Napilihau Villages

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COUNTY OF MAUI
DEPARTMENT OF PLANNING

March 25, 1998

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QUALITY

Mr. Gary Gill, Director
Office of Environmental Quality Control
State Office Tower, Room 702
235 South Beretania Street
Honolulu, Hawaii 96813-2347

Dear Mr. Gill:

RE: Findings of No Significant Impact (FONSI) Determination on the Final Environmental Assessment (EA) for the Use of County Lands for the 76-Unit Napilihau Villages Phase I Project at TMK: 4-3-3:108, Napili, Lahaina, Maui, Hawaii. (EA 970009)

Please find enclosed the Office of Environmental Quality Control (OEQC) Publication Form and four (4) copies of the Final Environmental Assessment (EA) Report (prepared by the applicant) for publication in the OEQC Bulletin. A diskette is enclosed containing the project description in a Wordperfect format. Also, enclosed are four (4) copies of the Maui Planning Department's Report.

The draft EA notice was first published in the January 8, 1998 OEQC Bulletin for the 296-unit Napilihau Villages I-IV project.

At the March 24, 1998 Maui Planning Commission meeting, the applicant conveyed that given the near to mid-term uncertainty regarding market conditions, the applicant has decided to withdraw Phases II-IV from the Special Management Area (SMA) Use Permit application. The project is now defined as the 76-unit Napilihau Villages Phase I project and related improvements. The Maui Planning Commission voted to approve filing of the Final EA for the redefined project as a Findings of No Significant Impact (FONSI). Please publish the FONSI notice in the April 8, 1998 OEQC Bulletin.

Thank you for your cooperation. If additional clarification is required, please contact Mr. Clayton Yoshida, Planning Program Administrator, of this office at 243-7735.

Very truly yours,

for DAVID W. BLANE
Director of Planning

DWB:CIY:cmh
Enclosures
c: Clayton Yoshida, AICP, Planning Program Administrator
Kelly Cairns, Deputy Corporation Counsel
Wayne Tanigawa, Napilihau Villages Joint Venture
Michael Munekiyo, Munekiyo & Arakawa, Inc.
Project File
CZM File
General File
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1998-04-08-MA-FEA-Napilihau Villages

Final Environmental Assessment

Napilihau Villages

Prepared for:

Napilihau Villages Joint Venture

March 1998

MUNEKIYO, ARAKAWA & HIRAGA, INC.

Final Environmental Assessment

Napilihau Villages

Prepared for:

Napilihau Villages
Joint Venture

March 1998

MUNEKIYO, ARAKAWA & HIRAGA, INC.

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Preface

Preface

The Napilihau Villages Joint Venture, the applicant and landowner for the Napilihau Villages project, prepared a Draft Environmental Assessment (EA) (pursuant to a November 5, 1997 Hawaii Supreme Court ruling) in accordance with Chapter 343, Hawaii Revised Statutes. The Draft EA addressed the entire 17-acre property encompassing 296 affordable townhouse units.

The proposed action initially consisted of four (4) phases. The 76-unit Phase I project, located on TMK 4-3-3:108, has been substantially completed with certificates of occupancy issued for three (3) of the eight (8) completed buildings. Construction on the ninth Phase I building has been initiated, with construction approximately 60% complete.

Given the near to mid-term uncertainty regarding market conditions, the applicant has decided to withdraw Phases II, III and IV (TMK's 4-3-3:110, 122 and 123). Should the applicant decide to proceed to develop these properties at a future point in time, new and separate applications for Special Management Area Permit approval will need to be filed with the Planning Department.

Accordingly, this document serves as the Final EA for the Napilihau Villages project, which is now limited to the the 76-unit Phase I project.

Although the Napilihau Villages project is now defined by Phase I alone, the project was assessed in the context of the total 296 units initially proposed for all phases. Issues relating to cumulative impacts have been addressed in this regard.

At its meeting of March 24, 1998, the Maui Planning Commission voted to approve the filing of the Final EA for the redefined project as a Findings of No Significant Impact.

Chapter I

Project Overview

I. PROJECT OVERVIEW

A. BACKGROUND

The Napilihau Villages Joint Venture is in the process of developing the 296-unit Napilihau Villages project located at Napili, Maui, Hawaii. Identified as TMK 4-3-3:108, 110, 122, and 123, the subject property encompasses an area of approximately 17 acres. See Figure 1. To date, 64 of the 296 apartment units have been completed as part of the project's Phase I development. Phase I improvements which have been substantially completed include eight (8) townhouse buildings, offstreet parking, landscaping, and offsite drainage improvements, including the installation of a 36-inch drainline within the Napilihau Street right-of-way, a 6-ft. by 4.5 ft. box culvert within the Lower Honoapiilani Highway right-of-way, and an upstream 5.5 million gallon detention basin. Construction on a ninth Phase I building has also been initiated, with approximately 60 percent of the work completed.

On November 5, 1997, the Supreme Court of the State of Hawaii ruled that an environmental assessment, prepared and processed in accordance with Chapter 343, Hawaii Revised Statutes, is required for the project.

In addressing the Supreme Court's ruling, this environmental document has been prepared to cover the entire 296-unit project scope.

B. PROPERTY LOCATION AND LAND OWNERSHIP

The Napilihau Villages site consists of four (4) tax map parcels as shown in Table 1. Figure 2 illustrates the spatial relationship among the various parcels.

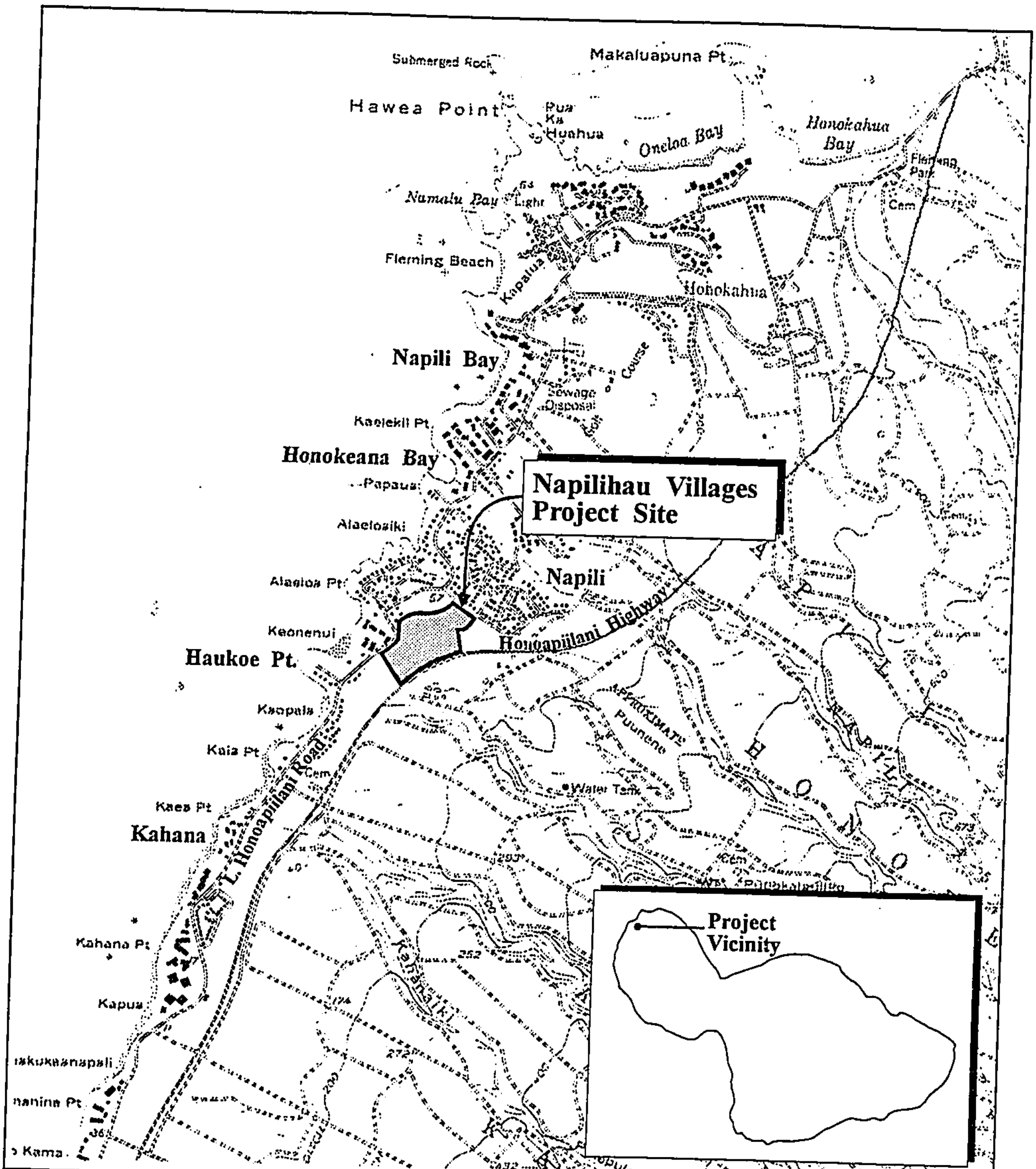


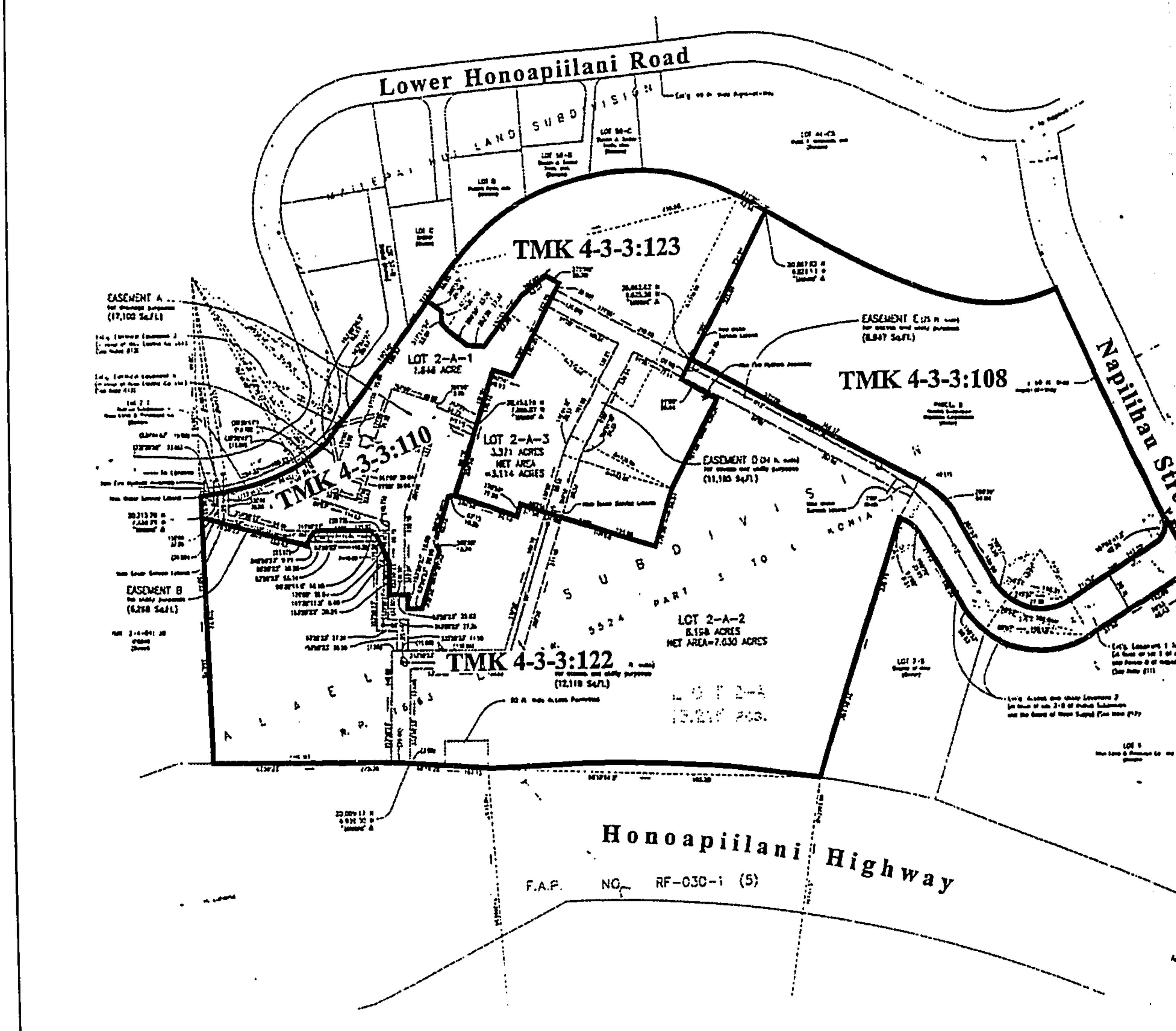
Figure 1

Napilihau Villages Environmental Assessment

Regional Location Map

MUNEKIYO, ARAKAWA & HIRAGA, INC.

Prepared for: Napilihau Villages Joint Venture



Source: Warren S. Unemori Engineering, Inc.

Figure 2

Napilihau Villages Environmental Assessment

Parcel Reference Map

Prepared for: Napilihau Villages Joint Venture

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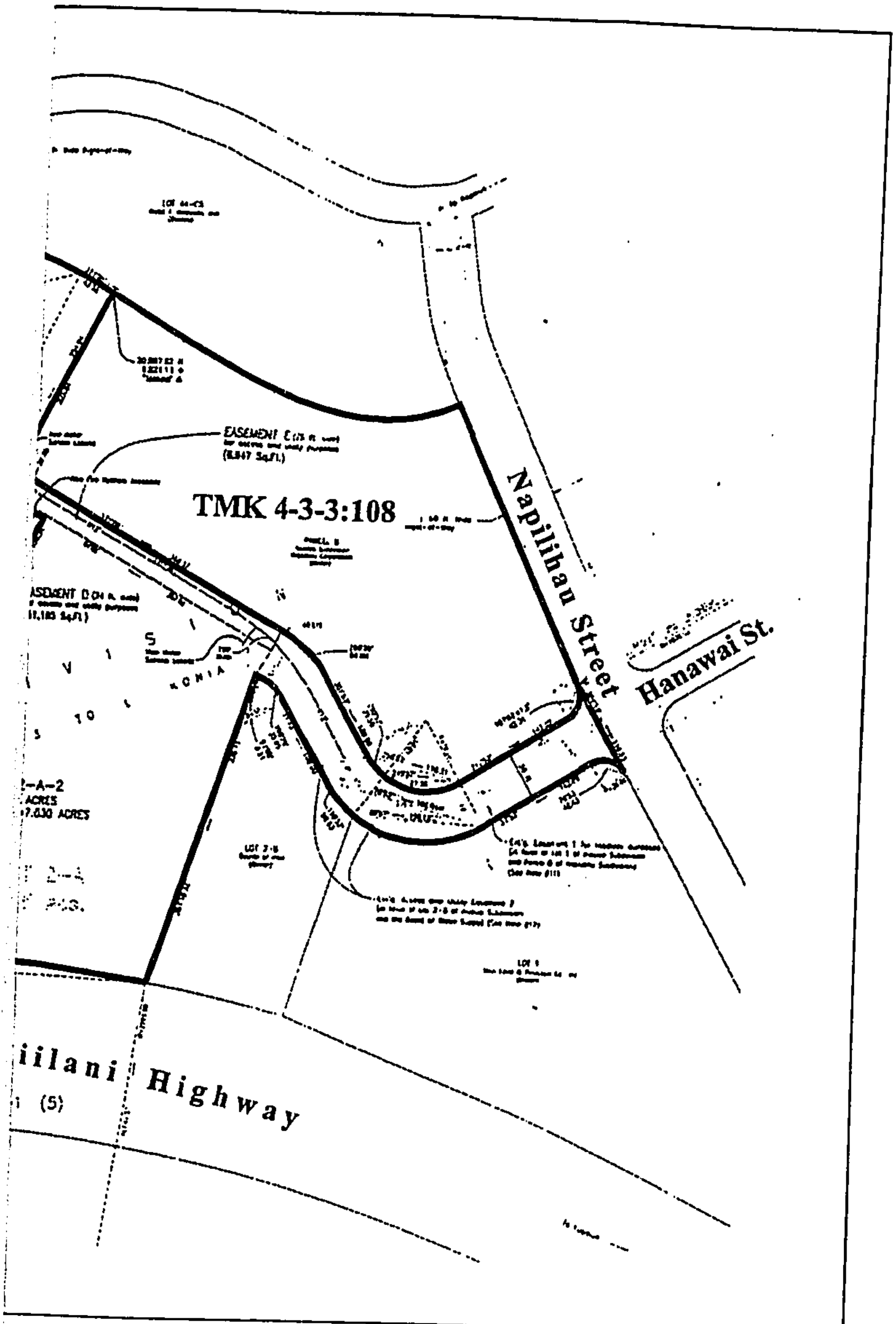

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The project site is bordered to the north by Napilihau Street. See Figure 3. The Napilihau Planned Unit Development and Hale Noho

Table 1

TAX MAP REFERENCE SUMMARY		
Tax Map Key Number	***Acreage***	***Phase/Use***
4-3-3:108	3.892	Phase I
4-3-3:110	1.646	Park Parcel
4-3-3:122	8.198	Phases III and IV
4-3-3:123	3.371	Phase II

residential project are situated in close proximity north of Napilihau Street. Further makai of these residential developments is the Lower Honoapiilani Road. There are a number of multi-family residential developments, including the Kahana Sunset and Alaeloa projects, makai of Lower Honoapiilani Road. To the east of the subject property lies the Napili Fire Station and the Napili Plaza. Honoapiilani Highway forms the project's southeastern boundary. Across Honoapiilani Highway, to the east, is Maui Pineapple Company's agricultural baseyard as well as significant acreages planted in pineapple. To the west of the project site are vacant lands as well as residential development adjacent to the Lower Honoapiilani Road.

The fee property owner is the Napilihau Villages Joint Venture. JGL Enterprises, Inc., the applicant for the project's original SMA, holds a partnership interest in the Napilihau Villages Joint Venture.

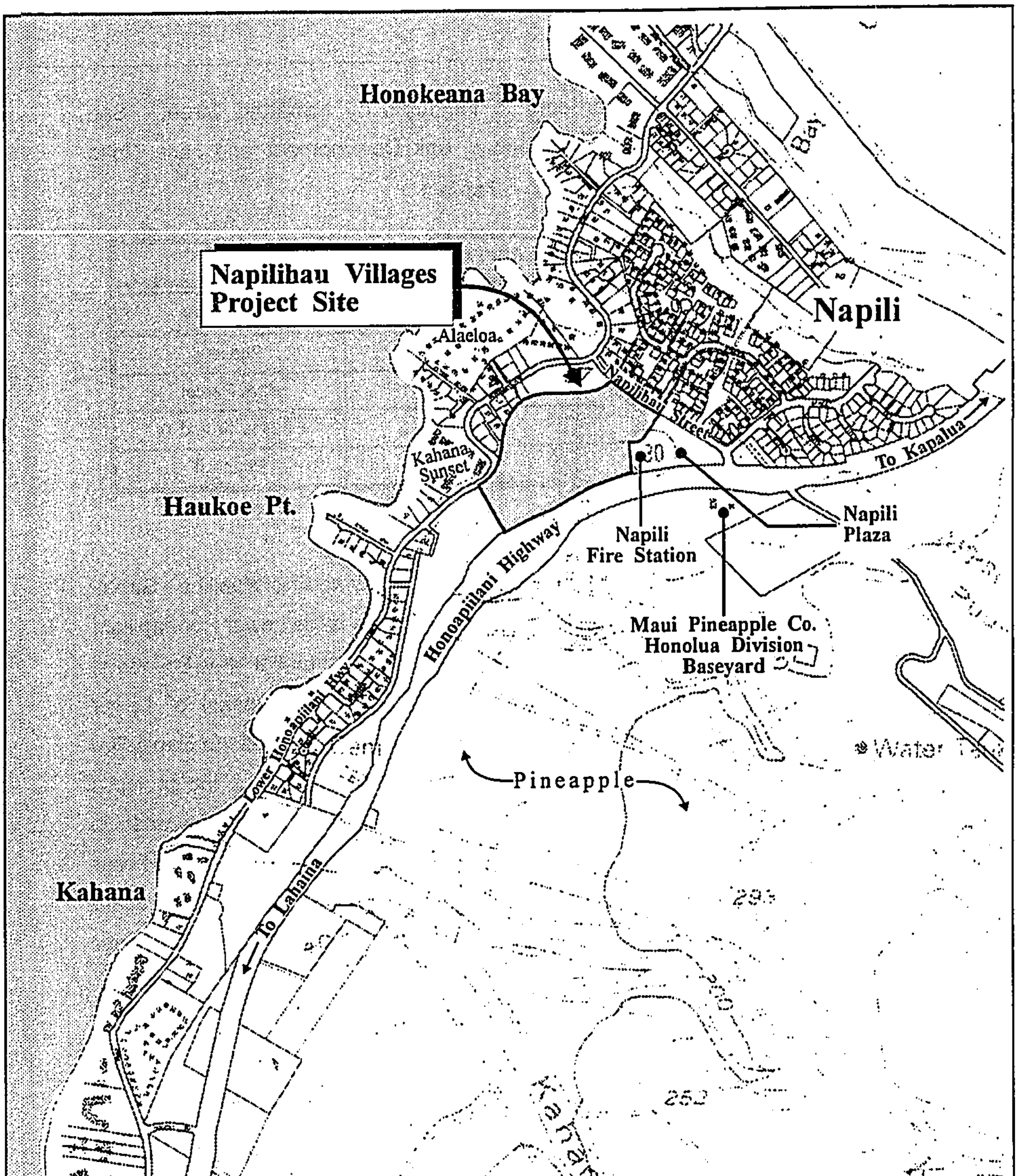

Figure 3

Napilihau Villages
Environmental Assessment
Site Location Map

Prepared for: Napilihau Villages Joint Venture

C. PROPOSED ACTION

The Napilihau Villages project is a 296-unit townhouse complex which is programmed to be developed in four (4) phases. See Figure 4. As previously noted, construction on Phase I, consisting of 76 units, has been initiated with certificates of occupancy issued for 24 units. Additional phases are anticipated to be implemented as shown in Table 2.

Table 2

NAPILIHAU VILLAGES PROPOSED PHASING			
Phase	***No. Units***	***Apartment Type***	***Anticipated Completion Date***
Phase I	76	2-Bedroom Units	Substantially Complete
Phase II	80	2-Bedroom Units	January 1999
Phase III	60	2-Bedroom Units	January 2002
Phase IV	80	2-Bedroom Units	January 2000[a]
Total	**296**		

[a] Phase IV will be completed before Phase III

Napilihau Villages is designed as an affordable housing project. The minimum sales provisions governing the marketing of units, as set forth by the project's original Special Management Area Permit, are as follows:

a. Ten (10) percent affordable to families with incomes at or below 80% of Maui County's median annual income;

b. Twenty (20) percent affordable to families with incomes at or below 81% to 120% of Maui County's median annual income; and

c. Twenty (20) percent affordable to families with incomes at or below 121% to 140% of Maui County's median annual income.

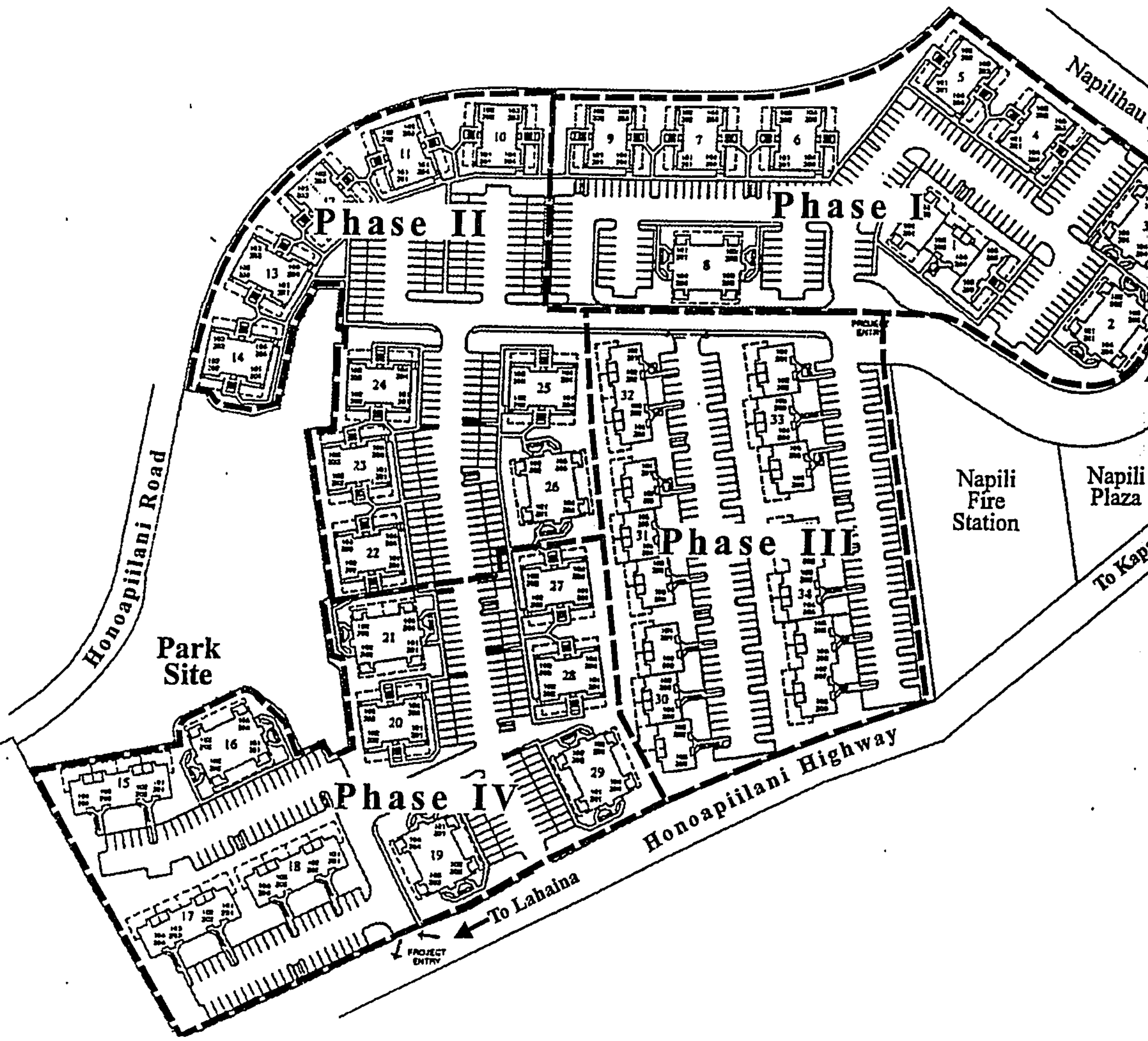

Figure 4 Napilihau Villages Environmental Assessment

Site Plan

Prepared for: Napilihau Villages Joint Venture

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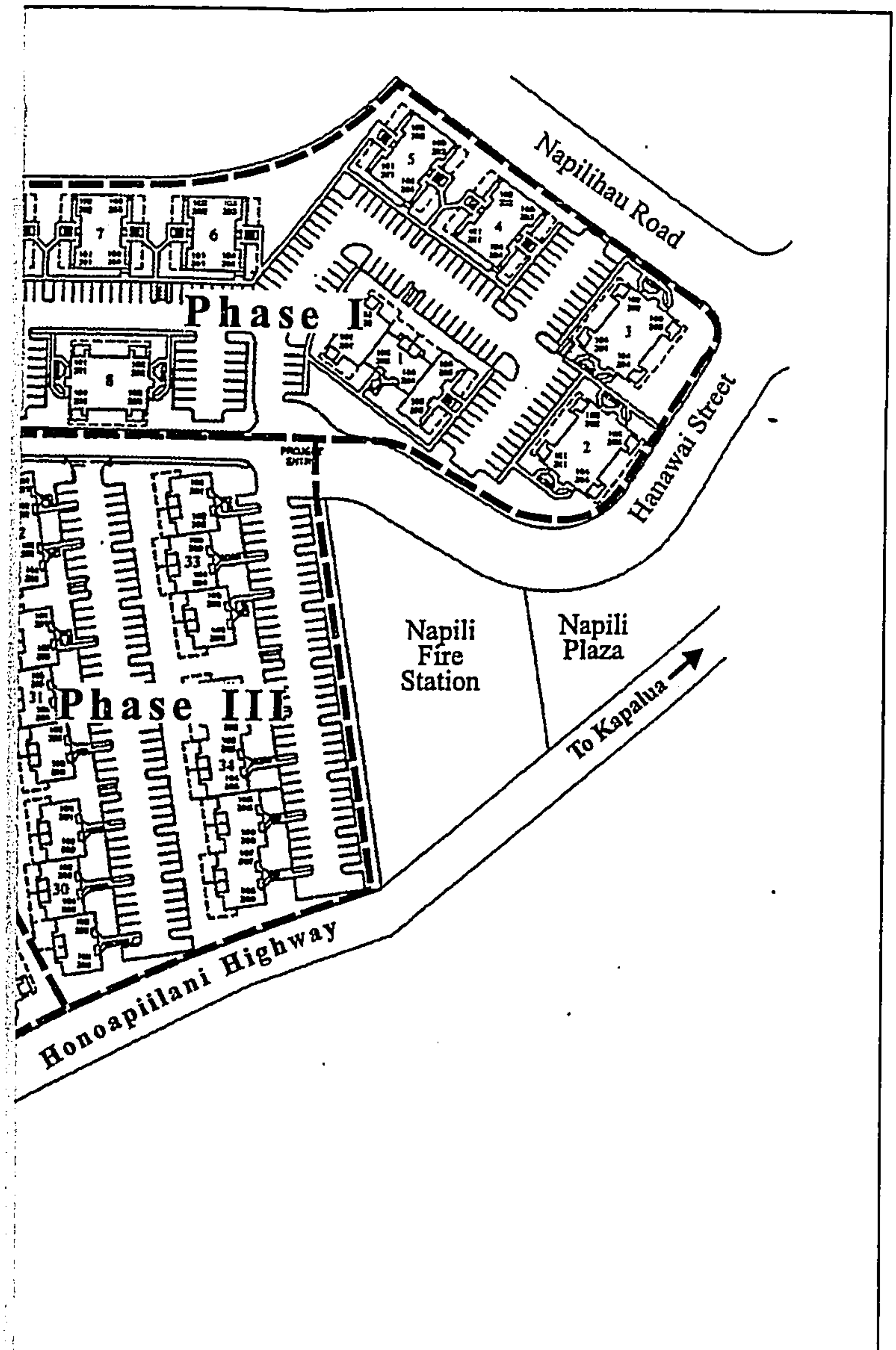

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Based on the 1997 Maui County median income of $53,600.00, approximate "for sale" price ranges for the foregoing income categories are:

a. Up to $135,500.00 for families with incomes at or below 80% of Maui County's median annual income;

b. $135,500.00 to $215,700.00 for families with incomes at or below 81% to 120% or Maui County's median annual income; and

c. $215,700.00 to $258,000.00 for families with incomes at or below 121% to 140% or Maui County's median annual income.

The price ranges cited above assume an interest rate of 8%.

Phase I units are "for sale", with prices ranging between $119,000 and $150,000. Phases II, III and IV are also planned as "for sale", with comparable sales prices. This pricing schedule is in keeping with governmental affordability guidelines.

It is noted that Phase II (80 units) was initially envisioned as an affordable rental project. However, these units will now be marketed as "for sale", in accordance with the sales criteria noted above.

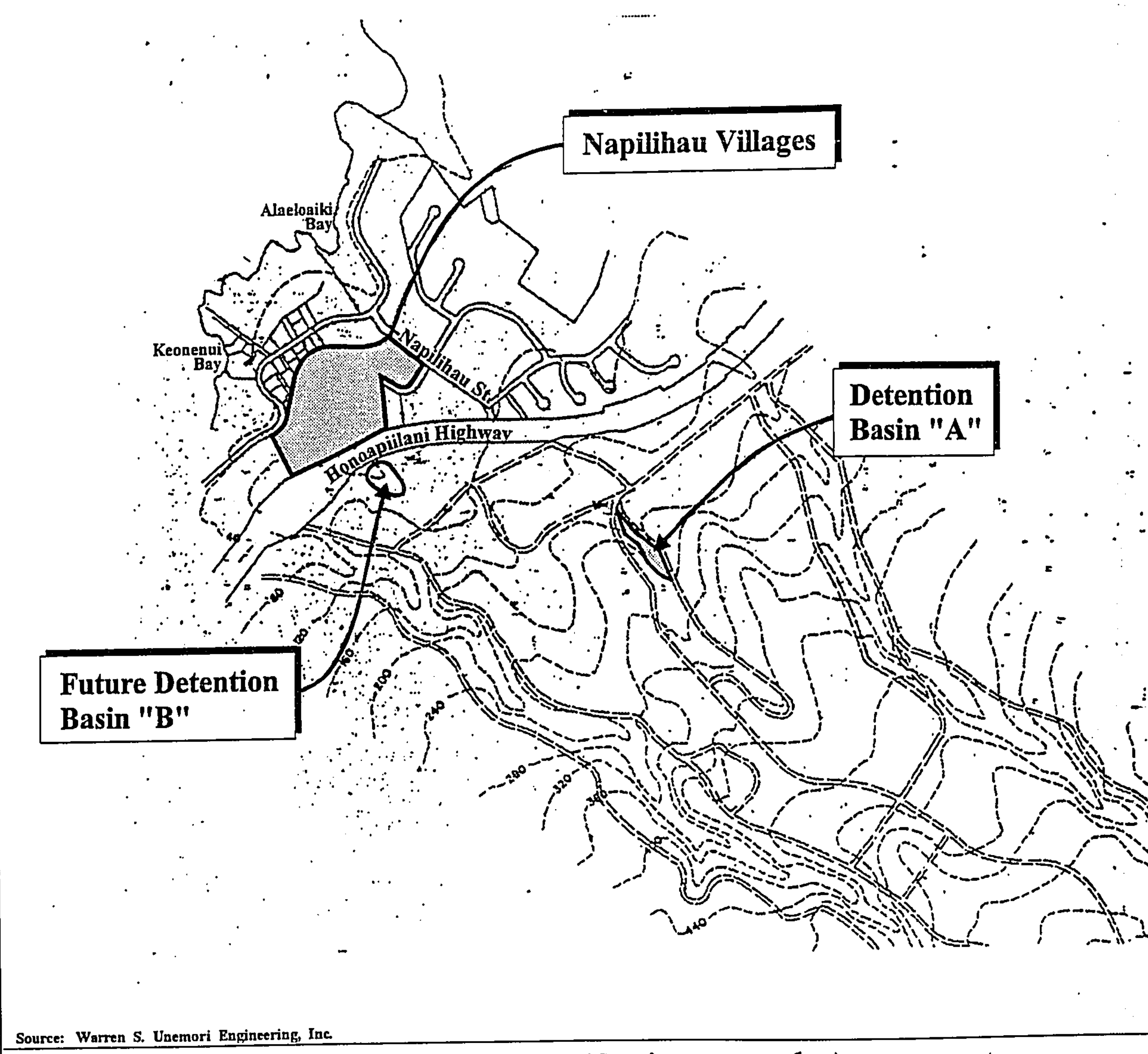
Buildings completed in Phase I reflect the architectural design character for the project. (See site photographs contained in Appendix "A".)

Additional onsite improvements include the installation of utility lines (i.e., water, sewer, drainage and electrical/telephone pipes and conduits), offstreet parking, landscaping and a 1.646-acre park (TMK 4-3-3:110) to fulfill the requirements of the County of Maui's parks and playground assessment. Park improvements will include grassing, irrigation and fencing. Upon completion of improvements, the park will be dedicated to the County of Maui.

Offsite construction involves improvements to the drainage system serving the property. Specific improvements include the installation of a 36-inch drainline within the Napilihau Street right-of-way and a 6-ft. x 4.5-ft. box culvert crossing Lower Honoapiilani Road, approximately 50 feet west of the Lower Honoapiilani Road-Napilihau Street intersection. In addition, two (2) drainage retention basin improvements have been programmed as part of the drainage system. See Figure 5. Retention Basin "A", located approximately 1,000 feet southeast of the Maui Pineapple Company's baseyard, is an expansion of an existing retention basin system at this location and has been designed to provide a system storage capacity of 11.3 acre-feet. Retention Basin "B" is located across Honoapiilani Highway, south of the project site. Retention Basin "B" has been designed to provide a storage capacity of 6.4 acre-feet. Details regarding the proposed drainage system are included in the Preliminary Drainage and Erosion Control Report and the Final Drainage and Erosion Control Reports (Phases I and II), which are incorporated herein and made a part of this EA document. Refer to Appendices "B", "C", and "D".

Construction of the 36-inch drainline along Napilihau Street, the 6-ft. x 4.5-ft. box culvert at the intersection of Napilihau Street and Lower Honoapiilani Road, and Retention Basin "A" have been completed.

Access to the property is provided via Hanawai Street. A second access, limited to right-turn in and right-turn out movements, will be provided at Honoapiilani Highway.



Source: Warren S. Unemori Engineering, Inc.

Figure 5 Napilihau Villages Environmental Assessment

Detention Basins Location

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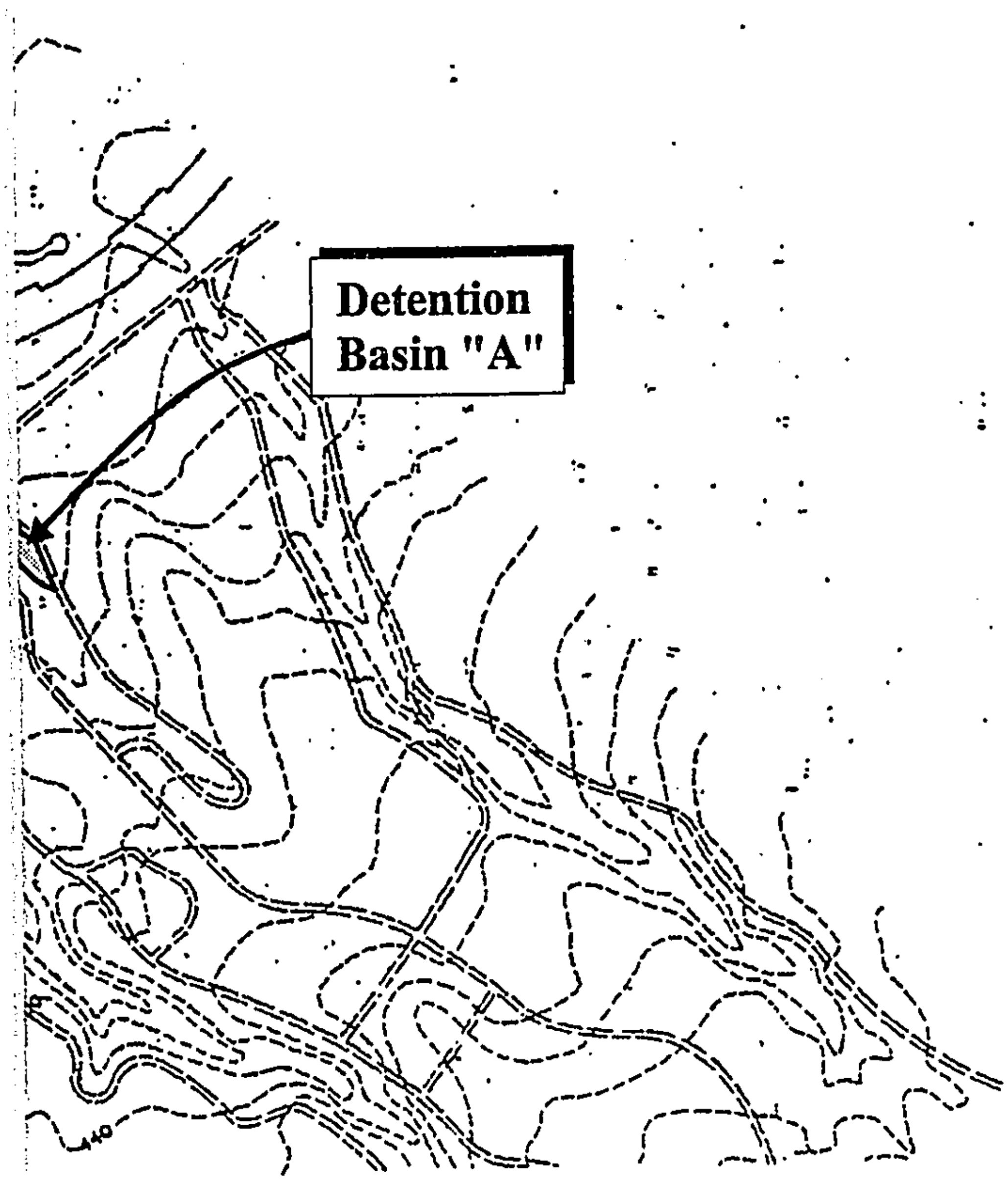

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Chapter II

Description of the Existing Environment

II. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. PHYSICAL SETTING

1. Surrounding Uses

Located makai or west of Honoapiilani Highway, the project site is situated in the midst of the developed portions of Napili. The site is surrounded by the Napili Fire Station, Napili Plaza, and single family and multi-family residential uses. Across Honoapiilani Highway, to the east, are pineapple fields cultivated by Maui Pineapple Company, Ltd.

2. Climate

Like most areas of Hawaii, West Maui's climate is relatively uniform year-round. The region's tropical latitude, its position relative to storm tracts and the Pacific anticyclone, and the surrounding ocean combine to produce this stable climate. Variations in climate among different regions, then, is largely left to local terrain.

In Lahaina, August is historically the warmest month with an average high temperature of approximately 88 degrees Fahrenheit and average low temperature of 70 degrees Fahrenheit. January is normally the coolest month of the year with an average high temperature of 80 degrees Fahrenheit and an average low temperature of approximately 62 degrees Fahrenheit (Department of Geography, 1983).

Rainfall at Lahaina is highly seasonal, with most precipitation occurring between October and April when winter storms hit the area. Precipitation data collected at the Wahikuli Station (#364) show that on average January is the wettest month, with 3.31

inches of precipitation, while June is the driest, with just 0.25 inches. The average annual total is 18.5 inches.

The winds in the region are also seasonal. The northeasterly tradewind occurs ninety (90) percent of the time during the summer, and just fifty (50) percent of the time in the winter. Wind patterns also vary on a daily basis, with tradewinds generally being stronger in the afternoon. During the day, winds blow onshore toward the warmer land mass. In the evening, the reverse occurs, as breezes blow toward the relatively warm ocean.

3. *Topography and Soils*

The project site is situated on gently sloping lands at approximately the 80-foot elevation. Slopes in the vicinity of the project site average approximately eight (8) percent.

At a regional scale, the topography of West Maui ranges from the gently sloping coastal areas to steep ridges and large amphitheater valleys. The maximum elevation of the West Maui Mountains is 5,788 feet at Puu Kukui.

The soil types at the project site consist of Kahana silty clay, 3 to 7 percent slopes (KbB) and Kahana silty clay, 7 to 15 percent slopes (KbC). See Figure 6. The KbB and KbC series consist of well-drained soils located on the uplands of Maui. These soils developed in material weathered from basic igneous rock. For Kahana silty clay, 3 to 7 percent slopes, characteristics of the soil include slow runoff and a slight erosion hazard. For Kahana silty clay, 7 to 15 percent slopes, the soil is characterized by moderately rapid permeability, slow to medium runoff and a slight to moderate

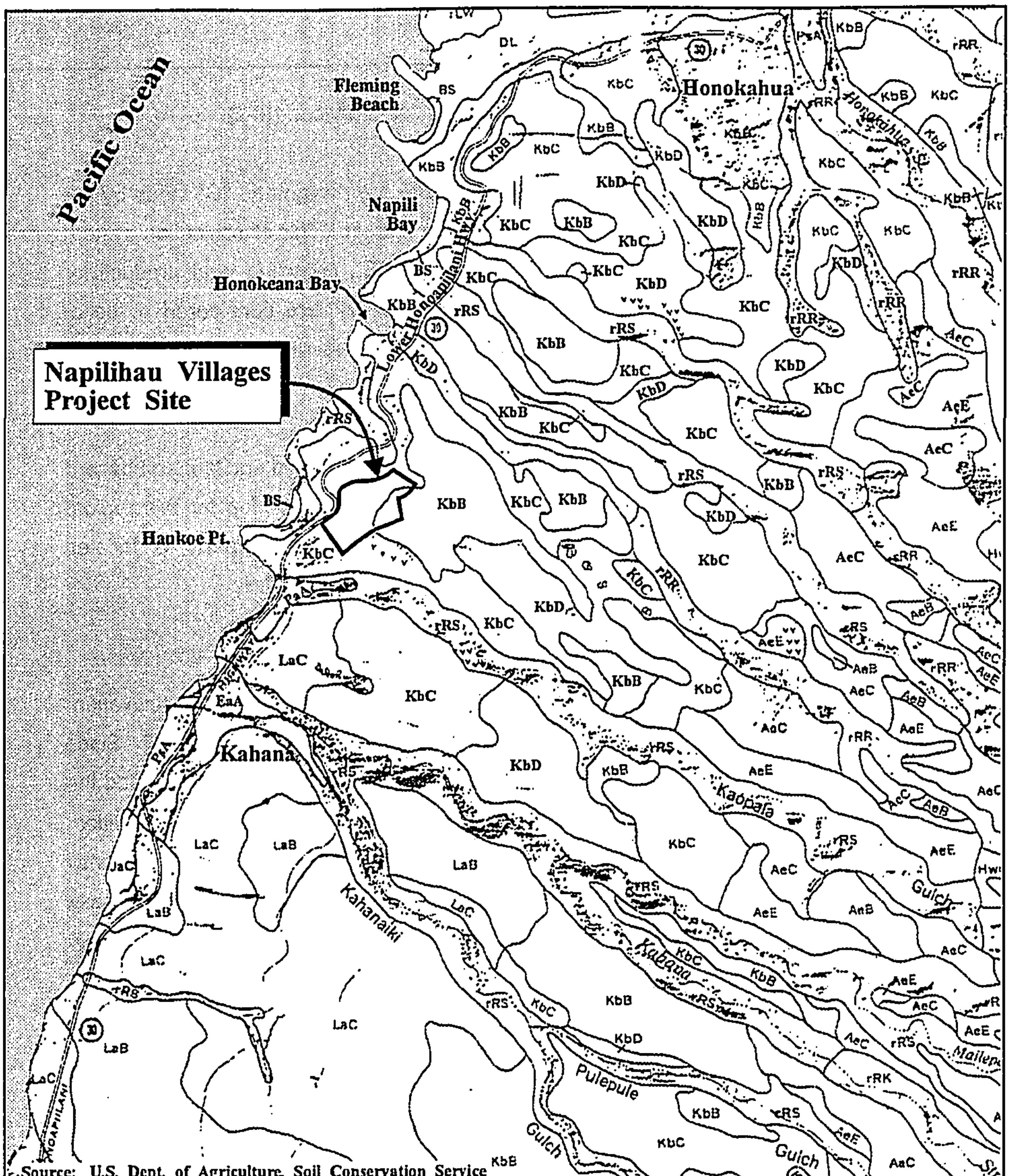

Figure 6

Napilihau Villages Environmental Assessment

Soil Classifications

Prepared for: Napilihau Villages Joint Venture

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erosion hazard (Soil Conservation Service, 1972).

Lands underlying the project site are designated "C" lands by the University of Hawaii Land Study Bureau. This classification system rates lands on a scale of "A" to "E", reflecting land productivity characteristics. Lands designated "A" are considered to be of highest productivity, with "E" rated lands ranked lowest.

4. *Flood and Tsunami Hazard*

The project site lies in an area of minimal flood and tsunami hazard as determined by the Flood Insurance Rate Map for this region. See Figure 7. At its closest point, the property is located approximately 600 feet away from the shoreline.

5. *Flora and Fauna*

The subject property was formerly used for pineapple cultivation. The last pineapple harvest at this location occurred in 1987. Since then, introduced species of weeds and grasses have occupied the site. The Phase I site has been cleared and grubbed. In addition, a portion of the Phase III area has been cleared and is currently being used as a construction staging area. The completed Phase I area has been landscaped with grass, groundcover, and trees.

The region's wildlife include a host of introduced species, including the Japanese White-eye, Zebra Dove, Spotted Dove, and Common Myna. Other mammals common to this region include rats, mice, and mongoose. The project site is not considered a significant habitat for avifauna or wildlife.

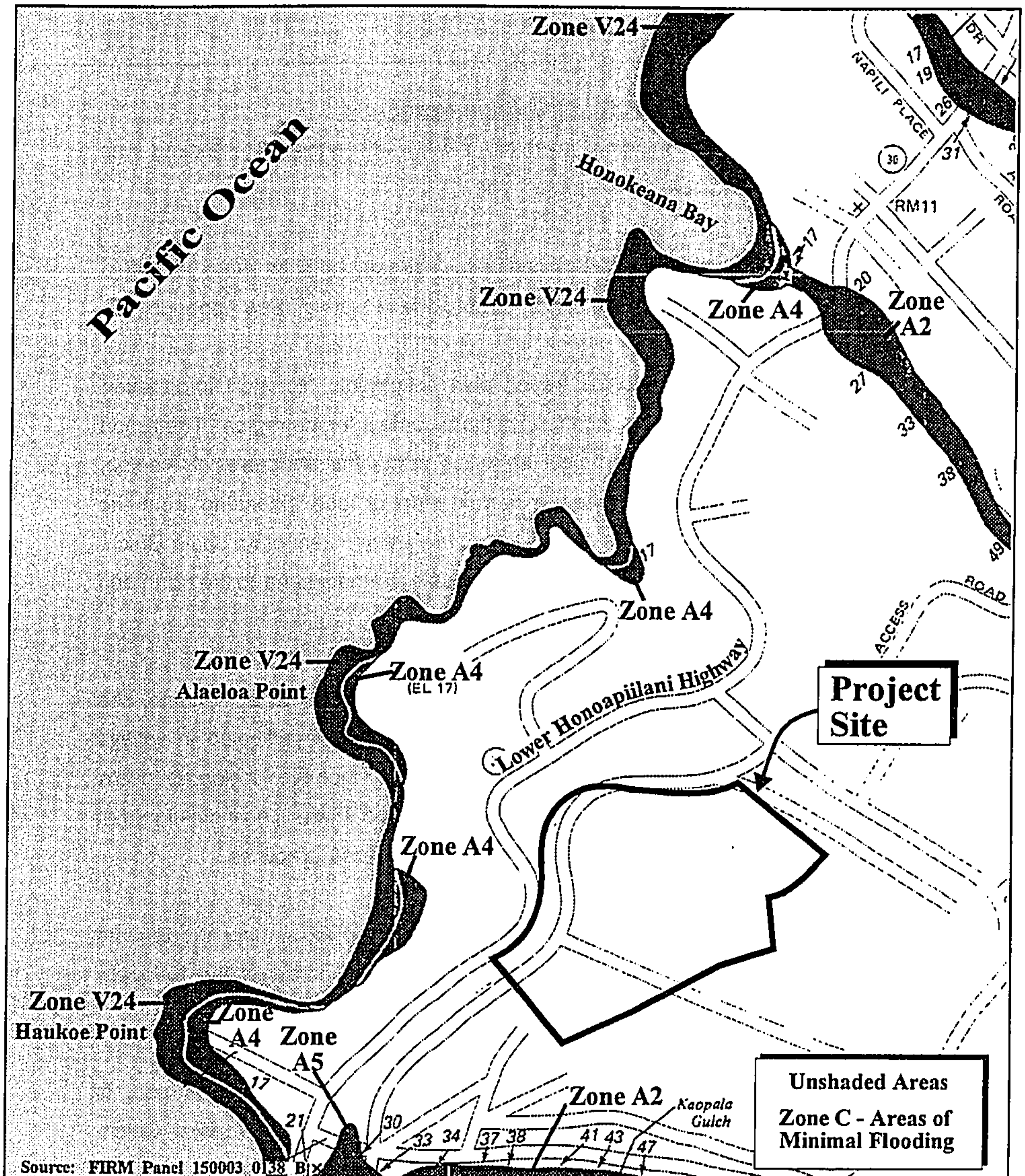

Figure 7

Napilihau Villages
Environmental Assessment
Flood Insurance Rate Map

MUNEKIYO, ARAKAWA & HIRAGA, INC.

0 250 500 1000 Feet

Prepared for: Napilihau Villages Joint Venture

6. ***Archaeological and Cultural Resources***

An archaeological inventory survey with subsurface testing was conducted on the project site.

No significant historic artifacts, midden, or sites were identified during the surface survey or subsurface testing. See Appendix "E".

The archaeological report also documents historical information which provides a general cultural context for the region. The report notes that the project area lies within the ahupua'a of Alaeloa, which encompasses a narrow strip of land extending from the mountains to the sea, including the entire extent of Ka'opala Gulch. Alaeloa is bordered by the ahupua'a of Honokeana to the north and Mailepai to the south.

Starting with whaling and missionary accounts at Lahaina, the report notes that this region was historically cultivated in valleys having reliable water source. However, since the Alaeloa ahupua'a does not have permanent stream source, there is no indication that this area was used for irrigated agricultural practices.

During the Great Mahele of the early 1850's, nine (9) tenants claimed lands in Alaeloa. These claims bordered the Ka'opala Gulch.

Sugar cane in the region was initiated with the establishment of Pioneer Mill in 1865. Fields extended to Ka'opala Gulch. Pineapple cultivation occurred north of Ka'opala Gulch.

A 1923 USGS map shows little evidence of human habitation in Alaeloa. Only six (6) structures are shown in the ahupua'a, one (1) on the coast, and the rest scattered along dirt tracks crossing the land on the northern side of Ka'opala Gulch.

Cultural parameters can also be defined by other archaeological studies which have been conducted in the vicinity of the project site. Griffen and Lovelace, in 1977, studied this area for the Honoapiilani Highway project and found one (1) site in the ahupua'a, at Ka'opala Gulch. A 30-meter section of trail along the northern slope of the gulch was located. This earthen trail was supported by a retaining wall constructed of flat, angular lava rocks. The site was considered of marginal archaeological value.

In 1988, Tourtellote conducted an archaeological inspection at the Rainbow Ranch, which is located about 100 meters inland of the Napilihau Villages project site. There were no sites located on this 12.5-acre property. A 1989 walk-through reconnaissance of the Napili Fire Station site by Archaeological Consultants of Hawaii, Inc. was also completed without finds.

Other studies conducted in nearby ahupua'a have confirmed sites which include a late pre-historic fishing settlement, historic walls and terraces, rock shelter, and rock platform.

In general, archaeological evidence suggest that the Alaeloa ahupua'a was occupied beginning in late prehistoric times. Early settlements would have relied on sweet potatoes as a staple, supplemented by ocean resources. Permanent habitation of Alaeloa during prehistoric times is uncertain. By historic times, there was a small population living in the ahupua'a. Prior to the introduction of sugar cane and pineapple, the area was probably used for ranching (in the late 19th century).

7. ***Air Quality***

The Lahaina region is not exposed to adverse air quality conditions. There are no point sources of airborne emissions in the immediate vicinity and the air quality at the property is considered good. On the mauka side of the property across Honoapiilani Highway are significant acreages in pineapple cultivation. As such, the area is subject to dust and equipment emissions associated with agricultural activities. Motor vehicles are also a primary source of indirect emissions in the region.

8. ***Noise Characteristics***

There are no significant fixed noise generators in the vicinity of the project site. Background noise in this locale can be attributed to traffic travelling on Honoapiilani Highway and Lower Honoapiilani Highway. The operation of agricultural equipment, such as pineapple harvesters, sprayers and trucks, may also contribute to noise levels on an intermittent and temporary basis. Noise generated by agricultural operations are considered normal and acceptable for such activities and do not adversely affect surrounding lands. In addition, arrival and departure flight tracks for the Kapalua-West Maui Airport lie to the south of the project site, placing the project area beyond the limits of airport noise exposure.

9. ***Scenic Resources***

The project site is located within an urban neighborhood which includes single and multi-family residential and vacation rental uses, the Napili Fire Station, and the Napili Plaza. To the east of the site, across Honoapiilani Highway, are cultivated fields of pineapple managed by Maui Pineapple Company, Ltd.

The property is located mauka or east of Lower Honoapiilani Road, the local collector road which runs near the coastline.

The site is not a part of a scenic corridor and is not considered to have significant scenic views to the ocean.

10. ***Marine Characteristics***

A marine environmental baseline survey was conducted for Keonenui and Alaeloaiki Bays, which are located downstream from the subject property. See Appendix "F". The baseline study notes that circulation patterns within the Keonenui Bay appear to be the result of strong currents originating out of the northeast, the North Pacific swell and associated inshore wave action, and tradewind influence. During the weak to modest tradewind conditions on December 9 and 10, 1997, water currents showed a discernible seaward flow during both flood and slack (ebb) tide periods.

Water circulation in the general vicinity of Alaeloaiki Bay is heavily influenced by the prevailing southwesterly currents associated with the Pailolo Channel, and inshore wave action. Tradewinds appear to exert a minimal influence on water circulation because of the alignment of the bay with respect to the coastline and prevailing winds. Current observations at this locale indicate a strong southwesterly component.

The survey of biota at Keonenui Bay indicates that coral diversity and density is very low. Coral species found at Keonenui include low, encrusting Porites lobata, a few colonies of encrusting Montipora flabellata, and occasional colonies of arborescent Pocillopora meandrina.

The survey also documented various species of algae, fish and microinvertebrates at Keonenui. Conspicuous algae included Ulva fasciata, Sargassum echinocarpum, and Ahnfeltia concinna. The survey also indicates that Keonenui Bay supports a modest fish fauna, but overall density is low. Only one (1) specie, the convict tang, demonstrated a ubiquitous distribution and is considered abundant. Microinvertebrates found at this location include patchy growths of zooanthids, the slate pencil urchin, rock-boring urchins and black-spined urchins.

At Alaeloaiki Bay, coral density was found to be higher than at Keonenui Bay. Coral coverage is estimated to range between two (2) to five (5) percent. In localized areas, coral coverage is occasionally higher, though generally patchy.

Ulva faciata was the dominant algae found at Alaeloaiki. Encrusting coralline algae were also noted in areas of breaking waves. Fish biota at Alaeloaiki Bay is similar to Keonenui Bay. Manini was the most commonly observed fish and was frequently observed in schools of 20 to 50 individual fish. Other fish species observed at Alaeloaiki included surgeon fish, achilles tang, orange spine, unicorn fish, eye-stripe surgeon fish, and goldring surgeon fish. Microinvertebrates are not well represented in the wave-exposed subtidal waters of Alaeloaiki Bay. The most commonly observed invertebrate was the rock-boring urchin.

It is noted that a single green sea turtle (Chelonia mydas) was observed foraging on marine algae immediately adjacent to Haukoe Point on December 10, 1997.

B. COMMUNITY SETTING

1. Land Use and Community Character

The vast majority of lands in West Maui are either State designated "Conservation" or "Agricultural". Generally, "Conservation" lands occupy the higher elevations, while the "Agricultural" district spans the middle ground. Major exceptions to this trend are the Honolua Stream and Pohakupule Gulch areas where the "Conservation" district extends down to sea level.

"Urban" designated lands, then, are left to occupy the lower elevations along the coast. Kapalua and Kaanapali contain Community Plan designations reflective of their resort nature. The communities of Kahana and Napili contain a mixture of resort, residential and business uses. Lahaina, meanwhile, encompasses a diverse mix of land uses, including residential, business, light industrial, recreational and agricultural uses.

Napili is located approximately eight (8) miles north of Lahaina Town between Kahana and Kapalua. The urbanized portions of the Kahana-Napili areas, makai of the Honoapiilani Highway, are typified by condominium apartments interspersed with single-family residential neighborhoods.

The town of Lahaina is the commercial center for West Maui. The town contains several shopping centers and retail business areas, and serves as a hub for the region's residential housing.

West Maui's attraction can be attributed to its year-round dry and warm climate, complemented by many white-sand beaches and scenic landscape. Visitor accommodations are located in Lahaina and the resort communities of Kaanapali, Kahana, Napili, and Kapalua. The State of Hawaii's Kapalua-West Maui Airport at Mahinahina links the region to Oahu and other neighbor islands.

Sugar cane and pineapple fields occupy much of the land in the area. Pioneer Mill, a vital part of the region's economy, is the State's smallest sugar plantation with approximately 6,700 acres in cultivation. Maui Land and Pineapple Company's fields sprawl along the slopes of the West Maui Mountains north of Lahaina.

2. *Population*

Just as the visitor count has grown, the resident population of the region surrounding the project site has increased in the last two decades. Population gains were especially pronounced in the 1970s as the developing visitor industry attracted many new residents. According to the 1990 Census of Population and Housing, resident population of the Lahaina District was 14,574. A projection of the resident population for the years 2000 and 2010 are 18,555 and 22,633 respectively (Community Resources, Inc., 1994).

Growth patterns at the County level exhibit a similar pattern. The County's 1980 resident population of 71,000 has since grown to just over 100,000. The estimated County population for the year 2010 is 145,200 (DBED, 1990).

3. *Economy*

The economy of Maui is heavily dependent upon the visitor industry. The dependency on the visitor industry is especially evident in West Maui, which is one of the State's major resort destination areas.

With regard to agriculture, Pioneer Mill utilizes approximately 6,700 acres for cultivation. In addition, Pioneer Mill maintains a full-time, year round workforce of approximately 100 employees. During harvesting season, which begins in early June and ends in late October, sugar operations are supported by a seasonal workforce (P. Brodie, Pioneer Mill Company, Ltd., March 27, 1995). Pioneer Mill has also diversified its agricultural operations by cultivating approximately 500 acres in coffee (P. Brodie, Pioneer Mill Company, Ltd., March 27, 1995).

Maui Land and Pineapple Company's fields remain an important component of the region's agricultural base.

4. *Housing*

According to the Hawaii Housing Policy Study Update 1997 the 1997 occupied housing unit count for the Island of Maui was estimated at 35,899 (Locations, Inc., 1997). Of this total, 6,347 occupied units were estimated for the West Maui Community Plan region. In the West Maui Community Plan region, housing unit types included approximately 3,425 single family units and about 2,500 multi-family units (including townhomes, condominiums, and apartments). The Hawaii Housing Policy Study Update 1997 estimates current housing demand (based on those who plan to move within the next two (2) years) for West Maui at about 1,600.

The Maui County Community Plan Update Program Socio-Economic Forecast Report (Community Resources, 1994) estimated that the 1996 housing demand for the West Maui Community Plan area at 1,110 with the year 2000 demand estimated at 1,819.

It is noted that sales and reservation activity for the Napilihau Villages project indicates that demand for affordable units continue. Of the initial 76 units developed for Phase I, 67 have been sold.

The large majority of buyers and potential buyers are anticipated to be current residents of the West Maui Community Plan area.

5. ***Police and Fire Protection***

The project site is within the Lahaina Police Station service area, which services all of the Lahaina district. The Lahaina Station is located in the Lahaina Civic Center complex at Wahikuli, and was built in the early 1970's. The Lahaina Patrol includes 54 full-time personnel, consisting of one (1) captain, one (1) lieutenant, seven (7) sergeants, and 39 police officers. The remaining six (6) personnel consist of public safety aides and administrative support staff (telephone conversation with Greg Takahashi, Maui Police Department, February 1996).

Fire prevention, suppression and protection services for the Lahaina District is provided by the Lahaina Fire Station, also located in the Lahaina Civic Center, and the Napili Fire Station, located adjacent to the project site. The Lahaina Fire Station includes an engine and a ladder company, and is staffed by 30 full-time personnel. The Napili Fire Station consists of an engine company including fifteen (15) full-time firefighting personnel (telephone conversation with Cindy Kagoshima, Maui Fire Department, February 1996).

6. ***Medical Facilities***

The only major medical facility on the Island is Maui Memorial Hospital, located midway between Wailuku and Kahului. The 185-bed facility provides general, acute, and emergency care services.

Private medical offices, however, are found in West Maui. For example, regular hours are offered by the Maui Medical Group, Lahaina Physicians, West Maui Healthcare Center, and Kaiser Permanente Lahaina Clinic.

7. ***Recreational Facilities***

West Maui is served by numerous recreational facilities offering diverse opportunities for the region's residents. These facilities include several County parks and beach parks in West Maui. Approximately one-third of the County parks are situated along the shoreline and are excellent swimming, diving, and snorkeling areas.

In addition, Kaanapali and Kapalua Resorts operate world-class golf courses which are available for public use.

8. ***Schools***

The State of Hawaii, Department of Education operates four (4) public schools in West Maui: Lahainaluna High School; Lahaina Intermediate School; King Kamehameha Elementary School; and Princess Nahienaena Elementary School. All of the public schools are located within the Lahaina Town area.

The region is also served by privately operated pre-elementary and elementary schools.

C. ***INFRASTRUCTURE***

1. ***Roadway System***

Honoapiilani Highway (State Highway 30) is the main roadway serving the West Maui region. This highway is the only link between West Maui and the rest of the Island (although a substandard segment of highway extends around the north coast of the Island to Waihee, providing limited access).

From a regional perspective, Honoapiilani Highway is the primary arterial which connects Lahaina, Kaanapali and Kapalua. The State of Hawaii, Department of Transportation is proposing the widening of Honoapiilani Highway, between Kaanapali Parkway to Honokowai Stream, to enable the establishment of two (2) travel lanes in each direction through this highway segment. It is noted that Honoapiilani Highway, bordering the project site, will continue to operate with a two-lane typical section configuration.

Lower Honoapiilani Road is a local roadway which provides access to and along the West Maui coastline, between Honokowai and Kapalua. Napilihau Street, which is located to the north of the property, provides an east-west connection between Lower Honoapiilani Road and Honoapiilani Highway.

Access to the subject property will be provided from Napilihau Street (via Hanawai Street) and Honoapiilani Highway. The Honoapiilani Highway access will be limited to right-turn in and right-turn out movements only.

2. ***Water***

The West Maui Region is served by the County's Board of Water Supply water system. The County water system services the coastal areas from Launiupoko to Kaanapali and from Honokowai to Napili (County of Maui, Department of Water Supply, 1990). The County's system includes both surface and groundwater sources.

The water system in the area consists of a 1.0 million gallon reservoir and various distribution lines. The 1.0 million gallon reservoir, located on the mauka side of Honoapiilani Highway about 3,100 feet southeast of the project, provides storage and feeds the distribution system in the area.

An existing 12-inch line along Hanawai Street provides water service for the project.

3. ***Wastewater Systems***

The County's wastewater collection and transmission system and the Lahaina Wastewater Reclamation Facility (LWRF) accommodate the region's wastewater needs. The LWRF, located along Honoapiilani Highway just north of Kaanapali Resort, has a design capacity of 9.0 MGD.

The Napilihau Villages property is served by the County's wastewater collection system. Flows generated by the project will be collected by an onsite system of 4-inch, 6-inch and 8-inch sewerlines. Wastewater generated by Phase I will be conveyed to an existing 8-inch County collector line located within Napilihau Street. Flows from Phases II, III, and IV will be conveyed to an existing 21-inch sewerline located at Lower Honoapiilani Road.

4. ***Solid Waste Disposal***

Residential refuse collection is provided by the County's Solid Waste Division. Private refuse collectors provide solid waste disposal services for commercial and institutional accounts. With the exception of the Hana region, residential and commercial solid waste from throughout the island is transported to the Central Maui Landfill at Puunene.

A refuse transfer station located at Olowalu accepts household and green wastes, as well as used oil, for transport to the Central Maui Landfill in Puunene. The disposal of commercial and institutional refuse is not permitted at the Olowalu transfer station (telephone conversation with Department of Public Works and Waste Management employee, Elaine Baker, March 1996).

5. ***Drainage***

The subject property falls within two (2) separate drainage basins, which are described below.

Drainage Basin "A"

The project's Phase I area falls within the limits of Drainage Basin "A". This drainage basin includes a 98-acre area mauka of the detention basins which are located approximately 1,000 feet southeast of the Maui Pineapple Company baseyard. In addition, the land area just below the detention basins, the Napili Plaza and the Napilihau Villages Phase I site fall within this drainage basin. Within Drainage Basin "A", flows from lands mauka of Honoapiilani Highway are conveyed across the highway via a triple 65-inch x 40-inch corrugated metal pipe. Flows are then passed through the Napili Plaza where connection is made to the recently installed 36-inch culvert which is aligned through a portion of Hanawai Street then to Napilihau Street. The 36-inch culvert within Napilihau Street terminates at the 6-ft. x 4.5-ft. box culvert which crosses Lower Honoapiilani Road approximately 50 feet west of the Lower Honoapiilani Road-Napilihau Street intersection. Flows from the box culvert are then released into an existing drainage swale aligned through the Alaeloa project, ultimately discharging into the ocean.

In addition to the drainage improvements located within Hanawai Street and Napilihau Street, Detention Basin "A", located mauka of Honoapiilani Highway, has been completed. Refer to Figure 5. Detention Basin "A", together with an adjacent existing detention basin, provides a storage volume of about 11.3 acre-feet.

Prior to the construction of Phase I of Napilihau Villages, flows from Drainage Area "A" were routed to a temporary detention basin located on the Phase I site. Overflow from this detention basin continued to flow in a makai direction, across Lower Honoapiilani Road, then to the existing drainage swale which traverses the Alaeloa project.

Drainage Basin "B"

Areas encompassing Phase II, Phase III, Phase IV, and the proposed park site fall within Drainage Basin "B". Drainage Basin "B" has a total area of approximately 97 acres, which includes lands located mauka or east of Honoapiilani Highway. Refer to Appendix "B".

Most of the area within this drainage basin is in agricultural use. The drainage basin extends about 6,100 feet from the ocean.

Phases II, III, and IV of the project comprises about 13 acres and represents about 13 percent of the total drainage basin area. Makai of the subject property is the Kahana Sunset condominium which comprises the remaining 10 acres of the drainage basin.

Existing drainage improvements for Drainage Basin "B" include sediment basins, a 66-inch culvert at Honoapiilani Highway, a 24-inch culvert at Lower Honoapiilani Road and the drainage system through Kahana Sunset.

There are two sediment basins located about 200 feet upstream of Honoapiilani Highway. These basins receive runoff from the mauka 66 acres of the drainage basin. This area includes pineapple fields and the Maui Pineapple Company office and baseyard.

The 66-inch culvert (crossing Honoapiilani Highway) receives runoff from the mauka 72 acres of the drainage basin and transports flows through the subject property. The culvert is designed to handle a 50-year storm flow of 242 cubic feet per second (CFS).

At Lower Honoapiilani Highway, there is a 24-inch culvert which receives runoff from about 87 acres and passes the runoff under the road and into the Kahana Sunset site. Lower Honoapiilani Road and an old railroad embankment on the subject property form a sump at the upstream end of the culvert. Because of the culvert's limited capacity, heavy rains may cause runoff to accumulate in the sump. Under severe storm conditions, however, runoff may fill the sump and overtop the old railroad embankment and Lower Honoapiilani Road.

The Kahana Sunset drainage system is at the lower end of the drainage basin. The drainage system takes the runoff from the upstream areas, passes it through the site, and discharges the runoff into the ocean.

To address drainage system requirements for Drainage Basin "B", a new detention basin ("B") will be constructed in connection with Phases II, III and IV. Refer to Figure 5. Detention Basin "B" will have a designed storage volume of 6.4 acre-feet.

6. ***Electrical and Telephone Service***

Electrical, telephone, and cable services for the West Maui region are provided by Maui Electric Company, Ltd., GTE Hawaii Telephone Company, Incorporated, and Hawaiian Cablevision Company, respectively.

Chapter III

Potential Impacts and Mitigation Measures

III. POTENTIAL IMPACTS AND MITIGATION MEASURES

A. IMPACTS TO THE PHYSICAL ENVIRONMENT

1. Flora and Fauna

The project's Phase I site has been cleared and grubbed in preparation for construction. Vegetation in the Phases II, III and IV areas currently include established weeds, grasses and shrubs, which developed following the abandonment of pineapple cultivation at the property. There are no known rare, endangered or threatened species of flora at the site. Upon completion, the project site will be landscaped and maintained. Plant species proposed for landscaping include a variety of grasses, groundcover, shrubs and trees, including croton, false olive, autograph tree, snow bush, and fiddle wood.

There are no known rare, endangered or threatened species of avifauna and wildlife in the vicinity of the project.

In summary, the displacement of approximately 16.5 acres of undeveloped, fallow pineapple lands is not anticipated to have an adverse effect on the area's flora and fauna.

2. Archaeological Resources

According to the archaeological inventory survey conducted on the project site, no significant historic artifacts, midden or sites were identified during the surface survey or the subsurface testing on the property. The absence of any significant historic sites can be largely attributed to the effects of pineapple cultivation on any pre-existing features.

The State Historic Preservation Division has determined that the project will have "no effect" on significant historic sites. See Appendix "G".

It is noted that historical research for the Alaeloa ahupua'a indicates that permanent pre-historic habitation at this ahupua'a is uncertain. By historic times, there was a small population living the ahupua'a. Prior to the introduction of sugar cane and pineapple, the area was probably used for ranching (in the late 19th century).

In the context of the area's land use history and surrounding existing developments, the implementation of the Napilihau Villages project is not anticipated to have an adverse impact upon cultural resources.

3. ***Air Quality***

Air quality impacts attributed to the project will include dust generated by short-term construction-related activities. Site work such as clearing, grubbing and grading, and utilities and roadway construction for example, will generate air-borne particulates. Dust control measures, such as regular watering and sprinkling have been, and will continue to be implemented to minimize wind-blown emissions.

Once the project is completed, project-related vehicular traffic will generate automotive emissions. However, project-related emissions are not expected to adversely impact local and regional ambient air quality conditions.

4. ***Noise***

Dominant noise sources in the project environs are traffic on Honoapiilani Highway and Napilihau Street.

Ambient noise conditions will also be temporarily impacted by construction activities. Heavy construction equipment, such as bulldozers, front-end loaders, and materials-carrying trucks and trailers, would be the dominant source of noise during the site construction period. Construction activities will be limited to normal daylight working hours.

Once completed, the project is not anticipated to be a noise source which will adversely impact surrounding properties.

5. ***Use of Chemicals and Fertilizers***

Use of herbicides, if any, on the project site will generally be limited to the initial plant establishment period.

Pesticides are anticipated to be used only as a treatment and not as a preventive measure. As a treatment, application usage will be minimal. In addition, plant selection for the project will be based on hardiness, drought tolerance, pest resistance as well as aesthetic concerns.

Nitrogen/Phosphorus/Potash fertilizers are anticipated to be applied to lawn areas, groundcover and flowering shrubs. With proper irrigation management practices, leaching of fertilizers should be minimal.

No adverse effects on surface, underground and marine water resources are anticipated.

6. ***Marine Resources***

Baseline marine environmental surveys were conducted in Keonenui Bay and Alaeloaiki Bay to define physical, circulation, and biotic conditions and to determine impacts to marine biota and water quality, if any, from the proposed action. Refer to Appendix "F".

The proposed drainage systems which will be installed for the project will include new or enhanced detention basins which are designed to reduce sediments in storm runoff. In addition to reducing sediment loads from runoff generated within the immediate upstream drainage basins, the drainage improvements will reduce peak discharge flows into the Keonenui and Alaeloaiki Bays.

The proposed drainage improvements combined with circulation patterns that permit rapid flushing is not anticipated to adversely impact the marine biota and coastal water quality.

B. IMPACTS TO COMMUNITY SETTING

1. ***Land Use and Community Character***

The Napilihau Villages project is anticipated to be compatible with surrounding land uses.

The Napili Fire Station and Napili Plaza are located to the east of the proposed project. The master planned Kapalua resort is located approximately one (1) mile to the north of the property.

The Napilihau Planned Unit Development and the Hale Noho residential developments are located in close proximity to the project site, near Napilihau Street. Single-family and multi-family residential uses are located on Lower Honoapiilani Highway.

2. ***Population and Local Economy***

The Napilihau Villages project will provide construction employment which will support the construction industry in the short term. For example, construction costs for the 76-unit Phase I project is estimated at about $8.0 million. Employment provided through the construction phase of project development will also help to support other businesses which are economically linked to the construction industry.

The project itself is not anticipated to result in significant population in-migration. The target market for the project is residents living within the community. For example, of the 67 buyers who have purchased units in Phase I, 60 or 90 percent currently reside within the West Maui Community Plan region.

3. ***Housing***

The Napilihau Villages project will provide a total of 296 multi-family units. A total of 216 units will be "for sale", with the remaining 80 units to be offered "for rent". Sales and rental prices will be established to meet applicable governmental affordability criteria.

Based on recent studies of housing needs in the West Maui area, there is indicated a continuing demand for housing in this region. Sales and reservation activity for the Napilihau Villages also indicates a continued demand for the townhome apartment product offered by the project.

In terms of impact, therefore, the subject action will meet demand for affordable housing in the West Maui Community Plan. There are no adverse effects to the local housing market anticipated as a result of the project.

4. ***Agriculture***

The project site contains the remnants of a pineapple field which were last planted in July 1983 and harvested in August 1987. The previous owner of the property, Maui Pineapple Company, utilized the site for pineapple cultivation. However, with the construction of Honoapiilani Highway, the subject property was separated from other larger fields in active pineapple cultivation, making it uneconomical for continued cultivation.

The effect of development of the subject property on agricultural endeavors in the region is not considered adverse.

5. ***Police, Fire and Medical Services***

The proposed project is not anticipated to affect service area limits and capabilities of police, fire and emergency medical operations.

6. ***Recreational Facilities***

To address recreational needs which may be generated by the project, a 1.646-acre park adjacent to the project will be dedicated to the County by the project developer. This facility is anticipated to meet neighborhood play area needs.

As previously indicated, the majority of owners and renters are expected to be current residents of the West Maui Community. From a regional perspective, therefore, the proposed project is not anticipated to create any increase in user demand for regional recreational facilities.

7. *Educational Facilities*

The Napilihau Villages project is designed to meet residential needs of West Maui families. In this regard, school-aged children will be a part of this community. For example, of the 67 purchasers of Phase I units, 20 owners have school-aged children as part of their family unit. However, inasmuch as these families are, for the most part, already residing in the West Maui Community Plan region, the project's impacts to school facilities are not considered adverse.

C. IMPACTS TO INFRASTRUCTURE

1. Roadways

A traffic impact report (TIR) was undertaken for the project in February 1993. See Appendix "H". The highway capacity analysis performed for the study is based upon procedures presented in the "Highway Capacity Manual", Special Report 209, Transportation Research Board, 1985, and the "Highway Capacity Software", Federal Highway Administration.

The primary intersections impacted by the Napilihau Villages development are noted as follows:

- Napilihau Street/Honoapiilani Highway
- Napilihau Street/Hanawai Street
- Napilihau Street/Lower Honoapiilani Road

- New access road to development/Lower Honoapiilani Road

The traffic analysis assumed a projected de facto increase in traffic of 3 percent per year plus the traffic generated by the Ritz-Carlton Hotel and the Napili Trade Center.

Based on the analysis, the 1993 traffic impact report sets forth the following conclusions:

Condition No. 1. With the projected traffic generated by the Ritz-Carlton Hotel and the Napili Trade Center development, the intersection of Honoapiilani Highway and Napilihau Street must be signalized in order for traffic from Napilihau Street to safely enter Honoapiilani Highway.

Condition No. 2. The intersection of Lower Honoapiilani Road and Napilihau Street must be improved to provide a left-turn storage lane on Lower Honoapiilani Road. This improvement will be required some time in 1993 or early 1994 due to de facto growth in traffic demand.

Condition No. 3. The left-turn storage lane on west bound Napilihau Street at Hanawai Street must be extended to accommodate the additional left-turn demand generated by the proposed development.

Condition No. 4. Honoapiilani Highway between Napilihau Street and Honokowai has adequate capacity to accommodate the additional traffic generated by the proposed project.

The following roadway improvements were recommended in 1993 to accommodate the projected traffic demand due to de facto growth in population and the proposed development:

Recommendation No. 1. Improve the Honoapiilani Highway/Kaanapali Parkway intersection by adding a minimum of 1,000 feet of additional laneage on the north side of the intersection to provide two through lanes for the south bound approach to the intersection and a longer merge area for north bound traffic through the intersection. This improvement is required to accommodate today's existing traffic and is not a result of the Napilihau Villages development.

Recommendation No. 2. Require the Napili Trade Center project to install the traffic signal system at the Honoapiilani Highway/Napilihau Street intersection. In conjunction with the installation of the traffic signal system, the left-turn storage lane for north bound traffic should be extended to provide a minimum storage length of 250 feet.

Recommendation No. 3. The intersection of Lower Honoapiilani Road and Napilihau Street be improved to provide a left-turn storage lane on Lower Honoapiilani Road. This improvement should be implemented now and not as a result of the Napilihau Villages Development.

Recommendation No. 4. The left-turn storage lane on west bound (makai bound) Napilihau Street at Hanawai Street be lengthened to a minimum length of 120 feet as part of the Napilihau Villages development to accommodate the left-turn demand to the project site.

Recommendation No. 5. The intersection of the proposed access road on Lower Honoapiilani Road should provide a left-turn storage lane of at least 40 feet on south bound Lower Honoapiilani Road.[a]

It is noted that the 1993 TIR assumed that the Napili Trade Center was to be an implemented project. Conclusions and recommendations from the 1993 study, therefore, addressed traffic impacts and mitigation measures which included the Napili Trade Center project. (Refer to Conclusion No. 1 and Recommendation No. 2, above.)

A Supplemental TIR was prepared in July 1997 to address current conditions (e.g., the Napili Trade Center project has not been implemented). The Supplemental TIR addressed Phase I traffic to determine if revised recommendations for traffic impact mitigation would be applicable. See Appendix "I". The Supplemental TIR concludes:

1. Total traffic volumes during the peak hour of traffic at the Honoapiilani Highway/Napilihau Street intersection have increased by approximately 19% during the morning peak hour of traffic and has decreased by approximately 10% during the afternoon peak hour of traffic.

2. However, the intersection continues to operate satisfactorily with an acceptable Level of Service "C". Left-turn movements from Honoapiilani Highway can be executed with very little delay.

3. The additional traffic volume resulting from Phase I of the Napilihau Villages has negligible impact on the operations of the Honoapiilani

[a] Access from Lower Honoapiilani Road was proposed as part of the project's initial development proposal. This access point was deleted in the final site plan.

Highway/Napilihau Street intersection. The trips generated by Phase I are equivalent to the day-to-day fluctuation of traffic on Honoapiilani Highway.

4. Although traffic volumes at the Honoapiilani Highway/Napilihau Street intersection meet the warrants for traffic signal, the installation of a traffic signal system may be delayed until cross street traffic volumes from the mauka area increase.

Furthermore, the Supplemental TIR recommends:

1. Geometric improvements for the roadways in the vicinity of the project contained in the 1993 Traffic Impact Report should be implemented, with the following exceptions:

   a. The extension to the left-turn storage lane on northbound Honoapiilani Highway be deferred and re-examined when Phase II of the Napilihau Villages is developed and ready for occupancy, or

   b. The left-turn storage lane be extended when a traffic signal system is installed at the Honoapiilani Highway/Napilihau Street intersection.

2. Any pro-rate share cost assessment for the installation of a traffic signal system at the intersection of Honoapiilani Highway and Napilihau Street be based upon the vehicular trips generated by the number of completed units at Napilihau Villages at the time the traffic signal system is installed, and not based upon the "future" build-out of Napilihau Villages (unless the traffic signal system is installed after build-out).

3. The Traffic Impact Report be updated when Phase II is ready to be implemented if the traffic signal system and the extension of the left-turn storage lane at the Honoapiilani Highway/Napilihau Street intersection have not been implemented.

The State Department of Transportation's comments on the Supplemental TIAR, as reflected in Appendix "J", are as follows:

1. The developer's pro rata share for the *installation of a traffic signal* system at the intersection of Honoapiilani Highway and Napilihau Street shall be the design of the traffic signal system. Design of the project shall be in accordance with preparation of PS&E for state highway projects. The State will install the traffic signal system at the intersection. Design should be completed by January 1998, or earlier.

2. Extension of the left turn storage lane shall be the responsibility of the developer. Appropriate length (storage, deceleration and taper lengths) shall be determined by using full build-out projection for Napilihau Villages. This may be installed concurrently with Phase II.

3. Supplemental TIAR states that Phase I construction includes the construction of right turn in/out from Honoapiilani Highway. Submit plans for review and approval. Basis of design report shall be included with the submittal.

During the review of the Draft Environmental Assessment, both the DOT and the County DPWWM commented that an updated traffic impact analysis report should be prepared. An updated TIAR addressing the entire 296 units has been prepared and incorporated herein as Appendix "K". The updated TIAR concludes:

1. Review of the traffic signal warrants for the Honoapiilani Highway and Napilihau Street intersection indicate that the intersection currently meets the accident warrant from the MUTCD. A traffic signal system should be installed at this intersection.

2. The intersection of Lower Honoapiilani Road and Napilihau Street should be improved to provide a left-turn storage lane on Lower Honoapiilani Road. This improvement will be required some time in 2000 or early 2001 due to de facto growth in traffic demand.

3. Analysis indicates the roadways in the vicinity of the proposed development has adequate capacity to accommodate the additional traffic generated by the proposed project and will not adversely impact traffic operations.

Based on these conclusions, the report recommends:

1. Widening of Honoapiilani Highway to four lanes from Kaanapali Parkway to Honokowai Channel Bridge.

2. Installing a traffic signal system at the Honoapiilani Highway and Napilihau Street intersection.

3. Improving the intersection of Lower Honoapiilani Road and Napilihau Street to provide a left-turn storage lane on Lower Honoapiilani Road to accommodate existing traffic conditions.

With regard to project-related improvements, the TIAR recommends:

1. The new driveway at Honoapiilani Highway be designed in accordance with State Department of Transportation requirements for acceleration and deceleration lanes and channelization to effect the turn restrictions.

2. The left-turn storage lane on northbound Honoapiilani Highway at Napilihau Street be extended to provide a minimum storage length of 250 feet which includes storage and deceleration.

Coordination with the State DOT and County DPWWM will continue to ensure that mitigation recommendations and requirements are addressed.

2. ***Wastewater***

Wastewater improvements for this project consist of onsite gravity sewers. Improvements within the site include 4-inch, 6-inch and 8-inch sewerlines. The onsite lines are designed to connect to an existing 21-inch gravity sewer along Lower Honoapiilani Road and an 8-inch gravity line along Napilihau Street. The existing collection system carries wastewater to the Lahaina Wastewater Reclamation Facility.

The approximate wastewater flow for the project is 75,000 gallons per day (assuming 255 gallons/unit). Development of each project phase will be coordinated with the DPWWM's Wastewater Reclamation Division to ensure that system capacity and related development requirements are addressed.

3. ***Water***

Water service to the project will be provided via connection to an existing 12-inch waterline at Hanawai Street. The daily demand for the project is estimated to be about 165,000 gallons per day (assuming average demand of 560 gallons/unit). To date, water system construction plans have been prepared and approved by the Department of Water Supply for Phases I and II. Water system improvements include distribution lines, fire hydrants and service laterals.

Design requirements for Phases III and IV will be coordinated with the Department of Water Supply. There are no anticipated adverse impacts to source or storage requirements as a result of the proposed action.

4. ***Drainage***

The project site falis within two (2) separate drainage basins. Phase I is located downstream of a 98-acre drainage area which conveys runoff to detention basins (including Detention Basin "A") which are situated about 1,000 feet southeast of the Maui Pineapple Company baseyard. Flows from the detention basins and areas downstream are then conveyed through the Napili Plaza to the 36-inch drainline which is located within the Hanawai Street and Napilihau Street right-of-way. Flows are ultimately discharged via a 6-ft. x 4.5-ft. box culvert at Lower Honoapiilani Road to an existing swale within the Alaeloa project.

Drainage improvements for Phase I have been designed to improve overall runoff management from this drainage basin. Specifically, the peak surface runoff released from the detention basins will be reduced from 120 cubic feet per second (cfs) to 13 cfs. Refer to Appendix "C". The incremental increase in runoff resulting from the project will be accommodated by 100 feet of 72-inch diameter subsurface corrugated aluminum pipe. The total post-development peak flows will be reduced to about 89 cfs, which represents a decrease of about 70 cfs from pre-development conditions.

Phases II, III and IV of the project are within the second drainage basin (totalling 72 acres). Proposed improvements for this drainage basin include the construction of a new detention basin (Detention Basin "B") located just mauka of Honoapiilani Highway (west of the Maui Pineapple Company baseyard). The proposed detention basin will have a storage capacity of 6.4 acre-feet. In addition to the construction of the detention basin, onsite subsurface perforated drains will be installed, similar to that installed for Phase I. Total post-development peak runoff from this drainage basin is estimated to be reduced from 131 cfs to 45 cfs, or approximately 66 percent.

5. ***Solid Waste***

The project will be implemented over a phasing period of about five (5) years, with the majority of future residents relocating to the project from within the West Maui Community Plan region. Under this development program, the impacts to the County's solid waste disposal system is not considered to be significant.

Once completed, the proposed project will be served by a private refuse collection company. Solid waste generated from the project will be disposed at the County's Central Maui Landfill.

Chapter IV

Relationship to Land Use Plans, Policies, and Controls

IV. RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

A. STATE LAND USE DISTRICTS

Chapter 205, Hawaii Revised Statutes, relating to the Land Use Commission, established the four major land use districts in which all lands in the State are placed. These districts are designated "Urban", "Rural", "Agricultural", and "Conservation". The subject property falls within the "Urban" district.

The proposed action involves the use of the property for a 296-unit residential townhome development which is a permitted use within the "Urban" District.

B. MAUI COUNTY GENERAL PLAN

The Maui County General Plan (1990 Update) sets forth broad objectives and policies to help guide the long-range development of the County. As stated in the Maui County Charter, "The purpose of the General Plan is to recognize and state the major problems and opportunities concerning the needs and the development of the County and the social, economic and environmental effects of such development and set forth the desired sequence, patterns and characteristics of future development".

The proposed action is in keeping with the following General Plan objectives and policies:

Objective:

To provide an economic climate which will encourage controlled expansion and diversification of the County's economic base.

Policy:

Maintain a diversified economic environment compatible with acceptable and consistent employment.

Objective:

To provide a choice of attractive, sanitary and affordable homes for all our residents.

Policy:

Encourage the construction of housing in a variety of price ranges and geographic locations.

C. ***WEST MAUI COMMUNITY PLAN***

Nine (9) community plan regions have been established in Maui County. Each region's growth and development is guided by a Community Plan, which contain objectives and policies drafted in accordance with the County General Plan. The purpose of the Community Plan is to outline a relatively detailed agenda for carrying out these objectives.

The proposed project falls within the jurisdiction of the West Maui Community Plan adopted in 1996. Land use guidelines are set forth by the Lahaina Community Plan Land Use Map. See Figure 8. The subject parcel is designated "Multi-Family Residential" by the Community Plan.

The proposed project is consistent with the Community Plan designation.

D. ***COUNTY ZONING***

The subject parcels are zoned A-1, Apartment. The Napilihau Villages project is a permitted use within this zoning district.

E. ***SPECIAL MANAGEMENT AREA***

The project site is located within the County's Special Management Area (SMA). Accordingly, the project has been reviewed with respect to the SMA objectives and policies as set forth by the Maui Planning Commission's Special Management Area Rules.

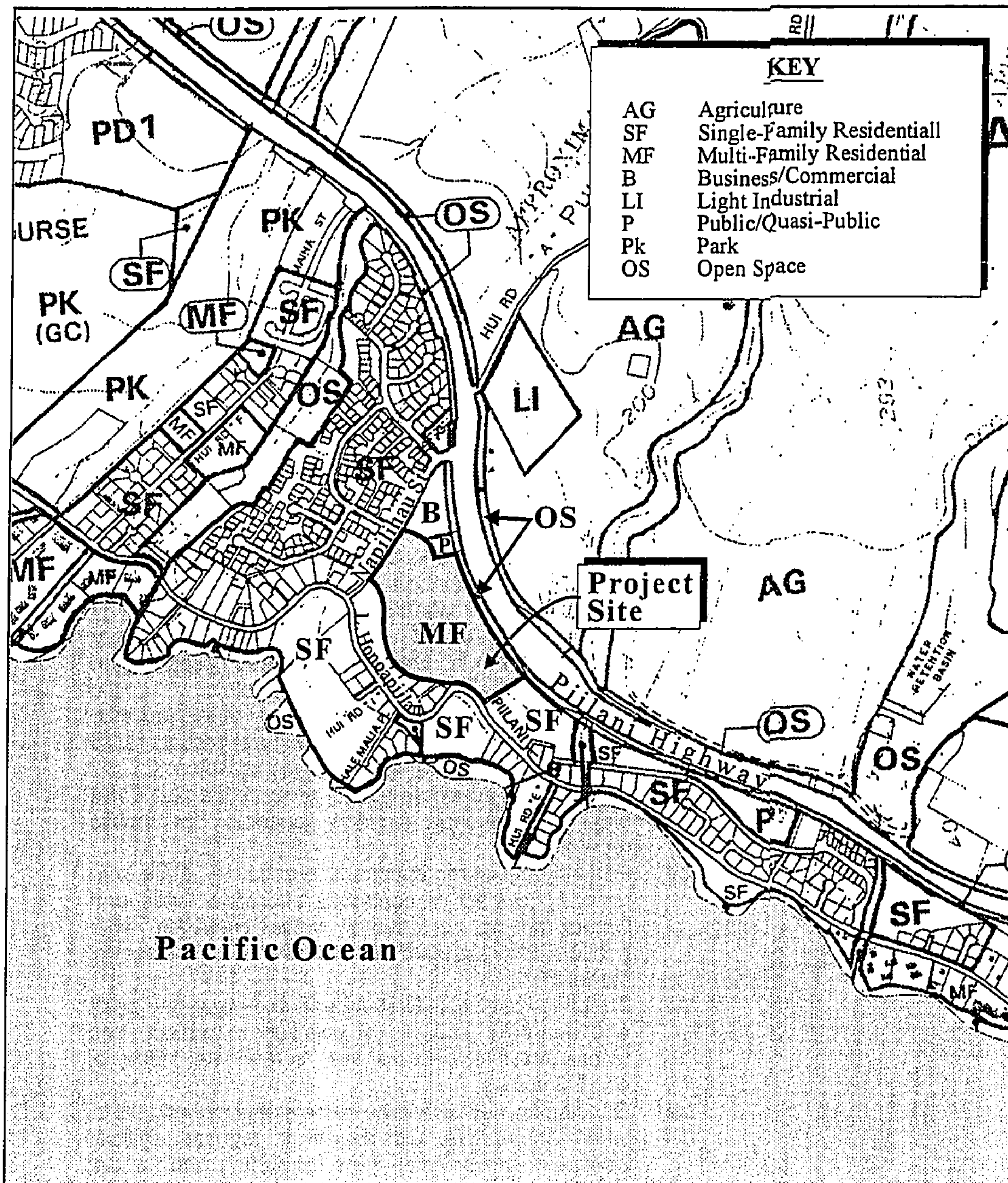

Figure 8 Napilihau Villages Environmental Assessment West Maui Community Plan Designation

Prepared for: Napilihau Villages Joint Venture

(1) ***Recreational Resources***

Objective:

Provide coastal recreational opportunities accessible to the public.

Policies:

(A) Improve coordination and funding of coastal recreational planning and management; and

(B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

- (i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;
- (ii) Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the state for recreation when replacement is not feasible or desirable;
- (iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;
- (iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;
- (v) Ensuring public recreational use of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;
- (vi) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;
- (vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and
- (viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use

commission, board of land and natural resources, county planning commissions; and crediting such dedication against the requirements of Section 46-6, HRS.

Response: The project developers will dedicate to the County of Maui, a 1.65-acre park located adjacent to the project site. The project itself is not anticipated to adversely impact demands on regional recreational facilities. In addition, the project is not anticipated to adversely impact coastal recreational opportunities and resources.

(2) ***Historic Resources***

Objective:

Protect, preserve and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

(A) Identify and analyze significant archeological resources;
(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and
(C) Support state goals for protection, restoration, interpretation, and display of historic resources.

Response: There are no historic or cultural features on the property which will be impacted by the Napilihau Villages project.

(3) ***Scenic and Open Space Resources***

Objectives:

Protect, preserve and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

(A) Identify valued scenic resources in the coastal zone management area;

(B) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

(C) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and

(D) Encourage those developments which are not coastal dependent to locate in inland areas.

Response: The project has been architecturally designed to be compatible in height and mass with surrounding properties. The site is not within a scenic corridor and does not adversely impact views to and along the shoreline.

(4) ***Coastal Ecosystems***

Objective:

Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

(A) Improve the technical basis for natural resource management;

(B) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

(C) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

(D) Promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate state water quality standards.

Response: Drainage Detention Basin "A" has been completed and Detention Basin "B" will be implemented as part of the project's overall drainage system. These detention basins are designed to improve coastal water quality by providing a siltation measure for storm waters generated in mauka agricultural lands. In addition, best management practices have been and will continue to be implemented as part of the project's site construction work. In this regard, appropriate technical measures have been, and will continue to be implemented to mitigate adverse impacts to coastal ecosystems.

(5) ***Economic Uses***

Objectives:

Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

(A) Concentrate coastal dependent development in appropriate areas;

(B) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

- (i) Use of presently designated locations is not feasible;
- (ii) Adverse environmental effects are minimized; and
- (iii) The development is important to the State's economy.

Response: The Napilihau Villages site is located within an area designated for multi-family use by the West Maui Community Plan. This location for multi-family use is considered appropriate in the context of surrounding multi-family, public/quasi-public and commercial uses.

(6) ***Coastal Hazards***

Objectives:

Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence and pollution.

Policies:

(A) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;
(B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint pollution hazards;
(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program;
(D) Prevent coastal flooding from inland projects; and
(E) Develop a coastal point and nonpoint source pollution control program.

Response: The project site is not located within an environmentally sensitive area which is subject to natural hazards. Appropriate technical measures have been designed to improve stormwater management for the project site and contributing drainage areas.

(7) ***Managing Development***

Objectives:

Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies:

(A) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;

(B) Facilitate timely processing of applications for development permits and resolve overlapping of conflicting permit requirements; and

(C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life-cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Response: The Napilihau Villages Joint Venture has worked closely with State and County agencies to ensure that regulatory permit requirements are processed in a smooth and timely manner. Opportunity for public understanding of the project has, and will be provided through the County's SMA permit process.

(8) ***Public Participation***

Objectives:

Stimulate public awareness, education, and participation in coastal management.

Policies:

(A) Maintain a public advisory body to identify coastal management problems and to provide policy advice and assistance to the coastal zone management program;

(B) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal-related issues, developments, and government activities; and

(C) Organize workshops, policy dialogues, and site-specific medications to respond to coastal issues and conflicts.

Response: The project has been, and will be reviewed through the County's SMA process to provide opportunity for governmental and public input. In addition, this environmental assessment will be processed in accordance with Chapter 343, Hawaii Revised Statutes to provide opportunity for comment by agencies and the public.

(9) ***Beach Protection***

Objectives:

Protect beaches for public use and recreation.

Policies:

(A) Locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;
(B) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and
(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.

Response: The Napilihau Villages project is not located in proximity to beach areas and will not affect beach processes or uses.

(10) ***Marine Resources***

Objectives:

Implement the State's ocean resources management plan.

Policies:

(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

(B) Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

(C) Coordinate the management of marine and coastal resources and activities management to improve effectiveness and efficiency;

(D) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

(E) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

(F) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Response: The proposed action is not anticipated to adversely impact marine resources in either Keonenui Bay or Alaeloaiki Bay, which are located downstream of the project site.

Chapter V

Summary of Adverse Environmental Effects Which Cannot Be Avoided

V. SUMMARY OF ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Implementation of the Napilihau Villages project will result in temporary construction-related impacts as described in Chapter III, Potential Impacts and Mitigation Measures.

Temporary noise and air quality impacts are typically associated with construction activities. These effects have been and will continue to be mitigated through appropriate construction management practices.

From a long-term perspective, there are no significant adverse environmental effects anticipated as a result of the Napilihau Villages project.

Chapter VI

Alternatives to the Proposed Action

VI. ALTERNATIVES TO THE PROPOSED ACTION

A. NO ACTION ALTERNATIVE

The "no action" alternative would result in agricultural lands continuing in a fallow state. This alternative does not possess beneficial community value, particularly since the property's land use entitlements enable the provision of new affordable housing opportunities.

B. OTHER LAND USE ALTERNATIVES

The potential for using the subject property for other land uses, such as single family residential use, have been identified in the past. The subject action proposes a multi-family development to address a specific market segment of the community, for which a multi-family format is most suitable. In particular, the provision of affordable units can be met through attached housing construction at densities higher than could be achieved under a single family subdivision format. In this regard, the multi-family project is proposed in keeping with its underlying Multi-Family land use designation set forth by the West Maui Community Plan.

C. SITE PLAN ALTERNATIVES

Initial planning for the project identified site development alternatives which considered options for building spatial configurations, vehicular access, and recreational facilities. Through the planning process and the Special Management Area review process, the final site plan was developed, which included the provision of the 1.646-acre park site. The final site plan has been reviewed to ensure that all State and County regulatory requirements can be addressed. To date, construction of nine (9) buildings have been initiated, and building permits for ten (10) additional buildings have been issued.

Chapter VII

Irreversible and Irretrievable Commitments of Resources

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The development of the Napilihau Villages project would involve the commitment of land for the development of multi-family apartment units. In addition, labor and materials resources would be expended as part of the project's construction phase. Commitment of these resources are considered irreversible and irretrievable. This commitment, however, is considered appropriate in the context of meeting residential housing needs for the community.

Chapter VIII

Findings and Conclusions

VIII. FINDINGS AND CONCLUSIONS

Every phase of the proposed action, expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action have been evaluated in accordance with the Significance Criteria of Section 11-200-12 of the Administrative Rules. Discussion of project conformance to the criteria is noted as follows:

1. *No Irrevocable Commitment to Loss or Destruction of any Natural or Cultural Resource Would Occur as a Result of the Proposed Project*

The project will not result in the loss or destruction of any valuable natural resources. The site was previously used for pineapple cultivation and was not considered a significant habitat or source for rare, endangered or threatened species of flora or fauna. Additionally, archaeological studies conducted on the site have been reviewed by the State Historic Preservation Division. The State Historic Preservation Division has determined that the action will have no effect on significant historic sites.

In addition, in the context of the area's land use history and surrounding existing developments, the implementation of the Napilihau Villages project is not anticipated to have an adverse impact upon cultural resources.

2. *The Proposed Action Would Not Curtail the Range of Beneficial Uses of the Environment*

The Napilihau Villages project will not curtail the range of beneficial uses of the environment. There are no impacts attributed to the project which will limit the use of surrounding lands. Environmental parameters such as air quality, water quality, and scenic views will similarly not be adversely affected by the project.

3. ***The Proposed Action Does Not Conflict With the State's Long-Term Environmental Policies or Goals or Guidelines as Expressed in Chapter 344, HRS***

The State Environmental Policy and Guidelines are set forth in Chapter 344, HRS. The proposed action is in consonance with the following policies and guidelines:

Environmental Policy:

Enhance the quality of life by:

* * *

(A) Establishing communities which provide a sense of identity, wise use of land, efficient transportation, and aesthetic and social satisfaction in harmony with the natural environment which is uniquely Hawaiian.

Guidelines:

* * *

Community Life and Housing

* * *

(A) Foster lifestyles compatible with the environment; preserve the variety of lifestyles traditional to Hawaii through the design and maintenance of neighborhoods which reflect the culture and mores of the community;

* * *

(D) Foster safe, sanitary and decent homes;

4. ***The Economic or Social Welfare of the Community or State Would Not Be Substantially Affected***

The project will directly benefit the local economy by providing construction and construction-related employment. The proposed project will also have a beneficial effect upon the social welfare of the community by providing for an affordable living environment for residents.

5. ***The Proposed Action Does Not Affect Public Health***

No adverse impacts to the public's health and welfare are anticipated.

6. ***No Substantial Secondary Impacts, Such as Population Changes or Effects on Public Facilities, are Anticipated***

The Napilihau Villages project is being implemented to provide affordable housing opportunities for Maui residents. The project is not a source of new population to the region as the majority of occupants would be from the West Maui region. For example, to date, of the 67 buyers in Phase I, 60 are current residents of the West Maui area. Moreover, existing and potential buyers and renters are expected to be primarily employed in the West Maui region. In this regard, the proposed project is not anticipated to adversely affect public services in the region, such as schools and police and fire protection. It is noted that a 1.646-acre park will be dedicated to the County of Maui to address parks and playgrounds assessment requirements for the project.

With regard to public facilities, improvements to infrastructure systems have been provided with the Phase I improvements and will continue to be provided with future phases. Infrastructure systems improvements are designed to mitigate impacts which may be attributed to the Napilihau Villages project.

In addition, existing off-site systems are able to accommodate demands generated by the proposed action. For example, it is noted that the proposed project will generate approximately 75,000 gallons of wastewater daily. This volume can be accommodated by the Lahaina Wastewater Reclamation Facility which has an unallocated capacity of approximately 890,000 gallons/day (Personal communication with Wastewater Reclamation Division staff, February, 1998). In this case therefore, there are no long-term adverse cumulative impacts to the wastewater treatment and reclamation system.

Similarly, the proposed drainage system improvements are designed to improve stormwater quality by reducing flow velocities and enabling settling of sediments within the proposed detention basins. From a cumulative standpoint therefore, the proposed stormwater mitigation measures are not anticipated to adversely contribute to coastal water degradation.

7. ***No Substantial Degradation of Environmental Quality is Anticipated***

Excavation, grading, and fill activities will create temporary short-term nuisances related to noise and dust. Appropriate dust control and noise mitigation measures have been and will continue to be implemented by the contractor to ensure that fugitive dust and noise generated in connection with construction is minimized.

Drainage system improvements have been designed to mitigate impacts to downstream properties and costal ecosystems.

It is also noted that the use of herbicides and fertilizers for landscape maintenance purposes will be minimal once the plant establishment phase of growth has been completed. Such use is not anticipated to result in long-term adverse impacts to downstream properties or coastal waters. It is also noted that the use of herbicides and fertilizers for landscape maintenance purposes is limited to relatively small areas (compared to application potential for the property's previous pineapple cultivation use).

Substantial degradation of environmental quality resulting from the project is not anticipated.

8. ***The Proposed Action Does Not Involve a Commitment to Larger Actions, Nor Would Cumulative Impacts Result in Considerable Effects On The Environment***

The project consists of 296 multi-family units, a 1.646-acre park, and attendant infrastructure improvements. There are no additional development components associated with the project. Accordingly, the impacts assessed herein have been based on the entire action.

9. ***No Rare, Threatened or Endangered Species or Their Habitats Would be Adversely Affected By The Proposed Action***

There are no rare, threatened or endangered species of flora, fauna, or avifauna or their habitats within the project limits.

10. ***Air Quality, Water Quality or Ambient Noise Levels Would Not Be Detrimentally Affected By The Proposed Project***

Construction activities will result in short-term air quality and noise impacts. Dust control measures, such as regular watering and sprinkling, and installation of dust screens have been and will continue to be implemented to minimize wind-blown emissions. Noise impacts will occur primarily from construction equipment. Equipment mufflers or other noise attenuating equipment, as well as proper equipment and vehicle maintenance, have been and will continue to be used during construction activities.

In the long term, the project is not anticipated to have a significant impact on air quality, water quality or ambient noise conditions.

11. The Proposed Project Would Not Affect Environmentally Sensitive Areas, Such As Flood Plains, Tsunami Zones, Erosion-prone Areas, Geologically Hazardous Lands, Estuaries, Fresh Waters or Coastal Waters

The project site is not located within any environmentally sensitive areas. In addition, the property is not located within a flood hazard or tsunami inundation area.

12. The Proposed Project Will Not Substantially Affect Scenic Vistas and Viewplanes Identified in County or State Plans or Studies

The project will not affect coastal scenic and open space resources and will not affect scenic view corridors.

13. The Proposed Project Will Not Require Substantial Energy Consumption

The subject project will involve the commitment of fuel for construction equipment, vehicles, and machinery during construction activities.

In the long term, the 296 multi-family units will create additional demand for electricity. However, in the context of the region's overall energy consumption, the project's demand for electricity is not considered excessive, nor is it considered substantial.

Chapter IX

List of Permits and Approvals

IX. LIST OF PERMITS AND APPROVALS

The following State and County permits and approvals are required for project implementation:

State of Hawaii

National Pollutant Discharge Elimination System (NPDES) Permit

County of Maui

Special Management Area (SMA) Use Permit

Construction Permits (e.g., grading, building).

Chapter X

Agencies Contacted in the Preparation of the Draft Environmental Assessment

X. AGENCIES CONTACTED IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT

The following agencies were contacted during the preparation of the Draft Environmental Assessment:

1. Neal Fujiwara
   Soil Conservationist
   Natural Resources Conservation Service
   U.S. Department of Agriculture
   210 Imi Kala Street, Suite 209
   Wailuku, Hawaii 96793-2100

2. Lolly Silva
   Department of the Army
   U.S. Army Engineer District, Hnl.
   Attn: Operations Division
   Bldg. T-1, Room 105
   Fort Shafter, Hawaii 96858-5440

3. Brooks Harper
   U. S. Fish and Wildlife Service
   P.O. Box 50167
   Honolulu, Hawaii 96850

4. Rick Egged, Director
   State of Hawaii
   Office of Planning
   Department of Business, Economic, Development and Tourism
   P. O. Box 2359
   Honolulu, Hawaii 96804

5. Denis Lau, Chief
   Clean Water Branch
   State of Hawaii
   Department of Health
   919 Ala Moana Blvd., Room 300
   Honolulu, Hawaii 96814

6. Herbert Matsubayashi
   District Environmental Health Program Chief
   State of Hawaii
   Department of Health
   54 High Street
   Wailuku, Hawaii 96793

7. Michael Wilson, Director
   State of Hawaii
   Department of Land and Natural Resources
   P. O. Box 621
   Honolulu, Hawaii 96809

8. Don Hibbard
   State of Hawaii
   Department of Land and Natural Resources
   State Historic Preservation Division
   33 South King St., 6th Floor
   Honolulu, Hawaii 96813

9. Rae Loui, Deputy Director
   State of Hawaii
   Department of Land and Natural Resources
   Water Resources Management Division
   P. O. Box 621
   Honolulu, Hawaii 96809

10. Kazu Hayashida, Director
    State of Hawaii
    Department ofTransportation
    869 Punchbowl Street
    Honolulu, Hawaii 96813

11. Ronald Davis, Chief
County of Maui
Department of Fire Control
200 Dairy Road
Kahului, Hawaii 96732

12. Stephanie Aveiro, Director
County of Maui
Department of Housing and Human Concerns
200 S. High Street
Wailuku, Hawaii 96793

13. Henry Oliva, Director
County of Maui
Department of Parks and Recreation
200 South High Street
Wailuku, Hawaii 96793

14. David W. Blane, Director
County of Maui
Department of Planning
250 South High Street
Wailuku, Hawaii 96793

15. Howard Tagomori, Chief
County of Maui
Police Department
55 Mahalani Street
Wailuku, Hawaii 96793

16. Charles Jencks, Director
County of Maui
Department of Public Works and Waste Management
200 South High Street
Wailuku, Hawaii 96793

17. David Craddick, Director
County of Maui
Department of Water Supply
200 South High Street
Wailuku, Hawaii 96793

18. Robbie Ann A.K. Guard
Coordinator
County of Maui
Office of Economic Development
200 South High Street
Wailuku, Hawaii 96793

Chapter XI

Early Consultation Comments

XI. EARLY CONSULTATION COMMENTS

This section includes correspondence received in response to the applicant's request for early consultation input. Responses to substantive comments are also included in this section.

Early consultation comments from the following agencies were received prior to the filing of the Draft EA:

1. U.S. Department of the Army, Operations Branch;
2. State of Hawaii, Department of Health, Maui District Health Office;
3. State of Hawaii, Department of Health, Clean Water Branch;
4. County of Maui, Department of Housing and Human Concerns;
5. County of Maui, Police Department; and
6. County of Maui, Department of Public Works and Waste Management.

Early consultation comments from the following agencies were received after the Draft EA was filed.

1. State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management;
2. State of Hawaii, Department of Land and Natural Resources, State Historic Preservation Division; and
3. State of Hawaii, Office of Planning.

DEC 5 1997

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

December 3, 1997

Operations Branch

Mr. Michael T. Munekiyo
Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

This letter is written in regards to your request for agency comments on the environmental assessment for the Napilihau Villages Phase I, II, and III project located in Napili, Maui, Hawaii.

Enclosed are copies of letters written by our office which stated that a Department of the Army (DA) permit would not be required. Under the Clean Water Act, a DA permit would be required if the project impacted waters of the U.S., which include wetlands. Since there is no indication that the project scope has changed, the no permit determination is still valid.

File Number 980000041 is assigned to this project. Please refer to this file number in any future correspondence with our office. Should you need additional information, you may call Ms. Lolly Silva of my staff at (808) 438-9258, extension 17.

Sincerely,

Linda M. Hihara-Endo, Ph.D., P.E.
Acting Chief, Operations Branch

Enclosures

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

March 18, 1993

Planning Division

Mr. Brian Miskae, Planning Director
Maui Planning Department
250 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Miskae:

Thank you for the opportunity to review and comment on the Shoreline Setback Variance Application for the Napilihau Villages IV Project, Maui (TMK 4-3-3: 108). The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. We have reviewed the application and note that the proposed drainage plans include a section of the concrete box culvert at Kaopala Bay. All work is above the mean high water line; therefore, a DA permit is not required.

b. The flood information provided on page 14 (Chapter 3, paragraph 3) is correct.

Sincerely,

Kisuk Cheung, P.E.
Director of Engineering

[illegible] 1992

Operations Division

SUBJECT: Napilihau Villages I, Alaeloa, Lahina, Maui, Hawaii TMK: 4-3-3:108, File No. NP92-160

Mr. Milton Arakawa
Michael T. Munekiyo Consulting, Inc.
2035 Main Street
Wailuku, Hawaii 96793

Dear Mr. Arakawa:

This responds to your letter dated September 22, 1992, regarding the subject project.

Based upon the information provided and telephone conversations between Ms. Suzanne Baba of my staff, Mr. Ronald Fukumoto and yourself, the retention basin has been determined to be an artificial pond created by excavation for desilting purposes. Under the U.S. Army Corps of Engineers' Regulatory Programs (33 CFR Parts 320 throught 330), artificial ponds created by excavation for such a purpose as stated above does not require a Section 404 permit. Therefore, a Department of the Army permit is not required for the subject project.

Should you have any questions, please contact Ms. Baba, Operations Division, at 438-9258.

Sincerely,

Michael T. Lee
Chief, Operations Division

MSWord
NAPILI
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CEPOD-CO-O

Lee
CEPOD-CO-O
Note: Mike had
his noted, but
forgot to sign.
WJC
9/
Ops Div File

Operations Division

Mr. Michael T. Munekiyo
Michael T. Munekiyo Consulting, Inc.
2035 Main Street
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

This is to acknowledge receipt of your August 11, 1992 letter regarding the proposed Napilihau Village Project, Napili, Maui, Hawaii, TMK: 4-3-3: 110. The project would provide multi-family residential units and parking areas on about 16.5 acres of land located makai of the Napili Plaza Shopping Center and the Napili Fire Station.

According to the brief descriptions provided, the project does not involve any work in ocean waters, rivers, or streams, and the soils are well-drained Kahana silty clays. On this basis, none of the work would occur in waters of the United States, and a Department of the Army permit is not required.

The presence of a retention basin was noted on TMK: 4-3-3:108. If any alteration of this basin in planned, additional information is required to determine whether Corps permit requirements are applicable.

Thank you for the opportunity to review this project. If there are any questions, please contact the Operations Division at 438-2958 and refer to file number NP 92-160.

Sincerely,

Michael T. Lee
Chief, Operations Division

DEC 11 1997

BENJAMIN J. CAYETANO
GOVERNOR

LAWRENCE MIIKE
DIRECTOR OF HEALTH

LAWRENCE HART, M.D., M.P.H.
DISTRICT HEALTH OFFICER

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, MAUI, HAWAII 96793

December 8, 1997

Michael T. Munekiyo, A.I.C.P.
Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

Subject: Early Consultation-Napilihau Village
Environmental Assessment
TMK: (2) 4-3-3:108, 110, 122, 123, 124

Thank you for the opportunity to comment on the project. We have no comments to offer at this time.

Should you have any questions, please call me at 984-8230.

Sincerely,

HERBERT S. MATSUBAYASHI
District Environmental Health Program Chief

DEC 10 1997

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

LAWRENCE MIIKE
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P O BOX 3378
HONOLULU, HAWAII 96801-3378

In reply please refer to
EMD/CWB

December 5, 1997

P1227HC

Mr. Michael T. Munekiyo
Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Dear Mr. Munekiyo:

Subject: **Napilihau Villages Environmental Assessment**

The Department of Health (Department) acknowledges receipt of your letter dated November 26, 1997 regarding the subject matter. The Department issued a Notice of General Permit Coverage (NGPC) on October 12, 1995 for the storm water discharge from the subject project site to the receiving waters named Alaeloaiki Bay at Latitude 20°59'30"N and Longitude 156°40'22"W and Keonenui Bay at Latitude 20°59'20"N and Longitude 156°40'32"W. This NGPC expired at midnight of October 28, 1997. The permittee had submitted a Notice of Intent to renew the existing coverage on September 24, 1997. The Department administratively extended the existing NGPC until a new NGPC under the applicable general permit is issued.

If the subject project is anticipated a wastewater discharge, such as effluent from hydro-testing and dewatering operation, to State waters, a National Pollutant Discharge Elimination System permit is required.

Should you have any questions, please contact Ms. Hong Chen, Engineering Section of the Clean Water Branch, at (808) 586-4309.

Sincerely,

DENIS R. LAU, P.E., CHIEF
Clean Water Branch

HC:auc

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
COUNTY OF MAUI

DEC 10 1997

LINDA CROCKETT LINGLE
Mayor
STEPHANIE AVEIRO
Director
MARK PERCELL
Deputy Director

200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • PHONE (808) 243-7805 • FAX (808) 243-7829

December 5, 1997

Mr. Michael Munekiyo
Project Manager
Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

Subject: Napilihau Villages
Environmental Assessment

We have reviewed your November 26, 1997 letter requesting our comments on the preparation of an Environmental Assessment (EA) for the subject project, and would like to request that the EA include a detailed description of how the project's affordable housing requirements will be fully satisfied.

Please call Wayde Oshiro of our Housing Division at 243-7351 if you have any questions.

Very truly yours,

Stephanie Aveiro

STEPHANIE AVEIRO
Director of Housing
and Human Concerns

WTO:wo

xc: Housing Administrator

MUNEKIYO & ARAKAWA, INC.

December 16, 1997

Stephanie Aveiro, Director
Department of Housing and
Human Concerns
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Napilihau Villages Environmental Assessment

Dear Ms. Aveiro:

Thank you for your comment letter of December 5, 1997, regarding the Napilihau Villages project. The environmental assessment (EA) will address affordable housing criteria and related implementation requirements.

A copy of the Draft EA will be provided to the Department of Housing and Human Concerns for review and comment.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:lfm
cc: Kimo Lee, Napilihau Villages Joint Venture
d:\lgf\napilihau\dhhcltr.001

Planning · Environmental Studies · Project Management
305 High Street, Suite 104 · Wailuku, Hawaii 96793 · Phone: (808) 244-2015 · Fax: (808) 244-8729

LINDA LINGLE
MAYOR

OUR REFERENCE
at
YOUR REFERENCE

POLICE DEPARTMENT
COUNTY OF MAUI

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

DEC 17 1997

HOWARD H. TAGOMORI
CHIEF OF POLICE

THOMAS PHILLIPS
DEPUTY CHIEF OF POLICE

December 12, 1997

Mr. Michael T. Munekiyo, A.I.C.P.
Project Manager
Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

Subject: Early Consultation - Napilihau Villages Environmental Assessment

We have received and reviewed your letter of November 26, 1997 regarding the above subject.

Enclosed is our comments. Thank you for the opportunity to make comments on the project summary.

Very truly yours,

Assistant Chief Charles Hall
for: HOWARD H. TAGOMORI
Chief of Police

Enclosure

TO : HOWARD TAGOMORI, CHIEF OF POLICE
MAUI COUNTY POLICE DEPARTMENT

VIA : CHANNELS

FROM : SERGEANT BRIAN DE MELLO
LAHAINA PATROL DIVISION

SUBJECT : COMMENTATION ON NAPILIHAU VILLAGES

ASSIGNMENT:

12/5/97, Assigned to conduct a respective review of the Napilihau Village located in Napili, Maui, Hawaii. There to assess any problems or safety conditions; expressly from the standpoint of the Maui County Police Department.

SUBJECT REVIEW:

Napilihau Villages, Phase 1, is located at the west entrance to the Napili Market Place. This is also across from Hanawai Street in Napili. Presently there is only one entrance/exit into this phase. The entrance/exit is also fed, by the entrances and exits of the Napili Fire Station and Medical Services. The west exit and entrance of the Napili Market Place shares this particular roadway as well.

Currently nine duplex type structures have been completed, with residential occupation, limited to three structures. On 12/5/97, at approximately 2050 hours, I cruised the parking lots of the Napilihau Village, assessing lighting, roadway design and other safety factors. The most notable safety conditions are addressed in the body of this report.

On the west side of the development, exists unmanaged scrub brush and grass. Currently with the advent of the rainy season, this does not appear to be much of a fire hazard or further vector problems. Therefore this will not be addressed.

Other such safety factors such as sidewalks, and roadway pavement condition was also taken into consideration. This too will be assessed in this report. In conjuction with roadway design I also considered installed storm drains which would handle flooding to County roadways. Most notable in this light are recent complaints by neighboring condominium owners and developers who have addressed concerns over inadequate storm water drainage. And such concerns that alleged storm waters would lead from the Napilihau Village project to that of Lower Honoapiilani Highway, and properties bordering the Highway.

SAFETY ITEMS OF CONSIDERATION:

The entrance and exit of the Napilihau Village Phase I project shares also the entrance and exit of the Napili Market Place as well as that of the Napili Emergency Services Station (Fire and Ambulance). Given a dire emergency situation, this may prove to be hazardous to the Napilihau Village residents having currently only one entrance and exit into the Phase. Further in this light, it may be advantageous to place along the sides of the entrance way posted no parking signs which will prohibit parking near that area.

Along Napilihau Road I noticed that the pavement is deteriorating and is currently in need of resurfacing. In this light no storm drain inlets were located along Napilihau Road. It is apparent that storm waters will flow from Napilihau Road to the west entrance of the Napilihau Village Project. There into the Napilihau Village exclusive entrance and down towards a dirt sump located towards the end of the Project. Through the parking lots of Phase I no storm drain inlets are found. This subsequently led to the concerns of neighboring Condominium and Resort owners and developers.

The sump in question is currently open and no fencing or barricades which would prevent young children from falling into the sump areinstalled. The sump is that of soft and dangerous mud which is border by high dirt sides. This has the capability of entraping a child who has played to close to the edges. This further needs to be addressed as a safety condition.

It is suggested that the buildings within the Project have large numbers on all sides of the building, visible to any Emergency unit responding to the various phases. It is further suggested that the numbers be of a dark color which is outstanding and plainly visible.

