Napilihau Villages

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# COUNTY OF MAUI DEPARTMENT OF PLANNING FINE

March 25, 1998

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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.

Mr. Gary Gill, Director March 25, 1998 Page 2

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,

SODAVID W. BLANE
Director of Planning

DWB:CIY:cmh

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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# Final Environmental Assessment

# Napilihau Villages

Prepared for:

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March 1998

Napilihau Villages Joint Venture



# Final Environmental Assessment

# Napilihau Villages

Prepared for:

March 1998

Napilihau Villages Joint Venture



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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.

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# Chapter I

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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

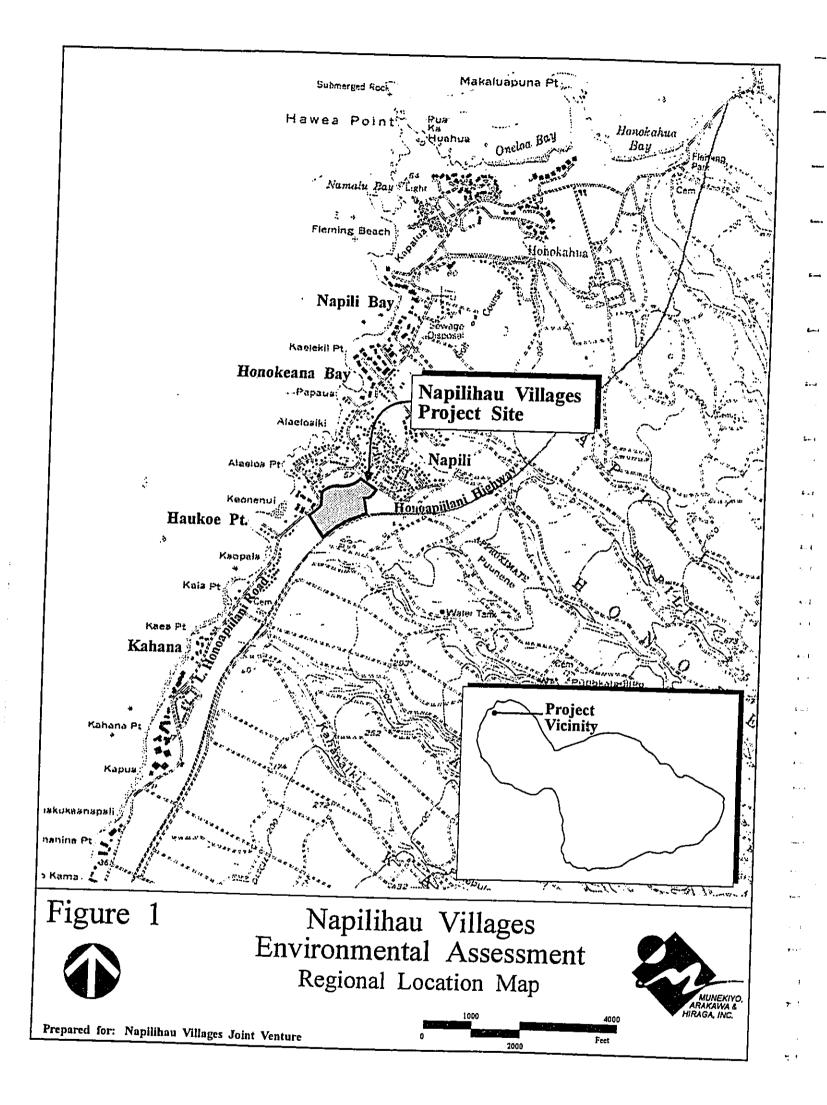
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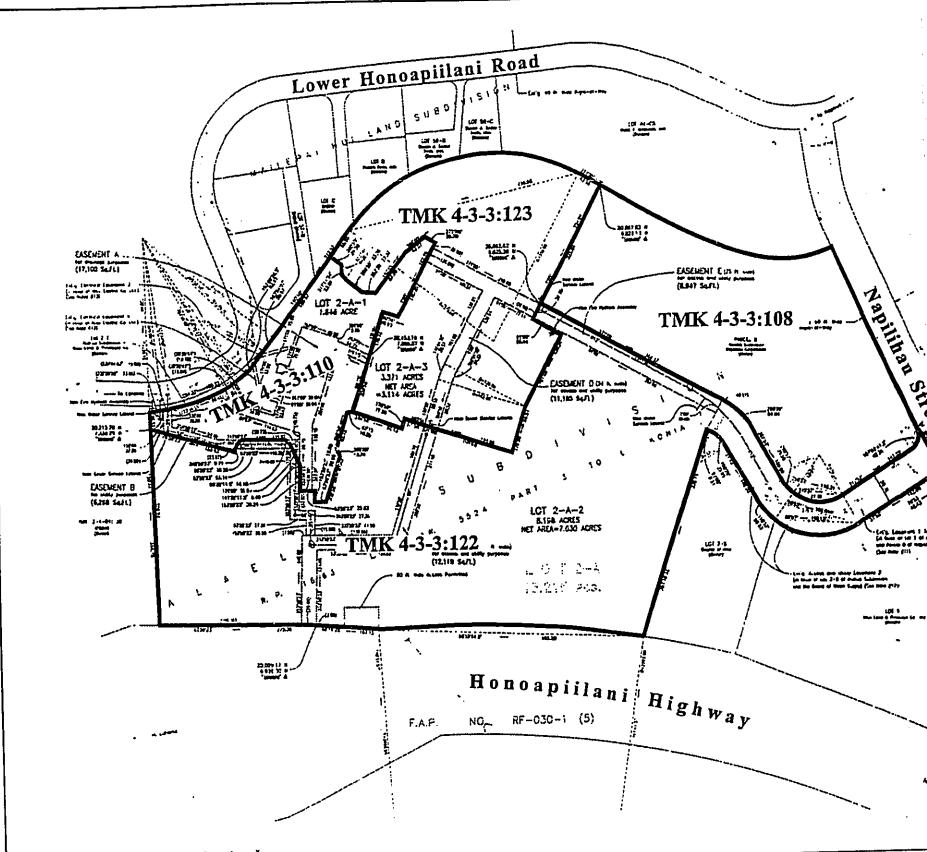
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The Napilihau Villages site consists of four (4) tax map parcels as shown in Table 1. Figure 2 illustrates the spatial relationship among the various parcels.





Source: Warren S. Unemori Engineering, Inc.

Figure 2

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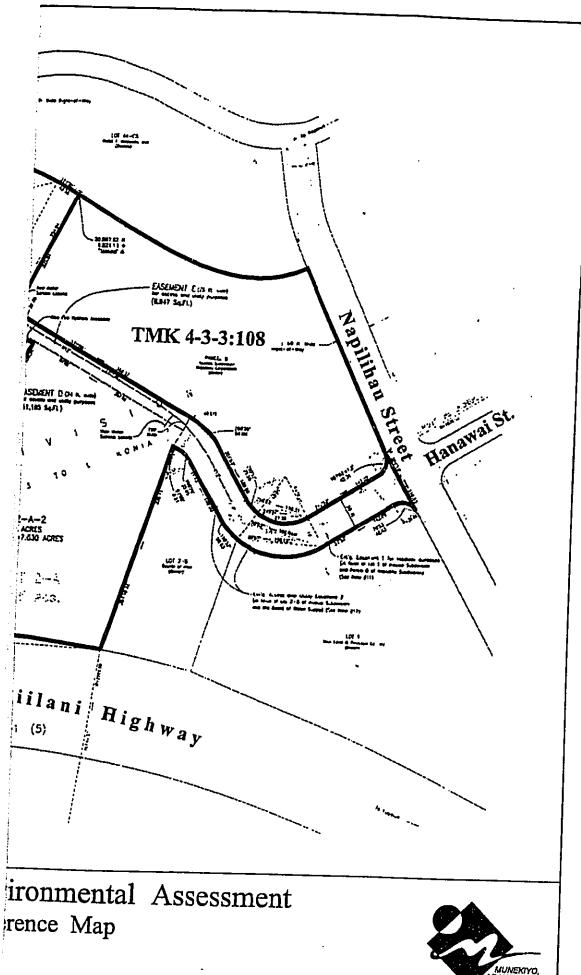
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Napilihau Villages Environmental Assessment Parcel Reference Map



Prepared for: Napilihau Villages Joint Venture

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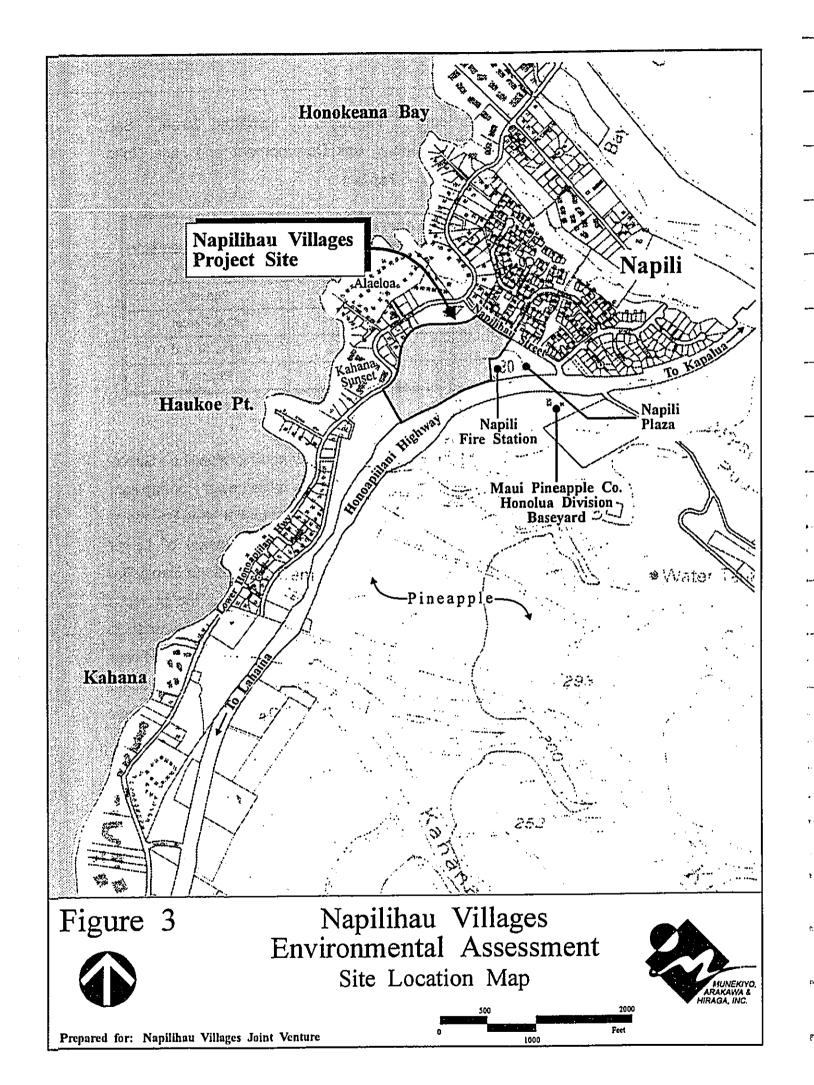
The project site is bordered to the north by Napilihau Street. See Figure 3. The Napilihau Planned Unit Development and Hale Noho

Table 1

TAX MAP REFERENCE SUMMARY			
Tax Map Key Number	Acreage	Phase/Use	
4-3-3:108	3.892	Phase 1	
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.



### C. PROPOSED ACTION

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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*	
Total	296			

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.

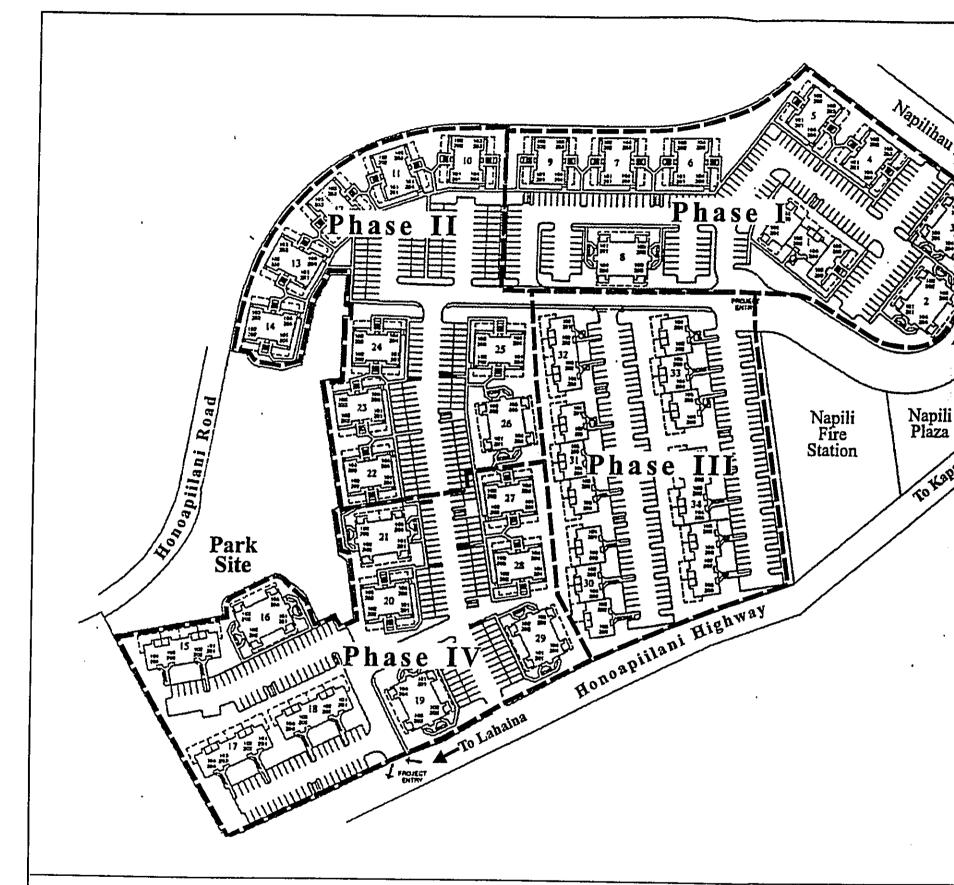


Figure 4

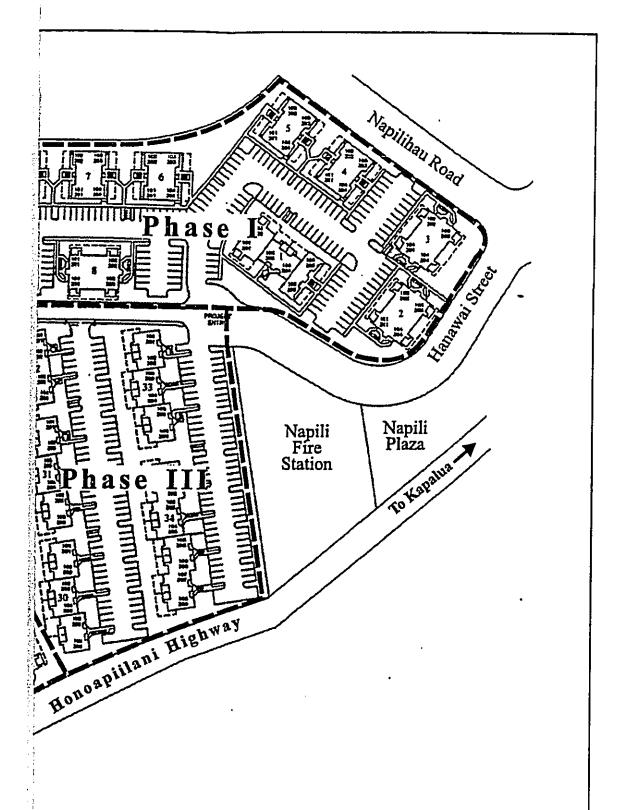
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Napilihau Villages Environmental Assessment Site Plan



Prepared for: Napilihau Villages Joint Venture

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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".)

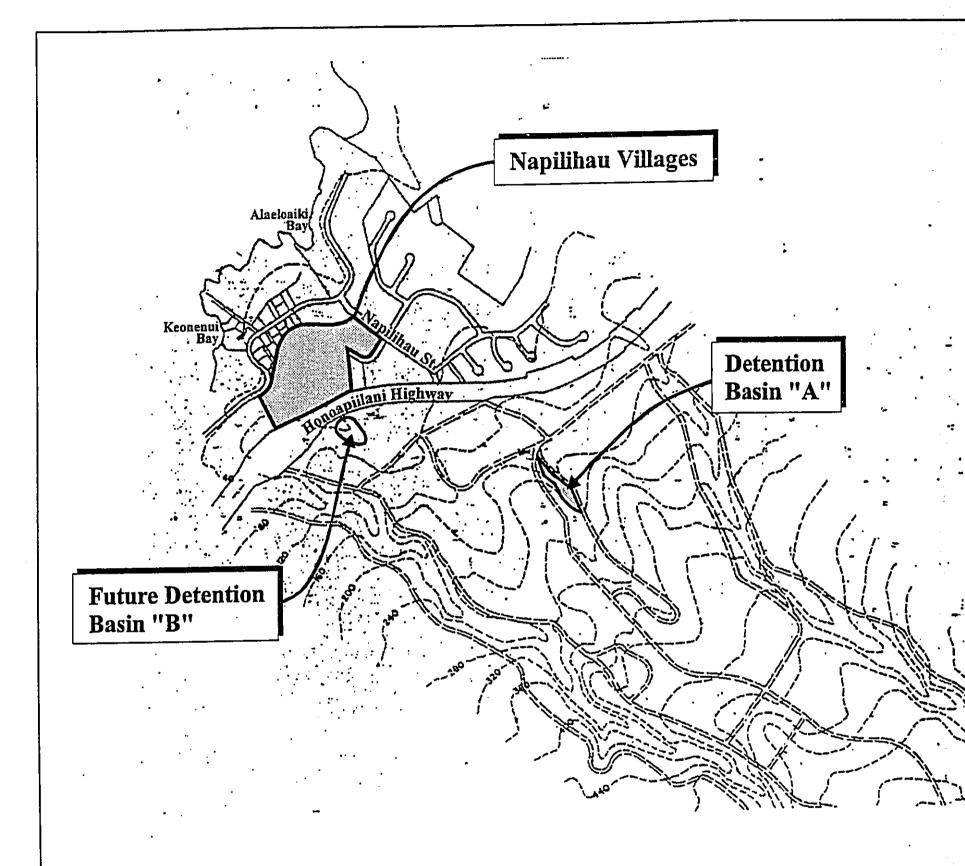
Additional onsite improvements include the installation of utility lines (i.e., water, sewer, drainage and electrical/telephone pipes and conduits), offstreet parking, landscaping and a 1.646-acre park (TMK 4-3-3:110) to fulfill the requirements of the County of Maui's parks and playground assessment.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

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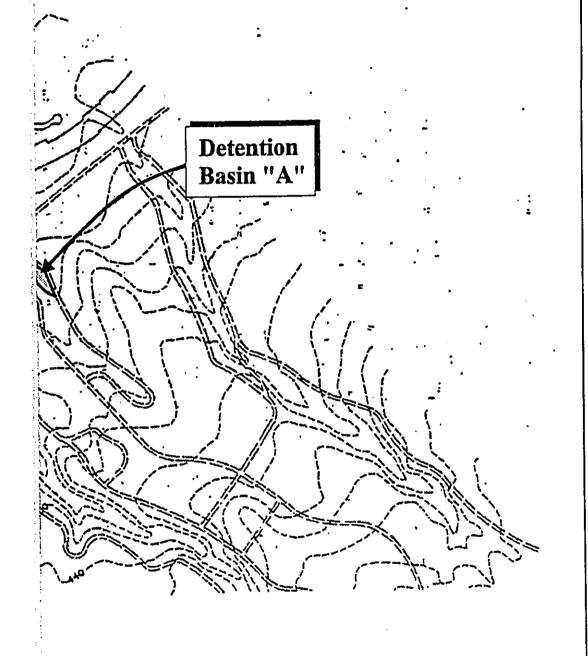
Napilihau Villages Environmental Assessment Detention Basins Location



Prepared for: Napilihau Villages Joint Venture

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# Chapter II

Description of the Existing Environment

# II. DESCRIPTION OF THE EXISTING ENVIRONMENT

### A. PHYSICAL SETTING

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### 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. <u>Climate</u>

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.

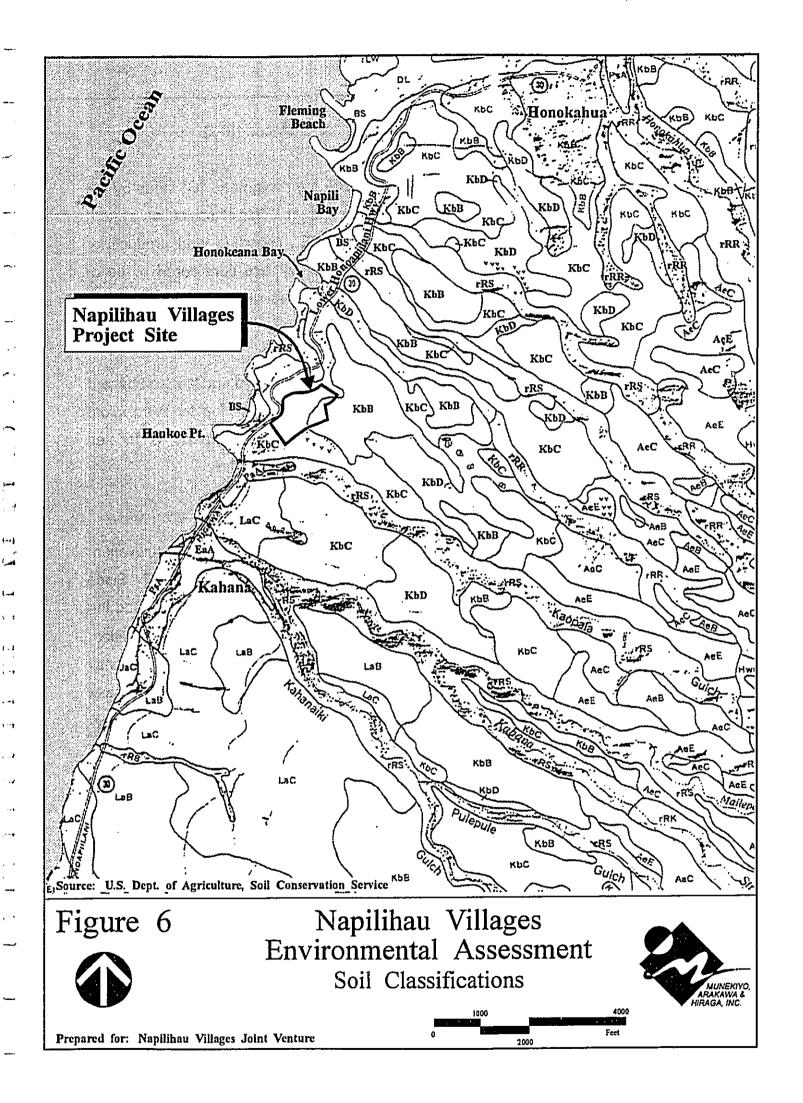
# 3. Topography and Soils

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

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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.

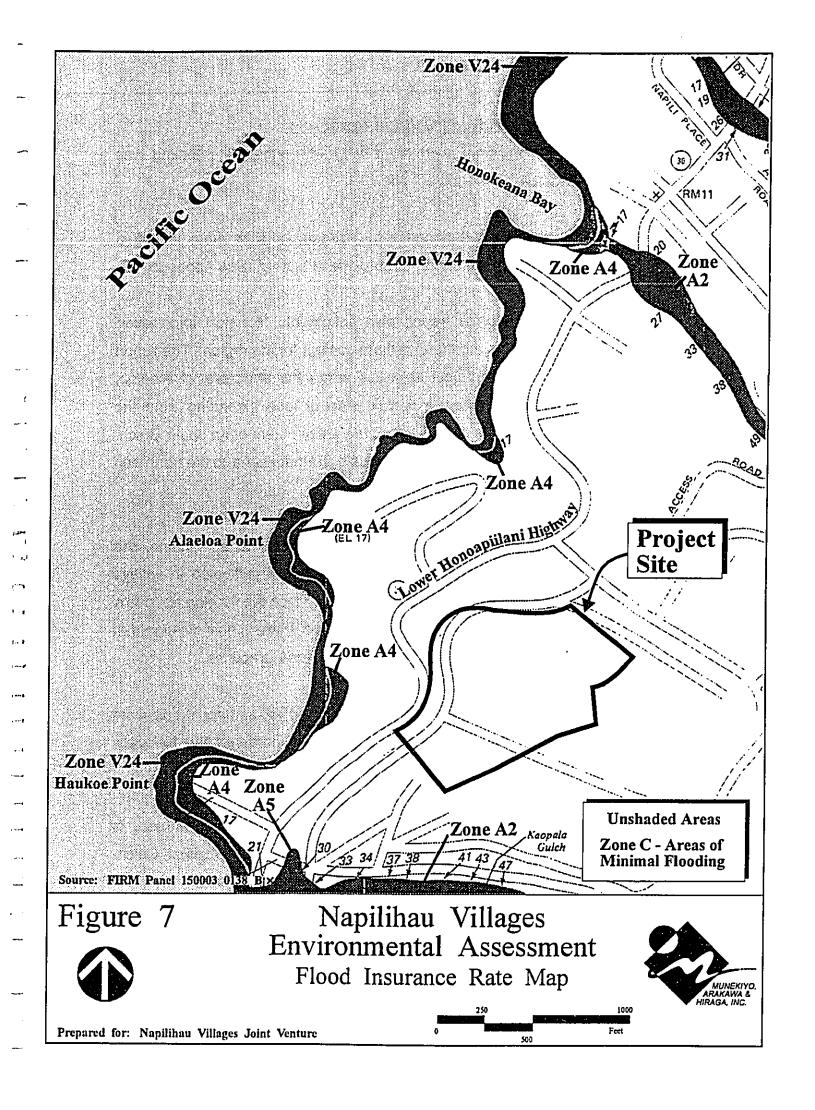
## 4. Flood and Tsunami Hazard

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.



## 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. <u>Scenic Resources</u>

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

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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 Iobata, 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 <u>Ulva fasciata</u>, <u>Sargassum echinocarpum</u>, and <u>Ahnfeltia concinna</u>. 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.

<u>Ulva faciata</u> 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

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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. <u>COMMUNITY SETTING</u>

### 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 <u>Hawaii Housing Policy Study Update 1997</u> 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 <u>Hawaii Housing Policy Study Update 1997</u> 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. <u>Medical Facilities</u>

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

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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. <u>Drainage</u>

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  $\boldsymbol{x}$ 40-inch corrugated metal pipe. Flows are then passed through the Napili Plaza where connection is made to the recently installed 36inch 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 Napi!ihau 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.

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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. <u>Archaeological Resources</u>

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

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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 buildozers, 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. <u>Use of Chemicals and Fertilizers</u>

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.

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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 Honoapillani 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

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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-Cariton 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 This improvement is intersection. 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.

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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. 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 Honoapillani Road.

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

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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 Honoapillani 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:

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- 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:

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- 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 Honoapillani Road and Napilihau Street to provide a left-turn storage lane on Lower Honoapillani 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.

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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 falls 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 Honoapillani 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.

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# Chapter IV

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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.

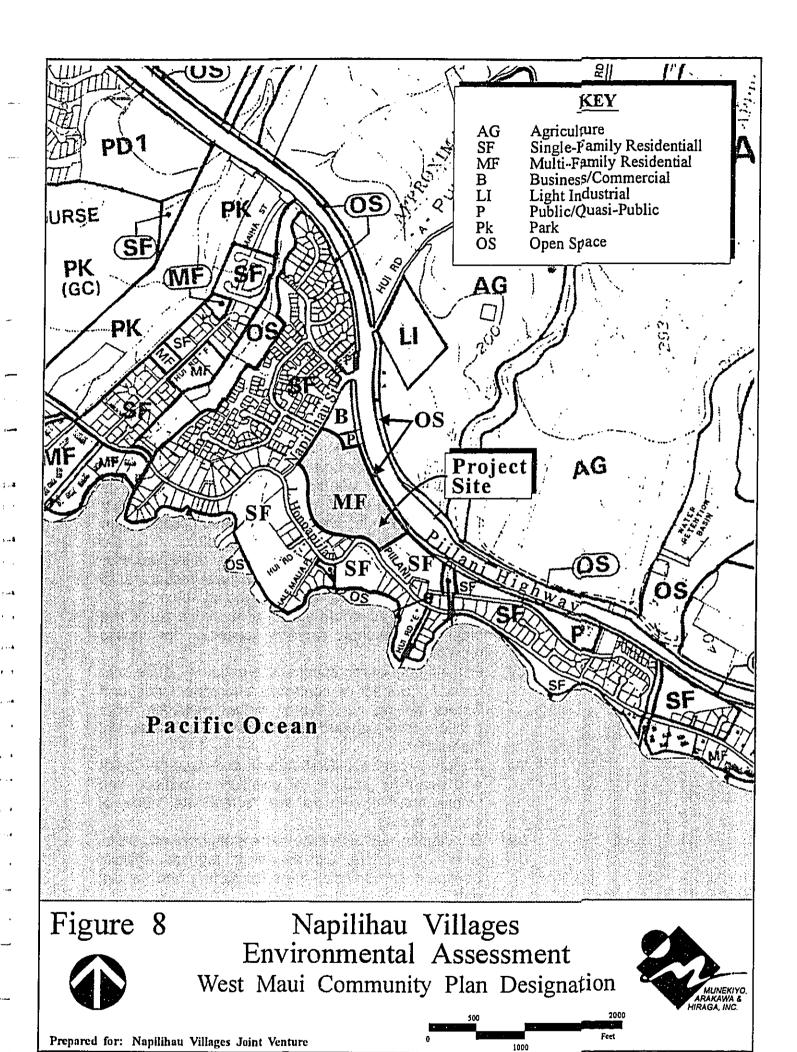
#### D. <u>COUNTY ZONING</u>

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 <u>Special Management Area Rules</u>.

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#### (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) <u>Historic Resources</u>

#### 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:

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- (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.

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

#### (3) <u>Scenic and Open Space Resources</u>

#### **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.

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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:

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- (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) <u>Coastal Hazards</u>

### **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) <u>Managing Development</u>

## **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;

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(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

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; ( ) (3) 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. <u>SITE PLAN ALTERNATIVES</u>

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

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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 <u>Significance Criteria</u> 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. <u>No Substantial Secondary Impacts, Such as Population Changes or Effects on Public Facilities, are Anticipated</u>

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. <u>Air Quality, Water Quality or Ambient Noise Levels Would Not Be</u> 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. <u>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</u>

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. <u>The Proposed Project Will Not Substantially Affect Scenic Vistas and Viewplanes Identified in County or State Plans or Studies</u>

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

## 13. <u>The Proposed Project Will Not Require Substantial Energy</u> <u>Consumption</u>

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:

- Neal Fujiwara
   Soil Conservationist
   Natural Resources Conservation
   Service
   U.S. Department of Agriculture
   210 Imi Kala Street, Suite 209
   Wailuku, Hawaii 96793-2100
- 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
- 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
- Denis Lau, Chief
   Clean Water Branch
   State of Hawaii
   Department of Health
   919 Ala Moana Blvd., Room 300
   Honolulu, Hawaii 96814

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- 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
- 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 of Transportation 869 Punchbowl Street Honolulu, Hawaii 96813

Robbie Ann A.K. Guard 18. Ronald Davis, Chief 11. Coordinator County of Maui County of Maui Department of Fire Control Office of Economic 200 Dairy Road Development Kahului, Hawaii 96732 200 South High Street Wailuku, Hawaii 96793 Stephanie Aveiro, Director 12. County of Maui Department of Housing and **Human Concerns** 200 S. High Street Wailuku, Hawaii 96793 Henry Oliva, Director 13. County of Maui Department of Parks and Recreation 200 South High Street Wailuku, Hawaii 96793 David W. Blane, Director 14. County of Maui Department of Planning 250 South High Street Wailuku, Hawaii 96793 Howard Tagomori, Chief 15. County of Maui Police Department 55 Mahalani Street Wailuku, Hawaii 96793 Charles Jencks, Director 16. County of Maui Department of Public Works and Waste Management 200 South High Street Wailuku, Hawaii 96793 David Craddick, Director 17. County of Maui Department of Water Supply 200 South High Street

Wailuku, Hawaii 96793

# Chapter XI

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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.

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## 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

March 18, 1993

. . . . . Street to a

Planning Division

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

1. 1711.0313 02405-00

Jan 1, 171,257 //IP(\*\*=\*;\*=:

Dear Mr. Miskae:

required.

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.

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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 CLEON-HD

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

Sincerely,

(1777)(14-7)-74; GEPOD-00-0

Kisuk Cheung, P.E. Director or Engineering -Caren-ab-r -.11 ::

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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

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MSWord NAPILI Mizue/9258 CEPOD-CO-O

Operations Division

Lec CEPOD-CO-O Note: Mile had in raled, but from the right Ops Div File a/k

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

Dear Mr. Munekiyo:

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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 BENJAMIN J. CAYETANO GOVERNOR



LAWRENCE MIKE

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

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BENJAMIN J. CAYETANO

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## STATE OF HAWAII DEPARTMENT OF HEALTH

P O BOX 3378

HONOLULU, HAWAII 96801-3378

In reply please refer to EMD/CWB

LAWRENCE MIKE

DIRECTOR OF HEALTH

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.

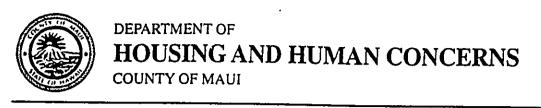
Should you have any questions, please contact Ms. Hong Chen, Engineering Section of the Clean Water Branch, at (808) 586-4309.

Sincerely,

DENIS R. LAU, P.E., CHIEF

Clean Water Branch

HC:auc



DEC 1 U 1991
LINDA CROCKETT LINGUE
Ma
STEPHANIE AVEI.
Director
MARK PERCE
Deputy Direc

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.

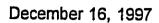
Very truly yours,

Stephanie arens

STEPHANIE AVEIRO Director of Housing and Human Concerns

WTO:wo

xc: Housing Administrator



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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:Ifm

cc: Kimo Lee, Napilihau Villages Joint Venture



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



HOWARD H. TAGOMORI-CHIEF OF POLICE

> . . ۲...

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 LAHATNA 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:

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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.

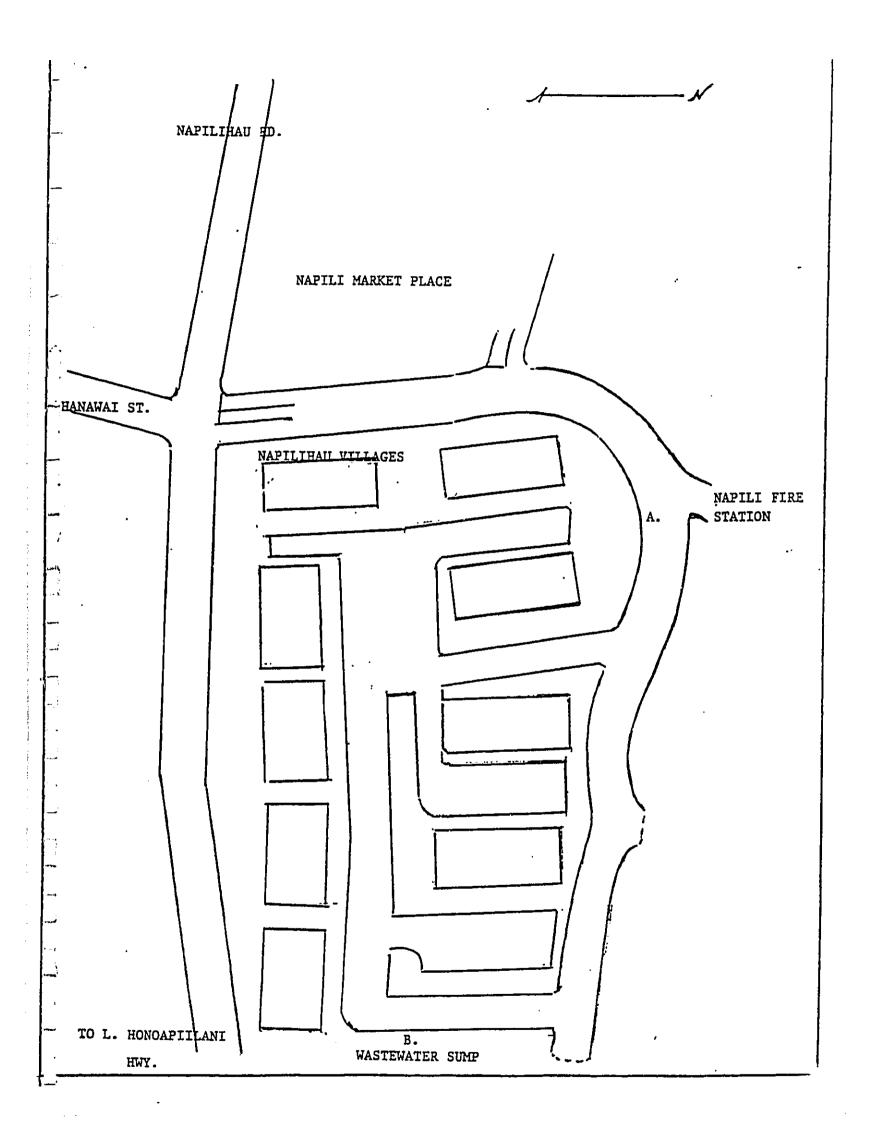
It is suggested that the buildings within the Project have large numbers on all sides of the building, visible to any Emergency unit responding to the various phases. It is further suggested that the numbers be of a dark color which is outstanding and plainly visible.

#### 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. Cur concerns address a Police perspective on such safety factors which may present future problems. These recommendations are presented for further review.

Sergeant Brian De Mello Lahaina Police, District IV

12/6/97 1330 hours







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.

Howard Tagomori, Chief of Police December 18, 1997 Page 2

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. 191/maplifee/mpdttr,001

LINDA CROCKETT LINGLE Mayor

CHARLES JENCKS
Director

DAVID C. GOODE Deputy Director

AARON SHINMOTO, P.E. Chief Staff Engineer



## 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

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

Solid Waste Division

BRIAN HASHIRO, P.E. Highways Division

MICHAEL D. WILSON CHANNERSON

ROBERT G. GIRALO DAVID A. NOBRIGA LAWRENCE H. MIIKE RICHARD H. COX HERBERT M. RICHARDS, JR.



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

RAE M. LOUI, P.E. DERUTY

DEC | 5 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.
- 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.

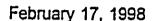
In addition to the above concerns, we recommend that this project be coordinated with the West Maui Mountains Watershed Partnership (C. Brewer, Amfac, Maui Land & Pine, Bishop Estate, The Nature Conservancy, Maui Board of Water Supply, and Department of Land and Natural Resources).

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





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

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.

- 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.
- The proposed project will connect to the DWS's domestic water system. The 2. 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.
- Non-point water pollution control measures have been and will continue to be 3. 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.

Rae Louie, Deputy Director February 12, 1998 Page 2

- Water conservation is being addressed through the use of low flow water fixtures. 4. At this time, there is no County effluent reuse lines in the vicinity of the project site.
- The proposed action will not affect existing streams and therefore will not require 5. a stream channel alteration permit.
- As needed, coordination with the West Maui Watershed partnership will be 6. undertaken during the course of project implementation. The second control of the second control of

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 

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Wayne Tanigawa, Napilihau Villages Joint Venture Clayton Yoshida, Planning Department jgl/nepillee/cownitr.001



#### STATE OF HAWAII

#### DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION 33 SOUTH KING STREET, 6TH FLOOR C1888 NAWAH ,UJUJONOH

January 28, 1998

Mr. Michael Munekiyo Munekiyo and Arakawa Inc. 305 High Street Suite 104

Dear Mr. Munekiyo:

Wailuku, Hawaii 96793

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.

DON MIBBARD, Administrator

State Historic Preservation Division

BD:jen

Aloha

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

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

DEPUTIES

GREET COLOMA-AGARAN

AGUACULTURE DEVELOPMENT PROGRAM

AQUATIC RESOURCES CONSERVATION AND

RESOURCES ENFORCEMENT CONVEYANCES FORESTRY AND WILDLIFE HISTORIC PRESERVATION

DIVISION LAND DIVISION

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### DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

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

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

OFFICE OF PLANNING

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

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 Egget Director

Office of Planning



January 19, 1998

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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:Ifm

cc: Clayton Yoshida, Planning Department (via mail)

Kimo Lee, Napilihau Villages Joint Venture (via mail)

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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.

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United States
Department of
Agriculture

Natural Resources Conservation Service

210 lmi Kala St. Suite 209 Wailuku, Hl 96793-2100

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

'98 JAN 20 P1:50

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DEPT OF PLANKING COUNTY OF MAIN January 16, 1998 CEIVED

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,

Meal S. Fujiwara

District Conservationist

GOVERNOR OCCUPANTOR

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JAN 30 P12:18

RECEIVE:

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STATE OF HAWAII DEPT OF FLARY A RESPONSE REFER TO:
DEPARTMENT OF ACCOUNTING COUNTY OF PLARY
AND GENERAL SERVICES

SURVEY DIVISION P. O. BOX 119 HONOLULU, HAWAN 96810 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.

> Landale W Horhundo RANDALL M. HASHIMOTO State Land Surveyor



### DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

BENJAMIN J. CA TAN
GC. L'RNO
SELII F. NAY
DIRECTO
BRADLEY J. MC MAI
DEPUTY DI 2TO
RICK JGEI
DIRECTOR. OFFICE OF PLANNINI

7 |

OFFICE OF PLANNING

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

Ref. No. P-7164

98 JAN 30 P12:1 9Tel.: (808) 587 846 Fax: (808) 587 \_824

DEPT OF PLANNAL CURRETY OF MAIN. RECEIVED

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)

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

Sincerely,

Rick Egged Director

Office of Planning

HERMAN M. AIZAWA, Ph.D. SUPERINTENDENT

#### STATE OF HAWAII '98 JAN 20 P1:48

DEPARTMENT OF EDUCATION

P O. BOX 2350 HONOLULU, HAWAII 95804 DEPT OF FLAMES COUNTY CONTROL FOR STANDARD 12, 1998

OFFICE OF THE SUPERINTENDENT

, ;

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. Mr. David W. Blaine Page 2 January 12, 1998

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.

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Sincerely,

Herman M. Aizav

HMA:hy

Attachments

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



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:

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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.

Herman Aizawa, Ph.D. February 18, 1998 Page 2

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)

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## STATE OF HAWAII

P. O. BOX 2360 HONOLULU, HAWAH 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

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER



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## STATE OF HAWAII

P. O. BOX 2380 HONOLULU, HAWAH 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.

Mr. Brian Miskae -2-February 1, 1993 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

HENJAMIN J. CAVETANO GIVERNOR STATE OF HAWAII



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STATE OF HAWAII 98 JAN 27 PI2:47

DEPARTMENT OF HAWAIIAN HOME LANDS

P.O. BOX 1879 DEPT OF PLANING HONOLULU, HAWAII VINDS CO. CO. TY OF PLANING 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,

HALI WATSON, Chairman

Hawaiian Homes Commission



LAWRENCE MIKE

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

98 JAN 15 PI2:37

STATE OF HAWAII DEPARTMENT OF HEALTH

DEPT OF PLANSIN COUNTY OF MAIL RECEIVED 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



LORRAINE H. AKIBA DIRECTOR

**LEONARD AGOR** DEPUTY DIRECTOR

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#### JAN 12 P12:15 STATE OF HAWAII

DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS

B30 PUNCHBOWL STREET DEDT OF PLANTS COUNTY OF " I 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

Lanain Hariz

Director



JAN 30 P12:20

#### STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES

DEPT OF PLANKS COUNTY OF HOME RECEIVED

LAND DIVISION PO 80X 621 HONOLULU, HAWAII 95809

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

: Napilihau Village Project

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

Very truly yours,

Hirden many CLEAN Y. UCHIDA Administrator

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

STATE PARKS WATER RESOURCE MANAGEMENT

AQUACULTURE DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN HECREATION
CONSERVATION AND
RESOURCES ENFENCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
EAND DIVISION
STATE PARKS



MICHARL D. WILSON, CHAIRPERSON

BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

GILBERT COLOMA-AGARAN

PROGRAM

AQUACULTURE DEVELOPMENT

STATE OF HAWAII JAN 29 P12:14

DEPARTMENT OF LAND AND NATURALTREGOURCES

STATE HISTORIC PRESERVATION (DIVIDION TO THE MEDICAL PROPERTY OF THE MEDICAL P

January 20, 1998

AGUATIC RESOURCES CONSERVATION AND RESOURCES ENFORCEMENT CONVEYANCES FORESTRY AND WILDLIFE HISTORIC PRESERVATION DIVISION LAND DIVISION STATE PARKS WATER AND LAND DEVELOPMENT

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

Dear Mr. Blane:

LOG NO: 20840 🖍 DOC NO: 9801BD15

SUBJECT:

Chapter 6E-42 Historic Preservation Review of a Draft Environmental

Assessment for the Napilihau Villages

'Alaeloa Ahupua'a, Lahaina District, Island of Maui

TMK 4-3-3: 108, 110, 122, and 123

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

DON HIBBARD, Administrator

State Historic Preservation Division

BD jen

CC

Aloha

Ralph Nagamine, Maur County Department of Public Works (fax. 243-7972)

ESTHER UEDA

98 JAN -5 P1:01

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DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

DEPT OF FLANGE

P.O. Box 2359 Honolulu, HI 96804-2359 Telephone: 808-587-3822 Fax: 808-587-3827

COUNTY OF MAIN 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

- 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 1) subject draft environmental assessment, is within the State Land Use Urban District.
- In regards to the text on page 47 of the subject draft 2) 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,

ESTHER UEDA

Executive Officer

EU:th



January 19, 1998

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

SUBJECT: <u>Draft Environmental Assessment for Napilihau Villages</u>

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
Kimo Lee, Napilihau Villages Joint Venture

BENJAMIN J. CAYETANO GOVERNOR



GARY GILL DIRECTOR

#### STATE OF HAWAII

#### OFFICE OF ENVIRONMENTAL QUALITY CONTROL

236 SOUTH BERETANIA STREET SUITE 702 HONOLULU, HAWAII 98813 TELEPHONE (808) 586-4186 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.

- Please discuss the <u>cumulative</u> and <u>indirect</u> 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.
- Please submit to the County for inclusion in the final environmental assessment and notice of determination, the <u>final</u> 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)



February 17, 1998

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

SUBJECT: <u>Draft Environmental Assessment for Napilihau Villages</u>

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.

- Cumulative and indirect impacts of chemicals and fertilizers, sediment loading and 1. 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

Wayne Tanigawa, Napilihau Villages Joint Venture CC: Clayton Yoshida, Planning Department

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#### STATE OF HAWAI'I

OFFICE OF HAWAIIAN AFFAIRS PT OF FLASHING 711 KAPI'OLANI BOULEVARD, SUITE 660 OFFICE OF STATE HONOLULU, HAWAI'I 96813 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,

Land and Natural Resources

Randall Ogata Administrator

cc: Napilihau Villages Joint Venture

Board of Trustees

CAC, Maui Island



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

JAN 23 1998

KAZU HAYASHIDA DIRECTOR

DEPUTY DIRECTORS BRIAN K. MINAAI GLENN M. OKIMOTO

IN REPLY REFER TO:

HWY-PS 2.7764

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



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

SUBJECT: <u>Draft Environmental Assessment for Napilihau Villages</u>

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.

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LINDA CROCKETT LINGLE MAYOR



RONALD P. DAVIS CHIEF

HENRY A. LINDO, SR. DEPUTY CHIEF

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'98 JAN 29 A10:11

#### COUNTY OF MAUI

200 DAIRY ROAD UUN Y (F. M. ).
KAHULUI, MAUI, HAWAII 967 (ED) 243-7561

January 26, 1998

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

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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

LINDA LINGLE Mayor

HENRY OLIVA Director

ALLEN SHISHIDO Deputy Director

1580-C KAAHUMANU AVENUE WAILUKU, HAWAII 96793 98

FEB 10 P3:07

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

DEPT OF PLANKING COUNTY OF MAY RECEIVES

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.

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c: Files

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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

- 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 recreation;
- 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;

Such parks and playgrounds shall not include golf courses, marinas, or other similar uses for which

a fee is charged;

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;

Prior subdivision 6. to approval, 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;

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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;

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

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 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;



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)



#### LINDA LINGLE MAYOR

**OUR REFERENCE** 

YOUR REFERENCE

#### POLICE DEPARTMENT

**COUNTY OF MAUI** 

55 MAHALANI STREET **WAILUKU, HAWAII 96793** 

(808) 244-6400 FAX (808) 244-6411 '98 FEB -4 P3:09HOWARD H. TAGOMORI CHIEF OF POLICE

DEPT OF 1 AND 4 THOMAS PHILLIPS CULTY YOU MAY DEPUTY CHIEF OF POLICE RECEIVED

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

HOWARD H. TAGOMORI fdr:

Chief of Police

LINDA LINGLE Mayor

CHARLES JENCKS
Director

DAVID C. GOODE Deputy Director



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

EASSIE MILLER, P.E. Wastewater Reciamation Division

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

BRIAN HASHIRO, P.E. Highways Division

Solid Waste Division

Telephone: (808) 243-7845 Fax: (808) 243-7955 DEPT OF COUNTY OF MAUI

DEPARTMENT OF PUBLIC WORKS

AND EVASTE MANAGEMENT

200 SOUTH HIGH STREET WAILUKU, MAUI, HAWAII 96793

January 26, 1998

MEMO TO: DAVID TO BLA

BLANE, DIRECTOR OF PLANNING

FROM:

CHARLES JENCKS, DIRECTOR OF PUBLIC WORKS AND WASTE

MANAGEMENT

SUBJECT:

ENLYRONMENTAL 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.



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

jgVnapilles/dpwwmtr.001

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DEPT OF PLANNING COUNTY OF MASS RECEIVED

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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

Klused J. Rinkauder

Manager, Engineering

ELR/dt:Ih

ATEPHANIE AVERO MARK PERCECT Deputs Director

200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • PHONE (808) 243 7825 • PEB 1828) 243-7825

February 13, 1998

DETT. IT I LIKE

TO:

Mr. David Blane

Director of Planning

FORM:

genzin

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:

- 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

Mr. David Blane Page 2 February 13, 1998

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.

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

WTO:wo

xc: Housing Administrator



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

### References

#### References

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

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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

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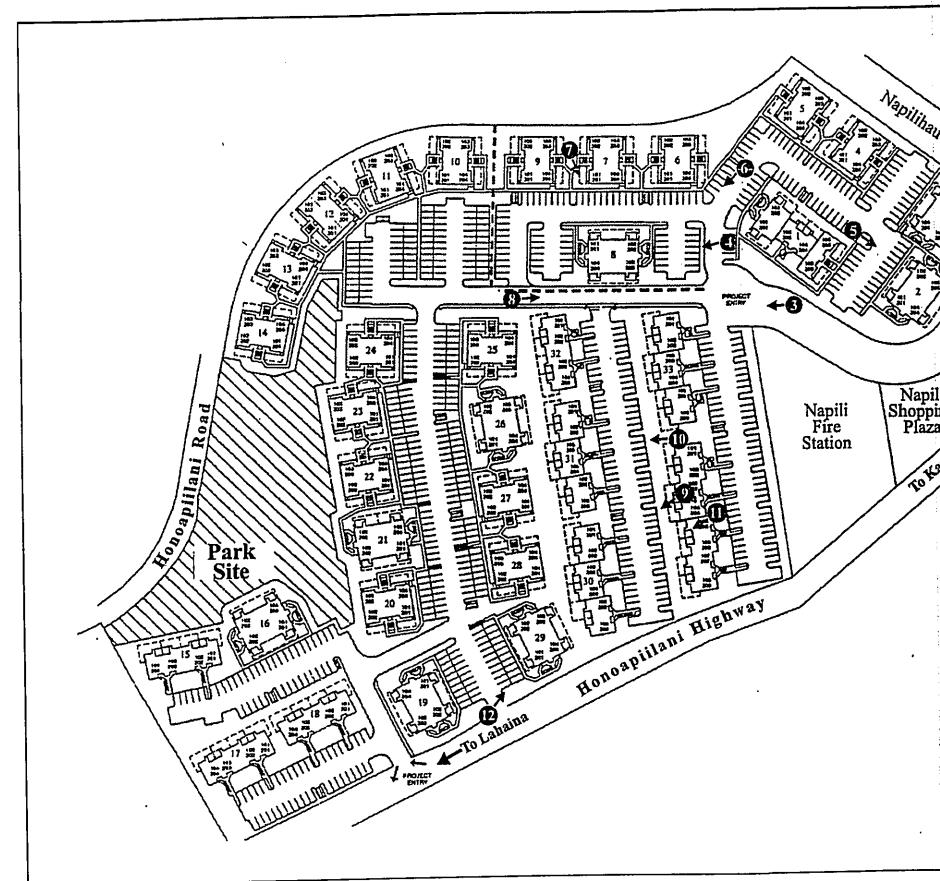
Appendix "I" Supplemental Traffic Impact Report

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

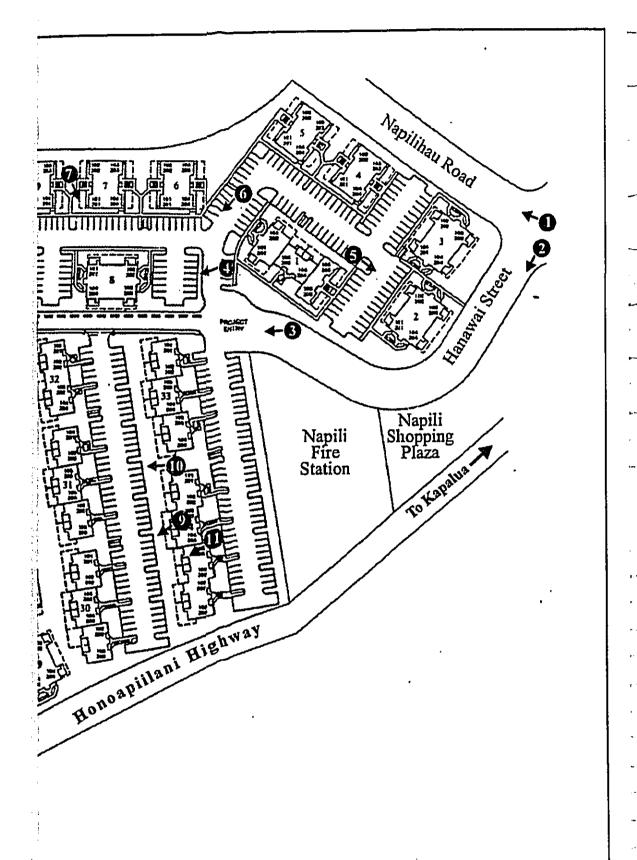


Napilihau Villages Environmental Assessment Site Photographs - Reference Map



Prepared for: JGL Enterprises, Inc.

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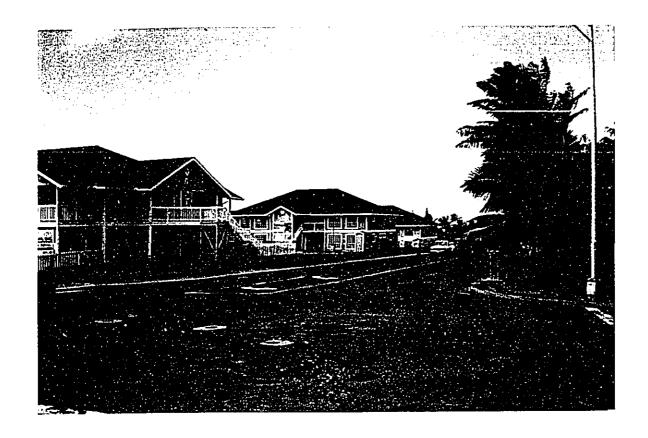


Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8



Photo 9



Photo 10



Photo 11



Photo 12

### Appendix B

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Preliminary Drainage and Erosion Control Report

# DRAINAGE AND SOIL EROSION CONTROL REPORT

### FOR

# NAPILIHAU VILLAGES

# Alaeloa, Lahaina, Maui, Hawail

### TMK: 4-3-03:110

JGL Enterprises, Inc.	Honoletic Hawaii
DEVELOPER:	ADDRESS:

### 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

# #:\rp51data\afowp\92037024.zpt (5.2)

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	A. Topography and Soil Conditions B. Flood and Tsunami Zone C. Drainage	3.4.6
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>	SOIL EROSION CONTROL PLAN	
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#### EXHIBITS

Location Map	Soil Survey Map	Flood Insurance Rate Map	Conceptual Drainage Plan (in pouch)
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### APPENDICES

A Hydrologic Calculations
B Universal Soil Loss Equation Calculations

#### 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

### 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:

# 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  $\pm$  feet M.S.L. to (+) 30  $\pm$  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;

# Existing Conditions:

Currently, runoff from the drainage area mauka and east of Napithau 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.

