sent me of the "Lick Observatory Trust." Something of this kind is needed here very much but we have so few people who take interest in scientific matters. Every body is bent upon making money in sugar and the all mighty dollar.* The original letter is with the Bishop Museum.

Audit that found that the University has been negligent in managing the cultural and environmental resources in the Science Reserve.

In 2004 OCCL opened investigations into alleged land use violations, and fined the University in 2004 for a series permit discrepancies and non-compliance issues at four observatories (reference, enforcement HA 05-08).

As discussed in the previous sections, a strong management regime is now in place that addresses many of the community's concerns, and that should prevent the abuses of the past. However, there is a strong contingent of residents who have reached the conclusion that science and their beliefs are in conflict.

Ian Barbour, the American physicist and theologian, identifies four distinct ways in which science and religion are related to each other[14]:

1. ***Conflict*** — the conviction that science and religion are fundamentally irreconcilable;
2. ***Contrast*** — the claim that there can be no genuine conflict since religion and science are each responding to radically different questions;
3. ***Contact*** — an approach that looks for dialogue, interaction, and possible "consonance" between science and religion. and especially for ways in which science shapes religious and theological understanding; and
4. ***Confirmation*** — the perspective that highlights the ways in which, at a very deep level, religion supports and nourishes the entire scientific enterprise.

Based upon the written and public testimony, it appears that many of the project's opponents align with the 'conflict' perspective of the first category. OCCL heard repeated testimony that Mauna Kea is a temple under siege, and many tied astronomy on the mountain to broader issues of cultural sovereignty and survival. A group of students from UH Hilo testified passionately that the presence of the existing telescopes impeded their connection to the akua. Others took this position even further, accusing scientists of being "motivated by pride, greed and arrogance," and asserting that "science leaves nothing but decimation in its wake."

This group allows no middle ground; for them there is no mitigation possible.

Most of the project's proponents, on the other hand, appeared to be in the second and third categories. Those that addressed spiritual and cultural issues stated that the two were interrelated, or else acknowledged the differences and looked for areas of dialogue.

[14] from Ian G. Barbour, *Religion in an Age of Science* (Harper San Francisco, 1990)

This is a remarkable change from thirty or forty years ago – anecdotal evidence suggests that a previous generation of scientists and managers on Mauna Kea were more dismissive of any spiritual concerns. There is certainly no indication that any report to this Board addressed deeper spiritual and cultural issues, or that the State ever took these into consideration when identifying land uses and classifications.

OCCL feels that this level of dialogue supports the applicant's assertion that TMT represents a new paradigm for development on Mauna Kea.

The second part of the question before the Board, though, is whether TMT itself is an appropriate use for the summit region, and more specifically, for the proposed site. There are those who support astronomy, and feel that it is a valid land use for the summit regions, and yet who feel that TMT is simply too big.

From a purely environmental perspective, staff believes that TMT is not "too big" – it's actual impact on resources will be less than smaller telescopes that were built in more vulnerable areas. On the other hand, it will be a significant *presence* on the mountain.

This is somewhat mitigated by the fact that TMT will be located at a lower elevation than the current group of telescopes, that it will be off the main Kūkahau`ula summit, and that it will not be visible from the Traditional Cultural Properties of Waiau and Līlīnoe. It will, however, be absolutely the most dominant feature on the north plateau, and will match Keck and Subaru for visual impacts from Waimea and Honoka`a.

OCCL heard testimony from individuals who felt that even this was appropriate, that the Hawaiians ancestors had mastered the art of wayfaring, and that TMT was a modern way for their *mo`opuna* to carry on these traditions - and that Polynesian wayfaring could lead us to the stars. In this view, a large project on Mauna Kea might be appropriate, but it must reflect *kūlia i ka nu'u,* a Hawaiian commitment to excellence.

OCCL believes that we should set the bar high. We acknowledge the sacredness of the mountain, and would insist that any development on it meet the world's highest standards of excellence. By this criteria, we find that TMT is a compatible use for this location.

6. The existing physical and environmental aspect of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, which ever is applicable.