CONCLUSION:

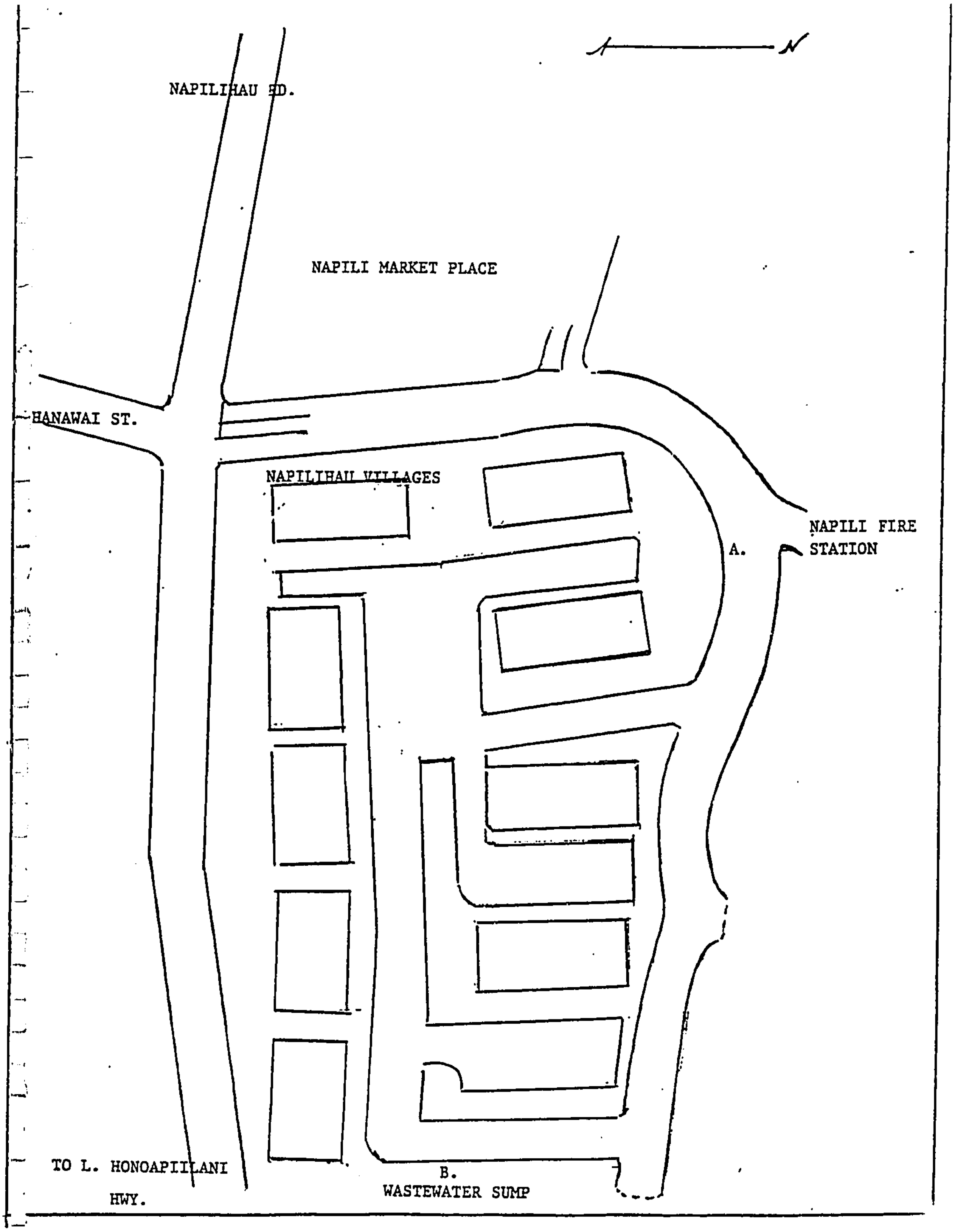
The aforementioned safety factor and areas of concern were addressed in correlation to a letter received from MUNEKIYO AND ARAKAWA INC. to this Department. Our concerns address a Police perspective on such safety factors which may present future problems. These recommendations are presented for further review.

Respectfully submitted,

Sergeant Brian De Mello
Lahaina Police, District IV
12/6/97 1330 hours

12/6/97

Capt. 12/8/97



N
NAPILIHAU RD.
NAPILI MARKET PLACE
HANAWAI ST.
NAPILIHAU VILLAGES
A.
NAPILI FIRE STATION
TO L. HONOAPIILANI HWY.
B.
WASTEWATER SUMP

MUNEKIYO & ARAKAWA, INC.

December 18, 1997

Howard Tagomori, Chief of Police
Police Department
County of Maui
55 Mahalani Street
Wailuku, Hawaii 96793

SUBJECT: Napilihau Villages Environmental Assessment

Dear Chief Tagomori:

Thank you for your letter of December 12, 1997 regarding the Napilihau Villages project. The Draft Environmental Assessment (EA) will address the issues noted in your letter. For clarification, we also note the following:

PROJECT ACCESS

The project will be served by two (2) access points, one (1) off of Napilihau Street and the second off of Honoapiilani Highway. The second access point at Honoapiilani Highway will be implemented with subsequent phases of the project and is intended to better distribute traffic to and from the project site.

DRAINAGE

As will be noted in the Draft EA, a new drainage system has been completed for the Phase I portion of the project. These improvements include a new 36-inch drainline within Napilihau Street as well as an enhanced detention basin located mauka of Honoapiilani Highway. The detention basin improvement has been designed to reduce peak storm runoff flows through downstream properties. In connection with onsite improvements, drainage catch basins and onsite drainlines have been completed for the Phase I project. Similar improvements will be made as subsequent phases are implemented. It is noted that the sump located at the makai end of the Phase I project is temporary and will be filled with the initiation of Phase II of the project.

BUILDING IDENTIFICATION

All buildings will be clearly identified with visible building numbers.

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Thank you again for your valuable input. A copy of the Draft EA will be transmitted to your office for review and comment.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:to
Attachments
cc: Kimo Lee, JGL Enterprises, Inc.
jgl/napilies/mpdltr.001

DEC 1 1 1997

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

December 8, 1997

Mr. Michael T. Munekiyo, A.I.C.P.
Munekiyo & Arakawa, Inc.
305 High Street Suite, Suite 104
Wailuku, Hawaii 96793

SUBJECT: EARLY CONSULTATION - NAPILIHAU VILLAGES ENVIRONMENTAL ASSESSMENT

Dear Mr. Munekiyo:

Thank you for allowing us to comment on the above project.

The Solid Waste Division of the County of Maui, Department of Public Works & Waste Management, does not have any comments.

If you have any questions please call me at 243-7875.

Sincerely,

Andy Hirose, Acting Chief
Solid Waste Division

AH:ah
cc: Charles Jencks

JAN 0 5 1998

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P. O. BOX 621
HONOLULU, HAWAII 96809

DEC 15 1997

Mr. Michael Munekiyo
Munekiyo & Arakawa, Inc.
1823 Wells Street, Suite #3
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

Early Consultation - Napilihau Villages Environmental Assessment

Thank you for your letter dated November 26, 1997 regarding JGL Enterprises, Inc. early consultation for an environmental assessment pursuant to Hawaii Revised Statutes Chapter 343.

We recommend that the Environmental Assessment for the proposed project address the following points:

1. How the project can be incorporated into the Maui Water Use and Development Plan.
2. The sources of potable and non-potable water for the proposed project.
3. Temporary and permanent measures to control non-point source water pollution.
4. Water conservation measures, such as plans for the use of reclaimed sewage effluent.
5. Whether the project would need a stream channel alteration permit (Hawaii Revised Statutes §174C-71) for alteration of the bed or banks of streams.

In addition to the above concerns, we recommend that this project be coordinated with the West Maui Mountains Watershed Partnership (C. Brewer, Amfac, Maui Land & Pine, Bishop Estate, The Nature Conservancy, Maui Board of Water Supply, and Department of Land and Natural Resources).

We appreciate your early consultation letter, and your concern for the Commission's permit requirements. If you have any questions, please call Charley Ice at 587-0251 or toll-free at 984-2400 (Maui), extension 70251.

Sincerely,

RAE M. LOUI
Deputy Director

CI:ss

MUNEKIYO, ARAKAWA & HIRAGA, INC.

February 17, 1998

Rae Louie, Deputy Director
State of Hawaii
Department of Land and Natural Resources
Commission on Water Resources Management
P.O. Box 621
Honolulu, Hawaii 96809

SUBJECT: Napilihau Villages Draft Environmental Assessment

Dear Ms. Louie:

Thank you for your comments of December 15, 1997. We are providing the following information in response to your comments.

1. In discussing this project with the Department of Water Supply (DWS), they have indicated that the Maui Water Use and Development Plan is currently being updated. In this regard, we will coordinate with the DWS to ensure that water use projections described in the Draft EA are addressed in update to the Maui Water Use and Development Plan.

2. The proposed project will connect to the DWS's domestic water system. The West Maui Water Master Plan (DWS, 1991) notes that the subject property falls within the northern system of the Lahaina-Alaeloa domestic water system. This system obtains its water from surface water flowing through the Honokohau Ditch and from four (4) high-level basal wells in upper Napili.

3. Non-point water pollution control measures have been and will continue to be implemented through the NPDES permitting system. An extension of the NPDES' Notice of General Permit Coverage for the project was recently granted by the Department of Health.

   From a long-term perspective, the Draft EA will address completed and proposed permanent drainage improvements designed to improve storm runoff water quality.

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4. Water conservation is being addressed through the use of low flow water fixtures. At this time, there is no County effluent reuse lines in the vicinity of the project site.

5. The proposed action will not affect existing streams and therefore will not require a stream channel alteration permit.

6. As needed, coordination with the West Maui Watershed partnership will be undertaken during the course of project implementation.

Thank you again for providing comments on this project. If there are any questions or if additional information is needed, please do not hesitate to call.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:to
cc: Wayne Tanigawa, Napilihau Villages Joint Venture
Clayton Yoshida, Planning Department
jg/napilias/ccwmltr.001

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

January 28, 1998

Mr. Michael Munekiyo
Munekiyo and Arakawa Inc.
305 High Street
Suite 104
Wailuku, Hawaii 96793

LOG NO: 20920
DOC NO: 9801BD52

Dear Mr. Munekiyo:

SUBJECT: Chapter 6E-42 Historic Preservation Review of the Napilihau Villages Environmental Assessment - Early Consultation Napili Ahupua'a, Lahaina District, Island of Maui TMK 4-3-3: 108, 110, 122, 123, and 124

This letter is a Historic Preservation response to a request for early consultation on an EA for the Napilihau Villages project in Napili Ahupua'a. Our review is based on reports, maps, and aerial photographs maintained at the State Historic Preservation Division; no field check was conducted of the subject property.

The general area seems likely to have once been the location of pre-Contact farming, perhaps with scattered houses. However, the subject property has been subjected to considerable alteration due to modern agriculture, so it is unlikely that significant historic sites will be encountered today. We therefore find the proposed construction to have "no effect" on significant historic sites.

As a contingency, should any unrecorded historic sites (i.e. subsurface pavings, artifacts, or human skeletal remains) be inadvertently uncovered during construction, we recommend that all work should cease in the vicinity and the contractor should immediately contact the State Historic Preservation Division.

If you have any questions please contact Boyd Dixon at 243-5169.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

BD:jen

cc. David Blane, Maui County Planning Department (fax: 243-7634)
Ralph Nagamine, Maui County Department of Public Works (fax: 243-7972)

DEC 19 1997

BENJAMIN J. CAYETANO
GOVERNOR
SEIJI F. NAYA
DIRECTOR
BRADLEY J. MOSSMAN
DEPUTY DIRECTOR
RICK EGGED
DIRECTOR, OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Flr., Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Tel.: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-7101

December 12, 1997

Mr. Michael T. Munekiyo, A.I.C.P.
Project Manager
Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

Subject: Napilihau Villages Environmental Assessment

In response to your notice about the preparation of an environmental assessment for the Napilihau Villages project, we offer the following comments.

Over the past years, government agencies and the community have expressed concerns about the presence of historic sites and artifacts and ancient burial sites in the Napili area. In addition, heavy rainfall has occurred in the area and presents a potential flood hazard situation. Furthermore, since the project site is situated near the ocean and has culverts that direct the flow of water to the ocean, there may be polluted runoff issues that need to be dealt with. Since these are important considerations for consistency with the Coastal Zone Management (CZM) objectives and policies, they should be clearly discussed in the section of the environmental assessment that presents the project's relationship with the CZM objectives and policies.

If there are any questions about this, please contact Howard Fujimoto of our CZM Program at 587-2898.

Sincerely,

Rick Egged
Director
Office of Planning

MUNEKIYO, ARAKAWA & HIRAGA, INC.

January 19, 1998

Rick Egged, Director
Department of Business, Economic
Development & Tourism
Office of Planning
235 S. Beretania Street, 6th Floor
Honolulu, Hawaii 96804

SUBJECT: Environmental Assessment for Napilihau Villages

Dear Mr. Egged:

Thank you for your early consultation letter dated December 12, 1997, commenting on the Napilihau Villages project.

In response to your comments, we note that the Draft Environmental Assessment (EA) incorporates sections relating to archaeology and drainage. In addition, the Draft EA includes point-by-point responses addressing the project's relationship to the Coastal Zone Management Program's objectives and policies.

Thank you again for providing comments on this project. If there are any questions or if additional information is needed, please do not hesitate to call.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:lfm
cc: Clayton Yoshida, Planning Department (via mail)
Kimo Lee, Napilihau Villages Joint Venture (via mail)
d\lgf\napilies\egged.001

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Chapter XII

Letters Received During the Draft Environmental Assessment Public Comment Period and Responses to Substantive Comments

XII. LETTERS RECEIVED DURING THE DRAFT ENVIRONMENTAL ASSESSMENT PUBLIC COMMENT PERIOD AND RESPONSES TO SUBSTANTIVE COMMENTS

The Notice of Availability of the Draft EA appeared in the January 8, 1998 edition of the Office of Environmental Quality Control's Environmental Notice. The 30-day comment period on the Draft EA expired on February 9, 1998. During this period, a total of 18 comment letters on the Draft EA were received. This section includes the comment letters received during this 30-day public comment period. In addition, where substantive comments have been provided, response letters to the commenting parties have been transmitted to address those substantive issues.

USDA

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

210 Imi Kala St.
Suite 209
Wailuku, HI
96793-2100

Our People...Our Islands...In Harmony

'98 JAN 20 P1:50

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

January 16, 1998

Mr. David Blane, Planning Director
County of Maui
Planning Department
250 S. High Street
Wailuku, Hawaii 96793

Dear Mr. Blane,

Subject: Napilihau Villages: TMK: 4-3-3: 108, 110, 122, 123
I.D. EA 970009, 92/SM1-026

I have no comment on the subject's Draft Environmental Assessment.

Thank you for the opportunity to comment.

Sincerely,

Neal S. Fujiwara

Neal S. Fujiwara
District Conservationist

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
SURVEY DIVISION
P. O. BOX 119
HONOLULU, HAWAII 96810

'98 JAN 30 P12:18

DEPT OF PLANN...
COUNTY OF M...
RECEIVE...

SAM CALLEJO
COMPTROLLER

RESPONSE REFER TO:

FILE NO. ________

January 28, 1998

MEMORANDUM

TO: Mr. David W. Blane, Planning Director
Maui County Planning Department

ATTN.: Mr. Clayton Yoshida,
AICP Planning Program Administrator

FROM: Randall M. Hashimoto, State Land Surveyor

SUBJECT: I.D.: EA 970009, 92/sm1-026
TMK: 4-3-3:108, 110, 122, and 123
Project Name: Napilihau Villages
Applicant: Napilihau Village Joint Venture

The subject proposal has been reviewed and confirmed that no Government Survey Triangulation Stations and Benchmarks are affected. The Survey Division has no objections to the proposed project.

Randall M. Hashimoto
RANDALL M. HASHIMOTO
State Land Surveyor

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Flr., Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

BENJAMIN J. CA[illegible]TAN
G[illegible]RNO[illegible]
SEIJI F. NAY[illegible]
DIRECTO[illegible]
BRADLEY J. MC[illegible]MA[illegible]
DEPUTY DI[illegible]TO[illegible]
RICK [illegible]GE[illegible]
DIRECTOR, OFFICE OF PLANNIN[illegible]

Tel.: (808) 587[illegible]84[illegible]
Fax: (808) 587[illegible]82[illegible]

Ref. No. P-7164

January 22, 1998

Mr. David W. Blane
Planning Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Draft Environmental Assessment, Napilihau Villages, Napili, Maui

We have reviewed the draft environmental assessment for the Napilihau Villages project and do not have any comments to offer. The document adequately addresses the concerns relating to the Coastal Zone Management (CZM) Program.

If there are any questions, please contact Charles Carole of our CZM Program at 587-2804.

Sincerely,

Rick Egged
Director
Office of Planning

BENJAMIN J. CAYETANO
GOVERNOR

HERMAN M. AIZAWA, Ph.D.
SUPERINTENDENT

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

January 12, 1998

Mr. David W. Blane, Director
Planning Department
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Napilihau Villages, EA 970009, 92/sm1-026

The Department of Education (DOE) projects that the 296 residential units at Napilihau Villages will have the following enrollment impacts:

	Students
Princess Nahienaena (K-5)	32
Lahaina Intermediate (6-8)	13
Lahainaluna High (9-12)	25

In 1993, the DOE requested that the developer of Napilihau Villages be required to make a fair-share contribution for school facilities as a condition of rezoning (see attachments).

Since no school condition was imposed at the rezoning stage, we are at this time requesting that a fair-share contribution be required of the developer as a condition of SMA permit approval.

The DOE's fair-share requirement is $850 per residential unit. For Napilihau Villages, this amounts to $251,600 based on a total of 296 units. Funds collected would be used for capital improvement projects within the Lahainaluna complex.

Thank you for the opportunity to comment. If you have any questions, please call Mr. Sanford Beppu at 733-4862.

Sincerely,

Herman M. Aizawa, Ph.D.
Superintendent

HMA:hy

Attachments

cc: A. Suga, OBS
R. Murakami, MDO

MUNEKIYO, ARAKAWA & HIRAGA, INC.

February 18, 1998

Herman Aizawa, Ph.D.
Superintendent
State of Hawaii
Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

SUBJECT: Napilihau Villages Environmental Assessment

Dear Dr. Aizawa:

We have received a copy of your letter of January 12, 1998 regarding the subject project, and would like to take this opportunity to provide a response on behalf of the Napilihau Villages Joint Venture.

As you know, the project is currently in the construction phase of development. Several units have been sold and are occupied. Due to the Hawaii Supreme Court's November 1997 decision to require the preparation of an Environmental Assessment (EA), however, work on the project has stopped until the EA process has been completed and Special Management Area Use Permit requirements addressed.

With regard to the Department of Education's request for a fair-share contribution for school facilities, it is noted that the majority of purchasers already reside in the West Maui region. Potential buyers are likewise anticipated to be residents of West Maui. In this regard, educational impacts attributed to the project are not deemed significant.

Since the project is partially completed and in the construction phase of development, we believe that the Napilihau Villages project is not a typical case under which the DOE's educational facilities assessment policies would apply.

In the context of the County's Special Management Area objectives and policies, therefore, we respectfully ask that the Department review and reconsider its recommendations for the Napilihau Villages project.

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If there are any questions or if additional information is needed, please do not hesitate to call.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:to
cc: David Blane, Planning Department (via mail)
Wayne Tanigawa, Napilihau Villages Joint Venture (via mail)
jg\napilies\doeltr.001

JOHN WAIHEE
GOVERNOR

CHARLES T. TOGUCHI
SUPERINTENDENT

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

January 11, 1993

Mr. Brian Miskae
Planning Director
Maui Planning Department
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Miskae:

SUBJECT: Napilihau Villages I, II and III
I.D. No. 92/CIZ-023
TMK: 4-3-003: 110

Our review of the subject application indicates that the proposed development will have an enrollment impact on the public schools in the area. The 224 residential units proposed will generate an estimated 24 students in grades K-5, 10 students in grades 6-12, and 20 students in grades 9-12.

The Department of Education (DOE) cannot assure the availability of classrooms to accommodate the 54 students from this project. Schools such as Kamehameha III, Nahienaena, and Lahainaluna High Schools are operating at or beyond capacity.

We request that the County require the developer to contribute a pro rata share to the satisfaction of the DOE for the construction of needed school facilities.

Should there be any questions, please call the Facilities Branch at 737-4743.

Sincerely,

Charles T. Toguchi
Superintendent

CTT:hy

cc: A. Suga
L. Lindsey

JOHN WAIHEE
GOVERNOR

CHARLES T. TOGUCHI
SUPERINTENDENT

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

February 1, 1993

Mr. Brian Miskae
Planning Director
Maui Planning Department
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Miskae:

SUBJECT: Napilihau Villages IV
I.D. No. 92/SM1-26
TMK: 4-3-003: 108

Our review of the subject application indicates that the proposed development will have an enrollment impact on the public schools in the area. The 88 multi-family residential units proposed will generate an estimated 10 students in grades K-5, 4 students in grades 6-12, and 6 students in grades 9-12.

The Department of Education (DOE) cannot assure the availability of classrooms to accommodate the 20 students from this project. Schools such as Kamehameha III, Nahienaena, and Lahainaluna High are operating at or beyond capacity. We previously responded on January 11, 1993, to a change in zoning application for Napilihau Villages I, II, and III. This additional village will increase the impact on the schools.

We request that the County require the developer to contribute a pro rata share based on the combination of Napilihau Villages I, II, III, and IV totaling 312 residential units to the satisfaction of the DOE for the construction of needed school facilities prior to the approval of zoning.

Should there be any questions, please call the Facilities Branch at 737-4743.

Sincerely,

Charles T. Toguchi
Superintendent

CTT:hy

cc: A. Suga
L. Lindsey

4490L2

BENJAMIN J. CAYETANO
GOVERNOR
STATE OF HAWAII

KALI WATSON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

JOBIE M. K. M. YAMAGUCHI
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

'98 JAN 27 P12:47
DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

January 26, 1998

Mr. David W. Blane, Planning Director
County of Maui, Planning Department
250 S. High Street
Wailuku, Maui, Hawaii 96793

Attn: Clayton Yoshida

Dear Mr. Blane:

Subject: Napilihau Villages, EA 970009, 92/sml-026
TMK: 4-3-3:108, 110, 122 and 123
Dated December 29, 1997

Thank you for requesting our review of the draft environmental assessement for the subject project.

The Department of Hawaiian Home Lands (DHHL) anticipates no adverse impacts from the proposed project. We also note that public health and safety concerns, as well as affordable housing requirements, are being addressed. DHHL has no objections to approval and implementation of this project.

Should you have any questions, please contact Daniel Ornellas of our Planning Office at 586-3836.

Aloha,

Darrell Yagodich

for KALI WATSON, Chairman
Hawaiian Homes Commission

BENJAMIN J. CAYETANO
GOVERNOR

LAWRENCE MIIKE
DIRECTOR OF HEALTH

LAWRENCE HART, M.D., M.P.H.
DISTRICT HEALTH OFFICER

'98 JAN 15 P12:37

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, MAUI, HAWAII 96793

January 13, 1998

Mr. David W. Blane
Director
Planning Department
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Napilihau Villages
TMK: (2) 4-3-3: 108, 110, 122, 123
EA 970009, 92/SM1 026

Thank you for the opportunity to comment on the application. Comments from this office were transmitted to our Honolulu Office. A coordinated response is forthcoming.

Should you have any questions, please call me at 984-8230.

Sincerely,

HERBERT S. MATSUBAYASHI
District Environmental Health Program Chief

BENJAMIN J. CAYETANO
GOVERNOR

LORRAINE H. AKIBA
DIRECTOR

LEONARD AGOR
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS
830 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

'98 JAN 12 P12:15
DEPT OF PL...
COUNTY OF ...
RECEIVE

January 9, 1998

Mr. Clayton Yoshida, AICP
Planning Program Administrator
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Yoshida:

The Department of Labor and Industrial Relations (DLIR) has received the Draft Environmental Assessment for the Napilihau Villages project.

According to the document provided, construction employment and other employment opportunities will be provided during the construction phase and to support other businesses. The department would like to offer its assistance in recruiting job applicants to fill those demands through its various employment and training agencies. Please contact Ms. Elaine Young, Administrator of DLIR's Workforce Development Division, to discuss how we may provide any needed assistance.

Thank you for the opportunity to comment on the Draft Environmental Assessment. If you have any questions or need more information, please call Ms. Naomi Harada, Chief of DLIR's Research and Statistics Office, at (808) 586-8999.

Very truly yours,

Lorraine H. Akiba
Director

'98 JAN 30 P12:20

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
P O BOX 621
HONOLULU, HAWAII 96809

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

January 22, 1998

LD-NAV
Ref.: EA970009.RCM

Honorable David W. Blane
Planning Director
County of Maui
Planning Department
250 S. High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

SUBJECT: Review : Draft Environmental Assessment
Applicants: Napilihau Village Joint Venture
Project : Napilihau Village
Location : Napili, Island of Maui, Hawaii
TMK : 2nd/ 4-3-01: 108, 122 and 123

Thank you for the opportunity to review and comment on the subject Draft Environmental Assessment.

The Department of Land and Natural Resources has no comments to offer on the subject matter at this time.

Should you have any questions, please feel free to contact Nicholas A. Vaccaro of the Land Division's Support Services Branch at 1-808-587-0438.

Very truly yours,

DEAN Y. UCHIDA
Administrator

c: Maui Land Board Member
At Large Land Board Member
Maui District Land Office

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

GILBERT COLOMA-AGARAN

'98 JAN 29 P12:14

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

RECEIVED

January 20, 1998

Mr. David Blane, Director
Department of Planning
250 South High Street
Wailuku, Hawaii 96793

LOG NO: 20840
DOC NO: 9801BD15

Dear Mr. Blane:

SUBJECT: Chapter 6E-42 Historic Preservation Review of a Draft Environmental Assessment for the Napilihau Villages
'Alaeloa Ahupua'a, Lahaina District, Island of Maui
<u>TMK 4-3-3: 108, 110, 122, and 123</u>

This letter is a Historic Preservation review of a draft EA for the Napilihau Villages located in 'Alaeloa Ahupua'a. Our review is based on reports, maps, and aerial photographs maintained at the State Historic Preservation Division; no field check was conducted of the subject property.

An archaeological inventory survey was conducted of the subject property in 1992 and the report was reviewed by this office (SHPD DOC NO. 9302AG05). No historic sites were recorded during the survey, so we found the proposed development to have "no effect" on significant historic sites (SHPD DOC NO. 9309AG30).

In the event that unrecorded historic remains (i.e. architecture, artifacts, or bones) are inadvertently uncovered during any construction on the site, all work should cease in the vicinity and the contractor should immediately contact the State Historic Preservation Division.

If you have any questions please contact Boyd Dixon at 243-5169

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

BD:jen

cc Ralph Nagamine, Maui County Department of Public Works (fax 243-7972)

BENJAMIN J. CAYETANO
GOVERNOR

ESTHER UEDA
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, HI 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

'98 JAN -5 P1:01
DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

January 2, 1998

Mr. David W. Blane
Director of Planning
Planning Department
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Napilihau Villages - Draft Environmental Assessment (EA 970009; 92/SM1-026)

We have reviewed the subject draft environmental assessment as transmitted by your memorandum dated December 29, 1997, and have the following comment to offer:

1) We confirm that the subject property, identified as TMK: 4-3-03: 108, 110, 122, and 123, and as shown in Figures 1 and 2 of the subject draft environmental assessment, is within the State Land Use Urban District.

2) In regards to the text on page 47 of the subject draft environmental assessment addressing State Land Use Districts, the section should be amended to include a representation that the subject property is within the State Land Use Urban District.

   As currently drafted, the section only represents that the proposed use of the subject property (296-unit residential townhome development) is a permitted use within the Urban District, without any representation that the subject property is within the Urban District.

We have no further comments to offer at this time.

Thank you for the opportunity to provide comments on the subject draft environmental assessment.

If you have any questions in regards to this matter, please feel free to contact me or Leo Asuncion of my staff at 587-3822.

Sincerely,

for ESTHER UEDA
Executive Officer

EU:th

MUNEKIYO, ARAKAWA & HIRAGA, INC.

January 19, 1998

Esther Ueda, Executive Director
State of Hawaii
Land Use Commission
P. O. Box 2359
Honolulu, Hawaii 96804-2359

SUBJECT: Draft Environmental Assessment for Napilihau Villages

Dear Ms. Ueda:

Thank you for your letter dated January 21, 1998 regarding the subject matter.

In response to Comment No. 2 of your letter, the text of the Final Environmental Assessment will be revised to reflect the property's location within the "Urban" district.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:lfm
cc: Clayton Yoshida, Planning Department } via mail
Kimo Lee, Napilihau Villages Joint Venture
d:\gl\napilies\ueda.001

Planning • Environmental Studies • Project Management
305 High Street, Suite 104 • Wailuku, Hawaii 96793 • Phone: (808) 244-2015 • Fax: (808) 244-8729

FEB 10 1998

BENJAMIN J. CAYETANO
GOVERNOR

GARY GILL
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
236 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

February 9, 1998

Mr. Kimo Lee
Napilihau Villages Joint Venture
900 Fort Street, Suite 1560
Honolulu, Hawai'i 96813

Dear Mr. Lee:

Having reviewed the draft environmental assessment (DEA) for the Napilihau Villages project (Munekiyo & Arakawa, Inc., December 1997), we submit the following comments for your response.

1) Please discuss the cumulative and indirect environmental effects of: chemicals and fertilizers after the initial vegetation establishment period (i.e., maintenance); sediment loading in near coastal waters; and, wastewater generation at Napilihau Villages.

2) Please submit to the County for inclusion in the final environmental assessment and notice of determination, the final Pentec Environmental Marine Baseline Study which was expected to be completed in January 1998.

Please submit to the County for inclusion in the final environmental assessment, a copy of this letter, any other comment letters and your responses. If there are any questions, please call Leslie Segundo of my staff at 586-4185. Thank you for the opportunity to comment.

Sincerely,

GARY GILL
Director of Environmental Quality Control

Enclosure

c: County of Maui Planning Department (w/enclosure)
Munekiyo & Arakawa, Inc. (w/enclosure)

MUNEKIYO, ARAKAWA & HIRAGA, INC.

February 17, 1998

Gary Gill, Director
Office of Environmental Quality Control
235 S. Beretania Street #702
Honolulu, Hawaii 96813

SUBJECT: Draft Environmental Assessment for Napilihau Villages

Dear Mr. Gill:

Thank you for your comments on the subject document, which are set forth in your February 9, 1998 letter to Mr. Kimo Lee. In response to your comments, we offer the following information.

1. Cumulative and indirect impacts of chemicals and fertilizers, sediment loading and wastewater generation will be addressed in terms of the Significance Criteria set forth in Section 11-200-12 of the Administrative Rules.

2. The Final Baseline Marine Environmental Survey prepared by Pentec Environmental will be included in the Final EA.

A copy of your letter and this response will also be incorporated in the Final EA.

Thank you again for your comments.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:to
cc: Wayne Tanigawa, Napilihau Villages Joint Venture
Clayton Yoshida, Planning Department
jgl/napilles/oeqcltr.001

Planning • Environmental Studies • Project Management
305 High Street, Suite 104 • Wailuku, Hawaii 96793 • Phone: (808) 244-2015 • Fax: (808) 244-8729

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

'98 JAN 12 P12:15
DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

January 6, 1998

David Blane
Director of Planning
Maui Planning Department
250 S. High Street
Wailuku, Maui 96793

Subject: Draft Environmental Assessment Napilihau Villages, Island of Maui

Dear Mr. Blane:

Thank you very much for the opportunity to review the above-referenced Draft Environmental Assessment (DEA). The Napili Villages Joint Venture is in the process of developing the 296-unit Naplilihau Villages project. The subject property encompasses an area of approximately 17 acres, and the project is programmed to be developed in four phases.

The Office of Hawaiian Affairs has no objections to the proposed project at this time. Based on the information contained in the DEA, the project bears no significant long-term adverse impacts on adjacent areas, scenic resources, or existing flora and fauna habitats. Furthermore, no known archaeological remains exist on the subject property due to previous land-use for pineapple cultivation.

If you have any questions or comments regarding this matter please contact Colin Kippen, Land and Natural Resources Division Officer, or Richard Stook, EIS Planner at 594-1755.

Sincerely yours,

Randall Ogata
Administrator

Colin Kippen, Officer
Land and Natural Resources

cc: Napilihau Villages Joint Venture
Board of Trustees
CAC, Maui Island

BENJAMIN J. CAYETANO
GOVERNOR

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
HWY-PS
2.7764

JAN 23 1998

Mr. Michael T. Munekiyo
Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

Subject: Environmental Assessment, Napilihau Villages [JGL Enterprises, Inc.], Napili, Maui, TMK: 4-3-3: 108, 110, 122-124

Please submit a Traffic Impact Analysis Report (TIAR) that covers the entire development at full buildout. The TIAR should analyze possible traffic impacts on Honoapiilani Highway and provide for mitigation of traffic impacts to include intersection improvements.

Very truly yours,

KAZU HAYASHIDA
Director of Transportation

MUNEKIYO,
ARAKAWA &
HIRAGA, INC.

February 17, 1998

Kazu Hayashida, Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

SUBJECT: Draft Environmental Assessment for Napilihau Villages

Dear Mr. Hayashida:

Thank you for your letter of January 23, 1998 regarding the need to submit a Traffic Impact Analysis Report (TIAR). A copy of the report will be submitted to your Department for review. The report will also be incorporated in the Final Environmental Assessment.

Thank you again for your comments.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:to
cc: Wayne Tanigawa, Napilihau Villages Joint Venture
Clayton Yoshida, Planning Department
Ted Kawahigashi, Austin Tsutsumi & Associates, Inc.
jgVnapilise/dotltr.001

Planning • Environmental Studies • Project Management
305 High Street, Suite 104 • Wailuku, Hawaii 96793 • Phone: (808) 244-2015 • Fax: (808) 244-8729

LINDA CROCKETT LINGLE
MAYOR

RONALD P. DAVIS
CHIEF

HENRY A. LINDO, SR.
DEPUTY CHIEF

'98 JAN 29 A10:11

COUNTY OF MAUI
DEPARTMENT OF FIRE CONTROL
200 DAIRY ROAD
KAHULUI, MAUI, HAWAII 96732
(808) 243-7561

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

January 26, 1998

Clayton Yoshida, AICP
Planning Program Administrator
Department of Planning
250 High Street
Wailuku, HI 96793

RE: Napilihau Villages Draft Environmental Assessment

Dear Mr. Yoshida

The Department of Fire Control has reviewed the draft EA for Napilihau Villages. While we do not agree that the project will result in no increase to the population of the area, the resources of the department are adequate to provide the needed services.

Thank you for the opportunity to comment.

Sincerely

Leonard F. Niemczyk. Captain
Fire Prevention Bureau
Department of Fire Control

DEPARTMENT OF
PARKS AND RECREATION
COUNTY OF MAUI

1580-C KAAHUMANU AVENUE WAILUKU, HAWAII 96793

LINDA LINGLE
Mayor

HENRY OLIVA
Director

ALLEN SHISHIDO
Deputy Director

(808) 243-7230
FAX (808) 243-7934

'98 FEB 10 P3:07

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

February 9, 1998

MEMO TO: David W. Blane, Planning Director

FROM: Henry Oliva, Director

SUBJECT: Napilihau Villages
TMK: 4-3-003: 110, 122, and 123 (EA 970009)

We have reviewed the subject application. The previous park assessment for the project was a 1.65 acre park parcel within the development that will be dedicated to the County. We would like to reopen discussion with the developer to make this park a "privately owned and maintained park and playground".

Attached is a description taken from the park assessment ordinance whereby the Parks and Recreation Director and the subdivider work together to receive a one hundred percent credit of the park assessment requirements for this type of park.

Thank you for the opportunity to comment. Should you have any questions, please contact me at 243-7626 or Patrick T. Matsui, Chief-Planning and Development, at 243-7931.

HO:PTM:gu

c: Files

s:\plan\gu\lahaina\dblane.mmo

a. The average value per square foot of lands classified as improved residential,

b. The average value per square foot of lands classified as apartment, and

c. The average value per square foot of lands classified as unimproved residential; or

2. Combine the payment of money with land to be provided or dedicated, on the basis of five hundred square feet per each lot or unit, in excess of three, resulting from the subdivision; or

3. Provide improvements to parks and playgrounds in the community plan region where the subdivision is located. The value of such improvements shall be at least equal to the sum of money required to be paid pursuant to this section. The estimate for the cost of the improvements provided shall be based upon cost estimates certified by an engineer licensed to practice in the State of Hawaii.

For subdivisions which qualify as affordable housing projects, this park assessment fee shall be deferred for either one year from the date of final subdivision approval or until fifty percent of the dwelling units of the affordable housing project are sold or rented, whichever occurs first.

D. The county shall use the money received pursuant to this section for the purpose of providing parks and playgrounds for the use of purchasers or occupants of lots or units in the subdivision. The money received in connection with a subdivision shall accrue to a park assessment fund, and shall be appropriated in the county budget for parks and playgrounds in the community plan region where the subdivision is located. The estimated amount available for appropriation in each community plan region shall be set forth in the operating budget and capital program proposed by the mayor.

E. A subdivider shall receive a credit of fifty percent of the area of privately owned and maintained parks and playgrounds if the director of parks and recreation determines that the park or playground fulfills the [following] conditions [:] set forth below. A subdivider shall receive a credit of one hundred percent of the area of privately owned and maintained parks and playgrounds if the director of parks and recreation determines that the park or playground will be available for public use in accordance with all statutes, rules and regulations pertaining to county parks, and if the director determines that the park or playground fulfills the conditions set forth below.

1. Setbacks and other areas required by law shall not be included in the computation of the credit;

2. The size, shape, topography, geology, access, use and location of the site shall be suitable for park and playground purposes, as determined after consultation with the director of parks and recreation;

3. The physical improvements provided shall meet the needs of the occupants of the subdivision, as determined after consultation with the director of parks and recreation;

4. Such parks and playgrounds shall not include golf courses, marinas, or other similar uses for which a fee is charged;

5. The subdivider shall improve the site with lot grading, grass planting, parking areas, adequate drainage, and comfort stations; provided, that the council may waive any of these requirements if the director determines that such improvements are available nearby, are impractical, or are unnecessary; provided further, that the director of public works and the director of parks and recreation shall have an opportunity to submit recommendations;

6. Prior to subdivision approval, the subdivider shall enter into an agreement with the county, and shall provide adequate security, to assure that the required improvements and facilities shall be constructed;

7. The use of the site shall be restricted to park and playground purposes by recorded covenants which shall run with the land, and which shall be enforceable by the owners and occupants of the subdivision, and by the county;

8. The perpetual maintenance of the site by the owners and occupants of the subdivision shall be assured by the recorded covenants running with the land, which shall obligate the owners and occupants of the subdivision to maintain the site in perpetuity, and which shall empower the county to enforce the covenants or cause the maintenance to be performed and subject the properties in the subdivision to a lien until the cost of the maintenance is reimbursed; and

9. Prior to approval of the subdivision, the subdivider shall execute and record a unilateral agreement in favor of the county to assure that such parks and playgrounds shall be privately and adequately maintained in perpetuity, and that the provisions of this section shall be observed.

F. A subdivider shall receive credit for lands dedicated or provided for park and playground purposes [within ten years] before the subdivision approval, if the director determines that the lands comply with the following requirements;

MUNEKIYO, ARAKAWA & HIRAGA, INC.

February 18, 1998

Henry Oliva, Director
County of Maui
Department of Parks and Recreation
1580-C Kaahumanu Avenue
Wailuku, Hawaii 96793

SUBJECT: Napilihau Villages

Dear Mr. Oliva:

We have received a copy of your memorandum of February 9, 1998 to the Planning Director regarding the subject matter.

In response to your comments, the Napilihau Villages Joint Venture is willing to discuss the applicability of Section 18.16.320(E) of the Maui County Code with the Department of Parks and Recreation.

We will coordinate with your office to arrange a meeting to discuss this provision of the code.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:to
cc: David Blane, Planning Department (via mail)
Wayne Tanigawa, Napilihau Villages Joint Venture (via mail)
jgl/napilies/dprltr.001

Planning • Environmental Studies • Project Management
305 High Street, Suite 104 • Wailuku, Hawaii 96793 • Phone: (808) 244-2015 • Fax: (808) 244-8729

POLICE DEPARTMENT
COUNTY OF MAUI

LINDA LINGLE
MAYOR

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

'98 FEB -4 P3:09

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

HOWARD H. TAGOMORI
CHIEF OF POLICE

THOMAS PHILLIPS
DEPUTY CHIEF OF POLICE

OUR REFERENCE

YOUR REFERENCE

February 4, 1998

MEMORANDUM

TO : DIRECTOR, PLANNING DEPARTMENT

FROM : HOWARD H. TAGOMORI, CHIEF OF POLICE

SUBJECT : I.D. No.: EA 970009, 92/sm1-026
TMK: 4-3-3:108, 110, 122, and 123
Project Name: Napilihau Villages
Applicant: Napilihau Village Joint Venture

✓ No recommendation or special condition is necessary or desired.

___ Refer to attachment(s).

Assistant Chief Richie Nakashima
for: HOWARD H. TAGOMORI
Chief of Police

LINDA LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

Telephone: (808) 243-7845
Fax: (808) 243-7955

'98 JAN 28

DEPT OF COUNTY OF MAUI

DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT

200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

Solid Waste Division

January 26, 1998

MEMO TO: DAVID W. BLANE, DIRECTOR OF PLANNING

FROM: CHARLES JENCKS, DIRECTOR OF PUBLIC WORKS AND WASTE MANAGEMENT

SUBJECT: ENVIRONMENTAL ASSESSMENT
NAPILIHAU VILLAGES
TMK (2) 4-3-003:108, 110, 122 AND 123
EA 97/009, 92/SM1/026

We reviewed the subject submittal and have the following comments.

1. Traffic report dated 1993 is outdated. This report should be revised to assess present conditions.

2. Detailed and final drainage reports and Best Management Practices Plans (BMP) will be required to be submitted and approved for all future phases of this project. The drainage report should include hydrologic and hydraulic calculations and the schemes for disposal of runoff waters. It must comply with the provisions of the "Rules for Design of Storm Drainage Facilities in the County of Maui" and should provide verification that the grading and runoff water generated by the project will not have an adverse effect on adjacent and downstream properties. The BMP plan shall show the location and details of structural and non-structural measures to control erosion and sedimentation to the maximum extent practicable

If you have any questions, please call David Goode at 243-7845.

DG:co/mt
xc: Engineering Division
Solid Waste Division
Wastewater Reclamation Division
S:\LUCA\CZM\NAPILIHA.

MUNEKIYO, ARAKAWA & HIRAGA, INC.

February 17, 1998

Charles Jencks, Director
Department of Public Works and
Waste Management
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Draft Environmental Assessment for Napilihau Villages

Dear Mr. Jencks:

We have received a copy of your January 26, 1998 memorandum to David Blane regarding the DPWWM's comments on the subject document. In response to your comments, we offer the following information.

1. An updated traffic impact report which addresses the entire project will be incorporated in the Final EA.

2. As with previous phases of the project, detailed and final drainage and soil erosion control reports will be submitted to your office as future increments of the project are developed. These submittals will be prepared in conformance with the "Rules for Design of Storm Drainage Facilities in the County of Maui".

A copy of your memorandum and this response will be incorporated in the Final EA.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:to
cc: Wayne Tanigawa, Napilihau Villages Joint Venture
Clayton Yoshida, Planning Department
jg\napilies\dpwwmltr.001

Planning • Environmental Studies • Project Management
305 High Street, Suite 104 • Wailuku, Hawaii 96793 • Phone: (808) 244-2015 • Fax: (808) 244-8729

Maui Electric Company, Ltd. • [illegible] West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96733-6898 • (808) 871-8[illegible]1

'98 JAN 14 A10:22

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

January 7, 1998

Mr. David W. Blane
Planning Director
Maui Planning Department
250 S. High Street
Wailuku, HI 96793

Dear Mr. Blane:

Subject: Napilihau Villages
TMK 4-3-3:108, 110, 122 and 123
I.D. EA 970009, 92/sm1-026

Thank you for allowing us to comment on the subject project.

In reviewing the information transmitted and our records, we have no objection to the subject project. If you have any questions or concerns, please call Dan Takahata at 871-2385.

Sincerely,

Edward L. Reinhardt
Manager, Engineering

ELR/dt:lh

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
COUNTY OF MAUI

Mayor
STEPHANIE AVEIRO
Director
MARK PERCELL
Deputy Director

200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • PHONE (808) 243-7805 • FAX (808) 243-7829

'98 FEB 13 P3:19

February 13, 1998

TO: Mr. David Blane
Director of Planning

FORM: ~~Ms.~~ Stephanie Aveiro
Director of Housing and Human Concerns

SUBJECT: Napilihau Villages
Draft Environmental Assessment
I.D. No. EA 970009, 92/sm1-026
TMK: 4-3-3:108,110,122 and 123

We have reviewed Napilihau Villages Joint Venture's Draft Environmental Assessment for the subject project, and would like to offer the following comments:

1. We request that the Developer identify the units that will be used to satisfy the affordable housing condition that is set forth in the Maui Planning Commission's Finding of Fact, Conclusions of Law, Decision and Order dated February 14, 1995. The affordable housing units should be identified as soon as possible but no later than 30 days prior to the start of the affordable housing sales program.

2. We have determined that the following sales prices are currently deemed affordable to the income groups shown:

$141,467	-	80% or less of County's median annual income.
$141,468 - $224,743	-	80.01% - 120% of County's median annual income.
$224,744 - $268,533	-	120.01% - 140% of County's median annual income.

Our determination is based on the U.S. Department of Housing and Urban Development's (HUD's) 1998 median family income of $55,500, a current prevailing interest rate of 8% for a 30 year fixed rate mortgage loan with zero discount point, a 5% downpayment and $175 for the buyer's customer trust fund. Please be advised that our final determination on affordability will be made when the units are actually offered for sale.

3. It is our understanding that the 80 affordable rental units in Phase II will be financed under the Housing Finance and Development Corporation's (HFDC's) Low Income Housing Tax Credit (LIHTC) program and that the proposed monthly rental rates (including utilities) will be $515 and $660. At these rates, we have determined that the units will be affordable to families with incomes at or below 80% of Maui County's median annual income.

4. We hereby request that the Developer be required to enter into an Affordable Housing Agreement with the County of Maui, to clearly establish procedures and requirements regarding the marketing of units, identification of the target market, manner in which affordable sales prices or rental rates will be determined, manner in which buyers and/or renters will be selected, etc.

Please call Wayde Oshiro of our Housing Division at extension 7351 if you have any questions.

WTO:wo

xc: Housing Administrator

MUNEKIYO, ARAKAWA & HIRAGA, INC.

March 3, 1998

Mark Percell, Deputy Director
County of Maui
Department of Housing and Human Concerns
200 S. High Street
Wailuku, Hawaii 96793

SUBJECT: Napilihau Villages Environmental Assessment

Dear Mr. Percell:

We appreciated the opportunity of meeting with you, Ed Okubo and Wayde Oshiro to discuss the Department's February 13, 1998 comments on the Napilihau Villages project.

As discussed, the Napilihau Village's Phase II increment will be offered as a "for sale" affordable project. The Napilihau Villages Joint Venture will not proceed with the HFDC Low Income Housing Tax Credit Program.

This will also confirm our intent to work with the Department in formulating a mutually agreeable affordable housing agreement.

We look forward to working with you and your staff in this regard.

Very truly yours,

Michael T. Munekiyo, A.I.C.P.
Project Manager

MTM:to
cc: David Blane, Planning Department
Wayne Tanigawa and Kevin Kasai, Napilihau Villages Joint Venture
jg\napilles\dhhcltr.002

Planning • Environmental Studies • Project Management
305 High Street, Suite 104 • Wailuku, Hawaii 96793 • Phone: (808) 244-2015 • Fax: (808) 244-8729

References

References

Community Resources, Inc., Maui County Community Plan Update Program Socio-Economic Forecast Report, January 1994.

County of Maui, Budget Details for Fiscal Year 1991, 1990.

County of Maui, Departments of Planning and Water Supply, Technical Report and Water Use Development Plan, March 1990.

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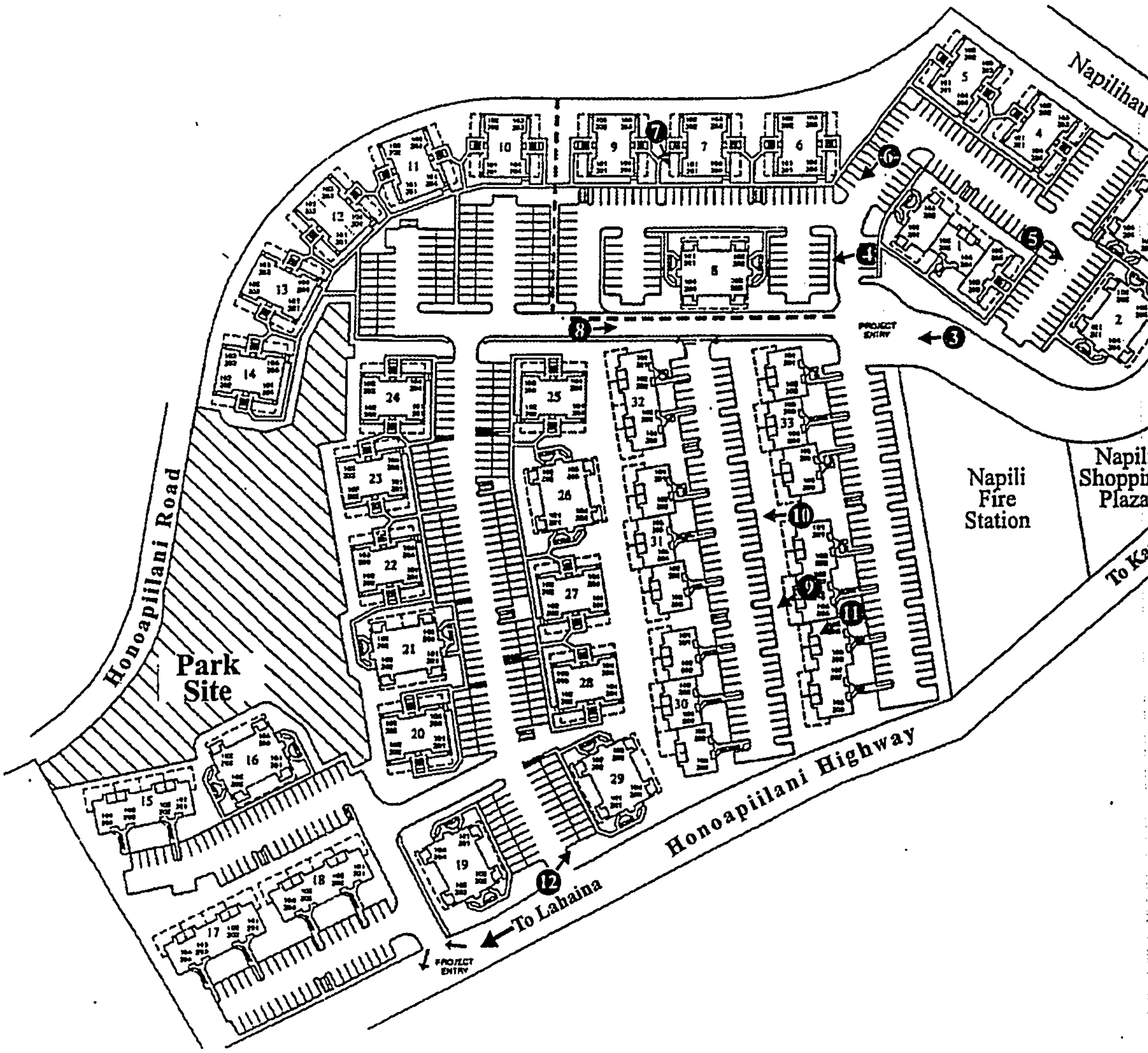
Appendices

INDEX OF APPENDICES

Appendix "A"	Site Photographs
Appendix "B"	Preliminary Drainage and Erosion Control Report
Appendix "C"	Final Drainage Report Phase I
Appendix "D"	Final Drainage Report Phase II
Appendix "E"	Archaeological Inventory Study
Appendix "F"	Baseline Marine Environmental Surveys
Appendix "G"	SHPD Letters Dated February 5, 1993 and September 23, 1993
Appendix "H"	Traffic Impact Report
Appendix "I"	Supplemental Traffic Impact Report
Appendix "J"	State Department of Transportation Letter dated August 11, 1997
Appendix "K"	Update of Traffic Impact Analysis Report for Napilihau Villages

Appendix A

Site Photographs



Napilihau Villages Environmental Assessment

Site Photographs - Reference Map

Prepared for: JGL Enterprises, Inc.

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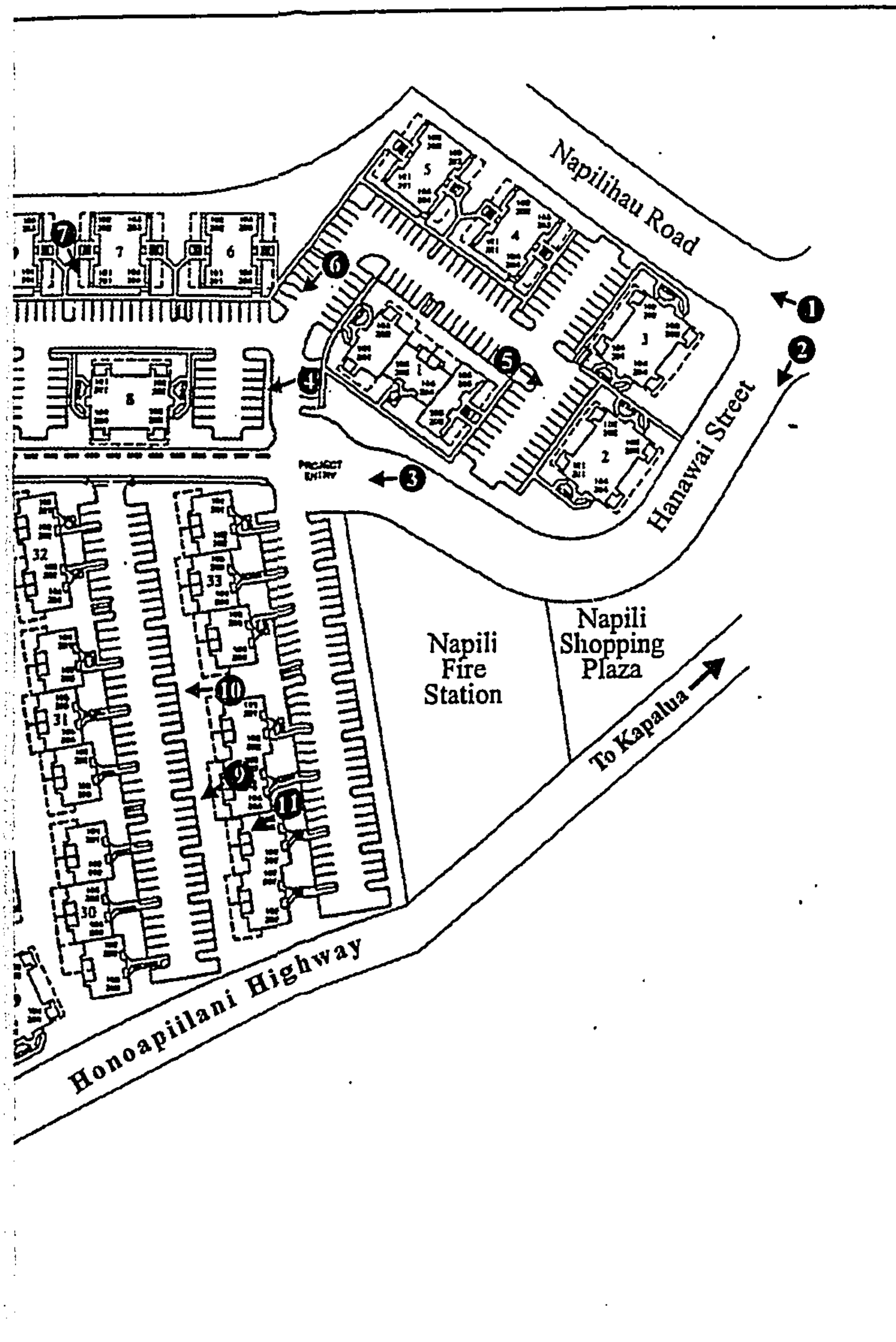

ges Environmental Assessment
ıtographs - Reference Map

MUNEKIYO, ARAKAWA & HIRAGA, INC.

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DOCUMENT CAPTURED AS RECEIVED

Photo 1

Photo 2

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Photo 3

Photo 4

DOCUMENT CAPTURED AS RECEIVED

Photo 5

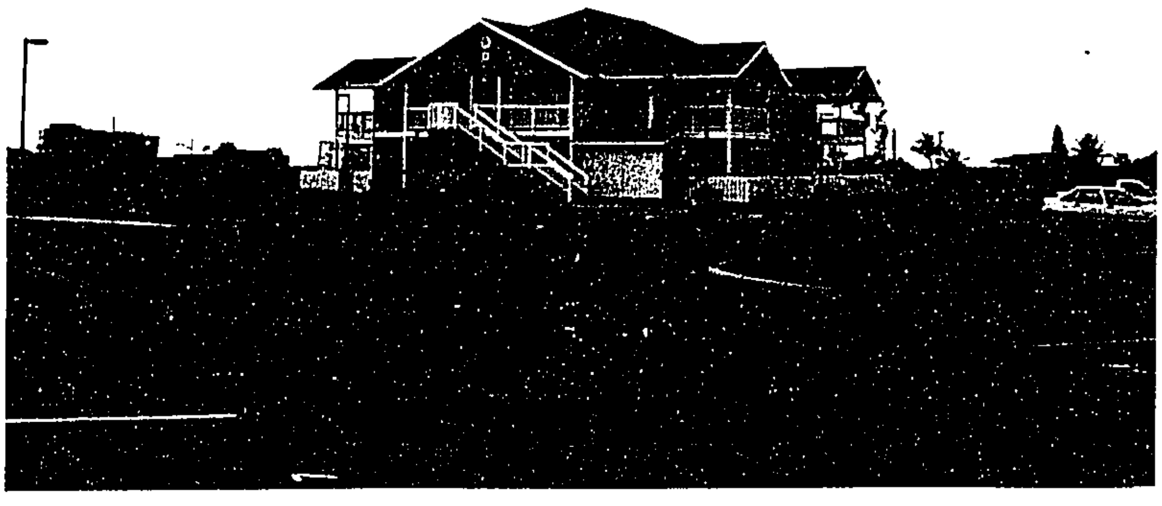

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

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Photo 11

Photo 12

Appendix B

Preliminary Drainage and Erosion Control Report

DRAINAGE AND SOIL EROSION CONTROL REPORT

FOR

NAPILIHAU VILLAGES

Alaeloa, Lahaina, Maui, Hawaii

TMK: 4-3-03:110

DEVELOPER: JGL Enterprises, Inc.
ADDRESS: Honolulu, Hawaii

Prepared By:

Warren S. Unemori Engineering, Inc.
Civil and Structural Engineers - Land Surveyors
Wells Street Professional Center, Suite 403
2145 Wells Street
Wailuku, Maui, Hawaii 96793

January 1993
Amended August, 1993

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TABLE OF CONTENTS

Drainage and Soil Erosion Control Report
for
Napilihau Villages

I. INTRODUCTION

This report has been prepared to evaluate existing onsite and offsite drainage conditions. It also provides a brief description of the proposed post-development drainage plan for subject development.

Calculations to determine the potential movement of soil due to rainfall and surface runoff off the project area in accordance with Chapter 20.08 of the Maui County Codes are also presented.

II. PROPOSED PROJECT

A. Site Location:

The project site is located in Lahaina, on the island of Maui, and in the State of Hawaii. It is situated immediately mauka (east) of Lower Honoapiilani Road and makai (west) of Honoapiilani Highway, and is approximately 600 feet southwest of the Lower Honoapiilani Road and Napilihau Street intersection (see Exhibit 1).

The project site encompasses an area of about 17.1 acres.

B. Project Description:

The proposed plan for the Napilihau Villages project is a multi-family development which will include asphalt paved driveways and parking areas, concrete sidewalks, concrete curb and gutters, and landscaping. Underground

utility systems for drainage, water, and sewerage systems, and electrical, telephone, and cable television distribution systems will also be installed.

II. EXISTING CONDITIONS:

A. Topography and Soil Conditions:

Presently, the project site consists of open land which is not being used for any particular purpose. Natural vegetation includes but is not limited to guava, klu, koa haole, lantana, natal redtop, and yellow foxtail. The site was previously used for pineapple cultivation.

The existing ground slopes in a northeasterly to southwesterly direction from an elevation of (+) 105 ± feet M.S.L. to (+) 30 ± feet M.S.L. with an average slope of 10.1%.

According to the "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii (August, 1972)", prepared by the United States Department of Agriculture, Soil Conservation Service, the soil is classified as Kahana Series, silty clay (KbC, 7 to 15 percent slopes and KbB, 3 to 7 percent slopes) (see Exhibit 2). This soil is characterized as having a moderately rapid permeability, slow to medium runoff and a slight to moderate erosion hazard.

B. Flood and Tsunami Zone:

According to Panel Number 150003 0138B of the Flood Insurance Rate Map, revised September 6, 1989, prepared by the United States Federal Emergency Management Agency, the entire site is situated within Zone C which is designated as areas prone to minimal flooding. (See Exhibit 3).

C. Drainage:

1. Existing Conditions:

Currently, runoff from the drainage area mauka and east of Napilihau Road/Honoapiilani Highway intersection, referred to as Drainage Basin "A" in the attached calculations sheet, is conveyed across the intersection by means of three 65" x 40" CMP culverts. It is then routed across the Napili Shopping Plaza parking lot through a drainline into a temporary detention basin at the northeasterly corner of the proposed Napilihau Village project site. Overflow from this basin drains into the adjacent vacant lot, then across Lower Honoapiilani Road through a 24-inch culvert towards a concrete lined channel that runs through the Alaeloa Condominium project site and subsequently into Alaeloaiki Bay. Based on the Rational Method the current 100-year runoff from these three basins are estimated to be 176 cfs, 18 cfs, and 4 cfs, respectively, for a total of 198 cfs. The minimum capacity of the existing concrete lined channel through Alaeloa Condominium site is estimated to be 71 cfs.

Runoff from the second drainage area located mauka of Honoapiilani Highway and south of Napilihau intersection, referred to as Drainage Basin "B", drains into a natural gully between Maui Land & Pineapple Company's baseyard and their employee dormitories. Runoff is then conveyed across Honoapiilani Highway through a 66-inch culvert to a depression in the westerly corner of the Napilihau Villages project site. Runoff that accumulates in this shallow ponding

area is conveyed across Lower Honoapiilani Road by a 24-inch culvert and subsequently across Kahana Sunset property into Keonenui Bay through a 30-inch drainline. Based on the headwater available, the inlet capacity of the 24-inch drainline is estimated to be approximately 70 cfs. Current runoff from Drainage Basin "B" and the proposed Napilihau Village site are estimated to be 116 cfs and 15 cfs, respectively, for a total of approximately 131 cfs. This is approximately 61 cfs more than the capacity of the existing drain line on Lower Honoapiilani Road.

IV. PROPOSED DRAINAGE PLAN

A. Area Mauka of Alaeloaiki Bay:

Drainage Basin "A" will be subdivided into Drainage Areas A-1 and A-2. Approximately 148 cfs from the upper 105 acres, hereinafter referred to as Area A-1, will be directed into a new detention basin to be constructed mauka of Rainbow Ranch. This new basin will be sized to detain a volume of approximately 10.6 acre-feet and release a maximum of 25 cfs. Runoff from Area A-2, or the remainder of Drainage Basin A, which is expected to total approximately 41 cfs, plus the 25 cfs released from the detention basin in Area A-1 will then be conveyed across Honoapiilani Highway and the Napili Shopping Plaza. This flow together with 18 cfs from Napili Plaza will be directed into a new drain line installed on Napilihau Street and connected to the existing 24-inch line on Lower Honoapiilani Road.

Post development runoff from the Napilihau Villages project site below Napili Plaza will be collected and directed into a subsurface detention system comprised of 70 feet of 72-inch diameter perforated corrugated aluminum pipe. A 15-inch release line will connect this subsurface system to the new drain line on Napilihau Street mentioned above. This 72-inch subsurface system will be sized to receive and store the post development runoff from the Napilihau Villages project site below Napili Plaza and release it slowly through a 15-inch release line. It will also serve as a debris catchment and desilting facility for onsite runoff. Total post development runoff from Drainage Basin "A", Napili Shopping Plaza and Napilihau Villages will be reduced to 90 cfs or approximately 108 cfs less than the current runoff into Alaeloaiki Bay from these areas.

B. Area Mauka of Keonenui Bay:

A new detention basin will also be constructed mauka of Honoapiilani Highway in the natural gully between Maui Land & Pineapple Company's baseyard and their employee dormitories. This detention basin will be designed to receive and store all of the runoff from Drainage Basin "B" and reduce the peak flow of approximately 116 cfs to an outflow volume of only 25 cfs.

Runoff from the westerly portion of the Napilihau Villages site now flowing into Keonenui Bay is expected to increase to approximately 44 cfs after development. Under current conditions the surface runoff is approximately 15 cfs. In order to keep the post development runoff from the project site as small as practically feasible, 295 feet of 8-foot diameter

perforated CAP pipes will be installed on site. The line connecting this subsurface system with the existing 24-inch line mauka of Lower Honoapiilani Highway will be sized to release a combined onsite/offsite volume of approximately 45 cfs. This is 25 cfs smaller than the capacity of the existing 24-inch line it will be draining into and 86 cfs less than the current peak flows from these areas.

V. SOIL EROSION CONTROL PLAN

A. Grading Plan:

Based on the Hawaii Environmental Simulation Laboratory (HESL) equations to estimate soil loss during the construction period, and complemented by the following erosion control plan, the soil loss during the construction period is well within the tolerable limits.

B. Soil Erosion Control Plan:

The following measures will be taken to control erosion during the site development period (estimated 12 months).

1. Minimize time of construction.
2. Retain existing ground cover until latest date to complete construction.
3. Early construction of drainage control features.
4. Use temporary area sprinklers in non-active construction area when ground cover is removed.

5. Station water truck on site during construction period to provide for immediate sprinkling, as needed, in active construction zones (weekends and holidays included).
6. Use temporary berms and cut-off ditches, where needed, for control of erosion.
7. Graded areas shall be thoroughly watered after construction activity has ceased for the day and on weekends.
8. All cut and fill slopes shall be sodded or planted immediately after grading work has been completed.

VI. CONCLUSION

According to our calculations, peak flow post development runoff into Alaeloaiki and Keonenui Bays will be reduced substantially (see Appendix A). Peak runoff into Alaeloaiki Bay will be reduced by 55% from the current volume of 195 cfs to 87 cfs. Peak runoff into Keonenui Bay will be reduced even more significantly from 131 cfs to 45 cfs for a decrease of 66%.

In addition with the construction of the two detention basins above Honoapiilani Highway and the subsurface detention facilities onsite conveyance of waterborne debris and silt into Alaeloaiki Bay and Keonenui Bay is expected to decrease.

According to our calculation based on HESL quidelines the potential for soil loss during construction is anticipated to be minimal and well within the tolerable limits (see Appendix B).

Based on the foregoing it is our professional opinion that the Napilihau Villages project will improve, not aggravate conditions of the downstream properties and coastal ecosystem.

WARREN S. UNEMORI
REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR
No. 1569
HAWAII

Report Prepared By:

Reed M. Ariyoshi

Report Checked By:

Warren S. Unemori

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CORRECTION

THE PRECEDING DOCUMENT(S) HAS
BEEN REPHOTOGRAPHED TO ASSURE
LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

5. Station water truck on site during construction period to provide for immediate sprinkling, as needed, in active construction zones (weekends and holidays included).
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Report Prepared By:

Reed M. Ariyoshi

Report Checked By:

WARREN S. UNEMORI REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR No. 1569 HAWAII

Warren S. Unemori

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VII. REFERENCES

1. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* August 1972. United States Department of Agriculture, Soil Conservation Service.

2. *Flood Insurance Rate Map, Maui County, Hawaii.* Community-Panel Number 150003 0138B. September 6, 1989. Federal Emergency Management Agency, Federal Insurance Administration.

3. *Drainage Master Plan for the County of Maui, State of Hawaii.* October 1971. R.M. Towill Corporation.

4. *Rainfall Frequency Atlas of the Hawaiian Islands, Technical Paper No. 43.* 1962. U.S. Department of Commerce, Weather Bureau.

5. *Storm Drainage Standards.* March 1986. Department of Public Works, City and County of Honolulu.

EXHIBITS

1. Location Map
2. Soil Survey Map
3. Flood Insurance Rate Map
4. Conceptual Drainage Plan (in pouch)

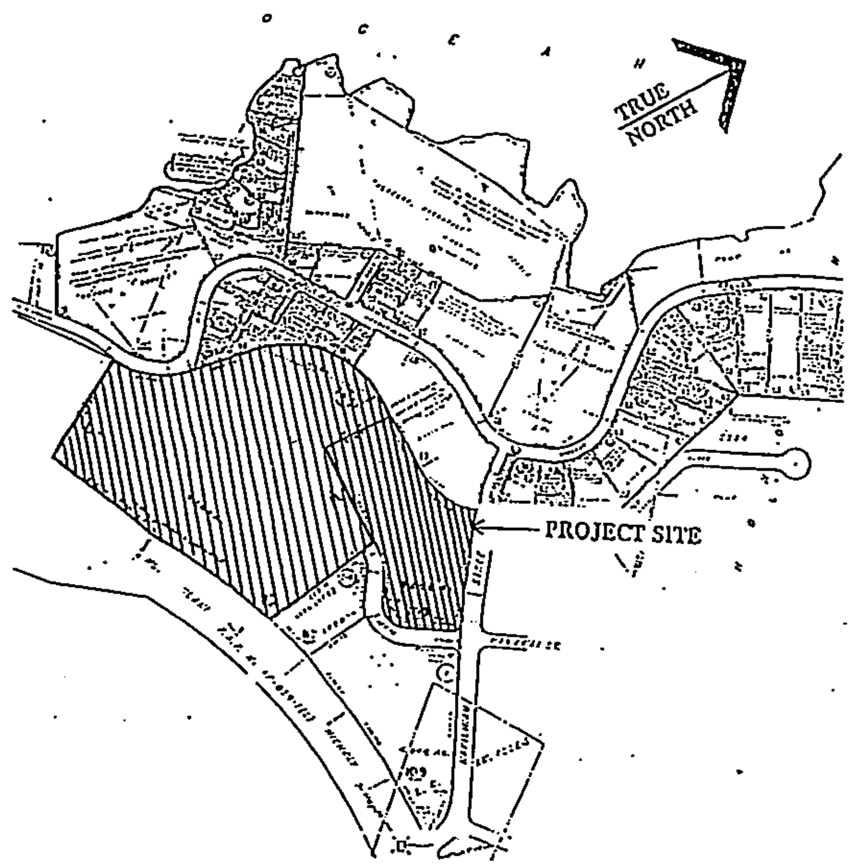


Exhibit 1
LOCATION MAP

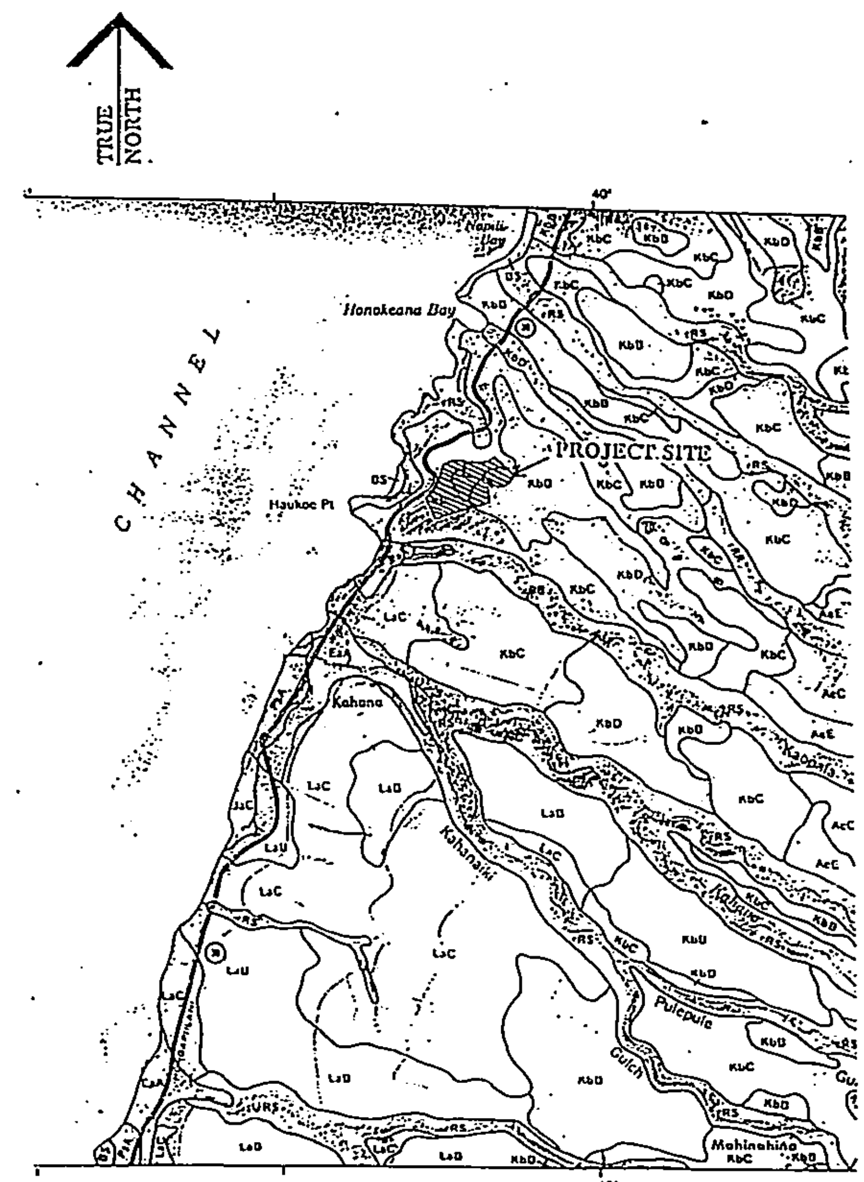


Exhibit 2
SOIL SURVEY MAP

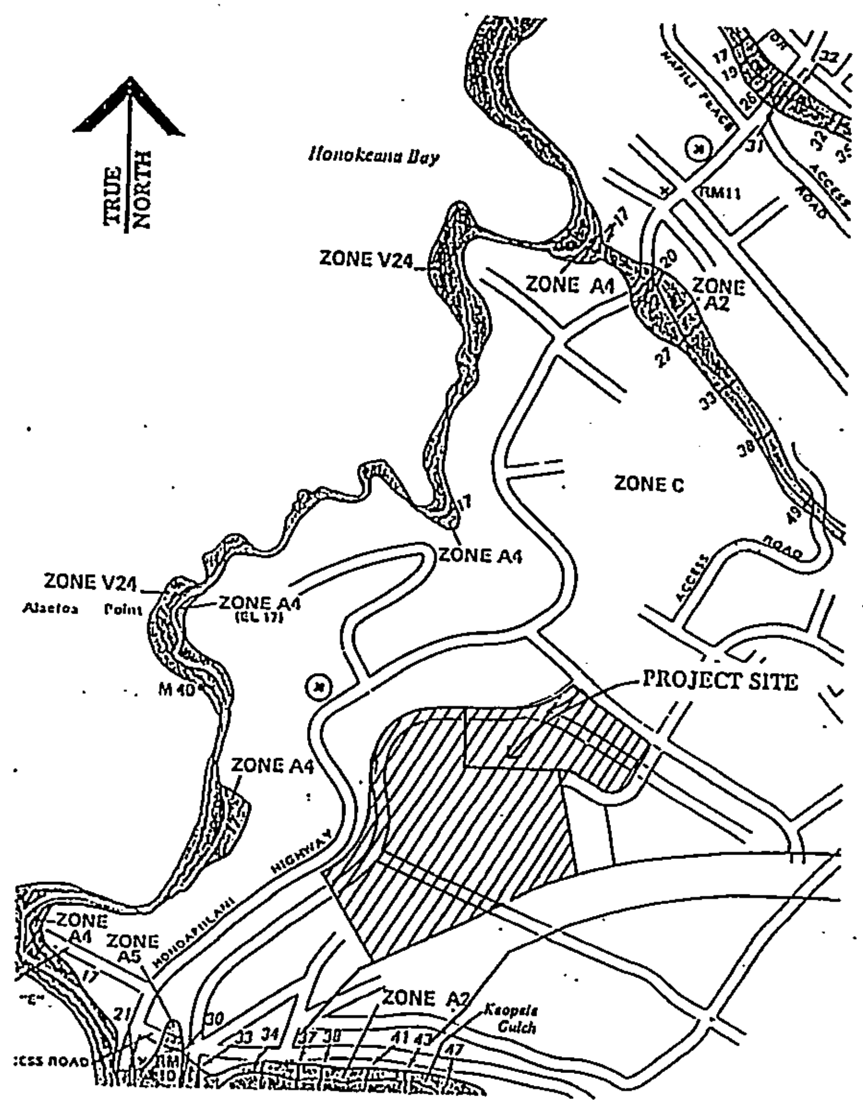
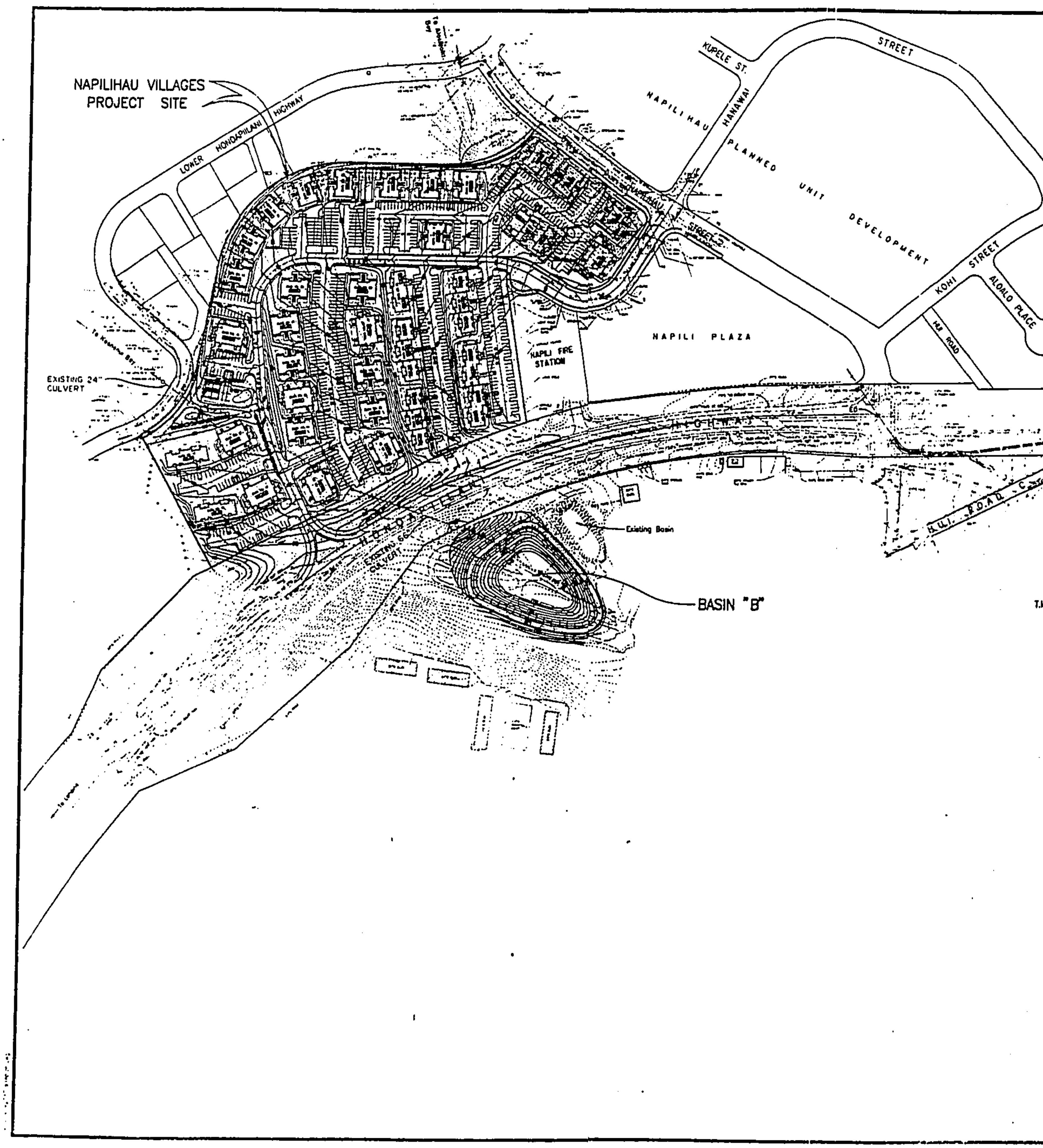
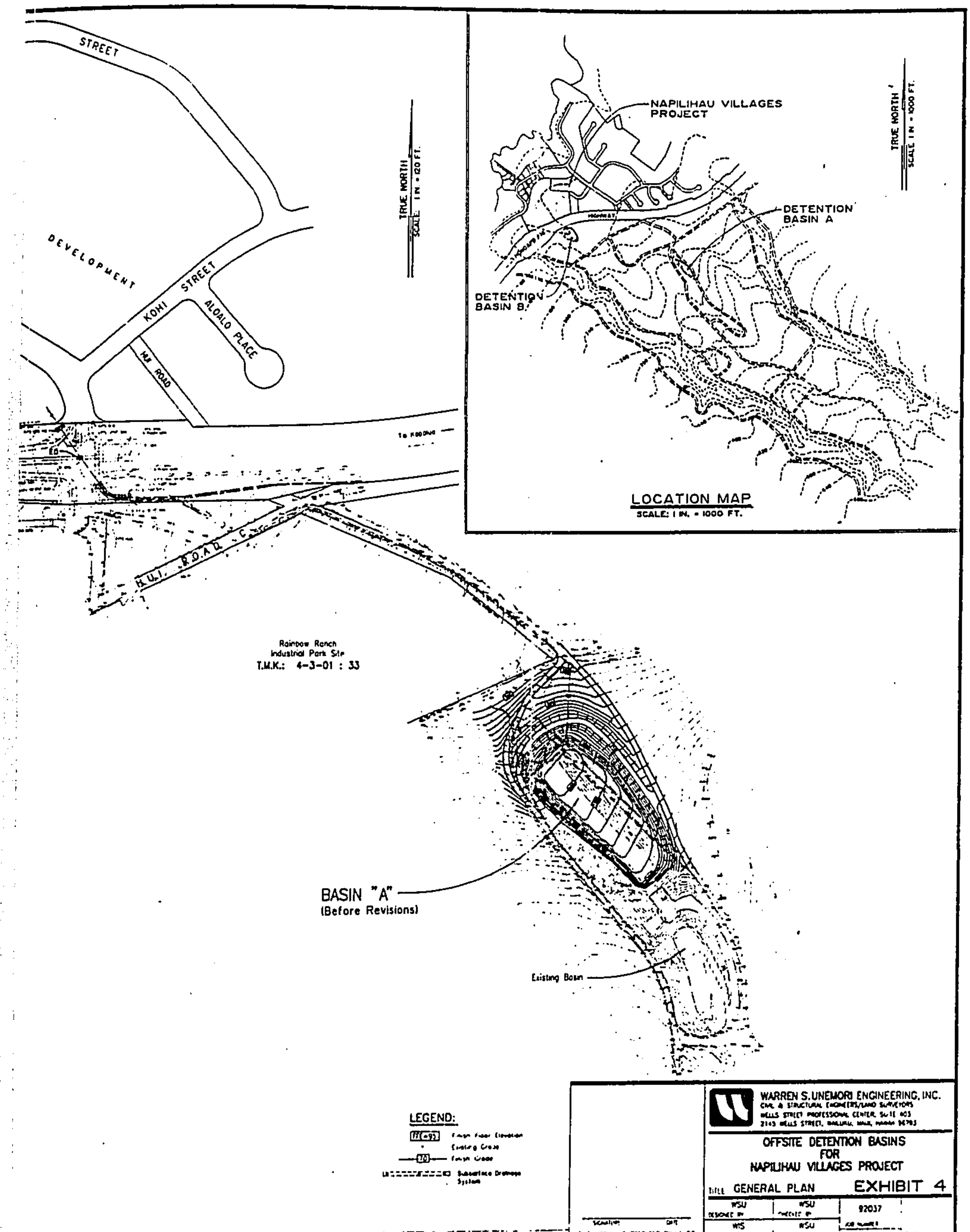


Exhibit 3
FLOOD INSURANCE RATE MAP



NAPILIHAU VILLAGES
PROJECT SITE
LOWER HONOAPIILANI HIGHWAY
KUPELE ST.
STREET
NAPILIHAU
HANAWAI
PLANNED UNIT DEVELOPMENT
KOHI STREET
ALOALO PLACE
NAPILI PLAZA
NAPILI FIRE STATION
EXISTING 24" CULVERT
EXISTING 66" CULVERT
Existing Basin
BASIN "B"


STREET
DEVELOPMENT
KOHI STREET
ALOALO PLACE
HUI ROAD C
TRUE NORTH
SCALE: 1 IN. = 120 FT.
Rainbow Ranch
Industrial Park Site
T.M.K.: 4-3-01 : 33
BASIN "A"
(Before Revisions)
Existing Basin
NAPILIHAU VILLAGES PROJECT
DETENTION BASIN A
DETENTION BASIN B
TRUE NORTH
SCALE: 1 IN. = 1000 FT.
LOCATION MAP
SCALE: 1 IN. = 1000 FT.
LEGEND:
WARREN S. UNEMORI ENGINEERING, INC.
OFFSITE DETENTION BASINS
FOR
NAPILIHAU VILLAGES PROJECT
GENERAL PLAN
EXHIBIT 4
92037

APPENDIX A

HYDROLOGIC CALCULATIONS

ONSITE DRAINAGE CALCULATION:

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street, Suite 403
Wailuku, Maui, Hawaii 96793

Date: August 17, 1993

SUBSURFACE DRAINAGE SYSTEM ANALYSIS AND DESIGN

Project: Napilihau Villages - Phases I, II, and III

Location: Alaeloa, Lahaina, Maui, Hawaii

Job Number: 92037

Objective: To determine the storage requirements for full attenuation of the anticipated increase in onsite surface runoff attributable to the project development. A recurrence interval of fifty (50) years is used.

I. Determine 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Lahaina, Maui,
R(50 Yr.-1Hr.) = 2.50 inches

II. Determine Pre-Development Runoff:

Pre-Development Component Areas:

Total Area (Ac.): 14.1

Pre-Development Runoff Coefficents:

Infiltration:	Medium	0.07
Relief:	Rolling (5-15%)	0.03
Vegetal Cover:	Poor (<10%)	0.05
Development Type:	Agricultural	0.15
	Composite Runoff Coeff't., C:	0.3

Pre-Development Time of Concentration:

Approx. Elev. Diff. (feet):		75
Higher Elev. (ft.):	105.0	
Lower Elev. (ft.):	30.0	
Approx. Runoff Length (ft.):		915
Average Slope:		8.2%

Ground Character:	Ave. grass
Time of Concentration (min.):	29.5

Pre-Development Intensity:

Intensity (in.): 3.6

Pre-Development Runoff:

Q (pre-dev.) = C x I x A (cfs):	15.23
Allowable Release Rate(cfs):	20.00

III. Determine Post-Development Runoff:

Post Development Component Areas:

Total Area (Ac.): 14.1

Post-Development Runoff Coefficents:

Infiltration:	Medium	0.07
Relief:	Rolling (5-15%)	0.03
Vegetal Cover:	Good	0.03
Development Type:	Industrial/Business	0.55
	Component Runoff Coeff't., C:	0.68

Post-Development Time of Concentration:

Approx. Elev. Diff. (feet):		50
Higher Elev. (ft.):	104.0	
Lower Elev. (ft.):	54.0	
Approx. Runoff Length (ft.):		930
Average Slope:		5.4%
Ground Character:		Bare soil
Time of Concentration (min.):		15

Post-Development Intensity:

Intensity (in.): 4.6

Post-Development Runoff:

Q (post-dev.) = C x I x A (cfs): 44.10

IV. Establish Initial Trench Cross Section Parameters:

Cover Over Pipe (ft.):	2.00
Pipe Diameter (ft.)	8.00
Cradle Depth Below Pipe (ft.):	1.00
Cradle Thickness on Sides of Pipe (ft.):	2.00
Total Trench Depth (ft.):	11.0
Total Trench Width (ft.):	12.0
Gross Trench Cross Sectional Area (sf/lf):	132.0
Pipe Cross Sectional Area (sf/lf):	50.3
Trench Aggreg. Cross Sectional Area (sf/lf):	81.7

V. Determine Exfiltration:

Determine Hydraulic Gradient:

Coefficient of Permeability Based on Values Contained in "Soil Survey of Islands of Kauai, Oahu, Maui, and Lanai, State of Hawaii" (dated August 1972).

Coefficient of Permeability (in/hr):	2.00
Coefficient of Permeability (in/sec):	0.00055
Coefficient of Permeability (ft/sec):	4.55E-05

Hydraulic Gradient, I = [(Total Depth of Trench)/2 + Dist. to Ground Water] / Dist. to Ground Water, where distance to groundwater is based on distance from bottom of trench section.

Approx. Dist. to Ground Water (ft.):	43.0
Hydraulic Gradient, I:	1.1

Assume Exfiltration Limited to Sides of Trench Only:

Assumed Initial Length of Pipe / Trench (ft.):	295.00
Unit Exfiltration Area (sf/lf):	22.00
Total Exfiltration Area (sf):	6,490.00
Total Rate of Exfiltration (cfs):	0.33
Factor of Safety:	2.0
Design Rate of Exfiltration (cfs):	0.17

VI. Determine Adequacy of Storage Volume Provided:

Determine Required Storage Volume:

Analytical procedures are based on methods prescribed in "Modern Sewer Design" (dated 1980, by the American Iron and Steel Institute).

Intensity values are obtained from the the Intensity-Duration Curves found page 122 of the "Drainage Master Plan for the County of Maui" (dated 1971, by R.M. Towill Corp.).

Time	I (in/hr)	Post-Dev.	Accum.	Allow.	Exfil'n.	Total	Storage	Comments
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
5	6.20	9.59	17,834	6,000	50	6,050	11,784	
10	5.20	9.59	29,915	12,000	100	12,100	17,815	
15	4.60	9.59	39,694	18,000	150	18,150	21,544	
20	4.15	9.59	47,748	24,000	200	24,200	23,548	
30	3.50	9.59	60,404	36,000	300	36,300	24,104	Peak Storage
40	3.15	9.59	72,485	48,000	400	48,400	24,085	
60	2.50	9.59	86,292	72,000	600	72,600	13,692	
80	2.20	9.59	101,249	96,000	800	96,800	4,449	
100	1.95	9.59	112,180	120,000	1,000	121,000	-8,820	

(COL 4) = (COL 1) x (COL 2) x (COL 3) x (60 sec./min.)
(COL 5) = Q(allowable) x (COL 1) x (60 sec./min.)
(COL 6) = (COL 1) x Q(exfil'n.) x (60 sec./min.)
(COL 7) = (COL 5) + (COL 6)
(COL 8) = (COL 4) - (COL 7)

Maximum Storage Required (cf):		24,104

Determine Provided Storage Volume:

Pipe Storage Capacity (cf):		14,828
Net Aggregate Cradle Storage Capacity (cf):		9,645
Gross Aggregate Cradle Volume (cf):	24,112	
Void Ratio (ie. percent voids):	0.40	
Total Storage Capacity Provided (cf):		24,473

{Storage Provided = 24,473 cf} > {Storage Required = 24,104 cf}; therefore initial assumptions based on 295 l.f. of 96 - inch diameter pipe are acceptable.

Warren S. Unemori Engineering, Inc.
Wells Street Professional Center
2145 Wells Street, Suite 403
Wailuku, Maui, Hawaii 96793

Date: August 17, 1993

SUBSURFACE DRAINAGE SYSTEM ANALYSIS AND DESIGN

Project: Napilihau Villages - Phase IV (Below Napili Plaza)

Location: Alaeloa, Lahaina, Maui, Hawaii

Job Number: 92037

Objective: To determine the storage requirements for full attenuation of the anticipated increase in onsite surface runoff attributable to the project development. A recurrence interval of fifty (50) years is used.

I. Determine 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Lahaina, Maui,
R(50 Yr.-1Hr.) = 2.50 inches

II. Determine Pre-Development Runoff:

Pre-Development Component Areas:

Total Area (Ac.): 3.1

Pre-Development Runoff Coefficents:

Infiltration:	Medium	0.07
Relief:	Rolling (5-15%)	0.03
Vegetal Cover:	Poor (<10%)	0.05
Development Type:	Agricultural	0.15
	Composite Runoff Coeff't., C:	0.3

Pre-Development Time of Concentration:

Approx. Elev. Diff'l. (feet): 29
Higher Elev. (ft.): 97.0
Lower Elev. (ft.): 68.0

Approx. Runoff Length (ft.): 410
Average Slope: 7.1%

Ground Character: Ave. grass
Time of Concentration (min.): 17

Pre-Development Intensity:

Intensity (in.): 4.4

Pre-Development Runoff:

Q (pre-dev.) = C x I x A (cfs): 4.09
Allowable Release Rate(cfs): 6.00

III. Determine Post-Development Runoff:

Post Development Component Areas:

Total Area (Ac.): 3.1

Post-Development Runoff Coefficents:

Infiltration:	Medium	0.07
Relief:	Rolling (5-15%)	0.03
Vegetal Cover:	Good	0.03
Development Type:	Industrial/Business	0.55
	Component Runoff Coeff't., C:	0.68

Post-Development Time of Concentration:

Approx. Elev. Diff'l. (feet): 15
Higher Elev. (ft.): 97.0
Lower Elev. (ft.): 82.0

Approx. Runoff Length (ft.): 380
Average Slope: 3.9%

Ground Character: Bare soil
Time of Concentration (min.): 14

Post-Development Intensity:

Intensity (in.): 4.8

Post-Development Runoff:

Q (post-dev.) = C x I x A (cfs): 10.12

IV. Establish Initial Trench Cross Section Parameters:

Cover Over Pipe (ft.):	2.00
Pipe Diameter (ft.)	6.00
Cradle Depth Below Pipe (ft.):	1.00
Cradle Thickness on Sides of Pipe (ft.):	2.00
Total Trench Depth (ft.):	9.0
Total Trench Width (ft.):	10.0
Gross Trench Cross Sectional Area (sf/lf):	90.0
Pipe Cross Sectional Area (sf/lf):	28.3
Trench Aggreg. Cross Sectional Area (sf/lf):	61.7

V. Determine Exfiltration:

Determine Hydraulic Gradient:

Coefficient of Permeability Based on Values Contained in "Soil Survey of Islands of Kauai, Oahu, Maui, and Lanai, State of Hawaii" (dated August 1972).

Coefficient of Permeability (in/hr):	2.00
Coefficient of Permeability (in/sec):	0.00055
Coefficient of Permeability (ft/sec):	4.55E-05

Hydraulic Gradient, I = [(Total Depth of Trench)/2 + Dist. to Ground Water] / Dist. to Ground Water, where distance to groundwater is based on distance from bottom of trench section.

Approx. Dist. to Ground Water (ft.):	59.0
Hydraulic Gradient, I:	1.1

Assume Exfiltration Limited to Sides of Trench Only:

Assumed Initial Length of Pipe / Trench (ft.):	70.00
Unit Exfiltration Area (sf/lf):	18.00
Total Exfiltration Area (sf):	1,260.00
Total Rate of Exfiltration (cfs):	0.06
Factor of Safety:	2.0
Design Rate of Exfiltration (cfs):	0.03

VI. Determine Adequacy of Storage Volume Provided:

Determine Required Storage Volume:

Analytical procedures are based on methods prescribed in "Modern Sewer Design" (dated 1980, by the American Iron and Steel Institute).

Intensity values are obtained from the the Intensity-Duration Curves found page 122 of the "Drainage Master Plan for the County of Maui" (dated 1971, by R.M. Towill Corp.).

Time	I (in/hr)	Post-Dev.	Accum.	Allow.	Exfil'n.	Total	Storage	Comments
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
5	6.20	2.11	3,921	1,800	9	1,809	2,112	
10	5.20	2.11	6,577	3,600	19	3,619	2,958	
15	4.60	2.11	8,727	5,400	28	5,428	3,299	Peak Storage
20	4.15	2.11	10,498	7,200	37	7,237	3,261	
30	3.50	2.11	13,280	10,800	56	10,856	2,425	
40	3.15	2.11	15,936	14,400	74	14,474	1,462	
60	2.50	2.11	18,972	21,600	111	21,711	-2,739	
80	2.20	2.11	22,260	28,800	148	28,948	-6,688	
100	1.95	2.11	24,664	36,000	185	36,185	-11,522	

(COL 4) = (COL 1) x (COL 2) x (COL 3) x (60 sec./min.)
(COL 5) = Q(allowable) x (COL 1) x (60 sec./min.)
(COL 6) = (COL 1) x Q(exfil'n.) x (60 sec./min.)
(COL 7) = (COL 5) + (COL 6)
(COL 8) = (COL 4) - (COL 7)

Maximum Storage Required (cf): 3,299

Determine Provided Storage Volume:

Pipe Storage Capacity (cf):		1,979
Net Aggregate Cradle Storage Capacity (cf):		1,728
Gross Aggregate Cradle Volume (cf):	4,321	
Void Ratio (ie, percent voids):	0.40	
Total Storage Capacity Provided (cf):		3,708

{Storage Provided = 3,708 cf} > {Storage Required = 3,299 cf}; therefore initial assumptions based on 70 l.f. of 72 - inch diameter pipe are acceptable.

NAPILIHAU VILLAGES PROJECT
SUMMARY OF FINDINGS TO DATE

August 18, 1993

1. **DRAINAGE BASIN "A" (Option 1 - Single Basin)**

Current Runoff (Single Basin 125 Acres)

Area above Honoapiilani Highway based on 100 year-1 hour rainfall and Rational Method		=	176 cfs
Napili Plaza (4.4 Acs. ±)	Allow	=	18 cfs
Napilihau Village IV	(C = 0.30)	=	4.0 cfs
			198.0 cfs
Capacity of Channel Section "A-A" in Alaeloa (see page 3)		=	(-) 71.5 cfs
Deficiency of Channel (196.6 - 71.5 cfs)		=	126.5 cfs

Post Development Runoff (Basins A1 + A2 = A)

Detention Basin A-1 (10.6 acre-ft.)	=	148 cfs
Release (18" pipe)	=	25 cfs
Drainage Basin A-2	=	41 cfs
Plus Release from A-1	=	25 cfs
Net Flow from Drainage Basin "A" (above Honoapiilani)	=	66 cfs
Napili Plaza	=	18 cfs
Napilihau Village IV - Post Development Runoff - (Maximum Release)	=	6.0 cfs
Total Post Development Runoff	=	90.0 cfs
Flow in excess of Channel Section "A-A" in Alaeloa (90.0 less 71.5 cfs)	=	18.5 cfs

OFFSITE DRAINAGE CALCULATIONS

2. DRAINAGE BASIN "B" (72 ACRES)

Current Offsite Runoff

Drainage Basin "B" above Honoapiilani Highway = 116 cfs

Napilihau Villages I, II, & III (C = 0.35) = 15 cfs
Total = 131.0 cfs ±

Capacity of existing 24" Culvert on Lower Honoapiilani Road:

Sump condition: $\frac{Hw}{D} = \frac{50-34}{2} = 8$ ft.

Capacity with inlet control (plat 19) = 70 - 75 cfs.

Post Development Runoff

Construct Detention Basin (6.4 ac. ft.) above Honoapiilani Highway

Depth of Water = 8.6 feet

Release thru 18" pipe line = 25 cfs ±

Post Development Runoff from Napilihau Villages I, II & III (C = 0.68) = 44 cfs

Total Runoff = 69 cfs ≈ 70 cfs

Additional Mitigative Measures within Napilihau Project Site:

Add 295 l.f. of 96-inch perforated pipes onsite to intercept project debris and provide additional onsite storage and reduce release to 15 to 20 cfs only. Say 20 cfs

Release from Detention Basin 25 cfs

Total = 45 cfs < 70 cfs ok

F.S. = 1.55

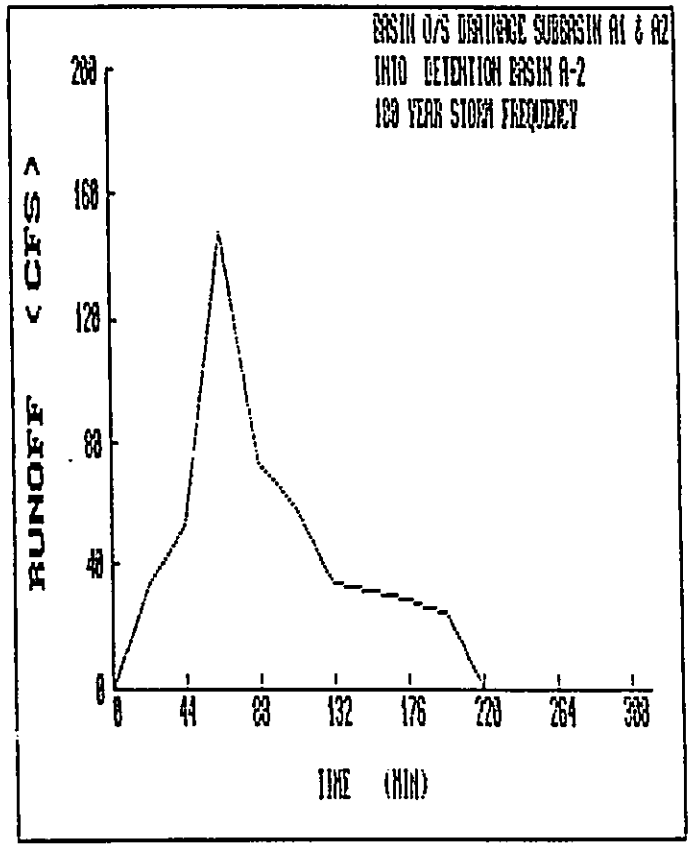
HYDROLOGIC REPORT FOR
NAPILIHAU VILLAGES
UNIVERSAL RATIONAL HYDROGRAPH

Q(PEAK) = C*I*A
100 YEAR STORM FREQUENCY

BASIN IDENTIFIER: O/S DRAINAGE SUBBASIN A1 & A2
DISCHARGES INTO: DETENTION BASIN A-2

BASIN AREA = 105.00 ACRES
RUNOFF COEFF. = 0.30
RAINFALL INT. = 4.70 IN/HR
TIME OF CONC. = 22.00 MINUTES
VOLUME = 634302.88 CUBIC FEET

TIME (MIN)	RUNOFF (C.F.S.)
0.0	0.0
11.0	16.5
22.0	32.9
33.0	43.1
44.0	53.3
55.0	100.6
66.0	147.9
77.0	110.6
88.0	73.2
99.0	65.6
110.0	58.0
121.0	45.7
132.0	33.5
143.0	32.0
154.0	30.6
165.0	29.1
176.0	27.6
187.0	25.5
198.0	23.5
209.0	11.7
220.0	0.0
231.0	0.0
242.0	0.0
253.0	0.0
264.0	0.0
275.0	0.0
286.0	0.0
297.0	0.0
308.0	0.0
319.0	0.0



W.S. UNEMORI ENGINEERING, INC.
Wailuku, Maui, Hawaii
JUNE 12, 1993

HYDROLOGIC REPORT FOR
NAPILIHAU VILLAGES
UNIVERSAL RATIONAL HYDROGRAPH

Q(PEAK) = C*I*A
100 YEAR STORM FREQUENCY

BASIN IDENTIFIER   OFFSITE DRAINAGE BASIN B
DISCHARGES INTO   H'PIILANI HWY CULVERT

BASIN AREA	=	72.00	ACRES
RUNOFF COEFF.	=	0.32	
RAINFALL INT.	=	4.86	IN/HR
TIME OF CONC.	=	20.00	MINUTES
VOLUME	=	440432.66	CUBIC FEET

TIME (MIN)	RUNOFF (C.F.S.)
0.0	0.0
10.0	14.1
20.0	28.2
30.0	35.1
40.0	41.9
50.0	77.0
60.0	112.0
70.0	84.1
80.0	56.2
90.0	49.9
100.0	43.6
110.0	37.0
120.0	30.4
130.0	26.2
140.0	21.9
150.0	19.5
160.0	17.2
170.0	16.4
180.0	15.6
190.0	7.8
200.0	0.0
210.0	0.0
220.0	0.0
230.0	0.0
240.0	0.0
250.0	0.0
260.0	0.0
270.0	0.0
280.0	0.0
290.0	0.0

POND-2 Version: 5.12 S/N: 1220515051

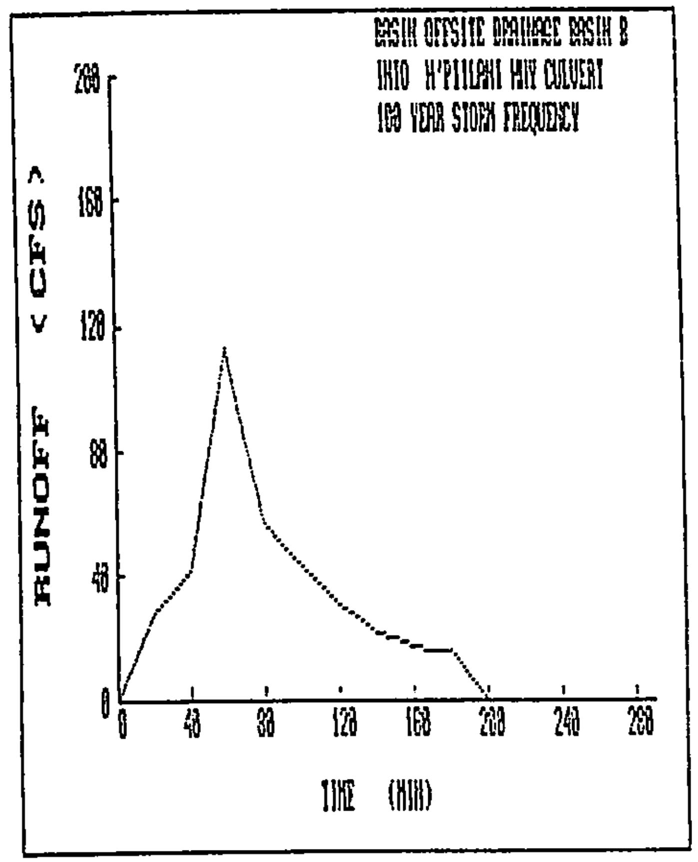
>>>>> OUTFLOW HYDROGRAPH ESTIMATOR <<<<<

Inflow Hydrograph: NVDBA1A2.HYD
Qpeak = 147.9 cfs

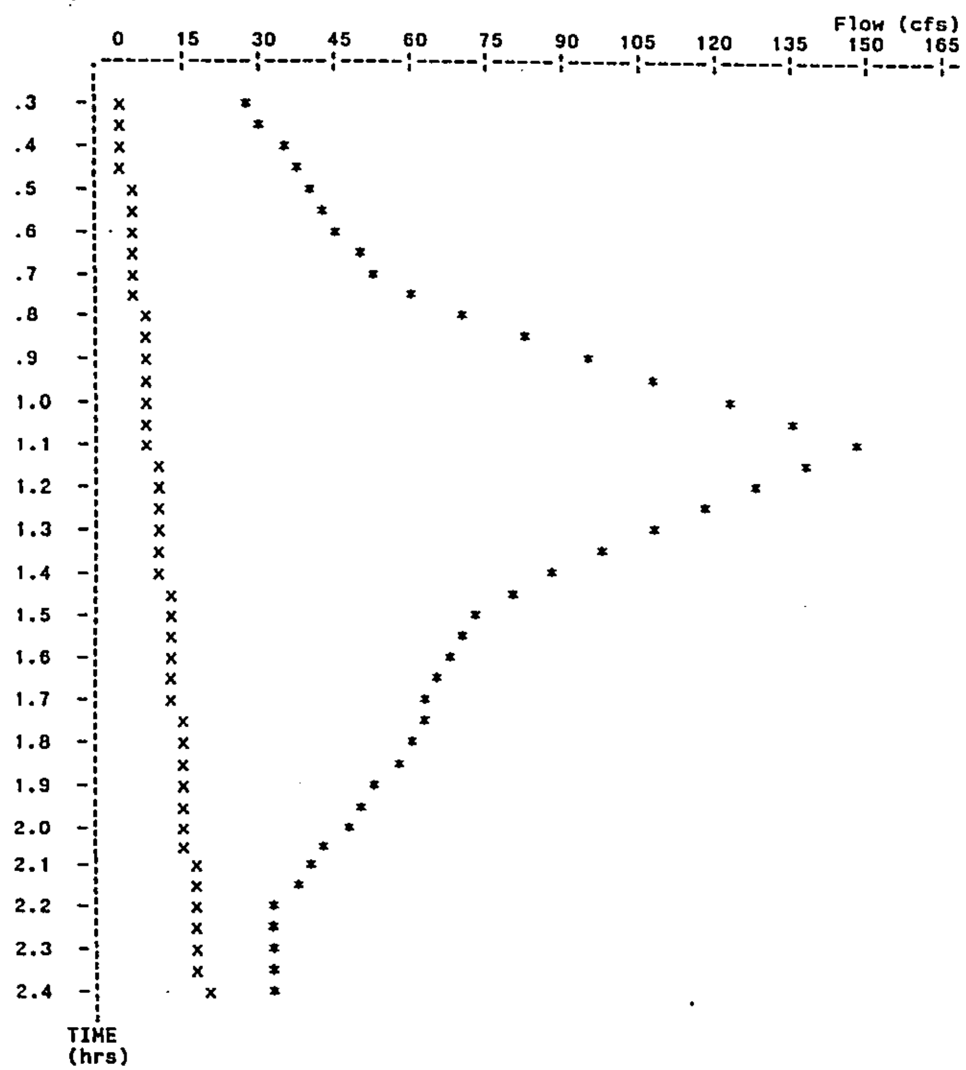
Estimated Outflow: ESTIMATE.EST
Qpeak = 25.0 cfs

Approximate Storage Volume
(computed from t= 0.00 to 3.16 hrs)

10.6 acre-ft



POND-2 Version: 5.12 S/N: 1220515051
Plotted: 08-16-1993



* File: NVDBA1A2.HYD Qmax = 147.9 cfs
x File: ESTIMATE.EST Qmax = 25.0 cfs

POND-2 Version: 5.12
S/N: 1220515051

HYDROGRAPH FILE
NVDBA1A2.HYD

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
0.000	0.00	2.700	29.50
0.100	9.20	2.800	28.70
0.200	18.20	2.900	27.90
0.300	26.90	3.000	26.80
0.400	34.60	3.100	25.70
0.500	40.30	3.200	24.60
0.600	45.90	3.300	23.50
0.700	51.60	3.400	16.90
0.800	70.70	3.500	10.50
0.900	95.60	3.600	4.30
1.000	121.60	3.700	0.00
1.100	147.90	3.800	0.00
1.200	127.20	3.900	0.00
1.300	106.70	4.000	0.00
1.400	87.00	4.100	0.00
1.500	71.90	4.200	0.00
1.600	67.70	4.300	0.00
1.700	63.50	4.400	0.00
1.800	59.30	4.500	0.00
1.900	53.50	4.600	0.00
2.000	47.00	4.700	0.00
2.100	40.30	4.800	0.00
2.200	33.50	4.900	0.00
2.300	32.70	5.000	0.00
2.400	31.90	5.100	0.00
2.500	31.10	5.200	0.00
2.600	30.40	5.300	0.00

HYDROGRAPH FILE
ESTIMATE.EST

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
0.000	0.00	2.600	20.55
0.100	0.79	2.700	21.34
0.200	1.58	2.800	22.13
0.300	2.37	2.900	22.92
0.400	3.16	3.000	23.71
0.500	3.95	3.100	24.50
0.600	4.74	3.200	---
0.700	5.53	3.300	---
0.800	6.32	3.400	---
0.900	7.11	3.500	---
1.000	7.90	3.600	---
1.100	8.69	3.700	---
1.200	9.48	3.800	---
1.300	10.27	3.900	---
1.400	11.06	4.000	---
1.500	11.85	4.100	---
1.600	12.64	4.200	---
1.700	13.43	4.300	---
1.800	14.22	4.400	---
1.900	15.01	4.500	---
2.000	15.80	4.600	---
2.100	16.59	4.700	---
2.200	17.39	4.800	---
2.300	18.18	4.900	---
2.400	18.97	5.000	---
2.500	19.76		

Last ordinate = 25.00 cfs at t = 3.16 hrs

>>>>> OUTFLOW HYDROGRAPH ESTIMATOR <<<<<

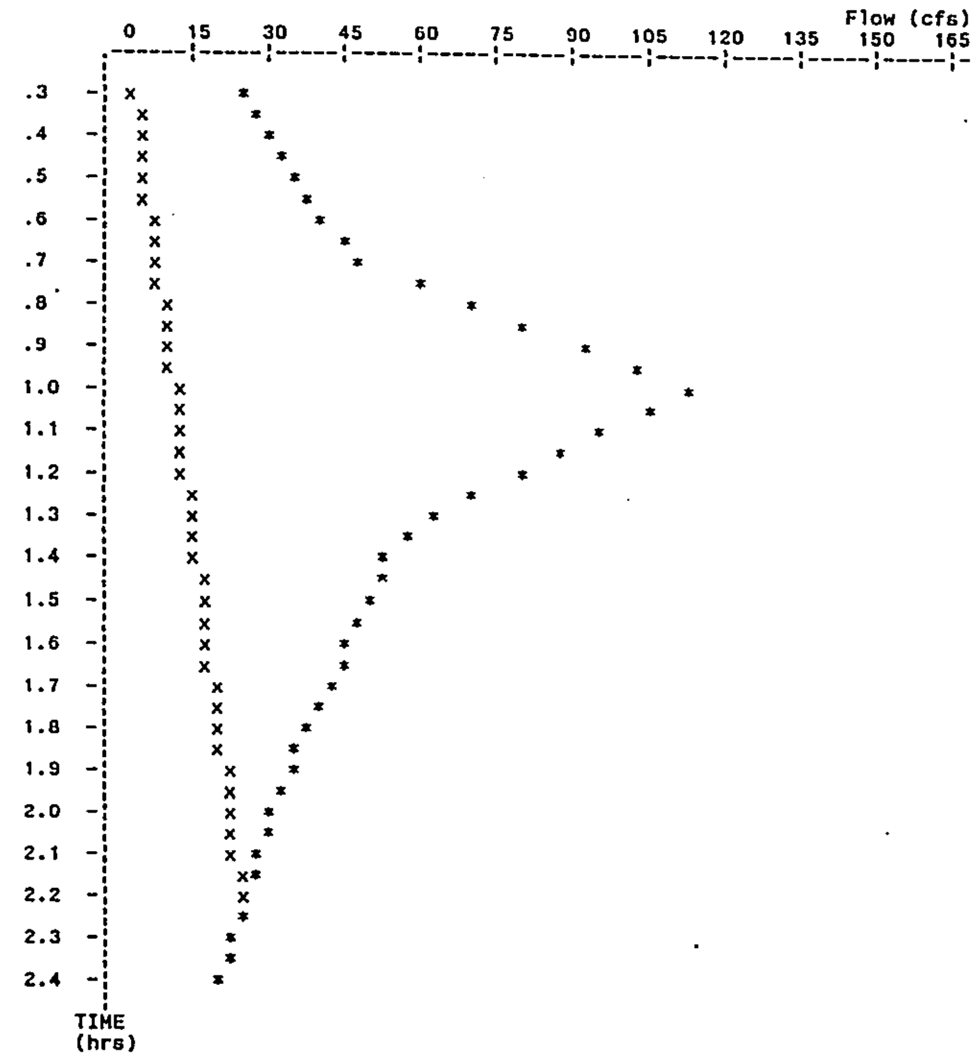
Inflow Hydrograph: NVDBB .HYD
Qpeak = 112.0 cfs

Estimated Outflow: ESTIMATE.EST
Qpeak = 25.0 cfs

Approximate Storage Volume
(computed from t= 0.00 to 2.21 hrs)

6.4 acre-ft

POND-2 Version: 5.12 S/N: 1220515051
Plotted: 06-15-1993



* File: NVDBB .HYD Qmax = 112.0 cfs
x File: ESTIMATE.EST Qmax = 25.0 cfs

POND-2 Version: 5.12
S/N: 1220515051

HYDROGRAPH FILE
NVDBB .HYD

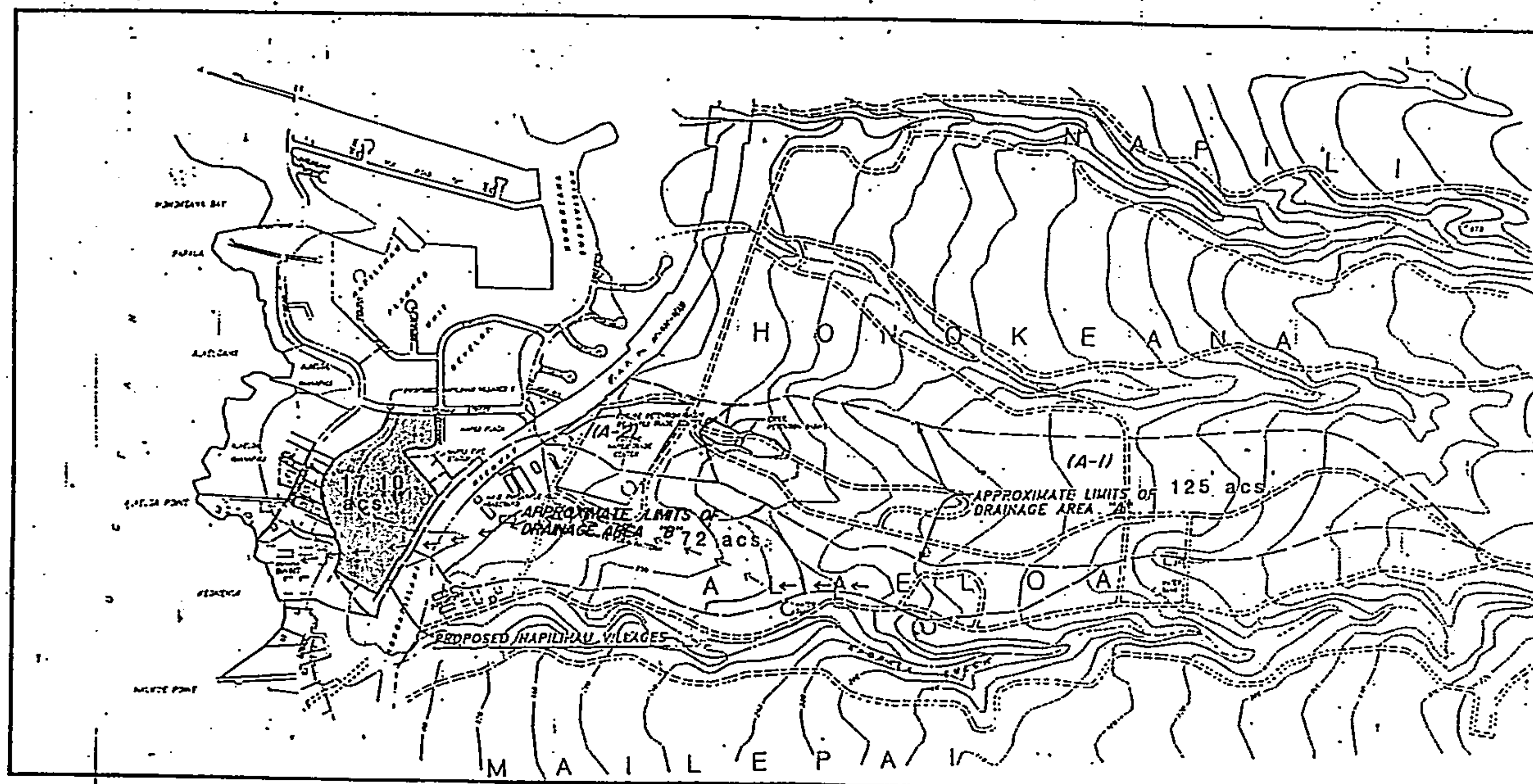
Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
0.000	0.00	2.300	22.70
0.100	8.30	2.400	20.90
0.200	16.70	2.500	19.50
0.300	25.60	2.600	18.10
0.400	31.00	2.700	17.10
0.500	35.10	2.800	16.60
0.600	39.10	2.900	16.10
0.700	48.50	3.000	15.60
0.800	70.40	3.100	11.00
0.900	91.40	3.200	6.30
1.000	112.00	3.300	1.50
1.100	95.60	3.400	0.00
1.200	78.90	3.500	0.00
1.300	61.40	3.600	0.00
1.400	53.60	3.700	0.00
1.500	49.90	3.800	0.00
1.600	46.20	3.900	0.00
1.700	42.40	4.000	0.00
1.800	38.20	4.100	0.00
1.900	34.30	4.200	0.00
2.000	30.40	4.300	0.00
2.100	27.90	4.400	0.00
2.200	25.40	4.500	0.00

POND-2 Version: 5.12
S/N: 1220515051

HYDROGRAPH FILE
ESTIMATE.EST

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
0.000	0.00	2.200	24.83
0.100	1.13	2.300	---
0.200	2.26	2.400	---
0.300	3.39	2.500	---
0.400	4.52	2.600	---
0.500	5.64	2.700	---
0.600	6.77	2.800	---
0.700	7.90	2.900	---
0.800	9.03	3.000	---
0.900	10.16	3.100	---
1.000	11.29	3.200	---
1.100	12.42	3.300	---
1.200	13.55	3.400	---
1.300	14.67	3.500	---
1.400	15.80	3.600	---
1.500	16.93	3.700	---
1.600	18.06	3.800	---
1.700	19.19	3.900	---
1.800	20.32	4.000	---
1.900	21.45	4.100	---
2.000	22.58	4.200	---
2.100	23.70		

Last ordinate = 25.00 cfs at t = 2.21 hrs



Drainage Area Map
Scale: Not To Scale

W.S. UNEMORI ENGINEERING, INC.
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Wailuku, Maui, Hawaii 96793

BY: DON H. IAEA JR.
DATE: February 2, 1993

HYDROLOGIC STUDY FOR NAPILI PLAZA SHOPPING CENTER

ALAELOA, LAHAINA, MAUI, HAWAII

BUSINESS AND COMMERCIAL USE

RECURRENCE INTERVAL:	50 years	HYDRAULIC LENGTH:	305.0 ft.
ONE-HOUR RAINFALL:	2.50 inches	ELEV'N. DIFFERENTIAL:	12.00 ft.
		HYDRAULIC SLOPE:	0.039 ft./ft.
WEIGHTED RUNOFF			
COEFFICIENT, C:	0.67	TIME OF CONCENTRATION:	5.8 min.
INTENSITY, I:	6.20 inches		
AREA, A:	4.40 acres	SUB BASINS CONSIDERED:	1

Q = C*I*A = 18.28 cfs

COMMENTS:

RUNOFF CALCULATIONS FOR NAPILI SHOPPING PLAZA

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Wailuku, Maui, Hawaii   96793

BY: DON H. IAEA JR.
DATE: February 2, 1993

NAPILI PLAZA SHOPPING CENTER
(continued)

TABULATION OF RUNOFF COEFFICIENTS & AREAS:

SUB-BASIN 1 OF 1 : BUSINESS AND COMMERCIAL USE

INFILTRATION:	Medium	0.07	
RELIEF:	Flat (0-5%)	0.00	COMPOSITE C = 0.670
VEGETAL COVER:	Poor (<10%)	0.05	AREA = 4.400 acres
DEVELOPMENT:	Industrial / Business	0.55	

APPENDIX B

UNIVERSAL SOIL LOSS EQUATION CALCULATIONS

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street Suite 403
Wailuku, Maui, Hawaii 96793

BY: DON H. IAEA JR.
DATE: February 2, 1993

H.E.S.L. FOR NAPILIHAU VILLAGES

1. HESL EQUATION: E = R*K*LS*C*P

WHERE:
- E = Soil Loss (tons/acre/year)
- R = Average Annual Rainfall Factor for Erosion
- K = Soil Erodibility Factor
- L = Horizontal Slope Length (feet)
- S = Average Slope (%)
- LS = Slope Factor (function of L and S)
- C = Cover and Management Factor
- P = Erosion Control Practice Factor

R = 200.0 tons/acre/year
(Soil Erosion & Sediment Control Guide for Hawaii; Appendix A: Average Annual Values of Rainfall Factor)

K = 0.17 Soil Series. KAHANA
(Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii; Soil Type Plates & Table 4; Soil Properties Related to Erosion & Sedimentation ....)