Runoss from the second drainage area located mauka of Honoapillani 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. Runoss is then conveyed across Honoapillani Highway through a 66-inch culvert to a depression in the westerly corner of the Napilihau Villages project site. Runoss 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

# 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 Sireet 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 Iess 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 & Pincapple 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.
- 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 erasion.
- Graded areas shall be thoroughly watered after construction activity has ceased for the day and on weekends.
- 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 Honoapillani 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.

Report Prepared By:

Reed M. Ariyoshi

Report Checked By:

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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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- Use temporary berms and cut-off ditches, where needed, for control of erosion.
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Report Prepared By:

Reed M. Ariyashi

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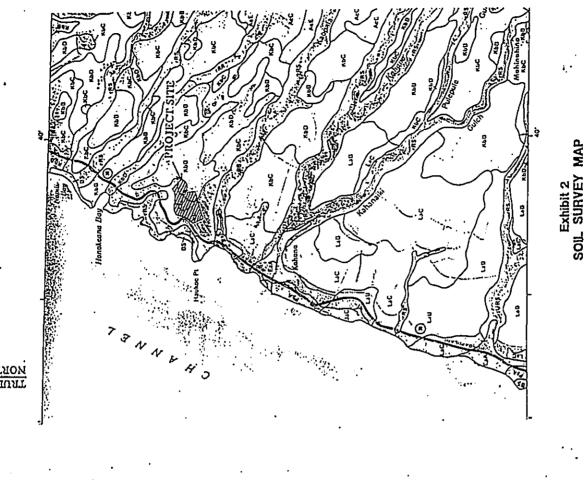
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## VII. REFERENCES

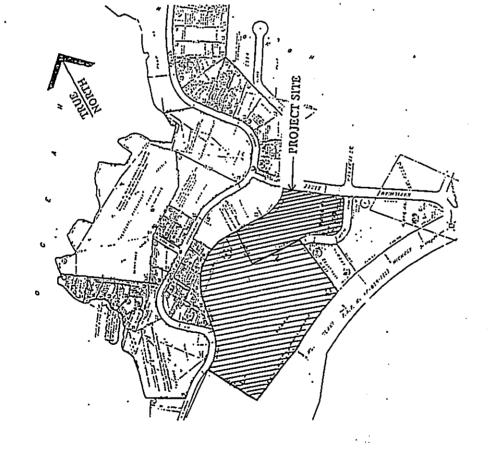
- Soil Survey of Islands of Kauai, Oalut, Maui, Molokai, and Lanai, State of Hawaii. August 1972. United States Department of Agriculture, Soil Conservation Service.
- Flood Insurance Rate Map, Maui County, Hawaii. Community-Panel Number 150003 0138B. September 6, 1989. Federal Emergency Management Agency, Federal Insurance Administration.
- 3. Drainage Maxer Plan for the County of Maui, State of Hawaii. October 1971. R.M. Towill Corporation.
- Rainfall Frequency Atlas of the Hawaiian Islands, Technical Paper No. 43. 1962. U.S. Department of Commerce, Weather Bureau.
- Storm Drairage Standards. March 1986. Department of Public Works, City and County of, Honolulu.

#### **EXHIBITS**

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

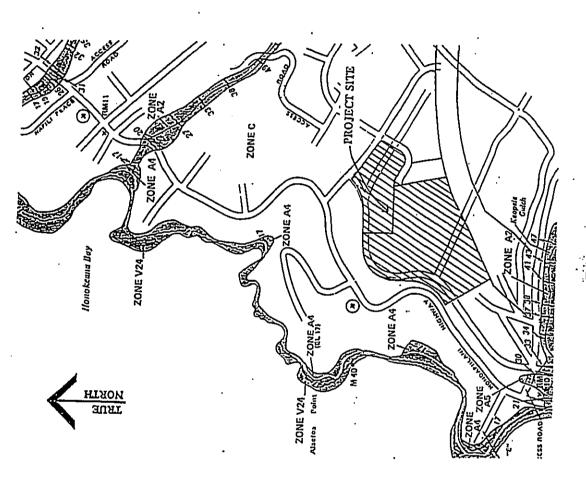






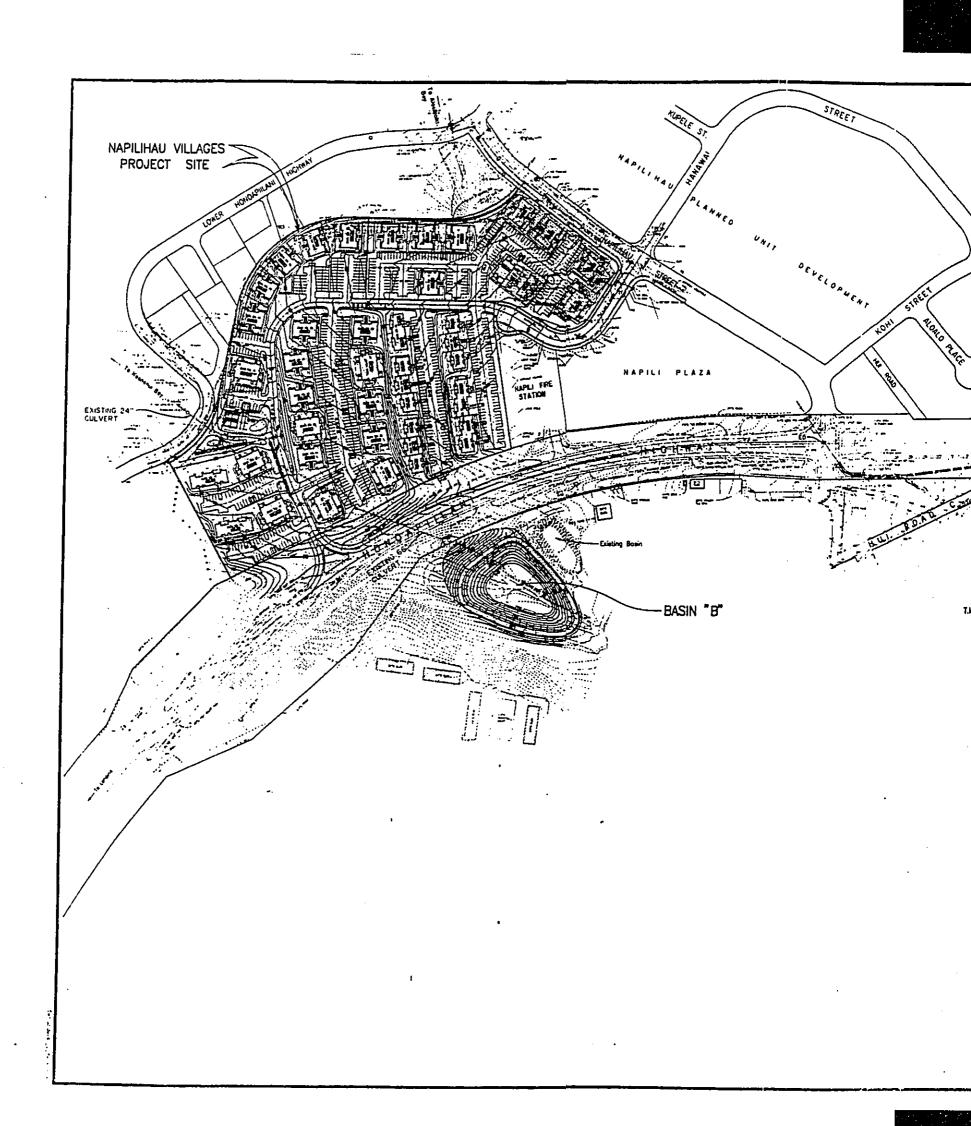
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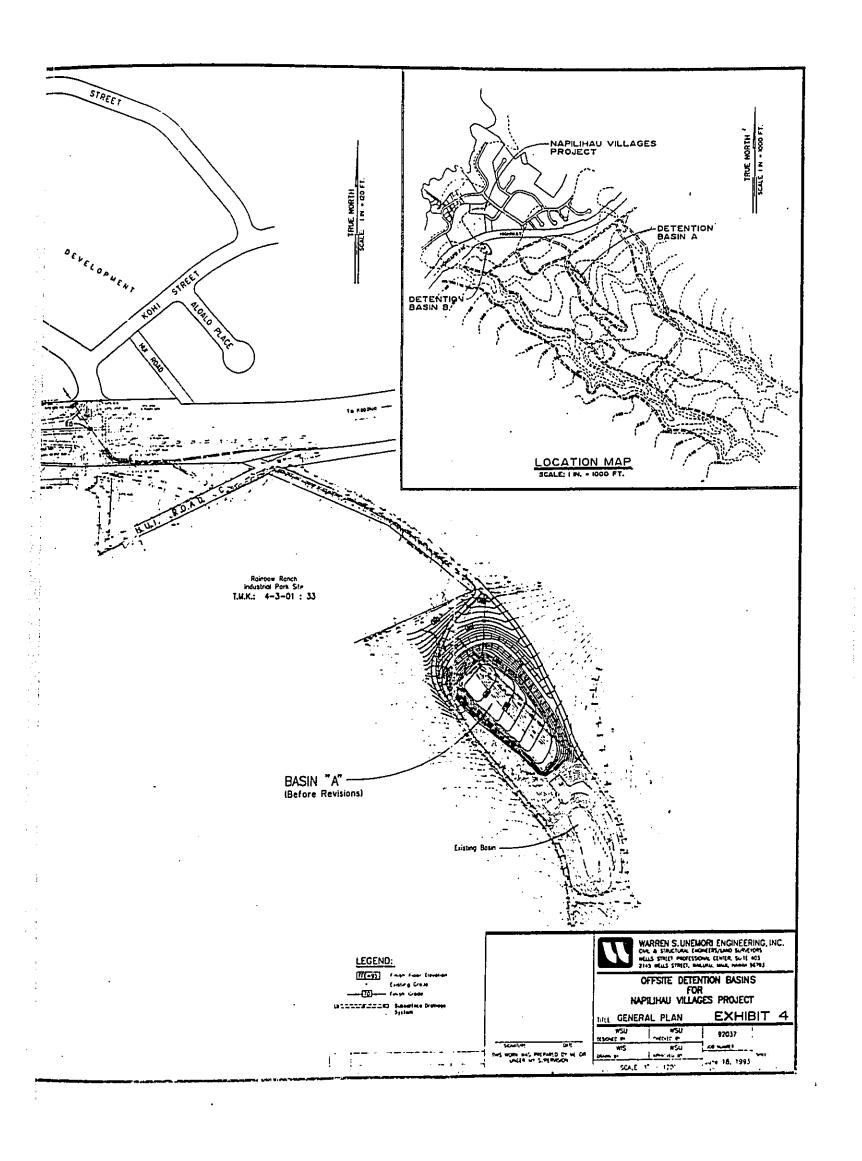
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EXHIDIT 3 FLOOD INSURANCE RATE MAP

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APPENDIX A HYDROLOGIC CALCULATIONS ONSITE DRAINAGE CALCULATION:

Warren S. Uhemod Engineering, Inc. Welte Street Protestional Center 2145 Weite Street , Suite 403 Walkdru, Maul , Hewall 96793

August 17, 1993

SUBSURFACE DRAINAGE SYSTEM ANALYSIS AND DESIGN

Napilihau Villages - Phases I, II, and III

Project: Location: Job Number,

Alzeioa, Lahaina, Maul, Hawaii

Ave. grass 20,55 Ground Character: Time of Concentration (min.):

Pre-Davelopment Intensity:

Intenstry (In.):

3.6

Pre-Development Runoff:

Q (pre-dev.) = C x l x A (cis): Allowable Release Hate(cis):

15.23 20.00

III. Determine Post-Development Runoff:

Post Development Component Areas:

Total Area (Ac.): Post-Development Runoff Coafficents:

7.

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. 1. Determine 50-Yr. - 1 Hr. Raintall:
From "Raintal Frequency Allas of the Hawalian Islands", for Lahaina, Maut,
R(50 Yr.-1Hr.) = 2.50 inches

0.07 0.03 0.03 0.05 0.05 Medium
Roling (5-15%)
Good
Industrial/Business
Component Runoif Coefft, C: Infaration:
Relief:
Vegetal Cover:
Development Type:

IL. Determine Pre-Development Runolf;

Pra-Davelopment Component Areas:

Total Area (Ac.):

7.

Pra-Davelopment Runoff Coefficents:

Medkum
Rolling (5-15%)
Poor (<10%)
Agricultural
Composite Runoit Coefft, C: Infination:
Relief:
Vegetal Cover:
Development Type:

0.03 0.05 0.15

Pre-Davelopment Time of Concentration:

Approx. Elev. Diff. (feet): Higher Elev. (ft.): 105.0 Lower Elev. (ft.): 30.0

73

Approx. Runoll Length (ft.): Average Slope:

915 8.2%

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44.10

Q (post-dev.) = Cx1xA (cfs):

Post-Development Runoff:

**4**.6

Intensity (in.):

Bare so

2

Time of Concentration (min.):

Post-Development Intensity:

Ground Character:

5.4% 5.4%

Approx Runoff Length (ft.): Average Slope:

S

104.0 54.0

Approx Elev. Diff. (feet): Higher Elev. (ft.): Lower Elev. (ft.):

Post-Development Time of Concentration:

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# W. Establish Initial Trench Cross Section Parameters:

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

#### V. Determine Exilitration;

### Determine Hydraulic Gradlent:

Coefficient of Permeability Based on Values Contained in "Soit Survey of Islands of Kaual, Oahu, Maud, and Lanal, State of Hawaii" (dated August 1972).

2.00	0.00055	4.55E-05
Coefficient of Permeability (in/ht):	Coefficient of Permeability (in/sec):	Coefficient of Permeability (h/sec):

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.

43.0		295.00 22.00 6,490.00	0.33 2.0
Approx Dist to Ground Water (ft.): Hydraulic Gradlent, t.	Assume Exititration Limited to Sides of Trench Only:	Assumed Initial Length of Pipe / Trench (it.); Unit Exituation Area (s//fi); Total Exituation Area (sf);	Total Rate of Extitration (cfs): Factor of Safery: Destinn Bate of Extitration (cfs):

# V. 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 fron and Steel Institute).

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

Commone							Post Storage	200				
Stoman	£	1	11 784	17.815	21544	87912	т	Т	: E	4 449	8.00 0.00	
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Accum.	Ξ		17,834	29,915	39,694	47,748	60,404	72,485	86,292	101,249	112,160	
Post-Dev.	8		9.59	9.59	9.59	9.59	65.6	9.59	65.6	9.59	9.59	
(પ/પા) ા	(2)		620	5.20	4.60	4.15	3.50	3.15	2.50	2.20	1.95	
Time	(3)		2	₽	5	2	8	<b>Q</b>	8	8	ā	

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24,104 Maximum Storage Required (cf):

### Determine Provided Storage Volume:

14,628	9,645		24,473
		24,112 0.40	
Pipe Storage Capacity (cf):	Net Appregate Cradie Storage Capacity (cf):	Gross Aggregate Cradle Volume (cl): Vold Railo (le, percent voids):	Total Storage Capacity Provided (cf):

{Storage Provided = 24.473 cf} > {Storage Required = 24.104 cf}; therefore initial assumptions based on 235 Lf. of 96 - inch dameter pipe are acceptable.

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Ava. grass

Ground Character.

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4.

4.09 6.00

3.3

	Walkday, Mari. Hawai 96793	F
	Obte: Annel 17 1001	I time of Concentration (min.):
		Pre-Development Intensity:
	SUBSURFACE DRAINAGE SYSTEM ANALYSIS AND DESIGN	
		וועפונאל (תר):
•		Pre-Davelopment Runoff:
Project	Naplithau Viilages - Phase IV (Below Naplii Plaza)	of track and or
Location:	Alselos, Lahsins, Maul, Hawall	Allowable Release Rate(cis):
Job Number:	92037	iil. Determine Post-Development Runoli;
7		Post Davelopment Component Areas:
Cojectiva:	To determine the storage requirements for full attenuation of the anticipated increase in rough a turbes modification modifications in the project development. A	Total Area (Ac.):
	CONTRACT OF INTO (30) Years is used.	Post-Development Runolf Coelficents:
l. Determine 50-Yr 1 Hr. Raintall:	abintall:	
From "Rainfall Frequency Allas R(50 Yr1Hr.) = 2.50 inches	From Tainfal Frequency Alias of the Hawailan Islands", for Lahalna, Maul. R(50 Yr14r.) = 2.50 brohes	
		Vegetal Cover: G Development Type: Industric
IL. Determine Pre-Davelopment Runoff:	nent Runott:	Сопролен
Pre-Development Component Grees	THOUSE OF SECTION AND ADDRESS OF SECTION ADDRESS OF SECTIO	Post-Drvelopment Time of Concentration:
	1,000,000,000	Approx Elev. Dift. (feet):
<b>T</b>	Total Area (Ac.):	
Pre-Development Runoff Coefficents:	off Coefficents:	רחשבו ביפת (נו"): פ

	9 6 5	51	380 3.9%	Bare sod	7		8,		10.12
Medium Rolling (5-15%) Good Industrial/Business	Companied number Coent, C; illon;	97.0 62.0							
Infitration: A Relief: Rotti Vegetal Cover: Development Type: Industr	Post-Urvelopment Time of Concentration:	Approx. Elev, Dirl. ((eel): Higher Elev, (t.): Lower Elev. (t.):	Approx. Runoli Length (ft.): Average Slope:	Ground Character:	Time of Concentration (min.):	Post-Development Intensily:	Intensity (in.):	Post-Davelopment Runolf:	Q (post-dev.) = Cx 1x A (cfs):

···

0.00 0.00 0.15 0.15

Medium
Roling (5-15%)
Poor (<10%)
Agricutural
Composite Runott Coeti 1, C.

Infitration:
Reflet:
Vegetal Cover:
Development Type:

x:\vddata\rmaxi\NVSBSRF3.XLS Page 2 of 4

 $(2.55 \pm 1) = 2.57 \epsilon_{1.5 \pm 1.5} \pm 2.5 \epsilon_{2.5}$ 

410 7.1%

Approx. Runoll Length (ft.): Average Slope:

ଷ

Approx. Elev. Dift. (feet):
Higher Elev. (ft.): 97.0
Lower Elev. (ft.): 68.0

Pre-Davelopment Time of Concentration:

x\xdata\max\\NVSBSRF3.XLS Page 1 of 4

# IV. Establish Initial Trench Cross Section Parameters:

2.00 6.00 1.00 2.00	9.0 10.0 90.0 28.3 61.7
Cover Over Pipo (IL): Pipo Diameter (IL) Cradie Depth Below Pipe (IL): Cradie Thickness on Sides of Pipe (IL):	Total Trench Depth (IL): Total Trench With (IL): Gross Trench Cross Sectional Area (s/A): Plya Cross Sectional Area (s/A): Trench Aggreg. Cross Sectional Area (s/A):

#### V. Determine Exfiltration:

### Determine Hydraulic Gradient:

Coefficient of Permeability Based on Values Contained In "Soil Survey of Islands of Kaual, Oahu, Maud, and Lanal, State of Hawaii" (daled August 1972).

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

Hydrautic Gradient, I = [ffotal 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.

59.0		70.00 18.00 1,260.00	0.06 2.0 0.03
Approx. Dist. to Ground Water (ft.): Hydraulic Gradient, I:	Assume Exfiltration Limited to Sides of Trench Only:	Assumed Initial Length of Pipe / Trench (ft.): Unit Exitration Area (sf/ti): Total Exitration Area (sf):	Total Rate of Extitration (cfs): Factor of Safety: Design Rate of Extitration (cfs):

# V. Determine Adequacy of Storage Volume Provided:

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### 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 Maul" (dated 1971, by R.M. Towil Corp.).

Comments				Peak Storage							
				Peak						1	L
Storage	(B)	2.112	2.958	3,299	3,261	2,425	1.462	-2,739	-6.689	11.522	
Total	(2)	1,809	9,619	5,428	7.237	10,856	14.474	21.711	28,948	36,185	
Exilin.	121	6	19	88	37	99	7.4	111	148	185	
Allow.	(S)	1,800	9.600	5.400	7.200	10,800	14,400	21.600	28,600	36,000	
Accum.	(2)	126°C	6,577	8,727	10.498	13,280	15,936	18,972	22,260	24,664	
Post-Dev.	Θ	117	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	
(rt//u) j	12	6.20	5.20	8	4.15	3.50	3.15	2.50	2.20	1.95	
Time	ε	2	₽	55	ଯ	ន	40	8	8	5	

(COL 4) = (COL 1) × (COL 2) × (COL 3) × (60 sec./min) (COL 5) = O(allowable) × (COL 1) × (60 sec./min) (COL 6) = (COL 1) × O(adil'n) × (60 sec./min) (COL 7) = (COL 5) + (COL 6) (COL 6) = (COL 4) - (COL 7)

3,299 Maximum Storage Required (cf):

### Determine Provided Storage Volume:

1,979	1,728	•	3,708
		4,321	
Pipe Storage Capacity (cf):	Net Aggregate Cradio Storage Capacity (cl):	Gross Aggregate Cradle Volume (cl): Vold Ratlo (le, percent volds):	Total Storage Capacity Provided (ci):

(Storage Provided = 3,708 ct) > (Storage Required = 3,299 ct); therefore initial assumptions based on 70 Lt. of 72 - inch diameter pipe are acceptable.

x:\xddata\rmax\\NVSBSRF3.XLS Page 4 of 4

x:\xidata\rmaxi\NVSBSRF3.XLS Page 3 of 4

## HAPILIHAU VILLAGES PROJECT SUMMARY OF PINDINGS TO DATE

August 18, 1993

		176 cfs	18 cfs	4.0 cfs 198.0 cfs	Ĩ	126.5 cfs		148 cfs		66 cfs	18 cfs	6,0 cfs	
		•	1	ı	4	II.		# #	11 11	н			
1. DRAINAGE BABIN "A" (Option 1 - Single Dasin) Current Runoff (Single Back not become	Area above Honoapiilani Highway based on 100 year-1 hour rinfall	and Rational Method	Mapili Plaza (4.4 Acs. ±) Allow	Napilihau Village IV (C = 0.30)	Capacity of Channel Section "A-A" in Alaeloa (see page 3)	Deficiency of Channel (196.6 - 71.5 cfs)	Post Development Runoff (Basins A1 + A2 = A)	Detention Dasin A-1 (10.6 acre-ft.) Release (18" pipe)	Drainage Basin A-2 Pius Release from A-1	Net Flow from Drainage Basin "A" (above Honoapillani)	Napili Plaza	Napilihau Village IV - Post Development Runoff - (Maximum Release)	Hotel Boot Bearing

OFFSITE DRAINAGE CALCULATIONS

1

90.0 cfs

18.5 cfs

Flow in excess of Channel Section "A-A" in Alaeloa (90.0 less 71.5 cfs)

Total Post Development Runoff

• | • ( g | **3** 

Napilihau Villages Project Summary of Findings to Date August 18, 1993

# 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
Capacity of existing 24" Culvert on Lower Honoapillani Road:

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

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

### Post Devalopment 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 Mapilihau Villages I, II & III (C = 0.68) = 44 cfs

Total Runoff = 69 cfs ≈ 70 cfs

# Additional Mitigative Measures within Napilihau Project Site:

Add 295 1.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.

Release from Detention Basin 25 cfs

Total = 45 cfs < 70 cfs ok F.S. = 1.55

PAGE W.S. UNEMORI ENGINEERING, INC. Wailuku, Maui, Hawaii JUNE 16, 1993

# HYDROLOGIC REPORT FOR

# NAPILIHAU VILLAGES

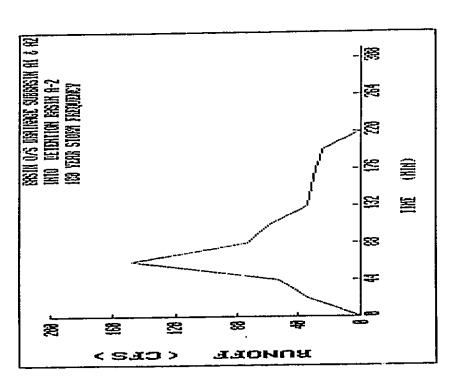
UNIVERSAL RATIONAL HYDROGRAPH

Q(PEAK) = C\*I\*A 100 YEAR STORH 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

RUNOFF (C.F.S.)		140.5 110.6 13.2 73.2 65.6	22 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
TIME (MIN)	22.0 33.0	.00 - 00 0 -	132.0 143.0 154.0 155.0 176.0 198.0	220.0 242.0 242.0 253.0 264.0 286.0 297.0 308.0

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

HYDROLOGIC REPORT FOR

NAPILIHAU VILLAGES

UNIVERSAL RATIONAL HYDROGRAPH

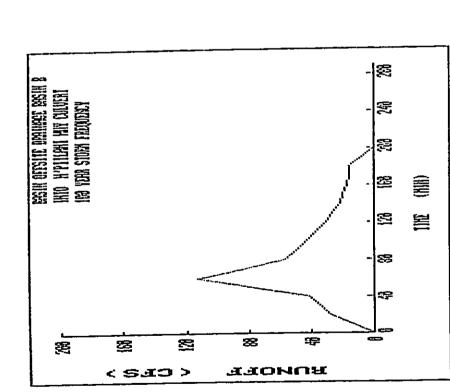
Q(PEAK) = C\*I\*A 100 YEAR STORM FREQUENCY BASIN IDENTIFIER OFFSITE DRAINAGE BASIN B DISCHARGES INTO H'PIILANI HHY CULVERT

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

RUNOFF	(C.F.S.)	0.0	14.1	28.2	35.1	41.9	77.0	112.0	84.1	56.2	6	ë	37.0	30.4	6	Ξ	-:	17.2	•	∹	7.8	0.0	0.0	0.0	٦.	٦.	٦,	0.0	•	0.0	0.0
TIHE	MIN)	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	0.06	100.0	110.0	120.0	-	140.0		•	5	0	ੜ	200.0	210.0	≅	230.0	₹	ū	Ö	270.0	8	ō

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

Inflow Hydrograph: NVDBA1A2.HYD Opeak = 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

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HYDROGRAPH FILE NYDBA1A2.HYD

2.HTD	Tima (hrs)
NYUBAIAZ.HTD	е F1ом s) (cfs)
	6 8)

Flow (cfs)	29.50		ė,	ក់ ។	÷		ċ	•	•		•	•	•	•				•	•	•	•	•				
	NN	•	•	•	• •	•		•	3.700	•	•	•	•	•	•	•	4.500	4.600	•	•	•	•	•	5.200	•	
Flow (cfs)	0.6	0	<u>.</u> و	: 6		<u>.</u> :	ď	ς.		÷.	٠.	90	ŗ.	<b>:</b>	ċ	e,	Ġ.	÷	Ļ.	ö	ë	તં	÷	÷	ö	
Time (hrs)		N I		ניי		٠.		, c	? •	. 100	1.200	1.300	1.400	1.500	1.600		1.800		•	Ξ.	Š.	ů	4.	2.500	9	

147.9 cfs 25.0 cfs

Qmax = Qmax =

NVDBA1A2.HYD ESTIMATE.EST

\* File: x File: 9

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HYDROGRAPH FILE ESTIMATE.EST

PH ESTIMATOR ((((	
>>>> OUTFLOW HYDROGRAPH	
*****	

Inflow Hydrograph: NVDBB .HYD Opeak = 112.0 cfs

Estimated Outflow: ESTIMATE.EST Opeak ≈ 25.0 cfs

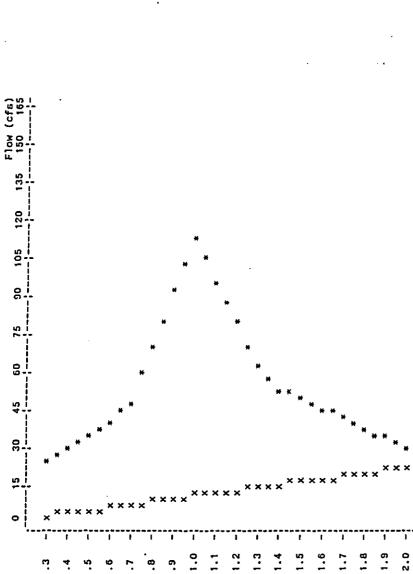
Flow (cfs)		20.55	21.34	22.13	22.92	23.71	24.50	;	ł	ļ		!	!	!	!	;	į	-	•	į	;	ļ	;	ļ	;		;	!	1	
Time (hrs)		2,000	•	•	٠	3.000	3.100	3.200	3.300	3.400	3.500	2 600	000.5	3.700	3.800	3.900	4.000	4.100	4 200	7 700	005.4	4.400	4.500	4.600	4.700	200	4.800	4.900	5.000	
Flow (cfs)	0.00	0.79	1.58	2.37	3, 18	3 9 9	2.5	† · ·	7	0.32	7.11	7.90	8.69	OF 6	200	10.21	11.06	11.85	12.64	13.43	14 22	15.01		08.61	16.59	17.39	18 18	0.00	10.00	07.61
Time (hrs)	0.000	0.100	0.200	0.300	0.400	0.500	0.600	0.700	000		006.0	1.000	1.100	1.200	1.300			000.	1.600	1.700	1.800	1.900	000		2.100	2.200	2,300	2.400	2.500	,,,,,

Last ordinate = 25.00 cfs at t = 3.16 hrs

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

6.4 acre-ft

HYDROGRAPH FILE NVDBB .HYD



Time Flow (cfs) (c

File: NVDBB .HYD Qmax = 112.0 cfs File: ESTIMATE.EST Qmax = 25.0 cfs

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TIHE (hrs)

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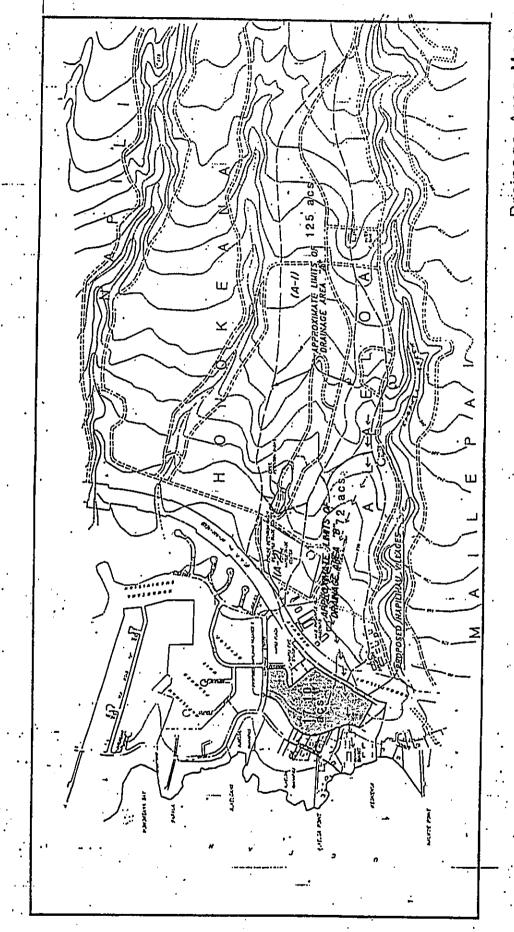
Page 1 of 1

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HYDROGRAPH FILE ESTIMATE.EST

Flow (cfs)	24.83	-	-	;	1 1		:	-	;	-		{	1	!	:	:		1	!	;	1 1	
투	2.200	2,300	2,400	2.500	2,600	2,700	2.800	2,900	3.000	3.100	3,200	3.300	3.400	'n	9	3.700	3.800	3.900	4.000	4.100	4.200	
Flow (cfs)	. 0	٦.	ď	7	4.52	٠,	6.33	-;	9.03	•	``	٠,	-:	14.67	15.80	ò	18.06	19.19	20.32	21.45	22.58	23.70
Time (hrs)	0.0	0.100	0.200	0.300	0.400	0.500	0.500	0.700	0.800	0.900	1.000	1.100	1.200	1.300	1.400	1.500	1.600	1.700	1.800	1.900	2.000	2.100

Last ordinate = 25.00 cfs at t = 2.21 hrs



Drainage Area Map Scale: Not To Scale

Pago 1 of 2 W.S. UNEMORI ENGINEERING, INC. 2145 Wolls Street Suite 403 Walluku, Maui, Hawaii 96793

BY: DON H. IAEA JR. DATE: February 2, 1993

# HYDROLOGIC STUDY

FOR

NAPILI PLAZA CHOPPING CENTER

ALACLUA, TAMBIHA, MAUI, MAWAII

BUSINESS AND COMMERCIAL USE

HYDRAULIC LENGTH: 305.0 ft. ELEV'H. DIFFERENTIAL: 12.00 ft. HYDRAULIC SLOPE: 0.039 ft./ft.

50 years 2.50 inches

RECURRENCE INTERVAL: ONE-HOUR RAINFALL:

TIME OF CONCENTRATION: 5.8 min.

CUB GASING CONSIDERED:

0.67 6.20 inches 4.40 weres

WEIGHTED RUNOFF COEFFICIENT, C: INTENSITY, I: AREA, A:

Q = C114A ± 10.28 cls

COMMENTS:

RUNOFF CALCULATIONS FOR NAPILI SHOPPING PLAZA

Page 2 of 2 W.C. UNEMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Wailuku, Maui, Mawaii 92793

....

BY: DON H. IAEA JR. DATC: February 2, 1993 NAPILI PLAZA SHOPPING CENTER (continued)

TABULATION OF RUNOFF COEFFICIENTS & AREAS:

SUB-BASIN 1 OF 1: BUSINESS AND COMMERCIAL USE

VEGETAL COVER: Flat (0-52)
VEGETAL COVER: Poor (410%)
DEVELOPMENT: Industrial / Pusings

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UNIVERSAL SOIL LOSS EQUATION CALCULATIONS APPENDIX B

H.C.S.L. Report Page 1 of 5 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Walluku, Mawii 96793

BY: DON H. IAEA JR. DATC: February 2, 1993

H.E.S.L. FOR NAPILIHAU VILLAGES

# 1. HESL EQUATION: E = R\*K\*LS\*C\*P

WHERE:

E = Soil Loss (Lons/acrc/year)
R = Average Annual Rainfall Factor
K = Soil Erodibility Factor
L = Horizontal Slope Longth (faet)
S = Average Slope (2)
LS = Slope Factor (function of t and S)
C = Cover and Management Factor
P = Erosion Control Practice Factor

R = 200.0 tons/acrc/year (Soil Erosion & Sediment Control Guide for Hawaii; Appendix A: Average Annual Values of Rainfall Factor)

" \*

0.17 Soil Series. KANANA (Soil Survey of Islands of Kausi. Oshu. Maui. Nolokai. and Lanai. State of Hawaii. Soil Type Plates & Table 4: Soil Proporties Related to Elesion & Sedimentation ....)

740.0 feet. 75.0 feet (Soil Erosion & Sediment Control Guide to: Hawaii. Table 16)

S = (5/L) = 10.1 %

ĽS,

H.E.S.L. Report Page 2 of 3 W.S. UNEMORI ENGINEERING, INC. 2145 Walls Street Suito 403 Walluku, Maui, Hawaii 96793

OY: DON II. 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)

(Soil Erosion & Sodiment Control Guido For Hawaii; the Universal Soil Loss Equation in Hawaii) P = 1.00

E = R\*K\*LS\*C\*P = 129.2 tons/were/year

## H=[(2\*F\*T)+(3\*D)]\*A\*E SEVERITY RATING NUMBER EQUATION:

H = Savority 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)

1.00 years

17.10 acres " Œ

E = R\*K\*LS\*C\*P = 129.2 tons/acre/year

F = 4 (Downslope-downstream detriment: Major)

D = 2 (Coastal water rating lactor: Class A)

H = [(2\*F\*T)+(3\*D)]\*A\*E = 30,939.5

Standard soverity rating (allowable): 50,000 2 30,939,5 =>OK

H.C.S.L. Report Fage 3 of 3 H.S. UNEMORI ENGINEERING, INC. 2145 Holls Street Suile 403 Mailuku, Maui, Hamaii 96793

BY: DON H. IAEA JR. DAIE: Fabruary 2, 1793

# NAPILIHAU VILLAGES [Continued]

# 3. MAXIMUM ALLOWABLE SOIL LOSS: E max = H max/(2FT+3D)A

E max : Η max/(2FT+3D)A, Ηmax = 50,000 = 20B.9 tons/acro/year = 129.2 Lons/acro/year = 20K Coastal Hazard: Class in waters are approximately 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:

- Soil Conservation Service (USDA), 'Guidatines for Use of the Universal Soil Loss Equation in Nawaii,' Technical Notes, Narch 1975, (Revised Draft)
- 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, Nahu, Maui, Molokai, and Lanai, State of Hawaii, August 1972, +;
  - Hawaii Environmental Simulation taboratory: 'Guidelines for Data Preparation, Parl 1: Universal Soil Loss Equation: Undated (Drail). 4,

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#### Appendix C

Final Drainage Report Phase I

### TABLE OF CONTENTS

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FOR

#### NAPILIHAU VILLAGES - PHASE I SITE IMPROVEMENTS

Alaeloa, Lahaina, Maui, Hawaii

**IMK: 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

June, 1994
Revised: March, 1995
Revised: July, 1995
Revised: September, 1995
Revised: December, 1995

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Hydrologic Calculations Hydraulic Calculations Universal Soil Loss Equation Calculations

APPENDICES

4-5 5-6 6-7 2-3 Page Grading Plan ..... Soil Erosion Control Plan ..... VII. REFERENCES ...... INTRODUCTION CONCLUSION ...... Location Map Soil Survey Map Flood Insurance Rate Map Offsite Drainage Area Map Grading Plan Drainage Area Map SOIL EROSION CONTROL PLAN PROPOSED DRAINAGE PLAN **EXISTING CONDITIONS** PROPOSED PROJECT 4 H EXHIBITS 4ほひ 4 4 5 ≥ Ħ >

Drainage and Soil Erosion Control Report for Napilihau Villages - Phase 1 Site Improvements

### 1 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 Napiiihau 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 guiters, 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,

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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.

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### B. Flood and Tsunami Zonc:

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:

#### Existing Conditions:

The drainage area mauka and east of the Napilihau Road/Honoapillani 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 Basia 'A', borein 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/Honoapillani 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 Honoapillani

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 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 Alachoa Condominium site is estimated to be

### 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 cularged 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 4.5x6' 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 Alaelouiki 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).

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

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The second secon

 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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- 6. Use temporary silt screen fencing, berms and cut-off ditches, where needed, for control of erosion.
- Graded areas shall be thoroughly watered after construction activity has ceased for the day and on weekends.
- 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 nunoff 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

- Soil Survey of Islands of Kanni, Oalut, Maui, Molokai, and Lanai, State of Hawaii. August 1972. United States Department of Agriculture, Soil Conservation Service.
- Flood Insurance Rate Map, Mani County, Hawaii. Community-Panel Number 150003 0138B. September 6, 1989. Federal Emergency Management Agency, Federal Insurance Administration.
- Drainage Master Plan for the Cou. sy of Massi, 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.
- Storm Draitage Standards. March 1986. Department of Public Works, City and County of Honolulu.

Report Prepared By:

Lance S. Nakamura

Report Checked By:

Reed M. Chuly

E\mp3idsta\domp\92037042.pt (wpwis61/hp4j2d.mp/hp4j2d)

-DETENTION BASIN A -NAPILIHAU VILLAGES PHASE I EXHIBIT 1 LOCATION MAP SCALE: 1 IN . = 1000 FT. FUTURE // DETENTION BASIN B ALAELOAIKI BAY KEONENUI

EXHIBITS

Location Map

Soil Survey Map

Flood Insurance Rate Map

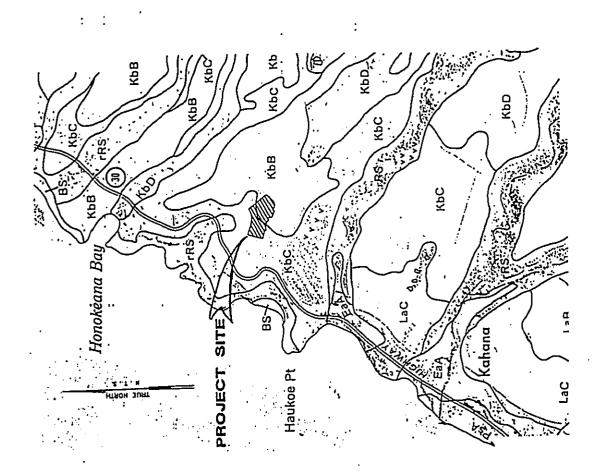
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Offsite Drainage Area Map

Grading Plan

Drainage Area Map ø

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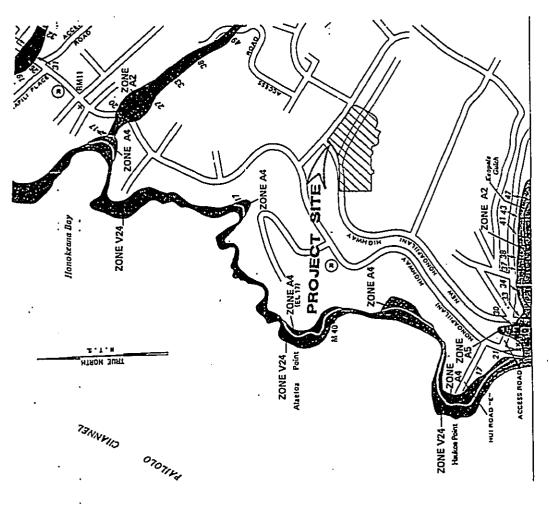


EXHIBIT 3 FLOOD INSURANCE RATE MAP

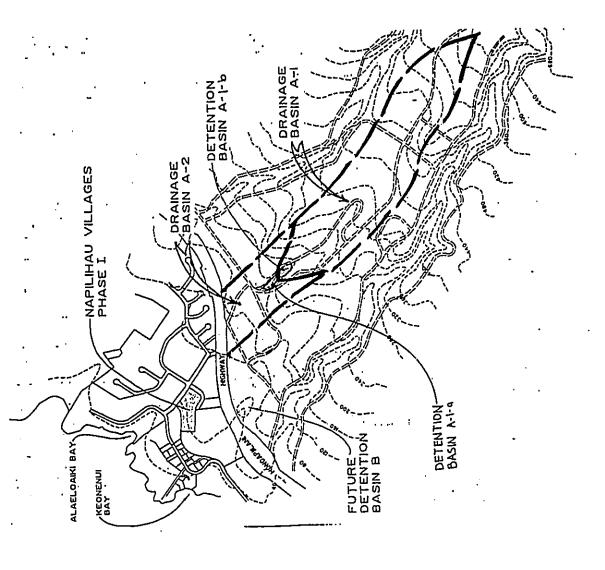


EXHIBIT 4 OFFSITE DRAINAGE AREA MAP

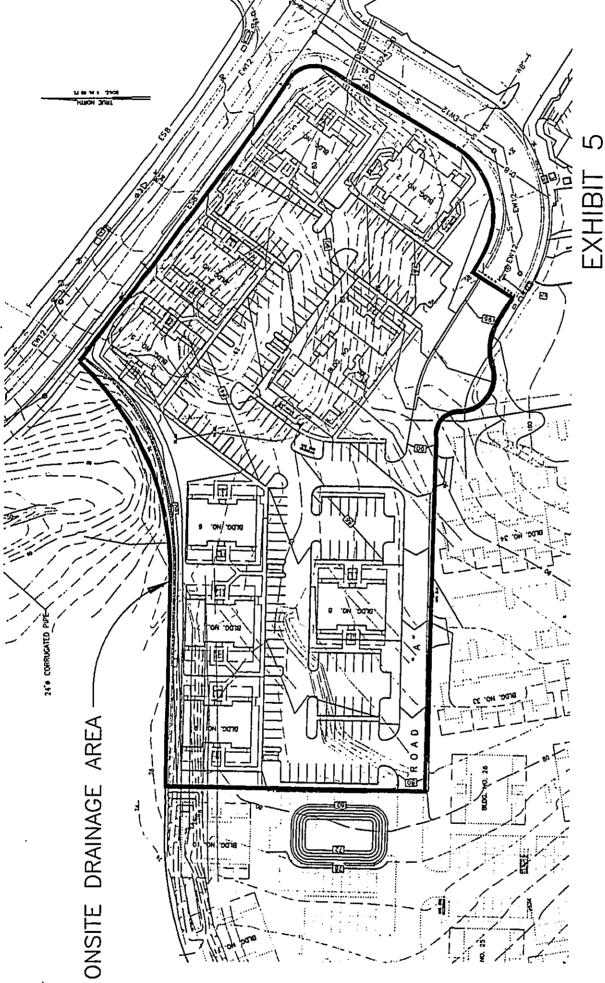
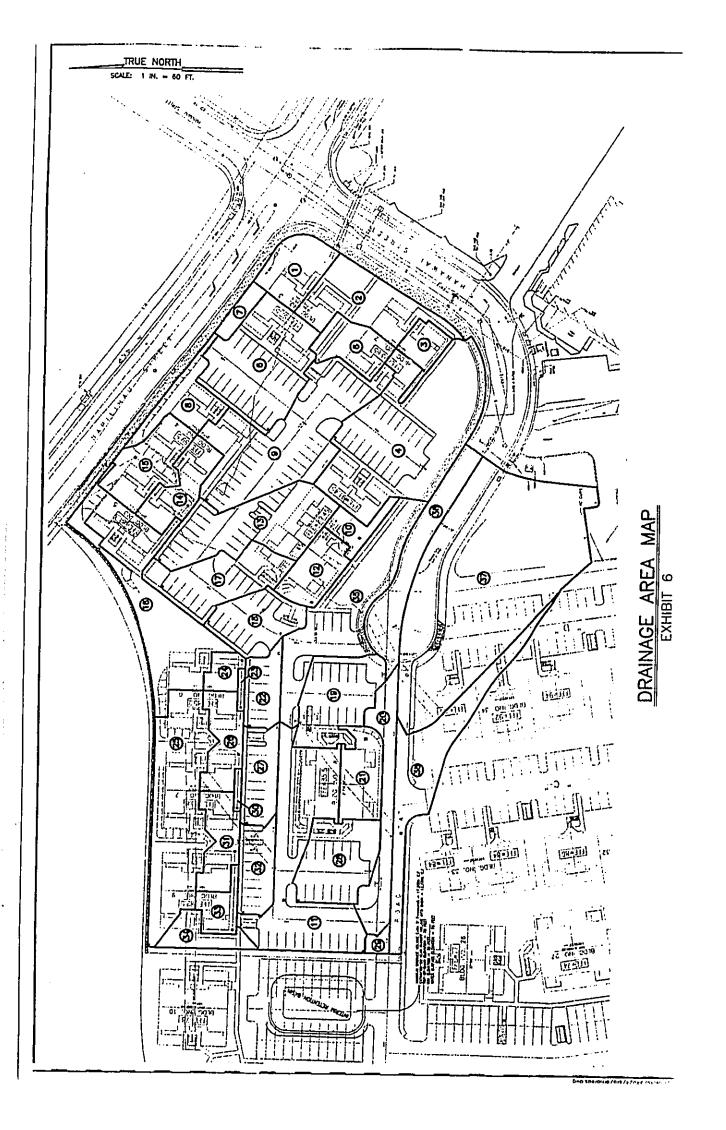


EXHIBIT 5 GRADING PLAN



A<u>PPENDIX A</u> HYDROLOGIC CALCULATIONS

ONSITE DRAINAGE CALCULATIONS

94024SA2.XLS

DRAINAGE SCHEDULE

10 YEAR RECURRENCE INTERVAL = 2.0 INCHES

Watten S. Unemod Engineering, Inc.
Webs. Street Professional Center
2145 Webs Street , Suite 403
VieMet, Mad , Hewal 96793

Dale: August 17, 1903, Rev. March 20,1995

Dale: August 17, 1903, Rev. March 20,199	DESIGN				-					Portation of the anticipated	e project development. A														3.1	•			70.07	0.03	0.05	:-    -	U.3			29	;		•	7.1%		
Date:	SUBSURFACE DRAINAGE SYSTEM ANALYSIS AND DESIGN			Napilihau Villages - Phase I (Below Napili Plaza)		a, Maul, Hawaii				To determine the storage requirements for full alternation of the anticipated	increase in onsite surface runoif attributable to the project development. A	recurrence interval of filly (50) years is used.					Otto V. 1447 – 2 to taken.													Rolling (5-15%)		-	Composie Kunon Coeiit, C:			(feet):	v. (f.): 97.0					CONTRACTOR SECTION OF THE POST
	SUBSURFACE DRAIL			Napilihau Villa		Alaeloa, Lahaina, Maul, Hawaii		92037		To determine th	increase in onsil	recurrence Inter-		;	r. Rainfall:	species Alfae of the Literature	utility Alids Of the Mawaii 2 FO feeber	Z.50 IIICHES			omen Duneff.	plient numbli:	Component Areas	•	Total Area (Ac.):	•	Pre-Development Runoff Coefficents:		Infiltration:	Refief:	Vegetal Cover:	Development Type:		Pre-Development Time of Concentration:		Approx. Elev. Diffl. (feet):	Higher Elev. (fl.):	Lower Elev. (fl.):		Aprox. Runoil Lengin (n.): Average Slope:	•	
				Project:		Location:		. Job Number		Objective:					l. Determine 50-Yr 1 Hr. Rainfall:	Cmm *OnicOs	Display Alles	- (:IDI-:III 06)V			Il Determine Dre-Develorment Duneste.		Pre-Development Component Areas:				Pre-Development F							Pre-Development								
	3	4	e	0	0	<b></b>	~ 1			- 01	0.85		9	0	0	6	ŧ.	7	đị.	9	0	6	12	<b>@</b>		8	<b>9</b>	2	2	2	<b>co</b> :	<u>n</u>	<b>•</b>	<b>t</b> 9			. 5	ı	03			
	(c(s)	0.24	0.43	0.10	0.90	0.18	0.67	0.00	0.27	60.0	0.0	0.19	0.46	0.20	0.30	0.59	0.34	0.32	0.39	0.36	0.20	0.19	0.02	0.08	0.57	0.18	0.24	0.32	0.05	0.02	0.18	0.23	9 5	<u> </u>	0.40	1.39	0.43	i	L Q 13.03			
	l (in/hr)	4.80	4.80	4.10	3.80	05.4	0.0	4.50	5.10	4.10	5.10	4.40	3.90	4.40	5.00	3.80	4.10	5.30	4.70	5.10	4.00	5.30	4.50	4.60	3.60	4.00	5.20	4.00	3.60	4.50	9.4	5.20	2 6	2 6	5.30	3.40	3.80	}	TOTAL			
	υ U	0.63	0.63	0.63	0.63	0.03	5 63	55.0	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.00	0.63	0.63	0.63	0.63	0.63				Page 1	
	AREA (acres)	0.08	0.14	0.04	0.38	6.0	0.6	0.07	0.28	0.03	0.27	0.07	0.19	0.07	0.10	0.25	0.13	0.10	0.13	0.11	0.08	0.06	0.01	0.03	0.25	0.07	0.07	0.13	0.01	0.0	0.07	0.0	0.0	0.22	0.12	0.65	0.18					
DRAINAGE	AREA	-	2	ო '	4 1	מח	) r	۰ د	ത	5	11	12	13	7	<b>2</b>	9 !	2	<b>2</b> 2	6	20	21	22	23	24	52	56	72	28	29	3 2	ទ	3 6	34	32	36	37	38				•	

tree			٠.
Ground Character:	Ave. grass		
Time of Concentration (min.):	17		
Pre-Development Intensity:		N. Establish Initial Trench Cross Section Parameters:	
Intensity (n.):	\$		
Pre-Development Runoff:		Cradle Thickness on Sides of Pipe (ft.): 1.00 Cradle Thickness on Sides of Pipe (ft.): 2.00	
Q {pre-dev.} = C x I x A {cfs}; Allowable Release Rate[cfs};	4.09	Total Trench Depth (ft.): 9.0 Total Trench Width (ft.): 10.0	
A. Determine Post-Development Runoff:			
Post Development Component Areas:		Trench Aggreg. Cross Sectional Area (st/f): 61.7	
Total Area (Ac.):	2.8	V. Determine Exfiltration:	
Post-Development Runolf Coellicents:		Determine Hydraulic Gradient:	
Infiltration: Medium	200	Coelficient of Permeability Based on Values Contained in "Soil Survey of Islands of Kaual, Oahu, Maul, and Lanai, State of Hawaii" (dated August 1972).	, Maui,
Rot	I	Coefficient of Permeability (arths): 2.00 Coefficient of Permeability (in/sec): 0.00055 Coefficient of Permeability (il/sec): 4.55E-05	
Composition Concentration:		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.	er,
Approx. Elev. Diff. (feet): Higher Elev. (ft.): 94.0 Lower Elev. (ft.): 82.0	23	Approx. Dist. to Ground Water (ft.): 59.0 Hydrautic Gradient, i: 1.1	
	340	Assume Exfiltration Limited to Sides of Trench Only:	
Average Slope:	3.5%		
Ground Character:	Bare soil	Unit Exfiltration Area (s/ff):	
Tune of Concentration (min.): Post-Development Intensity:	12	Total Rate of Extitration (cfs): 0.09 Factor of Satery: 2.0 Design Rate of Extitration (cfs): 0.04	
Intensity (m.):	8.4		
Post-Development Runoff;			
Q $\{post-dev.\} = C \times I \times A \{cfs\}:$	9.14		

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VI. Determine Adequacy of Storage Volume Provided:

Defermine Required Storage Volume:

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

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

_	_	_	_					_	_		_	
Comments							Peak Storage					
Storage	ē		2328	3.514	4.243	4.629	Т	Т	2,577	695	1.988	
Total	ε		1.213	2.426	3,640	4.853	7.279	9,706	14,559	19.412	24,265	
Extilfn.	5		13	26	07	53	79	901	159	212	265	
Allow.	E		1,200	2.400	3,600	4,800	7,200	009'6	14,400	19,200	24,000	
Ассит.	€		3,541	5.940	7,883	9,482	11,995	14,394	17,136	20,106	77,72	
Post-Dev.	(c)		1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.96	1.90	
(m/m)	ω		6.20	5.20	09.4	4.15	3.50	3.15	2.50	2.20	1.95	
Time	(1)		5	10	15	20	30	40	60	80	100	

(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(exfiltn.) x (60 sec./min.) (COL 7) = (COL 5) + (COL 6) (COL 8) = (COL 4) - (COL 7)

4,716 Maximum Storage Required (cf):

Determine Provided Storage Volume:

2,827	2,469	6,173 0.40	5,296
Pipe Slorage Capacity (cf):	Nel Aggregale Cradle Storage Capacity (c1):	Gross Aggregate Cradie Volume (cf): Void Ratio (le, percent voids):	Total Storage Capacity Provided (ct):

(Storage Provided = 5,296 cf) > {Storage Required = 4,716 cf); therefore initial assumptions based on 100 Lf. of 72-inch diameter pipe are acceptable.

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PAGE W.S. UNEMORI ENGINEERING, INC. Wailuku, Maui, Hawaii JUNE 9, 1994

FOR HYDROLOGIC REPORT

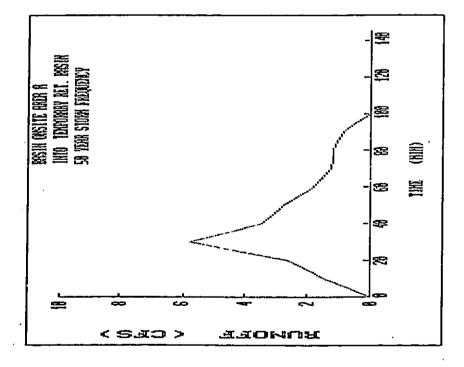
NAPILIHAU VILLAGES

UNIVERSAL RATIONAL HYDROGRAPH

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

REA A Y RET. BASIN	ACRES IN/HR MINUTES CUBIC FEET
ONSITE AREA A TEMPORARY RET	1.42 0.68 6.00 10.00 12774.89
BASIN IDENTIFIER DISCHARGES INTO	BASIN AREA RUNDFF COEFF. : RAINFALL INT. :: TIME OF CONC. ::

									•														
RUNDFF. (C.F.S.)	0.0	25.1	. 4 	5.8 5.4	4.5			1.8		۲.	1 -	1.0	0.9	6.4	9.0	0.0		0.0	•	0.0	0.0	٠,	0.0
TIME (MIN)	0.0 0.0 10.0	15.0	25.0	35.0	40.0	45.0 0.0	55.0	0.09	65.0	70.0	80.0	85.0	ö	95.0	, v	110.0	115.0	120.0	125.0	130.0	135.0	140.0	145.0



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PAGE W.S. Unemori Engineering, Inc. Wailuku, Hawaii MAY 31, 1995

Page 2 of 2 W.S. UNEMORI ENGINCERING, INC. 2145 Wells Street Swite 403 Walluku, mawi, Hawaii 96,793

BY: I ANCE NAKAMURA DAIT: May 31, 1995

NAPILIHAG VILLAGES - PHASE I [continued]

TABULATION OF RUNOFF COEFFICIENTS & AREAS:

HYDROLOGIC REPORT FOR

UNIVERSAL RATIONAL HYDROGRAPH NAPILIHAU VILLAGES - PHASE 1

Q(PEAK) = C\*1\*A 100 YEAR STORM FREGULUCY

PRF-DEV RELOW RASIN A-1-A FXISTING ONSITE RASIN BASIN IDENTIFIER DISCHARGES INTO

35.40 ACRES
0.35
4.06 IN/UR
20.00 MINUTES
236847.27 CURIC FEFT BASIN ARTA ENUOFF CHEF. FRAINFALL INT. FINE OF CONC. EVOLUME.

