Kaena Point State Park

Conceptual Plan

Dept. of Land & Natural Resources
Division of State Parks
State of Hawaii

00096

KAENA POINT STATE PARK
CONCEPTUAL PLAN

PREPARED FOR
DIVISION OF STATE PARKS, OUTDOOR RECREATION & HISTORIC SITES
Department of Land & Natural Resources
State of Hawaii

CONSULTANTS

HAWAII DESIGN ASSOCIATES, INC.
Landscape Architects / Planners

ANBE ARUGA & ISHIZU ARCHITECTS INC.
Architects

DESIGN PLANNERS ASSOCIATES, INC.
Planners

EIS CORPORATION
Environmental Studies

MURODA & ASSOCIATES INC.
Engineers

SEA ENGINEERING SERVICES INC.
Oceanographic Studies

WILSON OKAMOTO & ASSOCIATES INC.
Engineers

hawaii design associates
landscape architecture / planning
1110 university avenue suite 507
honolulu hawaii 96814 telephone 955-6074 / 947-4327

April 24, 1978

Mr. William Y. Thompson
Chairman and Member
Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii 96813

Dear. Mr. Thompson:

It is our pleasure to submit to you the Conceptual Plan for the Kaena Point State Park.

The purpose of our study was to investigate the recreational potentials of the western most portion of the Island of Oahu, and to develop a plan to guide improvements and protect the region for present and future generations. Although the study encompassed over 15,700 acres, only 2,830 acres has been proposed for a State Park. The plan was completed after a comprehensive analysis was made of all the bio-physical, social, and institutional aspects. These factors were then correlated and reflected as the objectives of basic goals established by the Division of State Parks.

We firmly believe that this plan will contribute not only towards meeting the demands for public recreation, but will also preserve the integrity of the site and surrounding areas and assist the State in achieving its long range planning goals.

It has been a gratifying experience for this firm to have been associated with you, your staff, and the people who have contributed so much in planning for the future of Hawaii.

Respectfully submitted,

HAWAII DESIGN ASSOCIATES, INC.

Melvin S. Kuraoka

MSK:hst

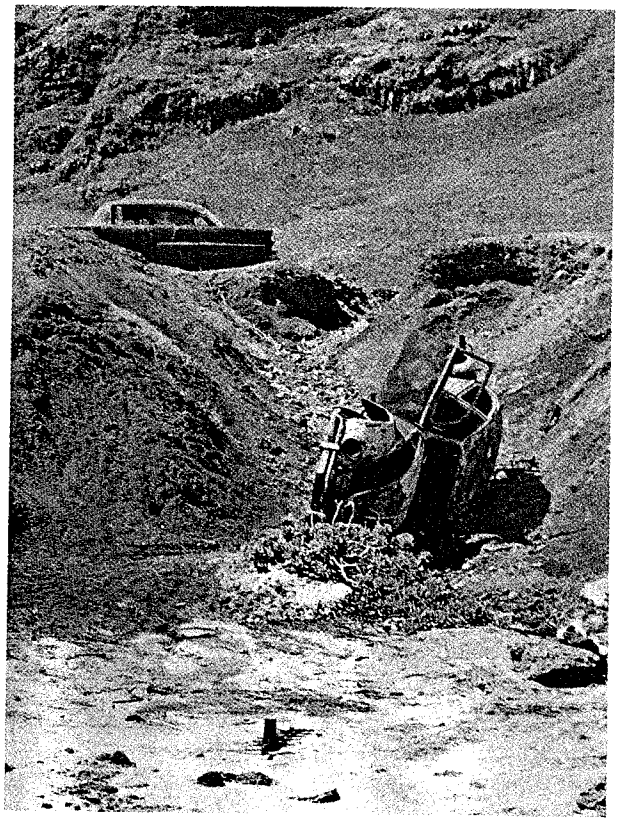
TABLE OF CONTENTS

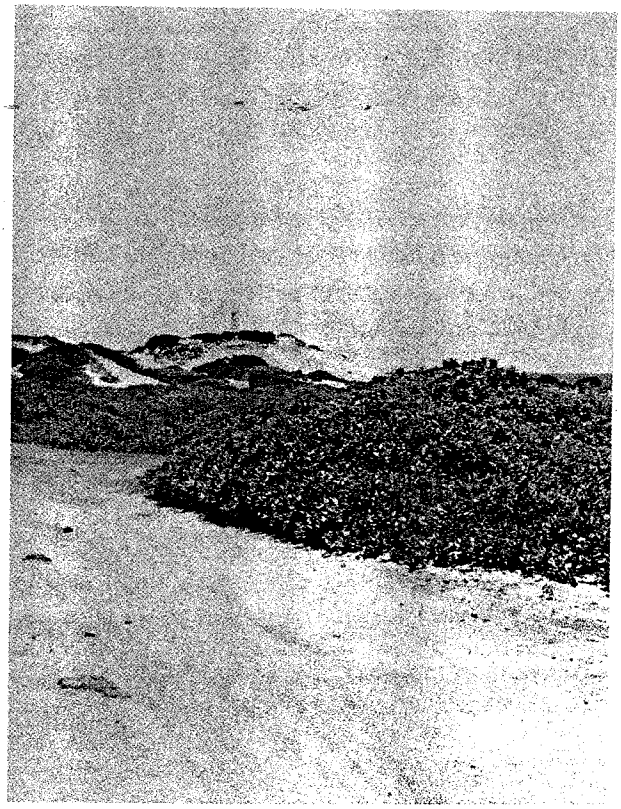
LIST OF FIGURES

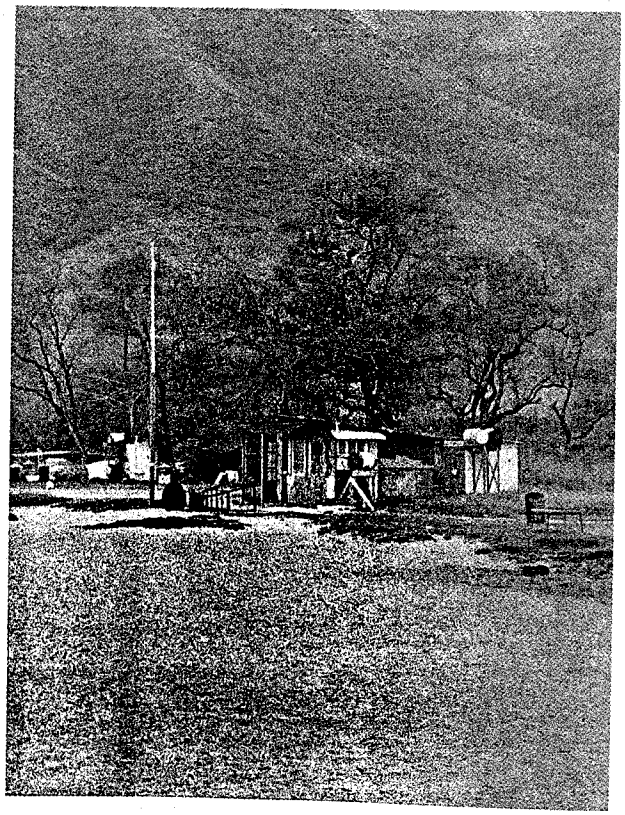
LIST OF TABLES

1

INTRODUCTION
THE PROCESS
THE PROGRAM
THE PLAN
BACKGROUND DATA
APPENDIX







PURPOSE

The Kaena Point region, or **Lands End** as it was called by early Hawaiians, is one of the last semi-wilderness areas remaining on the island of Oahu. The absence of an improved access route has maintained the region for many years in its natural, wilderness-like condition, thus conserving its resources and scenic beauty. Urbanization, which has rapidly encumbered and often destroyed other areas possessing similar qualities, has never gained an entry. More recently, however, increasing numbers of people have been attracted to the area, subjecting it to a variety of uncontrolled and conflicting uses and user conflicts. Many of these uses have resulted in destruction of fragile resources, and are threatening its unique character and values. The region is rapidly becoming a natural area in transition. Litter is marring scenic views. The unrestricted use of motorcycles and four-wheel drive vehicles along the coastal dune areas is increasing erosion and threatening native vegetation. Cattle grazing is destroying native plants as well as introducing undesirable species into pristine native forests. The uncontrolled use of firearms for target practice imperils the region's users to stray bullets. Fires caused by hikers, campers, motorcyclists, and military activities have damaged existing flora and subjected areas to erosion. If allowed to continue unabated, the region's natural resources and potentials for recreational, interpretive and educational uses could be lost forever. Proper guidelines and controls need to be established for immediate enforcement, or **Lands End could well become the End to the Land.**

In an effort to protect the environmental ethic while providing for public recreational use, the State Legislature authorized the Department of Land and Natural Resources, Division of State Parks, Outdoor Recreation and Historic Sites, to develop a long-range Recreational Conceptual Plan for the Kaena region. This study, then, is the process by which that plan evolved.

It is designed to:

1. determine the resources and their recreation values,
2. determine compatible recreational uses,
3. determine potential hazards, user conflicts, and constraints,
4. determine resource management needs, and
5. determine a mode of access which would best serve and be compatible with the planned recreation development.

In essence, this study provides the foundation or "program" for the Plan.

Conceived on the principle that planning for recreation is not merely an end unto itself, and that the Park is but a single feature within the total pattern of community form, it covers a wide spectrum of values that have a scale relationship not only to the site but to the surrounding communities, Oahu, and the State as well. In this manner, the study provides for a Plan that is also dedicated to over-all quality growth, and a higher purpose is fulfilled.

PROCEDURE

The scope of the study involved three major phases. Phase I was the research and analysis phase. It was the PROCESS by which the consultant assembled, evaluated and correlated an extensive amount of bio-physical, socio-economic, historic-cultural, and institutional data. Environmental, engineering, transportation, and oceanographic specialists, were consulted and numerous on-site investigations were carried out. Public input along with valuable reference material from published documents, drawings, maps, texts, and reports were also utilized. Vast quantities of information were necessary for the proper evaluation of an area as large and diverse as Kaena and for this reason, the study attempts to capsulize priority facts and features within the first section while providing more detailed studies under Background Data. As the material was analyzed and correlated, and as development potentials and constraints were identified, a basic philosophy emerged together with recommendations for park goals and objectives.

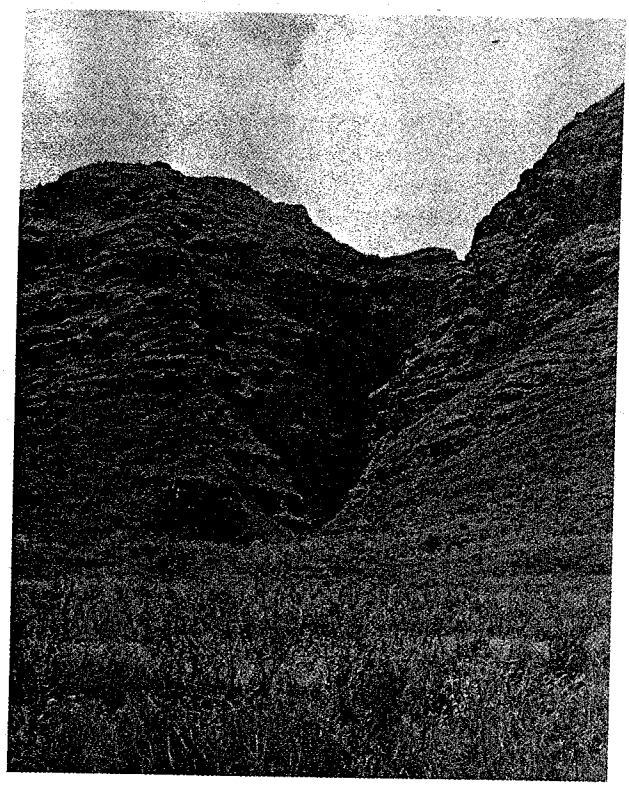
Phase II was a planning and design phase. It was an examination of design alternatives and development concepts based upon the identified recreation resource potentials and constraints, needs, public desires and recommended goals and objectives. In conjunction with this phase an Environmental Impact Statement, Notice of Preparation, describing these alternative development concepts was prepared and distributed for public review in March 1977. Public and agency responses were not only diverse but often conflicting. However, there was a general consensus for minimum improvements and preservation of the resources, which were incorporated in the recommendations which were submitted to the Board of Land and Natural Resources for review and acceptance. Upon acceptance in October