L = 740.0 feet.
δ = 75.0 feet
(Soil Erosion & Sediment Control Guide for Hawaii, Table 16)

S = (δ/L)
= 10.1 %

LS= 3.801

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street Suite 403
Wailuku, Maui, Hawaii 96793

BY: DON H. IAEA JR.
DATE: February 2, 1993

NAPILIHAU VILLAGES
(Continued)

C = 1.00
(Soil Erosion & Sediment Control Guide for Hawaii Tables 17-22, Pages 59-61; C=1.00 for Bare Soil)

P = 1.00
(Soil Erosion & Sediment Control Guide for Hawaii; the Universal Soil Loss Equation in Hawaii)'

E = R*K*LS*C*P
= 129.2 tons/acre/year

2. SEVERITY RATING NUMBER EQUATION: H=[(2*F*T)+(3*D)]*A*E

WHERE:
- H = Severity rating number
- T = Duration of land-disturbing activity (years)
- A = Area subject to disturbance (acres)
- E = Rate of soil loss under disturbed conditions (tons/acre/year)
- F = Downslope-downstream rating factor (rating points/ton)
- D = Coastal water rating factor (rating points/ton)

T = 1.00 years

A = 17.10 acres

E = R*K*LS*C*P
= 129.2 tons/acre/year

F = 4 (Downslope-downstream detriment: Major)

D = 2 (Coastal water rating factor: Class A)

H = [(2*F*T)+(3*D)]*A*E
= 30,939.5

Standard severity rating (allowable): 50,000 ≥ 30,939.5 =>OK

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street Suite 403
Wailuku, Maui, Hawaii 96793

BY: DON H. IAEA JR.
DATE: February 2, 1993

NAPILIHAU VILLAGES
(Continued)

3. MAXIMUM ALLOWABLE SOIL LOSS: E max = H max/(2FT+3D)A

E max = H max/(2FT+3D)A, Hmax = 50,000
= 208.9 tons/acre/year ≥ 129.2 tons/acre/year ∴ OK

Coastal Hazard: Class A waters are approximately 900 feet from the site.

CONCLUSION: Sedimentation hazard to coastal waters and downstream properties is minimal. Erosion rate computed for this project site is within the tolerable limits and additional control measures are not required.

4. REFERENCES:

1. Soil Conservation Service (USDA), 'Guidelines for Use of the Universal Soil Loss Equation in Hawaii.' Technical Notes, March 1975. (Revised Draft)

2. County of Maui; (Ord No. 816), 'Chapter 24, Soil Erosion and Sedimentation Control,' June 13, 1975.

3. Soil Conservation Service (USDA); 'Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, August 1972.

4. Hawaii Environmental Simulation Laboratory; 'Guidelines for Data Preparation, Part 1: Universal Soil Loss Equation; Undated (Draft).

Appendix C

Final Drainage Report Phase I

DRAINAGE AND SOIL EROSION CONTROL REPORT

FOR

NAPILIHAU VILLAGES - PHASE I
SITE IMPROVEMENTS

Alaeloa, Lahaina, Maui, Hawaii

TMK: 4-3-03:110

DEVELOPER: JGL Enterprises, Inc.
ADDRESS: Honolulu, Hawaii

REED M. ARIYOSHI LICENSED PROFESSIONAL ENGINEER No.5465-C HAWAII U.S.A.

Reed M. Ariyoshi

Prepared By:

Warren S. Unemori Engineering, Inc.
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June, 1994
Revised: March, 1995
Revised: July, 1995
Revised: September, 1995
Revised: December, 1995

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TABLE OF CONTENTS

Drainage and Soil Erosion Control Report
for
Napilihau Villages - Phase I
Site Improvements

I. INTRODUCTION

This report has been prepared to evaluate existing onsite and offsite drainage conditions. It also provides a brief description of the proposed post-development drainage plan for subject development.

Calculations to determine the potential movement of soil due to rainfall and surface runoff off the project area in accordance with Chapter 20.08 of the Maui County Codes are also presented.

Additional related discussions may be found in the Drainage and Soil Erosion Report for Napilihau Villages, dated August 1993.

II. PROPOSED PROJECT

A. Site Location:

The project site is located in Lahaina, on the island of Maui, and in the State of Hawaii. It is situated immediately mauka (east) of Lower Honoapiilani Road and makai (west) of Honoapiilani Highway, and is approximately 600 feet southwest of the Lower Honoapiilani Road and Napilihau Street intersection (see Exhibit 1).

The project site encompasses an area of approximately 4 acres, while offsite improvements will encompass an additional area of approximately 6.4 acres.

B. Project Description:

The proposed plan for the Napilihau Villages - Phase I, Site Improvements project is a multi-family development which will include asphalt paved driveways and parking areas, concrete sidewalks, concrete curb and gutters, and landscaping. Underground utility systems for drainage, water, and sewerage systems, and electrical, telephone, and cable television distribution systems will also be installed.

II. EXISTING CONDITIONS:

A. Topography and Soil Conditions:

Presently, the project site consists of open land, portion of which is temporarily being used as a detention basin. Natural vegetation includes but is not limited to guava, klu, koa haole, lantana, natal redtop, and yellow foxtail.

The existing ground on the eastern half of the subject property slopes in a southerly to northerly direction from an elevation of (+) 92± feet M.S.L. to (+) 62± feet M.S.L. with an average slope of 10.3% to a low point at the northern corner. The existing ground on the western half of the property slopes in a southerly to northerly direction from an elevation of (+) 86± feet M.S.L. to (+) 70± feet M.S.L. with an average slope of 7.3%

According to the "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii (August, 1972)" [1], prepared by the United States Department of Agriculture, Soil Conservation Service, the soil is classified as Kahana Series, silty clay (KbC, 7 to 15 percent slopes and KbB, 3 to 7 percent slopes) (see Exhibit 2). This soil is characterized as having a moderately rapid permeability, slow to medium runoff and a slight to moderate erosion hazard.

B. Flood and Tsunami Zone:

According to Panel Number 150003 0138B of the Flood Insurance Rate Map [2]: (1) the entire site is situated within Zone C which is designated as areas prone to minimal flooding (see Exhibit 3); and, (2) the project site is not within tsunami inundation boundaries identified thereon.

C. Drainage:

1. Existing Conditions:

The drainage area mauka and east of the Napilihau Road/Honoapiilani Highway intersection, herein collectively referred to as Drainage Basin "A" is subdivided into Drainage Basins A-1 and A-2 (see Exhibit 4, Offsite Drainage Area Map). Runoff from the upper 98 acres of Drainage Basin "A", herein referred to as Area A-1, is currently directed into two existing detention basins (A-1-a, A-1-b). The runoff from the remainder of Drainage Basin "A", herein referred to as Area A-2, is combined with the release from the existing detention basins (A-1-a, A-1-b) and conveyed across the Napilihau Road/Honoapiilani Highway intersection by three 65"x40" CMP culverts. It is then routed across the Napili Shopping Plaza parking lot through a drainline into a temporary detention basin at the northeasterly corner of the proposed Napilihau Village project site. Overflow from this basin drains into the adjacent vacant lot, then across Lower Honoapiilani

Road through a 24-inch culvert towards a concrete lined channel that runs through the existing Alaeloa Residential Condominium project site and subsequently into Alaeloaiki Bay.

Based on the Universal Rational Method, the current 100-year runoff from Area A-1 into the two existing offsite detention basins (A-1-a, A-1-b) is approximately 143 cfs. Detention basins A-1-a and A-1-b reduce the existing flow by a total of approximately 23 cfs, leaving a net runoff of 120 cfs. The runoff from Area A-2, the Napili Shopping Plaza parking lot, and the existing onsite area have a combined total of approximately 60 cfs. This runoff is combined with the 120 cfs release from detention basins A-1-a and A-1-b for a total runoff into the temporary onsite detention basin of approximately 180 cfs. The temporary onsite detention basin reduces the flow by approximately 28 cfs, leaving a net runoff of 152 cfs. The adjacent vacant lot and Napilihau Street contribute additional flows of 3 cfs and 4 cfs, respectively, for a total of 159 cfs. The maximum capacity of the existing concrete lined channel through Alaeloa Condominium site is estimated to be 71 cfs.

IV. PROPOSED DRAINAGE PLAN

A. Offsite Drainage:

The runoff from Area A-1 will continue to drain into detention basin A-1-b which will remain unchanged. The second existing detention basin (A-1-a) will be enlarged and improved to reduce the existing peak offsite runoff volume. After detention basin A-1-a is improved, the two detention basins (A-1-a, A-1-b) will combine to store a volume of approximately 11.3 acre-feet of runoff. The peak surface runoff released from the detention basins will be reduced from 120 cfs to 13 cfs. Runoff from Area A-2, which is expected to total approximately 47 cfs, combined with the 13 cfs of controlled release from detention basins A-1-a and A-1-b, will then be conveyed across Honoapiilani Highway and through the Napili Shopping Plaza. This flow, together with the approximately 18 cfs of surface runoff generated from Napili Shopping Plaza, will be directed into a new drainline which will be installed on Napilihau Street and Lower Honoapiilani Road. A new 4.5'x6' concrete box culvert will be installed to replace a portion of an existing 24" CMP drainline to reduce the discharge velocity at the outlet into the existing Alaeloa Residential Condominium concrete channel.

B. Onsite Drainage:

Onsite post development runoff from the Napilihau Villages Phase I project site below Napili Plaza will be collected and directed into a subsurface detention system comprised of approximately 100 feet of 72-inch diameter perforated corrugated aluminum pipe. A 10-inch release line will connect this subsurface system to an existing 12" concrete drainline. This 72-inch subsurface system will be sized to store the expected onsite post development runoff from the Napilihau Villages Phase I project site below Napili Plaza and release it slowly through the 10-inch release line. Approximately 4 cfs of surface runoff will be discharged through the 10-inch release line. It will also serve as a debris catchment and desilting facility for onsite runoff. Total post development runoff from Drainage Basin "A", Napili Shopping Plaza, the

adjoining vacant lot, Napilihau Street, and Napilihau Villages Phase I will be reduced to 89 cfs or approximately 70 cfs less than the current runoff into Alaeloaiki Bay from these areas.

A temporary detention basin will be installed within Phase II of the project site to store the portion of the onsite surface runoff that will not be conveyed to the aforementioned subsurface detention system

V. SOIL EROSION CONTROL PLAN

A. Grading Plan:

Based on the Hawaii Environmental Simulation Laboratory (HESL) equations to estimate soil loss during the construction period, and complemented by the following erosion control plan, the soil loss during the construction period is well within the tolerable limits.

B. Soil Erosion Control Plan:

The following measures will be taken to control erosion during the site development period (estimated 12 months).

1. Minimize time of construction.
2. Retain existing ground cover until latest date to complete construction.
3. Early construction of drainage control features.
4. Use temporary area sprinklers in non-active construction area when ground cover is removed.

5. Station water truck on site during construction period to provide for immediate sprinkling, as needed, in active construction zones (weekends and holidays included).

6. Use temporary silt screen fencing, berms and cut-off ditches, where needed, for control of erosion.

7. Graded areas shall be thoroughly watered after construction activity has ceased for the day and on weekends.

8. All cut and fill slopes shall be sodded or planted immediately after grading work has been completed.

VI. CONCLUSION

According to the analyses contained herein, peak post development runoff into Alaeloaiki Bay is expected to be reduced substantially (see Appendix A). The peak surface runoff discharging into Alaeloaiki Bay will be reduced by approximately 44% from the current flow of 159 cfs to 89 cfs. Drainage improvements will also reduce the discharge velocity at the drainage outlet into the existing Alaeloa Residential Condominium concrete channel.

In addition, with the construction of the detention basin above Honoapiilani Highway, the subsurface detention facility onsite, and the interim retention basin, conveyance of waterborne debris and silt into Alaeloaiki Bay is expected to decrease.

According to our calculation based on HESL guidelines the potential for soil loss during construction is anticipated to be minimal and well within the tolerable limits (see Appendix B).

Based on the foregoing it is our professional opinion that the Napilihau Villages project is expected to improve, and not aggravate conditions of the downstream properties.

VII. REFERENCES

1. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* August 1972. United States Department of Agriculture, Soil Conservation Service.

2. *Flood Insurance Rate Map, Maui County, Hawaii.* Community-Panel Number 150003 0138B. September 6, 1989. Federal Emergency Management Agency, Federal Insurance Administration.

3. *Drainage Master Plan for the County of Maui, State of Hawaii.* October 1971. R.M. Towill Corporation.

4. *Rainfall Frequency Atlas of the Hawaiian Islands, Technical Paper No. 43.* 1962. U.S. Department of Commerce, Weather Bureau.

5. *Storm Drainage Standards.* March 1986. Department of Public Works, City and County of Honolulu.

Report Prepared By:

Lance S. Nakamura

Report Checked By:

Reed M. Ariyoshi

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EXHIBITS

1. Location Map
2. Soil Survey Map
3. Flood Insurance Rate Map
4. Offsite Drainage Area Map
5. Grading Plan
6. Drainage Area Map

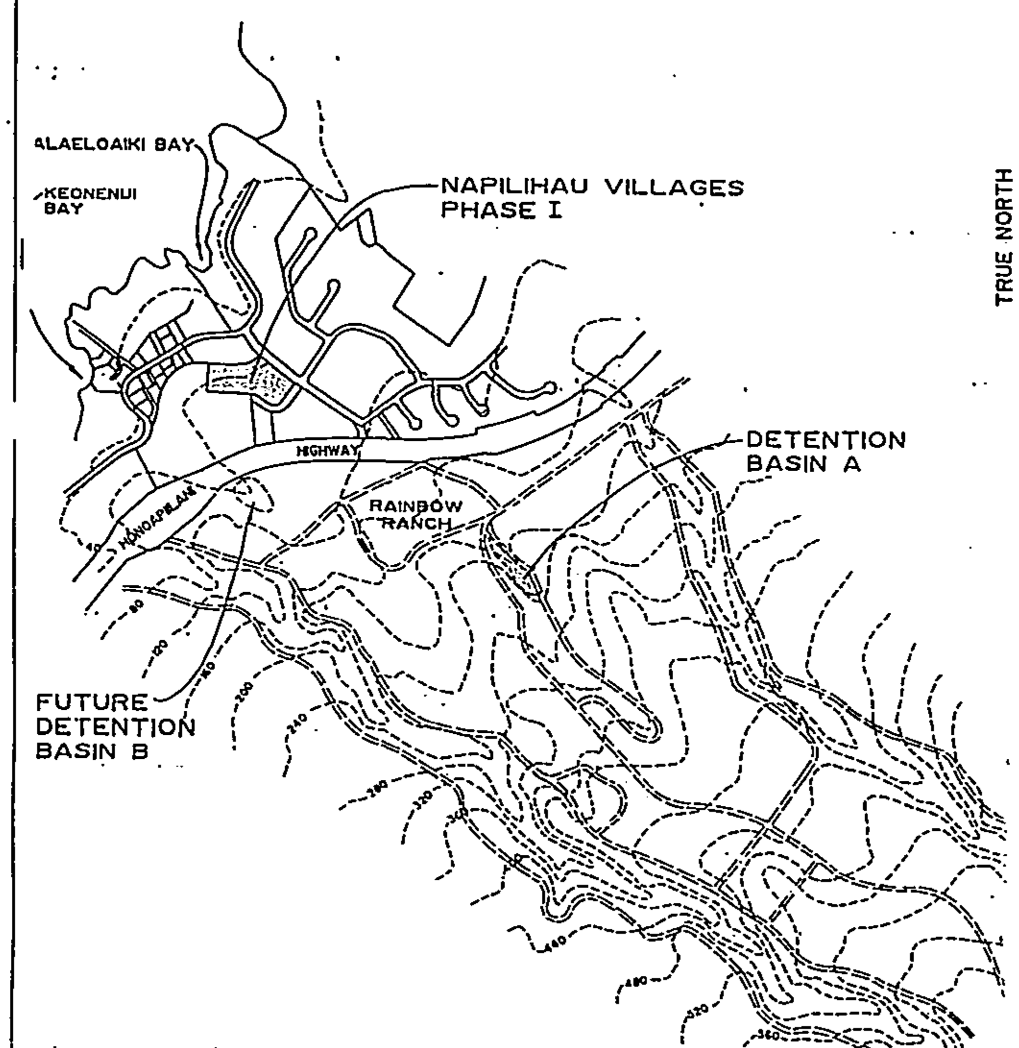


EXHIBIT 1
LOCATION MAP
SCALE: 1 IN. = 1000 FT.

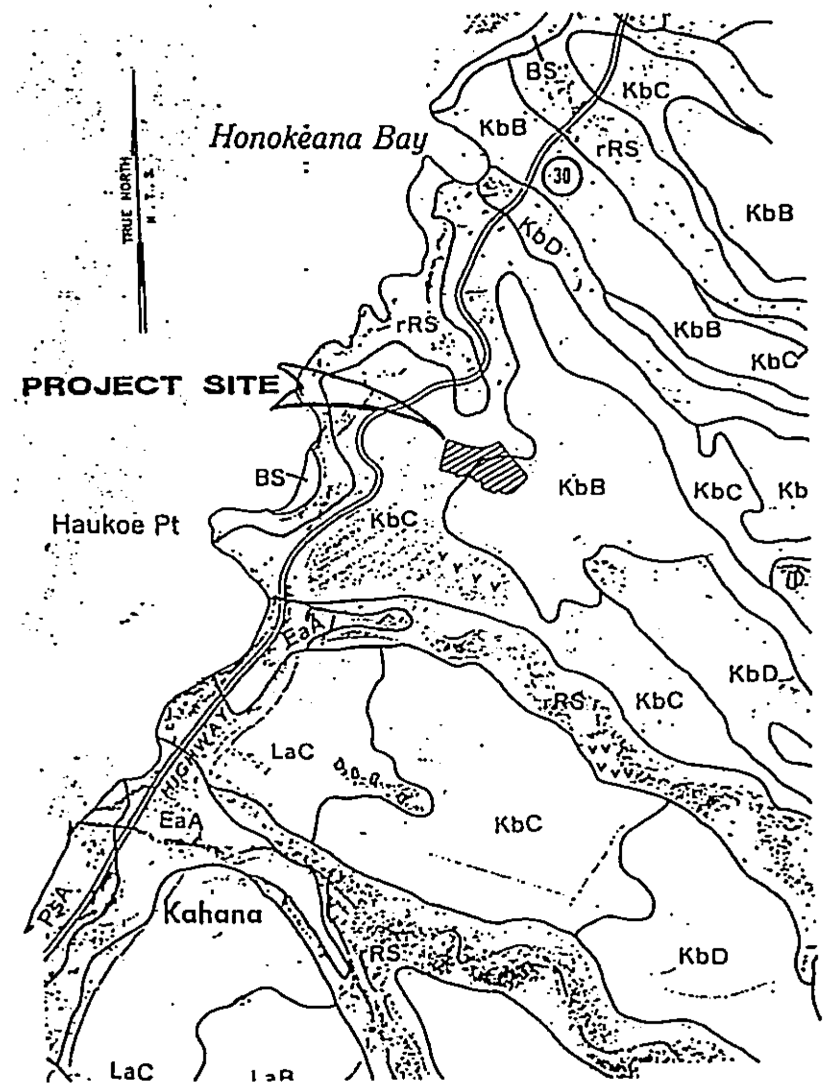


EXHIBIT 2
SOIL SURVEY MAP

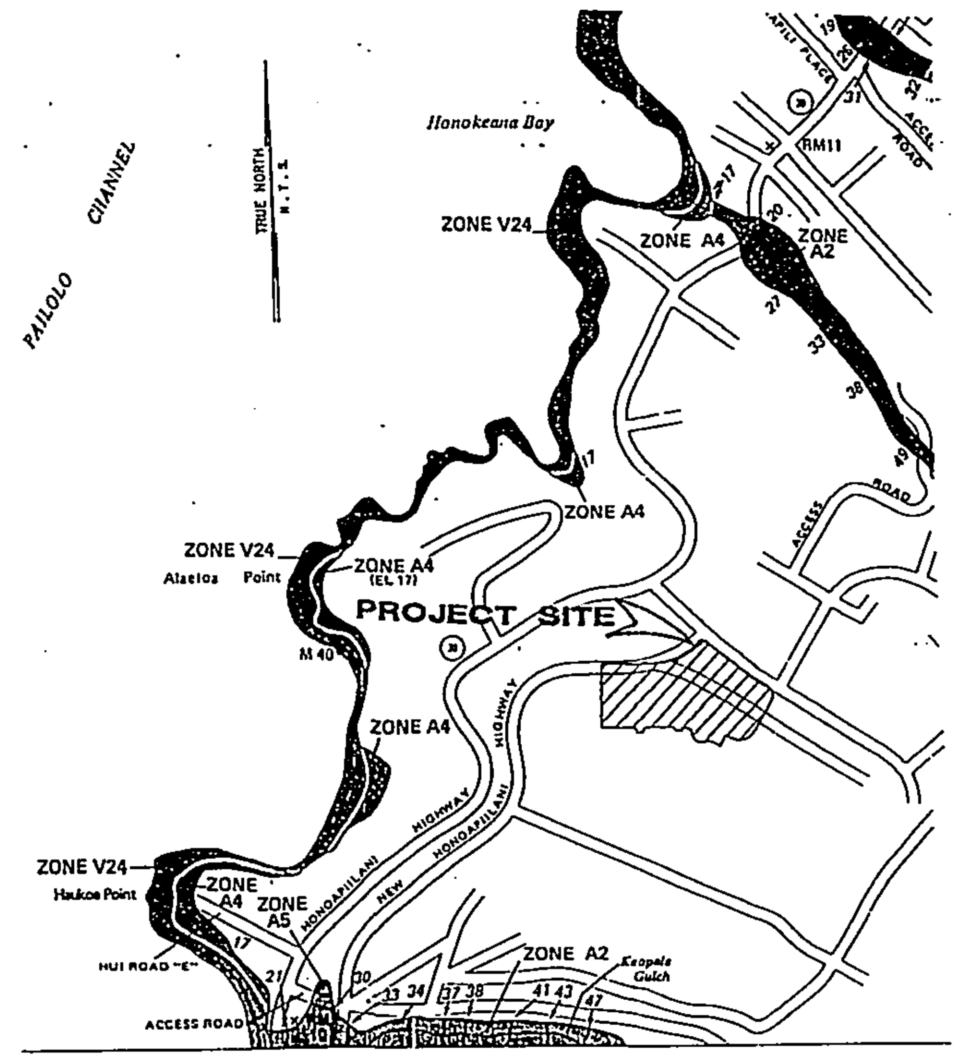


EXHIBIT 3
FLOOD INSURANCE
RATE MAP

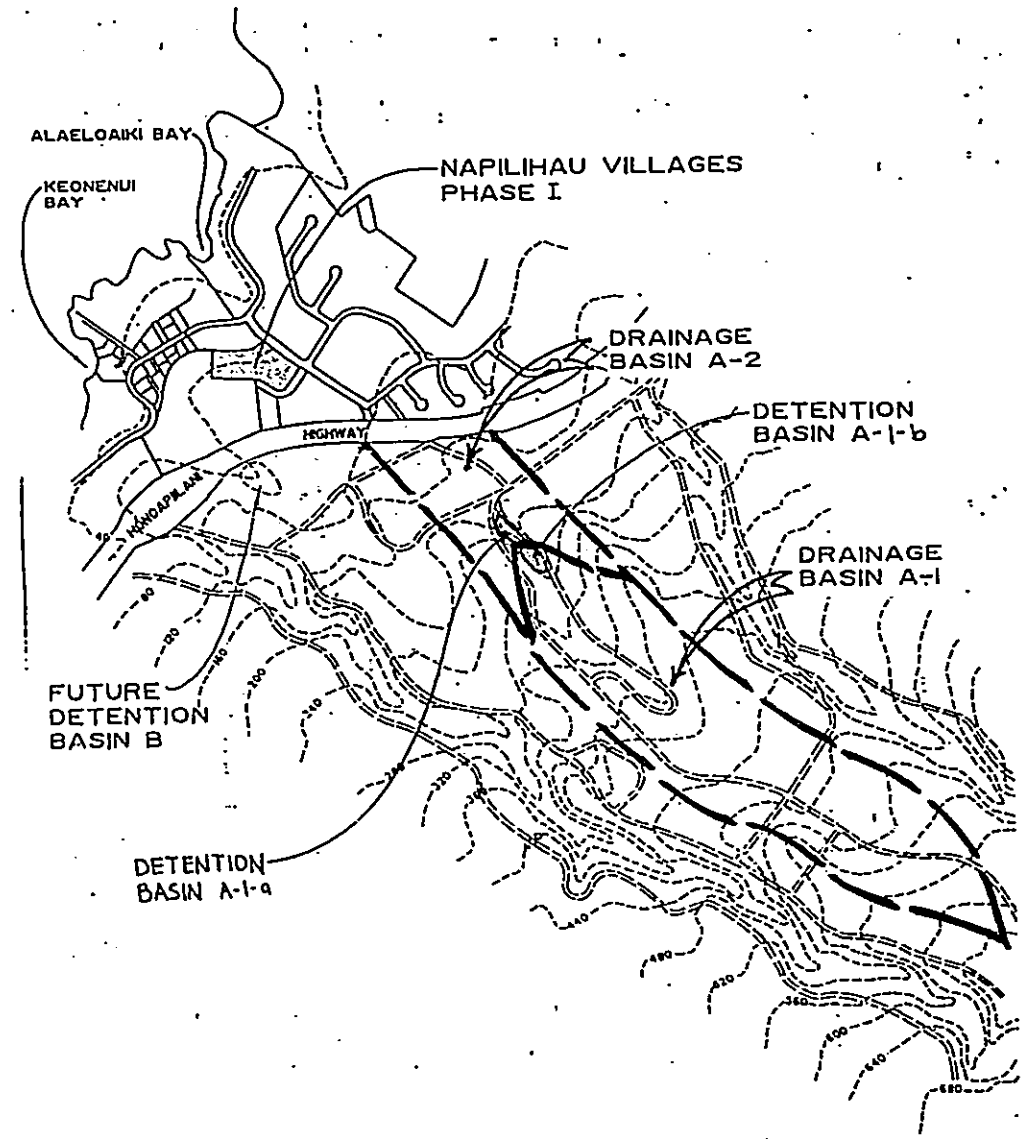


EXHIBIT 4
OFFSITE DRAINAGE AREA MAP

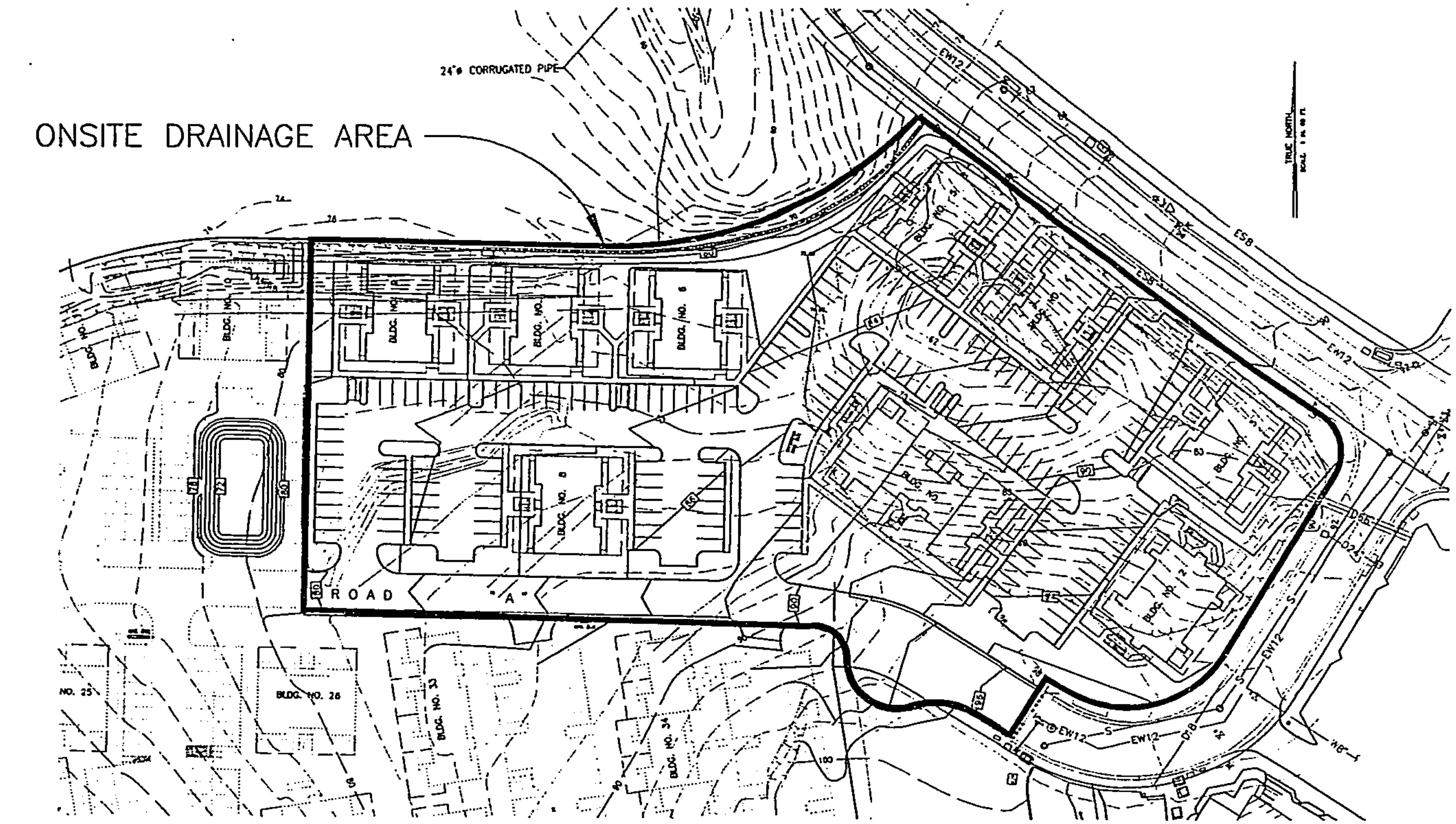
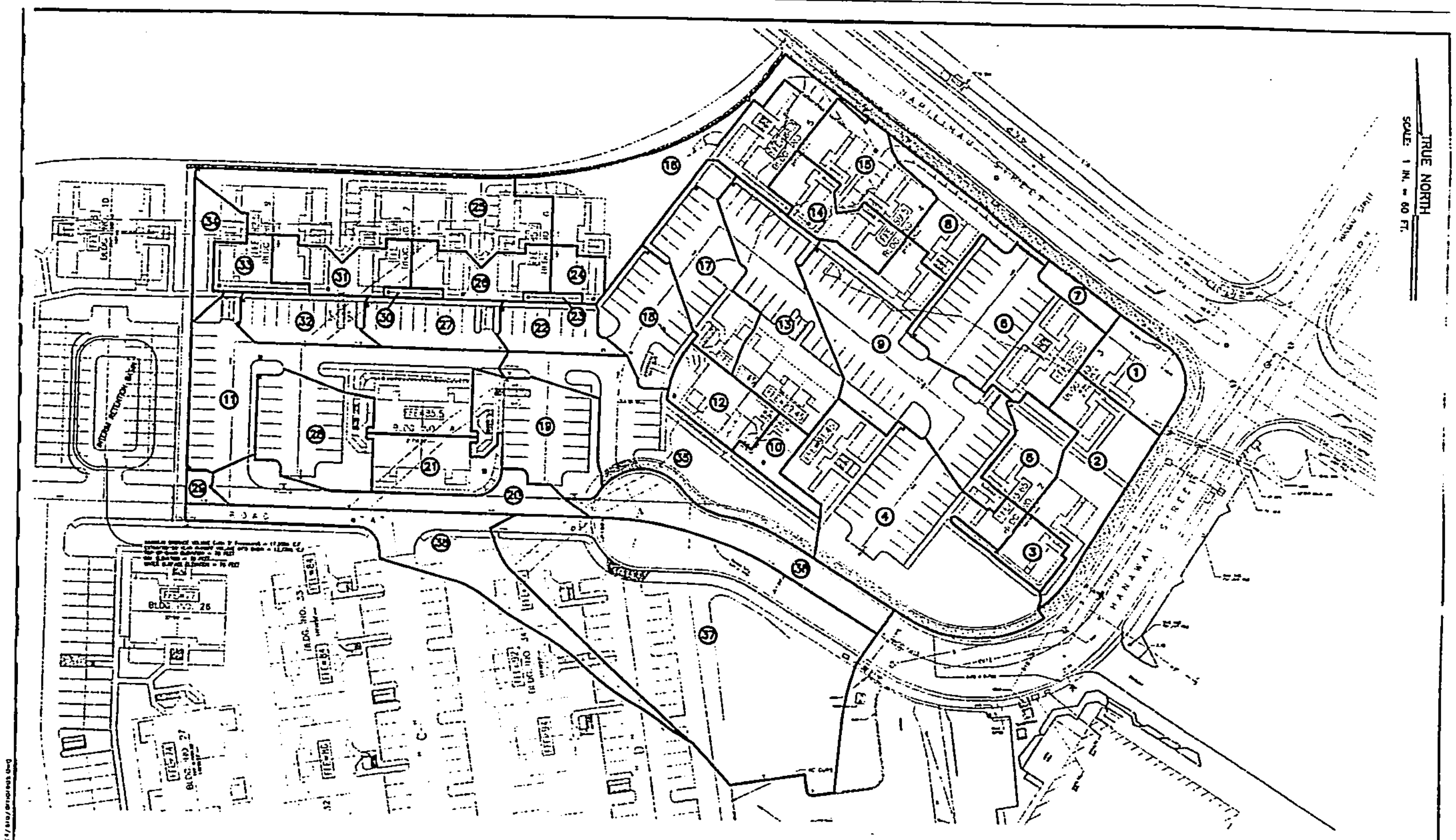


EXHIBIT 5
GRADING PLAN



DRAINAGE AREA MAP

EXHIBIT 6

APPENDIX A

HYDROLOGIC CALCULATIONS

ONSITE DRAINAGE CALCULATIONS

DRAINAGE SCHEDULE

10 YEAR RECURRENCE INTERVAL = 2.0 INCHES

DRAINAGE AREA	AREA (acres)	C	I (in/hr)	Q (cfs)
1	0.08	0.63	4.80	0.24
2	0.14	0.63	4.80	0.43
3	0.04	0.63	4.10	0.10
4	0.38	0.63	3.80	0.90
5	0.07	0.63	4.30	0.18
6	0.21	0.63	5.10	0.67
7	0.02	0.63	4.90	0.07
8	0.07	0.63	4.60	0.21
9	0.28	0.63	5.10	0.91
10	0.03	0.63	4.10	0.09
11	0.27	0.63	5.10	0.85
12	0.07	0.63	4.40	0.19
13	0.19	0.63	3.90	0.46
14	0.07	0.63	4.40	0.20
15	0.10	0.63	5.00	0.30
16	0.25	0.63	3.80	0.59
17	0.13	0.63	4.10	0.34
18	0.10	0.63	5.30	0.32
19	0.13	0.63	4.70	0.39
20	0.11	0.63	5.10	0.36
21	0.08	0.63	4.00	0.20
22	0.06	0.63	5.30	0.19
23	0.01	0.63	4.50	0.02
24	0.03	0.63	4.60	0.08
25	0.25	0.63	3.60	0.57
26	0.07	0.63	4.00	0.18
27	0.07	0.63	5.20	0.24
28	0.13	0.63	4.00	0.32
29	0.01	0.63	3.60	0.02
30	0.01	0.63	4.50	0.02
31	0.07	0.63	4.00	0.18
32	0.07	0.63	5.20	0.23
33	0.04	0.63	4.00	0.10
34	0.04	0.63	4.90	0.14
35	0.22	0.63	3.80	0.52
36	0.12	0.63	5.30	0.40
37	0.65	0.63	3.40	1.39
38	0.18	0.63	3.80	0.43
			TOTAL Q	13.03

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Date: August 17, 1993, Rev. March 28,1995

SUBSURFACE DRAINAGE SYSTEM ANALYSIS AND DESIGN

Project: Napilihau Villages - Phase I (Below Napili Plaza)

Location: Alaeloa, Lahaina, Maui, Hawaii

Job Number: 92037

Objective: To determine the storage requirements for full attenuation of the anticipated increase in onsite surface runoff attributable to the project development. A recurrence interval of fifty (50) years is used.

I. Determine 50-Yr. - 1 Hr. Rainfall:

From "Rainfall Frequency Atlas of the Hawaiian Islands", for Lahaina, Maui,
R(50 Yr.-1Hr.) = 2.50 Inches

II. Determine Pre-Development Runoff:

Pre-Development Component Areas:

Total Area (Ac.): 3.1

Pre-Development Runoff Coefficents:

Infiltration:	Medium	0.07
Relief:	Rolling (5-15%)	0.03
Vegetal Cover:	Poor (<10%)	0.05
Development Type:	Agricultural	0.15
	Composite Runoff Coeff., C:	0.3

Pre-Development Time of Concentration:

Approx. Elev. Diff. (feet):		29
Higher Elev. (ft.):	97.0	
Lower Elev. (ft.):	68.0	
Approx. Runoff Length (ft.):		410
Average Slope:		7.1%

Ground Character:	Ave. grass
Time of Concentration (min.):	17

Pre-Development Intensity:

Intensity (in.):	4.4

Pre-Development Runoff:

Q (pre-dev.) = C x I x A (cfs):	4.09
Allowable Release Rate(cfs):	4.00

III. Determine Post-Development Runoff:

Post Development Component Areas:

Total Area (Ac.):	2.8

Post-Development Runoff Coefficents:

Infiltration:	Medium	0.07
Relief:	Rolling (5-15%)	0.03
Vegetal Cover:	Good	0.03
Development Type:	Industrial/Business	0.55
	Component Runoff Coeff., C:	0.68

Post-Development Time of Concentration:

Approx. Elev. Diff. (feet):		12
Higher Elev. (ft.):	94.0	
Lower Elev. (ft.):	82.0	
Approx. Runoff Length (ft.):		340
Average Slope:		3.5%
Ground Character:		Bare soil
Time of Concentration (min.):		12

Post-Development Intensity:

Intensity (in.):	4.8

Post-Development Runoff:

Q (post-dev.) = C x I x A (cfs):	9.14

IV. Establish Initial Trench Cross Section Parameters:

Cover Over Pipe (ft.):	2.00
Pipe Diameter (ft.)	6.00
Cradle Depth Below Pipe (ft.):	1.00
Cradle Thickness on Sides of Pipe (ft.):	2.00
Total Trench Depth (ft.):	9.0
Total Trench Width (ft.):	10.0
Gross Trench Cross Sectional Area (sf/lf):	90.0
Pipe Cross Sectional Area (sf/lf):	28.3
Trench Aggreg. Cross Sectional Area (sf/lf):	61.7

V. Determine Exfiltration:

Determine Hydraulic Gradient:

Coefficient of Permeability Based on Values Contained in "Soil Survey of Islands of Kauai, Oahu, Maui, and Lanai, State of Hawaii" (dated August 1972).

Coefficient of Permeability (in/hr):	2.00
Coefficient of Permeability (in/sec):	0.00055
Coefficient of Permeability (ft/sec):	4.55E-05

Hydraulic Gradient, I = [(Total Depth of Trench)/2 + Dist. to Ground Water] / Dist. to Ground Water, where distance to groundwater is based on distance from bottom of trench section.

Approx. Dist. to Ground Water (ft.):	59.0
Hydraulic Gradient, I:	1.1

Assume Exfiltration Limited to Sides of Trench Only:

Assumed Initial Length of Pipe / Trench (ft.):	100.00
Unit Exfiltration Area (sf/lf):	18.00
Total Exfiltration Area (sf):	1,800.00
Total Rate of Exfiltration (cfs):	0.09
Factor of Safety:	2.0
Design Rate of Exfiltration (cfs):	0.04

VI. Determine Adequacy of Storage Volume Provided:

Determine Required Storage Volume:

Analytical procedures are based on methods prescribed in "Modern Sewer Design" (dated 1980, by the American Iron and Steel Institute).

Intensity values are obtained from the the Intensity-Duration Curves found page 122 of the "Drainage Master Plan for the County of Maui" (dated 1971, by R.M. Towill Corp.).

Time	I (in/hr)	Post-Dev.	Accum.	Allow.	Exfil'n.	Total	Storage	Comments
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
5	6.20	1.90	3,541	1,200	13	1,213	2,328	
10	5.20	1.90	5,940	2,400	26	2,426	3,514	
15	4.60	1.90	7,883	3,600	40	3,640	4,243	
20	4.15	1.90	9,482	4,800	53	4,853	4,629	
30	3.50	1.90	11,995	7,200	79	7,279	4,716	Peak Storage
40	3.15	1.90	14,394	9,600	106	9,706	4,688	
60	2.50	1.90	17,136	14,400	159	14,559	2,577	
80	2.20	1.90	20,106	19,200	212	19,412	695	
100	1.95	1.90	22,277	24,000	265	24,265	-1,988	

(COL 4) = (COL 1) x (COL 2) x (COL 3) x (60 sec./min.)
(COL 5) = Q(allowable) x (COL 1) x (60 sec./min.)
(COL 6) = (COL 1) x Q(exfilt'n.) x (60 sec./min.)
(COL 7) = (COL 5) + (COL 6)
(COL 8) = (COL 4) - (COL 7)

Maximum Storage Required (cf): 4,716

Determine Provided Storage Volume:

Pipe Storage Capacity (cf): 2,827

Net Aggregate Cradle Storage Capacity (cf): 2,469

Gross Aggregate Cradle Volume (cf): 6,173
Void Ratio (ie, percent voids): 0.40

Total Storage Capacity Provided (cf): 5,296

(Storage Provided = 5,296 cf) > (Storage Required = 4,716 cf); therefore initial assumptions based on 100 l.f. of 72-inch diameter pipe are acceptable.

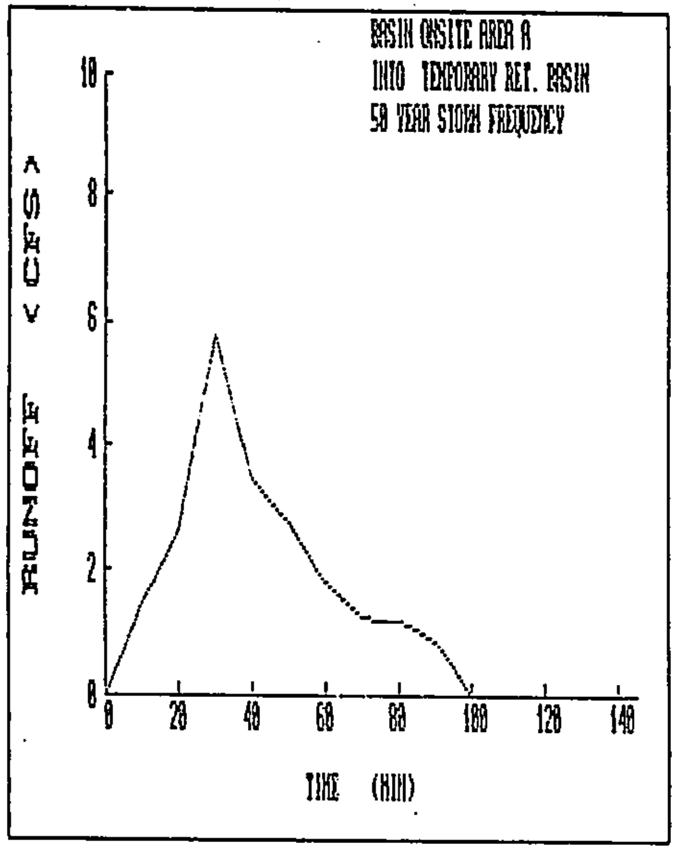
HYDROLOGIC REPORT FOR
NAPILIHAU VILLAGES
UNIVERSAL RATIONAL HYDROGRAPH

Q(PEAK) = C*I*A
50 YEAR STORM FREQUENCY

BASIN IDENTIFIER: ONSITE AREA A
DISCHARGES INTO: TEMPORARY RET. BASIN

BASIN AREA = 1.42 ACRES
RUNOFF COEFF. = 0.68
RAINFALL INT. = 6.00 IN/HR
TIME OF CONC. = 10.00 MINUTES
VOLUME = 12774.89 CUBIC FEET

TIME (MIN)	RUNOFF (C.F.S.)
0.0	0.0
5.0	0.7
10.0	1.5
15.0	2.1
20.0	2.6
25.0	4.2
30.0	5.8
35.0	4.6
40.0	3.5
45.0	3.1
50.0	2.8
55.0	2.3
60.0	1.8
65.0	1.5
70.0	1.3
75.0	1.2
80.0	1.2
85.0	1.0
90.0	0.9
95.0	0.4
100.0	0.0
105.0	0.0
110.0	0.0
115.0	0.0
120.0	0.0
125.0	0.0
130.0	0.0
135.0	0.0
140.0	0.0
145.0	0.0


BASIN ONSITE AREA A
INTO TEMPORARY RET. BASIN
50 YEAR STORM FREQUENCY
RUNOFF < CFS >
0
2
4
6
8
10
0
20
40
60
80
100
120
140
TIME (MIN)

HYDROLOGIC REPORT FOR

NAPILIHAU VILLAGES - PHASE 1

UNIVERSAL RATIONAL HYDROGRAPH

Q(PEAK) = C*I*A
100 YEAR STORM FREQUENCY

BASIN IDENTIFIER   PRE-DEV BELOW BASIN A-1-a
DISCHARGES INTO   EXISTING ONSITE BASIN

BASIN AREA	=	35.40	ACRES
RUNOFF COEFF.	=	0.35	
RAINFALL INT.	=	4.06	IN/HR
TIME OF CONC.	=	20.00	MINUTES
VOLUME	=	236047.27	CUBIC FEET

TIME (MIN)	RUNOFF (C.F.S.)
0.0	0.0
10.0	7.6
20.0	15.2
30.0	18.9
40.0	27.5
50.0	41.4
60.0	60.2
70.0	45.2
80.0	30.2
90.0	26.8
100.0	23.5
110.0	19.9
120.0	16.4
130.0	14.1
140.0	11.8
150.0	10.5
160.0	9.3
170.0	8.8
180.0	8.4
190.0	4.2
200.0	0.0
210.0	0.0
220.0	0.0
230.0	0.0
240.0	0.0
250.0	0.0
260.0	0.0
270.0	0.0
280.0	0.0
290.0	0.0

NAPILIHAU VILLAGES - PHASE I
[continued]

TABULATION OF RUNOFF COEFFICIENTS & AREAS:

SUB-BASIN 1 OF 3 : OFFSITE DRAINAGE BASIN A-2

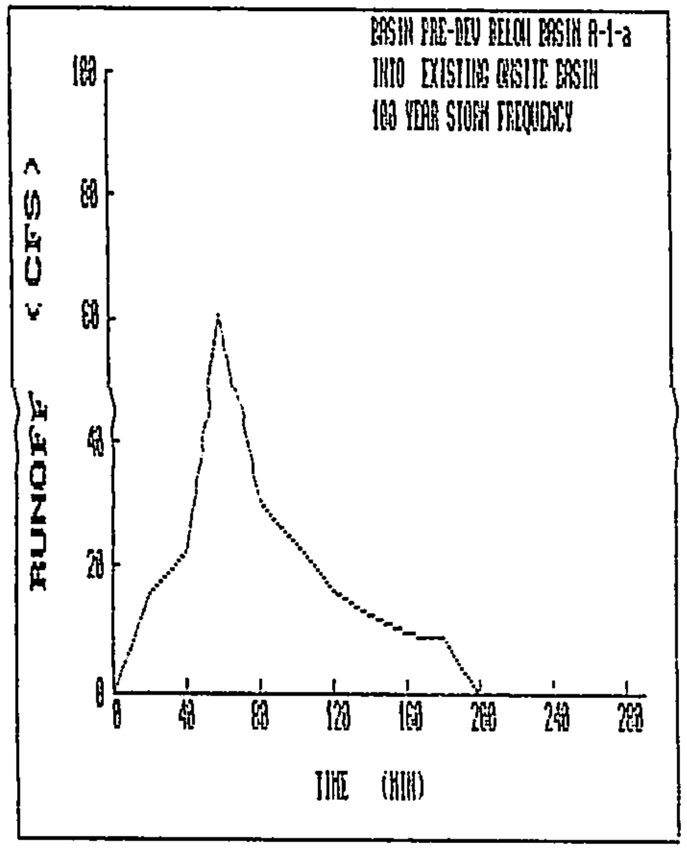
INFILTRATION:	Medium	0.07	
RELIEF:	Rolling (5-15%)	0.03	>>> COMPOSITE C = 0.300
VEGETAL COVER:	Poor (<10%)	0.05	>>> AREA = 27.000 acres
DEVELOPMENT:	Agricultural	0.15	

SUB-BASIN 2 OF 3 : NAPILI PLAZA SHOPPING CENTER

INFILTRATION:	Medium	0.07	
RELIEF:	Flat (0-5%)	0.00	>>> COMPOSITE C = 0.670
VEGETAL COVER:	Poor (<10%)	0.05	>>> AREA = 4.400 acres
DEVELOPMENT:	Industrial / Business	0.55	

SUB-BASIN 3 OF 3 : ONSITE PRE-DEVELOPMENT

INFILTRATION:	Medium	0.07	
RELIEF:	Rolling (5-15%)	0.03	>>> COMPOSITE C = 0.300
VEGETAL COVER:	Poor (<10%)	0.05	>>> AREA = 4.000 acres
DEVELOPMENT:	Agricultural	0.15	



W.S. Unemori Engineering, Inc.
Wailuku, Hawaii
MARCH 17, 1995

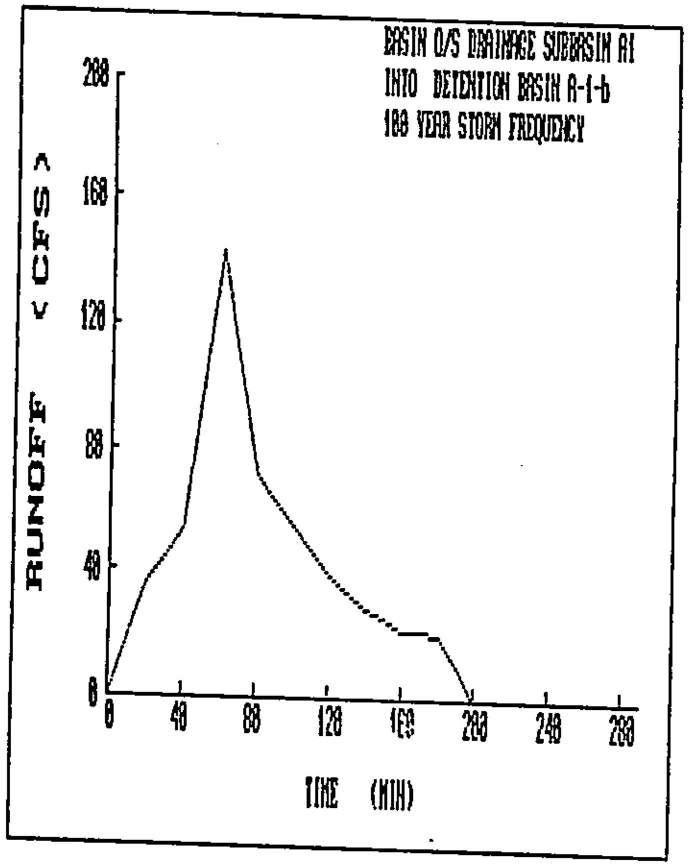
HYDROLOGIC REPORT FOR
NAPILIHAU VILLAGES - PHASE I
UNIVERSAL RATIONAL HYDROGRAPH

Q(PEAK) = C*I*A
100 YEAR STORM FREQUENCY

BASIN IDENTIFIER O/S DRAINAGE SUBBASIN A1
DISCHARGES INTO DETENTION BASIN A-1-b

BASIN AREA	=	98.00	ACRES
RUNOFF COEFF.	=	0.30	
RAINFALL INT.	=	4.86	IN/HR
TIME OF CONC.	=	20.00	MINUTES
VOLUME	=	562010.38	CUBIC FEET

TIME (MIN)	RUNOFF (C.F.S.)
0.0	0.0
10.0	18.0
20.0	36.0
30.0	44.7
40.0	53.5
50.0	98.2
60.0	142.9
70.0	107.3
80.0	71.7
90.0	63.7
100.0	55.7
110.0	47.2
120.0	38.8
130.0	33.4
140.0	27.9
150.0	24.9
160.0	22.0
170.0	20.9
180.0	19.9
190.0	9.9
200.0	0.0
210.0	0.0
220.0	0.0
230.0	0.0
240.0	0.0
250.0	0.0
260.0	0.0
270.0	0.0
280.0	0.0
290.0	0.0



W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street Suite 403
Wailuku, Maui, Hawaii 96793

BY: LANCE NAKAMURA
DATE: March 31, 1995

HYDROLOGIC STUDY
FOR
NAPILIHAU VILLAGES - PHASE I

ALAELOA, LAHAINA, MAUI, HAWAII

OFFSITE DRAINAGE BASIN A-2

RECURRENCE INTERVAL:	100 years	HYDRAULIC LENGTH:	2100.0 ft.
ONE-HOUR RAINFALL:	3.00 inches	ELEV'N. DIFFERENTIAL:	180.00 ft.
		HYDRAULIC SLOPE:	0.086 ft./ft.
WEIGHTED RUNOFF COEFFICIENT, C:	0.30	TIME OF CONCENTRATION:	12.0 min.
INTENSITY, I:	5.80 inches		
AREA, A:	27.00 acres	SUB BASINS CONSIDERED:	1

Q = C*I*A = 46.98 cfs

COMMENTS:

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street Suite 403
Wailuku, Maui, Hawaii 96793

BY: LANCE NAKAMURA
DATE: March 31, 1995

NAPILIHAU VILLAGES - PHASE I
[continued]

TABULATION OF RUNOFF COEFFICIENTS & AREAS:

SUB-BASIN 1 OF 1 : OPEN AREA

INFILTRATION:	Medium	0.07	
RELIEF:	Rolling (5-15%)	0.03	>>> COMPOSITE C = 0.360
VEGETAL COVER:	Poor (<10%)	0.05	>>> AREA = 27.000 acres
DEVELOPMENT:	Agricultural	0.15	

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street Suite 403
Wailuku, Maui, Hawaii 96793

BY: LANCE NAKAMURA
DATE: March 29, 1995

HYDROLOGIC STUDY
FOR
NAPILIHAU VILLAGES - PHASE I

ALAELOA, LAHAINA, MAUI, HAWAII

VACANT LOT

RECURRENCE INTERVAL:	100 years	HYDRAULIC LENGTH:	90.0 ft.
ONE-HOUR RAINFALL:	3.00 inches	ELEV'N. DIFFERENTIAL:	24.00 ft.
		HYDRAULIC SLOPE:	0.267 ft./ft.
WEIGHTED RUNOFF COEFFICIENT, C:	0.35	TIME OF CONCENTRATION:	7.0 min.
INTENSITY, I:	7.00 inches		
AREA, A:	1.10 acres	SUB BASINS CONSIDERED:	1

Q = C*I*A = 2.69 cfs

COMMENTS:

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street   Suite 403
Wailuku, Maui, Hawaii   96793

BY: LANCE NAKAMURA
DATE: March 29, 1995

NAPILIHAU VILLAGES - PHASE I
[continued]

ˌBULATION OF RUNOFF COEFFICIENTS & AREAS:

SUB-BASIN 1 OF 1 : OPEN AREA

.NFILTRATION:	Medium	0.07	
RELIEF:	Steep (>25%)	0.08	>>> COMPOSITE C = 0.350
ˈGETAL COVER:	Poor (<10%)	0.05	>>> AREA = 1.100 acres
DEVELOPMENT:	Agricultural	0.15	

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street   Suite 403
Wailuku, Maui, Hawaii   96793

BY: LANCE NAKAMURA
DATE: March 31, 1995

HYDROLOGIC STUDY
FOR
NAPILIHAU VILLAGES - PHASE I

ALAELOA, LAHAINA, MAUI, HAWAII

EXISTING OFFSITE CATCH BASIN #2

RECURRENCE INTERVAL:	100 years	HYDRAULIC LENGTH:	760.0 ft.
ONE-HOUR RAINFALL:	3.00 inches	ELEV'N. DIFFERENTIAL:	46.00 ft.
		HYDRAULIC SLOPE:	0.061 ft./ft.
WEIGHTED RUNOFF COEFFICIENT, C:	0.68	TIME OF CONCENTRATION:	8.0 min.
INTENSITY, I:	6.80 inches		
AREA, A:	0.50 acres	SUB BASINS CONSIDERED:	1

Q = C*I*A = 2.31 cfs

COMMENTS:

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street   Suite 403
Wailuku, Maui, Hawaii   96793

BY: LANCE NAKAMURA
DATE: March 31, 1995

HYDROLOGIC STUDY

FOR

NAPILIHAU VILLAGES - PHASE I

ALAELOA, LAHAINA, MAUI, HAWAII

EXISTING OFFSITE CATCH BASIN #3

RECURRENCE INTERVAL:	100 years	HYDRAULIC LENGTH:	760.0 ft.
ONE-HOUR RAINFALL:	3.00 inches	ELEV'N. DIFFERENTIAL:	46.00 ft.
		HYDRAULIC SLOPE:	0.061 ft./ft.
WEIGHTED RUNOFF COEFFICIENT, C:	0.68	TIME OF CONCENTRATION:	8.0 min.
INTENSITY, I:	6.80 inches		
AREA, A:	0.50 acres	SUB BASINS CONSIDERED:	1

Q = C*I*A =   2.31 cfs

COMMENTS:

W.S. UNEMORI ENGINEERING, INC.
2145 Walls Street   Suite 403
Wailuku, Maui, Hawaii   96793

BY: LANCE NAKAMURA
DATE: March 31, 1995

NAPILIHAU VILLAGES - PHASE I
[continued]

BULATION OF RUNOFF COEFFICIENTS & AREAS:

SUB-BASIN 1 OF 1 : NAPILIHAU STREET

NFILTRATION:	Negligible	0.20	
RELIEF:	Rolling (5-15%)	0.03	>>> COMPOSITE C = 0.680
GETAL COVER:	Poor (<10%)	0.05	>>> AREA = 0.500 acres
DEVELOPMENT:	Residential	0.40	

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street Suite 403
Wailuku, Maui, Hawaii 96793

BY: LANCE NAKAMURA
DATE: March 31, 1995

NAPILIHAU VILLAGES - PHASE I
[continued]

BULATION OF RUNOFF COEFFICIENTS & AREAS:

SUB-BASIN 1 OF 1 : NAPILIHAU STREET

```
INFILTRATION:  Negligible .................... 0.20
      RELIEF:  Rolling (5-15%) ............... 0.03  >>> COMPOSITE C = 0.680
 GETAL COVER:  Poor (<10%) ................... 0.05  >>> AREA =  0.500 acres
 DEVELOPMENT:  Residential ................... 0.40
```

RUNOFF CALCULATIONS
FOR NAPILI SHOPPING PLAZA

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street Suite 403
Wailuku, Maui, Hawaii 96793

BY: DON H. IAEA JR.
DATE: February 2, 1993

HYDROLOGIC STUDY

FOR

NAPILI PLAZA SHOPPING CENTER

ALAELOA, LAHAINA, MAUI, HAWAII

BUSINESS AND COMMERCIAL USE

RECURRENCE INTERVAL:	50 years	HYDRAULIC LENGTH:	305.0 ft.
ONE-HOUR RAINFALL:	2.50 inches	ELEV'N. DIFFERENTIAL:	12.00 ft.
		HYDRAULIC SLOPE:	0.039 ft./ft.
WEIGHTED RUNOFF COEFFICIENT, C:	0.67	TIME OF CONCENTRATION:	5.0 min.
INTENSITY, I:	6.20 inches		
AREA, A:	4.40 acres	SUB BASINS CONSIDERED:	1

Q = CIA = 18.28 cfs

COMMENTS:

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street Suite 403
Wailuku, Maui, Hawaii 96793

BY: DON H. IAEA JR.
DATE: February 2, 1993

NAPILI PLAZA SHOPPING CENTER
(continued)

TABULATION OF RUNOFF COEFFICIENTS & AREAS:

SUB-BASIN 1 OF 1 : BUSINESS AND COMMERCIAL USE

INFILTRATION:	Medium	0.07	
RELIEF:	Flat (0-5%)	0.00	>>> COMPOSITE C = 0.670
VEGETAL COVER:	Poor (<10%)	0.05	>>> AREA = 4.400 acres
DEVELOPMENT:	Industrial / Business	0.55	

APPENDIX B

HYDRAULIC CALCULATIONS

POND-2 Version: 5.17
S/N:

NAPILIHAU VILLAGES - PHASE I
ONSITE DETENTION BASIN
PRE-DEVELOPMENT

CALCULATED 06-01-1995 11:19:25
DISK FILE: NHVDS1 .VOL

Planimeter scale: 1 inch = 208.71032 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
62.00	0.04	0.04	0.00	0.00	0.00
64.00	0.08	0.08	0.18	0.12	0.12
66.00	0.14	0.14	0.31	0.21	0.33
68.00	0.21	0.21	0.51	0.34	0.67
70.00	0.30	0.30	0.76	0.51	1.18
72.00	0.42	0.42	1.08	0.72	1.89
74.00	0.54	0.54	1.43	0.95	2.85
76.00	0.65	0.65	1.78	1.19	4.03
78.00	0.78	0.78	2.14	1.42	5.46

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

CORRECTION

THE PRECEDING DOCUMENT(S) HAS
BEEN REPHOTOGRAPHED TO ASSURE
LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

APPENDIX B

HYDRAULIC CALCULATIONS

POND-2 Version: 5.17
S/N:

NAPILIHAU VILLAGES - PHASE I
ONSITE DETENTION BASIN
PRE-DEVELOPMENT

CALCULATED 06-01-1995 11:19:25
DISK FILE: NHVDS1 .VOL

Planimeter scale: 1 inch = 208.71032 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
62.00	0.04	0.04	0.00	0.00	0.00
64.00	0.08	0.08	0.18	0.12	0.12
66.00	0.14	0.14	0.31	0.21	0.33
68.00	0.21	0.21	0.51	0.34	0.67
70.00	0.30	0.30	0.76	0.51	1.18
72.00	0.42	0.42	1.08	0.72	1.87
74.00	0.54	0.54	1.43	0.95	2.85
76.00	0.65	0.65	1.78	1.19	4.03
78.00	0.78	0.78	2.14	1.42	5.46

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Outlet Structure File: NHVOS1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE I
ONSITE DETENTION BASIN
BEFORE DEVELOPMENT
****

COMPOSITE OUTFLOW SUMMARY

Elevation (ft)	Q (cfs)	Contributing Structures
62.00	0.0	
62.50	0.0	
63.00	0.0	
63.50	0.0	
64.00	0.0	
64.50	0.0	
65.00	0.0	
65.50	0.0	
66.00	0.0	
66.50	0.0	
67.00	0.0	
67.50	0.0	
68.00	0.0	
68.50	0.0	
69.00	0.0	
69.50	0.0	
70.00	0.0	
70.50	0.0	
71.00	0.0	
71.50	0.0	
72.00	0.0	
72.50	0.0	
73.00	0.0	
73.50	0.0	
74.00	0.0	
74.50	1.9	1
75.00	39.0	1
75.50	123.5	1
76.00	263.6	1
76.50	487.4	1
77.00	774.1	1
77.50	1126.8	1
78.00	0.0	

Outlet Structure File: NHVOS1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE I
ONSITE DETENTION BASIN
BEFORE DEVELOPMENT
****

Outlet Structure File: NHVOS1 .STR
Planimeter Input File: NHVOS1 .VOL
Rating Table Output File: NHVOS1 .PND

Min. Elev.(ft) = 62 Max. Elev.(ft) = 78 Incr.(ft) = .5

Additional elevations (ft) to be included in table:
* *

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table	Q Table
WEIR-XY	1	->	1

Outflow rating table summary was stored in file:
NHVOS1 .PND

Outlet Structure File: NHVOS1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE 1
ONSITE DETENTION BASIN
BEFORE DEVELOPMENT
****

>>>>>> Structure No. 1 <<<<<<
(Input Data)

WEIR-XY
Weir - Defined by X, Y Coordinates
E1 (ft) =74.4 E2 (ft) =78

X dist.(ft)	Y elev.(ft)
0	78
25	76
60	74.4
80	74.4
120	76
160	78

Outlet Structure File: NHVOS1 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE I
ONSITE DETENTION BASIN
BEFORE DEVELOPMENT
****

Outflow Rating Table for Structure #1
WEIR-XY Weir - Defined by X, Y Coordinates

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages	
62.00	0.0	E < Y min= 74.4	
62.50	0.0	E < E1=74.4	
63.00	0.0	E < E1=74.4	
63.50	0.0	E < E1=74.4	
64.00	0.0	E < E1=74.4	
64.50	0.0	E < E1=74.4	
65.00	0.0	E < E1=74.4	
65.50	0.0	E < E1=74.4	
66.00	0.0	E < E1=74.4	
66.50	0.0	E < E1=74.4	
67.00	0.0	E < E1=74.4	
67.50	0.0	E < E1=74.4	
68.00	0.0	E < E1=74.4	
68.50	0.0	E < E1=74.4	
69.00	0.0	E < E1=74.4	
69.50	0.0	E < E1=74.4	
70.00	0.0	E < E1=74.4	
70.50	0.0	E < E1=74.4	
71.00	0.0	E < E1=74.4	
71.50	0.0	E < E1=74.4	
72.00	0.0	E < E1=74.4	
72.50	0.0	E < E1=74.4	
73.00	0.0	E < E1=74.4	
73.50	0.0	E < E1=74.4	
74.00	0.0	E < E1=74.4	
74.50	1.9	W(ft)=24.687	Max. D(ft)=.1
75.00	39.0	W(ft)=40.125	Max. D(ft)=.6
75.50	123.5	W(ft)=71.562	Max. D(ft)=1.1
76.00	263.6	W(ft)=95.0	Max. D(ft)=1.6
76.50	487.4	W(ft)=111.25	Max. D(ft)=2.1
77.00	774.1	W(ft)=127.5	Max. D(ft)=2.6
77.50	1126.8	W(ft)=143.75	Max. D(ft)=3.1
78.00	0.0	E = or > E2=78	

POND-2 Version: 5.17 S/N:
EXECUTED: 06-01-1995 08:40:42

NAPILIHAU VILLAGES - PHASE I
ONSITE DETENTION BASIN
BEFORE DEVELOPMENT

Inflow Hydrograph: NHV5A .HYD
Rating Table file: NHVOSI .PND

----INITIAL CONDITIONS----
Elevation = 62.00 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + 0 (cfs)
62.00	0.0	0.000	0.0	0.0
62.50	0.0	0.024	11.5	11.5
63.00	0.0	0.051	24.7	24.7
63.50	0.0	0.082	39.8	39.8
64.00	0.0	0.118	56.9	56.9
64.50	0.0	0.159	76.7	76.7
65.00	0.0	0.207	100.1	100.1
65.50	0.0	0.263	127.2	127.2
66.00	0.0	0.327	158.5	158.5
66.50	0.0	0.400	193.8	193.8
67.00	0.0	0.482	233.1	233.1
67.50	0.0	0.571	276.5	276.5
68.00	0.0	0.670	324.3	324.3
68.50	0.0	0.779	377.1	377.1
69.00	0.0	0.899	435.3	435.3
69.50	0.0	1.032	499.3	499.3
70.00	0.0	1.176	569.3	569.3
70.50	0.0	1.334	645.6	645.6
71.00	0.0	1.506	728.8	728.8
71.50	0.0	1.692	819.1	819.1
72.00	0.0	1.894	916.7	916.7
72.50	0.0	2.111	1021.5	1021.5
73.00	0.0	2.341	1133.3	1133.3
73.50	0.0	2.587	1252.3	1252.3
74.00	0.0	2.848	1378.7	1378.7
74.50	1.9	3.124	1512.1	1514.0
75.00	39.0	3.413	1652.1	1691.1
75.50	123.5	3.716	1798.8	1922.3
76.00	263.6	4.034	1952.3	2215.9
76.50	487.4	4.366	2113.1	2600.5
77.00	774.1	4.714	2281.5	3055.6

EXECUTED 06-01-1995 08:40:42
DISK FILES: NHV5A .HYD : NHVOSI .PND

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + 0 (cfs)
77.50	1126.8	5.078	2457.6	3584.4

Time increment (t) = 0.050 hrs.

EXECUTED 06-01-1995 00:48:42
DISK FILES: NHV5A .HYD ; NHVOS1 .PND

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)
77.50	1126.8	5.078

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + 0 (cfs)
2457.6	3584.4

Time increment (t) = 0.050 hrs.

POND-2 Version: 5.17 S/N:
EXECUTED: 06-01-1995 08:48:42

Pond File: NHVOS1 .PND
Inflow Hydrograph: NHV5A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	62.00
0.050	2.20	2.3	2.3	2.3	0.00	62.10
0.100	4.56	6.8	9.1	9.1	0.00	62.40
0.150	6.04	11.4	20.5	20.5	0.00	62.84
0.200	9.12	16.0	36.5	36.5	0.00	63.39
0.250	11.40	20.5	57.0	57.0	0.00	64.00
0.300	13.60	25.1	82.1	82.1	0.00	64.61
0.350	15.57	29.3	111.3	111.3	0.00	65.21
0.400	16.68	32.3	143.6	143.6	0.00	65.76
0.450	17.79	34.5	178.1	178.1	0.00	66.28
0.500	18.90	36.7	214.7	214.7	0.00	66.77
0.550	19.98	38.9	253.6	253.6	0.00	67.24
0.600	21.06	41.0	294.7	294.7	0.00	67.69
0.650	22.14	43.2	337.9	337.9	0.00	68.13
0.700	26.28	48.4	386.3	386.3	0.00	68.58
0.750	31.95	58.2	444.5	444.5	0.00	69.07
0.800	37.62	69.6	514.1	514.1	0.00	69.61
0.850	71.59	109.2	623.3	623.3	0.00	70.35
0.900	135.36	207.0	830.2	830.2	0.00	71.56
0.950	168.59	304.0	1134.2	1134.2	0.00	73.00
1.000	180.29	348.9	1480.1	1483.1	1.47	74.39
1.050	171.80	352.1	1651.0	1832.2	90.59	75.31
1.100	159.18	331.0	1670.0	1902.0	152.01	75.60
1.150	145.05	304.2	1678.0	1982.2	152.11	75.60
1.200	131.12	276.2	1676.7	1954.2	138.73	75.55
1.250	118.61	249.7	1675.5	1926.5	125.50	75.51
1.300	108.02	226.6	1669.8	1902.1	116.13	75.46
1.350	100.39	208.4	1663.4	1878.2	107.41	75.40
1.400	96.05	196.4	1658.5	1859.9	100.69	75.37
1.450	92.22	188.3	1655.0	1846.7	95.90	75.34
1.500	88.61	180.8	1652.0	1835.8	91.89	75.31
1.550	85.13	173.7	1649.3	1825.7	88.22	75.29
1.600	81.66	166.8	1646.7	1816.1	84.69	75.27
1.650	78.18	159.8	1644.1	1806.5	81.20	75.25
1.700	74.61	152.8	1641.5	1796.9	77.69	75.23
1.750	71.02	145.6	1638.9	1787.2	74.13	75.21
1.800	67.47	138.5	1636.3	1777.4	70.56	75.19
1.850	63.90	131.4	1633.7	1767.7	67.00	75.17
1.900	60.42	124.3	1631.1	1758.0	63.46	75.14
1.950	57.18	117.6	1628.6	1748.7	60.05	75.12
2.000	54.20	111.4	1626.2	1739.9	56.86	75.11
2.050	51.73	105.9	1624.1	1732.1	54.01	75.09
2.100	49.34	101.1	1622.3	1725.2	51.47	75.07
2.150	46.98	96.3	1620.5	1718.6	49.05	75.06
2.200	44.79	91.8	1618.8	1712.2	46.74	75.05

POND-2 Version: 5.17 S/N:
EXECUTED: 06-01-1995 00:40:42

Pond File: NHVOS1 .PND
Inflow Hydrograph: NHV5A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
2.250	42.87	87.7	1617.2	1706.4	44.61	75.03
2.300	41.09	84.0	1615.0	1701.2	42.69	75.02
2.350	39.50	80.6	1614.5	1696.4	40.94	75.01
2.400	38.19	77.7	1613.4	1692.2	39.41	75.00
2.450	36.93	75.1	1611.6	1688.5	38.46	74.99
2.500	35.66	72.6	1609.1	1684.2	37.55	74.98
2.550	34.44	70.1	1606.1	1679.2	36.50	74.97
2.600	33.29	67.7	1603.1	1673.9	35.40	74.95
2.650	32.26	65.6	1600.0	1668.6	34.30	74.94
2.700	31.47	63.7	1597.2	1663.8	33.28	74.92
2.750	30.84	62.3	1594.7	1659.5	32.39	74.91
2.800	30.27	61.1	1592.6	1655.8	31.62	74.90
2.850	29.75	60.0	1590.7	1652.6	30.95	74.89
2.900	29.13	58.9	1589.0	1649.6	30.31	74.88
2.950	28.07	57.2	1587.0	1646.2	29.60	74.87
3.000	26.42	54.5	1584.3	1641.5	28.61	74.86
3.050	23.15	49.6	1579.8	1633.8	27.01	74.84
3.100	19.53	42.7	1573.2	1622.5	24.63	74.81
3.150	15.60	35.2	1565.1	1608.4	21.69	74.77
3.200	12.17	27.9	1556.0	1592.9	18.44	74.72
3.250	9.00	21.2	1546.9	1577.2	15.15	74.68
3.300	5.96	15.0	1538.0	1561.9	11.93	74.64
3.350	3.67	9.6	1529.7	1547.6	8.95	74.60
3.400	2.57	6.2	1523.0	1536.0	6.51	74.56
3.450	1.76	4.3	1517.9	1527.3	4.67	74.54
3.500	1.19	3.0	1514.2	1520.9	3.34	74.52
3.550	0.79	2.0	1511.5	1516.2	2.36	74.51
3.600	0.53	1.3	1509.0	1512.8	1.88	74.50
3.650	0.34	0.9	1506.2	1509.9	1.84	74.48
3.700	0.22	0.6	1503.2	1506.8	1.80	74.47
3.750	0.14	0.4	1500.0	1503.5	1.75	74.46
3.800	0.09	0.2	1496.8	1500.2	1.71	74.45
3.850	0.06	0.2	1493.7	1497.0	1.66	74.44
3.900	0.04	0.1	1490.5	1493.8	1.62	74.43
3.950	0.02	0.1	1487.4	1490.6	1.57	74.41
4.000	0.01	0.0	1484.4	1487.5	1.53	74.40
4.050	0.01	0.0	1481.5	1484.4	1.49	74.39
4.100	0.01	0.0	1478.6	1481.5	1.44	74.38
4.150	0.00	0.0	1475.8	1478.6	1.40	74.37
4.200	0.00	0.0	1473.1	1475.8	1.36	74.36
4.250	0.00	0.0	1470.4	1473.1	1.33	74.35
4.300	0.00	0.0	1467.8	1470.4	1.29	74.34
4.350	0.00	0.0	1465.3	1467.8	1.25	74.33
4.400	0.00	0.0	1462.9	1465.3	1.22	74.32
4.450	0.00	0.0	1460.5	1462.9	1.18	74.31
4.500	0.00	0.0	1458.2	1460.5	1.15	74.30

POND-2 Version: 5.17 S/N:
EXECUTED: 06-01-1995 00:40:42

Pond File: NHVOS1 .PND
Inflow Hydrograph: NHV5A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
4.550	0.00	0.0	1456.0	1458.2	1.12	74.29
4.600	0.00	0.0	1453.8	1456.0	1.09	74.29
4.650	0.00	0.0	1451.7	1453.8	1.06	74.28
4.700	0.00	0.0	1449.7	1451.7	1.03	74.27
4.750	0.00	0.0	1447.7	1449.7	1.00	74.26
4.800	0.00	0.0	1445.7	1447.7	0.97	74.25
4.850	0.00	0.0	1443.9	1445.7	0.94	74.25
4.900	0.00	0.0	1442.0	1443.9	0.92	74.24
4.950	0.00	0.0	1440.2	1442.0	0.89	74.23
5.000	0.00	0.0	1438.5	1440.2	0.86	74.23
5.050	0.00	0.0	1436.8	1438.5	0.84	74.22
5.100	0.00	0.0	1435.2	1436.8	0.82	74.21
5.150	0.00	0.0	1433.6	1435.2	0.79	74.21
5.200	0.00	0.0	1432.1	1433.6	0.77	74.20
5.250	0.00	0.0	1430.6	1432.1	0.75	74.20
5.300	0.00	0.0	1429.1	1430.6	0.73	74.19
5.350	0.00	0.0	1427.7	1429.1	0.71	74.19
5.400	0.00	0.0	1426.3	1427.7	0.69	74.18
5.450	0.00	0.0	1425.0	1426.3	0.67	74.18
5.500	0.00	0.0	1423.7	1425.0	0.65	74.17
5.550	0.00	0.0	1422.4	1423.7	0.63	74.17
5.600	0.00	0.0	1421.2	1422.4	0.61	74.16
5.650	0.00	0.0	1420.0	1421.2	0.60	74.16
5.700	0.00	0.0	1418.8	1420.0	0.58	74.15
5.750	0.00	0.0	1417.7	1418.8	0.56	74.15
5.800	0.00	0.0	1416.6	1417.7	0.55	74.14
5.850	0.00	0.0	1415.5	1416.6	0.53	74.14
5.900	0.00	0.0	1414.5	1415.5	0.52	74.14
5.950	0.00	0.0	1413.5	1414.5	0.50	74.13
6.000	0.00	0.0	1412.5	1413.5	0.49	74.13

****************** SUMMARY OF ROUTING COMPUTATIONS ******************

Pond File: NHVOS1 .PND
Inflow Hydrograph: NHVSA .HYD
Outflow Hydrograph: OUT .HYD

Starting Pond W.S. Elevation = 62.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 180.29 cfs
Peak Outflow = 152.11 cfs
Peak Elevation = 75.60 ft

***** Summary of Approximate Peak Storage *****

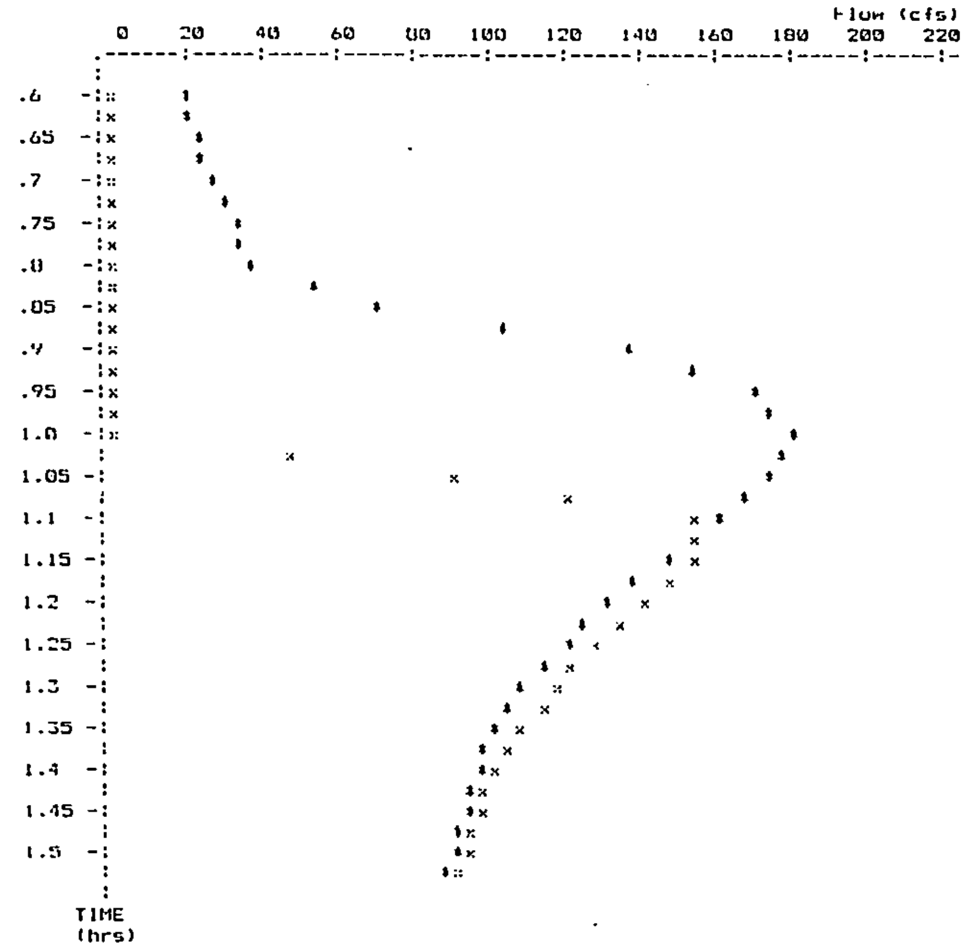
Initial Storage = 0.00 ac-ft
Peak Storage From Storm = 3.78 ac-ft

Total Storage in Pond = 3.78 ac-ft

Pond File: NHVOS1 .PND
Inflow Hydrograph: NHVSA .HYD
Outflow Hydrograph: OUT .HYD

EXECUTED: 06-01-1995
08:48:42

Peak Inflow = 180.29 cfs
Peak Outflow = 152.11 cfs
Peak Elevation = 75.60 ft



* File: NHVSA .HYD Qmax = 180.3 cfs
x File: OUT .HYD Qmax = 152.1 cfs

POND-2 Version: 5.17
S/N:

NAPILIHAU VILLAGES PROJECTS
DETENTION BASIN A-1-b

CALCULATED 06-01-1995 12:07:29
DISK FILE: NHVAIB .VOL

Planimeter scale: 1 inch = 208.7103 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
224.00	0.01	0.01	0.00	0.00	0.00
226.00	0.09	0.09	0.13	0.09	0.09
228.00	0.15	0.15	0.36	0.24	0.32
230.00	0.27	0.27	0.62	0.41	0.74
232.00	0.34	0.34	0.91	0.61	1.35
234.00	0.39	0.39	1.09	0.73	2.08
236.00	0.45	0.45	1.26	0.84	2.92
237.00	*I*	0.48	1.39	0.46	3.38
238.00	0.51	0.51	1.44	0.96	3.88
240.00	0.56	0.56	1.60	1.07	4.94

I ---> Interpolated area from closest two planimeter readings.

IA = (sq.rt(Area1) + ((Ei-E1)/(E2-E1))*(sq.rt(Area2)-sq.rt(Area1)))^2

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1,Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Outlet Structure File: NHVAIB .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE I
BASIN A-1-b
100 YEAR STORM (UNIVERSAL RATIONAL METHOD)
****

***** COMPOSITE OUTFLOW SUMMARY ****

Elevation (ft)	Q (cfs)	Contributing Structures
224.00	0.0	
224.50	0.0	
225.00	0.0	
225.50	0.0	
226.00	0.0	
226.50	0.0	
227.00	0.0	
227.50	0.0	
228.00	0.0	
228.50	0.0	
229.00	0.0	
229.50	0.0	
230.00	0.0	
230.50	0.0	
231.00	0.0	
231.50	0.0	
232.00	0.0	
232.50	0.0	
233.00	0.0	
233.50	0.0	
234.00	0.0	
234.50	0.0	
235.00	0.0	
235.50	0.0	
236.00	0.0	
236.50	0.0	
237.00	0.0	1
237.50	30.4	1
238.00	88.0	1
238.50	165.2	1
239.00	260.0	1
239.50	371.2	1
240.00	0.0	

Outlet Structure File: NHVAIB .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE I
BASIN A-1-b
100 YEAR STORM (UNIVERSAL RATIONAL METHOD)

****

Outlet Structure File: NHVAIB .STR
Planimeter Input File: NHVAIB .VOL
Rating Table Output File: NHVAIB .PND

Min. Elev.(ft) = 224 Max. Elev.(ft) = 240 Incr.(ft) = .5

Additional elevations (ft) to be included in table:
* *

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table	Q Table
WEIR-XY	1		-> 1

Outflow rating table summary was stored in file:
NHVAIB .PND

Outlet Structure File: NHVAIB .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE I
BASIN A-1-b
100 YEAR STORM (UNIVERSAL RATIONAL METHOD)

****

>>>>>> Structure No. 1 <<<<<<
(Input Data)

WEIR-XY
Weir - Defined by X, Y Coordinates
E1 (ft) =237 E2 (ft) =240

X dist.(ft)	Y elev.(ft)
0	240
6	237
36	237
42	240

Outlet Structure File: NHVA1B .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE 1
BASIN A-1-b
100 YEAR STORM (UNIVERSAL RATIONAL METHOD)
****

Outflow Rating Table for Structure #1
WEIR-XY Weir - Defined by X, Y Coordinates

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages	
224.00	0.0	E < Y min= 237	
224.50	0.0	E < E1=237	
225.00	0.0	E < E1=237	
225.50	0.0	E < E1=237	
226.00	0.0	E < E1=237	
226.50	0.0	E < E1=237	
227.00	0.0	E < E1=237	
227.50	0.0	E < E1=237	
228.00	0.0	E < E1=237	
228.50	0.0	E < E1=237	
229.00	0.0	E < E1=237	
229.50	0.0	E < E1=237	
230.00	0.0	E < E1=237	
230.50	0.0	E < E1=237	
231.00	0.0	E < E1=237	
231.50	0.0	E < E1=237	
232.00	0.0	E < E1=237	
232.50	0.0	E < E1=237	
233.00	0.0	E < E1=237	
233.50	0.0	E < E1=237	
234.00	0.0	E < E1=237	
234.50	0.0	E < E1=237	
235.00	0.0	E < E1=237	
235.50	0.0	E < E1=237	
236.00	0.0	E < E1=237	
236.50	0.0	E < E1=237	
237.00	0.0	E = Y min= 237	
237.50	30.4	W(ft)=32.0	Max. D(ft)=.5
238.00	88.0	W(ft)=34.0	Max. D(ft)=1.0
238.50	165.2	W(ft)=36.0	Max. D(ft)=1.5
239.00	260.0	W(ft)=38.0	Max. D(ft)=2.0
239.50	371.2	W(ft)=40.0	Max. D(ft)=2.5
240.00	0.0	E = or > E2=240	

POND-2 Version: 5.17 S/N:
EXECUTED: 05-31-1995 17:09:01

****
NAPILIHAU VILLAGES - PHASE 1
BASIN A-1-b
100 YEAR STORM (UNIVERSAL RATIONAL METHOD)
****

Inflow Hydrograph: NHVIA .HYD
Rating Table file: NHVA1B .PND

----INITIAL CONDITIONS----
Elevation = 224.00 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
224.00	0.0	0.000	0.0	0.0
224.50	0.0	0.008	3.8	3.8
225.00	0.0	0.023	11.3	11.3
225.50	0.0	0.049	23.6	23.6
226.00	0.0	0.087	41.9	41.9
226.50	0.0	0.135	65.3	65.3
227.00	0.0	0.190	92.2	92.2
227.50	0.0	0.253	122.6	122.6
228.00	0.0	0.324	156.9	156.9
228.50	0.0	0.406	196.4	196.4
229.00	0.0	0.501	242.6	242.6
229.50	0.0	0.612	296.1	296.1
230.00	0.0	0.738	357.3	357.3
230.50	0.0	0.877	424.7	424.7
231.00	0.0	1.025	496.2	496.2
231.50	0.0	1.182	571.9	571.9
232.00	0.0	1.347	651.9	651.9
232.50	0.0	1.520	735.7	735.7
233.00	0.0	1.699	822.4	822.4
233.50	0.0	1.885	912.1	912.1
234.00	0.0	2.076	1005.0	1005.0
234.50	0.0	2.275	1101.1	1101.1
235.00	0.0	2.481	1200.8	1200.8
235.50	0.0	2.695	1304.1	1304.1
236.00	0.0	2.916	1411.2	1411.2
236.50	0.0	3.144	1521.8	1521.8
237.00	0.0	3.380	1636.1	1636.1
237.50	30.4	3.624	1754.0	1784.4
238.00	88.0	3.875	1875.5	1963.5
238.50	165.2	4.133	2000.4	2165.6
239.00	260.0	4.397	2128.3	2388.3

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)
239.50	371.2	4.660

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + 0 (cfs)
2259.2	2630.4

Time increment (t) = 0.050 hrs.

Pond File: NHVAIB .PND
Inflow Hydrograph: NHVIA .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - 0 (cfs)	2S/t + 0 (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	224.00
0.050	5.40	5.4	5.4	5.4	0.00	224.61
0.100	10.80	16.2	21.6	21.6	0.00	225.42
0.150	16.20	27.0	48.6	48.6	0.00	226.14
0.200	21.60	37.8	86.4	86.4	0.00	226.89
0.250	27.00	48.6	135.0	135.0	0.00	227.68
0.300	32.40	59.4	194.4	194.4	0.00	228.48
0.350	36.87	69.3	263.7	263.7	0.00	229.20
0.400	39.40	76.3	340.0	340.0	0.00	229.86
0.450	42.09	81.6	421.6	421.6	0.00	230.48
0.500	44.70	86.8	508.4	508.4	0.00	231.08
0.550	47.34	92.0	600.4	600.4	0.00	231.68
0.600	49.90	97.3	697.7	697.7	0.00	232.27
0.650	52.62	102.6	800.3	800.3	0.00	232.87
0.700	62.44	115.1	915.4	915.4	0.00	233.52
0.750	75.85	138.3	1053.7	1053.7	0.00	234.25
0.800	89.26	165.1	1218.8	1218.8	0.00	235.09
0.850	102.67	191.9	1410.7	1410.7	0.00	236.00
0.900	116.08	218.8	1629.5	1629.5	0.00	236.97
0.950	129.49	245.6	1755.9	1875.1	59.56	237.75
1.000	142.90	272.4	1802.8	2028.3	112.76	238.16
1.050	132.22	275.1	1814.5	2077.9	131.71	238.28
1.100	121.54	253.8	1812.2	2068.3	128.02	238.26
1.150	110.86	232.4	1806.7	2044.6	118.99	238.20
1.200	100.18	211.0	1800.3	2017.7	108.70	238.13
1.250	89.50	189.7	1793.8	1990.0	98.11	238.07
1.300	78.82	168.3	1787.0	1962.1	87.54	238.00
1.350	70.90	149.7	1778.0	1936.7	79.39	237.93
1.400	68.50	139.4	1771.0	1917.4	73.16	237.87
1.450	66.10	134.6	1766.9	1905.6	69.39	237.84
1.500	63.70	129.8	1763.6	1896.7	66.50	237.81
1.550	61.30	125.0	1760.8	1888.6	63.93	237.79
1.600	58.90	120.2	1758.1	1881.0	61.47	237.77
1.650	56.50	115.4	1755.4	1873.5	59.04	237.75
1.700	54.00	110.5	1752.7	1865.9	56.60	237.73
1.750	51.45	105.5	1749.9	1858.1	54.11	237.71
1.800	48.90	100.4	1747.1	1850.2	51.58	237.68
1.850	46.36	95.3	1744.3	1842.3	49.04	237.66
1.900	43.84	90.2	1741.4	1834.5	46.51	237.64
1.950	41.32	85.2	1738.6	1826.6	43.98	237.62
2.000	38.80	80.1	1735.8	1818.8	41.46	237.60
2.050	37.18	76.0	1733.4	1811.8	39.23	237.58
2.100	35.56	72.7	1731.3	1806.1	37.39	237.56
2.150	33.94	69.5	1729.4	1800.8	35.69	237.55
2.200	32.30	66.2	1727.6	1795.7	34.04	237.53

POND-2 Version: 5.17 S/N:
EXECUTED: 05-31-1995 17:09:01

Pond File: NHVA1B .PND
Inflow Hydrograph: NHV1A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
2.250	30.65	63.0	1725.8	1790.5	32.39	237.52
2.300	29.00	59.7	1723.9	1785.4	30.74	237.50
2.350	27.60	56.6	1721.3	1700.5	29.62	237.49
2.400	26.70	54.3	1710.4	1775.6	28.61	237.47
2.450	25.80	52.5	1715.6	1770.9	27.64	237.45
2.500	24.90	50.7	1712.9	1766.3	26.70	237.44
2.550	24.03	48.9	1710.3	1761.8	25.78	237.42
2.600	23.16	47.2	1707.7	1757.5	24.89	237.41
2.650	22.29	45.5	1705.1	1753.1	24.00	237.39
2.700	21.70	44.1	1702.0	1749.2	23.19	237.38
2.750	21.45	43.2	1701.0	1746.1	22.55	237.37
2.800	21.12	42.6	1699.5	1743.5	22.03	237.36
2.850	20.80	41.9	1698.2	1741.4	21.59	237.36
2.900	20.50	41.3	1697.1	1739.5	21.21	237.35
2.950	20.20	40.7	1696.1	1737.8	20.85	237.34
3.000	19.90	40.1	1695.1	1736.2	20.52	237.34
3.050	16.90	36.0	1692.6	1731.9	19.65	237.32
3.100	13.90	30.8	1687.6	1723.4	17.91	237.29
3.150	10.90	24.8	1681.1	1712.4	15.65	237.26
3.200	7.92	18.8	1673.8	1699.9	13.09	237.22
3.250	4.95	12.9	1665.9	1686.6	10.36	237.17
3.300	1.90	6.9	1657.8	1672.8	7.53	237.12
3.350	0.00	2.0	1650.0	1659.7	4.85	237.08
3.400	0.00	0.0	1644.3	1650.0	2.86	237.05
3.450	0.00	0.0	1640.9	1644.3	1.69	237.03
3.500	0.00	0.0	1639.0	1640.9	1.00	237.02
3.550	0.00	0.0	1637.8	1639.0	0.59	237.01
3.600	0.00	0.0	1637.1	1637.8	0.35	237.01
3.650	0.00	0.0	1636.7	1637.1	0.20	237.00
3.700	0.00	0.0	1636.4	1636.7	0.12	237.00
3.750	0.00	0.0	1636.3	1636.4	0.07	237.00
3.800	0.00	0.0	1636.2	1636.3	0.04	237.00
3.850	0.00	0.0	1636.2	1636.2	0.02	237.00
3.900	0.00	0.0	1636.1	1636.2	0.01	237.00
3.950	0.00	0.0	1636.1	1636.1	0.01	237.00
4.000	0.00	0.0	1636.1	1636.1	0.01	237.00
4.050	0.00	0.0	1636.1	1636.1	0.00	237.00
4.100	0.00	0.0	1636.1	1636.1	0.00	237.00
4.150	0.00	0.0	1636.1	1636.1	0.00	237.00
4.200	0.00	0.0	1636.1	1636.1	0.00	237.00
4.250	0.00	0.0	1636.1	1636.1	0.00	237.00
4.300	0.00	0.0	1636.1	1636.1	0.00	237.00
4.350	0.00	0.0	1636.1	1636.1	0.00	237.00
4.400	0.00	0.0	1636.1	1636.1	0.00	237.00
4.450	0.00	0.0	1636.1	1636.1	0.00	237.00
4.500	0.00	0.0	1636.1	1636.1	0.00	237.00

POND-2 Version: 5.17 S/N:
EXECUTED: 05-31-1995 17:09:01

Pond File: NHVA1B .PND
Inflow Hydrograph: NHV1A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
4.550	0.00	0.0	1636.1	1636.1	0.00	237.00
4.600	0.00	0.0	1636.1	1636.1	0.00	237.00
4.650	0.00	0.0	1636.1	1636.1	0.00	237.00
4.700	0.00	0.0	1636.1	1636.1	0.00	237.00
4.750	0.00	0.0	1636.1	1636.1	0.00	237.00
4.800	0.00	0.0	1636.1	1636.1	0.00	237.00
4.850	0.00	0.0	1636.1	1636.1	0.00	237.00
4.900	0.00	0.0	1636.1	1636.1	0.00	237.00
4.950	0.00	0.0	1636.1	1636.1	0.00	237.00
5.000	0.00	0.0	1636.1	1636.1	0.00	237.00
5.050	0.00	0.0	1636.1	1636.1	0.00	237.00
5.100	0.00	0.0	1636.1	1636.1	0.00	237.00
5.150	0.00	0.0	1636.1	1636.1	0.00	237.00
5.200	0.00	0.0	1636.1	1636.1	0.00	237.00
5.250	0.00	0.0	1636.1	1636.1	0.00	237.00
5.300	0.00	0.0	1636.1	1636.1	0.00	237.00
5.350	0.00	0.0	1636.1	1636.1	0.00	237.00
5.400	0.00	0.0	1636.1	1636.1	0.00	237.00
5.450	0.00	0.0	1636.1	1636.1	0.00	237.00
5.500	0.00	0.0	1636.1	1636.1	0.00	237.00
5.550	0.00	0.0	1636.1	1636.1	0.00	237.00
5.600	0.00	0.0	1636.1	1636.1	0.00	237.00
5.650	0.00	0.0	1636.1	1636.1	0.00	237.00
5.700	0.00	0.0	1636.1	1636.1	0.00	237.00
5.750	0.00	0.0	1636.1	1636.1	0.00	237.00
5.800	0.00	0.0	1636.1	1636.1	0.00	237.00
5.850	0.00	0.0	1636.1	1636.1	0.00	237.00
5.900	0.00	0.0	1636.1	1636.1	0.00	237.00
5.950	0.00	0.0	1636.1	1636.1	0.00	237.00
6.000	0.00	0.0	1636.1	1636.1	0.00	237.00

****************** SUMMARY OF ROUTING COMPUTATIONS ******************

Pond File: NHVAIB .PND
Inflow Hydrograph: NHVIA .HYD
Outflow Hydrograph: OUT .HYD

Starting Pond W.S. Elevation = 224.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 142.90 cfs
Peak Outflow = 131.71 cfs
Peak Elevation = 230.20 ft

***** Summary of Approximate Peak Storage *****

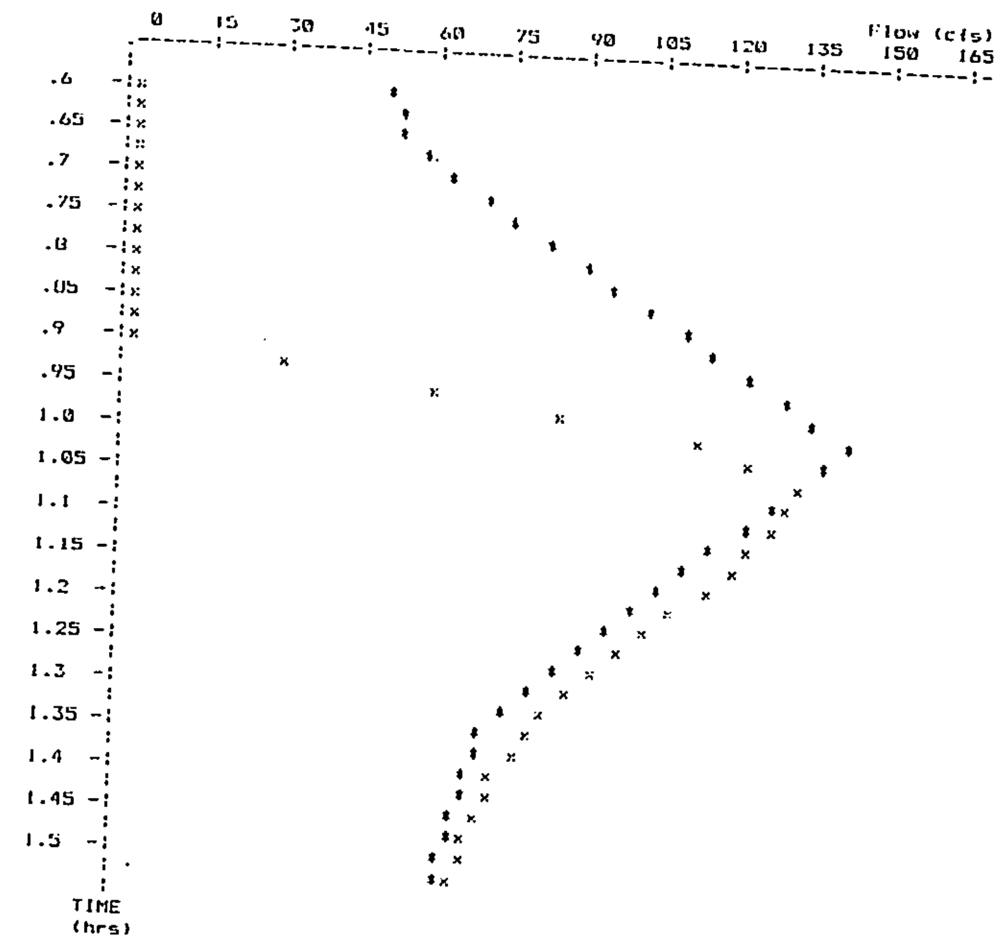
Initial Storage = 0.00 ac-ft
Peak Storage From Storm = 4.02 ac-ft

Total Storage in Pond = 4.02 ac-ft

Pond File: NHVAIB .PND
Inflow Hydrograph: NHVIA .HYD
Outflow Hydrograph: OUT .HYD

EXECUTED: 05-31-1995
17:09:01

Peak Inflow = 142.90 cfs
Peak Outflow = 131.71 cfs
Peak Elevation = 230.20 ft



* File: NHVIA .HYD Qmax = 142.9 cfs
x File: OUT .HYD Qmax = 131.7 cfs

POND-2 Version: 5.17
S/N:

NAPILIHAU VILLAGES - PHASE I
OFFSITE DETENTION BASIN A1A
PRE-DEVELOPMENT

CALCULATED 06-01-1995 11:10:17
DISK FILE: NHVA1APR.VOL

Planimeter scale: 1 inch = 208.7103 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
188.00	0.08	0.00	0.00	0.00	0.00
190.00	0.16	0.16	0.35	0.24	0.24
192.00	0.25	0.25	0.61	0.41	0.64
194.00	0.33	0.33	0.87	0.58	1.22
196.00	0.39	0.39	1.00	0.72	1.94

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Outlet Structure File: NHVA1APR.STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE I
OFFSITE DETENTION BASIN A1A
PRE-DEVELOPMENT
****

***** COMPOSITE OUTFLOW SUMMARY ****

Elevation (ft)	Q (cfs)	Contributing Structures
188.00	0.0	
188.50	0.0	
189.00	0.0	
189.50	0.0	
190.00	0.0	1
190.50	9.8	1
191.00	27.4	1
191.50	49.9	1
192.00	76.0	1
192.50	105.1	1
193.00	136.8	1
193.50	170.5	1
194.00	206.1	1
194.50	243.2	1
195.00	281.7	1
195.50	321.4	1
196.00	0.0	

Outlet Structure File: NHVA1APR.STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE I
OFFSITE DETENTION BASIN A1A
PRE-DEVELOPMENT

****

Outlet Structure File: NHVA1APR.STR
Planimeter Input File: NHVA1APR.VOL
Rating Table Output File: NHVA1APR.PND

Min. Elev.(ft) = 188 Max. Elev.(ft) = 196 Incr.(ft) = .5

Additional elevations (ft) to be included in table:
* *

****
SYSTEM CONNECTIVITY
****

Structure	No.	O Table		O Table
WEIR-VR	1		->	1

Outflow rating table summary was stored in file:
NHVA1APR.PND

Outlet Structure File: NHVA1APR.STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE I
OFFSITE DETENTION BASIN A1A
PRE-DEVELOPMENT

****

>>>>>> Structure No. 1 <<<<<<
(Input Data)

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)?	190
E2 elev.(ft)?	196
Weir coefficient?	2.8
Weir elev.(ft)?	190
Length (ft)?	10
Contracted/Suppressed (C/S)?	C

Outlet Structure File: NHVA1APR.STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****
NAPILIHAU VILLAGES - PHASE I
OFFSITE DETENTION BASIN A1A
PRE-DEVELOPMENT

****

Outflow Rating Table for Structure #1
WEIR-VR Weir - Vertical Rectangular

***** INLET-CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
188.00	0.0	E < Inv.El.= 190
188.50	0.0	E < Inv.El.= 190
189.00	0.0	E < Inv.El.= 190
189.50	0.0	E < Inv.El.= 190
190.00	0.0	H =0.0
190.50	9.8	H =.5
191.00	27.4	H =1.0
191.50	49.9	H =1.5
192.00	76.0	H =2.0
192.50	105.1	H =2.5
193.00	136.8	H =3.0
193.50	170.5	H =3.5
194.00	206.1	H =4.0
194.50	243.2	H =4.5
195.00	281.7	H =5.0
195.50	321.4	H =5.5
196.00	0.0	E = or > E2=196

C = 2.0 L (ft) = 10
H (ft) = Table elev. - Invert elev. (190 ft)
Q (cfs) = C * (L-.2H) * (H**1.5) -- Contracted Weir

POND-2 Version: 5.17 S/N:
EXECUTED: 05-31-1995 17:15:47

****
NAPILIHAU VILLAGES - PHASE I
OFFSITE DETENTION BASIN A1A
PRE-DEVELOPMENT
****

Inflow Hydrograph: NHV2A .HYD
Rating Table file: NHVA1APR.PND

----INITIAL CONDITIONS----
Elevation = 188.00 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA / INTERMEDIATE ROUTING COMPUTATIONS

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
188.00	0.0	0.000	0.0	0.0
188.50	0.0	0.044	21.4	21.4
189.00	0.0	0.098	47.3	47.3
189.50	0.0	0.161	78.0	78.0
190.00	0.0	0.235	113.9	113.9
190.50	9.8	0.321	155.1	164.9
191.00	27.4	0.416	201.5	228.9
191.50	49.9	0.523	253.2	303.1
192.00	76.0	0.642	310.8	386.8
192.50	105.1	0.772	373.6	478.7
193.00	136.8	0.911	441.0	577.8
193.50	170.5	1.061	513.3	683.8
194.00	206.1	1.220	590.6	796.7
194.50	243.2	1.389	672.2	915.4
195.00	281.7	1.565	757.4	1039.1
195.50	321.4	1.748	846.2	1167.6

Time increment (t) = 0.050 hrs.

POND-2 Version: 5.17 S/N:
EXECUTED: 05-31-1995 17:15:47

Pond File: NHVA1APR.PND
Inflow Hydrograph: NHV2A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	188.00
0.050	0.00	0.0	0.0	0.0	0.00	188.00
0.100	0.00	0.0	0.0	0.0	0.00	188.00
0.150	0.00	0.0	0.0	0.0	0.00	188.00
0.200	0.00	0.0	0.0	0.0	0.00	188.00
0.250	0.00	0.0	0.0	0.0	0.00	188.00
0.300	0.00	0.0	0.0	0.0	0.00	188.00
0.350	0.00	0.0	0.0	0.0	0.00	188.00
0.400	0.00	0.0	0.0	0.0	0.00	188.00
0.450	0.00	0.0	0.0	0.0	0.00	188.00
0.500	0.00	0.0	0.0	0.0	0.00	188.00
0.550	0.00	0.0	0.0	0.0	0.00	188.00
0.600	0.00	0.0	0.0	0.0	0.00	188.00
0.650	0.00	0.0	0.0	0.0	0.00	188.00
0.700	0.00	0.0	0.0	0.0	0.00	188.00
0.750	0.00	0.0	0.0	0.0	0.00	188.00
0.800	0.00	0.0	0.0	0.0	0.00	188.00
0.850	0.00	0.0	0.0	0.0	0.00	188.00
0.900	0.00	0.0	0.0	0.0	0.00	188.00
0.950	59.56	59.6	59.6	59.6	0.00	189.20
1.000	112.76	172.3	175.3	231.9	28.31	191.02
1.050	131.71	244.5	246.9	419.7	86.44	192.18
1.100	128.02	259.7	278.5	506.6	114.03	192.64
1.150	118.99	247.0	285.4	525.5	120.09	192.74
1.200	108.70	227.7	280.9	513.0	116.10	192.67
1.250	98.11	206.8	271.7	487.7	107.98	192.55
1.300	87.54	185.7	260.6	457.4	98.35	192.38
1.350	79.39	166.9	249.7	427.6	88.92	192.22
1.400	73.16	152.6	240.5	402.3	80.91	192.08
1.450	69.39	142.6	233.4	383.0	74.82	191.98
1.500	66.50	135.9	228.2	369.2	70.53	191.90
1.550	63.93	130.4	224.2	358.6	67.21	191.83
1.600	61.47	125.4	220.8	349.6	64.40	191.78
1.650	59.04	120.5	217.7	341.3	61.81	191.73
1.700	56.60	115.6	214.7	333.3	59.32	191.68
1.750	54.11	110.7	211.7	325.4	56.84	191.63
1.800	51.58	105.7	208.7	317.4	54.35	191.59
1.850	49.04	100.6	205.7	309.3	51.83	191.54
1.900	46.51	95.6	202.6	301.2	49.32	191.49
1.950	43.98	90.5	199.4	293.1	46.85	191.43
2.000	41.46	85.4	196.1	284.8	44.35	191.38
2.050	39.23	80.7	193.0	276.8	41.92	191.32
2.100	37.39	76.6	190.1	269.6	39.73	191.27
2.150	35.69	73.1	187.6	263.2	37.80	191.23
2.200	34.04	69.7	185.3	257.3	36.02	191.19

POND-2 Version: 5.17 S/N:
EXECUTED: 05-31-1995 17:15:47

Pond File: NHVA1APR.PND
Inflow Hydrograph: NHV2A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
2.250	32.39	66.4	183.1	251.7	34.32	191.15
2.300	30.74	63.1	180.9	246.2	32.65	191.12
2.350	29.62	60.4	179.0	241.3	31.15	191.08
2.400	28.61	58.2	177.3	237.2	29.92	191.06
2.450	27.64	56.3	175.9	233.6	28.83	191.03
2.500	26.70	54.3	174.6	230.3	27.83	191.01
2.550	25.70	52.5	173.3	227.1	26.91	190.99
2.600	24.89	50.7	171.9	223.9	26.04	190.96
2.650	24.00	48.9	170.4	220.7	25.16	190.94
2.700	23.19	47.2	169.0	217.6	24.30	190.91
2.750	22.55	45.7	167.7	214.7	23.51	190.89
2.800	22.03	44.6	166.6	212.3	22.84	190.87
2.850	21.59	43.6	165.7	210.2	22.27	190.85
2.900	21.21	42.8	164.9	208.5	21.79	190.84
2.950	20.85	42.1	164.2	207.0	21.37	190.83
3.000	20.52	41.4	163.6	205.6	20.99	190.82
3.050	19.65	40.2	162.0	203.8	20.49	190.80
3.100	17.91	37.6	161.3	200.4	19.55	190.78
3.150	15.65	33.6	158.8	194.8	18.02	190.73
3.200	13.09	28.7	155.5	187.5	16.01	190.68
3.250	10.36	23.5	151.6	178.9	13.65	190.61
3.300	7.55	17.9	147.4	169.5	11.06	190.54
3.350	4.85	12.4	142.2	159.8	8.81	190.45
3.400	2.86	7.7	136.1	149.9	6.90	190.35
3.450	1.69	4.6	130.4	140.6	5.12	190.26
3.500	1.00	2.7	125.7	133.1	3.67	190.19
3.550	0.59	1.6	122.2	127.3	2.57	190.13
3.600	0.35	0.9	119.6	123.1	1.76	190.09
3.650	0.20	0.6	117.8	120.1	1.19	190.06
3.700	0.12	0.3	116.5	118.1	0.79	190.04
3.750	0.07	0.2	115.6	116.7	0.53	190.03
3.800	0.04	0.1	115.0	115.7	0.34	190.02
3.850	0.02	0.1	114.7	115.1	0.22	190.01
3.900	0.01	0.0	114.4	114.7	0.14	190.01
3.950	0.01	0.0	114.2	114.4	0.09	190.00
4.000	0.01	0.0	114.1	114.3	0.06	190.00
4.050	0.00	0.0	114.1	114.1	0.04	190.00
4.100	0.00	0.0	114.0	114.1	0.02	190.00
4.150	0.00	0.0	114.0	114.0	0.01	190.00
4.200	0.00	0.0	114.0	114.0	0.01	190.00
4.250	0.00	0.0	114.0	114.0	0.01	190.00
4.300	0.00	0.0	114.0	114.0	0.00	190.00
4.350	0.00	0.0	114.0	114.0	0.00	190.00
4.400	0.00	0.0	113.9	114.0	0.00	190.00
4.450	0.00	0.0	113.9	113.9	0.00	190.00
4.500	0.00	0.0	113.9	113.9	0.00	190.00

Pond File: NHVA1APR.PND
Inflow Hydrograph: NHV2A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH — ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
4.550	0.00	0.0	113.9	113.9	0.00	190.00
4.600	0.00	0.0	113.9	113.9	0.00	190.00
4.650	0.00	0.0	113.9	113.9	0.00	190.00
4.700	0.00	0.0	113.9	113.9	0.00	190.00
4.750	0.00	0.0	113.9	113.9	0.00	190.00
4.800	0.00	0.0	113.9	113.9	0.00	190.00
4.850	0.00	0.0	113.9	113.9	0.00	190.00
4.900	0.00	0.0	113.9	113.9	0.00	190.00
4.950	0.00	0.0	113.9	113.9	0.00	190.00
5.000	0.00	0.0	113.9	113.9	0.00	190.00
5.050	0.00	0.0	113.9	113.9	0.00	190.00
5.100	0.00	0.0	113.9	113.9	0.00	190.00
5.150	0.00	0.0	113.9	113.9	0.00	190.00
5.200	0.00	0.0	113.9	113.9	0.00	190.00
5.250	0.00	0.0	113.9	113.9	0.00	190.00
5.300	0.00	0.0	113.9	113.9	0.00	190.00
5.350	0.00	0.0	113.9	113.9	0.00	190.00
5.400	0.00	0.0	113.9	113.9	0.00	190.00
5.450	0.00	0.0	113.9	113.9	0.00	190.00
5.500	0.00	0.0	113.9	113.9	0.00	190.00
5.550	0.00	0.0	113.9	113.9	0.00	190.00
5.600	0.00	0.0	113.9	113.9	0.00	190.00
5.650	0.00	0.0	113.9	113.9	0.00	190.00
5.700	0.00	0.0	113.9	113.9	0.00	190.00
5.750	0.00	0.0	113.9	113.9	0.00	190.00
5.800	0.00	0.0	113.9	113.9	0.00	190.00
5.850	0.00	0.0	113.9	113.9	0.00	190.00
5.900	0.00	0.0	113.9	113.9	0.00	190.00
5.950	0.00	0.0	113.9	113.9	0.00	190.00
6.000	0.00	0.0	113.9	113.9	0.00	190.00

****************** SUMMARY OF ROUTING COMPUTATIONS ******************

Pond File: NHVA1APR.PND
Inflow Hydrograph: NHV2A .HYD
Outflow Hydrograph: OUT .HYD

Starting Pond W.S. Elevation = 188.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 131.71 cfs
Peak Outflow = 120.09 cfs
Peak Elevation = 192.74 ft

***** Summary of Approximate Peak Storage *****

Initial Storage = 0.00 ac-ft
Peak Storage From Storm = 0.84 ac-ft

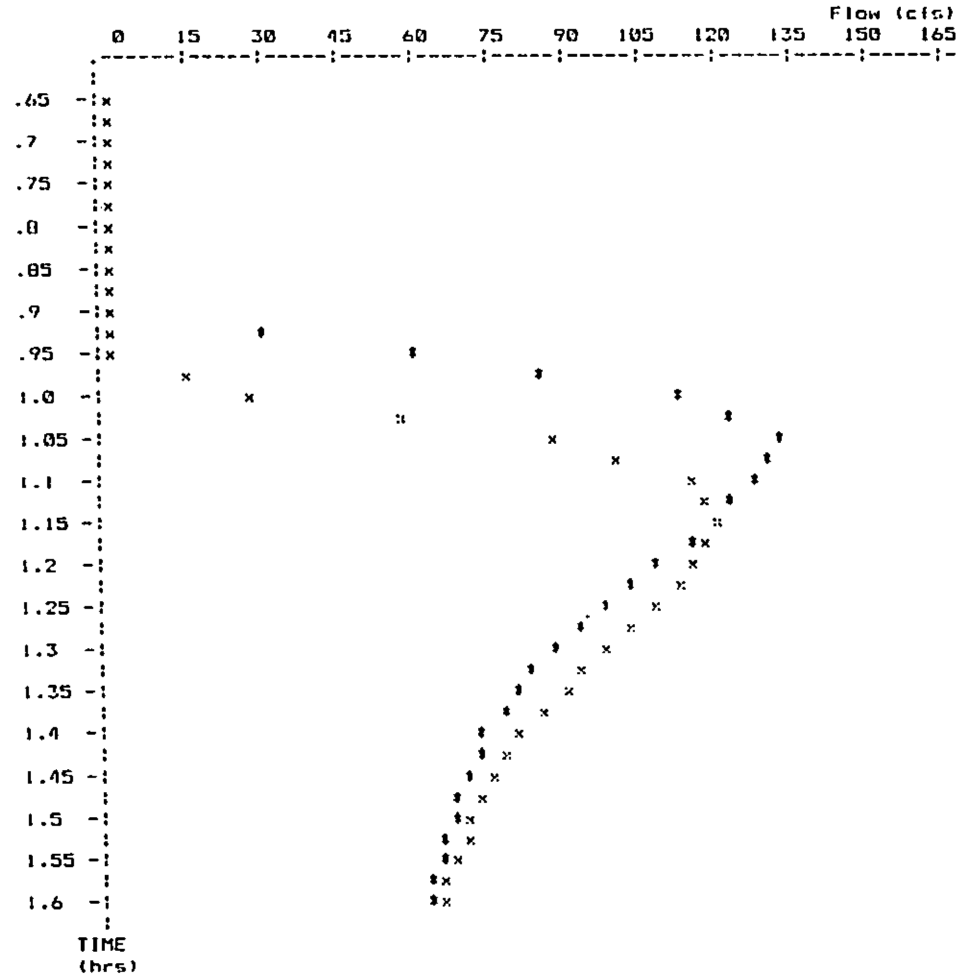
Total Storage in Pond = 0.84 ac-ft

POND-2 Version: 5.17 S/N:

Pond File: NHVA1APR.PND
Inflow Hydrograph: NHV2A .HYD
Outflow Hydrograph: OUT .HYD

EXECUTED: 05-31-1995
17:15:47

Peak Inflow = 131.71 cfs
Peak Outflow = 120.09 cfs
Peak Elevation = 192.74 ft



* File: NHV2A .HYD Qmax = 131.7 cfs
x File: OUT .HYD Qmax = 120.1 cfs

POND-2 Version: 5.17
S/N:

NAPILIHAU VILLAGES PROJECTS
DRAINAGE BASIN A-1-a
POST DEVELOPMENT

CALCULATED 06-01-1995 11:57:53
DISK FILE: NHV14 .VOL

Planimeter scale: 1 inch = 208.7103 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
189.00	0.00	0.00	0.00	0.00	0.00
190.00	0.22	0.22	0.24	0.08	0.08
192.00	0.56	0.56	1.14	0.76	0.84
194.00	0.69	0.69	1.88	1.25	2.09
196.00	0.82	0.82	2.26	1.51	3.60
198.00	0.96	0.96	2.66	1.77	5.37
200.00	1.05	1.05	3.02	2.01	7.39
202.00	1.14	1.14	3.30	2.20	9.58
204.00	1.24	1.24	3.57	2.38	11.96
206.00	1.33	1.33	3.85	2.57	14.53
208.00	1.43	1.43	4.14	2.76	17.28
210.00	1.54	1.54	4.45	2.97	20.25

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Outlet Structure File: NHV14 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****

NAPILIHAU VILLAGES - PHASE 1
BASIN A-1-a
100 YEAR STORM (UNIVERSAL RATIONAL HYDROGRAPH)
POST DEVELOPMENT

****

***** COMPOSITE OUTFLOW SUMMARY ****

Elevation (ft)	Q (cfs)	Contributing Structures
189.00	0.0	1
189.50	0.0	1
190.00	0.0	1
190.50	0.0	1
191.00	0.0	1
191.50	2.5	1
192.00	5.1	1
192.50	6.2	1
193.00	7.3	1
193.50	8.1	1
194.00	8.9	1
194.50	9.6	1
195.00	10.3	1
195.50	10.8	1
196.00	11.3	1
196.50	11.6	1
197.00	11.9	1
197.50	12.1	1
198.00	12.4	1
198.50	12.6	1
199.00	12.8	1
199.50	13.0	1
200.00	13.2	1
200.50	13.4	1
201.00	13.7	1
201.50	13.9	1
202.00	14.0	1
202.50	14.2	1
203.00	14.4	1
203.50	14.6	1
204.00	14.8	1
204.50	14.9	1
205.00	0.0	

Outlet Structure File: NHV14 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****

NAPILIHAU VILLAGES - PHASE I
BASIN A-1-a
100 YEAR STORM (UNIVERSAL RATIONAL HYDROGRAPH)
POST DEVELOPMENT

****

Outlet Structure File: NHV14 .STR
Planimeter Input File: NHV14 .VOL
Rating Table Output File: NHV14 .PND

Min. Elev.(ft) = 189 Max. Elev.(ft) = 205 Incr.(ft) = .5

Additional elevations (ft) to be included in table:
* *

****

SYSTEM CONNECTIVITY

****

Structure	No.	Q Table	Q Table
TABLE	1	->	1

Outflow rating table summary was stored in file:
NHV14 .PND

Outlet Structure File: NUV14 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****

NAPILIHAU VILLAGES - PHASE I
BASIN A-1-a
100 YEAR STORM (UNIVERSAL RATIONAL HYDROGRAPH)
POST DEVELOPMENT

****

>>>> Structure No. 1 <<<<
(Input Data)

TABLE
Input your own rating table.
E1 (ft) =189 E2 (ft) =205

Constant (ft) added to each elevation was: 0

Elev. (ft)	Q (cfs)
189	0
191	0
192	5.1
193	7.3
194	8.9
195	10.3
196	11.3
197	11.9
198	12.4
199	12.8
200	13.2
201	13.7
202	14
203	14.4
204	14.8
205	15.1

Outlet Structure File: NUV14 .STR

POND-2 Version: 5.17 S/N:
Date Executed: Time Executed:

****

NAPILIHAU VILLAGES - PHASE I
BASIN A-1-a
100 YEAR STORM (UNIVERSAL RATIONAL HYDROGRAPH)
POST DEVELOPMENT

****

Outflow Rating Table for Structure #1
TABLE Input your own rating table.