RUHOFF (C.F.S.)	0.0
TIME (MIN)	0.0

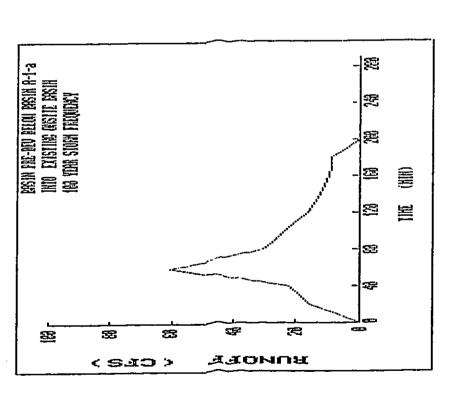
SUB-BASIN 1 OF 3 : OFFSITE DRAINAGE BASIN A-2	Medium	SUB-BASIN 2 OF 3: NAPILI PLAZA SHOPPING CENTER Mndium	SUB-BASIN 3 OF 3: ONSITE PRE-DEVELOPMENT Medium
	IMFILTRATION: RELITE: VEGFTAL COVER: DEVELOPMENT:	THFTL.TRATJON: RCL.TEF: VFGETAL COVIR: DEVEL.OPHENT:	INFTL.TRAFION: RELIEF: VEGETAL COVER: DEVELOPMENT:

														•																
(c.r.s.)	0.0	7.6	15.2	18.9	27.5	41.4	60.2	C	30.2	76.1	5.5.5	10.9	16.4	77.7		2 0			B.4					0.0	•	0.0	٠.	0.0	0.0	
(NIH)	0.0	10.0	20.0	30.0	40.0	50.0	0.00	70.0	no.0	90.0	100.0	110.0	120.0	1.70.0	140.0	150.0	160.0	170.0	180.0	٠,	200.0	210.0	220.0	2.30.0	240.0	250.0	0.025	270.0	2B0.0	

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PAGE W.S. Unsmori Engineering, Inc. Wailuku, Hawaii MARCH 17, 1995

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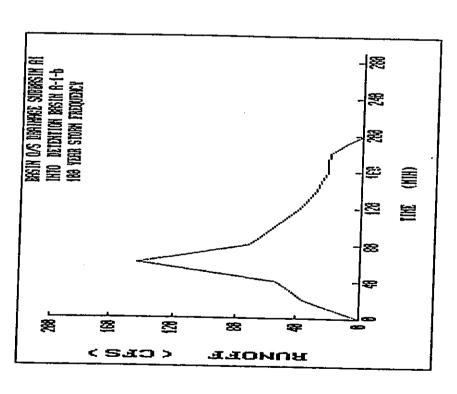
# HYDROLOGIC REPORT FOR

### NAPILIHAU VILLAGES - PHASE I UNIVERSAL RATIONAL HYDROGRAPH

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

D/S DRAINAGE SUBBASIN AL DETENTION BASIN A-1-6	98.00 ACRES 0.30 4.86 IN/HR 20.00 MINUTES 562010.38 CUBIC FEET
BASIN IDENTIFIER DISCHARGES INTO	UMSIN AREA : RUNDFF COEFF. : RAINFALL INT. : TIME OF CONC. :

RUNOFF (C.F.S.)	25.0 25.0 25.0 25.0 27.0	>
TIME (MIN)	0.0 20.0 30.0 50.0 50.0 60.0 70.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 1100.0 120.0 120.0 120.0 120.0 120.0 120.0 120.0 220.0 220.0 220.0 220.0 220.0	) )



Page 1 of 2 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Wailuku, Maui, Hawaii 96793

ВY: LANCE NAKAMURA DATE: March 31, 1995

# HYDROLOGIC STUDY

707

Η PHASE NAPILIMAU VILLAGES

ALALIDA, I AMATNA, MAUI, HAWAII

OFFSITE DRAINAGE BASIN A-2

HYDRAULIC LENGTH: 2100.0 ft. FLEV'N. DIFFERENTIAL: 180.00 ft. HYDRAULIC SLOPE: 0.086 ft./fl. TIME OF CONCENTRATION: 12.0 min. SUR RASINS CONSIDERED: 0.30 5.80 inches 77.00 acres 100 years 3.00 inches WEIGHTED RUNOFF
COEFFICIENT, C:
INTENSITY, I:
ARFA, A: RECURRENCE INTERVAL: OME-HOUR RAINFALL:

0 : C\*I\*A : 46.98 cfs

COMMENTS:

451 Gn : и ; 1...

Page ? of 2 H.S. UNEMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Walluku, Maui, Hawaii 96793

BY: LANCE NAKAMURA DAIC: March 31, 1995

T HOMMA + NAPILIHAU VILLAGES
[continued]

BULATION OF RUNOFF COEFFICIENTS & AREAS:

SUB-BASIN 1 OF 1 : OPEN AREA

Medium 0.07 Rolling (5-15%) 0.03 >>> COMPOSITE C = 0.3CO Poor (<10%) 0.05 >>> AREA = 27.000 acres Agricultural 0.15 HFILTRATION:
RELIEF:
GETAL COVER:
DEVELOPMENT:

Page 1 of 2 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Wailuku, Maui, Hawaii 96793

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BY: LANCE NAKAMURA DATE: March 29, 1995

HYDROLOGIC STUDY

FOR

H - PHASE NAPILIMAU VILLAGES

ALAELDA, LAHAINA, MAUI, HAWAII

VACANT LOT

HYDRAULIC LENGTH: 90.0 ft. ELEV'N. DIFFERENTIAL: 24.00 ft. HYDRAULIC SLOPE: 0.267 ft./ft. TIME OF CONCENTRATION: 7.0 min. 1 SUB BASINS CONSIDERED: 0.35 7.00 inches 1.10 acres RECURRENCE INTERVAL: 100 years ONE-HOUR RAINFALL: 3.00 inches WEIGHTED RUNOFF
COEFFICIENT, C:
INTENSITY, I:
AREA, A:

0 = C\*I\*A = 2.69 cfs

COMMENTS:

Page 2 of 2 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Wailuku, Haui, Hawaii 96793

BY: LANCE NAKAMURA DATE: March 29, 1995

- PHASE I NAPILIHAU VILLAGES [continued]

BULATION OF RUNOFF COEFFICIENTS & AREAS:

Page 1 of 2 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Streot Suite 403 Walluku, Maui, Hawaii 96793

BY: LANCE NAKAMURA DATE: March 31, 1995

HYDROLOGIC STUDY

FOR

Η - PHASE NAPILIMAU VILLAGES

ALAELDA, LAHATNA, MAUI, HAWAII

EXISTING OFFSITE CATCH BASIN #2

SLEV'N. DIFFERENTIAL: 46.00 ft. HYDRAULIC SLOPE: 0.061 ft./ft. TIME OF CONCENTRATION: 8.0 min. SUB BASINS CONSIDERED: 0 = C\*I\*A = 2.31 cfs 0.68 6.80 inches 0.50 acres RECURRENCE INTERVAL: 100 years ONE-HOUR RAINFALL: 3.00 inches WEIGHTED RUNDFF COEFFICIENT, C: INTENSITY, I: AREA, A:

COMMENTS:

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Page 2 of 2 M.S. UNEMORT ENGINEERING, INC. 2145 Wells Strent Suite 403 Wailuku, Maui, Hawaii 96793

RY: LANCE NAKAMURA DATE: March 31, 1995

NAPILIHAU VILLAGES - PHASE [continued]

H

BULATION OF RUNDFF COEFFICIENTS & AREAS:

SUN-BASIN 1 OF 1 : NAPILIHAU STREET

Page 1 of 2 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Wailuku, Maui, Hawaii 96793

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ا نوس)

BY: LANCE NAKAMURA DATE: March 31, 1995

HYDROLOGIC STUDY

FOR

Η PHASE 1 NAPILIHAU VILLAGES

ALAELOA, LAHAINA, MAUT. BAWATT

EXISTING OFFSITE CATCH BASIN #3

HYDRAULIC LENGTH: 760.0 ft. CLEV'N. DIFFERENTIAL: 46.00 ft. HYDRAULIC SLOPE: 0.061 ft./ft. TIME OF CONCENTRATION: 8.0 min. -SUB BASINS CONSIDERED: g = C+1+0 = 2.31 cfs 0.68 6.80 inches 0.50 acres RECURRENCE INTERVAL: 100 years ONE-HOUR RAINFALL: 3.00 inches WEIGHTED RUNDFF COEFFICIENT, C: INTENSITY, I: AREA, A:

COMMENTS:

Page 2 of 2 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Strent Suite 403 Wailuku, Maui, Hawaii 96793

BY: LANCE NAKAMURA DATE: March 31, 1995

# NAPILIHAU VILLAGES - PHASE I [continued]

# SUB-BASIN 1 OF 1: NAPILIHAU STREET

BULATION OF RUNDFF COEFFICIENTS & AREAS:	SUB-BASIN 1 OF 1 : MAPILIHAU STREET	NETLTRATION: Nagligible
BULATION OF RU	·	HELLEF: I RELIEF: I GETAL COVER: I DEVELOPMENT: 1
BULATI		RETLTF F GETAL DEVELO

RUNOFF CALCULATIONS FOR NAPILI SHOPPING PLAZA

₹ | 

Fage 1 of 2 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Walluku, Mawi, Hawaii 96793

BY: DON H. INEM 3R. DATE: February 2, 1993

STUDY HYDROLOGIC

NAPELE PLAZA SHOPPING CENTER

ALAGLOA, LAUATRA, MAUT, MAMAIL

**BUSINESS AND COMMERCIAL USE** 

CLEV'H. DIFFERENTIAL: 12.00 ft. HYTHANI IC SLOPE: 0.037 ft./ft. THAT OF CONCLAIRAFION: 5.8 min. CUR RABING CONCIDERED: 0 = CHH0 : 18,28 cls 0,47 6,20 inches 4,40 acres 50 yaars 2.50 inches MEIGHTED RUNDFF COCFFICTORN, C: INTERSITY, I: ANTO, A: RECURRENCE INTERVAL: ONE-HOUR CAIMFALL:

COMMONTO:

Pagn 2 of 2 W.S. UNFMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Wailuku, Maui, Hawaii 96793

BY: DON H. INEA JR. DATC: February 2, 1993

NOPILI PLAZA SHOPPING CENTER (continued)

TABULATION OF RUNDFF COEFFICIENTS & AREAS:

SUB-BASIN 1 OF 1: QUSINESS AND COMMERCIAL USE

NAPILIIAU VILLAGES – PHASE I ANSITE DETENTION BASIN PHE-REVELAPHENT CALCULATED 06-01-1995 11:19:25 DISK FILE: NHVDS1 .VQL Planimetor scale: 1 inch = 208,71032 ft.

Valume Sum (acre-ft)	0.69 0.12 0.33 0.57 1.16 1.89 2.85 5.46
* Volume (acre-ft)	0.00 0.12 0.31 0.31 0.51 0.92
A1+A2+sar(A14A2)	0.00 0.18 0.31 0.51 0.76 1.08 1.08 1.43
Area (acres)	6.00 6.00 6.14 6.21 6.20 6.20 6.42 6.54
Planimet <i>er</i> (sq.in.)	0.04 0.08 0.14 0.30 0.42 0.42 0.45
Elevation (ft)	62.00 64.00 64.00 60.00 70.00 72.00 74.00 76.00

Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) + (EL2 Et1) + (Arcal + Arca2 + sq.rt.(ArcaliArca2))
where: EL1, EL2 = Lower and upper elevations of the increment
Areal.Area2 = Arcas 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

POND-2 Version: 5.17 S/N: NAPTLINAL VILLAGES - PHASE I ONSITE DETENTION BASIN PRE-DEVELOPMENT CALCULATED 86-01-1995 11:19:25 DISK FILE: NHVDS1 .VDL Planimeter scale: 1 inch = 208.71032 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A14A2) (acres)	Yolume (acre-ft)	Volume Sum (acre-ft)
67.80	P. 04	61.134	99 9	66 6	į
64.00	0.08	80.8	0.19	21.0	
64.00	0.14	0.14	6.31	6	20.53
60.00	0.21	0.21	20.51	0.34	0.67
70.00	0.38	0.30	9.76	15.5	51.1
72.00	0.42	6.42	1.08	0.72	1.87
74.00	0.54	9.54	1.6.1	0.95	2.85
76.00	0.65	0.65	1.70	1.19	4.03
70.00	0.70	0.78	7.0	1.42	5,46

t incremental volume computed by the Conic Method for Reservoir Volumes.

APPENDIX B
HYDRAULIC CALCULATIONS

Volume + (1/3) + (EL2-EL1) + (Areal + Area2 + sq.rt.(Area1+Area2))

where: EL1. EL2 = Lower and upper elevations of the increment Areal.Area2 = Areas computed for EL1. EL2. respectively Volume = Incremental volume between EL1 and EL2

j.,

Outlet Structure File: NHVOSI .SIR

POND-2 Version: 5.17 Date Executed:

S/N: Time Executed:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*\*\*\* COMPOSITE OUTFLOW SUMMARY \*\*\*\*

(levation (ft)	0 (cfs)	Contributing	Structures
62.00	8		
62.50	9.B		
63.00	0.0		
63.50	ย.ช		
64.00	8.8		
64.50	8.6		
65.00	9.0		
65.50	8.8		
64.00	8.8		
66.50	8.8		
67.00	8.8		
67.50	8.8		
60.08	9.6		
•	9.0		
	0.0		
69.50	8.6		
	0.0		
70.50	8.8		
71.00	9.G		
_:	0.0	•	
	0.0		
72.50	0.0		
'n	G.6		
73.58	8.8		
	0.0		
74.50	1.9	-	
75.00	39.0	=	
75.50	123.5		
76.00	263.6	•	
•	467.4	_	
ζ.		-	
	1126.8	_	
70.07	G.9		

Outlet Structure File: NHVOS! .STR

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1

POND-2 Version: 5.17 Date Executed:

5/N: Time Executed:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Outlet Structure File: NHVOS1 .STR Planimeter Input File: NHVOS1 .VOL Rating Table Output File: NHVOS1 .PND

Min. Elev.(ft) = 6? Max. Elev.(ft) = 78 Incr.(ft) = .5

No. O Table O Table Structure

Outflow rating table summary was stored in file: NHVOSI .PND

Outlet Structure File: NIVOS1 ,51R

POND-2 Version: 5.17 Date Executed:

S/N: Time Executed:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

>>>>> Structure No. 1 <<<<<< Input Data)

WELH-XY Weir - Defined by X, Y Coordinates El (ft) =74.4 E2 (ft) =78

X dist.(ft) Y clev.(ft)

0 70
25 76
60 74.4
8W 74.4
120 76.1

Outlet Structure File: NAVOSI .SIR

S/N: lime Executed: POND-2 Version: 5.17 Date Expeuted:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Dutflow Rating Table for Structure #1 WEIR-XY Weir - Defined by X, Y Coordinates

\*\*\*\*\* INLET CONTROL ASSUMED \*\*\*\*

Mossages	1																									Max. D(ft)=.1	D(ft)		Direction .		1	DC .	
Compulation Mes	E < Y min= 74.4	< E1=74.4	< E1=74	E < E1=74.4	E < F1=74.4	E < E1=74.4	E < E1=74.4	E < E1=74.4	E < E1=74.4	1=7	E < E1=74.4	7=1	E < E1=74.4	=	E < E1=74.4	-		-	E < E1=74.4	E < C1=74.4	E < E1=74.4	7	E < E1=74.4	E < E1=74.4	E < E1=74.4	234.	W(ft)=40.125	M(ft)=71.562	W(ft)=95.0	W(ft)=111.25	W(ft)=127.5	F7	# Or > E
0 (cfs)	9	9.6	0.0	8.0	0.0	0.0	0.0	ଷ.ଷ	8.8	0.0	0.0	0.0	0.0	0.0	0.0	ย.0	ด.ต	0.0	9.6	0.0	0.0	0.0	0.0	6.0	8.8	1.9	39.6	123.5	263.6	487.4	4	1126.8	0.0
Elevation (ft)	62.00	62.50		62.50	64.00	64.58	65.00	65.50	66.00	66.50	67.00	67.50	68.88	68.50	69.68	69.58	70.00	70.58	71.03	71.50	٠	72.50	٠	٠	74.00	٠	75.00	75.50	76.00	76.50	٠		70.09

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POND-2 Version: 5.17 5/N: EXECUTED: 86-81-1995 - 80:40:42

\*\*\*\*\*\*\*\*\*\*\*\* NAPLILIMI VILLAGES - 1'11ASE, I ONSITE DETENTION BASIN DEFORE DEVELOPMENT

Inflow Hydrograph: NHVSA .HYD Ration Table file: NHVOS1 .PND

...- (NITIAL CONDITIONS ---[Lievalion = 62.00 ft
Outflow = 0.00 efs
Storage = 0.00 ac-ft

GIVEN POND DATA

INTERMEDIATE ROUTING COMPUTATIONS

25/L 25/L 25/L 25/L 25/L 26/S 11.2 24.7 29.8 29.8 25.9 76.9 76.9 100.1 1127.2 1127.2 1127.2 1127.2 1127.3 127.1 127.1 127.2 128.8 127.1 127.2 128.9 1645.6 1645.6 1645.6 1645.6 1645.6 1645.6 1645.6 1645.7 1645.7 1645.7 1645.8 1	Output   O	510RAGE	1	8		. 0.0	•	24.7 :	39.8	56.9	76.7	1001	127.2	158.5	173.0 :	233.1	276.5	324.3	377.1 :	435.3	499.3 :	569.3	645.6	720.0 :	819.1	916.7 :	1021.5 :	1133.3 :	1252.3	1378.7 :	1514.0 :	1691.1	1922.3	2215 9 1	
25/1 26/2 27/2 28/2	0.082(1) (C.) (C.) (C.) (C.) (C.) (C.) (C.) (C.	510RACE : 257 (ac-ft) : (c)   (c)	SMULTHUAL	25/L			 	.7 :	: 0:		.7 :		 	 	- 6.		 	 	 -	 r)	 M	 	. 9 .	0.		. 7 :	ω. 	17.		1.7 :	 -:	. 1 .:	3.B :		
		2	כח	25/1		9	=	ĭ,	2.0	3,6	76	100	127	158	193	233	276	324	377	435	499	569	645	728	819	916	1021	1133	1252	1376	15121	165	3621	1755	
		2		***	• ••	•••		••	••	••		••	••	••	••	••	••	••	••	••	••	••													
	0017FLOM 6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9		2 .	   <del> </del>	٠.;	• ••	••		••		•-	••	••		••	••	•-		••		••	••	- <b>-</b>											•	•
0017FLDM (c f f.) (c	z   5	)	_	EVAT 10		62.00	62.58	63.00	63.50	64.00	64.58	65.88	65.50	66.69	66.58	67.09	67.50	68.00	68.50	69.00	69.50	76.60	70.50	71.00	71.58	72.00	72.58	•	•	•	•	75.00	75.56	77. 00	
110N 0UTTCOM  110N 0UTTCOM  120 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	z 15°   5	EVATION:  (ft)  (22.86  62.86  63.00  64.86  64.86  65.90  66.80  66.90  67.80  68.90  68.90  71.80  71.80  72.80  73.80  74.50		ij.																••	••	••	••			••	••	••	••	••			••	-	-

EXECUTED 66-61-1995 UB:40547 PND BISK FILLS: NHVOSI PND

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Page 2

INTERMEDIATE ROUTING
COMPUTATIONS

25/t | 25/t + 0 | (cfs) | (cfs) | 2457.6 : 3584.4 : | ELEVATION: DUTF(ON | STORAGE | (+t) | (cfs) | (ac-ft) GIVEN POND DATA

Time increment (t) = 0.050 hrs.

GIVEN POND DATA

ELEVATION: OUTFLOW: STORAGE:
(ft) (cfs) (ac-ft)
77.50 1126.8 5.078

Time increment (1) - 0.050 hrs.

PUND-2 Version: 5.17 S/N: EXECUTED: 06-01-1995 00:48:42

Page 2

Pond File:
Inflow Hydrograph: NHVSA .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH	

ROUTING COMPUTATIONS	: 11+17 : 25/t - 0 : 25/t + 0 : QUIFLOW	; (cfs) ; (cfs) ; (cfs) ; (rfs)
W HYDROGRAPH	 : INFLOW:	s) : (c{s}) :
<u>-</u>		ົດ

: TIME	: INFLOW :	11+12		4,00		
(hrs)	(c/s)	(cfs)	(5)3)	(cfs) :	OUTFLOW (cfs)	:ELEVATION : (ft)
				.;		
			 		9.00	: 62.00
	: ::::::::::::::::::::::::::::::::::::	m i	2.0	m Ci	86.6	
		œ:	. 1.6	7.1	00.0	: 62.40
			ະ. ຄ.	20.5:	80.6	62.84
		16.0		36.51	00.00	. 63.39
		n -	57.0	57.0	0.00	64.00
• 1	100.00	- 1		02.13	8.08	•
				11.31	G. 30	1 65.21
	17 79.	2 12 12 12 12 12 12 12 12 12 12 12 12 12	143.6	143.6	D.80	65.76
		 קיני	1.8/-	178.1:	B.55	66.28
	100.01	000	7.14.7	214.7	8	. 66.77
009.00	21.86:		30,000	253.6:	0 0	•
0.650			/ 1 1/4 7	2.94.7	9.50	67.69
. D. 700	4 <	, ,	7.755	377.9	0 0	•
0.750	100		2.625	386.3;	8.68	
			יייייייייייייייייייייייייייייייייייייי	444.5	9.69 6	1 69.07
			. 1.4.1	514.1:	88.8	19.69
9700		C. 701	623.33	623.31	ର ଓ	36.35
		N-/U.	1130.2	030.2	3.96	71.56
004.0	168.27	0.00	1134.2	1134.21	90.00	72.00
000.	1310.77		1480.1	1483.1:	1.47	74.39
GC7	:08.171		1651.0	10.22.23	90.29	
	157.18:	S	14,70.0	1902.0:	152.01	75.60
500	14.1.0.1	304.2	1678.0	1902.21	152.11	75.60
907.		: 276.7	1676.7	1954.2	130.73	
MCZ-1	118.61	: 240.2	1675.5	1926.5	60	
1.500	: 108.02:	3.0.5	1669.13	1902.1	116.17	75 74
222.	1.76. 39	. 200.4	1663.4	1070.2:	107.01	27.7
1.400	96.05:	1961	1659.5	1859.9	100.69	
1.458	97.72	180.3	1655.8	1846.7	95.98	
1.300	88.61:	: 100.0	1652.0	10.25.83	91.89	
1.236	12.1:		1547.3	1075.7:	00.55	
909.	99.18	: 166.B :	1646.7	1816.11	84.69	75.27
500.	ъ,	: 159.B :	1644.1	1806.5	81.20	75.23
00/-1	74.61:	: 155.8	1641.5 :	1796.9	77.69	75.73
1.75g	7.02.	145.6	1639.9	1707.23	74.13	7.5.2
1.833	(17.47:	138.5	1636.3	1777.4	'n	21.57
1.850	63.98	131.4	1633.7	1757.7	47.98	75 17
1.900	60.42	124.3	1631.1	1758.0	9	
1.950	•	: 117.6 :	1628.6	1748 7:	60.05	(
2.930	54.28:	: 111.4 :	1626.7	1739.9	56.86	75.11
20.00	51.73	: 105.9	1624.1	1732.11	34.01	75.04
•	٠,		1622.3	1725.21	51.47	75.07
٠	S 1	96.3	1620.5	1718.63	19.05	75.06
2.300	44.79:	91.6	1618.8	1712.2	46.74	72.00
1 1 1 1 1 1 1	,	1				

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POND-2 Version: 5.17 S/N: EXECUTED: 06-01-1495 40:40:42

Pond File: NHVOS1 ,PND Inflow Hydrograph: NHVSA ,HYD Outflow Hydrograph: (3))

INFLOW HYDROGRAPH

ROUTING COMPUTATIONS

Ž	H MOT	Ž	INFLOW HYDROGRAPH				ROUT ING	Ž	COMPUTATIONS	, .	į			3
[	11		INFLOW	•	11+12		25/t - 0		25/t + 0 :	OUTFLOW	ίΕL	:ELEVATION:		-
-	(hrs)	••	(cfs)	•••	(c fs)	•• -	(cfs)		(cfs)	(cfs)		(ft)		١
Ì	2000	<u>!</u>	78.00	- ••	H7.7	: ··	1617.2		1706.4	14.61		75.03		••
	2.300		41.07:		84.8	••	1615.0	••	1701.2:	42.69	••	75.02		<u></u> .
	2,350	••	39.50	••	9.00		1614.5	••	1696.4	40.94	••	75.01		
	2.100	••	30.19:	••	77-7	••	1613.4		1672.2	39.41		73.66		
	4.10	••	36.93:	••		••	1611.6		5.0091	50.45		74.77		
	2.500	••	32.66	••	72.6	••	1.607.1		1604.2	37.33	. <b>.</b> .	14.78		
-	2.550	••	34.44:		76.1	••	1.606.1	••	1679.2	36.50	. <b>.</b> -	/4.4/		
	2.680		33.29		67.7	•	1685.1	••	16/3.9	55.40		74.40		
	2.650	••	32.26	••	65.6	••	1600.0	••	1668.6	34.50		4.44		• •
	2.700	••	31.47		63.7	•••	1597.2		1665.83	25.24		24.97		
		••	30.04:		4		13/4.7	• •	1637.3	10.74		74.71		•
	2.886	•••	30.27	•••	1.19	•••	1572.6	·- •	1633.83	20.10		24.46		•
	2.858		27.75		900	• •	1340.7		1632.0			7.2 833		•••
	004.		27.13	•	700.		0.1001			27 00		7.0 0.7		••
	957.		79.07		7.70	- •	705	• •	1640.4.	70.71		74 84		
	00000		10.42	• •	7	• •	0.500	• •	10 11.71	27.00		74.84		••
	מכטי.			•	0.4.0		0.7751	• •	0.000	7 4		50.00		
			14.00	- •		• •	1.07.01	• •	1,400 4	20.11		70 77		••
	1000			• -			1564.0		1502	18.44		74.72		*-
	,,,	٠.		• •		• •	1504.0	•	6777	1.51	•	74. AB		••
	7	• •	90.7	• •	15.00	• • •	1539.0		1561.9	11.93		74.64		•-
	2007		7.47		2.6	•	1529.7	• • •	1547.6	8.95		74.60		••
	3,480	• ••	2.57	•••	6.5	•	1523.0		1536.0	6.51	••	74.56		
	3.450		1.76		4.3	•••	1517.9	••	1527.3	4.69		74.54		•••
	3.580	•••	1.191		8.5	-	1514.2	••	1520.9	3.34		74.52		
	3.550		0.79		E::3		1511.5		1516.2	2.36	••	74.51		•
٠.	3.680	••	0.53:		1.3		1509.0		1512.8	<b></b>		74.50	<u></u> .	-
	3.650	••	0.34:		6.0		1506.1		1509.9	-		74.48	<b></b> .	• •
	3.700	•••	13.72		. U.6		1503.1	••	1506.8	08·1		74.47		• •
	3.750		0.14:		. 0.4	_	1500.0		1503.5	1.75		74.46		• •
	3.000	··	9.0%	-			1496.8	_	1500.2	1	. <u>.</u> .	74.40		•
٠.	3.850		0.06:		5	•	1493.7		1497.0	1.60		70.07		
	3.900		0.04				1470.1		7 600			74.41	<b></b>	
	300		5 6			_ ~	י ענוע ו		1407.5	1.53		74.40	. <b></b>	
							. 1001		1484.4			74.39		
٠.	20.00		5.5				1478.6		1401.5	. <del></del>		74.38		
		· ·			5		1475.8		1478.6	-		74.37		
	200		:00:0		9.9	. 62	1473.1		1475.0			74.36		
	75.0		30.0		9.0	2	1470.4		1473.1	1.33	 m	74.35		
• • •	4.300		0.00		9.0	9	1467.8	 m	1470.4	-	 o-	74.34	••	
•••	4.358	-	. 69.60:		8.6	9	1465.3	 ::	1467.8	<del>-</del>		74.33		
••	4.400	6	0.00			9	1462.9	-	1465.3	<u>-</u>	·	74.32	••	
••	4.450	2	00.00			Ö	1460.5	in .	1462.9	81.1	 m i		<b></b> .	
••	4.500		:00.00		 5	3	1458.	C	1460.5		·-	74.30		
1	1 1 1	į			1	;		i					1	

POND-2 Version: 5.17 5/N: EXECUTED: 06-01-1995 08:48:42

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Page 5

Pond File: NHVGA .HYD Inflow Hydrograph: NHVGA .HYD

The contract of the contract	•									
TIHE INFLOW   11+17   25/t - 0   25/t + 0   0UIFLOW   (cfs)   (cfs)	-	NFLOW H	ΥĎ	10GRAP11			אן דטסח	G COMPUTATIO	SZ	
4.550         0.00         0.0         1455.0         1456.2         1.112         74.           4.600         0.0         1455.0         1455.2         1.05         74.           4.600         0.00         0.0         1451.7         1453.8         1.05         74.           4.500         0.00         0.0         1447.7         1447.7         0.97         74.           4.000         0.00         0.0         1445.7         1447.7         0.97         74.           4.000         0.00         0.0         1443.9         1447.7         0.97         74.           4.000         0.00         0.0         1443.9         1442.7         0.97         74.           4.000         0.00         1443.9 <th< th=""><th>١ ــ ٠٠</th><th>TIME (hrs)</th><th>ļ</th><th>INTLOW :</th><th>·</th><th>11+12 (cfs)</th><th>1 (5)</th><th>+ (3)</th><th>OUTFLOW (c.fs)</th><th>ELEVATION : (ft)</th></th<>	١ ــ ٠٠	TIME (hrs)	ļ	INTLOW :	·	11+12 (cfs)	1 (5)	+ (3)	OUTFLOW (c.fs)	ELEVATION : (ft)
0.00   1.09   1.09   74.   7	<u>.</u>	1 4	<u>i</u>	0.00	<u>.</u>	9.6	1456.0	1458.23	1.12	74.29
0.00    0.00   1451.7   1453.8    1.06   74.   1463.8    1.06   74.   1467.7   1467.7   1.00   74.   1467.7   1467.7   1.00   74.   1467.7   1467.7   1.00   74.   1467.7   1467.7   1.00   74.   1467.7   1467.7   1.00   74.   1467.7   1467.7   1.00   74.   1467.7   1.00   74.   1467.7   1.00   74.   1467.7   1.00   74.   1467.7   1.00   74.   1467.7   1.00		4.600		0.00:		0.0	1453.8	1456.03	1.09	: 74.29
0.00    0.00   1449.7   1451.7    1.03   74.     0.00    0.00   1447.7   1449.7    1.03   74.     0.00    0.00   1442.7   1444.7    0.94   74.     0.00    0.00   1442.7   1442.9    0.92   74.     0.00    0.00   1442.7   1442.9    0.92   74.     0.00    0.00   1442.7   1442.9    0.92   74.     0.00    0.00   1442.8   1442.9    0.92   74.     0.00    0.00   1422.2   1432.8   0.84   74.     0.00    0.00   1433.6   1435.2   0.84   74.     0.00    0.00   1433.6   1433.8   0.87   74.     0.00    0.00   1433.6   1433.8   0.77   74.     0.00    0.00   1422.1   1433.8   0.77   74.     0.00    0.00   1422.1   1433.8   0.77   74.     0.00    0.00   1422.2   1422.1   0.77   74.     0.00    0.00   1422.2   1422.7   0.65   74.     0.00    0.00   1422.4   0.61   74.     0.00    0.00   1422.4   0.61   74.     0.00    0.00   1412.7   1418.8   0.55   74.     0.00    0.00   1412.5   1413.5   0.55   74.     0.00    0.00   1415.5   1415.5   0.50   74.     0.00    0.00   1415.5   1415.5   0.50   74.     0.00    0.00   1415.5   1415.5   0.50   74.     0.00    0.00   1415.5   1415.5   0.50   74.     0.00    0.00   1415.5   1415.5   0.50   74.     0.00    0.00   1415.5   1415.5   0.50   74.     0.00    0.00   1415.5   1415.5   0.50   74.     0.00    0.00   1415.5   1415.5   0.50   74.     0.00    0.00   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   1415.5   0.50   74.     0.00    0.00   1412.5   0.50   74.     0.00    0.00   1412.5   0.50   74.     0.00    0.00   1412.5   0.50   74.     0.00    0.00   1412.5   0.50   74.     0.00    0.00   1412.5   0.40   74.		4.650		0.00	•-	9.6	1451.7	1453.8:	1.06	: 74.2H
0.00    0.0    1447.7   1449.7   1.00    74.     0.00    0.0    1445.7   1445.7   0.97   74.     0.00    0.0    1445.9   1445.7   0.94   74.     0.00    0.0    1445.9   1445.0   0.92   74.     0.00    0.0    1445.9   1445.0   0.99   74.     0.00    0.0    1438.5   1446.8   0.99   74.     0.00    0.0    1438.5   1445.8   0.99   74.     0.00    0.0    1435.1   1435.2   0.94   74.     0.00    0.0    1435.1   1435.2   0.77   74.     0.00    0.0    1452.1   1453.6   0.77   74.     0.00    0.0    1452.1   1453.6   0.77   74.     0.00    0.0    1425.2   1425.2   0.67   74.     0.00    0.0    1425.2   1425.3   0.67   74.     0.00    0.0    1425.2   1425.3   0.67   74.     0.00    0.0    1425.2   1425.3   0.65   74.     0.00    0.0    1425.4   1425.7   0.63   74.     0.00    0.0    1425.4   1425.4   0.61   74.     0.00    0.0    1415.5   1415.5   0.55   74.     0.00    0.0    1415.5   1415.5   0.55   74.     0.00    0.0    1415.5   1415.5   0.50   74.     0.00    0.0    1415.5   1415.5   0.50   74.     0.00    0.0    1415.5   1415.5   0.50   74.     0.00    0.0    1415.5   1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    1415.5   0.50   74.     0.00    0.0    0.0    1415.5   0.50   74.     0.00    0.0		4.700		0.00:	••	0.0	1449.7	1451.73	1.03	: 74.27
0.000         0.00         1445.7         1445.7         0.97         74           0.000         0.00         1443.9         1445.7         0.94         74           0.000         0.00         1440.2         1442.0         0.94         74           0.001         0.00         1440.2         1442.0         0.95         74           0.001         0.00         1458.5         1440.2         0.96         74           0.001         0.01         1435.2         1436.5         0.96         74           0.001         0.01         1435.2         1435.2         0.77         74           0.001         0.01         1435.6         1435.6         0.77         74           0.001         0.01         1430.6         0.77         74           0.001         0.01         1425.1         1435.6         0.77         74           0.001         0.01         1427.7         1426.1         74           0.001         0.01         1425.0         1426.3         0.67         74           0.001         0.01         1425.7         0.67         74           0.001         0.01         1425.7         0.67		4.750		0.00:		6.9	1447.7	1449.7:	1.00	74.26
0.00   0.0   1443.9   1445.7   0.94   74,		4.000		0.00:		0.0	1445.7	1447.7	0.97	74.25
0.00    0.00    1442.0    1443.9    0.92    74,   0.00    0.00    1440.2    1442.0    0.09    74,   0.00    0.00    1440.2    1442.0    0.09    74,   0.00    0.00    1435.2    1435.2    0.07    74,   0.00    0.00    1435.2    1435.2    0.77    74,   0.00    0.00    1423.4    0.77    74,   0.00    0.00    1423.4    0.77    74,   0.00    0.00    1423.4    0.75    74,   0.00    0.00    1423.4    0.75    74,   0.00    0.00    1425.3    1425.4    0.75    74,   0.00    0.00    0.00    1425.3    1425.4    0.75    74,   0.00    0.00    0.00    1425.3    1425.3    0.45    74,   0.00    0.00    0.00    1425.4    0.45    0.45    0.45    0.45    0.65    0.		4.050		9.00:		6.6	1443.9	1445.7;	0.94	74.25
0.00   0.0   1440.2   1442.0   0.89   74,     0.00   1438.5   1440.2   0.86   74,     0.00   0.0   1435.2   1456.8   0.84   74,     0.00   0.0   1435.4   1435.2   0.77   74,     0.00   0.0   1452.1   1455.2   0.77   74,     0.00   0.0   1425.1   1435.2   0.77   74,     0.00   0.0   1425.1   1435.6   0.77   74,     0.00   0.0   1425.7   1425.1   0.71   74,     0.00   0.0   1425.2   1425.1   0.71   74,     0.00   0.0   1425.2   1425.1   0.71   74,     0.00   0.0   1425.2   1425.3   0.65   74,     0.00   0.0   1425.4   0.61   74,     0.00   0.0   1425.4   0.61   74,     0.00   0.0   1425.7   1425.4   0.65   74,     0.00   0.0   1425.7   1425.4   0.65   74,     0.00   0.0   1415.7   1416.8   0.55   74,     0.00   0.0   1415.5   1415.5   0.55   74,     0.00   0.0   1415.5   1415.5   0.50   74,     0.00   0.0   1415.5   1415.5   0.50   74,     0.00   0.0   1415.5   1415.5   0.50   74,     0.00   0.0   1415.5   1415.5   0.50   74,     0.00   0.0   1415.5   1415.5   0.50   74,     0.00   0.0   1415.5   1415.5   0.50   74,     0.00   0.0   1415.5   1415.5   0.50   74,     0.00   0.0   1415.5   1415.5   0.50   74,     0.00   0.0   0.0   1415.5   0.50   74,     0.00   0.0   0.0   1415.5   0.50   74,     0.00   0.0   0.0   1415.5   0.50   74,     0.00   0.0   0.0   1415.5   0.50   74,     0.00   0.0   0.0   0.0   0.0   0.0     0.00   0.0   0.0   0.0   0.0   0.0     0.00   0.00   0.00   0.00   0.00   0.00     0.00   0.00   0.00   0.00   0.00   0.00     0.00   0.00   0.00   0.00   0.00   0.00     0.00   0.00   0.00   0.00   0.00   0.00   0.00     0.00   0.		4.900		6.60	••	0.0	1442.0	1443.9	0.92	74.24
0.00    0.0   1438.5   1440.2   0.86   74   1435.2   0.00    1435.2   1435.2   0.07   74   1435.2   0.00    0.00    1435.2   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77   74   1435.2   0.77		4.950	••	0.00:		0.0	1440.2	142.0:	0.89	74.23
0.00   0.0   1425.8   1435.5   0.84   74,		5.000	••	0.99:	••	0.0	1438.5	1440.2	0.06	: 74.23
0.000   0.00   1435.2   1435.8   0.07   74,		5.059	••	GO:00:		6.0	1436.8	1439.53	0.84	74.23
0.00    0.0    1433.6   1435.2   0.79   74,     0.00    0.0    1432.1   1433.6   0.77   74,     0.00    0.0    1429.6   1432.1   0.73   74,     0.00    0.0    1427.7   1429.1   0.73   74,     0.00    0.0    1425.3   1427.7   0.67   74,     0.00    0.0    1425.0   1427.7   0.67   74,     0.00    0.0    1425.0   1427.7   0.65   74,     0.00    0.0    1425.1   1423.7   0.63   74,     0.00    0.0    1420.2   1423.7   0.63   74,     0.00    0.0    1410.1   1410.2   0.55   74,     0.00    0.0    1410.5   1415.5   0.52   74,     0.00    0.0    1410.5   1413.5   0.50   74,     0.00    0.0    1412.5   1413.5   0.50   74,     0.00    0.0    1412.5   1413.5   0.50   74,     0.00    0.0    1412.5   1413.5   0.50   74,     0.00    0.0    1412.5   1413.5   0.50   74,     0.00    0.0    1412.5   1413.5   0.50   74,     0.00    0.0    1412.5   1413.5   0.50   74,     0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0      0.00    0.0    0.0    0.0    0.0    0.0      0.00    0.0	••	5.100	••	0.00	••	6.6	1435.2	1436.8	9.02	74.21
0.00    0.0    1432.1   1433.6   0.77   74   1430.6   0.75   74   1430.6   0.75   74   1430.6   0.75   74   1430.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   74   1420.6   0.75   0.	•••	5,150		8.66:		8.8	1433.6	1435.2	0.79	74.2
0.00    0.0    1430.6   1432.1   0.75   74     0.00    0.0    1429.1   1450.6   0.75   74     0.00    0.0    1426.3   1427.7   0.67   74     0.00    0.0    1426.3   1426.3   0.67   74     0.00    0.0    1425.0   1426.3   0.67   74     0.00    0.0    1425.7   1426.3   0.65   74     0.00    0.0    1421.2   1422.4   0.61   74     0.00    0.0    1421.2   1422.4   0.61   74     0.00    0.0    1410.8   1410.6   0.56   74     0.00    0.0    1416.6   1416.6   0.55   74     0.00    0.0    1416.5   1416.5   0.52   74     0.00    0.0    1416.5   1415.5   0.52   74     0.00    0.0    1412.5   1415.5   0.50   74     0.00    0.0    1412.5   1413.5   0.54   74     0.00    0.0    1412.5   1413.5   0.54   74     0.00    0.0    1412.5   1413.5   0.54   74     0.00    0.0    1412.5   1413.5   0.54   74     0.00    0.0    1412.5   1413.5   0.54   74     0.00    0.0		5.200		0.00:		0.0	1432.1	1433.6	0.77	
0.00    0.0   1429.1   1430.6  0.73   74   1420.1   1420.1   1420.1   1420.1   1420.1   1420.1   1420.1   1420.1   1420.1   1420.1   1420.1   1420.1   1420.1   1420.2   1420.2   1420.2   1420.2   1420.2   1420.2   1420.1   142		5.250	••	9.00	••	0.0	1430.6	1432.13	0.75	74
0.00    0.0    1427.7   1429.1    0.71   74   1420.2    0.00    74   1426.3   1427.7    0.67   74   1420.2    0.67   74   1420.2    0.67   74   1420.2    0.67   74   1420.2    0.67   74   1420.2    0.67   74   1420.2    0.67   74   1420.2    0.67   74   1420.2    0.67   74   1420.2    0.67   74   1420.2    0.67   74   1420.2    0.61   74   1420.2    0.61   74   1420.2    0.61   74   1420.2    0.61   74   1420.2    0.61   74   1420.2    0.61   74   1420.2    0.61   74   1420.2    0.61   74   1420.2    0.61   74   1420.2    0.61   74   1420.2    0.61   74   1420.2    0.61   0.61   1420.2    0.61		5.300	••	6.00:		0.0	1429.1	1430.6	0.73	. 74
0.00    0.0   1426.3   1427.7   0.69   74   74   0.00    0.0   1425.0   1426.3   0.67   74   74   0.00    0.0   1425.0   1426.3   0.67   74   74   0.00    0.0   1422.4   1423.7   0.63   74   74   0.00    0.0   1421.2   1422.4   0.61   74   0.00    0.0   1421.2   1422.4   0.61   74   0.00    0.0   1422.2   1422.3   0.60    74   0.00    0.0	•••	5.350	••	0.00	••	0.0	1427.7	: 1429.1	0.71	
0.00    0.0   1425.0   1426.3  0.67   74   74   76   76   76   76   76		5.420	••	00.0		8.6	1426.3	1427.7	0.67	. 74
0.00    0.0    1425.7   1425.0    0.65   74     0.00    0.0    1422.4   1422.4   0.61   74     0.00    0.0    1421.2   1422.4   0.61   74     0.00    0.0    1410.8   1420.0    0.58   74     0.00    0.0    1417.7   1410.8   0.56   74     0.00    0.0    1416.5   1416.6   0.55   74     0.00    0.0    1415.5   1415.5   0.52   74     0.00    0.0    1412.5   1413.5   0.50   74     0.00    0.0    1412.5   1413.5   0.49   74     0.00    0.0    1412.5   1413.5   0.49   74     0.00    0.0    0.0    0.0    0.0	••	5.450	••	00.00	••	0.0	1425.0	1426.3	0.67	
0.00    0.0    1/22.4   1/23.7   0.63   74   0.00    0.00    1/22.4   0.61    74   0.00    0.00    1/22.4   0.61    74   0.00    0.00    1/20.2   0.60    74   0.00    0.00    1/20.2   0.60    74   0.00    0.00    1/20.2   0.50    74   0.00    0.00    1/20.2   0.50    74   0.00    0.00    1/20.2   1/20.2   0.52    74   0.00    0.00    1/20.2   1/20.2   0.50    1/20.2   0.00    0.00    1/20.2   0.10    1/20.2   0.10    1/20.2   0.10    1/20.2   0.20    0.00		5.500	••	6.00:	••	0.0	1423.7	1425.0	0.65	••
0.00    0.0   1421.2   1422.4   0.61   74   0.60    74	••	5.550	••	00.00	••	0.0	1422.4	1423.7	0.63	
0.00    0.0    1420.0    1421.2  0.60  74   0.00    0.0    1410.8    1420.0  0.56  74   0.00    0.0    1415.7    1410.8  0.55  74   0.00    0.0    1415.5    1416.6  0.55  74   0.00    0.0    1415.5    1416.5  0.52  74   0.00    0.0    1412.5    1413.5  0.50  74		5.600	••	0.00:	••	0.0	1421.2	1422.4	19.0	
0.00    0.0   1410.8   1420.0  0.58   74   6.00    0.50   1417.7   1418.8   0.56   74   74   75   75   75   75   75   75	••	5.650	••	0.00	••	9.8	1420.0	1421.2	0.60	
0.00    0.0    1417.7   1410.8  0.56   74   1410.8  0.56   74   1416.6   1417.7   0.55   74   1416.6   1417.7   0.55   74   1416.6   0.55   74   1416.6   0.55   74   1416.6   0.52   74   1416.6   0.50   74   1417.5   0.60   74   1417.5   0.60   74   74   74   74   74   74   74   7		5,700		6.00:	••	9.0	1410.8	1420.0	0.58	7.4
0.00;   0.0   1416.6   1417.7   0.55   74.1   1417.7   0.55   74.1   1415.5   1416.6   0.55   74.1   1416.6   0.55   74.1   1416.6   0.55   74.1   1416.6   0.50   74.1   1416.6   0.50   74.1   1416.6   0.50   74.1   1416.6   0.60   1416.5   1416.5   0.49   74.1	••	5.750	••	0.00:	••	0.0	1417.7	1410.8	0.56	14
0.000: 0.00: 1415.5: 1416.6: 0.55: 74.1 0.000: 0.00: 1415.5: 0.52: 74.1 0.000: 0.00: 1415.5: 0.52: 74.1 0.000: 0.00: 1412.5: 1414.5: 0.49: 74.1	••	5.888	••	0.00	••	0.0	1416.6	1417.7	. a.55	••
0.00;   0.0;   1414.5   1415.5;   0.52   74.1 		5.850		0.00:	••	ຍ.ຄ	1415.5	: 1416.6		: 74.1
; 0.00; ; 0.0; 1413.5; 1414.5; 0.50; 74.1 ; 0.00; ; 0.0; 1412.5; 1413.5; 0.49; 74.1	••	5.900	•-	9.40:		9.6	: 1414.5	1415.5	••	74.1
; 0,00; ; 0.0; 1412.5; [413.5; 0.49; 74.1		5.950	••	0.00:	••	0.0	1413.5	: 1414.5	<b>.</b>	: 74
	•••	6.000	•••	0.00:		0.0	1412.5	1 (413.5	6	. 74

POND-2 Version: 5.17 5/N:

Pond File: NHVOS1 .PND Inflow Hydrograph: NHV5A .HYD Gutflow Hydrograph: OUI .HYD

190.29 cfs 152.11 cfs 75.60 ft Peak Inflow = Peak Outflow = Peak Elevation =

EXECUTED: 06-01-1995 08:48:42

Page 7

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* SUMMARY OF ROUTING COMPUTATIONS \*\*\*\*\*\*\*\*\*\*\*\*\*

Pond File: NIVOS1 .PND Inflow Hydrograph: NHVSA .HVD Outflow Hydrograph: OUF .HYD

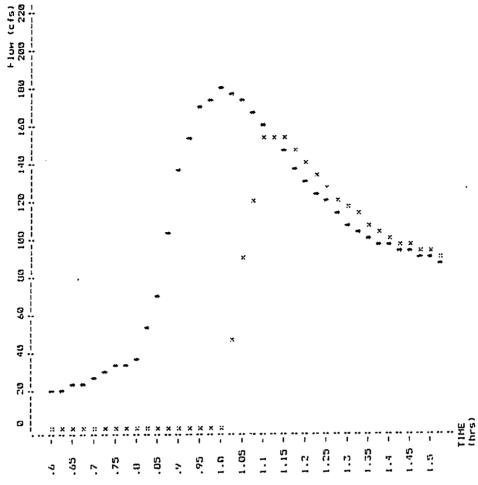
Starting Pond W.S. Elevation = 62.00 ft

titit Summary of Peak Dutflow and Peak Elevation fifts

Peak Inflow = 180.29 cfs Peak Outflow = 152.11 cfs Peak Elevation = 75.60 ft

#### Summary of Approximate Peak Storage ####

3.70 ac-ft Initial Storage Peak Storage From Storm = Total Storage in Pond



Omax = 188.3 cfs Omax = 152.1 cfs

HYD.

# File: NHV5A x File: OUT

POND-2 Versian: 5.17 S/N:

### NAPILLIIAU VILLAGES PROJECTS DETENTION BASIN A-1-b

Plunimeter scale: 1 inch = 708,7103 ft.

12:07:79

CALCULATED 06-01-1975 015K FILE: NHVAID .VOL

Elevation (11)	Planimeter (sq.in.)	Area (acros)	AltA2tsar(AltA2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
224.00	0.0	0.01	0.00	09.0	00.00
226.00	0.07	9.87	0.13	0.09	69.0
228.00	0.15	9.15	6.36	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	55.1
234.00	0.39	95.0	1.09	0.73	2.00
236.00	0.13	B. 45	1.26	D. 84	2.92
237.00	::	13.481		0.46	3.38
238.00	0.51	0.51	1.44	0.76	3.88
240.00	Ø.54	0.56	1.60	1.07	4.94

\*1\* ---> Interpolated area from closest two planimeter readings.

E1, E2 = Closest two elevations with planimeter data Ei = Clevation at which to interpolate area Areas. Areas computed for E1, E2, respectively IA = Interpolated area for E1 whore: E1, E2 Ei

t Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) \* (EL2-EL1) \* (Arral + Arra2 + sq.rt.(Arcal\*Arra2)) where: ELI, FL2 - Lower and upper elevations of the increment Areal,Area2 = Areas computed for ELI, EL2, respectively Volume - Incremental volume between ELI and EL2

Outlet Structure File: NHVAID .SIR

j.ca

1 1

POND-2 Version: 5.17 Date Executed:

S/N: Time Executed:

#### COMPOSITE DUTFLOW SUNMARY ####

\*

Structures	) 																																
Contributing																											-	_		_	-	-	
(c/s)	8.0	0.0	0.0	0.0	6.0	<b>6.0</b>	9.6	0.0	0.0	0.0	9.G	8.0	0.0	8.8	6.6	8.8	6.0	5.6	9.G	9.6	Ŋ.O	0.0	9.0	0.0	0.0	6.0	9.6	3B.4	nn.0	165.2	260.0	271.2	0.0
Elevation (ft)	.00	224.50	225.00	225.50	226.00	27.6.30	227.08	227.50	228.88	228.50	229.00	229.50	230.00	236.56	٠	231.50	•	ξ;	733.88	۳.	234.88	234.58	235.00	735.50	236.00	254.50	237.00	237.50	230.00	239.50	229.00	239.50	240.00

Outlet Structure Lile: NIVALE .SHE

The state of the s

POND-2 Version: 5.17 Date Executed:

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Outlet Structure File: NIVAIB .STR Planimeter Input File: NIVAIB .VOL Intum Table Galput File: NIVAIB .VOL

Min. Elev.(11) = 224 Maii. Elev.(11) = 240 Incr.(11) = .5 Additional elevations (11) to be included in table:

SARRAS SA

No. O Table U lable Structure

Dutflow rating table summary was stured in file: NHVAID .PND

Oothet Structure File: MIVAII .SH

PORTO 2 Version: 5.17 Date Escuted:

fime Laccuted:

\*\*\*\*\*\*\*\*\*\*\*\*

>>>>> Structure No. 1 <<<<<< li>(Input Data)

WEIR-XY Weir - Defined by X, Y Coordinates El (IL) =237 E2 (IL) =240

X dist.(ft) V elev.(ft)

B

240

6

235

34

237

237

a⊤ f . i 51

SZN: Time Executed: POND-2 Version: 5.17 Date Executed:

Outlet Structure File: MIVAIB .5IR

\*

Outflow Raling Lable for Structure III METH-XY Wair - Defined by X. Y Goordinates

THITE INLET CONTIOL ASSUMED FRITE

Newsmajire	237																										257	2	. D. E	. DC+t)=1	DC10=5.1	Man. 81117-2.5	E2=240
Computed ton	=uiw X > 3	E : E1=227	L - C1+227	E > E19237	E < E1-237	L < U1-237	11	€ < U1=237	E < C1=237	E < E1-237	, E1:	E < E1=237	_	E < E1=237	E < E1-227	E < E1=237	<u>"</u>	E < E1=237	C < E1=237	E < E14237	E + E1-237	5	_	E < 0.1=237	-	E / C1-737	4	MCFC - 32.8	W(ft)-34.0	M(ft)=36.0	W(FE)=30.0	Willy - Sur. W	部へ 40 単語
(51.5)	8	0.0	S.	G. 9	s. s	8.8	9.6	Ð. 9	Ŋ.0	0.0	8.9	S. S	S. 63	a.e	0.0	0.0	9.6	9. 9	9	9.0	8	s. s	ອ. ຮ	o.0	9 9	ย.ย	8. 8.	F. 00	0n.u	165.2	260.0	571.75	o.e
leval i	1	224.58	225.00	225.50	226.00	226.58	227.00	227.50	228.90	228.50	229.00	229.50	236.00	236.08		221.30	232.00	232.80	233.00	244.50	234.00	234.50	275.00	235.58	236.00	256.58	237.98	237.50	230.00	238.5W	209.68	239.30	249.00

POND-2 Version: 5.17 5/N: EXECUTED: 85-31-1995 17:09:01

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Rating Table file: NHVAIB .PND

----INITIAL CONDITIONS---Elevation = 224.88 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

INTERMEDIATE ROUTING COMPUTATIONS

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	6	9.0	.,	1.3	٠	41.9	65.2	72.	122.6	56.	196.	242.4	296.	357	424	496	571.	.159	33	022.	912.	1005.0	1.01.	1200.0	304.	411.	521.8	636.	704	1963.	2165.	388.
SNO	1 U	į			•	-	Ī	-	_	_	_	L1	L1	m	4	4	'n	•	,	-	G.	=	=	Ξ	=======================================	<u>-</u>	==	ĭ		_	<b>L</b> 4 j	N
COMPUTAT 10NS	25/t (c	į																														
P		<u> </u>	•••												••				••	••			••	•-	••		••			••		
Į.		ļs	Ξ.	'n	۰,	a.	'n	۲.	45	6	4	0	-:	m		Ŋ	c.	ç.		4:	7	9		9.0	:	ij	B	5.1	9	i U	2 4	P.
	<del>ق</del> گ	9	M	Ξ	L1	4	65.3	92.2	122.6	156	196	242	296	357	424	496.	571	55	735.	127	912	1005	1.1011	200.	384	141	521	1636.1	1754.0	1875.	80	212
COMPUTAT	25/t (cfs	į																				_	_	_	_	_						
		Ì																								••				••		
	** **			••	••	••	••	••	•-	••	•-	••	••	•	••		••	••	••													
			::	ä	::	::	<u>بر</u>	 8	:2	5	:90	::	ë	738:	77	5	32:	:47:	5261:	:66	:: ::	76:	275	481:	:549	:916	144:	98	. 524;	.875	133	397
 	P del	0.000	H. 500	0.023	. 1349	0.087	::	061.0	0.253	0.324	0.406	0.501	0.612	0.7	6.077	Ġ	1.182	2	'n	1.699	1.895	2.075	Ç1			•	.;	3.380	3	3.0	-	P. 4
 	STURAGE (ac-ft)	5	S	2	9	0	0		5	2	ن	٠	۳	-	_							•	•									
DATA															. <u>.</u>														٠.		••	
	3	: :: : ::	5		5	ى ت	5	3	2	9	0	8	<u>ء</u>	Ö	S	8	0	5	s	ο.	e.	9	₽.	3	s.	5	3	g.6	4.00	o.	ei	9
NO.	UTFLD (cfs)	3		8.6	0	Ø	9	0	ä	0	9	8	9	s	٥	9	c	3	G	0	9	Ø	9	2	8	2	S	S	5	9	165.2	260
GIVEN POND	OUTFLOW (cfs)	1																														
2	!	<u>.</u> .	••	••		••	••	••	•-		••	••	••	••	••	•-	••	••	•-	••	••	••	••	·-	••		••	••	<u>-</u> -			
Ü	10N	25	S	35	S	33.	SS.	5	ş	200	5	60.	5	30.	500	.00	.50	88	3	35.	50	89.	55.	235,60	53.	95.	Š.	90.	5		1.50	00.
	ELEVAT	100	23.4	225.88	225	226.	226.	227	227	228.	17.0	627	229	230	230	133			17	233	233	134	23.4	75.7	35	23.5	236	237	757	238	238.	239
	9	15			• •	• •	• •	• •		•••				•••	•••	•	••			••										••	••	

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Pond File: NIKVAIB FIND Inflow Hydrographs: NHVIA .HYD

| INTERMEDIATE ROUTING
| COMPUTATIONS | 25/t | 25/t + 0 | (cfs) | (cfs

| GIVEN POND DAFA | STORAGE | (11) | (cfs) | (ac.1L) | | (cfs) | (ac.1L) | | (23,58 | 371.2 | 4.660 |

lime increment (t) = 0.050 hrs.