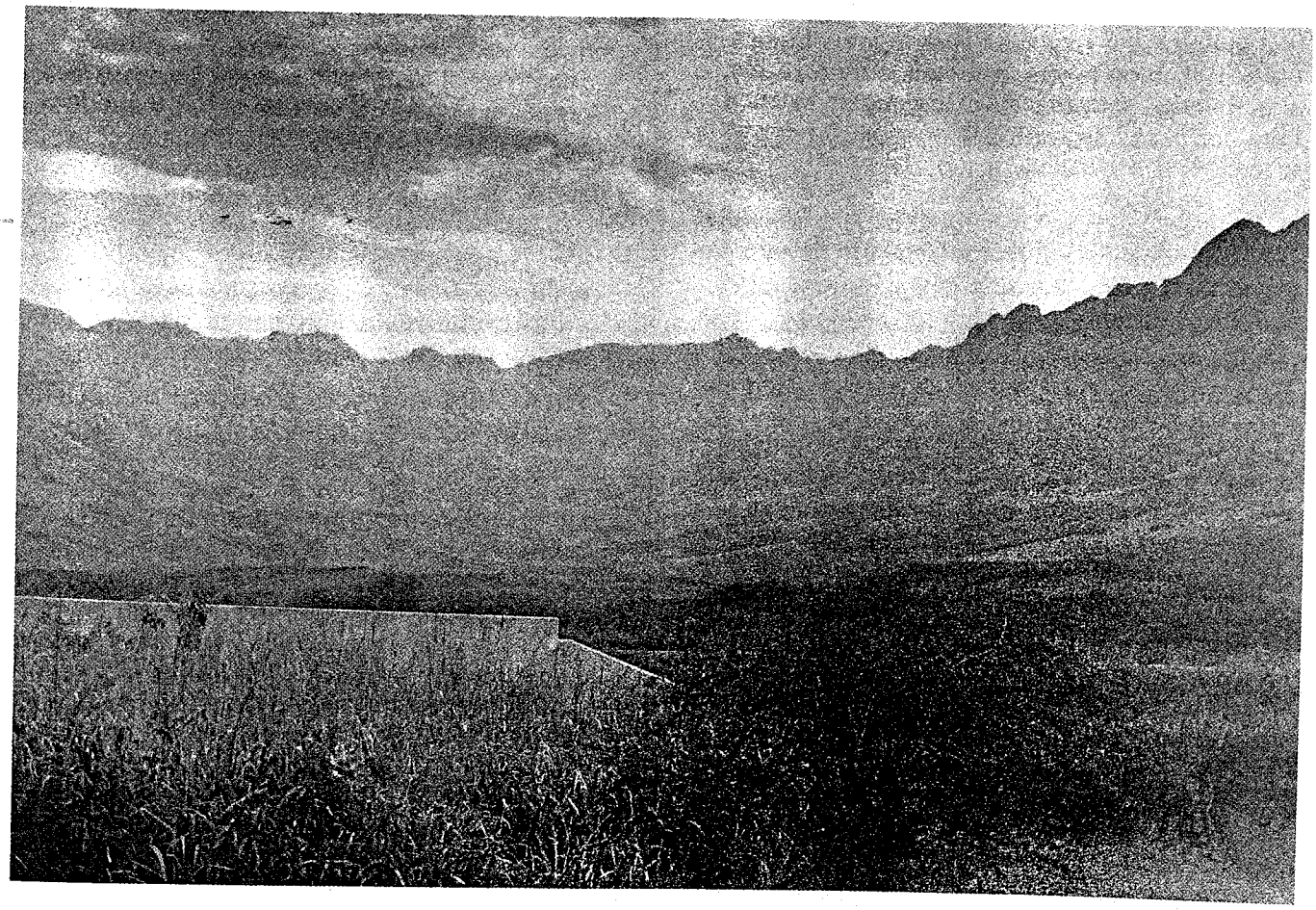
1977, the PROGRAM for the Conceptual Plan was complete: identifying basic philosophy, goals, objectives and concepts.

Phase III, was the development of the final CONCEPTUAL PLAN. It features detailed recommendations for the improvement and management of the proposed recreation area.

The study approach was adopted in the above sequence to assure the logical evolution of a dynamic plan as opposed to the imposition of a preconceived concept. In this manner, the plan is relevant not only to current application but to any future review or re-evaluation as well. If any one element changes over time, the change can be measured and re-correlated to provide for modifications.

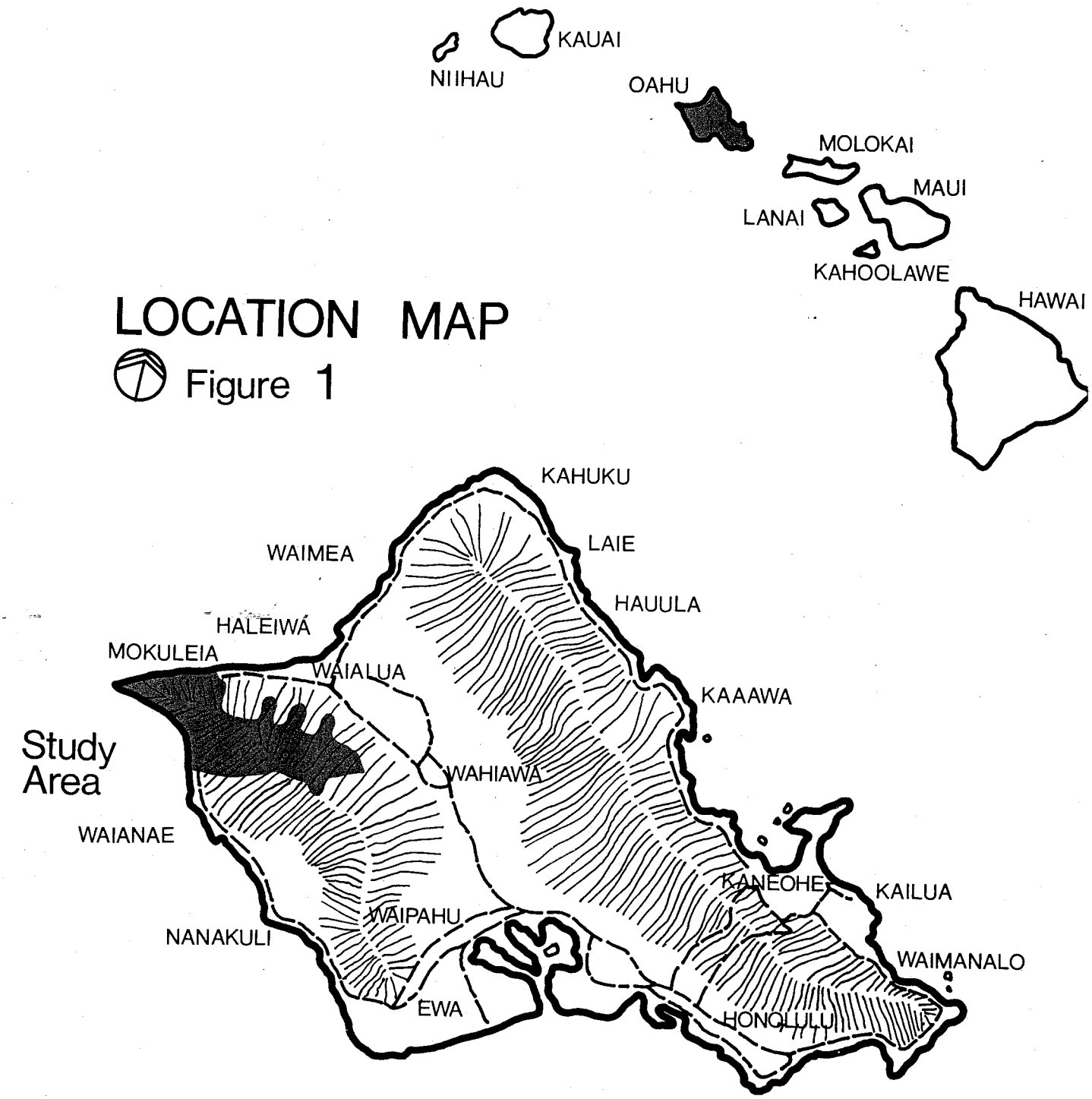
It should also be emphasized that throughout the study, input from private citizens, community groups, and public agencies have provided important information influential in the development of the plan and in the decision making process. This assured the success of the planning process and the relevancy of the final plan.





2

INTRODUCTION
THE PROCESS
THE PROGRAM
THE PLAN
BACKGROUND DATA
APPENDIX


KAUAI
NIIHAU
OAHU
MOLOKAI
MAUI
LANAI
KAHOOLAWE
HAWAI
LOCATION MAP
Figure 1
KAHUKU
LAIE
WAIMEA
HAUULA
HALEIWA
MOKULEIA
WAIALUA
KAAAWA
Study Area
WAHIAWA
WAIANAE
KANEOHE
KAILUA
WAIPAHU
NANAKULI
WAIMANALO
EWA
HONOLULU
ISLAND OF OAHU

BACKGROUND RESEARCH

LOCATION AND SIZE

The study area is located on the extreme western portion of the island of Oahu, and for study purposes, has been divided into three sectors—coastal, upland mountain, and Makua/Kahanahaiki Valleys. It is flanked by the rural communities of Mokuleia, Waialua, and Haleiwa to the east and Makaha, Waianae, Maili, and Nanakuli to the south. It encompasses approximately 15,700 acres including 10 miles of shoreline. The coastal area comprises 2,400 acres or 15% of the whole, from Kaneana (Makua) Cave to Dillingham Military Reservation. Makua/Kahanahaiki Valleys comprise 4,800 acres or 30% of the whole. The upland mountain sector takes in the remaining 8,500 acres, or 55% of the whole, and consists of all of the upper land of the Waianae Range from Puu Pane to Mt. Kaala, the highest point on Oahu, and down to Puu Pueo just above Kaena Point (Figure 1).

DESCRIPTION

The Kaena region is a rugged, semi-wilderness area. It ranges from jagged coastlines with rocky headlands, long white sand beaches, sand dune areas, boulder beaches and sandy coves, to steep valleys, grasslands, and rich native forests. It is an area of intense natural and scenic beauty, "...an area of sweeping ocean and mountain vistas presided over by massive Mt. Kaala, Oahu's highest mountain."

Harry Witten
"Makua Kaena Park," April 1977
Honolulu Star-Bulletin

It possesses extremely unique and spectacular qualities that distinguish it from nearly every other area on Oahu.

ACCESS

Access is available along Farrington Highway from two directions: 1) from the Waianae Coast, a distance of approximately 42 miles from Honolulu to the end of an improved road beyond Keawaula Bay; 2) via Waialua, along the Mokuleia Coast and up to a point beyond Camp Erdman which is approximately 37 miles from Honolulu. An unpaved dirt road extends from the end of Farrington Highway along the Waianae Coast approximately 2½ miles from Kaena Point. The road is approximately 14 feet wide and in poor condition as a result of erosion and high wave action. Access beyond the end of the existing paved road from Mokuleia is also by an unpaved road which is in an eroded condition. Vehicular access to the mountain region of the project site from the Mokuleia side is by the existing paved Nike or Federal Aviation Agency (FAA) roads, and through the Waianae side by the Satellite Tracking Station road. Trails extend into the Waianae Range with access over State, military and privately-owned lands. Major trails are the Dupont (Kaupakuhale) Trail, Mokuleia Trail, Peacock Flats Trail, Kealia Trail and Kuaokala Trail (Figure 5).

Boat access is limited because of the rugged coastline and surf conditions. Access from the sea is safest at Makua and Keawaula Beaches.

CLIMATE

Temperatures range from a low of 50°F to a high of 96°F, with an annual mean of 75°F. High temperatures are somewhat reduced by the surrounding cool ocean currents. The days are generally warm, but the nights are typically cool (Figure 6).

Prevailing tradewinds are characteristically northeasterly and easterly. Average wind movement is approximately ½ mph, but velocities approaching 50 mph have been recorded.

Rainfall on Oahu is generally attributed to the moisture-laden northeasterly tradewinds moving in from the sea. Subsequently, the Waianae Range of the study site receives less rain than the Koolau Range of eastern Oahu, and the Leeward or western side of the Waianae Range receives less rain than its windward side. It varies within a wide range from less than 20 inches along the semi-arid coastal areas, to 75 inches at the higher altitudes in the humid mountain areas. During an average year, almost 90% of the days in the lower regions have no rain. From October to April, storm-generated "Kona" winds deliver the bulk of annual rainfall to the leeward coast and, often, as much as 4.3 inches may fall within a 24-hour period.

GEOLOGY/HYDROLOGY

The geologic formations found within the study area consist of rugged lava structures, extensive calcareous sand deposits, towering cliffs, deep gorges, alluvial fans, dikes, mud flows, accumulations of basaltic outcroppings and benchrock, consisting of rounded basalt boulders (Figures 6 & 7).

The Waianae Mountain Range is the older of the two mountain ranges forming Oahu. It is basically a single shield volcano formed by repeated fis-

sure eruptions from three rift zones extending out from a central vent near the summit of the original dome. Streams carved deep valleys on the western range and lava flows resulted in steep slopes on the eastern range.

The majority of the fresh ground water supply in the Waianae district can be found between the lava flows of the lower and middle layers of the Waianae Volcanic Series. The aquifer is large and water is available from well sources along the coastline fronting Makua Valley and Mokuleia. The quality of water from wells tapping the aquifer is generally good, with the possible exception of sea water intrusion near the shoreline areas and leachate contamination by hydrothermally altered volcano rocks.

TOPOGRAPHY

The study area (Figure 8), is dominated by the Waianae range extending northwest from Mt Kaala down to Kaena Point at sea level. The range has a series of large deep valleys cut by wind and water erosion and nearly vertical cliffs up to 1,600 feet in height. On the leeward side of the range, two precipitous ridges extending from the main spine to the ocean define the gently sloping Makua Valley. On the windward side the slopes are not as uniformly steep and there are many valleys extending out toward the flat Waialua plain.