As discussed in the previous discussions, OCCL has concluded that TMT will not have a significant impact on the environmental characteristics of the land.

In terms of beauty and open space, TMT represents a series of trades. Astronomy is an identified use in the Conservation District, and BLNR has approved over a dozen permanent and temporary observatories on the parcel since 1974. The majority of these were build in or adjacent to an area that is now recognized by the State Historic Preservation Division as a Traditional Cultural Property.

OMKM has stated that it is their goal for future telescopes to migrate off the main ridge and away from the TCP. TMT is being proposed for an area on the north plateau of Mauna Kea that has not hosted permanent facilities or developments. It is opening up a new area, but also leading the way in the move away from the more culturally and environmentally sensitive places in the summit region.

TMT has proposed some additional off-site mitigation. TMT will fund the re-naturalization of the closed Access Road on Poli`ahu, partially re-naturalize the Batch Plant Staging Area after construction, and camouflage the utility pull boxes in certain locations to reduce the visual impact from the summit area.

OCCL supports the concept of moving observatories away from the Kūkahau`ula summit ridge. If viewed from *only* the perspective of the north plateau, then TMT will have a significant impact. When viewed from the perspective of the whole summit region, and taking into consideration the off-site re-naturalization programs, OCCL concludes that the physical and environmental aspects of the land will be preserved and in some cases improved upon.

7. Subdivision of the land will not be utilized to increase the intensity of land uses in the Conservation District.

There will be no subdivision of land for this proposed project.

8. The proposed land use will not be materially detrimental to the public health, safety and welfare.

OCCL has seen no evidence that the project will be detrimental to public health, safety, or welfare.

Staff believes the proposed project has the potential to benefit the public health, safety, and welfare. There will be direct economic benefits through construction contracts, new jobs, and incoming research grants; and educational benefits by keeping Hawaiian institutions at the forefront of astronomical research. There is also the less tangible benefit of increasing humanity's overall pool of knowledge.

CONCLUSION

OCCL believes that the applicant has done a fair job in identifying the major and moderate impacts of the project, and in developing mitigation measures that will bring the long-term impacts down to either minor or negligible levels

Our conclusion is based on a number of factors: that the proposed location is removed from the Kūkahau`ula Summit and other identified culturally significant features, that the proposed location is removed from critical habitat for threatened and endangered species; that the proposal will operate under a strong management regime; and that the proposal will offer significant benefits to the economy, educational programs, and environmental protection programs.

Opposition to the TMT has been led by the Sierra Club, KAHEA Environmental Alliance, Mauna Kea `Anaina Hou, and the Royal Order of Kamehameha. These groups put forward four main categories of objection: that the project is illegal; ; that the project will cause significant environmental damage via the extinction of species and damage to the aquifer; that the project requires stronger management plans; and that the project will impact the sacred nature of Mauna Kea.

OCCL notes that "astronomy" is an identified land use in the Resource Subzone of the State Land Use Conservation District under an approved management plan, and that the Board of Land and Natural Resources approved both a comprehensive management plan and four resource management subplans. The Board has the legal authority to make a decision on the permit application. OCCL believes that the claims that the project is illegal are without merit.

Sierra Club representatives state that they are not opposed to astronomy or science, but have co-authored letters that "object to any telescope to continue its existence beyond the 2033 lease termination," and state that it is their policy "to discourage any further development within the Mauna Kea Science Reserve until such a plan has been approved by BLNR and taken into consideration in all future operational and development efforts in the Reserve."[15]

Sierra Club calls for BLNR to approve a new "stand-alone comprehensive plan to be prepared by a disinterested party, with active participation of community groups and interested parties, to faithfully serve as a planning and operations guide for a balanced approach towards activities and development within the Mauna Kea Science Reserve"

Like Sierra Club, KAHEA's official position also seems to vacillate between "do another plan" and "stop the bulldozers." In some public testimony they claim to respect astronomy, and that they merely seek better management of the mountain's resources. This position is then seemingly contradicted by statements that TMT is a "massive

[15] Taken from hawaii.sierraclub.org; accessed January 18, 2011

expansion of industrial land use" backed by "immensely wealthy organizations and some of Hawai`i's highest paid lawyers" intent on "further desecration."[16]