; ;	2	בייייייייייייייייייייייייייייייייייייי	•		!	ROUTIN	ROUTING COMPUTATIONS	ŅS	
-	TIME :	INFLOW:	••	11+12	/50	. 0 - 1/	- 5 4 7756		
٦¦	(hrs)	(cfs) :	•••	(cfs)		118)	· 🕃	(cfs)	: (ft)
<b>13</b>	. 000	B.00:	• •-		!	2.6			
9		5.40:	•-	ن. 4.	••			99.5	224.00
9	 80 !	10.00:		16.2	•-	21.6		9 5	224.61
9 :	S C	16.20:	••	27.6		40.6	48.6	9 6	74.077
s c		21.60		37.8		06.4	96.4	50.0	224 00
9 5	1007	27.00:	<b></b> ·	48.6	••.	6.5.1	135.03	9	10.021
:		10 to	•	39.4		194.4	194.4:	88.8	228 4B
		30.87	••	67.3		263.7	263.73	00.00	220.00
c	200	ייני מסייני		76		346.9	340.01	00.0	229.HA
ė		1,0.7	·• ·	7.10		421.6 :	421.6	0.00	1.0 AR
6	֓֞֜֜֜֜֝֓֜֜֝֓֓֓֓֓֓֜֜֜֜֜֓֓֓֓֓֓֜֜֜֜֓֓֓֓֓֡֓֜֜֜֡֓֡֓֡֓֡֓	37 70		0.00	••	500.4	500.4:	0.40	231.08
6	204			9 ·		500.4 :	603.4:	00.00	731. AB
2		ייייייייייייייייייייייייייייייייייייי			••	5,17.7 :	697.7:	6.66	
6	7007	2000		9::0		: : : : : : : : : : : : : : : : : : :	000.3	80.8	232.07
•	750	75. 07.				215.4		00.00	233.52
	200	7.00		130.		1053.7	1053.7:	8.00	274.25
		0.70		165.1	••	1218.8 ;	1210.03	20.00	. 00 210
. 5		10.5.57		6.161	••	1410.7	1410.7:	00.00	226.88
	2 2 2 2 2	100.011	·- ·	210.6	••	1629.5	1629.5;	0.00	2.74.97
; -	200			245.6	•-	1755.9		59.56	237.75
: -			<b>-</b> •	272.4		1802.8	2020.3:	112.76	238.16
-	1001	101.50		1.07.		1014.5	•	131.71	230.26
_	150	115.27		277.0		1012.2	2069.3;	128.02	238.26
_	200	189.19:	<b></b> .			1 BM6.7		118.99	238.20
_	250	.05.50	. <b>.</b> .	1.00.7		2000		108.70	1 238.12
<u>.</u> ;	380	78.02		201	- •	1775.8	1990.03	98.11	238.07
<u>:</u>	350	70.98	• • •	1 49 7		0.7071	1.7971	B7.54	238.00
_:	400	68.50		1.59.4		3,776		79.39	237.93
_;	150	.001.09		7 7			1717.4	73.16	237.87
-	500	63.70:	. <u>-</u> ,	2 2		7,00,7	1905.6	69.39	237.84
_:	550 :	61.38	·	125.6		0.007	1876.73	66.50	237.81
_	: 007			120.2		2.0071	1800.6	63.93	237.79
=	: 959	56.58:	•-	115.4			1961.6	61.47	237.77
_:	. 200	54.80:		110.5		7477	10.2701	24.04	237.75
<u>.</u>	750 :	51.45	••	105.5		1740 0	1000.4	26.60	237.73
_	: 000:	48.90:		100.4			:1.0031		237.71
_	: acg:	46.36		7.22		1200	27.0001	85.1C	237.68
_	- 006	45.64:		0.85			1842.3	49.04	237.64 :
	. 056	412		2			1054.3	16.51	237.64
	: 000	. SE. BU.	•••			0.17.	1976.6	93.56	237.62
ci	2.050 :	37.181		2 4 4 5		173.0	:0.0: :	41.46	237.60
.;	: GMI	175.75	· -			7.77	10.11.0	37.73	237.5B
ei.	. 150	23.94		0		1731	1804.1:	37.39	237.56
	300						1600.8	ō	237.55
			•						

- 1 - 1

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POND-2 Version: 5.17 S/N: EXECUTED: 05-31-1995 17:09:01

Pond Cile:
Inflow Hydrograph: NIVIA .HYD
Outflow Hydrograph: DIT

ROUTING COMPUTATIONS INFLOW HYDROGRAPH

1111111					1			
TIME :	INFLOW:		11-11	S.	1 1	ب	- ⊢	15
3	15.00		(01:1)	:	(618)	(c(a)	(c(s)	(ft)
2.250	30.65	•-	0.3.0		ű	1790.5	32.39	Ŋ
	29.00:		59.7			1785.41	30.74	'n
2.350			9.90		1721.3	1700.5:	29.62	237.49
٠	26.70		7		1710.4	1775.61		4
•	•	•-	: T		1/15.4	1774.9:	27.64	4
1.000					1712.9	1766.	26. 28	4
900.7	5		10.9		1710.3	1761.B:	25.78	4.
2.600	23.16:		47.2		1707.7	1757.5	24.89	
650	22.29		3.5		1705.1	1753.1:	24.00	m
2.700	21.70:	••	99		1702.0	1749.2:		
2.7.30	22.45	••	11.7		1701.0	1746.1:		1 237.37
	17.12.	••	3.5		1699.5	1743.5:	22.03	
2.850	20.801	••	41.9		1698.2	1741.4:	21.59	
2.980	20.50:	•-	41.3		1697.1	1739.5:	21.21	n
2.950			10.7		1696.1	1737.8	20.85	
3.000	٠		16.1		1695.1	1736.2:	20.52	
3.00.0	16.90:		76.0		1692.6 :	1731.9:	19.65	237.32
3.108	13.903	••	30.0		1687.6 ;	1723.4;	٥	
3.150	10.90:	••	H 4.		1681.1	1712.4:	15.65	
3,203 :	7.92:		18.8		1673.8 :	1699.9:		237.22
3.250	4.951	•-	12.9		1665.9	1686.6	10.36	237.17
3.300	1.90:1	••	6.9		1657.8	1672.8		237.12
3.350	9.00:	••	2.6		1650.0	1659.7;		237.00
3,400	0.60:	••	0		1644.3 :	1650.0:	2.86	237.05
3.450	. 69.				1640.9:	1644.3;	1.69	237.03
3.508	:89.0	••	0.0		1639.8	1640.9:	1.80	237.02
3.559 :	. 00. 0	••	9		1637.11	1639.0	0.59	237.01
3.600	. cc:	••	9.9		1637.1	1637.8	0.35	237.01
3.650	. 00°.	••	0.0		1636.7	1637.13	•	237.00
3,700	0.00	••	0.0		1636.4	1636.7:		237.00
5.758	9.00:	••	9		1636.3	1636.4	6.07	237.00
3.800	200.5		0		1636.2 ;	1636.33	69.09	237.00
3.656		••	S		1636.2	1636.23	0.02	237.00
3.700	6.80	•-	5 5		1636.1	1636.23	8.01	237.00
3.436	00.0	•	9 9		1636.1	1636.13	0.01	237.00
9.000	90.0	••	ຄ ອ		1636.1	1636.13	0.01	237.00
4.050		••	9.0		1636.1	1636.13	0.00	237.00
	:00.0	••	S :		1636.1	1636.1	8.0	237.00
4.150			3		1636.1	1636.13	0.00	237.00
4 - 206	0.00	••	0.0		1636.1	1636.11	00.00	237.00
4.256	. 60.0	••	8		1636.1	1636.13	0.00	237.00
4.500	0.00		9.9		1636.1	1636.11	0.00	237.00
4.350	0.00:	••	a.c		1636.1	1636.13	0.80	237.00
4.400	•	••	9 9	••	1636.1	1636.13	9.66	237.00
456		••	9. 9.		1636.1	1636.13	00.0	237.00
		••	9		1636.1	1636.1:		

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POND-2 V	CXECUTED

Page 4

Pond File: NHVAH .HYD Outflow Hydrograph: NHVIA .HYD Outflow Hydrograph: OUT .HYD

10.36   10.3	25.	(5) (2)		 3	INFLOW	; (c(s)
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		•	3.8	3.8	3.80 : : 60.6	
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		_	Ŋ.	: ::	••	••
			8.6	 S	0.60: : :00.6	••

Starting Pond W.S. Elevation = 224.00 ft

#### Summary of Peak Outflow and Peak Clevation ##### Peak Inflow = 140.70 efs Peak Outflow = 131.71 efs Peak Elevation = 230.30 ft

Initial Storage # 0.00 ac-ft
Peak Storage From Storm :: 0.00 ac-ft
Total Storage in Pond < 4.02 ac-ft

EXECUTED: 45-31-1995 17:49:51 0 15 30 45 60 75 90 105 120 135 150 165 Page 7 Omax = 142.9 cfs Omax = 131.7 cfs Pond File: Inflow Hydrograph: NIVIA .HYD Outflow Hydrograph: OUT .HYD 142.70 cfs 131.71 cfs 238.20 ft POND-2 Version: 5.17 S/N: Peak Inflow = Peak Gutflow = Peak Elevation = \* File: NHVIA .HVD x File: OUT .HYD TIME (hrs) 1.05 -1.35 -1.6 - -1.15 -5.7 1.25 -- :: - :: 77 - 4.1 1.45 -.95

PGND-2 Version: 5.17 5/N:

NAPILLINDU VILLAGES - PUNSC I OFFSITE DETENTION BASIN AIA PRE-DEVELOPPENT

CALCULATED 06-81-1995 11:18:17 DISK FILE: NHVATAPR.VOL

Pianimeter scale: 1 inch = 208.7103 ft.

Volume Volume Sum (acre-ft) (acre-ft)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0
	0.00 0.24 0.41 0.58 0.72
01+A2+sar(A1+A2) (acres)	0.00 0.16 0.16 0.25 0.25 0.61 0.35 0.07
Area (arres)	0.00 0.16 0.25 0.25 0.39
Planimete (ca.in.)	0.08 8.16 0.25 0.33 0.33
Elevation (ft)	190.00 190.00 192.00 194.00

s Incremental volume computed by the Conic Method for Neservoir Volumes. Volume = (1/3) + (EL2-LLI) + (Area) + Area2 + 59.rt.(Area19Area2))

where: ELI, tL2 = Lower and upper elevations of the increment Areal, Area2 = Area5 computed for ELI, EL2, respectively Volume = incremental volume between ELI and EL2

\*

S/N: Time Executed:

Dutlet Structure File: MIVAINAR.STR

POND-2 Version: 5.17 Date Executed:

\*\*\*\* CUMPOSITE DUTFLOW SUPERRY \*\*\*

	ting Structures																	
	Cantributing				•		-	-4 •	_			<b></b> .	<b>-</b> - •	<b>-</b> - •			-	
•	(cfs)	9. 9	9. 9	8. 8	5.5	9. 9.	a. o.	27.4	4.66	76.0	102.1	136.0	170.5	206.1	1443.13	201.7	F. 125	ອ.ອ
	Elevation (ft)		148.50	00.481	189,50	190.00	198.50	191.60	191.50	192,00	142,58	193.00	193.50	194.00	94.50	195.00	195.50	196.00

Dutlet Structure Cile: MIVAIAPR.SIR

S/N: Time Executed: POND-2 Version: 5.17 Date Executed:

NAPILINA VILLAGES - PHASE I OFFUITE DETENTION BASIN AIA PHE-NEVELOPHENT

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Outlet Structure File: NHVALANESTH Planimeter Input File: NHVALAHER.VOL Rating Table Output File: NHVALAPR.PND

Min. Elev.((t) = 180 Max. Elev.((t) = 196 Incr.((t) = .5

Assessantistatessantassantatessantas

O Table O Table No. -Structure Outflow rating table summary was stored in file: NHVAIAPR.PND

Cullet Structure File: NHVAIAPR.STR

POND-2 Version: 5.17 Date Executed:

S/N: Time Executed:

933333 Structure No. 1 PRESEST (Input Data) \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

WEIR-VH Weir - Vertical Rectangular

E1 clev.(ft)? 190
E2 clev.(ft)? 2.8
Weir coefficient? 2.8
Weir elev.(ft)? 190
Length (ft)? 190
ConLructed/Supuressed (6/5)? C

U

4.1

4 - 4

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Outlet Structure File: MHVAIAPR.STR

PUND-2 Version: 5.17 Date Executed:

S/N: Time Frecuted:

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Outflow Rating Table for Structure #1 WEIR-VR Woir - Vertical Rectangular \*\*\*\* INLET CONTROL ASSUMED \*\*\*\*

Computation Messages	E < 1nv.El. 2 190	_	-	. El.a	H =6.0	5. a =	H -1.6	S:1= H	H -2.0	E : C = H	5.0° = 1	3.5	11 24.0	H =4.5	H =5.0	H =5.5	E = or ' E2=176
	9.0	g. 8	8. 8	9. 9.	3. S	9.0	27.4	49.9	26.0	185.1	136.0	170.5	206.1	244.2	201.7	321.4	0.0
Elevation (11)	160.00	100,58	187.88	107.50	190.00	190.50	191.00	191.50	192.08	192.50	193.00	173.50	174.00	174.50	195.00	195.50	146.00

C = 2.0 L ((1) = 10 H (+t) = Table elev. - Invert elev. ( 190 ft ) O (c(s) = C + (L-.2||) + (H++||.5) -- Contracted Welr

POND-2 Version: 5.17 5/N: EXECUTED: 05-31-1795 17:15:47

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Inflow Hydrograph: MIV2A .HYD fating Table file: NHVAIMPR.PND

Elevation = 188.00 ft

American a made cla exacted a made active

| COMPUTATIONS | COMPUTATIONS | COMPUTATIONS | CCF5 | CCF5

lime increment (t) = 0.050 hrs.

**n**- > f

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POND-2 Version: 5.17 S/N: EXECUTED: 05-31-1995 17:15:47

Pond File: NHVALAPR.PND Inflow Hydrograph: NHVZA .HYD Outflow Hydrograph: OUT .HYD

VFLOW HY	INFLOW HYDROGRAPH			ROUTING	ROUTING COMPUTATIONS	ŝ			
TIME	INFLOW :	•	11+12		ٔ بد	OUTFLOW	ELE.	EVAT ION:	
(hrs)	(cfs)		(cfs)	(c(s)	(c(s)	(cfs)		45)	
2.250	32.39	• ••	56.4	103.1	251.7:	34.32		91.15	
•	: 30.74;	••	63.1	180.9	246.2:	32.65		91.12	
	29.62	•••	60.4	179.6	241.3	31.15		71.08	
	19.02				17.75	27.72		78	
5.456 5.456 5.456	27.64		יייי מני	. 7.6/1	3 t.	27.83		91.01	
				77.77	227.11	26.91		06 00	
2.400	24.89	•	50.7		222.91	26.04		90.06	
2.650	24.00		48.7	170.4	220.7:	25.16	••	190.94	
2,700	23.19	••	47.2	169.0	217.61	24.30		16.061	
	: 22.55:	••	45.7	167.7	214.73	23.51		190.87	
2.608	: 22.03	• <b>-</b>	44.6	166.6	212.33	22.84		78.061	
	21.59	••	43.5	165.7 :		L1 ·		190.05	
2.900	12.12		0.2	164.9	208.5	21.79		176.84	
2.950	20.95	••		164.2	207.03	21.37		20.07	
3.000	20.52	••	41.4	163.6	202.6	76.97		78.87	
3.050			40.1	162.8	203.83	79.07		20.00	
3.100	17.91	••	37.6	161.3	200.4	24.55		170.78	
3.150	15.65		33.6	150.8	194.8	18.02		27.07.	
300	13.09	•••	29.7	מילטן	10.00	10.61		100.00	
2.2	25.50	• •		. 0.101	071	200		190.54	
3	1 T	· ·	12.4	142.7		8.81		190.45	
200	2.68		7.7	136.1	149.9	6.90	••	190.35	•-
456	69.1	•	4.6	138.4	140.6	5.12	••	190.26	••
3.500	1.00		2.7	125.7	133.1	3.67		190.19	••
3.550	: 0.59		9-1	: 5.221	127.3	2.57	••	190.13	
3.600	: Ø.35:	••	6.9	119.6	123.1	1.76		190.09	•••
3.650	: 0.20	••	9.0 	117.8	120.1	1.19		90.06	
3.700	9 		9 t	L	1.0	9 6		1000	
3.750			y -	0.5	ייי	14		196.62	•
2000				7.41.	115.1	0.22	<b></b>	190.001	
200			5	114.4	114.7	6.14		190.01	••
2 C			9.0		114.4	60.00	••	190.00	
4.599			0.0	114.1	114.3			190.00	
4.050		==	0.0	: 114.1	114.1	. 0.04	••	190.00	
4.100		···	9.0 9.0	114.0	114.1			190.00	
•		::	a.e	114.0	114.0	9		190.00	
•	60.00	=	e.e	9.5.1	114.0	<b>.</b> .		30.061	
4.250	9	::	5.0	114.0	114.0	S	••	190.03	
4 7.00		:	0.0		٠		:	190.08	
•	 	=	0.0	0.11				90.00	
4.400			9 (	5 C	5 t i i			90.00	
4.458	 		9 :			55.5			
4.500		5	9	113.4		5	•	• 1	
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FOND-2 Version: 5.17 5/N:
EXECUTED: 05-51-1995 17:11:47
Pond File: NIVALAPR.PND
Inflow Hydrograph: NHV2n .HVD
Outflow Hydrograph: DUI .HVD

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	í		<u> </u>		• • •	·	·	-	-		-	-	-	•	•				••	••											•	
NS.	CUTFLOW	(c/s)	00.00	0.00	0.00	09.0	00.00	8.68	89.8	00.00	6.00	00.00	0.00	0.00	8.00	00.00	00.00	00.00	00.00	00.00					0.00	0.00	00.00	0.00	00.00	00.00	00.00	0.00
ROUTING COMPUTATIONS	25/1 1 0 :	(cfs)	113.9	113.9	113.9	113.9	6.51	113.9	113.9:	113.9	113.9	113.9:	113.9	113.9	113.9	113.9	113.9	113.93	113.9;	113.93	113.9	113.9	113,9	113.9	113.9	113.93	113.9	113.9;	113.9;	113.9;	113.9;	113.9
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ROUT	25/t - 0	(cfs)	113.9	113.9	113.9	117.9	113.7	113.9	113.9	113.9	113.4	113.9	113.9	113.9	113.7	113.7	113.9	113.9	113.9	113.9	113.9	113.9	113.9	113.9	113.9	113.9	113.9	113.9	113.9	113.9	113.9	113.9
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	11+12	(c fs)	0.0	0.0	9.6	8.8	8.8	0.0	9.0	ຄ.ຍ	ତ.ଓ	8.6	B.8	0.0	8.8	0.0	0.0	0.0	0.0	0.0	9.G	0.0	9 9	0.0	9. 9	0.0	6.5	0.0	0.0	0.0	ଓ.ପ	0.0
'		'	• ••	••	••	••			••	••	••	••	••	••	••	••	•			••	••	••	••	••	••	••	••	••	••	••	••	••
INFLOW HYDROGRAPH	INFLOW:	(cfs)	0.00:	0.00:	0.00:	:00.0	0.00:	: MN :	0.08:	0.00:	. 00 · 0	0.60:	0.00:	9.00:	0.00:	B.00:	0.00:	0.08:	0.08:	0.00:	0.00:	0.00:	0.00:	0.60:	G.0G:	0.00:	9.00:	0.66	0.00	0.00:	G-00:	0.68:
4	••	:		•	••	••	••	••	••	•-			••	••		••	••	••			••	••		••	••	••	••		••	••	••	••
NFLOW 1	TIME	(hrs)	4.558	4.605	4.650	4.700	4.750	4.000	4.850	4.900	4.950	5.000	5.050	5.166	3.150	5.200	5.258	5.380	5.350	5.490	5.450	5. KSG	0.00	2.600	5.650	5.700	5.750	5.800	5.059	5.700	5.950	6.800
- 1	• •	'.	• • •	••	••	٠.	••	••	••	••	••		••	••	· •		••	••									••	••			••	••

POND-2 Version: 5.17 S/N: EXECUTED: 05-31-1995 17:15:47

Page 4

Bage 5

Pond File:
Inflow Hydrograph: NHV2A .HYD
Outilow Hydrograph: OUT .HYD

Startung Pend W.S. Flevalion a 188.00 It

44444 Summary of Peak Outflow and Peak Elevation 41444

Peak Inflow = 151.71 cfs
Poak Outflow = 120.09 cfs
Peak Elevation = 172.74 ft

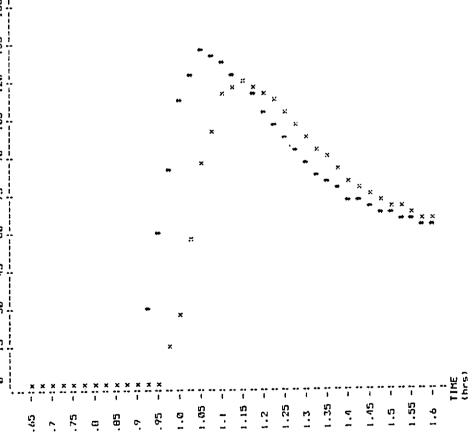
\*\*\*\*\* Summary of Approximate Peak Storage \*\*\*\*\*

Josthal Storage - 0.00 ac-ft Peak Storage From Storm = 0.84 ac-ft Total Storage in Pond = 0.84 ac-ft

POND-7 Version: 5.17 S/N:

Pond File: NHVOAND Inflow Hydrograph: NHV2A .HVD Outflow Hydrograph: OUT .HYD

Peak Inflow = 131.71 cfs Peak Outflow = 120.89 cfs Peak Elevation = 192.74 ft

CXECUTED: 05-31-1995 17:15:47 

POND-2 Version: 5.17 57N:

Page 6

#### NAPIL HIAU VILLAGES PRUJECTS DRAINAGE DASIN A-1-3 POST DEVELOPMENT

CALCULATED 06-01-1995 11:57:53 DISK FILE: NHV14 .VOL Planimeter scale: 1 inch = 208.7103 ft.

109.00         0.00         0.00         0.00         0.00           190.00         0.22         0.24         0.24         0.00         0.00           190.00         0.56         0.56         0.56         1.14         0.76         0.03           194.00         0.69         0.69         0.69         0.00         0.00         0.00           194.00         0.96         0.96         0.96         2.66         1.77         5.37           200.00         1.09         1.09         2.66         1.77         5.37           200.00         1.19         1.14         3.50         2.20         9.58           204.00         1.14         1.14         3.50         2.20         9.58           204.00         1.33         1.33         3.65         11.36         11.36           206.00         1.43         1.43         4.14         2.76         17.28           210.00         1.54         1.54         4.14         2.77         20.25	Elevation (11)	Planimeter (sq.in.)	Area (acres)	AL+A2+sur (AL+A2) (Acres)	Valume (acre-ft)	Volume Sum (acre-ft)
0.22	109.00	90.9	0.00	0.00	03.0	8.88
0.56 0.56 1.14 0.76 0.76 0.69 0.69 0.69 1.00 1.25 0.82 0.82 0.82 0.82 0.82 0.82 0.82 0.82	190.00	0.22	0.22	0.24	W.00	0.08
0.69 0.62 1.00 1.25 0.02 0.02 0.02 0.02 0.02 0.02 0.05 1.05 1.05 1.05 1.05 1.05 1.05 1.05	192.00	0.56	ø.56	1.14	0.76	0.34
0.462 0.402 2.26 1.51 0.76 0.76 2.66 1.77 1.05 1.05 5.46 2.20 1.14 1.14 3.30 2.20 1.24 3.57 2.38 1.37 1.33 3.48 2.57 1.45 1.45 4.14 2.76	194.00	69.0	9.59	1.00	1.35	2.03
0.76 0.76 2.66 1.77 1.05 1.05 5.02 2.20 1.14 1.14 5.30 2.20 1.24 5.30 2.38 1.33 1.33 3.85 2.37 1.45 1.43 4.14 2.76	196.00	0.82	0.112	2.26	1.51	3.60
1.05 1.05 5.02 2.01 1.14 1.14 5.30 2.20 1.24 5.57 2.38 1.33 1.33 3.85 2.57 1.45 1.45 4.14 2.76	198.60	0.76	9.36	2.66	1.77	5.37
1.14 1.14 3.30 2.20 1.24 1.24 3.57 2.36 1.33 1.33 4.14 2.57 1.45 1.53 4.14 2.76	200.00	1.05	1.85	3.02	2.01	7.39
1.24 1.24 5.57 2.38 1.33 1.33 3.85 2.57 1.45 1.43 4.14 2.76 1.54 1.54 4.45 2.97	202.00	-:-	1.14	55.55	2.20	9.58
1.33 1.33 3.85 2.57 1.45 1.43 4.14 2.76 1.54 1.54 4.45 2.97	204.00	1.24	1.24	5.57	2.38	11.36
1.45 1.93 4.14 2.76 1.54 1.54 4.45 2.97	206.00	1.33	1.33	3.85	2.57	14.53
1.54 1.54 4.45 2.77	200.00	1.43	1.43	4.14	2.76	17.28
	210.00	1.54	1.54	4.45	2.77	20.25

Incremental volume computed by the Conse Method for Neservoir Volumes.
Volume = (1/3) \* (EL2-EL1) \* (Areal + Area2 + sq.rt.(Area1\*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment Areal, Areas computed for EL1, EL2, respectively Volume = Incremental volume between EL1 and EL2

المشيخ \*---4 . 4

131.7 cfs 170.1 cfs

Omax =

UYI. UYII.

File: NHV2A File: OUT

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≅is: Outlet Structure File: NHV14 :/N: [ime txecuted: POND-2 Version: 1.17 Date Executed:

## \*\*\*\* COMPOSITE OUTFLOW SUMMARY \*\*\*\*

Elevation (ft)	0 (cfs)	Contributing Structures
187.00	8.8	1
189.50	B.8	-
190.00	S. 53	-
190.50	8.8	-
191.00	8 8	-
191.50	ડ સ	_
192,00	5.1	-
172.50	6.2	-
193.00	7.3	
193.50	B.1	-
174.80	8.9	-
174.50	4.6	1
195.00	10.3	-
195.50	10.0	-
196.00	 	-
196.50	9.11	
197.00	6.11	-
197.50	1::1	***
198.00	F::1	-
198.50	12.6	
199.00	12.0	-
199.50	•	-
200.00	•	-
200.58	•	-
	٠	
201.58	13.9	
202.68	14.0	_
202.50	14.2	_
203.00	14.4	
203.50	14.6	<b>—</b>
204.00	14.8	
204.58	•	-
205.00	9	

≅IS: Outlet Structure Lile: NHVIA PUND ? Version: 5.17 Date Executed:

SZN: Tímy Executed:

Outlet Structure Cile: NAVIA Planimeter Input File: NAVI4 Rating Table Output File: NIVI4

Min. Elev.(ft) = 189 Max. Elev.(ft) = 205 Incr.(ft) = .5 Additional elevations (ft) to be included in table:

No. O Table O Table Structure TABLE Butilow rating table summary was stored in file: NHV14 .PMD

Batlet Structure File: NIVIA .SER

POND-2 Version: 5.17 Date Executed:

S/N: Time Executed:

MAPILIMO VILLAGES - PHASE I
BASIN A-1-a
100 YEAR STORM UNIVERSAL RATIONAL HYDROGRAPH)
POST DEVELOPMENT

22, 122 Structure No. 1 100100 Chiput Data)

Input your OWN rating table.

Constant (1t) added to each elevation was: 8

(c15) (l	52	5	5.1	7.3	0.9	1M.3	11.3	11.7	12.4	12.8	5.5	13.7	14	14.4	14.13	15.1
Elev. (ft)	189	191	192	193	194	193	196	197	190	199	200	201	202	202	2004	202

.S1R Outlet Structure fale: Nalvia

POND-2 Version: 5.17 Date Executed:

S/N: Time Executed:

ing fable for S	VOLUM DA
Out.ftow Rat	

Interpolated from input Interpolated from Interpolated	Elevation (ft) 109.00 109.50	0 (cfs)	Computation M	Messages from input	table
Interpolated from input		9.5: 9.5:			able
Interpolated from input		2 (1 () 2 () -			alıle.
Interpolated from input Interpolated from input		6.2			al de
Interpolated from input		u.1 u.9			alıle
Interpolated from input		7.6 10.3			able
Interpolated from input		10.B			able
Interpolated from input Interpolated from input		11.6			aple
Interpolated from input		 			alıle
interpolated from input Interpolated from input Interpolated from input Interpolated from input Interpolated from input E = nr > L2=205		12.6			able
Interpolated from input Interpolated from input Interpolated from input Interpolated from input E = nr > L2=205		13.0			aple
Interpolated from input Interpolated from input Interpolated from input E = nr > L2=205		13.4			able
Interpolated from input Interpolated from input E = nr > L2=205		13.9			aple
Interpolated from input Interpolated from input E = nr > L2=205		4.2			able
Interpolated from input E = nr > 12=205		14.6 14.0			alde
		14.9 0.0	nterpolated = nr > L2=2	Ë	able

F. . 1 **5** 4 } }\* }

POND-2 Version: 5.17 S/N: EXECUTED: 06-01-1995 11:49:05

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\* NOPILLHIOU VILLOGES - PHOSE I \*
DITSITE DETENTION BOSIN A-1-a \* \*

Inflow Hydrograph: MHVZA .HYD Rating Table file: NHV14 .PND

---- INITIAL CONDITIONS-----Elevation # 187.00 (t Outflow - 0.00 cfs Storage \* 0.00 ac-ft

GIVEN PONID DATA

INTERMEDIATE ROUTING COMPUTATIONS

'	1 1 1 1	GIVEN POND DATA	5 ¦	40	ļ	СОМРОТ	COMPUTAT LONS	;	
ų.	ELEVATION:	OUTFL		STURAGE:	••	25/t	25/t	5	••
!	(44)	(6/8)	:	(ac-ft) :	•	(cfs)	) o)	3	
	189.88	เก.	• ••	6.000:	<u>.</u>		1	5	
••	107.50	9.8	••	9.012:				, c	
	170.00	: 0.th	••	0.079:		29.2		30.2	
••	•	6	••					1001	
	•		••	•		180.2		180.2	
	171.50	ν 	••	9.581:		201.1		203.6	
	192.00	5.1		0.837;		435.6		410.1	
	192.50	. 6.2		1.126:		6.050		271.55	
	193.00	::	•-	1.431:		692.7		700.0	
	192.50	9.1		1.753:		848.2		856. T	
	194.00	8.9	••	2.091:	••	1011.0	-	620.7	
	194.50	9.6	•-	2.445;		1103.2		19.5 B	
••	195.00	E'01 :		2.814:	••	1361.9	-		
••	195.50	10.0		3.199;	-:	•	-	- 655	
••	196.00	11.3		3.600:		1742.3	-	75.7. 4	
••	176.58	11.6		4.017:		1944.4	-	1954.0	
	197.96	11.9	••	4.452;	••	2154.7	. (4	2166.6	
••	197.58	<u>:</u>	••	4.984;	••	2373.5	i C4	2385.6	
	198.00	12.4	••	5.374;		2601.0		2613.4	
	198.58	3.C	••	5.059;	••	2035.7	. C1	2848.3	
••	199.00	:: ::		6.356:		3076.1	<b>+</b> )	3000.9	
•••	199.50	3.5		4.864:	••	3322.3	17	3235.3	
	200.000	13.2		•	••	3574.4	ю	3587.6	
	•	13.4	••	•	••	3032.2	m	36145.5	
	•	٠		•	••	4075.3	4	107.6	
	201.50	6 · ·		9.016:		4363.9 :	~	4377.8	
	201.100	14.B		7.503:	••	4630.0	₹	Г	
•••	2050	14.2	•-	10.160	••	4917.6	4	4731.0	
		7.7		10.749:		5202.7	ເດ	717.1	
	•	14.6				5493.3	ß	5507.9	
	264.88	: 14.0		11.967		3789.6	ห	5804.4	
ı			1				121111		

EXECUTED 06-01-1995 11:49:05 DISK FILES: NHV2A .HYD: NHV14

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Page 2

GIVEN POND DATA

25/t : 25/t + 0 (cfs) (cfs) (cfs) (cfs) (cfs) INTERMEDIATE ROUFING COMPUTATIONS 

Time increment (t) = 0.050 hrs.

:

POND-2 Version: 5.17 5/N: EXECUTED: 06-01-1995 11:47:05

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Pond File:	Inflow Hydrograph:	Outflow Hydrograph: (

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:	-
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•	Z

ELEVATION:	189.00	187.08	189.80	107.00	199.00	189.00	189.00	189.00	189.00	189.90	189.68	189.08	189.00	167.00	189.00	109.001	190.17		197.07	193.00		195.39	195.77	196.10	196.98	196.92	197.16	197.38	197.58	197.77	1981	198.26	198.40	198.53	190.45	28.72	
i :		 63 i	 9 6					 Ø		 9 6		 5	 S	 S 6		 :s		 ne	 : –					 9			 	 ភេៈ	 			51	 -5		 •9 (		
OUTFLOW (c.fs.)	80.0	8.90	9 6	0.0	00.00	0.00	00.0	0.00	8.6	9 5	0.00	6 60	20.0 0	9 6	0.0	00.00	0.03	- a	7.41	n. 5រា	7.47	10.69	11.07	92.11	5.11	11.93	11.94	12.05	12.15	01.0	12.4	r.		12.6	9.51	12.70	
25/t + 0 : (cfs) :	0.8	8.6		S	8 8	0.0	0.0	8	5 6		8.03	6.9	8	2 5	6	8.8	59.61	7.1.2	722.4	954.6:	1163.1	13.8.1	1663.7	1794.1:	7076	2133.8	2235.53	2332.0	2473.6	10 10 10 10 10 10 10 10 10 10 10 10 10 1	2667.0	2737.7	2803.23	2863.5	1919.01	7017.9	
25/t = 0 : (cfs)	0.0	 6.6		5.5	9.6	. อ.อ	 8.8	 6:0	 56	 	0.9	 5.	 5.0	 S C		0.0	59.6	14.2 2	707.6	937.4	- 1 - 5 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	1.196.0	1641.5 :	1771.4	2003.1	2110.1	: 5.11.5	1307.9	2400	2403.3	2642.1	2712.7	2778.1	2030.3	2893.6 :	2992.5	
	. <b></b> .				••	••					••			• •					• ••				••	•		•-	••		• •		••		••				-
11+12	1 1	5 6 5 6	: s	8.6	B.B	6.0	8.0	6.0	S 5	: S : S	a.o	S :	e s	3 5	8.8	9.0	59.6	744.5	259.7	247.0	708.0	195.7	166.4	522.5	135.9	130.4	125.4	2.05.	6 6	1623.7	100.6	95.6	90.5	05.4	2,4,2	2.5	
!				••	••	••	••			• ••	••	••	•••			••							••	•		••	•••					•-	•••		•• ••		•
INFLOM:	8.00.0	20.00	9.99	61.00:	0.00:	0.00:	8.00:	::::::::::::::::::::::::::::::::::::::	99.6	0.99	0.00:	. 88.0	::::::::::::::::::::::::::::::::::::::	0.00:	R. AB:	0.00:	59.56	131.75	120.02:	110.99:	90.11:	17.54:	79.59:	75.16:	66.58	63.93:	61.47:	14.69		51.38	49.04:	46.51;	43.90:	41.46	29.23	35.69	
:	• • •				••	••	••	•	• •	• ••				• ••	••	••								•• ••	• ••		•••			• ••	••	••	•••			• ••	-
TIME (hrs)	0.000	9.00	9.156	0.200	•	•	•	20.40C	•	N. 550	0.600	0.650	750		0.850	004.0	9.458	.050	1.180	1.159	1250	1.300	1.350	2007	1.580	1.550	1.600	7.00.	7.7		1.850	1.900	1.928	2000.7	2.020	2.150	
' - :																																					

# PAND-2 Version: 5.17 S/N: EXECUTED: 06-01-1995 11:17:05

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Pond File: NIV14 , PND Inflow Hydrograph: NHV2A , HYD Outflow Hydrograph: OUT , HYD

INFLOW HYDROGRAPH	

ROUTING COMPUTATIONS

••	TIME	INFLOW :	٠	11+12 :	25/t - 0 :	28/1 + 0 :	DITELON	FI FVATION:
i	(hrs)	(c(s)		(cfs) :	c (s)	3	(cfs)	: (45) :
		32.39		6.00	677		12.81	- 120 COT
••	2.300 :	30.74:	••		2114.9	3140.6		199.16
•••	2.350	29.62	••	60.4	119	3175.2	12.87	199.181
	٩, ١	•	••		3181.9	3207.7	ō.	199.24
	200				2.5	3230.23	6.	199.30
		.0. /W.		 	2.48.6	-		199.36
	2.699		- •		, נ ט ט ט ט ט ט ט ט			179.41
		24.08	• •	- C HE	1 <	9 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	7.00	
		73.17	•••	17.5	7222		٠	147.21
••		22.55	••	45.7	5.55	7 5		65 661
••		22.031	••	14.6	74	400	13.63	19.661
	2.850	21.59:	••	43.6	391			199,46
	٠	21.21	••	47.8	400		13.08	199.70
	•	20.05:	••	42.1	3424.2		13.09	199.73
	•	70.52:	••	41.4:	3439.4	3465.63	13.18	: 199.76 ;
	•	19.65:		46.2	2453.2	3479.6	Ξ.	: 199.79 :
	•	17.91:		37.6	3464.6	-	-	199.81
	٠	15.75	••	4.55	3471.9	3498.23	Ξ.	199.02:
	٠	12-02	••	20.7	3474.4	3500.7	٦.	: 199.63 :
	202.5	10.36	•••	in d	3471.6	3497.9	13.13	199.87
	•				2.0000	5407.5	۳.	199.81
		7.86	• •	7.7	10.00	3475.6	13.11	199.78
		: 67.1			1,000		2 2	
•••		.68.			1300	1417 9	•	17.7.661
••	3.550	:,0.5	••	1.6	3361.4	1 1	7	199.40
••	•	•	••	0.0	3326.3	Ŋ		199.55
••	3.650	۲.	••	9.4	3310.F	3336.9	3	: 199.50
	•	S. 17		10 10	3205.2	3311.21		: 199.45 ;
	3.758	0.07	••	 c:	259	3285.4	•	: 199.40
	3. BMD	e i	••	 G:	23.	3257.6:	Ċ	: 199.35 :
	2000	: : : : : : : : : : : : : : : : : : :	•	c	5207.9	3233 8		199.29
• ••			• -	 	7.7810	:0.0075	200	199.24
••	4.000			0.0		100	20.41	
	4.050	9.08:	••		0105.1	5130.8		199,08
	4.100 :	•	••	8.8	3079.5	21.85.1	ς	199.03
	4.150	•	••	: a.e	5055.9	3079.5		198.96
	4.200	•	••	9.0	Z028.3	7253.9	۲.	: 198.93:
	4.250		••	 6 5	3002.8	3020.33	7	: 198.07 :
	n, 1	8.00	••	 5 5	1977.4	٦.	12.73	: 198.82 :
	2000	3.55.5	• •	 8.5 5.5	2952.0	2977.4:	7.55	
•••	4.450	8.88:	••	6	2000	1000	•	7.07.
	4.5000	8.89.	• ••	5	207.4	2901	24.0	99.961
				!			٠	10.87.

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5 = 3	Pond File: Inflow Hyd Dalflow Hy	; 44 144 144	Pond File: Inflow Hydrograph: Unlflow Hydrupraph:	NIV 14 NIV 2A OUT	14 . PND 26 . HYD 11YD	366						
=	VFLOW E	Ϋ́	INFLOW HYDROGRAPH				HOUTING	HOUTING COMPUTATIONS	ŝ			
١	TIME		INFLOW	i 	11+12		25/1 - 0 :	25/t + 0 :	OUTFLOW	E	FI FVAT 10N:	. 3
	(hrs)		(615)	•••	(c(s)	<b></b> .	(5/2)	(c(s)	(c/s)		(11)	
	4.550	! 		i	9.0	ļ	2050.7	2877. 8	67.61	<u>.</u>	198 87.	·- ·
	4.400	••	9.00:	••	8.0		2025.5	2850.7:	12.60		196.51	• ••
••	4.650	••	9.00:	••	0.0	••	2800.4 :	2825.5	12.58		198,45	•••
	4.700	••	ଓ.୯୬:		0.0	••	2775.2 :	2800.4:	12.56		198.48	••
	4.750	••	8.00:		S. S	••	2758.7	2775.21	12.54		198.34	••
	000.	••	0.00:		0.0		2725.1	2750.21	12.52		198.29	••
	4.650	••	0.00:		8.8	••	2700.2	2725.11	12.50		190.24	••
	4.900	••	5.00:	••	8.8	••	2675.2	2700.2	12.47	••	198.18	••
	4.958	••	0.00:		9.9	••	2650.3 :	2675.23	12.45		198.13	
••	5.000	••	6.00:	•-	8.8		2625.4	2650.3	12.43		198.08	•••
	5.050	••	0.00:		8.8		2600.6:	2625.4	12.41		198.03	••
	5.188	•-	0.08;	••	8.8	••	2575.8	2600.6	12.38	••	197.97	
	5.150	••	00.0		9.9	••	2551.1	25/2.8	12.35		147.42	
	5.200	••	0.00:		9.9		25,26.5	2551.11	12.32		197.86	••
	5.250	••	6.69:		8.8	••	2501.9	2526.5	12.29	••	197.81	••
	25.0	•	.00.0		2.0	••	1, 42 5 547	. F. 105.7	27.25		147.76	٠.
٠.	5,358	••	0.00:		6.8	••	2455.0 :	2477.4	12.22	••	197.78	_
	5.490	<b></b>	0.00:	••	B.B		2420.6 :	2453.83	12.19		197.65	
••	5.450	••	6.00:	••	ອ.ຕ		2404.3 :	2420.63	-	••	197.59	_
••	5.500		00.00	•-	9.0	••	2380.1	2404.3	12.12	••	197.54	_
••	5.550	••	00.00:	••	6.6		2355.9	2380.1	12.09	••	197.49	
	5.600	••	0.00:		0.0		2331.7	2355.9	12.07	••	197.43	
••	5.650	••	00.00	••	0.0	••	2307.6	2331.7	12.05	•••	197.38	_
•-	5.700	••	0.00:	••	Ø.6		2283.6	2307.6	-		197.32	
	5.750	••	0.00:	••	0.0		2259.5	2283.6	12.01	••	197.27	
	5.000		9.86		0.0		2235.6 :	2259.51	11.98		197.21	
•-	5.050	••	0.06:		9.6		2211.6 :	2235.6	_	••	197.16	
••	5,700	<u></u>	00.0	••	0.0	••	2107.0 :	2211.6	-	••	197.10	_
••	5.958	••	0.60	••	0.0		2163.9	2107.03	_	••	197.05	_
•		•		•	:	٠						

POND-2 Version: 5.17 S/N: EXECUTED: 06-01-1995 11:49:05

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\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* SUMMARY OF ROUTING COMPUTATIONS \*\*\*\*\*\*\*\*\*\*\*\*\*

Pond File:
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 #####

0.00 ac-ft 7.21 ac-ft 7.21 ac-ft Initial Storage Peak Storage From Storm =

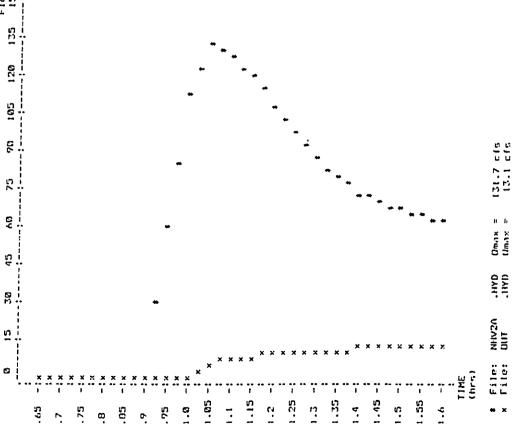
Total Storago in Pond

POND-2 Version: 5.17 S/N:

Pond File: Inflow Hydrograph: NHV2A Dutflow Hydrograph: flUT

131,71 cfs 13.13 cfs 197,03 ft Peak Inflow = Peak Outflow = Peak Elevation =

EXECUTED: 06-01-1995 11:49:05



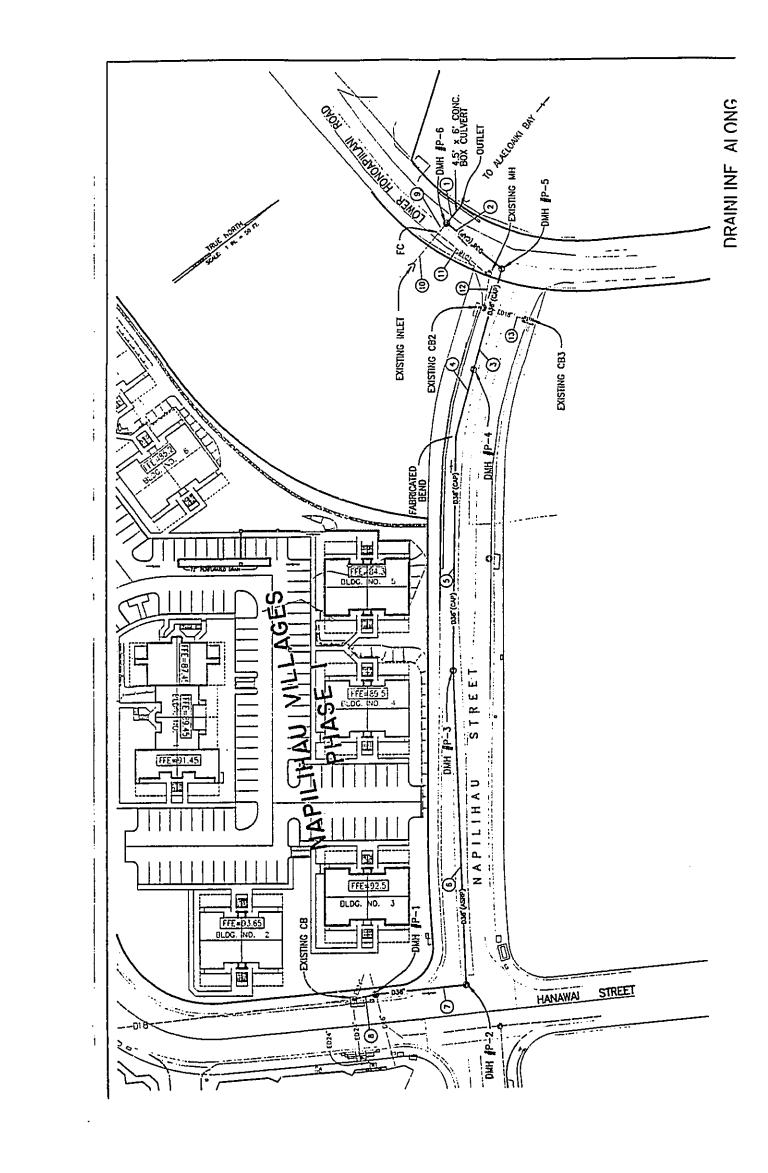
Omax = 131.7 cfs Umax = 13.1 cfs

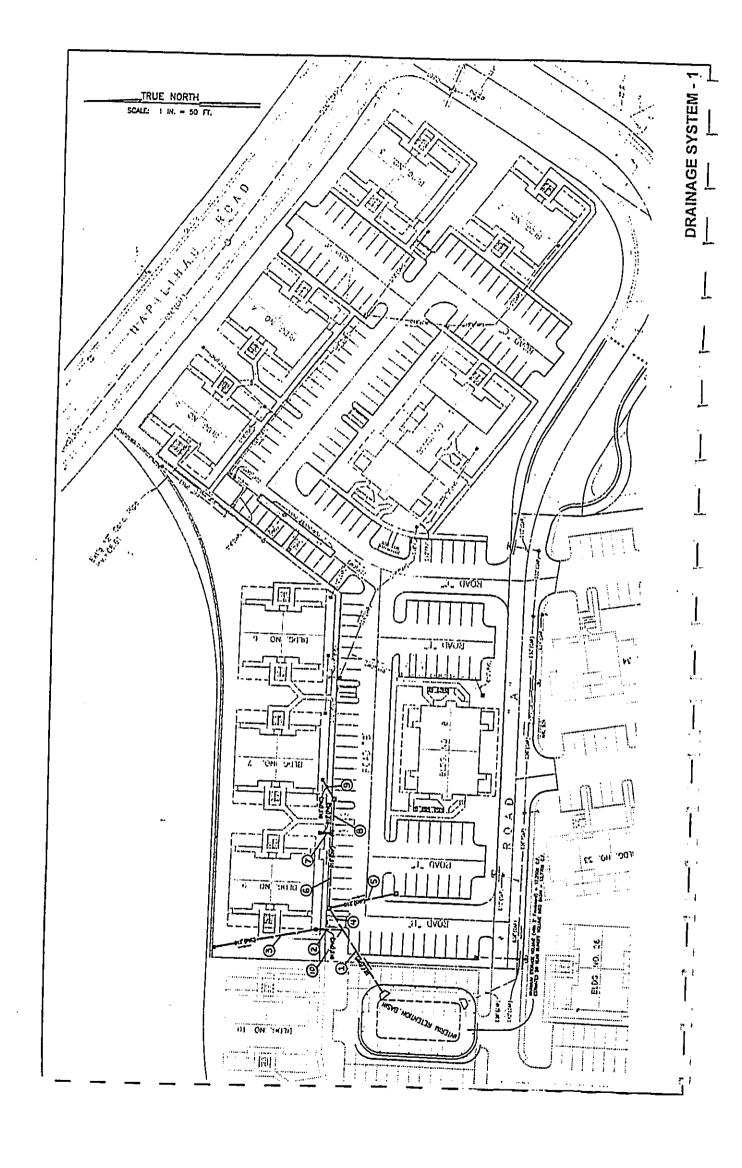
WARREN S, UNEMORI ENGINEERING, INC.
CML 4 SINUCIUM, INCHERSAMO SURFIDOS
CML 4 SINUCIUM, INCHERSAMO SURFERO
STANDARD STREET WALLY WALL WARNING TO
ITT FROM 212 AND TAKE FOR THE STREET WALLY WANNING TO

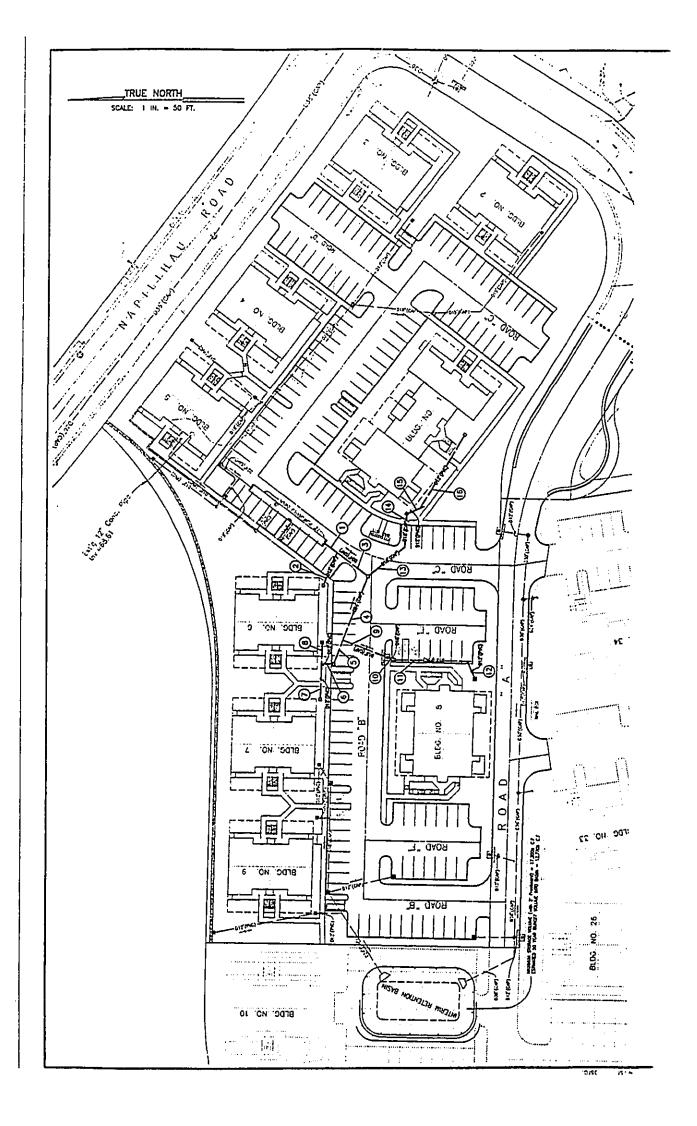
Page 7

000 NAPILIHALI VILLAGES - PHASE I
CHUMITON L'SM 0111 3/21/15
CHUMITON RHA 0111 3/21/15

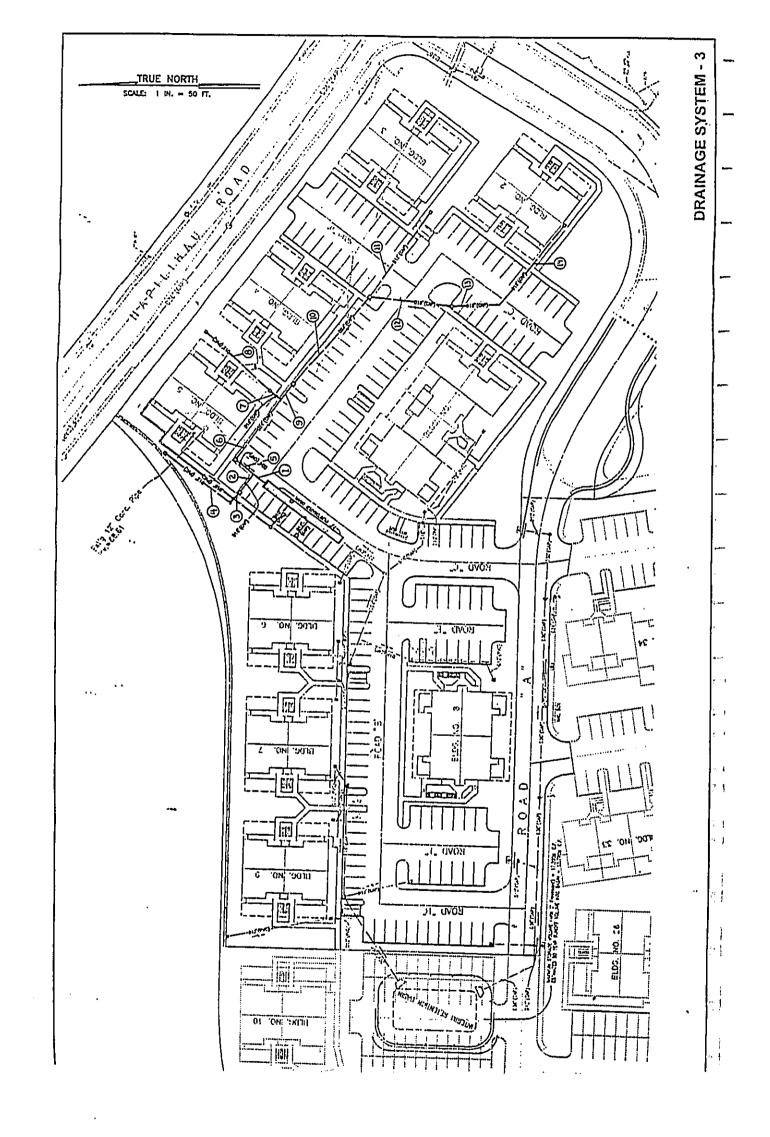
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- <del>5</del> - c	υ				 ·	 
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emporar capacity			-7 E-P		 	
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Octo adapt	Storage	Reguir	onsite		 	 
- <u>ÿ</u> <u>;</u>		ne.20			 	_
- 13 - 13 - 13 - 13 - 13 - 13 - 13 - 13						 <u> </u>