The following is a general slope breakdown on lands found in the study area:

SLOPE	ACRES	PERCENT OF TOTAL AREA
0–10%	±1,260 acres	8%
10–20%	±3,320 acres	21%
20–30%	±2,840 acres	18%
30%	±8,280 acres	53%
TOTAL ACREAGE	±15,700 acres	100%

ARCHAEOLOGICAL & HISTORIC SITES

Except for a study conducted in 1970 by S. Boucher along the Waianae Coast shoreline, no current in-depth archaeological studies have been conducted. Most of the archaeological sites known to or supposed to have existed could either not be located or have been destroyed. About all that remains as cultural testimony are the legends and chants.

Archaeological sites that do remain are high coral walls which probably served as cattle pens, house foundations, and numerous C-shaped structures and mounds, the exact purpose of which has not been determined. These were all located in the Keawaula Ahupua'a where Poha Cave is also found. Poha Cave is said to contain nine underground streams of fresh water that run to the middle of the channel between Oahu and Kauai. In the opposite direction, it is supposed to connect to a cave in Kaaawa on the Windward Coast (Figure 13).

In Makua, the only remaining significant features are the Ukanipo Heiau and natural cave formation which lies between the divide of Makua and Ohikilolo Valleys. This cave (Kaneana) was considered to be a sacred place and "Kapu", as religious ceremonies were held there. It is said to be the dwelling place of a shark-god or goddess and literally means "cave of god".

According to the State Historic Preservation Office, the remains of a fishing camp exists beneath the lighthouse on Kaena Point. The site itself is one of three open dune midden sites known for Oahu and is listed on the Hawaii Register of Historic Places. It pre-dates the European occupancy of the islands and is considered highly valuable both for its research potential and due to the fact that such sites are quite scarce.

Beyond the point towards Mokuleia is a large white rock which marks the boundary of the legendary "Souls Leap" so often referred to in Hawaiian religion. It is here departed souls are claimed to leave the earth and enter into "endless night". This legend underscores the spiritual significance of the point to native Hawaiians.

LAND OWNERSHIP AND TENURE

Most of the land within the study area for the park is owned by the state. This includes all of the Mokuleia and Kuaokala, and a portion of the Makua Keaau Forest Reserves. Approximately 40% of this state owned land is presently occupied by tenants under a general lease or revocable permit basis. The terms of the general leases are variable up to the year 2029. Those lands under a revocable permit (which is issued and administered by the State Department of Land and Natural Resources, Division of Land Man-

agement) are subject to more temporary terms, as defined here:

> "The Board of Land and Natural Resources may issue permits for the temporary occupancy of state lands or interest therein on a month-to-month basis under such conditions which will serve the best interests of the State, subject, however, to such restrictions as may from time to time be expressly provided by law. Such permit on a month-to-month basis may continue for a period not to exceed one year from the date of its issuance; provided, that the board may allow the permit to continue on a month-to-month basis for an additional one year period." (Hawaii Revised Statutes, §171-55).

Such land can thus be reclaimed by the State within 30 days, upon notice to the tenant. Approximately 15% of the tenant occupied land is subject to this ruling of the revocable permit.

The two principal tenants on state lands are the federal government (military reservations) and the Mokuleia Ranch and Land Company (pasture).

At least 50% of coastal land is also owned by the state and extends south from Kaena Point to the study limits at Kaneana Cave. The public has access to all of these shores. Included is a long stretch which was recently acquired and another section leased to the federal government. Along the north shore, east from Kaena Point, ownership of a 2½ mile stretch of shoreline is presently being acquired from the Mokuleia Ranch and Land Company.

The state also owns a valley parcel north of the northern boundary of the Mokuleia Forest Reserve, which is being used as a military reservation.

The federal government is the second largest landowner in the area, controlling approximately 25% of the study area. The largest parcel encompasses a large part of Makua and Kahanahaiki Valleys. It was ceded by the state to the federal government in 1964 by Executive Order 11166 signed by the President, setting it aside for military use with smaller parcels located to the east of Makua Beach and Kaena Point, and the Dillingham Military Reservation at the northeastern boundary of the study area. These areas were included within the study in the event the federal government decides the valley's use is no longer required and returns the land to the State.

Other major landowners abutting the study area include the Mokuleia Ranch and Land Company, Castle and Cooke (Waialua Sugar Company), Elizabeth Lester Marks, Makaha Valley Inc. (Waianae Development, Ltd.) and the Bond/Wild Estate. The Ranch Company, and Castle and Cooke almost entirely own the three lower valley areas north of the northern boundary of Mokuleia Forest Reserve. Access through and use of these lands is permitted with owner's consent. The Marks' property is located adjacent to the southern boundary of the site at Okihikilolo and the Makaha Valley, Inc. parcel is within the Waianae Kai Forest Reserve (Figure 15).

Smaller, private landowners have very small holdings which consist almost entirely of shoreline areas along the Windward Coast.

LAND ACQUISITIONS

Funds in the amount of 808,000 dollars were first released and deposited with the First Circuit Court of Hawaii in August, 1971, and the first actual acquisition occurred in December of 1975 when 385.58 acres of land and 1057 acres of sea fishery along the Leeward Coast were purchased from Mrs. Elizabeth Lester Marks. The purchase of this large, privately owned parcel placed land ownership under major control of the State. Presently, a majority of privately owned lands found along the windward coastal area have been condemned but not yet purchased. One small privately owned parcel located west of Camp Erdman and a larger parcel consisting of the northern half of Kaena Point itself will be condemned for park purposes within the near future. Since the first acquisitions were completed, the State has placed a high priority on the purchase of all remaining lands on the northern coastline of the study area for recreational purposes. However, lands currently owned by the YMCA at Camp Erdman are not considered necessary for acquisition due to the fact they are already recreation areas which makes their use compatible to the desired usages of the study area as a whole.

LAND USE PATTERNS

Historic

Historically, the land divisions (ahupua'a) within the study area have provided relatively poor land resources. Climatic and physical features limited the agricultural use of the land to, primarily, sweet potato cultivation. Taro was grown only in a few isolated areas where sufficient fresh water could be found. Makua Valley was said to be

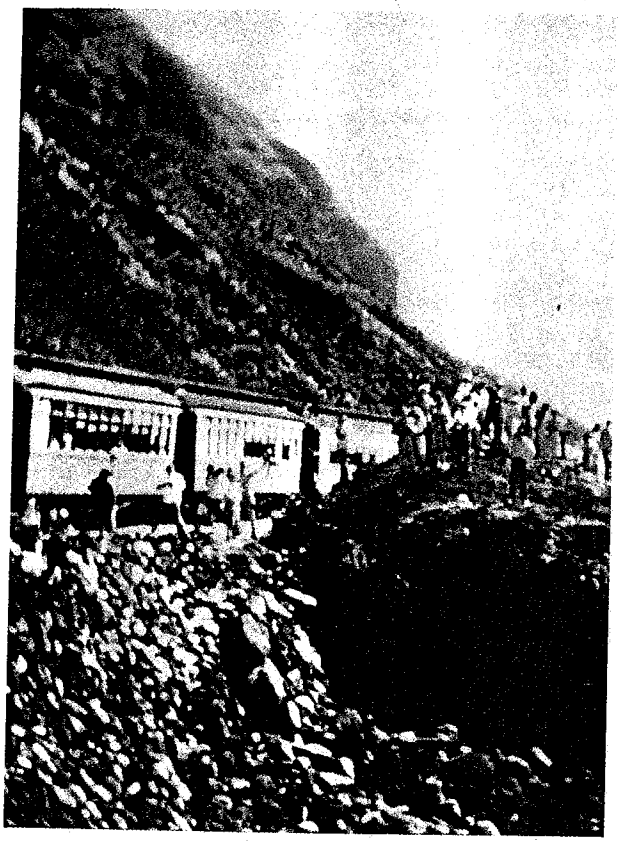
one of these areas and it is thought that there was enough fresh water so as to make it an exception to the rule. Nonetheless, whatever was denied early Hawaiians by the land, was given to them by the sea. Flourishing livelihoods were maintained through an abundance of rich marine resources. The coasts were dotted with camps, villages, and fishing shrines. Family groups fished the shores and deep sea fishing was exceptional. Even salt deposits were harvested from along the coastline for use and for barter.

During the mid-1800's white settlers arrived and introduced vegetables and fruits not previously grown. Scattered clusters of sugar cane and an abundance of maile lauii grew in Koiahi Gulch next to Makua Valley. By the 1870's, ranching began in the area and most of the valleys were being used as grazing lands. With the completion of the railroad around Kaena Point in 1898, ranching soon became the dominant industry.

The railroad followed a coastal route from Ewa Plantation into the Waianae district, Makua Valley, and on up to Kaena Point. It then circled the Point, passed through Waialua and extended all the way into Kahuku. For the next fifty years the trains transported cattle and pigs to slaughterhouses and moved vegetables and fruits from Makua Valley to urban markets. By the mid-1930's, Makua Valley was yielding commercial crops to markets as far off as Honolulu. These crops included sweet potatoes, watermelons, corn, cucumbers, pumpkins, papaya, and even tobacco and cotton.

With the advent of World War II, the United States military declared martial law and confiscated Makua Valley to prepare for an expected enemy attack. In anticipation of invasion, defensive positions were created in extreme haste. Fences were torn down, wells and irrigation systems destroyed, and any available material that could be found was utilized. All inhabitants were finally evicted by June of 1942 and farming in Makua Valley ended. Before the war was out, it was being used as an intensive training and target area. Whatever survived the original takeover was eventually destroyed during this time. Buildings, homes, churches, and even cemeteries were laid waste. It is also speculated that any archaeological or historic sites that may have existed were also razed. Bombing, target practice, and military maneuvering continued from this period on into the present.

Little recorded history of early Hawaiian activities exists about the upland mountain areas. However, the development of Makua and Kahanahaiki Valleys in the early 1900's for ranching caused cattle and horse grazing to overflow from the valleys into the upland areas especially a Kuaokala. Pineapple cultivation was also attempted at the plateau of Kuaokala.



Existing

All of the State owned land not occupied by tenants is open to the general public for recreational purposes. This includes both Kuaokala and Mokuleia Forest Reserves and most of the shoreline from Mokuleia to Makua Valley. Hunting and hiking are the principal activities on the reserve lands while fishing, educational walks, picnicking, camping, surfing, motorcycling, and hiking all are popular along the shores. Leased lands are used primarily for pasture and military purposes. The upland mountain areas above Kaena Point are leased for pasture and hunting is also permitted as it is part of Kuaokala Game Management Area. The coastal lands fronting Makua Valley and mauka of Keawaula Bay are military training areas. The shoreline within these boundaries is open to the public for recreation.

Federally owned Makua Valley is divided into a major maneuver area and a heavily used impact area for live fire exercises and aerial helicopter

gunnery qualification. It is also the sole facility on Oahu for disposing of approximately one hundred fifty to two hundred ten tons of explosives and unserviceable ordnance annually. The impact area is heavily contaminated with unexploded ordnance and is closed to the public. The quantity and location of undetonated material is unknown.

The ridge above Kaena Point is used by the United States Air Force Satellite Tracking Station. At the westernmost tip, the United States Coast Guard operates and maintains an automatic battery operated lighthouse. The Kaena Point Military Reservation located east of the point has been declared as excess of the needs of the United States Army in Hawaii. However, the House Armed Services Committee has not approved this action and has ruled that the U.S. Government is not in favor of relinquishing control at this time. Radar, radio, visual defense and television relay uses are also located at Mt. Kaala.

Privately owned land along the Mokuleia Coast and leased land at Kuaokala are used by Mokuleia Ranch and Land Company for grazing. Although recreational activities are permitted within these lands, permission for any use on or access through these lands must first be obtained from the owners.

Surrounding Areas

The major land use of territories abutting the northern boundary of the study area is, essentially, agricultural in nature. This includes the communities of Mokuleia, Waialua, and Haleiwa, which are all classified as rural and share unique homogenous characteristics. Extensive sugar cane cultivation exists in Waialua on lands owned by Castle and Cooke. In Mokuleia, the Mokuleia Ranch and Land Company currently use their lands for horse and cattle grazing. Dillingham Military Reservation is used as a general aviation airport by both civilian and military aircraft and quarrying operations exist nearby. Mokuleia is also a popular recreation spot. Camp Erdman operates recreational facilities along the beach on the western end and the United States Army maintains a beach park. Local residents enjoy the good fishing and surfing and it is here we also find the annual Hawaiian Polo matches where local teams host both mainland and international games. Haleiwa serves primarily as the center of commerce for the north shore communities and along with poultry, dairy and egg farming, an attractive commercial fishing industry is enjoyed.

Land uses for communities bordering the southern boundary of the study area are also agricultural in nature. Communities of Makaha, Waianae, Nanakuli and Maili are located along the major access route, Farrington Highway. Their agricultural activities are diverse and include lands for grazing, dairying, egg, poultry and pig farming, vegetable growing, floriculture and horticulture. Commercial fishing is plentiful within these communities and they also serve the tourist industry with several resort facilities in and around Makaha. Makaha Valley is highly valued for its recreational uses such as golf which is available at the Makaha Country Club and trail-riding out of the local stables. Makaha Beach has some of Hawaii's best surfing featuring both local and international surfing championships.

RELATED PLANNING POLICIES

Natural Area Reserves

At this time there are currently 12,683 acres of land officially in Natural Area Reserve Systems throughout the State.* Within the project study area, one site has been nominated and is awaiting final approval pending acquisition of private land within the designated area. This is the natural coastline ecosystem at Kaena Point, which includes all the area of the promontory itself up to the original railroad grade (Figure 11). It is the first of its kind to be nominated for inclusion in the system. The Kaena sand dunes provide critical habitats for a number of endangered endemic coastal plants and associated insects. These features have made this area suitable for inclusion in the Natural Area Reserve System.