Elevation (ft)	Q (cfs)	Computation Messages
189.00	0.0	
189.50	0.0	Interpolated from input table
190.00	0.0	Interpolated from input table
190.50	0.0	Interpolated from input table
191.00	0.0	
191.50	2.5	Interpolated from input table
192.00	5.1	
192.50	6.2	Interpolated from input table
193.00	7.3	
193.50	8.1	Interpolated from input table
194.00	8.9	
194.50	9.6	Interpolated from input table
195.00	10.3	
195.50	10.8	Interpolated from input table
196.00	11.3	
196.50	11.6	Interpolated from input table
197.00	11.9	
197.50	12.1	Interpolated from input table
198.00	12.4	
198.50	12.6	Interpolated from input table
199.00	12.8	
199.50	13.0	Interpolated from input table
200.00	13.2	
200.50	13.4	Interpolated from input table
201.00	13.7	
201.50	13.9	Interpolated from input table
202.00	14.0	
202.50	14.2	Interpolated from input table
203.00	14.4	
203.50	14.6	Interpolated from input table
204.00	14.8	
204.50	14.9	Interpolated from input table
205.00	0.0	E = or > E2=205

POND-2 Version: 5.17 S/N:
EXECUTED: 06-01-1995 11:49:05


```
**********************************
*                                *
*  NAPILIHAU VILLAGES - PHASE I  *
*  OFFSITE DETENTION BASIN A-1-a *
*        POST DEVELOPMENT        *
*                                *
**********************************
```

Inflow Hydrograph: NHV2A .HYD
Rating Table file: NHV14 .PND

----INITIAL CONDITIONS----
Elevation = 189.00 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
189.00	0.0	0.000	0.0	0.0
189.50	0.0	0.012	5.8	5.8
190.00	0.0	0.079	38.2	38.2
190.50	0.0	0.207	100.1	100.1
191.00	0.0	0.372	180.2	180.2
191.50	2.5	0.581	201.1	203.6
192.00	5.1	0.837	405.0	410.1
192.50	6.2	1.126	545.0	551.2
193.00	7.3	1.431	692.7	700.0
193.50	8.1	1.753	848.2	856.3
194.00	8.9	2.091	1011.8	1020.7
194.50	9.6	2.445	1183.2	1192.8
195.00	10.3	2.814	1361.9	1372.2
195.50	10.8	3.199	1548.3	1559.1
196.00	11.3	3.600	1742.3	1753.6
196.50	11.6	4.017	1944.4	1956.0
197.00	11.9	4.452	2154.7	2166.6
197.50	12.1	4.904	2373.5	2385.6
198.00	12.4	5.374	2601.0	2613.4
198.50	12.6	5.859	2835.7	2848.3
199.00	12.8	6.356	3076.1	3088.9
199.50	13.0	6.864	3322.3	3335.3
200.00	13.2	7.385	3574.4	3587.6
200.50	13.4	7.910	3832.2	3845.6
201.00	13.7	8.461	4095.3	4109.0
201.50	13.9	9.016	4363.9	4377.8
202.00	14.0	9.583	4638.0	4652.0
202.50	14.2	10.160	4917.6	4931.8
203.00	14.4	10.749	5202.7	5217.1
203.50	14.6	11.350	5493.3	5507.9
204.00	14.8	11.962	5789.6	5804.4

EXECUTED 06-01-1995 11:49:05
DISK FILES: NHV2A .HYD : NHV14 .PND

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
204.50	15.0	12.586	6091.5	6106.5

Time increment (t) = 0.050 hrs.

POND-2 Version: 5.17 S/N:
EXECUTED: 06-01-1995 11:49:05

Pond File: NHV14 .PND
Inflow Hydrograph: NHV2A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH — ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	189.00
0.050	0.00	0.0	0.0	0.0	0.00	189.00
0.100	0.00	0.0	0.0	0.0	0.00	189.00
0.150	0.00	0.0	0.0	0.0	0.00	189.00
0.200	0.00	0.0	0.0	0.0	0.00	189.00
0.250	0.00	0.0	0.0	0.0	0.00	189.00
0.300	0.00	0.0	0.0	0.0	0.00	189.00
0.350	0.00	0.0	0.0	0.0	0.00	189.00
0.400	0.00	0.0	0.0	0.0	0.00	189.00
0.450	0.00	0.0	0.0	0.0	0.00	189.00
0.500	0.00	0.0	0.0	0.0	0.00	189.00
0.550	0.00	0.0	0.0	0.0	0.00	189.00
0.600	0.00	0.0	0.0	0.0	0.00	189.00
0.650	0.00	0.0	0.0	0.0	0.00	189.00
0.700	0.00	0.0	0.0	0.0	0.00	189.00
0.750	0.00	0.0	0.0	0.0	0.00	189.00
0.800	0.00	0.0	0.0	0.0	0.00	189.00
0.850	0.00	0.0	0.0	0.0	0.00	189.00
0.900	0.00	0.0	0.0	0.0	0.00	189.00
0.950	59.56	59.6	59.6	59.6	0.00	190.17
1.000	112.76	172.3	229.4	231.9	1.25	191.25
1.050	131.71	244.5	462.7	473.9	5.60	192.22
1.100	128.02	259.7	707.6	722.4	7.41	193.07
1.150	118.99	247.0	937.4	954.6	8.50	193.80
1.200	108.70	227.7	1146.1	1165.1	9.49	194.42
1.250	98.11	206.8	1332.5	1352.9	10.22	194.95
1.300	87.54	185.7	1496.8	1518.1	10.69	195.39
1.350	79.39	166.9	1641.5	1663.7	11.07	195.77
1.400	73.16	152.6	1771.4	1794.1	11.36	196.10
1.450	69.39	142.6	1890.9	1913.9	11.54	196.40
1.500	66.50	135.9	2003.3	2026.7	11.70	196.67
1.550	63.93	130.4	2110.1	2133.8	11.85	196.92
1.600	61.47	125.4	2211.5	2235.5	11.96	197.16
1.650	59.04	120.5	2307.9	2332.0	12.05	197.38
1.700	56.60	115.6	2399.3	2423.6	12.15	197.58
1.750	54.11	110.7	2485.5	2510.0	12.26	197.77
1.800	51.58	105.7	2566.4	2591.2	12.37	197.95
1.850	49.04	100.6	2642.1	2667.0	12.45	198.11
1.900	46.51	95.6	2712.7	2737.7	12.51	198.26
1.950	43.98	90.5	2778.1	2803.2	12.56	198.40
2.000	41.46	85.4	2838.3	2863.5	12.61	198.53
2.050	39.23	80.7	2893.6	2919.0	12.66	198.65
2.100	37.39	76.6	2944.9	2970.3	12.70	198.75
2.150	35.69	73.1	2992.5	3017.9	12.74	198.85
2.200	34.04	69.7	3036.6	3062.2	12.78	198.94

POND-2 Version: 5.17 S/N:
EXECUTED: 06-01-1995 11:49:05

Pond File: NHV14 .PND
Inflow Hydrograph: NHV2A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH — ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
2.250	32.39	66.4	3077.4	3103.1	12.81	199.03
2.300	30.74	63.1	3114.9	3140.6	12.84	199.10
2.350	29.62	60.4	3149.5	3175.2	12.87	199.18
2.400	28.61	58.2	3181.9	3207.7	12.90	199.24
2.450	27.64	56.3	3212.3	3238.2	12.92	199.30
2.500	26.70	54.3	3240.8	3266.7	12.94	199.36
2.550	25.78	52.5	3267.3	3293.3	12.97	199.41
2.600	24.89	50.7	3292.0	3318.0	12.99	199.46
2.650	24.00	48.9	3314.9	3340.9	13.00	199.51
2.700	23.19	47.2	3336.1	3362.1	13.02	199.55
2.750	22.55	45.7	3355.7	3381.8	13.04	199.59
2.800	22.03	44.6	3374.2	3400.3	13.05	199.63
2.850	21.59	43.6	3391.7	3417.8	13.07	199.66
2.900	21.21	42.8	3408.3	3434.5	13.08	199.70
2.950	20.85	42.1	3424.2	3450.4	13.09	199.73
3.000	20.52	41.4	3439.4	3465.6	13.10	199.76
3.050	19.65	40.2	3453.3	3479.6	13.11	199.79
3.100	17.91	37.6	3464.6	3490.9	13.12	199.81
3.150	15.65	33.6	3471.9	3498.2	13.13	199.82
3.200	13.09	28.7	3474.4	3500.7	13.13	199.83
3.250	10.36	23.5	3471.6	3497.9	13.13	199.82
3.300	7.53	17.9	3463.3	3489.5	13.12	199.81
3.350	4.85	12.4	3449.4	3475.6	13.11	199.78
3.400	2.86	7.7	3430.9	3457.1	13.10	199.74
3.450	1.69	4.6	3409.3	3435.5	13.08	199.70
3.500	1.00	2.7	3385.9	3412.0	13.06	199.65
3.550	0.59	1.6	3361.4	3387.5	13.04	199.60
3.600	0.35	0.9	3336.3	3362.3	13.02	199.55
3.650	0.20	0.6	3310.8	3336.9	13.00	199.50
3.700	0.12	0.3	3285.2	3311.2	12.98	199.45
3.750	0.07	0.2	3259.5	3285.4	12.96	199.40
3.800	0.04	0.1	3233.7	3259.6	12.94	199.35
3.850	0.02	0.1	3207.9	3233.8	12.92	199.29
3.900	0.01	0.0	3182.2	3208.0	12.90	199.24
3.950	0.01	0.0	3156.4	3182.2	12.88	199.19
4.000	0.01	0.0	3130.8	3156.5	12.85	199.14
4.050	0.00	0.0	3105.1	3130.8	12.83	199.08
4.100	0.00	0.0	3079.5	3105.1	12.81	199.03
4.150	0.00	0.0	3053.9	3079.5	12.79	198.98
4.200	0.00	0.0	3028.3	3053.9	12.77	198.93
4.250	0.00	0.0	3002.8	3028.3	12.75	198.87
4.300	0.00	0.0	2977.4	3002.8	12.73	198.82
4.350	0.00	0.0	2952.0	2977.4	12.71	198.77
4.400	0.00	0.0	2926.6	2952.0	12.69	198.72
4.450	0.00	0.0	2901.3	2926.6	12.67	198.66
4.500	0.00	0.0	2876.0	2901.3	12.64	198.61

POND-2 Version: 5.17 S/N:
EXECUTED: 06-01-1995 11:49:05

Pond File: NHV14 .PND
Inflow Hydrograph: NHV2A .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
4.550	0.00	0.0	2050.7	2076.0	12.62	198.56
4.600	0.00	0.0	2025.5	2050.7	12.60	198.51
4.650	0.00	0.0	2000.4	2025.5	12.58	198.45
4.700	0.00	0.0	2775.2	2800.4	12.56	198.40
4.750	0.00	0.0	2750.2	2775.2	12.54	198.34
4.800	0.00	0.0	2725.1	2750.2	12.52	198.29
4.850	0.00	0.0	2700.2	2725.1	12.50	198.24
4.900	0.00	0.0	2675.2	2700.2	12.47	198.18
4.950	0.00	0.0	2650.3	2675.2	12.45	198.13
5.000	0.00	0.0	2625.4	2650.3	12.43	198.08
5.050	0.00	0.0	2600.6	2625.4	12.41	198.03
5.100	0.00	0.0	2575.8	2600.6	12.38	197.97
5.150	0.00	0.0	2551.1	2575.8	12.35	197.92
5.200	0.00	0.0	2526.5	2551.1	12.32	197.86
5.250	0.00	0.0	2501.9	2526.5	12.29	197.81
5.300	0.00	0.0	2477.4	2501.9	12.25	197.76
5.350	0.00	0.0	2453.0	2477.4	12.22	197.70
5.400	0.00	0.0	2420.6	2453.0	12.19	197.65
5.450	0.00	0.0	2404.3	2420.6	12.16	197.59
5.500	0.00	0.0	2380.1	2404.3	12.12	197.54
5.550	0.00	0.0	2355.9	2380.1	12.09	197.49
5.600	0.00	0.0	2331.7	2355.9	12.07	197.43
5.650	0.00	0.0	2307.6	2331.7	12.05	197.38
5.700	0.00	0.0	2283.6	2307.6	12.03	197.32
5.750	0.00	0.0	2259.5	2283.6	12.01	197.27
5.800	0.00	0.0	2235.6	2259.5	11.98	197.21
5.850	0.00	0.0	2211.6	2235.6	11.96	197.16
5.900	0.00	0.0	2187.8	2211.6	11.94	197.10
5.950	0.00	0.0	2163.9	2187.8	11.92	197.05
6.000	0.00	0.0	2140.1	2163.9	11.90	196.99

POND-2 Version: 5.17 S/N:
EXECUTED: 06-01-1995 11:49:05

****************** SUMMARY OF ROUTING COMPUTATIONS ******************

Pond File: NHV14 .PND
Inflow Hydrograph: NHV2A .HYD
Outflow Hydrograph: OUT .HYD

Starting Pond W.S. Elevation = 109.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 131.71 cfs
Peak Outflow = 13.13 cfs
Peak Elevation = 199.83 ft

***** Summary of Approximate Peak Storage *****

Initial Storage = 0.00 ac-ft
Peak Storage From Storm = 7.21 ac-ft

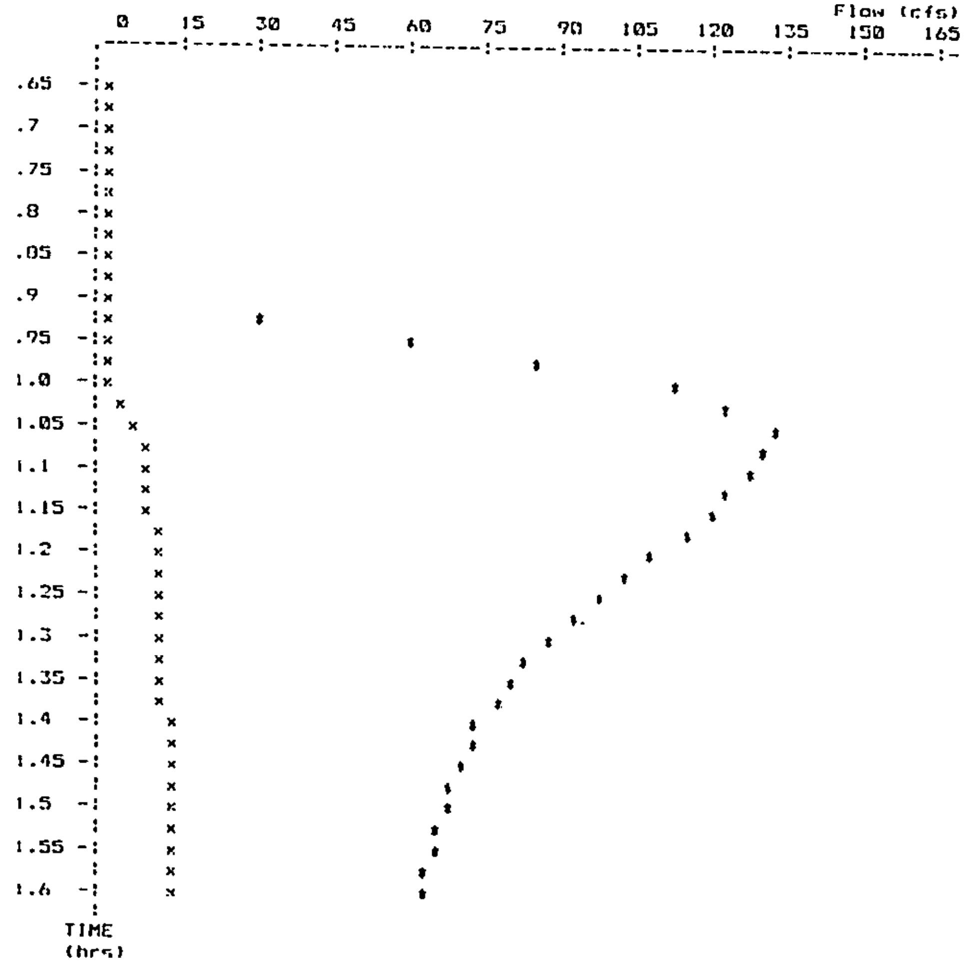
Total Storage in Pond = 7.21 ac-ft

POND-2 Version: 5.17 S/N:

Pond File: NHV14 .PND
Inflow Hydrograph: NHV2A .HYD
Outflow Hydrograph: OUT .HYD

Peak Inflow = 131.71 cfs
Peak Outflow = 13.13 cfs
Peak Elevation = 197.03 ft

EXECUTED: 06-01-1995
11:49:05



* File: NHV2A .HYD Qmax = 131.7 cfs
x File: OUT .HYD Qmax = 13.1 cfs

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS AND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793
TEL: (808) 242-4403 FAX: (808) 244-4446

JOB NAPILIHAU VILLAGES - PHASE I
CALCULATED BY LSN DATE 3/29/95
CHECKED BY RHA DATE 3/29/95

Objective: Determine if temporary onsite retention basin has adequate storage capacity to hold design storm

Onsite Retention Basin:

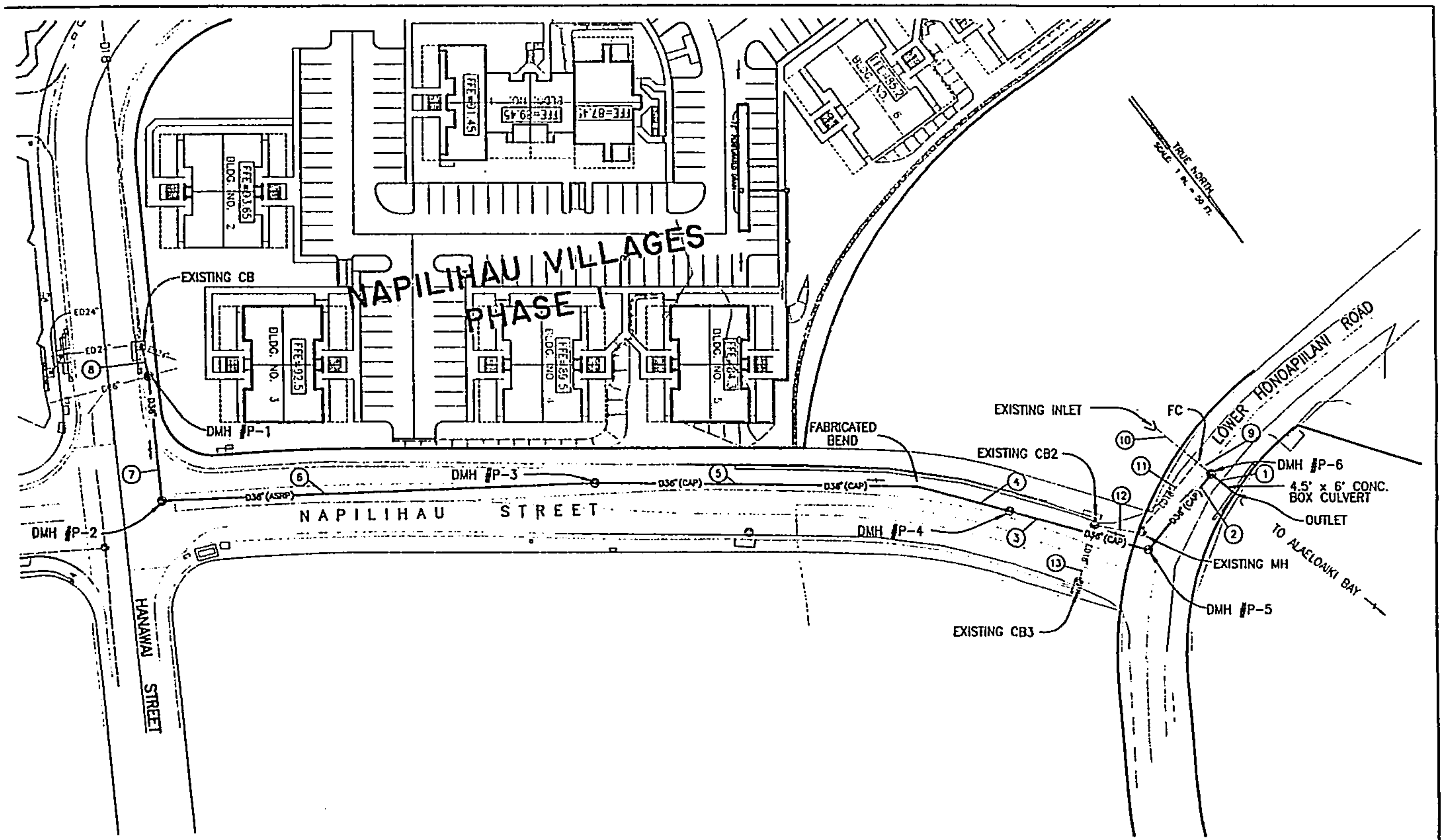
Storage volume w/ 2' freeboard = 17,200 C.F

Design storm (50 year - 1 hour):

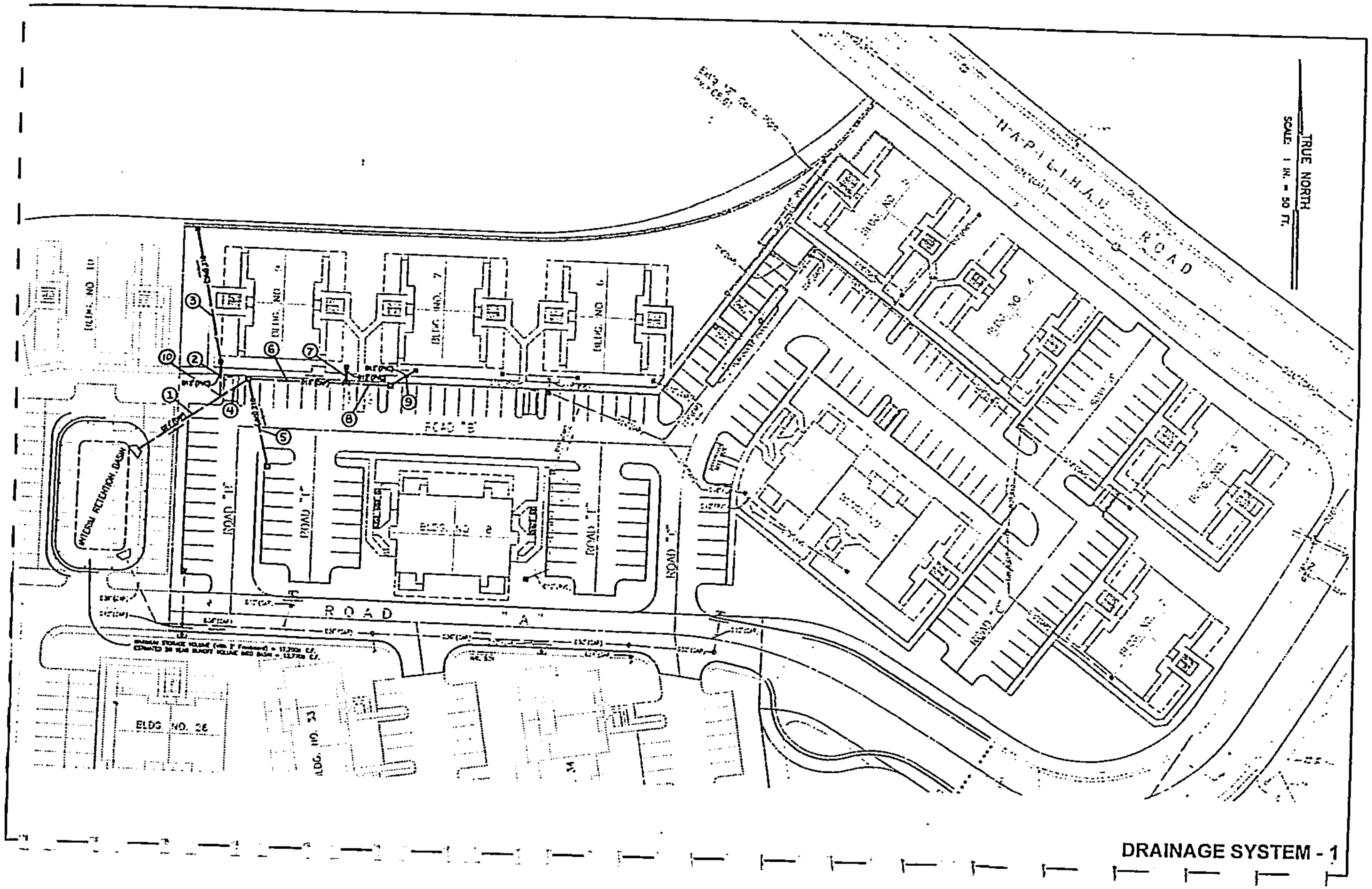
Required storage volume = 12,770 C.F.

∴ 12,770 C.F. < 17,200 C.F, therefore the temporary onsite retention basin has adequate capacity to store the design storm.

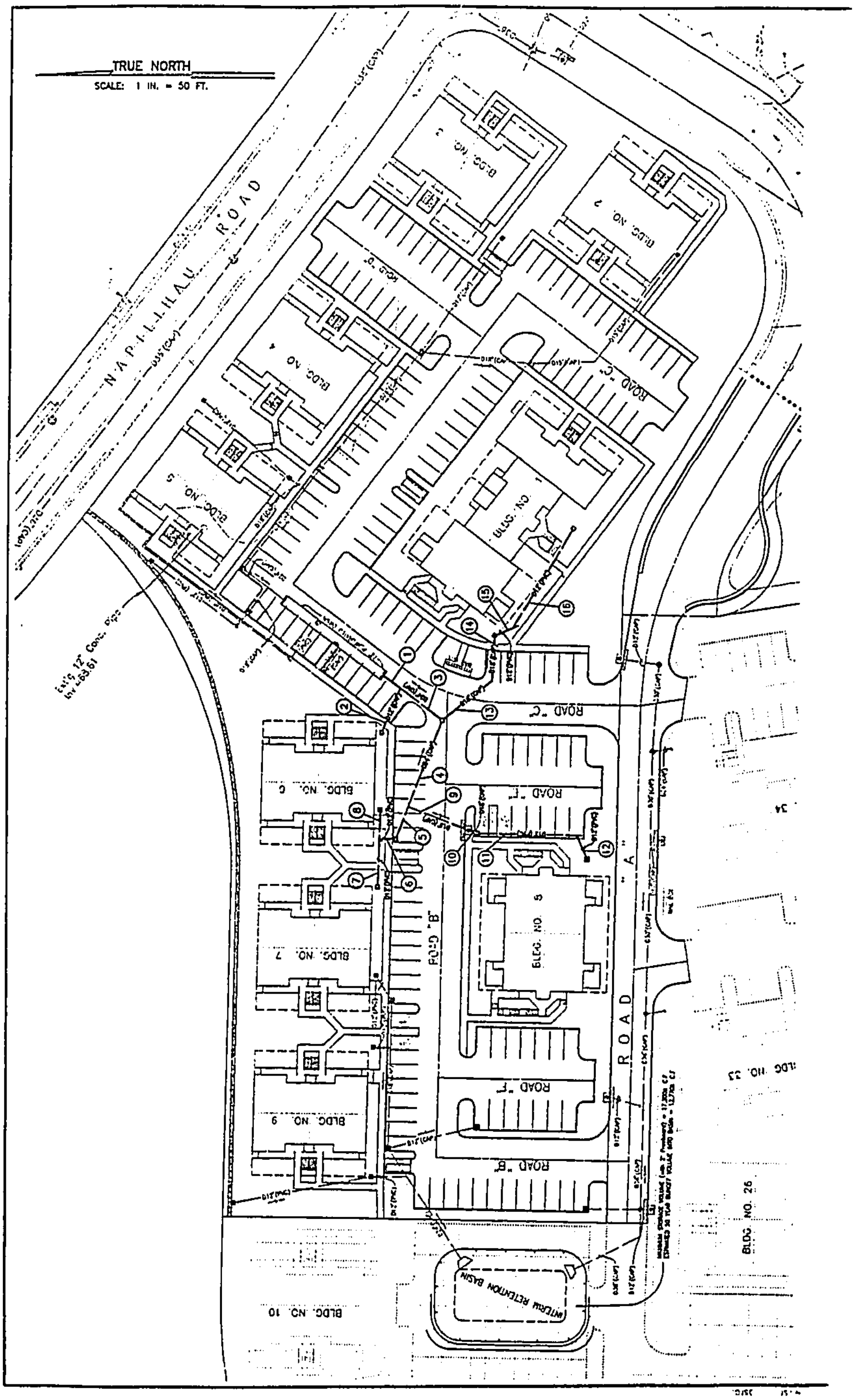
SHEET ____ OF ____



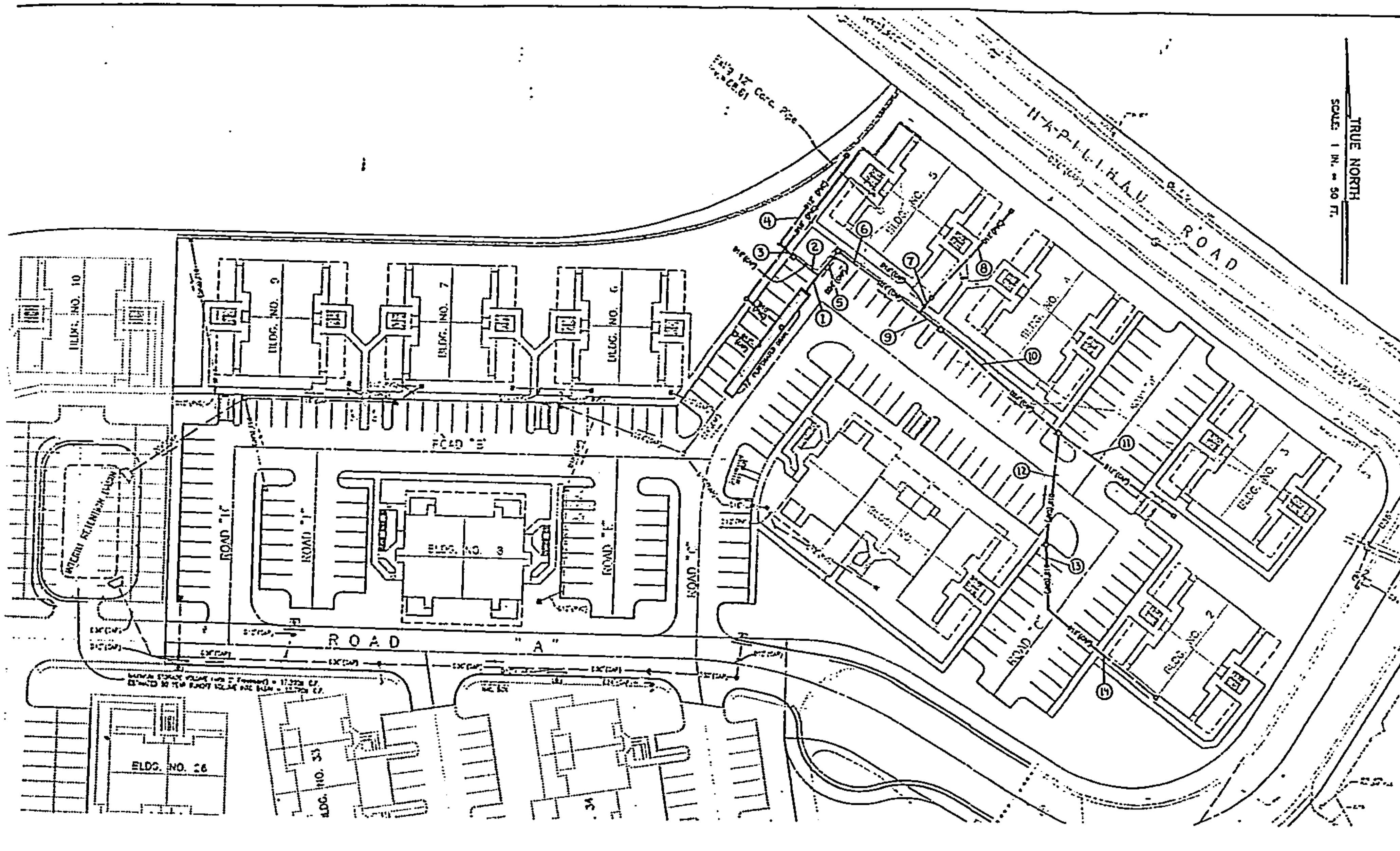
DRAINLINE ALONG



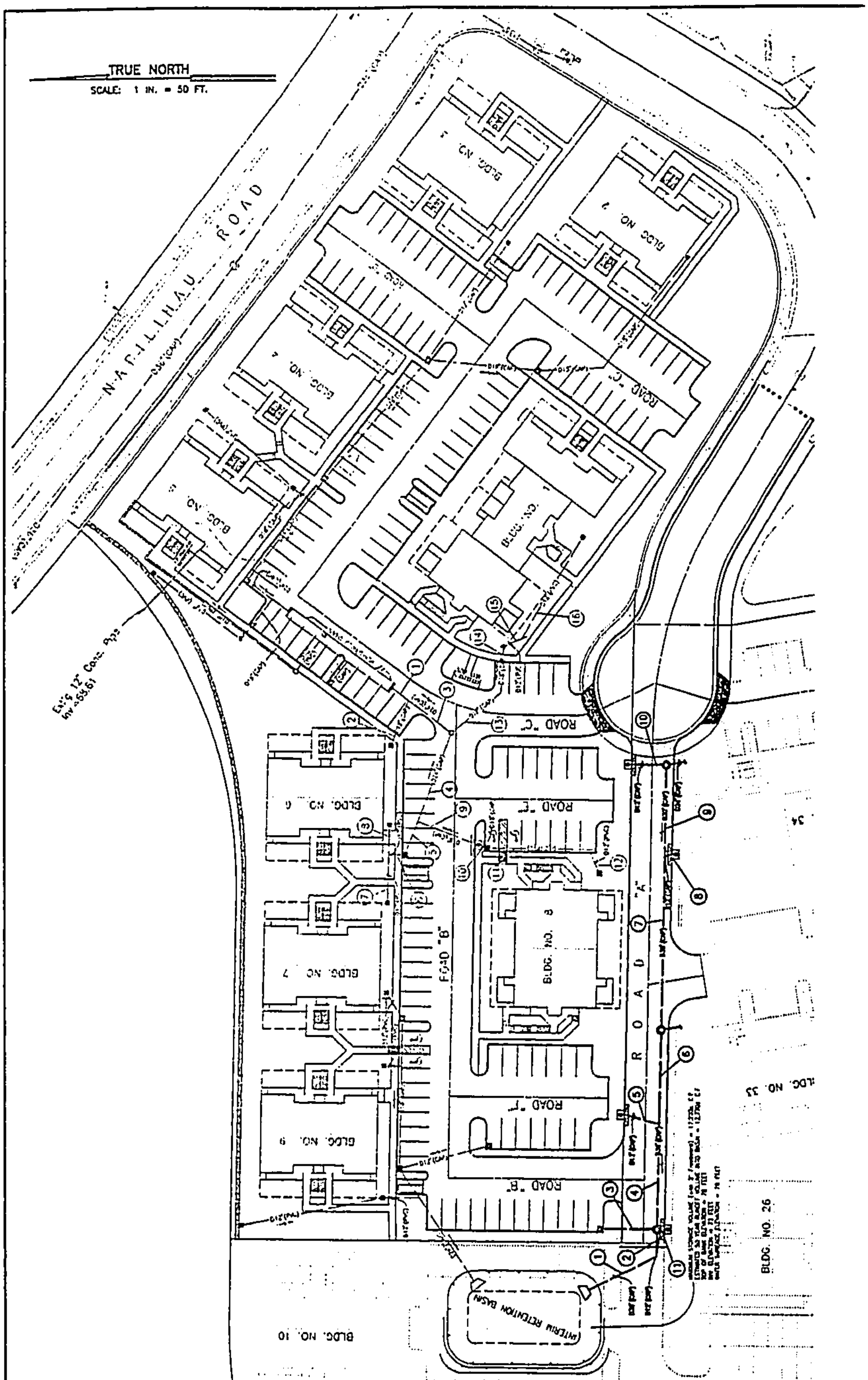
DRAINAGE SYSTEM - 1



TRUE NORTH
SCALE: 1 IN. = 50 FT.
NAPILIHAU ROAD
ROAD "A"
ROAD "B"
ROAD "C"
ROAD "F"
BLDG. NO. 6
BLDG. NO. 7
BLDG. NO. 8
BLDG. NO. 9
BLDG. NO. 10
BLDG. NO. 26
INTERIM RETENTION BASIN



DRAINAGE SYSTEM - 3


TRUE NORTH
SCALE: 1 IN. = 50 FT.
ROAD
BLDG. NO. 6
BLDG. NO. 7
BLDG. NO. 8
BLDG. NO. 9
BLDG. NO. 10
BLDG. NO. 26
ROAD "B"
ROAD "C"
ROAD "E"
ROAD "F"
ROAD "A"
INTERIM RETENTION BASIN

HYDRAULIC REPORT FOR

NAPILIHAU VILLAGES PH-1

DRAINAGE SYSTEM 1

TO RETENTION BASIN

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
Rainfall file: SAMPLE

Run Date: 07-12-1995
File: b:SRA1.ST3

LINE 1 / Q = 0.99 / HT = 24 / WID = 24 / N = .017 / L = 58.14 / JLC = .3

outlet/fabcon / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	72.50	3.02	72.25	4.33	72.79	15.92	5.75	0.23
UPSTRM	74.64	3.02	74.39	4.33	74.93	15.92	3.97	0.23

Drainage area (ac) =	0.00	Slope of invert (%) =	3.6800
Runoff coefficient =	0.00	Slope energy grade line (%) =	3.6800
Time of conc (min) =	0.69	Critical depth (in) =	4.23
Inlet time (min) =	0.00	Natural ground elev. (ft) =	80.36
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	33.18
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

Note: Normal depth assumed

LINE 2 / Q = 0.67 / HT = 12 / WID = 12 / N = .013 / L = 21.02 / JLC = 1.3

TRANS/GICB#C1 / DNLN = 10

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	74.82	2.51	74.61	5.62	75.31	2.76	N/A	0.12
UPSTRM	75.73	2.51	75.52	5.62	76.22	2.76	4.56	0.12

Drainage area (ac) =	0.00	Slope of invert (%) =	4.3292
Runoff coefficient =	0.00	Slope energy grade line (%) =	4.3292
Time of conc (min) =	0.45	Critical depth (in) =	4.16
Inlet time (min) =	0.00	Natural ground elev. (ft) =	81.08
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.10
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	7.41
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

Note: Normal depth assumed

F8 * V.71

LINE 3 / Q = 0.57 / HT = 12 / WID = 12 / N = .013 / L = 81.75 / JLC = 1

GICB#C1/GICB#C2 / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	76.37	10.16	75.52	0.80	76.38	11.04	4.56	0.71
UPSTRM	76.77	3.84	76.34	2.63	76.87	11.20	2	0.22

Drainage area (ac) =	0.00	Slope of invert (%) =	1.0031
Runoff coefficient =	0.00	Slope energy grade line (%) =	0.6072
Time of conc (min) =	0.00	Critical depth (in) =	3.84
Inlet time (min) =	0.00	Natural ground elev. (ft) =	79.34
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.57
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	3.57
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

FB = 2.57

LINE 4 / Q = 0.99 / HT = 24 / WID = 24 / N = .017 / L = 20.16 / JLC = 1.3

FABCON/GICB#B1 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	74.64	3.02	74.39	4.33	74.93	15.92	3.97	0.23
UPSTRM	75.38	3.02	75.13	4.33	75.67	15.92	3.97	0.23

Drainage area (ac) =	0.00	Slope of invert (%) =	3.6706
Runoff coefficient =	0.00	Slope energy grade line (%) =	3.6706
Time of conc (min) =	0.58	Critical depth (in) =	4.23
Inlet time (min) =	0.00	Natural ground elev. (ft) =	81.10
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.23
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	33.14
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

Note: Normal depth assumed

FB = 5.34

LINE 5 / Q = 0.32 / HT = 12 / WID = 12 / N = .01 / L = 53.72 / JLC = 1

GICB#B1/GICB#D1 / DNLN = 4

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	75.76	7.56	75.13	0.61	75.77	9.52	4.97	0.52
UPSTRM	75.99	2.88	75.47	2.21	76.06	10.25	4.38	0.14

Drainage area (ac) =	0.00	Slope of invert (%) =	1.0052
Runoff coefficient =	0.00	Slope energy grade line (%) =	0.5504
Time of conc (min) =	0.00	Critical depth (in) =	2.88
Inlet time (min) =	0.00	Natural ground elev. (ft) =	81.56
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.32
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	4.64
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

FC = 5.57

LINE 6 / Q = 0.44 / HT = 18 / WID = 18 / N = .014 / L = 59 / JLC = .8

GICB#B1/90dTEE / DNLN = 4

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	75.76	7.56	75.13	0.62	75.77	11.66	4.47	0.70
UPSTRM	76.50	3.04	76.25	2.23	76.58	13.48	N/A	0.20

Drainage area (ac) =	0.00	Slope of invert (%) =	1.8983
Runoff coefficient =	0.00	Slope energy grade line (%) =	1.3805
Time of conc (min) =	0.25	Critical depth (in) =	3.04
Inlet time (min) =	0.00	Natural ground elev. (ft) =	0.00
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	13.43
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

LINE 7 / Q = 0.18 / HT = 12 / WID = 12 / N = .013 / L = 10 / JLC = 1

90dTEE/GICB#B2 / DNLN = 6

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	76.57	3.78	76.25	0.85	76.58	6.74	N/A	0.21
UPSTRM	78.71	2.16	78.48	1.87	78.77	9.22	2	0.10

Drainage area (ac)	= 0.00	Slope of invert (%)	=22.3000
Runoff coefficient	= 0.00	Slope energy grade line (%)	=21.9275
Time of conc (min)	= 0.00	Critical depth (in)	= 2.16
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 81.48
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.00	Additional Q (cfs)	= 0.18
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 16.02
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

FB = 2.77

LINE 8 / Q = 0.26 / HT = 18 / WID = 18 / N = .014 / L = 27.5 / JLC = 1.3

90dTEE/GICB#B3 / DNLN = 6

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	76.57	3.78	76.25	0.96	76.58	8.25	N/A	0.27
UPSTRM	76.96	2.33	76.77	1.93	77.02	12.10	3.88	0.13

Drainage area (ac)	= 0.00	Slope of invert (%)	= 1.8909
Runoff coefficient	= 0.00	Slope energy grade line (%)	= 1.6112
Time of conc (min)	= 0.10	Critical depth (in)	= 2.33
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 82.15
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.00	Additional Q (cfs)	= 0.24
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 13.41
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

FB = 5.11

LINE 9 / Q = 0.02 / HT = 12 / WID = 12 / N = .013 / L = 17.33 / JLC = 1

GICB#B3/GICB#B4 / DNLN = 8

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	77.04	3.24	76.77	0.12	77.04	6.23	4.38	0.17
UPSTRM	79.47	0.72	79.39	1.04	79.48	5.70	2	0.02

Drainage area (ac)	= 0.00	Slope of invert (%)	=15.1183
Runoff coefficient	= 0.00	Slope energy grade line (%)	=14.0995
Time of conc (min)	= 0.00	Critical depth (in)	= 0.72
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 82.39
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.00	Additional Q (cfs)	= 0.02
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 13.85
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

FB = 2.92

LINE 10 / Q = 0.00 / HT = 12 / WID = 12 / N = .013 / L = 2 / JLC = .3

FABCON/DRNTRANS / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	74.73	4.06	74.39	0.00	74.73	6.98	4.27	0.23
UPSTRM	74.73	2.91	74.49	0.00	74.73	10.29	N/A	0.15

Drainage area (ac)	= 0.00	Slope of invert (%)	= 4.9999
Runoff coefficient	= 0.00	Slope energy grade line (%)	= 0.2102
Time of conc (min)	= 0.12	Critical depth (in)	= 0.00
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 0.00
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.00	Additional Q (cfs)	= 0.00
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 7.96
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

HYDRAULIC REPORT FOR

NAPILIHAU VILLAGES PH-1

DRAINAGE SYSTEM 2

TO PERFORATED DRAIN

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
Rainfall file: SAMPLE

Run Date: 07-12-1995
File: a:SRA2.ST3

LINE 1 / Q = 1.86 / HT = 24 / WID = 24 / N = .017 / L = 12.12 / JLC = .3

OUTLET/FABCON / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	[illegible]	2.82	72.03	8.97	75.52	15.46	4.83	0.21
UPSTRM	[illegible]	2.82	73.75	8.97	75.24	15.46	4.83	0.21

Drainage area (ac)	0.00	Slope of invert (%)	=14.1914
Runoff coefficient	0.00	Slope energy grade line (%)	=14.1914
Time of conc (min)	1.13	Critical depth (in)	5.79
Inlet time (min)	0.00	Natural ground elev. (ft)	80.58
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative CIA	0.00	Additional Q (cfs)	0.00
Q = CA * I (cfs)	0.00	Line capacity (cfs)	65.16
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

Note: Normal depth assumed

LINE 2 / Q = 0.08 / HT = 12 / WID = 12 / N = .01 / L = 25.22 / JLC = 1

FABCON/GICRHE1 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	74.36	7.52	73.75	0.16	74.36	9.37	5.83	0.50
UPSTRM	81.43	1.44	81.28	1.50	81.47	7.80	2	0.05

Drainage area (ac)	0.00	Slope of invert (%)	=29.8573
Runoff coefficient	0.00	Slope energy grade line (%)	=28.1884
Time of conc (min)	0.00	Critical depth (in)	1.44
Inlet time (min)	0.00	Natural ground elev. (ft)	= 84.28
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative CIA	0.00	Additional Q (cfs)	0.08
Q = CA * I (cfs)	0.00	Line capacity (cfs)	= [illegible]
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FB = 2.85

LINE 3 / Q = 1.78 / HT = 24 / WID = 24 / N = .017 / L = 31.2 / JLC = 1.3

FABCON/DMH#E1 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	74.36	7.32	74.75	2.19	74.43	13.26	4.83	0.81
UPSTRM	78.62	5.67	78.15	3.14	78.78	20.39	4.86	0.57

Drainage area (ac) =	0.00	Slope of invert (%)	=14.1026
Runoff coefficient =	0.00	Slope energy grade line (%)	=13.9120
Time of conc (min) =	0.25	Critical depth (in)	= 5.67
Inlet time (min) =	0.00	Natural ground elev. (ft)	= 85.01
Intensity (in/hr) =	0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	0.00	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs)	= 64.95
Q catchment (cfs) =	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft)	= N/A

FB = 6.19

LINE 4 / Q = 1.50 / HT = 24 / WID = 24 / N = .017 / L = 55.12 / JLC = .8

DMH#E1/90dTEE / DNLN = 3

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	78.82	8.06	78.15	1.62	78.86	13.91	4.36	0.93
UPSTRM	79.54	5.20	79.11	2.99	79.68	12.78	N/A	0.50

Drainage area (ac) =	0.00	Slope of invert (%)	= 1.7417
Runoff coefficient =	0.00	Slope energy grade line (%)	= 1.4878
Time of conc (min) =	0.45	Critical depth (in)	= 5.70
Inlet time (min) =	0.00	Natural ground elev. (ft)	= 0.00
Intensity (in/hr) =	0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	0.00	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs)	= 22.83
Q catchment (cfs) =	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft)	= N/A

LINE 5 / Q = 0.39 / HT = 24 / WID = 24 / N = .017 / L = 20.41 / JLC = 1.3

90dTEE/GICB#E2 / DNLN = 4

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	79.65	6.53	79.11	0.56	79.66	12.92	N/A	0.69
UPSTRM	79.69	2.73	79.46	1.98	79.75	15.24	2	0.20

Drainage area (ac) =	0.00	Slope of invert (%)	= 1.7148
Runoff coefficient =	0.00	Slope energy grade line (%)	= 0.4338
Time of conc (min) =	0.21	Critical depth (in)	= 2.65
Inlet time (min) =	0.00	Natural ground elev. (ft)	= 83.46
Intensity (in/hr) =	0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	0.00	Additional Q (cfs)	= 0.19
Q = CA * I (cfs) =	0.00	Line capacity (cfs)	= 22.65
Q catchment (cfs) =	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft)	= N/A

FB = 3.69

LINE 6 / Q = 0.20 / HT = 12 / WID = 12 / N = .013 / L = 9.59 / JLC = .8

GICB#E2/90dTEE / DNLN = 5

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	79.77	4.07	79.46	0.98	79.78	6.64	5	[illegible]
UPSTRM	80.24	2.28	80.04	1.93	80.29	9.41	N/A	0.10

Drainage area (ac) =	0.00	Slope of invert (%)	= 6.0480
Runoff coefficient =	0.00	Slope energy grade line (%)	= 5.2796
Time of conc (min) =	0.16	Critical depth (in)	= 2.78
Inlet time (min) =	0.00	Natural ground elev. (ft)	= 0.00
Intensity (in/hr) =	0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	0.00	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs)	= 8.76
Q catchment (cfs) =	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft)	= N/A

LINE 7 / Q = 0.18 / HT = 12 / WID = 12 / N = .013 / L = 28.09 / JLC = 1

90dTEE/GICB#E4 / DNLN = 6

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.28	2.83	80.04	1.27	80.30	5.83	N/A	0.14
UPSTRM	80.55	2.16	80.37	1.87	80.61	9.22	1.5	0.10

Drainage area (ac)	0.00	Slope of invert (%)	0.9268
Runoff coefficient	0.00	Slope energy grade line (%)	1.0961
Time of conc (min)	0.00	Critical depth (in)	2.16
Inlet time (min)	0.00	Natural ground elev. (ft)	82.87
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.18
Q = CA * I (cfs)	0.00	Line capacity (cfs)	3.56
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FG * 2.27

LINE 8 / Q = 0.02 / HT = 12 / WID = 12 / N = .013 / L = 16.91 / JLC = 1

90dTEE/GICB#E3 / DNLN = 6

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.28	2.83	80.04	0.14	80.28	5.86	N/A	0.14
UPSTRM	80.87	0.72	80.79	1.04	80.88	5.70	2	0.02

Drainage area (ac)	0.00	Slope of invert (%)	4.4552
Runoff coefficient	0.00	Slope energy grade line (%)	3.5918
Time of conc (min)	0.00	Critical depth (in)	0.72
Inlet time (min)	0.00	Natural ground elev. (ft)	85.79
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.02
Q = CA * I (cfs)	0.00	Line capacity (cfs)	2.50
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FG * 2.92

LINE 9 / Q = 1.11 / HT = 18 / WID = 18 / N = .014 / L = 38.08 / JLC = .8

90dTEE/CB#F3 / DNLN = 4

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	79.65	6.54	79.11	1.92	79.71	10.85	N/A	0.58
UPSTRM	80.41	1.82	80.21	2.91	80.74	15.95	2.38	0.38

Drainage area (ac)	0.00	Slope of invert (%)	2.8887
Runoff coefficient	0.00	Slope energy grade line (%)	2.7107
Time of conc (min)	0.44	Critical depth (in)	4.82
Inlet time (min)	0.00	Natural ground elev. (ft)	84.10
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.52
Q = CA * I (cfs)	0.00	Line capacity (cfs)	16.57
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FG * 3.38

LINE 10 / Q = 0.59 / HT = 18 / WID = 18 / N = .014 / L = 5.05 / JLC = 1.3

CB#F3/GICB#F1 / DNLN = 9

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.72	6.09	80.21	1.12	80.74	10.47	2.48	0.53
UPSTRM	80.67	5.74	80.56	2.23	80.75	14.60	1.27	0.27

Drainage area (ac)	0.00	Slope of invert (%)	2.9703
Runoff coefficient	0.00	Slope energy grade line (%)	0.2196
Time of conc (min)	0.11	Critical depth (in)	3.52
Inlet time (min)	0.00	Natural ground elev. (ft)	83.84
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.59
Q = CA * I (cfs)	0.00	Line capacity (cfs)	16.81
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FB = 3.07

LINE 11 / Q = 0.20 / HT = 12 / WID = 12 / N = .01 / L = 58.62 / JLC = .3

GICB#F1/45dBEND / DNLN = 10

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.77	4.23	80.56	0.66	80.78	7.62	2.47	0.30
UPSTRM	81.14	2.28	80.95	1.93	81.20	2.41	N/A	0.10

Drainage area (ac) =	0.00	Slope of invert (%) =	1.0065
Runoff coefficient =	0.00	Slope energy grade line (%) =	0.7158
Time of conc (min) =	0.08	Critical depth (in) =	2.28
Inlet time (min) =	0.00	Natural ground elev. (ft) =	0.00
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	4.63
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

LINE 12 / Q = 0.20 / HT = 12 / WID = 12 / N = .01 / L = 14.98 / JLC = 1

45dBEND/GICB#F2 / DNLN = 11

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	81.16	2.48	80.25	1.70	81.20	5.46	N/A	0.12
UPSTRM	81.35	2.28	81.10	1.23	81.41	2.41	?	0.10

Drainage area (ac) =	0.00	Slope of invert (%) =	1.0013
Runoff coefficient =	0.00	Slope energy grade line (%) =	1.3574
Time of conc (min) =	0.00	Critical depth (in) =	2.28
Inlet time (min) =	0.00	Natural ground elev. (ft) =	84.10
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.20
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	4.63
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

FB = 2.75

LINE 13 / Q = 0.28 / HT = 18 / WID = 18 / N = .014 / L = 28.96 / JLC = .3

DMH#E1/45dBEND / DNLN = 3

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	78.32	3.06	78.15	0.57	78.32	12.04	5.56	0.77
UPSTRM	80.12	2.42	79.22	1.27	80.13	12.29	N/A	0.14

Drainage area (ac) =	0.00	Slope of invert (%) =	6.1112
Runoff coefficient =	0.00	Slope energy grade line (%) =	4.6217
Time of conc (min) =	0.22	Critical depth (in) =	2.42
Inlet time (min) =	0.00	Natural ground elev. (ft) =	0.00
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	24.11
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

LINE 14 / Q = 0.28 / HT = 18 / WID = 18 / N = .014 / L = 43.01 / JLC = 1.3

45dBEND/GICB#GL / DNLN = 13

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.14	2.64	79.92	1.74	80.19	6.89	N/A	0.16
UPSTRM	82.75	2.42	82.55	1.27	82.81	12.29	?	0.14

Drainage area (ac) =	0.00	Slope of invert (%) =	6.1119
Runoff coefficient =	0.00	Slope energy grade line (%) =	6.1058
Time of conc (min) =	0.44	Critical depth (in) =	2.42
Inlet time (min) =	0.00	Natural ground elev. (ft) =	86.05
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.12
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	24.11
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

FB = 3.22

HYDRAULIC REPORT FOR

NAPILIHAU VILLAGES PH-1

DRAINAGE SYSTEM 3

TO PERFORATED DRAIN

LINE 15 / Q = 0.09 / HT = 12 / WID = 12 / N = .013 / L = 11.28 / JLC = .3

GICB#G1/45dBEND / DNLN = 14

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	82.03	5.36	82.55	0.50	82.83	6.35	2.5	0.18
UPSTRM	83.08	1.54	82.95	1.55	83.11	8.00	N/A	0.06

Drainage area (ac)	0.00	Slope of invert (%)	3.5460
Runoff coefficient	0.00	Slope energy grade line (%) =	2.4839
Time of conc (min)	0.38	Critical depth (in)	1.54
Inlet time (min)	0.00	Natural ground elev. (ft)	0.00
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative CA	0.00	Additional Q (cfs)	0.00
Q = CA * I (cfs)	0.00	Line capacity (cfs)	6.71
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

LINE 16 / Q = 0.09 / HT = 12 / WID = 12 / N = .013 / L = 66.14 / JLC = 1

45dBEND/GICB#G2 / DNLN = 15

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	83.09	1.66	82.95	1.57	83.12	1.46	N/A	0.07
UPSTRM	85.54	1.56	85.35	1.55	85.55	8.00		0.06

Drainage area (ac)	0.00	Slope of invert (%)	3.5222
Runoff coefficient	0.00	Slope energy grade line (%) =	3.5177
Time of conc (min)	0.00	Critical depth (in)	1.55
Inlet time (min)	0.00	Natural ground elev. (ft)	88.25
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative CA	0.00	Additional Q (cfs)	0.09
Q = CA * I (cfs)	0.00	Line capacity (cfs)	6.68
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FE * 2.BY

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs Run Date: 07-12-1995
Rainfall file: SAMPLE File: a:SRA3.ST3

LINE 1 / Q = 4.65 / HT = 24 / WID = 24 / N = .017 / L = 11.66 / JLC = .8

OUTLET/90dTEE / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	72.52	1.08	71.98	15.15	75.00	18.05	8.75	0.35
UPSTRM	74.06	1.08	74.52	15.15	77.54	18.03	6.1	0.35

Drainage area (ac)	0.00	Slope of invert (%)	21.7838
Runoff coefficient	0.00	Slope energy grade line (%)	21.7838
Time of conc (min)	2.02	Critical depth (in)	9.16
Inlet time (min)	0.00	Natural ground elev. (ft)	82.62
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.00
Q = CA * I (cfs)	0.00	Line capacity (cfs)	80.73
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

Note: Normal depth assumed

LINE 2 / Q = 0.93 / HT = 12 / WID = 12 / N = .013 / L = 18 / JLC = 1

90dTEE/GICB#11 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	77.00	12.00	74.52	1.18	77.02	0.00	7.1	0.79
UPSTRM	77.53	4.91	77.12	5.08	77.63	11.80	4.07	0.30

Drainage area (ac)	0.00	Slope of invert (%)	14.4445
Runoff coefficient	0.00	Slope energy grade line (%)	3.6271
Time of conc (min)	0.11	Critical depth (in)	4.91
Inlet time (min)	0.00	Natural ground elev. (ft)	82.20
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.34
Q = CA * I (cfs)	0.00	Line capacity (cfs)	13.53
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FB = 4.52

LINE 3 / Q = 0.59 / HT = 12 / WID = 12 / N = .013 / L = 11 / JLC = .8

GICB#11/90dBEND / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	77.68	6.67	77.12	1.52	77.70	8.95	4.07	0.45
UPSTRM	77.68	5.72	77.20	1.60	77.72	11.22	N/A	0.37

Drainage area (ac)	0.00	Slope of invert (%)	0.7272
Runoff coefficient	0.00	Slope energy grade line (%)	0.1236
Time of conc (min)	0.36	Critical depth (in)	3.91
Inlet time (min)	0.00	Natural ground elev. (ft)	0.00
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.00
Q = CA * I (cfs)	0.00	Line capacity (cfs)	3.04
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

LINE 4 / Q = 0.59 / HT = 12 / WID = 12 / N = .013 / L = 63 / JLC = 1

90dBEND/GICB#12 / DNLN = 3

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	77.71	6.10	77.20	1.47	77.74	8.56	N/A	0.40
UPSTRM	77.81	6.52	77.25	1.11	77.84	11.98	[illegible]	[illegible]

Drainage area (ac)	0.00	Slope of invert (%)	0.0794
Runoff coefficient	0.00	Slope energy grade line (%)	0.1527
Time of conc (min)	0.00	Critical depth (in)	3.91
Inlet time (min)	0.00	Natural ground elev. (ft)	79.25
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.59
Q = CA * I (cfs)	0.00	Line capacity (cfs)	1.00
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FB = 4.44

LINE 5 / Q = 3.72 / HT = 24 / WID = 24 / N = .017 / L = 18 / JLC = 1.8

90dTEE/GICB#H1 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	77.00	24.00	74.92	1.18	77.02	0.00	6.1	3.14
UPSTRM	79.02	8.19	78.34	5.93	79.26	22.76	?	0.95

Drainage area (ac) =	0.00	Slope of invert (%)	=21.2222
Runoff coefficient =	0.00	Slope energy grade line (%)	=12.4396
Time of conc (min) =	1.92	Critical depth (in)	= 8.19
Inlet time (min)	0.00	Natural ground elev. (ft)	= 82.34
Intensity (in/hr)	0.00	Upstream surcharge (ft)	= 0.00
Cumulative CtA	0.00	Additional Q (cfs)	= 0.46
Q = CA * I (cfs)	0.00	Line capacity (cfs)	= 72.68
Q catchment (cfs) =	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft)	= N/A

FB = 2.89

LINE 6 / Q = 3.26 / HT = 24 / WID = 24 / N = .017 / L = 58.18 / JLC = .8

GICB#H1/90dTEE / DNLN = 5

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	79.45	13.37	78.34	1.81	79.50	17.21	?	1.80
UPSTRM	79.98	7.67	79.34	4.77	80.20	22.58	N/A	0.87

Drainage area (ac) =	0.00	Slope of invert (%)	= 1.7188
Runoff coefficient =	0.00	Slope energy grade line (%)	= 1.1942
Time of conc (min)	1.59	Critical depth (in)	= 7.67
Inlet time (min) =	0.00	Natural ground elev. (ft)	= 0.00
Intensity (in/hr) =	0.00	Upstream surcharge (ft)	= 0.00
Cumulative CtA	0.00	Additional Q (cfs)	= 0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs)	= 22.68
Q catchment (cfs) =	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft)	= N/A

LINE 7 / Q = 0.50 / HT = 18 / WID = 18 / N = .013 / L = 11 / JLC = 1.3

90dTEE/GICB#J1 / DNLN = 6

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.16	9.79	79.34	0.51	80.16	13.27	N/A	0.98
UPSTRM	80.15	7.70	79.51	0.69	80.16	17.81	2.27	0.72

Drainage area (ac) =	0.00	Slope of invert (%)	= 1.5455
Runoff coefficient =	0.00	Slope energy grade line (%)	= -0.0037
Time of conc (min) =	0.38	Critical depth (in)	= 3.24
Inlet time (min) =	0.00	Natural ground elev. (ft)	= 83.29
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative CtA =	0.00	Additional Q (cfs)	= 0.20
Q = CA * I (cfs) =	0.00	Line capacity (cfs)	13.05
Q catchment (cfs) =	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft)	= N/A

FB = 3.13

LINE 8 / Q = 0.30 / HT = 12 / WID = 12 / N = .013 / L = 68.35 / JLC = 1

GICB#J1/GICB#J2 / DNLN = 7

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.16	7.82	79.51	0.55	80.17	9.69	2.77	0.54
UPSTRM	80.51	3.79	80.20	2.17	80.58	10.13	?	0.14

Drainage area (ac)	0.00	Slope of invert (%)	1.0095
Runoff coefficient =	0.00	Slope energy grade line (%)	= 0.6022
Time of conc (min) =	0.00	Critical depth (in)	= 2.79
Inlet time (min) =	0.00	Natural ground elev. (ft)	= 83.20
Intensity (in/hr) =	0.00	Upstream surcharge (ft)	= 0.00
Cumulative CtA =	0.00	Additional Q (cfs)	= 0.30
Q = CA * I (cfs) =	0.00	Line capacity (cfs)	= 3.58
Q catchment (cfs)	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	= N/A

FB = 2.69

LINE 9 / Q = 2.76 / HT = 24 / WID = 24 / N = .017 / L = 15.32 / JLC = 1.3

90dTEE/GICBMH2 / DNLN = 6

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.16	9.72	79.34	2.29	80.24	15.55	N/A	1.20
UPSTRM	80.19	7.06	79.60	3.58	80.39	21.87	3.31	0.77

Drainage area (ac)	0.00	Slope of invert (%)	1.6971
Runoff coefficient	0.00	Slope energy grade line (%)	0.9788
Time of conc (min)	1.51	Critical depth (in)	7.06
Inlet time (min)	0.00	Natural ground elev. (ft)	84.91
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.91
Q = CA * I (cfs)	0.00	Line capacity (cfs)	22.54
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FB = 4.46

LINE 10 / Q = 1.85 / HT = 24 / WID = 24 / N = .017 / L = 89.64 / JLC = 1.3

GICBMH2/GICBMH3 / DNLN = 9

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.45	10.16	79.60	1.46	80.48	15.62	3.31	1.27
UPSTRM	82.88	5.78	82.40	3.18	83.04	20.52	3.88	0.58

Drainage area (ac)	0.00	Slope of invert (%)	3.1736
Runoff coefficient	0.00	Slope energy grade line (%)	2.8539
Time of conc (min)	1.01	Critical depth (in)	5.78
Inlet time (min)	0.00	Natural ground elev. (ft)	88.29
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.67
Q = CA * I (cfs)	0.00	Line capacity (cfs)	30.57
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FB = 5.20

LINE 11 / Q = 0.18 / HT = 12 / WID = 12 / N = .01 / L = 82.07 / JLC = 1

GICBMH3/GICBMK1 / DNLN = 10

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	83.09	8.22	82.40	0.31	83.09	9.93	4.88	0.57
UPSTRM	88.14	2.16	87.90	1.87	88.19	9.22	2	0.10

Drainage area (ac)	0.00	Slope of invert (%)	6.7016
Runoff coefficient	0.00	Slope energy grade line (%)	6.2169
Time of conc (min)	0.00	Critical depth (in)	2.16
Inlet time (min)	0.00	Natural ground elev. (ft)	90.90
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.18
Q = CA * I (cfs)	0.00	Line capacity (cfs)	11.98
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FB = 2.77

LINE 12 / Q = 1.00 / HT = 18 / WID = 18 / N = .014 / L = 64.97 / JLC = 1.3

GICBMH3/GICBMH4 / DNLN = 10

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	83.09	8.22	82.40	1.27	83.11	12.17	4.33	0.79
UPSTRM	83.43	4.58	83.05	2.87	83.56	15.68	5.44	0.35

Drainage area (ac)	0.00	Slope of invert (%)	1.0005
Runoff coefficient	0.00	Slope energy grade line (%)	0.6851
Time of conc (min)	0.45	Critical depth (in)	4.58
Inlet time (min)	0.00	Natural ground elev. (ft)	90.00
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.90
Q = CA * I (cfs)	0.00	Line capacity (cfs)	9.75
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

FB = 6.41

LINE 13 / Q = 0.10 / HT = 12 / WID = 12 / N = .01 / L = 37.01 / JLC = .3

GICB#H4/45dBEND / DNLN = 12

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	83.59	4.51	83.05	0.23	83.59	8.84	5.24	0.44
UPSTRM	85.06	1.61	84.95	1.59	85.10	8.18	N/A	0.06

Drainage area (ac) =	0.00	Slope of invert (%) =	5.0797
Runoff coefficient =	0.00	Slope energy grade line (%) =	4.0801
Time of conc (min) =	0.44	Critical depth (in) =	1.61
Inlet time (min) =	0.00	Natural ground elev. (ft) =	0.00
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative CA =	0.00	Additional Q (cfs)	0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	10.43
Q catchment (cfs)	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

LINE 14 / Q = 0.10 / HT = 12 / WID = 12 / N = .01 / L = 79.83 / JLC = 1

45dBEND/GICB#H5 / DNLN = 13

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	85.08	1.75	84.93	1.41	85.11	4.58	N/A	0.07
UPSTRM	89.17	1.61	89.00	1.59	89.21	8.18	2.25	0.06

Drainage area (ac)	0.00	Slope of invert (%)	5.0983
Runoff coefficient =	0.00	Slope energy grade line (%) =	5.0943
Time of conc (min) =	0.00	Critical depth (in) =	1.61
Inlet time (min) =	0.00	Natural ground elev. (ft) =	92.25
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative CA	0.00	Additional Q (cfs) =	0.10
Q = CA * I (cfs)	0.00	Line capacity (cfs) =	10.45
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft) =	N/A

FB = 3.08

HYDRAULIC REPORT FOR

NAPILIHAU VILLAGES PH-1

DRAINAGE SYSTEM 4

TO RETENTION BASIN

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
Rainfall file: SAMPLE

Run Date: 07-12-1995
File: a:SRA4.ST3

LINE 1 / Q = 3.71 / HT = 36 / WID = 36 / N = .019 / L = 43.53 / JLC = .3

OUTLET/45dBEND / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	72.70	5.46	72.25	5.49	73.17	25.82	4.75	0.68
UPSTRM	74.04	5.46	73.59	5.49	74.51	25.82	N/A	0.68

Drainage area (ac) =	0.00	Slope of invert (%) =	3.0783
Runoff coefficient =	0.00	Slope energy grade line (%) =	3.0783
Time of conc (min) =	1.70	Critical depth (in) =	7.37
Inlet time (min) =	0.00	Natural ground elev. (ft) =	0.00
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	80.06
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

Note: Normal depth assumed

LINE 2 / Q = 3.71 / HT = 36 / WID = 36 / N = .019 / L = 15.78 / JLC = 1.8

45dBEND/DMH#A1 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	74.04	5.46	73.59	5.49	74.51	25.82	N/A	0.68
UPSTRM	74.52	5.46	74.07	5.49	74.99	25.82	5.23	0.68

Drainage area (ac) =	0.00	Slope of invert (%) =	3.0418
Runoff coefficient =	0.00	Slope energy grade line (%) =	3.0418
Time of conc (min) =	1.61	Critical depth (in) =	7.37
Inlet time (min) =	0.00	Natural ground elev. (ft) =	80.30
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	79.59
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

Note: Normal depth assumed

FB = 4.93

LINE 3 / Q = 1.13 / HT = 12 / WID = 12 / N = .01 / L = 33 / JLC = 1

DMH#A1/GICB#A1 / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	75.37	12.00	74.07	1.44	75.40	0.00	5.23	0.79
UPSTRM	75.42	11.83	74.40	1.44	75.45	2.35	4.76	0.78

Drainage area (ac) =	0.00	Slope of invert (%) =	1.0000
Runoff coefficient =	0.00	Slope energy grade line (%) =	0.1519
Time of conc (min) =	0.00	Critical depth (in) =	5.41
Inlet time (min) =	0.00	Natural ground elev. (ft) =	80.17
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.02
Cumulative C*A =	0.00	Additional Q (cfs) =	1.13
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	4.63
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

FB = 4.75

LINE 4 / Q = 2.15 / HT = 36 / WID = 36 / N = .019 / L = 60.55 / JLC = .8

DMH#A1/FABCON / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	75.57	15.58	74.07	0.75	75.58	23.68	5.23	2.23
UPSTRM	76.05	5.61	75.58	5.06	76.19	26.11	N/A	0.70

Drainage area (ac) =	0.00	Slope of invert (%) =	2.4938
Runoff coefficient =	0.00	Slope energy grade line (%) =	1.3483
Time of conc (min) =	1.28	Critical depth (in) =	5.61
Inlet time (min) =	0.00	Natural ground elev. (ft)	0.00
Intensity (in/hr)	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.00
Q = CA * I (cfs)	0.00	Line capacity (cfs) =	72.06
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

LINE 5 / Q = 0.36 / HT = 12 / WID = 12 / N = .01 / L = 20.71 / JLC = 1

FABCON/CB#A2 / DNLN = 4

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	76.16	7.00	75.58	0.26	76.17	9.17	N/A	0.48
UPSTRM	76.18	4.32	75.79	1.41	76.71	11.52	4.69	0.25

Drainage area (ac) =	0.00	Slope of invert (%) =	1.0140
Runoff coefficient =	0.00	Slope energy grade line (%) =	0.1912
Time of conc (min) =	0.00	Critical depth (in) =	3.05
Inlet time (min) =	0.00	Natural ground elev. (ft) =	81.48
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.36
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	4.66
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

FB = 5.30

LINE 6 / Q = 1.79 / HT = 36 / WID = 36 / N = .019 / L = 54.71 / JLC = 1.3

FABCON/DMH#A2 / DNLN = 4

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	76.16	7.00	75.58	1.85	76.22	15.88	N/A	0.97
UPSTRM	77.38	5.12	76.95	2.91	77.51	25.14	3.23	0.61

Drainage area (ac) =	0.00	Slope of invert (%) =	2.5041
Runoff coefficient =	0.00	Slope energy grade line (%) =	2.3599
Time of conc (min) =	0.97	Critical depth (in) =	5.12
Inlet time (min) =	0.00	Natural ground elev. (ft) =	83.18
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	72.21
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

FB = 5.63

LINE 7 / Q = 1.79 / HT = 30 / WID = 30 / N = .010 / L = 100.41 / JLC = .8

DMH#A2/FABCON / DNLN = 6

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	77.55	7.17	76.95	1.99	77.61	14.67	3.73	0.90
UPSTRM	80.10	5.36	79.65	5.01	80.24	22.99	N/A	0.60

Drainage area (ac) =	0.00	Slope of invert (%) =	2.6890
Runoff coefficient =	0.00	Slope energy grade line (%) =	2.6179
Time of conc (min) =	0.49	Critical depth (in) =	5.36
Inlet time (min) =	0.00	Natural ground elev. (ft) =	0.00
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	48.57
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

LINE 8 / Q = 1.39 / HT = 12 / WID = 12 / N = .01 / L = 4.14 / JLC = 1

FABCON/CB#A3 / DNLN = 7

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.29	6.71	79.65	5.08	80.36	8.98	N/A	0.45
UPSTRM	82.69	6.00	82.00	3.54	82.89	12.00	2.47	0.32

Drainage area (ac) =	0.00	Slope of invert (%) =	56.7632
Runoff coefficient =	0.00	Slope energy grade line (%) =	61.1819
Time of conc (min) =	0.00	Critical depth (in) =	6.00
Inlet time (min) =	0.00	Natural ground elev. (ft) =	85.47
Intensity (in/hr) =	0.00	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.00	Additional Q (cfs) =	1.39
Q = CA * I (cfs) =	0.00	Line capacity (cfs) =	34.88
Q catchment (cfs) =	0.00	Inlet length (ft) =	0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft) =	0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft) =	N/A

FB = 2.78

LINE 9 / Q = 0.40 / HT = 30 / WID = 30 / N = .018 / L = 52.73 / JLC = 1.3

FABCON/DMH#A3 / DNLN = 7

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	80.21	6.71	79.65	0.19	80.21	14.19	N/A	0.82
UPSTRM	81.28	2.54	81.07	2.00	81.54	16.69	4.19	0.20

Drainage area (ac) =	0.00	Slope of invert (%)	= 2.6930
Runoff coefficient =	0.00	Slope energy grade line (%)	= 2.1442
Time of conc (min) =	0.12	Critical depth (in)	= 2.54
Inlet time (min) =	0.00	Natural ground elev. (ft)	= 87.76
Intensity (in/hr) =	0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	0.00	Additional Q (cfs)	= 0.00
Q = CA * I (cfs)	0.00	Line capacity (cfs)	= 48.61
Q catchment (cfs) =	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft)	= N/A

FB = 6.40

LINE 10 / Q = 0.40 / HT = 12 / WID = 12 / N = .01 / L = 22.27 / JLC = 1

DMH#A3/CB#A4 / DNLN = 9

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	81.36	3.51	81.07	2.09	81.43	6.47	5.69	0.12
UPSTRM	83.62	3.22	83.27	2.36	83.71	10.63	4	0.17

Drainage area (ac)	0.00	Slope of invert (%)	= 9.3787
Runoff coefficient =	0.00	Slope energy grade line (%)	=10.2418
Time of conc (min) =	0.00	Critical depth (in)	= 3.22
Inlet time (min) =	0.00	Natural ground elev. (ft)	87.27
Intensity (in/hr) =	0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A	0.00	Additional Q (cfs)	= 0.40
Q = CA * I (cfs)	0.00	Line capacity (cfs)	= 14.55
Q catchment (cfs)	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft)	= N/A

FB = 3.65

LINE 11 / Q = 0.43 / HT = 12 / WID = 12 / N = .01 / L = 4 / JLC = 1

DMH#A1/CB#A1 / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	75.37	12.00	74.07	0.55	75.37	0.00	5.23	0.79
UPSTRM	76.37	3.34	76.00	2.41	76.46	10.75	2.88	0.18

Drainage area (ac) =	0.00	Slope of invert (%)	=48.2500
Runoff coefficient =	0.00	Slope energy grade line (%)	=24.0208
Time of conc (min) =	0.00	Critical depth (in)	= 3.34
Inlet time (min) =	0.00	Natural ground elev. (ft)	= 79.89
Intensity (in/hr) =	0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A =	0.00	Additional Q (cfs)	= 0.43
Q = CA * I (cfs)	0.00	Line capacity (cfs)	= 52.16
Q catchment (cfs)	0.00	Inlet length (ft)	= 0.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs) =	0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs) =	0.00	Ponding width (ft)	= N/A

FB = 3.52

HYDRAULIC REPORT FOR

NAPILIHAU VILLAGES

PHASE I

DRAINLINE ALONG

NAPILIHAU STREET

REVISED 12/18/95

(4.5' X 6' BOX CULVERT

AT THE OUTLET

INTO ALAELOA PROPERTY)

Return Period = 50 Yrs — Run Date: 12-18-1995
Rainfall file: SAMPLE — File: 94024E14.ST3

LINE 1 / Q = 89.70 / HT = 54 / WID = 72 / N = .028 / L = 17 / JLC = .2

OUTLET/DMHP6 / Outfall — Freeboard = 7.93'

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	46.76	51.84	42.44	3.46	46.95	72.00	N/A	25.92
UPSTRM	46.80	51.91	42.47	3.46	46.99	72.00	11.62	25.96

Drainage area (ac)	0.00	Slope of invert (%)	0.2000
Runoff coefficient	0.00	Slope energy grade line (%)	0.2323
Time of conc (min)	4.01	Critical depth (in)	22.88
Inlet time (min)	0.00	Natural ground elev. (ft)	58.60
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.00
Q = CA * I (cfs)	0.00	Line capacity (cfs)	75.78
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

LINE 2 / Q = 78.39 / HT = 36 / WID = 36 / N = .013 / L = 58 / JLC = .8

DMHP6/DMHP5 / DNLN = 1 — Freeboard = 4.24

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	50.68	28.59	48.30	13.02	53.32	29.11	7.29	6.02
UPSTRM	51.55	28.59	49.17	13.02	54.19	29.11	5.83	6.02

Drainage area (ac)	0.00	Slope of invert (%)	1.5000
Runoff coefficient	0.00	Slope energy grade line (%)	1.5000
Time of conc (min)	3.68	Critical depth (in)	33.42
Inlet time (min)	0.00	Natural ground elev. (ft)	58.00
Intensity (in/hr)	0.00	Upstream surcharge (ft)	0.00
Cumulative C*A	0.00	Additional Q (cfs)	0.00
Q = CA * I (cfs)	0.00	Line capacity (cfs)	81.68
Q catchment (cfs)	0.00	Inlet length (ft)	0.00
Q carryover (cfs)	0.00	Gutter slope (ft/ft)	0.0000
Q captured (cfs)	0.00	Cross slope (ft/ft)	0.0000
Q bypassed (cfs)	0.00	Ponding width (ft)	N/A

Note: Normal depth assumed

```
LINE 3 / Q = 78.39 / HT = 36 / WID = 36 / N = .019 / L = 81 / JLC = .8
-----------------------------------------------------------------------
DMHP5/DMHP4 / DNLN = 2                           FREEBOARD - 7.63

          HGL    DEPTH  INVERT    VEL     EGL    T WID   COVER    AREA

DNSTRM   53.66   36.00   49.17   11.09   55.57    0.00    5.83    7.07
UPSTRM   56.62   33.42   53.84   11.45   58.66   18.56    7.56    6.84

Drainage area (ac) =   0.00        Slope of invert (%)          = 5.7600
Runoff coefficient =   0.00        Slope energy grade line (%) = 3.8135
Time of conc (min) =   3.23        Critical depth (in)          =  33.42
Inlet time (min)   =   0.00        Natural ground elev. (ft)    =  64.40
Intensity (in/hr)  =   0.00        Upstream surcharge (ft)      =   0.00
Cumulative C*A     =   0.00        Additional Q (cfs)           =   0.00
Q = CA * I (cfs)   =   0.00        Line capacity (cfs)          = 109.52
--------------------------------------------------------------------
Q catchment (cfs)  =   0.00        Inlet length (ft)            =   0.00
Q carryover (cfs)  =   0.00        Gutter slope (ft/ft)         = 0.0000
Q captured (cfs)   =   0.00        Cross slope (ft/ft)          = 0.0000
Q bypassed (cfs)   =   0.00        Ponding width (ft)           =    N/A
-----------------------------------------------------------------------
```

```
LINE 5 / Q = 78.39 / HT = 36 / WID = 36 / N = .019 / L = 186 / JLC = .5
-----------------------------------------------------------------------
fb/DMHP3 / DNLN = 4                              FREEBOARD - 5.82'

          HGL    DEPTH  INVERT    VEL     EGL    T WID   COVER    AREA

DNSTRM   66.28   36.00   62.99   11.09   68.19    0.00     N/A    7.07
UPSTRM   79.26 ✓ 33.42   76.47   11.45   81.30   18.56    6.62    6.84

Drainage area (ac) =   0.00        Slope of invert (%)          = 7.2500
Runoff coefficient =   0.00        Slope energy grade line (%) = 7.0454
Time of conc (min) =   1.89        Critical depth (in)          =  33.42
Inlet time (min)   =   0.00        Natural ground elev. (ft)    =  86.10
Intensity (in/hr)  =   0.00        Upstream surcharge (ft)      =   0.00
Cumulative C*A     =   0.00        Additional Q (cfs)           =   0.00
Q = CA * I (cfs)   =   0.00        Line capacity (cfs)          = 122.87
--------------------------------------------------------------------
Q catchment (cfs)  =   0.00        Inlet length (ft)            =   0.00
Q carryover (cfs)  =   0.00        Gutter slope (ft/ft)         = 0.0000
Q captured (cfs)   =   0.00        Cross slope (ft/ft)          = 0.0000
Q bypassed (cfs)   =   0.00        Ponding width (ft)           =    N/A
-----------------------------------------------------------------------
```

```
LINE 4 / Q = 78.39 / HT = 36 / WID = 36 / N = .019 / L = 55 / JLC = .3
-----------------------------------------------------------------------
DMHP4/fb / DNLN = 3                              FREEBOARD = N/A

          HGL    DEPTH  INVERT    VEL     EGL    T WID   COVER    AREA

DNSTRM   60.77 ✓ 21.21   59.00   18.10   65.85   35.42    2.4     4.33
UPSTRM   64.76   21.21   62.99   18.10   69.84   35.42     N/A    4.33

Drainage area (ac) =   0.00        Slope of invert (%)          = 7.2545
Runoff coefficient =   0.00        Slope energy grade line (%) = 7.2545
Time of conc (min) =   2.93        Critical depth (in)          =  33.42
Inlet time (min)   =   0.00        Natural ground elev. (ft)    =   0.00
Intensity (in/hr)  =   0.00        Upstream surcharge (ft)      =   0.00
Cumulative C*A     =   0.00        Additional Q (cfs)           =   0.00
Q = CA * I (cfs)   =   0.00        Line capacity (cfs)          = 122.91
--------------------------------------------------------------------
Q catchment (cfs)  =   0.00        Inlet length (ft)            =   0.00
Q carryover (cfs)  =   0.00        Gutter slope (ft/ft)         = 0.0000
Q captured (cfs)   =   0.00        Cross slope (ft/ft)          = 0.0000
Q bypassed (cfs)   =   0.00        Ponding width (ft)           =    N/A
Note: Normal depth assumed
-----------------------------------------------------------------------
```

```
LINE 6 / Q = 78.39 / HT = 36 / WID = 36 / N = .013 / L = 250 / JLC = .8
-----------------------------------------------------------------------
DMHP3/DMHP2 / DNLN = 5                           FREEBOARD = 7.44'

          HGL    DEPTH  INVERT    VEL     EGL    T WID   COVER    AREA

DNSTRM   80.28   36.00   76.47   11.09   82.19    0.00    6.62    7.07
UPSTRM   83.73   36.00   80.22   11.09   85.64    0.00    9.47    7.07

Drainage area (ac) =   0.00        Slope of invert (%)          = 1.5000
Runoff coefficient =   0.00        Slope energy grade line (%) = 1.3818
Time of conc (min) =   0.51        Critical depth (in)          =  33.42
Inlet time (min)   =   0.00        Natural ground elev. (ft)    =  92.70
Intensity (in/hr)  =   0.00        Upstream surcharge (ft)      =   0.51
Cumulative C*A     =   0.00        Additional Q (cfs)           =   0.00
Q = CA * I (cfs)   =   0.00        Line capacity (cfs)          =  81.68
--------------------------------------------------------------------
Q catchment (cfs)  =   0.00        Inlet length (ft)            =   0.00
Q carryover (cfs)  =   0.00        Gutter slope (ft/ft)         = 0.0000
Q captured (cfs)   =   0.00        Cross slope (ft/ft)          = 0.0000
Q bypassed (cfs)   =   0.00        Ponding width (ft)           =    N/A
-----------------------------------------------------------------------
```

LINE 7 / Q = 78.39 / HT = 36 / WID = 36 / N = .013 / L = 72 / JLC = .3

DMHP2/DMHP1 / DNLN = 6 — FREEBOARD: 5.37

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	85.26	36.00	80.22	11.09	87.17	0.00	9.47	7.07
UPSTRM	86.26	36.00	81.30	11.09	88.17	0.00	7.89	7.07

Drainage area (ac)	= 0.00	Slope of invert (%)	= 1.5000
Runoff coefficient	= 0.00	Slope energy grade line (%)	= 1.3818
Time of conc (min)	= 0.11	Critical depth (in)	= 33.42
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 92.20
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 1.96
Cumulative C*A	= 0.00	Additional Q (cfs)	= 77.39
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 81.68
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

LINE 8 / Q = 1.00 / HT = 24 / WID = 24 / N = .017 / L = 19 / JLC = .8

DMHP1/EXT.CB / DNLN = 7 — FREEBOARD: 5.16

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	86.83	24.00	82.80	0.32	86.83	0.00	7.39	3.14
UPSTRM	86.84	20.84	85.10	0.35	86.84	16.24	4.9	2.90

Drainage area (ac)	= 0.00	Slope of invert (%)	=12.1052
Runoff coefficient	= 0.00	Slope energy grade line (%)	= 0.0410
Time of conc (min)	= 0.00	Critical depth (in)	= 4.25
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 92.00
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.00	Additional Q (cfs)	= 1.00
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 60.18
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

LINE 9 / Q = 11.31 / HT = 24 / WID = 24 / N = .017 / L = 10 / JLC = .3

DMHP6/FC / DNLN = 1 — FREEBOARD: N/A

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	46.84	24.00	43.51	3.60	47.04	0.00	13.09	3.14
UPSTRM	46.88	24.00	44.00	3.60	47.08	0.00	N/A	3.14

Drainage area (ac)	= 0.00	Slope of invert (%)	= 4.9000
Runoff coefficient	= 0.00	Slope energy grade line (%)	= 0.4277
Time of conc (min)	= 0.64	Critical depth (in)	= 14.29
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 0.00
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.88
Cumulative C*A	= 0.00	Additional Q (cfs)	= 0.00
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 38.29
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

LINE 10 / Q = 6.69 / HT = 24 / WID = 24 / N = .017 / L = 31 / JLC = .8

FC/INLET / DNLN = 9 — FREEBOARD: N/A

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	46.94	24.00	44.00	2.13	47.01	0.00	N/A	3.14
UPSTRM	47.04	15.84	45.61	3.04	47.19	22.74	N/A	2.20

Drainage area (ac)	= 0.00	Slope of invert (%)	= 5.1936
Runoff coefficient	= 0.00	Slope energy grade line (%)	= 0.5734
Time of conc (min)	= 0.00	Critical depth (in)	= 10.99
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 0.00
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.00	Additional Q (cfs)	= 6.69
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 39.42
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

LINE 11 / Q = 4.62 / HT = 18 / WID = 18 / N = .014 / L = 53 / JLC = .8

FC/EXT.MH1 / DNLN = 9

FREEBOARD = 3.32'

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	46.94	18.00	44.00	2.61	47.05	0.00	N/A	1.77
UPSTRM	55.21	9.84	54.39	4.67	55.55	17.92	2.9	0.99

Drainage area (ac)	= 0.00	Slope of invert (%)	=19.6038
Runoff coefficient	= 0.00	Slope energy grade line (%)	=16.0429
Time of conc (min)	= 0.34	Critical depth (in)	= 9.84
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 58.80
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.00	Additional Q (cfs)	= 0.00
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 43.17
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

LINE 12 / Q = 4.62 / HT = 18 / WID = 18 / N = .014 / L = 28 / JLC = .8

EXT.MH1/EXT.CB2 / DNLN = 11

FREEBOARD = 3.64'

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	55.43	13.10	54.39	3.35	55.66	15.35	2.9	1.38
UPSTRM	56.04	9.84	55.22	4.67	56.38	17.92	3.27	0.99

Drainage area (ac)	= 0.00	Slope of invert (%)	= 2.9643
Runoff coefficient	= 0.00	Slope energy grade line (%)	= 2.5826
Time of conc (min)	= 0.19	Critical depth (in)	= 9.84
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 60.00
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.00	Additional Q (cfs)	= 2.31
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 16.79
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

LINE 13 / Q = 2.31 / HT = 18 / WID = 18 / N = .014 / L = 34 / JLC = .8

EXT.CB2/EXT.CB3 / DNLN = 12

FREEBOARD = 3.11'

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	56.31	13.10	55.22	1.68	56.36	15.35	3.27	1.38
UPSTRM	56.89	6.96	56.14	3.66	57.09	17.53	2.36	0.63

Drainage area (ac)	= 0.00	Slope of invert (%)	= 2.7059
Runoff coefficient	= 0.00	Slope energy grade line (%)	= 1.6858
Time of conc (min)	= 0.00	Critical depth (in)	= 6.96
Inlet time (min)	= 0.00	Natural ground elev. (ft)	= 60.00
Intensity (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C*A	= 0.00	Additional Q (cfs)	= 2.31
Q = CA * I (cfs)	= 0.00	Line capacity (cfs)	= 16.04
Q catchment (cfs)	= 0.00	Inlet length (ft)	= 0.00
Q carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.0000
Q captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.0000
Q bypassed (cfs)	= 0.00	Ponding width (ft)	= N/A

APPENDIX C

UNIVERSAL SOIL LOSS EQUATION CALCULATIONS

U.S.L.E. Report   Page 1 of 3
W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street   Suite 403
Wailuku, Maui, Hawaii   96793

BY. [illegible]
DATE: June 21, 1994

U.S.L.E.
FOR
NAPILIHAU VILLAGES - PHASE I

1. USLE EQUATION: E = R*K*LS*C*P

WHERE. E = Soil Loss (tons/acre/year)
R = Average Annual Rainfall Factor for Erosion
K = Soil Erodibility Factor
L = Horizontal Slope Length (feet)
S = Average Slope (%)
LS = Slope Factor (Function of L and S)
C = Cover and Management Factor
P = Erosion Control Practice Factor

R = 200.0 tons/acre/year
(Soil Erosion & Sediment Control Guide for Hawaii, Appendix A. Average Annual Values of Rainfall Factor)

K = 0.17 Soil Series: KOMOHO
(Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. Soil Type Plates & Table 1; Soil Properties Related to Erosion & Sedimentation ....)

L = [illegible] feet
S = [illegible] feet
(Soil Erosion & Sediment Control Guide for Hawaii, Table 16)

S = (S/L)
7.1 %

LS = 1.2[illegible]

NAPILIHAU VILLAGES - PHASE I
[Continued]

C : 1.00
(Soil Erosion & Sediment Control Guide for Hawaii Tables 17-22, Pages 59-61; C:1.00 for Bare Soil)

P 1.00
(Soil Erosion & Sediment Control Guide for Hawaii, the Universal Soil Loss Equation in Hawaii)'

E RIKILSICIP
43.0 tons/acre/year

2. SEVERITY RATING NUMBER EQUATION: H=[(2*F*T)+(3*D)]*A*E

WHERE: H Severity rating number
T = Duration of land-disturbing activity (years)
A = Area subject to disturbance (acres)
E = Rate of soil loss under disturbed conditions (tons/acre/year)
F = Downslope-downstream rating factor (rating points/ton)
D = Coastal water rating factor (rating points/ton)

T : 1.00 years

A 3.10 acres

E : RIKILSICIP
13.0 tons/acre/year

F 4 (Downslope downstream detriment. Major)

D 2 (Coastal water rating factor. Class A)

H : [(2*F*T)+(3*D)]*A*E
1,865.6

Standard severity rating (allowable). 50,000 ≥ 1,865.6 =OK

NAPILIHAU VILLAGES - PHASE 1
[Continued]

3. MAXIMUM ALLOWABLE SOIL LOSS: E max = H max/(2FT+3D)A

E max = H max/(2FT+3D)A, Hmax : 50,000
= 1,152.1 tons/acre/year ≥ 43.0 tons/acre/year = OK

Coastal Hazard. Class A waters are approximately [illegible] feet from the site.

CONCLUSION. Sedimentation hazard to coastal waters and downstream properties is minimal. Erosion rate computed for this project site is well within the tolerable limits and additional control measures are not required.

4. REFERENCES:

1. Soil Conservation Service (USDA), "Guidelines for Use of the Universal Soil Loss Equation in Hawaii," Technical Notes, March 1975. (Revised Draft)

2. County of Maui; (Ord No. 816), "Chapter 24, Soil Erosion and Sedimentation Control," June 17, 1975.

3. Soil Conservation Service (USDA), "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, August 1972

4. Hawaii Environmental Simulation Laboratory, "Guidelines for Data Preparation, Part I. Universal Soil Loss Equation, Updated (Draft).

Appendix D

Final Drainage Report Phase II

Established 1969

DRAINAGE AND SOIL EROSION CONTROL REPORT FOR THE MASS GRADING OF

NAPILIHAU TOWNHOMES (PHASE II)

Alaeloa, Lahaina, Maui, Hawaii
TMK: (2) 4-3-003: Portion of 110

OWNER: Napilihau Villages Joint Venture
ADDRESS: Honolulu, Hawaii

REED M. ARIYOSHI
LICENSED PROFESSIONAL ENGINEER
NO. 5465-C
HAWAII, U.S.A.

March 6, 1997
REVISED: June 20, 1997

WARREN S. UNEMORI ENGINEERING, INC.
Civil and Structural Engineers - Land Surveyors
Wells Street Professional Center - Suite 403
2145 Wells Street
Wailuku, Maui, Hawaii 96793

TABLE OF CONTENTS

Drainage and Soil Erosion Control Report for Mass Grading of Napilihau Townhomes (Phase II)

I. INTRODUCTION

This drainage and soil erosion report has been prepared to evaluate both the existing site drainage conditions and proposed drainage plan for the subject development.

An investigation to determine the potential movement of soil due to rainfall and surface runoff during construction of the project in accordance with Chapter 20.08 of the Maui County Codes is also included.

II. PROPOSED PROJECT

A. Site Location:

The project site is located in Alaeloa, Lahaina, on the island of Maui, and in the State of Hawaii. It is situated immediately east (mauka) of Lower Honoapiilani Road and west (makai) of Honoapiilani Highway, and is approximately 600 feet southwest of the Lower Honoapiilani Road and Napilihau Street intersection (see Exhibit 1).

The project site of Napilihau Townhomes (Phase II) encompasses an area of approximately 3.371 acres.

B. Project Description:

Napilihau Townhomes is the second phase of a proposed four phase multi-family housing project which will ultimately consist of approximately ten, two story buildings, a neighborhood park site, and an offsite detention basin.

Roadway improvements will include asphalt paved roadways and parking lots, concrete sidewalks, concrete curbs and landscaping. Underground utility improvements will consist of underground drainage, sewer, and water distribution systems along with underground electrical, telephone, and cable distribution systems.

This phase of the project will consist of mass grading for the proposed improvements, including but not limited to buildings pads, parking lots, and detention basin. All exposed areas will be grassed as required to minimize soil erosion.

III. EXISTING CONDITIONS:

A. Topography and Soil Conditions:

The project site is presently undeveloped and not being used for any particular purpose. Natural vegetation includes but is not limited to guava, natal redtop, yellow foxtail, klu, lantana, and koa haole.

The existing ground slopes from an elevation of (+) 83± feet M.S.L. to (+) 53 feet M.S.L. in a northeasterly to southwesterly direction with an average slope of 11.8%.

According to the "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii (August, 1972)", prepared by the United States Department of Agriculture, Soil Conservation Service, the soil on the project site is Kahana Series, silty clay (KbC), 7 to 15 percent slopes (see Exhibit 2). This soil is characterized as having a moderately rapid permeability, slow to medium runoff and the water erosion hazard is slight.

B. Drainage:

Presently, the onsite surface runoff volume generated on the project site is calculated to be approximately 6.7 cfs (see Appendix A). This surface runoff volume presently sheet flows off the project site into an existing natural drainageway located on the southwesterly side of the project site. This surface runoff volume is conveyed across Lower Honoapiilani Road by means of an existing 24-inch diameter culvert and subsequently across Kahana Sunset property into Keonenui Bay by an underground drainage system.

C. Flood and Tsunami Zone:

According to Panel Number 150003 0138B of the Flood Insurance Rate Map, revised September 6, 1989, prepared by the United States Federal Emergency Management Agency, the entire project site is situated within Zone C which is designated as areas subject to minimal flooding (see Exhibit 3).

IV. DRAINAGE PLAN

A. General:

According to our calculations, the peak post development offsite and onsite surface runoff volume generated by the Napilihau Townhomes project in Phase II will be approximately 23.8 cfs. This translates to a net increase of approximately 17.1 cfs over the present peak runoff volume.

A temporary detention basin will be constructed within the future park site situated on the southwesterly side of the Phase II project site to handle this additional post development runoff. This detention basin is being sized to accommodate the entire Napilihau Townhomes development in Phase II (see Appendix A). The basin will receive, temporarily store, and slowly release the surface runoff generated from the project site at a rate which is lower than the current pre-development peak runoff. Approximately seventy five percent (75%) of the pre-development runoff (5.0 cfs) will be released out of the detention basin through a new 12 inch diameter corrugated aluminum (CAP) drainline, all in compliance with the provisions of Chapter 4, "Rules for the Design of Storm Drainage Facilities in the County of Maui".

The peak runoff volume expected to be generated from the Phase II Napilihau Townhomes site and the detention basin site after completion of mass grading is 53 cfs. This is approximately 1.4 cfs less than the present pre-development runoff from the same area. This is attributable to the use of flatter grades and more uniform vegetal cover throughout the site. After mass grading is completed runoff will be directed into the temporary detention basin mentioned earlier by the use of berms and grassed swales.

This report was prepared primarily for the mass grading phase of the Napilihau Townhomes project site. A comprehensive drainage report for Phase II will be submitted later together with the construction plans for the ultimate site improvements.

B. Hydrologic Calculations:

The hydrologic calculations are based on the "Rules for the Design of Storm Drainage Facilities for the County of Maui", Title MC-15, Chapter 4 and the "Rainfall Frequency Atlas of the Hawaiian Islands", Technical Paper No. 43, U. S. Department of Commerce, Weather Bureau.

Rational Formula used:

$$Q = CIA$$

Where $\dot{Q}$ = Rate of Flow (cfs)

C = Rainfall Coefficient

I = Rainfall Intensity (inches/hour)

A = Area (Acres)

The hydrologic calculations for this project may be found in Appendix A.

C. Conclusion:

Since the temporary detention basin has been sized to handle the full 23.8 cfs post-development runoff from the ultimate Phase II Napilihau Townhomes project, and the runoff after mass grading is projected to be less than the current pre-development volume, it is our professional opinion that this mass grading phase of the project will not have any adverse impact on the adjoining properties.

V. SOIL EROSION CONTROL PLAN

A. Grading Plan:

Grading work for the roadways, lots, and offsite detention basin encompasses an area of 5.0 acres which is less than the maximum allowable fifteen (15) acres. Upon completion of grading, all exposed areas will be grassed as required.

B. Soil Erosion Control Plan:

The following measures will be taken to control erosion during the site development period.

1. Minimize time of construction.
2. Retain existing ground cover until latest date to complete construction.
3. Early construction of drainage control features.
4. Use temporary area sprinklers in non-active construction area when ground cover is removed.
5. Station water truck on site during construction period to provide for immediate sprinkling, as needed, in active construction zones (weekends and holidays included).
6. Use temporary berms, filter berms, and cut-off ditches, where needed, for control of erosion.
7. Graded areas shall be thoroughly watered after construction activity has ceased for the day and on weekends.

8. All cut and fill slopes shall be sodded or planted immediately after grading work has been completed.
9. Install silt screens where appropriate.

C. Conclusion:

Although the "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, (August, 1972)", characterizes the soil at the project site as having a slight water erosion hazard, our calculations indicate that the sedimentation hazard to coastal waters and downstream properties for the proposed development are minimal (see Appendix B). The soil loss per unit area and severity rating computed for the proposed development are well within the tolerable limits and additional erosion control measures are not required.

Report Prepared By:

Eric A. Nakagawa

Report Checked By:

Reed M. Ariyoshi, P.E.

VI. REFERENCES

1. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* August 1972. United States Department of Agriculture, Soil Conservation Service.

2. *Flood Insurance Rate Map, Maui County, Hawaii.* Community-Panel Number 150003 0138B. September 6, 1989. Federal Emergency Management Agency, Federal Insurance Administration.

3. *Drainage Master Plan for the County of Maui, State of Hawaii.* October 1971. R.M. Towill Corporation.

4. *Rainfall Frequency Atlas of the Hawaiian Islands, Technical Paper No. 43.* 1962. U.S. Department of Commerce, Weather Bureau.

5. *Rules for the Design of Storm Drainage Facilities, Title MC-15, Chapter 4.* July 14, 1995. Department of Public Works, County of Maui.

EXHIBITS

1. Location Map
2. Soil Survey Map
3. Flood Insurance Rate Map
4. USGS Map
5. Pre-Development Flow Pattern Map

a:\wp51data\sfowp\95\95034013.rpt

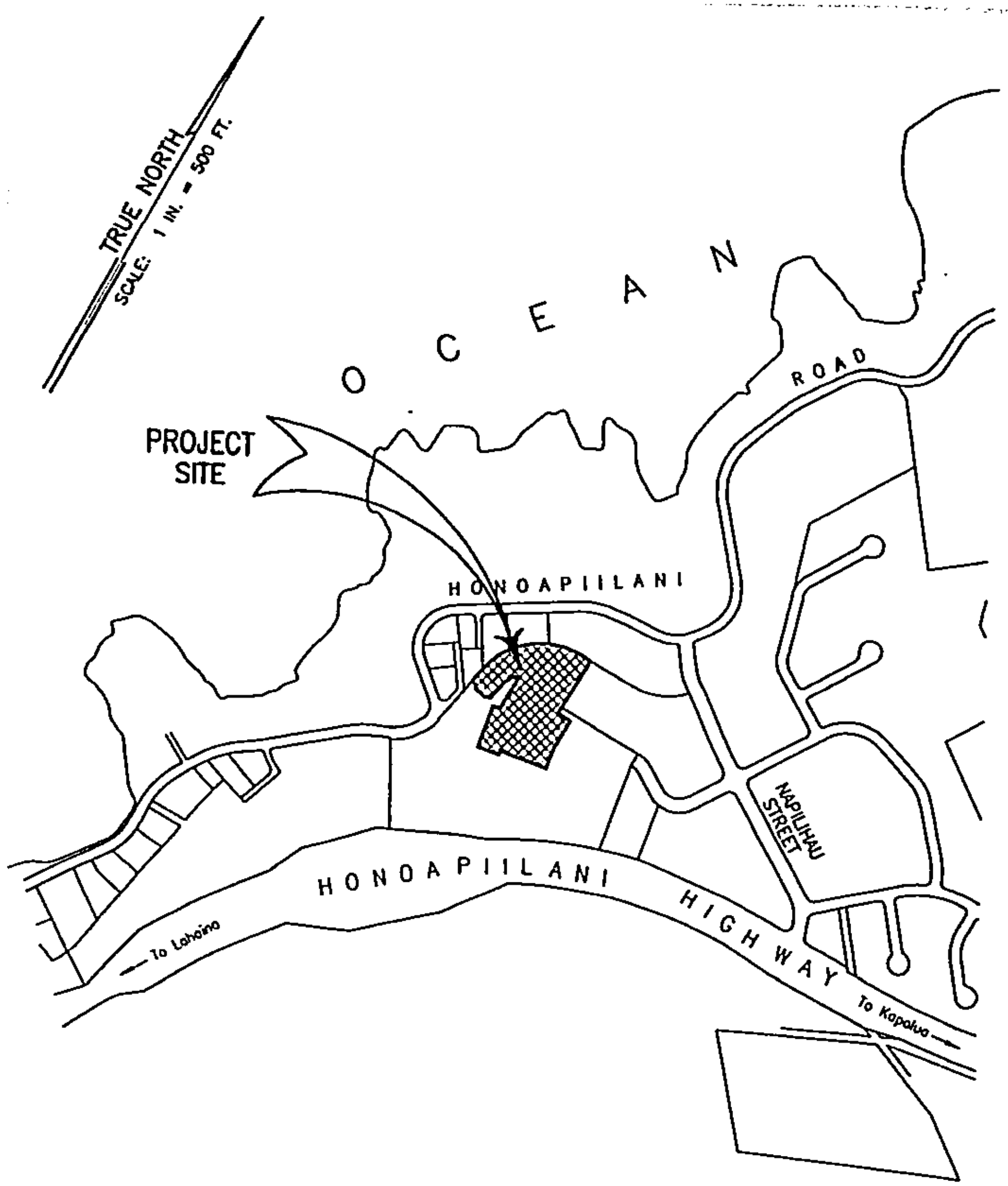


EXHIBIT 1
LOCATION MAP

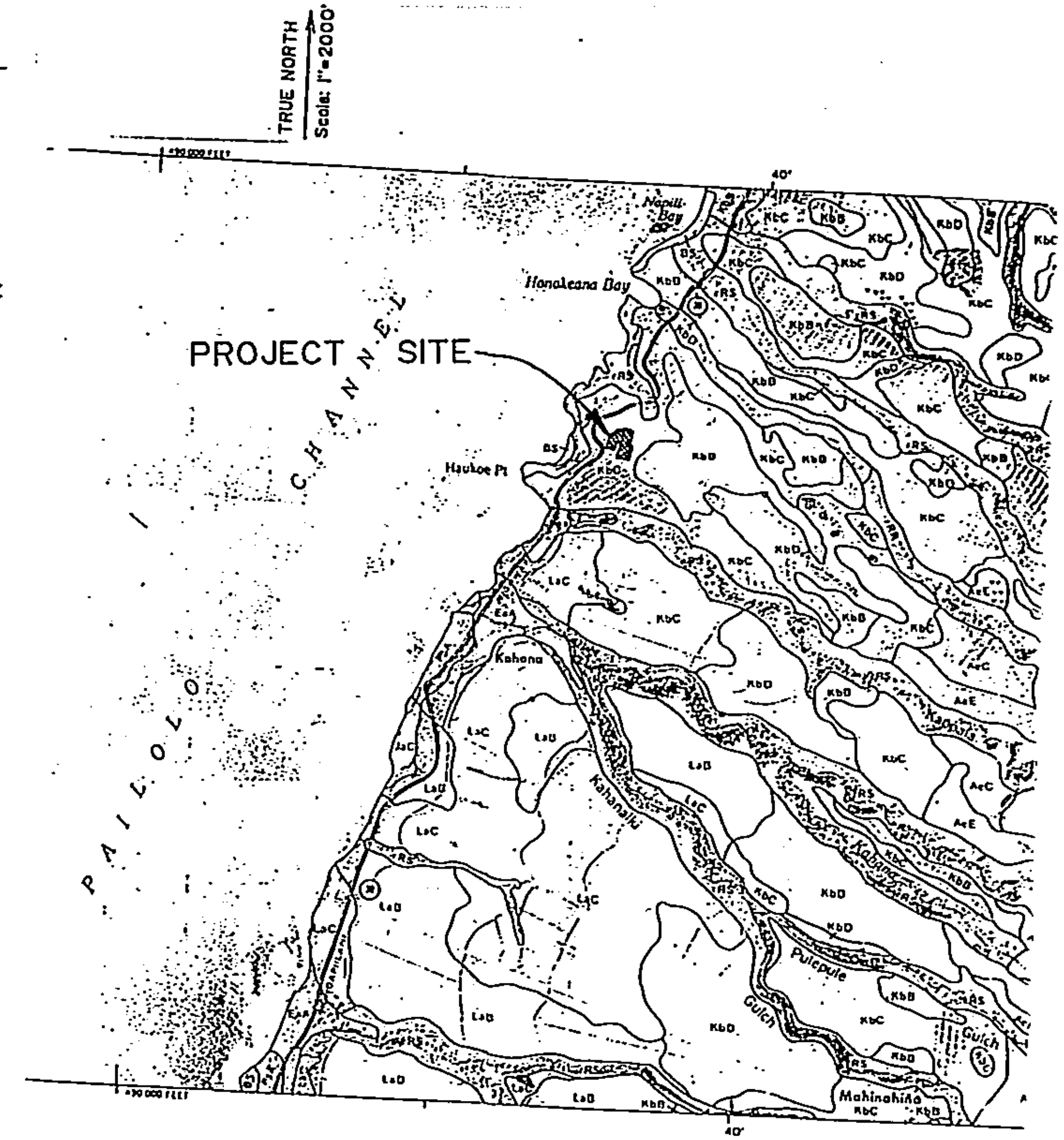


EXHIBIT 2
SOIL SURVEY MAP

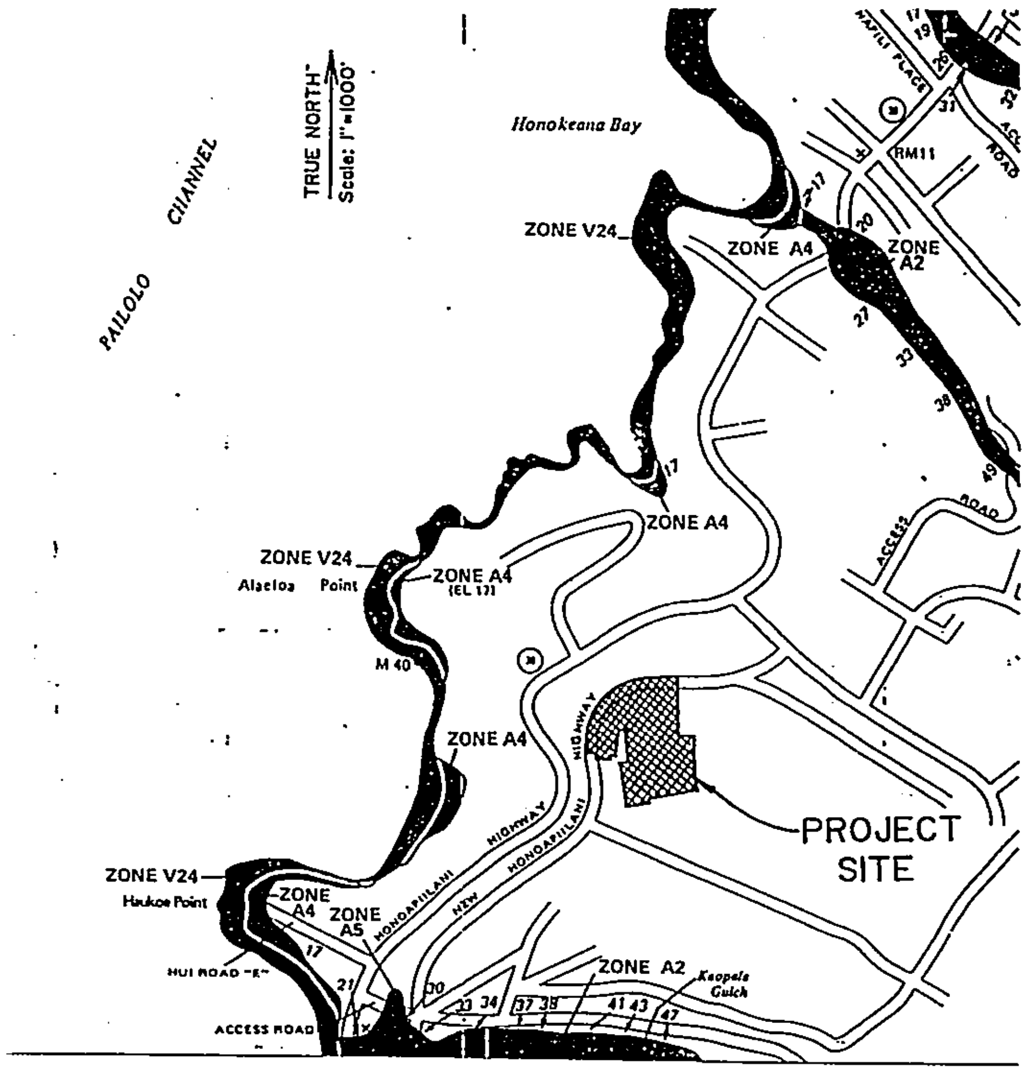
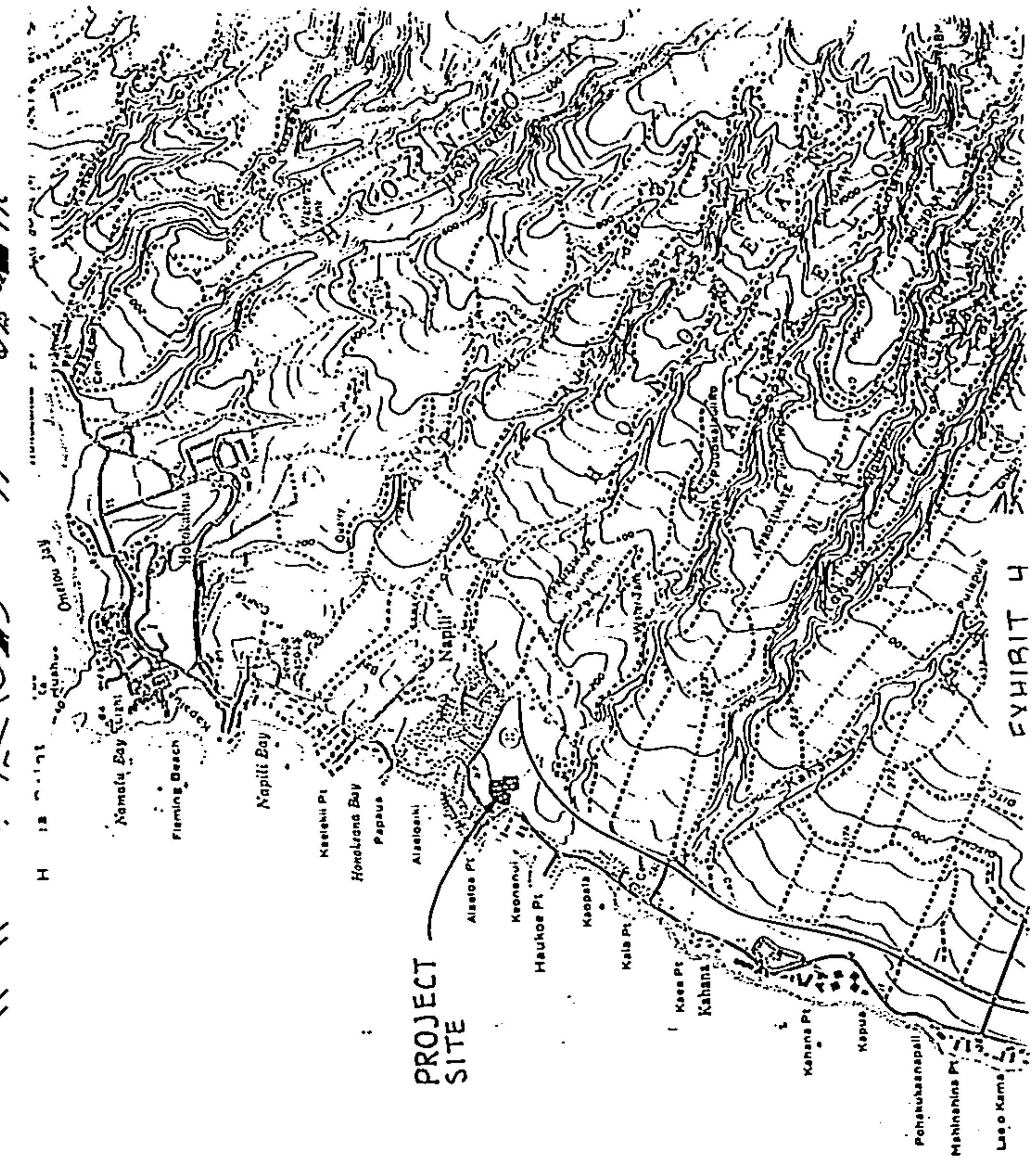
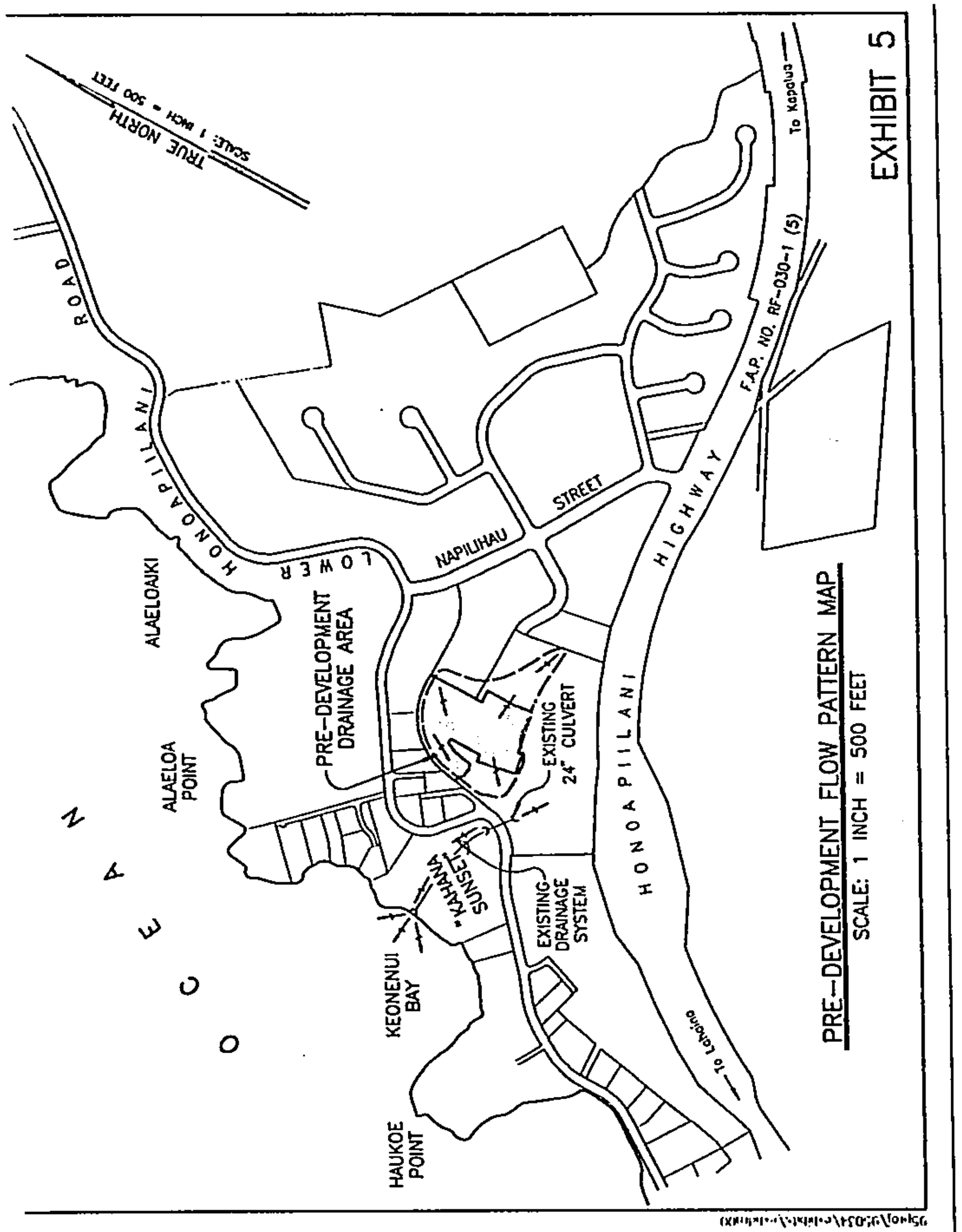


EXHIBIT 3
FLOOD INSURANCE RATE MAP





APPENDIX A

HYDROLOGIC CALCULATIONS

PAGE
W.S. Unemori Engineering, Inc.
Wailuku, Hawaii
MARCH 3, 1997

HYDROLOGIC REPORT FOR

Napilihau Townhomes

UNIVERSAL RATIONAL HYDROGRAPH

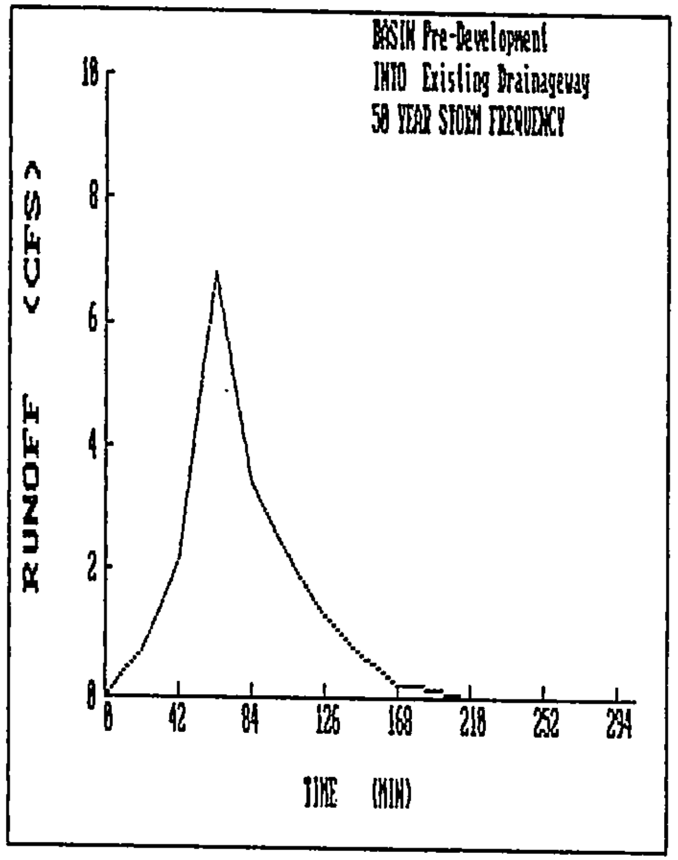
Q(PEAK) = C*I*A
50 YEAR STORM FREQUENCY

BASIN IDENTIFIER Pre-Development
DISCHARGES INTO Existing Drainageway

BASIN AREA	=	5.57	ACRES
RUNOFF COEFF.	=	0.30	
RAINFALL INT.	=	4.04	IN/HR
TIME OF CONC.	=	21.00	MINUTES
VOLUME	=	22170.50	CUBIC FEET

TIME (MIN)	RUNOFF (C.F.S.)
0.0	0.0
10.5	0.4
21.0	0.7
31.5	1.4
42.0	2.2
52.5	4.5
63.0	6.8
73.5	5.1
84.0	3.4
94.5	2.8
105.0	2.2
115.5	1.8
126.0	1.3
136.5	1.0
147.0	0.7
157.5	0.4
168.0	0.2
178.5	0.2
189.0	0.1
199.5	0.1
210.0	0.0
220.5	0.0
231.0	0.0
241.5	0.0
252.0	0.0
262.5	0.0
273.0	0.0
283.5	0.0
294.0	0.0
304.5	0.0

PRE-DEVELOPMENT DRAINAGE CALCULATIONS



WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS AND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793
TEL: (808) 242-4403 FAX: (808) 244-4856

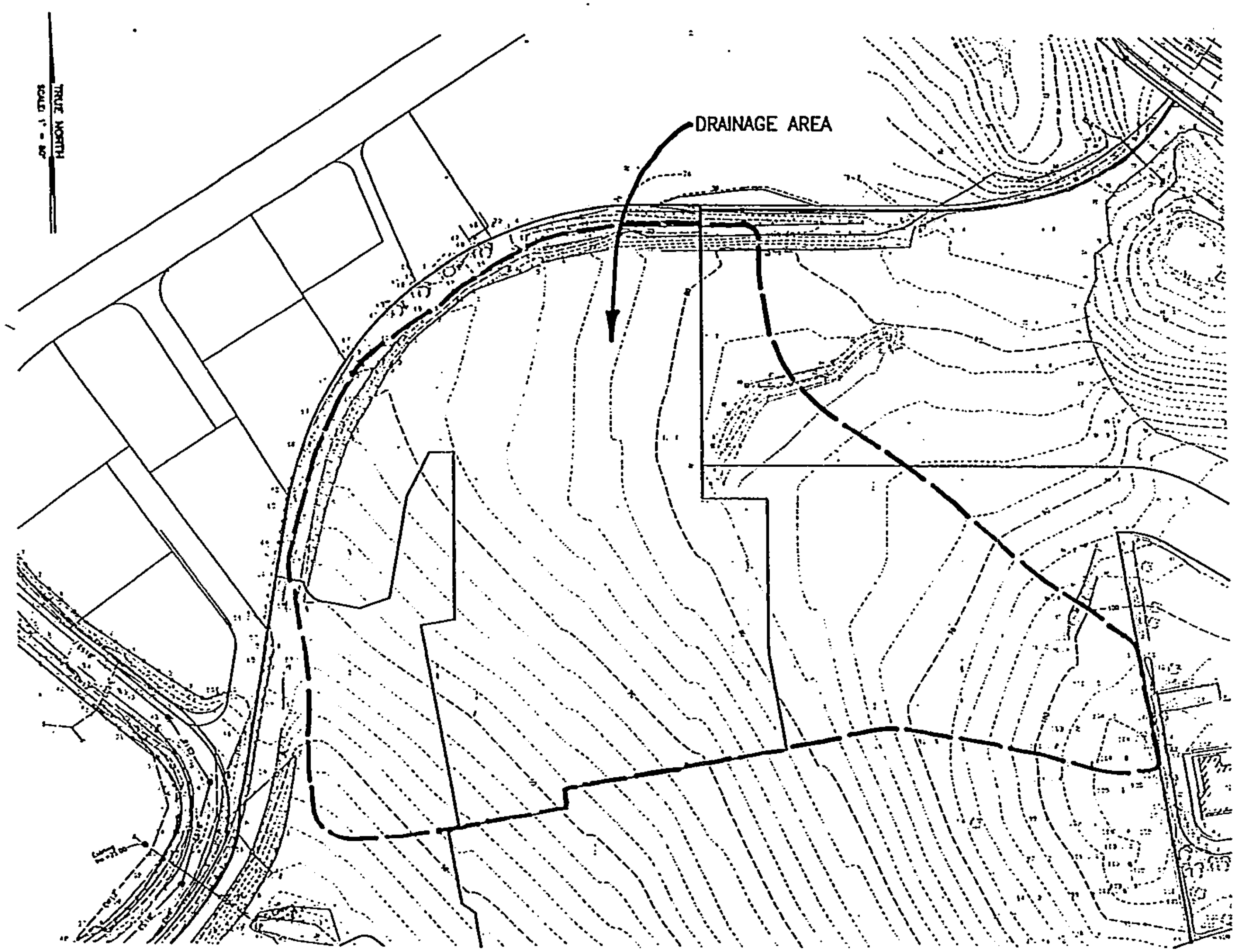
JOB: Napilihau Townhomes Mass Grading
CALCULATED BY: EAN DATE: 6/20/97
CHECKED BY: RHA DATE: 6/20/97

Determine: Runoff Coefficient for Pre-Development Surface Runoff

Solution: According to Table 1 of the Rules for the Design of Storm Drainage Facilities, Title MC-15, Chapter 4, July 14, 1995, Department of Public Works, County of Maui:

Runoff Coefficient = Agricultural + Poor + Rolling + Medium
= 0.15 + 0.05 + 0.03 + 0.07
= 0.30

SHEET ____ OF ____



PRE-DEVELOPMENT DRAINAGE AREA

W.S. Unemori Engineering, Inc.
Wailuku, Hawaii
MARCH 3, 1997

HYDROLOGIC REPORT FOR

Napilihau Townhomes

UNIVERSAL RATIONAL HYDROGRAPH

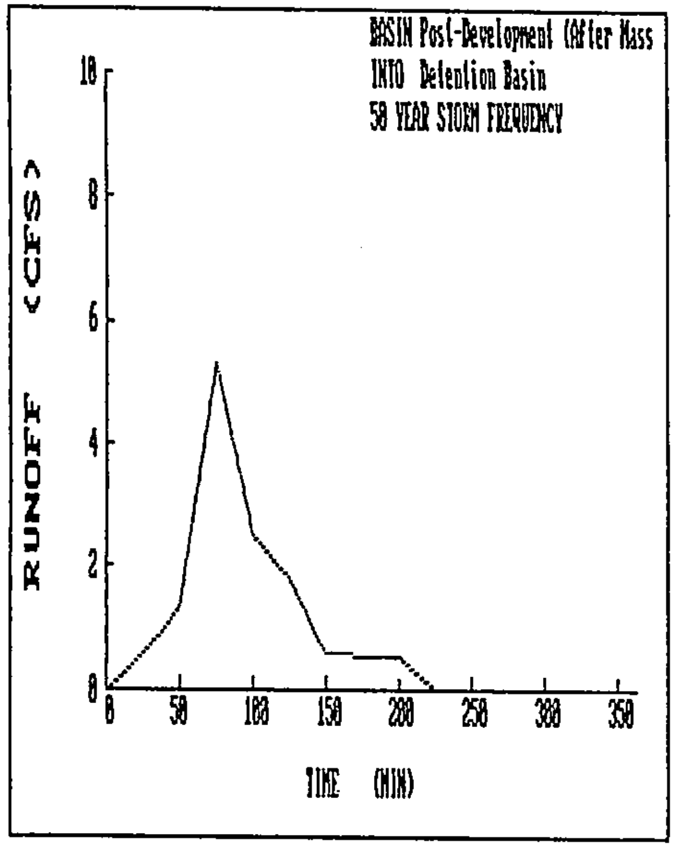
Q(PEAK) = C*I*A
50 YEAR STORM FREQUENCY

BASIN IDENTIFIER   Post-Development (After Mass Grading)
DISCHARGES INTO   Detention Basin

BASIN AREA	=	5.57	ACRES
RUNOFF COEFF.	=	0.25	
RAINFALL INT.	=	3.80	IN/HR
TIME OF CONC.	=	25.00	MINUTES
VOLUME	=	19756.09	CUBIC FEET

TIME (MIN)	RUNOFF (C.F.S.)
0.0	0.0
12.5	0.3
25.0	0.6
37.5	1.0
50.0	1.3
62.5	3.3
75.0	5.3
87.5	3.9
100.0	2.5
112.5	2.2
125.0	1.8
137.5	1.2
150.0	0.6
162.5	0.6
175.0	0.5
187.5	0.5
200.0	0.5
212.5	0.3
225.0	0.0
237.5	0.0
250.0	0.0
262.5	0.0
275.0	0.0
287.5	0.0
300.0	0.0
312.5	0.0
325.0	0.0
337.5	0.0
350.0	0.0
362.5	0.0

POST-DEVELOPMENT (AFTER MASS GRADING) DRAINAGE CALCULATIONS



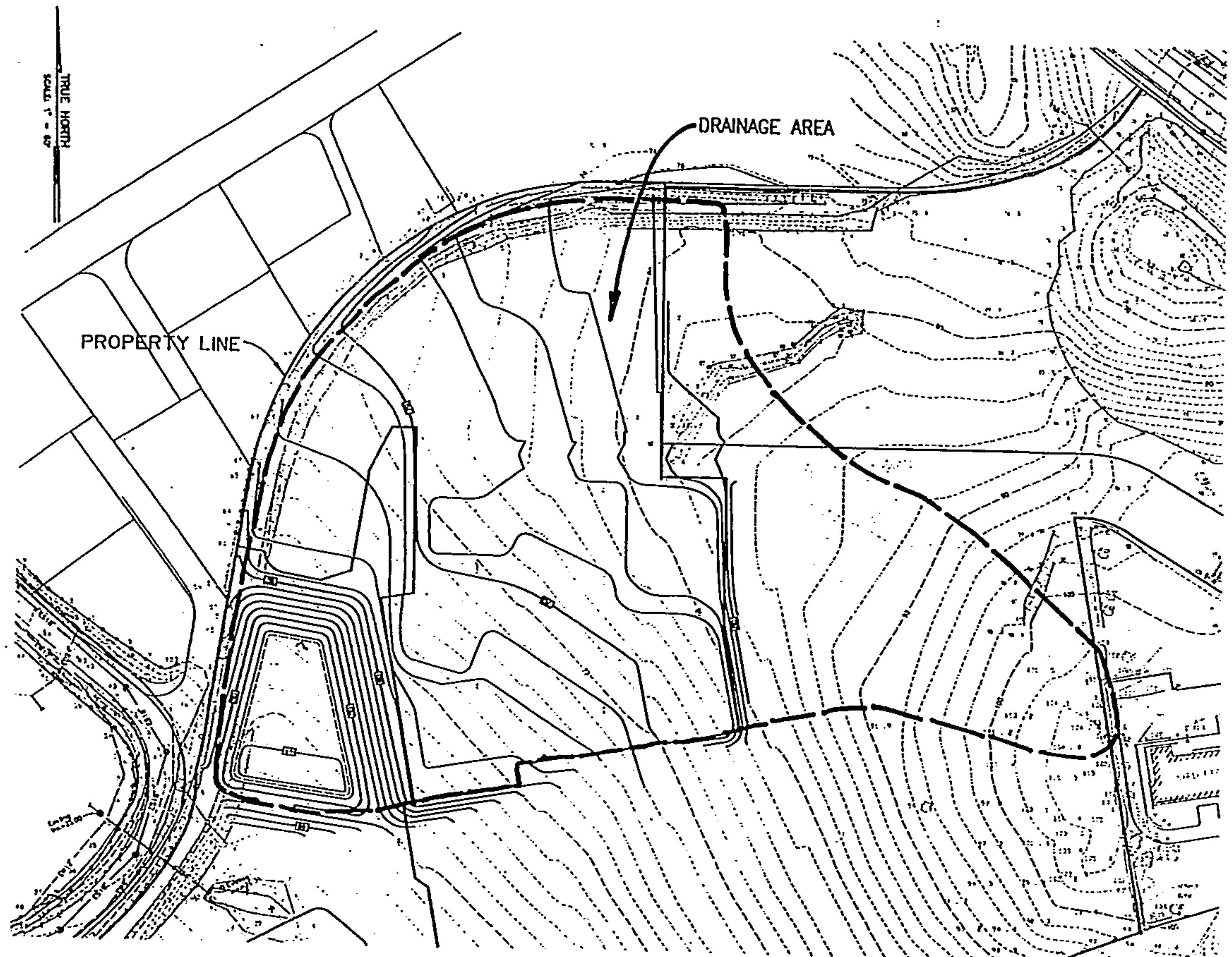
WARREN S. UNEMORI
ENGINEERING, INC.
Civil & Structural Engineers - Land Surveyors
2123 Kaohu St. Wailuku, Maui, Hawaii 96793
Phone 244-9294

JOB Napilihau Townhomes Mass Grading
SHEET NO. 1 OF 1
CALCULATED BY EAN DATE 6/20/97
CHECKED BY RMA DATE 6/20/97
SCALE

Determine: Runoff Coefficient for Post Development after the Mass Grading of the Project

Solution: According to Table 1 of the Rules for the Design of Storm Drainage Facilities, Title MC-15, Chapter 4, July 14, 1995. Department of Public Works, County of Maui.