Mauna Kea `Anaina Hou echoes the claim that the Comprehensive Management Plan is inadequate, but takes the argument a step further, stating that "Mauna Kea's public lands are being exploited by foreign nations, corporations, and the University of Hawaii who are all seeking to profit from telescope construction on the summit at the expense of its unique natural habitat, pure drinking water, and sacred cultural resources."[17]

It was concerns raised by Sierra Club and others that led to the 998 State Audit which found that the University had been negligent in managing the cultural and environmental resources in the Science Reserve. The audit, and subsequent lawsuits, led to the formation of the Office of Mauna Kea Management and the development and BLNR approval of the Comprehensive Management Plan, the Cultural Resources Management Plan, the Natural Resources Management Plan, the Public Access Plan, and the Decommissioning Plan.

It is OCCL's opinion that a strong management regime, approved by the BLNR, is now in place for caring for the mountain's resources. TMT is the first significant project to be proposed under this new framework.

The fundamental flaw that Sierra Club et al. make is not recognizing that strong management - *which they fought for* - requires significant investment. Environmental protection costs money. Protecting historic and cultural resources costs money. Education costs money. Maintaining public access and ensuring the public safety costs money. Routine infrastructure maintenance costs money.

Stopping TMT, and fighting any and all development, will not restore the mountain to a pre-Contact state of grace. The existing roads, electric lines, and facilities will not disappear. Rather, as funds dry up, active and strong management will become difficult, maintenance and renovations will slow, infrastructure will crumble – and the very cultural and environmental resources that Sierra Club et al purport to protect will suffer.

Concerns about the project's impact on the spiritual nature of Mauna Kea remain. Interpretation of the spiritual impact is based upon individual perception; for some no mitigation is possible, and any development on the mountain would be sacrilegious. For other lineal descendants modern astronomy is consistent with the trajectory of Hawaiian culture, and they trace a line from the traditional navigators through King Kalākaua to today's scientists.

The TMT proposal acknowledges traditional and cultural practices, and the applicants have worked extensively with cultural practitioners during the planning and design process. A site was chosen that was removed from the most significant traditional cultural properties in the summit region. OCCL notes that these actions differentiate TMT from

[16] From KAHEA's page on Sacred Summits, kahea.groundwire.org/issues/sacred-summits, Accessed January 18, 2011.
[17] From KAHEA's website salsa.democracyinaction.org Accessed January 18, 2011

previous observatories on Mauna Kea, and lend credence to the proponent's claim that TMT represents a "new paradigm."

As they have in the past, the Board faces the difficult task of deciding whether the project may proceed, and will need to weigh the public benefits of the proposed project against the remaining cultural impacts to the summit plateau. OCCL has tried its best to represent the range of viewpoints on this project, and has included the full text of many documents for the record.

OCCL has concluded that the applicant meets the Conservation Criteria outlined in Hawai`i Administrative Rules (HAR) §13-5. After careful review of the application and associated environmental documents, and balancing the potential benefits against the potential impacts of the project, OCCL will recommend that the Board approve this proposal.

Should the Board decide to approve a Conservation District Use Permit for TMT, OCCL recommends that permit be subject additional conditions:

The following are based upon consultation with DOFAW:

- The University will ensure that the survey of the power line corridor easement complies with DLNR standards and is in accordance with the conditions contained in the grant of easement (including the Mauna Kea Ice Age Natural Area Reserve) that was approved by the BLNR in August 1985. The University will provide copies of the survey to DOFAW.

- OMKM will consult with the U.S. Fish and Wildlife Service and experts who are advising OMKM, including representatives from the DLNR, on surveys of the wēkiu bug and invertebrates regarding surveys along the utility corridor, including Pu'u Hau Kea and the pu'u west of the Parking Area 1.

- The construction contractor will be required to minimize the visual changes to land within the utility line right-of-way during utility upgrades. Any disturbance outside of the easement area of the construction corridor will be restored to the extent possible.