*The Natural Area Reserve System was established by state law, Act 139 in 1970 to "preserve the perpetuity" specific land and water areas.

Another system of possible natural area reserves within the study area is presently referred to as the Kaala-Pahole Natural Area Reserve. The Commission has not yet submitted a formal nomination, but the process of drafting the proposal is underway. This ecosystem has notable associations of predominantly native flora as well as native insects and land snails. The reserve is planned to be relatively large, 2,700 acres, because the plants and animals display marked local endemism. It would occupy three sections—Pahole Gulch, the north slopes of Mt. Kaala, and

the western slopes of Puu Pane. These include four basic types of vegetation:

Semi-deciduous Seasonal Forest or Dryland Sclerophyll Forest

Evergreen Seasonal Forest or Mixed Mesophytic Forest or Moist Forest

Submontane Rain Forest

Montane Bog

Special Management Zones

The Hawaii Shoreline Protection (HSP) Act of 1975 was a significant step taken to protect and manage Hawaii's Coastal Resources. Special interim controls authorized by this Act have been adopted and implemented by each county until Hawaii's Coastal Zone Management Program for the State is developed and implemented. All of the shoreline within the study area, approximately ten miles, is presently within the area designated as a Special Management Area by the City and County of Honolulu (Figure 17). Specifically, it includes all of the coast from the quarry to Kaena Point extending 1,000 feet inland; all of Kaena Point up to Puu Pueo; south of Kaena Point from the coast to the top of the Waianae Range, including all of Keawaula and Kahanahaiki Valleys, and Makua Valley from the shore inland 3,500 feet. All development in the Special Management Area is processed through the Department of Land Utilization and is subject to review and approval by the City Council.

The Coastal Zone Management Bill (House Bill 122) was passed by the State legislature on April 4, 1977. The approved bill (Act 188) was sent to the Governor for his approval. It was signed on June 8, 1977.

Under this act each county is required to amend their present SMA's as necessary to conform with the policies and objectives set forth by the Coastal Zone Management Act. The signing of the Coastal Zone Management Act requires the counties to amend their regulations and boundaries within a two year period to conform to the objectives, policies and guidelines as enacted. Until that time the City and County of Honolulu will continue to issue permits under established guidelines set out by the Shoreline Protection Act which was incorporated in the Coastal Zone Management law.

State Land Use Designation

Lands located within the study area are governed by Federal, State, and County institutional controls. Land Use District boundaries, as *classified* by the State Land Use Commission, are Conservation and Agriculture. Lands within the Conservation District include the Mokuleia and Kuoakala Forest Reserves, Makua Valley, coastal areas from Keawaula around Kaena Point to the north, an area adjacent to Camp Erdman and the Dillingham Quarry. Lands currently owned by Mokuleia Ranch and Land Company on the northern portion of the study area along with lands on the upland areas of Kuaokala are presently classified as agricultural (Figure 16).

City and County General Plan & Zoning

The City and County of Honolulu General Plan has classified lands as Preservation, Park, Agriculture, Military and Residential. The majority of land is General Planned as preservation, with military and agricultural designations having the next largest acreages. Lands General Planned as Preservation include portions of Makua Valley, the Mokuleia and Kuaokala Forest Reserves, the uplands of Kuaokala, and the pali areas of Keawaula of Mokuleia. Lands General Planned for agriculture are found within Makua Valley, with other lands planned for military use located at Kaena Point (Coast Guard Facility and Kaena Military Reservation) northeast of Keawaula and Kahanahaiki Valley. The coastline from the southern boundary of the study area at Kaneana Cave around Kaena Point toward Camp Erdman is designated as park and concurs with the City's "lei of green" park concept for the island. An area west of Camp Erdman is classified as residential (Figure 16).

A new General Plan for the City and County of Honolulu was adopted by Resolution No. 238, on January 18, 1977. The General Plan is based on statements of Objectives and Policies. The Department of General Planning is presently preparing specific detailed Development Plans for the various regions of the island, which will not be completed until 1979. Until the plans are completed and adopted by Ordinance, the existing General Plan Map of 1964, Detailed Land Use Maps, and Zoning will remain in force and provide guidelines for land use decisions.

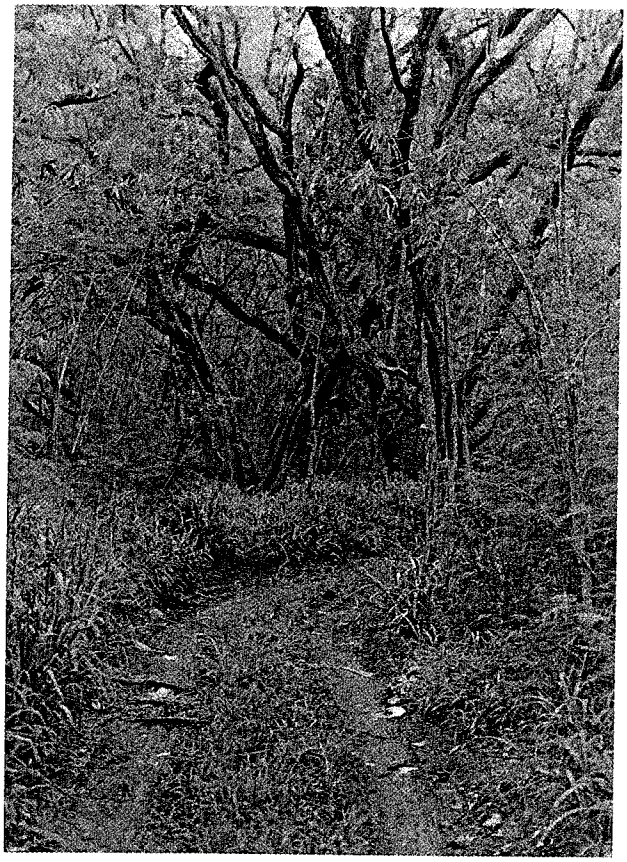
Zoning within the study area is Agriculture (AG-1) from Keawaula Bay south and west into Kahanahaiki and Makua Valleys. All other lands are zoned Preservation (P-1), (Figure 17).

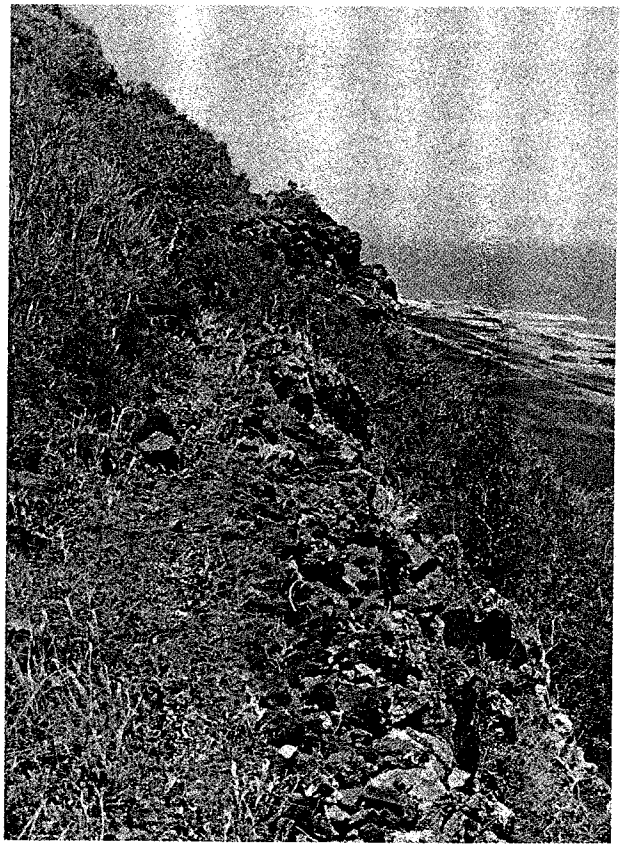
State of Hawaii Comprehensive Open Space Plan

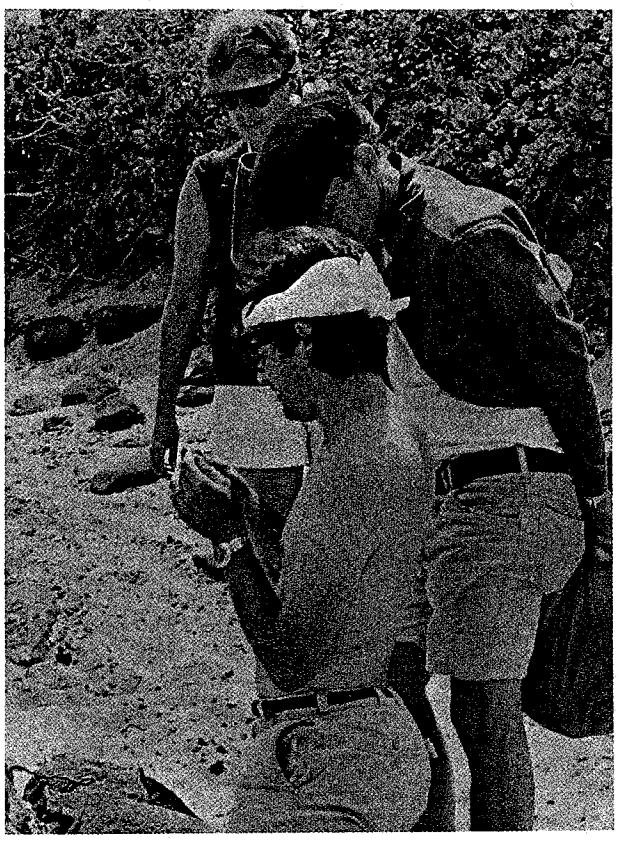
In 1972 the State Department of Planning and Economic Development conducted an open space study for Hawaii that encompassed elements that affect environmental quality, such as population policies, urbanization patterns, resource uses, transportational alternatives and other man-engineered growth factors. One of the goals of this study was the development of an Open Space Plan to provide guidelines to help the State achieve the highest objectives for land and water resources for the long range future of the State. The Open Space Plan identified and mapped those lands that are valuable in one or more of the following categories:

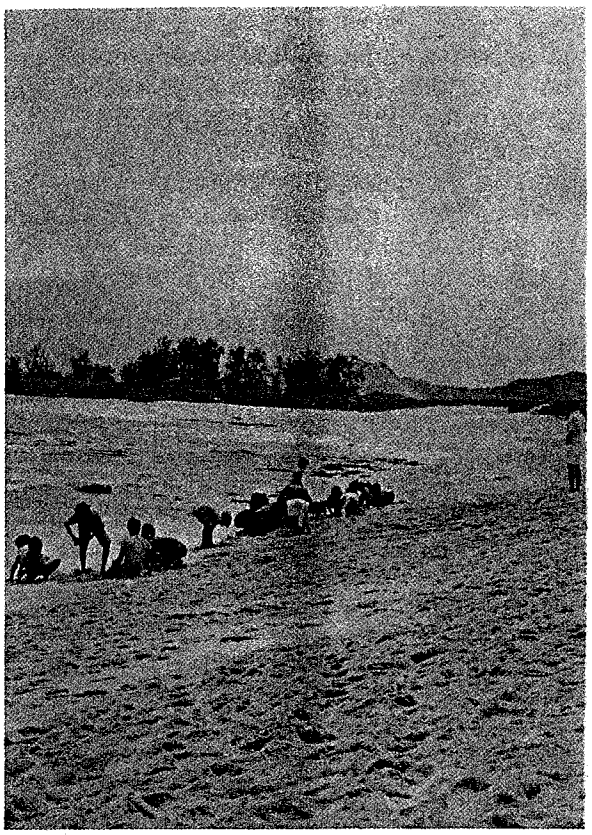
- Conservation and preservation of natural resources
- Agriculture
- Parks and recreation
- Historic and scenic preservation
- Public Health and Welfare
- Shaping urban growth

The plan is based on criteria compatible with statewide goals and can serve as a basis for future statewide quality growth. It identifies the Kaena Point region as an area that has potential for four of above listed criteria, namely, conservation and preservation of natural resources, development of parks and recreational facilities, an opportunity for historic and scenic preservation, and as a chance for promoting public health and welfare. The Kaena Point region is identified as one for high priority for state acquisition for open space uses.









BACKGROUND ANALYSIS/ EVALUATIONS AND CORRELATIONS

RECREATION DEMANDS

The 1975 State Outdoor Recreation Plan is the only available survey on recreation participation and projected user demands. Based on this study and our own observations of users and their activities within the study area, it is anticipated that the planned park will help satisfy the growing recreational demands of both the surrounding communities and Oahu as a whole.

On Oahu, the highest participation rates occur primarily at shoreline and off-shore areas and are mostly passive-oriented in nature. They include swimming, sunbathing, picnicking, walking and jogging, and bicycling. On week-ends nearly 40% of all these activities occur outside the districts where the participants reside. Apparently many of these recreators look to the districts surrounding the Kaena region to satisfy these demands as they are heavily impacted by outside users. The Waianae district (Waianae to Nanakuli) is a major recreational destination point with outside residents accounting for 55% of all users. In the Waialua district (Waialua to Punaluu) up to 75% are non-district participants. Most of the activities within these districts occur at shoreline areas and consist of swimming, sunbathing, and picnicking.