Runoff Coefficient = Agricultural + High + Rolling + Medium
= 0.15 + 0.00 + 0.03 + 0.07
= 0.25



POST-DEVELOPMENT (AFTER MASS GRADING) DRAINAGE AREA

W.S. Unemori Engineering, Inc.
Wailuku, Hawaii
JUNE 5, 1997

HYDROLOGIC REPORT FOR

Napilihau Townhomes

UNIVERSAL RATIONAL HYDROGRAPH

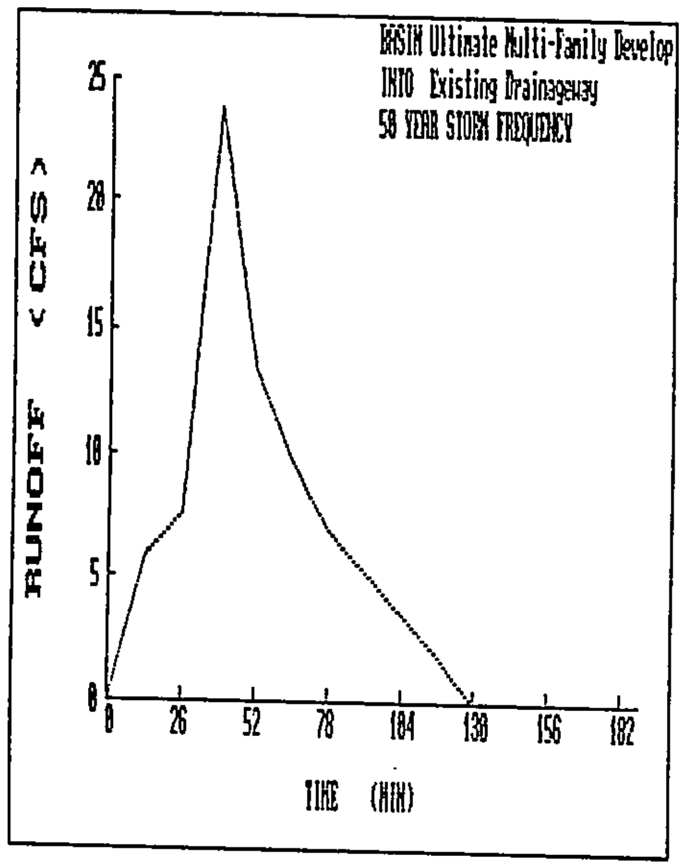
Q(PEAK) = C*I*A
50 YEAR STORM FREQUENCY

BASIN IDENTIFIER Ultimate Multi-Family Development
DISCHARGES INTO Existing Drainageway

BASIN AREA =	7.08	ACRES
RUNOFF COEFF. =	0.70	
RAINFALL INT. =	4.80	IN/HR
TIME OF CONC. =	13.00	MINUTES
VOLUME =	60536.55	CUBIC FEET

TIME (MIN)	RUNOFF (C.F.S.)
0.0	0.0
6.5	3.0
13.0	6.0
19.5	6.8
26.0	7.6
32.5	15.7
39.0	23.8
45.5	18.5
52.0	13.3
58.5	11.4
65.0	9.6
71.5	8.3
78.0	6.9
84.5	6.0
91.0	5.2
97.5	4.3
104.0	3.5
110.5	2.6
117.0	1.8
123.5	0.9
130.0	0.0
136.5	0.0
143.0	0.0
149.5	0.0
156.0	0.0
162.5	0.0
169.0	0.0
175.5	0.0
182.0	0.0
188.5	0.0

POST-DEVELOPMENT (ULTIMATE MULTI-FAMILY) DRAINAGE CALCULATIONS



WARREN S. UNEMORI ENGINEERING, INC.
Civil & Structural Engineers • Land Surveyors
2123 Kaohu St. Wailuku, Maui, Hawaii 96793
Phone 244-9294

JOB Napilihau Townhomes Mass Grading
SHEET NO. 1 OF 1
CALCULATED BY EAN DATE 6/20/97
CHECKED BY RMA DATE 6/20/97
SCALE

Determine: Runoff Coefficient for the Ultimate Multi-family Development

Solution: According to Table 1 of the Rules for the Design of Storm Drainage Facilities, Title MC-15, Chapter 4. July 14, 1995. Department of Public Works, County of Maui:

Runoff Coefficient = Industrial/Business + Poor + Flat + Medium
= 0.55 + 0.05 + 0.00 + 0.07
= 0.67

According to Table 2 of the Rules for the Design of Storm Drainage Facilities, Title MC-15, Chapter 4. July 14, 1995. Department of Public Works, County of Maui:

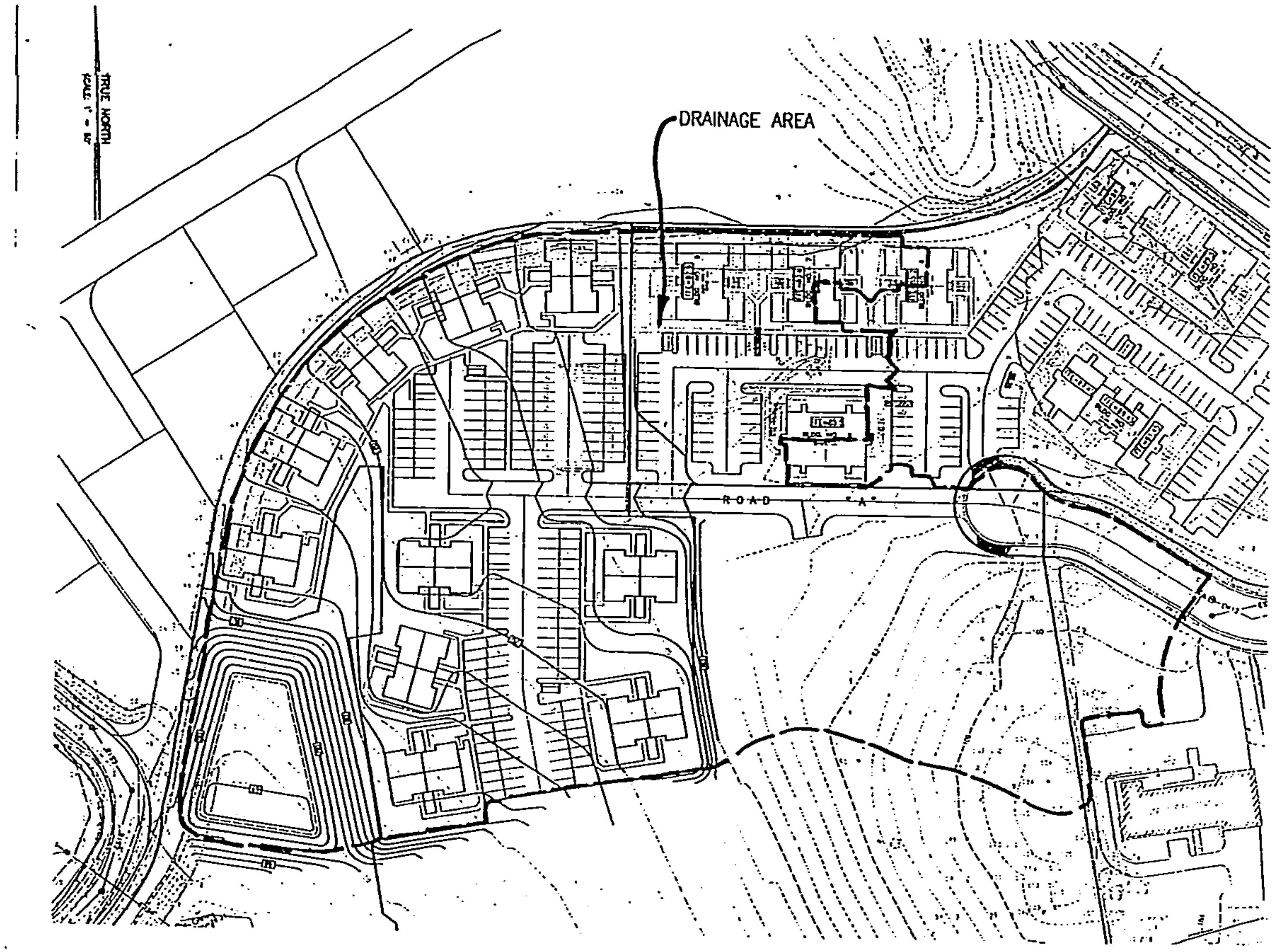
$$\text{Runoff Coefficient} = (\text{Paved Area}/\text{Total Area})(0.95) + (\text{Landscaped Area}/\text{Total Area})(0.30)$$
$$= (88460.83/146840.76)(0.95) + (58379.93/146840.76)(0.30)$$
$$= 0.5723 + 0.1193$$
$$= 0.69$$

According to Table 3 of the Rules for the Design of Storm Drainage Facilities, Title MC-15, Chapter 4. July 14, 1995. Department of Public Works, County of Maui:

Minimum Runoff Coefficients For Built-up Areas:

Hotel, apartment areas C = 0.70

Therefore, using the guidelines outlined in the Rules for the Design of Storm Drainage Facilities, Title MC-15, Chapter 4. July 14, 1995. Department of Public Works, County of Maui, the runoff coefficient for the ultimate multi-family development is 0.70.



POST-DEVELOPMENT (ULTIMATE MULTI-FAMILY) DRAINAGE AREA

POND-2 Version: 5.17 S/N:
EXECUTED: 06-05-1997 23:57:31

Inflow Hydrograph: 9503 .HYD
Rating Table file: TEST .PND

----INITIAL CONDITIONS----
Elevation = 44.00 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)
44.00	0.0	0.000
44.50	1.9	0.044
45.00	2.7	0.127
45.50	3.3	0.238
46.00	3.9	0.356
46.50	4.3	0.483
47.00	4.7	0.617
47.50	5.1	0.759
48.00	5.5	0.909
48.50	5.8	1.068
49.00	6.1	1.235
49.50	6.4	1.412

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
0.0	0.0
9.9	11.8
28.5	31.2
53.1	56.4
79.6	83.5
107.9	112.2
137.9	142.6
169.6	174.7
203.1	208.6
238.6	244.4
276.0	282.1
315.4	321.8

Time increment (t) = 0.108 hrs.

TEMPORARY DETENTION BASIN DRAINAGE CALCULATIONS

Pond File: TEST .PND
Inflow Hydrograph: 9503 .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	44.00
0.108	3.00	3.0	2.0	3.0	0.48	44.13
0.217	6.00	9.0	7.5	11.0	1.78	44.47
0.325	6.80	12.8	15.8	20.3	2.25	44.72
0.433	7.60	14.4	24.9	30.2	2.66	44.97
0.541	15.70	23.3	42.0	48.2	3.10	45.34
0.650	23.80	39.5	73.8	81.5	3.85	45.96
0.758	18.50	42.3	107.3	116.1	4.35	46.56
0.866	13.30	31.8	129.8	139.1	4.66	46.94
0.975	11.40	24.7	144.8	154.5	4.85	47.19
1.083	9.60	21.0	155.9	165.8	4.99	47.36
1.191	8.30	17.9	163.6	173.8	5.09	47.49
1.300	6.90	15.2	168.5	178.8	5.15	47.56
1.408	6.00	12.9	171.0	181.4	5.18	47.60
1.516	5.20	11.2	171.9	182.2	5.19	47.61
1.625	4.30	9.5	171.0	181.4	5.18	47.60
1.733	3.50	7.8	168.5	178.8	5.15	47.56
1.841	2.60	6.1	164.4	174.6	5.10	47.50
1.949	1.80	4.4	158.7	168.8	5.03	47.41
2.058	0.90	2.7	151.6	161.4	4.94	47.29
2.166	0.00	0.9	142.8	152.5	4.82	47.15

****************** SUMMARY OF ROUTING COMPUTATIONS ******************

Pond File: TEST .PND
Inflow Hydrograph: 9503 .HYD
Outflow Hydrograph: OUT .HYD

Starting Pond W.S. Elevation = 44.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 23.80 cfs
Peak Outflow = 5.19 cfs
Peak Elevation = 47.61 ft

***** Summary of Approximate Peak Storage *****

Initial Storage = 0.00 ac-ft
Peak Storage From Storm = 0.79 ac-ft

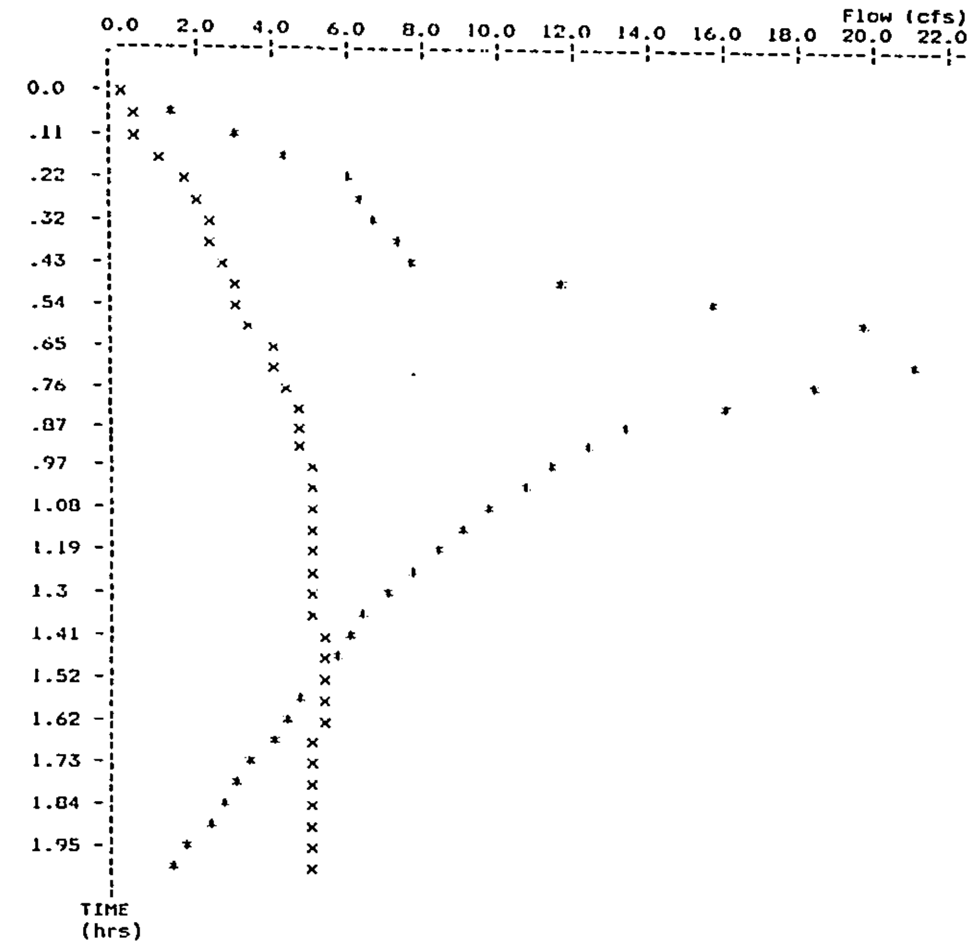
Total Storage in Pond = 0.79 ac-ft

POND-2 Version: 5.17 S/N:

Pond File: TEST .PND
Inflow Hydrograph: 9503 .HYD
Outflow Hydrograph: OUT .HYD

Peak Inflow : 23.80 cfs
Peak Outflow : 5.19 cfs
Peak Elevation : 47.61 ft

EXECUTED: 06-05-1997
23:57:31



* File: 9503 .HYD Qmax = 23.8 cfs
x File: OUT .HYD Qmax = 5.2 cfs

APPENDIX B

UNIVERSAL SOIL LOSS EQUATION CALCULATIONS

W.S. UNEMORI ENGINEERING, INC.
2145 Wells Street Suite 403
Wailuku, Maui, Hawaii 96793

BY: EAN
DATE: March 3, 1997

H.E.S.L. FOR NAPILIHAU TOWNHOMES

1. HESL EQUATION: E = R*K*LS*C*P

WHERE:
- E = Soil Loss (tons/acre/year)
- R = Average Annual Rainfall Factor for Erosion
- K = Soil Erodibility Factor
- L = Horizontal Slope Length (feet)
- S = Average Slope (%)
- LS = Slope Factor (function of L and S)
- C = Cover and Management Factor
- P = Erosion Control Practice Factor

R = 200.0 tons/acre/year
(Soil Erosion & Sediment Control Guide for Hawaii; Appendix A: Average Annual Values of Rainfall Factor)

K = 0.17 Soil Series: Kahana
(Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii; Soil Type Plates & Table 4; Soil Properties Related to Erosion & Sedimentation ....)

L = 260.0 feet
k = 30.0 feet
(Soil Erosion & Sediment Control Guide for Hawaii; Table 16)

S = (k/L)
= 11.5 %

LS= 2.740

NAPILIHAU TOWNHOMES
[Continued]

C = 1.00
(Soil Erosion & Sediment Control Guide for Hawaii Tables 17-22, Pages 59-61; C=1.00 for Bare Soil)

P = 1.00
(Soil Erosion & Sediment Control Guide for Hawaii; the Universal Soil Loss Equation in Hawaii)'

E = R*K*LS*C*P
= 93.2 tons/acre/year

2. SEVERITY RATING NUMBER EQUATION: H=[(2*F*T)+(3*D)]*A*E

WHERE:
- H = Severity rating number
- T = Duration of land-disturbing activity (years)
- A = Area subject to disturbance (acres)
- E = Rate of soil loss under disturbed conditions (tons/acre/year)
- F = Downslope-downstream rating factor (rating points/ton)
- D = Coastal water rating factor (rating points/ton)

T = 1.00 years

A = 5.00 acres

E = R*K*LS*C*P
= 93.2 tons/acre/year

F = 4 (Downslope-downstream detriment: Major)

D = 2 (Coastal water rating factor: Class A)

H = [(2*F*T)+(3*D)]*A*E
= 6,521.1

Standard severity rating (allowable): 50,000 r 6,521.1 =>OK

NAPILIHAU TOWNHOMES
[Continued]

3. MAXIMUM ALLOWABLE SOIL LOSS: E max = H max/(2FT+3D)A

E max = H max/(2FT+3D)A, Hmax = 50,000
= 714.3 tons/acre/year r 93.2 tons/acre/year =>OK

Coastal Hazard: Class A waters are approximately 280 feet from the site.

CONCLUSION: Sedimentation hazard to coastal waters and downstream properties is minimal. Erosion rate computed for this project site is well within the tolerable limits and additional control measures are not required.

4. REFERENCES:

1. Soil Conservation Service (USDA): 'Guidelines For Use of the Universal Soil Loss Equation in Hawaii,' Technical Notes, March 1975. (Revised Draft)

2. County of Maui; (Ord No. 816), 'Chapter 24, Soil Erosion and Sedimentation Control,' June 13, 1975.

3. Soil Conservation Service (USDA); 'Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai; State of Hawaii, August 1972.

4. Hawaii Environmental Simulation Laboratory; 'Guidelines for Data Preparation, Part 1: Universal Soil Loss Equation; Undated (Draft).

Appendix E

Archaeological Inventory Study

ARCHAEOLOGICAL INVENTORY SURVEY WITH SUBSURFACE TESTING REPORT, FOR A PROPERTY LOCATED AT TMK: 4-3-03:108 AND 110, 'ALAELOA AHUPUA'A, LAHAINA DISTRICT, ON THE ISLAND OF MAUI

SEPTEMBER 1992

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Abstract

An inventory survey with subsurface testing was performed by Archaeological Consultants of Hawaii, Inc. on a property owned by JGL Enterprises. Neither the surface survey, nor the two test units, encountered cultural or historic materials of significance. The absence of significant historic sites on the property has been attributed to the disturbances associated with pineapple cultivation. ACH concludes that the proposed housing construction will have "no effect" on significant historic resources.

Section 1: Introduction

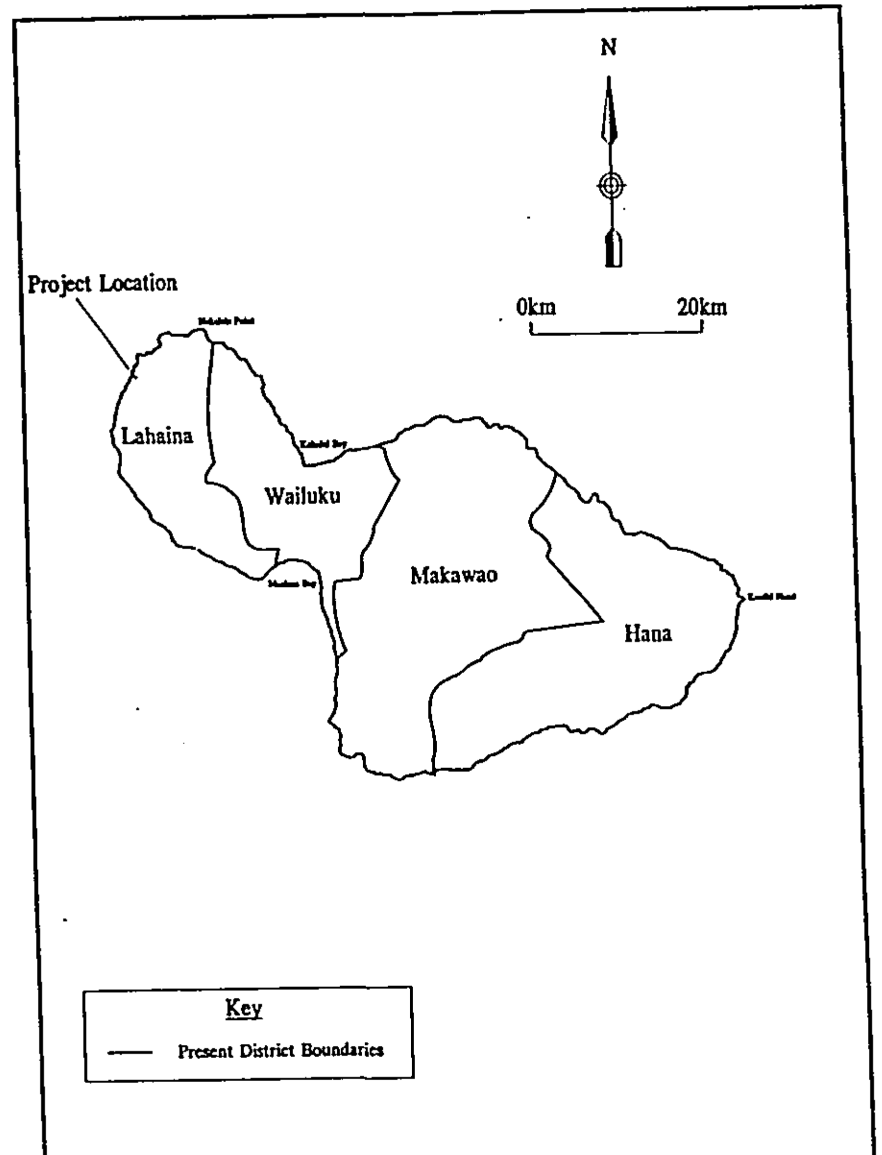
At the request of Mr. Jim Lee, Archaeological Consultants of Hawaii, Inc. (ACH) conducted an archaeological inventory survey with subsurface testing at TMK 4-3-03:108 and 110. This property, owned by JGL Enterprises, is located in the ahupua'a of 'Alaeloa, district of Lahaina, on the Island of Maui (see Map 1). The purpose of the inventory survey is to assess the significance of cultural resources on the property to the interests of historic preservation.

Section 2: Physical Setting

The geographical grid reference for the subject property is 20 59' 16" N and 156 40' 16" W, and the UTM coordinates are 2322560m N and 742170m E (see Maps 2 and 3). The project area is located in the ahupua'a of Alaeloa, Maui, approximately 500m from the Pailolo Channel at Alaeloa Point. This property is bounded to the north by Napilihau Street, to the east or mauka side by a shopping center and a fire station, the Honoapi'ilani Highway to the south, and the Old Piilani Road along the west or makai property edge. The areal extent of the subject property totals 16.459 acres.

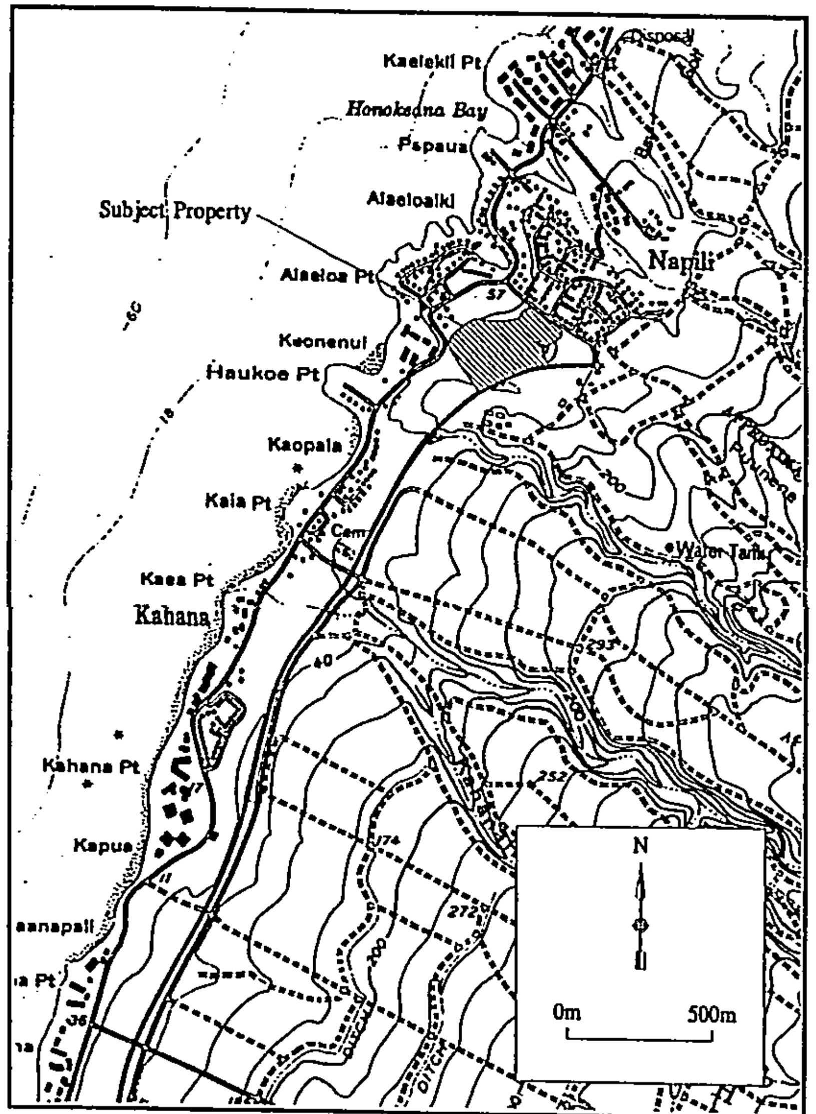
According to Foote et al., the soils on the subject property belong to the Kahana Series which developed as the underlying basic igneous rock was weathered (1972: Sheet #92). The Kahana silty clay is characteristically dark reddish brown; forms subangular fine blocks; very sticky and very plastic; and reacts vigorously with dilute hydrogen peroxide (Foote et al. 1972: 50-51).

Map 1: Project Location on a Map of Maui



TMK: 4-3-03:108 and 110; Napili, Maui   Archaeological Consultants of Hawaii, Inc. 1992

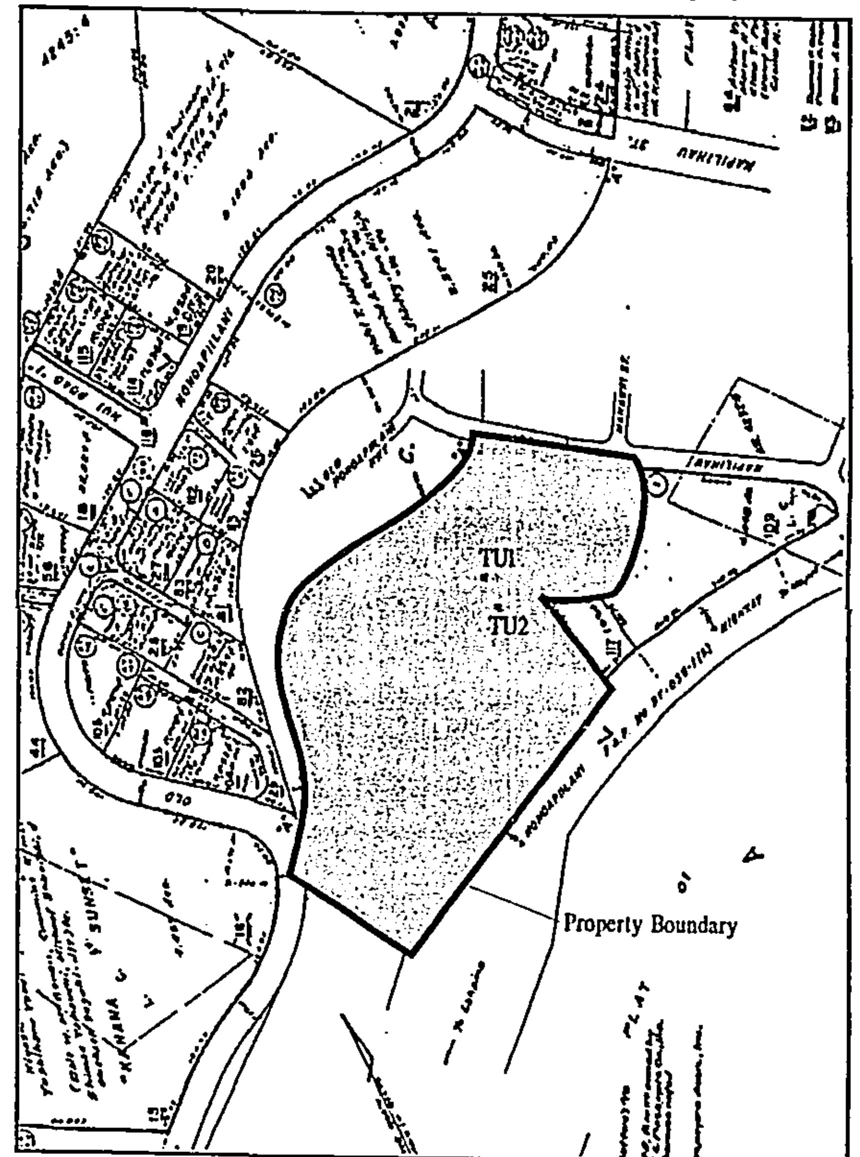
Map 2: Location of the Subject Property on a U.S.G.S. Topographic Map



TMK: 4-3-03:108 and 110; Napili, Maui

Source: U.S.G.S. 7.5 Minute Series (Topographic); Napili Quadrangle 1983

Map 3: Locations of the Test Units on the Subject Property



TMK: 4-3-03:108 and 110; Napili, Maui

After: Tax Map

The subject property, which lies at an approximate elevation of 80 feet above sea level, receives 30 to 45 inches of precipitation a year (Armstrong 1973: 56). The vegetation consists of pineapple (Ananas spp.); camphor trees (Cinnamomum camphora); wild tamarind or haole koa, (Leucaena glauca); bittermelon (Momordica charantia); guava (Psidium guajava); and clumps of grass. The topography suggests that the subject property has been used for pineapple cultivation. This is indicated by the plowed, level terraces which are divided by unpaved roads.

Section 3: Historical Accounts

The project area lies within the ahupua'a of 'Alaeloa, in the present day district of Lahaina on the dry leeward slopes of the West Maui Mountains. Formerly, 'Alaeloa was in the district of Ka'anapali, which included most of the north facing valleys in West Maui. Its shape typifies the traditional ahupua'a, a narrow strip of land extending from the mountains to the sea, and includes the entire extent of Ka'opala Gulch. 'Alaeloa is bordered on the north by the ahupua'a of Honokeana and on the south by Mailepai.

Early ethnographic accounts of Ka'anapali are few, for visitors, whalers, and missionary efforts were centered further south in well-watered Lahaina. Vancouver visited Maui in 1783, sailing along the leeward coast from Kipahulu to Lahaina and noted that the western shores of Maui were in a state of devastation. In Lahaina, few Hawaiians came out to trade, and those who did traveled in worn canoes, and had few hogs and little fruit with which to barter (Speakman 1978:72). Vancouver understood the poverty of the people of Maui to be a result of the previous hundred years of warfare on the island.

The eighteenth century was a period of intense warfare in much of Maui. After the death of Kekaulike, high chief of Maui, there was a struggle between two of his sons, Kamehameha-nui, and Ka-uki, for succession. Intense fighting took place at Napili and Honokahua in Ka'anapali (Kamakau 1992:74).

Stewart (1928) wrote of Lahaina and its surrounding areas and remarked on the "high degree of cultivation in the better-watered gulches in the region." (as quoted in Griffin and Lovelace 1977:63). However, the valleys north of Honokowai become increasingly drier and are not as well-watered as the area around Lahaina. Thus Stewart's description is unlikely to apply to 'Alaeloa. Land use in 'Alaeloa in traditional times would have depended, to a large extent, upon the existence of a permanent stream. Handy and Handy (1972:494)(also Handy 1940:159) recorded evidence of native Hawaiian agriculture in the area in the 1930's:

North of Lahaina are five valleys watered by streams draining the western slopes of the West Maui watershed: Honokawai, Kahana, Honokahua, Honolua, and Honokohau. The first four all had extensive lo'i lands in their valley bottoms, where terraces rose tier on tier in symmetrical stone-faced lo'i. On this part of the coast there is no sloping kula land seaward of the valleys as there is back of Lahaina and southeastward.

Ka'opala, while relatively large, is smaller than both Kahana Valley to the south and Honokahua Valley to the north. Presently, its stream is dry, the water having been diverted for the irrigation of large agricultural fields. However, the L.C.A.'s located within this ahupua'a do not indicate that irrigated agriculture was practiced in Ka'opala prior to the diverting of the stream.

During the Great Mahele of the early 1850's, nine land tenants claimed 32 apana (land parcel) in 'Alaeloa (Index of Land Commission Awards, State Archives). The majority of these apana were claimed as kula land ("kula" in the Foreign Testimony Books, and translated into the English version of the Native Testimony Books as "potato pasture" or just "pasture"). These claims bordered Ka'opala Stream. Kuleana awards were scattered all along the stream; one was located at the head of the stream, at the confluence of two very small tributaries. Taro was mentioned just twice, once as "dry taro land", and once as just "taro land", in patches approximately half a mile inland from the coast. Five house lots were claimed in 'Alaeloa, all of which were located on the seashore (Native and Foreign Testimony and Register Books, State Archives).

In the later half of the nineteenth century, much of Ka'anapali was used for the grazing of life stock. A Hawaii Government Survey map of the island of Maui (W. D. Alexander, surveyor, 1885, brought up to date in 1903 by John M. Donn) illustrates land use for the entire island. On this map, the land north of Honokowai is designated as "grazing land", whereas Honokowai itself and the area to the south were being used for sugarcane cultivation. Use of Ka'anapali as pasturage was prevalent until about 1915, when sugar and pineapple plantations were established.

The initial sugar cane interests in West Maui were controlled by the Pioneer Mill Company out of Lahaina. The Pioneer Mill plantation was established in 1865 by an Irishman, James C. Campbell, and by 1900, controlled some 3,600 acres in Ka'anapali, stretching beyond Wahikuli. A railroad was built in 1887, and in 1919 extended as far as Honokeana, just north of 'Alaeloa. A 1928 field map of the lands of Pioneer Mill Co, Ltd. indicates that the northernmost cane field extended from the south to the southern edge of Ka'opala Gulch. On the northern side of the gulch, nothing is shown; pineapples are designated further to the north, in Napili and beyond (Conde and Best 1973:252-255).

A 1923 USGS map (Lahaina Quadrangle) shows little evidence of human habitation in 'Alaeloa. A railroad follows the coast through 'Alaeloa, and turns inland just north in Honokeana. Only six structures are shown in the ahupua'a, one on the coast, and the rest scattered along dirt tracks crossing the land on the northern side of Ka'opala Gulch, all in the seaward half of 'Alaeloa.

A huge tract of land north of Ka'opala Gulch was controlled by Baldwin Packers, Inc., and cultivated in pineapple from the beginning of the century until recently. In 1943, Baldwin Packers released 92 acres of this land in upper 'Alaeloa and Mailepai as Forest Reserve.

During the 1970's, much of coastal Ka'anapali was developed as resorts and condominiums. Coastal 'Alaeloa, much of which was awarded to native Hawaiians during the Mahele, has passed through many hands and remained a residential area (Tax History Sheets, Real Property Division). The shopping center adjacent to the subject property serves this population as well as that of Napili town. Just beyond Napili town, Maui Land and Pineapple Co. (formerly Baldwin Packers Inc.), has developed Kapalua into condominiums and apartments.

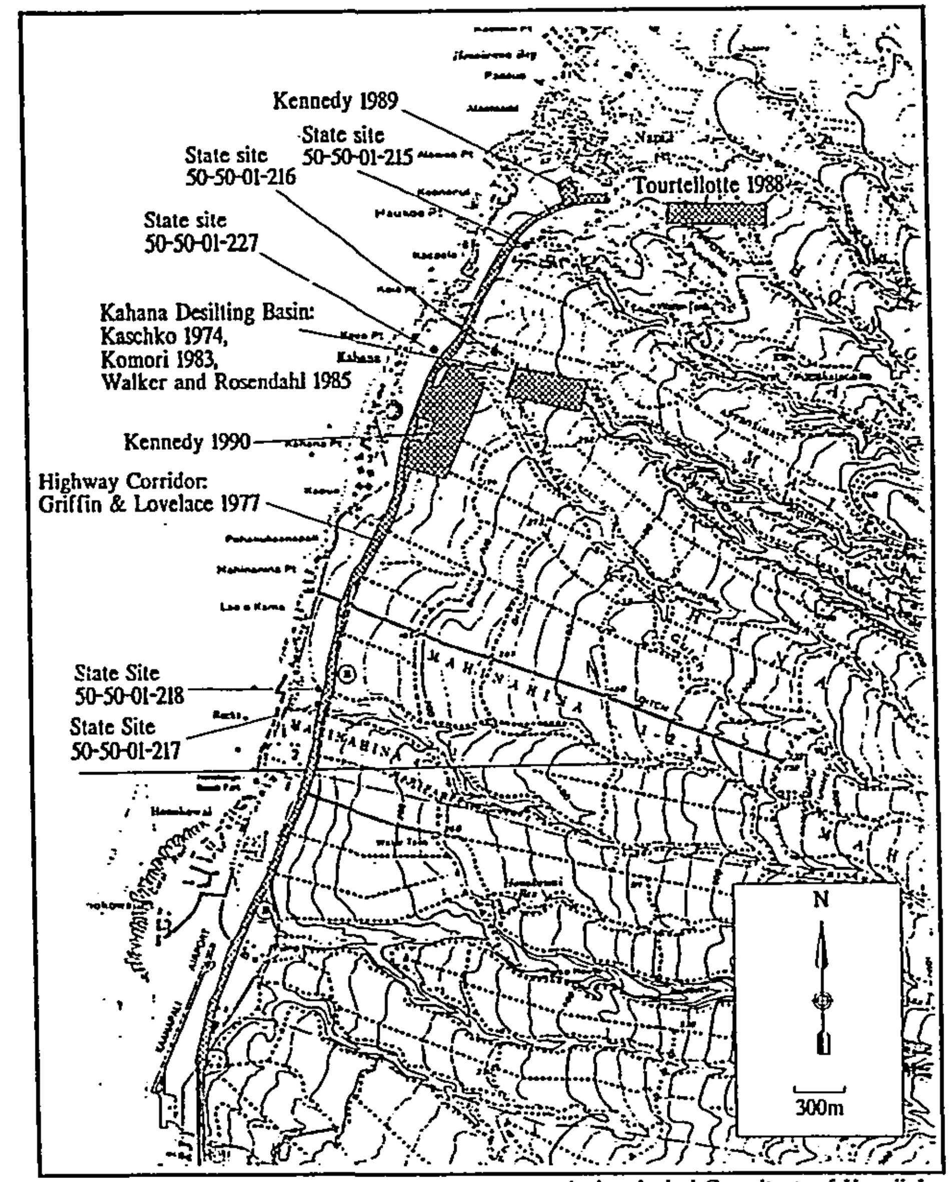
Section 4: Previous Archaeology

Early archaeological research conducted in the district of Ka'anapali was performed in 1928 and 1929 by W. M. Walker as part of an island wide study (Walker 1931). He field checked sites previously recorded by Thrum and Stokes, and found one site in 'Alaeloa (Site 15), on the coast. It was a small rectangular stone enclosure, and was reported as having been completely destroyed.

Recently in 'Alaeloa, only three formal archaeological surveys have been conducted (see Map 4). The first was in 1977, when Griffin and Lovelace surveyed the Honopi'ilani Highway corridor; their study included the lands of Honokowai, Mahinahina, Kahana, Mailepai and 'Alaeloa, concentrating on areas in the gulches. Flat areas between the gulches were not surveyed due to their use for sugar cane, which had caused extensive disturbances.

Griffin and Lovelace recorded a total of five archaeological sites: two in Mahinahina Gulch, two in Kahanaiki Gulch, and one in Ka'opala Gulch (in 'Alaeloa). The two sites in Kahana were; Site #50-50-01-216 (a low wall

Map 4: Previous Archaeology in the Vicinity of the Project Area



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along the boundary of Kahana and Mailepai Ahupua'a), and Site #50-50-01-227 (a retaining wall along the bank of Kahananui Stream). These sites were thought to be prehistoric, but of marginal archaeological value based upon the criteria for eligibility for the State and National Register of Historic Places. In Mahinahina Gulch, two habitation related cultural deposits were found exposed in the banks of the main channel (Sites #50-50-01-217 and 218); a small amount of carbonized remains at this site was radiocarbon dated, yielding a possible occupation span from A.D. 1150 to 178. In 'Alealoa a 30 meter section of a trail running along the north slope of Ka'opala Gulch was located (Site #50-50-01-215); this earthen trail was supported by a retaining wall, constructed of flat, angular lava rocks. This site was also considered of marginal archaeological value (Griffin and Lovelace 1977:14-19).

1988, Tourtellote conducted an archaeological inspection of 12.5 acres at Rainbow Ranch, approximately a hundred meters inland from the project area (see Map 4). Rainbow Ranch lies on gently sloping pasture land between Napili and Ka'opala Gulches. One broken basalt rubbing stone of unknown age was located in the northwestern corner of the property, but no sites were located, and the artifact was considered an isolated find of no archaeological importance.

In 1989, Archaeological Consultants of Hawaii, Inc., conducted a walk-through reconnaissance on the property of the proposed Napili Fire Station (see Map 4). The subject property was located in a pineapple field just next to the main road in Napili town, adjacent to the present subject property. No sites were found.

In 1973, the Bishop Museum conducted a survey of the Honolua Development Area in the ahupua'a of Honokahua, Oneloa, and Kapalua, on the northern side of West Maui (approximately two miles to the north of the present project area)(Kirch 1973a). He recorded nine archaeological sites near the coast, six of which were said to be "probably prehistoric". One of these sites, Site #50-Ma-D13-1, at Hawea Point in Honokahua, was excavated and identified as a small, late-prehistoric fishing settlement (Kirch 1973b).

Much work has been done in Kahana ahupua'a, approximately a mile and a half to the south of 'Alaeloa. Archaeological research of the Kahana Desilting Basin, in preparation for the construction of a siltation dam, was conducted first by Kaschko (1974) for the Bishop Museum Soil Conservation Service (see Map 4). During his preliminary walk-through, he noted numerous stone walls, terraces, alignments, and an historic midden deposit. He estimated that all of the features observed were either historic, or had been altered in historic times.

A second more intensive survey was conducted later by Komori (1983). Seven archaeological sites were recorded in this survey. Two sites were interpreted as prehistoric, Site #D10-3a and 3b (State Site #50-50-01-1741), consisting of an unmodified overhang-shelter and a 10m segment of terracing; and Site #B10-9a and 9b (State Site #50-50-01-1747), a small unmodified overhang rockshelter in which an 'ulu maika (prehistoric Hawaiian game stone) was found. A number of wall segments and terraces, Sites #D10-6 and D10-7 (State Sites #50-50-01-1744 and 1745) were found close to the stream and were thought to be associated with historic ranching activities. Two other historic sites were found: Site #D10-4a and 4b (State Site #50-50-01-1742), three terraces and a deposit of early historic material, interpreted as possibly historic; and Site #D10-5a, 5b, and 5c (State Site #50-50-01-1743), a rectangular enclosure and two dog burials, thought to have been created by "hippies" who had previously resided in the gulch area (Komori 1983:7). It was recommended that Sites #1742, 1743, and 1744 be excavated and tested.

In 1985, Walker and Rosendahl conducted archaeological testing of cultural remains associated with the Kahana Desilting Basin. Results of limited surface collections and test excavations conducted within the project area did not support the tentative conclusions reached by Komori in 1983. While Komori had concluded that Sites #1742, 1743, and 1744 were remains of historic ranching activities, Walker suggested, based upon archaeological and ethnographic evidence, that the Kahana Gulch was used by the Hawaiian people in the late prehistoric and early historic periods for the cultivation of sweet potato.

In 1990, ACH conducted an inventory survey of a parcel in coastal Kahana, approximately a mile and a half to the south (Kennedy 1990). Two significant historic sites were discovered: a two tiered basalt rock platform (State Site #50-50-03-2878), and a single, crude petroglyph (State Site #50-50-03-2879). A small basalt abrader was also found. Excavations at the two tiered platform revealed that it contained a human burial (Kennedy and Denham 1992).

Section 5: Land Use Summary

Section 5.1: Chronology of Land Uses

Based upon relevant archaeological, ethnographic, and historic information presented above, general settlement patterns for 'Alaeloa may be put forth. Because the gulches north of Lahaina present a somewhat marginal environment, they were probably not populated until the expansion period of Hawaiian occupation of the islands. Hawaiians probably first came to the area by canoe, and exploited the coast for its abundant marine resources.

The archaeological evidence in the area surrounding 'Alaeloa generally suggests an occupation period beginning in late-prehistoric times (Kirch 1973, Griffin and Lovelace 1977). If we assume that the climate hasn't changed since pre-contact times, early settlements would have relied upon sweet potatoes as a staple, supplemented heavily by the littoral resources of the coast. Permanent habitation of 'Alaeloa itself in prehistoric times is uncertain.

By historic times, there was a small population living in houselots on the coast of 'Alaeloa. L.C.A. evidence suggests that individual families had permanent residences on the flat coastal strip, and travelled inland to agricultural plots where kula crops, primarily sweet potatoes, were cultivated. A trail on the north side of Ka'opala Gulch may have been used as a path to garden plots upstream.

'Alaeloa was probably used for ranching during the late nineteenth century. When pineapple and sugarcane came to Ka'anapali in the early twentieth century, cultivation of sweet potatoes in the gulches was abandoned. Walker (1985) suggested this abandonment occurred as a result of the large scale irrigation of sugarcane fields with water from the streams formerly used for potato cultivation.

Sugarcane and pineapple cultivation continue up to the present, but are slowly being phased out in favor of more economically viable uses of the land. Rainbow Ranch, a riding stable, is operating just mauka of Honoapiilani Highway. The coastal strip of 'Alaeloa is residential and commercial, being the "outskirts" of Napili town. The shoreline continues to be the location of the highest concentration of people in Napili.

Section 5.2: Expected Archaeological Finds

The land use history for this area suggests that the most likely finds would be related to habitation and agriculture. L.C.A. records show that people were living in this area, although not on this property, during the mid-1800's, and it can be inferred that people were probably living in this area prior to that date. Habitations were probably permanent, people subsisting off the marine resources available along the coast and from their cultivated plots inland. It is probable that agricultural plots were concentrated along the gulches in order to benefit from the shelter and increased moisture.

Permanent habitations would most likely be indicated by enclosures, platforms, and terraces. These features would most likely contain concentrations of shell and faunal midden, charcoal, and, perhaps, artifacts. Agricultural areas would be indicated by low rock walls, dryland agricultural terraces, and agricultural soil horizons.

Since this property had been used for pineapple cultivation it was extremely unlikely that any significant surface or subsurface historic sites would be encountered. Prior to cultivation, the land would have been cleared, removing any surface features. During pineapple cultivation the land is plowed to a depth of approximately 50cm, thus any subsurface cultural component would be heavily disturbed to that depth. Given this land use history, ACH did not expect to find any significant historic sites on the subject property.

Section 6: Archaeological Methods

Joseph Kennedy, M.A., was the Principal Investigator. The fieldwork was conducted by MaryAnne B. Maigret, B.A., and John Kruse, on July 30 and 31, 1992.

The pedestrian sweeps of the surface proceeded from the Old Piilani Highway on the west, or makai edge of the property, toward the southeast and the Honoapiilani Highway. These sweeps were repeated at 10 meter intervals until 100% of the surface had been surveyed. The prevalence of irrigation drip lines, black plastic, two wrecked automobiles, two guard shacks with associated litter, and scattered piles of concrete and trash, were noted by the fieldcrew.

Subsurface testing occurred in two locations (see Map 3). Excavation was undertaken manually. Samples of shoveled soil were sifted through 1/4 inch screens. The first test unit was excavated in the middle of an agricultural road. The rationale for this strategy was that the unimproved road was less likely to have been repeatedly plowed or disked. In other words, the road may have withstood fewer subsurface impacts than the agricultural field, and it would be the most likely location of any intact subsurface deposits.

The second test unit was excavated on the flat terrain of the former pineapple field. Here, the provenience of archaeological finds would be somewhat indeterminate, since large scale cultivation practices necessitated regular plowing for aeration of the soil. Therefore, this test unit provided comparison and control with the profile and soil samples taken from the first test unit. Given that this property was used for pineapple cultivation it was not thought necessary to excavate any additional units.

Soil samples were collected from each stratigraphic layer. These soils were subject of standard tests to determine their physical characteristics. The soils removed for analysis are stored at Archaeological Consultants of Hawaii, Inc., 59-624 Pupukea Road, Haleiwa, Oahu.

Section 7: Findings

Test Unit #1 was located on the unimproved road bed between the pineapple fields. An area 1 meter by 0.6 meters was excavated to a depth of 70cmbs (cm below surface). The dry soil encountered in this test unit was compacted and did not contain any stones (see Figure 1). Layer I was a dark reddish brown (Munsell 2.5YR 3/4) silty clay typical of the Kahana silty clays.

Test Unit #2 measured 0.8 meters on each side, and was excavated to a depth of 75cmbs (see Figure 2). This unit was located to the south of the first test unit. Layer I was a well aerated, loose soil derived from the plow zone. This soil contained shreds of black plastic and irrigation tubing. This soil was dark reddish brown (Munsell 2.5YR 3/4) silty clay typical of the Kahana silty clays. At a depth of 42cmbs the second layer of soil was encountered. This soil was the same as Layer I except that it was more compact indicating that it had not been disked nor plowed. No remnants of historic agriculture materials were found in Layer II (see Figure 2).

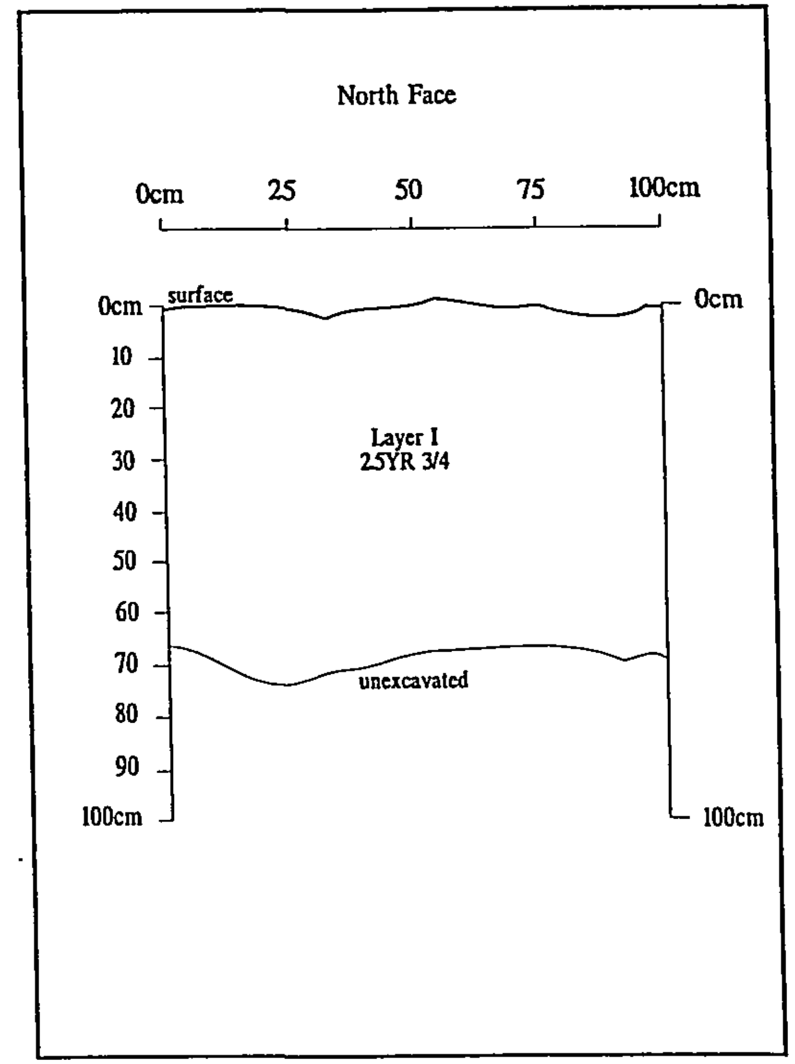
Section 8: Discussion of Findings

No significant historic artifacts, midden, or sites were identified during the surface survey or the subsurface testing on the subject property. The absence of any significant historic sites can be largely attributed to the effects of pineapple cultivation on any pre-existing features.

The stratigraphy on the subject property is characteristic of the Kahana silty clays which Foote et al. had indicated for this area. These soils are classed as an ustox, or an oxisol of the suborder ust (Foote, et al., 1972: 218). Oxisols form where tropical weathering is extreme, and consist primarily of kaolin minerals and oxides of iron, silica, aluminum, and titanium (Foote, et al., 1972: 217-218). This soil type is characteristically dry during the summer months.

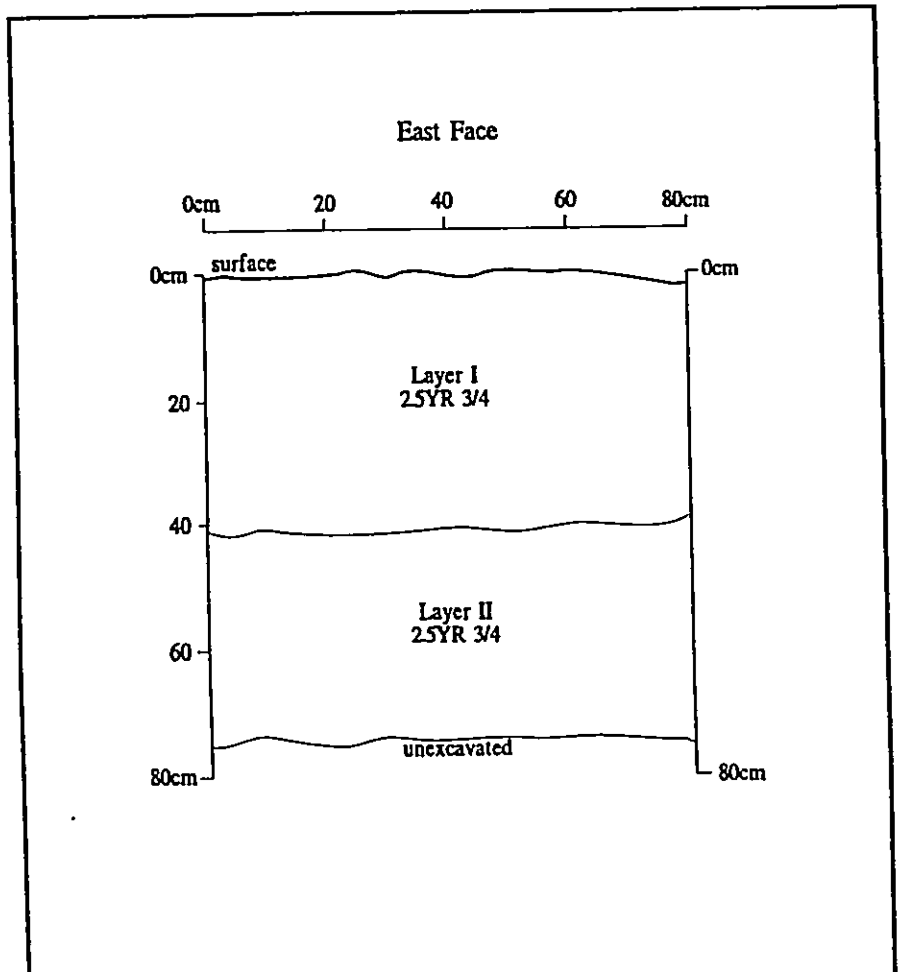
The management of these fields for pineapple cultivation greatly disturbed the pre-existing environment. There were changes in topography or slope, and drainage which occurred as a result of the fields being plowed and leveled. The creation of a plow zone, evidently almost 50cm deep, reduced the likelihood of discovering in situ deposits or features of historic significance. Further, the pineapple plants were sometimes plowed under, adding a small amount of organic material to the Kahana silty clay. Although Foote et al. note that once harvested, the pineapple crop was rarely used as mulch due to the increases in heart and root rot (1972:

Figure 1: Test Unit 1 Profile



TMK: 4-3-03:108 and 110; Napili, Maui — Archaeological Consultants of Hawaii, Inc. 1992

Figure 2: Test Unit 2 Profile



TMK: 4-3-03:108 and 110; Napili, Maui   Archaeological Consultants of Hawaii, Inc. 1992

141). These soils were probably treated with pesticides during the period of pineapple cultivation. The stratigraphy did not vary between the two test units, although the road surface was more dense and compact, as would be expected.

Section 9: Conclusion

The archaeological inventory survey with subsurface testing of TMK 4-3-03:108 & 110 did not discover any significant historic deposits or structures. The absence of historic materials is probably due to the past impacts of pineapple cultivation, including plowing and the destruction of the natural terrain. It is thus not entirely unexpected that no significant sites, midden or artifacts were encountered. The conclusion of Archaeological Consultants of Hawaii, Inc., is that the proposed housing construction will have "no effect" on significant historic resources.

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Appendix F

Baseline Marine Environmental Surveys

Pentec
ENVIRONMENTAL

Baseline Marine Environmental Surveys
Keonenui and Alaeloaiki Bays
Napili, West Maui, Hawaii

Project No. 363-001

Prepared for:

Napilihau Villages Joint Venture

Prepared by:

Pentec Environmental, Inc.
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December 23, 1997

Baseline Marine Environmental Surveys
Keonenui and Alaeloaiki Bays
Napili, West Maui, Hawaii

Project No. 363-001

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December 23, 1997

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Napili, West Maui, Hawaii

INTRODUCTION

Baseline marine environmental surveys were conducted in Keonenui and Alaeloaiki bays, Napili, West Maui, to define extant physical, chemical, circulation, and biotic conditions, and to determine the direct, indirect, and cumulative impacts, if any, of a proposed townhouse development and associated drainage improvement plan on coastal and nearshore marine resources.

Survey results indicate that environmental impact on marine biota and coastal water quality will be negligible. This determination is based on the following factors

- The long-standing usage of coastal embayments as receiving waters for upland agricultural runoff.
- Circulation patterns that permit rapid flushing of each bay.
- Use of upland (off-site) and on-site sediment detention basins to collect runoff water and remove suspended solids.
- A decrease in the volume of stormwater discharges.
- The projected improved quality of stormwater discharges originating from both upland (off-site) agricultural areas and the project site.

No sensitive resources, nor any known rare, threatened, or endangered species, will be directly or indirectly affected by proposed project actions.

PURPOSE

The purpose of the surveys is to develop baseline physical, chemical, and biological information for the Napilihau Villages Joint Venture (the developer). This information is to be used for preparation of an environmental assessment (EA) for the Napilihau Villages townhouse development, Napili, West Maui. In November 1997, the Hawaii Supreme Court ruled that Maui County had erred in not requiring the developer to prepare an EA for the entire project and rescinded the Special Management Area (SMA) permit. The November ruling stopped construction. However, on the basis of public safety considerations, Maui County subsequently authorized the developer to complete construction of several townhouses within Phase 1 of the development that were nearing completion. The court ruling stipulated that the Napilihau Villages Joint Venture must prepare and submit an EA encompassing the entire project, and undergo public review and comment in order to proceed with subsequent phases of the development.

METHODS

CHEMICAL/PHYSICAL MEASUREMENTS

Salinity and temperature measurements were made with a Yellow Springs Instrument Company (YSI) salinity-conductivity-temperature meter equipped with a YSI Model 3300 nickel-platinum conductivity and temperature probe. According to manufacturer-supplied specifications, maximum worst-case instrument and probe error is ±0.7 degrees Centigrade (°C); salinity, ±0.2 parts per thousand (ppt).

Dissolved oxygen (DO) measurements were made with a YSI Model 51B dissolved oxygen meter equipped with a YSI Model 5739 pressure-compensated polarographic sensor. The instrument was calibrated according to factory guidelines in a water-vapor-saturated chamber. Manufacturer's data indicate a probable error accumulation (maximum worst-case situation) of ±0.52 parts per million (ppm). All measurements entailed *in situ* sampling.

Water quality sampling stations are shown in Figure 1.

WATER CURRENT MEASUREMENTS

Water current measurements were made using disposable surface drogues that expose less than 2 percent of their surface area above water. Surface drogues were used to determine water circulation and residence times because storm drain runoff waters would consist of low-density fresh water that would ride atop the denser ocean waters upon discharge into both Keonenui and Alaeloaiki bays. Drogue deployments were timed to analyze water circulation patterns during the morning incoming (flood) tide and the afternoon outgoing (ebb) tide periods that were encountered on December 9, 11, and 12, 1997. Three drogues, deployed from shoreline and spaced roughly 50 ft apart, were used in all water current studies in Keonenui Bay.

In Keonenui Bay, drogue velocity measurements were conducted by estimating distance traveled over time along a 100-meter-long surveyors' tape placed parallel to the north shore of Haukoe Point. These velocity estimates were subsequently verified by a diver tracking several drogues between measured offshore reference points during comparable tidal periods. This comparison showed close agreement with drogue velocity differences averaging less than ±10 percent over shoreline-based estimates.

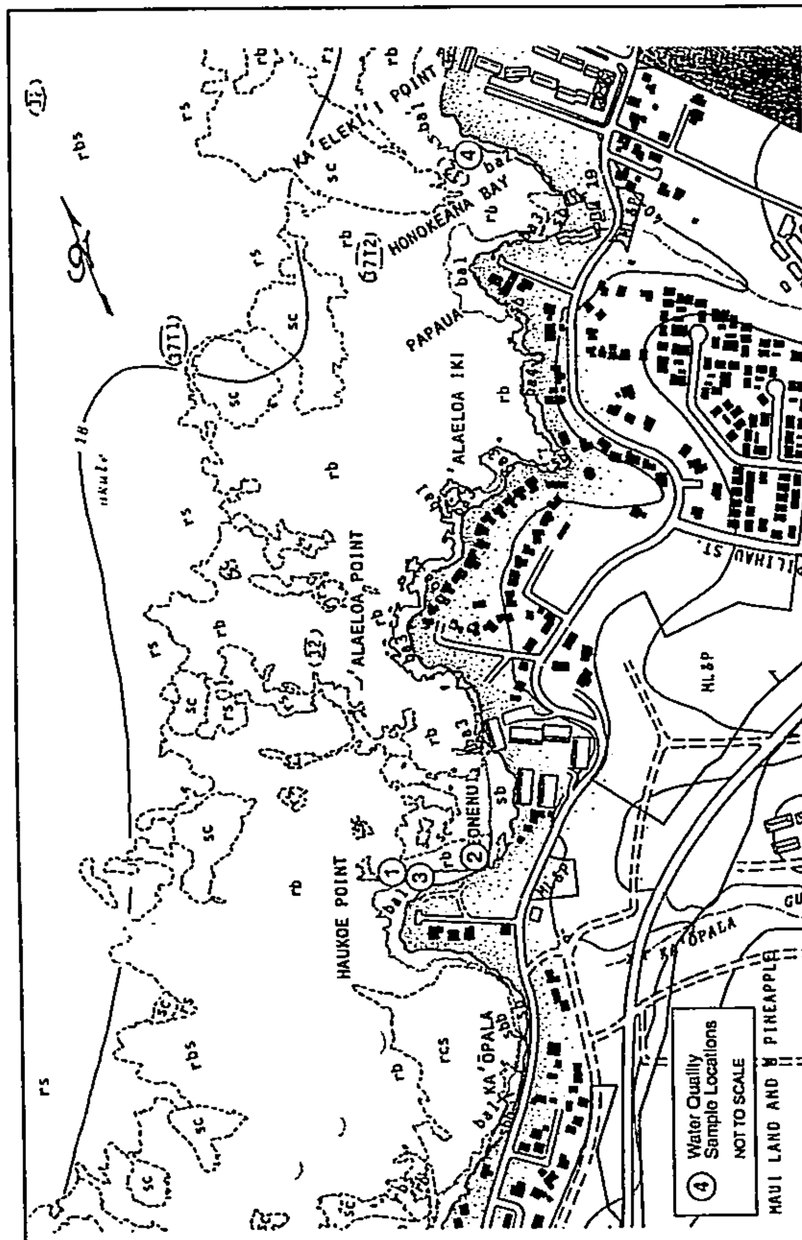

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Figure 1
Water quality sampling stations.

12/10/97 Fig_1.FH7

Because of high surf action and difficult shoreline access, water current measurements in Alaeloaiki Bay were conducted by the diver tracking individual drogues along a surveyors' tape deployed along the rough path of the drogue. Generally, between 5 to 10 meters of tape was placed across the bottom and the diver "tracked" the drogue, measuring distance traveled over time. Distances measured varied as a function of site-specific bottom conditions (surge channels and underwater topography). A total of three separate drogue casts were made in Alaeloaiki Bay under normal tradewind conditions on December 10, 1997.

BIOLOGICAL SURVEYS

Qualitative marine biological surveys were conducted with mask and snorkel apparatus. The general physical features, habitats, and biota within both Keonenui and Alaeloaiki bays were defined through a series of more or less random snorkel traverses from approximately the shoreline to the mouth of both bays, and several traverses along the length of each bay (Figure 2). Care was exercised in selecting traverses that appeared representative of the physical features and habitats of both bays, as determined by review of US Geological Survey (USGS) (Napili Quadrant 1983) and Maui Island Coastal Resource Inventory (MICRI) (Aecos, Inc., 1981) maps, and aerial photographs. Overall survey coverage of marine habitats in both bays is estimated at between 10 and 15 percent.

The nearshore subtidal boulder and intertidal zone on Haukoe Point (south side of Keonenui Bay) could not be surveyed by a diver because of hazardous wave conditions and limited underwater visibility. Because of the adverse physical conditions, walkover surveys were conducted from shore during low tide over the December 9-12, 1997, survey period. Morning low tides ranged from a predicted +0.8 to +1.0 ft, adjusted for time and tidal high and low tides to Lahaina, Maui. (Hawaiian Dredging Construction Company 1997). Although the shoreline surveys proved adequate for identifying intertidal flora and fauna, the boulder (talus) zone within a roughly 50-ft-wide "surge and wave zone" corridor adjacent to Haukoe Point was not surveyed. Nonetheless, one traverse was made in this boulder-covered zone that was roughly 100 ft from shore and parallel to the south side of Haukoe Point. However, because of water visibilities limited to less than 3 ft, certain resident fishes, algae, and invertebrates associated with the more wave-exposed reaches of this zone were likely omitted from the data record.

Tide pool surveys (and water quality measurements) were conducted on the north side of Haukoe Point on December 9, 1997, and intermittently between December 10-12, 1997, when wave conditions permitted. Because of their prevailing small size, tide pools were examined by immersion of the diver's head into the water, or by observations from above the pool.

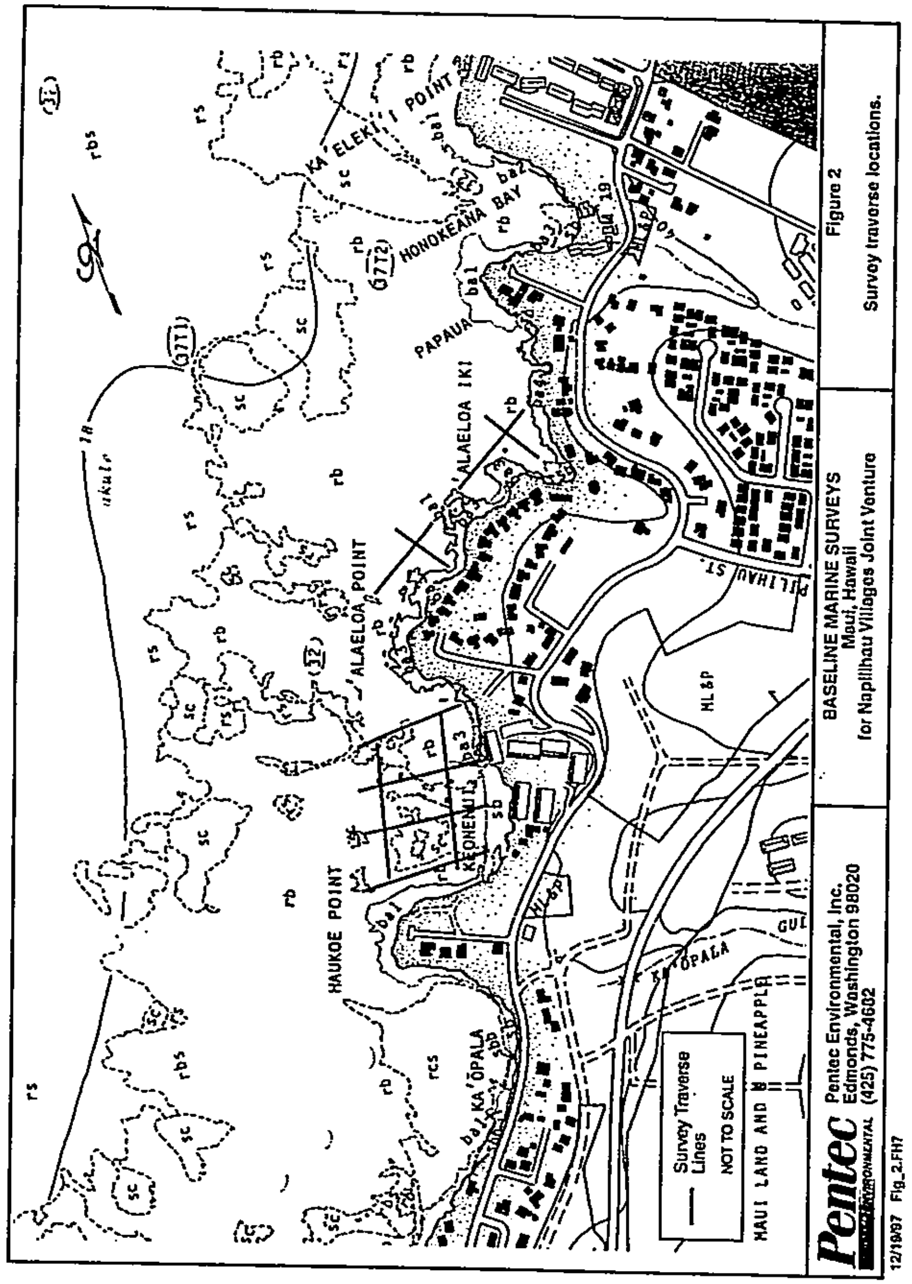

Figure 2
Survey traverse locations.

Representative physical features and habitats in all study areas were photographically documented using a Nikonos V underwater camera.

PROJECT SITE SURVEY OF TOWNHOUSE AND UPLAND DETENTION BASINS

On December 8, 1997, brief surveys were made of the Napilihau Villages Phase 1 interim sediment detention basin and an off-site upland detention basin (detention basin "A") adjacent to Hui Road and upland agricultural fields (Napilihau Village - Phase 1 blueprint drawing dated 3/27/95, prepared by Warren S. Unemori Engineering, Inc.). Detention basin A was recently constructed by the developers as part of the project's erosion control plan. This detention basin is situated immediately below an older sediment detention basin.

The surveys indicate that both basins appear to be functioning as designed. Both basins showed evidence of sediment accumulation. The interim detention basin (below the Phase 1 development) also appears to be serving as an efficient trap for wind-blown trash, cans, and other debris.

A brief conversation with the construction contractor (Jeffery T. Weller, Albert C. Kobyashi, Inc., General Contractor) revealed that exposed soils on the site are periodically watered to reduce dust during construction. A plastic fence also has been installed to minimize fugitive dust from affecting adjacent areas.

PHYSICAL ENVIRONMENT

KEONENUI BAY

Keonenui Bay is roughly 1,000 ft wide from north to south and is fronted by the Pailolo Channel. It is bounded at its south end by Haukoe Point, and on its north end by Alaeloa Point. The south and north sides of the bay are dominated by a wave-exposed, elevated volcanic bench that extends roughly 6 to 20 ft above mean sea level. Massive subtidal boulders occur in a zone that extends roughly 100 ft offshore along the entire north side of Haukoe Point.

A narrow (10- to 20-ft-wide) wave and wave backwash-scoured moat occurs near the shoreline across most of the inshore reaches of the bay. The beach is characterized by a relatively steep 12 to 20 percent slope that, during periods of modest to large wave action, produces a significant, moat-scouring backwash.

The south side of the bay is subjected to significant North Pacific swells and wave action. Swell and wave action in the bay during gusty tradewind and "high surf advisory" periods (experienced in the afternoons during the December 8-12 survey period) is both irregular and complex. Although most swells or wave sets were observed impacting perpendicular to the beach, some incoming swells or wave sets deflect off the south, inshore, side of Haukoe Point, and result in an unusual wave break that is directed northeast and almost parallel to the bay's beach.

The head of the bay is dominated by a broad sand beach, low basalt cliffs, stone masonry seawalls and stairs, and numerous stormwater drainage pipelines that emanate from the Kahana Sunset condominium and adjacent residential housing to the south. Sheetflow rainwater runoff and/or irrigation runoff from an undeveloped, partially landscaped area on the north side of Haukoe Point periodically contribute silt and sediment to the bay (Figure 3).

The central portion of the bay is dominated by wide expanses of unconsolidated sand; occasional deposits of bioclastic rubble, boulders, and cobbles; and, in localized areas, undulating, sand-scoured volcanic rock (Figure 4). There is no evidence of terrigenous (upland) sediment deposition in the bay.

Figure 3 Sediment deposit from sheetwater runoff on Haukoe Point.

Figure 4 Sand-scoured volcanic boulders in central Keonenui Bay.

Land use above (mauka) the beach consists of the Kahana Sunset condominium and single-family residences. Strand vegetation surrounding the bay is dominated by *Scaevola* sp., casuarina (*Casuarina* sp.), coconut palms (*Cocos nucifera*), grass lawns and, in the rocky supratidal zone on Haukoe Point, an unidentified small prostrate succulent.

A small intertidal blow hole occurs adjacent to the shoreline near the northeastern corner of the bay.

ALAELOAIKI BAY

Alaeloaiki Bay is roughly 2,000 ft long from north to south and is dominated by an irregular, rocky shoreline and five small coves. Eroded basalt and massive, craggy boulders characterize this very sinuous, wave-exposed shoreline. A gently sloping to sometimes steep volcanic cliffline borders south and east sides the bay.

Historically, the bay appears to have received runoff waters from a gulch that once drained upland agricultural lands through the general area of the present Napili Plaza shopping center. Dense vegetation occurs in the gulch on the west (makai) side of Lower Honoapiilani Road. The presence of dense vegetation and the absence of stormwater debris in the lower gulch suggests that surface-water flows have been significantly attenuated or re-directed to other areas in recent years.

Inshore areas in Alaeloaiki Bay are dominated by massive volcanic boulders, ledges, and rock outcrops, some of which expose during low tide. Wave-scoured surge channels intersperse the area and provide vertical relief on an otherwise undulating volcanic rock bottom. Some surge channels form depositional areas for bioclastic rubble and occasional coralline sand deposits. None of the surge channels showed evidence of sediment from terrigenous sources.

Land use above the shoreline is dominated by single-family housing, planted coconut palms, *Scaevola* sp., and grass lawns.

WATER QUALITY

KEONENUI BAY

Water quality conditions encountered within the study area were typical of coastal embayments along the West Maui shoreline. Ocean water temperatures ranged from 24.8 to 25.5°C during the survey period (Table 1). The lower temperature readings were the result of sampling observed during early morning, or of intertidal or subtidal groundwater discharges.

Also as a result of groundwater discharges, nearshore salinity readings were often variable and generally lower than at adjacent offshore sampling areas. Salinity measurements ranged from 32.1 to 33.0 ppt.

Table 1 Water quality observed in Keonenui and Honokeana Bays, Napili, West Maui.

Station no.	Date	Time (hours)	Temperature (°C)	Salinity (ppt)	Dissolved oxygen (ppm)
1 (ocean)	12/9/97	0945	24.8	33.0	6.75
2 (ocean)	12/9/97	0950	24.8	32.8	6.78
3 (low tide pool)	12/9/97	1006	24.8	33.0	6.74
3 (mid tide pool)	12/9/97	1008	24.0	33.1	6.52
3 (high tide pool)	12/9/97	1012	22.0	22.2	4.22
4 (ocean)	12/10/97	0912	24.9	32.8	6.52
4 (ocean)	12/10/97	1028	25.6	33.0	6.65
1 (ocean)	12/11/97	1330	25.5	33.0	6.75
2 (ocean)	12/11/97	1337	24.5	32.1	6.74
3 (low tide pool)	12/11/97	1346	25.5	33.0	6.70
3 (mid tide pool)	12/11/97	1348	25.2	33.0	6.44
3 (high tide pool)	12/11/97	1355	21.0	23.1	5.03
4 (ocean)	12/11/97	1610	24.9	33.0	6.60

Dissolved oxygen measurements indicated saturated to near-saturated conditions, as would be expected along a turbulent, wave-exposed shoreline. These DO measurements ranged from 6.52 to 6.75 ppm.

Water quality measurements conducted within several large tide pools on Haukoe Point showed wide variability compared to adjacent ocean waters. In general, the closer the tide pool to the ocean, the greater the similarity to ocean water conditions. By contrast, water temperatures in elevated "splash zone" tide pools were low (e.g., as low as 21.0°C) as a result of cool nighttime air temperatures. Splash zone tide pools are subject to rainwater runoff and/or irrigation water runoff, which resulted in salinity measurements as low as 22.2 ppt. Measurements of DO also yielded similar variability, with saturated conditions dominating low, wave-exposed pools, and low DO levels (probably resulting from algal respiration at night) characterizing high intertidal or splash zone tide pools.

ALAELOAIKI BAY

Because of hazardous waves and the absence of public access to nearshore waters, water quality measurements could not be conducted in Alaeloaiki Bay. As an alternative, water quality measurements were conducted at the adjacent Honokeana Bay, which was protected from wave action and was accessible by shoreline. These measurements were comparable to conditions found within Keonenui Bay, and are believed to be representative of conditions that would be found within Alaeloaiki Bay. Water temperatures ranged from 24.9 to 25.6°C; salinity values from 32.8 to 33.0 ppt; and DO from 6.52 to 6.65 ppm (Table 1). The only significant visible difference between Honokeana Bay and Keonenui and Alaeloaiki bays was its extremely low turbidity. Waters were essentially pristine (underwater visibility about 70 ft) and, despite the presence of a massive (6-by-12-ft) concrete box culvert, showed no evidence of silt or sediment accumulation.

WATER CIRCULATION

KEONENUI BAY

At Keonenui Bay, water circulation patterns appear to be the result of strong currents originating out of the northeast (associated with the Pailolo Channel), of North Pacific swell and associated inshore wave action, and of tradewind influences. Surface-water circulation did not appear to be significantly influenced by tidal period during the December 9-12, 1997, survey period.

During weak to modest tradewind conditions on December 9 and 10, water currents demonstrated a strong seaward and southwesterly flow during both flood and slack (ebb) tide periods. Strong, sustained, and gusty tradewinds during the afternoon of December 9 complicated water currents as a result of both wave action and a significant wind fetch on all but the most inshore reaches of Keonenui Bay.

During "normal" afternoon tradewinds, strong wave action on the bay's south side results in water "piling up" in the bay, which is reflected in moderately high-velocity currents that exit the bay on its southwest side. Surface current velocities during such periods are variable and range from about 3 to 12 ft/minute. Upon exiting the bay on its southwest side, water current velocities increase to between 10 and 20 ft/minute as the bay's water mass interacts with the strong southwesterly currents and fetch associated with the Pailolo Channel. Surface waters appear to flush Keonenui Bay within a period of between 45 to 55 minutes under normal tradewind conditions. Figure 5 depicts the prevailing surface-water current pattern observed during the study period in Keonenui Bay.

During extremely high tradewinds and "high surf advisory" conditions reported by the US Weather Service (observed during the afternoon on December 11 and 12), surface-water circulation in the inner third of the bay is complicated by large wave sets (between an estimated 6 to 10 ft), the previously reported irregular shoreline wave break, and a strong wind fetch. During such periods, circulation in the bay appears to "stall" in the extreme southeast, inshore side of the bay (adjacent to the landward edge of Haukoe Point) because of large breaking waves (both perpendicular and parallel to the beach) and wind fetch. (Two of three drogues were briefly grounded on the shore during the afternoon of December 11.) This stalling phenomenon appears to be more the result of the method used to determine water current patterns and velocities than the result of actual surface-water movements. Drogue casts conducted within the middle reaches of the bay during the same afternoon period on December 11 demonstrated a seaward and southwesterly movement at velocities of about 20 ft/minute. During this period, drogues advanced seaward and to the southwest against a significant shore break.

ALAELOAIKI BAY

Water circulation in the general vicinity of Alaeloaiki Bay was heavily influenced by the prevailing southwesterly currents (associated with the Pailolo Channel) and inshore wave action during the survey period (December 10, 1997). Tradewinds appear to exert a minimal influence on water circulation because of the alignment of the bay with respect to the coastline and prevailing winds. Although water current measurements were limited by hazardous wave action, all drogue measurements indicated a strong southwesterly component, with velocities of between 3 and 7 ft/minute recorded during weak tradewind conditions on December 10. Figure 5 depicts the prevailing surface-water current pattern observed during the study period in Alaeloaiki Bay.

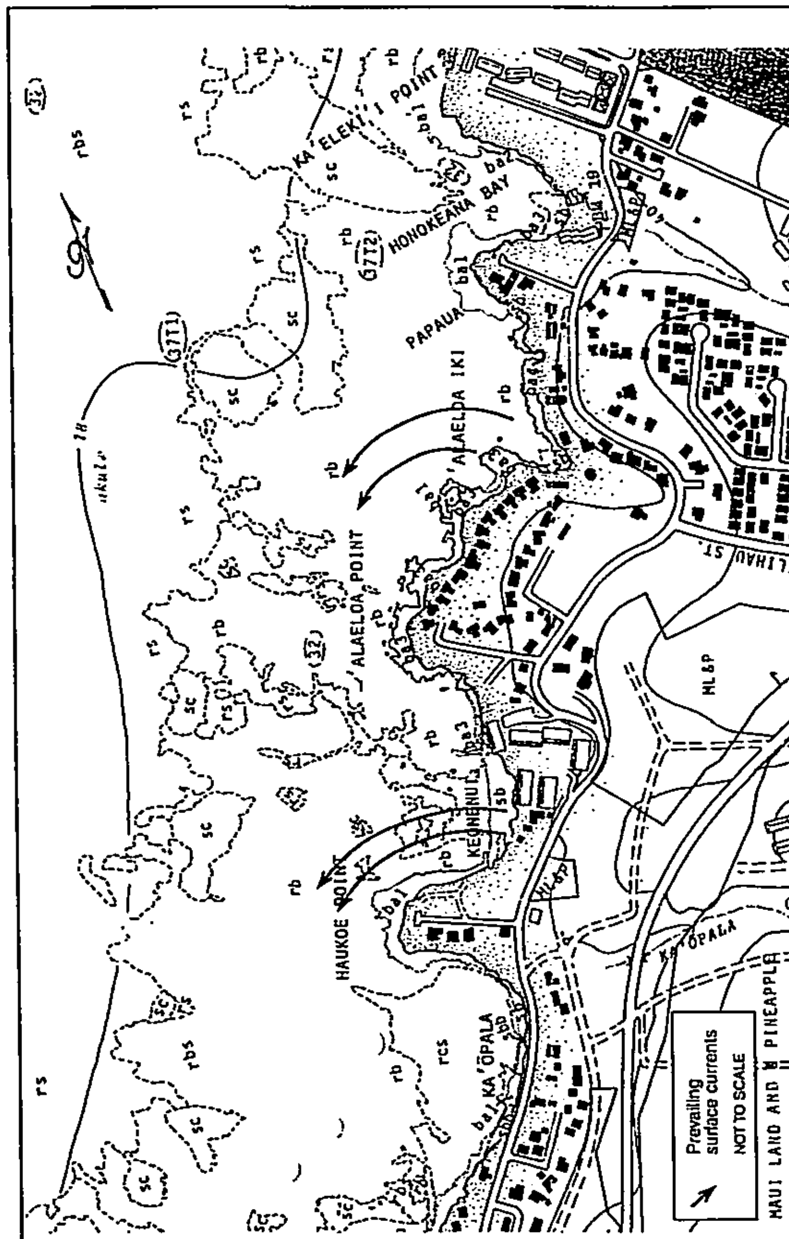

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Figure 5
Prevailing surface water currents.

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BIOTA

KEONENUI BAY

Corals

Coral diversity and density are very low throughout Keonenui Bay. Represented species include low, encrusting colonies of lobe coral (*Porites lobata*) and *Montipora flabellata*, occasional colonies of arborescent cauliflower coral (*Pocillopora meandrina*), and two colonies of *Leptastrea purpurea* (Figure 6).

Several colonies of *P. damicoris* demonstrated structural deformities, such as broken or sand-abraded branches, and many of the colonies observed were partially overgrown with filamentous green epibenthic algae. Although density is low throughout the bay, corals are most abundant along the bay's northern side, where numerous boulders and ledges provide wave-protected solid surfaces above the bay's sandy basin. Corals are absent from all mid-bay locations surveyed because of the absence of significant vertical relief and the presence of shifting, unconsolidated sand. Unconsolidated sands are inimical to coral settlement and growth as a result of chronic abrasion.

A few colonies of encrusting *P. lobata* were recorded near the wave-exposed southern shoreline of the bay (offshore of Haukoe Point), but extant colonies were small, patchy in distribution, and sometimes partially covered by a sand veneer. Most colonies of *P. lobata* demonstrated irregular fissures caused by the burrowing of snapping shrimp (*Alpheus* sp.). Wave action and sand scour produce conditions not generally suitable for coral development in sandy areas along the bay's southeast shoreline.

Algae

Conspicuous algae noted on the north and south sides of the bay include *Ulva fasciata* ("palahalaha"), *Acanthophora spicifera*, *Hypnea* sp., *Sargassum echinocarpum*, *Ahnfeltia concinna* (dark red growth form only), *Dictyota acutiloba*, and, in high intertidal tide pools, a turf composed of *Enteromorpha* sp. Encrusting coralline algae observed included *Porolithon onkodes*, which dominated all high-energy intertidal and subtidal habitats in the study area, *Hydrolithon breviclavium*, *Hydrolithon reinboldii*, *Lithophyllum kotschyanum*, and *Neogoniolithon frutescens*. Observations from atop the Haukoe Point cliffline indicated that inshore boulders and vertical

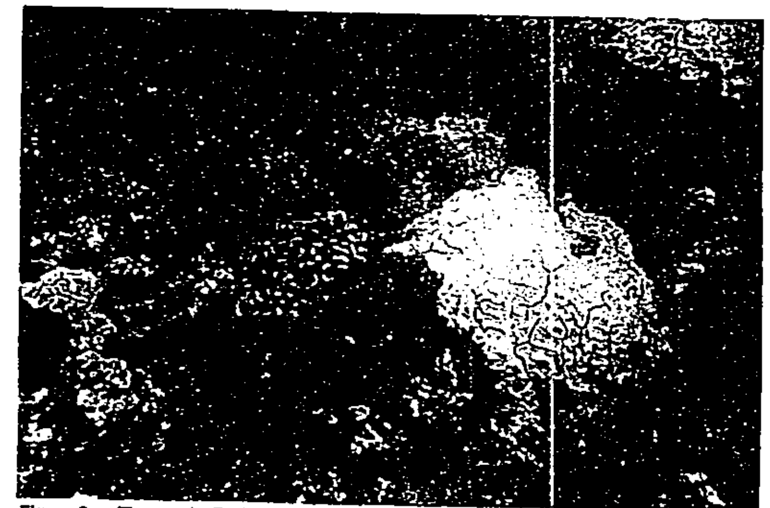

Figure 6 The corals *Porites lobata* and *Pocillopora meandrina* on north side of Keonenui Bay.

Figure 7 Wave-exposed tide pools on Haukoe Point (water quality analytical instruments are shown in foreground).

walls support a very dense and diverse algal flora. However, hazardous swells, breaking waves, and poor underwater visibility precluded underwater surveys from being conducted in this zone. Algal species associated with this physically dominated shoreline were therefore omitted from the data record.

Fishes

Keonenui Bay supports a modest fish fauna, but overall density is low. Only one species, the convict tang (*Acanthurus triostegus*; "manini") was observed to be ubiquitous throughout the various habitats within the bay (and in intertidal tide pools) and is considered abundant. Large schools (more than 100 individuals) of manini appeared to be numerous on the bay's north and south sides, and small schools (less than 10 individuals) of juveniles were frequently observed feeding upon epibenthic algae associated with scattered rock and cobble outcrops in the sandy central portion of the bay. Aside from the convict tang, the blue jack (*Caranx melampygus*; "omilu"), which was recorded in several small schools of perhaps 10 to 20 individuals in the sandy central and northern section of the bay, is the only other species considered abundant.

A school of perhaps 30 to 50 juvenile needlefish (*Tylosurus crocodilus*) was observed just outside the shorebreak, adjacent to the south side of the bay.

Wave-swept rocky areas provide the preferred habitat for surgeonfishes. As a result, surgeonfishes are common in the study area. In addition to the manini, represented surgeonfishes observed include the eye-stripe surgeonfish (*Acanthurus dussumieri*; "palani"), whitebar surgeonfish (*Acanthurus leucopareius*; "maikoiko"), orangeband surgeonfish (*Acanthurus olivaceus*; "na'ena'e"), achilles tang (*Acanthurus achilles*; "paku'iku'i), goldring surgeonfish (*Ctenochaetus strigosus*; "kole"), and the orangespine unicornfish (*Naso lituratus*; "umaumalei").

Along the bay's north side, juvenile reef triggerfish (*Rhinecanthus rectangulus*; "humuhumu-nukunuku-a-pua'a") and lei triggerfish (*Sufflamen bursa*) are common, as is the blackside hawkfish (*Paracirrhites forsteri*; "hilu pili-ko'a"), saddle wrass (*Thalassoma duperrey*; "hinalea lau-wili"), yellow-tail coris wrass (*Coris gaimard*) (juveniles with red and white spots), juvenile rockmovers (*Novaculichthys taeniourus*), unidentified parrotfishes (*Scarus* sp.), and a single filefish ("o'ili"). At least four other species of juvenile wrasses (family Labridae) were observed. However, limited underwater visibility and the inability to distinguish color patterns sufficient to identify these fish to either the genus or species level (many juvenile wrasses undergo distinctive color pattern and morphological changes as they mature, making accurate field identification particularly problematic) made identification impossible.

Butterflyfishes (family Chaetodontidae) were observed to be uncommon to rare. Represented species observed include the raccoon butterflyfish (*Chaetodon lunula*; "kikakapu"), threadfin butterflyfish (*Chaetodon auriga*), saddleback butterflyfish (*Chaetodon ephippium*), lined butterflyfish (*Chaetodon lineolatus*; "kikakapu"), and the reticulated butterflyfish (*Chaetodon reticulatus*). A spotted puffer (*Arothron meleagris*) and a spotted trunkfish (*Ostracion meleagris*) also were observed on the north side of the bay.

Damselfishes (family Pomacentridae) were uncommon throughout the areas surveyed. Represented species observed include the Hawaiian sergeant (*Abudefduf abdominalis*; "mamo"), adult black-spot seargents (*Abudefduf sordidus*), and the Pacific gregory (*Stegastes fasciolatus*).

Other species of fish are probably associated with the wave-exposed base of the cliffline and subtidal boulders (talus) along Haukoe Point. However, hazardous wave surge and restricted underwater visibility prevented underwater surveys from being conducted in this area.

A somewhat unusual finding was the absence of goatfishes (family Mullidae) and squirrelfishes (family Holocentridae) from all areas surveyed, as was the relatively few butterflyfishes (family Chaetodontidae) that were observed. The small number of butterflyfishes observed may be explained by the absence of significant coral reef development and/or fish collecting. The absence of squirrelfishes and goatfishes, and the prevailing small size of other species observed (including manini), may be the result of shorecasting or spearfishing activities (there are a number of fishing pole holders secured on Haukoe Point).

Tide pools on Haukoe Point (Figure 7) were observed to harbor a large number of juvenile black-spot seargents, a small eel (*Gymnothorax* sp.), juvenile manini, numerous blennies (*Cirripectes* sp.), unidentified juvenile wrasses, and a single juvenile mullet (*Mugil* sp.).

Macroinvertebrates

The larger and more conspicuous invertebrates observed include patchy growths of zooanthids (*Palythoa tuberculosa* and *Zoanthus* sp.), slate pencil urchins (*Heterocentrotus mammillatus*), rock-boring urchins (*Echinometra mathaei*), and black-spined urchins (*Diadema paucispinum*; "wana"). A single sea cucumber (either *Holothuria atra* or *Holothuria nobilis*) was observed in a protected sandy depression in the center of the bay.

High intertidal and splash zone organisms associated with rocky shorelines were observed, including periwinkles (*Littorina* sp.; "pupu kolea"), black nerites (*Nerita picea*; "pipipi"), false opihi (*Siphonaria normalis*), shingle urchins (*Colobocentrotus atratus*), and grapsid crabs (*Grapsus tenuicrustatus*; "a'ama").

ALAELOAIKI BAY

Corals

In contrast to the low coral density in Keonenui Bay, coral density is significantly greater in all areas surveyed within Alaeloaiki Bay. Coral coverage is estimated to range between 2 and 5 percent, though overall coverage appears lower because of the preponderance of encrusting corals over that of arborescent corals. In localized areas, coral coverage is occasionally higher, though generally patchy. Represented species include *P. lobata*, *M. flabellata*, and *P. meandrina*. Although measurements were not made, qualitative observations suggest that the corals associated with Alaeloaiki Bay are generally larger than colonies observed in Keonenui Bay. Factors responsible for the larger coral colonies observed may include the location of the bay, which confers some degree of protection from direct influences of seasonal North Pacific swell and associated wave action, and the absence of abrasive sand deposits.

Algae

Ulva fasciata and *Ahnfeltia concinna* are the dominant algae of the wave-exposed intertidal zone. Encrusting coralline algae also are common in areas of breaking waves. Represented species include the dominant *P. onkodes*, and confluent to sometimes patchy growths of *N. frutescens*, *H. breviclavium*, *H. reinboldii*, and *L. kotschyanum*. Rocks and boulders not encrusted with coralline algae are frequently covered by a turf composed of a mix of well-cropped filamentous red and green epibenthic algae (Figure 8). The cropped nature of the algae (most likely resulting from their use as forage by herbivorous fish) made it impossible to identify the algae.

Fishes

Because of the wave-exposed nature of the small embayments that Alaeloaiki Bay comprises, there is little habitat diversity demonstrated along the coastline. The fish biota is similar to that observed along the rocky, wave-dominated north side of Keonenui Bay. Manini was observed to be the most common fish (Figure 9), and was frequently observed in schools of an estimated 20 to 50 individuals. Surgeonfishes are ranked second in abundance. Represented species (in order of estimated abundance) include the achilles tang, orangespine unicornfish, eye-stripe

Figure 8 Zone of well-cropped fleshy and filamentous algae in Alaeloaiki Bay.

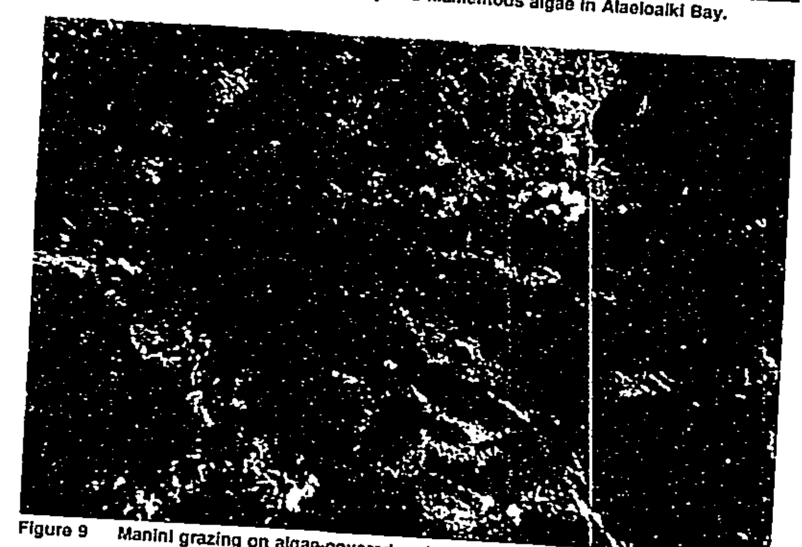

Figure 9 Manini grazing on algae-covered rocks in Alaeloaiki Bay.

surgeonfish, and the goldring surgeonfish. The endemic saddle wrass is common in all areas surveyed. Also observed were numerous juvenile wrasses representing several different species. Damselfishes and butterflyfishes were occasionally to rarely observed in association with widely scattered arborescent coral colonies.

Macroinvertebrates

Macroinvertebrates are not well-represented in the wave-exposed subtidal waters of Alaeloaiki Bay (or were difficult to identify or enumerate in high-energy, low-visibility waters). The most commonly observed invertebrate was the rock-boring urchin.

ENDANGERED, THREATENED, AND PROTECTED SPECIES

A single green sea turtle (*Chelonia mydas*; "honu") with a carapace length estimated at between 25 and 30 inches was observed foraging on marine algae immediately adjacent to Haukoe Point on December 10, 1997.

Several pods of spinner dolphins (*Stenella longirostris*) were observed transiting the coastline between Keonenui and Alaeloaiki bays on December 9 and 10. An estimated 100 to 200 dolphins were observed in a single pod during the morning of December 9.

DISCUSSION

REGIONAL CONSIDERATIONS

Review of available published and unpublished reports revealed little additional information on physical environmental conditions, water quality, or biota associated with Keonenui or Alaeloaiki bays. The Maui Coastal Zone Atlas (Aecos, Inc., 1981) did not identify any defined environmentally sensitive habitats (areas designated by diverse marine life [high coral cover and/or a diversity and abundance of fishes], seabird populations, native strand vegetation, or waterbird habitat) within either bay or along any portion of the West Maui coastline between Kaanapali and Honokahua Bay. This is not unusual given the historic use of the area for agriculture and, more recently, extensive urban, commercial, and tourism development.

Water quality related to coastal development in West Maui is often a contentious issue within county and state government and the affected publics. Although agricultural soil management and erosion control practices have improved over the years, and numerous federal and county-government supported watershed programs, including construction of runoff settling basins for agricultural runoff, have been constructed (or are currently under construction; e.g., the Honolua Watershed project, Honokeana Basin - Structure No.3), stormwater runoff from agricultural uplands will continue to exert a negative impact upon coastal and marine resources in West Maui. A roughly 2-mile-long swath (extending from near Kapalua to near the eastern edge of the Kaanapali Airport) of pineapple fields has been recently cleared south (mauka) of Honoapiilani Highway, exposing topsoil to potential erosion. Thus, stormwater runoff, soil erosion, and associated coastal sedimentation is a regional, not a site-specific, problem.

Given the small acreage of the proposed Napilihau Villages development, as well as its in-place or planned off-site and on-site sediment detention basins, stormwater runoff and associated potential erosion from this development is negligible compared to other areas in West Maui that experience upland agricultural runoff and erosion without the benefit of settling basins. Figure 10 depicts regional runoff and sedimentation in the Napili area on July 29, 1993 (R.M. Towill Aerial Photography; photograph No. 8893-1). As shown in the photograph, there is a relatively small area of discolored coastal water in the vicinity of the Napilihau Villages project site; whereas a large area of discolored water characterizes the area east (makai) of cleared upland agricultural lands.

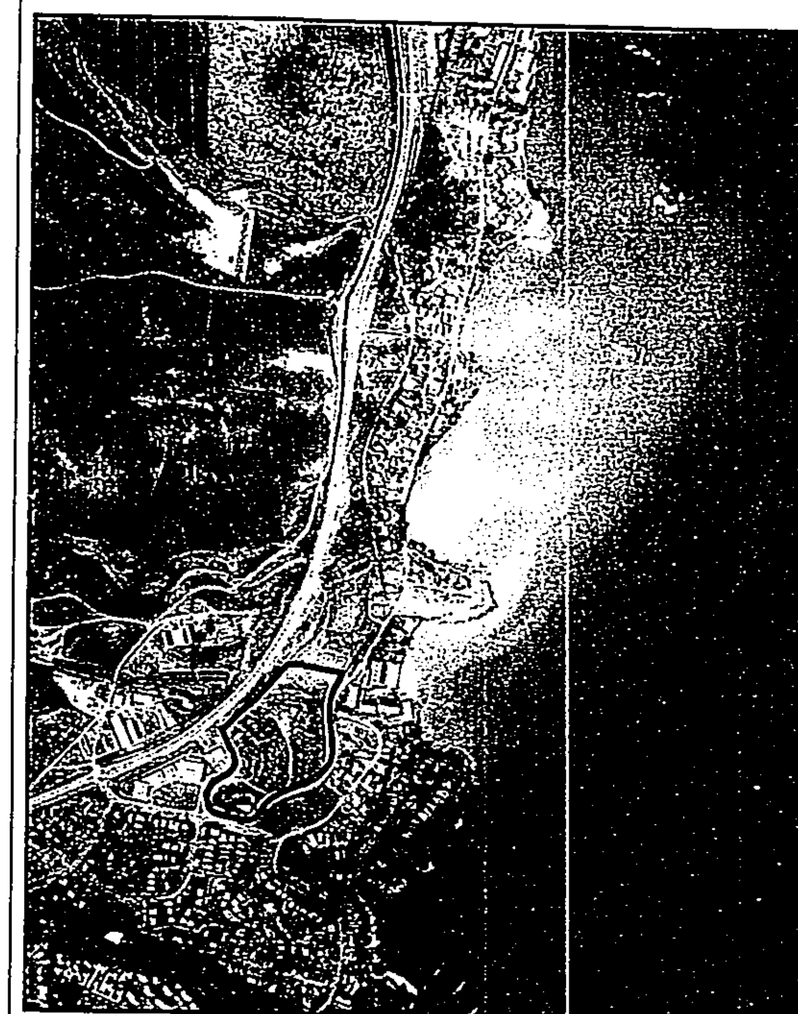

Fig_10.FH7

Figure 10 Agricultural erosion impacting water quality in Napili coastal waters (R.M. Towill Corporation, photograph No. 8893-1, July 29, 1993). Napilihau Villages site outlined in red.

Pentec

Except in areas demonstrating exceptionally heavy or chronic sediment loading, such as at the mouths of major drainage gulches, or in areas demonstrating poor mixing with adjacent ocean water (e.g., Kaopala Bay—an embayment in Napili demonstrating a pronounced counterclockwise eddy [MBA International 1992]), most coastal areas in West Maui are well-flushed by strong currents associated with the Pailolo Channel and wind fetch caused by the prevailing tradewinds.

Flushing is also significant in many exposed coastal areas (e.g., Keonenui Bay) as a result of the North Pacific swell during the winter months (the condition observed during the surveys reported herein). These coastal areas probably flush to a similar degree during periods of South Pacific swell generated during generally infrequent southerly ("Kona") wind conditions.

Regional tropical cyclonic disturbances, such as hurricanes, may also contribute to ameliorating sediment impacts by transporting deposited sediments offshore or directing sediments to beach areas.

As a result of circulation and mixing, many coastal embayments in West Maui that have been subjected to chronic and often massive stormwater and associated silt and sediment discharges often demonstrate little evidence of significant, long-term, or cumulative impacts on corals, fish, or other benthic resources (including Keonenui, Alaeloaiki, and Kaopala bays). This conclusion is in part based upon a brief survey conducted in Honokeana Bay on December 9, 1997.

Honokeana Bay was selected for a brief survey because of public accessibility, its location below a major drainage gulch, and the presence of a massive (roughly 6-by-12-ft) concrete box culvert at the shoreline. The size of the box culvert suggests that, at least historically, this tiny, protected bay was a receiving water for massive upland stormwater runoff and associated sediment loads. The surveys indicated that the bay is pristine. Sediment was not evident, water visibility was in excess of 70 ft, and marine biota demonstrated high diversity. More than 33 species of fish, 18 species of noncoralline algae, and 3 species of corals were inventoried in less than 10 minutes along a roughly 300-ft snorkel dive across the center of the bay (data not shown). Although limited in scope, this evidence suggests that water circulation significantly ameliorates stormwater and sediment discharges and the cumulative, long-term impacts on nearshore biota are not readily apparent, even in a relatively wave-protected bay such as Honokeana.

KEONENUI BAY

Physical Environment

The proposed project is not expected to produce any significant long-term or cumulative changes or impacts upon the physical environment of Keonenui Bay. Minor quantities of silt may be temporarily deposited in the central portion of the bay if runoff from the Napilihau Villages townhouses development coincided with becalmed conditions. However, this runoff would be visually indistinguishable from runoff from existing drainage sources, and would contain quantitatively less silt and other suspended solids than is currently discharged into the bay from drainage pipelines and sheetflow originating from existing condominium and residential housing, and from Haukoe Point. Increased sediment loading from the proposed townhouse development is unlikely, because both in-place and planned upland (off-site) detention basins, and on-site detention basins within the townhouse development would trap most sediment. Because the bay's benthic environment is dominated by unconsolidated sands and sand-scoured boulders and cobbles, there is no significant benthic fauna that would be adversely impacted.

Under normal tradewind conditions, no significant silt deposition is expected within the bay, because wave action and water currents would rapidly dilute and disperse any such discharges into the strong currents associated with the Pailolo Channel. Because of the presence of existing and planned upland detention basins, and existing and planned on-site detention basins, total annual sediment loading to West Maui's coastal waters will be reduced.

Water Quality

A minor, short-term degradation in water quality is expected to occur during and immediately following significant rainfall events, even with in-place or planned sediment detention basins. Water quality degradation would be in the form of a temporary increase in suspended solids, turbidity, and nutrient levels within Keonenui Bay.

The increase in suspended solids and turbidity levels would be visible from the shoreline and take the form of a silt plume that would turn bay waters into a reddish-brown color until the discharge ceased and the bay flushes. Silty waters and silt plumes resulting from stormwater runoff associated with local, regional, and cyclonic rainfall events currently characterize the bay. Most of the sediment contribution to Keonenui Bay (and other West Maui coastal areas and embayments) appears to originate from pre-existing, off-site soil erosion associated with upland agricultural activity. However, according to the developer's drainage and soil erosion report (Warren S. Unemori Engineering, Inc., 1995), the bay will be receiving a smaller volume of higher-quality runoff water associated with the proposed townhouse development because of diversion of pre-existing flows and use of off-site and on-site sediment detention basins. Such actions should improve the quality and decrease the volume of runoff waters entering Keonenui Bay.

Nutrient level (nitrogen and phosphorus) associated with normal soils and runoff from fertilized upland agricultural areas may temporarily increase during periods of heavy runoff within Keonenui Bay. However, because of ample flushing of the bay, nutrient residence time would be insufficient to result in an increase in primary production in the bay, or result in any detectable eutrophication of the bay.

Stormwater discharges would result in a short-term reduction in the salinity of surface waters within Keonenui Bay. Such short-term changes in salinity are not considered significant because of the rapid flushing of the bay, adaptations of intertidal organisms to rapid salinity changes, and the presence of existing stormwater discharges. Existing freshwater discharges into the bay have not produced any evidence of adverse impacts.

Although terrestrially derived silt and sediment particles are able to act as pollutants themselves, they are also able to carry other chemical compounds that become attached to individual sediment particles and have the potential to be incorporated into biological systems. Hydrocarbons originating from on-site or off-site bitumuls mixing, fuel trucks, and equipment mobilization yards are examples of pollutants that could attach to sediment particles and be transported into coastal waters. However, existing and proposed detention basins would provide effective traps for any such hydrocarbons or related pollutants, and largely prevent them from entering coastal waters at a concentration that might prove injurious to marine biota.

Water Circulation

Stormwater runoff entering the bay from the townhouse development is composed of fresh water, which, because of its low density, would ride atop and float upon the denser (saltier) ocean water. Except for some mixing that is likely to occur in the inshore wave zone, most of the water will be transported out of the bay in a southwesterly direction during normal tradewind conditions. Because of the small size of most silt particles, most of the silt will be retained within the surface layer of the bay, where it would be transported into the strong

currents and wind fetch associated with the Pailolo Channel. Mixing and dilution would rapidly take place within channel waters.

Discharge waters originating from the townhouse development and adjacent uplands will be of a higher quality than most existing stormwater discharges into Keonenui Bay because of the presence of upland (off-site) and on-site detention basins that would retain suspended solids.

Biota

As a function of the tidal period, a surface layer of silty water flowing out of Keonenui Bay may produce minor, short-term impacts to tide pool flora and fauna in the vicinity of Haukoe and Alaeloa points. This could occur if runoff periods coincided with normal tradewind and wave conditions, which could deposit silty surface waters into exposed tide pools. However, this impact is judged to be inconsequential, because tide pool organisms are extremely resilient and well-adapted to withstand silt loading, freshwater inundation, varying water temperatures, stagnant waters, low DO levels, intense solar radiation, and other physical extremes.

A silt-laden freshwater plume is not expected to adversely impact benthic organisms associated with the deeper, central portion of the bay, because the low-saline water and any associated silt would not, except in areas of heavy wave action, come in contact with benthic organisms. Unlike heavier sediments that could adversely impact corals, silt particles are generally of a size that corals can easily remove from exposed tissues. Surveys did not show the present of terrigenous silt or sediment deposits anywhere within Keonenui Bay. The bay's biota demonstrate no evidence of chronic or cumulative adverse impacts from historic discharges. There is no reason to suggest that future discharges, which will be of a better quality and lower volume, would do anything other than enhance conditions in the bay for resident biota.

A silt plume would be expected to result in a short-term reduction in primary production in the bay as a result of an attenuation in photosynthetic rates among microscopic, fleshy and calcareous algae residing in the bay. Any such reductions in primary production are not significant, because normal photosynthesis processes would quickly resume shortly following cessation of runoff and subsequent flushing of the bay.

ALAELOAIKI BAY

Physical Environment

Stormwater runoff is not expected to produce any significant short- or long-term or cumulative impacts upon Alaeloaiki Bay's physical environment, beyond that currently experienced under normal runoff conditions. Water quality is likely to improve because of the existing or planned sediment detention basins. The combination of upland (off-site) agricultural and on-site sediment detention basins, and strong wave and water currents would prevent sediment deposition from altering intertidal or subtidal habitats within the bay. Although a receiving basin for upland agricultural runoff for years, there were no areas of silt or sediment buildup observed in any portion of the bay during the survey period.

Water Quality

Because of the exposed nature of the bay to wave action, strong currents associated with the Pailolo Channel, and wave fetch associated with tradewind conditions, no significant impacts upon intertidal or subtidal habitats or species is expected from temporarily elevated levels of silt associated with stormwater runoff. Similarly, a temporary reduction in the salinity level as a result of a point-source stormwater discharge is not expected to produce conditions inimical to the survival of intertidal or subtidal biota. Because of rapid flushing, nutrients (e.g., nitrogen and phosphorus) would have insufficient retention time in the bay to increase primary production or result in any detectable eutrophication.

Water Circulation

Coastal water circulation patterns in or near Alaeloaiki Bay would not be significantly altered by the proposed discharge of off-site or on-site stormwater. As was described for Keonenui Bay, stormwater runoff entering the bay from the townhouse development and upland agricultural fields is composed of fresh water, which, because of its low density, would ride atop and float upon the denser (saline) ocean water. Except for mixing, which is likely to occur in the inshore wave zone, most of the stormwater runoff will be transported out of the bay in a southwesterly direction during normal tradewind conditions.

Because of the small size of silt particles, most suspended silt will be retained within the surface layer of the bay, where it would be transported into the strong currents and wind fetch

associated with the Pailolo Channel. Rapid dilution and dispersion would take place within offshore channel waters.

Although possibly not visually discernible, discharge waters originating from the townhouse development and adjacent uplands will be of a higher quality than most existing stormwater discharges into Alaeloaiki Bay. This is the result of the presence of upland (off-site) and on-site detention basins that will retain sediments and other suspended solids.

Biota

Stormwater discharges and temporarily elevated silt levels may exert a minor but insignificant impact upon tide pool organisms during periods of normal tradewind and wave action. Intertidal organisms, including juvenile fishes that often use tide pools as nurseries, are adapted to withstand physical environmental extremes, and would not be adversely impacted. Extant biota associated with subtidal reef flats, surge channels, and channel walls show no evidence of silt or sediment stress from existing stormwater runoff.

ENDANGERED, THREATENED, AND PROTECTED SPECIES

There are four federally listed endangered or threatened species associated with ocean and coastal waters in the vicinity of Maui: the endangered humpback whale (*Megaptera novaeangliae*), Hawaiian monk seal (*Monachus schauinslandi*), hawksbill turtle (*Eretmochelys imbricata*; "honu'ea"), and the threatened green sea turtle (*Chelonia mydas*; "honu").

Humpback whales frequent Hawaiian waters during the winter and are commonly observed in offshore waters between December and April. Because of their oceanic, pelagic distribution, the proposed project would have no impact on humpback whale populations.