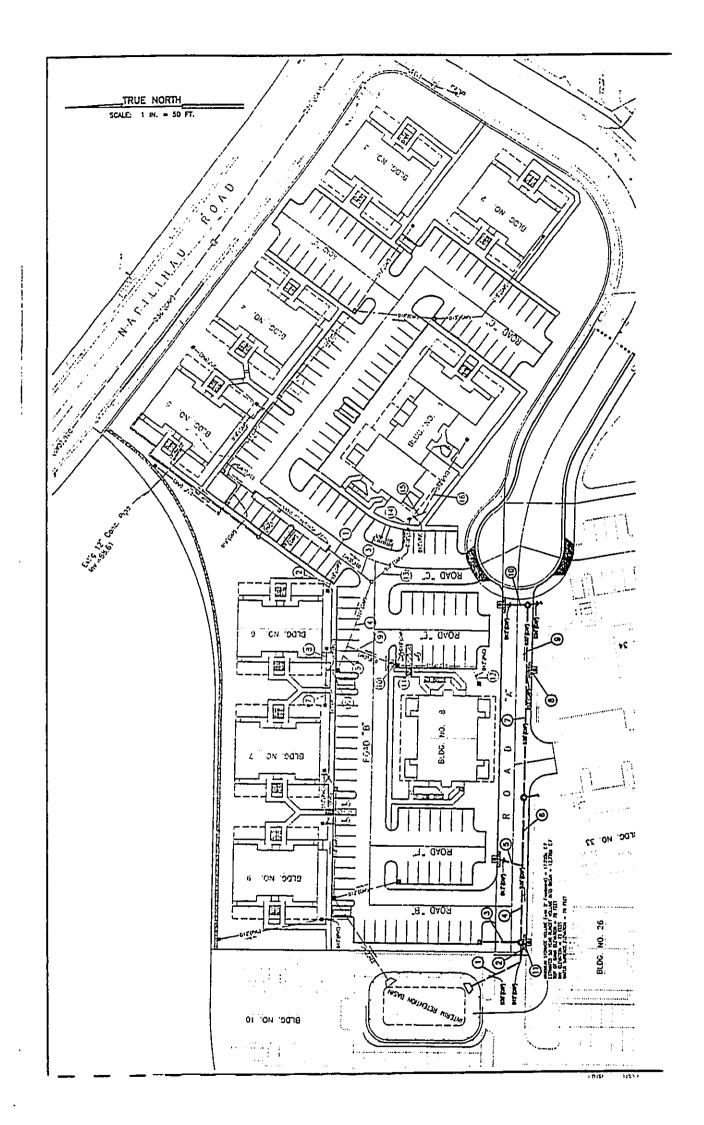






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## HYDRAULIC REPORT FOR

NAPILIHAU VILLAGES PH-1

DRAINAGE SYSTEM 1

TO RETENTION BASIN

STORM SEWER DESIGN / ANALYSIS

Rælifn Perigd ≥ 10 Yrs Ræinfall file: SAHPLE

LINE 1 / G = 0.99 / HT = 24 / WID = 24 / N = .017 / L = 58.14 / JLC = .3 outlet/fabcon / Outfall Nun Date: 07-12-1995 File: b:SRA1.ST3

	덮	DEPTH	DEPTH INVERT	VEL	ĘĠ	T WID	COVER	AREA
DNSTRH UPSTRH	72.50	3.02	72.25	4.33	72.79	15.92	5.75	0.23
Orainace	Drainage arra (ac) :		0.00	Slope	Globe of invert (%)	(3.)	ì	0.000 E
Runoff c	Runoff coefficient	1:	0.00	Slope	31009 Georgy Grade line (%) = 3 Anno	Track 15	ne (2:) =	3 6000
Time of	Time of conc (min)	н	69.0	Critic	Critical depth (in)	(in)	;" :	NG V
Inlet ti	Inlet time (min)	o "	00.0	Nutura	Notural ground elev. (ft)	d elev.	(ft) =	30.36
Intensit	Intensity (in/lur)	ď	0.00	Urstr	Joshesa Surchange (ft)	tarae (f	t)	
Cumulative Cto	ν÷ C‡Σ	o n	0.00	A-Kii ti	A-Kii tional O (cfs)	crs)	"	00.00
* 50 = 0	0 = Cn * 1 (cfs)		00.0	Line	Line expecity (cfs)	(cfs)	"	33.18
Q cat.clm	a catchment (cfs)	0 =	0.00	Inlet	Inlet length (ft.)	-FL)		
Q carryo	Carryover (cfs)	· 0	0.00	SULTY:	Outure slope (ft/ft)	(17,ft)	' 11	0000
a captur	A captured (cfs)	e H	0.00	Ci.ose	Cross slops (ft/ft)	(1/ft)	11	0000
a bypass	0 bypassed (cfs)	ö "	0.00	Pendir	Ponding width ((L)	(11)	11	9/11
10te: No	Note: Normal depth assumed	1 ASSUBIC	S		,			

LINE 2 / Q = 0.67 / HT = 12 / WID = 12 / N = .013 / L = 21.02 / JLC = 1.3 TRANS/GICBHC1 / DNLN = 10

TO /CULTU	INTERNATION / DIRECT - TO	ווא וו	2					
	Ę	DEPTH	DEPTH INVERT	VEL	EQ	T WIO	COVER	AREA
ONSTRH UPSTRH	74.82	7.51	74.61	5.62	75.31	9.76 9.76	11/n 1_56	0.12
Drainage	Dražnage krea (kc) o		0.00	Slope	Stope of invert. (%)	1. (2)	,1	1002 P 5
Runoff co	Runoff coefficient		0 <b>-0</b>	S) 0 X	CHAPTON C	Slope engroy grade line (2) = 4.2292	। (हु) व	4.2292
Time of	Time of conc (min)	h	0.45	Critic	Critical choth (in)	(in)	· •	3 - 3
Inlet ti	Inlet time (min)	3	00.0	Natura	אן הונסווור	Matural Ground elev. (ft)	Ft.) ::	81.08
Intensit	Intensity (in/hr)	11	0.00	Upstro	Surd	Upstrow surcharge (ft)		000
Cumulative C*O	Vo C#O	٠.	0.00	noteli t.	Additional q (cfs)	cf3)	,	01.0
(   c   c   c   c   c   c	( c(s)	;ı	0.00	Line	Line equate (cfs)	(cfs)	ţı	7.41
0 catchille	9 catchment (cfs)	ŭ,	0.00	Interior	Inter- leading (ft.)	(1)		00
0 carryo	O CALLYOVER (CIS)	·	0.00	Gutter	Gutter slope (ft/ft)	ft/ft)	u	00000 =
a captured (cfs)	ed (cls)	"	0.00	Cross	Cross slope (ft/ft)	(t/ft)	13	00000 =
a bypassed (efe.)	ed (effs)	11	0.00	Pondir	Ponding width (ft)	(ft)	:.	۷ <u>/</u> ۷
Note: No	Note: Normal Orphic Assumed	MIRSTE C	loc)				FB . 4.71	14.74

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LINE 3 / Q = 0.57 / HT = 12 / WID = 12 / N = .013 / L = 81.75 / JLC = 1

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ONLN
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GIOBRO1/GIOBRO2

AREA	0.71	1.0031 = 0.6072 = 3.84 = 79.34 = 0.00 = 0.57	0000 = 00000 = 0000 =
Œ		ввиния	8 H D H
COVER	4.56	(f f t)	1
T WID	11.04	(S)	999 999
-	==		## <u>#</u>
සිය	76.23	Slope of invert (%) = 1.0031 Slope energy grade line (%) = 0.6072 Critical depth (in) = 3.84 Natural ground clev. (ft) = 79.34 Upstroum archarage (ft) = 0.00 Line cupacity (cfs) = 3.57	inlat laigin (ft) (ulbor slop* (ft/ft) Gross slop* (fl/ft) Pondiny widil (ft)
VEL	0.80	Slope Slope Critic Ratura Nostr	Inlet Cuttos Cross Pondir
INVERT	75.52	00000001	2505
Ħ		00.000000000000000000000000000000000000	9999
DEPTH	10.16 3.04		
OE	2 %		00
Ħ Ħ	76.37	fricier fricier of (min) (in/lur) (cfs)	(cfs) (cfs) (cfs)
	L 1	Service of the contract of the	
	DNSTRH UPSTRH	Drainage area (ac) Runoff coefficient Time of conc (min) Inlet time (min) Intrasity (in/lur) Cumulative C*n Q = Cn * I (cfs)	q catchment (cfs) p carryover (cfs) q captiment (cfs) q bypassed (cfs)

LINE 4 / Q = 0.99 / HT = 24 / WID = 24 / N = .017 / L = 20.16 / JLC = 1.3 FABCON/GICS#B1 / DNLN = 1

	HGL	DEPTH	DEPTH INVERT	VEL	ဌ	T WID	COVER	AREA
DNSTRH UPSTRH	74.64	3.02	74.39	4.33	74.93	15.92	3.97	0.23
Drainage area ( Runoff coefficition of conc (n Inlet time (mir Intersity (in/) Quanthative C*A	Drainage area (ac) Runoff coefficient Time of conc (min) Intel time (min) Cuntersity (in/hr) Cuntative C** Q = ch * (cfs)	p <sub>h</sub> racks	0.00 0.00 0.00 0.00 0.00	Slops Slops Critic Nature Upstre Additi	Slope of invert (%) Slove energy grade 1 Critical depth (in) Halarah ground alev Upstream surcharce ( Acklitional 0 (eff) Line capacity (efs)	Slope of invert (%) Slope energy grade line (' Critical depth (in) Habbral ground elev. (ft) Upstream surcharree (ft) Aktitional 0 (efc) Line capacity (efs)	<del>ن</del>	3.6706 7.6706 4.23 61.10 0.00 0.22 7.714
o catchm o carryo o captur o bypass Note: No	Destrument (cfs) = 0.00 Quaryover (cfs) = 0.00 Quartured (cfs) = 0.00 Quartured (cfs) = 0.00 Abypassed (cfs) = 0.00	\$	. 2000	Indet Outte Cross Pondir	unlet languh (ft) Quiter Slop- (ft/ft) Gross slop- (fi/ft) Ponding Width (ft)	Indet bragh (ft) Outer slop- (ft/ft) Cross slop= (ft/ft) Ponding width (ft)	, a	0.00 = 0.0000 = 0.0000 = 0.0000 = 5.33

LINE 5 / Q = 0.32 / HT = 12 / WID = 12 / N = .01 / L = 53.72 / JLC = 1 GICG#B1/GICG#D1 / DNLN = 4

	מישובי לי בחומי ל	į	•						
	헍	DEPTI	= -	DEPTH INVERT	VEL	EG	T WID	COVER	AREA
DNSTRH UPSTRH	75.76	7.56		75.13 75.47	2.21	75.77	9.52 10.25	4.33	0.52
Drainage	Drainage area (ac)	!! •	00.0	0	5) 0,76	Slope of invert (%)	1. (4.)	Į.	= 1,0052
Runoff c	Runoff coefficient	اا د	0.00	6	Slope	Slope energy grade line $(\mathfrak{L})$ = 0.5504	rade lir	ક (ફ) ક	0.5504
Time of	Time of conc (min)	11	0.00	0	Critic	Gritical (Apth (in)	(in)	21	2.13
Inlet ti	Inlet time (min)	н	0.0	5	Nature	Matural ground elev. (ft)	elev. (	(ft) =	51.56
Intensit	Intensity (in/hr)	11	0.00	c	UPATE	Jostnosm sundange (ft.)	arge (f)	<u>.</u> ت	0.0
CURULATIVE C*A	Ve C*U	11	9.6	0	nodi ti	odditional a (cfs)	cfs)	h	0.32
* 5 " o	Q = CA * 1 (cfs)	u	0.00	0	Line c	ine capacity (cfs)	(cts)	11	4.6.1
0 catchin	0 catchment (cfs)		0.0	. =	inlet leng	Inlet Length (ft)	ft)		00.0
O CALLYO	a carryover (cfa)	ŀ	00.0	c	Cutter	Gutter slope (ft/ft)	(17/17)	11	0.0000
o centur	0 cepturist (cfs)	ıŧ	S.C	2	170055	Gross slope (ft/ft)	1/11)	II.	0000.0
genaya b	a hyparseed (cf)	ıt	0.00	c	Poridir	Ponding width (ft)	(E.E.)	*1	N/N
				1	1			FC =	FC = 5.57

LINE 6 / 9 = 0.44 / HT = 18 / WID = 18 / N = .014 / L = 59 / JLC = .8

	AREA	0.70	Slope of invert (t) = 1.1993 Slope enroy urack line (t) = 1.3005 Gritical chapl (in) : 5.04 Natural ground elev. (ft) = 0.00 Obstram surcharge (ft) = 0.00 Additional 0 (cfs) = 0.00 Line capacity (cfs) : 15.43 Inlet broth (ft) = 0.00 Cross slope (ft/ft) = 0.000 Cross slope (ft/ft) = 0.000 Cross slope (ft/ft) = 0.000
	COVER	1.47 N/0	TE (E)
	T WID	11.66 13.48	rt (h) n (in) n (in) d clev. harge (cfs) (cfs) (ft/ft) ff/ft)
	EGL	75.77 76.54	Slope of invert (%) Slope energy urade line ( Gritical dayuh (in) Matural ground elev. (It) Mystream surcharge (ft) Additional 0 (cfs) Line capacity (cfs) Line theory (ft) Conse slope (ft/ft) Conse slope (ft/ft) Ponding width (ft)
	VEL	0.62	Slope Slope Critic Natur Upstr Ndi U Line Line Inlet Cutte Cross Pondi
GICB#B1/90dTEE / DNLN = 4	DEPTH INVERT	75.13	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0
	DEPTH	7.56	
	렃	75.76 76.50	Drainage area (ac) Runoff coefficient Lime of core (min) Inter time (min) Intersity (in/Nr) Cumulative C*A Q = CA * 1 (cls) Q = CA * 1 (cls) Q = catchment (cfs)
GICB#B1/		ONSTRH UPSTRH	Drainage area (Runoff coefficial Lime of core (ministrative Carl Carl Carl Carl Carl Carl Carl Carl

114E 7 / Q = 0.18 / HT = 12 / WID = 12 / N = .013 / L = 10 / JLC = 1 90dree/GIC8#82 / DMLN = 6

LINE 9 / G = 0.02 / HT = 12 / WID = 12 / N = .013 / L = 17.33 / 3LC = 1

3.78 2.16 2.16 1 0.00 1 0.00 1 0.00 1 0.00	25	0.85 76.58 6.74 N/A 0.21 0.10 7 8.7/ 2.22 2 0.10 0.10 at invert (%) = 22.3000 3lope energy grade line (%) = 21.9275 Gritical choth (in) = 2.46 Halberal ground elev. (ft) = 81.48	7 (3) #22 (4)	0.21 0.10 =22.3000 =21.9275 = 3.16 = 81.48
		of invert (%) cal chpth (in) al ground elev. (ft.	(a) 123 (b) 123 (c) 123	2.3000 1.9275 2.16 81.48
		energy grade line (cal ckpth (in)	(n) =2)	1.9275 2.16 81.48
1.088		ical chpth (in)	# # *	2.16
. 11 11 11	`	al ground elev. (ft.	11	81. 45:
11 11 11				
		Jactream surcharge (Ft.)	17	0.00
#	•	nuklitional O (cfs)	ų	0.18
1	-	ing capacity (efs)	1.	16.32
o carcharat (ofs) · 0.00		Inter Tradit (ft)	я	9.0
11	•	Auther slope (ft/ft)	11	= 0.0000
11	-	Cross slopy (ft/ft)	)1	0.000
l:		Pointing width (ft)	H	Ş

LINE 8 / 0 = 0.26 / HT = 18 / HID = 18 / N = .014 / L = 27.5 / JLC = 1.3

90dTEE/G)	90dTEE/GICB#B3 / DNLN = 6	NCN =	ç					
	Ā	DEPTH	INVERT	VEL	ಕ್ಷದ	T WID	COVER	AREA
DNSTRH UPSTRH	76.57	3,78	76.25	0.96 1.95	76.5B 77.02	8.25	11/0 3.88	0.27
Drainage Runoff o Time of Inlet ti	Drainage area (ac) = Runoff coefficient = Time of conc (min) = Inlet time (min) = Intensity (in/hr) =		0.00 0.00 0.10 0.00 0.00	Slope Slope Gritin Ratura Upe tr	Slope of invert (%) Slope every grade 1 Critical depth (in) Ratural ground elev- Upstrom surdargo	Slope of invert (%) Slope energy grade line (%) Critical depth (in) Natural ground clea. (1.) Upstrom surcharge (ft)	76 (3) 9c (11) 12 (11) 12 (11) 13 (11)	1,8202 1,6112 2,33 82,15 0,00
Cumulative C+O	$Qumulative C^4 \Lambda$ $Q = C \Lambda * 1 (cfs)$	н и	0.00	Line	Arditional O (cfs) Line capacity (cfs)	(cfs) (cfs)	ų μ ¦	13.41
a carryo a carryo a captur a bypass	d catchment (cfs) d carryover (cfs) d captured (cfs) d bypassed (cfs)	8 5, 11 0	0.00	Inlet Autbe Cross Fondi	Inlet length (ft) Auther slop: (ft/ft) Gross slop: (ft/ft) Fonding width (ft)	(ft) (ft/ft) ft/ft) (ft/	11 12 12 11 11 11 11 11 11 11 11 11 11 1	0.00 0.0000 0.00000 0.00000 0.00000

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6108#83/	GICS#83/GICS#84 / DNLN = 8	DNL'N II	8					:
	HQ.	DEPTH	INVERT	VEL	EQ.	T WID	COVER	AREA
DNSTRH UPSTRM	77.04	3.24	76.77 62.67	0.12	77.04	6.23	4.38	0.17
On an Older	Drainace area (AC)	н	00.00	51003	Slore of invert (%)	t (%)		:15,1183
Gamoff o	Ramoff coafficient	4	0.00	Slope	Slope energy grade line (%)	grade lin	(F)	
Time of	Time of conc (min)	п	00	Critic	cal, depth	(ii)		11
inlet ti	Inlet time (min)	i4	00.00	Kutur	Retural ground elev. (ft)	l etev.	(T.	≈
Intensit	Intensity (in/hr)	1.	0.00	Upstr	Upstream surcharge (ft)	Jacobs (F	ij	= 0°00
Cumulative Cth	V- CtO	"	0.00	nddi t:	Additional Q (cfs)	(c[s)		= 0.02
- C: " 0	( sta) 1 + NO = 0	1:	0.00	Line	Line emmeity (efs)	(લ્દ્રાંશ)		= 1.5.85
7770	Colon transfer Colon	"	00.00	Inlet	nlet landh (ft)	(ft)		00°0
O CALLY	CALLWOVER (CES)	21	00.0	Sutte	Sutter slope (ft/ft)	(ft/ft)		00000 =
o captur	captured (cfs)	ı	0,.00	Cross	Cross slope (ft/ft)	rt/rt)		= 0.0000
O bypas	bypassed (cfs)	H	0.00	Pondî	Ponding width (ft)	(ft)		u/v
1							F.B.	FB : 2.92
		1						

LINE 10	/ 0 = 0.	H / 00	T = 12 /	LINE 10 / Q = 0.00 / HT = 12 / WID = 12 / N = .013 / L = 2 / JLC = .3	)" = N /	ין / צונ	: 2 / JL	E. = O
FABCON/D	FABCON/DRNTRANS / DNLN = 1	DNLN	= 1					
	HG.	DEPTH	DEPTH INVERT	VEL	뎐	T WIO	COVER	AREA
DNSTRH	74.73	4.06	74.39	0.00	74.73	6.98	4.97 N/n	0.73
	(400) 600.00 6000.000	!	9	91000	Slope of invert (%)	rt (%)		£ 4,9900
Tamoff o	Company of the text	, ,,	00.00	610De	Greedy	Slope energy drade line (%)	(3) ea	= 0.2102
Time of	Time of conc (min)	, ,	0,12	Critic	Critical dapth (in)	n (in)	•	00.00
Inlet ti	Inlet time (min)	l:	0.00	Hatur	al groun	natural ground elev. (ft)	: Ge	00.0
Intrasia	Intrasity (in/ln)	11	0.00	Upstr	ouns and	Jpstroam surchards (ft.)	2	. 0.00
Cumulative C*A	ive CtA	,:	00.00	Ockli t	Acklitional Q (cfs)	(cfs)		00-0
ម ម	0 = CA * 1 (efs)	to.	0.00	enić.l	Line capacity (efs)	(cfs)		26-7
Catch	catchment (cfs)		0.00	Inlet len	Inlet length (ft)	( ft)		00.00
O CALLY	D CAFFYOVER (CFS)	11	00.0	aitte	Qutter slope (ft/ft)	(ft/ft)		= 0.0000
o captu	a captured (cfs)	li	00.0	Cross	Cross slope (ft/ft)	rt/ft)		0.0000 =
a bypas	(e.fe.) pessed (e.fe.)	1;	0.00	Ponch	Ponding width (ft.)	(H)		C/2

## HYDRAULIC REPORT FOR

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NAPILIHAU VILLAGES PH-1

DRAINAGE SYSTEM 2

TO PERFORATED DRAIN

## STORM SEWER DESIGN / ANALYBIS

Run Date: 07-12-1995	FILC: GISKAZ-SIS
Return Period = 10 Yrs	Rainfall file: SAMPLE

LINE 1 / G = 1.86 / HT = 24 / WID = 24 / N = .017 / L = 12.12 / JLC = .3	
TH / 98.	 Outfall
LINE 1 / G = 1	OUTLET/FABCON /

	ρĭ	DEPTH	DEPTH INVERT	VEL	EQ.	T WID	COVER	NREN
ONSTRH UPSTRH	72.27	8 8 8 8 8 8	72,93 73,75	1,97 8,92	75.52	15.46 15.46	4.43 4.83	0.21
Orginera	Orajibaga (1981 (1981)		00.0	Stols	Slope of invert (3)	rt (E)		714.1914
Runolf	Runolf contricient		0.00	Stope	energy (	wad this	3	Slope energy and the line (%) =14.1914
Time of	Time of east (mire)		1.13	Ç. i Lî	critical depth (in)	(E)		5.79
Injet t	Inlest time (min)		0.001	स्माराज्य	אוווטשט רב	Return ground elev. (ft)	(4F)	. 50.58
luterie.	Interest by (Ju/lu)		0.00	11/2/11	Sent and	Heatherm caredones (11)	<b>∵</b>	0.0
Cimelant	Chinal Alive Cin		00.0	ock li L	ncklitional Q (efs)	(ete)		00.00
מ = כט	(C-10)   1 (C-1-)		00.0	Lum	Lare capacity (efc)	(eJe)		31.53
		; ; ;	. 6	1000	Trailing Transmitter (1972)		; !	00-0
	Carcinetti (cic.)				College Story (12/ft)	(11/61)		= 0.0000
	(l.) Irrations of		0.00	0.00	3000 Jan (11/11)	01/11		000010 -
DMKE	(1) Dayses (1)	٠,	(H)	Pendi	Ponding wirlth (FL)	(11)		ν/::
Hober II	Notice Hornett of pulp agetine of	क्षा करण	F					
					:	1 :		

### LINE 2 / Q = 0.08 / HT = 12 / WID = 12 / N = .01 / L = 25.22 / JLC = 1 FABCON/GICAHE1 / DNLN = 1

FABCON/C	FABCON/GICAREL / DALN = 1	מארא יו	-					
	J D	DEPTII	HOL DEPTH INVERT	VEL ECL	EG	T WID COVER	COVER	AREA
DNSTRM UPSTRH	74.36 RL.43	757	7.52 73.75 1.44 81.28	0.16	0.16 74.36 1.50 81.47	9,37 5,83 7,80 2	5.83	0.50
Drainag	Drainage area (ac) :	ľ	00.0	Slop	Slope of hiver's (".)	: :: ::		-2.1,8573
Runoff	Runoff coefficient	; ;	95.0	Slops Slops	Slope exercy grade line (%) *28.1884 Coresta a state (in)	nil soor.	::	- 15.44
10 5m1 10 101	Inter of constants	4.	. E. C	H. LLII	Reduced eround elex. (ft)	1 otov. (	(J)	14.28
Intrae	Interest by (un'tur)		00.0	(4 r.Lr.	Openiors auchinos (FE)	rinde (F)	<b>∵</b>	0.00
Crime 1.11.	Crimulative 130	;	0,00	RELIT	AMILIONAL O (CT.)	(-15)		30.0
G : 0	(190)   1 (0) = 0		00.0	Lin	Line capacity (eff)	(ਵਸਤ)		05.4
17150	o estellment (eff.)	, ! :	. 00.0	CILLA	fulled, beneath (TE)	(I.E)		. 0.0)
N.1 1120 D	(SIS) FAMALIST (SIS)	t.	0.00	911.0	GREEN STOP (TL/FE)	CLL/FE)		0000*0
C Captur	Q equipment (c.f.s.)		0.00	. 36.03	Green salops (TL/FE)	ite.		0.000.0
a byke.	(C.10) INTEREST (C.10)	_	0.00	Permit	Pearding wealth (1t)			Ç ₩
:	:	•	:		:		F.B.	£8 ± 2,85

LINE 3 / Q = 1.78 / HT = 24 / WID = 24 / N = .017 / L = 31.2 / JLC = 1.3

LINE 3 /	LINE 3 / u = 1.70 / III								
70/10000	1 = NIHO / HERMANNET I	1 1 2							
FORCE VI		i				!	4	V30V	
	호	DEPTH	DEPTH INVERT	VEL	<b>1</b> 03	T WID	COVER		
DNSTRH		5.67	74.75 78.15	2.13	70.78	13.26	4.83	0.81	
Drainare area ( Runoff coeffici Time of cone (m Inter, time (min Intervally (in/l) Quantitative CFA  Q = CA + 1 (cfe Q = CA +	Drainage area (ac) Runoff coefficient Time of cone (min) Interestry (in/lu) Quantative CFA  q = cn + 1 (cfa)	no potential de la constanta	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	Stops Critis Critis Batum Uratro Arkita Critis Critis Critis Critis Critis Critis	stope of invert (*) stope energy grade 1 critical depth (in) Ratural ground elev- the tream surcharge (acts) Line especify (cfs) Inlet bendh (ft) ancher stope (ft/ft) Grass stope (ft/ft) Forgins stope (ft/ft)	slope of invert (%) slope energy grade line (%) crifical dyph (in) Rabinal ground elev. (FL) Up.tream surcharer (fL) akhitional of (els) Line capacity (cls) unlet lampl (fL) anther slope (fL/fL) critics stope (fL/fL) critics stope (fL/fL) critics stope (fL/fL)	Slope of invert.(%)	invert (2) = 14.1026 ity grade line (b) = 15.9120 ity drade line (b) = 15.9120 ity drade line (c) = 5.67 round ed.w. (Ft) = 0.00 ity (cEs) = 0.00 city (cFs) = 0.00 ops (ft/ft) = 0.00 ops (ft/ft) = 0.00 ops (ft/ft) = 0.000 ops (ft/ft) = 0.000 ops (ft/ft) = 0.0000 ops (ft/ft) = 0.0000 ops (ft/ft) = 0.0000	

LINE 4 / Q = 1.50 / HT = 24 / WID = 24 / N = .017 / L = 55.12 / JLC = .8

אמובכ / ג	DHH#E1/90dTEE / DNLN = 3					03/60	OBEO	
ğ	DEPTH	DEPTH INVERT	VEL	넌	1 1	Syek		
78.82	31.06 5.20	/8.15 /9.11	68. 14.	78,316	13.91	4.36 N/A	0.23	
Drainsay area (ac) Figure of cone (min) Infer time (min) Quantistic (min) Quanti		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	Stopy of the Return Metal Metal Metal Line Hubbl Grow Grow Grow	Stope of invar. (2)   1.7417	4, (3) 1, (10) 1, (10) 1, (10) 1, (10) 1, (10) 1, (10) 1, (10) 1, (10) 1, (10) 1, (10) 1, (10) 1, (10)	(C) 4	10. 1.7417 11. 10.000 10.000 10.000 10.000 10.000 10.000 11. 10.0000 11. 10.0000 12.00000 13.00000 14.00000 15.00000 16.00000 17.00000 18.00000 18.00000 19.00000 19.00000 10.00000 10.00000 10.00000 10.00000 10.00000 10.00000 10.00000	

LINE 5 / 0 = 0.37 / HT = 24 / WID = 24 / N = .017 / L = 20.41 / JLC = 1.3

90dTEE/6	1031162 /	90dTEE/GICBIIE2 / ONLN = 4	•					
	<u>5</u>	DEPTH	DEPTH INVERT	VEL	ដូច	T WID	COVER	OREO
DNSTRM	72.65	6.55	77.11	3.56 1.98	79.66 79.75	12.52	6, 6, 7,	0.62
Drainings aread ( Ruroff condition)  Time of condition  Interestly (influentially)  Quantiality (70  Q = CA + 1 (cdf)  Q catching (10)  Q carryowy (0)  Q carryowy (0)  Q carryowy (0)  Q carryowy (0)  Q carryowy (0)	Drainage area (26)  Furnif conflicient  Time of corre (min)  Indet time (min)  Omitative Gro  q = GA + 1 (2fc)  q = GA + 1 (2fc)  q = ctelment (2fc)  q carelment (2fc)	550001	0.00   Sleps of invert (%)   -1.71.88   0.00   Sleps energy grade line (%)   -0.528   0.00   Clifered event (in)   -1.71.88   0.00   Clifered event (in)   -1.71.88   0.00   Clifered event (in)   -1.71.88   0.00   0.00   Clifered event (in)   -1.71.88   -1.71.88   Clifered event (in)   -1.71.88   -1	Sleps Solves On its Solves On	Slope of invert (2)  3.65 5) i Escal depth (in)  1.71.30 6) i Escal depth (in)  1.41.20 6) i Escal depth (in)  1.41.20 6) i Escal depth (in)  1.41.20 1.42 1.42 1.43 1.43 1.43 1.43 1.43 1.43 1.43 1.43	rt (5) grade lin h (10) d other today (7) (cf.) ((11) ((11/1)	(fr) (fr) (fr) (fr) (fr) (fr) (fr) (fr)	2.65 2.65 7.65 7.65 7.65 7.65 7.65 7.65 7.65 7

LINE 6 / Q = 0.20 / HT = 12 / WID = 12 / N = .013 / L = 9.59 / JLC = .8

CICSHEZ/	GICRHEZ/20dlile / DALN = 3	חמרני -	•					4
	101	DEPTH	DEPTH INVERT	VĽL	ĘĠ.	T WID	COVER	OISED
DNSTRH UPSTRH	79.77 30.25	700-7	79-16 30-04	1.038 1.038	70.78 30.29	9.41	; H/0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Desiracts and Branch Court Lime of court Indian (Court Line) (Court Li	Destinate and (ac)  [smoot could intellige of cota (min)  [most kim (min)  [most kim (min)  [most kim (in/m)  [most kim (col)  [most kim (col)		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	Stope	slope of invert (%) Stope energy cross line (%) 5,27% Grillogt tyth (in) Grillogt tyth (i	11. (2.) 11. (2.) 12. (2.) 13. (2.) 14. (2.) 15. (2.) 16. (2.) 16. (2.) 17. (2.) 17. (2.) 17. (2.) 17. (2.) 17. (2.) 17. (3.)	(ft)	6.0430 6.2776 6.2776 0.00 0.00 0.00 8.76 8.76 8.76 0.00 0.00 0.0000

3---

t "I

**F**---

3-1

6 // 7 / 84

## LINE 7 / Q = 0.18 / HI = 12 / WID = 12 / N = .013 / L = 28.09 / JLC = 1

20dTEE/G	20dTCE/G1CB#E4 / DNLN = 6	סאנא = (	3					
	ם	DEPTH	DEPTH INVERT	VEL		T WID	COVER	OREA
ONSTRH UPSTRH	80.28 80.58	7.43 2.16	30.04 30.39	1.27	19,03	5.445 9.22	8,70 1.5	0.14
Drain up Ranoff	Brainage area (see) funcify coefficient fine of core (min)		90.0	310px 310px 51 - 51	Slope of invart (%) Slope energy grade line (%) Griffed depth (in)	L (3) Freet 1ii L (iii)	(3)	0.7768 1.0961 2.16
Intersity (in/) Countative C+O O = CO + 1 (ex	Intersity (in/la) Committive C+O O = Ch + 1 (eds.)		888	Upathra Ockli L	fatural, graduct (1977, (197) Applicam (urdate) Addicional (1966) Lifter capacity (eff)	(als)		0.00 0.18 3.56
O caldin O caldin O captu	0 calciment (cfs) 0 carrywer (cfs) 0 captural (cfs) 0 byvecset (cfs)		00.00 0.00 0.00 0.00	Ember Ontber Cross	Index Dwelli (11) Order stops (E/E) Gross stops (E/E) Penting wells (E/E)	11.) (14/fi.) (17.15) (11.)	i ! li » i i	0,000 - 0 - 0000 - 0 - 0000 - 0 - 0000 - 0 - 0000 - 0 - 00000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 00000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 00000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 00000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 00000 - 00000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 0000 - 000
	:						97	66.2.27

### 1.1ME B / Q = 0.02 / HT = 12 / WID = 12 / M = .013 / L = 16.91 / JLC = 1 90dTEE/GICDHG3 / DNLN = 6

	HG	OCPTIL	DEPTIL INVERT	אניר נימי	EG.	T WID	T WID COVER	.nren
DNSTRH UPSTRH	30.23 80.87	2, 83 0, 72	7,365 (30,404) 0,72 (81,72)	  	0,14 mq.m. 1,04 m0,18,	7, 36 7, 70	91.	0.14
Orain er Runolf	Drainerrande (ac) Runolf cod ficient			2 to 10 to 1	Slope of invert (2) (3) (4,4252) Slope objects divide time (2) (3,5918)	t. (%) hasky ter	· (2) :1	7 4.4352 3.5915
Time of tribat Li	Fine of cour (min) trifet, time (man)		0.00	C 17.	Gailead Aspill (in) Bebrat ground elev. (11)	- CEE - 10-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1		80.73 80.73
Until ity (in/4) Cimentaliy (310)	Unterrity vin/km > Cumentality vin	= =	0.00	1 <u>1                                  </u>	Opelliosom (III) finaloji (15) Defiliosofil D. (148)	E) (188	<u></u>	2 2 3 3 3
<u>.</u>	( + -) +		=	Ê	(sd.e) Albashse ab i	(:1:)		Q
בוייויי ס	a catalon ark (c. lc.)		150.11	=======================================	bilist breath (11.)	<u>-</u>	•	0.00
۲. از: ا	d carryoner (clear	= '	G. G.	-41.14	arther edope (14/10)	31/11	.*	0.0000
111/15/20	Q tegatificat (cdc.)	= <b>=</b>		Toller Toller	tions stops (TL/IL) Panding pight (TL)		1 4	0000°°
:					FQ * 2.92		F 8 +	2.82

### LINE 7 / 9 : 1.11 / HT : 18 / WID = 18 / N : .014 / L = 38.08 / JLC = .0 90dfee/CBIF3 / DNLN = 4

	럴	DEPTH	DEPTH INVERT	VEL	5	1 W1D	COVER	OREO
DNSTRM	77.65		72.11	1.92	79.71	10.85	Q/N	0.58
E STORE	13.15:	-	1.7.1er	7.7	, , , the	2.5	3	15
Drainac	Draftmer . u . v (. e.)		0.00	31010	(%) The of the state	3		Linar".
Runoff	Runoff coefficient.		fi. 00)	Slope	Stope and the death line (f.)	Truck lin	(B) (E	2,7107
Time of	Time of cong (min) :	_	11.44	Cr. Lis	tribisa dyun (in)	(E)	•	4.82
Inlet ti	Inlet tim. (min)	-	G. (B)	H. dbill.	Babinal ground होस्प. (11)	1 c) cv	3	34.10
Interior	Intermedity Cin/ln )	٠.	0.00	Brath	Spectres and english (11)	1) .Gara	t)	00.0
Quared art.	Quadhative of a		0.00	11110	paki tional Q (efs)	(SES)		0.152
5 6	( 42)   1 (U) = b	ε	0.00	Lin	Line capterly (cfs)	(c1s)		74.91
Q catchanant.	Q certicipation (ed.)	·	0.00	110	nder, bacilli (11.)	(11)	i !	0.00
the carl ye	di cari yover (eds.)		0.00	1211.15	ONLINE TOPE (TILLE)	CHÉLLO		0,0000
a capital	a captured (e.fs.)	•	0.00	7.0 E	CHAIL STORY (LL/TL)	(11/71)	•	00000
atarket b	(Hayperseal (effs.)	c	0.03	Perdi	Pending wedde (Ft.)	(LT)	•	¥ ::
					***************************************			F6 . 3.38

## CRWF3/GICBNF1 / DNLN = 9

	럴	OEPTIC	THVERT	VEL	EG.	T WID	COVER	OREA
ONSTRH	79.1M	6.073	10.72 10.75	27.7	80,78 80,75	10.47	2.58	5 0 5 5 7 1 2 2
Drainer	Drainege acce (ac)		0.00	Slate	Stope of most t (2)	(1)		2020.
Ranottic	Ranott Swellisisal.		9.01	<u>च</u>	Abete	Stope merely grade tine (2) + 0.2196	· (%) **	0.21%
Timeot	Time of cone (min)		1.11	: : : C:	वानंदिन्त क्षिमा (m)	(11)		3. 52
Inlet ti	Indet time (min)		0.00	11.:111	d cuoun	Rathurd quound ollow, (11.)	(11)	83.84
Interest	Untrarsity Cit/lie)		0.00	Uritr	Cam - max	Upatrosmanna derege (ft)	3	00.0
Campletive CIO	<b>○1</b> ○>	Ξ	CI. 180	0.4H	(ckli Limed to (cls)	(3/15)	•	0.39
# (F) : 5	Gardy at Letter)		űo"u	1 114	(धार) द्वा कलाहरू त्वार	(cita)	:	16.31
Q catchin	Q cetelurat (cfs)	! : : !	n. 00	Listot	hilet, Jeneilla (ft.)	(L)		00.0
0 1117	Q CHEYWAY (CF.)	Ξ	0,.10	PALLE	(11/11) store return	(11/11)		0.000
miches 6	Q explined (c.15)		(5)	0.000	Dos slaw (11/11)	11/11)		0.000.0
cankq b	d byperson (c.f.)	=	19.131	Post lit	Parching wiellli (312)	(31)	•	H/A
		:	:	:	:	£8 * 3.07	F8 =	FB = 3.07

LINF 11 / Q = 0.20 / HT = 12 / WID = 12 / N = .01 / L = 58.62 / JLC = .3 GICOMF1/45cBEND / DMLN = 10

	럴	DEPTH	OCPTII INVERT	VEI.	Ċ.	M T	Chyrin	200
DNSTRH UPSTRH	30.77	4.23	80,56 80,95	1.93	80.75	7.69	2.47 HZn	090
Drain or a car Runoff confict Line of cane (ni Inlet time (ni) Inbresity (in/) Oundative Cr	Drain up a ca (ac) r Runoff coefficient. Line of cane (min) - Indet Line (min) Indersity (in/hr) Oundative (ch	_	60.00 10.00	Stope Stope Critic Return Uprate Store	Stope of invert (2) Slope eterty grads line (3) Ciliford depth (in) Return ground elev. (11) Optivem ethologye (11) Optivioud a (ets.)	t (2)	ĝ	1.0065 0.7458 2.23 0.00 0.00
Gutchin Gura you Gaptaira byanasa	0 eutchment (efs) 0 eur youe (efs) 9 explained (efs) 9 bypavesel (efs)		90.00 00.00 00.00	tribet, be Orthor v Gross ab	repti (	15 17(15) 17(15) 17(15)	* * * *	0.00 0.00 0.00 0.00 0.00 0.00

LINE 12 / Q = 0.20 / HT = 12 / WID = 12 / N = .01 / L = 14.98 / JLC = 1 45cDEND/GICOHF2 / DNLN = 11

	1	-	DULLIN INVENT	\r \	d d	TWID	COVER	OPFO
DNSTRH UPSTRH	81.16 81.33	2 K	801.25	1.70	81.28 31.43	5.46	N/0	9 0
Drain, by arroy ( Runoff coefficial Tibes of cone (m Index time (min Index tim	Draining area (ac)  Runof crefficient.  The of conc (min): Intert. Line (min)  Untert. Line (min)  Cumdadive Cro  O = Co + 1 (c-f.)  O = Co + 1 (c-f.)	and the second		Stopy Stopy Ortice Betare Metter Ablitte Cone of Cone of Cone of Cone of Cone of Cone Cone of Cone of Cone of Cone of Cone of Cone of Cone of Cone of Cone of Cone of Cone of Cone of	Slope of invert (2) Slope theory grade 1 Go the first of pills (fin) Rebursh ground every blotteres (fin) the cape of Go (Go) time cape of Go) time cape of Go) time cape of Go) time the replace (fin) times the cape (fin) times cape (fin) the cape of Go) satisfact width (fin) barefine width (fin)	Stope of invert (2) Stope steery grade line (2) : Griffical depth (in) Reland ground ctov. (7) Orline freed (ct.) Orline cycer (R) Orline cyce	(a) (b) (c) (d) (d) (d) (d) (d) (d) (d) (d) (d) (d	1.0013 1.0013 1.2574 2.28 64.10 0.00 0.00 0.00 0.00 0.00 0.00 0.00

LINE 13 / G = 0.26 / HT = 18 / WLD = 18 / R = .014 / L = 28.96 / JLC = .3 DHHIE1/45GHCHD / DNLN = 3

	गु	DEPTH	DEPTH INVERT	Wr.I.	5	_ 10 13 10	COMER	02510
ONSTRH UPSTRH	78.32	3.06	78.15	697 197	781,352 300, 13	12.04	556	77.0
Dratings and the lamber of control of the control of control of the control of th	Dratings and Card Manoff opellistern Lime of cone (min) Inlest Lime (min) Inlestreity (m/m) Gmittalive (m/m) Qmittalive (m/m)		90°0 90°0 90°0 90°0 90°0	Slope Slope Children Rabins Orklini	ologic of three L (a) clope energy modes (b) those depth (in) buttered spround alegarithms in close (in) count it (close) the energy (b) the energy (color) countries (close)	object of the t. (5) clope energy quade line (2) - clope energy quade line (2) - clope energy (10) diedress energency (11) fill tional qualety (15) fill tional qualety (15)	(2) 4	34
Catabiii Carryo Captiir Cyystas	d catablent (k.b.) 0 carryover (k.b.) 0 captured (k.b.) 0 bytacast (k.b.)	5000 - 1	0.00 0.00 0.00 0.00	Inlot Outton Cross Poidin	Unlet Jength (Tt) Outest stops (Tt/ft) Gross stops (Tt/ft) Pording width (ft)	16) 17/16) (71)		0.00 0.00 0.0000 0.0000

LINE 14 / Q = 0.28 / HT = 10 / WIII = 18 / N = .014 / L = 43.01 / 3LC = 1.3

45cmEND/	45chenb/01ching / DNLN = 13	/ DNLN	/ DNLN = 13					
	걸	DCP11	DEPTH INVERT	VEL	<u>:</u>	1 WID COVER	COVER	OFF
ONSTRH UPSTRH	80.13 80.73	57.6 57.6	20.02 20.03 135	1.74	80.19 80.81	6.48 19.29	. E.	0.16
Un advisory arrest (acc) Kunoff conditional Times of conditional Hilber Line (min) Hilber Line (min) Omnidation (acf) On a Ch + t (acf) On	Unafrays and (ac) Ranoff coefficient Time of coefficient Hilber Lime (min) Midre Lime (min) Oundaring (ac/n) of an of (af)  The coefficient of a filter of a filtr of a filter of a filtr o			Shops of the state	Slope of most L (2) Slope of most dept (in) Bulling depth (in) Bulling strong electronic literations in inchange (wkfi kloned q (vfs) one especially (vfs) the strong (fl./fl.) Gulba stope (fl./fl.) Pontfing width (fl.)	Slope of inval. (2) Stope groupy grade line (2) Stiliest depath (in) Behard ground elev. (11) Refriction of crisp (R) Inc. squastity (R) Inc. tangle (R)	ê <sub>3</sub>	6.11 to 6.1038 6.1038 86.05 0.40 0.19 24.11 0.00 0.00 0.0000
			:			5.22 3.22	F.C .	3.22

LING 15 / Q = 0.00 / HT = 12 / WID = 12 / N = 013 / L = 11 00 / HC = 7

LINE 15 / Q = 0.07 / HT = 12 / WID = 12 / N = .013 / L = 11.28 / JLC = .3 GIGBHG1/45GBEND / DNLN = 14

	<u>ದ</u>	prrm	DEP'111 THYE'R	VI.I.	Ë	T WID COVER	COVER	OREA
DNSTRH	112.03	5.36	3.36 82.55	0′.0	37, 33	55.5		51
UPSTRH	43.00	1.33	1467.23	<u>:</u>	Ξ.	13° 13	11/0	0.0
Jeannege	Draimege area (ac)	_	10.1	314	Slept of invert (2)	(3)		Hallet A
tunof1 e	Runoff conficient.		0.00	: Popp	Alvi-dis	Chops are a contracting the contractions	2 (2)	0,000
Time of	Time of core (ain)		150	CAST	Critical duli City	(10)		
Inles, Lie	Inlet Lime (min)		11, 00	R. Ilin.	d offering	Batha d around eleg. (11)	. (11	0
Internit	Intervity Cin/In)	=	00.0	1) 1 1.1	To HI to Albert	Upe lacean correlations (11)		
Chinal Alive Offi	Vet UPD	=	0.40		Ochli Lional D cele )	-		
1 0.0 . 0	(He) 1 1 (He) 0	=	1.11	1	Little capacity (cft.)	(cde)	٠	٠ ٠ ٠
		•						
) entelm	0 entitlement (c.t.)	=	9:19	Intest.	lutet, tength (11,)	(11)		00.00
Mane &	Q carryoned (cfs)	ε	11117	1.11.1.	(11/11) - tope (11/11)	(11/11)	'	00000
- 14-hi	० अनुनेताल्य (अड)		00-0	1000	(11/11) relate compa	(11/11)		0.0000
Jankie (	d lighterard (eds.)	=	0.00	Position	Position width (TE)	(IF)	;	N/O

LINE 16 / G = 0.07 / HT = 12 / WID = 12 / N = .013 / L = 66.14 / JLC = 1 45d@HD/GIQHES / DR.N = 15

VCL COL THID O	55.75 1.55 35.45 1.56 87.8 5.75 1.75 35.75 35.00	Clops of insert (2)   5,5272     Clops of insert (2)   5,5177     Critical Graft (in)   1,53     Grift of ground dow, (11)   89,35     Grift of ground dow, (11)   89,35     Grift of the construction of (15)   0,09     Critical of (15)   0,09     Critical of (15)   0,09     Critical bright (11)   0,000     Critical bright (11)   0,000     Critical down (11/11)   0,0000     Critical down (11/111)   0,0000     Critical down (11/111)   0,0000     Critical down (11/1111
5		Business most (562) 0,000 [Billiot Lored Ficient, 0,300 [Filler of cure emitry 0,000 [Filler of cure em

HYDRAULIC REPORT FOR

NAPILIHAU VILLAGES PH-I

DRAINAGE SYSTEM 3

TO PERFORATED DRAIN

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs

Rainfall file: SAMPLE

LINE 1 / 0 = 4.65 / Hf = 24 / NHD = 24 / N = .017 / L = 11.66 / JLC = .8

OUTLET/PODIEE / Outfall

DOLLETY	DOLLET/2001EE / DUCTALL	TIELEN						
	걸	DEPTIL	DEPTH INVERT	VEL	Ľď,	T WID	COVER	NREA
DNSTRH UPSTRH	77.52	1.01	71.98 74.50	15.15 13.15	75.00 77.54	18.03 13.03	8.75 6.1	0.35
Drainer	Draitent (46)		00.0	Slegs	Sleggy of appealt (2)	(::)		71,78.23
Runotf	Runotf .orfficient		0.00	Slors	Stolye overny grade Line (%) -21,7038	muck Lin	(3)	-21,723
Tine of	Time of core (min)		20.0	121.00	Chitecal challi (in)	(iii)		2.16
Intert ti	Irilort, Limes (mine)	ı	(1)	Hathu .	Rathuad quound edey, (11.)	1 (2)(2)	(11)	33.62
Interesit	Interest by Cin/ln )	ı	00.0	th dh	Up diesmenticherer (ft.)	narop (f	7	00.00
amalative Can	. C.D.		0.041	יו ווויט	Achiliann Q (cfs)	(e) v)		00.00
0 = Ch 1	( J )   t V = b		00.4	Lan	Lare capacity (efs.)	(efs)		::0.73
o celedin	D catchine art. (cfc.)	: : :	(91)	HILY.	ուն-գ. հեզոն (11.)	(11)	:	- 0.00
O caury	G Guryowr (Cla)		0.00	131117	CHEST CLOSES (TLATE)	(11/11)		0000°0 2
G captur	Gentland (eff.)		00.00	12.00	2008 Auge (11/11)	(11/11)		THOOP .
a byre-	a bypressi (cl.)	=	19 (31)	Pendu	Penching wiellh (11.)	(11)		E/O
Rnt: R	Rote: Bornett Optice med	वात रक्षत्र मा	7					

| a bysecal (cf.) | 0 00 | Forelite will (TL) | R/ | Robert Holmed + Publicationsed | Cline 2 / a = 0.93 / HI = 12 / WID = 12 / N = .013 / L = 18 / 3LC = 1 | 90dfec/Gichill / DNLN = 1

	ઇ	DEPTH	DEPTH INVERT	VEL	4	U WID	T WID COVER	NREN
DNSTRM	77,00	00.31	14.50	1.13	20.77	0.00	1.1	0.79
UPSTRH	17.55	4,21	77.12	::0::	11.4.3	11.30)	4.07	0.30
Dr.diter	Ordinape area (ac)		00.0	Hope	Glope at any rt (E)	·L (".")		. [4,4445
Panel C	lanoff card ficially		5 50	: dol:	· Alv.Lak	Stopy operally appeals Time (2.) * 3,6273.	(1)	3.6711
I m	Time of cores (min)		11 11	i l.i	Critical depth (in)	1 (111)		16.1
Inlest, Li	Inder Lime (min)		11,11,11	il.dun.	H cll style	il.dun.el anound olev. (11.)	. (11	82.20
Inbara	Inbaraty (m/lu)		1911	Upr.Li	THE THE	Opediesme emelicarie (11)	•	00.00
Cemental, d.j.vi . C30	V (30)		0,130	ne Hi L	fielificated (f. cets)	(*1)		11.34
0.1	(H) 1: U. 6			. <u>.</u>	The expension (e.f.s.)	(··[··)	•	13.55
	:			•		:		:
a cetalin	q cetalimant (c15)		(111)	Talet.	falet brigh (11)	(11)	١,	00.00
Wing D	Catalyover (eds.)		1). 11(1	124Lbg	Outby stops (11/11)	(11/10)	•	0.0000
O carlin	0 equipmed (c.f.)		0.00	G100.65	Chess alope (TL/TD)	(11/11)	•	0.0000
G byyar	(into) provide 6		0.00	Pendi	Ponding wirth (1E)	(1E)	•	2/2

LINE 3 / Q = 0.59 / HT = 12 / WID = 12 / N = .013 / L = 11 / JLC = .8 GIC3#11/70cDEND / DNLN = 2

: : :

	렃	DEPTH	DEPTIL INVERT	VEL	Ö	T WID	COVER	OREA
DNSTRM UPSTRM	77.68	5.72	77.15	1.52	77.70	8.95 11.29	4.07 i4/0	0.45
Prainace turoff c	Drainage area (ac) - Ruioff coefficient.	٠	0.00	910 910 910 910 910 910 910 910 910 910	Stope of invert (5)	Steps of invest (5) - 0.7272 Slope arengy grade line (2) - 0.1236	· (3) 4	0.7272
Inbet Lime (mir Intersity (in/l Omulative Cin	Indea the (min) Indeasity (in/h) Omulative Ca	, ,	9 8 5 6		ta tricat equil (10) Batural grand elev- Upatrosm surdauge ( pkHtionett o (els)	California offen (101) Bathwal ground elev. (11) Upstroem surcheuse (ft.) Aktitional O (els.)		0000
Central Central	Q extellment (cls.) Q extryment (cls.) Q explanel (cls.)		8888	Indet, Ontro	Inlet terrall (ft) Anter slove (ft/ft) from: slove (ft/ft)			000070

LINE 4 / Q = 0.59 / HI = 12 / WID = 12 / N = .013 / L = 63 / JLC = 1

	Η̈́	DEPTH	DEPTH INVERT	VCL	EG.	T WID	COVER	UREA
DNSTRM UPSTRH	77.71 77.80	6. In	5.77 17.73	1.47	11.14 17.34	8 % U.33	Win I	= -
Oradiner	Drainey - mess (183)		00.0	. Health	Stope of Hwart (%)	(1.)		F1./0 B
Randli	Rated Cost to and		=======================================	: Alol ::	ALCHIE!	(") -diel star D star are - store	(::)	7.3,1.0
Time of	Time of cone (man)		0.00	11111	Collect Collicin)	(ui)	•	14
Intest, ti	Intest, Lime (men)	٤	16,1911	Reful.	al spour	Refunction on our et eleve (TL)	(11)	79.75
Interest	Interesty conduction	:	[11]	the dr	Lean enter	Openioran curchagogo (TL)		9.60
Church day 1110	V: 1:10	2	190 0	11111	646 Lichell O (ef.)	(*.[.*)		0.55
	Carring C	=	<b>.</b>	-	time especity (cls.)	(-12)	•	93.1
Q ceta.hii	ी द्यकितील वर्ष (५.१८)		00.0	1010-1	Intert Territor (FE)	(FE)		. 00.0
CHINE	G CHIYMME (CDS)		130 13	1.11.15:1	Gitter clops (1L/IL)	(11/11)		0.0000
o custan	0 captured (effs)		11111	3.00	Cross stops (TL/IL)	11/11)	•	0,000
O byter	O byjecant (cde)	=	E	Pondi	Pougline wiells (ft)	(1t)		N/N

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promption of the second of the

## LINE 5 / Q = 3.72 / HT = 24 / WID = 24 / N = .017 / L = 18 / JLC = 1.8

	현	DEPTH	DEPTH INVERT	VEL	EG	T WID	COVER	AREN
DNSTRM UPSTRH	77.00	24.00 8.17	74.50 /11.50	1.13	77.02	0.00	6.1	3.14 0.25
Orain 92 area (ac)	31. 15 July		0.00	31012	Slope of invert (%)	(::) 1	¥ 1	21.2222
Runoff evelficient =	efficies	•	00.0	Store	Abger	rade 111	Store (2) 'and chack the cross store	27.54
Time of cone (min)	ज्ञाहः (भ्राप्त				ामाध्या क्ष्मित (गा)	(==)		13.17
Inlet Lime (min)	er (min)		0.00	Huham	al egrange	Habital around elev. (11)		F
Interest by (10/liv)	ל (זמ/ווו.		0.03	143, 143	Sum seller	the tressure streets by (11)		0.0
Omitative Cin	0.0		0.00	10 th 11 1.	additional o (cf.)	(cl.)	۱.	2.0
0 = Ch + 1 (aft.)	(-3fc-)		00.0	1.015	Line capacity (cfs.)	(c[s])		3.4
		:	:				. '	
o catalinear (cds)	art (eft		0.0	(E)ot	(n) of bardfu (11)	(11:)	,	0.00
O carryover (cfs)	ar Colv	ı	0.00	Calife	DILLER STOPE (FL/FL)	(+t/ft)	<b>+:</b>	. 0.0000
Continued (eff)	(c.(c.)	<u>-</u>	0.00	Cross	Cross stops (ft/ft)	rt/[1.)	•	0.0000
(cls) bearing (cls)	(CIS)	,	0.00	Pendi	Pending width (ft)	(11°)	41	×
•				į			68 = 2.89	2.89

## LINE 6 / Q = 3.26 / HT = 24 / WID = 24 / N = .017 / L = 58.18 / JLC = .8 GICD#H1/90dTEE / DNLN = 5

	호	OEPTH INVERT	INVERT	VEL	r G	T WID	COVER	NREN
DNSTRM UPSTRM	79.45	15.57 78.54	711.54	1.31	79.50 89.20	17.21 22.38	, H/A	1.00
Drattheys area ( Runoff coefficial Time of cone (m Intel, time (min Intel, time (in/h) Chmulative (in/h) Q = CA + I (all	Draunets area (ac) Runoff coefficient: Time of cours (min) Inder, time (min) Constraint (in/hn) Committive (3n) q = (2n + 1 (ac))		0,00 0,00 0,00 0,01 0,00 0,00	Stops Stops Child Child Refer Refer Child	slope of awer I. (3) Slope energy drafe I Gritacal depth (in) Rathral ground elev- lip libean en force ( militional 9 (efs.) time capacaty (efs.)	Slope of invert (5) Slope energy grads line ( Gritical depth (in) Rithral ground else. (10) Myllichan quarte (fb) Aktional Q (cfs) Cine sapasty (cfs)	£	1.7133 1.1242 7.67 0.00 0.00 0.00
o catchin o carryn o carryn o bypred	a catchment (cfc) : a carryover (cfc) a captured (cfc) a bypresed (cfc)		00.00 00.00 00.00 00.00	Inbet Ontbet Orosse Fondi	Inter, terruli (11.) Galler : tope (ff/11.) Gres, stope (11/11.) Fondirer width (11.)	(11) (11/10) (11/10) (110)	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0.00 0.0000 0.0000

## LINE 7 / Q + 0.50 / 11 = 18 / WID = 18 / N = .013 / L = 11 / 3LC = 1.3

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		1000	TOUR	100	Č	T 121	COVER	OREO
	4	111	DEPTH INVERS	1	j			
HOLONO	20 17	9 79		0.51	30,16	13.27	N/N	0.28
UPSTRH	30.15	7.70	15 6/	0.00	:10.17	17.81	2.27	0.72
5 (545) 15 (8) (500) 5	(14.5) (14.1)		(0.19)	Slops	Slaps of siwert (2)	rt. (3.)		1.5455
Runoff carefficient.	of licinit		00.00	(1) Of (1)	Shores	circide 130	Hope energy quade line (%) =-0.0037	0.0037
Time of C	Lime of Cases (min)	•		i, i	Britiscal depth (in)	1 (in)	• •	42.24
Inlet time (min)	·· (mjn.)		0.00	Ratur	of cfroun	Ratural cround olev. (ft)	•	13.23
Interest ty (m/lin)	( on/lin)	=	0.00	Uprile	A HES MINE	Openioral curdings (ft)	7	0.0
Cammilative Cto	0.0	0	0.00	Oct li 1.	rickli tioned (a (etc.)	(cta)	1	0.20
(c-j-c) 1 + U; - b	(:J:) 1	G :	00.0	Line	Line capacity (cfs)	(c/5)		13.05
O catchmark (eds.)	art (eds.)		00.0	11111	Integt Length (11)	(TE)	l.	0.00
O cours manual (cfc)	(-1-)		0, tie	Carthe	(it/ft) stops (ft/ft)	(11/11)	Þ	= 0.0000
a cardinal (cfs.)	4 (cfs.)		0.00	Cross	Cross stope (11/ft)	11/Tt)	11	- 0.0000
(Paperson (Paperson )	4 (cfc)	:	0.00	Pondi	Ponding width (ft)	( ft.)	1.	٤

### CINE 8 / Q = 0.30 / HT = 12 / WID = 12 / N = .013 / L = 68.35 / JLC = 1 GICHIJ/GICBHJZ / DNLN = 7

	<u>ק</u>	DEPTH INVERT	INVERT	VEL	EQ.	T WID COVER	COVER	NREN
DNSTRM UPSTRM	30, Kg 30, St	7.82 7.7.	18,70	97.0	30.17	9,69 2,77	17:5	0,13
Ordinate and (Runoff coefficial Time of cone to intertains (min intertains (min intertains)	Draftage area (act)  Rainoff coofficient  Time of cone (min) interactly (indu) Constantive cro q e cro at (act) q catchwart (act)		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	Stopy	stope of inval (%)  Stope of enval (%)  Grider depth (in)  Brineal quand clev. (fb)  Upstream inclures (fb)  Additional Q (cfs)  Line capacity (cfs)  Inter bandh (fb)  dutter stope (ft/fb)  dross stope (ft/fb)	L (C) June Direction 1 (C) L (	(a) :	1,000% 0,632% 0,00 0,00 0,00 0,00 0,00 0,00 0,00 0,
					:		. 0.	