Although demands for coastal recreation activities involving beach use are fairly well met within the Leeward communities, in the Waialua district and on an island-wide basis they are not. Oahu supports the major portion of the state's population (82%) and visitor industry, yet there are only 657 beach acres available for public use out of which only 184 front an improved park. This is only .27 of an improved beach acre for each 1000 persons.

According to the 1975 State Comprehensive Outdoor Recreation Plan, demands for the following activities, which would be available within the study site, have been projected to be either high, medium-high, or medium throughout 1990 (Table 1). They were based on the existing supply of available recreation lands and current trends in population, tourism, incomes, and leisure time.

TABLE 1 IDENTIFIABLE RECREATIONAL NEEDS

OAHU

High	Medium
Swimming	Fishing
Sunbathing	Surfing
Beach camping	Diving
Beach picnicking	
Hiking	
Walking/jogging	
Bicycling	

WAIALUA-PUNALUU

High	Medium-High	Medium
Swimming	Diving	Swimming
Beach camping		Fishing
Beach picnicking		Surfing
Inland picnicking		
Hiking		
Walking/jogging		
Diving		

WAIANAE-NANAKULI

High	Medium-High	Medium
Beach camping	Bicycling	Beach picnicking
Inland picnicking	Fishing	Walking/jogging
Diving	Diving	Surfing

USERS

Users within the study area and adjacent lands consist of recreators, educators, land owners, local residents and other interested groups. Below is a list of groups who presently use the area and are concerned about its future. They have been listed according to shore, valley or mountain areas, depending upon where their activities and concerns are centered.

USERS	SHORE	VALLEY	MOUNTAIN
Fishermen	X		
Surfers	X		
Divers/Swimmers/Sunbathers	X		
Hikers	X	X	X
Campers	X	X	X
Picnickers	X	X	X
Educators: Nature Study (Plants, wildlife ecosystems)	X	X	X
History	X	X	
Archaeology	X	X	
Conservationists	X	X	X
Local Residents	X	X	X
Native Hawaiians	X	X	X
Motorcyclists	X	X	
Bicyclists	X		
Ranch Owners	X		X
Military	X	X	X
Visitors	X	X	X
Photographers	X	X	X
Horseback Riders	X		
Hang-gliders			X
Power Generator Advocates (windmills)			X
Hunters (bird and mammal)			X

USER CONSTRAINTS

There are two types of constraints involved, physical and institutional. Physical constraints constitute those limits which are imposed by physical conditions: surfers are confined to areas where wave action is good; fishermen, campers and picnickers are limited to walking or jeeps in getting to the promontory; motorcyclists are confined to available trail areas.

Institutional constraints, which predominate, include: limited access through privately owned lands which affects all users of the mountain uplands—hunting regulations; confinement of activities to specified areas—hunters restricted by game management areas, the military and ranchers (cattle) limited to their own boundaries.

USER VALUES, CONFLICTS AND CONCERNS

"Upon approaching Kaena Point one can feel relief from the pressures of urban living. We come to this sea-shore, semi-wilderness in search of some natural values from which modern man has been separated."

"A Nature Walk to Kaena Oahu"
Ed Arrigoni, February 1977

The special, wilderness-like quality of the area and the unique experiences it provides—**experiences which are physically, psychologically, and spiritually revitalizing**—is the highest, measurable value found among the users today. Consequently, maintaining and preserving this quality is a major concern. It is shared by recreators, sportsmen, educators, conservationists, and even the passing visitor. However, many of these users express their concerns for preservation in very subjective terms and their activities have become the source of various conflicts and disputes. Motorcyclists value the terrain and isolated location but only to the extent that it supports their particular activity. The fact that the activity is destroying native vegetation and advancing erosion is not included in their concept of preservation. The United States Military would also like to preserve the remoteness that a wilderness area provides as it insures the necessary distance between their target areas and the general public. Yet, judging from the destructive activities in Makua Valley, other wilderness qualities do not appear to be of significant value. Hunters value the wilderness for its plentiful supply of game animals but their activity, if not

controlled, may endanger the safety of other users. Furthermore, many of these hunted feral species play destructive roles in the area's bio-ecological processes, destroying native vegetation, contributing to erosion, and even indirectly affecting bird populations.

The area is also valued by ranchers for its grazing lands, by the United States Military for the special conformation of the land within Makua Valley which makes it ideally suited to their types of military activities, and by windmill advocates for its potential along the Waianae Ridgeline to provide an alternate energy source. These values, too, are a source of conflicts. Conservationists take issue with ranchers whose cattle are destroying native vegetation and contributing to erosion. The U.S. Military activities within Makua Valley have restricted public use within the valley and created safety and fire hazards. Those who advocate constructing the giant windmills find opposition from naturalists who contend that this type of construction in the area would violate its special scenic and wilderness quality.

Another issue of significant concern is the controversy surrounding the proposal to provide access by means of a scenic parkway around the Point. An improved road presents the threat of introducing uncontrolled and massive influxes of people. Those who oppose the road fear that such large numbers of visitors could not be controlled effectively and that widespread neglect and abuse to the environment would occur. Ironically, this could very well destroy what many of the road's supporters traveled so far to experience. Ranchers already endure rustling, vandalism and the neglect of visitors who allow cattle to escape and carelessly set fires. Sportsmen and conservationists fear a depletion of the biological resources, some of which are already endangered. Even surrounding communities feel threatened and are afraid their current rural life-styles and cultural values would be seriously altered.

RECREATIONAL POTENTIALS

Because of the region's outstanding combinations of undeveloped mountain, valley, and coastal areas, great opportunities for a wide range of potential recreational uses exist. Furthermore, unlike many other large, state-owned parcels which may have use and/or user restrictions, lands joined within the study area are not significantly diminished by the presence of prohibited restrictions. These areas of high recreational potentials are shown in figure 2.

Coastal Sector

Shoreline and offshore resources along the coastal areas offer a wide variety of recreational opportunities which include sunbathing, swimming, beachcombing, surfing, diving, fishing, canoeing, picnicking, bicycling, camping, scenic viewing, photography, hiking and walking. Potential for these activities is highest at Makua Beach, Keawaula (Yokohama) Bay, and within the lands surrounding Camp Erdman. These three areas have been identified as having high active recreational potentials, while the coastal areas in between Keawaula Bay and Camp Erdman would be best suited for passive recreational pursuits.

The Makua Beach—Keawaula Bay and Camp Erdman areas are recommended as **active recreation areas** due to their large white sand beaches, existing accessibility, and bio-physical resources which could support near and offshore recreational pursuits. Although both areas possess similar resource qualities, the areas surrounding Camp Erdman are less suited for intensive ocean related recreational usage due to climatic and hazardous water conditions. Strong, northeasterly trades result in constant exposure to high winds, turbid water conditions and dangerous wave activity during most of the year. The lack of mature trees along the shore to act as a windbreak and provide shade also makes the area unpleasant for recreational activity especially during the hot summer months. However, tree groves located mauka of the road do provide potential inland camping areas. While fishing, camping, sunbathing, picnicking and surfing potentials do exist, they are less desirable and require more knowledgeable or experienced users.

The Dillingham rock quarry located east of Camp Erdman will be returned to State control in the near future. Potential uses of this quarry and surrounding areas are for a park maintenance area, parking, firing range, and moto-cross course for motorcyclists who will be restricted from utilizing the coastal area between the control points.

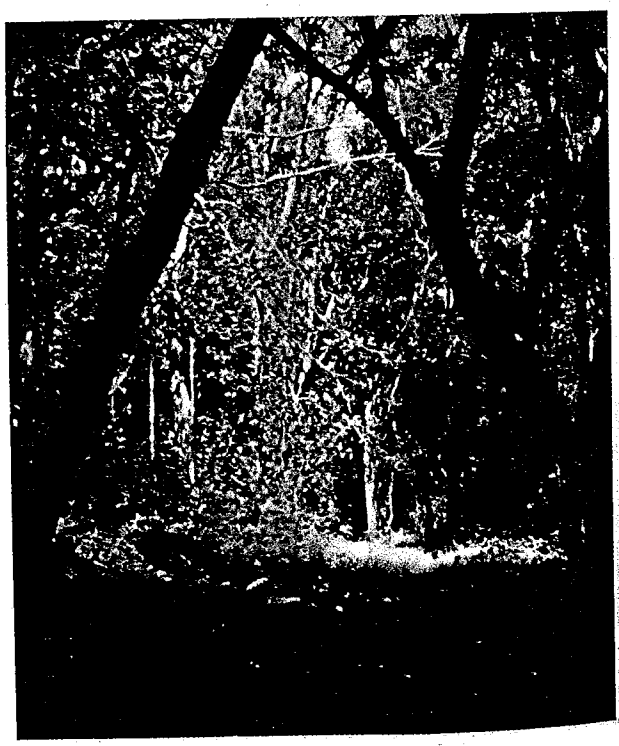
By contrast, Makua Beach and Keawaula Bay are both sheltered by the Waianae Range and have longer, sunnier days, lower wind factors, arid climates, and excellent water conditions. The water is easily accessible and much safer for swimming, fishing, surfing and diving, except during certain summer and winter months when large wave activity may occur. The presence of mature trees along the large white sand beaches, the protected shoreline and calm waters create an ideal setting for offshore and nearshore activities especially for family outings at Makua Beach. Keawaula Bay has similar qualities as those found at Makua. However, the lack of mature trees along the shoreline to provide protection from the sun makes this area more exposed. Mature kiawe forest stands further inland of Keawaula Bay provide an excellent area where camping activities could occur.

Areas of special interest found within the Makua Beach—Keawaula Bay areas are Kaneana (Makua) Cave, remnants of an old railroad grade, the Makua Protestant Cemetery, and other historical features such as the C-shaped structures, planting mounds, cattle pens and other remnants of past ranching activities.

The coastal area beyond the end of the improved road along both the windward and leeward coasts is best suited as a **passive low intensity** use recreation area where the major experience would be five miles of undeveloped semi-wilderness shoreline. This shoreline is ideal for fishing and other food gathering activities, hiking, photography, educational and interpretive pursuits. Geological formations such as sea cliffs and arches, caves, dikes, coves and coastal formations of rugged coralline rock, basalt ledges and boulders with interconnected tidal pools active with tropical fishes and fauna are excellent areas for educational and interpretive activities. Climatic conditions along the windward coastline towards Kaena Point are very similar to those conditions found in the Camp Erdman area. Constant exposure to strong, northeasterly trades, a hot arid climate, turbid water conditions and dangerous surf and tidal conditions create a harsher and wilder condition than those found along the leeward coastline. The leeward coastline from Keawaula Bay towards Kaena Point is better protected from the elements with nearshore and offshore waters best suited for fishing, diving and snorkeling.

The areas behind the two coastlines also differ. On the leeward coast the Waianae Range drops almost directly to the sea. The windward coastline has a wide, relatively flat plain approximately one half mile in width sloping from the toe of the Pali to the sea which provides an area for potential hiking, educational and interpretive pursuits. Several large gulches exist and remnants of an old path which once provided access to Kuaokala for pineapple cultivation are major points of interest.

At Kaena Point, the apex of two major ocean currents converge. Here breathtaking scenic views of both coastlines may be experienced. The area surrounding the point is steeped with Hawaiian legends and mythology and the open midden site is of great archaeological value. Also located at the point is a unique coastal ecosystem of flora ('ohai) which are found nowhere else in the world. Other remnants of the past include the old railroad grade, abandoned gun emplacements and building foundations that were erected during World War II.



Upland Mountain Sector

Although two other areas exist on Oahu for mountain related recreational pursuits, they are located directly adjacent to urban areas and the experiences there are never really fulfilling because of the restrictive factors imposed by urbanization. The sounds of cars and dogs barking can be readily heard and the general proximity of the natural areas are too often not sufficiently separated from adjacent urbanized lands to allow the recreator to fully realize the mountain experience. However, the upland mountain sectors of the Kaena region with its isolated conditions, cool climate, spectacular scenery, relatively low rainfall compared to other hiking areas in the wetter Koolau range, and native flora and fauna ecosystems creates one of the best locations on Oahu for mountain related activities.

Opportunities exist for a variety of experiences which could provide enjoyable alternatives to beach-oriented activities. These experiences include mountain hiking, camping, picnicking, hunting, scenic viewing, backpacking, and photography.

The upland mountain sector has been divided into two sectors, the **Central Upland and Remote Open Sector.** Found within the Central Upland Sector are two potential major active recreation areas located at the Nike Facilities and Peacock Flats. The Nike Facilities, already under state control, could be easily converted into a mountain headquarters with overnight group accommodations. However, these facilities have been vandalized and would require repairs and renovations before it could be opened for recreational uses. Because the facilities are completely secured by a fence, it would be an excellent facility for use by school aged groups. Cooking facilities along with water and power service would have to be re-established. Peacock Flats, the only developable area within this sector for park facilities, comprises approximately 100 acres of relatively flat rolling land within The Mokuleia Forest Reserve. Located over three miles away from the nearest urbanized community, the isolation of the area could provide a truly natural and stimulating experience for those who bring in their own equipment and supplies. The area's mature stands of eucalyptus and Norfolk Island pine provide a perfect setting in which to enjoy the sound of the wind through trees, the songs of birds, and the cry of the peacocks in the lower valleys. The tranquility of the area is matched only by the breath-taking view of the windward coastline and deep valleys. Camping and picnicking is anticipated as the major activity with secondary activities such as hiking, scenic viewing, photography, educational and interpretive pursuits to occur within the immediate areas. An easily traversable foot trail leads from the Peacock Flats area through a prime example of a native dry-land forest. Many of the species to be observed here often are read about but rarely seen by the majority of the population. A species of native land snails is also present along the route. The trail continues past an old abandoned forestry shelter to the rim of Makua Valley where the spectacular view of the Valley to the sea is to be found. Interconnecting trails are also located throughout the central upland area providing the recreator with ever changing conditions and scenery. Hunting could occur within this sector, however close coordination between the Division of Fish and Game, the Division of Forestry, and the Division of State Parks would be required to insure the safety of all users. Presently there are no permanent facilities or infrastructure to support use of the Peacock Flats area.