The Hawaiian monk seal has a range that could occasionally include coastal waters and beaches in the vicinity of Maui. The range of the monk seal is largely restricted to the northwestern Hawaiian Islands. A small colony is believed to exist on Lehua Island and at Niihau Island (Naughton, J., National Marine Fisheries Service. 1987. Pers. comm.). Because of the unlikelihood of their presence in Maui's coastal waters, the project would have no impact on monk seal colonies or statewide populations as a whole.

The hawksbill turtle is critically endangered throughout its range. In Hawaii, hawksbill nesting has been occasionally recorded on isolated beaches on Hawaii, Oahu, Molokai, and Maui.

Because of disturbances associated with extensive urbanization and high recreational use of beaches, it is unlikely that hawksbill turtles would use West Maui beaches for nesting. Therefore, the proposed project is not expected to impact hawksbill turtles.

A single green sea turtle was observed foraging in Keonenui Bay on December 10, 1997. Green sea turtles are relatively common in coastal areas of West Maui. In Hawaiian waters, most green sea turtle nesting occurs at French Frigate Shoals in the remote northwestern Hawaiian Islands. Because there will be no construction activities associated with coastal waters, no significant disturbances to green sea turtles or their foraging or resting habitats is expected to result from the proposed project.

Several pods of spinner dolphins were observed transiting the coastline between Keonenui and Alaeloaiki bays on December 9 and 10, 1997. Spinner dolphins (and bottlenose dolphins (*Tursiops truncatus*)) are of common occurrence in offshore waters throughout Hawaii. Although not protected under the Endangered Species Act, the Marine Mammal Protection Act confers some degree of protection to these marine mammals. Because of their largely oceanic, pelagic distribution, no impacts on protected marine mammals are expected to result from the proposed project.

REFERENCES CITED

Aecos, Inc. 1981. Maui coastal zone atlas - overprint edition (Hawaii coral reef inventory, Island of Maui [MICRI], Part C.1). Prepared for Harbors Division, Department of Transportation; Office of Coastal Zone Management; and the National Oceanic and Atmospheric Administration. Job H.C. 0010, Honolulu, Hawaii.

Hawaiian Dredging Construction Company. 1997. '97 tide calendar. Honolulu, Hawaii.

MBA International. 1992. Final baseline environmental survey and report of Kaopala Bay, West Maui, Kahana Homesites Project, Mailepai, Alaeloa, Lahaina, appendix B of draft environmental assessment - Napilihau Villages drainline (March 1993). Prepared for Warren S. Unemori Engineering, Inc., Wailuku, Maui, Hawaii.

Naughton, J. 1987. National Marine Fisheries Service, Pacific Island Office, Honolulu, Hawaii. Personal communication. Cited in The Traverse Group, Inc. 1988. Natural resources management plan, Pacific Missile Range Facility Barking Sands. Prepared for US Navy, Pacific Division, Pearl Harbor, Hawaii.

Warren S. Unemori Engineering, Inc. 1995. Drainage and soil erosion control report for Napilihau Villages Phase 1 site improvements, Alaeloa, Lahaina, Maui, Hawaii. Prepared for JGL Enterprises, Inc., Honolulu, Hawaii (revised December 1995).

Appendix G

SHPD Letters Dated February 5, 1993 and September 23, 1993

JOHN WAIHEE
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCE

DEPUTIES

JOHN P. KEPPELER, II
DONA L. HANAIKE

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

February 5, 1993

LOG NO: 7308
DOC NO: 9302AG05

Mr. Michael T. Munekiyo
1823 Wells St., Suite 3
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

SUBJECT: **Historic Preservation Review of the Proposed Napilihau Villages Drainline**
Napili, Lahaina, Maui
TMK: 4-3-03: 110

Thank you for the opportunity to comment on the proposed drainage improvements for the Napilihau Villages.

The area of the proposed Napilihau Villages I, I, and III has been previously surveyed (Kennedy et al. 1992. Archaeological Inventory Survey with Subsurface Testing Report for a Property Located at TMK: 4-3-03:108 and 110, Alaeloa Ahupua'a, Lahaina District, on the Island of Maui). No historic sites were identified; this absence is due to extensive disturbance caused by years of pineapple cultivation. Based on this negative finding, it appears that no historic sites are likely to exist in the proposed drainline and desilting basin. Both areas have undergone extensive modification from pineapple cultivation and road construction. Therefore, we believe that the proposed project will have "no effect" on significant historic sites.

Please contact Ms. Annie Griffin at 587-0013 if you have any questions about these comments.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

AG:amk

JOHN WAIHEE
GOVERNOR OF HAWAII

KEITH AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

JOHN P. KEPPELER II
DONA L. HANAIKE

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CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

'93 SEP 30 P3:46

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

September 23, 1993

Mr. Brian Miskae, Director
Maui Planning Department
250 South High Street
Wailuku, Maui, Hawaii 96793

LOG NO: 9322
DOC NO: 9309AG30

Dear Mr. Miskae:

SUBJECT: **County of Maui, Historic Preservation Review of Napilihau Villages I, II, III, & IV**
Alaeloa, Lahaina, Maui
TMK: 4-3-03: 110

Thank you submitting a copy of the Revised Drainage and Soil Erosion Control Report for the proposed Napilihau Villages.

We have no comments on this report. Our office has previously determined that the proposed Napilihau Villages will have no effect on historic sites.

Please contact Annie Griffin at 587-0013 if you have any questions.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

AG:111

PLANNING
Comments
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EXHIBIT 12

Appendix H

Traffic Impact Report

TRAFFIC IMPACT REPORT

FOR

NAPILIHAU VILLAGES

NAPILI, MAUI, HAWAII

FINAL REPORT

PREPARED FOR

JGL ENTERPRISES, INC.

By

Austin, Tsutsumi & Associates, Inc.
Engineers • Surveyors
Honolulu • Hilo • Wailuku, Hawaii

TRAFFIC IMPACT REPORT

FOR

NAPILIHAU VILLAGES

NAPILI, MAUI, HAWAII

FINAL REPORT

PREPARED FOR

JGL ENTERPRISES, INC.

By

Austin, Tsutsumi & Associates, Inc.
Engineers • Surveyors
Honolulu • Hilo • Wailuku, Hawaii

February 1993

CONTENTS

ATA AUSTIN TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS

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CONTENTS

APPENDICES (Contd.)

D CAPACITY ANALYSIS COMPUTATIONS (Contd.)

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

TED S. KAWAHIGASHI P.E.
GEORGE M. MEUTER P.E.
KENNETH K. KUROKAWA P.E.
THOMAS S. OTAGURO
IVAN K. NAKATSUKA P.E.

TRAFFIC IMPACT REPORT

FOR

NAPILIHAU VILLAGES

NAPILI, MAUI, HAWAII

I. INTRODUCTION

A. Purpose and Scope of Study

The purpose of this study is to assess the traffic impacts resulting from the proposed Napilihau Villages development, an affordable multi-family residential housing project.

This report presents the findings and recommendations of this traffic study, the scope of which includes:

1. A description of the proposed development
2. An assessment of existing roadway and traffic conditions
3. Development of trip generation characteristics for the proposed development
4. Development of traffic projections
5. Identification and assessment of traffic impacts resulting from the trips generated by the proposed development, superimposed over the projected traffic conditions.

REPLY TO:
501 SUMNER STREET, SUITE 521 • HONOLULU, HAWAII 96817-5031
PHONE 808/533-3646 • FAX NO. 526-1267

OFFICES IN:
HONOLULU, HAWAII
WAILUKU, MAUI, HAWAII • HILO, HAWAII

6. Recommendation(s) of roadway improvements which would mitigate the traffic impacts identified in this study.

B. **Location**

The proposed development is located in Napili, Maui, Hawaii between Honoapiilani Highway and Lower Honoapiilani Road and is bordered on the north by Napilihau Street. More specifically, the project is located at TMK: 4-3-3:108 and TMK: 4-3-3:110. Exhibit No. 1 shows the location of the project.

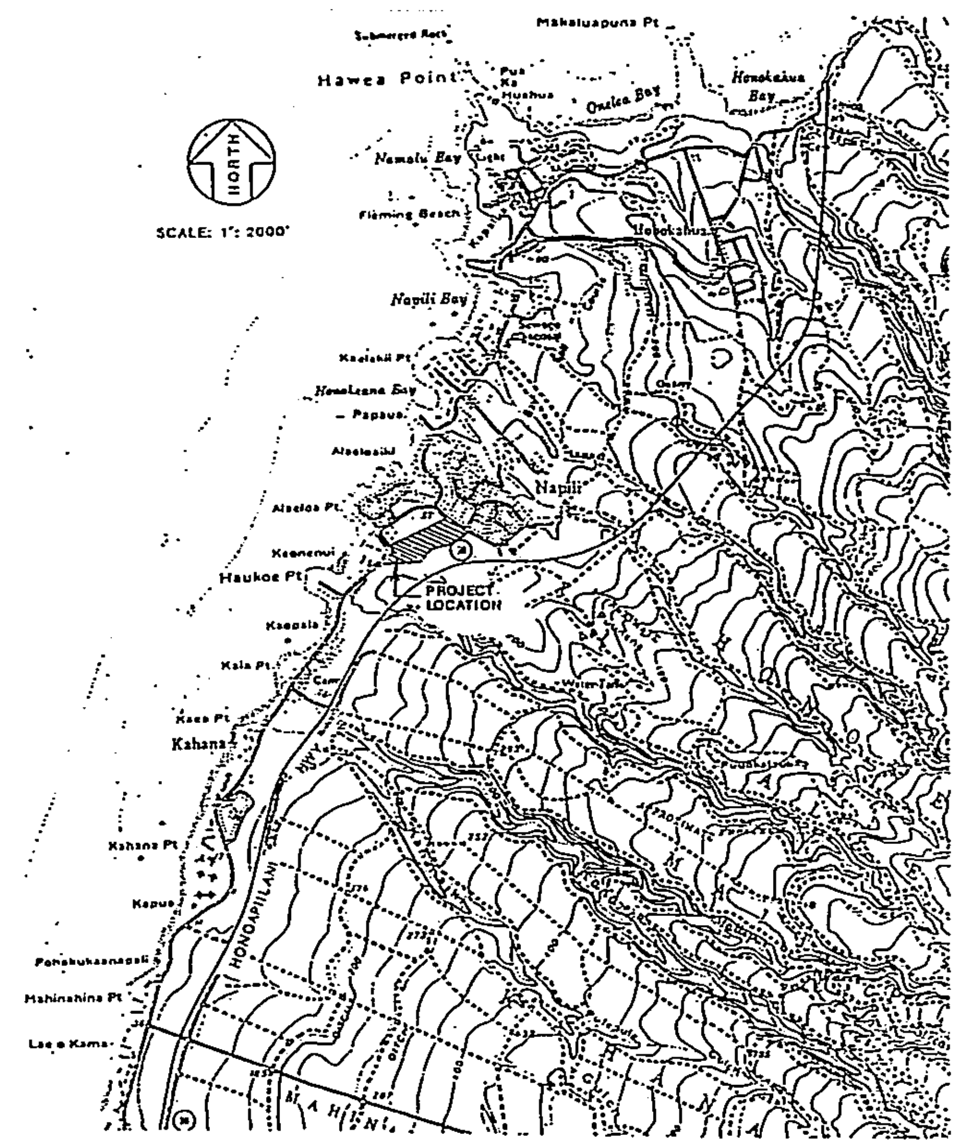
C. **Project Description**

JGL Enterprises, Inc. is proposing to develop 312 multi-family residential units on a 16.5-acre site in Napili. The project site is bounded by Honoapiilani Highway, Napili Plaza Shopping Center and the Napili Fire Station on the mauka side, Lower Honoapiilani Road on the makai side, and Napilihau Street on the north side.

Access to the development will be via Hanawai Street from Napilihau Street and a new street connection to Honoapiilani Highway. This new access will be restricted to right turns only into and out of the development.

The project is proposed to be developed in four (4) phases as follows:

Phase	I	-	76	units	June	1995
Phase	II	-	84	units	February	1996
Phase	III	-	64	units	November	1996
Phase	IV	-	88	units	March	1997
Total		-	312	units		



ATA AUSTIN TSUTSUMI & ASSOC. INC. ENGINEERS • SURVEYORS	TRAFFIC IMPACT REPORT NAPILIHAU VILLAGES PROJECT LOCATION	EXHIBIT 1

Phases I, II and III are located in TMK: 4-3-3:110, which requires a zone change to A-1 Apartment District. The Phase IV development is located entirely in TMK: 4-3-3:108 and is zoned as A-1 Apartment District.

Exhibit No. 2 shows the site plan for the proposed project.

II. EXISTING CONDITIONS

A. General

At present, the project site is fallow, being a pineapple field at one time. It is located adjacent to the Napili Plaza Shopping Center and the Napili Fire Station. North of Honoapiilani Highway, at the intersection of Napilihau Street and Honoapiilani Highway, is Maui Land & Pineapple Company's Honolua Plantation and Rainbow Ranch riding stables. North of Napilihau Street are existing residential units which are served by Hanawai Street and Kohi Street.

The Rainbow Ranch site has been approved by the County for a mixed use development consisting of residential, general office and light industrial uses. The development is called Napili Trade Center.

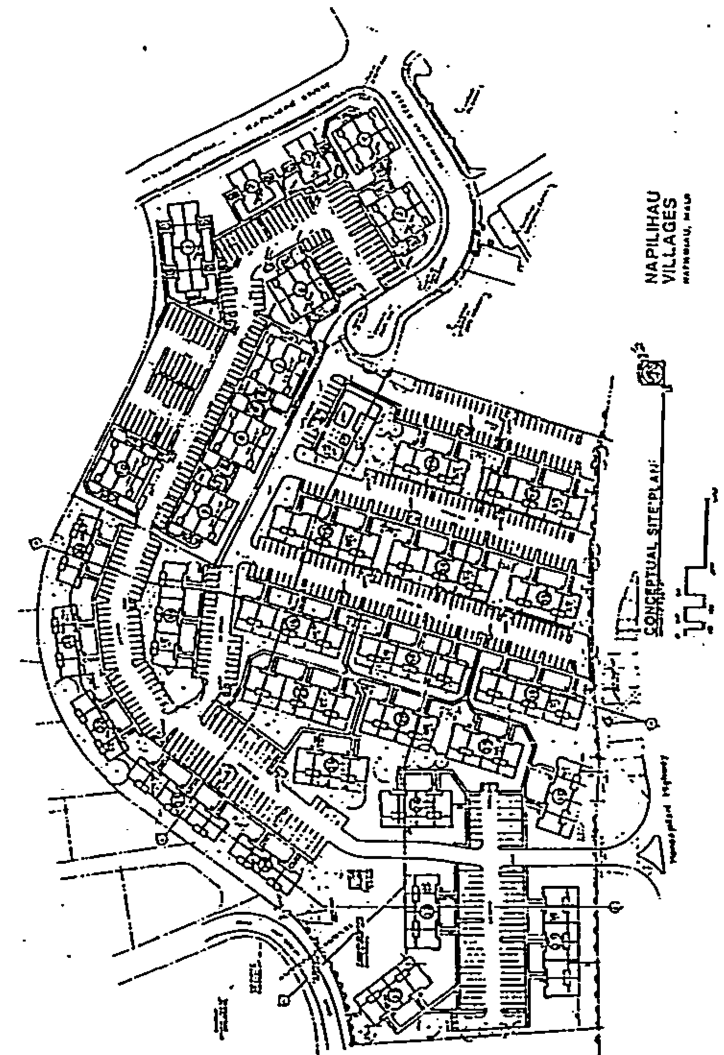
At Kapalua Resort to the north, the Ritz-Carlton Hotel, with 550 units, was opened for business in October 1992.

No other major developments in the project area are known to be approved for implementation in the near future.

B. Roadway System

The primary roadways in the immediate vicinity of the project are: Honoapiilani Highway, Napilihau Street and Lower Honoapiilani Road.

Honoapiilani Highway is a State arterial highway, which provides the regional circulation from Kapalua through West Maui and linkage to Central and South Maui. It is a high-quality, two-lane highway with all major



Source: JGL Enterprises

AUSTIN, TSUTSUMI & ASSOC., INC. ENGINEERS • SURVEYORS	TRAFFIC IMPACT REPORT NAPILIHAU VILLAGES SITE PLAN	EXHIBIT 2

intersections channelized with separate left-turn storage lanes and deceleration/acceleration lanes.

Napilihau Street is a County of Maui two-lane collector road connecting Honoapiilani Highway and Lower Honoapiilani Road. Left-turn storage lanes are provided at its intersections with cross streets and parking is permitted along the north curb.

Lower Honoapiilani Road is a two-lane County of Maui collector road that winds through Napili, Kahana and Honokowai, generally following the coastline. In the immediate vicinity of the project, Lower Honoapiilani Road is narrow, with limited shoulder areas.

Other streets in the area include Hanawai Street and Kohi Street, which are local streets connecting to Napilihau Street and serving residential areas north of Napilihau Street.

C. Traffic

1. Traffic Volumes

Peak period of commuter traffic turning movement count data were obtained on September 8 and 9, 1992 at the Napilihau Street intersections with Honoapiilani Highway, Hanawai Street, and Lower Honoapiilani Road. In addition, 24-hour traffic counts were obtained from the State Department of Transportation (DOT) for Honoapiilani Highway at the Kahana Stream Bridge and on Lower Honoapiilani Road at the Kahana Stream Bridge.

The AM and PM peak hour of commuter traffic varied slightly at each of the intersections studied. The AM peak commuter hour of traffic at Napilihau Street and Honoapiilani Highway occurred between 6:30 AM and 7:30 AM. The AM peak hour of commuter traffic at Napilihau Street and Hanawai Street occurred between 7:00 AM and

8:00 AM; and at Napilihau Street and Lower Honoapiilani Road it was between 7:15 AM and 8:15 AM.

Similarly, the PM peak hour of commuter traffic varied slightly, with Napilihau Street/Honoapiilani Highway intersection and Napilihau Street/Hanawai Street intersection peak hour occurring between 3:15 and 4:15 PM; and at Lower Honoapiilani Road, the peak hour was between 3:30 and 4:30 PM.

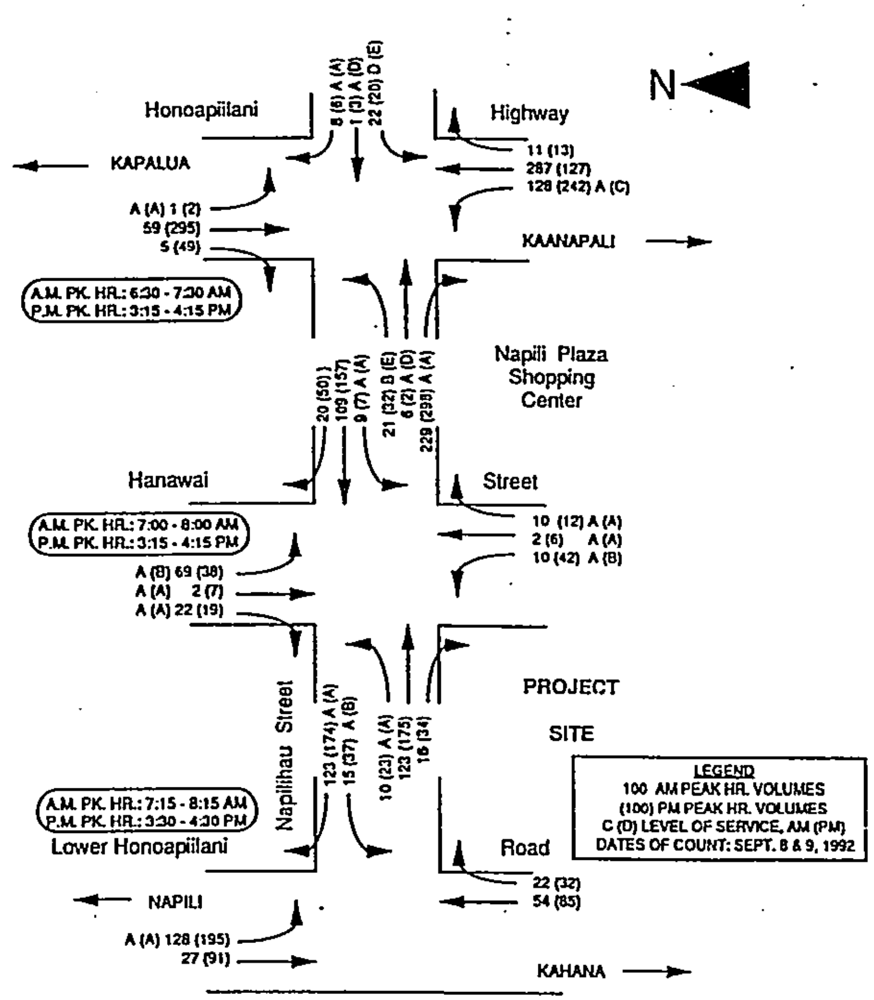
The existing peak hours of commuter traffic are shown on Exhibit No. 3. The peak period count data are included in Appendix A.

2. Capacity Analysis Methodology

Capacity analysis, throughout this report, is performed utilizing the procedures presented in the "Highway Capacity Manual, 1985" (HCM), The Transportation Research Board Special Report 209, utilizing the Highway Capacity Software developed by the Federal Highway Administration. The continuous highway segments are evaluated based upon HCM procedures for "two-lane" and "multi-lane" highways. Capacity analysis for continuous highway segments will be defined in terms of volume-to-capacity (V/C) ratios, which is defined by the rate of traffic flow divided by the capacity of the highway.

Intersection analysis is based upon HCM procedures for "signalized intersection", and "unsignalized intersections". Signalized intersection capacity analysis was performed utilizing the "operational method" described in the HCM. Level of Service (LOS) defines the quality of traffic operations at the intersection in terms of delay to the motorist. The LOS ranges from "A" to "F" with "A" denoting little or no delay, to "F" of delays exceeding 60 seconds.

Unsignalized intersection operation is measured in terms of Levels of Service (LOS). LOS for unsignalized intersections have no



Napilihau.exist

ATA AUSTIN, TSUTSUMI & ASSOC., INC. ENGINEERS • SURVEYORS	TRAFFIC IMPACT REPORT NAPILIHAU VILLAGES EXISTING COMMUTER TRAFFIC VOLUMES	EXHIBIT 3

relationship to LOS for signalized intersections or continuous roadway segments. LOS for an unsignalized intersection is based upon the delay experienced by side street traffic, specifically the left turn, through, and right-turn movements from the side street to the main highway, and left turns off the main highway. The LOS ranges from LOS "A", for little or no delay, to LOS "E", for very long traffic delays. LOS "F" indicates that the capacity of the lane has been exceeded and the queuing may cause severe congestion on other traffic movements in the intersections. This condition usually warrants intersection improvements. It is assumed that the through and right-turn movements on the main highway have the right-of-way and, therefore, are not impeded by side street movements.

Definitions for Level of Service terms used in this report are included in Appendix B.

3. Assessment of Existing Traffic Operations

Observations of existing traffic operations on Napilihau Street and at its intersection with Honoapiilani Highway indicate that traffic moves quite well at the present time; i.e., with little or no delay.

The LOS computations of the commuter peak periods of traffic confirm the field observations.

Honoapiilani Highway between Kapalua and Honokowai (at its intersection with Lower Honoapiilani Road) operates with little or no delay. However, between Honokowai and Kaanapali Parkway, traffic was observed to queue in the south bound direction during both the AM and PM peak periods of commuter traffic. Field observations indicate a bottleneck condition exists in the south bound direction at the Kaanapali Parkway intersection. The south bound vehicular demand exceeds the capacity of the single south bound approach lane at this intersection.

III. TRIP GENERATION CHARACTERISTICS

A. General

The trip generation rates utilized in estimating the volume of vehicular traffic generated by the proposed development are based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in "Trip Generation, 5th Edition". These empirically derived rates correlate independent variables defining land use intensity with traffic count data.

B. Traffic Generation

The vehicular trip generation was computed for each of the four phases based upon the number of units per phase. Table 1 shows the breakdown of the total number of weekday trip ends, and AM and PM peak hour trips generated by the project.

When completely occupied, the 312 units will generate approximately 1,830 vehicular trip ends per weekday (24 hours); 138 AM peak hour trips and 171 PM peak hour trips.

Trip generation computations for the various phases and for the Ritz-Carlton Hotel are appended in Appendix C.

TABLE 1

SUMMARY – PROJECT GENERATED TRIPS
NAPILIHAU VILLAGES

Phase No.	Dwell-ing Units	Week-day Trip Ends	AM Pk Hr Enter, Trips	AM Pk Hr Exit, Trips	PM Pk Hr Enter, Trips	PM Pk Hr Exit, Trips
I	76	445	6	28	28	14
II	84	492	6	31	30	16
III	64	375	5	23	23	12
IV	88	516	7	32	32	16
TOTAL	312	1828	24	114	113	58

C. Other Projected Traffic

De facto traffic growth was taken at 3% per year, based upon the State DOT traffic counts at the Kahana Stream Bridge for the Honoapiilani Corridor (both Highway and Lower Road). Although the State's "Island-Wide Long-Range Highway Plan" for Maui projected a 7.5% per year increase in traffic for this area, because of the present recessionary times and delays in new development, the 3% growth pattern was utilized in projecting de facto traffic growth for the Years 1995, 1996 and 1997.

Projected traffic generated by the Ritz-Carlton Hotel, which opened for business in October 1992, and the Napili Trade Center, which is scheduled for completion in 1993, are included in the intersection LOS analysis for this project. However, at this time, it does not appear that the Napili Trade Center will be completed in 1993.

The trips generated by the Ritz-Carlton Hotel, with 550 rooms, is projected for 70% occupancy. The Napili Trade Center traffic distribution at Honoapiilani Highway and Napilihau Street intersection is based upon the traffic impact report "Rainbow Ranch Project", dated February 25, 1991, prepared by the Traffic Management Consultant.

D. Trip Distribution

Traffic with destinations south of the project site will most likely exit the site via the new right-turn only intersection at Honoapiilani Highway. Traffic with destinations north of the site will exit the development via Hanawai Street and Napilihau Street. All traffic originating south of the development will have to utilize Napilihau Street and Hanawai Street in order to enter the development.

Traffic distribution is based, to a large extent, upon how the existing traffic exiting Hanawai Street from the north disperses at Napilihau Street and, similarly, how traffic on Napilihau Street disperses at Honoapiilani Highway and at Lower Honoapiilani Road. Some professional judgment was also applied based upon employment centers in the West Maui area.

IV. TRAFFIC IMPACTS

A. General

The following are the primary intersections impacted by the Napilihau Villages development:

- Napilihau Street/Honoapiilani Highway
- Napilihau Street/Hanawai Street
- Napilihau Street/Lower Honoapiilani Road
- New access road to development/Honoapiilani Highway (restricted to right-turns-in and -out, only).

The intersections are analyzed for each of the target years of 1995, 1996 and 1997, without the project, and with the project implemented per

the phases identified earlier. All access roadways will be constructed under Phase I of the development.

The traffic analysis assumed a projected de facto increase in traffic of 3% per year plus the traffic generated by the Ritz-Carlton Hotel and the Napili Trade Center (NTC).

Further, assuming that the NTC development would be fully implemented by the Year 1994, and that a traffic signal system would be operational (per County of Maui Public Works Committee Report No. 91-332 that NTC would install a traffic signal system) at the Napilihau Street/Honoapiilani Highway intersection, this intersection was analyzed as a signalized intersection utilizing the operational method per the HCM.

B. Projected Traffic Volumes Without the Project

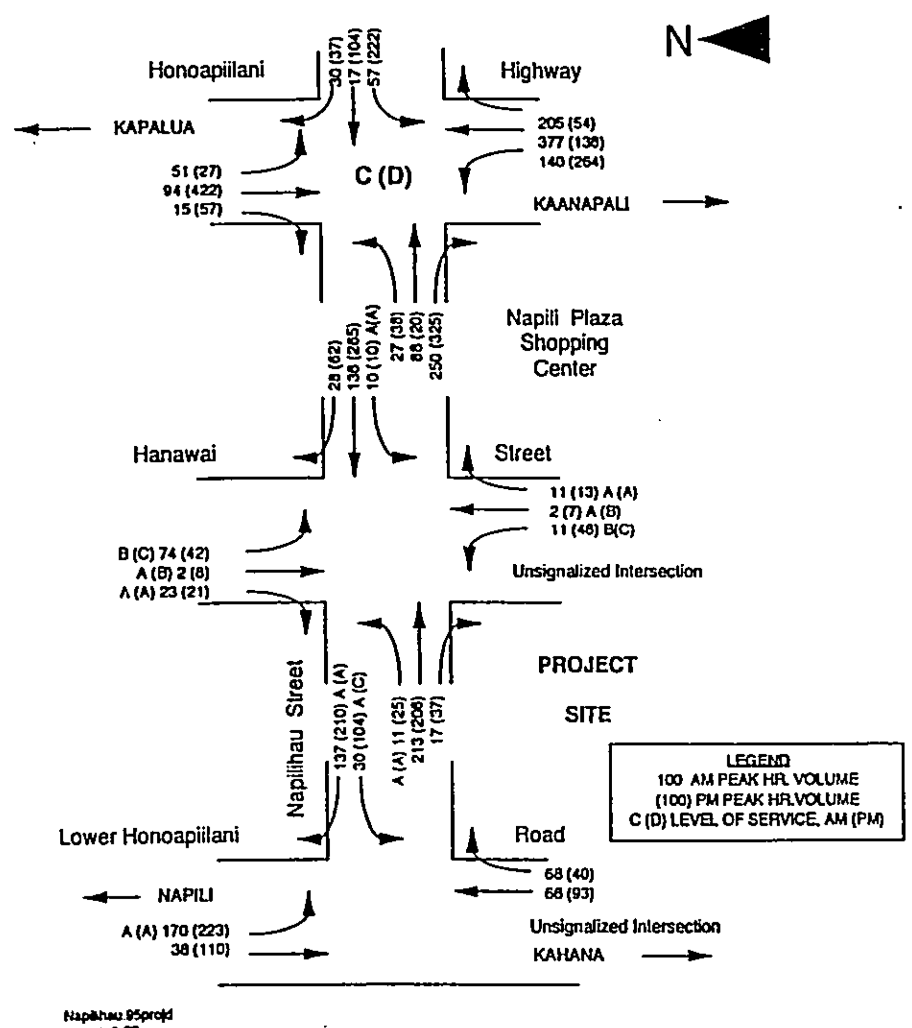
The capacity analysis computations are appended in Appendix "D".

1. 1995

- Napilihau Street/Honoapiilani Highway intersection will operate at LOS "C" during the AM peak hour of traffic and at LOS "D" during the PM peak hour of traffic, indicating that the intersection will be able to satisfactorily accommodate the projected traffic demand as a signalized intersection.
- Napilihau Street/Hanawai Street intersection and Napilihau Street/Lower Honoapiilani Road intersection would continue to operate with little or no delay as an unsignalized intersection.
- Exhibit No. 4 shows the projected traffic volumes and LOS.

2. 1996

- Napilihau Street/Honoapiilani Highway intersection would continue to operate satisfactorily as a signalized intersection.



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- Napilihau Street/Hanawai Street intersection and Napilihau Street/Lower Honoapiilani Road intersection would also continue to operate satisfactorily as an unsignalized intersection.
- Exhibit No. 5 shows the projected traffic volumes and LOS.

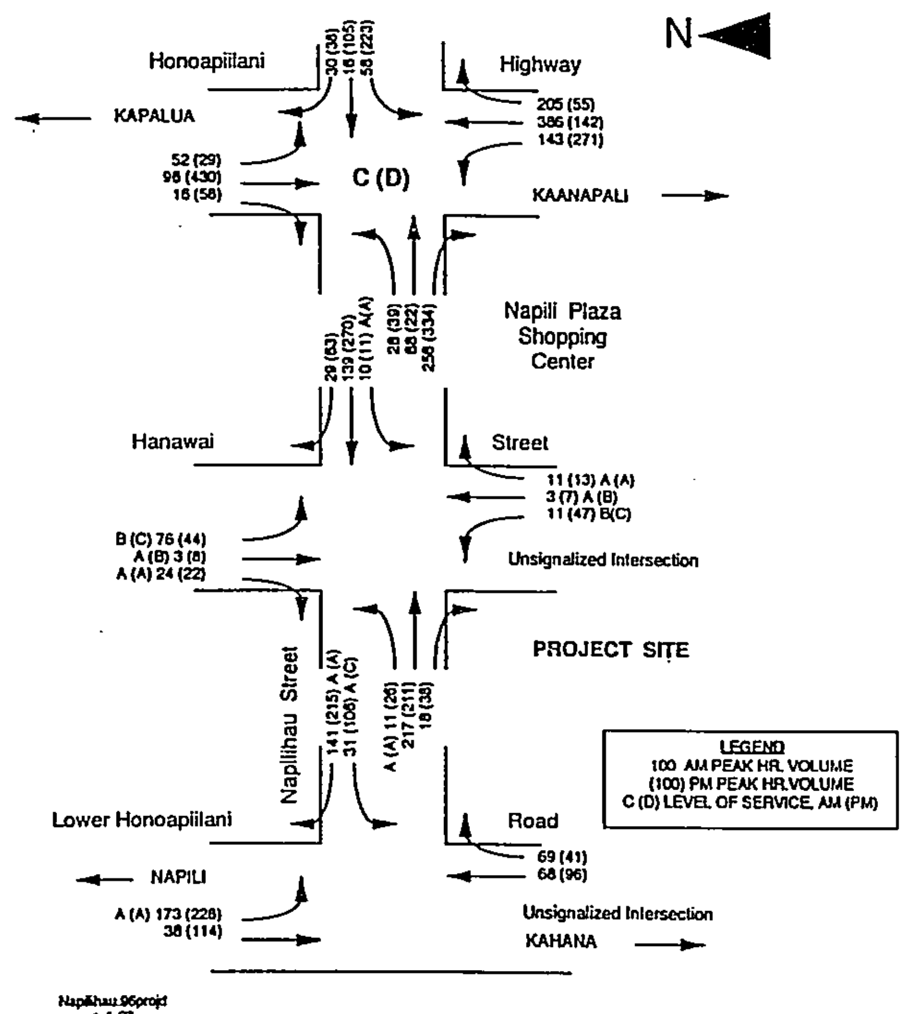
3. 1997

- Napilihau Street/Honoapiilani Highway intersection would generally operate satisfactorily, except that the north bound left-turning traffic could experience some delay, from time to time, depending upon prevailing conditions.
- Napilihau Street/Hanawai Street intersection will operate satisfactorily, with little or no delay for traffic exiting Hanawai Street.
- Napilihau Street/Lower Honoapiilani Road intersection will continue to operate satisfactorily, with some delay for left turning vehicles from Napilihau Street to south bound Lower Honoapiilani Road.
- Exhibit No. 6 shows the projected traffic volumes and LOS.

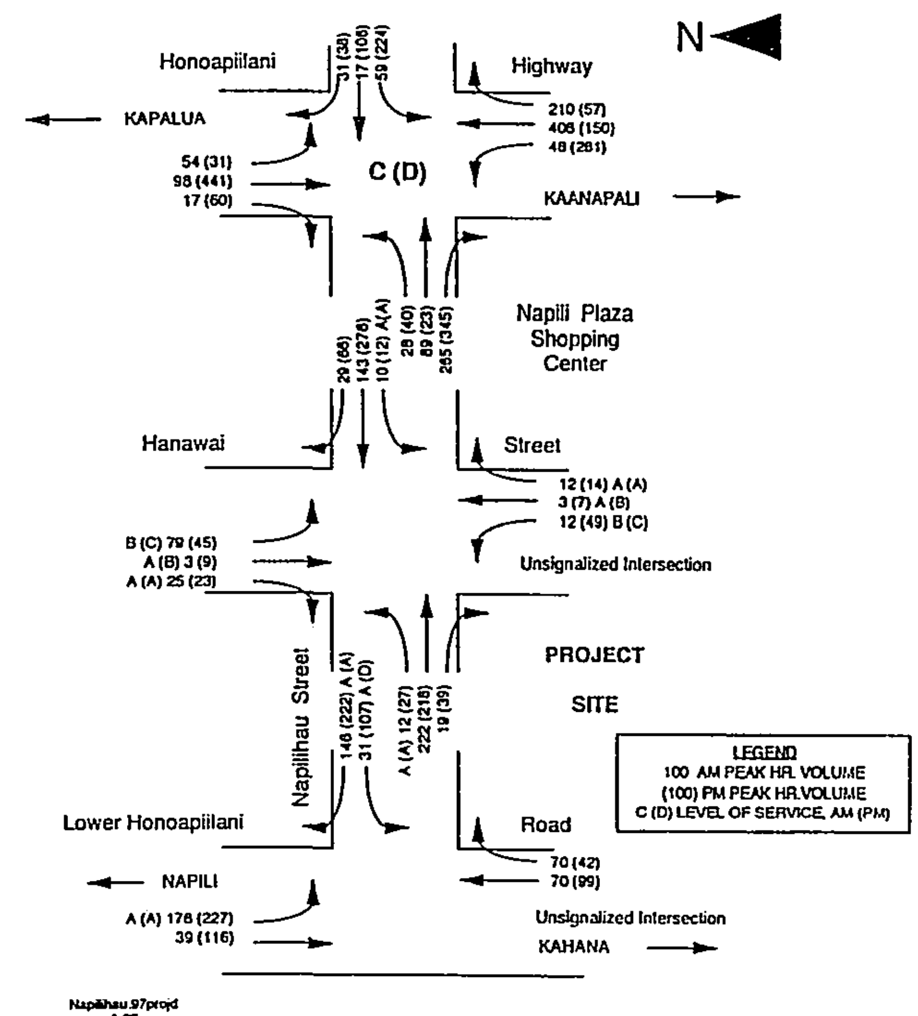
C. **Cumulative Traffic Volumes With the Project**

1. **Phase I – 1995**

- Napilihau Street/Honoapiilani Highway intersection will operate satisfactorily as a signalized intersection at LOS "C" in the AM peak hour of traffic and at LOS "D" during the PM peak hour of traffic.
- Napilihau Street/Hanawai Street intersection will operate satisfactorily, with traffic exiting Hanawai Street experiencing minimal delays at LOS "C" during the PM peak hour of traffic.



AUSTIN, TSUTSUMI & ASSOC., INC. ENGINEERS • SURVEYORS	TRAFFIC IMPACT REPORT NAPILIHAU VILLAGES 1996 PROJECTED COMMUTER PEAK HOUR VOLUMES WITHOUT PROJECT	EXHIBIT 5



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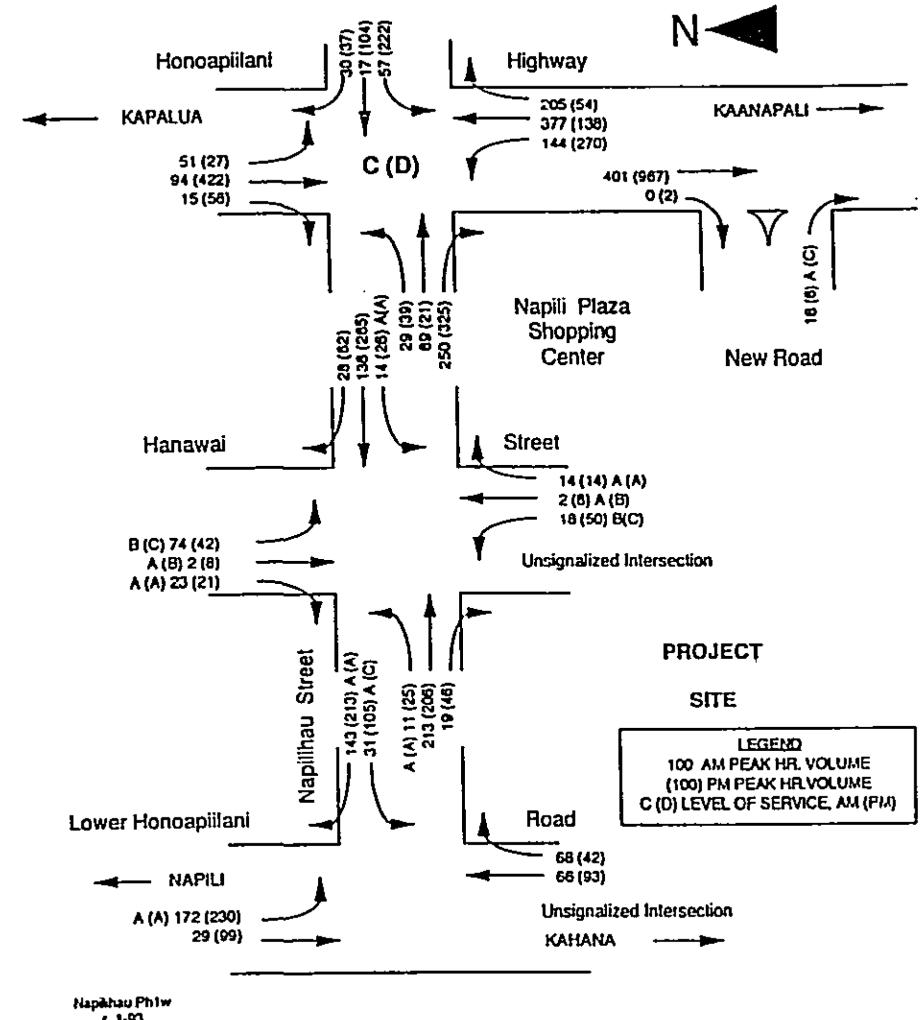
- Napilihau Street/Lower Honoapiilani Road intersection will operate with very minimal delay for traffic turning left from Napilihau Street to south bound Lower Honoapiilani Road.
- The right-turn traffic at the new intersection with Honoapiilani Highway will have little or no delay in entering Honoapiilani Highway.
- Exhibit No. 7 shows the projected traffic volumes and LOS.

2. Phase II – 1996

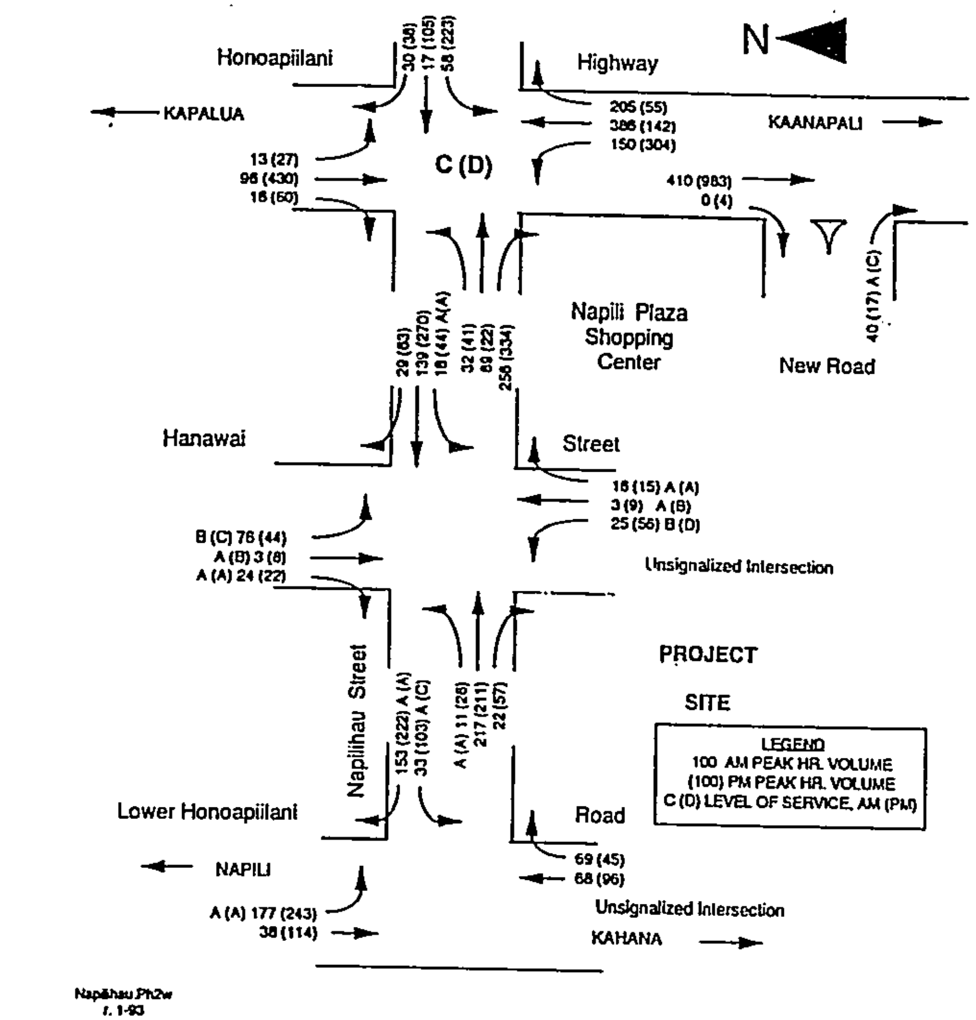
- Napilihau Street/Honoapiilani Highway intersection will operate satisfactorily, except for the north bound left-turn movement during the PM peak hour of traffic, which will be at capacity (LOS "E").
- Napilihau Street/Hanawai Street intersection will continue to operate satisfactorily as an unsignalized intersection, with traffic exiting Hanawai Street experiencing some delay at LOS "D".
- Napilihau Street/Lower Honoapiilani Road intersection will continue to operate with minimal delay for left-turning vehicles from Napilihau Street.
- The right-turn exit from the development at the new intersection with Honoapiilani Highway will continue to operate with little or no delay to exiting traffic.
- Exhibit No. 8 shows the projected traffic volumes and LOS.

3. Phase III – 1996

- Napilihau Street/Honoapiilani Highway intersection will continue to operate satisfactorily, except for the north bound left-turn movement during the PM peak hour of traffic.



ATA AUSTIN TSUTSUMI & ASSOC., INC. ENGINEERS • SURVEYORS	TRAFFIC IMPACT REPORT NAPILIHAU VILLAGES 1995 CUMULATIVE COMMUTER PEAK HOUR VOLUMES WITH PROJECT (PH. I)	EXHIBIT 7



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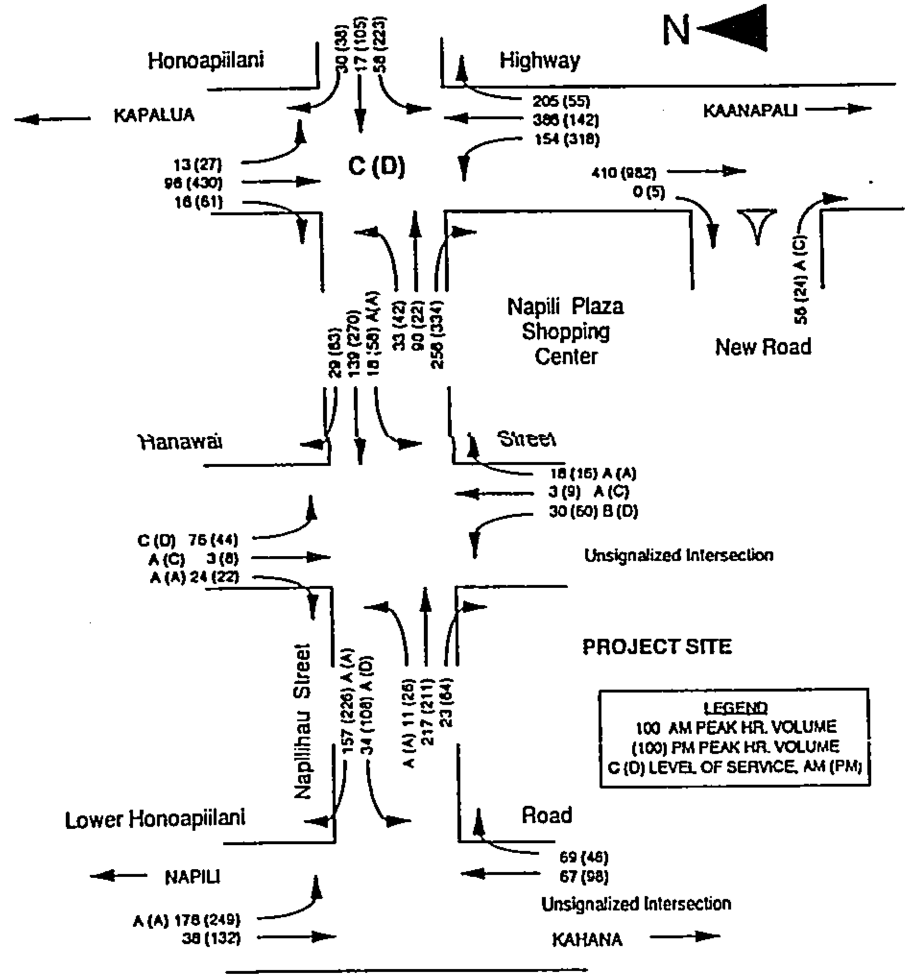
- Napilihau Street/Hanawai Street intersection will continue to operate satisfactorily with exiting traffic experiencing some delay at LOS "D".
- Napilihau Street/Lower Honoapiilani Road intersection will continue to operate satisfactorily with left-turning vehicles from Napilihau Street experiencing some delay at LOS "D".
- Right turns out of this project site to Honoapiilani Highway continue to operate satisfactorily.
- Exhibit No. 9 shows the projected traffic volumes and LOS.

4. Phase IV – 1997

- Napilihau Street/Honoapiilani Highway intersection will continue to operate satisfactorily, except for the north bound left-turn movement during the PM peak hour of traffic. Consideration should be given to adding a second left-turn lane for north bound traffic to turn into Napilihau Street.
- Napilihau Street/Hanawai Street intersection will continue to operate satisfactorily as an unsignalized intersection.
- Napilihau Street/Lower Honoapiilani Road intersection will continue to operate satisfactorily.
- The new restricted movement intersection at Honoapiilani Highway will operate satisfactorily as an unsignalized intersection.
- Exhibit No. 10 shows the projected traffic volumes and LOS.

D. Regional Impacts

The majority of the traffic generated from the proposed development will head south on Honoapiilani Highway. By the Year 1995, it is anticipated



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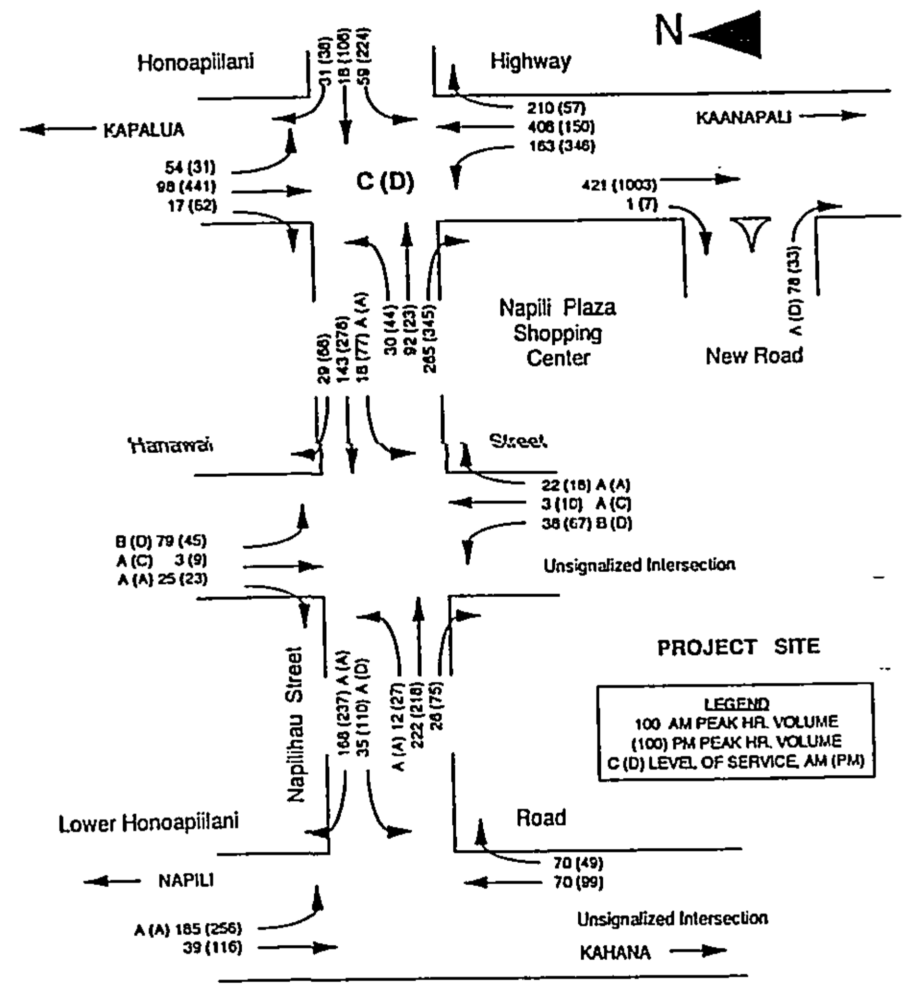
TRAFFIC IMPACT REPORT NAPILIHAU VILLAGES 1996 CUMULATIVE COMMUTER PEAK HOUR VOLUMES WITH PROJECT (PH. III)	EXHIBIT 9

-22-



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TRAFFIC IMPACT REPORT NAPILIHAU VILLAGES 1997 CUMULATIVE COMMUTER PEAK HOUR VOLUMES WITH PROJECT (PH. IV)	EXHIBIT 10

-23-

that the south bound approach roadway to the Kaanapali Parkway intersection will have been widened to provide two south bound lanes. This improvement will eliminate the bottleneck at this intersection and facilitate traffic flow on Honoapiilani Highway.

Other future improvements proposed by the State DOT include the construction of the Lahaina Bypass Road, which would begin at Honokowai north of Honokowai Stream, and bypass Kaanapali and Lahaina Town before rejoining Honoapiilani Highway south of Lahaina at Puamana. Anticipated completion of the Bypass Road is about 1997 or later. In addition, the intersection of Honoapiilani Highway and Lower Honoapiilani Road will most likely be signalized by the Year 1995.

V. CONCLUSIONS

The following are the conclusions of this traffic study:

1. With the projected traffic generated by the Ritz-Carlton Hotel and the Napili Trade Center development, the intersection of Honoapiilani Highway and Napilihau Street must be signalized in order for traffic from Napilihau Street to safely enter Honoapiilani Highway.
2. The intersection of Lower Honoapiilani Road and Napilihau Street must be improved to provide a left-turn storage lane on Lower Honoapiilani Road. This improvement will be required some time in 1993 or early 1994 due to de facto growth in traffic demand.
3. The left-turn storage lane on west bound Napilihau Street at Hanawai Street must be extended to accommodate the additional left-turn demand generated by the proposed development.
4. Honoapiilani Highway between Napilihau Street and Honokowai has adequate capacity to accommodate the additional traffic generated by the proposed project.

VI. RECOMMENDATIONS

The following roadway improvements are recommended to accommodate existing and projected traffic demand due to de facto growth in population and not as a result of the proposed development.

1. Improve the Honoapiilani Highway/Kaanapali Parkway intersection by adding a minimum of 1,000 feet of additional laneage on the north side of the intersection to provide two through lanes for the south bound approach to the intersection and a longer merge area for north bound traffic through the intersection. This improvement is required to accommodate today's existing traffic.
2. The intersection of Lower Honoapiilani Road and Napilihau Street be improved to provide a left-turn storage lane on Lower Honoapiilani Road. This improvement should be implemented by the Year 1995 due to de facto growth in traffic demand.

The following roadway improvements are recommended to accommodate the additional traffic generated by the proposed development:

1. The left-turn storage lane on west bound (makai bound) Napilihau Street at Hanawai Street be lengthened to a minimum length of 120 feet to accommodate the left-turn demand to the project site. This shuld be implemented with the Phase I development.
2. The new intersection at Honoapiilani Highway be designed in accordance with State Department of Transportation requirements for acceleration and deceleration lanes and channelization to effect the turn restrictions.
3. The left-turn storage lane on north bound Honoapiilani Highway at Napilihau Street be extended to a minimum storage length of 250 feet in conjunction with the installation of a traffic signal system at this

intersection. It is assumed that the Napili Trade Center development will be installing the traffic signal before the Napilihau Villages project completes the first residential units.

APPENDIX A

EXISTING PEAK PERIOD TRAFFIC COUNT

NAPILIHAU TOWNHOMES

SITE CODE : 2
Major St. : HONOAPIILANI HIGHWAY
Minor St. : NAPILIHAU STREET
Weather : SUNNY

PAGE: 1
FILE: HONONAP

Primary Movements: Vehicles

DATE: 9/03/92

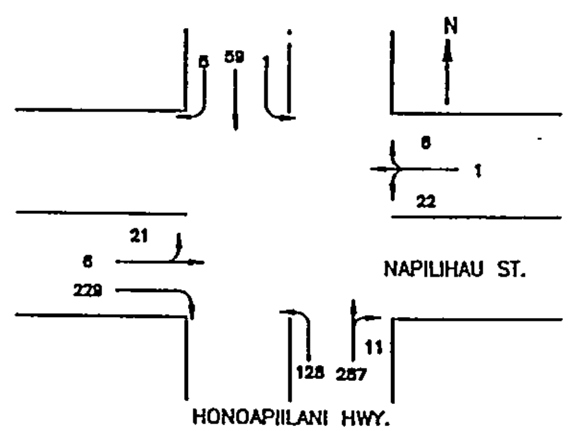
Time Begin	From East RT	From East THRU	From East LT	From South RT	From South THRU	From South LT	From West RT	From West THRU	From West LT	From North RT	From North THRU	From North LT	Vehicle Total
6:15	3	1	11	2	48	12	29	3	5	3	7	1	125
6:30	0	0	5	2	133	26	31	1	5	0	6	0	207
6:45	3	0	5	2	80	32	55	3	6	2	16	0	204
HR TOTAL	6	1	21	6	261	68	115	7	16	5	29	1	536
7:00 AM	3	1	4	3	40	36	79	2	8	2	21	1	198
7:15	0	0	8	4	34	38	64	0	2	1	16	3	167
7:30	3	0	3	3	31	45	58	2	6	3	12	2	168
7:45	2	3	2	1	38	39	66	0	9	4	16	2	182
HR TOTAL	8	4	17	11	143	158	267	4	25	10	65	5	715
8:00 AM	1	1	3	3	40	33	45	0	4	3	15	2	149
8:15	0	1	2	4	40	27	40	2	6	5	27	0	154
DAY TOTAL	15	7	43	24	444	284	467	13	51	23	136	7	1556

PEAK PERIOD ANALYSIS FOR THE PERIOD: 6:15 AM - 8:30 AM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
East	6:15 AM	0.60	9	2	25	36	25	6	69
South	6:30 AM	0.67	11	287	128	426	3	67	30
West	7:00 AM	0.83	267	4	25	296	90	1	8
North	7:30 AM	0.70	15	70	5	90	17	78	6

Entire Intersection

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
East	6:30 AM	0.91	6	1	22	29	21	3	76
South		0.67	11	287	128	426	3	67	30
West		0.72	229	6	21	256	89	2	8
North		0.60	5	59	1	65	8	91	2



NAPILIHAU TOWNHOMES

SITE CODE : 1
Major St. : HONOAPIILANI HIGHWAY
Minor St. : NAPILIHAU STREET
Weather : SUNNY

PAGE: 1
FILE: HONONAPM

Primary Movements: Vehicles

DATE: 3/23/92

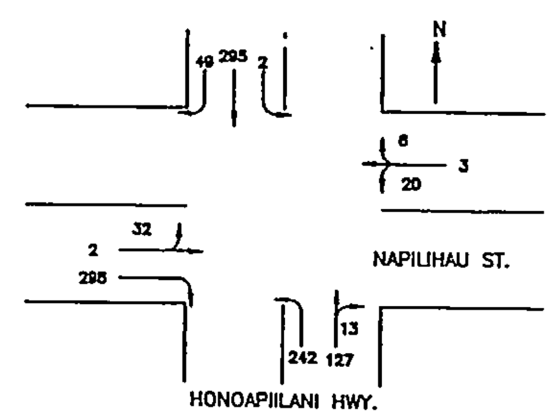
Time Begin	From East RT	From East THRU	From East LT	From South RT	From South THRU	From South LT	From West RT	From West THRU	From West LT	From North RT	From North THRU	From North LT	Vehicle Total
3:15	1	1	7	1	32	56	74	0	9	4	43	0	228
3:30	1	0	2	3	28	60	77	1	11	16	149	2	351
3:45	1	0	4	2	29	64	64	1	9	11	50	0	235
HR TOTAL	3	1	13	6	89	180	215	2	29	33	242	1	814
4:00 PM	3	2	7	7	31	62	83	0	3	15	53	2	275
4:15	0	0	1	2	35	62	63	1	3	11	48	2	219
4:30	0	1	1	0	34	60	69	1	10	11	52	0	239
4:45	0	0	1	1	35	55	64	1	3	10	42	2	212
HR TOTAL	3	3	10	10	142	239	279	3	19	40	187	2	944
5:00 PM	0	2	1	1	20	53	63	6	5	3	40	0	180
5:15	1	0	3	3	26	32	56	1	13	5	41	0	221
DAY TOTAL	7	6	27	20	277	544	613	6	66	83	510	2	2161

PEAK PERIOD ANALYSIS FOR THE PERIOD: 3:15 PM - 5:30 PM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
East	3:15 PM	0.60	6	3	20	29	21	10	69
South	3:45 PM	0.92	11	136	248	395	3	34	63
West	3:15 PM	0.93	298	2	32	332	90	1	10
North	3:30 PM	0.52	56	292	2	350	16	83	1

Entire Intersection

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
East	3:15 PM	0.60	6	3	20	29	21	10	69
South		0.89	13	127	242	382	3	33	63
West		0.93	299	2	32	332	90	1	10
North		0.51	49	295	2	346	14	85	1



NAPILIHAU TOWNHOMES

SITE CODE : 2
Major St. : NAPILIHAU STREET
Minor St. : HANAWAI STREET
Weather : SUNNY

PAGE: 1
FILE: NAPHANAM
DATE: 9/03/92

Primary Movements: Vehicles

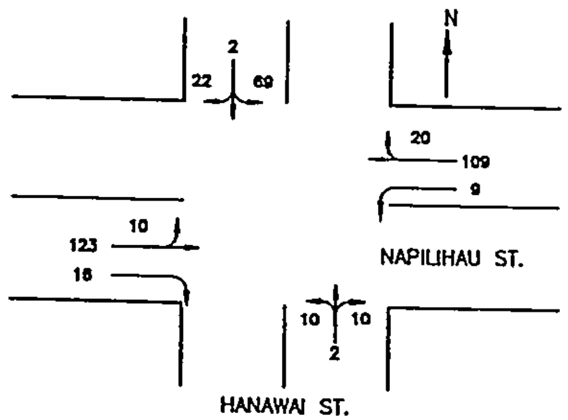
Time Begin	From South RT	From South THRU	From South LT	From West RT	From West THRU	From West LT	From North RT	From North THRU	From North LT	From East RT	From East THRU	From East LT	Vehicle Total
6:15	0	1	0	1	13	0	3	1	11	4	7	2	43
6:30	0	0	1	2	13	2	6	2	13	5	17	1	63
6:45	0	1	0	3	15	2	5	2	14	4	26	0	92
HR TOTAL	0	2	1	6	41	4	14	5	38	13	50	3	198
7:00 AM	0	3	2	4	30	1	3	1	20	3	26	3	96
7:15	1	0	1	3	28	2	5	0	17	3	29	3	91
7:30	2	0	6	2	29	2	5	1	15	7	27	1	98
7:45	7	1	3	7	36	6	9	0	11	7	27	2	119
HR TOTAL	10	2	10	16	123	10	22	2	69	20	109	9	402
8:00 AM	3	0	1	7	32	2	5	2	7	4	22	3	93
8:15	2	0	2	3	23	2	1	0	7	4	20	2	66
DAY TOTAL	15	4	16	32	239	18	42	7	122	41	221	19	356

PEAK PERIOD ANALYSIS FOR THE PERIOD: 6:15 AM - 8:30 AM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
South	7:30 AM	0.61	14	1	12	27	52	4	44
West	7:15 AM	0.79	19	125	11	155	12	81	7
North	7:00 AM	0.97	22	2	69	93	24	2	74
East	7:00 AM	0.96	20	109	9	138	14	79	7

Entire Intersection

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
South	7:00 AM	0.50	10	2	10	22	45	9	45
West		0.76	16	123	10	149	12	83	7
North		0.97	22	2	69	93	24	2	74
East		0.96	20	109	5	132	15	72	7



NAPILIHAU TOWNHOMES

SITE CODE : 1
Major St. : NAPILIHAU STREET
Minor St. : HANAWAI STREET
Weather : SUNNY

PAGE: 2
FILE: NAPHANPM
DATE: 9/08/92

Primary Movements: Vehicles

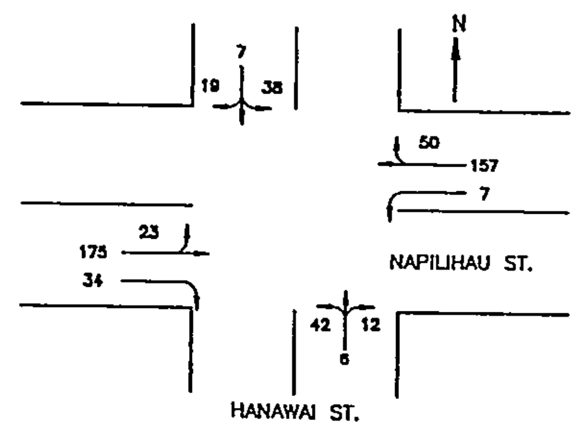
Time Begin	From South RT	From South THRU	From South LT	From West RT	From West THRU	From West LT	From North RT	From North THRU	From North LT	From East RT	From East THRU	From East LT	Vehicle Total
3:15	5	2	11	10	37	7	6	2	13	13	35	2	148
3:30	2	2	12	8	45	1	4	1	10	10	36	2	133
3:45	2	1	11	9	37	5	6	0	9	13	40	2	135
HR TOTAL	9	4	34	27	119	13	16	3	32	36	103		407
4:00 PM	3	2	8	7	55	10	5	4	6	14	43	4	161
4:15	4	1	6	2	48	6	6	1	7	12	35	1	131
4:30	5	1	9	8	42	9	5	4	13	8	35	1	140
4:45	3	4	6	14	31	8	5	2	8	8	31	2	132
HR TOTAL	15	8	29	31	185	33	21	11	34	42	145	6	565
5:00 PM	0	1	13	15	33	7	6	2	7	14	23	3	128
DAY TOTAL	24	13	73	73	346	53	41	16	73	92	235	11	1121

PEAK PERIOD ANALYSIS FOR THE PERIOD: 3:15 PM - 5:15 PM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
South	3:15 PM	0.83	12	6	42	60	20	10	70
West	4:00 PM	0.87	31	155	35	221	12	73	15
North	4:00 PM	0.75	21	11	34	66	32	17	52
East	3:15 PM	0.86	50	157	7	214	23	73	3

Entire Intersection

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
South	3:15 PM	0.83	12	6	42	60	20	10	70
West		0.79	34	175	23	232	15	75	10
North		0.76	19	7	38	64	30	11	59
East		0.86	50	157	7	214	23	73	3



NAPILIHAU TOWNHOMES

SITE CODE : 2
Major St. : LOWER HONOAPIILANI RD
Minor St. : NAPILIHAU STREET
Weather : SUNNY

PAGE: 1
FILE: LHONAPA
DATE: 5/??/92

Primary Movements: Vehicles

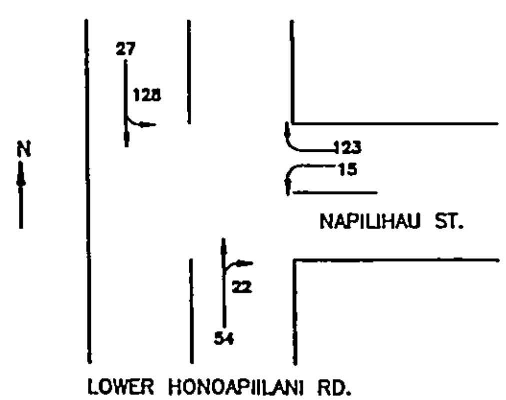
Time Begin	From West RT	From West THRU	From West LT	From North RT	From North THRU	From North LT	From East RT	From East THRU	From East LT	From South RT	From South THRU	From South LT	Vehicle Total
6:15	0	0	0	0	7	12	9	0	2	0	3	0	33
6:30	0	0	0	0	3	12	24	0	1	4	8	0	52
6:45	0	0	0	0	7	16	36	0	6	12	5	0	102
HR TOTAL	0	0	0	0	17	40	67	0	9	15	23	0	138
7:00 AM	0	0	0	0	11	20	27	0	0	7	10	0	83
7:15	0	0	0	0	4	26	38	0	3	4	16	0	85
7:30	0	0	0	0	7	33	33	0	4	6	10	0	93
7:45	0	0	0	0	10	38	33	0	3	6	20	0	106
HR TOTAL	0	0	0	0	32	123	123	0	10	23	56	0	367
8:00 AM	0	0	0	0	6	33	27	0	5	6	3	2	85
8:15	0	0	0	0	9	23	16	0	6	9	11	0	74
DAY TOTAL	0	0	0	0	66	239	233	0	33	53	95	6	724

PEAK PERIOD ANALYSIS FOR THE PERIOD: 6:15 AM - 8:30 AM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
West	12:00 AM	0.00	0	0	0	0	0	0	0
North	7:00 AM	0.80	0	32	123	155	0	21	79
East	7:15 AM	0.93	123	0	15	138	89	0	11
South	7:00 AM	0.76	23	56	0	79	29	71	0

Entire Intersection

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
West	7:15 AM	0.00	0	0	0	0	0	0	0
North		0.80	0	27	128	155	0	17	83
East		0.93	123	0	15	138	89	0	11
South		0.72	22	54	0	76	29	71	0



NAPILIHAU TOWNHOMES

SITE CODE : 2
Major St. : LOWER HONOAPIILANI RD
Minor St. : NAPILIHAU STREET
Weather : SUNNY

PAGE: 1
FILE: LHONAPP
DATE: 5/??/92

Primary Movements: Vehicles

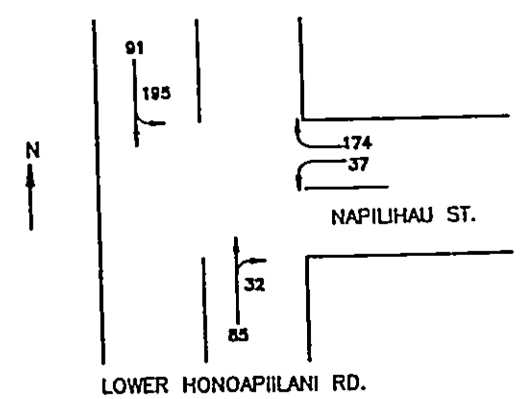
Time Begin	From West RT	From West THRU	From West LT	From North RT	From North THRU	From North LT	From East RT	From East THRU	From East LT	From South RT	From South THRU	From South LT	Vehicle Total
3:30	0	0	0	0	20	47	43	0	8	5	15	0	150
3:45	0	0	0	0	21	38	44	0	11	14	22	0	152
HR TOTAL	0	0	0	0	41	85	87	0	19	19	41	0	290
4:00 PM	0	0	0	0	13	67	45	0	19	6	22	0	153
4:15	0	0	0	0	13	43	33	0	10	7	18	0	136
4:30	0	0	0	0	11	46	35	0	9	12	15	0	132
4:45	0	0	0	0	22	58	37	0	7	13	18	0	155
HR TOTAL	0	0	0	0	53	214	163	0	35	25	75	0	565
5:00 PM	0	0	0	0	18	52	31	0	11	9	15	2	135
5:15	0	0	0	0	25	49	37	0	11	12	18	0	143
DAY TOTAL	0	0	0	0	167	358	315	0	75	72	152	0	1139

PEAK PERIOD ANALYSIS FOR THE PERIOD: 3:30 PM - 5:30 PM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
West	12:00 AM	0.00	0	0	0	0	0	0	0
North	4:00 PM	0.76	0	53	214	267	0	20	80
East	3:30 PM	0.89	176	0	37	213	82	0	18
South	3:45 PM	0.86	39	82	0	121	32	68	0

Entire Intersection

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
West	3:30 PM	0.00	0	0	0	0	0	0	0
North		0.73	0	51	155	206	0	32	65
East		0.89	174	0	37	211	82	0	18
South		0.91	32	85	0	117	27	73	0



APPENDIX B

DEFINITIONS OF LEVELS OF SERVICE

LEVEL OF SERVICE DEFINITIONS

1. LEVEL OF SERVICE OF SIGNALIZED INTERSECTIONS

Level of service for signalized intersections is defined in terms of delay. Delay is a measure of driver discomfort, frustration, fuel consumption and lost travel time. specifically, level-of-service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. The criteria are given in Table A-1.

Table A-1. Level-of Service Criteria for Signalized Intersections

Level of Service	Stopped Delay for Vehicle (SEC)
A	≤ 5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	> 60.0

Delay is a complex measure, and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group or approach in question.

Level-of-service A describes operations with very low delay, i.e., less than 5.0 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

Level-of-service B describes operations with delay in the range of 5.1 to 15.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.

Level-of-service C describes operations with delay in the range of 15.1 to 25.0 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

Level-of-service D describes operations with delay in the range of 25.1 to 40.0 seconds per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Level-of-service E describes operations with delay in the range of 40.1 to 60.0 seconds per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths and high v/c ratios. Individual cycle failures are frequent occurrences.

Level-of-service F describes operations with delay in excess of 60.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

2. LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Level of Service definitions for unsignalized intersections is determined by the reserve or unused capacity of a lane. The potential capacity is determined by the size and frequency in gaps in conflicting traffic that can accommodate the side street demand. The reserve capacity is equal to the potential capacity minus the traffic demand. A lower Level of Service translates into longer side street delay. The Levels of Service criteria are shown in the following table:

Table A-2. Level-of-Service Criteria
for Unsignalized Intersections

Reserve Capacity (PCPH)	Level of Service	Expected Delay to Minor Street Traffic
≥ 400	A	Little or no delay
300-399	B	Short traffic delays
200-299	C	Average traffic delays
100-199	D	Long traffic delays
0- 99	E	Very long traffic delays
< 0	F	Extreme traffic delays

NAPILHAU.TG230

SUMMARY OF TRIP GENERATION RATES

Land Use or Bldg. Type: RESIDENT'L CONDO/TH ITE CODE: 230
Project Name: Napilihau Villages, Ph. IV
Location: Napili, Maui

Independent Variable: Dwelling Units UNITS: 88

			TRIP RATE	VOLUME
AVERAGE WEEKDAY VEHICLE TRIP ENDS			5.86	516
PEAK	A.M.	ENTER	0.07	7
HOUR	between	EXIT	0.37	32
OF	7 and 9	TOTAL	0.44	39
ADJACENT	P.M.	ENTER	0.36	32
STREET	Between	EXIT	0.19	16
TRAFFIC	4 and 6	TOTAL	0.55	48
PEAK	A.M.	ENTER	0.08	7
HOUR		EXIT	0.36	32
OF		TOTAL	0.44	39
GENERATOR	P.M.	ENTER	0.35	31
		EXIT	0.19	17
		TOTAL	0.54	48
SATURDAY VEHICLE TRIP ENDS			5.67	499
PEAK		ENTER	0.25	22
HOUR OF		EXIT	0.22	19
GENERATOR		TOTAL	0.47	41
SUNDAY VEHICLE TRIP ENDS			4.84	426
PEAK		ENTER	0.22	19
HOUR OF		EXIT	0.23	20
GENERATOR		TOTAL	0.45	40

Reference: ITE "Trip Generation," 5th Edition,1991
Comments:

ATA Austin, Tsutsumi & Associates, Inc. Civil Engineers • Surveyors

APPENDIX C

TRIP GENERATION

SUMMARY, PROJECT GENERATED TRIPS
NAPILIHAU VILLAGES

r.1/28/93

PHASE NO.	DWELLING UNITS	AVE WEEKDAY TRIP ENDS	AM PK HR ENTER. TRIPS	AM PK HR EXIT. TRIPS	PM PK HR ENTER. TRIPS	PM PK HR EXIT. TRIPS
I	76	445	6	28	28	14
II	84	492	6	31	30	16
III	64	375	5	23	23	12
IV	88	516	7	32	32	16
TOTAL	312	1828	24	114	113	58

SUMMARY OF TRIP GENERATION RATES

Land Use or Bldg. Type: RESIDENT'L CONDO/TH ITE CODE: 230
Project Name: Napilihau Villages, Ph. I
Location: Napili, Maui

Independent Variable:	Dwelling Units		UNITS: 76	
			TRIP RATE	VOLUME
AVERAGE WEEKDAY VEHICLE TRIP ENDS			5.86	445
PEAK	A.M.	ENTER	0.07	6
HOUR	between	EXIT	0.37	28
OF	7 and 9	TOTAL	0.44	33
ADJACENT	P.M.	ENTER	0.36	28
STREET	Between	EXIT	0.19	14
TRAFFIC	4 and 6	TOTAL	0.55	42
PEAK	A.M.	ENTER	0.08	6
HOUR		EXIT	0.36	27
OF		TOTAL	0.44	33
GENERATOR	P.M.	ENTER	0.35	27
		EXIT	0.19	14
		TOTAL	0.54	41
SATURDAY VEHICLE TRIP ENDS			5.67	431
PEAK		ENTER	0.25	19
HOUR OF		EXIT	0.22	16
GENERATOR		TOTAL	0.47	36
SUNDAY VEHICLE TRIP ENDS			4.84	368
PEAK		ENTER	0.22	17
HOUR OF		EXIT	0.23	17
GENERATOR		TOTAL	0.45	34

Reference: ITE "Trip Generation," 5th Edition,1991
Comments:

SUMMARY OF TRIP GENERATION RATES

Land Use or Bldg. Type: RESIDENT'L CONDO/TH ITE CODE: 230
Project Name: Napilihau Villages, Ph. III
Location: Napili, Maui

Independent Variable: Dwelling Units UNITS: 64

			TRIP RATE	VOLUME
AVERAGE WEEKDAY VEHICLE TRIP ENDS			5.86	375
PEAK	A.M.	ENTER	0.07	5
HOUR	between	EXIT	0.37	23
OF	7 and 9	TOTAL	0.44	28
ADJACENT	P.M.	ENTER	0.36	23
STREET	Between	EXIT	0.19	12
TRAFFIC	4 and 6	TOTAL	0.55	35
PEAK	A.M.	ENTER	0.08	5
HOUR		EXIT	0.36	23
OF		TOTAL	0.44	28
GENERATOR	P.M.	ENTER	0.35	22
		EXIT	0.19	12
		TOTAL	0.54	35
SATURDAY VEHICLE TRIP ENDS			5.67	363
PEAK		ENTER	0.25	16
HOUR OF		EXIT	0.22	14
GENERATOR		TOTAL	0.47	30
SUNDAY VEHICLE TRIP ENDS			4.84	310
PEAK		ENTER	0.22	14
HOUR OF		EXIT	0.23	15
GENERATOR		TOTAL	0.45	29

Reference: ITE "Trip Generation," 5th Edition,1991
Comments:

SUMMARY OF TRIP GENERATION RATES

Land Use or Bldg. Type: RESIDENT'L CONDO/TH ITE CODE: 230
Project Name: Napilihau Villages, Ph. II
Location: Napili, Maui

Independent Variable: Dwelling Units UNITS: 84

			TRIP RATE	VOLUME
AVERAGE WEEKDAY VEHICLE TRIP ENDS			5.86	492
PEAK	A.M.	ENTER	0.07	6
HOUR	between	EXIT	0.37	31
OF	7 and 9	TOTAL	0.44	37
ADJACENT	P.M.	ENTER	0.36	30
STREET	Between	EXIT	0.19	16
TRAFFIC	4 and 6	TOTAL	0.55	46
PEAK	A.M.	ENTER	0.08	7
HOUR		EXIT	0.36	30
OF		TOTAL	0.44	37
GENERATOR	P.M.	ENTER	0.35	29
		EXIT	0.19	16
		TOTAL	0.54	45
SATURDAY VEHICLE TRIP ENDS			5.67	476
PEAK		ENTER	0.25	21
HOUR OF		EXIT	0.22	18
GENERATOR		TOTAL	0.47	39
SUNDAY VEHICLE TRIP ENDS			4.84	407
PEAK		ENTER	0.22	19
HOUR OF		EXIT	0.23	19
GENERATOR		TOTAL	0.45	38

Reference: ITE "Trip Generation," 5th Edition,1991
Comments:

APPENDIX D

CAPACITY ANALYSIS COMPUTATIONS

1 – EXISTING AM AND PM COMMUTER
PEAK HOUR OF TRAFFIC

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .94

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HONOAPIILANI HWY

NAME OF THE ANALYST.................. BS

DATE OF THE ANALYSIS (mm/dd/yy)...... 9/09/92

TIME PERIOD ANALYZED................. 06:30 TO 07:30

OTHER INFORMATION.... HONONAAH 93-028

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE EASTBOUND: STOP SIGN

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	21	22	128	1
THRU	6	1	287	59
RIGHT	229	6	11	5

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	1	2	3
LANE USAGE	LT + R	LTR		

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	40	N
WESTBOUND	0.00	90	40	N
NORTHBOUND	2.00	90	20	N
SOUTHBOUND	-2.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MAJOR LEFTS				
SB	5.50	5.50	0.00	5.50
NB	5.50	5.50	0.00	5.50
MINOR THROUGHS				
EB	6.50	6.50	0.00	6.50
WB	6.50	6.50	0.00	6.50
MINOR LEFTS				
EB	7.00	7.00	0.00	7.00
WB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 9/09/92 ; 06:30 TO 07:30
OTHER INFORMATION.... HONONAAH 93-028

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) P	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH			RESERVE CAPACITY c = c - v R SH		LOS
MINOR STREET										
EB LEFT	25	417	359	>	370	359	>	339	335 >B	B
THROUGH	7	479	415	>		415	>		408 >	A
RIGHT	268	999	999			999			731	A
MINOR STREET										
WB LEFT	26	283	195	>		195	>		169 >	D
THROUGH	1	481	417	>	238	417	>	204	416 >C	A
RIGHT	7	934	934	>		934	>		927 >	A
MAJOR STREET										
SB LEFT	1	775	775			775			774	A
NB LEFT	191	997	997			997			806	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 9/09/92 ; 06:30 TO 07:30
OTHER INFORMATION.... HONONAAH 93-028

1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .78

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HONOAPIILANI HWY

NAME OF THE ANALYST.................. BS

DATE OF THE ANALYSIS (mm/dd/yy)...... 9/08/92

TIME PERIOD ANALYZED................. 15:15 TO 16:15

OTHER INFORMATION.... HONOHAPH 93-028

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE EASTBOUND: STOP SIGN

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	32	20	242	2
THRU	2	3	127	295
RIGHT	298	6	13	49

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	1	2	3
LANE USAGE	LT + R	LTR		

ADJUSTMENT FACTORS Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	40	N
WESTBOUND	0.00	90	40	N
NORTHBOUND	2.00	90	20	N
SOUTHBOUND	-2.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS					
	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MAJOR LEFTS					
	SB	5.50	5.50	0.00	5.50
	NB	5.50	5.50	0.00	5.50
MINOR THROUGHS					
	EB	6.50	6.50	0.00	6.50
	WB	6.50	6.50	0.00	6.50
MINOR LEFTS					
	EB	7.00	7.00	0.00	7.00
	WB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 9/08/92 ; 15:15 TO 16:15
OTHER INFORMATION.... HONOHAPH 93-028

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
EB LEFT	45	222	95	> 96 95 >	48 49 >E	E
THROUGH	3	269	116	> 116 >	113 >	D
RIGHT	420	935	935	935	514	A
MINOR STREET						
WB LEFT	28	121	33	> 33 >	4 >	E
THROUGH	4	260	112	> 45 112 >	4 108 >E	D
RIGHT	8	996	996	> 996 >	987 >	A
MAJOR STREET						
SB LEFT	3	912	912	912	909	A
NB LEFT	434	670	670	670	236	C

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 9/08/92 ; 15:15 TO 16:15
OTHER INFORMATION.... HONONAPH 93-028

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .84

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BS

DATE OF THE ANALYSIS (mm/dd/yy)...... 9/09/92

TIME PERIOD ANALYZED................. 07:00 TO 08:00

OTHER INFORMATION.... NAPHANAH 93-028

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	10	9	10	69
THRU	123	109	2	2
RIGHT	16	20	10	22

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	28	N
SOUTHBOUND	0.00	90	28	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
NB	5.50	5.50	0.00	5.50
SB	5.50	5.50	0.00	5.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MINOR THROUGHS				
NB	6.50	6.50	0.00	6.50
SB	6.50	6.50	0.00	6.50
MINOR LEFTS				
NB	7.00	7.00	0.00	7.00
SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 9/09/92 ; 07:00 TO 08:00
OTHER INFORMATION.... NAPHANAM 93-028

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) P	ACTUAL MOVEMENT CAPACITY c (pcph) M	SHARED CAPACITY c (pcph) SH	RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET						
NB LEFT	13	531	513 >	513 >	499 >	A
THROUGH	3	611	601 > 669	601 > 640	599 >A	A
RIGHT	13	996	996 >	996 >	983 >	A
MINOR STREET						
SB LEFT	90	545	530 >	530 >	440 >	A
THROUGH	3	613	603 > 598	603 > 476	600 >A	A
RIGHT	29	996	996 >	996 >	967 >	A
MAJOR STREET						
EB LEFT	13	939	939	939	926	A
WB LEFT	12	926	926	926	914	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 9/09/92 ; 07:00 TO 08:00
OTHER INFORMATION.... NAPHANAM 93-028

1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BS

DATE OF THE ANALYSIS (mm/dd/yy)...... 9/08/92

TIME PERIOD ANALYZED................. 15:15 TO 16:15

OTHER INFORMATION.... NAPHANPM 93-028

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	23	7	42	38
THRU	175	157	6	7
RIGHT	34	50	12	19

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	28	N
SOUTHBOUND	0.00	90	28	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS					
	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS					
	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS					
	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS					
	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 9/08/92 ; 15:15 TO 16:15
OTHER INFORMATION.... NAPHANPM 93-028

CAPACITY AND LEVEL-OF-SERVICE Page-3

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) P	ACTUAL MOVEMENT CAPACITY c (pcph) M	SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH		LOS
MINOR STREET								
NB LEFT	53	420	399 >		399 >		345 >	B
THROUGH	8	497	484 >	461	484 >	385	476 >B	A
RIGHT	15	974	974 >		974 >		959 >	A
MINOR STREET								
SB LEFT	48	432	413 >		413 >		365 >	B
THROUGH	9	503	490 >	509	490 >	420	461 >A	A
RIGHT	24	975	975 >		975 >		951 >	A
MAJOR STREET								
EB LEFT	29	852	852		852		823	A
WB LEFT	9	850	850		850		841	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 9/08/92 ; 15:15 TO 16:15
OTHER INFORMATION.... NAPHANPM 93-020

1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BS

DATE OF THE ANALYSIS (mm/dd/yy)...... 9/09/92

TIME PERIOD ANALYZED................. 07:15 TO 08:15

OTHER INFORMATION.... LHONNAPA 93-020

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	15	0	128
THRU	--	0	54	27
RIGHT	--	123	22	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
WB	5.50	5.50	0.00	5.50
MAJOR LEFTS				
SB	5.00	5.00	0.00	5.00
MINOR LEFTS				
WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 9/09/92 ; 07:15 TO 08:15
OTHER INFORMATION.... LHONNAPA 93-028

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	16	675	601	601	586	A
RIGHT	127	996	996	996	869	A
MAJOR STREET						
SB LEFT	162	1000	1000	1000	838	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 9/09/92 ; 07:15 TO 08:15
OTHER INFORMATION.... LHONNAPA 93-028

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .82

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BS

DATE OF THE ANALYSIS (mm/dd/yy)...... 9/08/92

TIME PERIOD ANALYZED................. 15:30 TO 16:30

OTHER INFORMATION.... LHONNAPA 93-028

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	37	0	195
THRU	--	0	85	91
RIGHT	--	174	32	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	WB	5.50	5.50	0.00	5.50
MAJOR LEFTS	SB	5.00	5.00	0.00	5.00
MINOR LEFTS	WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 9/08/92 ; 15:30 TO 16:30
OTHER INFORMATION.... LHONNAPA 93-028

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	41	511	413	413	372	B
RIGHT	191	971	971	971	780	A
MAJOR STREET						
SB LEFT	262	994	994	994	732	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... HAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 9/08/92 ; 15:30 TO 16:30
OTHER INFORMATION.... LHONNAPA 93-028

ATA AUSTIN TSUTSUMI & ASSOCIATES INC
CIVIL ENGINEERS • SURVEYORS

APPENDIX D

CAPACITY ANALYSIS COMPUTATIONS

2 – PROJECTED COMMUTER PEAK HOUR TRAFFIC VOLUMES WITHOUT PROJECT FOR THE YEARS 1995, 1996, 1997

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1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****************************************************************************
INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........A.M. PEAK HOUR
COMMENT.......1995 PROJ. COMM. AM PK.HR. VOL. W/O PROJ.  HONA95AO
----------------------------------------------------------------------------
          VOLUMES          :               GEOMETRY
      EB    WB    NB    SB :      EB          WB          NB          SB
LT    27    57   140    51 : LT   12.0   LTR  12.0   L    12.0   L    12.0
TH    88    17   377    94 : R    12.0        12.0   TR   12.0   T    12.0
RT   250    30   205    15 :      12.0        12.0        12.0   R    12.0
RR    60    10    60    10 :      12.0        12.0        12.0        12.0
                           :      12.0        12.0        12.0        12.0
                           :      12.0        12.0        12.0        12.0
----------------------------------------------------------------------------
                          ADJUSTMENT FACTORS
     GRADE    HV    ADJ PKG  BUSES   PHF   PEDS    PED. BUT.   ARR. TYPE
      (%)    (%)    Y/N  Nm    Nb                  Y/N  min T
EB    3.00   2.00    N    0     0   0.90    10      Y   22.8       3
WB   -3.00   2.00    N    0     0   0.90    10      Y   22.8       3
NB    0.00   2.00    N    0     0   0.90     0      Y   16.8       3
SB    0.00   2.00    N    0     0   0.90     0      Y   16.8       3
----------------------------------------------------------------------------
                        SIGNAL SETTINGS          CYCLE LENGTH =  90.0
          PH-1   PH-2   PH-3   PH-4               PH-1   PH-2   PH-3   PH-4
EB  LT     X                           NB  LT      X
    TH     X                               TH             X
    RT     X                               RT             X
    PD     X                               PD             X
WB  LT     X                           SB  LT      X
    TH     X                               TH             X
    RT     X                               RT             X
    PD     X                               PD             X
GREEN     21.0   0.0    0.0    0.0     GREEN      20.0   35.0   0.0    0.0
YELLOW     5.0   0.0    0.0    0.0     YELLOW      4.0    5.0   0.0    0.0
----------------------------------------------------------------------------
                          LEVEL OF SERVICE
     LANE GRP.   V/C     G/C     DELAY    LOS    APP. DELAY     APP. LOS
EB     LT       0.285   0.256    17.5     C        19.0            C
       R        0.556   0.256    19.9     C
WB     LTR      0.637   0.256    23.9     C        23.9            C
NB     L        0.394   0.233    22.5     C        20.5            C
       TR       0.826   0.411    20.0     C
SB     L        0.143   0.233    20.8     C        14.1            B
       T        0.143   0.411    10.7     B
       R        0.009   0.411    10.1     B
----------------------------------------------------------------------------
INTERSECTION:     Delay =  19.6 (sec/veh)   V/C = 0.660    LOS = C
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1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****************************************************************************
INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........P.M. PEAK HOUR
COMMENT.......1995 PROJ. COMM. PM PK.HR. VOL. W/O PROJ.  HONA95PO
----------------------------------------------------------------------------
          VOLUMES          :               GEOMETRY
      EB    WB    NB    SB :      EB          WB          NB          SB
LT    38   222   264    27 : LT   12.0   LTR  12.0   L    12.0   L    12.0
TH    20   104   138   422 : R    12.0        12.0   TR   12.0   T    12.0
RT   325    37    54    57 :      12.0        12.0        12.0   R    12.0
RR   140    10    25    10 :      12.0        12.0        12.0        12.0
                           :      12.0        12.0        12.0        12.0
                           :      12.0        12.0        12.0        12.0
----------------------------------------------------------------------------
                          ADJUSTMENT FACTORS
     GRADE    HV    ADJ PKG  BUSES   PHF   PEDS    PED. BUT.   ARR. TYPE
      (%)    (%)    Y/N  Nm    Nb                  Y/N  min T
EB    3.00   2.00    N    0     0   0.90    10      Y   22.8       3
WB   -3.00   2.00    N    0     0   0.90    10      Y   22.8       3
NB    0.00   2.00    N    0     0   0.90     0      Y   16.8       3
SB    0.00   2.00    N    0     0   0.90     0      Y   16.8       3
----------------------------------------------------------------------------
                        SIGNAL SETTINGS          CYCLE LENGTH =  90.0
          PH-1   PH-2   PH-3   PH-4               PH-1   PH-2   PH-3   PH-4
EB  LT     X                           NB  LT      X
    TH     X                               TH             X
    RT     X                               RT             X
    PD     X                               PD             X
WB  LT     X                           SB  LT      X
    TH     X                               TH             X
    RT     X                               RT             X
    PD     X                               PD             X
GREEN     35.0   0.0    0.0    0.0     GREEN      19.0   23.0   0.0    0.0
YELLOW     5.0   0.0    0.0    0.0     YELLOW      3.0    5.0   0.0    0.0
----------------------------------------------------------------------------
                          LEVEL OF SERVICE
     LANE GRP.   V/C     G/C     DELAY    LOS    APP. DELAY     APP. LOS
EB     LT       0.112   0.411    10.6     B        11.5            B
       R        0.336   0.411    11.8     B
WB     LTR      0.913   0.411    30.5     D        30.5            D
NB     L        0.821   0.211    35.4     D        28.4            D
       TR       0.384   0.278    17.2     C
SB     L        0.004   0.211    21.7     C        34.8            D
       T        0.947   0.278    37.7     D
       R        0.124   0.278    15.7     C
----------------------------------------------------------------------------
INTERSECTION:     Delay =  28.3 (sec/veh)   V/C = 0.902    LOS = D
```

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .84

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. DSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 07:00 TO 08:00

OTHER INFORMATION.... 1995 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. NAH A95A0

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	11	10	11	74
THRU	213	126	2	2
RIGHT	17	20	11	23

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:00 TO 08:00
OTHER INFORMATION.... 1995 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. NAH A95A0

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) P	ACTUAL MOVEMENT CAPACITY c (pcph) M	SHARED CAPACITY c (pcph) SH		RESERVE CAPACITY c = c - v R SH		LOS
MINOR STREET								
NB LEFT	14	426	409 >		409 >		395 >	B
THROUGH	3	503	494 >	565	494 >	534	491 >A	A
RIGHT	14	956	956 >		956 >		942 >	A
MINOR STREET								
SB LEFT	97	440	426 >		426 >		329 >	B
THROUGH	3	508	498 >	493	498 >	363	495 >B	A
RIGHT	30	995	995 >		995 >		965 >	A
MAJOR STREET								
EB LEFT	14	895	895		895		881	A
WB LEFT	13	816	816		816		803	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:00 TO 08:00
OTHER INFORMATION.... 1995 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. NAH A95A0

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 15:15 TO 16:15

OTHER INFORMATION.... 1995 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. NAH A95P0

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	25	10	46	42
THRU	206	265	7	8
RIGHT	37	62	13	21

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	28	N
SOUTHBOUND	0.00	90	28	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
NB	5.50	5.50	0.00	5.50
SB	5.50	5.50	0.00	5.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MINOR THROUGHS				
NB	6.50	6.50	0.00	6.50
SB	6.50	6.50	0.00	6.50
MINOR LEFTS				
NB	7.00	7.00	0.00	7.00
SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:15 TO 16:15
OTHER INFORMATION.... 1995 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. NAH
A95PO

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
NB LEFT	50	314	293	> 293 >	234 >	C
THROUGH	9	302	369	> 348 369 >	264 360 >	C B
RIGHT	16	953	953	> 553 >	937 >	A
MINOR STREET						
SB LEFT	53	327	307	> 307 >	254 >	C
THROUGH	10	391	377	> 392 377 >	302 367 >	B B
RIGHT	27	903	903	> 903 >	876 >	A
MAJOR STREET						
EB LEFT	32	722	722	722	690	A
WB LEFT	13	811	811	811	798	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:15 TO 16:15
OTHER INFORMATION.... 1995 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. NAH
A95PO

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR.................... .87

AREA POPULATION..................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 07:15 TO 08:15

OTHER INFORMATION.... 1995 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. LHN A95AO

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	30	0	170
THRU	--	0	66	30
RIGHT	--	137	63	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	WB	5.50	5.50	0.00	5.50
MAJOR LEFTS	SB	5.00	5.00	0.00	5.00
MINOR LEFTS	WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:15 TO 08:15
OTHER INFORMATION.... 1995 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. LHN A95AO

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) P	ACTUAL MOVEMENT CAPACITY c (pcph) M	SHARED CAPACITY c (pcph) SH	RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET						
WB LEFT	31	594	503	503	472	A
RIGHT	142	979	979	979	838	A
MAJOR STREET						
SB LEFT	215	992	992	992	777	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:15 TO 08:15
OTHER INFORMATION.... 1995 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. LHN A95AO

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .82

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 15:30 TO 16:30

OTHER INFORMATION.... 1995 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. LHN A95PO

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	104	0	223
THRU	--	0	93	110
RIGHT	--	210	40	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	30	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS WB	5.50	5.50	0.00	5.50
MAJOR LEFTS SB	5.00	5.00	0.00	5.00
MINOR LEFTS WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:30 TO 16:30
OTHER INFORMATION.... 1995 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. LHH
A95PO

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	114	463	355	355	241	C
RIGHT	230	955	955	955	725	A
MAJOR STREET						
SB LEFT	299	991	991	991	692	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:30 TO 16:30
OTHER INFORMATION.... 1995 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. LHH
A95PO

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1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
************************************************************************
INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........A.M. PEAK HOUR
COMMENT.......1996 PROJ. COMM. AM PK.HR. VOL. W/O PROJ.  HONA96AO
------------------------------------------------------------------------
         VOLUMES          :                 GEOMETRY
     EB    WB    NB    SB :      EB          WB          NB          SB
LT   28    58   143    52 : LT  12.0   LTR  12.0   L   12.0   L   12.0
TH   88    16   386    96 : R   12.0        12.0   TR  12.0   T   12.0
RT  256    30   205    16 :     12.0        12.0       12.0   R   12.0
RR  140    10    50    10 :     12.0        12.0       12.0       12.0
                          :     12.0        12.0       12.0       12.0
                          :     12.0        12.0       12.0       12.0
------------------------------------------------------------------------
                       ADJUSTMENT FACTORS
     GRADE    HV    ADJ PKG  BUSES   PHF    PEDS   PED. BUT.   ARR. TYPE
      (%)    (%)    Y/N  Nm   Nb                   Y/N  min T
EB    3.00   2.00    N   0     0    0.90    10      Y   22.8       3
WB   -3.00   2.00    N   0     0    0.90    10      Y   22.8       3
NB    0.00   2.00    N   0     0    0.90     0      Y   16.8       3
SB    0.00   2.00    N   0     0    0.90     0      Y   16.8       3
------------------------------------------------------------------------
                    SIGNAL SETTINGS              CYCLE LENGTH =  90.0
        PH-1   PH-2   PH-3   PH-4               PH-1   PH-2   PH-3   PH-4
EB  LT   X                           NB  LT       X
    TH   X                               TH              X
    RT   X                               RT              X
    PD   X                               PD              X
WB  LT   X                           SB  LT       X
    TH   X                               TH              X
    RT   X                               RT              X
    PD   X                               PD              X
GREEN   20.0   0.0    0.0    0.0     GREEN      20.0   36.0   0.0    0.0
YELLOW   5.0   0.0    0.0    0.0     YELLOW      4.0    5.0   0.0    0.0
------------------------------------------------------------------------
                         LEVEL OF SERVICE
     LANE GRP.   V/C     G/C    DELAY   LOS   APP. DELAY    APP. LOS
EB      LT      0.300   0.244   10.0     C       18.2          C
        R       0.354   0.244   18.4     C
WB      LTR     0.500   0.244   20.3     C       20.3          C
NB      L       0.402   0.233   22.6     C       20.5          C
        TR      0.834   0.422   20.0     C
SB      L       0.146   0.233   20.8     C       13.8          B
        T       0.142   0.422   10.3     B
        R       0.011   0.422    9.7     B
------------------------------------------------------------------------
INTERSECTION:      Delay =  19.1 (sec/veh)   V/C = 0.631      LOS = C
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1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
************************************************************************
INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........P.M. PEAK HOUR
COMMENT.......1996 PROJ. COMM. PM PK.HR. VOL. W/O PROJ.  HONA96PO
------------------------------------------------------------------------
         VOLUMES          :                 GEOMETRY
     EB    WB    NB    SB :      EB          WB          NB          SB
LT   39   223   271    29 : LT  12.0   LTR  12.0   L   12.0   L   12.0
TH   22   105   142   430 : R   12.0        12.0   TR  12.0   T   12.0
RT  334    38    55    58 :     12.0        12.0       12.0   R   12.0
RR  160    10    25    10 :     12.0        12.0       12.0       12.0
                          :     12.0        12.0       12.0       12.0
                          :     12.0        12.0       12.0       12.0
------------------------------------------------------------------------
                       ADJUSTMENT FACTORS
     GRADE    HV    ADJ PKG  BUSES   PHF    PEDS   PED. BUT.   ARR. TYPE
      (%)    (%)    Y/N  Nm   Nb                   Y/N  min T
EB    3.00   2.00    N   0     0    0.90    10      Y   22.8       3
WB   -3.00   2.00    N   0     0    0.90    10      Y   22.8       3
NB    0.00   2.00    N   0     0    0.90     0      Y   16.8       3
SB    0.00   2.00    N   0     0    0.90     0      Y   16.8       3
------------------------------------------------------------------------
                    SIGNAL SETTINGS              CYCLE LENGTH =  90.0
        PH-1   PH-2   PH-3   PH-4               PH-1   PH-2   PH-3   PH-4
EB  LT   X                           NB  LT       X
    TH   X                               TH              X
    RT   X                               RT              X
    PD   X                               PD              X
WB  LT   X                           SB  LT       X
    TH   X                               TH              X
    RT   X                               RT              X
    PD   X                               PD              X
GREEN   34.0   0.0    0.0    0.0     GREEN      19.0   24.0   0.0    0.0
YELLOW   5.0   0.0    0.0    0.0     YELLOW      3.0    5.0   0.0    0.0
------------------------------------------------------------------------
                         LEVEL OF SERVICE
     LANE GRP.   V/C     G/C    DELAY   LOS   APP. DELAY    APP. LOS
EB      LT      0.121   0.400   11.0     B       11.8          B
        R       0.325   0.400   12.1     B
WB      LTR     0.940   0.400   34.8     D       34.8          D
NB      L       0.843   0.211   37.3     D       29.3          D
        TR      0.381   0.289   16.7     C
SB      L       0.090   0.211   21.7     C       31.8          D
        T       0.928   0.289   34.3     D
        R       0.122   0.289   15.2     C
------------------------------------------------------------------------
INTERSECTION:      Delay =  28.7 (sec/veh)   V/C = 0.913      LOS = D
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1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1

****

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .84

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 07:00 TO 08:00

OTHER INFORMATION.... 1996 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. NAH A96A0

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	11	10	11	76
THRU	217	139	3	3
RIGHT	18	29	11	24

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	28	N
SOUTHBOUND	0.00	90	28	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:00 TO 08:00
OTHER INFORMATION.... 1996 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. NAH A96A0

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_P (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
NB LEFT	14	410	400 >	400 >	386 >	B
THROUGH	4	497	487 > 553	487 > 521	433 >	A A
RIGHT	14	953	953 >	953 >	939 >	A
MINOR STREET						
SB LEFT	100	432	418 >	418 >	319 >	B
THROUGH	4	501	491 > 486	491 > 351	487 >	B A
RIGHT	31	995	995 >	995 >	964 >	A
MAJOR STREET						
EB LEFT	14	890	890	890	876	A
WB LEFT	13	810	810	810	797	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:00 TO 08:00
OTHER INFORMATION.... 1996 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. NAH A96A0

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .67

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 15:15 TO 16:15

OTHER INFORMATION.... 1996 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. NAH A96P0

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	36	11	47	44
THRU	211	270	7	6
RIGHT	33	63	13	22

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
NB	5.50	5.50	0.00	5.50
SB	5.50	5.50	0.00	5.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MINOR THROUGHS				
NB	6.50	6.50	0.00	6.50
SB	6.50	6.50	0.00	6.50
MINOR LEFTS				
NB	7.00	7.00	0.00	7.00
SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:15 TO 16:15
OTHER INFORMATION.... 1996 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. NAH
A96PO

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)		SHARED CAPACITY c_{SH} (pcph)			RESERVE CAPACITY $c_R = c_{SH} - v$		LOS
MINOR STREET										
NB LEFT	59	305	203	>		203	>		224 >	C
THROUGH	9	373	359	>	237	359	>	252	351 >C	B
RIGHT	16	950	950	>		950	>		933 >	A
MINOR STREET										
SB LEFT	56	318	299	>		299	>		243 >	C
THROUGH	10	382	367	>	383	367	>	289	357 >C	B
RIGHT	20	899	899	>		899	>		871 >	A
MAJOR STREET										
EB LEFT	33	716	716			716			603	A
WB LEFT	14	804	804			804			770	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:15 TO 16:15
OTHER INFORMATION.... 1996 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. NAH
A96PO

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 10/3/92

TIME PERIOD ANALYZED................. 2/3/93

OTHER INFORMATION.... 1996 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. LHN A96A0

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	31	0	173
THRU	--	0	68	38
RIGHT	--	141	69	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS WB	5.50	5.50	0.00	5.50
MAJOR LEFTS SB	5.00	5.00	0.00	5.00
MINOR LEFTS WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 10/3/92 ; 2/3/93
OTHER INFORMATION.... 1996 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. LHN A96A0

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) P	ACTUAL MOVEMENT CAPACITY c (pcph) M	SHARED CAPACITY c (pcph) SH	RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET						
WB LEFT	32	590	497	497	465	A
RIGHT	146	976	976	976	830	A
MAJOR STREET						
SB LEFT	219	991	991	991	773	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 10/3/92 ; 2/3/93
OTHER INFORMATION.... 1996 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. LHN A96AO

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .82

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 15:30 TO 16:30

OTHER INFORMATION.... 1996 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. LHN A96PO

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	106	0	228
THRU	--	0	96	114
RIGHT	--	215	41	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	WB	5.50	5.50	0.00	5.50
MAJOR LEFTS	SB	5.00	5.00	0.00	5.00
MINOR LEFTS	WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:30 TO 16:30
OTHER INFORMATION.... 1996 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. LHN
A96PO

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	116	453	344	344	228	C
RIGHT	236	951	951	951	715	A
MAJOR STREET						
SB LEFT	306	990	990	990	684	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:30 TO 16:30
OTHER INFORMATION.... 1996 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. LHN
A96PO

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS'
DATE..........2/1/93
TIME..........A.M. PEAK HOUR
COMMENT.......1997 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. HONA97AO

	VOLUMES				:	GEOMETRY							
	EB	WB	NB	SB	:	EB		WB		NB		SB	
LT	28	59	148	54	:	LT	12.0	LTR	12.0	L	12.0	L	12.0
TH	89	17	408	98	:	R	12.0		12.0	TR	12.0	T	12.0
RT	265	31	210	17	:		12.0		12.0		12.0	R	12.0
RR	160	10	50	10	:		12.0		12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	3.00	2.00	N	0	0	0.90	10	Y	17.5	3
WB	-3.00	2.00	N	0	0	0.90	10	Y	17.5	3
NB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3
SB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3

SIGNAL SETTINGS CYCLE LENGTH = 90.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
WB	LT	X				SB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
GREEN		20.0	0.0	0.0	0.0	GREEN		21.0	36.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		3.0	5.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	LT	0.303	0.244	10.0	C	10.1	C
	R	0.321	0.244	10.2	C		
WB	LTR	0.495	0.244	20.1	C	20.1	C
NB	L	0.416	0.233	22.7	C	22.5	C
	TR	0.875	0.422	22.4	C		
SB	L	0.152	0.233	20.9	C	13.9	B
	T	0.145	0.422	10.3	B		
	R	0.012	0.422	9.8	B		

INTERSECTION: Delay = 20.3 (sec/veh) V/C = 0.653 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........P.M. PEAK HOUR
COMMENT.......1997 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. HONA97PO

	VOLUMES				:	GEOMETRY							
	EB	WB	NB	SB	:	EB		WB		NB		SB	
LT	40	224	281	31	:	LT	12.0	LTR	12.0	L	12.0	L	12.0
TH	23	106	150	441	:	R	12.0		12.0	TR	12.0	T	12.0
RT	345	38	57	60	:		12.0		12.0		12.0	R	12.0
RR	160	10	25	10	:		12.0		12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	3.00	2.00	N	0	0	0.90	10	Y	17.5	3
WB	-3.00	2.00	N	0	0	0.90	10	Y	17.5	3
NB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3
SB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3

SIGNAL SETTINGS CYCLE LENGTH = 90.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
WB	LT	X				SB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
GREEN		34.0	0.0	0.0	0.0	GREEN		19.0	24.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		3.0	5.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	LT	0.125	0.400	11.0	B	12.0	B
	R	0.346	0.400	12.3	B		
WB	LTR	0.972	0.400	40.5	E	40.5	E
NB	L	0.874	0.211	40.4	E	31.2	D
	TR	0.403	0.289	16.9	C		
SB	L	0.096	0.211	21.7	C	34.6	D
	T	0.952	0.289	37.7	D		
	R	0.127	0.289	15.3	C		

INTERSECTION: Delay = 31.4 (sec/veh) V/C = 0.942 LOS = D

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .84

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. ESS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/2/93

TIME PERIOD ANALYZED................. A.M. PEAK HOUR

OTHER INFORMATION.... 1997 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. NAH
69790

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	12	10	12	79
THRU	222	143	3	3
RIGHT	19	29	12	25

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/2/93 ; A.M. PEAK HOUR
OTHER INFORMATION.... 1997 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. NAH
69790

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) P	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH			RESERVE CAPACITY c = c - v R SH		LOS
MINOR STREET										
NB LEFT	16	409	391	>		391	>		375 >	B
THROUGH	4	483	478	>	544	473	>	509	474 >A	A
RIGHT	16	949	949	>		949	>		934 >	A
MINOR STREET										
SB LEFT	103	423	408	>		408	>		305 >	B
THROUGH	4	492	482	>	476	482	>	336	478 >B	A
RIGHT	33	993	993	>		993	>		960 >	A
MAJOR STREET										
EB LEFT	16	685	685			685			670	A
WB LEFT	13	803	803			803			790	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/2/93 ; A.M. PEAK HOUR
OTHER INFORMATION.... 1997 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. NAH A97AO

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/2/93

TIME PERIOD ANALYZED................. P.M. PEAK HOUR

OTHER INFORMATION.... 1997 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. NAH A97PO

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	27	12	49	45
THRU	218	276	7	9
RIGHT	37	56	14	23

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS					
	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS					
	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS					
	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS					
	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/2/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1997 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. NAH
A97PO

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_P (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)		RESERVE CAPACITY $c_R = c_{SH} - v$		LOS
MINOR STREET								
NB LEFT	62	292	270 >		270 >		208 >	C
THROUGH	9	361	347 >	324	347 >	235	333 >C	B
RIGHT	18	945	945 >		945 >		927 >	A
MINOR STREET								
SB LEFT	57	307	287 >		287 >		230 >	C
THROUGH	11	370	355 >	371	355 >	273	344 >C	B
RIGHT	29	894	894 >		894 >		865 >	A
MAJOR STREET								
EB LEFT	34	706	706		706		672	A
WB LEFT	15	795	795		795		779	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/2/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1997 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. NAH
A97PO

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .67

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. A.M. PEAK HOUR

OTHER INFORMATION.... 1997 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. LHN A97A0

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	31	0	173
THRU	--	0	70	39
RIGHT	--	146	70	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	1	2	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS WB	5.50	5.50	0.00	5.50
MAJOR LEFTS SB	5.50	5.50	0.00	5.50
MINOR LEFTS WB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; A.M. PEAK HOUR
OTHER INFORMATION.... 1997 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. LHN A97A0

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_P (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	32	524	433	> 433 > 811	401 > 628	A >A
RIGHT	151	996	996	> 996 >	845 >	A
MAJOR STREET						
SB LEFT	225	931	931	931	706	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; A.M. PEAK HOUR
OTHER INFORMATION.... 1997 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. LHN A97AO

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .82

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. P.M. PEAK HOUR

OTHER INFORMATION.... 1997 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. LHN A97PO

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	107	0	227
THRU	--	0	99	116
RIGHT	--	222	42	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	1	2	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS WB	5.50	5.50	0.00	5.50
MAJOR LEFTS SB	5.50	5.50	0.00	5.50
MINOR LEFTS WB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... HAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1997 PROJ. COMM. FM PK.HR. VOL. W/O PROJ. LHH
A97PO

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c (pcph) P	ACTUAL MOVEMENT CAPACITY c (pcph) M	SHARED CAPACITY c (pcph) SH	RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET						
WB LEFT	117	393	290 >	290 >	173 >	D
			> 556	> 195	>D	
RIGHT	244	996	996 >	996 >	752 >	A
MAJOR STREET						
SB LEFT	305	919	919	919	615	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... HAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1997 PROJ. COMM. FM PK.HR. VOL. W/O PROJ. LHH
A97PO

ATA AUSTIN TSUTSUMI & ASSOCIATES INC
CIVIL ENGINEERS • SURVEYORS

APPENDIX D

CAPACITY ANALYSIS COMPUTATIONS

3 – CUMULATIVE COMMUTER PEAK HOUR TRAFFIC VOLUMES WITH PROJECT FOR:

PHASE I - 1995
PHASE II - 1996
PHASE III - 1996
PHASE IV - 1997

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1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****************************************************************************
INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........A.M. PEAK HOUR
COMMENT.......1995 CUM. COMM. AM PK.HR. VOL. W/P PH.1  HONA95AP
----------------------------------------------------------------------------
          VOLUMES            :                  GEOMETRY
      EB    WB    NB    SB   :     EB          WB            NB           SB
LT    29    57   144    51   : LT  12.0   LTR  12.0   L   12.0   L   12.0
TH    89    17   377    94   : R   12.0        12.0   TR  12.0   T   12.0
RT   250    30   205    15   :     12.0        12.0       12.0   R   12.0
RR   160    10    50    10   :     12.0        12.0       12.0       12.0
                             :     12.0        12.0       12.0       12.0
                             :     12.0        12.0       12.0       12.0
----------------------------------------------------------------------------
                          ADJUSTMENT FACTORS
     GRADE    HV    ADJ PKG  BUSES   PHF   PEDS   PED. BUT.   ARR. TYPE
      (%)     (%)   Y/N  Nm   Nb                  Y/N  min T
EB    3.00   2.00    N    0    0    0.90    10    Y    17.5        3
WB   -3.00   2.00    N    0    0    0.90    10    Y    17.5        3
NB    0.00   2.00    N    0    0    0.90     0    Y    11.5        3
SB    0.00   2.00    N    0    0    0.90     0    Y    11.5        3
----------------------------------------------------------------------------
                          SIGNAL SETTINGS            CYCLE LENGTH =  90.0
       PH-1   PH-2   PH-3   PH-4               PH-1   PH-2   PH-3   PH-4
EB  LT   X                            NB  LT    X
    TH   X                                TH           X
    RT   X                                RT           X
    PD   X                                PD           X
WB  LT   X                            SB  LT    X
    TH   X                                TH           X
    RT   X                                RT           X
    PD   X                                PD           X
GREEN  20.0   0.0    0.0    0.0       GREEN    22.0   35.0    0.0    0.0
YELLOW  5.0   0.0    0.0    0.0       YELLOW    3.0    5.0    0.0    0.0
----------------------------------------------------------------------------
                          LEVEL OF SERVICE
     LANE GRP.   V/C     G/C     DELAY   LOS    APP. DELAY    APP. LOS
EB     LT       0.306   0.244    10.0     C        10.0           C
       R        0.275   0.244    17.9     C
WB     LTR      0.455   0.244    19.5     C        19.5           C
NB     L        0.387   0.244    21.9     C        21.1           C
       TR       0.843   0.411    20.9     C
SB     L        0.137   0.244    20.2     C        13.9           B
       T        0.143   0.411    10.7     B
       R        0.009   0.411    10.1     B
----------------------------------------------------------------------------
INTERSECTION:       Delay =  19.5 (sec/veh)   V/C = 0.614     LOS = C
```

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........P.M. PEAK HOUR
COMMENT.......1995 CUM. COMM. PM PK.HR. VOL. W/P PH.1 HONA95PP

	VOLUMES EB	WB	NB	SB	GEOMETRY EB		WB		NB		SB
LT	39	222	270	27	LT	12.0	LTR	12.0	L	12.0	L 12.0
TH	21	104	138	422	R	12.0		12.0	TR	12.0	T 12.0
RT	325	37	54	58		12.0		12.0		12.0	R 12.0
RR	160	10	25	10		12.0		12.0		12.0	12.0
						12.0		12.0		12.0	12.0
						12.0		12.0		12.0	12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	3.00	2.00	N	0	0	0.90	10	Y	17.5	3
WB	-3.00	2.00	N	0	0	0.90	10	Y	17.5	3
NB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3
SB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3

SIGNAL SETTINGS — CYCLE LENGTH = 90.0

		PH-1	PH-2	PH-3	PH-4
EB	LT	X			
	TH	X			
	RT	X			
	PD	X			
WB	LT	X			
	TH	X			
	RT	X			
	PD	X			
GREEN		33.0	0.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0

		PH-1	PH-2	PH-3	PH-4
NB	LT	X			
	TH		X		
	RT		X		
	PD		X		
SB	LT	X			
	TH		X		
	RT		X		
	PD		X		
GREEN		20.0	24.0	0.0	0.0
YELLOW		3.0	5.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	LT	0.123	0.309	11.4	B	12.2	B
	R	0.317	0.389	12.5	B		
WB	LTR	0.949	0.389	36.7	D	36.7	D
NB	L	0.797	0.222	33.0	D	26.7	D
	TR	0.370	0.209	16.6	C		
SB	L	0.080	0.222	21.1	C	30.0	D
	T	0.911	0.209	32.3	D		
	R	0.122	0.209	15.2	C		

INTERSECTION: Delay = 20.0 (sec/veh) V/C = 0.899 LOS = D

1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .84

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 07:00 TO 08:00

OTHER INFORMATION.... 1995 CUM. COMM. AM PK.HR. VOL. W/P PH.1 NAHA9 5AW

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	11	14	18	74
THRU	213	136	2	2
RIGHT	19	23	14	[illegible]

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
NB	5.50	5.50	0.00	5.50
SB	5.50	5.50	0.00	5.50
MAJOR LEFTS				
EB	5.50	5.50	0.00	5.50
WB	5.50	5.50	0.00	5.50
MINOR THROUGHS				
NB	6.50	6.50	0.00	6.50
SB	6.50	6.50	0.00	6.50
MINOR LEFTS				
NB	7.00	7.00	0.00	7.00
SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:00 TO 08:00
OTHER INFORMATION.... 1995 CUM. COMM. AM PK.HR. VOL. W/P PH.1 NANA?
SAW

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
NB LEFT	24	422	404 >	404 >	380 >	E
THROUGH	3	499	488 > 537	403 > 492	485 >A	A
RIGHT	18	955	955 >	955 >	937 >	A
MINOR STREET						
SB LEFT	97	433	417 >	417 >	320 >	E
THROUGH	3	503	491 > 403	491 > 334	489 >B	A
RIGHT	30	995	995 >	995 >	965 >	A
MAJOR STREET						
EB LEFT	14	895	895	895	881	A
WB LEFT	16	814	814	814	798	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:00 TO 08:00
OTHER INFORMATION.... 1995 CUM. COMM. AM PK.HR. VOL. W/P PH.1 NANA?
SAW

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. DSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 15:15 TO 16:15

OTHER INFORMATION.... 1995 CUM. COMM. PM PK.HR. VOL. W/P PH.1 HANAS SPW

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	25	26	50	42
THRU	396	265	8	8
RIGHT	46	62	14	21

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:15 TO 16:15
OTHER INFORMATION.... 1995 CUM. COMM. PM PK.HR. VOL. W/P PH.1 HANAS SPW

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_P (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)		SHARED CAPACITY c_{SH} (pcph)			RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET									
NB LEFT	63	301	276	>		276 >		213 >	C
THROUGH	10	369	350	>	330	350 >	239	340 >C	B
RIGHT	18	948	948	>		948 >		930 >	A
MINOR STREET									
SB LEFT	53	310	287	>		287 >		233 >	C
THROUGH	10	374	355	>	339	355 >	275	345 >C	B
RIGHT	27	903	903	>		903 >		876 >	A
MAJOR STREET									
EB LEFT	32	722	722			722		690	A
WB LEFT	33	800	800			800		767	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... MANNWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:15 TO 16:15
OTHER INFORMATION.... 1995 CUM. COMM. PM PK.HR. VOL. W/P PH.1 NAHA?
SPW

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. ESS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 07:15 TO 08:15

OTHER INFORMATION.... 1995 CUM. COMM. AM PK.HR. VOL. W/P PH.1 LHHA9
SAU

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	31	6	172
THRU	--	0	66	29
RIGHT	--	143	63	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	WB	5.50	5.50	0.00	5.50
MAJOR LEFTS	SB	5.00	5.00	0.00	5.00
MINOR LEFTS	WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:15 TO 08:15
OTHER INFORMATION.... 1995 CUM. COMM. AM PK.HR. VOL. W/P PH.1 LHHAS
SAW

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_m (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	32	601	507	507	475	A
RIGHT	148	979	979	979	831	A
MAJOR STREET						
SB LEFT	217	992	992	992	774	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH-SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:15 TO 08:15
OTHER INFORMATION.... 1995 CUM. COMM. AM PK.HR. VOL. W/P PH.1 LHHAS
SAW

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .82

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 15:30 TO 16:30

OTHER INFORMATION.... 1995 CUM. COMM. PM PK.HR. VOL. W/P PH.1 LHNA9 5PM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	105	0	230
THRU	--	0	93	99
RIGHT	--	213	42	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	WB	5.50	5.50	0.00	5.50
MAJOR LEFTS	SB	5.00	5.00	0.00	5.00
MINOR LEFTS	WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:30 TO 16:30
OTHER INFORMATION.... 1995 CUM. COMM. PM PK.HR. VOL. W/P PH.1 LHNA9 5PM

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	115	465	353	353	238	C
RIGHT	234	954	954	954	720	A
MAJOR STREET						
SB LEFT	309	990	990	990	682	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:30 TO 16:30
OTHER INFORMATION.... 1995 CUM. COMM. PM PK.HR. VOL. W/P PH.1 LHNA9
5PM

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR.................... .9

AREA POPULATION..................... 10000

NAME OF THE EAST/WEST STREET......... NEW ROAD

NAME OF THE NORTH/SOUTH STREET....... HONOAPIILANI HWY

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. AM PEAK HOUR

OTHER INFORMATION.... 1995 CUM. COMM. AM PK.HR. VOL. W/P PH.1 HONE9
5AM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE EASTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	0	--	0	230
THRU	0	--	0	401
RIGHT	18	--	42	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	1	--	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	-----	---	---	-
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	---	---	---
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
EB	5.50	5.50	0.00	5.50
MAJOR LEFTS				
NB	5.00	5.00	0.00	5.00
MINOR LEFTS				
EB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; AM PEAK HOUR
OTHER INFORMATION.... 1995 CUM. COMM. AM PK.HR. VOL. W/P PH.1 HONE9
SAW

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
EB LEFT	0	529	529 >	529 >	529 >	A
			>	667 >	645	>A
RIGHT	22	667	667 >	667 >	645 >	A
MAJOR STREET						
NB LEFT	0	757	757	757	757	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; AM PEAK HOUR
OTHER INFORMATION.... 1995 CUM. COMM. AM PK.HR. VOL. W/P PH.1 HONE9
SAW