LINE 9 / 0 = 2.76 / HT = 24 / WID = 24 / N = .017 / L = 15.32 / JLC = 1.3 90dTEE/GIGSUHZ / DNLN = 6

	į		DEJ'TH INVERT	VE.L	럳	1 ₩10	COVER	NRED
DNSTRM UPSTRM	30,16 30,19	9.79	05.67	2.20 5.38	#0.24 #0.59	21.07	8,7n	1.20
Trainer K.	Ordinger area (as)		0.00	Stope	Steps of from L (2)	(::) 1		1.6331
	Manoral Constitutions		0.00	<del>1</del> :	Abdida	Slope energy death line (2) = 0.9788	- (::) -1	0.9788
niet, tin	Inlet time (min)		0.00			r (in)	•	7.06
nbardi.	Interest ty (in/In)		น.อา	U. C. Live	The state	Production of the contraction (15)		16.63 0.00
		= :	= : = :	(r kli t.	(ekli timed (teta)	(*Ita)		10.0
3		= :	06.70		Lone sepacity (see)	(s.fs)	•	3
Collection	9 enterment (cfs.)	2	0.00		Intert Perketti (TE)		• • • •	
0 = 1 y = 1	Contyna (efe.)	٥	0.00	Carl. to a	Giller Cloby (FL/FL)	(1/11)	•	0.0000
r Irriches		<b>:</b>	G. :	Great.	Proces stops (ft/ft)	ft/ft)	٠,	0000 0
* 14/60	Calcal Innantion	5	0.0	l'ordin	Pondina width (TL)	<u> </u>	·	≥

LINE 10 / 0 = 1.85 / III = 24 / WIB = 24 / N = .017 / L = 89.64 / JLC = 1.3
GIGSHI12/GIGDHI3 / DNLN = 9

	T WID COVER AREA	15.42 4.31 1.27 20.15 3.88 0.50	7:21-7: (2.	ine (2.)		ı	(Tt)	**	
	E01. 1	EST-1187	(%) The Authority (%)	י לוי זי נוץ יולית	(u) मार्चन क्रिया (u)	Reduced egrowed edes, (TE)	Mystresm constructs (14)	nellitional q (eff.)	I the expacitly (cas)
	VEL	1, 46 81 3	Slop.	Slope	90.00	75.114H-51	Upvelve	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	I the expansity (ca
DNLN :: 9	DEPTH INVERT	10, 16 72, 60 5, 73 82, 40	1.		ı	0.00		5.5	0,.0
or country of cutting / DNCN = 9	FIG.	50, 45 10, 88	Draftiere area (ac)	Remoil Competitional		Intertaction (Berl)	Country (Injur)		4 (41 t ) (4.15.)
CI CIENTEZ		DNSTRH UPSTRH	Drainer	Timol I					

FB 5.20

LINE 11 / G :: 0.18 / HT = 12 / WID :: 12 / N = .01 / L = 82.07 / JLC = 1 GICD#H3/GICD#K1 / DNLN = 10

	OREO	0.57	6.7016 6.2163 7.16 70.90 0.00 0.00 7.000 7.0000 7.0000 7.0000 7.0000 7.0000 7.0000	
	COVER	4.5g	(2) TO (2) TO (3) TO (4) TO (4	
	T WID	26.4 26.4	rt (%) reade lin r (in) floater, (fr) (cfs) (ff) floater, (fr) (ff)	
	EG	83.09 81.19	3199   of invort (%)   -6.7016     31932   energy grade line (%)   -6.2163     3115   drilled dryth (in)   -2.16     41417   dryth (in)   -2.16     41417   dryth (in)   -0.30     41417   dryth (in)   -0.30     51617   dryth (in)   -0.30     51617   dryth (in)   -0.000     51617   dry	
	VEL	1.51	Steps Stops Still Hatur Hatur Hatur Medit Line Line Couts Guttes Cross	
2	DEPTH INVERT	82.48 87.30		
	DEPTH	8-72 2-16		
TO THE TOTAL TOTAL	ΗĊ	8.5, 02) 382, 1.5	rainage most (action of the control	
		DNSTRH UPSTRH	Draince age (ac) Runoff coefficient Time of cone (uin) Indet time (unn) Indet time (unn) Omnitative cen 0 = CA * 1 (afa) 0 catchment (efa)	

LINE 12 / G = 1.00 / HI = 18 / WID = 18 / N = .014 / L = 64.97 / JLC = 1.3

GICB##13/G	GIORNIIS/GICERNIA / DNLN = 10	DNLN =	10					
	ള	DEPTH	DEPTH INVERT	VEL.	덩	T WID	COVER	AREA
DNSTRH UPSTRH	88,09 88,43	#.39 4.14	821.40 851.05	1.27	85.13 83.16	12,17	£ 2	0.79
Drafinus and the Ruroff could find I fine of cour (min) Interest to (min) Interest to (min) Interest to (min) Interest to (min) Interest (min	Drainwe area (ar)  Ruroff cont (min)  Intel Line (min)  Intels to (nyln)  Outhlative (to  Outhlative (to)  Outhlative (to)	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Stopes Stopes Stopes States Continue of the stopes	Steps of invert (%) Steps gierry chack line (%) Critical deput (in) British deput (in) British aurebarge (†) Additional Q (cfs) I the capacity (cfs) Inter chaute (f.) Catter slope (ft/ft) States slope (ft/ft) Conding width (ft.)	1 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1		0.000 0.000 0.00 0.00 0.00 0.00 0.00 0
		:					FB 3	FB = 6.41

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LINE 13 / 0 = 0.10 / HT = 12 / WID = 12 / N = .01 / L = 37.01 / JLC = .3

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	텇	DEPTH	DEPTH INVERT	VEL	Ęģ	T WID COVER	COVER	AREA
DNSTRH UPSTRH	85.59 85.06	6.5	85.05 84.95	0.23	83.59 85.10	8.114 8.18	5.24 N/0	0.44
			00 10	3	Clow of invert (7)	CE (EE)	٠.	5.0797
	Control of the contro		90.0	i de la	SOLITON.	Slove energy crude line (%) = 4.0801	# (E) 22	4.0801
Y Simes and	Vision of court (man)		17.0	0.11.	Critical depth (in)	i (in)		1.61
120,000	Teller time (min)		000	Ratific	al caous	Ratural ground elev. (11)	. (11)	00.00
	Interest to (in/lin)	;	00.0	11/1/11	sum sarred	Dystream surchage (11)	1,	00.0
	Comment of State (35)	1:	00.0	O. F. I.	acklinional a (ets.)	(cits)		00.00
0.00	0 = (0 + 1 (c)(3)		0.00	- <u>i</u>	Une capital by (eds.)	(sj.e)	•	10.43
•		,					:	
a feet to a	( 10) transmitten		0.00	111111	1111-4, barella (11.)	(11)	1.	0.00
מינונים מ	Color and		5	CHILD	GILLS Slope (ft/ft)	(ft/ft)	14	- 0.0000
	Color power (City)		90 0	C1.038	Cross slope (ft/ft)	(1/11)	1:	000000 =
	o breverse of (cfs)		0.00	Poncli	Pending width (ft)	(ft)	l.	N/N

## LINE 14 / 0 = 0.10 / HT = 12 / WID = 12 / N = .01 / L = 79.83 / JLC = 1 45cdeh0/GICBHHS / DNLN = 13

	the state of the s	i	1					
	HG	DEPTH	DEPTH INVERT	VEL	EQ.	T WID	COVER	OREA
DNSTRH UPSTRH	กร.บก กร.17	1.75	84.93 89.00	1.41 1.13	1.41 R5.11 1.49 R5.21	2.4 2.5	12,25	0.07
Drainane	Designate area (ac)		0.00	Stols	Stops of invert (%)	(3) 1		5, 0283
Bundfe	Burnett cool ficient		0.00	Slope	Stope energy grade time (%) # 5,0943	grade til	# (E) 설	1,0043
Time of	Time of cone (min) -		0.00	11.7	ditasid diplication		,	1.4.1
ונינטן	Inlest time (min)		0.00	1111111	al enough		(11.)	72.75
Interesi	Interesity (in/la)		0.00	Up · La	Upsterson constanted (18)	Distriction (1		00.0
Charlettive Cto	رن . در در د		1.60	OCH II E.	त्यां धंकान प (दिन्)	(연단)	1-	0.10
. c.	(*45°)   (*15°)		0.00	<u>.</u>	Lime express by (els.)	(cl:)	• !	10.45
1			• • •	. :			· ·	90.0
e catalia	g catalinant (els)	,	00.		Call tables assets			
N 1.11.2 C	(cits) wower (cfs.)		11.00	3115	anter adope (TL/LE)	(+11/117)	•	00000
n captra	(efections)		0.00	50 O	Gos stope (HL/ft)	11/11)		0.000.0
o byer	a byse and (effe.)		0.01	Perr	Perpiling width (FE)	(1:1)	•	U/N
							- 82	FB - 3.08

## HYDRAULIC REPORT FOR

NAPILIHAU VILLAGES PH-1

DRAINAGE SYSTEM 4

TO RETENTION BASIN

STORM SEWER DESIGN / ANALYSIS

Run Date: 07-12-1995 File: a:SRA4.ST3	
Return Period = 10 Yrs Rainfoll file: SAMPLE	

LINE 1 / Q = 3.71 / HI = 36 / WID = 36 / N = .019 / L = 43.53 / JLC = .3		OUTLET/45cBEND / OUTfall
<u>`</u>	-	
"	į	_
Ξ		[5]
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5.7	İ	`
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<u>ب</u>	į	1
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	ם	DEPTH	DEPTH INVERT	VEL	EG	T WID	T WID COVER	AREA
DNSTRM	72.70	5.46	5.46 72.25	5.49	75.17	25.82	4.75	0.63
UPSTRH	74.04	5.46	65 27	5.49	1, 42 74.51		N/V	0.63
Orainor	Orașinarea (aus)		0,00	· 61:	(%) The of the story	(3)		3,0705
Rursoff	Runoff confficient	6	0.00	Slop.	Crieraly o	Slope opergy grade Line (%) = 3.0703	= (3) =	2.0702
Times of	Time of conc. (min.)		07.1	Ciri Lia	Critical Oppili (in)	(iii)	:•	7.37
Inlet ti	Inlet time (min)		0.00	H. clair.	d chount	Hetaned quound often, (FL)	(FE)	0,0
Interit	(m/h) (in/h)	Ξ	00.0	Ux.ti	County and	dixtres in currences (11)		00.0
CLIMITALIAN CTO	V- C10	=	0.00	Ockli L	acklinional a (ets)	(*);	'	00.0
ណ្ឌ ព្រះ ព្រះ	0 0 1 1 (cfs.)	٠.	0.00	Line	Line equally (efs)	(sis)	•	50.03
a cuch	Q cutchment (cfs)			IIII-L	Inter Tenedia (TL)	(11)	· · · · · · · · · · · · · · · · · · ·	(((),0)
C CITYO	( Carryova (cfs.)	:	0.01	21.15	ताका अक्ट (म्यूम)	(11/11)	''	- 0.0000
Q cyntan	a captured (cfs)	-	0.00	C. 1177.	G1025 (11,/11.)	11,711.)	:.	0.0000
O Logses	a legistrati (cf.)	:.	0.00	1.046	Possiling wields (41)	(11)	••	υ/N
Hot.: No	Rober Normel Olylli cerminal	11 . C . I III	7.1					
:		:		!		:	:	1

## LINE 2 / G = 3.71 / HT = 36 / WID = 36 / N = .019 / L = 15.78 / JLC = 1.8 45d7eND/DMHMA1 / DMLN = 1

	ם	JEPTI	DEPTH INVERT	VEL	r d	T WID	T WID COVER	AREA
DNSTRM UPSTRH	74.04	÷ ;	5.46 75.57 5.46 74.07		5.42 74.54 5.19 74.22	8 K	11/0 5.23	0.68
Drainer	Drainege and (58)		0.03	Stole	Slope of near L (2)	rt (::)	1.	3,0418
Famout C	famous coefficient		0.00	31018	AL LOLD	Slope energy quade time (2)	(2)	3,0418
Time of	Time of same (min) "	:	1.5.1	Ci i Li	Bulical dolla (in)	n Cin)	•	7.37
Inlost ti	Inlet time (min)		00.11	Retur	uno.ab po	Retained eround edge, (11)	(11)	80,30
Intervil	Interview (m/la)		00.0	Upsettr	3.1113 IIIA	Upotreven turcharge (Tt)		00.00
Omilative Cto	V- Ctn		0.00	0.1.1i t.	Athlitional a (cis)	(লঙ)	••	0,00
+ v.u . o	(slb) 1 + V3 - B		00.0	- ins	। तार द्याप्रस्टां (इडि)	(cls)	:	79.59
O catch	D catchwark (cls.)		00.0	Infer	Intel tength (ft.)	(ft.)	:	00.00
מאַ זונט מ	(cits) revoy (cits)	:	0.00	Contro	CALLEY STOPY (TL/TL)	(11/11)	1.	0.0000 =
O captur	0 captured (cf.)		00.0	2.6.73	Correlpte (11/11)	11/11.)	"	0000.0 =
G byter:	a hyper and (c.fr.)		110 11	Poleli	Populity wirth (11.)	(11)		19/U
Note: ik	Rober Bornell Oppiliary	7	lt all				2	54 . 4.83
			:					

**8**-1

### LINE 3 / Q = 1.13 / HT = 12 / WID = 12 / N = .01 / L = 33 / JLC = 1 DMH#A1/GICGBA1 / DMLN = 2

	Η̈́	DEPTII	DEPTH INVERT	VEL	EG.	T WID	COVER	UREA
ONSTRH UPSTRH	75.31	17.00 11.83	74.07	1.44	75.40 75.45	0.00	5.23	0.79 0.78
Drainage	Drafteige area (ac) -		0.00	Stope	Slope of liwert (%)	(E)		0.000.1
Runoff c Time of	Runoff coefficient Time of conc (min)	11 •	0.00	53 ope	Slope energy drade l Critical dapth (in)	Slope erengy drade line (%) * 0.1519 Oritical daub (in)	E	- 0.1517 - 5.41
inlost ti	(nlet time (min)	"	. 00.0	W. charry	אן יוו טרווע	Bulinal oround elev. (41.)	(11)	= 80.17
Integral	Integrate (in/ln)	- -	0.00	Upratin	Date: mx	Upotrosm carcharge (Ft)	3	- 0.02
Committel Nove Cth	U1.3 . W		G. D.I.	ı Eli t	mikli Lioned at (cds)	(efs)		. 1.13
ម ខេម	a + cm + 1 (eds.)		0.00	1 inc.	। सिर्वे दक्षातापुर (द्वांड)	(829)		4.63
o citable	q cutchinant (+ fs.)	!	0.00	terle-t.	helest legalli (IL)	(11)		00"0
0 Ch 1 VC	(cla) twover (cf.)	,	0.00	0311.153	Carther (ft/ft)	(ft/ft)		. 0.0000
G caustin	a captined (e.f.s.)		0.00	Crown	Grees adopt (11/11)	(1/LT)		- 0.000
a byse	a bypercard (cdc)		0.00	1'ordi	Ponding Width (FL)	(LF)		: P./n
:						V.	69	56% = 83

## LINE 4 / Q = 2.15 / HI = 36 / WID = 36 / N = .019 / L = 60.55 / 3LC = .8 DHHIN1/FABCOH / DNLN = 2

	힏	DEPTII	DEPTII INVERT	VEL	EG.	T WID	COVER	S.	חששט
DNSTRH UPSTRH	7657	15.5g	15,580 74,07 5,61 75,38	37.0	75.43	23.68 76.11	3.23 N/0	-l d	0.73
Dromage servet ( Runolf coefficial Lines of coefficial Intel Line (mit Intersity (m/V Committee CO	Orionage surve (ac) Ruioff coofficient Time of cour (min) Intel. Line (min) Intel. Line (min) Constitution (min) Constitution (min)		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Stole Sto Stole Stole Stole Stole Stole Stole Stole Stole Stole Stole St	slope of invert. (3) slope energy grape to a risegy 64ph (in) betain ground elev- therrown surfaces (betained to (cfs) right energy (cfs)	Slope of invert. (2) Slope equivy quade line (2) = 1.3483 of the ground ellips. (1) = 5.61 Bethind ground elev. (11) = 0.00 in the ground elev. (12) = 0.00 in the ground elev. (13) = 0.00 in the ground of (25) = 0.00 in the ground of (25) = 72.06	is (%)	1,248.4 1,348.4 1,00 0,00 0,00 0,00 0,00	5.61 5.61 0.00 0.00 0.00
catchina canton capture byxes	a catchinate (afs) q carrywore (afs) a captinate (afs) a byxesore (abs)		50.0 60.0 60.0 60.0 60.0 60.0 60.0	Hitter Control	Intel, teagh (ft) Outles slope (ft/ft) Cross slope (ft/ft) Pending willh (ft)	TED CTC/TED TC/TED CTCD		0.00 0.00 0.00 0.00 0.00 0.00 0.00	0.00 0000 0000 0/A

### -. i d

### LINE 5 / Q = 0.36 / HT = 12 / HID = 12 / N = .01 / L = 20.71 / 3LC = 1 FABCON/CDHAZ / DNLN = 4

	덫	DEPTH	DEPTH INVERT	VEL	Ľď	T WID	COVER	NREA
DNSTRH UPSTRH	76. 16 76. 18	7.40	72.75	0.76	71.77	7.17	H/A 1.69	0.45 0.25
Dr.vin.eq	Drain we area (ac)		0.00	Stoops	Stone of invest (2)	(3) 1.		0.10
Ranoff	Runoff coefficient -	-	0.00	500	AULIAN	State of a (a) and state of the color of the	E ( : ) E	6161
Time of	Time of care: (min.)		0.00	17.1	Chiliad chall (in)	(iii)	1	77/
Inlet t	Inlet Line (min)		0.00	N. TELLI	d en ounce	Nathurd Cround cleve (41)	11)	21.0
Interesi	Interest by (in/hr)		0.00	17.45	Sub-Sare	Urdasa archarca (F)		
Camillative Cth	IVE CTD		0.00	OCHIE	achitronal a (efs.)		; ;	
5	( · · · )		0.00	-	tuer cope ity (c.f.)	( · · · ·		
:								
o estata	o edidment (etc.)	-	0.00	11111-1	litter Pengilli (ft.)	r.	,,	_
P CALLY	a carryover (cls.)		0.00	CHLES	Outer slow (fl/ft)	ft/ft)	,	0000
<b>ロ</b> c中加	व व्यक्तामान्य (टाइ)	:	0.00	0.000	Green slope (fit/fit)	(1/1t)	1	0000
orkq o	(sign) persicky o	0	0.00	Porchi	Porching wields (ft)	(ft.)		N/0
							68 7 5.20	5.20

## LINE 6 / G = 1.79 / HT = 36 / WID = 36 / N = .019 / L = 54.71 / JLC = 1.3 FABCON/OHIWA2 / DNLH = 4

	10,	DCPTH	DEPTH INVERT	VEL	달	T WID	COVER	OREA
DNSTRH UPSTRH	76. 16 77.58	5.12	75.58	1.45	77.51 77.51	15.63	3.23	0.27
Drainage Buoff ex	Prainage actions (ac)		9.9	Slope	Slope of invart (S)	t (")	*	: 2.5041
Time of conc (mit	lime of cone (min)	1 4.	0.00	Salah Katura	aropar capataly drager J Strikest Chyth (in) Schutzil around atea	studen trend frack into (5) - 2,0599 on the trend of the control o		5.12
Intervity (in/hr Cumilative Cth D = th t 1 (cfs)	Intervity (in/lnc) Compative Cro		\$ <b>9</b> 8	יון כין סכונו ר	Octilion anchurga	helicem ancharge (II)	· ·	0.00
० ट्रमदीक	a catchwart (c.fs)	= : <del>=</del>	90.4		fulled, bandla (ff.)			72.21
9 cerryover (cfs.) 9 captired (cfs.)	9 curryover (cfs.) 9 captured (cfs.)		0.00	Chose	arthra dope (ft/ft) Green alone (11/ft)	(1/10)		00000
d byrecest (etc.)	st (els)	5	0.00	Countin	Comfine wield (ft.)	(:L)	•	11/0
		,	:	:			£8.	68 - 5.63

## LINE 7 / G = 1.79 / HT = 30 / WID = 30 / N = .010 / L = 100.41 / JLC = .8 DMH#n2/FnBCOH / DNLN = 6

	Ę	DCPTH	DEPTH INVERT	VEL	ដូ	T WID	COVER	OREA
ONSTRH UPSTRH	10.10	5.36	70.25 70.65	10.3	77.6L 30.24	14.67	. 7. N/N	0.20
Drainage	Drainage area (ac)		0.00	Sloce	Slove of inverte	(a)	•	7.007
Rurioff	Runoff exefficient		00.00	Slep	cheray	Slope energy grade line (%)		0,417.6
Time of	Time of core (min)		0.47	.TD	Critical explicit)	(in)		
Inlet 1	Inlet time (min)		0.00	Hutter.	d caroung	hittired ground elev. (11)	(11)	200
Intensi	Interest by (in/ln)		0.00	Uprith	Stan : UP.	Upotrosm rundances (ft)	``	00.0
Qumulative CFA	iv. CFA	;	0.00	Actd: 1.	Acklitional 9 (cfs)	င်း		00.0
נין י	0 = CD + 1 (cE)		0.00	ij	I in equacity (efs)	(cfc)	•	48.57
:								
	g catalment (c.b.)		0.00	1116.1	Intert Jeneth (ft)	(11)	•	00 0
O Carry	1 carryova (cfs)	٠ ٠	0.00	Culter	Cultur slope (fl/ft)	(1741)	,,	00000
a capitui	R captured (effs)		0.00	(3.033	Trans slow (TL/TL)	(1/11)		
Q byty ##	9 byseved (eff.)	:	00.0	Perclin	Pording width (ft)	(ft)	•	0/1

### LINE 8 / Q = 1.39 / HI = 12 / WID = 12 / N = .01 / L = 4.14 / JLC = 1 FORCON/CORRY / DAM = -7

	호	DEPTH	DEPTH INVERT	VEL	Ę	T WID	COVER	OREA
DNSTRH UPSTRH	180,193 180,693	6.71	59.62	5.08	80.35 80.30	8.28 12.00	N/0 2.47	0.45
Orainage near (ac) -	(592) 155-11		0.10	3]0[5	Slove of invert (*)	(3) +	i	-6,4,76,47
Runoff coefficient	efficient		0.00	01000	ATE COV	Ir acts Tir	Stote and on the state of the s	200
Time of c	Time of cone (ain)	1,	0.00	Critic	Oritical dentil (in)	Cin		00 7
Inlest, time (min)	· (min)	, ,	0.00	Hilm	Hating Ground oley, (TE)	l color		27 73
Inbergity (in/in)	(in/in)		0.00	1)[2,417.	Arthur sur deduction	1) (6).04	:	5
Committee Ctn	U.5	=	0.10	OCK II L.	Ockli Gorni (a (cls.)	CER		-
Q = 170 + 1 (cfs.)	(GE)		0.00	Line	Line capacity (efs)	(cls)	1"	34.33
Color of the second color	10 (offs)	:	90 0				-	
Color water Color		: :			(11) tribition (11)	()	<b>:</b> .	0.0
AOA - 117 - 1	(212)	-	0.00		Orther stops (FL/FL)	[]/[]	٠.	0.0000
प दक्षणामान्य (त्याः)	(::::) T	с	0.00	8000	Total Cloth	1/11)	٤.	2. 0.0000
0 bypresset (cfc.)	41 (c·f;.)	-	0.00	Portelir	Pending width (Ft.)	(TE)	;,	5/2

6.71 P. 6.5 0.49 80.21 14.19 H/A 2.54 31.07 2.00 81.54 16.65 4.19 8.0.00 310ps of unvert (%) 7.2 0.00 510ps errorgy grade line (%) 7.2 0.00 critical depth (in) 7.2 0.00 Gritical depth (in) 7.2 0.00 Unit that a stockness (ft) 7.2 0.00 hadren ground elev. (ft) 7.2 0.00 hadren ground elev. (ft) 7.3 0.00 hadren stockness (ft) 7.3 0.00 hadren stockness (ft) 7.3 0.00 hadren stockness (ft) 7.3 0.00 hadren stockness (ft/ft) t) 7.3 0.00 hadren stockness (ft/ft/ft/ft/ft/ft/ft/ft/ft/ft/ft/ft/ft/f	-ABCON/DI	FABCON/DHIMAS / DNLN = 7	NLN = 7	_					
2.54		ΗĞ	DEPTH	INVERT	VILL	ç	T WID	COVER	NREN
10.100 3 lope of invert (%)	ONSTRH	80.21 31.28	6.71 2.54		0. P	ED.21 81.54	11.19	N/A 1.19	0.30
2.00 310ps energy grade title (2, 7, 2, 1, 0, 12) aritical depth (in) = 2 oritical depth (in) = 2 oritical ground elev. (Ft.) = 87 origon (laborated ground elev. (Ft.) = 10 origon (laborated grade (laborated grade) = 1 origon (laborated grade) = 1 origon (laborated grade) = 1 origon (laborated grade) = 1 origon (laborated grade) = 1 origon (laborated grade) = 0.00 origon (laborated grade) = 0.00 origing width (ft.) = 0.00	· Cocaries of	M.) 1.51	1	017	COUNTY	OME TO	11 (3)	1.	- 2,6930
continent depth (in) = 2  continent ground elev. (bt.) = 32  continent ground elev. (bt.) = 33  continent ground elev. (bt.) = 33  continent ground elev. (bt.) = 43  continent ground (ele)  continent ground (ft.) = 60  continent group (ft./ft.) = 60  continent group group (ft./ft.) = 60  continent group group (ft./ft.) = 60  continent group group (ft./ft.) = 60  continent group g	Runoft o	mailicien		00.00	:dol:	+41-1 Cly	grade Bi	÷ (%) ë	2,1442
0.00 Upolical ground elev. (11) = 87 0.00 Upolican attributes (11) = 0 0.00 Octional D (eff.) = 0 0.00 Line expectly (eff.) = 0 0.00 Outbat Regili (fl.) = 0 0.00 Cutbat Regili (fl.) = 0 0.00	Time of	coric (min	;•	3.12	critic	ad dapt	11 (iii)	"	7.54
0.00 Openion a carcharge (ft) 0 0.00 Orditional a (ch:) 0 0.00 Line capacity (cfe) 40 0.00 Index troub (ft) 1 0 0.00 Cares slope (ft/ft) 0.00 0.00 Cares slope (ft/ft) 0.00	Inlet th	(EIII)	Į,	1,00	Hatura	חוסווט זו	delew.	- (11)	87.76
0.00 nekitional a (chi) 0 0 0.00 line capacity (cfe) 48 0.00 tudet tength (ft) c 0.00 capacity (cff.) 0.00 capacit	Interest	v (in/hr)	·	00.0	Urstr	Cum cattle	harage (F	T	00.0
0.00 tuber traph (cf.) 6.00 0.00 cross stope (ft/ft.) 7.0.0	Cameal att.	V- C*A		0.00	neklit	ional O	(:tb:)	•	00-0
0.00 tutot tragh (ft) : 0 0.00 Cutos stope (ft/ft) 0.00 0.00 Cuess stope (ft/ft) - 0.0	n - cn t	(313)	-	00.0	- in-	ya ica daca	(efc)	•	411.63
0.00 Oither App. (Ft/IL) 0.0 0.00 Cross stope (Ft/Ft) - 0.0 0.00 Ponding width (ft.)	o catalin	cent. (etc.)		. 60	i i i	Light of the second of the sec	. (1.1)	:	00.00
0.00 Gross stopy (FL/FL) = 0.0	O CHELON	Vor (cds.	1	00.0	Otto	lop	(11/11)	•	0.0000
0.00 Ponding width (ft.)	0 captur	स्य (दक्षि)	,	0.00	Ciross	) adops	rt/H.)	•	- 0.0000
	d bypara	(clo) po		00.0	Pondi	na width	ı (ft.)	I.	<u></u>

LINE 10 / Q = 0.40 / HT = 12 / WID = 12 / N = .01 / L = 22.27 / JLC = 1 DM:UN3/CRUNA / DMLN = 9

ER OREA	0.17	10   10   10   10   10   10   10   10
8	5.69	2 G G
T WID COVER	6.47	Slope of invart (\$) Slope of invart (\$) Slope every quade line (\$ Erithal depth (in) Bataral ground elev. (11) Urchresm en charry (11) Urchresm en charry (12) Interviewity (els) Line capacity (els) Line capacity (els) Line capacity (els) Cather elope (11/1) Gross elope (11/11) Gross elope (11/11)
Ę	81.45 85.71	Slope of invart (%) Slope of invariant drawing the Slope of the Slope of Sl
VEL	7.183	GO CONTRACTOR OF
DEPTH INVERT	2,54 at.07	
DEPTH	7.5	
10	RL.36 R.6.62	Draitiup strat (ad)  Namorf Cost train.  Time of Cost (ain)  Infer time (ain)  Infer time (ain)  Commistive (35)  Quantative (35)  Quantative (45)
	DNSTRH UPSTRH	Orained Runolf Time of Infet t Infet t Complet Q = CA Q =

/ mc = 1
*
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WID
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LINE

LINE 11 / 4 : 0:43 / 111 - 17 / 412 - 17 / 112 - 17 / 113		10 / 04	/ 77 -	77 - 71		, ,	,	
DHHIM1/COMM / DNLN = 2	1801 / DR	4LN = 2						
	된		DEPTH INVERT	VEL	ניטר	T WID	COVER	OREA
DNSTRH UPSTRH	75,37 76,31	17,00	74.07	9 5 7	1557	0.00	5.75 2.83	0.79
Brainings area (ac)	1) min		00.00	edote	Stope of invert (%)	rt (E)	100	-48,2500
Runoff coefficient Time of conc (min)	otticit one (mi		9 5. 6 5.	STOPS CLITT	Slope amergy grade Critical depth (in)	Slope andryy grade line (G) 534.0700 Gritisal dyph (in) - 3.34	. G G 원	3.34
Inlet Lim: (min)	m: (min)		0.00	Retrin	all cgrouns	Returnal eground elev. (ft)	(נני) ה	79.85
Intrasity (in/la) Omulative C40	V Circlis	٠.	8 6.8 8 7	Upstr od II t	Opstrova surcharge Odlitiond 9 (efs)	Upstram surcharge (16) nelitional 9 (efs)	: ,	0.40
( - 1 : ( - 1 : ( - 1 : )	(-J:-) I	:	0.00	Line	Line capacity (efs)	(cfs)	' !	50.16
Q cutchment (.f.)	nt (i.f.		0.00	1111-1	Intel beneath (ft.)	(11)	•	0.00
Q curryover (eff.)	1. (c:L:		00.0	Cutte	Outur clope (ft/ft)	(F1/11)	•	0000"0
<b>Q</b> ट्यानमा बर्च (जांक)	स्त (त्यांक)		0.00	Crosss	Cross slope (ft/ft)	(1/11)	•	- 0.0000
d bypeak (cfs)	(c(c)	r:	0.00	Pondi	Ponding width (ft)	(Ft)	••	ς V
							68	FB = 3.52

HYDRAULIC REPORT FOR

NAPILIMAU VILLAGES

PIIASE I

DRAINLINE ALONG

NAPILIHAU STREET

REVISED 12/18/95

(4.5' X 6' BOX CULVERT
AT THE OUTLET
INTO ALAELOA PROPERTY)

LINE 1 / Q = 89.70 / HT OUTLET/DMHP6 / Outfall	/ HT fall	= 54 / 9	WID = 72 /	2	.028 / L = 17 / //////////////////////////////////	17 / JLC	8 / L = 17 / JLC = .2 T.Knrca = 7.43;
HGL	DEPTII	INVERT	VEL	TOE	T WID	COVER	AREA
DNSTRH 46.76 UPSTRH 46.80	51.84 51.91	42.44	3.46	46.95	72.00	N/A 11.62	25.92 25.96
Drainage area (ac) Runoff coefficient	н	0.00	Slope	of invert	rt (%) grade line	= (%) =	00
	11: 11:	4.01	Critic		١,		2010
		0.00	Upstr	Upstream surcharge	3		
	1 11	0.00	Line	capacity (cfs	(cfs)	. 11	
catchment (cfs)	ı	0.00	Inlet	length	(ft)		١ ٩
carryover (cts)		90.0	Gutte	Gutter slope (It/It Cross slope (ft/ft)	(IT/IT) ft/ft)	n (1	0.0000
	0	0.00	Pondi	Ponding width	(ft)	"	N/A
DESTRIBLE 2 / Q = 78.39	) / HT	= 36 /	WID = 36	0. = N /	.013 / L =	58 /	JLC = .8
HGL	DEPTH	INVERT	VEL	TOT	T WID	COVER	AREA
DNSTRM 50.68 UPSTRM 51.55	28.59 28.59	48.30	13.02	53.32 54.19	29.11 29.11	7.29	6.02
Drainage area (ac) Runoff coefficient	" "	0.00	Slope	of inve	ert (%) grade li	line (%)	= 1.5000
		3.68	Criti	Critical depth (in)	(in)		33.42
Inter time (min) Intensity (in/hr) Cumulative C*A	. 11 11 1	8888	Natur Upstr Addit	Natural Bround erev Upstream surcharge Additional Q (cfs)	•		
7 . 5	.	3 !	11111		(443)		:
catchment	(1 11	0.00	Inlet Gutte	Inlet length Gutter slope	(ft) (ft/ft)		
q captured (cis) Q bypassed (cis)	H U	0.00	Cross	Cross slope (It/It) Ponding width (ft)	(ft)		= 0.0000 = N/A
ote: Norma	h assumed	ımed					

LINE 3 / Q = 78.39 / HT = 36 / WID = 36 / N = .019 / L = 81 / JLC = .8	 FREGDINGS - 7.143
LINE 3 / Q = 78.39 / HT = 36 / WI	DMHP5/DMHP4 / DNLN = 2

ринр5/ри	DMHP5/DMHP4 / DNLN = 2	2 = 2			FR	FREER DREWS . 7.143	. 7.Ja3	
	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRH UPSTRH	53.66 56.62	36.00	49.17 53.84	11.09	55.57 58.66	0.00	5.83	7.07
Brainage area (a Runoff coefficie Time of conc (mi Inter time (min) Intersity (in/hr Gumulative GA Q = CA * I (cfs) Q catchment (cfs Q catchment (cfs Q carryover (cfs Q carryover (cfs Q carryover (cfs	Brainage area (ac) Runoff coefficient Time of conc (min) Inlet time (min) Intensity (in/hr) Cumulative C*A Q = CA * I (cfs) Q = CA * I (cfs) Q catchment (cfs) Q catchment (cfs) Q carryover (cfs) Q carryover (cfs) Q captured (cfs) Q bypassed (cfs)		000000000000000000000000000000000000000	Slope Slope Critic Natura Upstre Additi Line Inlet Gutter Gotter Cross	Slope of invert (%) Slope energy grade line (%) Critical depth (in) Natural ground elev. (ft) Upstream surchargo (ft) Additional Q (cfs) Line capacity (cfs) Inlet length (ft) Cutter slope (ft/ft) Cross slope (ft/ft)	t (%) rade lir (in) l elev. ( cfs) (cfs) (ft) ft/ft) (ft)		5.7600 3.8135 33.42 64.40 0.00 0.00 109.52 0.000 0.000

LINE 4 / Q = 78.39 / HT = 36 / WID = 36 / N = .019 / L = 55 / JLC = .3 DHIP4/fb / DNLN = 3  $RREPLINEQ : N_{\rm IA}$ 

	*	20	ı,		0	0	0	_	. 0	0	0	<	:
	AREA	4.33	7.2545	33.42	0.00	0.00	0.00	122.91	00.0	= 0.0000	0.000	V/N	
			۲.					1		Ö	ö		
4	COVER	., ₹	"	Slope energy grade line (%) = 7.2545 Critical depth (in)	Ħ	B	D	14	, "	Н	B	Ħ	
	8	2.4 N/A	•	<u>.</u>	ft)	_		i					
PKEEKDINGO - IA	8	22	_:	딉_	Natural ground elev. (ft)	Upstream surcharge (ft)		_		<b>~</b>	_		
3	T WID	35.42 35.42	Slope of invert (%)	Slope energy grade Critical depth (in)	ele	rge	fs)	Line capacity (cfs)	£	Gutter slope (ft/ft)	Cross slope (ft/ft)	ft)	•
ž		ហេវ	vert	ᅜᇎ	nug	rcha	Additional Q (cfs)	ty (	Inlet length (ft)	<u>ت</u>	Ξ	Ponding width (ft)	
	EGL	65.85 69.84	i	lerg de de	gro	ns s	la1	Line capaci	angt	Jop	lope	PIA	
	-		o	e er ica]	ral	reau	tior	Cal	t 16	r.	S	ing	:
	VEL	18.10 18.10	lop	rip rit	latu	lpst	ddi	ine	nle	ütt	ros	puo,	
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BY. 1388 DAIT: Jan. 21, 1994

H.E.S.L. FOR NAPILIMOU VILLAGES - PRASE

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UNIVERSAL SOIL LOSS EQUATION CALCULATIONS APPENDIX C

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M.C.S.I. Repart Page 2 of 3 M.C. UNITIONI ENCINEERING, INC. 2145 Wells Stroet Suite 405 Maileka, Hawii, Hawaii 96793

BY, EMI PATE, June, 21, 1994

### CHOCHE CHOCHAIN OFFICIATION

- 5 Swiftment Control Guide for Hawaii Pages 59-64; C:1.00 for Bate Suil) (Sail frosion tables 17-22. : 1.00
- (Soil Frazion & Sutiment Control Guida for Hawaii, the Universal Soil Luss Equation in Hawaii)
- 17.0 ten de tel / pen DESTRUCTION

## 2. SEVERITY BOLLING NUMBER\_EQUALIGN: II=[(2+F+T)+(3+D)]+A+E

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H.C.S.L. Report Page 3 of 3 H.S. UHCHONI CHGINCERING, INC. 2145 Holls Street Suite 403 Hailuku, Hani, Hawaii 26733

BY: CIM DATE: June 21, 1994

### HOOME -NAPILINGU VILLAGES [footinged]

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CONCLUSION. Sections about the constant waters and downstream properties to minimal. Freedom rate computed for this parallel site is not district the total cable limits and additional control messar is not required.

#### 4. REFERENCES.

- Joid Compression Service (BJFs), "Guidelings For Use of the Universal Soit Lors Equation in Hausir," Technical Below, Barch 1975, (Baylerst Fratt)
- County of Mania (Oct No. 215), "Chapter 24, Soil Erosian and Selimentation Control," June 17, 1935, c:
- Survey of mai, State Soit conservation Service (RCDA), "Soit Souve February of Servi, Ocha, Bani, Notekai, and Lansi, of Haroi, August 1972 ۲,
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#### Appendix D

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Final Drainage Report Phase II

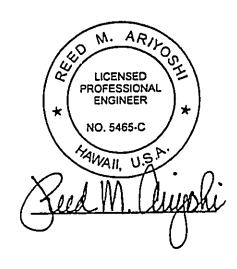
#### DRAINAGE AND SOIL EROSION CONTROL REPORT FOR THE MASS GRADING OF

#### NAPILIHAU TOWNHOMES (PHASE II)

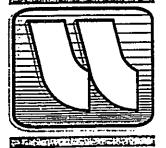
Alaeloa, Lahaina, Maui, Hawaii TMK: (2) 4-3-003: Portion of 110

OWNER: Napilihau Villages Joint Venture

ADDRESS: Honolulu, Hawaii



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

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#### Drainage and Soil Erosion Control Report for Mass Grading of Napilihau Townhomes (Phase II)

#### INTRODUCTION

This drainage and soil crosion 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.

#### 11. PROPOSED PROJECT

#### A. Site Location:

The project site is located in Alacloa, 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 Napililiau 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 crosion.

#### 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 Ilawaii (August, 1972)". prepared by the United States Department of Agriculture, Soil Conservation Service, the soil on the project site is Kahana Series, silly 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 crosion 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 dianneter culvert and subsequently across Kahana Sunset property into Keonenui Bay by an underground drainage system.

#### C. Flood and Tsunanii 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 Napililiau 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.

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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 runoss volume expected to be generated from the Phase II Napilithau Townhomes site and the detention basin site after completion of mass grading is 5.3 cfs. This is approximately 1.4 cfs less than the present predevelopment runoss site and area. This is attributable to the use of statter grades and more uniform vegetal cover throughout the site. After mass grading is completed runoss 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 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 ppendix A.

#### C. Conclusion;

Since the temporary detention basin has been sized to handle the full 73.8 efs. post-develoquent, countf 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

#### . 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.

- . Minimize time of construction.
- 2. Retain existing ground cover until latest date to complete construction.
- 3. Early construction of drainage control features.
- 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).
- Use temporary berms, filter berms, and cut-off ditches, where needed, for control of erosion.
- 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 Ilawaii, (August, 1972)", characterizes the soil at the project site as laving 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 crosion control measures are not required.

Report Prepared By:

Report Checked By:

Euc Makungana

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#### VI. REFERENCES

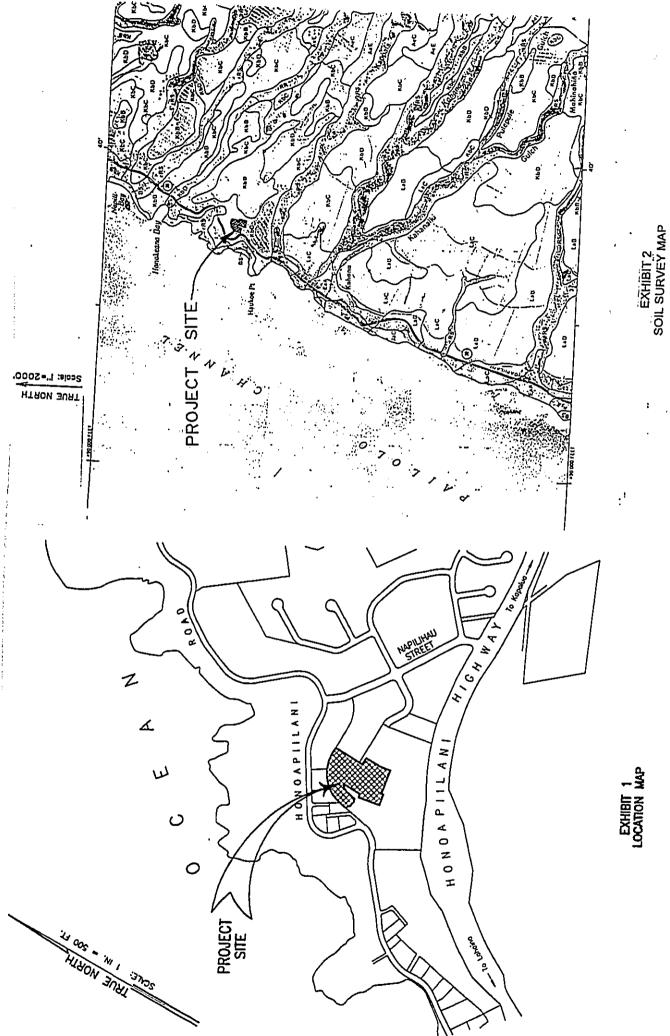
...

- Soil Survey of Islands of Kauui, Oaliu, Maui, Molokui, and Lanai, State of Hawail.
  August 1972. United States Department of Agriculture, Soil Conservation Service.
- Flood Insurance Rate Map, Mani 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.
- 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 Maul.

#### **EXHIBITS**

- 1. Location Map
- Soil Survey Map
- . Flood Insurance Rate Map
- 4. USGS Map
- 5. Pre-Development Flow Pattern Map

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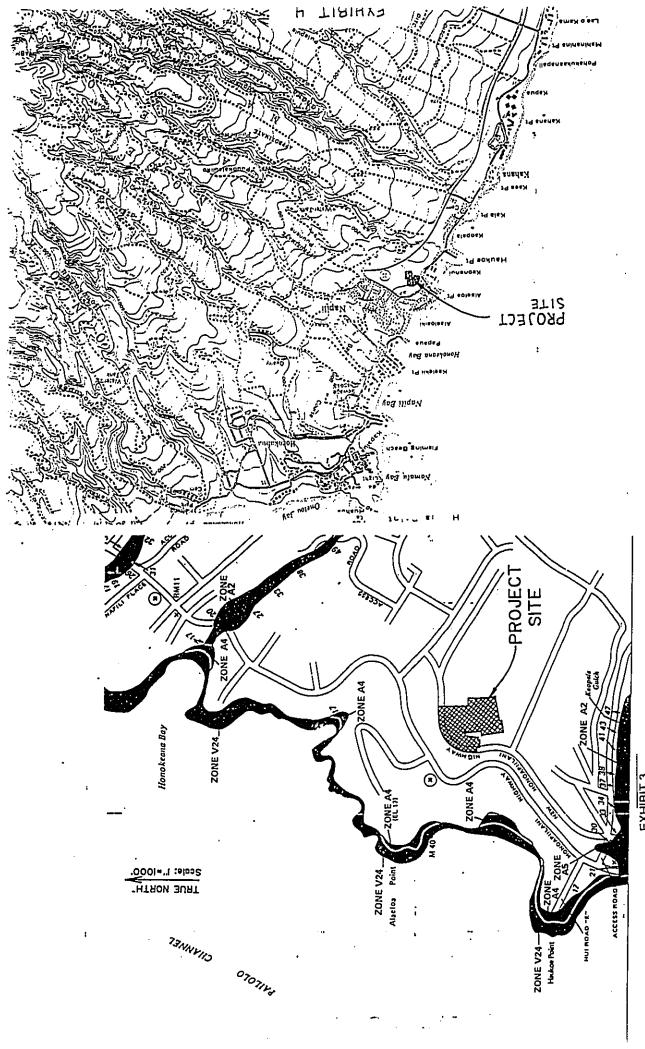
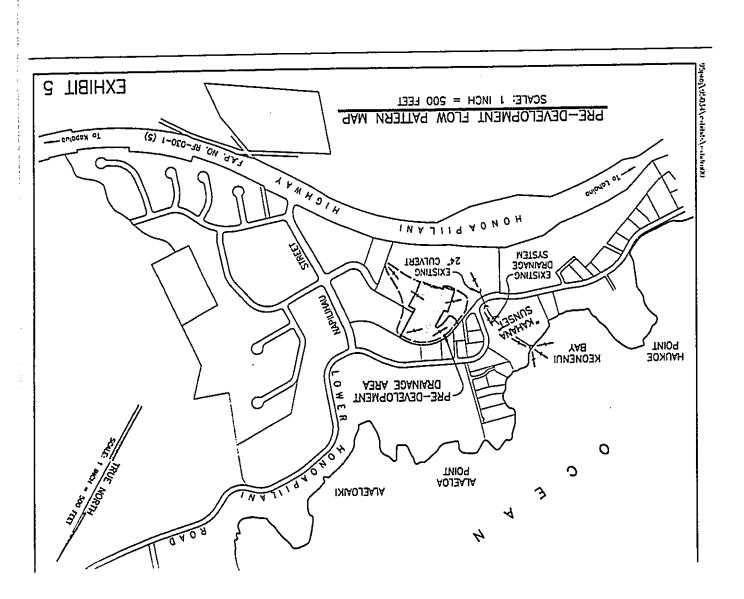


EXHIBIT 3 FLOOD INSURANCE RATE MAP



HYDROLOGIC CALCULATIONS APPENDIX A

PAGC W.S. Unemori Engineering, Inc. Wailuku, Hawaii MARCH 3, 1997

## HYDROLOGIC REPORT FOR

## Napilihau Townhomes

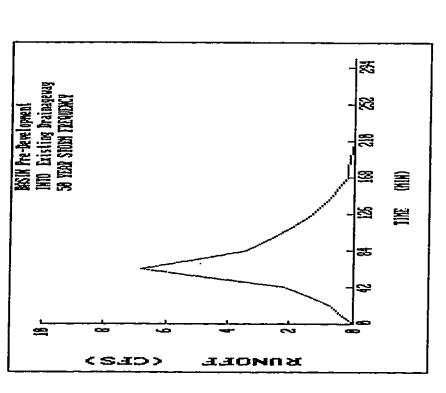
## UNIVERSAL RATIONAL HYDROGRAPH

O(PEAK) = C\*I\*A 50 YEAR STORM FREQUENCY

Pre-Development Existing Drainageway	ACRES	IN/HR	MINUTES	CHRIC FFFT
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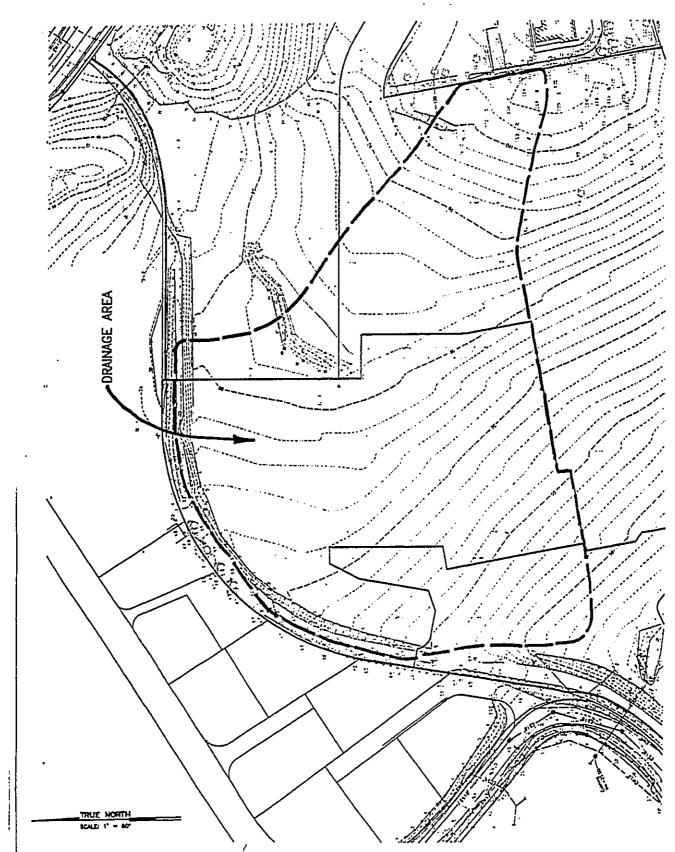
PRE-DEVELOPMENT DRAINAGE CALCULATIONS



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PRE-DEVELOPMENT DRAINAGE AREA

PAGE W.S. Unemori Engineering, Inc. Wailuku, Hawaii MARCH 3, 1997

HYDROLOGIC REPORT FOR

Napilihau Townhomes

UNIVERSAL RATIONAL HYDROGRAPH

O(PEAK) = C\*I\*A SO YEAR STORM FREQUENCY

BASIN IDENTIFIER Post-Davelopment (After Mass Grading) DISCHARGES INTO Detention Basin

BASIN AREA = 5.57 ACRES
RUNDFF COEFF. = 0.25
RAINFALL INT. = 3.80 IN/HR
TIME OF CONC. = 25.00 MINUTES
VOLUME = 19756.09 CUBIC FEET

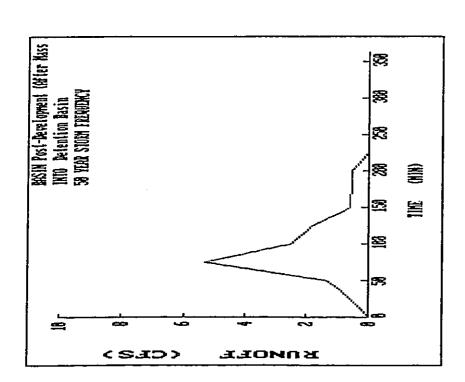
RUNDFF	(c.f.s.)
TIME	HIN)

•	0.0	0.3	9.0	1.0	1.3	3.3	5.3	3.9	2.5	2.2	1.8	1.2	9.0	9.0	. 8.0	0.5	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	0.0	12.5	25.0	37.5	50.0	62.5	75.0		_	112.5	_		_				200.0		225.0	-:	_	262.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0	362.5	

POST-DEVELOPMENT (AFTER MASS GRADING) DRAINAGE CALCULATIONS

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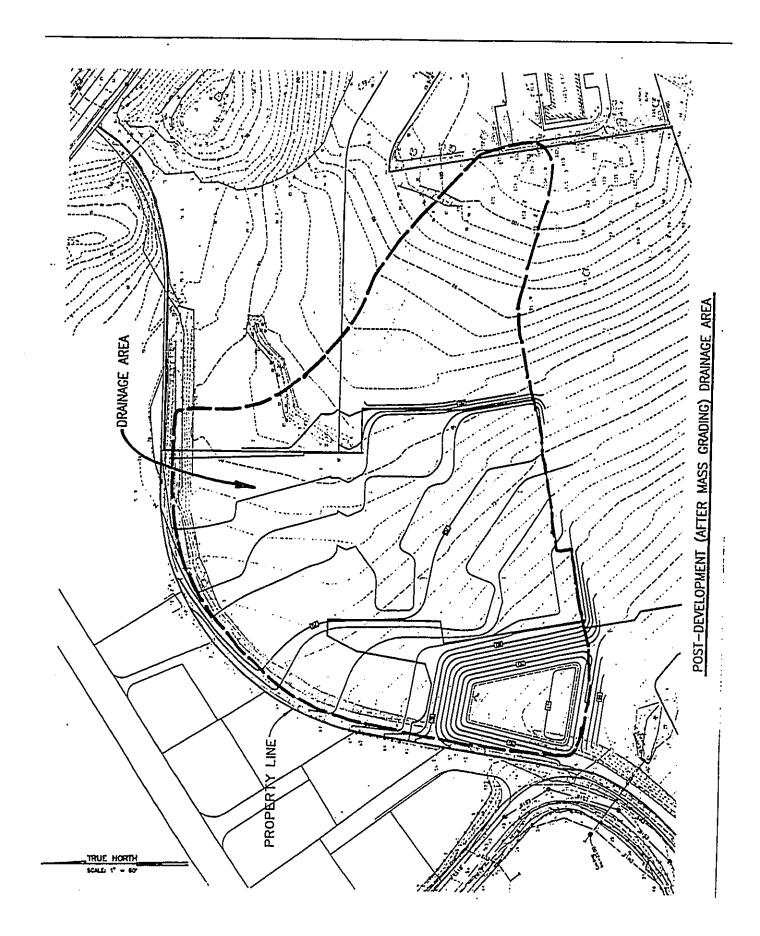
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Solution	<u> </u>	407	According to Storm Drainage July 14, 1995. E	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ding to Drainag 14, 1995	to Ainac	96.	Tat P. P. P. P. P. P. P. P. P. P. P. P. P. P	Table 1 Facilities Department	1 <del>[</del> ] 7		of 4 Titi		Ruk HC-15	ne Ruks, for c. HC-15, Che fublic works	S	Chap Pks, (	+ + 5 S	the poster 4	ح نے کی ا	Pergn 4 of 1		of of		<u>.</u>	
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# HYDROLOGIC REPORT FOR

Napilihau Townhomes

UNIVERSAL RATIONAL HYDROGRAPH

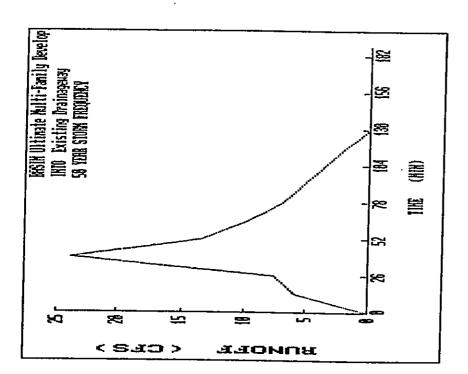
Q(PEAK) = C\*I\*A 50 YEAR STORM FREQUENCY

BASIN IDENTIFIER DISCHARGES INTO

Ultimate Multi-Family Development Existing Drainageway
7.08 ACRES
0.70
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13.00 MINUTES
60536.55 CUBIC FEET BASIN AREA ERUNOFF COEFF. ERAINFALL INT. ETIME OF COMC. EVOLUME

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TIME (MIN)	0.0 6.5 13.0 26.0 28.0 39.0 45.5	58.5 665.0 71.5 78.0 84.5 97.5 104.0 110.5 123.5 136.0	143.0 149.5 156.0 162.5 169.0 175.5 182.0

POST-DEVELOPMENT (ULTIMATE MULTI-FAMILY) DRAINAGE CALCULATIONS



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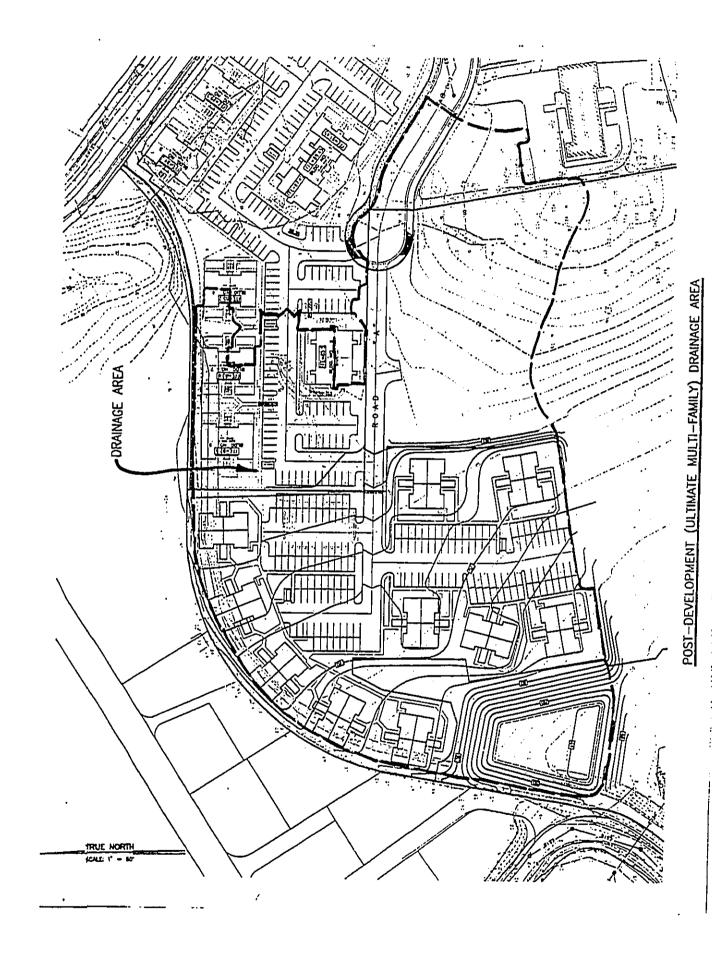
Runoff Coefficient for the Ultimate Hulti-family Development	Accordate Table 1 of the Rules for the Design of Storm Drainage Facilities, Title HC-15, Chapter 4. July 14,1995. Department, of Rublic Works, County of Naui:	Runoff Coefficient = Industrial/Business + Roor + Flat + Hedium = 0.55 + 0.05 + 0.00 + 0.07	According to Table 2 of the Rules for the Design of Storm Drainage Facilities, 17He HC-15, Chapter 4. July 14,1995. Department of Public Works, County of Hauii	Runoff (ocfficent = (Paved Area) fotal Area) (0.45) + (Landscaped Area) fotal Area) (0.30) = (8346.89)	According to Table 3 of the Rules for the Design of Shym Drainage Facilities, Title HC-15, chopter 4. July 14, 1195. Department of Public Works, County of Haui: Hinimum Runoff Coefficients for Built- up Arcus.	
Determine:	Selution	* * * * * * * * * * * * * * * * * * *				Therefore, usi Storm Drain Department Coefficient

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Inflow Hydrograph: 9503 .HYD Rating fable file: TEST .PHD

Elevation = 44.00 ft Outflow = 0.00 cfs Storage = 0.00 ac-ft

INTERMEDIATE ROUTING
COMPUTATIONS
2S/t 2S/t + 0 GIVEN POND DATA

ELEVATION OUTFLOW STORAGE

(ft.) (cfs.) (ac-ft.)