The remote open sector includes a majority of the Kuaokala Plateau and the Mokuleia Forest Reserve. Because the Kuaokala area is composed of mostly grasses and shrubs with isolated pockets of native and exotic dryland species, is hot and arid, and is presently used for cattle grazing, major recreational pursuits except for hunting are not desirable. Likewise, because a major portion of the Mokuleia forest is remote and not easily accessible and because it possesses areas of outstanding native flora and fauna ecosystems, it should be protected and preserved and not improved for major recreation use. Hunting would continue as the major recreation activity with hiking, educational and interpretive pursuits also permitted.

Makua Valley

Because of the dangers and hazards created by unexploded ordnance within both Makua and Kahanahaiki Valleys, any recreational activity at this time would not be feasible. However, should the state ever regain control of these federally owned areas and eliminate the safety hazards, opportunities for recreational and educational pursuits are great.

Makua and Kahanahaiki Valleys are surrounded by the Waianae Range with almost vertical sides rising over 2500 feet in height creating an amphitheater-like space on the valley floor. Present military facilities which exist on the valley floor include a guard/observation tower and heli-

copter landing pads located mauka of Farrington Highway, an explosive disposal area, and inoperable vehicles used as targets dispersed throughout the valley. Along the numerous ridges running like fingers vertically to this floor, a large number of endangered flora species have been protected from the direct fire of weapons and fires which often occur. Compared to these gulches, the floor itself is burnt over and the vegetation has been replaced with exotic grasses, shrubs and trees. Sloping gently from the sea it provides a large area where many activities could be supported. Because of its size and enclosure by the ridgeline, a traditional Hawaiian land division, or ahupua'a, could be established as a major educational and interpretive project. If a project of this magnitude was initiated and traditional use and respect of the lands and the surrounding sea instituted, the overall educational value to the residents of the state would be invaluable. Other major uses that could be supported are group and individual camping, hiking, horseback riding and scenic viewing. Historical and archaeological sites are known to exist within the valley and if restored would provide very important educational and interpretive features of Hawaii's past.

DEVELOPMENT CONSTRAINTS AND DESIGN CONSIDERATIONS

Constraints to recreational development are, essentially, physical and institutional in nature. They either positively prescribe desirable limitations or they negatively impose restrictions. Positive physical constraints are reflected by the natural and cultural resources, particularly those which are fragile or endangered such as native flora and fauna, and the institutional programs that have been established to protect them—Coastal Zone Management Act, Natural Area Reserve Systems, Water Pollution Control Act, Clear Water Act, and established fishing and hunting seasons. These positive constraints can be augmented and intensified by the incorporation of protective management and conservation programs and informative educational and interpretive programs.

Negative physical constraints are those hazardous conditions which threaten the health, safety and welfare of the users. They are identified as floods, tsunamis, high surf, strong winds, steep mountainous topography, fire, and dangerous conflicts created by users. All of these threats can be mitigated through proper planning and design in conjunction with the initiation of management, educational and interpretive programs. Other negative constraints are imposed by the lack of adequate access and infrastructure.

Negative institutional constraints originate from problems involving access, and land ownership and tenure. Federally owned areas such as Makua and Kahanahaiki Valleys are totally restricted to recreational usage, while privately owned lands must be condemned and purchased prior to improvements or protective measures being instituted. Access through privately owned lands to the mountain sectors is limited and the procedures for obtaining authorization to pass through them is often cumbersome. These constraints, insofar as limiting the recreational potential of the upland areas is concerned, impose higher restrictions than the physical constraints. The only alternatives for ameliorating them are to either purchase the lands outright or negotiate for permanent easements or rights-of-way.

Funding for implementation in relationship to the completed plan and program may also be an institutional constraint if funds are not available and/or released in a sequential order. This could preclude actual implementation of the park plan.

The following evaluations are more detailed studies of those constraints which demand specific considerations in the actual park design.

Climate

Although warm sunny days exist along the coastal sector making it ideal for nearshore and offshore related activities, the windward coast is subject to continuous northeasterly tradewinds during most of the year. These winds coupled with the hot, arid condition and a lack of water often create unpleasant and harsh conditions for the average recreator utilizing this coastal sector. Therefore, alteration of the effects of wind conditions is one of the most important factors involved in the design of recreation areas within this sector.

In siting of facilities along the windward coast, structures should have entry points, shower and changing areas, and restrooms buffered by walls facing into the wind. Camping and picnic areas should be buffered by the use of mounding and vegetation planted to act as windbreaks. Nearshore sand dune areas and exposed areas near recreation nodes should be planted with vegetation to stabilize the soil and sand thus reducing wind and water erosion, sand and dust storms.

The upland sector is ideal for mountain activities, having less rainfall than in the wetter Koolau Mountain Range. However, during the wetter winter months trails may become wet and slippery. Besides providing improvements at the Nite Facilities and the Peacock Flats area for camping and picnicking, improvements of existing trail systems, construction of rest/rain shelters and the establishment of new trails should be considered. These improvements would be under the control of the Division of Forestry, and coordination should be made with both the Divisions of State Parks, and Fish and Game.

Tsunami, Flooding and High Surf Conditions

The entire coastal sector is subject to tsunami inundation. Areas subject to inundation extend to the 50' contour, generally covering a narrow strip of land along the leeward coast except at Makua Beach, Keawaula Bay, and a much wider area from Kaena Point to Camp Erdman along the windward coast. Areas subject to flooding are generally located near the mouths of streams that drain the area, especially along the leeward coastline. The largest area subject to flooding occurs at the Makua Beach area, at the mouth of Kalaukauila Stream and at Manini Gulch. During the majority of the year the region receives very low rainfall. Flooding usually occurs during the winter months when large scale precipitation usually associated with cold fronts, kona storms and upper level low pressure systems causes concentrated periods of intense rainfall. High surf conditions and undertows related to ocean storm conditions create serious hazards especially for the inexperienced or uninformed recreators. Sharp lava formations and coral exposed by high surf conditions and shifting sands at Keawaula Bay is also a related hazard especially during periods of high surf. Although existing hazards involving tsunami inundations, flooding and high surf conditions exist, with proper design and siting of permanent facilities, and development of a warning system, it should not seriously affect the use of these areas for recreational pursuits. An early warning alert system presently exists throughout the state concerning potential tsunami dangers. Also, present monitoring of the weather provides information of potential flooding dangers caused by intense rainstorms and high surf conditions.

Fire

Because of low rainfall, especially during the summer months, a majority of the coastal area is subject to fires which are basically human related. In addition to fires resulting from careless hikers, or from sparks caused by motorcycle backfires, the major cause of fires is a result of military usage of Makua Valley as a firing range. The major danger period occurs during the summer months when the combination of low precipitation, high temperatures, and low humidity creates a major fire danger along the leeward coastal area and Makua Valley. Associated fire hazards also exist within the upland mountain sector from the Kuaokala Plateau to the Peacock Flats area and within the dry-land forest areas. These fires are usually set by careless recreators or have jumped the Waianae ridgeline from the lower coastal and valley areas. Although firebreaks have been established within Makua Valley, the capability to fight fires is often hampered by a lack of proper equipment and water, poor access, and unfavorable topography.

Since existing access is available to the three coastal areas where major activities will occur, the capability to fight fires within these areas is available. With the development of fire breaks especially at Keawaula Bay and Peacock Flats, removal of highly flammable undergrowth, restricting use within specific areas during high fire danger periods and close coordination between the military, the Division of State Parks and the Division of Forestry, fire hazards could be greatly reduced.

Soils and Erosion

Associated with the danger that fire presents is the hazard of damaging existing ocean ecosystems as a result of soil erosion. Presently, waters fronting the coastal area are in a natural wilderness condition and have been classified as Class AA or A, the highest ratings for offshore waters. The major area subject to soil erosion is located within Makua Valley, and would pose the greatest hazard to water quality. However, since soil erosion here is directly related to fires occurring within this region, the problem of fire must be contended with first.

Other major affected areas are located along the windward coast and at Kaena Point where northeasterly tradewinds predominate throughout the year. Areas such as these should be revegetated and stablized to prevent further loss of soil and sand, and large scale clearing and grubbing operations should not occur without taking immediate revegetation measures. Because of a lack of water, continuous wind conditions and salt spray, revegetation of exposed areas would be

recommended during the winter months, when rain can be expected to fall within the area. Plants selected should be tolerant to arid beach conditions and reinforce those presently existing within each specific area. Native species which once may have grown within the area should be utilized where possible, instead of recently introduced exotic species. The requirement of watering would have to be accomplished initially by use of a water truck, unless water sources are available. Any revegetation of the upland sector should be coordinated with the Divisions of Forestry, and Fish and Game.

Furthermore, because the region is isolated and unurbanized, most of the soils have been classified by reconnaisance surveys only, with no in-depth studies conducted. Soils in both the high use coastal areas and upland mountain areas should, therefore, be tested for development capabilities before any design of facilities is begun.

Slopes

Although ± 2840 acres of land within the study area have slopes of between 20 and 30%, and ± 8280 acres have slopes over 30%, lands suitable for active recreational areas are located at Makua Beach and Valley, Keawaula Bay, along the Mokuleia coast from Kaena Point to Camp Erdman, the Kuaokala and Peacock Flats area. Major areas having slopes over 30% include the Waianae Range and major lands within the Mokuleia Forest Reserve east of Peacock Flats. Slopes do not present a problem in relationship to the improvement of the identified active recreation areas, and present a positive factor in defining the coastal recreational areas. The steep mountain conditions present a majestic backdrop for the park and rough and difficult mountain conditions for those more experienced and adventurous. Dangerous conditions which exist are found in those areas which have almost sheer vertical drops of over 2,000 feet. Interpretive and warning sinage explaining the difficult conditions and potential dangers which the recreator may face within the upland mountain region should be posted.

Archaeological and Historic Sites

Every effort should be made to preserve what remains here of Hawaii's past. Prior to any improvements actually being implemented, a thorough archaeological survey should be made. After all sites having either archaeological or historic value have been identified and studied, those having interpretive value should be restored, protected, and utilized in conjunction with an interpretive trail program. Those sites located within Kahanahaiki or Makua Valley presently have restricted access to view them, and the midden site at Kaena Point should be protected from general use until it has been fully studied. Kaneana Cave should have a face lifting by sandblasting the existing graffiti from the face of the walls, and the area surrounding the Makua Protestant Cemetery should be cleared of the existing underbrush.

Flora and Fauna

Kaena Point and that portion of land along the slopes east of the point nominated as a Natural Area Reserve provides critical habitats for a number of endangered endemic coastal plants and associated insects. The Kaena Point site has been seriously altered by off-road vehicles, which are destroying existing vegetation and exposing sand dune areas to wind erosion. This must be prohibited or the educational and interpretive values of this critical ecosystem could be lost forever.

Within the upland mountain sector those areas along the ridgeline and within the valley walls forming Makua Valley have also been identified as areas having endemic flora of great significance.

Existing flora should be preserved where possible for erosion control, wind breaks, screening, privacy, noise reduction and shade. Main stands of kiawe should be preserved with selective thinning made to create spatial niches. However, because kiawe is shallow rooted and interdependent for support, thinning should be selective. Existing trees and groundcovers should be preserved especially along beach areas and reinforced where necessary to stabilize sand dune areas. Endangered endemic species found at Kaena Point should be protected with fencing or some other form of control. Because of a lack of water for irrigation of areas other than those active nodes at Makua Beach, Keawaula Beach and areas surrounding Camp Erdman, plants selected should be tolerant to arid conditions, poor soil, salt spray and minimum watering. Plantings would be best during the winter season which brings the most rain to the area.

In areas having highly flammable brush and grass, firebreaks should be cut and maintained as mowed grass areas. Identified noxious or poisonous plants should be removed where possible and eradication programs established where fea-

sible. Picnic, camping, and beach backup areas along the coastal sector should be irrigated. However, because of the water situation, total irrigation water demand and user demand will have to be related to water availability and storage capacities for each use area.

Within the Peacock Flats area a firebreak should be cut to provide a break in the flammable grasses which are growing in the area. Although existing trees may have to be removed during construction from the immediate area, they can be replaced in a more defined pattern thus separating recreational activity areas.

Adjacent to the Peacock Flats area is one of the best native dryland forests found on Oahu. Because of its shallow root systems and highly flammable built-up vegetative cover, this forest area is highly susceptible to trampling and fires and must be protected. Another important feature of this forest is that certain flora are the host plants for specific species of land snails and insects, and if the ecological balance is altered this would, in turn, affect the survival of these species.