1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .9

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NEW ROAD

NAME OF THE NORTH/SOUTH STREET....... HONOAPIILANI HWY

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. P.M. PEAK HOUR

OTHER INFORMATION.... 1995 CUM. COMM. PM PK.HR. VOL. W/P PH.1 HONE9 5PW

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE EASTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	0	--	0	230
THRU	0	--	0	967
RIGHT	0	--	42	2

NUMBER OF LANES

	EB	WB	NB	SB
LANES	1	--	1	1

ADJUSTMENT FACTORS Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	-----	---	---	-
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	---	---	---
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS EB	5.50	5.50	0.00	5.50
MAJOR LEFTS NB	5.00	5.00	0.00	5.00
MINOR LEFTS EB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1995 CUM. COMM. PM PK.HR. VOL. W/P PH.1 HONE9 5PW

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) P	ACTUAL MOVEMENT CAPACITY c (pcph) M	SHARED CAPACITY c (pcph) SH	RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET						
EB LEFT	0	207	207 >	207 >	207 >	C
			>	302 >	292 >	C
RIGHT	10	302	302 >	302 >	292 >	C
MAJOR STREET						
NB LEFT	0	362	362	362	362	E

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1995 CUM. COMM. PM PK.HR. VOL. W/P PH.1 HONE9
SPW

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........A.M. PEAK HOUR
COMMENT.......1996 CUM. COMM. AM PK.HR. VOL. W/P PH.2 HONA96AP

	VOLUMES EB	WB	NB	SB		GEOMETRY EB		WB		NB		SB
LT	32	58	150	13	LT	12.0	LTR	12.0	L	12.0	L	12.0
TH	89	17	386	96	R	12.0		12.0	TR	12.0	T	12.0
RT	256	30	205	16		12.0		12.0		12.0	R	12.0
RR	160	10	50	10		12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	3.00	2.00	N	0	0	0.90	10	Y	17.5	3
WB	-3.00	2.00	N	0	0	0.90	10	Y	17.5	3
NB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3
SB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3

SIGNAL SETTINGS CYCLE LENGTH = 90.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
WB	LT	X				SB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
GREEN		20.0	0.0	0.0	0.0	GREEN		21.0	36.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		3.0	5.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	LT	0.313	0.244	18.1	C	18.0	C
	R	0.294	0.244	18.0	C		
WB	LTR	0.478	0.244	19.9	C	19.9	C
NB	L	0.422	0.233	22.7	C	20.6	C
	TR	0.834	0.422	20.0	C		
SB	L	0.037	0.233	20.3	C	11.4	B
	T	0.142	0.422	10.3	B		
	R	0.011	0.422	9.7	B		

INTERSECTION: Delay = 19.1 (sec/veh) V/C = 0.630 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........P.M. PEAK HOUR
COMMENT.......1996 CUM. COMM. PM PK.HR. VOL. W/P PH.2 HONA96PP

	VOLUMES EB	WB	NB	SB	GEOMETRY EB		WB		NB		SB
LT	41	223	304	27	LT 12.0	LTR	12.0	L	12.0	L	12.0
TH	22	105	142	430	R 12.0		12.0	TR	12.0	T	12.0
RT	334	38	55	60	12.0		12.0		12.0	R	12.0
RR	160	10	25	25	12.0		12.0		12.0		12.0
					12.0		12.0		12.0		12.0
					12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	3.00	2.00	N	0	0	0.90	10	Y	17.5	3
WB	-3.00	2.00	N	0	0	0.90	10	Y	17.5	3
NB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3
SB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3

SIGNAL SETTINGS CYCLE LENGTH = 90.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
WB	LT	X				SB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
GREEN		34.0	0.0	0.0	0.0	GREEN		20.0	23.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		3.0	5.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	LT	0.126	0.400	11.0	B	11.0	B
	R	0.325	0.400	12.1	B		
WB	LTR	0.945	0.400	35.6	D	35.6	D
NB	L	0.890	0.222	42.4	E	33.3	D
	TR	0.396	0.278	17.3	C		
SB	L	0.080	0.222	21.1	C	37.8	D
	T	0.965	0.278	40.6	E		
	R	0.092	0.278	15.6	C		

INTERSECTION: Delay = 32.0 (sec/veh) V/C = 0.940 LOS = D

1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .94

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 07:00 TO 08:00

OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.2 HANA96AM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	11	18	25	76
THRU	217	139	3	3
RIGHT	22	29	16	24

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:00 TO 08:00
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.2 NAHA9
6AW

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_P (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)		RESERVE CAPACITY $c_R = c_{SH} - v$		LOS
MINOR STREET								
NB LEFT	32	410	390		390		357	B
THROUGH	4	400	475	504	475	446	471 >A	A
RIGHT	21	951	951		951		930	A
MINOR STREET								
SB LEFT	100	419	400		400		301	E
THROUGH	4	491	478	463	478	363	474 >B	A
RIGHT	31	995	995		995		964	A
MAJOR STREET								
EB LEFT	14	890	890		890		876	A
WB LEFT	24	805	805		805		782	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:00 TO 08:00
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.2 NAHA9
6AW

1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1
****

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 15:15 TO 16:15

OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.2 NAHA9
6PU

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	26	44	56	44
THRU	211	270	9	8
RIGHT	57	63	15	22

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS					
	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS					
	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS					
	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS					
	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:15 TO 16:15
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.2 NAHA9
6PU

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)		RESERVE CAPACITY $c_R = c_{SH} - v$		LOS
MINOR STREET								
NB LEFT	71	279	251 >		251 >		100 >	D
THROUGH	11	345	322 >	299	322 >	173	310 >D	D
RIGHT	19	938	938 >		938 >		919 >	A
MINOR STREET								
SB LEFT	56	285	257 >		257 >		201 >	C
THROUGH	10	347	323 >	335	323 >	242	313 >C	B
RIGHT	23	899	899 >		899 >		871 >	A
MAJOR STREET								
EB LEFT	33	716	716		716		683	A
WB LEFT	56	783	783		783		727	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:15 TO 16:15
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.2 NAHA9
6PW

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 07:15 TO 08:15

OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.2 LHNA9
6AW

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	33	0	177
THRU	--	0	68	38
RIGHT	--	153	69	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS WB	5.50	5.50	0.00	5.50
MAJOR LEFTS SB	5.00	5.00	0.00	5.00
MINOR LEFTS WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:15 TO 08:15
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.2 LHNA9
6AW

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_m (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	34	506	492	492	458	A
RIGHT	158	976	976	976	818	A
MAJOR STREET						
SB LEFT	224	991	991	991	768	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:15 TO 08:15
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.2 LHNA9
6AW

1985 HCM: UNSIGNALIZED INTERSECTIONS

****

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .82

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 15:30 TO 16:30

OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.2 LHHA9 6PM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	103	0	243
THRU	--	0	96	114
RIGHT	--	222	45	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS WB	5.50	5.50	0.00	5.50
MAJOR LEFTS SB	5.00	5.00	0.00	5.00
MINOR LEFTS WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:30 TO 16:30
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.2 LHHA9 6PM

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	113	439	325	325	212	C
RIGHT	244	948	948	948	705	A
MAJOR STREET						
SB LEFT	226	909	909	909	683	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:30 TO 16:30
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.2 LHHA? 6PM

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .9

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NEW ROAD

NAME OF THE NORTH/SOUTH STREET....... HONOAPIILANI HWY

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. AM PEAK HOUR

OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.2 HONE? 6AM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE EASTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	0	--	0	230
THRU	0	--	0	410
RIGHT	40	--	42	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	1	--	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	---	---	---	-
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	---	---	---
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	EB	5.50	5.50	0.00	5.50
MAJOR LEFTS	NB	5.00	5.00	0.00	5.00
MINOR LEFTS	EB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; AM PEAK HOUR
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.2 HONE9
6AW

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) P	ACTUAL MOVEMENT CAPACITY c (pcph) M	SHARED CAPACITY c (pcph) SH	RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET						
EB LEFT	0	523	523	> 523	> 523 >	A
				> 660	> 611	>A
RIGHT	49	660	660	> 660	> 611 >	A
MAJOR STREET						
NB LEFT	0	749	749	749	749	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; AM PEAK HOUR
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.2 HONE9
6AW

1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1
****

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .9

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NEW ROAD

NAME OF THE NORTH/SOUTH STREET....... HONOAPIILANI HWY

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. P.M. PEAK HOUR

OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.2 HONE9 6PM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE EASTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	0	--	0	230
THRU	0	--	0	903
RIGHT	17	--	42	4

NUMBER OF LANES

	EB	WB	NB	SB
LANES	1	--	1	1

ADJUSTMENT FACTORS Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	-----	---	---	-
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	---	---	---
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS				
EB	5.50	5.50	0.00	5.50
MAJOR LEFTS				
NB	5.00	5.00	0.00	5.00
MINOR LEFTS				
EB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.2 HONE9 6PM

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_SH (pcph)	RESERVE CAPACITY c_R = c_SH - v	LOS
MINOR STREET						
EB LEFT	0	202	202 >	202 >	202 >	C
			> 295	> 274	>C	
RIGHT	21	295	295 >	295 >	274 >	C
MAJOR STREET						
NB LEFT	0	354	354	354	354	B

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.2 HONE9 6PM

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........A.M. PEAK HOUR
COMMENT.......1996 CUM. COMM. AM PK.HR. VOL. W/P PH.3 HONA96A3

	VOLUMES EB	WB	NB	SB		GEOMETRY EB		WB		NB		SB
LT	33	58	154	13	LT	12.0	LTR	12.0	L	12.0	L	12.0
TH	90	17	306	96	R	12.0		12.0	TR	12.0	T	12.0
RT	256	30	205	16		12.0		12.0		12.0	R	12.0
RR	160	10	100	10		12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	3.00	2.00	N	0	0	0.90	10	Y	17.5	3
WB	-3.00	2.00	N	0	0	0.90	10	Y	17.5	3
NB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3
SB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3

SIGNAL SETTINGS CYCLE LENGTH = 90.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
WB	LT	X				SB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
GREEN		21.0	0.0	0.0	0.0	GREEN		22.0	34.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		3.0	5.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	LT	0.305	0.256	17.6	C	17.5	C
	R	0.281	0.256	17.5	C		
WB	LTR	0.450	0.256	19.0	C	19.0	C
NB	L	0.413	0.244	22.1	C	19.7	C
	TR	0.791	0.400	19.0	C		
SB	L	0.035	0.244	19.7	C	12.1	B
	T	0.150	0.400	11.1	B		
	R	0.011	0.400	10.5	B		

INTERSECTION: Delay = 18.4 (sec/veh) V/C = 0.592 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........P.M. PEAK HOUR
COMMENT.......1996 CUM. COMM. PM PK.HR. VOL. W/P PH.4 HONA96P3

	VOLUMES EB	WB	NB	SB	GEOMETRY EB		WB		NB		SB	
LT	42	223	318	27	LT	12.0	LTR	12.0	L	12.0	L	12.0
TH	22	105	142	430	R	12.0		12.0	TR	12.0	T	12.0
RT	334	38	55	61		12.0		12.0		12.0	R	12.0
RR	160	10	25	25		12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	3.00	2.00	N	0	0	0.90	10	Y	17.5	3
WB	-3.00	2.00	N	0	0	0.90	10	Y	17.5	3
NB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3
SB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3

SIGNAL SETTINGS CYCLE LENGTH = 90.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
WB	LT	X				SB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
GREEN		33.0	0.0	0.0	0.0	GREEN		21.0	23.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		3.0	5.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	LT	0.132	0.389	11.4	B	12.3	B
	R	0.335	0.389	12.6	B		
WB	LTR	0.985	0.389	43.7	E	43.7	E
NB	L	0.894	0.233	40.9	E	32.6	D
	TR	0.396	0.278	17.3	C		
SB	L	0.076	0.233	20.5	C	37.7	D
	T	0.965	0.278	40.6	E		
	R	0.095	0.278	15.6	C		

INTERSECTION: Delay = 33.6 (sec/veh) V/C = 0.955 LOS = D

1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .84

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 07:00 TO 08:00

OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.3 HANA96A3

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	11	18	30	75
THRU	217	139	3	3
RIGHT	23	29	18	24

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:00 TO 08:00
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.3 NAHA9
6A3

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)		SHARED CAPACITY c_{SH} (pcph)			RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET									
NB LEFT	39	410	389	>		389 >		350 >	B
THROUGH	4	438	475	>	499	475 >	432	471 >A	A
RIGHT	24	950	950	>		950 >		926 >	A
MINOR STREET									
SB LEFT	100	417	398	>		398 >		298 >	C
THROUGH	4	490	477	>	465	477 >	330	473 >B	A
RIGHT	31	995	995	>		995 >		964 >	A
MAJOR STREET									
EB LEFT	14	690	690			690		676	A
WB LEFT	24	804	804			804		781	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:00 TO 08:00
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.3 NAHA9
6A3

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. GSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 15:15 TO 16:15

OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.3 NAHA9
6P3

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	26	53	60	44
THRU	211	270	9	0
RIGHT	64	63	16	22

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	23	N
SOUTHBOUND	0.00	90	23	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:15 TO 16:15
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.3 NAHA9
6P3

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M		SHARED CAPACITY c (pcph) SH			RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET									
NB LEFT	76	269	237	>		237	>		162 > D
THROUGH	11	334	306	>	284	306	>	177	295 >D C
RIGHT	20	934	934	>		934	>		914 > A
MINOR STREET									
SB LEFT	56	271	241	>		241	>		185 > D
THROUGH	10	333	306	>	317	306	>	223	296 >C C
RIGHT	28	699	699	>		699	>		671 > A
MAJOR STREET									
EB LEFT	33	716	716			716			683 A
WB LEFT	73	776	776			776			702 A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAUAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:15 TO 16:15
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.3 NAHA9
6P3

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 07:15 TO 08:15

OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.3 LHNA9
6A3

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	34	0	178
THRU	--	0	66	38
RIGHT	--	157	69	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS					
	WB	5.50	5.50	0.00	5.50
MAJOR LEFTS					
	SB	5.00	5.00	0.00	5.00
MINOR LEFTS					
	WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:15 TO 03:15
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.3 LHNA9
6A3

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE $v(pcph)$	POTEN-TIAL CAPACITY c_P (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	35	585	491	491	456	A
RIGHT	162	976	976	976	814	A
MAJOR STREET						
SB LEFT	225	991	991	991	766	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 07:15 TO 03:15
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.3 LHNA9
6A3

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .92

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. 15:30 TO 16:30

OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.3 LHNA9 6P3

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	106	0	249
THRU	--	0	96	132
RIGHT	--	226	46	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS WB	5.50	5.50	0.00	5.50
MAJOR LEFTS SB	5.00	5.00	0.00	5.00
MINOR LEFTS WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:30 TO 16:30
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.3 LHNA9 6P3

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	119	419	307	307	189	D
RIGHT	248	948	948	948	700	A
MAJOR STREET						
SB LEFT	334	989	989	989	655	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; 15:30 TO 16:30
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.3 LHNA9 6P3

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .9

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NEW ROAD

NAME OF THE NORTH/SOUTH STREET....... HONOAPIILANI HWY

NAME OF THE ANALYST.................. ESS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. AM PEAK HOUR

OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.3 HONE9 6A3

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE EASTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	0	--	0	230
THRU	0	--	0	410
RIGHT	56	--	42	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	1	--	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	-----	---	---	-
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	---	---	---
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS EB	5.50	5.50	0.00	5.50
MAJOR LEFTS NB	5.00	5.00	0.00	5.00
MINOR LEFTS EB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; AM PEAK HOUR
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.3 HONE9
6A3

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_m (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
EB LEFT	0	523	523	> 523 > 660	> 523 > 591	A >A
RIGHT	60	660	660	> 660	> 531	> A
MAJOR STREET						
NB LEFT	0	749	749	749	749	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; AM PEAK HOUR
OTHER INFORMATION.... 1996 CUM. COMM. AM PK.HR. VOL. W/P PH.3 HONE9
6A3

1985 HCM: UNSIGNALIZED INTERSECTIONS Page-1

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .9

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NEW ROAD

NAME OF THE NORTH/SOUTH STREET....... HONOAPIILANI HWY

NAME OF THE ANALYST.................. SSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. P.M. PEAK HOUR

OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.3 HONE9 6P3

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE EASTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	0	--	0	230
THRU	0	--	0	902
RIGHT	24	--	42	5

NUMBER OF LANES

	EB	WB	NB	SB
LANES	1	--	1	1

ADJUSTMENT FACTORS Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	-----	---	---	-
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	---	---	---
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	EB	5.50	5.50	0.00	5.50
MAJOR LEFTS	NB	5.00	5.00	0.00	5.00
MINOR LEFTS	EB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.3 HONE9 6P3

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c (pcph) p	ACTUAL MOVEMENT CAPACITY c (pcph) M	SHARED CAPACITY c (pcph) SH	RESERVE CAPACITY c = c - v R SH	LOS
MINOR STREET						
EB LEFT	0	202	202 >	202 >	202 >	C
			> 295	> 265		>C
RIGHT	29	295	295 >	295 >	265 >	C
MAJOR STREET						
NB LEFT	0	354	354	354	354	B

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. W/P PH.3 HONE9
6P3

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........A.M. PEAK HOUR
COMMENT.......1997 CUM. COMM. AM PK.HR. VOL. W/P PH.4 HONA97AP

	VOLUMES EB	WB	NB	SB	GEOMETRY EB		WB		NB		SB
LT	30	59	163	54	LT	12.0	LTR	12.0	L	12.0	L 12.0
TH	92	18	408	98	R	12.0		12.0	TR	12.0	T 12.0
RT	265	31	210	17		12.0		12.0		12.0	R 12.0
RR	160	10	100	10		12.0		12.0		12.0	12.0
						12.0		12.0		12.0	12.0
						12.0		12.0		12.0	12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	3.00	2.00	N	0	0	0.90	10	Y	17.5	3
WB	-3.00	2.00	N	0	0	0.90	10	Y	17.5	3
NB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3
SB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3

SIGNAL SETTINGS CYCLE LENGTH = 90.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
WB	LT	X				SB	LT	X			
	TH	X					TH		X		
	RT	X					RT		X		
	PD	X					PD		X		
GREEN		21.0	0.0	0.0	0.0	GREEN		22.0	34.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		3.0	5.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	LT	0.302	0.256	17.6	C	17.6	C
	R	0.307	0.256	17.6	C		
WB	LTR	0.475	0.256	19.4	C	19.4	C
NB	L	0.438	0.244	22.4	C	21.2	C
	TR	0.834	0.400	20.9	C		
SB	L	0.145	0.244	20.3	C	14.2	B
	T	0.153	0.400	11.2	B		
	R	0.013	0.400	10.5	B		

INTERSECTION: Delay = 19.4 (sec/veh) V/C = 0.625 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..NAPILIHAU ST./HONOAPIILANI HIGHWAY
AREA TYPE.....OTHER
ANALYST.......BSS
DATE..........2/1/93
TIME..........P.M. PEAK HOUR
COMMENT.......1997 CUM. COMM. PM PK.HR. VOL. W/P PH.4 HONA97PP

	VOLUMES EB	WB	NB	SB	GEOMETRY EB		WB		NB		SB
LT	44	224	346	31	LT 12.0	LTR	12.0	L	12.0	L	12.0
TH	23	106	150	441	R 12.0		12.0	TR	12.0	T	12.0
RT	345	38	57	62	12.0		12.0		12.0	R	12.0
RR	200	10	25	25	12.0		12.0		12.0		12.0
					12.0		12.0		12.0		12.0
					12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	3.00	2.00	N	0	0	0.90	10	Y	17.5	3
WB	-3.00	2.00	N	0	0	0.90	10	Y	17.5	3
NB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3
SB	0.00	2.00	N	0	0	0.90	0	Y	11.5	3

SIGNAL SETTINGS CYCLE LENGTH = 100.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT		X			NB	LT	X			
	TH		X				TH		X		
	RT		X				RT		X		
	PD						PD		X		
WB	LT	X	X			SB	LT	X			
	TH	X	X				TH		X		
	RT	X	X				RT		X		
	PD	X	X				PD		X		
GREEN		21.0	14.0	0.0	0.0	GREEN		25.0	27.0	0.0	0.0
YELLOW		0.0	5.0	0.0	0.0	YELLOW		3.0	5.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	LT	0.390	0.160	24.9	C	28.3	D
	R	0.676	0.160	29.8	D		
WB	LTR	1.023	0.370	55.9	E	55.9	E
NB	L	0.900	0.250	44.1	E	35.3	D
	TR	0.401	0.290	18.7	C		
SB	L	0.081	0.250	21.8	C	36.6	D
	T	0.948	0.290	39.3	D		
	R	0.093	0.290	16.7	C		

INTERSECTION: Delay = 39.4 (sec/veh) V/C = 0.960 LOS = D

1985 HCM: UNSIGNALIZED INTERSECTIONS
****

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .94

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. A.M. PEAK HOUR

OTHER INFORMATION.... 1997 CUM. COMM. AM PK.HR. VOL. W/P PH.4 HANA97AM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	12	13	33	79
THRU	222	143	3	3
RIGHT	26	29	22	25

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	28	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; A.M. PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. AM PK.HR. VOL. W/P PH.4 NAHA9
7AW

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)		SHARED CAPACITY c_{SH} (pcph)			RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET									
NB LEFT	50	400	379	>		379 >		330 >	E
THROUGH	4	479	465	>	405	465 >	402	451 >A	A
RIGHT	29	945	945	>		945 >		916 >	A
MINOR STREET									
SB LEFT	103	404	333	>		303 >		230 >	C
THROUGH	4	400	466	>	450	466 >	310	463 >B	A
RIGHT	33	993	993	>		993 >		960 >	A
MAJOR STREET									
EB LEFT	16	885	885			885		870	A
WB LEFT	24	795	795			795		771	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; A.M. PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. AM PK.HR. VOL. W/P PH.4 NAHA9
7AW

****

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .87

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... HANAWAI STREET

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. P.M. PEAK HOUR

OTHER INFORMATION.... 1997 CUM. COMM. PM PK.HR. VOL. W/P PH.4 NAHA9 7PM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST

CONTROL TYPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	27	77	67	45
THRU	216	276	10	9
RIGHT	75	66	10	23

NUMBER OF LANES AND LANE USAGE

	EB	WB	NB	SB
LANES	2	2	1	1
LANE USAGE			LTR	LTR

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	0.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	NB	5.50	5.50	0.00	5.50
	SB	5.50	5.50	0.00	5.50
MAJOR LEFTS	EB	5.50	5.50	0.00	5.50
	WB	5.50	5.50	0.00	5.50
MINOR THROUGHS	NB	6.50	6.50	0.00	6.50
	SB	6.50	6.50	0.00	6.50
MINOR LEFTS	NB	7.00	7.00	0.00	7.00
	SB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. PM PK.HR. VOL. W/P PH.4 NAHA9 7PM

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_P (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)		SHARED CAPACITY c_{SH} (pcph)			RESERVE CAPACITY $c_R = c_{SH} - v$		LOS
MINOR STREET										
NB LEFT	65	249	212	>		212	>		128 >	D
THROUGH	13	307	274	>	256	274	>	136	261 >D	C
RIGHT	23	923	923	>		923	>		900 >	A
MINOR STREET										
SB LEFT	57	249	213	>		213	>		156 >	D
THROUGH	11	305	272	>	285	272	>	187	261 >D	C
RIGHT	29	894	894	>		894	>		865 >	A
MAJOR STREET										
EB LEFT	34	706	706			706			672	A
WB LEFT	97	757	757			757			660	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... HANAWAI STREET
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. PM PK.HR. VOL. W/P PH.4 NAHA9
7PM

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR...................... .97

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. A.M. PEAK HOUR

OTHER INFORMATION.... 1997 CUM. COMM. AM PK.HR. VOL. W/P PH.4 LHNA9
7AM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	35	0	105
THRU	--	0	70	39
RIGHT	--	160	70	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	2	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS WB	5.50	5.50	0.00	5.50
MAJOR LEFTS SB	5.00	5.00	0.00	5.00
MINOR LEFTS WB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; A.M. PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. AM PK.HR. VOL. W/P PH.4 LHNA9 7AW

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	36	576	479	479	443	A
RIGHT	174	973	973	973	799	A
MAJOR STREET						
SB LEFT	234	991	991	991	757	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; A.M. PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. AM PK.HR. VOL. W/P PH.4 LHNA9 7AW

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR.................... .82

AREA POPULATION..................... 10000

NAME OF THE EAST/WEST STREET......... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET....... LOWER HONOAPIILANI ROAD

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. P.M. PEAK HOUR

OTHER INFORMATION.... 1997 CUM. COMM. PM PK.HR. VOL. W/P PH.4 LHNA9 7PM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE WESTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	--	110	0	256
THRU	--	0	99	116
RIGHT	--	237	49	0

NUMBER OF LANES

	EB	WB	NB	SB
LANES	--	1	2	1

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	-----	---	---	-
WESTBOUND	-4.00	90	20	N
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	---	---	---
WESTBOUND	0	0	0
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS WB	5.50	5.50	0.00	5.50
MAJOR LEFTS SB	5.50	5.50	0.00	5.50
MINOR LEFTS WB	7.00	7.00	0.00	7.00

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. PM PK.HR. VOL. W/P PH.4 LHNA9 7PM

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
WB LEFT	121	368	255 >	255 > 518	134 > 137	D > D
RIGHT	260	995	995 >	995 > 518	735 > 137	A > D
MAJOR STREET						
SB LEFT	343	910	910	910	567	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET
NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPIILANI ROAD
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. PM PK.HR. VOL. W/P PH.4 LHNA9 7PM

1985 HCM: UNSIGNALIZED INTERSECTIONS

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .9

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NEW ROAD

NAME OF THE NORTH/SOUTH STREET....... HONOAPIILANI HWY

NAME OF THE ANALYST.................. 855

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. AM PEAK HOUR

OTHER INFORMATION.... 1997 CUM. COMM. AM PK.HR. VOL. W/P PH.4 HONE9 7AM

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE EASTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	0	--	0	230
THRU	0	--	0	421
RIGHT	78	--	42	1

NUMBER OF LANES

	EB	WB	NB	SB
LANES	1	--	1	1

ADJUSTMENT FACTORS

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	-----	---	---	-
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	---	---	---
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS EB	5.50	5.50	0.00	5.50
MAJOR LEFTS NB	5.00	5.00	0.00	5.00
MINOR LEFTS EB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; AM PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. AM PK.HR. VOL. W/P PH.4 HONE9 7AM

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTENTIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
SB LEFT	0	514	514 >	514 >	514 >	A
			>	650 >	555	>A
RIGHT	95	650	650 >	650 >	555 >	A
MAJOR STREET						
NB LEFT	0	738	738	738	738	A

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; AM PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. AM PK.HR. VOL. W/P PH.4 HONE9 7AM

IDENTIFYING INFORMATION

AVERAGE RUNNING SPEED, MAJOR STREET.. 30

PEAK HOUR FACTOR..................... .9

AREA POPULATION...................... 10000

NAME OF THE EAST/WEST STREET......... NEW ROAD

NAME OF THE NORTH/SOUTH STREET....... HONOAPIILANI HWY

NAME OF THE ANALYST.................. BSS

DATE OF THE ANALYSIS (mm/dd/yy)...... 2/3/93

TIME PERIOD ANALYZED................. P.M. PEAK HOUR

OTHER INFORMATION.... 1997 CUM. COMM. PM PK.HR. VOL. W/P PH.4 HONE9 7PW

INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

MAJOR STREET DIRECTION: NORTH/SOUTH

CONTROL TYPE EASTBOUND: STOP SIGN

TRAFFIC VOLUMES

	EB	WB	NB	SB
LEFT	0	--	0	230
THRU	0	--	0	1003
RIGHT	33	--	42	7

NUMBER OF LANES

	EB	WB	NB	SB
LANES	1	--	1	1

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	N
WESTBOUND	-----	---	---	-
NORTHBOUND	0.00	90	20	N
SOUTHBOUND	0.00	90	20	N

VEHICLE COMPOSITION

	% SU TRUCKS AND RV'S	% COMBINATION VEHICLES	% MOTORCYCLES
EASTBOUND	0	0	0
WESTBOUND	---	---	---
NORTHBOUND	0	0	0
SOUTHBOUND	0	0	0

CRITICAL GAPS

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTMENT	FINAL CRITICAL GAP
MINOR RIGHTS	EB	5.50	5.50	0.00	5.50
MAJOR LEFTS	NB	5.00	5.00	0.00	5.00
MINOR LEFTS	EB	6.50	6.50	0.00	6.50

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/3/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. PM PK.HR. VOL. W/P PH.4 HONE9 7PW

CAPACITY AND LEVEL-OF-SERVICE

MOVEMENT	FLOW-RATE v(pcph)	POTEN-TIAL CAPACITY c_p (pcph)	ACTUAL MOVEMENT CAPACITY c_M (pcph)	SHARED CAPACITY c_{SH} (pcph)	RESERVE CAPACITY $c_R = c_{SH} - v$	LOS
MINOR STREET						
EB LEFT	0	194	194 >	194 >	194 >	D
			> 236	> 245		>C
RIGHT	40	206	206 >	206 >	245 >	C
MAJOR STREET						
NB LEFT	0	343	343	343	343	B

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET...... NEW ROAD
NAME OF THE NORTH/SOUTH STREET.... HONOAPIILANI HWY
DATE AND TIME OF THE ANALYSIS..... 2/2/93 ; P.M. PEAK HOUR
OTHER INFORMATION.... 1997 CUM. COMM. PM PK.HR. VOL. W/P PH.4 HONE? 7FU

Appendix I

Supplemental Traffic Impact Report

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

#97-39

July 21, 1997

JGL
HL
KL
IK
FILE

Napilihau Villages Joint Venture
Napilihau Corporation
Pioneer Plaza, Suite 1560
900 Fort Street Mall
Honolulu, Hawaii 96813

Attention: Mr. Kimo Lee, Project Manager

Gentlemen:

Subject: Supplemental Traffic Impact Report (TIR)

This is a letter report to supplement the "Traffic Impact Report for Napilihau Villages, Napili, Maui, Hawaii, dated February 1993, for J.G.L. Enterprises, Inc." This supplemental report reviews the current traffic condition at the intersection of Honoapiilani Highway and Napilihau Street, and assesses the potential impact of traffic generated by Phase I of Napilihau Villages.

Phase I consists of the 76 multi-family dwelling units and includes the construction of the right-turn only ingress and egress from Honoapiilani Highway, the improvement of the intersection of Napilihau Street and Hanawai Street, and extension of the left-turn storage lane to Napilihau Street on northbound Honoapiilani Highway, and pro-rata share of the construction of the traffic signal system to be installed at the Honoapiilani Highway/Napilihau Street intersection.

Current Traffic Conditions

The Honoapiilani Highway/Napilihau Street intersection is a 4-legged (cross) intersection with STOP control on Napilihau Street. Honoapiilani Highway is the major roadway with full channelization for the left-turn movements. Honoapiilani Highway through the Napili/Kahana area is a 2-lane, rural arterial highway. The posted speed limit at this location is 45 miles per hour (mph).

Peak period of traffic turning movement counts were obtained at the Honoapiilani Highway/Napilihau Street intersection on May 15, 1997, and are attached hereto. The morning traffic counts were conducted between 6:30 AM and 8:30 AM, and the afternoon traffic counts were conducted between 3:30 PM and 4:30 PM. The peak hour of traffic

occurs between 7:45 AM and 8:45 AM and between 4:00 PM and 5:00 PM, respectively, for the morning and afternoon peak periods of traffic.

Traffic observations during the peak period of traffic indicate that the intersection operates with very little delay (congestion) to the motorists. Level of Service (LOS) of the intersection is LOS "C" for both the morning and evening peak hours of traffic. The most constrained traffic movement was the through movement on Napilihau Street from the mauka side to the makai side of Honoapiilani Highway. However, the westbound (makai) movement operated at LOS "C". Figure 1 shows the peak hour traffic volumes and level of service of the intersection. Computations of the level of service for the intersection are also attached to this letter.

Phase I Traffic

Phase I consists of the 76 multi-family dwelling units. The vehicular trips generated by the 76 units are as follows (from the 1993 TIR):

	Enter	Exit
AM Peak Hour	6	28
PM Peak Hour	28	14

Weekday trip ends = 445

When the vehicular trips generated by Phase I are superimposed upon the current traffic volumes at the Honoapiilani Highway/Napilihau Street intersection, it was found to have no significant impact on the traffic operations. Figure 2 shows the peak hour traffic volumes and the level of service computation. Level of Service computations for this intersection with the vehicular traffic generated by the project are attached to this letter.

Conclusions

The following are the conclusions of this Supplemental TIR:

1. Total traffic volumes during the peak hour of traffic at the Honoapiilani Highway/Napilihau Street intersection have increased by approximately 19% during the morning peak hour of traffic and has decreased by approximately 10% during the afternoon peak hour of traffic.

2. However, the intersection continues to operate satisfactorily with an acceptable Level of Service "C". Left-turn movements from Honoapiilani Highway can be executed with very little delay.

3. The additional traffic volume resulting from Phase I of the Napilihau Villages has negligible impact on the operations of the Honoapiilani Highway/Napilihau Street intersection. The trips generated by Phase I are equivalent to the day-to-day fluctuation of traffic on Honoapiilani Highway.

4. Although traffic volumes at the Honoapiilani Highway/Napilihau Street intersection meet the warrants for traffic signal, the installation of a traffic signal system may be delayed until cross street traffic volumes from the mauka area increase.

Recommendations

The following are the recommendations of this supplemental TIR:

1. Geometric improvements for the roadways in the vicinity of the project contained in the 1993 Traffic Impact Report should be implemented, with the following exceptions:

   a. The extension to the left-turn storage lane on northbound Honoapiilani Highway be deferred and re-examined when Phase II of the Napilihau Villages is developed and ready for occupancy, or

   b. The left-turn storage lane be extended when a traffic signal system is installed at the Honoapiilani Highway/Napilihau Street intersection.

2. Any pro-rata share cost assessment for the installation of a traffic signal system at the intersection of Honoapiilani Highway and Napilihau Street be based upon the vehicular trips generated by the number of completed units at Napilihau Villages at the time the traffic signal system is installed, and not based upon the "future" build-out of Napilihau Villages (unless, of course, the traffic signal system is installed after build-out).

3. The Traffic Impact Report be updated when Phase II is ready to be implemented if the traffic signal system and the extension of the left-turn storage lane at the Honoapiilani Highway/Napilihau Street intersection have not been implemented.

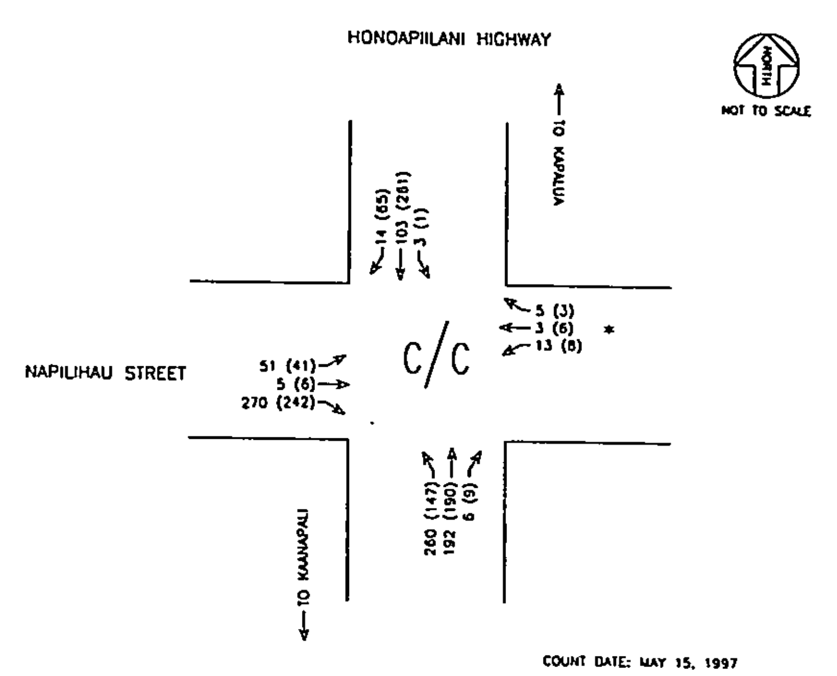
Very truly yours,

AUSTIN, TSUTSUMI & ASSOCIATES, INC.

By *[signature]*
TED S. KAWAHIGASHI, P.E.
President

TSK:

Attachments: Existing Traffic Volume/LOS Computations
LOS Computations with Phase I Traffic



LEGEND:

XXX (XXX) AM (PM) PEAK HOUR TRAFFIC VOLUMES.

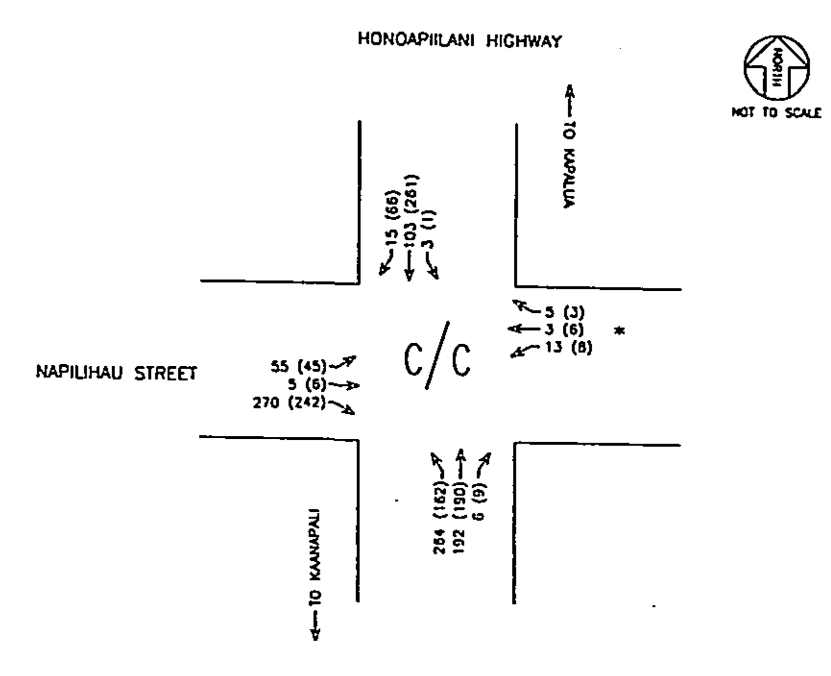
a/b AM/PM PEAK HOUR LEVEL OF SERVICE FOR MOST CONSTRAINED MOVEMENT AT STOP-CONTROLLED INTERSECTION

* DENOTES MOST CONSTRAINED MOVEMENT

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII

EXISTING COMMUTER PEAK HOUR TRAFFIC VOLUMES

FIGURE 1



LEGEND:

XXX (XXX) AM (PM) PEAK HOUR TRAFFIC VOLUMES.

a/b AM/PM PEAK HOUR LEVEL OF SERVICE FOR MOST CONSTRAINED MOVEMENT AT STOP-CONTROLLED INTERSECTION

* DENOTES MOST CONSTRAINED MOVEMENT

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII

1997 COMMUTER PEAK HOUR VOLUME WITH PHASE I TRAFFIC

FIGURE 2

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

EXISTING CONDITION

TRAFFIC COUNTS AND LEVEL OF SERVICE COMPUTATIONS

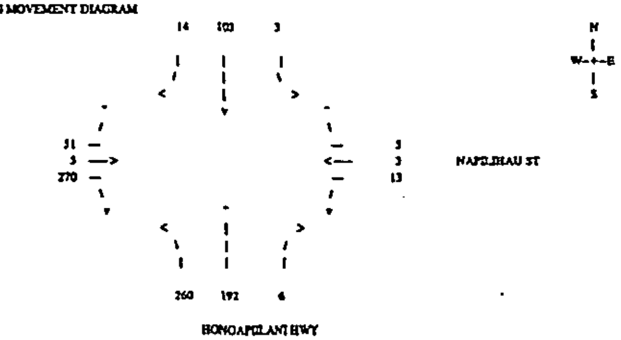
ata inc.

INTERSECTION COUNT SURVEY SUMMARY

North/South Street : HONOAPIILANI HWY Period: AM
East/West Street : NAPILIHAU ST Date: 5/15/97
Weather : CLEAR Day : THURS

15 MINUTE PERIOD	HONOAPIILANI HWY NORTHBOUND LEFT	NB THRU	NB RIGHT	SOUTHBOUND LEFT	SB THRU	SB RIGHT	NAPILIHAU ST EASTBOUND LEFT	EB THRU	EB RIGHT	WESTBOUND LEFT	WB THRU	WB RIGHT	TOTAL VOLUME 15 MIN	TOTAL VOLUME HOURLY
630 - 645	56	49	2	1	14	6	13	0	67	3	0	2	213	
645 - 700	63	59	4	0	23	5	17	0	61	4	1	1	238	
700 - 715	66	52	2	3	36	5	9	1	76	3	0	0	253	
715 - 730	68	39	0	0	22	3	14	1	68	4	0	2	221	925
730 - 745	63	42	0	0	22	1	11	3	65	2	2	2	213	925
745 - 800	55	27	2	0	21	12	7	1	49	3	0	0	179	866
800 - 815	64	32	1	0	27	4	14	0	60	2	0	0	204	817
815 - 830	63	51	0	1	29	3	9	3	39	3	1	3	207	803
PEAK 15 MINUTE PERIOD:														
700 - 715	66	52	2	3	36	5	9	1	76	3	0	0	253	-
PEAK HOUR PERIOD:														
645 - 745	260	192	6	3	103	14	51	5	270	13	3	5	-	925
PEAK HOUR FACTOR:														
645 - 745	0.96	0.81	0.38	0.25	0.72	0.70	0.73	0.42	0.89	0.81	0.38	0.63		
		0.91			0.68			0.95			0.88			

PEAK HOUR TURNING MOVEMENT DIAGRAM



ATA INC

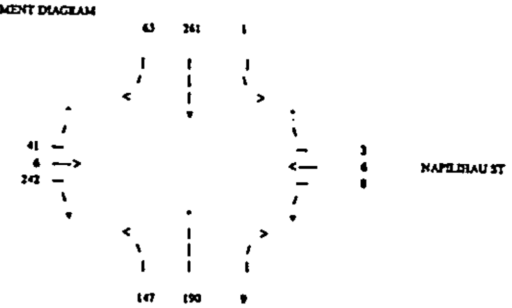
INTERSECTION COUNT SURVEY SUMMARY

North/South Street : HONOAPIILANI HWY
East/West Street : NAPILIHAU ST
Weather : CLEAR

Period: PM
Date: 5/15/97
Day: THURS

15 MINUTE PERIOD	HONOAPIILANI HWY NORTHBOUND LEFT	THRU	RGHT	SOUTHBOUND LEFT	THRU	RGHT	NAPILIHAU ST EASTBOUND LEFT	THRU	RGHT	WESTBOUND LEFT	THRU	RGHT	TOTAL VOLUME 15 MIN	HOURLY
1530 - 1545	32	41	0	0	52	24	8	2	33	3	4	0	219	
1545 - 1600	40	39	4	0	55	15	5	1	62	5	1	0	227	
1600 - 1615	17	27	1	0	93	16	8	0	44	3	3	3	215	
1615 - 1630	44	57	4	1	39	8	15	0	82	2	1	0	233	914
1630 - 1645	32	43	3	0	81	26	13	3	52	2	2	0	259	954
1645 - 1700	54	61	1	0	48	13	5	3	64	1	0	0	232	979
1700 - 1715	31	41	3	0	58	11	5	0	50	1	1	1	202	966
1715 - 1730	32	34	1	0	54	13	3	2	39	1	1	0	182	895
PEAK 15 MINUTE PERIOD: 1630 - 1645	32	43	3	0	81	26	13	3	52	2	2	0	259	-
PEAK HOUR PERIOD: 1600 - 1700	147	190	9	1	261	63	41	6	242	8	6	3	-	979
PEAK HOUR FACTOR: 1600 - 1700	0.68	0.78	0.56	0.25	0.70	0.63	0.68	0.50	0.74	0.67	0.50	0.25		
		0.75			0.75			0.74			0.47			

PEAK HOUR TURNING MOVEMENT DIAGRAM



ATA Inc. TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street: HONOAPIILANI HWY
Minor Street: NAPILIHAU ST
Scenario: EXISTING
Peak Hour: AM PEAK

Print Date: 09-Jul-97
Analyst: EDK
File Name: NAPHAP A
Intersection #: 1

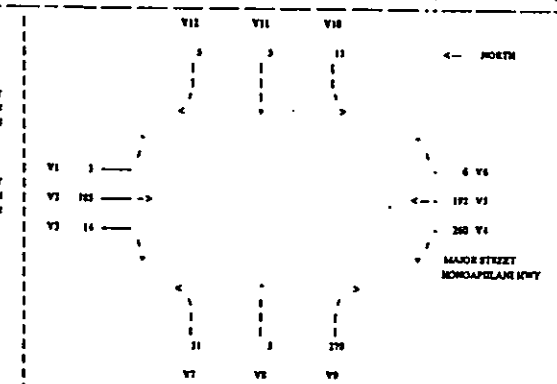
Peak Hour Factor: 1.00

—MAJOR STREET—
Num of Lanes - V2: 1
Excl LT - V1 (Y/N): Y
Excl RT - V3 (Y/N): N
Stop/Yield - V3 (Y/N): N
Grade - V1,V2,V3: 0

Num of Lanes - V5: 1
Excl LT - V4 (Y/N): Y
Excl RT - V6 (Y/N): N
Stop/Yield - V6 (Y/N): N
Grade - V4,V5,V6: 0

—MINOR STREET—
Num of Lanes - V8: 1
Grade - V7,V8,V9: 0
Shared Lane-V7,8,9: 3
(0=N,1=LT,2=TR,3=LTR)

Num of Lanes - V11: 1
Grade - V10,V11,V12: 0
Shared Lane-V10,11,12: 3
(0=N,1=LT,2=TR,3=LTR)



VOLUME ADJUSTMENTS												
MOVEMENT NO.	1	2	3	4	5	6	7	8	9	10	11	12
HOURLY FLOW RATE, V(vph)	3	183	14	260	172	6	31	3	270	13	3	3
VOLUME, v (pcph)	3	183	14	286	172	6	36	6	297	14	3	6

STEP 1: RT FROM MINOR STREET						
Conflicting Flows:	Vc9 = 1/2 V3 + V2 =	110	vhp	Vc12 = 1/2 V6 + V5 =	175	vhp
Potential Capacity:	Cp,9 =	1218	pcph	Cp,12 =	1103	pcph
Movement Capacity:	Cm,9=Cp,9=	1218	pcph	Cm,12=Cp,12=	1103	pcph
Prob. of Queue free Lane:	po,9=1-v9/Cm,9 =	0.76		po,12=1-v12/Cm,12=	0.99	

STEP 2: LT FROM MAJOR STREET						
Conflicting Flows:	Vc,4 = V2 + V3 =	317	vhp	Vc,1 = V5 + V6 =	198	vhp
Potential Capacity:	Cp,4 =	1308	pcph	Cp,1 =	1350	pcph
Movement Capacity:	Cm,4=Cp,4=	1308	pcph	Cm,1=Cp,1=	1350	pcph
Prob. of Queue-free State:	po,4=1-v4/Cm4=	0.81		po,1=1-v1/Cm1=	1.00	
Major Left Shared Lane						
Prob. of Queue-free State	p*o,4=	NA		p*o,1=	NA	

PAGE 1 OF 2

—continued—

ATA Inc. TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street:	HONOAPIILANI HWY	Prep Date:	09-Jun-97
Minor Street:	NAPILIHAU ST	Analyst:	EDK
Scenario:	EXISTING	File Name:	NAPNAP P
Peak Hour:	PM PEAK	Intersection #:	1

Peak Hour Factor: 1.00

——MAJOR STREET——	
Num of Lanes - V2:	1
Excl LT - V1 (Y/N):	Y
Excl RT - V3 (Y/N):	N
Stop/Yield - V3 (Y/N):	N
Grade - V1,V2,V3:	0
Num of Lanes - V5:	1
Excl LT - V4 (Y/N):	Y
Excl RT - V6 (Y/N):	N
Stop/Yield - V6 (Y/N):	N
Grade - V4,V5,V6:	0

——MINOR STREET——	
Num of Lanes - V8:	1
Grade - V7,V8,V9:	0
Shared Lane V7,8,9:	5
(0=N,1=LT,2=TR,3=LTR)	
Num of Lanes - V11:	1
Grade - V10,V11,V12:	0
Shared Lane V10,11,12:	5
(0=N,1=LT,2=TR,3=LTR)	

Intersection diagram: V12 3, V11 6, V10 8 (minor street approach, top); <-- NORTH; V1 1, V2 261, V3 43 (major street, left); V6 9, V5 190, V4 147 (major street, right) — MAJOR STREET HONOAPIILANI HWY; V7 41, V8 6, V9 242 — MINOR STREET - NAPILIHAU ST

VOLUME ADJUSTMENTS												
MOVEMENT NO.	1	2	3	4	5	6	7	8	9	10	11	12
HOURLY FLOW RATE, V(vph)	1	261	43	147	190	9	41	6	242	8	6	3
VOLUME, v (pcph)	1	261	43	162	190	9	45	7	266	9	7	3

STEP 1: RT FROM MINOR STREET						
Conflicting Flows:	Vc9 = 1/2 V3 + V2 =	284	vhp	Vc12 = 1/2 V6 + V5 =	195	vhp
Potential Capacity:	Cp,9 =	983	pcph	Cp,12 =	1194	pcph
Movement Capacity:	Cm,9=Cp,9=	983	pcph	Cm,12=Cp,12=	1194	pcph
Prb. of Queue-free State:	po,9=1-v9/Cm,9=	0.73		po,12=1-v12/Cm,12=	1.00	

STEP 2: LT FROM MAJOR STREET						
Conflicting Flows:	Vc,4 = V2 + V3 =	326	vhp	Vc,1 = V5 + V6 =	199	vhp
Potential Capacity:	Cp,4 =	1199	pcph	Cp,1 =	1378	pcph
Movement Capacity:	Cm,4=Cp,4=	1199	pcph	Cm,1=Cp,1=	1378	pcph
Prb. of Queue-free State:	po,4=1-v4/Cm4=	0.86		po,1=1-v1/Cm1=	1.00	
Major Left Shared Lane						
Prob. of Queue-free State:	p*o,4=	NA		p*o,1=	NA	

ATA Inc. TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street:	HONOAPIILANI HWY	DATE:	09-Jun-97
Minor Street:	NAPILIHAU ST	Analyst:	EDK
Scenario:	EXISTING	File Name:	NAPNAP A
Peak Hour:	AM PEAK	Intersection #:	1

STEP 3: TH FROM MINOR STREET						
Conflicting Flows:	Vc,8 = 1/2V3+V2+V1+V6+V5+V4 =	571	vph	Vc,11 = 1/2V6+V5+V4+V3+V2+V1 =	575	vph
Potential Capacity:	Cp,8 =	547	pcph	Cp,11 =	541	pcph
Capacity Adj Factor:	f8 = po,4*po,1 =	0.81		f11 = po,4*po,1 =	0.81	
Movement Capacity:	Cm,8 = Cp,8*f8 =	442	pcph	Cm,11 = Cp,11*f11 =	440	pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 =	0.99		po,11 = 1-v11/Cm,11 =	0.99	

STEP 4: LT FROM MINOR STREET						
Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+1/2(V11+V12) =	572	vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+1/2(V8+V9) =	706	vph
Potential Capacity:	Cp7 =	494	pcph	Cp10 =	413	pcph
Major Left, Minor Through Impedance Factor:	P"7=po,11*f11 =	0.80		P"10=po,8*f8 =	0.80	
Major Left, Minor Through Adjusted Impedance Factor:	p'7 =	0.85		p'10 =	0.84	
Capacity Adjustment Factor:	f7 = p'7*po,12 =	0.84		f10 = p'10*po,9 =	0.64	
Movement Capacity:	Cm,7 = f7*Cp,7 =	417	pcph	Cm,10 = f10*Cp,10 =	264	pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	30	417	SHRD	SHRD	-
MINOR THROUGH (8)	8	442	916	6.4	B
MINOR RIGHT TURN (9)	297	1218	SHRD	SHRD	—
MINOR LEFT TURN (10)	16	264	SHRD	SHRD	-
MINOR THROUGH (11)	3	440	312	16.9	C
MINOR RIGHT TURN (12)	6	1183	SHRD	SHRD	-
MAJOR LEFT (1)	3	1380	--NA--	2.6	A
MAJOR LEFT (4)	206	1308	--NA--	2.9	A
MINOR APPROACH (7)(8)(9)	-	-	-	6.4	B
MINOR APPROACH (10)(11)(12)	-	-	-	16.9	C
MAJOR APPROACH (1)(2)(3)	-	-	-	0.1	A
MAJOR APPROACH (4)(5)(6)	-	-	-	1.7	A
TOTAL INTERSECTION (1-12)	-	-	-	3.3	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5 & <=10
C	>10 & <=20
D	>20 & <=30
E	>30 & <=45
F	>45

ATA AUSTIN, TSUTSUMI & ASSOC., INC.
CIVIL ENGINEERS • SURVEYORS

LEVEL OF SERVICE COMPUTATIONS
WITH PHASE I TRAFFIC

ATA Inc. — TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS — 1994 HCM

Major Street:	HONOAPIILANI HWY	DATE:	08-Jul-97
Minor Street:	NAPILIHAU ST	Analyst:	EDK
Scenario:	EXISTING	File Name:	NAPIHAP.P
Peak Hour:	PM PEAK	Intersection #:	1

STEP 3: TH FROM MINOR STREET

Conflicting Flows:	Vc,8 = 1/2V3+V2+V1+V4+V5+V6 =	641	vph	Vc,11 = 1/2V6+V5+V4+V3+V2+V1 =	660	vph
Potential Capacity:	Cp,8 =	383	pcph	Cp,11 =	406	pcph
Capacity Adj Factor:	f8 = pv,4*pv,1 =	0.86		f11 = pv,4*pv,1 =	0.86	
Movement Capacity:	Cm,8 = Cp,8*f8 =	435	pcph	Cm,11 = Cp,11*f11 =	420	pcph
Prob. of Queue-free State:	pv,8 = 1-v8/Cm,8 =	0.98		pv,11 = 1-v11/Cm,11 =	0.98	

STEP 4: LT FROM MINOR STREET

Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+1/2(V11+V12) =	641	vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+1/2(V8+V9) =	760	vph
Potential Capacity:	Cp7 =	431	pcph	Cp10 =	384	pcph
Major Left, Minor Through Impedance Factor:	P"7 = pv,11*f11 =	0.83		P"10 = pv,8*f8 =	0.83	
Major Left, Minor Through Adjusted Impedance Factor:	p'7 =	0.80		p'10 =	0.87	
Capacity Adjustment Factor:	f7 = p'7*pv,12 =	0.80		f10 = p'10*pv,9 =	0.63	
Movement Capacity:	Cm,7 = f7*Cp,7 =	390	pcph	Cm,10 = f10*Cp,10 =	240	pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	45	390	SHRD	SHRD	-
MINOR THROUGH (8)	7	435	775	7.3	B
MINOR RIGHT TURN (9)	364	985	SHRD	SHRD	—
MINOR LEFT TURN (10)	9	240	SHRD	SHRD	-
MINOR THROUGH (11)	7	420	341	11.2	C
MINOR RIGHT TURN (12)	3	1104	SHRD	SHRD	-
MAJOR LEFT (1)	1	1370	-NA-	2.6	A
MAJOR LEFT (4)	162	1100	-NA-	3.5	A
MINOR APPROACH (7)(8)(9)	-	-	-	7.3	B
MINOR APPROACH (10)(11)(12)	-	-	-	11.2	C
MAJOR APPROACH (1)(2)(3)	-	-	-	0.0	A
MAJOR APPROACH (4)(5)(6)	-	-	-	1.6	A
TOTAL INTERSECTION (1-12)	-	-	-	3.2	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5 & <=10
C	>10 & <=20
D	>20 & <=30
E	>30 & <=45
F	>45

ATA Inc.

TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS — 1994 HCM

Major Street:	HONOAPIILANI HWY		
Minor Street:	NAPILIHAU ST	Print Date:	21-Jul-97
Scenario:	WITH PROJECT	Analyst:	KDK
Peak Hour:	AM PEAK	File Name:	HANNAP2A
		Intersection #:	1

Peak Hour Factor: 1.00

——MAJOR STREET——

Num of Lanes - V2:	1
Excl LT - V1 (Y/N):	Y
Excl RT - V3 (Y/N):	N
Stop/Yield - V3 (Y/N):	N
Grade - V1,V2,V3:	0
Num of Lanes - V5:	1
Excl LT - V4 (Y/N):	Y
Excl RT - V6 (Y/N):	N
Stop/Yield - V6 (Y/N):	N
Grade - V4,V5,V6:	0

——MINOR STREET——

Num of Lanes - V8:	1
Grade - V7,V8,V9:	0
Shared Lane-V7,8,9 (0=N,1=LT,2=TR,3=LTR)	3
Num of Lanes - V11:	1
Grade - V10,V11,V12	0
Shared Lane-V10,11,12 (0=N,1=LT,2=TR,3=LTR)	3

V12 5, V11 3, V10 13 <— NORTH

V1 3, V2 103, V3 15

6 V6, 192 V5, 264 V4

MAJOR STREET HONOAPIILANI HWY

55 V7, 5 V8, 270 V9

MINOR STREET - NAPILIHAU ST

VOLUME ADJUSTMENTS												
MOVEMENT NO.	1	2	3	4	5	6	7	8	9	10	11	12
HOURLY FLOW RATE, V(vph)	3	103	15	264	192	6	55	5	270	13	3	5
VOLUME, v (pcph)	3	103	15	290	192	6	61	6	297	14	3	6

STEP 1: RT FROM MINOR STR						
Conflicting Flows:	Vc9 = 1/2 V3 + V2 =	111	vhp	Vc12 = 1/2 V6 + V5 =	195	vhp
Potential Capacity:	Cp,9 =	1217	pcph	Cp,12 =	1103	pcph
Movement Capacity:	Cm,9=Cp,9=	1217	pcph	Cm,12=Cp,12=	1103	pcph
Prb. of Queue-free State:	po,9=1-v9/Cm,9=	0.76		po,12=1-v12/Cm,12=	0.99	

STEP 2: LT FROM MAJOR ST						
Conflicting Flows:	Vc,4 = V2 + V3 =	118	vhp	Vc,1 = V5 + V6 =	198	vhp
Potential Capacity:	Cp,4 =	1506	pcph	Cp,1 =	1380	pcph
Movement Capacity:	Cm,4=Cp,4=	1506	pcph	Cm,1=Cp,1=	1380	pcph
Prb. of Queue-free State:	po,4=1-v4/Cm4=	0.81		po,1=1-v1/Cm1=	1.00	
Major Left Shared Lane Prob. of Queue-free State	p*o,4=	NA		p*o,1=	NA	

—continued—

ATA Inc.

TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS — 1994 HCM

Major Street: HONOAPIILANI HWY — DATE: 21-Jul-97
Minor Street: NAPILIHAU ST — Analyst: KDK
Scenario: WITH PROJECT — File Name: HANNAP2A
Peak Hour: AM PEAK — Intersection #: 1

STEP 3: TH FROM MINOR STREET						
Conflicting Flows:	Vc,8 = 1/2V3+V2+V1+V6+V5+V4 =	576	vph	Vc,11 = 1/2V6+V5+V4+V3+V2+V1 =	580	vph
Potential Capacity:	Cp,8 =	544	pcph	Cp,11 =	541	pcph
Capacity Adj Factor:	f8 = po,4*po,1 =	0.81		f11 = po,4*po,1 =	0.81	
Movement Capacity:	Cm,8 = Cp,8*f8 =	438	pcph	Cm,11 = Cp,11*f11 =	436	pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 =	0.99		po,11 = 1-v11/Cm,11 =	0.99	

STEP 4: LT FROM MINOR STREET						
Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) =	577	vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) =	710	vph
Potential Capacity:	Cp7 =	491	pcph	Cp10 =	411	pcph
Major Left, Minor Through Impedance Factor:	P''7=po,11*f11 =	0.80		P''10=po,8*f8 =	0.79	
Major Left, Minor Through Adjusted Impedance Factor:	p'7 =	0.85		p'10 =	0.84	
Capacity Adjustment Factor:	f7 = p'7*po,12 =	0.84		f10 = p'10*po,9 =	0.64	
Movement Capacity:	Cm,7 = f7*Cp,7 =	413	pcph	Cm,10 = f10*Cp,10 =	262	pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	61	413	SHRD	SHRD	–
MINOR THROUGH (8)	6	438	898	6.7	B
MINOR RIGHT TURN (9)	297	1217	SHRD	SHRD	---
MINOR LEFT TURN (10)	14	262	SHRD	SHRD	–
MINOR THROUGH (11)	3	436	349	11.0	C
MINOR RIGHT TURN (12)	6	1103	SHRD	SHRD	–
MAJOR LEFT (1)	3	1380	–NA–	2.6	A
MAJOR LEFT (4)	290	1506	–NA–	3.0	A
MINOR APPROACH (7)(8)(9)	-	-	-	6.7	B
MINOR APPROACH (10)(11)(12)	-	-	-	11.0	C
MAJOR APPROACH (1)(2)(3)	-	-	-	0.1	A
MAJOR APPROACH (4)(5)(6)	-	-	-	1.8	A
TOTAL INTERSECTION (1-12)	-	-	-	3.8	A

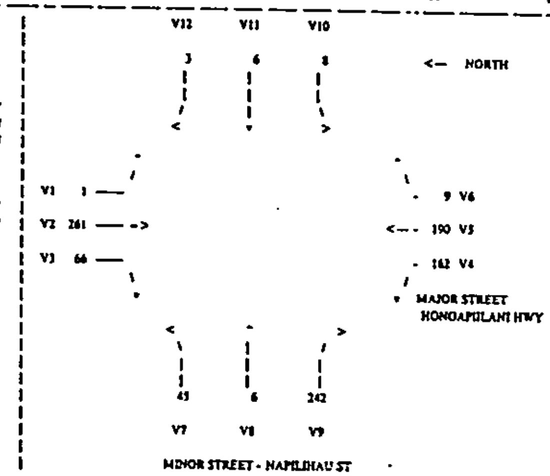
LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5& <=10
C	>10& <=20
D	>20& <=30
E	>30& <=45
F	>45

ATA Inc. — TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS — 1994 HCM

Major Street:	HONOAPIILANI HWY		
Minor Street:	NAPILIHAU ST	Print Date:	21-Jul-97
Scenario:	WITH PROJECT	Analyst:	KDK
Peak Hour:	PM PEAK	File Name:	HANNAP2P
		Intersection #:	1

Peak Hour Factor:	1.00
——MAJOR STREET——	
Num of Lanes - V2:	1
Excl LT - V1 (Y/N):	Y
Excl RT - V3 (Y/N)	N
Stop/Yield - V3 (Y/	N
Grade - V1,V2,V3:	0
Num of Lanes - V5:	1
Excl LT - V4 (Y/N):	Y
Excl RT - V6 (Y/N)	N
Stop/Yield - V6 (Y/	N
Grade - V4,V5,V6:	0
——MINOR STREET——	
Num of Lanes - V8:	1
Grade - V7,V8,V9:	0
Shared Lane-V7,8	3
(0=N,1=LT,2=TR,3=LTR)	
Num of Lanes - V11	1
Grade - V10,V11,	0
Shared Lane-V10,11	3
(0=N,1=LT,2=TR,3=LTR)	



VOLUME ADJUSTMENTS												
MOVEMENT NO.	1	2	3	4	5	6	7	8	9	10	11	12
HOURLY FLOW RATE, V(vph)	1	261	66	162	190	9	45	6	242	8	6	3
VOLUME, v (pcph)	1	261	66	178	190	9	50	7	266	9	7	3

STEP 1: RT FROM MINOR STR						
Conflicting Flows:	Vc9 = 1/2 V3 + V2 =	294	vhp	Vc12 = 1/2 V6 + V5 =	195	vhp
Potential Capacity:	Cp,9 =	983	pcph	Cp,12 =	1104	pcph
Movement Capacity:	Cm,9=Cp,9=	983	pcph	Cm,12=Cp,12=	1104	pcph
Prb. of Queue-free State:	po,9=1-v9/Cm,9=	0.73		po,12=1-v12/Cm,12=	1.00	

STEP 2: LT FROM MAJOR STR						
Conflicting Flows:	Vc,4 = V2 + V3 =	327	vhp	Vc,1 = V5 + V6 =	199	vhp
Potential Capacity:	Cp,4 =	1197	pcph	Cp,1 =	1378	pcph
Movement Capacity:	Cm,4=Cp,4=	1197	pcph	Cm,1=Cp,1=	1378	pcph
Prb. of Queue-free State:	po,4=1-v4/Cm4=	0.85		po,1=1-v1/Cm1=	1.00	
Major Left Shared Lane						
Prob. of Queue-free State	p*o,4=	NA		p*o,1=	NA	

—continued —

ATA Inc. — TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS — 1994 HCM

Major Street:	HONOAPIILANI HWY	DATE:	21-Jul-97
Minor Street:	NAPILIHAU ST	Analyst:	KDK
Scenario:	WITH PROJECT	File Name:	HANNAP2P
Peak Hour:	PM PEAK	Intersection #:	1

STEP 3: TH FROM MINOR STREET						
Conflicting Flows:	Vc,8 = 1/2V3+V2+V1+V6+V5+V4 =	656	vph	Vc,11 = 1/2V6+V5+V4+V3+V2+V1 =	683	vph
Potential Capacity:	Cp,8 =	494	pcph	Cp,11 =	477	pcph
Capacity Adj Factor:	f8 = po,4*po,1 =	0.85		f11 = po,4*po,1 =	0.85	
Movement Capacity:	Cm,8 = Cp,8*f8 =	420	pcph	Cm,11 = Cp,11*f11 =	406	pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 =	0.98		po,11 = 1-v11/Cm,11 =	0.98	

STEP 4: LT FROM MINOR STREET						
Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) =	656	vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) =	776	vph
Potential Capacity:	Cp7 =	442	pcph	Cp10 =	376	pcph
Major Left, Minor Through Impedance Factor:	P"7=po,11*f11 =	0.84		P"10=po,8*f8 =	0.84	
Major Left, Minor Through Adjusted Impedance Factor:	p'7 =	0.87		p'10 =	0.87	
Capacity Adjustment Factor:	f7 = p'7*po,12 =	0.87		f10 = p'10*po,9 =	0.64	
Movement Capacity:	Cm,7 = f7*Cp,7 =	383	pcph	Cm,10 = f10*Cp,10 =	240	pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	50	385	SHRD	SHRD	–
MINOR THROUGH (8)	7	420	774	7.9	B
MINOR RIGHT TURN (9)	266	983	SHRD	SHRD	—
MINOR LEFT TURN (10)	9	240	SHRD	SHRD	–
MINOR THROUGH (11)	7	406	331	11.5	C
MINOR RIGHT TURN (12)	3	1104	SHRD	SHRD	–
MAJOR LEFT (1)	1	1378	–NA–	2.6	A
MAJOR LEFT (4)	178	1197	–NA–	3.5	A
MINOR APPROACH (7)(8)(9)	-	-	-	7.9	B
MINOR APPROACH (10)(11)(12)	-	-	-	11.5	C
MAJOR APPROACH (1)(2)(3)	-	-	-	0.0	A
MAJOR APPROACH (4)(5)(6)	-	-	-	1.7	A
TOTAL INTERSECTION (1-12)	-	-	-	3.4	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVIC	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5& <=10
C	>10& <=20
D	>20& <=30
E	>30& <=45
F	>45

Appendix J

State Department of Transportation Letter Dated August 11, 1997

DEC-03-97 14:08 FROM:ATA HONOLULU ID:8085261267 PAGE 1/1

BENJAMIN J. CAYETANO
GOVERNOR

RECEIVED
AUG 13 1997
AUSTIN, TSUTSUMI & ASSOCIATES, INC.
Honolulu, Hawaii 96817-503

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
Brian K. Minaai
GLENN M. OKIMOTO

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

IN REPLY REFER TO:

Hwy-M 2.195-97

August 11, 1997

Mr. Ted Kawahigashi, P.E.
President
Austin Tsutsumi & Associates, Inc.
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817

Dear Mr. Kawahigashi:

Subject: Supplemental TIAR for Napilihau Villages, ME-97-45

These are our comments:

1. The developer's pro rata share for the installation of a traffic signal system at the intersection of Honoapiilani Highway and Napilihau Street shall be the design of the traffic signal system. Design of the project shall be in accordance with preparation of PS&E for state highway projects. The State will install the traffic signal system at the intersection. Design should be completed by January 1998, or earlier.

2. Extension of the left turn storage lane shall be the responsibility of the developer. Appropriate length (storage, deceleration and taper lengths) shall be determined by using full build-out projection for Napilihau Villages. This may be installed concurrently with Phase II.

3. Supplemental TIAR states that Phase I construction includes the construction of right turn in/out from Honoapiilani Highway. Submit plans for review and approval. Basis of design report shall be included with the submittal.

If there are any questions, please contact Mr. Ferdinand Cajigal of our Engineering Section at 877-5061.

Very truly yours,

Robert O. Siarot
District Engineer, Maui

/fmc

Appendix K

Update of Traffic Impact Analysis Report for Napilihau Villages

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

#97-39.1

February 18, 1998

Mr. Wayne Tanigawa
BRJ Napili, Inc.
1001 Bishop Street
Pauahi Tower, Suite 1570
Honolulu, Hawaii 96813

Dear Mr. Tanigawa:

Subject: Traffic Impact Analysis Report for Napilihau Villages

We have enclosed a copy of the updated Traffic Impact Analysis Report (TIAR) for Napilihau Villages to be included in the Final Environmental Assessment (EA). However, it was recently brought to our attention that Phase II of the proposed project will be developed as fee simple multi-family townhouses. As stated in the Advanced Draft EA, the TIAR assumed that Phase II would be developed as rental multi-family townhouses. Review of the trip generation rates indicate that the rental multi-family townhouses generate more trips then the fee simple townhouses. Since the TIAR uses the rental multi-family townhouse trip rate for the Phase II development, the trips generated are an overestimate of the projected traffic and therefore the analysis would be conservative. Revising the trip generation rates to the fee simple multi-family townhouses would not alter the traffic operations significantly.

Should you have any questions, please feel free to contact us.

Very truly yours,

AUSTIN, TSUTSUMI & ASSOCIATES, INC.

By Ted S. Kawahigashi
TED S. KAWAHIGASHI, P.E.
President

Enclosure

cc: Mr. Michael Munekiyo - Munekiyo, Arakawa & Hiraga, Inc. w/o encl.

TRAFFIC IMPACT ANALYSIS REPORT FOR NAPILIHAU VILLAGES NAPILI, MAUI, HAWAII

Prepared For

NAPILIHAU VILLAGES

FEBRUARY 1998

Prepared By

Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031
Telephone: (808) 533-3646
Facsimile: (808) 526-1267
Honolulu • Wailuku, Hawaii

TRAFFIC IMPACT ANALYSIS REPORT
FOR
NAPILIHAU VILLAGES
NAPILI, MAUI, HAWAII

Prepared For

NAPILIHAU VILLAGES

Prepared By

Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031

February 1998

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Continued

TRAFFIC IMPACT ANALYSIS REPORT
FOR
NAPILIHAU VILLAGES
NAPILI, MAUI, HAWAII

I. INTRODUCTION

A. Purpose and Scope of Study

A Traffic Impact Report was conducted for Napilihau Villages, dated February 1993, which assessed the traffic impacts resulting from the proposed development. On November 5, 1997, the State of Hawaii Supreme Court ruled that an environmental assessment would be need for the Napilihau Villages. In order to comply with the ruling Napilihau Villages Joint Venture is in the process of preparing the environmental documents. Therefore, the purpose of this study is to update the February 1993 Traffic Impact Report for the proposed Napilihau Villages for inclusion with the environmental documents.

B. Study Methodology

This report presents the findings and recommendations of this traffic study, the scope of which includes:

1. A description of the proposed development.
2. An assessment of existing roadway and traffic conditions.
3. Development of trip generation characteristics for the proposed development.
4. Development of traffic projections.
5. Identification and assessment of traffic impacts resulting from the trips generated by the proposed development, superimposed over the projected traffic conditions.

6. Recommendation(s) of roadway improvements which would mitigate the traffic impacts identified in this study.

C. Location

The proposed development is located in Napili, Maui, Hawaii between Honoapiilani Highway and Lower Honoapiilani Road and is bordered on the north by Napilihau Street. More specifically, the project is identified as TMK: 4-3-3:108, 110, 122 and 123. Figure 1 shows the location of the project.

D. Project Description

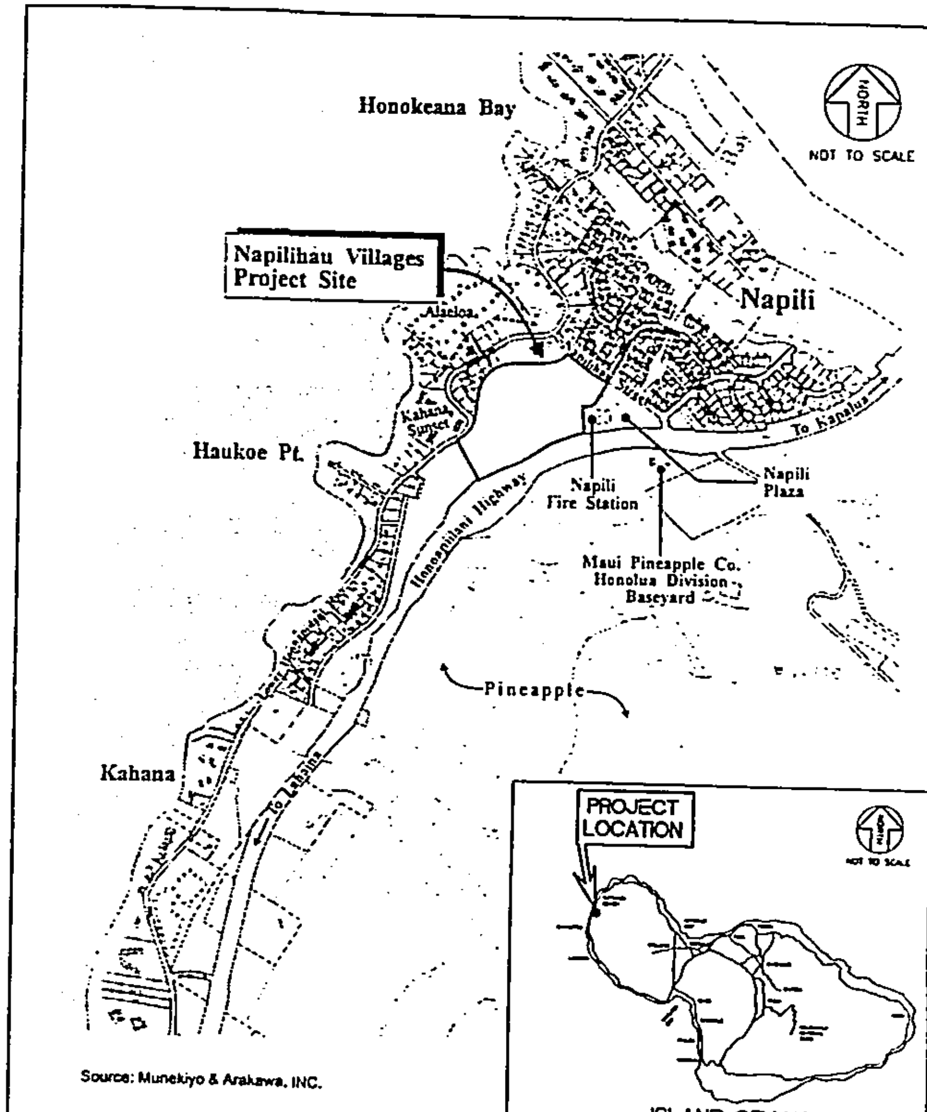
Napilihau Villages Joint Venture, is proposing to develop 296 multi-family residential units on a 16.5-acre site in Napili. The project site is bounded by Honoapiilani Highway, Napili Plaza Shopping Center and the Napili Fire Station on the mauka side, Lower Honoapiilani Road on the makai side, and Napilihau Street on the north side.

Access to the development will be via Hanawai Street from Napilihau Street and a new driveway connection onto Honoapiilani Highway. This new driveway will be restricted to right turns only, into and out of the development, and is proposed to be constructed during Phase IV of the proposed project.

The project is proposed to be developed in the following four (4) phases:

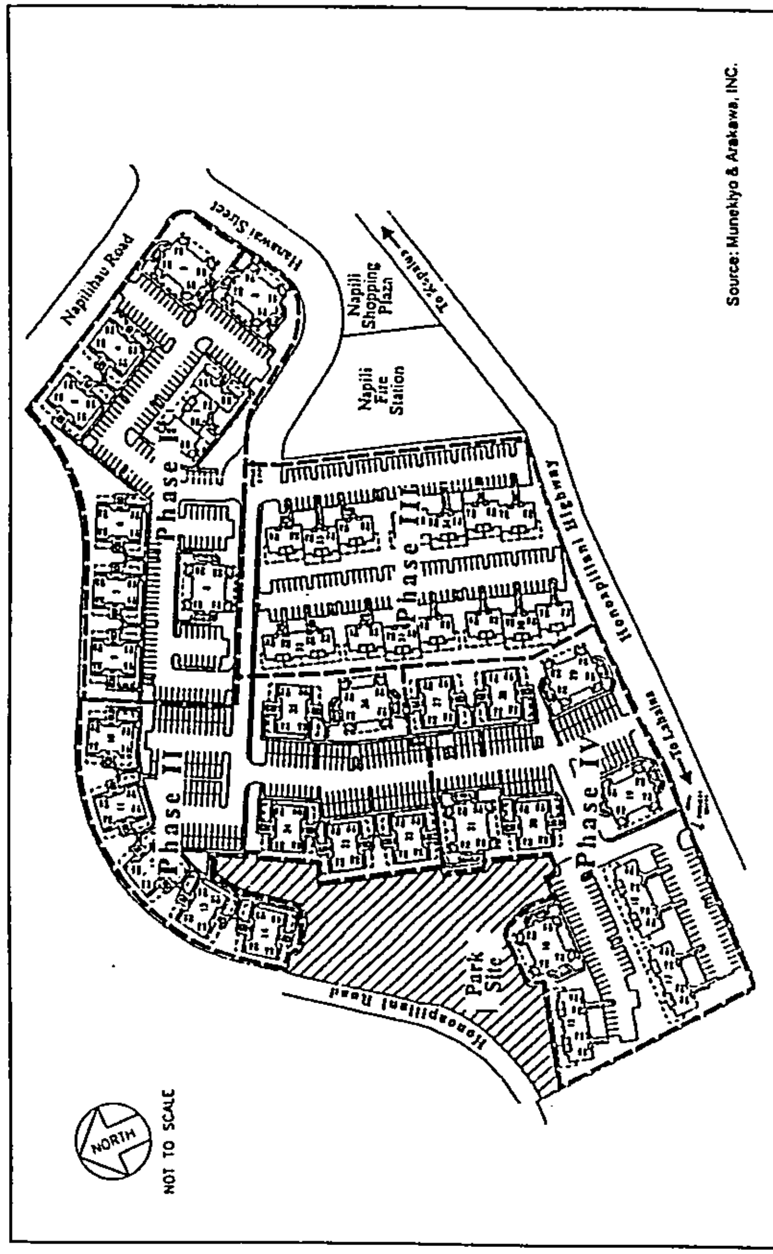
Phase	Units	Year
I	76	1998
II	80	2000
III	60	2002
IV	80	2000
Total	296	

Phases I, III and IV of the proposed project are planned to be sold as fee-simple multi-family townhouses. Phase II is planned as an affordable rental project. Figure 2 shows the site plan for the proposed project.



NAPILIHAU VILLAGES | AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII | FIGURE 1

VICINITY MAP



Source: Munekiyo & Arakawa, INC.

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

NAPILIHAU VILLAGES

SITE PLAN

FIGURE 2

II. EXISTING CONDITIONS

A. General

At present, Phase I of the project has been substantially completed with 68 units nearing completion and with construction started on the remaining 8 units. The remaining areas of the project site, formerly pineapple fields, lie fallow. The project site is located adjacent to the Napili Plaza Shopping Center and the Napili Fire Station. North of Honoapiilani Highway, at its intersection with Napilihau Street, is Maui Land & Pineapple Company's Honolua Plantation and Rainbow Ranch riding stables. North of Napilihau Street are existing residential units which are served by Hanawai Street and Kohi Street.

Development of Rainbow Ranch was approved by the County of Maui as a mixed-use site consisting of residential, general office and light industrial uses and was to have been completed in 1994. However, at the time of this writing, construction has not been started. It is unclear on the type of development or its construction schedule. An update to the traffic impact study for Rainbow Ranch would probably be needed to assess the traffic impacts from that proposed site and to reassess the existing traffic conditions. Therefore, analysis contained within this report does not include the traffic generated by the Rainbow Ranch development.

The Kahana Subdivision, a 286-unit residential development south of the proposed Napilihau Villages, is currently under construction with the major infrastructure work completed.

The Honokowai Marketplace development, located south of the proposed development at the corner of Honoapiilani Highway and Lower Honoapiilani Road, is proposed to consist of approximately 74,000 square feet of retail space and 380 parking stalls.

The Kaanapali Vacation Club is a 280-unit timeshare resort development located south of the proposed development at the corner of Honoapiilani Highway and Pukolii Road.

No other major developments in the project area are known to be approved for implementation in the near future.

B. Roadway System

The primary roadways in the immediate vicinity of the project are: Honoapiilani Highway, Napilihau Street and Lower Honoapiilani Road.

Honoapiilani Highway is a State arterial highway, which provides the regional circulation from Kapalua through West Maui and linkage to Central and South Maui. It is a high-quality, two-lane highway with all major intersections channelized with separate left-turn storage lanes and deceleration/acceleration lanes.

Napilihau Street is a County two-lane collector road connecting Honoapiilani Highway and Lower Honoapiilani Road. Left-turn storage lanes are provided at its intersections with cross streets and parking is permitted along the north curb.

Lower Honoapiilani Road is a County two-lane collector road that winds through Napili, Kahana and Honokowai, generally following the coastline. In the immediate vicinity of the project, Lower Honoapiilani Road is narrow, with limited shoulder areas.

Other streets in the area include Hanawai Street and Kohi Street, which are local streets connecting to Napilihau Street and serving residential areas north of Napilihau Street.

C. Traffic

1. Traffic Volumes

Weekday AM and PM peak period traffic turning movement counts were conducted on Tuesday, May 15, 1997 at the Honoapiilani Highway and Napilihau Street intersection. Traffic volume counts were also obtained on Thursday, January 15, 1998 at the Napilihau Street intersections with Hanawai Street and Lower Honoapiilani Road.

The AM and PM peak hour of commuter traffic varied slightly at each of the intersections studied. The AM peak commuter hour of traffic at the Napilihau Street intersections with Honoapiilani Highway and Hanawai Street occurred between 6:45 AM and 7:45 AM. The AM peak hour of commuter traffic occurred between 7:00 AM and 8:00 AM at the Napilihau Street and Lower Honoapiilani Road intersection.

Similarly, the PM peak hour of commuter traffic varied slightly, at the three Napilihau Street intersections. The Honoapiilani Highway intersection occurred between 3:00 PM and 4:00 PM, the Hanawai Street intersection occurred between 3:45 PM and 4:45 PM and the Lower Honoapiilani Road intersection occurred between 3:30 PM and 4:30 PM.

Machine counts from the State of Hawaii, Department of Transportation (SDOT) were obtained for the Honoapiilani Highway and Napilihau Street intersection. Review of the 1997 machine counts indicates discrepancies within the count. Therefore, the 1997 counts were supplemented with the 1995 SDOT machine counts.

The existing peak hours of commuter traffic are shown on Figure 3. Turning movement count data are contained in Appendix A.

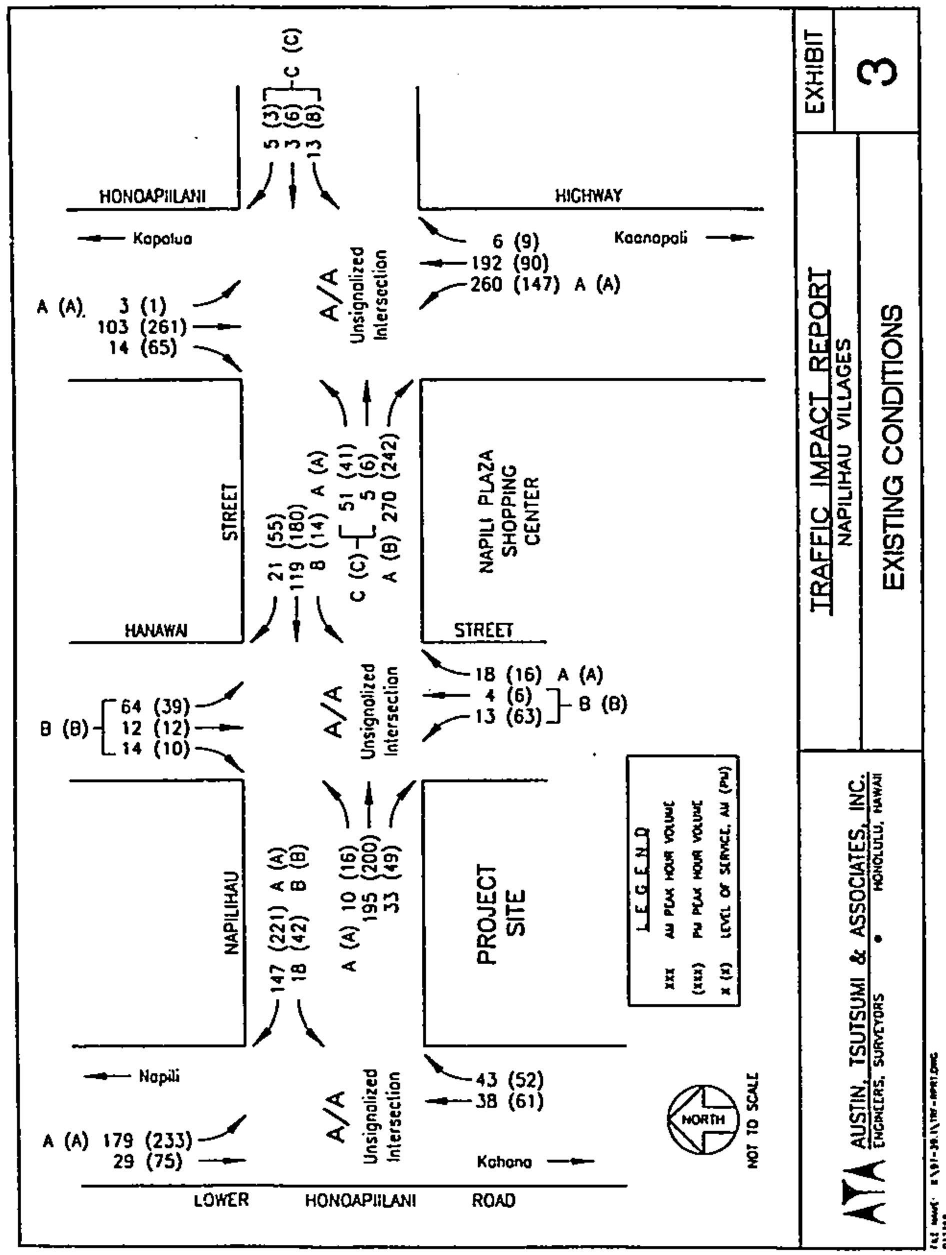
2. Roadway Improvements

One of the recommended improvements to accommodate the additional traffic generated by the Napilihau Villages development, contained in the February 1993 TIAR, was to lengthen the west bound (makai bound) Napilihau Street left-turn storage lane to a minimum length of 120 feet at its intersection with Hanawai Street. Construction of the recommended improvement has been completed by the developer.

3. Existing Level of Service Analysis

Level of Service (LOS) is a qualitative measure used to describe the conditions of traffic flow, ranging from free-flow conditions at LOS A to congested conditions at LOS F. Methods for calculating volume-to-capacity ratios, delays and corresponding level of service from the 1994 Highway Capacity Manual - Special Report 209 were utilized for this study. Level of Service definitions for unsignalized intersections are provided in Appendix B. Figure 3 also shows the LOS results at the study intersections.

Analysis indicates that the three intersections are operating at LOS C or better during both peak hours of traffic as unsignalized intersections under existing conditions. However, review of the traffic signal warrants contained in the Manual on Uniform Traffic Control Devices (MUTCD),



indicates that the intersection of Honoapiilani Highway and Napilihau Street meets the requirements of the accident warrant. Therefore, it is recommended that the intersection be signalized. With the signalization, the intersection is estimated to operate at LOS B during both the AM and PM peak hours of traffic.

III. TRIP GENERATION CHARACTERISTICS

A. General

The trip generation rates utilized in estimating the volume of vehicular traffic generated by the proposed development are based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in "Trip Generation, 6th Edition". These empirically derived rates correlate independent variables defining land use intensity with traffic count rate. Table 1 summarizes the trip rates used for this study.

TABLE 1
ITE TRIP RATES

Land Use	Units	Avg. Weekday Trip Rate	AM Peak Hour		PM Peak Hour	
			Rate	% In	Rate	% In
Residential Condo	DU	6.78	0.54	17%	0.64	67%
Low-Rise Rental Apartment	DU	9.95	0.58	20%	0.69	66%

B. Traffic Generation

Vehicular trip generation was computed for each of the four phases based upon the number of units per phase. Table 2 shows the breakdown of the total number of weekday trip ends, and AM and PM peak hour trips generated by the project.

When completely occupied, the 296 units will generate approximately 2,272 vehicular trip ends per weekday (24 hours); 164 AM peak hour trips and 195 PM peak hour trips.

TABLE 2

PROJECT-GENERATED TRIPS
NAPILIHAU VILLAGES

Phase No.	Dwelling Units	Weekday Trip Ends	AM Peak Hour		PM Peak Hour	
			Enter, Trips	Exit, Trips	Enter, Trips	Exit, Trips
I	76	515	7	34	33	16
II	80	797	9	37	36	19
III	60	422	6	28	27	13
IV	80	538	7	36	34	17
TOTAL	286	2,272	29	135	130	65

C. Other Projected Traffic

De facto traffic growth was taken at 4.5% per year, based upon the SDOT traffic counts at the Kahana Stream Bridge for the Honoapiilani Corridor (both Highway and Lower Road). Although the State's "Island-Wide Long-Range Highway Plan" for Maui projected a 7.5% per year increase in traffic for this area, because of the present recessionary times and delays in new development, the 4.5% growth pattern was utilized in projecting de facto traffic growth for the Years 1998, 2000 and 2002.

Projected traffic generated by the Kahana Subdivision, Honokowai Marketplace Development and Kaanapali Vacation Club projects were also included in the future traffic projections. Traffic projections for the Kahana Subdivision are based upon the 'Traffic Impact Assessment Report for ML&P NHLC Subdivision, dated July 26, 1991, prepared by Pacific Planning & Engineering, Inc. Traffic projections for the Honokowai Marketplace are based upon the TIAR for the Proposed Honokowai Commercial Development, dated May 22, 1992, prepared by The Traffic Management Consultant. Traffic projections for the Kaanapali Vacation Club are based upon the TIAR for the Kaanapali Vacation Club, dated January 1997, prepared by Austin Tsutsumi & Associates, Inc.

D. Trip Distribution

Since the driveway accessing Honoapiilani Highway would not be constructed until the Year 2000, Phase IV of the proposed project, traffic generated from Phase I with destinations to the south on Honoapiilani Highway would have to exit the property via Hanawai Street. With the completion of the driveway onto Honoapiilani Highway, it is estimated that 75% of the traffic with destinations to the south on Honoapiilani Highway would most likely exit the site via the new right-turn only driveway at Honoapiilani Highway; with the remainder via Hanawai Street. Traffic with destinations north of the site would exit the development via Hanawai Street and Napilihau Street. All traffic originating south of the development would have to utilize Napilihau Street and Hanawai Street in order to enter the development.

Traffic distribution is based, to a large extent, upon existing traffic patterns from the subdivision on the north side of Napilihau Street. These traffic patterns were used to distribute traffic from Napilihau Villages, using Hanawai Street, onto Napilihau Street, Honoapiilani Highway and Lower Honoapiilani Road. Professional judgment was also applied based upon employment centers in the West Maui area.

IV. FUTURE TRAFFIC IMPACTS

A. General

The following are the primary intersections impacted by the Napilihau Villages development:

- Napilihau Street/Honoapiilani Highway
- Napilihau Street/Hanawai Street
- Napilihau Street/Lower Honoapiilani Road
- New driveway to development/Honoapiilani Highway (restricted to right-turns-in and -out, only, constructed in Year 2000).

The intersections are analyzed for each of the target years of 1998, 2000 and 2002, base year (without the project), and with the project implemented per the phases identified earlier.

B. Roadway Improvements

SDOT is currently in the process of developing the plans for the Honoapiilani Highway widening. Plans call for widening Honoapiilani Highway to four lanes between Kaanapali Parkway to Honokowai Channel Bridge. Construction of the highway widening project is anticipated to begin in 1998 with completion estimated by the Year 2000. This improvement will eliminate the bottleneck at the intersection of Honoapiilani Highway and Kaanapali Parkway and would also facilitate traffic flow on Honoapiilani Highway.

The County of Maui is also in the process of developing the plans for Phase III of the Lower Honoapiilani Road improvements. The plans call for improving Lower Honoapiilani Road from the Mahinahina bridge to Kahana by constructing left-turn lanes where adequate right-of-way is available and constructing a sidewalk. A request for proposals, (RFP) for Phase IV of the Lower Honoapiilani Road Improvements from Kahana to Napilihau has been advertised for design.

C. Base Year Analysis Without the Project

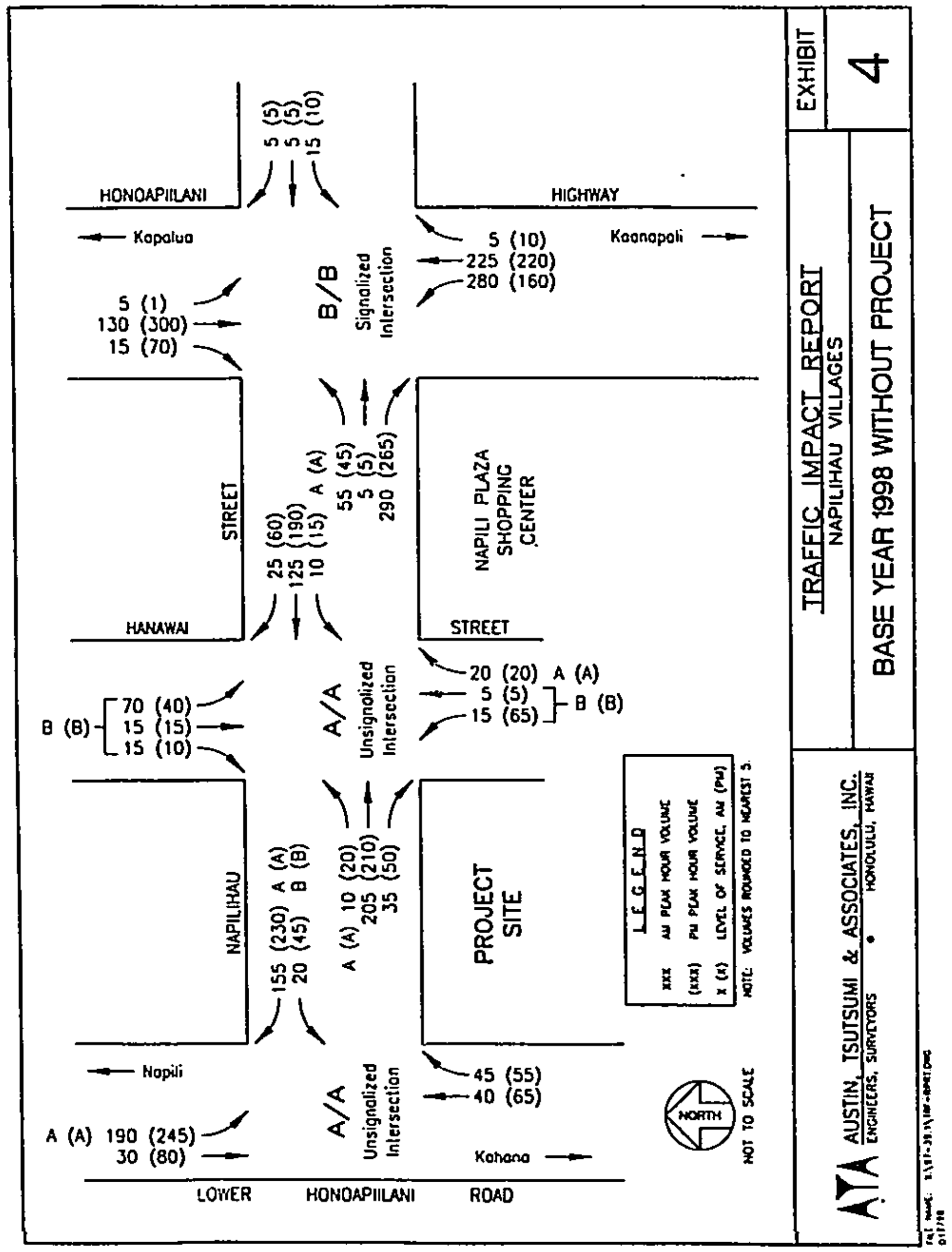
Table 3 summarizes the LOS analysis for the Base Years 1998, 2000, and 2002 without the project. The analysis assumes the traffic signal at Honoapiilani Highway and Napilihau Street has been constructed. However, the analysis assumes the improvements to Lower Honoapiilani Highway have not been implemented. The capacity analysis computations are appended in Appendix C.

1. Base Year 1998

The signalized intersection of Napilihau Street/Honoapiilani Highway and the unsignalized intersections of Napilihau Street/Hanawai Street and Napilihau Street/Lower Honoapiilani Road would continue to operate at acceptable LOS's during the AM and PM peak hours of traffic. Figure 4 shows the projected traffic volumes and LOS.

TABLE 3
BASE YEAR (WITHOUT PROJECT) LEVEL-OF-SERVICE SUMMARY

	Base Year 1998				Base Year 2000				Base Year 2002			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service
Honoapiilani Highway and Napilihau *Street - Signalized Intersection*												
Northbound Approach	10.5	B	9.2	B	10.4	B	9.3	B	10.3	B	9.2	B
Southbound Approach	10.7	B	10.0	B	11.3	B	10.2	B	11.9	B	11.3	B
Eastbound Approach	7.5	B	8.4	B	7.3	B	8.7	B	7.2	B	8.4	B
Westbound Approach	14.9	B	14.8	B	14.9	B	14.9	B	14.9	B	11.9	B
Overall Intersection	9.7	B	9.3	B	9.6	B	9.6	B	9.6	B	9.8	B
Napilihau Street and Hanawai Street - Unsignalized Intersection												
Northbound Approach												
Shared Left/Through	6.3	B	8.7	B	6.6	B	9.7	B	7.1	B	11.0	B
Right	3.5	A	3.6	A	3.6	A	3.7	A	3.7	A	3.7	A
Southbound Approach												
Shared Left/Through/Right	6.8	B	7.5	B	7.3	B	8.3	B	8.0	B	9.0	B
Eastbound Left Turn	2.5	A	2.9	A	2.5	A	2.9	A	2.6	A	3.0	A
Westbound Left Turn	2.8	A	2.9	A	2.9	A	3.0	A	2.9	A	3.1	A
Overall Intersection	1.7	A	1.8	A	1.7	A	2.1	A	1.9	A	2.3	A
Lower Honoapiilani Road and Napilihau Street - Unsignalized Intersection												
Southbound Left Turn	2.7	A	3.0	A	2.8	A	3.1	A	2.8	A	3.2	A
Westbound Approach												
Left Turn	6.1	B	8.6	B	6.5	B	9.4	B	6.9	B	10.5	C
Right Turn	3.3	A	3.7	A	3.4	A	3.9	A	3.4	A	4.0	A
Overall Intersection	2.4	A	2.7	A	2.4	A	2.9	A	2.5	A	3.1	A



2. **Base Year 2000**

The Napilihau Street/Honoapiilani Highway signalized intersection, the Napilihau Street/Hanawai Street unsignalized intersection and the Napilihau Street/Lower Honoapiilani Road unsignalized intersection would continue to operate satisfactorily in the Year 2000 without the proposed development. Figure 5 shows the projected traffic volumes and LOS.

3. **Base Year 2002**

Napilihau Street/Honoapiilani Highway, Napilihau Street/Hanawai Street and Napilihau Street/Lower Honoapiilani Road intersection would also continue to operate satisfactorily in the year 2002 without the proposed development. Figure 6 shows the projected traffic volumes and LOS.

D. **Cumulative Traffic Volumes With the Project**

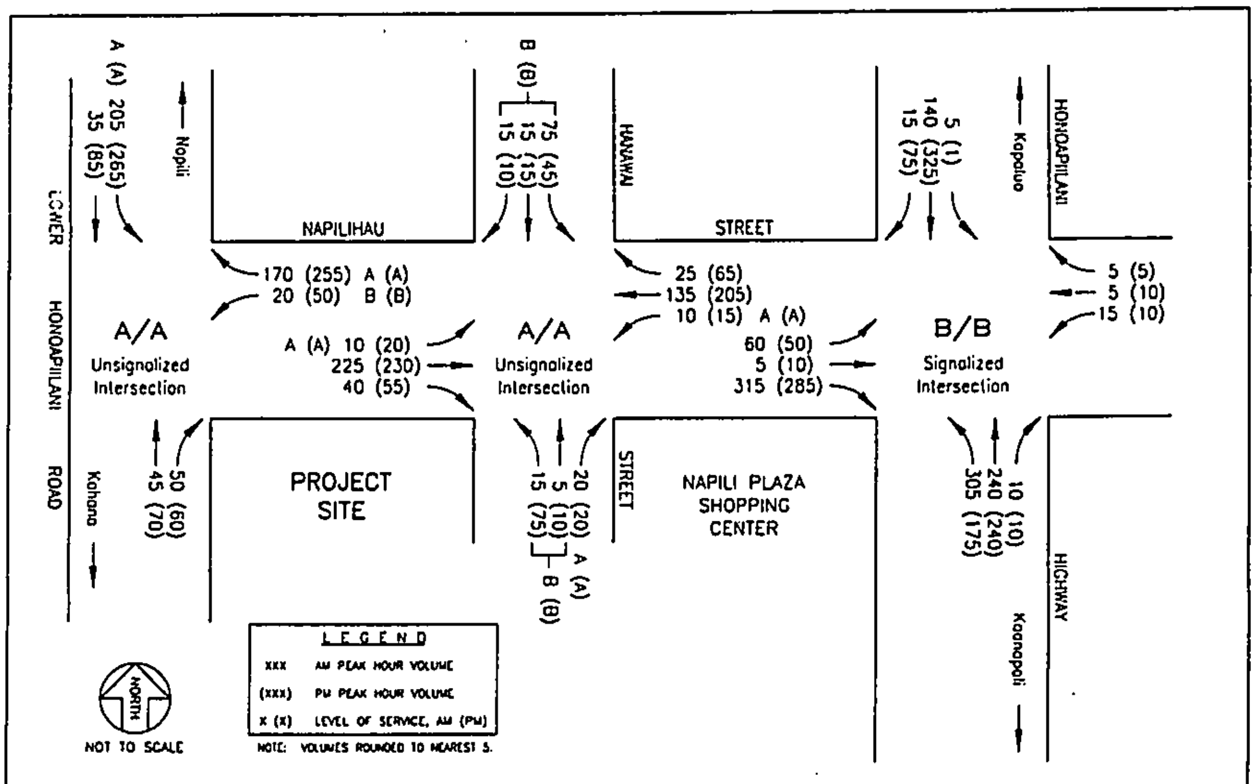
Table 4 summarizes the LOS analysis for the Years 1998, 2000, and 2002 with the proposed project. The capacity analysis computations are contained in Appendix C.

1. **Phase I – 1998**

Napilihau Street/Honoapiilani Highway intersection is estimated to operate satisfactorily as a signalized intersection experiencing minimal delays, LOS B, during both the AM peak and PM peak hours of traffic with Phase I of the proposed development.

The unsignalized intersections of Napilihau Street/Hanawai Street and Napilihau Street/Lower Honoapiilani Road would continue to operate satisfactorily, with traffic exiting Hanawai Street experiencing minimal delays, LOS B, during both AM and PM peak hours of traffic.

Figure 7 shows the projected traffic volumes and LOS.



TRAFFIC IMPACT REPORT
NAPILIHAU VILLAGES

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BASE YEAR 2000 WITHOUT PROJECT

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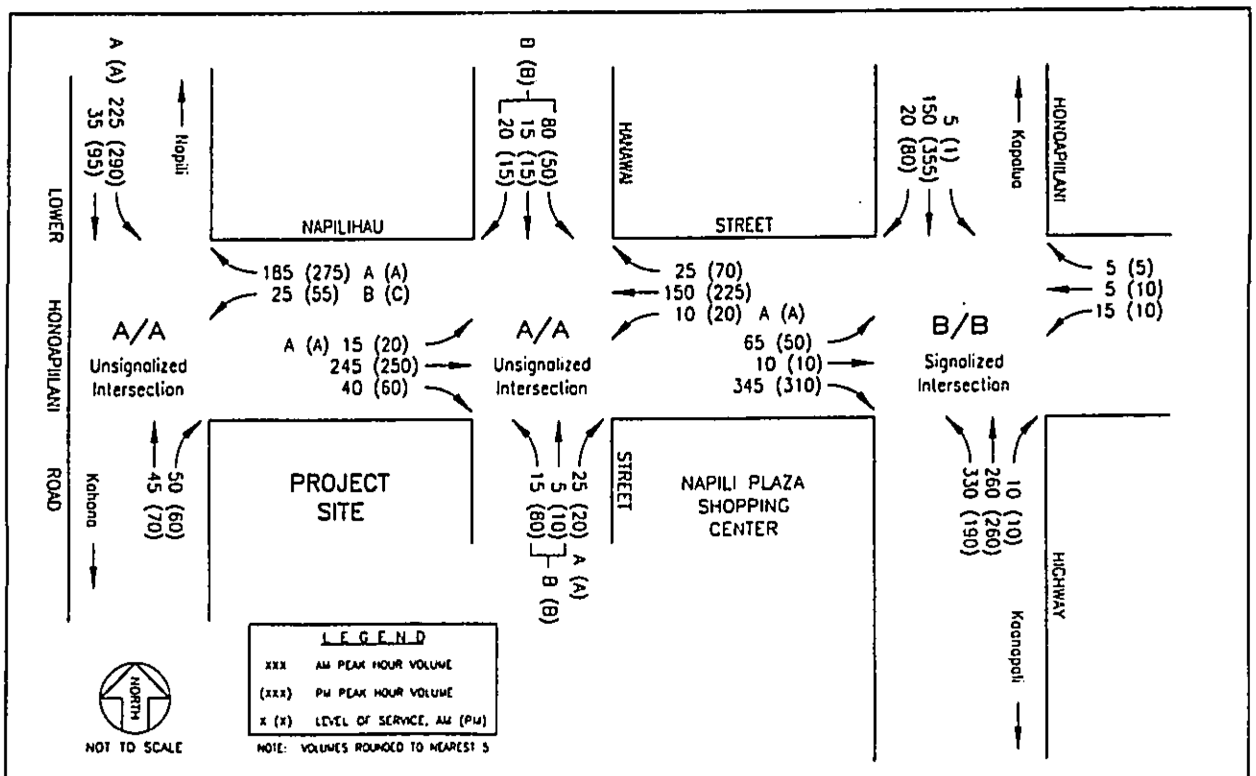

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NAPILIHAU VILLAGES

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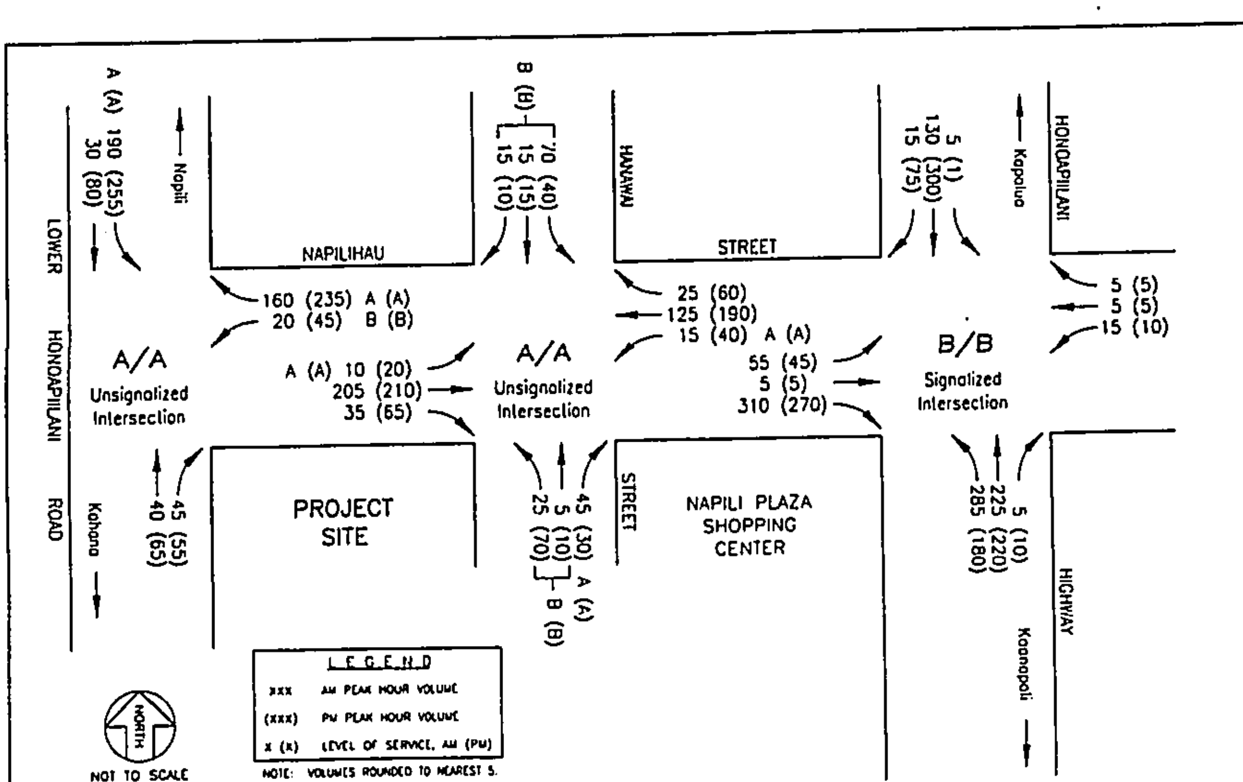
TABLE 4
WITH PROJECT LEVEL-OF-SERVICE SUMMARY

	Year 1998				Year 2000				Year 2002			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service
Honoapiilani Highway and Napilihau Street - Signalized Intersection												
Northbound Approach	10.7	B	9.3	B	10.8	B	9.7	B	11.6	B	10.2	B
Southbound Approach	10.7	B	10.6	B	11.2	B	11.5	B	11.3	B	11.9	B
Eastbound Approach	7.6	B	8.0	B	7.6	B	7.9	B	7.8	B	8.1	B
Westbound Approach	14.9	B	14.8	B	14.9	B	14.9	B	14.9	B	14.9	B
Overall Intersection	9.7	B	9.5	B	9.8	B	9.9	B	10.3	B	10.3	B
Napilihau Street and Hanawai Street Unsignalized Intersection												
Northbound Approach												
Shared Left/Through	6.6	B	9.6	B	7.5	B	12.9	C	8.3	B	16.3	C
Right	3.6	A	3.6	A	3.7	A	3.8	A	3.9	A	3.9	A
Southbound Approach												
Shared Left/Through/Right	7.2	B	8.3	B	8.1	B	10.3	C	8.6	B	12.0	C
Eastbound Left Turn	2.5	A	2.9	A	2.5	A	2.9	A	2.6	A	3.0	A
Westbound Left Turn	2.8	A	3.0	A	2.9	A	3.3	A	3.0	A	3.5	A
Overall Intersection	1.9	A	2.1	A	2.3	A	2.7	A	2.3	A	3.3	A
Lower Honoapiilani Road and Napilihau Street - Unsignalized Intersection												
Southbound Left Turn	2.7	A	3.0	A	2.8	A	3.2	A	2.9	A	3.3	A
Westbound Approach												
Left Turn	6.1	B	8.8	B	6.7	B	10.3	C	7.0	B	11.8	C
Right Turn	3.3	A	3.7	A	3.4	A	3.9	A	3.5	A	4.1	A
Overall Intersection	2.4	A	2.8	A	2.5	A	3.0	A	2.6	A	3.2	A
Honoapiilani Highway and New Driveway												
Eastbound Right Turn	N/A	N/A	N/A	N/A	5.0	B	5.7	B	5.5	B	6.2	B



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CORRECTION

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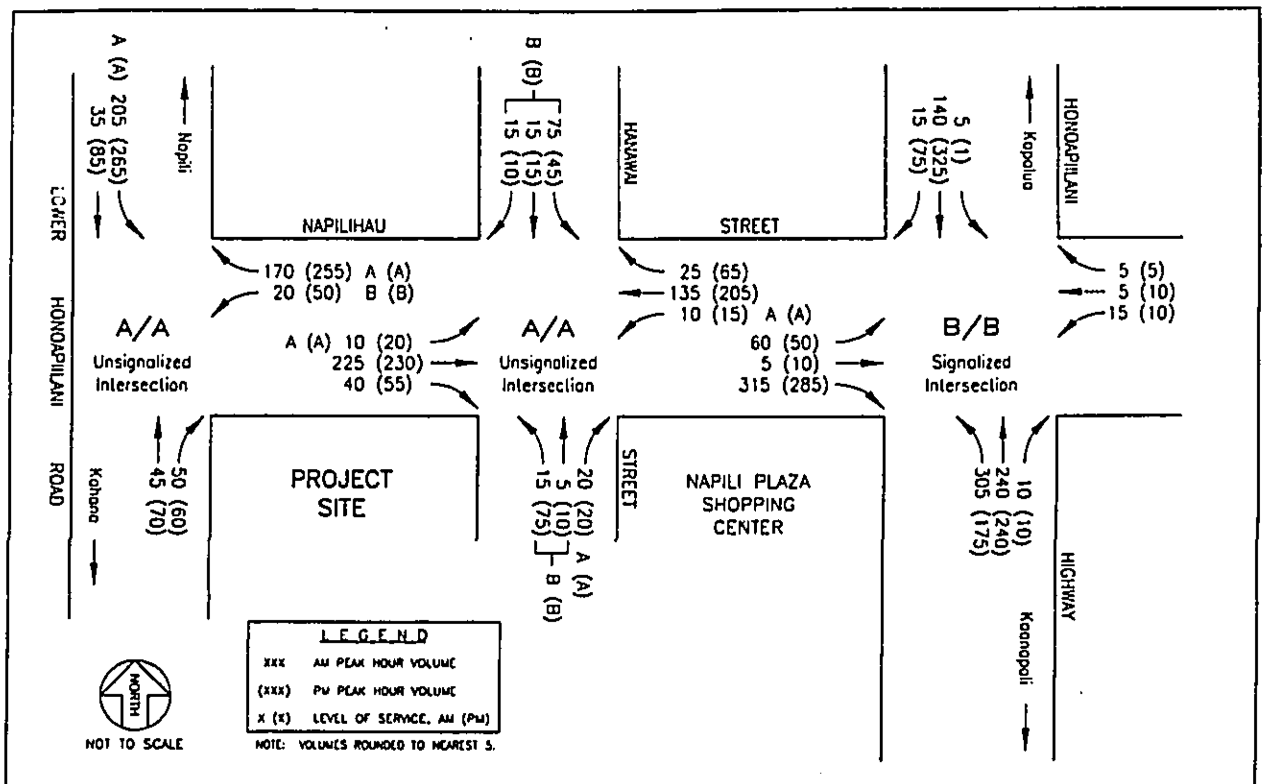

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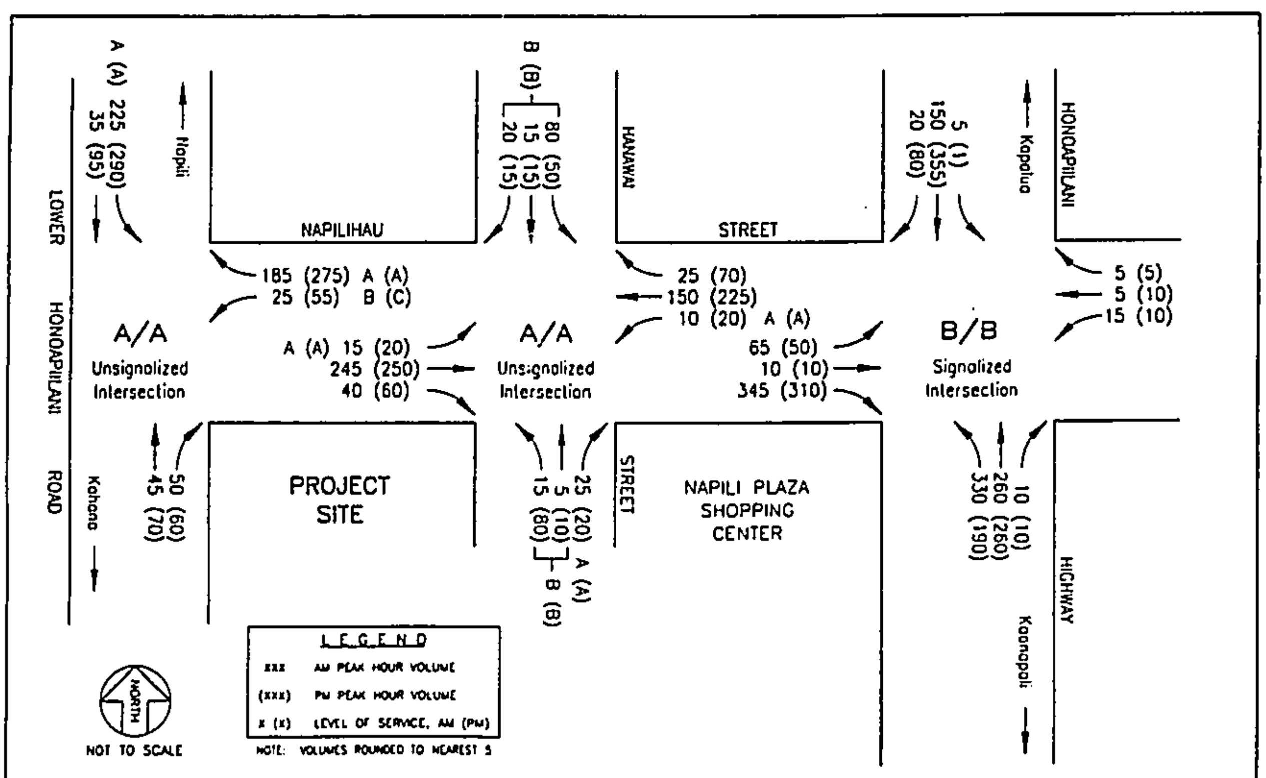

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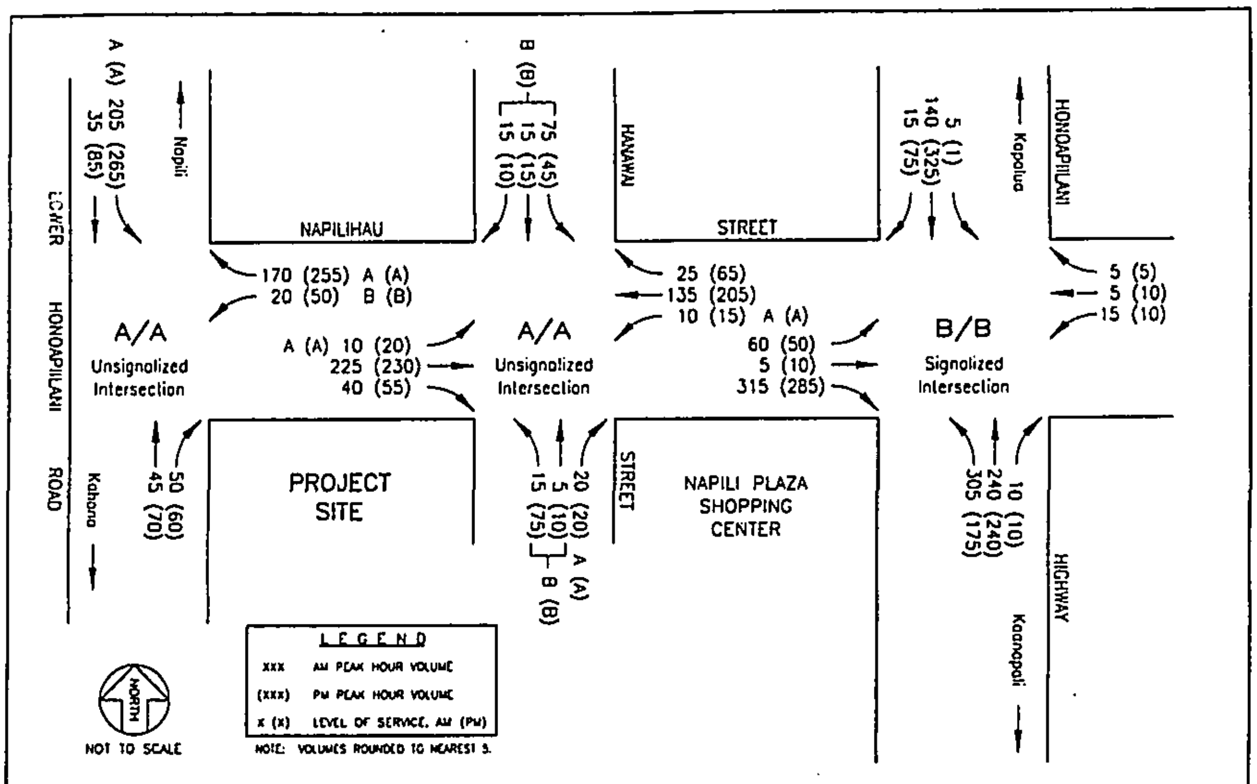

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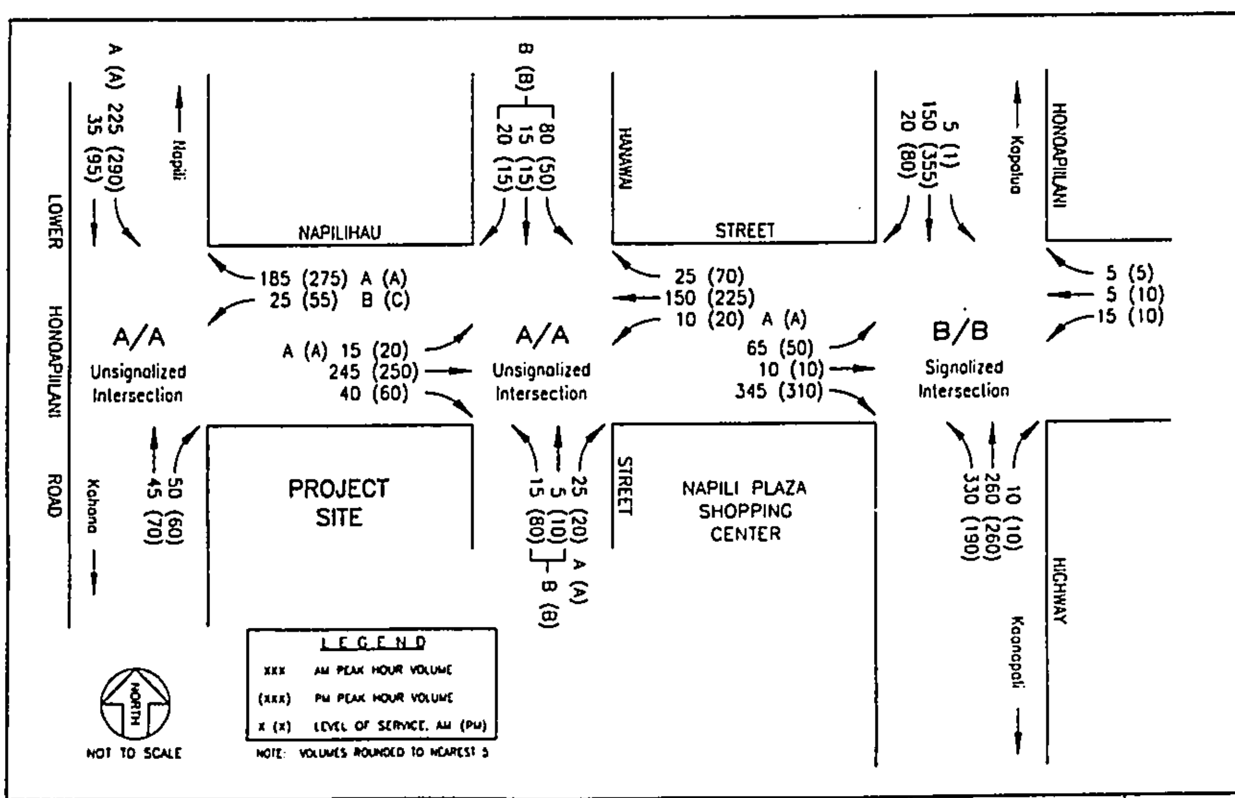

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NAPILIHAU VILLAGES

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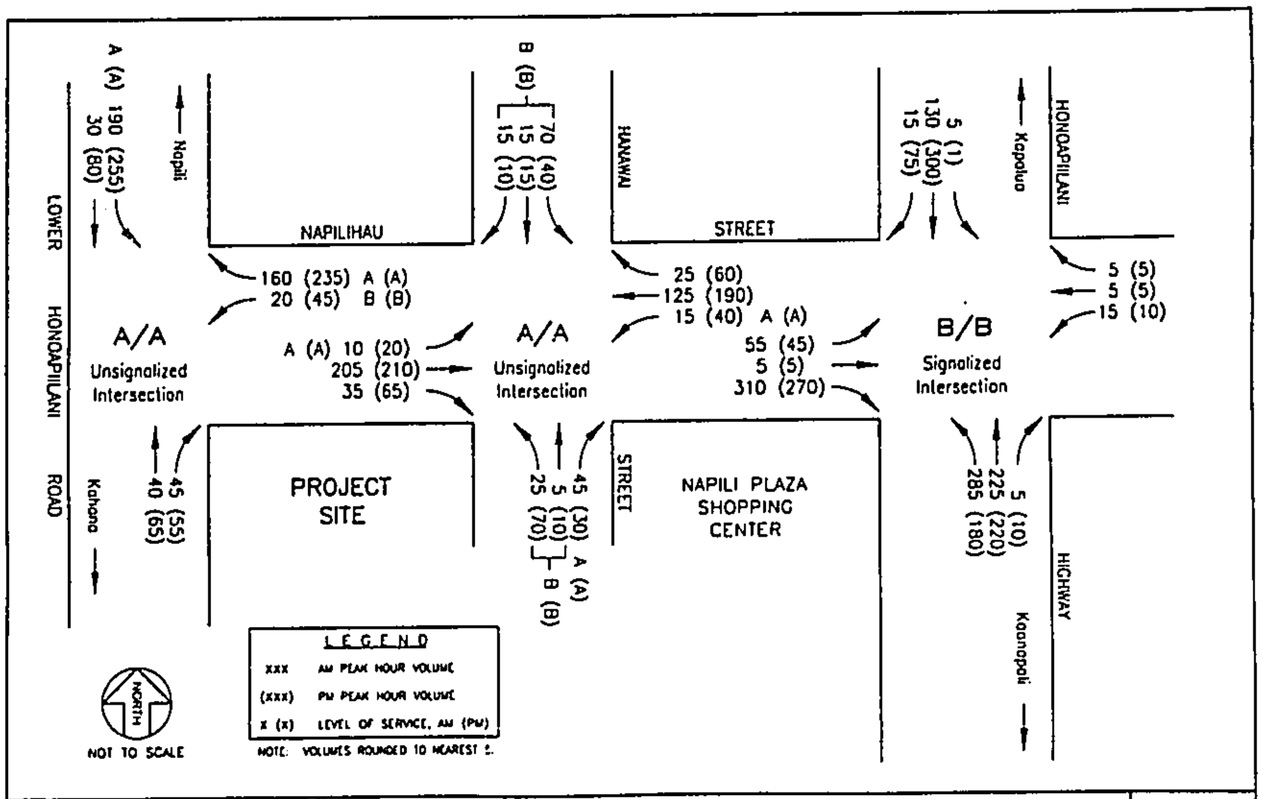
TABLE 4
WITH PROJECT LEVEL-OF-SERVICE SUMMARY

	Year 1998				Year 2000				Year 2002			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service	Delay (Seconds)	Level of Service
Honoapiilani Highway and Napilihau Street - Signalized Intersection												
Northbound Approach	10.7	B	9.3	B	10.8	B	9.7	B	11.6	B	10.2	B
Southbound Approach	10.7	B	10.6	B	11.2	B	11.5	B	11.3	B	11.9	B
Eastbound Approach	7.6	B	8.0	B	7.6	B	7.9	B	7.8	B	8.1	B
Westbound Approach	14.9	B	14.8	B	14.9	B	14.9	B	14.9	B	14.9	B
Overall Intersection	9.7	B	9.5	B	9.6	B	9.9	B	10.3	B	10.3	B
Napilihau Street and Hanawai Street Unsignalized Intersection												
Northbound Approach												
Shared Left/Through	6.6	B	9.6	B	7.5	B	12.9	C	8.3	B	16.3	C
Right	3.6	A	3.6	A	3.7	A	3.8	A	3.9	A	3.9	A
Southbound Approach												
Shared Left/Through/Right	7.2	B	8.3	B	8.1	B	10.3	C	8.6	B	12.0	C
Eastbound Left Turn	2.5	A	2.9	A	2.5	A	2.9	A	2.6	A	3.0	A
Westbound Left Turn	2.8	A	3.0	A	2.9	A	3.3	A	3.0	A	3.5	A
Overall Intersection	1.9	A	2.1	A	2.3	A	2.7	A	2.3	A	3.3	A
Lower Honoapiilani Road and Napilihau Street - Unsignalized Intersection												
Southbound Left Turn	2.7	A	3.0	A	2.8	A	3.2	A	2.9	A	3.3	A
Westbound Approach												
Left Turn	6.1	B	8.8	B	6.7	B	10.3	C	7.0	B	11.6	C
Right Turn	3.3	A	3.7	A	3.4	A	3.9	A	3.5	A	4.1	A
Overall Intersection	2.4	A	2.8	A	2.5	A	3.0	A	2.6	A	3.2	A
Honoapiilani Highway and New Driveway												
Eastbound Right Turn	N/A	N/A	N/A	N/A	5.0	B	5.7	B	5.5	B	6.2	B



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NAPILIHAU VILLAGES

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7

2. **Phases II and IV – 2000**

Napilihau Street/Honoapiilani Highway intersection is estimated to continue to operate satisfactorily as a signalized intersection experiencing minimal delays, LOS B, during both the AM peak and PM peak hours of traffic with Phase I, II and IV of the proposed development.