44.00 0.00

44.50 2.7 0.023

45.00 2.7 0.127

45.50 3.3 0.238

46.00 3.9 0.356

47.00 4.7 0.412

47.00 4.7 0.412

48.00 5.5 0.909

48.00 5.5 0.909

49.00 6.1 1.068

Time increment (t) = 0.108 hrs.

TEMPORARY DETENTION BASIN DRAINAGE CALCULATIONS

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Pond File: TEST Inflow Hydrograph: 9503 Outflow Hydrograph: OUT

INFLOW HYDROGRAPH

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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
7.700	9.30	15.2	168.5	178.8	5.15	47.56
1.408	00.9	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		164.4	174.6	5.10	47.50
1.444	1.80	4.4	158.7	168.8	5.03	47.41
8c0.2	0.00	2.7	151.6	161.4	4.94	47.29
5.166	00.0	0.3	142.8	152.5	4.82	47.15

POND-2 Version: 5.17 S/N: EXECUTED: 06-05-1997 23:57:31

Page 2

Page 3

Pond file: Inflow Hydrograph: 9503 Outflow Hydrograph: OUT

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 \*\*\*\*\*

0.00 ac-ft 0.79 ac-ft 0.79 ac-ft Initial Storage Peak Storage From Storm :

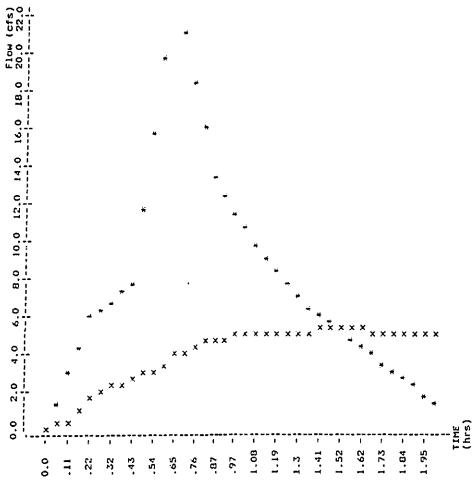
Total Storage in Pond

POND-2 Version: 5.17 S/N:

Poled File: HEST (1940 Inflow Hydrograph: 9503 .HYD OLEFTON Hydrograph: IIIT .HYD

Peak Inflow : 73,80 cfs Peak Outflow : 5,19 cfs Peak Flevation : 47,61 ff

EXFGIUTE: 06 05-1997 .11 -



23.8 cfs 5.2 cfs

Omax ::

HYD.

\* File: 9503 × File: OUT

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H.E.S.L. Report Page 1 of 3 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Walluku, 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

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 (1)
C = Cover and Management Factor
P = Erosion Control Practice Factor WHERE:

UNIVERSAL SOIL LOSS EQUATION CALCULATIONS

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 & Sudimentation ....)

L = 260.0 feet k = 30.0 feet (Soil Erosion & Sadiment Control Guide for Hawaii; Table 16)

S = (k/L) = 11.5 %

LS= 2.740

H.E.S.L. Report Page 2 of 3 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Stroet Suite 403 Wailuku, Maui, Hawaii 96793

BY: EAN DATE: March 3, 1997

# NAPILIHAU TOWNHOMES [Continued]

- ntrol Guide for Hawaii C=1.00 for Bare Soil) C = 1.00 (Soil Erosion & Sediment Control Tables 17-22, Pages 59-61; C=1.0
- (Soil Erosion & Sediment Control Guide for Hawaii; the Universal Soil Loss Equation in Hawaii)'

P = 1.00

E = R\*K\*LS\*C\*P = 93.2 tons/acre/year

# H=[(2\*F\*T)+(3\*D)]\*A\*E 2. SEVERITY PATING NUMBER EQUALION:

- WHERE:
- H = Soverity 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)

- 1.00 years
- 5.00 acres " Œ
- 93.2 tons/acre/year E = R\*K\*LS\*C\*p = 93.2 tor
- 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

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H.E.S.L. Report Page 3 of 3 W.S. UNEMORI ENGINEERING, INC. 2145 Wells Street Suite 403 Wailuku, Maui, Hawaii 96793

BY: EAN DATE: March 3, 1997

# NAPILIHAU TOWNHOMES [Continued]

# 3. MAXIMUM ALLOWABLE SOIL LOSS: E max = H max/(2FT+3D)A

93.2 tons/acre/year =>OK E max = H max/(2FT+3D)A, Hmax = 50,000 = 714.3 tons/acre/yoar r 93.2

Coastal Hazard: Class A waters are approximately feet from the site.

and d for and CONCLUSION: Sedimentation hazard to coastal waters downstream properties is minimal. Erosion rate computed this project site is well within the tolerable limits additional control measures are not required.

## 4. REFERENCES:

- Soil Conservation Service (USDA): 'Guidelines For Use of the Universal Soil Loss Equation in Hawaii,' Technical Notes, March 1975. (Revised Draft)
- County of Maui; (Ord No. 816), 'Chapter 24, Soil Erosion and Sedimentation Control,' June 13, 1975. 6
- 'Soil Survey of and Lanai; State Soil Conservation Service (USDA); 'Soil Surve Islands of Kauai, Oahu, Maui, Molokai, and Lanai; of Hawaii, August 1972. ņ
- Hawaii Environmental Simulatíon Laboratory; 'Guidelines for Data Preparation, Part I: Universal Soil Loss Equation; Undated (Draft). ÷

### Appendix E

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Archaeological Inventory Study

ARCHAROLOGICAL: INVENTORY SUBVEY WITH

VISUASURY LOCATED AT TANK 43-93-108 AND 10,

PROPERTY LOCATED AT TANK 43-93-108 AND 10,

VALAELOA AHUDUAA, LAHAINA DISTRICT,

ON THE ISLAND OF MAUI

SEPTEMBER 1992

SEPTEMBER 1992

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Archaeological Inventory Survey with Subsurface Testing Report for a Property Located at THK 4-3-03:108 and 110, in 'Alaeloa Abupua's, Labaina District, on the Island of Haui.

#### Abstract

on a An inventory survey with subsurface testing was performed by Archaeological Consultants of Hawaii, Inc. on superformed 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. Acid concludes that the proposed housing construction will have "no effect" on significant historic resources.

# Section 1: Introduction

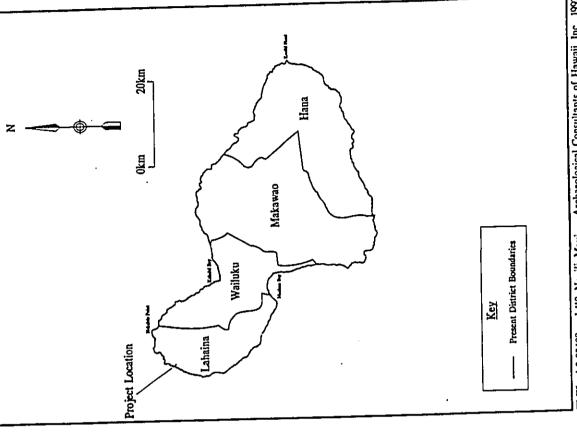
At the request of Mr. Jim Lee, Archaeological consultants of Hawaii, Inc. (ACH) conducted an archaeological inventory survey with subsurface testing at THK 4-3-03:108 and 110. This property, owned by JGL Enterprises, is located in the <u>alupuata</u> of 'Alaeloa district of Lahaina, on the Island of 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 are 232560m N and 156 40' 16" N, and the UTH coordinates are 232560m N and 742170m E (see Haps 2 and 3). The project area is located in the ahupual of Alasloa, Maui, approximately 500m from the Pailolo Channel at Alasloa 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 Pillani 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 slity clay is characteristically dark reddish brown; forms subangular time blocks; very sticky and very plastic; and reacts vigorously with dilute hydrogen peroxide (Foote et al. 1972: 50-51).

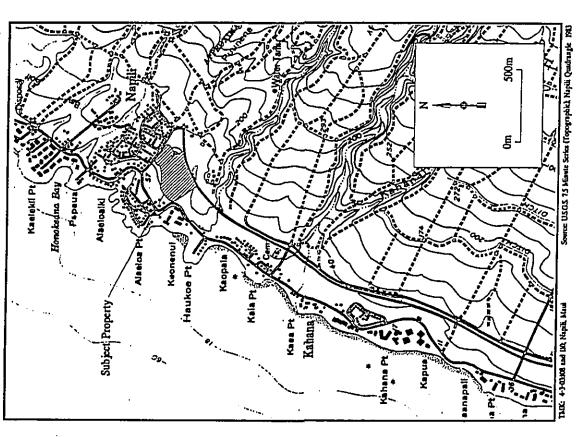
Map 1: Project Location on a Map of Maui



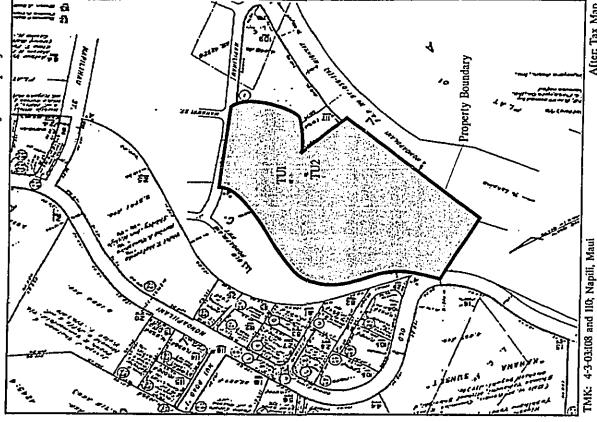
Archaeological Consultants of Hawaii, Inc. 1992 TAIK: 4-3-03:108 and 110, Napili, Maui

Map 2: Location of the Subject Property on a USGS. Topographic Map

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Map 3: Locations of the Test Units on the Subject Property



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 (Anamas EDD.): camphor trees (Cinnamonus camphors): wild tamarind or hacle koa, (Leucaena glauca): bittermelon (Monordica charantia): guava (Psidium qualiava): 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 <u>ahupus's</u> 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 marrow strip of land extending from the mountains to the sea, and includes the entire extent of Alaeloa is bordered on the north by the ahupua'a of Honokeana and on the south by Hailepai.

Early athnographic accounts of Ka'anapali are few, for visitors, whalers, and missionary efforts were centered further south in well-watered Lahaina. Vancouver visited Haui in 1783, sailing along the leevard coast from Kipahulu to Lahaina and noted that the western shores of Haul 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). Wancouver understood the poverty of the people of Maui to be a result of the previous hundred years of warfare on the island.

In much of Maul. After the death of Kokaulike, high chief of Maul, 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). Hower, the valleys north of Honokwal become increasingly drier and are not as wellwatered 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 Haui watershed: Honokawai, Kahanu, Honokahua, Honolua, and Honokohau. The first four all had extensive 10',1 lands in their valley bottoms, where terraces rose tier on tier in symmetrical stone-faced 10',1. 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 "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 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 Haui (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 pasturage was prevalent until about 1915, when sugar and pineapple plantations were established.

Some i. A ar as The initial sugar cane interests in West Maui were controlled by the Pioneer Mill Company out of Lahaina. The Pioneer Mill Danathished in 1865 by an Irishman, James C. Campbell, and by 1900, controlled some 3,600 acres in Ka'anapali, stretching beyond Wahikuli. Faliroad was built in 1887, and in 1919 extended as far Honokeana, just north of 'Alaeloa. A 1928 field map of lands of Pioneer Hill Co, Ltd. Indicates that the northernmost cane field extended from the south to the

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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 Havalians during the Hahele, 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 Habili town, Hau Iand 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. H. Walker as part of an island wide study (Walker 1931). He field checked sittes 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.

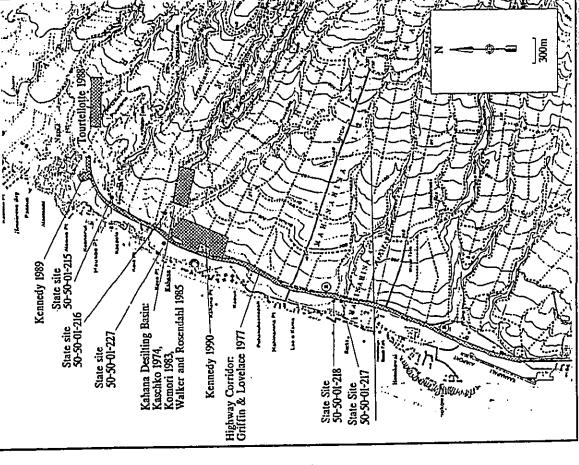
Recently in 'Alaeloa, only three formal archaeological surveys have been conducted (see Hap 4). The first was in 1977, when Griffin and Lovelace surveyed the Honopi'ilani Highway corridor; their study included the lands of Honokowai, Mahinahina, Kahana, Hailepai and 'Alaeloa, concentrating on areas in 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 Hahinahina 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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Archaeological Consultants of Hawaii, Inc.

along the boundary of Kahana and Hallepai Ahupua'a), and Site \$150-50-01-227 (a retaining wall along the bank of Kahananui Stream). These sites were thought to be prehistoric, but of Stream). These sites were thought to be prehistoric, but of 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 places. In Mahinahina Gulch, two habitation related cultural camins at this site was radiocarbon dated, yielding a remains at this site was radiocarbon dated, yielding a remains at this site was radiocarbon dated, yielding a possible occupation span from A.D. 1150 to 178. In 'Alealoa of Ka'oppla Gulch was located (site \$50-50-01-215); this of Ka'oppla Gulch was located (site \$50-50-01-215); this of flat, angular lava rocked by a retaining wall, constructed asthem 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

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 Ra opala Gulches. One broken basault 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 Hapili Fire Station (see Map 4). The subject property was located in a pineapple field just next to the main road in Mapili town, adjacent to the present subject property. No sites were found.

In 1973, the Bishop Museum conducted a survey of the Honolum Development Area in the ahupua, of Honokahua, Oneloa, and Kapalua, on the northern side of West Haui (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 Haven Point in Honokahua, was excavated and identified as a small, late-prehistoric fishing settlement (Kirch 1971b).

Much work has been done in Kahana ahupua'a. Alaeloa. Archaeological research of the Kahana Desiting Basin, in preparation for the construction of alltation dam, was conservation for the construction of a siltation dam, was conservation for the manual of the paration of a siltation dam, was conservation Service (see Hap 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 1910-3a and 3b (State Site 150-50-01-1741), consisting of an unmodified overhang-shelter and a lom segment of terracing; and Site 1910-9a and 9b (State Site 190-0-1747), a small unmodified overhang rockshelter in which an 'ulu maika wall segments and some stone) was found. A number of (prehistoric Hawailan game stone) was found. A number of sites 150-50-01-1744 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 1910-4 and 4b (State Site 150-50-01-1742), three terraces and a deposit of early historic material, interpreted as possibly historic; and Site 1910-5a, 5b, and 5c (State Site 150-50-1174), 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 suggested, that the Kahana Guich was used by the Hawaiian evidence, that 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 \$50-50-01-2878). 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 cance, 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.

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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'anapall in the early twentieth century, cultivation of sweet potatoes in the guiches 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 sconomically viable uses of the land. Rainbow Ranch, a riding stable, is operating just mauka of Honcapillani 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 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 mailne 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 agress 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. Frior 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

# Section 6: Archaeological Methods

Joseph Kennedy, M.A., was the Principal Investigator. The fieldwork was conducted by HaryAnne B. Haigret, B.A., and John Kruse, on July 30 and 31, 1992.

The pedestrian sweeps of the surface proceeded from the property, toward the southeast and the Honoapillani 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 (Hunsell 2.5YR 1/4) silty clay typical of the Kahana silty clays.

Test Unit \$2 measured 0.8 meters on each side, and was located to a depth of 75cmbs (see Figure 2). This unit was located to the south of the first test unit. Layer I was a wall aerated, loose soil derived from the plow zone. This soil contained shreds of black plastic and irrigation tubing. This soil was dark reddish brown (Hunsell 2.5FR 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

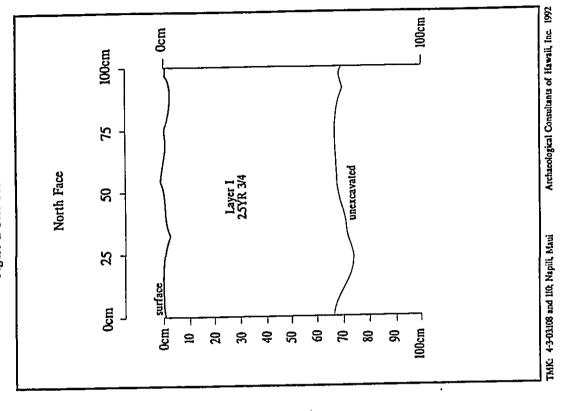
No significant historic artifacts, midden, or sites were identified during the surface survey or the subsurface stanting on the subject property. The absence of any significant historic sites can be largely attributed to the effects of pineapple cultivation on any pre-existing features.

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 Sity deposits or features of historic significance. Further, the pineapple plants were sometimes plowed under, adding a small amount of organic naterial 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

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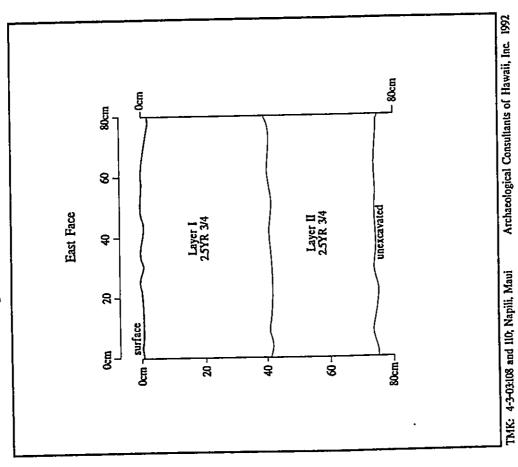
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Figure 2: Test Unit 2 Profile



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.

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# gection 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



Baseline Marine Environmental Surveys Keonenui and Alaeloaiki Bays Napili, West Maui, Hawaii

Project No. 363-001

Prepared for:

Napilihau Villages Joint Venture Pioneer Plaza, Suite 1560 900 Fort Street Honolulu, Hawaii 96813

Prepared by:

Pentec Environmental, Inc. 120 Third Avenue South, Suite 110 Edmonds, Washington 98020 (425) 775-4682

December 23, 1997

AND THE PROPERTY.

December 23, 1997

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. 120 Third Avenue South, Suite 110 Edmonds, Washington 98020 (425) 775-4682

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- Figure 2 Survey traverses.
- Figure 3 Sediment deposit from sheetwater runoff on Haukoe Point.
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#### TABLE

Table 1 Water quality observed in Keonemui and Honokeana Bays, Napili, West Maui.

#### Baseline Marine Environmental Surveys Keonenul and Alaeloaiki Bays Napili, West Maul, Hawali

## INTRODUCTION

Baseline marine environmental surveys were conducted in Keonenui and Alaeloaibi 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.

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#### 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 rescluded the Special Management Area (5MA) 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 mamifacturer-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 Keonemui 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 Keonemi Bay.

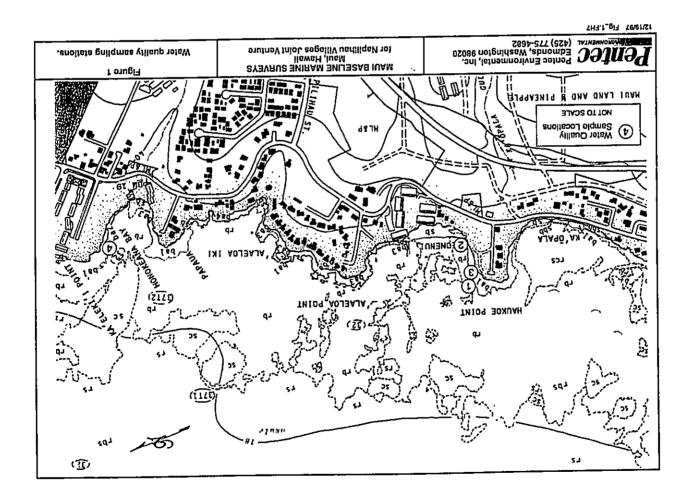
In Keonenui Bay, drogue velocity measurements were conducted by estimating distance traveled over time along a 100-meter-long surveyors' tape placed parallel to the north shore of Haukoe Point. These velocity estimates were subsequently verified by a diver tracking several drogues between measured offshore 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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Because of high surf action and difficult shoreline access, water current measurements in Alaeloaids 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 lape 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, 1977.

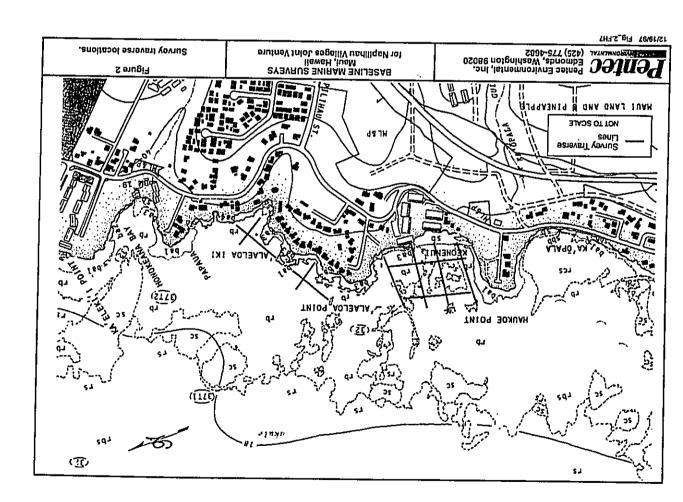
# BIOLOGICAL SURVEYS

Qualitative marine biological surveys were conducted with mask and snorkel apparatus. The general physical features, habitats, and biota within both Keonemui 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 (USCS) (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.

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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

to Hui Road and upland agricultural fields (Napilihau Village - Phase 1 blueprint drawing dated 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 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.

Inc., General Contractor) revealed that exposed soils on the site are periodically watered to A brief conversation with the construction contractor (Jeffery T. Weller, Albert C. Kobyashi, reduce dust during construction. A plastic fence also has been installed to minimize fugitive dust from affecting adjacent areas.

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# PHYSICAL ENVIRONMENT

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## KEONENUI BAY

Keonenui Bay is roughly 1,000 ft wide from north to south and is fronted by the Pailolo Charnel. 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 guisty 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 Sunsel 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.

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Figure 3 Sediment deposit from sheetwater runoif on Haukoe Point.



igure 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 Scarola sp., casuarina (Casuarina sp.), coconut palms (Coox 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 vokanic 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 Napill Plaza shopping center. Dense vegetation occurs in the gulch on the west (makal) side of Lower Honoapillani 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 Alaeloaidi Bay are dorninated 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, Sazrola 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 Keonemi and Honokeana Bays, Napili, West Maul.

Station no.	Date	Time (mours)	Temperature (°C)	Salinity (ppt)	Dissolved oxygen (ppm)
1 (ocean)	12/9/97	0945	24.8	33.0	6.75
2 (ocean)	12/9/07	0320	24.8	32.8	6.78
3 (low tide pool)	12/9/97	1006	24.8	33.0	6.74
3 (mid tids pool)	12/9/97	1008	24.0	33.1	6.52
3 (high tide pool)	129/97	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 (mld tide pool)	12/11/97	1348	25.2	33.0	6.44
3 (Ngh tide pool)	12/11/97	1355	21.0	23.1	5.03
4 (ocean)	12/11/97	1610	24.9	33.0	6.60

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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.

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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 righttime air temperatures. Splash zone tide pools are subject to rainwater runoff and/or trrigation 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 Keonemu 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 Keonemui 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.

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## 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

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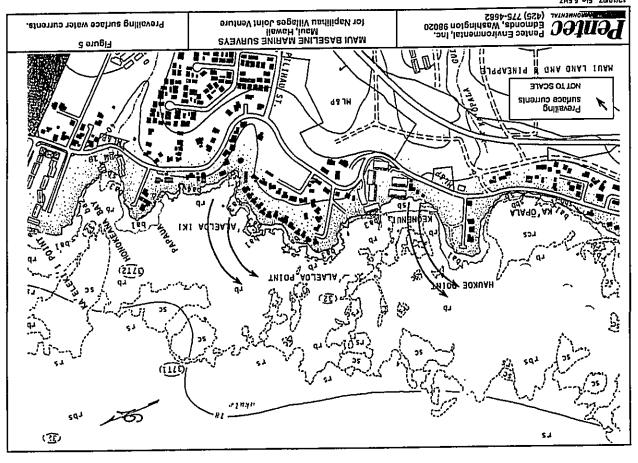
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middle reaches of the bay during the same afternoon period on December 11 demonstrated a seaward and southwesterly movement at velocities of about 20 ft/minute. During this period, drogues advanced seaward and to the southwest against a significant 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 ff/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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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 (Pocillopara meandrina), and two colonies of Leptastrea purpurea (Figure 6).

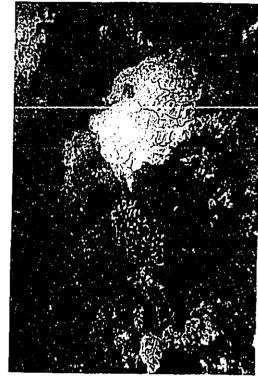
Several colonies of *P. damicaris* demonstrated structural deformities, such as broken or sandabraded branches, and many of the colonies observed were partially overgrown with filamentous green epibenthic algae. Although density is low throughout the bay, corals are most abundant along the bay's northern 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. lokuta* 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. lokuta* demonstrated irregular fissures caused by the burrowing of snapping shrimp (*Alipheus* sp.). Wave action and sand scour produce conditions not generally suitable for coral development in sandy areas along the bay's southeast shoreline.

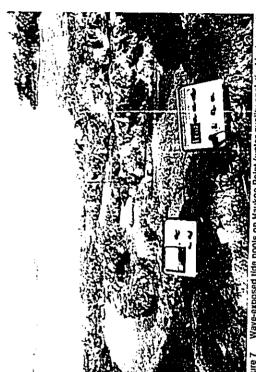
#### Algae

Conspicuous algae noted on the north and south sides of the bay include Ultu fasciata ("palahalaha"), Acauthophora spicifen, Hypnea sp., Sargassum eclinocarpum, Abufeltia concinna (dark red growth form only), Dictyola 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 brevichvium, Hydrolithon reinboldii, Lithophyllum kotschymum, and Neogoniolithon frutescens. Observations from atop the Haukoe Point cliffline indicated that inshore boulders and vertical

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ure 6 The corals Porties lobata and Pociliopora meandring on north side of Keonenul Bay.



ure 7 Wave-exposed tide pools on Haukoe Point (water quality analytical Instract are shown in foreground).

walls support a very dense and diverse algal ficra. However, hazardous swells, breaking waves, and poor underwater visibility preduded underwater surveys from being conducted in this zone. Algal species associated with this physically dominated shoreline were therefore omitted from the data record.

#### Fishes

Keonemul Bay supports a modest fish fauna, but overall density is low. Only one species, the convict lang (Aamthurus 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 (fless 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 lang, the blue jack (Cararx 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 dussumirri; "palani"), whilebar surgeonfish (Acanthurus leucopareius; "maikolko"), orangeband surgeonfish (Acanthurus olivaceus; "na'ena'e"), achilles tang (Acanthurus adnilles; "paku'iku'i), goldring surgeonfish (Clenochactus strigosus; "kole"), and the orangespine unicornfish (Naso lituratus; "umaumalei").

Along the bay's north side, juverile reef triggerfish (Rhincanthus rectangulus; "humuhumunukura-pua'a") and lei triggerfish (Sufflamen bursa) are common, as is the blackside hawkfish (Paracirrhites forsteri; "hilu pill-bo'a"), saddle wrass (Thalassoma duperrey; "hinalez lauwill"), yellow-tail coris wrass (Coris gaimard) (juveniles with red and white spois), juvenile rockmovers (Noncalichthys lacmianus), unidentified parrotfishes (Sarus sp.), and a single filefish ("o'ill"). At least four other species of juvenile wrasses (family Labridae) were observed. However, limited underwater visibility and the trability 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.

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Buiterflyfishes (family Chaetodontidae) were observed to be uncommon to rare. Represented species observed include the raccoon butterflyfish (Chaetodon lunula; "kikakapu"), threadfin butterflyfish (Chaetodon euriga), saddleback butterflyfish (Chaetodon ephippium), lined butterflyfish (Chaetodon fincolutus; "kikakapu"), and the reticulated butterflyfish (Chaetodon reticulatus). A spotted putfer (Arothron melagris) and a spotted trunkfish (Ostracion melagris) 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 Jasciolatus).

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 Guaetodontidae) 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 mathaa), 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 nentes (Neria picas: "pipipi"), false

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opihi (Siphonaria normalis), shingle urchins (Colobocentrolus atratus), and grapsid crabs (Grapsus

## ALAELOAIKI BAY

#### Corals

In contrast to the low coral density in Keonenui Bay, coral density is significantly greater in 5 percent, though overall coverage appears lower because of the preponderance of encrusing 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, 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

Ultor fusciata and Abnfettia concinna are the dominant algae of the wave-exposed intertidal Zone. Encrushing coralline algae also are common in areas of breaking waves. Represented Species include the dominant P. ontkodes, and confluent to sometimes patchy growths of N. frutescens, H. brevichavium, H. reinboldii, and L. kotschyanum. Rocks and boulders not encrusted with coralline algae are frequently covered by a furf composed of a mix of well-cropped filamentous red and green epibenthic algae (Figure 8). The cropped nature of the algae (most 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 30 individuals. Surgeonfishes are ranked second in abundance. Represented species (in order of estimated abundance) include the achilles tang, orangespine unicomfish, eye-stripe

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Figure 8 Zone of well-cropped fleshy and Illamentous 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 Alaeloaid 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 (Stantla langinostris) were observed transiting the coastline between Keonemii and Alaeloalid bays on December 9 and 10. An estimated 100 to 200 dolphins were observed in a single pod during the morning of December 9.

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#### DISCUSSION

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# REGIONAL CONSIDERATIONS

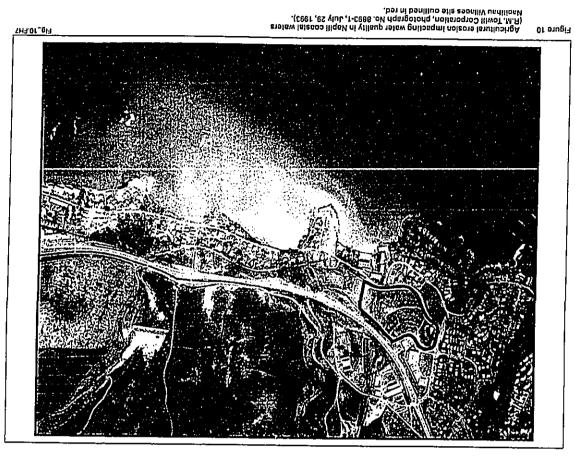
Review of available published and unpublished reports revealed little additional information on physical environmental conditions, water quality, or biota associated with Keonenui or Alaeloaiki bays. The Maui Coastal Zone Atlas (Aecos, Inc., 1981) did not identify any defined environmentally sensitive 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 cleaved upland agricultural lands.

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Except in areas demonstrating exceptionally heavy or chronic sediment loading, such as at the mouths of major drainage gukches, 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 35 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

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#### **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 dischanges 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 runoif associated with local, regional, and cyclonic rainfall events currenly 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

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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 Keonemii Bav.

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.

Sormwater discharges would result in a short-term reduction in the salinity of surface waters within Keonemul 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 politiants 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 bitumuis 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

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currents and wind fetch associated with the Pailolo Channel. Mixing and dilution would rapidly take place within channel waters.

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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.

#### Siota

As a function of the tidal period, a surface layer of silty water flowing out of Keonemui 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, stagmant 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 biola 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 that.

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.

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## ALAELOAIKI BAY

## Physical Environment

Stormwater runoff is not expected to produce any significant short- or long-term or cumulative impacts upon Alaeloalid 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 infinical 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 Alaeloaidi Bay would not be significantly altered by the proposed discharge of off-site or on-site stormwater. As was described for Keonenul 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

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associated with the Pailolo Channel. Rapid dilution and dispersion would take place within offshore channel waters.

Although possibly not visually discertible, discharge waters originating from the townhouse development and adjacent uplands will be of a higher quality than most existing stormwater discharges into Alaeloaid 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.

#### Flots

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 blota 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 Maut: the endangered humpback whale (Megaptern norwangliae), Hawaiian monk seal (Monachus schauinslandi), hawksbill turtle (Erdmochelys imbriate; "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 Hawailan 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 Hawailan 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 unlikelithood 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.

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Because of disturbances associated with extensive urbanization and high recreational use of beaches, it is unlikely that hawksbill turtles would use West Maul beaches for nesting. Therefore, the proposed project is not expected to impact hawksbill turtles.

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A single green sea turtle was observed foraging in Keonenul Bay on December 10, 1997. Green sea turtles are relatively common in coastal areas of West Maui. In Hawailan 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 transitus)) 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

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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, Peatl Harbor, Hawaii.

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#### Appendix G

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SHPD Letters Dated February 5, 1993 and September 23, 1993 JOHN WATHEE HAWAH TO ROHRSVOE

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#### STATE OF HAWAII

#### DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION 33 BOUTH KIND STREET, 6TH FLOOR HONOLULU, HAWAII 98813 WILLIAM W. PATY, CHAIRPERSON BOARD OF LAND AND NATURAL RESOURCE

DEPUTIES

John F. Keppeler. II Dona L. Hanaike

AQUACULTURE CEVELOPMENT PROGRAM

AGUATIC RESOURCES

Conservation and Environmental affairs

CONSERVATION AND RESOURCES ENFORCEMENT

CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
CIVISION

CIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

February 5, 1993

Mr. Michael T. Munekiyo 1823 Wells St., Suite 3 Wailuku, Hawaii 96793 LOG NO: 7308

DOC NO: 9302AG05

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 Inventory Survey with Subsurface Testing Report for a Property Inventory Survey with Subsurface Testing Report for a Property Inventory Survey with Subsurface Testing Report for a Property Inventory Survey with Subsurface Testing Report for a Property Inventory Survey with Subsurface Testing Report for a Property Inventory Survey with Subsurface Testing Report for a Property Inventory Survey with Subsurface Testing Report for a Property Inventory Survey with Subsurface Testing Report for a Property Inventory Survey William Inventory Inventory Inventory Inventory Inventory Survey William Inventory Inven

Please contact Ms. Annie Griffin at 587-0013 if you have any questions about these comments.

sincerely

DON HIBBARD, Administrator

State Historic Preservation Division

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DEPARTMENT OF LAND AND NATURAL PRESONNESSANNING

STATE HISTORIC PRESERVATION DIVISION TY OF MAU!
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KETTH ARUE, CHAIRFERSON BOARD OF LAND AND NATURAL NERG

DEPUTES

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 PANKS WATER AND LAND DEVELOPMENT

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:

County of Maui, Historic Preservation Review of SUBJECT:

Napilihau Villages I, II, III, & IV

Alaeloa, Lahaina, Maui TMR: 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,

TON HIBBARD, Administrator

State Historic Preservation Division

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## Appendix H

Traffic Impact Report

TRAFFIC IMPACT REPORT

NAPILI, MAUI, HAWAII

FINAL REPORT

PREPARED FOR

JGL ENTERPRISES, INC.

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Austin, Tsutsumi & Associates, Inc. Engineers • Surveyors Honobilu • Hilo • Waituku, Hawaii

TRAFFIC IMPACT REPORT

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FOR

NAPILIHAU VILLAGES

NAPILI, MAUI, HAWAII

FINAL REPORT

PREPARED FOR

JGL ENTERPRISES, INC.



Ву

Austin, Tsutsumi & Associates, Inc. Engineers • Surveyors Honolutu • Hilo • Wailuku, Hawaii

February 1993

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  PHASE II 1996

  PHASE III 1996

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AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVE ENGINEERS + BLOWEFORS CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

TRAFFIC IMPACT REPORT

## NAPILIHAU VILLAGES

NAPILI, MAUI, HAWAII

## INTRODUCTION

A. Purpose and Scope of Study

the proposed Napilihau Villages development, an affordable multi-family The purpose of this study is to assess the traffic impacts resulting from 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
- Development of trip generation characteristics for the proposed development
- Development of traffic projections
- Identification and assessment of traffic impacts resulting from the trips generated by the proposed development, superimposed over the projected traffic conditions. ശ്

REPLY TO: 501 SUINNER STREET, SUITE 521 • HOMOLULU. HAWAII 96817-5031 PHONE BOOF 533-3646 • FAX NO: 526 1267

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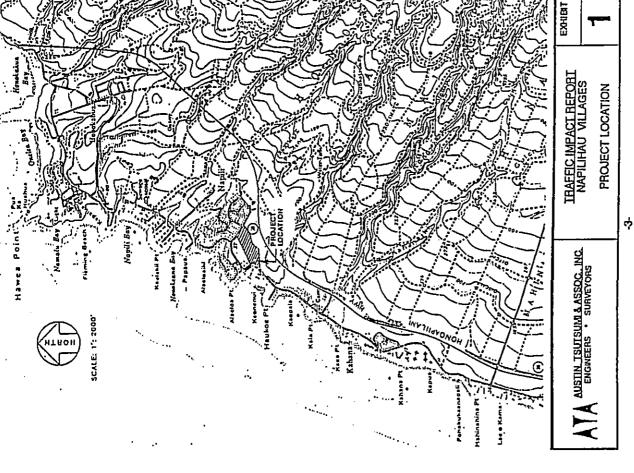
- Recommendation(s) of roadway improvements which would miligate the traffic impacts identified in this study. Ö
- Location œ,

The proposed development is located in Napii, Maui, Hawaii between Honoapiilani Highway and Lower Honoapiilani Road and is bordered on the north by Napithau 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.

Project Description ڻ

by Honoapiilani Highway, Napiii Plaza Shopping Center and the Napiii Fire 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 Station on the mauka side, Lower Honoapillani Road on the makal side, and Napilihau Street on the north side. Access to the development will be via Hanawai Street from Napilihau Honoapiilani Highway. This new access will be restricted to right turns only into and out of the Street and a new street connection to development. The project is proposed to be developed in four (4) phases as follows:

Phase         I         76         units         June           Phase         II         -         84         units         February           Phase         III         -         64         units         November           Phase         IV         -         88         units         March           Total         -         312         units         -	1995	1996	1996	1997	
- = ≡ > 67 · · · · · · · · · · · · · · · · · · ·	June	February	November	March	
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Phases I, Il 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.

# EXISTING CONDITIONS

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#### 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 Honoapiliani Highway, at the intersection of Napilihau Street and Honoapiliani 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 Napiil Trade Center.

At Kapalua Resort to the north, the Ritz-Cartton Hotel, with 550 units, was opened for business in October 1992.

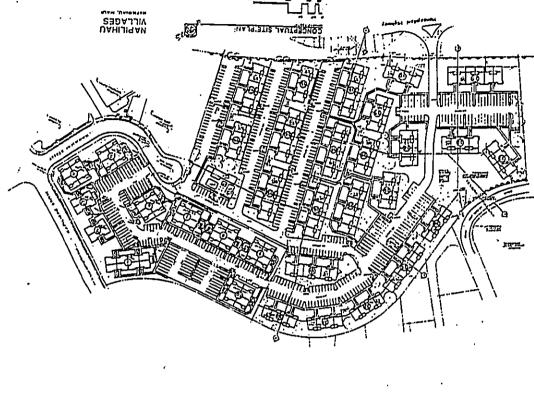
No other major developments in the project area are known to be approved for implementation in the near future.

## B. Roadway System

The primary roadways in the immediate vicinity of the project are: Honoapillani Highway, Napilihau Street and Lower Honoapillani Road.

Honoapillani Highway is a State arterial highway, which provides the regional circulation from Kapalua through West Maui and Enkage to Central and South Maui. It is a high-quality, two-lane highway with all major

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Source: JGL Exterprises

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SITE PLAN

Intersections channelized with separate left-turn storage lanes and deceleration/acceleration lanes.

Napiithau 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 Honoapiliani 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 Honoapiliani Road is narrow, with limited shoulder areas.

Other streets in the area include Hanawai Street and Kohl 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 Honoapillani Highway, Hanawai Street, and Lower Honoapillani Road. In addition, 24-hour traffic counts were obtained from the State Department of Transportation (DOT) for Honoapillani Highway at the Kahana Stream Bridge and on Lower Honoapillani 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 Honoapillani 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 Honoapillani Road it was between 7:15 AM and 8:15 AM.

Similarly, the PM peak hour of commuter traffic varied slightly, with Napilihau Street/Honoapillani Highway intersection and Napilihau Street/Hanawai Street intersection peak hour occurring between 3:15 and 4:15 PM; and at Lower Honoapillani 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-tane" 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 intersections". Signalized intersections". Signalized 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 Lavels of Service (LOS). LOS for unsignalized intersections have no

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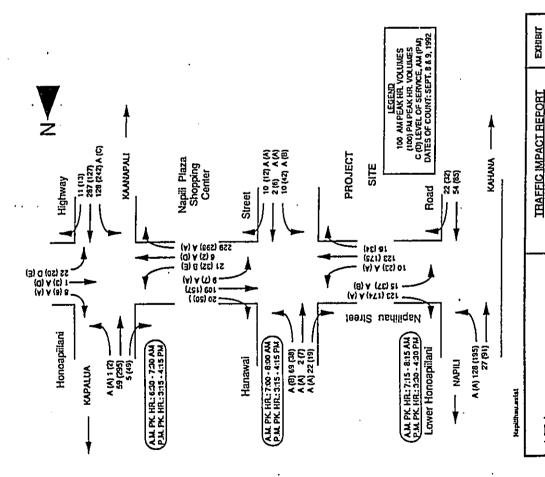
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relationship to LOS for signalized intersections or continuous roadway segments. LOS for an unsignalized intersection is based upon the delay experienced by side street traffic, specifically the left turn, through, and right-turn movements from the side street to the main highway, and left turns off the main highway. The LOS ranges from LOS "F", for little or no delay, to LOS "F", for very long traffic delays. LOS" 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 Honoapillani 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,

Honoapillari Highway between Kapalua and Honokowai (at its intersection with Lower Honoapillari 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

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NAPILHAU VILLAGES
EXISTING COMMUTER
TRAFFIC VOLUMES

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demand exceeds the capacity of the single south bound approach lane at this intersection,

# TRIP GENERATION CHARACTERISTICS

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#### A. General

The trip generation rates utilized in estimating the volume of vehicular accepted techniques developed by the Institute of Transportation Engineers traffic generated by the proposed development are based upon generally (ITE) and published in Trip Generation, 5th Edition. These empirically derived rates correlate independent variables defining land use intensity with traffic count date.

#### Traffic Generation Ð.

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-Cartton Hotel are appended in Appendix C.

#### TABLE 1

# SUMMARY – PROJECT GENERATED TRIPS NAPILIHAU VILLAGES

Phase ing Neek- No. Units         Week- Trip Enter No. Units         AM Pk Ends         AM Pk Hr Hr Hr Hr Hr Hr Hr Hr Hr Hr Hr Hr Hr			_	-	_	_	٠,.	_	_
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	Phase No.	_	=	=	_		2	TOTAL	

# 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 increase in traffic for this area, because of the present recessionary times Corridor (both Highway and Lower Road). Although the State's 'Island-Wide Long-Range Highway Plan" for Maui projected a 7.5% per year 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 Napiii 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 Napiil Trade Center will be completed in 1993.

The trips generated by the Ritz-Carlton Hotel, with 550 rooms, is projected for 70% occupancy. The Napii Trade Center traffic distribution

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at Honoapillani 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 Honoapiliani Highway. Traffic with destinations north of the site will exit the development via Hanawal 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 Honoapiliani Highway and at Lower Honoapiliani Road. Some professional judgment was also applied based upon employment centers in the West Maui area.

# IV. THAFFIC IMPACTS

#### A. General

The following are the primary intersections impacted by the Napilihau Villages development:

- Napilihau Street/Honoapillani Highway
- Napilhau Street/Hanawai Street
- Napilihau Street/Lower Honoapillani 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

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the phases identified earlier. All access roadvays 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-Cartton 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 Mauf Public Works Committee Report No. 91-332 that NTC would install a traffic signal system) at the Napilhau Street/Honoapillani Highway intersection, this intersection was analyzed as a signalized intersection utilizing the operational method per the HCM.

# B. Projected Traffic Volumes Without the Project

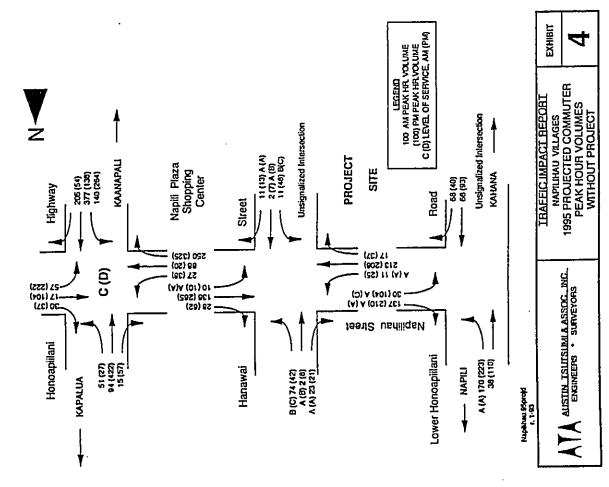
The capacity analysis computations are appended in Appendix 'D'.

#### 1995

- Napilihau Street/Honoapiliani 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 Honoapiliani 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/Honoapillani Highway intersection would continue to operate satisfactority as a signalized intersection.



Street/Lower Honoapillani Road intersection would also continue Napilihau Street/Hanawai Street intersection and Napilihau to operate satisfactorily as an unsignalized intersection.

Exhibit No. 5 shows the projected traffic volumes and LOS.

#### 1997 က

generally operate satisfactorily, except that the north bound lett-Napilihau Street/Honoapillani Highway intersection would 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.
- vehicles from Napilihau Street to south bound Lower Honoapillani Napilihau Street/Lower Honoapilani Road intersection will continue to operate satisfactorily, with some delay for left turning Road.
- Exhibit No. 6 shows the projected traffic volumes and LOS.

## Cumulative Traffic Volumes With the Project ပ

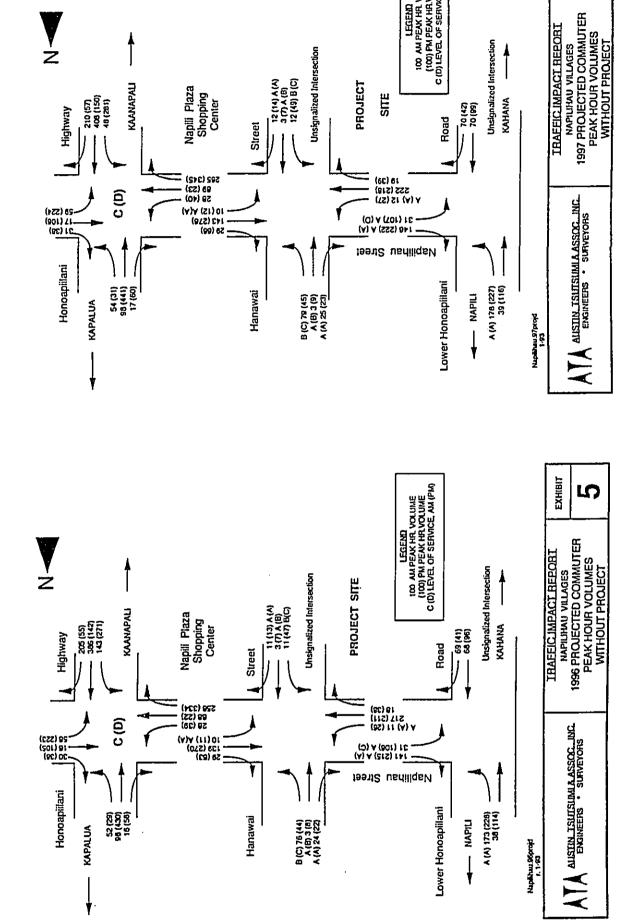
#### Phase I - 1995 ÷

- Napilihau Street/Honoapillani Highway intersection will operate satisfactorily as a signalized intersection at LOS "C" in the AM peak hour of traffic and at LOS "O" during the PM peak hour of traffic.
- torily, with traffic exiting Hanawai Street experiencing minimal Napilihau Street/Hanawai Street Intersection will operate satisfacdelays at LOS 'C' during the PM peak hour of traffic.

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100 AM PEAK HR VOLUME (100) PM PEAK HR VOLUME C (D) LEVEL OF SERVICE, AM (PM)

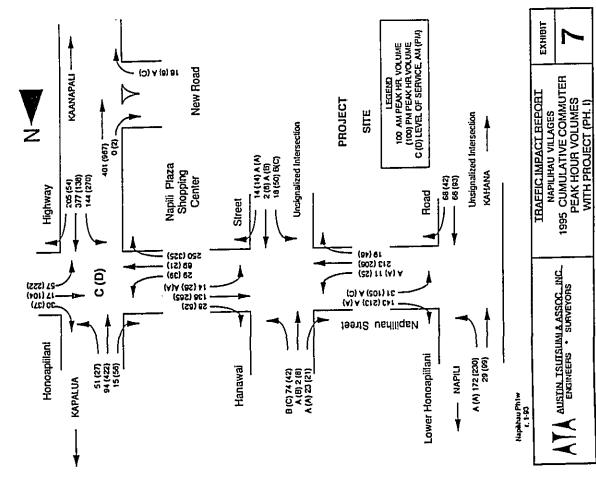
- operate with very minimal delay for traffic turning left from Napilihau Street/Lower Honoapillani Road intersection will Napithau Street to south bound Lower Honoapillani Road.
- Highway will have little or no delay in entering Honoapillani The right-turn traffic at the new intersection with Honoapillani Highway.
- Exhibit No. 7 shows the projected traffic volumes and LOS.