Within the wet upland forest and the montane bog located at Mt. Kaala where flora is extremely sensitive to man's encroachments, it is imperative that users are informed of the dangers of trampling, fires and introduction of new species. All areas that will require clearing and grubbing should be surveyed for the presence of rare and endangered species before construction commences.

Infrastructure

Presently, only electricity, telephone service, and access exist to service the major planned recreation areas along both coastlines with water and sewage services unavailable. Water and sewage are probably the two most critical elements in determining recreational usage of the area. Since water and sewage service to serve the park is not planned in the foreseeable future, and because of the high costs involved in connecting to existing systems, these services will have to be implemented as separate park systems. Because of the potential of groundwater contamination and seepage of pollutants to surface waters, the exact method for sewage disposal should be made after perculation and soil tests are conducted. Cesspools would provide a viable option if they are determined to conform to State and County regulations. If not, it is recommended that sewage be controlled by a self-contained system.

Water from wells is known to have been available when the area was inhabited and ranched in the early 1900's. Test wells which have since been drilled also indicate the availability of water, however the chloride content may not make water potable for drinking purposes. Water would however, be suitable for bathing, sewage disposal, irrigation and fire purposes. Storage facilities would be required to insure water availability during periods of high use, especially on weekends, holidays and during the summer months. As an alternative, potable water may be provided by trucking it to centralized water storage tanks along the coast, especially at Kaena Point to serve hikers who venture from the more active recreation areas from both sides.

Since no continuing records have been recorded on water availability and quality, records should be kept to determine the draw on the basal lens and the quality of the available water. As improvements are made, test wells to locate potable water sources should be conducted.

Existing telephone communications exist up to the Satellite Tracking Station Road on the Leeward Coast and to Camp Erdman on the Windward Coast. For emergency purposes, existing communication service should be extended, especially to high use areas.

In the central upland sector, existing electrical, communications, sanitary and water lines exist to serve the Nike facilities. The re-establishment of these services and the providing of new services at the Peacock Flats areas would be required to allow for recreational usage of these areas. Another potential source of water would be by tapping existing springs in the mountains and piping this water by gravity flow to the Peacock Flats area.

Access

Coastal Sector

The existing unimproved access, which is a major development constraint and a primary management concern, imposes a large number of design considerations in planning for the park. Within the coastal sector, five alternative modes of access to serve the park were investigated. These alternatives were foot trails, bicycle trails, a multi-functional people mover system such as a mini-bus system or historically restored railway, and a scenic parkway. Because of the existing topography along the coastal sector, there is little choice of alternative routes for these modes. The access corridor would have to be located between the shore and the steeper pali lands. Footpaths

would generally follow the shoreline as they do now. Vehicular access, where allowed would be kept as far mauka of high use shoreline recreation areas as economically feasible for construction. This would minimize the impact of usage within the coastal sector and avoid having to divide the recreation areas. Each of these alternatives has a significant effect on controlling the intensity of use within the area due to the different degrees of mobility each affords the user. Also, the overall costs of each mode and effect on the environment and surrounding communities is directly related to the function and requirements of the mode. Because these factors were crucial in relationship to park philosophy, and because an intra-regional transportation system is a potential land use along the coastal sector the alternative modes were investigated in depth to evaluate their feasibility.

Foot trails, as an independent system, prescribe low intensity use due to their natural, restrictive effect upon the numbers and types of park users. This is attributable to the physical demands of walking. Furthermore, as the walking distances increase, certain activities requiring logistics will become less popular. However, the closer proximity to the resources and more leisurely pace would encourage more in-depth participation and provide for a higher quality experience. These trails are also less destructive to the natural resources and basically non-polluting. Usage could occur immediately with additional improvements developed as required.

The unimproved road and trails which presently exist past Keawaula Bay and Camp Erdman should be improved with a hierarchy designating primary, secondary, and tertiary trails. The primary trail would follow the present alignment of the existing unimproved dirt road. A secondary trail would follow the abandoned railroad right-of-way from a point east of Kaena Point to Camp Erdman. Tertiary trails would connect primary and secondary trails and provide access to the pali lands and upland mountain sector along both coasts.

Bicycle trails, like foot trails, also prescribe low intensity development, are minimally disruptive to the natural resources, non-polluting, and encourage a closer relationship to the environment. However, they similarly favor one specific recreator and their implementation may preclude usage of the same trail by hikers.

The unimproved road which presently exists past Keawaula Bay to Camp Erdman could be improved as the bikeway route. As such, it would have designated stops at points of interest or at points connecting to the existing foot trail systems. This system has been investigated in the Leeward Oahu Bicycle Transportation Plan and is in accord with the islandwide Bikeway Master Plan. However, development should occur in sequence with this plan and not separately.

A mini-bus system would favor a wider variety and larger number of users, some of whom might not be capable of walking or bicycling through the area. A separate right-of-way would be required but a trail would still be available for hikers. The system would also be more disruptive to the physical environment and existing military land may be necessary for construction of the terminal facilities at Kahanahaiki Valley.

The advantages of a restored railway system are similar to those for the mini-bus system. They both offer the same opportunities except that the railroad has the extra benefit of restoring part of the former railroad and providing an enjoyable historic experience. Like the mini-bus system, its implementation would require a separate right-of-way and military land may be required for terminal facilities construction. Operational costs may also be a major prohibitive factor unless a large ridership can be attracted and/or an ample fee is charged. A similar system is being planned for the Waipahu district by the City and County of Honolulu.

The scenic parkway is in accord with the 1964 General Plan for the City and County of Honolulu and would serve the main objectives of the proposed intra-regional/island transportation facility by completing the around-the-island route and connecting the Windward and Leeward communities of Waianae and Waialua. However the goals and objectives of the Department of Land and Natural Resources, Division of State Parks, are not the same as those of the Department of Transportation and reflect a separate philosophy. Notwithstanding the fact that a state park must be made reasonable accessible, this philosophy does not encourage the use of a parkway for Intra/Regional/Island Transportation purposes. Although it would provide the opportunity for the largest numbers and types of users and would afford the greatest degree of freedom and mobility, it would also provide for an unlimited means of vehicular access to a portion of the proposed park which now offers a limited semi-wilderness experience. Unrestricted vehicular access could also increase management problems in control-

ling the number of visitors to fragile natural and cultural features. For park purposes public vehicular access is only needed to the high use beach areas at Makua, Keawaula and the Camp Erdman areas. Vehicular access to Kaena Point itself is only needed for maintenance and emergency purposes. If public vehicular access is desired to the Kaena Point area another alternative would be to extend the roadway along the Windward Coast to a parking area just short of Kaena Point.

Since the coastal land also has high potential value as a transportation corridor a two-lane parkway linking the windward and leeward coastal communities and completing the link around Oahu, was also fully considered. The selected corridor was kept as far mauka as feasible to minimize its impact on the shoreline and prevent the parkway from dividing developable state park areas. Where there is no coastal plain between Keawaula Bay and Kaena Point the potential highway corridor would be located along the hillside above the present railroad bed and would require a series of half bridges. This section of the parkway would be particularly costly making it difficult to justify its expense as a transportation link at this time. Public hearings on the park project also brought out major concerns in both windward and leeward communities regarding undesired changes which may include increased traffic, undesirable patterns of land development and alterations to cultural values and lifestyles. In view of the fuel shortage situation the future of pleasure driving was also questioned.

While the impact of a scenic parkway on the natural and cultural features of the park can be minimized with careful design and management, there is no way to avoid the irreversible loss of the semi-wilderness experience. Consequently, considering the recreational values and parkway construction costs as well as public opposition, the parkway construction alternative is not recommended. It is not within the scope of this report to determine the effects that future events may have on the site and its facilities beyond identifying them as significant planning contingencies. These effects can best be determined by monitoring the situation. By reserving the parkway corridor this option remains available for the future.

Upland Mountain Sector

Access to the upland mountain sector is expected to continue using existing roads and trails. Although use of the roads are presently restricted, it would not be desirable to develop any new roads to the upland area due to the steep topography and high construction costs. Presently the Nike Road does provide access to the major active mountain recreation areas. However, due to the steep grades often exceeding 20%, this narrow one way road with limited areas for pulling off and dangerous sides with no railings would not be desirable for public use. Also, once the recreator reaches Peacock Flats or the Nike Facilities, there is no other area to which a vehicle can be driven. Because of these factors it would be best to restrict and control access, and establish a shuttle system to be regulated by the Department of Land & Natural Resources. This shuttle system could originate from the Dillingham quarry site (once it is returned to the State) where secured parking and other facilities could be developed. The shuttle bus should consist of four wheel drive vehicles with adequate storage areas for camping supplies and equipment. A cable car or incline track vehicle are other modes that could possibly provide access.

DESIGN CAPACITY

Although resource carrying capacities cannot be implicitly determined at this point in time, it is possible to achieve a general desirability profile. This is accomplished by relating recommended recreation standards and existing park capacities to the identified resource areas that could be developed to support recreational activities. Based on the proposed park philosophy and goals and objectives, it is not desirable at this time to develop any park area at its maximum capacity. This is primarily because the effects of anticipated uses on the natural resources and the environment in relationship to overall user satisfaction would require monitoring over time to insure compatibility. The present absence of improvements and security within all three active beach areas and the origins and distances that have to be travelled to reach the park, would also tend to limit the level of usage until improvements are made.

Coastal Area

All proposed active areas along the coastline have large sandy beaches and supporting backup areas for picnicking, parking and attendant uses.

A breakdown of acreage per high use recreational areas is shown in Table 2.

veloped to support recreational activities. Based on the proposed park philosophy and goals and objectives, it is not desirable at this time to develop any park area at its maximum capacity. This is primarily because the effects of anticipated uses on the natural resources and the environment in relationship to overall user satisfaction would require monitoring over time to insure compatibility. The present absence of improvements and security within all three active beach areas and the origins and distances that have to be travelled to reach the park, would also tend to limit the level of usage until improvements are made.

Coastal Area

All proposed active areas along the coastline have large sandy beaches and supporting backup areas for picnicking, parking and attendant uses.

A breakdown of acreage per high use recreational areas is shown in Table 2.

TABLE 2 HIGH USE RECREATIONAL AREA BREAKDOWN

	Beach	Picnic & Backup Area	Camping	Total
Makua Beach	15 acres	34 acres	17 acres	66 acres
Keawaula Beach	11 acres	6 acres	56 acres	73 acres
Camp Erdman	19 acres	17 acres	9 acres	45 acres

By assigning low, medium and high square foot allocations for specific uses such as beach activities, picnicking, parking and backup areas, estimates as to the total number of recreators which the resources could accommodate were calculated.

Because park development and improvements are to occur incrementally, and because the park concept stresses preservation of the resources, square foot allocations were generous when compared to allocations found at other parks. Spatial area calculations per individual for the three high use coastal areas are as follows:

Makua Beach and Backup Areas ± 49 acres (2,134,440 S.F.)

Use Intensity	Water	Beach	Picnic & Backup	Total S.F./Ind.	Total No. of Recreators
Low	100 sf	200 sf	1500 sf	1800 sf	1186
Medium	75 sf	150 sf	1300 sf	1525 sf	1400
High	50 sf	100 sf	1200 sf	1350 sf	1581

*Note: sf = square feet.

Seventeen acres of land adjacent to Makua Beach have been proposed for camping. Based on developing 60% of the area for group camping with 8 individuals per site, and 40% for individual camping with 2 individuals per site, the following spatial allocations were calculated:

Makua Beach Camping Area ± 17 acres (740,520 S.F.)

Use Intensity	Sq. Ft./Ind. Site	# of Sites	# of Recreators	Sq. Ft./Grp. Site	# of Sites	# of Recreators
Low	2500 sf	122	244	22,500 sf	19	152
Medium	2000 sf	152	304	20,000 sf	22	176
High	1500 sf	203	406	17,500 sf	25	200

Although Keawaula Bay has similar recreational qualities as those found at Makua Beach, its open exposure and lack of mature trees along the shoreline, make it less desirable for extended stays.

Using this assumption, a larger square foot allocation has been used to determine user capacity. Using the allocations for Makua Beach, spatial calculations per individual were increased by 50% for both the beach and camping areas and are as follows:

Keawaula Beach and Back Up Areas ± 17 acres (740,520 S.F.)

Use Intensity	Water	Beach	Picnic & Backup	Total S.F./ Individual	Total # of Recreators
Low	200	400	3000	3600	206
Medium	150	300	2600	3050	243
High	100	200	2400	2700	274

The area mauka of Keawaula Bay offers some protected areas created by groves of mature kiawe trees. Again a majority of the area, 60% (33.6 acres) was calculated for group camping, with individual camping making up the other 40% (22.4 acres).

Keawaula Beach Camping Areas ± 56 acres (2,439,360 S.F.)

Use Intensity	Sq. Ft./Ind. Site	# of Sites	# of Recreators	Sq. Ft./Grp. Site	# of Sites	# of Recreators
Low	3750	43	344	33,750	260	520
Medium	3000	48	384	30,000	325	650
High	2000	56	448	26,250	434	868

Because of the constant climatic conditions and water hazards along the coastal areas surrounding Camp Erdman, it is anticipated that the beach areas would be less intensely used. Therefore the same square foot calculations as that of Keawaula Bay have been used. Calculations of anticipated number of recreators are as follows:

Areas Surrounding Camp Erdman Beach and Backup Areas ±36 acres (1,568,160 S.F.)