Analysis of the unsignalized intersection of Napilihau Street/Hanawai Street will continue to operate satisfactorily, with traffic exiting Hanawai Street experiencing a slight increase in delay, LOS C, during the PM peak hours of traffic.

Napilihau Street/Lower Honoapiilani Road intersection is estimated to operate satisfactorily as an unsignalized intersection, with left turns exiting Napilihau Street experiencing a slight increased delay, LOS C, during the PM peak hours of traffic.

The right-turn exit from the development at the new driveway with Honoapiilani Highway would operate with little or no delay to exiting traffic.

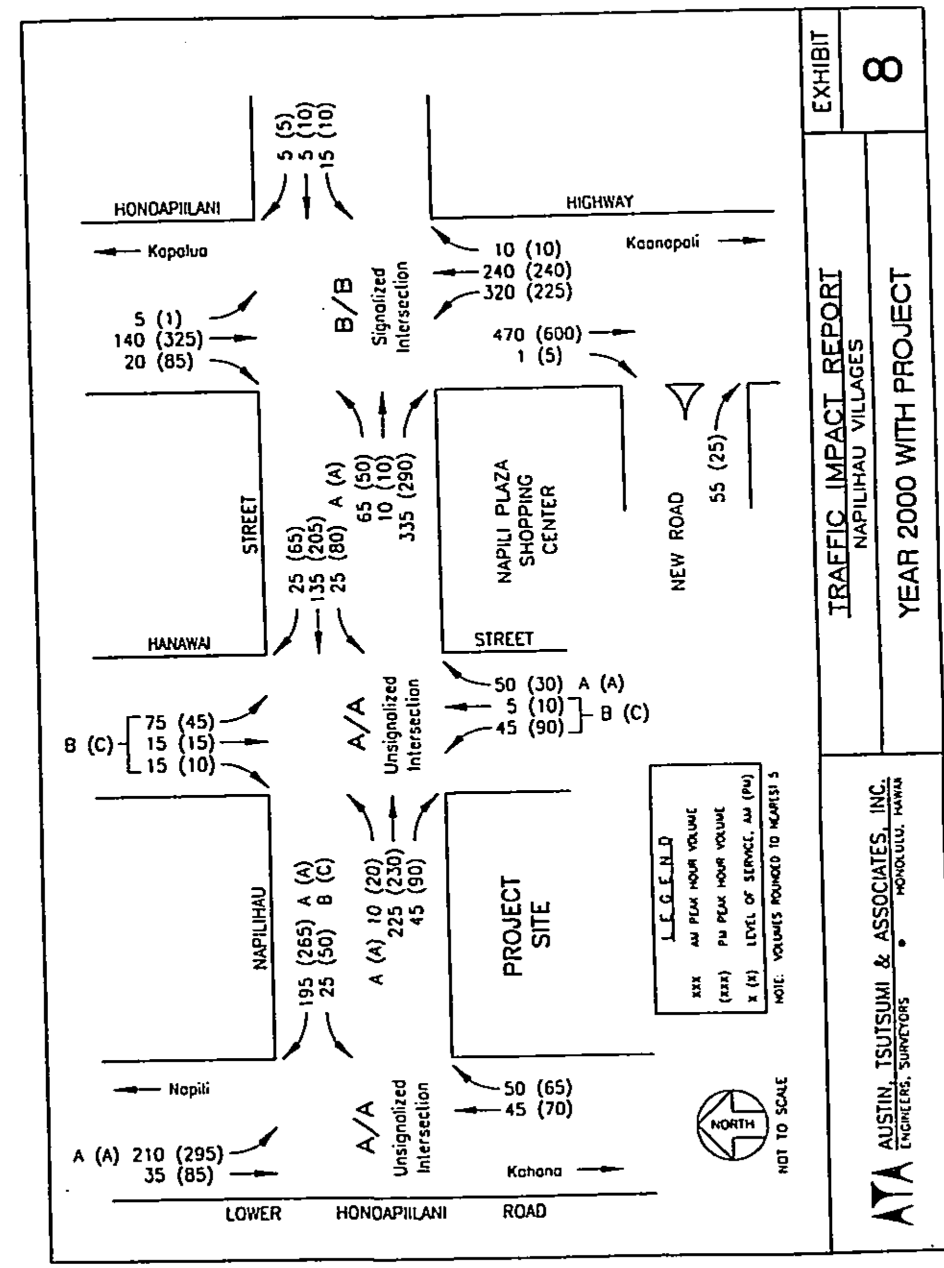
Figure 8 shows the projected traffic volumes and LOS.

3. **Phase III – 2002**

The signalized intersection of Napilihau Street/Honoapiilani Highway would continue to operate satisfactorily at LOS B during both the AM and PM peak hours of traffic with the buildout of the proposed development.

Napilihau Street/Hanawai Street intersection is estimated to operate satisfactorily with exiting traffic experiencing some delay at LOS C.

Analysis also indicates that the Napilihau Street/Lower Honoapiilani Road intersection will continue to operate satisfactorily with left-turn vehicles from Napilihau Street experiencing some delay at LOS C.



Traffic turning right out of the new driveway to Honoapiilani Highway would continue to operate satisfactorily.

Figure 9 shows the projected traffic volumes and LOS.

V. CONCLUSIONS

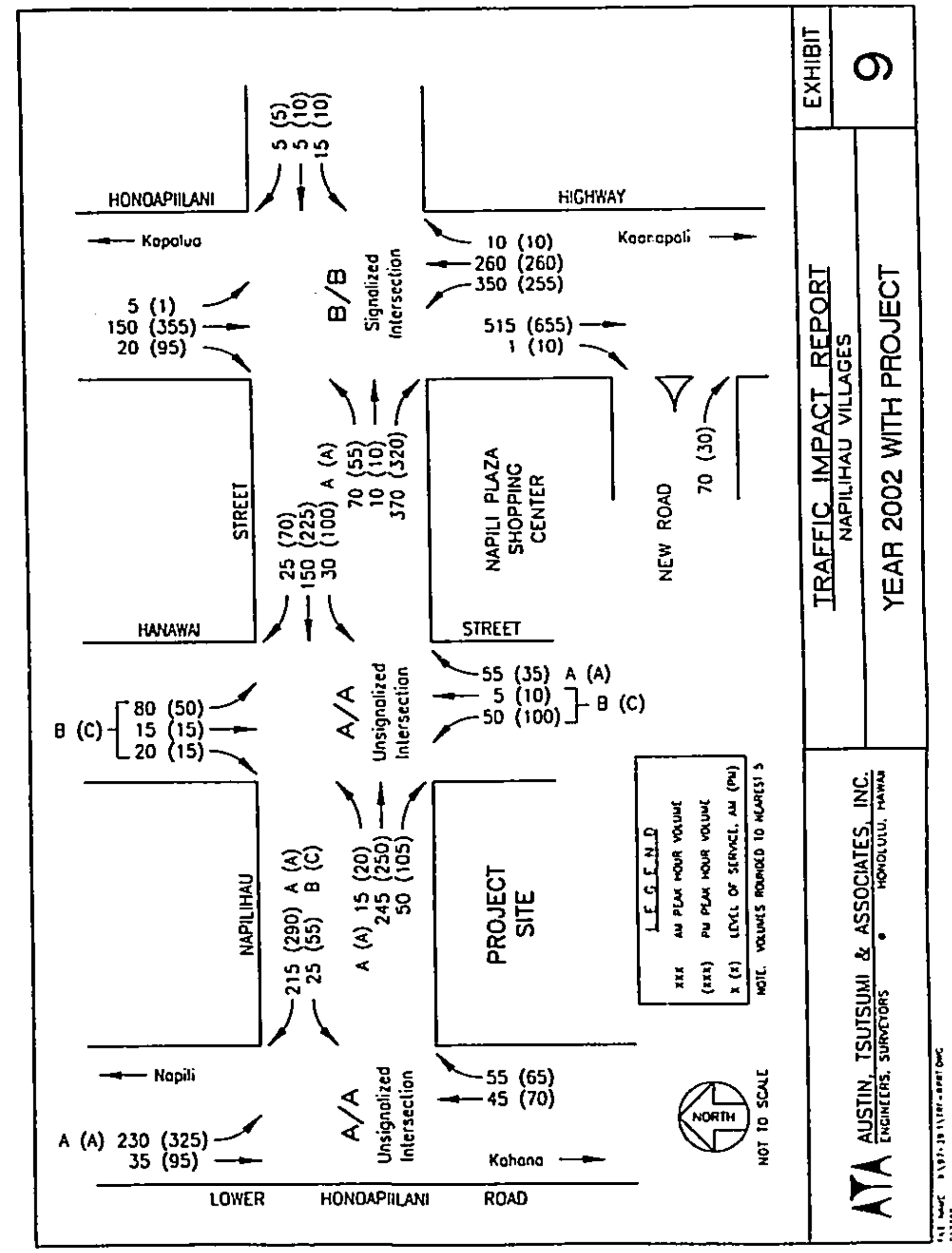
The following are the conclusions of this traffic study:

1. Review of the traffic signal warrants for the Honoapiilani Highway and Napilihau Street intersection indicate that the intersection currently meets the accident warrant from the MUTCD. A traffic signal system should be installed at this intersection.
2. The intersection of Lower Honoapiilani Road and Napilihau Street should be improved to provide a left-turn storage lane on Lower Honoapiilani Road. This improvement will be required some time in 2000 or early 2001 due to de facto growth in traffic demand.
3. Analysis indicates the roadways in the vicinity of the proposed development has adequate capacity to accommodate the additional traffic generated by the proposed project and will not adversely impact traffic operations.

VI. RECOMMENDATIONS

The following roadway improvements are recommended to accommodate existing and base year traffic demand due to de facto growth in population and not as a result of the proposed development.

1. Widening of Honoapiilani Highway to four lanes from Kaanapali Parkway to Honokowai Channel Bridge.
2. Installing a traffic signal system at the Honoapiilani Highway and Napilihau Street Intersection.
3. Improving the intersection of Lower Honoapiilani Road and Napilihau Street to provide a left-turn storage lane on Lower Honoapiilani Road to accommodate existing traffic conditions.



The following roadway improvements are recommended to accommodate the additional traffic generated by the proposed development:

1. The new driveway at Honoapiilani Highway be designed in accordance with State Department of Transportation requirements for acceleration and deceleration lanes and channelization to effect the turn restrictions.

2. The left-turn storage lane on northbound Honoapiilani Highway at Napilihau Street be extended provide to a minimum storage length of 250 feet which includes storage and deceleration.

REFERENCES

1. Institute of Transportation Engineers, Trip Generation, 6th Edition, 1997

2. Transportation Research Board, Highway Capacity Manual, Special Report 209, 1994.

3. State of Hawaii, Department of Transportation, Final Report, Maui Long-Range Land Transportation Plan, February 1997.

4. Pacific Planning & Engineering, Inc., Traffic Impact Assessment Report for ML&P NHLC Subdivision, July 26, 1991.

5. The Traffic Management Consultant, Traffic Impact Analysis Report for the Proposed Honokowai Commercial Development, TMK: 4-4-1:02, 11 & 12, May 22, 1992.

APPENDICES

APPENDIX A

TRAFFIC COUNT DATA

ATA INC 1/26/98

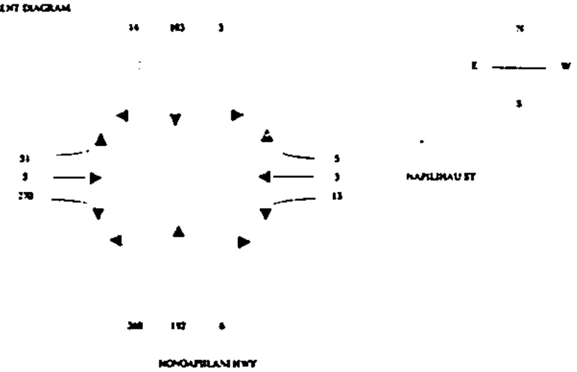
INTERSECTION COUNT SURVEY SUMMARY

North/South Street : HONOAPIILANI HWY
East/West Street : NAPILIHAU ST
Weather : CLEAR

Period AM
Date 3/15/97
Day TUES

15 MINUTE PERIOD	HONOAPIILANI HWY NORTHBOUND LEFT	THRU	RGHT	SOUTHBOUND LEFT	THRU	RGHT	NAPILIHAU ST EASTBOUND LEFT	THRU	RGHT	WESTBOUND LEFT	THRU	RGHT	TOTAL VOLUME 15 MIN	HOURLY
630 - 645	56	49	2	1	14	6	11	0	43	3	0	2	213	
645 - 700	63	39	4	0	23	5	17	0	64	4	1	1	238	
700 - 715	66	52	2	3	36	5	9	1	76	3	0	0	253	
715 - 730	68	39	0	0	22	3	14	1	68	4	0	2	221	925
730 - 745	63	42	0	0	22	1	11	3	65	2	2	2	213	925
745 - 800	35	27	2	0	21	13	7	1	49	5	0	0	179	866
800 - 815	64	32	1	0	27	4	14	0	40	2	0	0	204	817
815 - 830	63	31	0	1	29	3	9	3	39	5	1	3	207	803
PEAK 15 MINUTE PERIOD 700 - 715	66	52	2	3	36	3	9	1	76	3	0	0	253	–
PEAK HOUR PERIOD 645 - 745	260	172	6	3	103	14	31	5	270	13	3	5	–	925
PEAK HOUR FACTOR 645 - 745	0.96	0.81	0.38	0.25	0.72	0.70	0.75	0.42	0.89	0.81	0.38	0.63		
		0.91			0.66			0.93			0.86			

PEAK HOUR TURNING MOVEMENT DIAGRAM



ATA INC

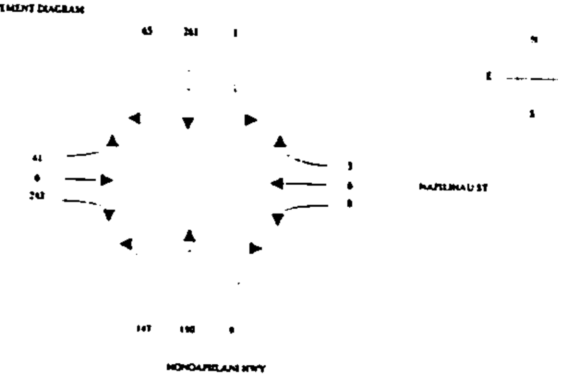
INTERSECTION COUNT SURVEY SUMMARY

North/South Street : HONOAPIILANI HWY
East/West Street : NAPILIHAU ST
Weather : CLEAR

Period PM
Date 3/15/97
Day TUES

15 MINUTE PERIOD	HONOAPIILANI HWY NORTHBOUND LEFT	THRU	RGHT	SOUTHBOUND LEFT	THRU	RGHT	NAPILIHAU ST EASTBOUND LEFT	THRU	RGHT	WESTBOUND LEFT	THRU	RGHT	TOTAL VOLUME 15 MIN	HOURLY
1530 - 1545	32	41	0	0	32	24	8	2	53	3	4	0	219	
1545 - 1600	40	39	4	0	33	15	5	1	62	5	1	0	221	
1600 - 1615	17	29	1	0	93	10	8	0	44	3	3	3	215	
1615 - 1630	44	57	4	1	39	8	15	0	82	2	1	0	233	910
1630 - 1645	32	45	3	0	81	26	13	3	52	2	2	0	239	956
1645 - 1700	34	43	1	0	48	15	3	3	64	1	0	0	232	979
1700 - 1715	31	41	3	0	38	10	3	0	50	1	1	1	202	966
1715 - 1730	32	34	3	0	54	13	2	2	39	1	1	0	182	895
PEAK 15 MINUTE PERIOD 1630 - 1645	32	45	3	0	81	26	13	3	52	2	2	0	239	–
PEAK HOUR PERIOD 1600 - 1700	147	190	9	1	261	65	41	6	242	8	6	3	–	979
PEAK HOUR FACTOR 1600 - 1700	0.66	0.78	0.56	0.25	0.70	0.63	0.66	0.50	0.74	0.67	0.50	0.25		
		0.73			0.75			0.74			0.67			

PEAK HOUR TURNING MOVEMENT DIAGRAM



AUSTIN, TSUTSUMI & ASSOCIATES
501 SUMNER ST. SUITE 521
HONOLULU, HI. 96817
(808) 533-3646

Weather :
Counted by: Alika S.
Board # : 5
Other :

Study Name: NSHA-AM
Site Code : 00346780
Start Date: 01/15/98
Page : 1

Vehicle group 1

Start Time	From North Left	Thru	Right	Other	Napilihau Street From East Left	Thru	Right	Other	Hanawai Street From South Left	Thru	Right	Other	From West Left	Thru	Right	Other	Intvl. Total
01/15/98																	
06:45	11	4	4	1	1	28	12	0	0	4	1	0	6	55	9	0	136
Hour	11	4	4	1	1	28	12	0	0	4	1	0	6	55	9	0	136
07:00	19	2	2	0	1	27	1	0	4	0	8	0	2	45	6	0	117
07:15	26	3	0	0	2	26	3	0	5	0	4	0	0	48	7	0	124
07:30	8	3	8	0	4	38	5	0	4	0	5	0	2	47	11	0	135
07:45	5	2	4	0	3	35	7	0	4	0	2	0	4	32	4	0	102
Hour	58	10	14	0	10	126	16	0	17	0	19	0	8	172	28	0	478
08:00	7	0	1	0	2	32	7	0	5	1	3	0	1	29	10	0	98
08:15	11	1	1	0	2	30	4	0	5	3	2	0	6	41	9	0	115
08:30	6	1	0	0	5	29	8	0	14	0	6	0	2	35	9	0	115
Total	93	16	20	1	20	245	47	0	41	8	31	0	23	332	65	0	942
% Apr.	71.5	12.3	15.3	0.7	6.4	78.5	15.0	-	51.2	10.0	38.7	-	5.4	79.0	15.4	-	.
% Int.	9.8	1.6	2.1	0.1	2.1	26.0	4.9	-	4.3	0.6	3.2	-	2.4	35.2	6.9	-	.

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501 SUMNER ST. SUITE 521
HONOLULU, HI. 96817
(808) 533-3646

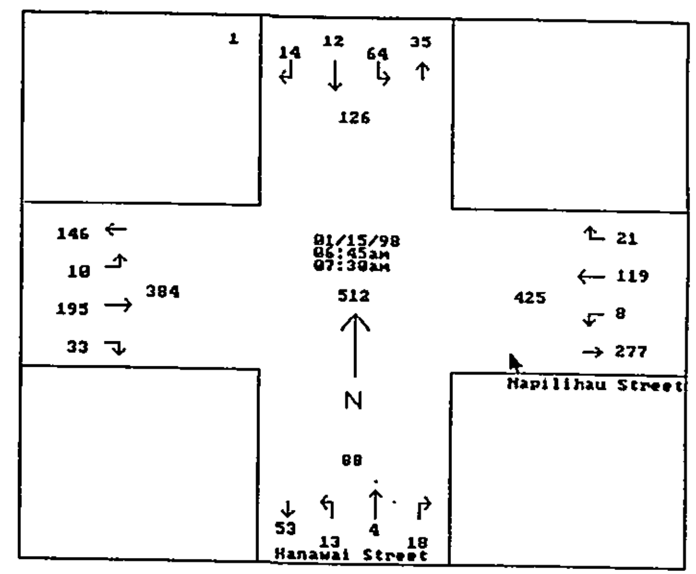
Weather :
Counted by: Alika S.
Board # : 5
Other :

Study Name: NSHA-AM
Site Code : 00346780
Start Date: 01/15/98
Page : 2

Vehicle group 1

Peak Hour Analysis By Entire Intersection for the Period: 06:45 on 01/15/98 to 07:45 on 01/15/98

Start Time	From North Left	Thru	Right	Other	Napilihau Street From East Left	Thru	Right	Other	Hanawai Street From South Left	Thru	Right	Other	From West Left	Thru	Right	Other	Intvl. Total
Time	06:45				06:45				06:45				06:45				
Vol.	64	12	14	1	8	119	21	0	13	4	18	0	10	195	33	0	
Pct.	70.3	13.1	15.3	1.0	5.4	80.4	14.1	0.0	37.1	11.4	51.4	0.0	4.2	81.9	13.8	0.0	
Total	91				148				35				238				
High	07:15				07:30				07:00				06:45				
Vol.	26	3	0	0	4	38	5	0	4	0	8	0	6	55	9	0	
Total	29				47				12				70				
PHF	0.784				0.787				0.729				0.850				



AUSTIN, TSUTSUMI & ASSOCIATES
501 SUMNER ST. SUITE 521
HONOLULU, HI, 96817
(808) 533-3646

Weather :
Counted by: Molly Y
Board # : 5
Other :

Study Name: NSHS-PM
Site Code : 00000005
Start Date: 01/15/98
Page : 1

Vehicle group 1

Start Time	From North Left	Thru	Right	Other	Napilihau Street From East Left	Thru	Right	Other	Hanawai Street From South Left	Thru	Right	Other	From West Left	Thru	Right	Other	Intvl. Total
01/15/98																	
15:00	5	1	3	0	3	42	14	0	19	3	4	0	8	59	12	0	173
15:15	8	1	1	0	4	43	7	0	8	2	6	0	4	38	9	0	131
15:30	8	1	4	0	5	38	17	0	16	0	4	0	2	41	18	0	154
15:45	15	3	7	0	2	54	9	0	16	0	2	0	1	37	7	0	153
Hour	36	6	15	0	14	177	47	0	59	5	16	0	15	175	46	0	611
16:00	9	3	2	0	4	36	18	0	15	0	6	0	9	55	15	0	172
16:15	8	3	1	0	3	48	16	0	15	3	2	0	0	52	13	0	164
16:30	7	3	0	0	5	42	12	0	17	3	6	0	6	56	14	0	171
16:45	9	2	4	0	5	40	6	0	20	2	2	0	1	38	16	0	145
Hour	33	11	7	0	17	166	52	0	67	8	16	0	16	201	58	0	652
Total	69	17	22	0	31	343	99	0	126	13	32	0	31	376	104	0	1263
% Apr.	63.8	15.7	20.3	-	6.5	72.5	20.9	-	73.6	7.6	18.7	-	6.0	73.5	20.3	-	-
% Int.	5.4	1.3	1.7	-	2.4	27.1	7.8	-	9.9	1.0	2.5	-	2.4	29.7	8.2	-	-

AUSTIN, TSUTSUMI & ASSOCIATES
501 SUMNER ST. SUITE 521
HONOLULU, HI, 96817
(808) 533-3646

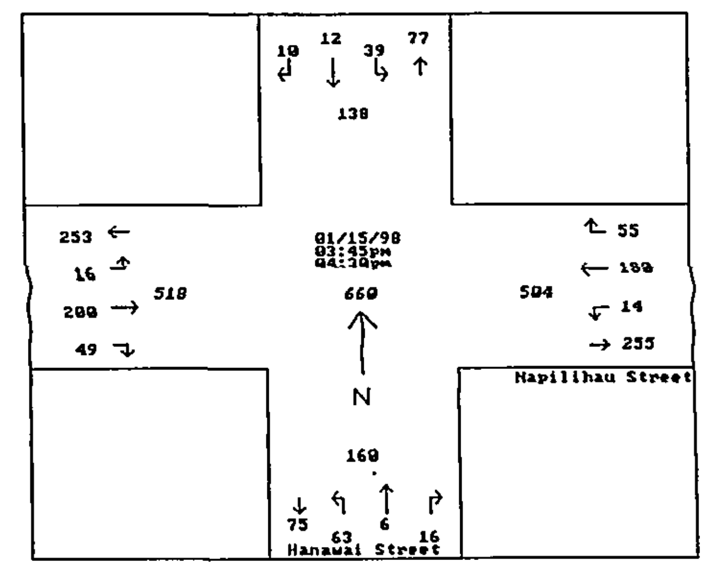
Weather :
Counted by: Molly Y
Board # : 5
Other :

Study Name: NSHS-PM
Site Code : 00000005
Start Date: 01/15/98
Page : 2

Vehicle group 1

Peak Hour Analysis By Entire Intersection for the Period: 15:45 on 01/15/98 to 16:45 on 01/15/98

Start Time	From North Left	Thru	Right	Other	Napilihau Street From East Left	Thru	Right	Other	Hanawai Street From South Left	Thru	Right	Other	From West Left	Thru	Right	Other	Intvl. Total
Time	15:45				15:45				15:45				15:45				
Vol.	39	12	10	0	14	180	55	0	63	6	16	0	16	200	49	0	
Pct.	63.9	19.6	16.3	0.0	5.6	72.2	22.0	0.0	74.1	7.0	18.8	0.0	6.0	75.4	18.4	0.0	
Total	61				249				85				265				
High	15:45				16:15				16:30				16:00				
Vol.	15	3	7	0	3	48	16	0	17	3	6	0	9	55	15	0	
Total	25				67				26				79				
PHF	0.610				0.929				0.817				0.838				



Weather :
Counted by: Carmela N.
Board # : 6
Other :

AUSTIN, TSUTSUMI & ASSOCIATES
501 SUMNER ST. SUITE 521
HONOLULU, HI. 96817
(808) 533-3646

Study Name: NSLH-AM
Site Code : 00000006
Start Date: 01/15/98
Page : 1

Vehicle group 1

Start Time	From North Left	From North Thru	From North Other	Napilihau St From East Left	Napilihau St From East Right	Napilihau St From East Other	Lower Honoapiilani Roa From South Thru	Lower Honoapiilani Roa From South Right	Lower Honoapiilani Roa From South Other	Intrvl. Total
01/15/98										
06:45	33	1	0	2	29	0	4	9	0	78
Hour	33	1	0	2	29	0	4	9	0	78
07:00	49	6	0	4	26	0	9	6	0	100
07:15	52	4	0	4	36	0	11	14	0	121
07:30	43	8	0	4	37	0	4	11	0	107
07:45	35	11	0	6	48	0	14	12	0	126
Hour	179	29	0	18	147	0	38	43	0	454
08:00	32	10	0	5	27	0	10	10	0	94
08:15	33	7	0	3	24	0	7	9	0	83
08:30	38	15	0	14	34	0	13	16	0	130
Total	315	62	0	42	261	0	72	87	0	839
% Apr.	83.5	16.4	-	13.8	86.1	-	45.2	54.7	-	.
% Int.	37.5	7.3	-	5.0	31.1	-	8.5	10.3	-	.

Weather :
Counted by: Carmela N.
Board # : 6
Other :

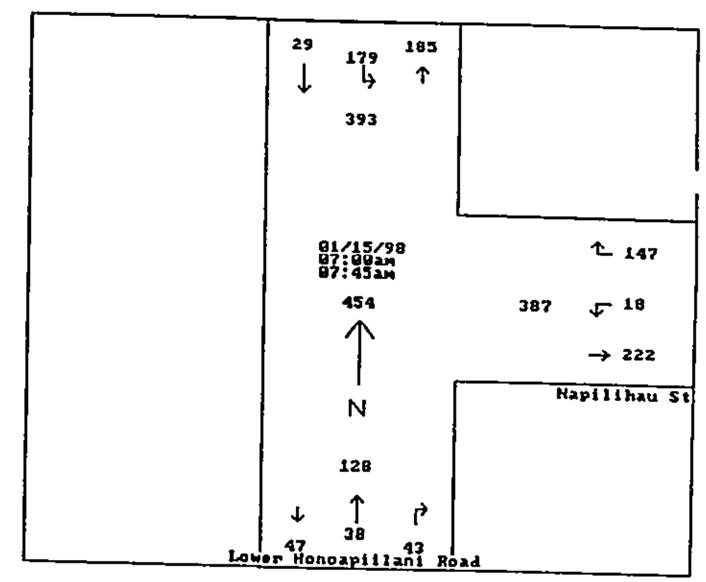
AUSTIN, TSUTSUMI & ASSOCIATES
501 SUMNER ST. SUITE 521
HONOLULU, HI. 96817
(808) 533-3646

Study Name: NSLH-AM
Site Code : 00000006
Start Date: 01/15/98
Page : 2

Vehicle group 1

Peak Hour Analysis By Entire Intersection for the Period: 07:00 on 01/15/98 to 08:00 on 01/15/98

Start Time	From North Left	From North Thru	From North Other	Napilihau St From East Left	Napilihau St From East Right	Napilihau St From East Other	Lower Honoapiilani Roa From South Thru	Lower Honoapiilani Roa From South Right	Lower Honoapiilani Roa From South Other	Intrvl. Total
Time	07:00			07:00			07:00			
Vol.	179	29	0	18	147	0	38	43	0	
Pct.	86.0	13.9	0.0	10.9	89.0	0.0	46.9	53.0	0.0	
Total	208			165			81			
High	07:15			07:45			07:45			
Vol.	52	4	0	6	48	0	14	12	0	
Total	56			54			26			
PHF	0.928			0.763			0.778			



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501 SUMNER ST. SUITE 521
HONOLULU, HI. 96817
(808) 533-3646

Weather :
Counted by: Melvin Y.
Board # : 6
Other :

Study Name: NSLH-PM
Site Code : 00000006
Start Date: 01/15/98
Page : 1

Vehicle group 1

Start Time	From North Left	From North Thru	From North Other	Napilihau St From East Left	Napilihau St From East Right	Napilihau St From East Other	Lower Honoapiilani Roa From South Thru	Lower Honoapiilani Roa From South Right	Lower Honoapiilani Roa From South Other	Intrvl. Total
01/15/98										
15:00	70	23	0	13	63	0	17	9	0	195
15:15	45	15	0	12	44	0	18	12	0	146
15:30	50	22	0	15	45	0	13	15	0	160
15:45	42	24	0	19	56	0	13	9	0	163
Hour	207	84	0	59	208	0	61	45	0	664
16:00	70	17	0	7	54	0	13	13	0	174
16:15	59	19	0	6	62	0	14	11	0	171
16:30	62	15	0	10	49	0	21	19	0	176
16:45	46	9	0	18	53	0	13	14	0	153
Hour	237	60	0	41	218	0	61	57	0	674
Total	444	144	0	100	426	0	122	102	0	1338
% Apr.	75.5	24.4	-	19.0	80.9	-	54.4	45.5	-	-
% Int.	33.1	10.7	-	7.4	31.8	-	9.1	7.6	-	-

AUSTIN, TSUTSUMI & ASSOCIATES
501 SUMNER ST. SUITE 521
HONOLULU, HI. 96817
(808) 533-3646

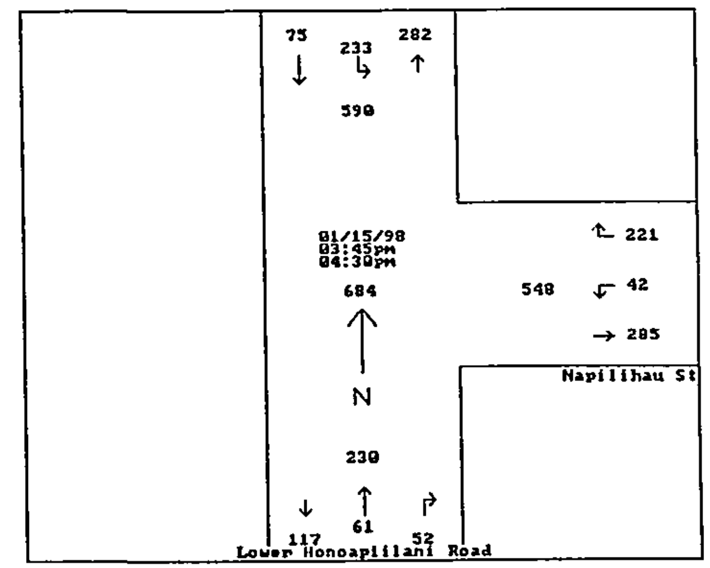
Weather :
Counted by: Melvin Y.
Board # : 6
Other :

Study Name: NSLH-PM
Site Code : 00000006
Start Date: 01/15/98
Page : 2

Vehicle group 1

Peak Hour Analysis By Entire Intersection for the Period: 15:30 on 01/15/98 to 16:30 on 01/15/98

Start Time	From North Left	From North Thru	From North Other	Napilihau St From East Left	Napilihau St From East Right	Napilihau St From East Other	Lower Honoapiilani Roa From South Thru	Lower Honoapiilani Roa From South Right	Lower Honoapiilani Roa From South Other	Intrvl. Total
Time	15:45			15:45			15:45			
Vol.	233	75	0	42	221	0	61	52	0	
Pct.	75.6	24.3	0.0	15.9	84.0	0.0	53.9	46.0	0.0	
Total	308			263			113			
High	16:00			15:45			16:30			
Vol.	70	17	0	19	56	0	21	19	0	
Total	87			75			40			
PHF	0.885			0.876			0.706			



APPENDIX B

LEVEL OF SERVICE DEFINITIONS

LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Level of Service for unsignalized intersections is defined in terms of delay. Delay is a measure of driver discomfort, frustration, fuel consumption and lost travel time. Specifically, level-of-service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. The Levels of Service criteria are shown in the following table:

Level-of-Service Criteria
for Unsignalized Intersections

Stopped Delay for Vehicle (Seconds)	Level of Service	Expected Delay to Minor Street Traffic
≤ 5.0	A	Little or no delay
5.1 to 10.0	B	Short traffic delays
10.1 to 20.0	C	Average traffic delays
20.1 to 30.0	D	Long traffic delays
30.1 to 45.0	E	Very long traffic delays
> 45.0	F	Extreme traffic delays

LEVEL OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

Level of Service for signalized intersections is defined in terms of delay. Delay is a measure of driver discomfort, frustration, fuel consumption and lost travel time. Specifically, level-of-service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. The Levels of Service criteria are shown in the following table:

Level-of-Service Criteria
for Unsignalized Intersections

Level of Service	Stopped Delay for Vehicle (Seconds)
A	≤ 5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	> 60.0

Delay is a complex measure, and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group or approach in question

Level-of-Service A describes operations with very low delay, i.e., less than 5.0 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

Level-of-Service B describes operations with delay in the range of 5.1 to 15.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.

Level-of-Service C describes operations with delay in the range of 15.1 to 25.0 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

Level-of-Service D describes operations with delay in the range of 25.1 to 40.0 seconds per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failure are noticeable.

Level-of-Service E describes operations with delay in the range of 40.1 to 60.0 seconds per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths and high v/c ratios. Individual cycle failure are frequent occurrences.

Level-of-Service F describes operations with delay in excess of 60.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contribution causes to such delay levels.

APPENDIX C

LOS CALCULATIONS

```
HCS: Unsignalized Intersections    Release 2.1e     HHNS-A.HCO      Page 1
===========================================================================
Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL   32611-2083
Ph: (904) 392-0378
===========================================================================
Streets: (N-S) Honoapiilani Hwy                   (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information.........      Existing Traffic Conditions AM Peak Hou
                                r
Two-way Stop-controlled Intersection
===========================================================================
           |  Northbound   |  Southbound   |   Eastbound   |   Westbound
           |  L    T    R  |  L    T    R  |  L    T    R  |  L    T    R
           | ---- ---- ----| ---- ---- ----| ---- ---- ----| ---- ---- ----
No. Lanes  |  1    1  < 0  |  1    1    1  |  0  > 1    1  |  0  > 1  < 0
Stop/Yield |             N |             N |               |
Volumes    | 260  195    5 |   5  105   15 |  50    5  270 |  15    5    5
PHF        | .95  .95  .95 | .95  .95  .95 | .95  .95  .95 | .95  .95  .95
Grade      |       0       |       0       |       0       |       0
MC's (%)   |               |               |               |
SU/RV's (%)|               |               |               |
CV's (%)   |               |               |               |
PCE's      |1.10           |1.10           |1.10 1.10 1.10 |1.10 1.10 1.10
---------------------------------------------------------------------------


                          Adjustment Factors

Vehicle                             Critical         Follow-up
Maneuver                            Gap (tg)         Time (tf)
-------------------------------------------------------------------
Left Turn Major Road                  5.00              2.10
Right Turn Minor Road                 5.50              2.60
Through Traffic Minor Road            6.00              3.30
Left Turn Minor Road                  6.50              3.40
```

```
HCS: Unsignalized Intersections    Release 2.1e     HHNS-A.HCO      Page 2
===========================================================================

                 Worksheet for TWSC Intersection
-------------------------------------------------------------
Step 1: RT from Minor Street              WB            EB
-------------------------------------------------------------
Conflicting Flows: (vph)                  208           111
Potential Capacity: (pcph)               1086          1216
Movement Capacity: (pcph)                1086          1216
Prob. of Queue-Free State:               0.99          0.74
-------------------------------------------------------------
Step 2: LT from Major Street              SB            NB
-------------------------------------------------------------
Conflicting Flows: (vph)                  210           127
Potential Capacity: (pcph)               1361          1491
Movement Capacity: (pcph)                1361          1491
Prob. of Queue-Free State:               1.00          0.80
-------------------------------------------------------------
Step 3: TH from Minor Street              WB            EB
-------------------------------------------------------------
Conflicting Flows: (vph)                  614           600
Potential Capacity: (pcph)                519           528
Capacity Adjustment Factor
 due to Impeding Movements               0.79          0.79
Movement Capacity: (pcph)                 412           420
Prob. of Queue-Free State:               0.99          0.99
-------------------------------------------------------------
Step 4: LT from Minor Street              WB            EB
-------------------------------------------------------------
Conflicting Flows: (vph)                  742           610
Potential Capacity: (pcph)                394           469
Major LT, Minor TH
 Impedance Factor:                       0.78          0.78
Adjusted Impedance Factor:               0.83          0.83
Capacity Adjustment Factor
 due to Impeding Movements               0.62          0.83
Movement Capacity: (pcph)                 244           388
-------------------------------------------------------------

              Intersection Performance Summary

                                          Avg.    95%
             Flow    Move   Shared   Total    Queue           Approach
             Rate    Cap     Cap     Delay    Length   LOS      Delay
Movement    (pcph)  (pcph)  (pcph) (sec/veh)  (veh)           (sec/veh)
--------   ------  ------  ------  -------  -------  -----  ---------
EB  L         58     388 >   391     11.0     0.6      C
EB  T          6     420 >                                       5.2
EB  R        312    1216              4.0     1.2      A

WB  L         18     244 >
WB  T          6     412 >   320     12.4     0.2      C        12.4
WB  R          6    1086 >

NB  L        301    1491              3.0     0.8      A         1.7
SB  L          6    1361              2.7     0.0      A         0.1

              Intersection Delay =      3.0 sec/veh
```

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Honoapiilani Hwy (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst.................. KKN
Date of Analysis.......... 1/16/98
Other Information......... Existing Traffic Conditions PM Peak Hour

Two-way Stop-controlled Intersection

	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
No. Lanes	1	1	< 0	1	1	1	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	150	190	10	1	260	65	40	5	245	10	5	5
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	206	274
Potential Capacity: (pcph)	1089	1006
Movement Capacity: (pcph)	1089	1006
Prob. of Queue-Free State:	0.99	0.72

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	211	342
Potential Capacity: (pcph)	1360	1178
Movement Capacity: (pcph)	1360	1178
Prob. of Queue-Free State:	1.00	0.85

Step 3: TH from Minor Street	WB	EB
Conflicting Flows: (vph)	706	644
Potential Capacity: (pcph)	465	501
Capacity Adjustment Factor due to Impeding Movements	0.85	0.85
Movement Capacity: (pcph)	396	427
Prob. of Queue-Free State:	0.98	0.99

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	770	678
Potential Capacity: (pcph)	379	429
Major LT, Minor TH Impedance Factor:	0.84	0.84
Adjusted Impedance Factor:	0.88	0.88
Capacity Adjustment Factor due to Impeding Movements	0.63	0.87
Movement Capacity: (pcph)	239	374

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
EB L	46	374 >	379	11.0	0.5	C	
EB T	6	427 >					5.9
EB R	284	1006		5.0	1.3	A	
WB L	12	239 >					
WB T	6	396 >	339	11.4	0.1	C	11.4
WB R	6	1089 >					
NB L	174	1178		3.6	0.5	A	1.5
SB L	1	1360		2.6	0.0	A	0.0

Intersection Delay = 2.5 sec/veh

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD	
LOSTTIME	3.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	14	103	3	5	3	13	6	192	260	270	5	51
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1398	0	0	1854	1770	1583	1627	0

Phasing Parameters

SEQUENCES	61			
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	120	30	
GREENTIMES	5.00	12.00	19.00	10.00
YELLOWTIMES	4.00	.00	5.00	5.00
CRITICALS	9	3	8	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	.00	1
PEDTIME	.0	0

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .33 Vehicle Delay 9.4 Level of Service B+

```
        ------------------------------------------------------
Sq 61 | Phase 1   | Phase 2     | Phase 3    | Phase 4      |
**/** ------------------------------------------------------
      |      +    |             | + +        |          ^   |
  .   |      +    |             | + +        |         **** |
 /|\  |      +>   |             |<+ +        |        <**** |
  |   |           |         ^   |   v        |    ^    **** |
  |   |           |             |        ^   |++++     v    |
North |     <*    |     <+ + +> |      * *>  |++++>         |
  |   |++++  *    |++++ + + +   |      * *   |++++          |
      |     v *   |     v + + + |      * *   |    v         |
      ------------------------------------------------------
      | G/C= .083 | G/C= .200   | G/C= .317  | G/C= .167    |
      | G=   5.0" | G=  12.0"   | G=  19.0"  | G=  10.0"    |
      | Y+R= 4.0" | Y+R=   .0"  | Y+R= 5.0"  | Y+R= 5.0"    |
      | OFF=  .0% | OFF=15.0%   | OFF=35.0%  | OFF=75.0%    |
      ------------------------------------------------------
C= 60 sec   G= 46.0 sec = 76.7%  Y=14.0 sec = 23.3%  Ped=  .0 sec =   .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								10.4	B	
RT	12/1	.026	.350	490	554	16	.029	9.7	B+	25 ft
TH	12/1	.096	.350	586	652	114	.175	10.3	B	62 ft
LT	12/1	.007	.100	114	169	3	.017	18.5	*C+	25 ft
NB Approach								10.4	B	
TH+RT	12/1	.159	.550	986	1020	220	.216	5.3	*B+	83 ft
LT	12/1	.206	.300	461	531	289	.544	14.3	*B	171 ft
WB Approach								14.8	B	
LT+TH+RT	12/1	.038	.200	213	280	23	.082	14.8	*B	25 ft
EB Approach								7.4	B+	
RT	12/1	.235	.550	834	871	300	.344	5.8	B+	114 ft
LT+TH	12/1	.069	.200	253	325	63	.194	15.2	C+	43 ft

Napilihau Villages
Traffic Impact Report Existing
PM Peak Hour

02/11/98
15:50:24

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA		NONCBD
LOSTTIME		3.0
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	65	261	1	3	6	8	9	90	147	242	6	41
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.50	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1494	0	0	1837	1770	1583	1671	0

Phasing Parameters

SEQUENCES	61			
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	120	30	
GREENTIMES	5.00	9.00	22.00	10.00
YELLOWTIMES	4.00	.00	5.00	5.00
CRITICALS	9	3	8	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	.00	1
PEDTIME	.0	0

Napilihau Villages
Traffic Impact Report Existing
PM Peak Hour

02/11/98
15:50:34

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .30 Vehicle Delay 9.6 Level of Service B+

```
Sq 61 | Phase 1   | Phase 2    | Phase 3    | Phase 4    |
**/** |           |            |            |            |
      |    +      |            | + +        |     ^      |
      |    +      |            | + +        |      ****  |
 /|\  |    +>     |            |<+ +        |    ^<****  |
  |   |           |        ^   |   v        |       **** |
North |      <*   |   <+ + +>  |      ^     |++++   v    |
  |   |++++ *     |++++ + + +  |     * *>   |++++>       |
      |    v *    |   v + + +  |     * *    |++++        |
      |           |            |     * *    |  v         |
      | G/C= .083 | G/C= .150  | G/C= .367  | G/C= .167  |
      | G=   5.0" | G=   9.0"  | G=  22.0"  | G=  10.0"  |
      | Y+R= 4.0" | Y+R=  .0"  | Y+R= 5.0"  | Y+R= 5.0"  |
      | OFF=  .0% | OFF=15.0%  | OFF=30.0%  | OFF=75.0%  |
```

C= 60 sec G= 46.0 sec = 76.7% Y=14.0 sec = 23.3% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								9.7	B+	
RT	12/1	.079	.400	575	633	72	.114	8.6	B+	36 ft
TH	12/1	.197	.400	686	745	290	.389	9.9	B+	147 ft
LT	12/1	.003	.100	114	169	1	.006	18.5	*C+	25 ft
NB Approach								10.6	B	
TH+RT	12/1	.094	.550	977	1011	110	.109	4.9	*A	42 ft
LT	12/1	.131	.250	368	442	163	.369	14.4	*B	103 ft
WB Approach								14.8	B	
LT+TH+RT	12/1	.031	.200	230	299	19	.064	14.8	*B	25 ft
EB Approach								8.3	B+	
RT	12/1	.215	.500	747	792	269	.340	7.0	B+	113 ft
LT+TH	12/1	.060	.200	261	334	53	.159	15.1	C+	36 ft

HCS: Unsignalized Intersections Release 2.1e NSHS-A.HC0 Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Existing Traffic Conditions AM Peak Hour

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	10	195	33	8	119	21	13	4	18	64	12	14
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e NSHS-A.HC0 Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	222	136
Potential Capacity: (pcph)	1069	1181
Movement Capacity: (pcph)	1069	1181
Prob. of Queue-Free State:	0.98	0.99

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	240	147
Potential Capacity: (pcph)	1317	1459
Movement Capacity: (pcph)	1317	1459
Prob. of Queue-Free State:	0.99	0.99

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	388	395
Potential Capacity: (pcph)	683	677
Capacity Adjustment Factor due to Impeding Movements	0.98	0.98
Movement Capacity: (pcph)	673	667
Prob. of Queue-Free State:	0.99	0.98

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	392	389
Potential Capacity: (pcph)	628	630
Major LT, Minor TH Impedance Factor:	0.96	0.98
Adjusted Impedance Factor:	0.97	0.98
Capacity Adjustment Factor due to Impeding Movements	0.96	0.96
Movement Capacity: (pcph)	602	608

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	15	602 >	616	6.0	0.0	B	4.7
NB T	4	673 >					
NB R	21	1069		3.4	0.0	A	
SB L	74	608 >					
SB T	14	667 >	668	6.4	0.6	B	6.4
SB R	17	1181 >					
EB L	12	1459		2.5	0.0	A	0.1
WB L	9	1317		2.8	0.0	A	0.1

Intersection Delay = 1.5 sec/veh

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Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Existing Traffic Conditions PM Peak Hour

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1 <	0	1	1 <	0	0 >	1	1	0 >	1 <	0
Stop/Yield			N			N						
Volumes	16	200	49	14	180	55	63	6	16	39	12	10
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	237	218
Potential Capacity: (pcph)	1050	1074
Movement Capacity: (pcph)	1050	1074
Prob. of Queue-Free State:	0.98	0.99

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	263	247
Potential Capacity: (pcph)	1285	1307
Movement Capacity: (pcph)	1285	1307
Prob. of Queue-Free State:	0.99	0.99

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	516	513
Potential Capacity: (pcph)	585	587
Capacity Adjustment Factor due to Impeding Movements	0.97	0.97
Movement Capacity: (pcph)	569	571
Prob. of Queue-Free State:	0.99	0.98

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	499	498
Potential Capacity: (pcph)	544	545
Major LT, Minor TH Impedance Factor:	0.95	0.96
Adjusted Impedance Factor:	0.96	0.97
Capacity Adjustment Factor due to Impeding Movements	0.95	0.95
Movement Capacity: (pcph)	517	519

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	73	517 >	521	8.2	0.6	B	
NB T	7	569 >					7.3
NB R	19	1050		3.5	0.0	A	
SB L	45	519 >					
SB T	14	571 >	580	7.1	0.4	B	7.1
SB R	12	1074 >					
EB L	19	1307		2.8	0.0	A	0.2
WB L	17	1285		2.8	0.0	A	0.2

Intersection Delay = 1.7 sec/veh

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Existing Traffic Conditions AM Peak Hou
r

Two-way Stop-controlled Intersection

	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
No. Lanes	0	1	< 0	0	> 1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		38	43	18	147					179		29
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	62	
Potential Capacity: (pcph)	1288	
Movement Capacity: (pcph)	1288	
Prob. of Queue-Free State:	0.97	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	85	
Potential Capacity: (pcph)	1562	
Movement Capacity: (pcph)	1562	
Prob. of Queue-Free State:	0.99	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.99	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	236	
Potential Capacity: (pcph)	773	
Major LT, Minor TH Impedance Factor:	0.99	
Adjusted Impedance Factor:	0.99	
Capacity Adjustment Factor due to Impeding Movements	0.99	
Movement Capacity: (pcph)	762	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	207	762		6.5	1.2	B	6.0
WB R	34	1288		2.9	0.0	A	
SB L	21	1562		2.3	0.0	A	0.3

Intersection Delay = 2.8 sec/veh

HCS: Unsignalized Intersections Release 2.1e NSLHR-P.HCO Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Existing Traffic Conditions PM Peak Hour

Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1 <	0	0	> 1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		61	52	233	75					42		221
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e NSLHR-P.HCO Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	92	
Potential Capacity: (pcph)	1244	
Movement Capacity: (pcph)	1244	
Prob. of Queue-Free State:	0.79	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	119	
Potential Capacity: (pcph)	1504	
Movement Capacity: (pcph)	1504	
Prob. of Queue-Free State:	0.82	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.81	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	416	
Potential Capacity: (pcph)	608	
Major LT, Minor TH Impedance Factor:	0.81	
Adjusted Impedance Factor:	0.81	
Capacity Adjustment Factor due to Impeding Movements	0.81	
Movement Capacity: (pcph)	494	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	48	494		8.1	0.3	B	
WB R	256	1244		3.6	0.9	A	4.3
SB L	270	1504		2.9	0.7	A	2.2

Intersection Delay = 2.7 sec/veh

Napilihau Villages
Traffic Impact Report Base Year 1998
AM Peak Hour

02/11/98
15:34:09

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD	
LOSTTIME	3.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	15	130	5	5	5	15	5	225	280	290	5	55
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1398	0	0	1856	1770	1583	1584	0

Phasing Parameters

SEQUENCES	61						
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	30		PEDTIME	.0	0
GREENTIMES	5.00	12.00	19.00	10.00			
YELLOWTIMES	4.00	.00	5.00	5.00			
CRITICALS	9	3	8	5			
EXCESS	0						

Napilihau Villages
Traffic Impact Report Base Year 1998
AM Peak Hour

02/11/98
15:34:21

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .36 Vehicle Delay 9.7 Level of Service B+

```
Sq 61 | Phase 1  | Phase 2   | Phase 3   | Phase 4  |
**/** ----------------------------------------------
      |    +     |           |  + +      |       ^  |
      |    +     |           |  + +      |     **** |
 /|\  |    +>    |           | <+ +      |    <**** |
  |   |          |      ^    |    v    ^ |   ^ **** |
North |    <*    |  <+ + +>  |       * *>|++++  v   |
  |   |++++ *    |++++ + + + |       * * |++++>     |
      |   v *    |   v + + + |       * * |++++      |
      |          |           |           |  v       |
      ----------------------------------------------
      | G/C= .083| G/C= .200 | G/C= .317 | G/C= .167|
      | G= 5.0"  | G= 12.0"  | G= 19.0"  | G= 10.0" |
      | Y+R= 4.0"| Y+R= .0"  | Y+R= 5.0" | Y+R= 5.0"|
      | OFF= .0% | OFF=15.0% | OFF=35.0% | OFF=75.0%|
      ----------------------------------------------
```

C= 60 sec G= 46.0 sec = 76.7% Y=14.0 sec = 23.3% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								10.7	B	
RT	12/1	.027	.350	490	554	17	.031	9.7	B+	25 ft
TH	12/1	.114	.350	586	652	144	.221	10.5	B	79 ft
LT	12/1	.011	100	114	169	6	.034	18.5	*C+	25 ft
NB Approach								10.5	B	
TH+RT	12/1	.179	.550	987	1021	256	.251	5.4	*B+	97 ft
LT	12/1	.218	.300	461	531	311	.586	14.8	*B	184 ft
WB Approach								14.9	B	
LT+TH+RT	12/1	.045	.200	213	280	29	.104	14.9	*B	25 ft
EB Approach								7.5	B+	
RT	12/1	.249	.550	834	871	322	.370	5.9	B+	122 ft
LT+TH	12/1	.074	.200	246	317	67	.211	15.3	C+	45 ft

Napilihau Villages
Traffic Impact Report Base Year 1998
PM Peak Hour

02/11/98
15:35:46

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD	
LOSTTIME		3.0
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	70	300	1	5	5	10	10	220	160	265	5	45
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1458	0	0	1851	1770	1583	1637	0

Phasing Parameters

SEQUENCES	61			
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	120	30	
GREENTIMES	5.00	9.00	22.00	10.00
YELLOWTIMES	4.00	.00	5.00	5.00
CRITICALS	9	3	8	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	.00	1
PEDTIME	.0	0

Napilihau Villages
Traffic Impact Report Base Year 1998
PM Peak Hour

02/11/98
15:36:31

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .34 Vehicle Delay 9.3 Level of Service B+

```
Sq 61 | Phase 1 | Phase 2 | Phase 3 | Phase 4 |
**/** -----------------------------------------
      |     +    |           | + +      |      ^   |
      |     +    |           | + +      |     **** |
 /|\  |     +>   |           |<+ +      |    <**** |
  |   |          |       ^   |   v    ^ |   ^  **** |
  |   |          |           |          |++++   v  |
North |    <*    |   <+ + +> |      * *>|++++>     |
  |   |++++ *    |++++ + + + |      * * |++++      |
      |   v *    |   v + + + |      * * |   v      |
      -----------------------------------------
      | G/C= .083 | G/C= .150 | G/C= .367 | G/C= .167 |
      | G=   5.0" | G=   9.0" | G=  22.0" | G=  10.0" |
      | Y+R= 4.0" | Y+R=  .0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF=  .0% | OFF=15.0% | OFF=30.0% | OFF=75.0% |
      -----------------------------------------
```

C= 60 sec G= 46.0 sec = 76.7% Y=14.0 sec = 23.3% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								10.0	B+	
RT	12/1	.083	.400	575	633	78	.123	8.6	B+	39 ft
TH	12/1	.220	.400	686	745	333	.447	10.3	B	168 ft
LT	12/1	.003	.100	114	169	1	.006	18.5	*C+	25 ft
NB Approach								9.2	B+	
TH+RT	12/1	.179	.550	984	1018	255	.250	5.4	*B+	97 ft
LT	12/1	.141	.250	368	442	178	.403	14.6	*B	113 ft
WB Approach								14.8	B	
LT+TH+RT	12/1	.036	.200	224	292	23	.079	14.8	*B	25 ft
EB Approach								8.4	B+	
RT	12/1	.231	.500	747	792	294	.371	7.1	B+	124 ft
LT+TH	12/1	.063	.200	255	327	56	.171	15.1	C+	38 ft

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512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street   (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour without Project 1998

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	10	205	35	10	125	25	15	5	20	70	15	15
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	234	145
Potential Capacity: (pcph)	1054	1169
Movement Capacity: (pcph)	1054	1169
Prob. of Queue-Free State:	0.98	0.98

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	253	158
Potential Capacity: (pcph)	1299	1441
Movement Capacity: (pcph)	1299	1441
Prob. of Queue-Free State:	0.99	0.99

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	414	420
Potential Capacity: (pcph)	662	657
Capacity Adjustment Factor due to Impeding Movements	0.98	0.98
Movement Capacity: (pcph)	650	646
Prob. of Queue-Free State:	0.99	0.97

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	418	414
Potential Capacity: (pcph)	606	610
Major LT, Minor TH Impedance Factor:	0.96	0.97
Adjusted Impedance Factor:	0.97	0.98
Capacity Adjustment Factor due to Impeding Movements	0.95	0.96
Movement Capacity: (pcph)	576	585

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	18	576 >	593	6.3	0.0	B	
NB T	6	650 >					4.9
NB R	23	1054		3.5	0.0	A	
SB L	81	585 >					
SB T	18	646 >	644	6.8	0.7	B	6.8
SB R	18	1169 >					
EB L	12	1441		2.5	0.0	A	0.1
WB L	12	1299		2.8	0.0	A	0.2

Intersection Delay = 1.7 sec/veh

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512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour without Project 1998

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	20	210	50	15	190	60	65	5	20	40	15	10
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	248	232
Potential Capacity: (pcph)	1037	1056
Movement Capacity: (pcph)	1037	1056
Prob. of Queue-Free State:	0.98	0.99

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	274	263
Potential Capacity: (pcph)	1269	1285
Movement Capacity: (pcph)	1269	1285
Prob. of Queue-Free State:	0.99	0.98

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	548	542
Potential Capacity: (pcph)	563	567
Capacity Adjustment Factor due to Impeding Movements	0.97	0.97
Movement Capacity: (pcph)	545	549
Prob. of Queue-Free State:	0.99	0.97

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	530	529
Potential Capacity: (pcph)	522	523
Major LT, Minor TH Impedance Factor:	0.94	0.96
Adjusted Impedance Factor:	0.95	0.97
Capacity Adjustment Factor due to Impeding Movements	0.94	0.95
Movement Capacity: (pcph)	491	495

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	75	491 >	495	8.7	0.6	B	
NB T	6	545 >					7.5
NB R	23	1037		3.6	0.0	A	
SB L	46	495 >					
SB T	18	549 >	554	7.5	0.5	B	7.5
SB R	12	1056 >					
EB L	23	1285		2.9	0.0	A	0.2
WB L	18	1269		2.9	0.0	A	0.2

Intersection Delay = 1.8 sec/veh

HCS: Unsignalized Intersections Release 2.1e F8NSLHRA.HC0 Page 1

Center For Microcomputers In Transportation
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512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour without Project 1998

Two-way Stop-controlled Intersection

	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
No. Lanes	0	1 <	0	0 >	1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		40	45	190	30					20		155
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e F8NSLHRA.HC0 Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	66	
Potential Capacity: (pcph)	1282	
Movement Capacity: (pcph)	1282	
Prob. of Queue-Free State:	0.86	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	89	
Potential Capacity: (pcph)	1555	
Movement Capacity: (pcph)	1555	
Prob. of Queue-Free State:	0.86	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.86	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	298	
Potential Capacity: (pcph)	712	
Major LT, Minor TH Impedance Factor:	0.86	
Adjusted Impedance Factor:	0.86	
Capacity Adjustment Factor due to Impeding Movements	0.86	
Movement Capacity: (pcph)	609	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	23	609		6.1	0.0	B	
WB R	179	1282		3.3	0.5	A	3.6
SB L	220	1555		2.7	0.5	A	2.3

Intersection Delay = 2.4 sec/veh

HCS: Unsignalized Intersections Release 2.1e F8NSLHRP.HC0 Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour without Project 1998

Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	< 0	0	> 1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		65	55	245	80					45		230
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e F8NSLHRP.HC0 Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	97	
Potential Capacity: (pcph)	1236	
Movement Capacity: (pcph)	1236	
Prob. of Queue-Free State:	0.78	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	126	
Potential Capacity: (pcph)	1493	
Movement Capacity: (pcph)	1493	
Prob. of Queue-Free State:	0.81	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.80	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	439	
Potential Capacity: (pcph)	590	
Major LT, Minor TH Impedance Factor:	0.80	
Adjusted Impedance Factor:	0.80	
Capacity Adjustment Factor due to Impeding Movements	0.80	
Movement Capacity: (pcph)	472	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	52	472		8.6	0.3	B	4.5
WB R	266	1236		3.7	0.9	A	
SB L	284	1493		3.0	0.8	A	2.2

Intersection Delay = 2.7 sec/veh

Napilihau Villages
Traffic Impact Report Base Year 2000
AM Peak Hour

02/11/98
15:42:09

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD	
LOSTTIME	3.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	THH	LT
VOLUMES	15	140	5	5	5	15	10	240	305	315	5	60
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1384	0	C	1852	1770	1583	1576	0

Phasing Parameters

SEQUENCES	61						
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	30		PEDTIME	.0	0
GREENTIMES	5.00	13.00	18.00	10.00			
YELLOWTIMES	4.00	.00	5.00	5.00			
CRITICALS	9	3	8	5			
EXCESS	0						

Napilihau Villages
Traffic Impact Report Base Year 2000
AM Peak Hour

02/11/98
15:42:21

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .38 Vehicle Delay 9.6 Level of Service B+

```
Sq 61  | Phase 1  | Phase 2  | Phase 3  | Phase 4  |
**/**  |----------|----------|----------|----------|
       |    +     |          | + +      |    ^     |
 /|\   |    +     |          | + +      |     **** |
  |    |    +>    |          |<+ +      |   <***** |
  |    |          |     ^    |  v       |  ^  **** |
North  |          |          |       ^  |++++  v   |
  |    |   <*     | <+ + +>  |     * *> |++++>     |
       |++++ *    |++++ + + +|     * *  |++++      |
       |  v *     |  v + + + |     * *  |  v       |
       |----------|----------|----------|----------|
       |G/C= .083 |G/C= .217 |G/C= .300 |G/C= .167 |
       |G=  5.0"  |G= 13.0"  |G= 18.0"  |G= 10.0"  |
       |Y+R= 4.0" |Y+R=  .0" |Y+R= 5.0" |Y+R= 5.0" |
       |OFF=  .0% |OFF=15.0% |OFF=36.7% |OFF=75.0% |
       |----------|----------|----------|----------|
C= 60 sec   G= 46.0 sec = 76.7%   Y=14.0 sec = 23.3%   Ped= .0 sec = .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								11.3	B	
RT	12/1	.027	.333	463	528	17	.032	10.2	B	25 ft
TH	12/1	.122	.333	553	621	156	.251	11.1	B	88 ft
LT	12/1	.011	.100	114	169	6	.034	18.5	*C+	25 ft
NB Approach								10.4	B	
TH+RT	12/1	.191	.550	984	1018	278	.273	5.5	*B+	106 ft
LT	12/1	.234	.317	491	560	339	.605	14.5	*B	195 ft
WB Approach								14.9	B	
LT+TH+RT	12/1	.045	.200	211	277	29	.105	14.9	*B	25 ft
EB Approach								7.3	B+	
RT	12/1	.266	.567	863	897	350	.390	5.6	B+	128 ft
LT+TH	12/1	.080	.200	244	315	73	.232	15.4	C+	49 ft

Napilihau Villages
Traffic Impact Report Base Year 2000
PM Peak Hour

02/11/98
15:39:01

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD	
LOSTTIME	3.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	75	325	1	5	10	10	10	240	175	285	10	50
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.50	.90	.90	.90	.90	.90	.50	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1473	0	0	1852	1770	1583	1614	0

Phasing Parameters

SEQUENCES	61						
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	30		PEDTIME	.0	0
GREENTIMES	5.00	9.00	22.00	10.00			
YELLOW							
CRITICALS	9	3	8	5			
EXCESS	0						

Napilihau Villages
Traffic Impact Report Base Year 2000
PM Peak Hour

02/11/98
15:39:41

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .37 Vehicle Delay 9.6 Level of Service B-

```
Sq 61 | Phase 1    | Phase 2    | Phase 3    | Phase 4    |
**/** |            |            |            |            |
      |     +      |            |  + +       |        ^   |
      |     +      |            |  + +       |      ****  |
 /|\  |     +>     |            |<+ +        |    ^<****  |
  |   |            |       ^    |  v     ^   |      ****  |
  |   |            |            |            |++++   v    |
North |     <*     |  <+ + +>   |      * *>  |++++>       |
  |   |++++ *      |++++ + + +  |      * *   |++++        |
      |    v *     |   v + + +  |      * *   |   v        |
      |------------|------------|------------|------------|
      |G/C= .083   |G/C= .150   |G/C= .367   |G/C= .167   |
      |G=   5.0"   |G=   9.0"   |G=  22.0"   |G=  10.0"   |
      |Y+R= 4.0"   |Y+R=  .0"   |Y+R= 5.0"   |Y+R= 5.0"   |
      |OFF=  .0%   |OFF=15.0%   |OFF=30.0%   |OFF=75.0%   |
```

C= 60 sec G= 46.0 sec = 76.7% Y=14.0 sec = 23.3% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								10.2	B	
RT	12/1	.087	.400	575	633	83	.131	8.7	B+	42 ft
TH	12/1	.235	.400	686	745	361	.485	10.6	B	183 ft
LT	12/1	.003	.100	114	169	1	.006	18.5	*C+	25 ft
NB Approach								9.3	B+	
TH+RT	12/1	.191	.550	984	1018	278	.273	5.5	*B+	106 ft
LT	12/1	.151	.250	368	442	194	.439	14.9	*B	123 ft
WB Approach								14.9	B	
LT+TH+RT	12/1	.042	.200	227	295	28	.095	14.9	*B	25 ft
EB Approach								8.7	B+	
RT	12/1	.245	.500	747	792	317	.400	7.3	B+	134 ft
LT+TH	12/1	.073	.200	251	323	67	.207	15.3	C+	45 ft

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Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst.................. KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour without Project 2000

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	10	225	40	10	135	25	15	5	20	75	15	15
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	258	155
Potential Capacity: (pcph)	1025	1156
Movement Capacity: (pcph)	1025	1156
Prob. of Queue-Free State:	0.98	0.98

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	279	168
Potential Capacity: (pcph)	1262	1426
Movement Capacity: (pcph)	1262	1426
Prob. of Queue-Free State:	0.99	0.99

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	448	456
Potential Capacity: (pcph)	635	629
Capacity Adjustment Factor due to Impeding Movements	0.98	0.98
Movement Capacity: (pcph)	624	618
Prob. of Queue-Free State:	0.99	0.97

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	451	448
Potential Capacity: (pcph)	580	583
Major LT, Minor TH Impedance Factor:	0.95	0.97
Adjusted Impedance Factor:	0.96	0.98
Capacity Adjustment Factor due to Impeding Movements	0.95	0.96
Movement Capacity: (pcph)	551	558

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	18	551 >	568	6.6	0.0	B	
NB T	6	624 >					5.1
NB R	23	1025		3.6	0.0	A	
SB L	87	558 >					
SB T	18	618 >	613	7.3	0.8	B	7.3
SB R	18	1156 >					
EB L	12	1426		2.5	0.0	A	0.1
WB L	12	1262		2.9	0.0	A	0.2

Intersection Delay = 1.7 sec/veh

HCS: Unsignalized Intersections   Release 2.1e   FONSHS-P.HCO   Page 1

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University of Florida
512 Weil Hall
Gainesville, FL   32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street   (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour without Project 2000

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	20	230	55	15	205	65	75	10	20	45	15	10
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections   Release 2.1e   FONSHS-P.HCO   Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	271	250
Potential Capacity: (pcph)	1009	1034
Movement Capacity: (pcph)	1009	1034
Prob. of Queue-Free State:	0.98	0.99

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	300	284
Potential Capacity: (pcph)	1233	1255
Movement Capacity: (pcph)	1233	1255
Prob. of Queue-Free State:	0.99	0.98

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	592	587
Potential Capacity: (pcph)	533	537
Capacity Adjustment Factor due to Impeding Movements	0.97	0.97
Movement Capacity: (pcph)	515	519
Prob. of Queue-Free State:	0.98	0.97

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	572	574
Potential Capacity: (pcph)	494	493
Major LT, Minor TH Impedance Factor:	0.93	0.94
Adjusted Impedance Factor:	0.95	0.96
Capacity Adjustment Factor due to Impeding Movements	0.94	0.94
Movement Capacity: (pcph)	464	461

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	87	464 >	470	9.7	0.8	B	
NB T	12	516 >					8.5
NB R	23	1009		3.7	0.0	A	
SB L	52	461 >					
SB T	18	519 >	515	8.3	0.6	B	8.3
SB R	12	1034 >					
EB L	23	1255		2.9	0.0	A	0.2
WB L	18	1233		3.0	0.0	A	0.2

Intersection Delay = 2.1 sec/veh

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour without Project 2000

Two-way Stop-controlled Intersection

	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
No. Lanes	0	1 <	0	0 >	1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		45	50	205	35					20		170
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	74	
Potential Capacity: (pcph)	1270	
Movement Capacity: (pcph)	1270	
Prob. of Queue-Free State:	0.84	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	100	
Potential Capacity: (pcph)	1536	
Movement Capacity: (pcph)	1536	
Prob. of Queue-Free State:	0.85	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.84	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	326	
Potential Capacity: (pcph)	685	
Major LT, Minor TH Impedance Factor:	0.84	
Adjusted Impedance Factor:	0.84	
Capacity Adjustment Factor due to Impeding Movements	0.84	
Movement Capacity: (pcph)	577	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	23	577		6.5	0.0	B	3.7
WB R	197	1270		3.4	0.6	A	
SB L	238	1536		2.8	0.6	A	2.4

Intersection Delay = 2.4 sec/veh

HCS: Unsignalized Intersections   Release 2.1e   F0NSLHRP.HC0   Page 1

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===

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour without Project 2000

Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	< 0	0	> 1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		70	60	265	85					50		255
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections   Release 2.1e   F0NSLHRP.HC0   Page 2

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Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	106	
Potential Capacity: (pcph)	1224	
Movement Capacity: (pcph)	1224	
Prob. of Queue-Free State:	0.76	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	137	
Potential Capacity: (pcph)	1475	
Movement Capacity: (pcph)	1475	
Prob. of Queue-Free State:	0.79	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.78	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	474	
Potential Capacity: (pcph)	563	
Major LT, Minor TH Impedance Factor:	0.78	
Adjusted Impedance Factor:	0.78	
Capacity Adjustment Factor due to Impeding Movements	0.78	
Movement Capacity: (pcph)	439	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	58	439		9.4	0.4	B	4.8
WB R	295	1224		3.9	1.1	A	
SB L	307	1475		3.1	0.9	A	2.3

Intersection Delay = 2.9 sec/veh

Napilihau Villages
Traffic Impact Report Base Year 2002
AM Peak Hour

02/11/98
15:43:49

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD	
LOSTTIME		3.0
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	20	150	5	5	5	15	10	260	330	345	10	65
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTOR	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1362	0	0	1853	1770	1583	1584	0

Phasing Parameters

SEQUENCES	61						
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	30		PEDTIME	.0	0
GREENTIMES	5.00	14.00	17.00	10.00			
YELLOWTIMES	4.00	.00	5.00	5.00			
CRITICALS	9	3	8	5			
EXCESS	0						

Napilihau Villages
Traffic Impact Report Base Year 2002
AM Peak Hour

02/11/98
15:44:01

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .40 Vehicle Delay 9.6 Level of Service B+

```
Sq 61 | Phase 1  | Phase 2   | Phase 3   | Phase 4  |
**/** ---------------------------------------------------
      |    +     |           | + +       |       ^   |
 /|\  |    +     |           | + +       |      **** |
  |   |    +>    |           |<+ +       |  ^  <**** |
      |          |      ^    |   v   ^   |      **** |
North |    <*    |   <+ + +> |     * *>  |++++   v   |
  |   |++++ *    |++++ + + + |     * *   |++++>      |
      |   v *    |   v + + + |     * *   |++++       |
      |          |           |           |   v       |
      ---------------------------------------------------
      |G/C= .083 |G/C= .233  |G/C= .283  |G/C= .167  |
      |G=   5.0" |G=  14.0"  |G=  17.0"  |G=  10.0"  |
      |Y+R= 4.0" |Y+R=  .0"  |Y+R= 5.0"  |Y+R= 5.0"  |
      |OFF=  .0% |OFF=15.0%  |OFF=38.3%  |OFF=75.0%  |
      ---------------------------------------------------
```

C= 60 sec G= 46.0 sec = 76.7% Y=14.0 sec = 23.3% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								11.9	B	
RT	12/1	.033	.317	434	501	22	.044	10.8	B	25 ft
TH	12/1	.128	.317	520	590	167	.283	11.8	B	96 ft
LT	12/1	.011	.100	114	169	6	.034	18.5	*C+	25 ft
NB Approach								10.3	B	
TH+RT	12/1	.203	.550	985	1019	300	.294	5.6	*B+	114 ft
LT	12/1	.250	.333	523	590	367	.622	14.2	*B	206 ft
WB Approach								14.9	B	
LT+TH+RT	12/1	.046	.200	206	272	29	.107	14.9	*B	25 ft
EB Approach								7.2	B+	
RT	12/1	.286	.583	892	924	383	.415	5.4	B+	135 ft
LT+TH	12/1	.087	.200	246	317	83	.262	15.5	C+	56 ft

Napilihau Villages
Traffic Impact Report Base Year 2002
PM Peak Hour

02/12/98
11:08:42

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA		NONCBD
LOSTTIME		3.0
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	80	355	1	5	10	10	10	260	190	310	10	50
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1473	0	0	1853	1770	1583	1614	0

Phasing Parameters

SEQUENCES	61						
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	30		PEDTIME	.0	0
GREENTIMES	5.00	10.00	21.00	10.00			
YELLOWTIMES	4.00	.00	5.00	5.00			
CRITICALS	9	3	8	5			
EXCESS	0						

Napilihau Villages
Traffic Impact Report Base Year 2002
PM Peak Hour

02/12/98
11:09:03

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .40 Vehicle Delay 9.8 Level of Service B+

```
Sq 61 | Phase 1   | Phase 2    | Phase 3    | Phase 4   |
**/** |           |            |            |           |
      |   +       |            |  + +       |    ^      |
 /|\  |   +       |            |  + +       |     ****  |
  |   |   +>      |            | <+ +       |    <****  |
North |           |      ^     |    v       |  ^  ****  |
  |   |     <*    |  <+ + +>   |     ^      |++++  v    |
      | ++++ *    | ++++ + + + |     * *>   |++++>      |
      |   v *     |   v + + +  |     * *    |++++       |
      |           |            |     * *    |   v       |
      |G/C= .083  | G/C= .167  | G/C= .350  | G/C= .167 |
      |G=   5.0"  | G=  10.0"  | G=  21.0"  | G=  10.0" |
      |Y+R= 4.0"  | Y+R=  .0"  | Y+R= 5.0"  | Y+R= 5.0" |
      |OFF=  .0%  | OFF=15.0%  | OFF=31.7%  | OFF=75.0% |
```

C= 60 sec G= 46.0 sec = 76.7% Y=14.0 sec = 23.3% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								11.3	B	
RT	12/1	.092	.383	547	607	89	.147	9.2	B+	46 ft
TH	12/1	.252	.383	653	714	394	.552	11.7	B	205 ft
LT	12/1	.003	.100	114	169	1	.006	18.5	*C+	25 ft
NB Approach								9.2	B+	
TH+RT	12/1	.203	.550	985	1019	300	.294	5.6	*B+	114 ft
LT	12/1	.161	.267	399	472	211	.447	14.4	*B	130 ft
WB Approach								14.9	B	
LT+TH+RT	12/1	.042	.200	227	295	28	.095	14.9	*B	25 ft
EB Approach								8.4	B+	
RT	12/1	.262	.517	776	818	344	.421	7.0	B+	140 ft
LT+TH	12/1	.073	.200	251	323	67	.207	15.3	C+	45 ft

HCS: Unsignalized Intersections   Release 2.1e   F2NSHS-A.HCO   Page 1

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University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street   (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour without Project 2002

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	15	245	40	10	150	25	15	5	25	80	15	20
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections   Release 2.1e   F2NSHS-A.HCO   Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	279	171
Potential Capacity: (pcph)	1000	1134
Movement Capacity: (pcph)	1000	1134
Prob. of Queue-Free State:	0.97	0.98

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	300	184
Potential Capacity: (pcph)	1233	1401
Movement Capacity: (pcph)	1233	1401
Prob. of Queue-Free State:	0.99	0.99

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	490	498
Potential Capacity: (pcph)	603	598
Capacity Adjustment Factor due to Impeding Movements	0.98	0.98
Movement Capacity: (pcph)	589	585
Prob. of Queue-Free State:	0.99	0.97

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	496	492
Potential Capacity: (pcph)	547	549
Major LT, Minor TH Impedance Factor:	0.95	0.97
Adjusted Impedance Factor:	0.96	0.98
Capacity Adjustment Factor due to Impeding Movements	0.94	0.95
Movement Capacity: (pcph)	514	520

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	18	514 >	531	7.1	0.0	B	5.2
NB T	6	589 >					
NB R	29	1000		3.7	0.0	A	
SB L	92	520 >					
SB T	18	585 >	583	8.0	0.9	B	8.0
SB R	23	1134 >					
EB L	18	1401		2.6	0.0	A	0.1
WB L	12	1233		2.9	0.0	A	0.2

Intersection Delay = 1.9 sec/veh

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Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour without Project 2002

Two-way Stop-controlled Intersection

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	20	250	60	20	225	70	80	10	20	50	15	15
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	294	274
Potential Capacity: (pcph)	983	1006
Movement Capacity: (pcph)	983	1006
Prob. of Queue-Free State:	0.98	0.98

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	326	311
Potential Capacity: (pcph)	1199	1219
Movement Capacity: (pcph)	1199	1219
Prob. of Queue-Free State:	0.98	0.98

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	648	642
Potential Capacity: (pcph)	499	502
Capacity Adjustment Factor due to Impeding Movements	0.96	0.96
Movement Capacity: (pcph)	480	483
Prob. of Queue-Free State:	0.98	0.96

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	626	626
Potential Capacity: (pcph)	460	460
Major LT, Minor TH Impedance Factor:	0.93	0.94
Adjusted Impedance Factor:	0.94	0.95
Capacity Adjustment Factor due to Impeding Movements	0.93	0.93
Movement Capacity: (pcph)	426	428

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	92	426 >	432	11.0	1.0	C	
NB T	12	480 >					9.6
NB R	23	983		3.7	0.0	A	
SB L	58	428 >					
SB T	18	483 >	493	9.0	0.7	B	9.0
SB R	18	1006 >					
EB L	23	1219		3.0	0.0	A	0.2
WB L	23	1199		3.1	0.0	A	0.2

Intersection Delay = 2.3 sec/veh

Page 1

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University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour without Project 2002

Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1 <	0	0 >	1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		45	50	225	35					25		185
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	74	
Potential Capacity: (pcph)	1270	
Movement Capacity: (pcph)	1270	
Prob. of Queue-Free State:	0.83	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	100	
Potential Capacity: (pcph)	1536	
Movement Capacity: (pcph)	1536	
Prob. of Queue-Free State:	0.83	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.83	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	348	
Potential Capacity: (pcph)	666	
Major LT, Minor TH Impedance Factor:	0.83	
Adjusted Impedance Factor:	0.83	
Capacity Adjustment Factor due to Impeding Movements	0.83	
Movement Capacity: (pcph)	550	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	29	550		6.9	0.0	B	3.8
WB R	215	1270		3.4	0.7	A	
SB L	261	1536		2.8	0.7	A	2.4

Intersection Delay = 2.5 sec/veh

HCS: Unsignalized Intersections Release 2.1e F2NSLHRP.HC0 Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour without Project 2002

Two-way Stop-controlled Intersection

	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
No. Lanes	0	1 <	0	0 >	1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		70	60	290	95					55		275
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e F2NSLHRP.HC0 Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	106	
Potential Capacity: (pcph)	1224	
Movement Capacity: (pcph)	1224	
Prob. of Queue-Free State:	0.74	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	137	
Potential Capacity: (pcph)	1475	
Movement Capacity: (pcph)	1475	
Prob. of Queue-Free State:	0.77	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.76	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	510	
Potential Capacity: (pcph)	536	
Major LT, Minor TH Impedance Factor:	0.76	
Adjusted Impedance Factor:	0.76	
Capacity Adjustment Factor due to Impeding Movements	0.76	
Movement Capacity: (pcph)	406	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	64	406		10.5	0.6	C	5.1
WB R	318	1224		4.0	1.2	A	
SB L	336	1475		3.2	1.0	A	2.4

Intersection Delay = 3.1 sec/veh

Napilihau Villages
Traffic Impact Report Year 1998 with Project
AM Peak Hour

02/11/98
15:27:22

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA		NONCBD
LOSTTIME		3.0
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	15	130	5	5	5	15	5	225	285	310	5	55
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.50	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1398	0	0	1856	1770	1583	1584	0

Phasing Parameters

SEQUENCES	61						
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	30		PEDTIME	.0	0
GREENTIMES	5.00	12.00	19.00	10.00			
YELLOWTIMES	4.00	.00	5.00	5.00			
CRITICALS	9	3	8	5			
EXCESS	0						

Napilihau Villages
Traffic Impact Report Year 1998 with Project
AM Peak Hour

02/11/98
15:27:34

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .37 Vehicle Delay 9.7 Level of Service B+

```
         -----------------------------------------------------
Sq 61   |  Phase 1   |  Phase 2   |  Phase 3   |  Phase 4   |
**/**    -----------------------------------------------------
        |      +     |            | + +        |        ^   |
        |      +     |            | + +        |       **** |
  /|\   |      +>    |            |<+ +        |      <**** |
   |    |            |        ^   |   v     ^  |    ^  **** |
   |    |            |            |            |++++   v    |
 North  |    <*      |    <+ + +> |         * *>|++++>      |
   |    |++++ *      |++++ + + +  |         * * |++++       |
        |    v *     |    v + + + |         * * |    v      |
         -----------------------------------------------------
        | G/C= .083  | G/C= .200  | G/C= .317  | G/C= .167  |
        | G=   5.0"  | G=  12.0"  | G=  19.0"  | G=  10.0"  |
        | Y+R= 4.0"  | Y+R=  .0"  | Y+R= 5.0"  | Y+R= 5.0"  |
        | OFF=  .0%  | OFF=15.0%  | OFF=35.0%  | OFF=75.0%  |
         -----------------------------------------------------
```

C= 60 sec G= 46.0 sec = 76.7% Y=14.0 sec = 23.3% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								10.7	B	
RT	12/1	.027	.350	490	554	17	.031	9.7	B+	25 ft
TH	12/1	.114	.350	586	652	144	.221	10.5	B	79 ft
LT	12/1	.011	.100	114	169	6	.034	18.5	*C+	25 ft
NB Approach								10.7	B	
TH+RT	12/1	.179	.550	987	1021	256	.251	5.4	*B+	97 ft
LT	12/1	.222	.300	461	531	317	.597	14.9	*B	187 ft
WB Approach								14.9	B	
LT+TH+RT	12/1	.045	.200	213	280	29	.104	14.9	*B	25 ft
EB Approach								7.6	B+	
RT	12/1	.262	.550	834	871	344	.395	6.1	B+	131 ft
LT+TH	12/1	.074	.200	246	317	67	.211	15.3	C+	45 ft

Napilihau Villages
Traffic Impact Report Year 1998 with Project
PM Peak Hour

02/12/98
11:14:35

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD	
LOSTTIME	3.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	75	300	1	5	5	10	10	220	180	270	5	45
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1458	0	0	1851	1770	1583	1637	0

Phasing Parameters

SEQUENCES	61							
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE	
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1	
CYCLES	60	120	30		PEDTIME	.0	0	
GREENTIMES	5.00	10.00	21.00	10.00				
YELLOWTIMES	4.00	.00	5.00	5.00				
CRITICALS	9	3	8	5				
EXCESS	0							

Napilihau Villages
Traffic Impact Report Year 1998 with Project
PM Peak Hour

02/12/98
11:14:52

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .35 Vehicle Delay 9.5 Level of Service B+

```
Sq 61  | Phase 1    | Phase 2    | Phase 3    | Phase 4    |
**/**  |------------|------------|------------|------------|
       |    +       |            | + *        |        *   |
 /|\   |    +       |            | + +        |     ****   |
  |    |    +>      |            |<+ +        |   ^ <****  |
  |    |            |     ^      |   v     ^  |      ****  |
North  |        <*  |  <+ + +>   |     * *> |++++   v     |
  |    | ++++ *     |++++ + + +  |     * *  |++++>        |
       |    v *     |  v + + +   |     * *  |++++         |
       |            |            |          |  v          |
       | G/C= .083  | G/C= .167  | G/C= .350  | G/C= .167  |
       | G=   5.0"  | G=  10.0"  | G=  21.0"  | G=  10.0"  |
       | Y+R= 4.0"  | Y+R=  .0"  | Y+R= 5.0"  | Y+R= 5.0"  |
       | OFF=  .0%  | OFF=15.0%  | OFF=31.7%  | OFF=75.0%  |
```

C= 60 sec G= 46.0 sec = 76.7% Y=14.0 sec = 23.3% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max. Queue
SB Approach								10.6	B	
RT	12/1	.087	.383	547	607	83	.137	9.2	B+	43 ft
TH	12/1	.220	.383	653	714	333	.466	10.9	B	173 ft
LT	12/1	.003	.100	114	169	1	.006	18.5	*C+	25 ft
NB Approach								9.3	B+	
TH+RT	12/1	.179	.550	984	1018	255	.250	5.4	*B+	97 ft
LT	12/1	.154	.267	399	472	200	.424	14.2	*B	124 ft
WB Approach								14.8	B	
LT+TH+RT	12/1	.036	.200	224	292	23	.079	14.8	*B	25 ft
EB Approach								8.0	B+	
RT	12/1	.235	.517	776	818	300	.367	6.7	B+	122 ft
LT+TH	12/1	.063	.200	255	327	56	.171	15.1	C+	38 ft

HCS: Unsignalized Intersections Release 2.1e P8NSHS-A.HC0 Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour with Project 1998

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	10	205	35	15	125	25	25	5	45	70	15	15
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e P8NSHS-A.HC0 Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	234	145
Potential Capacity: (pcph)	1054	1169
Movement Capacity: (pcph)	1054	1169
Prob. of Queue-Free State:	0.95	0.98

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	253	158
Potential Capacity: (pcph)	1299	1441
Movement Capacity: (pcph)	1299	1441
Prob. of Queue-Free State:	0.99	0.99

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	420	425
Potential Capacity: (pcph)	657	653
Capacity Adjustment Factor due to Impeding Movements	0.98	0.98
Movement Capacity: (pcph)	643	639
Prob. of Queue-Free State:	0.99	0.97

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	422	432
Potential Capacity: (pcph)	603	595
Major LT, Minor TH Impedance Factor:	0.95	0.97
Adjusted Impedance Factor:	0.96	0.98
Capacity Adjustment Factor due to Impeding Movements	0.95	0.93
Movement Capacity: (pcph)	571	552

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	29	571 >	582	6.6	0.1	B	
NB T	6	643 >					4.8
NB R	52	1054		3.6	0.0	A	
SB L	81	552 >					
SB T	18	639 >	615	7.2	0.7	B	7.2
SB R	18	1169 >					
EB L	12	1441		2.5	0.0	A	0.1
WB L	18	1299		2.8	0.0	A	0.3

Intersection Delay = 1.9 sec/veh

HCS: Unsignalized Intersections Release 2.1e P8NSHS-P.HCO Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street (E-W) Napilihau Street
Major Street Direction ... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis...... ... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour with Project 1998

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1 <	0	1	1 <	0	0 >	1	1	0 >	1 <	0
Stop/Yield			N			N						
Volumes	20	210	65	40	190	60	70	10	30	40	15	10
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e P8NSHS-P.HCO Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	255	232
Potential Capacity: (pcph)	1028	1056
Movement Capacity: (pcph)	1028	1056
Prob. of Queue-Free State:	0.97	0.99

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	289	263
Potential Capacity: (pcph)	1248	1285
Movement Capacity: (pcph)	1248	1285
Prob. of Queue-Free State:	0.96	0.98

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	581	584
Potential Capacity: (pcph)	541	539
Capacity Adjustment Factor due to Impeding Movements	0.95	0.95
Movement Capacity: (pcph)	512	510
Prob. of Queue-Free State:	0.98	0.96

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	563	571
Potential Capacity: (pcph)	500	495
Major LT, Minor TH Impedance Factor:	0.91	0.92
Adjusted Impedance Factor:	0.93	0.94
Capacity Adjustment Factor due to Impeding Movements	0.92	0.91
Movement Capacity: (pcph)	461	450

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	81	461 >	467	9.6	0.8	B	
NB T	12	512 >					8.0
NB R	35	1028		3.6	0.0	A	
SB L	46	450 >					
SB T	18	510 >	510	8.3	0.5	B	8.3
SB R	12	1056 >					
EB L	23	1285		2.9	0.0	A	0.2
WB L	46	1248		3.0	0.0	A	0.4

Intersection Delay = 2.1 sec/veh

Center For Microcomputers In Transportation
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512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour with Project 1998

Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	< 0	0	> 1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		40	45	190	30					20		160
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	66	
Potential Capacity: (pcph)	1282	
Movement Capacity: (pcph)	1282	
Prob. of Queue-Free State:	0.86	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	89	
Potential Capacity: (pcph)	1555	
Movement Capacity: (pcph)	1555	
Prob. of Queue-Free State:	0.86	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.86	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	298	
Potential Capacity: (pcph)	712	
Major LT, Minor TH Impedance Factor:	0.86	
Adjusted Impedance Factor:	0.86	
Capacity Adjustment Factor due to Impeding Movements	0.86	
Movement Capacity: (pcph)	609	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	23	609		6.1	0.0	B	3.6
WB R	185	1282		3.3	0.5	A	
SB L	220	1555		2.7	0.5	A	2.3

Intersection Delay = 2.4 sec/veh

HCS: Unsignalized Intersections Release 2.1e P8NSLHRP.HC0 Page 1

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Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

===

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour with Project 1998

Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1 <	0	0 >	1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		65	55	255	80					45		235
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e P8NSLHRP.HC0 Page 2

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Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	97	
Potential Capacity: (pcph)	1236	
Movement Capacity: (pcph)	1236	
Prob. of Queue-Free State:	0.78	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	126	
Potential Capacity: (pcph)	1493	
Movement Capacity: (pcph)	1493	
Prob. of Queue-Free State:	0.80	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.79	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	449	
Potential Capacity: (pcph)	582	
Major LT, Minor TH Impedance Factor:	0.79	
Adjusted Impedance Factor:	0.79	
Capacity Adjustment Factor due to Impeding Movements	0.79	
Movement Capacity: (pcph)	461	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	52	461		8.8	0.3	B	4.5
WB R	272	1236		3.7	0.9	A	
SB L	295	1493		3.0	0.8	A	2.3

Intersection Delay = 2.8 sec/veh

Napilihau Villages
Traffic Impact Report Year 2000 with Project
AM Peak Hour

02/11/98
15:20:43

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD	
LOSTTIME		3.0
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

	SB	WB	NB	EB
APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	20	140	5	5	5	15	10	240	320	335	10	65
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1362	0	0	1852	1770	1583	1584	0

Phasing Parameters

SEQUENCES	61			
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	120	30	
GREENTIMES	5.00	13.00	18.00	10.00
YELLOWTIMES	4.00	.00	5.00	5.00
CRITICALS	9	3	8	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	.00	1
PEDTIME	.0	0

Napilihau Villages
Traffic Impact Report Year 2000 with Project
AM Peak Hour

02/11/98
15:20:53

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .40 Vehicle Delay 9.8 Level of Service B+

```
Sq 61 | Phase 1  | Phase 2  | Phase 3  | Phase 4  |
**/** -------------------------------------------
      |     +    |          | + +      |     ^    |
      |     +    |          | + +      |     **** |
 /|\  |     +>   |          |<+ +      |    <**** |
  |   |          |     ^    |   v   ^  |  ^  **** |
North |          |          |          |++++  v   |
  |   |     <*   |   <+ + +>|   * *>   |++++>     |
      |++++ *    |++++ + + +|   * *    |++++      |
      |    v *   |  v + + + |   * *    |   v      |
      -------------------------------------------
      |G/C= .083 |G/C= .217 |G/C= .300 |G/C= .167 |
      |G=   5.0" |G=  13.0" |G=  18.0" |G=  10.0" |
      |Y+R= 4.0" |Y+R=  .0" |Y+R= 5.0" |Y+R= 5.0" |
      |OFF=  .0% |OFF=15.0% |OFF=36.7% |OFF=75.0% |
```

C= 60 sec G= 46.0 sec = 76.7% Y=14.0 sec = 23.3% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								11.2	B	
RT	12/1	.033	.333	463	528	22	.042	10.3	B	25 ft
TH	12/1	.122	.333	553	621	156	.251	11.1	B	88 ft
LT	12/1	.011	.100	114	169	6	.034	18.5	*C+	25 ft
NB Approach								10.8	B	
TH+RT	12/1	.191	.550	984	1018	278	.273	5.5	*B+	106 ft
LT	12/1	.243	.317	491	560	356	.636	15.0	*C+	205 ft
WB Approach								14.9	B	
LT+TH+RT	12/1	.046	.200	206	272	29	.107	14.9	*B	25 ft
EB Approach								7.6	B+	
RT	12/1	.279	.567	863	897	372	.415	5.8	B+	136 ft
LT+TH	12/1	.087	.200	246	317	83	.262	15.5	C+	56 ft

Napilihau Villages
Traffic Impact Report Year 2000 with Project
PM Peak Hour

02/12/98
11:20:41

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA		NONCBD
LOSTTIME		3.0
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	85	325	1	5	10	10	10	240	225	290	10	50
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1473	0	0	1852	1770	1583	1614	0

Phasing Parameters

SEQUENCES	61							
PERMISSIVES	NO	NO	NO	NO		LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES		OFFSET	.00	1
CYCLES	60	120	30			PEDTIME	.0	0
GREENTIMES	5.00	11.00	20.00	10.00				
YELLOWTIMES	4.00	.00	5.00	5.00				
CRITICALS	9	3	8	5				
EXCESS	0							

Napilihau Villages
Traffic Impact Report Year 2000 with Project
PM Peak Hour

02/12/98
11:20:54

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # .0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .39 Vehicle Delay 9.9 Level of Service B+

```
Sq 61 | Phase 1  | Phase 2  | Phase 3  | Phase 4  |
**/** |----------|----------|----------|----------|
      |    +     |          | + +      |     ^    |
      |    +     |          | + +      |    **** |
 /|\  |    +>    |          |<+. +     |  ^ <****|
  |   |          |     ^    |  v    ^  |++++ ****|
North |   <*     | <+ + +>  |     * *> |++++>  v  |
  |   |++++ *    |++++ + +  |     * *  |++++     |
      |  v  *    |  v + +   |     * *  |  v      |
      |----------|----------|----------|----------|
      |G/C= .083 |G/C= .183 |G/C= .333 |G/C= .167 |
      |G=   5.0" |G=  11.0" |G=  20.0" |G=  10.0" |
      |Y+R= 4.0" |Y+R=  .0" |Y+R= 5.0" |Y+R= 5.0" |
      |OFF=  .0% |OFF=15.0% |OFF=33.3% |OFF=75.0% |
```

C= 60 sec G= 46.0 sec = 76.7% Y=14.0 sec = 23.3% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								11.5	B	
RT	12/1	.096	.367	519	581	94	.162	9.7	B+	50 ft
TH	12/1	.235	.367	620	683	361	.529	12.0	B	193 ft
LT	12/1	.003	.100	114	169	1	.006	18.5	*C+	25 ft
NB Approach								9.7	B+	
TH+RT	12/1	.191	.550	984	1018	278	.273	5.5	*B+	106 ft
LT	12/1	.183	.283	429	501	250	.499	14.3	*B	151 ft
WB Approach								14.9	B	
LT+TH+RT	12/1	.042	.200	227	295	28	.095	14.9	*B	25 ft
EB Approach								7.9	B+	
RT	12/1	.249	.533	804	844	322	.382	6.4	B+	127 ft
LT+TH	12/1	.073	.200	251	323	67	.207	15.3	C+	45 ft

HCS: Unsignalized Intersections Release 2.1e PONSHS-A.HC0 Page 1

Center For Microcomputers In Transportation
University of Florida
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Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour with Project 2000

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	10	225	45	25	135	25	45	5	50	75	15	15
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e PONSHS-A.HC0 Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	260	155
Potential Capacity: (pcph)	1022	1156
Movement Capacity: (pcph)	1022	1156
Prob. of Queue-Free State:	0.94	0.98

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	284	168
Potential Capacity: (pcph)	1255	1426
Movement Capacity: (pcph)	1255	1426
Prob. of Queue-Free State:	0.98	0.99

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	466	476
Potential Capacity: (pcph)	621	614
Capacity Adjustment Factor due to Impeding Movements	0.97	0.97
Movement Capacity: (pcph)	602	595
Prob. of Queue-Free State:	0.99	0.97

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	468	482
Potential Capacity: (pcph)	567	557
Major LT, Minor TH Impedance Factor:	0.94	0.96
Adjusted Impedance Factor:	0.95	0.97
Capacity Adjustment Factor due to Impeding Movements	0.94	0.91
Movement Capacity: (pcph)	532	509

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	52	532 >	538	7.5	0.3	B	5.6
NB T	6	602 >					
NB R	58	1022		3.7	0.0	A	
SB L	87	509 >					
SB T	18	595 >	567	8.1	0.9	B	8.1
SB R	18	1156 >					
EB L	12	1426		2.5	0.0	A	0.1
WB L	29	1255		2.9	0.0	A	0.4

Intersection Delay = 2.3 sec/veh

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Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street   (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour with Project 2000

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1 <	0	1	1 <	0	0 >	1	1	0 >	1 <	0
Stop/Yield			N			N						
Volumes	20	230	90	80	205	65	90	10	30	45	15	10
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	290	250
Potential Capacity: (pcph)	987	1034
Movement Capacity: (pcph)	987	1034
Prob. of Queue-Free State:	0.96	0.99

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	337	284
Potential Capacity: (pcph)	1184	1255
Movement Capacity: (pcph)	1184	1255
Prob. of Queue-Free State:	0.92	0.98

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	678	692
Potential Capacity: (pcph)	481	473
Capacity Adjustment Factor due to Impeding Movements	0.91	0.91
Movement Capacity: (pcph)	435	428
Prob. of Queue-Free State:	0.97	0.96

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	658	666
Potential Capacity: (pcph)	440	436
Major LT, Minor TH Impedance Factor:	0.87	0.88
Adjusted Impedance Factor:	0.90	0.91
Capacity Adjustment Factor due to Impeding Movements	0.89	0.88
Movement Capacity: (pcph)	391	382

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	105	391 >	395	12.9	1.3	C	10.8
NB T	12	435 >					
NB R	35	987		3.8	0.0	A	
SB L	52	382 >					
SB T	18	428 >	432	10.3	0.7	C	10.3
SB R	12	1034 >					
EB L	23	1255		2.9	0.0	A	0.2
WB L	92	1184		3.3	0.2	A	0.8

Intersection Delay = 2.7 sec/veh

Center For Microcomputers In Transportation
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Ph: (904) 392-0378

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour with Project 2000

Two-way Stop-controlled Intersection

	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
No. Lanes	0	1 <	0	0	> 1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		45	50	210	35					25		195
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	74	
Potential Capacity: (pcph)	1270	
Movement Capacity: (pcph)	1270	
Prob. of Queue-Free State:	0.82	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	100	
Potential Capacity: (pcph)	1536	
Movement Capacity: (pcph)	1536	
Prob. of Queue-Free State:	0.84	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.84	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	332	
Potential Capacity: (pcph)	680	
Major LT, Minor TH Impedance Factor:	0.84	
Adjusted Impedance Factor:	0.84	
Capacity Adjustment Factor due to Impeding Movements	0.84	
Movement Capacity: (pcph)	570	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	29	570		6.7	0.0	B	3.8
WB R	226	1270		3.4	0.7	A	
SB L	243	1536		2.8	0.6	A	2.4

Intersection Delay = 2.5 sec/veh

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HCS: Unsignalized Intersections    Release 2.1e    PONSLHRP.HCO    Page 1
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Center For Microcomputers In Transportation
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512 Weil Hall
Gainesville, FL    32611-2083
Ph: (904) 392-0378
==========================================================================
Streets: (N-S) Lower Honoapiilani              (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information.........    Future Traffic Conditions PM Peak Hour
                              with Project 2000
Two-way Stop-controlled Intersection
==========================================================================
            |  Northbound  |  Southbound  |  Eastbound   |  Westbound
            |  L   T    R  |  L    T   R  |  L   T   R  |  L   T    R
            | ---- ---- ---| ---- ---- ---| ---- ---- ---| ---- ---- ----
No. Lanes   |  0   1 <  0  |  0 >  1   0  |  0   0   0  |  1   0    1
Stop/Yield  |           N  |           N  |              |
Volumes     |     70   65  | 295   85     |              |  50       265
PHF         |    .95  .95  | .95  .95     |              | .95       .95
Grade       |      0       |       0      |              |       0
MC's (%)    |              |              |              |
SU/RV's (%) |              |              |              |
CV's (%)    |              |              |              |
PCE's       |              |1.10          |              |1.10      1.10
--------------------------------------------------------------------------

                         Adjustment Factors

Vehicle                          Critical         Follow-up
Maneuver                         Gap (tg)         Time (tf)
----------------------------------------------------------------
Left Turn Major Road               5.00             2.10
Right Turn Minor Road              5.50             2.60
Through Traffic Minor Road         6.00             3.30
Left Turn Minor Road               6.50             3.40
```

```
HCS: Unsignalized Intersections    Release 2.1e    PONSLHRP.HCO    Page 2
==========================================================================

                    Worksheet for TWSC Intersection
---------------------------------------------------------------
Step 1: RT from Minor Street                WB              EB
---------------------------------------------------------------
Conflicting Flows: (vph)                    108
Potential Capacity: (pcph)                  1221
Movement Capacity: (pcph)                   1221
Prob. of Queue-Free State:                  0.75
---------------------------------------------------------------
Step 2: LT from Major Street                SB              NB
---------------------------------------------------------------
Conflicting Flows: (vph)                    142
Potential Capacity: (pcph)                  1467
Movement Capacity: (pcph)                   1467
Prob. of Queue-Free State:                  0.77
TH Saturation Flow Rate: (pcphpl)           1700
RT Saturation Flow Rate: (pcphpl)
Major LT Shared Lane Prob.
 of Queue-Free State:                       0.75
---------------------------------------------------------------
Step 4: LT from Minor Street                WB              EB
---------------------------------------------------------------
Conflicting Flows: (vph)                    508
Potential Capacity: (pcph)                  538
Major LT, Minor TH
 Impedance Factor:                          0.75
Adjusted Impedance Factor:                  0.75
Capacity Adjustment Factor
 due to Impeding Movements                  0.75
Movement Capacity: (pcph)                   406
---------------------------------------------------------------

                   Intersection Performance Summary

                                      Avg.     95%
          Flow   Move   Shared   Total    Queue            Approach
          Rate   Cap     Cap     Delay    Length   LOS      Delay
Movement (pcph) (pcph)  (pcph) (sec/veh)  (veh)           (sec/veh)
-------- ------ ------  ------ --------- -------- -----  ---------
WB  L      58    406              10.3      0.5      C
                                                             5.0
WB  R     307   1221               3.9      1.1      A

SB  L     342   1467             . 3.2      1.0      A       2.5

          Intersection Delay =      3.0 sec/veh
```

HCS: Unsignalized Intersections   Release 2.1e   POHHND-A.HCO   Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Honoapiilani Highway   (E-W) New Driveway
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour with Project 2000

Two-way Stop-controlled Intersection

	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
No. Lanes	0	0	0	0	1 <	0	0	0	1	0	0	0
Stop/Yield			N			N						
Volumes					465	1			55			
PHF					.95	.95			.95			
Grade					0			0				
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's									1.10			

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections   Release 2.1e   POHHND-A.HCO   Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)		490
Potential Capacity: (pcph)		782
Movement Capacity: (pcph)		782
Prob. of Queue-Free State:		0.92

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
EB R	64	782		5.0	0.2	B	5.0

Intersection Delay = 0.5 sec/veh

HCS: Unsignalized Intersections Release 2.1e POHHND-P.HCO Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Honoapiilani Highway (E-W) New Driveway
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour with Project 2000

Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	1 <	0	0	0	1	0	0	0
Stop/Yield			N			N						
Volumes					605	5			25			
PHF					.95	.95			.95			
Grade					0			0				
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's									1.10			

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e POHHND-P.HCO Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)		640
Potential Capacity: (pcph)		656
Movement Capacity: (pcph)		656
Prob. of Queue-Free State:		0.96

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
EB R	29	656		5.7	0.0	B	5.7

Intersection Delay = 0.2 sec/veh

Napilihau Villages
Traffic Impact Report Year 2002 with Project
AM Peak Hour

02/12/98
11:17:57

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD	
LOSTTIME		3.0
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	20	150	5	5	5	15	10	260	350	370	10	70
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1349	0	0	1853	1770	1583	1577	0

Phasing Parameters

SEQUENCES	61						
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	30		PEDTIME	.0	0
GREENTIMES	5.00	13.00	18.00	10.00			
YELLOWTIMES	4.00	.00	5.00	5.00			
CRITICALS	9	3	8	5			
EXCESS	0						

Napilihau Villages
Traffic Impact Report Year 2002 with Project
AM Peak Hour

02/12/98
11:18:0?

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .44 Vehicle Delay 10.3 Level of Service B

```
Sq 61 |  Phase 1  |  Phase 2  |  Phase 3  |  Phase 4  |
**/** |           |           |           |           |
      |     +     |           | + +       |     ^     |
      |     +     |           | + +       |      **** |
 /|\  |     +>    |           |<+ +       |   ^ <**** |
  |   |           |     ^     |   v   ^   |      **** |
North |    <*     |  <+ + +>  |           |++++  v    |
  |   |++++ *     |++++ + + + |     * *>  |++++>      |
      |   v *     |   v + + + |     * *   |++++       |
      |           |           |     * *   |   v       |
      | G/C= .083 | G/C= .217 | G/C= .300 | G/C= .167 |
      | G=  5.0"  | G= 13.0"  | G= 18.0"  | G= 10.0"  |
      | Y+R= 4.0" | Y+R=  .0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF=  .0% | OFF=15.0% | OFF=36.7% | OFF=75.0% |

      C= 60 sec   G= 46.0 sec = 76.7%  Y=14.0 sec = 23.3%  Ped=  .0 sec =  .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								11.3	B	
RT	12/1	.033	.333	463	528	22	.042	10.3	B	25 ft
TH	12/1	.128	.333	553	621	167	.269	11.2	B	94 ft
LT	12/1	.011	.100	114	169	6	.034	18.5	*C+	25 ft
NB Approach								11.6	B	
TH+RT	12/1	.203	.550	985	1019	300	.294	5.6	*B+	114 ft
LT	12/1	.261	.317	491	560	389	.695	16.2	*C+	224 ft
WB Approach								14.9	B	
LT+TH+RT	12/1	.046	.200	205	270	29	.107	14.9	*B	25 ft
EB Approach								7.8	B+	
RT	12/1	.303	.567	863	897	411	.458	6.1	B+	150 ft
LT+TH	12/1	.092	.200	244	315	89	.283	15.6	C+	60 ft

Napilihau Villages
Traffic Impact Report Year 2002 with Project
PM Peak Hour

02/12/98
11:22:13

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD	
LOSTTIME	3.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	95	355	1	5	10	10	10	260	255	320	10	55
WIDTHS	12.0	12.0	12.0	.0	12.0	.0	.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	0	1	0	0	1	1	1	1	0
UTILIZATIONS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	4.0
MINIMUMS	5.0	13.0	5.0	5.0	16.0	5.0	5.0	10.0	5.0	5.0	16.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1583	1863	1770	0	1465	0	0	1853	1770	1583	1606	0

Phasing Parameters

SEQUENCES	61			
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	120	30	
GREENTIMES	5.00	11.00	20.00	10.00
YELLOWTIMES	4.00	.00	5.00	5.00
CRITICALS	9	3	8	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	.00	1
PEDTIME	.0	0

Napilihau Villages
Traffic Impact Report Year 2002 with Project
PM Peak Hour

02/12/98
11:22:23

SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St
Degree of Saturation (v/c) .43 Vehicle Delay 10.3 Level of Service B

```
        ------------------------------------------------------
Sq 61  |  Phase 1   |  Phase 2   |  Phase 3   |  Phase 4   |
**/**   ------------------------------------------------------
       |     +      |            | + +        |         ^  |
       |     +      |            | + +        |        ****|
 /|\   |     +>     |            |<+ +        |      <**** |
  |    |            |            |   v        |   ^    ****|
  |    |            |      ^     |       ^    |++++   v    |
North  |      <*    |    <+ + +> |      * *>  |++++>       |
  |    |++++  *     |++++ + + +  |      * *   |++++        |
       |    v *     |    v + + + |      * *   |   v        |
        ------------------------------------------------------
       | G/C= .083  | G/C= .183  | G/C= .333  | G/C= .167  |
       | G=   5.0"  | G=  11.0"  | G=  20.0"  | G=  10.0"  |
       | Y+R= 4.0"  | Y+R=   .0" | Y+R= 5.0"  | Y+R= 5.0"  |
       | OFF=   .0% | OFF=15.0%  | OFF=33.3%  | OFF=75.0%  |
        ------------------------------------------------------
       C= 60 sec   G= 46.0 sec = 76.7%  Y=14.0 sec = 23.3%   Ped=  .0 sec =   .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								11.9	B	
RT	12/1	.105	.367	519	581	106	.182	9.8	B+	57 ft
TH	12/1	.252	.367	620	683	394	.577	12.5	B	210 ft
LT	12/1	.003	.100	114	169	1	.006	18.5	*C+	25 ft
NB Approach								10.2	B	
TH+RT	12/1	.203	.550	985	1019	300	.294	5.6	*B+	114 ft
LT	12/1	.203	.283	429	501	283	.565	15.1	*C+	171 ft
WB Approach								14.9	B	
LT+TH+RT	12/1	.042	.200	225	293	28	.096	14.9	*B	25 ft
EB Approach								8.1	B+	
RT	12/1	.269	.533	804	844	356	.422	6.6	B+	140 ft
LT+TH	12/1	.078	.200	250	321	72	.224	15.3	C+	49 ft

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
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Ph: (904) 392-0378

Streets: (N-S) Hanawai Street (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour with Project 2002

Two-way Stop-controlled Intersection

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	15	245	50	30	150	25	50	5	55	70	15	20
PHF	.55	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	284	171
Potential Capacity: (pcph)	994	1134
Movement Capacity: (pcph)	994	1134
Prob. of Queue-Free State:	0.94	0.98

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	311	184
Potential Capacity: (pcph)	1219	1401
Movement Capacity: (pcph)	1219	1401
Prob. of Queue-Free State:	0.97	0.99

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	516	530
Potential Capacity: (pcph)	585	575
Capacity Adjustment Factor due to Impeding Movements	0.96	0.96
Movement Capacity: (pcph)	561	551
Prob. of Queue-Free State:	0.99	0.97

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	522	535
Potential Capacity: (pcph)	528	519
Major LT, Minor TH Impedance Factor:	0.93	0.95
Adjusted Impedance Factor:	0.94	0.96
Capacity Adjustment Factor due to Impeding Movements	0.93	0.90
Movement Capacity: (pcph)	489	466

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	58	489 >	495	8.3	0.4	B	
NB T	6	561 >					6.1
NB R	64	994		3.9	0.1	A	
SB L	81	466 >					
SB T	18	551 >	538	8.6	0.9	B	8.6
SB R	23	1134 >					
EB L	18	1401		2.6	0.0	A	0.1
WB L	35	1219		3.0	0.0	A	0.4

Intersection Delay = 2.3 sec/veh

HCS: Unsignalized Intersections   Release 2.1e   P2NSHS-P.HC0   Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Hanawai Street   (E-W) Napilihau Street
Major Street Direction.... EW
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour with Project 2002

Two-way Stop-controlled Intersection

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	< 0	1	1	< 0	0	> 1	1	0	> 1	< 0
Stop/Yield			N			N						
Volumes	20	250	105	100	225	70	100	10	35	50	15	15
PHF	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
Grade		0			0			0			0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's	1.10			1.10			1.10	1.10	1.10	1.10	1.10	1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections   Release 2.1e   P2NSHS-P.HC0   Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (vph)	318	274
Potential Capacity: (pcph)	955	1006
Movement Capacity: (pcph)	955	1006
Prob. of Queue-Free State:	0.96	0.98

Step 2: LT from Major Street	WB	EB
Conflicting Flows: (vph)	374	311
Potential Capacity: (pcph)	1137	1219
Movement Capacity: (pcph)	1137	1219
Prob. of Queue-Free State:	0.90	0.98

Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph)	756	774
Potential Capacity: (pcph)	438	428
Capacity Adjustment Factor due to Impeding Movements	0.88	0.88
Movement Capacity: (pcph)	386	377
Prob. of Queue-Free State:	0.97	0.95

Step 4: LT from Minor Street	NB	SB
Conflicting Flows: (vph)	734	742
Potential Capacity: (pcph)	398	394
Major LT, Minor TH Impedance Factor:	0.84	0.85
Adjusted Impedance Factor:	0.88	0.89
Capacity Adjustment Factor due to Impeding Movements	0.86	0.85
Movement Capacity: (pcph)	343	335

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
NB L	116	343 >	347	16.3	1.7	C	
NB T	12	386 >					13.3
NB R	41	955		3.9	0.0	A	
SB L	58	335 >					
SB T	18	377 >	394	12.0	1.0	C	12.0
SB R	18	1006 >					
EB L	23	1219		3.0	0.0	A	0.2
WB L	116	1137		3.5	0.3	A	0.9

Intersection Delay = 3.3 sec/veh

HCS: Unsignalized Intersections Release 2.1e P2NSLHRA.HC0 Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Lower Honoapiilani (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour with Project 2002

Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1 <	0	0 >	1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		45	55	230	35					25		215
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e P2NSLHRA.HC0 Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	76	
Potential Capacity: (pcph)	1267	
Movement Capacity: (pcph)	1267	
Prob. of Queue-Free State:	0.80	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	105	
Potential Capacity: (pcph)	1528	
Movement Capacity: (pcph)	1528	
Prob. of Queue-Free State:	0.83	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.82	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	355	
Potential Capacity: (pcph)	660	
Major LT, Minor TH Impedance Factor:	0.82	
Adjusted Impedance Factor:	0.82	
Capacity Adjustment Factor due to Impeding Movements	0.82	
Movement Capacity: (pcph)	543	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	29	543		7.0	0.0	B	3.9
WB R	249	1267		3.5	0.8	A	
SB L	266	1528		2.9	0.7	A	2.5

Intersection Delay = 2.6 sec/veh

HCS: Unsignalized Intersections   Release 2.1e   P2NSLHRP.HC0   Page 1

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Streets: (N-S) Lower Honoapiilani   (E-W) Napilihau Street
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour with Project 2002

Two-way Stop-controlled Intersection

	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
No. Lanes	0	1	< 0	0	> 1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		70	65	325	95					55		290
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections   Release 2.1e   P2NSLHRP.HC0   Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	108	
Potential Capacity: (pcph)	1221	
Movement Capacity: (pcph)	1221	
Prob. of Queue-Free State:	0.72	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	142	
Potential Capacity: (pcph)	1467	
Movement Capacity: (pcph)	1467	
Prob. of Queue-Free State:	0.74	
TH Saturation Flow Rate: (pcphpl)	1700	
RT Saturation Flow Rate: (pcphpl)		
Major LT Shared Lane Prob. of Queue-Free State:	0.73	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	550	
Potential Capacity: (pcph)	509	
Major LT, Minor TH Impedance Factor:	0.73	
Adjusted Impedance Factor:	0.73	
Capacity Adjustment Factor due to Impeding Movements	0.73	
Movement Capacity: (pcph)	370	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	64	370		11.8	0.6	C	5.3
WB R	336	1221		4.1	1.3	A	
SB L	376	1467		3.3	1.2	A	2.6

Intersection Delay = 3.2 sec/veh

HCS: Unsignalized Intersections Release 2.1e P2HHND-A.HCO Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378

Streets: (N-S) Honoapiilani Highway (E-W) New Driveway
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions AM Peak Hour with Project 2002

Two-way Stop-controlled Intersection

	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
No. Lanes	0	0	0	0	1	< 0	0	0	1	0	0	0
Stop/Yield			N			N						
Volumes					510	1			70			
PHF					.95	.95			.95			
Grade					0			0				
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's									1.10			

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e P2HHND-A.HCO Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)		538
Potential Capacity: (pcph)		739
Movement Capacity: (pcph)		739
Prob. of Queue-Free State:		0.89

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
							5.5
EB R	81	739		5.5	0.3	B	

Intersection Delay = 0.7 sec/veh

HCS: Unsignalized Intersections Release 2.1e P2HHND-P.HC0 Page 1

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Streets: (N-S) Honoapiilani Highway (E-W) New Driveway
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KKN
Date of Analysis.......... 1/16/98
Other Information......... Future Traffic Conditions PM Peak Hour with Project 2002

Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	1 <	0	0	0	1	0	0	0
Stop/Yield			N			N						
Volumes					660	8			29			
PHF					.95	.95			.95			
Grade					0			0				
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's									1.10			

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e P2HHND-P.HC0 Page 2

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)		699
Potential Capacity: (pcph)		613
Movement Capacity: (pcph)		613
Prob. of Queue-Free State:		0.94

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
							6.2
EB R	34	613		6.2	0.0	B	

Intersection Delay = 0.3 sec/veh

END

CERTIFICATION

I HEREBY CERTIFY THAT THE MICROPHOTOGRAPH APPEARING IN THIS REEL OF FILM ARE TRUE COPIES OF THE ORIGINAL DOCUMENTS.

2004
DATE

Sammy Yoshimura
SIGNATURE OF OPERATOR

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