The following are based upon consultation with SHPD:

- Compliance with the Historic Preservation Mitigation Plan be specifically referenced by the Board as any condition of approval of the permit.

- The Archaeological Monitoring Plan will be submitted to the State Historic Preservation Division for review and approval prior to the onset of construction.

In addition, OCCL would assume that all mitigation measures and programs discussed in the EIS, CDUA, Construction Plan, and Maintenance Plan should be assumed to be part of this permit, including but not limited to:

- Employees will attend mandatory cultural and natural resources training.
- Outreach staff will work with the `Imiloa Astronomy Center and OMKM to develop information exhibits for visitors regarding the natural, cultural and archaeological resources of Mauna Kea.
- The applicant will fund the re-naturalization of the closed Access Road on Poli`ahu, partially re-naturalize the Batch Plant Staging Area after construction, and camouflage the utility pull boxes in certain locations to reduce the visual impact from the summit area.
- The applicant will implement an invasive species control program;
- The applicant will perform arthropod monitoring prior to, during, and for two years following construction in the area of the Access Way on the alpine cinder cone habitat.
- The applicant will work with OMKM to develop and implement a habitat restoration study.
- Wastewater will be collected and transported down the mountain for treatment as part of a "Zero Waste Management" policy.
- The applicant will fill employment opportunities locally to the greatest extent possible.
- Employees traveling beyond Hale Pōhaku will take part in a mandatory ride-sharing program using project vehicles.
- The facilities will use energy savings devices such as solar hot water systems, photovoltaic power systems, energy efficient light fixtures, and the use of Energy Star rated appliances.
- The applicant will provide $1 million annually, adjusted for inflation, for "Community Benefits Package" which will commence with construction and continue through the term of the sublease. The package will be administered via The Hawai`i Island New Knowledge (THINK) Fund Board of Advisors.
- The applicant will partner with other institutions to implement a Workforce Pipeline Program, headed by at least one full-time position through the Community Outreach office, to prepare local residents for jobs in science, engineering, and technical fields.

TMT will prepare annual reports for OMKM. These reports, due on December 31 each year, will provide OMKM with information about TMT's activities, potential new actions, goals, and objectives in the coming year. The reports would include information recorded in the on-going logs, records of annual staff Cultural and Natural Resources Training Program completion, and findings/outcomes of annual audits and inspections. **OCCL recommends that TMT provide OCCL and the BLNR with a copy of these annual reports.**

OMKM will conduct twice-annual inspections of the TMT Project site for evidence of CDUP and TMT Management Plan violations. **OCCL recommends that our office be notified of the inspection date, should staff be available to attend.**

The applicant proposes that the TMT Management Plan be updated every five years, as necessary, based on (a) updates to the Mauna Kea CMP; (b) strengths or weaknesses revealed through the monitoring and reporting program; (c) relevant new or modified laws, regulations, and policies; and (d) modifications to the operation of the TMT Observatory.

OCCL feels that it would be valuable for DLNR to be active participants in the management plan review. **OCCL recommends that the BLNR be allowed to name a representative from the Department to work with TMT on their Management Plan updates.**

Due to the challenges encountered when undertaking high-altitude construction, the applicant is requesting that the period allowed for the start of construction if a CDUP is granted by two years, and that the total time allowed for construction be ten years. OCCL has no objections to this, and will recommend that the Board modify the standard condition as requested.

RECOMMENDATION:

Based on the preceding analysis, Staff recommends that the Board of Land and Natural Resources Approve this Conservation District Use Application (CDUA) HA-3598 for the Thirty Meter Telescope at the Mauna Kea Science Reserve, Ka`ohe Mauka, Hāmakua District, Hawai`i, TMK (3) 4-4-015:009, subject to the following conditions:

1. The applicant shall comply with all applicable statutes, ordinances, rules, regulations, and conditions of the Federal, State, and County governments, and applicable parts of the Hawaii Administrative Rules, Chapter 13-5;

2. The applicant shall obtain appropriate authorization from the department for the occupancy of state lands, if applicable;