Use Intensity	Water	Beach	Picnic & Backup	Total Sq. Ft./ Individual	Total # of Recreators
Low	200	400	3000	3600	436
Medium	150	300	2600	3050	514
High	100	200	2400	2700	581

Camping sites which are in high demand within the surrounding area have been calculated using the Makua Beach allocations and are as follows:

Areas Surrounding Camp Erdman Camping Areas ± 9 acres (392,040 S.F.)

Use Intensity	Sq. Ft./Ind. Site	# of Sites	# of Recreators	Sq. Ft./ Grp. Site	# of Sites	# of Recreators
Low	2500	63	126	22,500	10	80
Medium	2000	78	156	20,000	12	96
High	1500	105	210	17,500	13	104

Based on the above calculations the following totals were estimated for the three major high use coastal recreation areas (Table 3). This total was further broken down into four equal five year estimates. This incremental breakdown has been developed as such because high capacity is not anticipated immediately. Continuing condemnation and land acquisition proceedings must first occur along with funding before facilities and improvements can be made. These estimates, however, provide a guide for long range planning and budgeting purposes.

TABLE 3 COASTAL USAGE ESTIMATES

Use Intensity	Beach/ Backup	Camping Ind.	Camping Grp.	Anticipated Totals	Recreators/ Acre	% of Total 25% 1-5 yr.	50% 6-10 yr.	75% 11-15 yr.	100% 16-20 yr.
Makua Beach 66 acres									
Low	1186	244	152	1582	24/a	396	792	1188	1582
Medium	1400	304	176	1880	28/a	470	940	1410	1880
High	1581	406	200	2187	33/a	547	1094	1641	2187
Keawaula Bay 73 acres									
Low	206	344	520	1070	15/a	268	536	803	1070
Medium	243	384	650	1277	17/a	319	638	957	1277
High	274	448	868	1590	22/a	398	796	1192	1590
Areas Surrounding Camp Erdman 45 acres									
Low	436	126	80	642	14/a	161	322	483	642
Medium	514	156	96	766	17/a	192	384	576	766
High	581	210	104	895	20/a	224	448	672	896

As shown in the above calculation, the ratio of the total number of recreators to the acreages available for recreation is low. By visualizing twenty two football players on a football field which is approximately 1 acre in size, one can see that the anticipated density along the high use coastal areas which range from between 14 to 33 persons per acre is very similar to what would be found at a football game. The beach area at Ala Moana Park, probably the most heavily used beach park in the State, has similar beach acreages as those found at Makua Beach. However, Ala Moana beach capacity is estimated at 3730 or 272 persons per acre as compared to Makua Beach with a desired maximum capacity of 1581 or 33 persons per acre. Because of the need to conserve the fragile natural resources which are the source of the areas recreational potential and identity, particularly between Keawaula Bay and Camp Erdman, estimates appear to be appropriate for each area. However, as stated earlier, these estimates were only developed as recommended guides. The actual number of recreators desirable can only truly be determined after the existing usage, user satisfaction and use impacts on the resources are monitored over time. As determined by a continual monitoring program, limits can be adjusted as necessary to either increase or decrease specific uses.

Estimates were also made for the area between Keawaula Bay and Camp Erdman. This semi-wilderness coastal area is anticipated to attract mostly users pursuing secondary activities due to its close proximity to high use areas which satisfy most of the primary needs. Fishing, hiking, educational and interpretive pursuits would be the major activities that would occur. Recreators who would use this area for primary activities would more than likely be generated from the windward side. They would include fishermen, hikers, botanist, students, and other educational groups.

By adding the anticipated number of users for each use intensity category, an estimate of the total numbers of recreators utilizing the high acary activity to Kaena Point, the following estimates were developed:

Use Intensity	Makua Beach	Keawaula Bay	Camp Erdman	Total
Low	1582	1070	642	3294
Medium	1880	1277	766	3923
High	2187	1590	895	4672

Further, by estimating that from the above totals a specific percentage of the recreators would utilize the coastal areas from both sides as a secondary activity to Kaena Point, the following estimates were developed:

Anticipated Number of Users Between Keawaula Bay and Camp Erdman

Use Intensity	Total Users	10% 1-5 yr.	15% 6-10 yr.	20% 11-15 yr.	25% 16-20 yr.
Low	3294	329	494	659	826
Medium	3923	392	588	785	981
High	4672	467	701	934	1168

It may be further anticipated that an additional 25% of the total number of recreators anticipated per five year period would be generated as a primary use along the coastal shoreline.

Central Upland Area

Estimates were also calculated for two areas within the central upland areas proposed for park usage. Existing usage of the area by hunters and hikers will continue to occur, with estimates for the Nike Facilities and Peacock Flats areas calculated based on new recreators being attracted to the areas once improvements are made. Access to these sites would be the major factor in determining when and to what degree the upland mountain areas would be improved.

The Nike facilities, located west of Peacock Flats, encompasses approximately 4.5 acres. Within this site there are six existing buildings, of which two could very easily be renovated for group camping for school aged children. Of the six buildings, the administration building and building containing sleeping quarters and mess facilities should be renovated for sleeping purposes. The other four buildings could be used either for storage, administration, or maintenance purposes or quarters for park personnel. Depending

upon how each building is renovated, it is estimated that these two facilities could house a total of between 100 to 200 recreators at any one time.

Peacock Flats

Because of the desire to provide mountain recreators with a true mountain experience and because of the number of acres available at Peacock Flats (100 acres), large square foot allocations were made for camping and picnic areas. Presently only one half of the acreage has been planned for with the remaining acreage to be utilized for firebreaks and reserved for future recreational uses. Camping area calculations are as follows:

Peacock Flats Camping Area Calculations ±12 acres 522,720 S.F.

Use Intensity	Sq. Ft./ Ind. Site	# of acres	# of sites	# of recreators	Sq. Ft./ Grp. Site	# of acres	# of sites	# of recreators
low	5000	5	44	88	40,000	7	8	64
medium	4000	5	55	110	32,000	7	10	80
high	3000	5	73	146	24,000	7	13	104

Peacock Flats Picnic Area Calculations ±15 acres 653,400 S.F.

Use Intensity	Sq. Ft./ Ind. Site	# of acres	# of sites	# of recreators	Sq. Ft. Grp. Site	# of acres	# of sites	# of recreators
low	4000	7	76	228	22,500	8	15	120
medium	3500	7	87	261	20,000	8	17	136
high	3000	7	102	306	17,500	8	20	160

Peacock Flats Cabin Area Calculations ±20 acres 871,200 S.F.

Use Intensity	# of Cabins per acre	# of acres	# of Cabins	# of Recreators
low	1	20	20	320
medium	1.5	20	30	480
high	2	20	40	640

It is anticipated that a majority of the recreators would utilize the upland areas for overnight use, with others using the area on a 6-8 hour day use basis. Secondary activities originating from the Nike site or Peacock Flats area are anticipated to be hiking and nature walks into the dryland forest areas, with bird and mammal hunting as another major single purpose activity. Since the planned recreational areas fall within areas used for hunting, and because of the fragile conditions existing in the shallow rooted dryland forest areas, close coordination is required between the Divisions of State Parks, Forestry and Fish and Game.

OTHER LAND USES

Because the study area currently sustains more than one land use and additional uses have either been considered or proposed, an attempt was made to evaluate their general feasibility and measure their compatibility to state goals for recreation—"To preserve and enhance for present and future generations a natural, scenic, and cultural resource of statewide significance as nearly as possible in the original and natural condition and provide opportunities for appropriate type of recreation where such will not destroy or impair the features and values to be preserved."

Agriculture

There are no "prime" or "unique" agricultural lands located within the proposed park boundary. The agricultural potential of the study area is poor with over 85% of the soils being classified as unsuitable for cultivating crops. Although modifications would allow for certain crops to be grown during selected seasons of the year, the combination of accessibility, little available water and the high cost of providing irrigation systems renders this option economically unsound. Agriculture within Makua Valley might be possible from a soil standpoint but improbable as long as it remains contaminated by unexploded ordnance and under military control.

Timber Production

The potential for a forest based industry is also limited. Although experimental plots have been planted within the forest reserve areas of Mokuleia, Makua Keaau and Kuaokala, these areas do not contain timber stands of current or potential commercial use. The introduction of exotic timber species within areas having some of the best stands of dryland forest, the lack of access and milling facilities, and the economics of scale required for a commercial timber production are other problems that would influence the establishment of commercial timber production within the upland mountain sector. Another concern is the effects that forest production would have in diminishing the recreational, scenic and aesthetic qualities of the area. In consideration of this and of the objectives for a timber industry (which are to aid rural development, to redistribute population, and to expand the economic base of Hawaii) the program would be better suited to the outer islands of Hawaii, Maui, Molokai, or Kauai.

Tele-Communications and Tracking Systems

The continued use of the upland areas for these purposes would not significantly conflict with recreational pursuits except possibly for hunting, but they do somewhat diminish the scenic and aesthetic qualities of the area. The necessity of developing restricted areas around existing facilities may interfere with hunting along the Waianae ridgeline, however, the greatest conflict exists at Mt. Kaala. Because of construction activities, the montane bog eco-system has been seriously altered. Also, the continued use of helicopters at Mt. Kaala have resulted in adverse effects on the flora as a result of rotor blasting.

Military Operations Within Makua Valley

The amphitheater-like conformation of the land within Makua Valley makes it ideally suited to the type of military activities being carried out in the area today. However, these activities impose a variety of environmental and psychological intrusions and along with safety hazards created, may make continued use of the valley for these purposes incompatible with park use.

Wind Powered Electric Generation

High wind velocities atop the Waianae Range provide the potential for construction of a windmill or series of windmills in this area. Although their presence would not seriously conflict with recreation goals due to their siting away from high use areas, nor inflict any significant disturbance to the environment, they would adversely affect the scenic and aesthetic quality of the area. However, wind generated electricity could well become a relatively pollution free method of creating electricity, and, in all fairness, the objections to such a project must be weighed against critical national demands for alternate energy sources and the benefits it would provide for the State of Hawaii.

Intra-Regional/Island Transportation Facilities

In addition to developing the coastal area for park purposes, the construction of a through road connecting the leeward and windward coastal sections around Kaena Point was first proposed in 1929 by Senator Francis Brown. Due to difficulties in obtaining rights-of-way from private landholders, and cost increases, construction did not commence until 1954. By 1956 the improved dirt road was nearly completed, but

since that time, little has been done to maintain or improve this facility. In 1967, the State Department of Transportation included a road around Kaena Point as part of the State's secondary highway system, thus qualifying for federal aid. In 1971, the Department of Transportation proposed a two-lane low speed highway with an off-ramp and parking area at Kaena Point. However, due to considerable public opposition, the project was halted and it was jointly agreed by the Department of Transportation and Department of Land and Natural Resources that a park plan to include access considerations be completed prior to making any irreversible commitment. This Kaena Point State Park Conceptual Plan was prepared in part to fulfill this joint agreement.

RECOGNITION OF BACKGROUND WEAKNESSES

Although background research data was ample to prepare the Conceptual Plan, several areas would require detailed studies to be performed prior to design of any improvements. They are as follows:

Topographic Studies

Detailed topographic surveys at an appropriate scale should be prepared prior to development of detailed design plans.

In-Depth Socio-Economic Studies

In-depth, socio-economic studies should be conducted if intensive development and/or a connecting through road between the southern and northern park boundaries is proposed.

Hydrologic Studies

Hydrologic studies should be conducted to identify and locate potential water sources and test existing water quality and quantity.

Soil Studies

Detailed soil surveys should be conducted to determine soil capabilities for development prior to preparation of detailed plans.

Flora Studies

More detailed studies should be conducted to identify the locations of additional native species habitats, and means to eradicate undesirable exotic species.

Fauna Studies

Studies should be conducted to determine the bio-ecological relationships between endangered land snails and insects and their host flora. These studies should also determine the influences of man and other possible predators to the species.

In-Depth User Survey

No in-depth user survey has been conducted for the area, with data available limited to the 1975 SCORP responses to a household survey. Periodic on site user surveys should be established after plans have been implemented to insure that needs are being met and that user conflicts are being resolved.

Oceanographic Survey

Due to constant turbidity and seeing qualities of the water along the northern coast, difficulty was encountered in determining species, counts and habitats. However, based on conditions existing in other similar areas, generalizations made about this area should suffice at this time. Additional studies may be required to determine the impact of development upon drainage ways exiting into the sea.

Historic, Archaeological and Legendary Sites

Prior to improvements being made in any area, on-site surveys and investigations should be conducted, with preservation and restoration measures of important sites implemented upon completion of investigative studies.

UNRESOLVED ISSUES

The study has identified several unresolved issues which will require further in depth research and discussions before certain portions of the park plan can be implemented. The joint civilian-military use of Makua Valley mauka of Farrington Highway is one of the major unresolved issues. This issue cannot be resolved at this time, and will involve policy decisions to be made between the State and Federal Government. Another unresolved issue is the setting of the exact date when the removal of the unauthorized structures on Makua Beach will commence. These unauthorized structures present potential health and safety problems and inhibit recreational use of the beach area by the public. Access, and the means of transporting recreators to high use areas at Peacock Flats and the Nike Facilities is a third issue that would require further study before improvements can be implemented. The

final unresolved issue is the provision of access to the Kaena Point area for the handicapped and the elderly.