3. The applicant shall comply with all applicable Department of Health administrative rules;

4. Any work done or construction to be done on the land shall be initiated within two years of the approval of such use, in accordance with construction plans that have been signed by the Chairperson, and, unless otherwise authorized, shall be completed within ten (10) years of the approval. The applicant shall notify the Department in writing when construction activity is initiated and when it is completed;

5. Before proceeding with any work authorized by the Board, the applicant shall submit four copies of the construction and grading plans and specifications to the Chairperson or his authorized representative for approval for consistency with the conditions of the permit and the declarations set forth in the permit application. Three of the copies will be returned to the applicant. Plan approval by the Chairperson does not constitute approval required from other agencies;

6. All representations relative to mitigation set forth in the Environmental Impact Statement and Conservation District Use Application are incorporated as conditions of the permit;

7. The activities and conditions set out in the Historic Preservation Mitigation Plan, Archaeological Monitoring Plan, Construction Plan, Maintenance Plan, and Arthropod Monitoring Plan are incorporated as conditions of this permit;

8. The project will comply with any terms and conditions outlined in the Comprehensive Management Plan and associated Resource Sub Plans;

9. The above referenced activities include but are not limited to:
   - Ensuring that employees attend mandatory cultural and natural resources training;

- Working with the `Imiloa Astronomy Center and OMKM to develop information exhibits for visitors regarding the natural, cultural and archaeological resources of Mauna Kea;
- Funding the re-naturalization of the closed Access Road on Poli`ahu, partially re-naturalize the Batch Plant Staging Area after construction, and camouflage the utility pull boxes in certain locations to reduce the visual impact from the summit area;
- Implementing an invasive species control program;
- Working with OMKM to develop and implement a habitat restoration study;
- Implementing the "Zero Waste Management" policy;
- Filling employment opportunities locally to the greatest extent possible;
- Mandating that employees traveling beyond Hale Pōhaku take part in a ride-sharing program using project vehicles;
- Using energy savings devices such as solar hot water systems, photovoltaic power systems, energy efficient light fixtures, and the use of Energy Star rated appliances;
- Providing $1 million annually, adjusted for inflation, for "Community Benefits Package" which will commence with construction and continue through the term of the sublease. The package will be administered via The Hawai`i Island New Knowledge (THINK) Fund Board of Advisors; and
- Partnering with other institutions to implement a Workforce Pipeline Program, headed by at least one full-time position through the Community Outreach office, to prepare local residents for jobs in science, engineering, and technical fields;

10. The University will notify OCCL of the date of the twice-annual inspections of the project site, and allow staff to attend if available;

11. The applicant will provide OCCL and BLNR a copy of their annual report to OMKM;

12. The applicant will allow BLNR to name a DLNR representative to participate in the five-year management review process;

13. When provided or required, potable water supply and sanitation facilities shall have the approval of the department of health and the board of water supply;

14. The applicant understands and agrees that this permit does not convey any vested rights or exclusive privilege;

15. In issuing this permit, the Department and Board have relied on the information and data that the applicant has provided in connection with this permit application. If, subsequent to the issuance of this permit, such information and data prove to be false, incomplete or inaccurate, this permit may be modified, suspended or revoked, in whole or in part, and/or the Department may, in addition, institute appropriate legal proceedings;

16. Where any interference, nuisance, or harm may be caused, or hazard established by the use, the applicant shall be required to take the measures to minimize or eliminate the interference, nuisance, harm, or hazard;

17. Should historic remains such as artifacts, burials or concentration of charcoal be encountered during construction activities, work shall cease immediately in the vicinity of the find, and the find shall be protected from further damage. The contractor shall immediately contact HPD (692-8015), which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary; the applicant will also notify OHA at the same time;

18. During construction, appropriate mitigation measures shall be implemented to minimize impacts to off-site roadways, utilities, and public facilities

19. Other terms and conditions as may be prescribed by the Chairperson; and

20. Failure to comply with any of these conditions shall render this Conservation District Use Permit null and void.

Respectfully submitted,

Michael Cain, Staff Planner
Office of Conservation and Coastal Lands

Approved for submittal:

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William J. Aila, Interim Chairperson
Board of Land and Natural Resources