#### Phase 11 - 1996 તં

- Napilihau Street/Honoapillani 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 ŗ
- operate satisfactorily as an unsignalized intersection, with traffic Napilihau Street/Hanawai Street Intersection will continue to exiting Hanawai Street experiencing some delay at LOS "D".
- Napilihau Street/Lower Honoapillani Road intersection will continue to operate with minimal delay for left-furning vehicles from Napilihau Street.
- with Honoapiilani Highway will continue to operate with little or no The right-turn exit from the development at the new intersection delay to exiting traffic.
- Exhibit No. 8 shows the projected traffic volumes and LOS.

#### Phase III - 1996 က်

to operate satisfactorily, except for the north bound left-turn Napilhau Street/Honoapillani Highway Intersection will continue movement during the PM peak hour of traffic.



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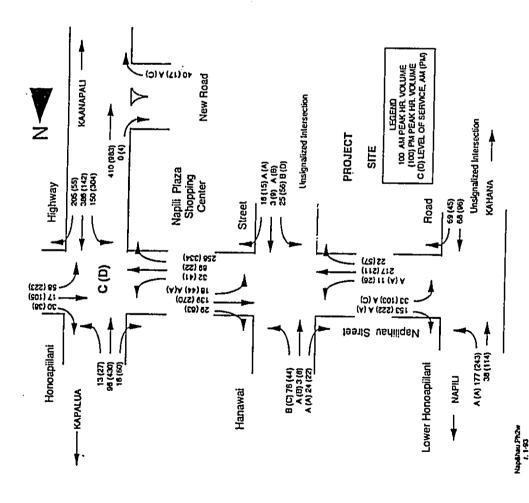


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- Napilihau Street/Hanawai Street intersection will continue to operate satisfactorily with exiting traffic experiencing some delay at LOS 'D'.
- Napilihau Street/Lower Honoapillani Road intersection will continue to operate satisfactorily with left-turning vehicles from Napilihau Street experiencing some delay at LOS 'D'.
- Right turns out of this project site to Honoapillani Highway continue to operate satisfactorily.
- Exhibit No. 9 shows the projected traffic volumes and LOS.

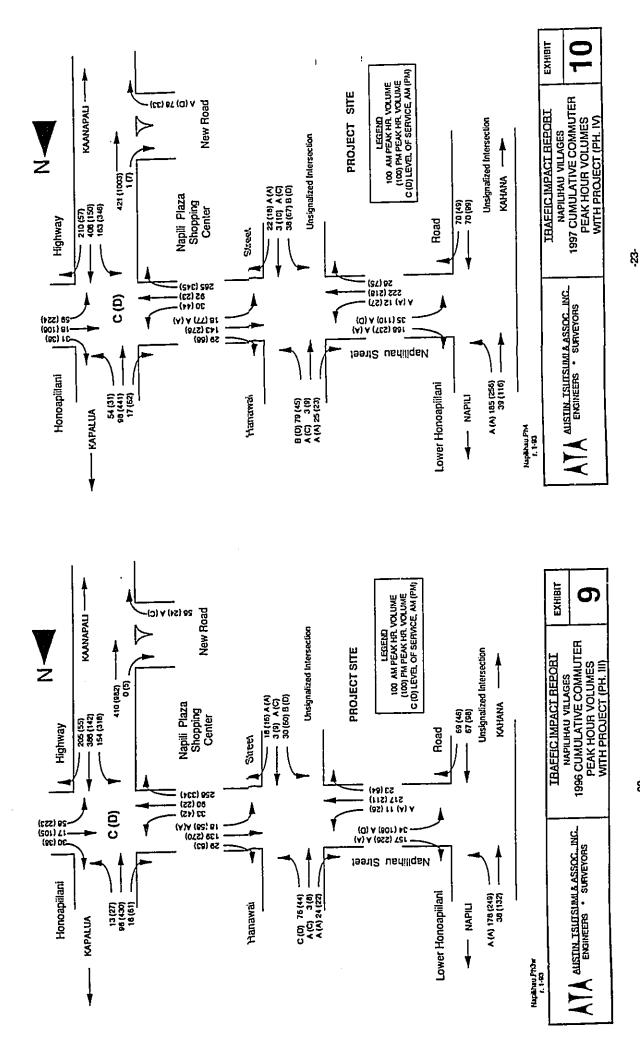
## 4. Phase IV - 1997

- to operate satisfactority, except for the north bound left-turn Napiihau Street/Honoapiilani Highway intersection will continue 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 Honoapillani Road intersection will continue to operate satisfactorily.
- The new restricted movement intersection at Honoapillani Highway will operate satisfactorily as an unsignalized intersection.
- Exhibit No. 10 shows the projected traffic volumes and LOS.

#### Regional Impacts o.

The majority of the traffic generated from the proposed development will head south on Honoapillani Highway. By the Year 1995, it is anticipated

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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 Honoapiliani 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 Honoapillani Highway south of Lahaina at Puamana. Anticipated completion of the Bypass Road is about 1997 or later. In addition, the intersection of Honoapillani Highway and Lower Honoapillani Road will most likely be signalized by the Year 1995.

## V. CONCLUSIONS

The following are the conclusions of this traffic study:

- With the projected traffic generated by the Riz-Carlton Hotel and the Napili Trade Center development, the intersection of Honoapillani Highway and Napilihau Street must be signalized in order for traffic from Napilihau Street to safely enter Honoapillani Highway.
- The intersection of Lower Honoapillani Road and Napilihau Street must be improved to provide a left-turn storage lane on Lower Honoapillani Road. This improvement will be required some time in 1993 or early 1994 due to de facto growth in traffic demand.
- 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.
- Honoapillari Highway between Napilihau Street and Honokowai has adequate capacity to accommodate the additional traffic generated by the proposed project.

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# 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.

- Improve the Honoapillani 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.
- The intersection of Lower Honoapillani Road and Napilihau Street be improved to provide a left-turn storage lane on Lower Honoapillani 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:

- The left-turn storage lane on west bound (makai bound) Napiiihau
   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.
- The new intersection at Honoapillani 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 Honoapillani 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

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wil be installing the traffic signal belove the Napilihau Villages project intersection. It is assumed that the Napiii Trade Center development completes the first residential units.

# APPENDIX

EXISTING PEAK PERIOD TRAFFIC COUNT

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# 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

Stopped Delay for Vehicle (SEC)	\$\frac{\leq}{5.0}\$ 5.1 to 15.0 15.1 to 25.0 25.1 to 40.0 40.1 to 60.0 \$\rightarrow\$ 60.0
Level of Service	∢восш⊩

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.

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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 unlavorable progression, fong 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.

Lavel-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.

# 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

	Expected Delay to Minor Street Traffic	Little or no delay	Short traffic delays	Average traffic delays	Long traffic delays	Very long traffic delays	Extreme traffic delays	
,	Level of Service	∢	<b>ഇ</b>	ပ	۵	ш	ıL	
	Reserve Capacity (PCPH)	400	300-389	200-289	100-199	85 -	o v	

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# SUMMARY OF TRIP GENERATION RATES

TE CODE: 230 RESIDENT'L CONDO/TH Napilihau Villages, Ph. IV Napili, Maui Land Use or Bidg. Type: Project Name: Location:

Independent Variable:	ariable:	Dwelling Units	S C	UNITS: 88
			TRIP RATE	VOLUME
AVERAGE WEEKDAY VEHICLE TRIP ENDS	DAY VEHICLE	TRIP ENDS	5.86	516
PEAK	A.M.	ENTER	0.07	
HOUR	between	EXIT	0.37	32
OF	7 and 9	TOTAL	0.44	93
<b>ADJACENT</b>	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	
HOUR		EXIT	0.36	32
OF.		TOTAL	0.44	39
GENERATOR	₽. Æ.	ENTER	0.35	
		EXIT	0.19	11
		TOTAL	0.54	48
SATURDAY VEHICLE TRIP ENDS	CLE TRIP END	Şı	5.67	499
PEAK		ENTER	0.25	22
HOUR OF		ЕХП	0.22	19
GENERATOR		TOTAL	0.47	41

HOUR OF EXIT
GENERATOR TOTAL
Reference: ITE "Trip Generation," 5th Edition, 1991

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HOUR OF GENERATOR SUNDAY VEHICLE TRIP ENDS

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Comments:

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# APPENDIX

TRIP GENERATION

Total Control of the

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NAPILHAU.TG230

SUMMARY, PROJECT GENERATED TRIPS NAPILIHAU VILLAGES

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 PHASE NO.
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# SUMMARY OF TRIP GENERATION RATES

Land Use or Bidg. Type: RESIDENT'L CONDO/TH ITE CODE: 230
Project Name: Napilihau Villages, Ph. I
Location: Napili, Maui

UNITS: 76

Dwelling Units

Independent Variable:

TRIP RATE         VOLL           AVERAGE WEEKOAY VEHICLE THIP ENDS         5.86           PEAK         A.M.         ENTER         0.07           HOUR         Detween         EXIT         0.44           ADJACENT         P.M.         ENTER         0.36           STREET         Between         EXIT         0.19           TRAFFIC         4 and 6         TOTAL         0.55           PEAK         A.M.         ENITER         0.08           HOUR         EXIT         0.36           OF         TOTAL         0.35           SATURDAY VEHICLE TRIP ENDS         EXIT         0.19           PEAK         EXIT         0.25           HOUR OF         EXIT         0.25           BEAK         ENTER         0.25           HOUR OF         EXIT         0.22           HOUR OF         EXIT         0.23           HOUR OF         EXIT         0.23           HOUR OF         EXIT         0.23           HOUR OF         EXIT         0.23           EXIT         0.23         0.23           EXIT         0.23         0.23           EXIT         0.247					
A.M.				TRIP RATE	VOLUME
A.M. ENTER	AVERAGE WEEK	DAY VEHICLE	TRIP ENDS	5.86	445
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T and 9 TOTAL  T and 6 TOTAL  C 4 and 6 TOTAL  A.M. ENTER  A.M. ENTER  EXIT  TOTAL  TOTAL  TOTAL  TOTAL  TOTAL  TOTAL  TOTAL  TOTAL  TOTAL  TOTAL  TOTAL  ENTER  OF EXIT  ENTER  OF EXIT  FATOR  TOTAL  ENTER  OF EXIT  FATOR  TOTAL  TOTAL  FATOR  TOTAL  FATOR  TOTAL  FATOR  TOTAL  FATOR  TOTAL  FATOR  FATOR  FATOR  FOR EXIT  FATOR  FOR EXIT  FATOR  FOR EXIT  FATOR  TOTAL	HOUR	between	EXIT	0.37	28
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C   4 and 6   TOTAL	STREET	Between	EXIT	0.19	14
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P.M. ENTER EXIT TOTAL HICLE TRIP ENDS EXIT TOTAL EXIT TOTAL EXIT EXIT TOTAL	OF		TOTAL	0.44	83
EXIT TOTAL ENTER EXIT TOTAL ENTER EXIT TOTAL TOTAL	GENERATOR	P.M.	ENTER	0.35	27
ENTER EXIT TOTAL ENTER ENTER EXIT TOTAL			EXIT	0.19	14
ENTER EXIT TOTAL ENTER EXIT TOTAL			TOTAL	0.54	41
ENTER OF EXIT RATOR TOTAL Y VEHICLE TRIP ENDS ENTER OF EXIT RATOR TOTAL	SATURDAY VEHI	CLE TRIP ENI	SC	5.67	431
EXIT TOTAL ENTER EXIT TOTAL	PEAK		ENTER	0.25	19
TOTAL ENTER EXIT TOTAL	HOUR OF		EXIT	0.22	16
ENTER EXIT TOTAL	GENERATOR		TOTAL	0.47	36
ENTER Exit Total	SUNDAY VEHICL	E TRIP ENDS		4.84	368
EXIT TOTAL	PEAK		ENTER	0.22	17
TOTAL	HOUR OF		EXIT	0.23	47
	GENERATOR		TOTAL	0.45	34

Reference: ITE Trip Generation," 5th Edition,1991 Comments:

NaphhauVil TrGn

Page 1

NAPILHALITGZ30

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# SUMMARY OF TRIP GENERATION RATES

SUMMARY OF TRIP GENERATION RATES

NAPILHAU.TG230

ITE CODE: 230 Napilihau Villages, Ph. III RESIDENT'L CONDO/TH Napili, Maui Land Use or Bldg. Type: Project Name: Location:

UNITS: 64	
	TRIP RATE
Dwelling Units	
Independent Variable:	

			TRIP RATE	VOLUME
AVERAGE WEEKDAY VEHICLE TRIP ENDS	DAY VEHICLE	TRIP ENDS	5.86	375
PEAK	A.M.	ENTER	0.07	£
HOUR	between	EXIT	0.37	ន
OF	7 and 9	TOTAL	0.44	28
ADJACENT	P.M.	ENTER	0.36	R
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	R
OF		TOTAL	0.44	28
GENERATOR	P.M.	ENTER	0.35	22
		EXIT	0.19	12
		TOTAL	0.54	35
SATURDAY VEHICLE TRIP ENDS	CLE TRIP END	s	5.67	383
PEAK		ENTER	0.25	16
HOUR OF		EXIT	0.22	4
GENERATOR		TOTAL	0.47	8
SUNDAY VEHICLE TRIP ENDS	E TRIP ENDS		4.84	310
PEAK		ENTER	0.22	14
HOUR OF		EXIT	0.23	15
GENERATOR		TOTAL	0.45	83
Reference: ITE	Trio Genera	Reference: ITE "Trio Generation " 5th Edition 1001		

Reference: ITE "Trip Generation," 5th Edition, 1991 Comments: NAPRIHALI TG230

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37 30 16 46 30 23 23 16 45 476 22 85 89 VOLUME 407 6 6 6 8 TE CODE: 230 UNITS: 84 0.44 0.19 0.35 0.37 0.08 0.36 0.44 0.19 5.67 0.25 0.22 0.55 4.84 0.22 TRIP RATE 5.86 0.54 0.47 Napilihau Villages, Ph. II RESIDENT'L CONDO/TH Reference: ITE "Trip Generation," 5th Edition, 1991 **Dwelling Units** Napili, Maui AVERAGE WEEKDAY VEHICLE TRIP ENDS
PEAK A.M. ENTER TOTAL ENTER TOTAL TOTAL ENTER ENTER ENTER TOTAL TOTAL TOTAL EXI EXI EXI X SATURDAY VEHICLE TRIP ENDS SUNDAY VEHICLE TRIP ENDS Land Use or Bidg. Type: between Between 7 and 9 4 and 6 Independent Variable: P.M. A.M. P.M. Project Name: GENERATOR GENERATOR GENERATOR ADJACENT HOUR OF HOUR OF Location: STREET TRAFFIC HOUR PEAK HOUR PEAK R Ą

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ATA ALGER TRUTRAME ASSOCIATE

# APPENDIX D

CAPACITY ANALYSIS COMPUTATIONS

1 – EXISTING AM AND PM COMMUTER PEAK HOUR OF TRAFFIC

1985 HCH: UN	NS I GHAI	LIZEO I	UNSIGNALIZED INTERSECTIONS ETERTETERRESEREEREERE	TIONS	PAGE-1 1905 HCM: UMSIGMALIZED INTERSECTIONS ************************************	
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AVERAGE RUHNING SPEED, HAJOR	ING SP	EED, H	JOR STREET	EE 1	30	
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NAME OF THE	HORTH,	THE NORTH/SOUTH STREET	STREET.,		HONDAPIILANI HWY	
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OTHER INFORMATION.	HATION	¥ ::	HONONAAN 93-028	93-058		
INTERSECTION TYPE	34Y1 KI	AND	CONTROL			
INTERSECTION TYPE:	ON TYP!	E: 4-LEG	g			
HAJOR STREET	ET OTRÍ	ECT ION:	DIRECTION: NORTH/SOUTH	SOUTH		
CONTROL TYPE	PE EAS	EASTBOUND:	STOP	SIGN		
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ADJUSTHENT FACTORS

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	PERCENT GRADE		CURB RADIUS (ft) FOR RIGHT TURNS	CURB RADIUS (ft) ACCELERATION LANE FOR RIGHT TURNS FOR RIGHT TURNS
EASTBOUND	0.0	90	40	
VESTBOUND	0.00	90	4	r
ноктивоино	2,00	96	50	z
SOUTHBOUND	-2.00	90	50	z
VEHICLE COMPOSITION	HPOSITION			

	* SU TRUCKS	* COMBINATION		
	AND RV'S	VEHICLES	* HOTORCYCLES	
FASTBOILD				
	•	•	>	
WESTBOUND	0	0	0	
NORTHBOUND	0	o	0	
SOUTHBOUND	c	c	c	
	•	,	•	
CRITICAL GAPS	Sc			

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT	FINAL CRITICAL GAP
HINOR RIGHIS EE	0.50 0.50	5.50	0.00	5.50
HAJOR LEFTS SB		8.50	9 9 9	S. 50
MINOR THROUGHS EB		6.50 6.50	00.0	05.3 05.3 05.3
MINOR LEFTS EB	8 7.00 8 7.00	7.00	00.0	7.00
HOLFAROUNT SHIPMEN	11011420000			

IDENTIFYING INFORMATION

NAME OF THE EAST/WEST STREET.... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET... HONOAPIXLANI 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

Page-3

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ACT1184	RESERVE	C × C - V 1.05	-
	SHARED CAPACITY	c (pcph)	115
or Tillet	HOVEHENT	c (pcph)	
POTEN-	FLOW- TIAL RATE CAPACITY	c (pcph)	
	FLOW- RATE	v(pcph)	1
		HOVENENT	

	8		~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		<b>a a</b>
	335 408 731		169 416 927		774 906
	339		204		
	^^		~ ~ ~		
	359 415 999		195 417 934		775 997
	370		238		
	^^		^^^		
	359 415 999		195 417 934		775 997
	417 479 999		283 481 934		775 997
	25 7 268		2g 7		191
HINOR STREET	EB LEFT THROUGH RIGHT	MINOR STREET	VB LEFT THROUGH RIGHT	MAJOR STREET	SB LEFT NB LEFT

# 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.... HONOWAAN 93-028

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1985 HCH: Exercises	UNSIGN	ALIZED	UNSIGNALIZED INTERSECTIONS HERRITHESTRICKERSERY	CTIONS		Page-1 Besseresereseresereseresereseresereseres
IDENTIFYING		INFORMATION				
AVERAGE RUNNING SPEED, HAJOR	NNING S	PEEO, 1	1A JOR ST	STREET	30	
PEAK HOUR FACTOR.	FACTOR.				.78	
AREA POPULATION.	ATION.				10000	
NAME OF TH	THE EAST/WEST STREET.	PEST S	TREET		NAPILIHAU STREET	REET
NAME OF TH	THE NORTH/SOUTH STREET	L/SOUTH	STREET.	:	HONDAPIILANI HWY	HNY
NAME OF TH	THE ANALYST.			:	BS	
DATE OF TH	IE ANALY	<ul><li>S15,</li></ul>	THE ANALYSIS (mm/dd/yy)	:	9/08/92	
TIME PERIOD ANALYZED.	D ANALY	/ZED			15:15 10 16:15	15
OTHER INFORMATION HONONAPH 93-028	RHATION	:	ONONAPH	93-028		
INTERSECTION TYPE	ION TYPE	PA BA	CONTROL			
INTERSECTION TYPE: 4-LEG	ON TYPE	: 4-LE	ور			
HAJOR STREET DIRECTION: NORTH/SOUTH	ET OIRE	CTION:	NORTH/	HINOS		
CONTROL TYPE		EASTBOUND:	S10P	SIGN		
CONTROL TY	TYPE WEST	WESTBOUND:	S10P	SIGH		
TRAFFIC VC	VOLUKES					
	83	<b>9</b>	92	88		
LEFT	32	20	242	~		
THRU	8	m	127	295		
RIGHT	298	9	E1	49		
NUMBER OF	LANES AND LANE	AND LAN	IE USAGE			
	83	8	9	뜆	85	
LANES		2	-	8		
LANE USAGE	E LT +	œ	LTR			

ADJUSTHENT FACTORS	FACTORS		; ; ; ; ;		Page-2
	PERCENT GRADE	SHT.	CURB RADIUS FOR RIGHT TI	(ft) URNS	ACCELERATION LANE FOR RIGHT TIPMS
EASTBOUND	0.00	90			2
WESTBOUND	0.00	90	40		: 2
NORTHBOUND	2.00	90	20		: 20
SOUTHBOUND	-2.00	90	20		; 20
VEHICLE COP	COMPOSITION	; ; ; ; ; ; ;			:
	* SU AND	SU TRUCKS x CO AND RV*S VE	COMBINATION VEHICLES	* HOTORCYCLES	DLES
EASTBOUND		•	0	0	
WESTBOUND		0	0	0	
КОКТИВОИНО		0	0	0	
SOUTHBOUND		0	0	o	
CRITICAL G	GAPS		ļ		
	TAB T)	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST	T. FINAL
HINOR RIGHTS	<u>;</u>	* ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! !	-	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
	EB 48	5.50 5.50	5.50	0.00	5.50 5.50
NAJOR LEFTS	8 &	5.50	5.50	0.00	5.50
MINOR THROUGHS EB	0GHS EB 848	6.50	6.50	0.00	6.50 6.50
MINOR LEFTS	S EB 8	7.00	7.00	0.00	7.00
IDENTIFYING	G INFORMATION	MOTION			
NAME OF THE EAST/VES NAME OF THE NORTH/SO DATE AND TIME OF THE	OF THE EAST/WEST OF THE NORTH/SOU AND TIME OF THE	T STREET UTH STREET ANALYSIS.		STREET INI HIN	TO 16:15
DINCK THE	ייוואן דמעי		820-54		

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CAPACIT

Page-3

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507	!
RESERVE CAPACITY C = C - v LOS R SH	
SHARED CAPACIIY C (PCPh)	
ACTUAL HOVEKENT CAPACITY C (PCPh)	
POTEN- FLOM- TIAL RATE CAPACITY V(PCPh) C (PCPh)	
FLOY- RATE V(pcph)	
MOVEHENT	

### MINOR STREET

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49 113 514		4	108	987		909
8			4			
^^		^	^	^		
95 116 935		33	112	966		912
96			45			
^^		^	^	^		
95 116 935		33	112	966		912
				•		
222 269 935		121	260	966		912
'						
45		28	4	8		E 2
LEFT Through Richt	EET		동	RIGHT	EET	
1.25	E S	F	2	풀	31 K	LEFT
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8	HINOR STREE!	9			HAJOR STREE	8 2
	Ξ				Ē	

Elwese	₽ : 0	NAHE (HAME OATE OTHER	IDENIIFYING INFORMATION	NAME OF THE EAST/MEST STREET NAPILIHAU STREET MANE OF THE NORTH/SQUTH STREET HONOAPILLANI MY DATE AND TIME OF THE ANALYSIS 9/08/92 ; 15:15 TO 16:15 OTHER INFORMATION HONONAPH 93-028
	P S S S S S S S S S S S S S S S S S S S	IDENTIFY NAME OF NAME OF DATE AND	ING	五五五五

### NAME OF THE EAST/WEST STREET...... NAPILIHAU STREET TIME PERIOD ANALYZED...... 07:00 TO 08:00 NAME OF THE HORTH/SOUTH STREET...... HAMAWAI STREET DATE OF THE ANALYSIS (mw/dd/yy)..... 9/09/92 AREA POPULATION..... 10000 NAME OF THE ANALYST..... BS AVERAGE RUNNING SPEED, HAJOR STREET.. 30 OTHER INFORMATION.... NAPHANAH 93-028 INTERSECTION TYPE AND CONTROL IDENTIFYING INFORMATION

## TRAFFIC VOLUHES

CONTROL TYPE NORTHBOUND: STOP SIGN CONTROL TYPE SOUTHBOUND: STOP SIGN

HAJOR STREET DIRECTION: EAST/WEST

INTERSECTION TYPE: 4-LEG

85	69	2	22	
竪	21	2	10	
89	6	109	20	!
<b>æ</b>	91	123	16	
	LEFT	THRU	RIGHT	

## NUMBER OF LANES AND LANE USAGE

LANES	EB	WB 2	NB T	88 -
LAKE USAGE			LIR	LTR

ADJUSTHENT FACTORS	CTORS					Page-2										
36	PERCENT RIGHT	RIGHT TURN	CURB RADIUS (ft)		CELERAT)	ACCELERATION LANE FOD DIGHT TIBUS	CAPACI	CAPACITY AND LEVEL-OF-SERVICE	OF-SERVICE						Pag	Page-3
EASTBOUND	;	!	20		x			FLOW-	POTEN- TIAL			SHARED		RESERVE	ñ	
WESTBOUND	0.00	90	20		z		HOVEHENT	RATE HT v(pcph)	CAPACITY ) c (pcph)	55		CAPACITY c (pcph)		٣	<u>, ₹</u>	507
моятивоико	0.00	90	28		z				٩	=	55   			# i	_	i
SOUTHBOUND	0.00	90	28		z		MINOR	HINOR STREET								
	NOITION						<b>1</b> 92			513	^	51	<u>~</u> ۳			4
		•			! ! !	•		THROUGH 3		109	^ ^	109 699	^ ^	640	599	æ «
	X SU TRUCKS AND RU'S		* COMBINATION VEHICLES	* HOTORCYCLES	ICLES		HINOR	=			•	3	•			
EASTBOUND	0		0	0			SB LEFT					530	^ e			
WESTBOUND	0		0	0			- 4	THROUGH 3 RIGHT 29	613 996	966 996	ν • •	598 603 996	۵.0 د د	476	600	
КОЯТНВОИКО	0		0	0			HAJOR	HAJOR STREET								
SOUTHBOUND	0		0	o			183	EB LEFT 13	939	939		939	6		956	⊄
CRITICAL GAPS	S						1 84	WB LEFT 12				926	<u>يو</u>		914	Œ
	TABULAR VALUES (Table 10-2)	/ALUES 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT		FINAL HIICAL GAP	INSERT	IDENIJEYING INFORMATION	KDII							
MINOR RIGHTS	KB 5.50	20.00	5.50	0.00	<b>!</b>	5.50	NAME O	MANE OF THE EAST/WEST STREET NAPILIHAU STREET NAME OF THE NORTH-SOUTH STREET HANAMAI STREET OATE AND TIME OF THE ANALYSIS 9/09/92 : 07:00 TO 08:00	SOUTH STRE	ET H	PILIHAL NAWAI	J STREET STREET	10 00	00:80	}	
HAJOR LEFTS	EB 5.50	20 00	5.50	0.00		5.50	OTHER.	OTHER INFORMATION NAPHANAN 93-028	карня	IAH 93-026	-					
NINOR THROUGHS NB SB	HS 6.50 88 6.50	50	6.50	0.00		05.50										
NINOR LEFTS	NB 7.00 SB 7.00	88	7.00	0.00		7.00										
IDENTIFYING INFORMATION	INFORMATION															
NAME OF THE EASTANEST STREET NAPILIHAU STREET HAME OF THE NORTH/SOUTH STREET HANAWAI STREET DATE AND TIME OF THE ANALYSIS 9/09/92; 07:00 TO 08:00 OTHER INFORMATION HAPHANAM 93-028	EAST/NEST S NORTH/SOUTH IE OF THE AN	TREET STREET. ALYSIS	NAPILIH HANAWAI 9/09/92	AU STREET STREET ; 07:00	10 08:0	i										

INTERSECTION TYPE: 4-LEG

MAJOR STREET DIRECTION: EAST/WEST CONTROL IVPE NORTHBOUND: STOP SIGN

CONTROL TYPE SOUTHBOUND: STOP SIGN

TRAFFIC VOLUNES

EB WB NB
LANES 2 2 1
LANE USAGE

NUMBER OF LANES AND LANE USAGE

LTR

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ADJUSTHENT FACTORS	FACTORS	; ; ; ; ;		ADJUSTHENT FACTORS PAGE-2
	PERCENT GRACE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	z
WESTBOUND	0.00	90	20	z
NORTHBOUND	0.00	90	28	×
\$0UTHBOUND	0.00	90	28	z
VEHICLE COMPOSITION	POSITION	_		

	X SU TRUCKS AND RV*S	* COMBINATION VEHICLES	* HOTORCYCLES
EASTBOUND	0	0	0
MESTBOUND	0	0	0
иоктивоии	0	0	0
<b>SOUTHBOUND</b>	0	0	0
CRITICAL GAPS	S		
		i i i i i i i	

	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT	FINAL CRITICAL GAP
HINOR RIGHTS NB SB	5.50	5.50	0.00	5.50
HAJOR LEFTS EB WB	5.50	5.50	0.00	5.50
HINOR THROUGHS NB SB	6.50	6.50	0.00	6.50 6.50
HINOR LEFTS NB RB SB	7.00	7.00	0.00	7.00
IDENTIFYING INFORMATION	FORMATION	1		

NAME OF THE EASI/WEST STREET..... NAPILLIHAU STREET
NAME OF THE NORTH/SOUTH STREET... HANAMAI STREET
DATE AND TIME OF THE ANALYSIS..... 9/08/92; 15:15 TO 16:15
OTHER INFORMATION.... NAPHANPH 93-028

JICE
OF-SERV
LEVEL-
몽
CAPACITY

Page-3

F 105		B 4 4		B 45 4		<b>c</b> c
		~ # ~		~ <del>~</del> ~		
RESERVE CAPACITY C = C - v R SH		345 476 959		365 461 951		823 841
RESERVE CAPACITY		385		420		
8		~~~		^^^		
SHARED CAPACITY (pcph) SH		399 484 974		413 490 975		852 850
SHARED CAPACITY C (pcph) SH		461		509		
;		~~~		^^^		
ACTUAL HOVEKENT CAPACITY C (PCPh) H		399 484 974		413 490 975		852 850
POTEN- FLOM- TIAL RATE CAPACITY V(PCPh) C (PCPh)		420 497 974		432 503 975		852 850
FLOW- RATE v(pcph)		88 81		48		29
KOVEHENT	MINOR STREET	NB LEFT THROUGH RIGHT	HINOR STREET	SB LEFT THROUGH RIGHT	MAJOR STREET	EB LEFT NB LEFT

## IDENTIFYING INFORMATION

	NAPILIHAU STREET	HANAMAI STREET	9/08/92 ; 15:15 TO 16:15	920
	NAME OF THE EAST/WEST STREET NAPILIHAU STREET	NAME OF THE MORTH/SOUTH STREET HANAMAI STREET	DATE AND TIME OF THE ANALYSIS 9/08/92; 15:15 TO 16:15	DIMER INFORMATION NACHANDM 92-078

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LANES

NUMBER OF LANES

1985 HCH: IIIIIIII	UNSIG	UNSIGNALIZED INTERSECTIONS	INTERS	ECTIONS	Page-1 FITEEXIETETETETETETETETETETETETETETETETET
IDENTIFYING	NG INFO	INFORMATION			
AVERAGE RUNNING SPEED,	UNNING	SPEED, 1	HAJOR S	STREET	30
PEAK HOUR FACTOR	FACTOR				.87
AREA POPULATION.	LATION.				10000
HANE OF T	THE EAST.	EAST/WEST STREET.	IREET		NAPILIHAU STREET
NAME OF TI	THE NORTI	NORTH/SOUTH STREET	STREET	:	LOWER HONDAPIILANI ROAD
HANE OF T	THE ANALYST.	YST			BS
DATE OF TI	THE ANAL	ANALYSIS (mm/dd/yy)	*/dd/yy		9/09/92
TIKE PERIOD ANALYZED	OD ANAL	YZED			07:15 T0 08:15
OTHER INFORMATION	DRHATIO		FONKAPA	LHONNAPA 93-028	
INTERSECTION	ION TYPE	ON O	CONTROL		
INTERSECTION TYPE: 1-INTERSECTION	ION TYP	E: 1-IN	FRSECT	¥01	3 3 3 5 2 7 7 6 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
HAJOR STREET	EET OIRI	DIRECTION: MORTH/SOUTH	MORTHZ	SOUTH	
CONTROL TYPE	YPE WES	WESTBOUND:	STOP S	SIGN	
TRAFFIC VOLUHES	OLUMES				
	83	豊	쭞	88	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
LEFT	1	15	0	128	
THRU	1	•	24	23	
RIGHI	}	123	23	0	

ADJUSTHENT FACTORS

Page-2

EASTBOUND	PERCENT	GRADE ANGLE		CURB RADIUS (ft) ACCELERATION LANE FOR RIGHT TURNS FOR RIGHT TURNS
<b>WESTBOUND</b>	-4.00	90	20	z
NORTHBOUND	0.00	90	. 50	z
SOUTHBOUND	0.00	90	20	2
VEHICLE COMPOSITION	POSITION		-	

	* SU TRUCKS AND RV'S	* COMBINATION VEHICLES	* HOTORCYCLES	
EASTBOUND	1	;		
WESTBOUND	0	0	0	
NORTHBOUND	0	0	0	
SOUTHBOUND	0	0	0	
CRITICAL GAPS	S			

	TABUI (Tat	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT	FINAL CRITICAL GAP
HINOR RIGHTS		# 1 1 1 1 1			+ + +
_	<b>9</b>	5.50	5.50	0.00	5.50
HAJOR LEFTS					
	5B	2.00	2.00	0.00	5.00
HINOR LEFTS					
_	82	6.50	6.50	0.00	6.50
IDENTIFYING INFORMATION	NFORMA1	XOX.			

IDENTIFYING INFORMATION

NAME OF THE EAST/MEST STREET.... NAPILIHAU STREET

NAME OF THE NORTH/SOUTH STREET... LOWER HONDAPILIANI ROAD

OATE AND TIME OF THE ANALYSIS.... 9/09/92; 07:15 TO 08:15

OTHER INFORMATION... LHONNAPA 93-028

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CAPACITY AND LEVEL-OF-SERVICE	LEVEL-OF	AND LEVEL-OF-SERVICE			Pa	Page-3
HOVEHENT	FLOW- RATE v(pcph)	POTEN- FLOW- 11AL RATE CAPACITY V(PCPh) C (PCPh)	ACTUAL HOVEHENT CAPACITY C (PCPh) N	SHARED CAPACITY C (PCPh) SH	RESERVE CAPACITY C = C - V R SH	, Los
HINOR STREET						
WB LEFT RIGHT	16 127	675 996	966	966 109	586 869	⊄ Œ
HAJOR STREET						
SB LEFT	162	1000	1000	1000	838	⋖

TUENTE YANG INFORMATION	NAME OF THE EAST/MEST STREET NAPILIHAU STREET NAME OF THE NORTH/SOUTH STREET LOWER HONDAPILIANI ROAD DATE AND TIME OF THE AMALYSIS 9/09/92; 07:15 TO 08:15 OTHER INFORMATION LHONNAPA 93-020
COENTIFYI	IANE OF T MAKE OF T MATE AND THER INF
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NAKE OF THE NORTH/SOUTH STREET..... LOWER HONDAPILLANI ROAD KAHE OF THE EAST/WEST STREET..... NAPILIHAU STREET DATE OF THE ANALYSIS (BW/dd/yy)..... 9/08/92 AREA POPULATION..... 10000 PEAK HOUR FACTOR......82 NAME OF THE ANALYST...... BS AVERAGE RUNHING SPEED, HAJOR STREET.. 30 OTHER INFORMATION... LHONNAPA 93-028 INTERSECTION TYPE AND CONTROL HAJOR STREET DIRECTION: NORTH/SOUTH CONTROL TYPE WESTBOUND: STOP SIGN INTERSECTION TYPE: 1-INTERSECTION IDENTIFYING INFORMATION TRAFFIC VOLUMES NUMBER OF LANES LANES RIGHT LEFT THRU

	GRADE	ANGLE	FOR RIGHT TO	RNS	FOR RIGHT TURNS
EASTBOUND				:       .	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
WESTBOUND	-4.00	90	20	_	z
HORTHBOUND	0.00	9.0	20	_	z
SOUTHBOUND	0.00	90	20	_	z
VEHICLE COM	COMPOSITION				
	X SU 1	SU TRUCKS % CO AND RV'S VE	COMBINATION VEHICLES	* HOTORCYCLES	נרני
EASTBOUND	,				1
WESTBOUND		0	0	0	
HORTHBOUND		0	0	0	
соитнвоии		0	0	0	
CRITICAL GAPS	PS				
	. 1ABU	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST ADJUSTHENT	II. FINAL II CRITICAL GAP
HINOR RIGHTS	Z Ra	5.50	5.50	0.00	5.50
HAJOR LEFTS	88	5.00	5.00	0.00	8.00
HINOR LEFIS	8	6.50	6.50	0.00	05.9
IOENT IFYING	INFORMATION	ATION			

CAPACITY AND LEVEL-OF-SERVICE	LEVEL-0	AND LEVEL-OF-SERVICE			Pa	Page-3
KOVEHENT	FLOW- RATE v(pcph)	POTEN- FLOW- TIAL RATE CAPACITY V(PCPA) C (PCPA)	ACTUAL MOVEHENT CAPACITY C (PCPb) H	SHARED CAPACITY C (pcph) SH	RESERVE CAPACITY C = C - V R SH	891
HINOR STREET						
WB LEFT RIGHT	41	511 971	413	413 971	372	Φ ∢
HAJOR STREET						
SB LEFT	292	994	994	994	732	€

IDENITYING INFORMATION

HAME OF THE EAST/WEST STREET..... NAPILIHAU STREET

HAME OF THE NORTH/SOUTH STREET.... LOWER HONGAPILLANI ROAD

DATE AND TIME OF THE ANALYSIS..... 9/08/92 ; 15:30 TO 16:30

OTHER INFORMATION.... LHONNAPA 93-02B

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## APPENDIX

CAPACITY ANALYSIS COMPUTATIONS

2 - PROJECTED COMMUTER PEAK HOUR TRAFFIC VOLUMES WITHOUT PROJECT FOR THE YEARS 1995, 1996, 1997

1985 HCM: SIGNALIZED INTERSECTIONS SINNARY GEODOT

						HOMASSAD
	INTERSECTIONWAPILIHAU ST./HONDAPIILANI HIGHWAY					COMMENT1995 PRO1. COMM. AN DX.HR. VOI. WZD DR01. HBMA95AD
	HIGH					Ö
	ILANI					X HD
	NOAPI					AM
	ST. 78				HOUR	DHH
	IHAU			m	PEAK	PRO 1.
	KAPIL	OTHER.	.BSS	2/1/9	A.H.	1995
REPORT	110H					
SUNKARY REPORT	INTERSECTION. WAPILINAU ST./RONOAPIILANI HIGHWAY	AREA TYPEOTHER	ANALYSTBSS	DATE2/1/93	TIME A.M. PEAK HOUR	COMMENT.

	8	12.0	12.0	12.0	12.0	12.0	12.0		1YPE		m	<b>~</b>	e		
		ر	_	œ					ARR.			•	••	"	
	显	12.0	12.0	12.0	12.0	12.0	12.0		BUT.	ojo T	22.8	22.B	16.0	16.8	
SEONETRY		_	2						PEO.	ĭ	<b>&gt;</b>	>	>	<b>&gt;</b> -	
3	8	12.0	12.0	12.0	12.0	12.0	12.0	RS	PEDS		ខ្ព	2	0	۰	
		LTR						FACTORS	돲		.90	.30	.30	.90	
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5 <u>7</u> 5	쭢	140	377	30 205	9				主	<b>*</b>	2.00	8.9	8.3	8	
ş	9	2	7	8	9		•								
	8	22	88	220	9				GRADE	Ê	3.00	-3.00	0.00	0.0	
		=	Ξ	RI	8			:			8	8	垒	88	

				SIG	SIGNAL SETTINGS	TINGS		Ī	כאכוב ר	ENGTH =	90.0
		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2 PH-3	PH-3	PH-4
83	5	×				92	רו				
	≖	×					Ŧ		×		
	RI	×					Rſ		×		
	2	×					5		×		
9	5	×				88	-	×			
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	RT	×					R		×		
	8	×					5		×		
GRE	*	21.0	0.0	0.0	0.0	GREE	<b>.</b>	20.0	35.0	0.0	0.0
YELLOW	5	5.0	0.0	0.0	0.0	YELLOW	3	4.0	5.0	0.0	0.0
					LEVEL OF SERVICE	SERV	125	<u> </u>		! ! !	
	LANE GRP.	GRP.	γ,	3	OEL.	Я¥	507	APP	. DELAY		APP. LOS
88	<b>=</b>	_	0.285	0.256	17	s.	ں		19.0		J
	œ		0.556	0.256	19	6.	u				
₹8	<u> </u>	LIR LIR	0.637	0.256	23	6.	U		23.9		Ų
<b>2</b> 2	_		0.394	0.233	22	.5	U		20.5		J
	¥	~	0.826	0.411	2	0.	u				
SB	ب		0.143	0.233	20.8	e. -	ں		14.1		8
	_		0.143	0.411	2		œ				
	œ		0.00	0.411	2	<b>:</b>	(O				
H	INTERSECTION:	::	Dela	ay = 15	Delay = 19.6 (sec/veh)	/veh)	į.	V/C = 0.660	90	105 = C	

1905 HCH: SIGUALIZED INTERSECTIONS SUMMARY REPORT

		HUID
AMALYSTBSS	2	DFAY
BSS	2/1/5	×
	:	
51	:	
AHALY	DATE.	TIME
-		

	HONA95PO	
	M/O PR03.	
	. VOL. 1	
	PH PK.HR	
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IDENTIFYING INFORMATION	INFOS:	1411011				***
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AREA POPULATION	. Indi.			¥ :::	10000	
USEC OF THE EAST/UEST STREET	EASTA	VEST STR	EET	:	HAPILIHAU STREET	
3112 OF 31EE	HORTH	ILE HORTH/SOUTH STREET	TREET	HA	HANAUNI STREET	
NAME OF THE	. GRALYST			553		
DATE GF TIE	. AIBLY	SIS (mm/	AllalYSIS (mp/dd/yy)		2/3/93	
TING PERICO AMALYZED	אושרא	:			00:50 01 00:20	
OTHER THFORMATION	HAT 10H	:	1995 PROJ. A95AO	COhd. #1	1995 PROJ. CONd. AN PX.HR. YOL. W/J PROJ A95AO	кој. икн
INTERSECTION TYPE	H TYPE	CHE	CONTROL			
INTERSECTION TYPE: 4-LEG	IN TYPE	: 4-LEG				
hajèr street	ET OJRE	CT10#: 1	DIRECTION: CHST/WEST			
CONTREL TYPE HORTHBOUND: STOP	7E 110RT	HEOUND:		SIGN		
CONTROL TYPE		SOUTHEOUND:	STOP	SIGN		
TRAFFIC VOLUMES	LUMES					
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-	CACENT	ŘÍGHÍ TURN GNGLE	CURB RADIUS (ft FOR RIGHT TURNS	_	ACCELERATION LANE FOR RIGHT TURNS
CASTERONS	9.00	06	87		
.EC160URD	00.0	06	20		z
HORTHBOUND	0.0	90	82		2
SOUTHBOURD	00.00	90	S		z
אבאזכרב כסאן	COMPOSITION				,
	1 98 1 1 98	SU TRUCKS % CO AND RV*S VE	CONBINATION VEHICLES	* HOTOACYCLES	ឡ
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นะรายงบทก		0	0	0	
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CALLICAL GAPS	\$				
	1AE (12	TAEULAR VALUES (Table 10-2)	ADJUSTED VALUE	<b>H</b> 0	FINAL CRITICAL GAP
ATMOR PICHIS	.,				<b>;</b>
	5 6	5.50	5.50	6.6 6.6	5.50 5.50
STIST TEFTS					
	8 8	5.50	5.50	0.00	5.50 5.50
AINGR THROUGHS NG S3	हम इ. इ. इ.	6.50	6.50	0.00	6.50
ETHOR LEFTS	88 83	7.00	7.00	0.00	7.00
SERIIF ING	1:1FORHATION	A110H			
TRACE OF THE EAST/LES KANE OF THE NORTH/SO OWLE AND THE OF THE OTHER INFORMATION	EHST/UEST RORTH/SOU HE OF THE HATTON	ENTIVESS STREET RGRIH/SOUTH STREET. E. OF TAE ANALYSIS INTION 1995 PROJ.	HANAWAI S HANAWAI S 2/3/93; (	IAU STREET [ STREET ; 07:00 TO 03:00 PK.HR. VOL. W/O	3:00 W/O PR0J. NAH

ADJUSTIKENT FACTORS

Brief Comment of the

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LAKE USAGE

Page-3
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HIRGL 1	rPE seu	CONTROL TYPE SOUTHBOUND: STOP SIGN	S10P 9	SIGH		
TRAFFIC VOLUNES	OLUMES					
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inau	20¢	592	^	o		
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ABER UF	ריאנכ	WUNEER OF LINKS AND LANE USAGE	USAGE	 	1	
		83	9	22	88	
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LANE USAGE	ιų			LIR	LIR	

ABJUSTNLNT FACTORS

Page-2

	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (11) FOR RIGHT TURNS	PERCENT RIGHT TURN CURB RADIUS (11) ACCELERATION LANE GRACE ANGLE FOR RIGHT TURNS FOR RIGHT TURNS
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1.25160040	0.00	90	20	z
CHUGRIHBOUND	0.00	30	82	=
SOUTHEGUND	0.00	90	28	I
VEHICLE COMPOSITION	HPOS1110M	_		

* hulorcycles	CONBINATION VEHICLES O O O	AND RUCKS AND RUS 0 0 0	CASTEQUND LESTEGUND AGETHEGUND CORTHEGUND
	נאווונאר פאנצ	દ્	CRITICAL GAPS
o	0	0	ситивочио
0	•	0	ÚR THEOUND
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0	0	0	STEDUND
* HUTORCYCLES	* CONBINATION VEHICLES	S SU TRUCKS AND RV'S	

		TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGNT DIST. ADJUSTHENT	FINAL CRITICAL GAP
ATMOR :	TINDR RIGHTS NB SB	5.50	5.50	0.00	5.50 5.50
rajor LEFTS	LEFTS E3 E3	5.50	5.50	0.00	5.50
r. Ingr	LINGR TARGUGHS NB SB	6.50	6.50	0.00	6.50
NINOR LEFTS	LEFTS NB SB	7.00	7.00	0.00	7.00
10501	T Sulvai	HOTHERSTHE THEORIGINAL			

IDENTIFYING INFORMATION

WANT OF THE EAST/ABST STREET..... HAPILIHAD STREET

WANT OF THE NORTH/SGUIN STREET..... HANAWAI STREET

DATE GID TIME OF THE MANAYSS.... 2/3/93 : 15:15 TO 16:15

OTHER INFORMATION... 1995 PROJ. CORN. PH PK.HR. VOL. W/O PROJ. HAH

A95PO

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Page-3	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
CAFACITY AND LEVEL-OF-SERVICE	

<b>по</b> VЕНЕИТ	FLGW- RATE v(pcph)	POTEN- FLOW- TIAL RRIE CAPACITY V(PCPh) C (PCPh) P	ACTUAL HOVEHENT CAPACITY C (PCPh) H	SHA CAP SH SH	SHARED CAPACITY C (PCPh) SH	E0 0 =	RESERVE CAPACITY C = C - V R SH	, i	507	ώ i
AINOR STREET										- (
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NINDR STREET										
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## TOENTIEVING INFORMATION

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NAPILIHAU STREET HANGUAI STREET	2/3/93; 15:15 10 OHH. FH PK.HR. VOL.
THE EAST/JEST STREET NAPILIHAD STREET NAME OF THE HOSTH/SOUTH STREET HANAUAI STREET	CATE AND TIME OF THE ANALYSIS 273/93; 15:15 TO 16:15 OTHER THEORMATION 1995 PROJ. COMM. PM PK.MR. VOL. 6/0 PROJ. 935PO
SF 116	AND THE
Harry Park	CATE CTIER

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LANES	1		63	-1	1	

ANDESTREAT FACTORS	F ACTORS			addistrucht factors
	GRADE	EIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURMS	ACCELERATION LANE FOR RICHT TURNS
Chisteound	i	i	;	
UES160UND	-4.00	90	20	Ŧ
HORTHBOUND	0.00	30	20	z
SOUTHEGUND	0.00	90	70	×
VEHICLE COMPOSITION	1FOSITION	_		JEHICLE COMPOSITION

* KOTGRCYCLES	† 1	0	٥	o	ראוונגן מאף?
* COMBINATION VEHICLES	1		o	0	
S SU TRUCKS AND RU'S	;	0	0	0	9
	CASTEOUND	4EST50UND	исктавдинр	CHUGGHTUGE	CAITICAL GAPS

	TABULA (Tab)	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT	FINAL CRITICAL GAP
MINGS RIGHT	្ន	5.50	5.50	0.00	5.50
nkjar Lefts	85	5.00	5.00	0.00	5.00
AINDR LEFTS	ä	6.50	6.50	00.0	6.50
IDENTIFYING THFORMATION	TREOFMAT.	los I			
HART OF THE	EAST/VES	NAME OF THE EAST/WEST STREET NAPILLINGU STREET NAME OF THE WASHACOUTH STREET LOWER HONDAPTILE.	. MAPTLIH	MARÉ OF THE EAST/WEST STREET MAPILIHAU STREET MARE OF THE WASTW/SOUTH STREET ROUGH HONDORTILANT ROAD	

IDENTIFYING THEORYNITON

NAME OF THE EASTVEST STREET..... NAPILIHAN STREET

NAME OF THE NORTHY-COUTH STREET.... LOUER HONOAPTILANI ROAD

DATE AND THE OF THE ANALYSIS.... 2/3/93; 07:15 TO 00:15

CTHER INFORMATION... 1995 FROJ. COHM. AN PK.MR. VOL. W/O FROJ. LHM

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CATACLTY AND LEVEL-OF-SERVICE

Page-3

105		<b>4</b> 6	Œ
RESERVE CAPACITY C = C - V R SH		472	111
SHARED CAPACITY C (pcph) SH		503 979	266
ACTUAL HOVEHENT CAPACITY C (PCPh) h		503 979	992
FLCM- TIAL RATE CAPACITY V(PCPh) C (PCPh)		594	266
FLCM- RATE v(pcph)		31	215
HOVEHENT	HINGR STREET	ku LEFT RIGHT	najor strcet so ceft

IOCUTITYINS INFORMATION

WARE OF THE EAST/AUEST STREET..... NAPILIHAN STREET

NAME OF THE NORTH/SOUTH STREET.... LOWER HONOAPILLANT ROAD

DATE AND THE OF THE ANALYSIS.... 2/3/93; 57:15 TO 00:15

OTHER INFORMATION... 1995 PROJ. COMM. AN PK.HR. VOL. W/O PROJ. LHN

A95AO

Page-1 :fferstrikerrikeritettiticed intersections OTHER INFORMATION.... 1995 PROJ. COHM. PH PK.HR. VOL. N/O PROJ. LHIN NAME OF THE WORTH/SOUTH STREET...... LOWER HOWDAPILLANI ROAD NAME OF THE EAST-WEST STREET...... NAPILINAU STREET AREA POPULATION...... 10009 DATE OF THE ANALYSIS (BB/3d/yy)..... 2/3/93 NAME OF THE ANALYST......BSS AVERACE RUMING SPEED. NAJOR STREET.. 30 IOENTEYING INFORMATION A95PO INTERSECTION TYPE AND CONTROL

INTERSECTION TYPE: T-INTERSECTION

RAJOR STREET DIRECTION: WORTH/SOUTH

CONTROL TYPE MESTEDUND: STOP SIGN

TRAFFIC VOLUMES

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1104	0	210
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HUNDER OF LANES

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		CARES

FINAL CRITICAL GAP ISCULIFIZED INFORMATION

HANE OF THE CASTVAEST STREET..... HAPILIHAU STREET

HANG OF THE NORTH/SOUTH STREET.... LOWER HONO/PILLAHT ROAD

DATE AND TIME OF THE ANALYSIS..... 2/3/33 : 15:-0 TO 16:20

OTHER INFORMATION... 1995 PROJ. COMM. FM PK.HR. VOL. W/O FROJ. LMM

A95PO Page-2 GRADE ANGLE FOR RIGHT TURMS FOR KLOMI TURMS

CRADE ANGLE FOR RIGHT TURMS FOR KLOMI TURMS 5.50 5.00 6.50 \* HOTORCYCLES SIGNT DIST. ADJUSTHENT 0 0.00 0.00 0.00 ADJUSTED VALUE 0.5 20 ដ AND KA'S CONBINATION
AND KA'S VEHICLES 5.50 5.00 6.50 0 tabulna valuES (Table 10-2) 90 5 6 6.50 5.50 5.03 0 0 VEHICLE COMPOSITION ADJUSTMENT FACTORS 7.00 0.00 0.00 nAJOR LEF1S SB NINOR LEFTS EB CRITICAL GAPS NINOR AICHTS SOUTHEOUSID NOETHBOUND CHOSTRE OUND 502711609913 LASTBOURD JCS:EGUND Ensteauno CEST BOUND

ביייי איף איף איף איף איף איף איף איף איף	ri- re rcph)	POTEN- FLOM- TIAL RATE CAPACITY V(pcph) C (pcph) P	ACTUAL MOVEHENT CAPACITY C (PCPh)	SHARED CAPACITY C (PCPh)	RESERVE CAPACITY C = C - V R SH	S
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se LCFT	399	991	166	166	692	Œ
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HARE OF THE EAST-WEST STREET HAPILIHAU STREET HARE OF THE HORINSCUTH STREET LOWER HONOAPIILANT ROAD SATE AND THES OF THE ANALYSIS 2/3/93 ; 15:30 TO 16:30 CTHER INFORMATION 1995 PROJ. COMM. PH PK.HR. VOL. W/O PROJ.	17.4ES 31.74ES 37. THE 107	T STREET. MIH STREE ANNLYSIS 1995 PA A95PO	1 LOUE:	IHAU STREET R HONOAPIILA 93 : 15:30 TG PH PK.HR. VOL	11 ROAD 16:30 4/0 PROJ.	불

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1985 HCH: SIGNALIZED INTERSECTIONS
SUNMARY REPORT
INTERSECTION. HAPPLIMAU ST./HONDAPILLANI HIGHWAY
AREA TYPE.....OTHER
ANALYST......85S
DATE......A.M. PEAK HOUR
CONHENT.....1996 PROJ. COMM. AM PK.HR. VOL. W/O PROJ. HONA96AO

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8	_	0.090		0.211	_	21.7	۲.	Ų		31.8			_
	<b>-</b>	0.928		0.289	٥	34	m	0					
	œ	0.122	55	0.289	<u>e</u>	15	15.2	ں					

Delay = 19.1 (sec/veh) V/C = 0.631 LOS = C

INTERSECTION:

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1935 HGH: UNGIGHALIZED INTERSECTIONS
TABLE CHICKLES OF THE STREET OTHER INFORMATION... 1996 PROJ. COMM. AN PK.HR. VOL. 4/0 PROJ. MAN A9660 LATERSECTION TYPE AND CONTROL HANG OF THE EAST/UCST STREET..... HAPILIHAU STREET Ting FERIOD adaLY2ED...... 07:00 10 00:00 MANE OF THE HORTHZSOUTH STREET..... HANAUAI STREET MREA FOFULATION..... 10000 GAIC OF THE SWALFGIS (MD/dd//y)..... 273/93 mant of the Adelyst..... BSS IDENTIFYING INFORMATION AVERACE AUMING SPEED, HAJOR STREET.. 30 CONTROL LIFE SOUTHEROND: STOP SIGN COMPROL TYPE NORTHBOUND: STOP SIGN najes statet sirection: dastamest **8** 8 HUNCER OF LANES AND LANE USAGE LATERSECTION TYPE: 4-LEG 139 IRAFFIC VOLUMES :17 LANCS 21CH1 LEFT 1353

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LANE USACE

ACTENTIFICATIONS	FACTORS		1	1		Page-2	٠,
	PERCENT CRAGE	RICHT TURN ANGLE	CYRB RADIUS FOR RIGHT TO	US (ft) TURNS	ACCELERATION FOR RIGHT	ACCELERATION LANE FOR RIGHT TURNS	
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-C115CU10	c.00	6	SZ	_	2		•
исатнвоино	0.00	90	28		æ		
SOUTHEOUND	0.00	96	28		=		
VEHICLE COP	COMPOSITION						1
	2 5	RUCKS %	ATIO ES	* ROTORCYCLES	CYCLES		
2ASTECUND	;			1	0		
UECTEORIO		0	0		o		
: JATHIOGIO		0	0		0		
COURTHEOUND		0	¢		0		
ואבניבאני כי	زيهج		1				1
	1881 51)	ABULNR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT		FINAL RITICAL	GAP
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66JOR L2F1S	<b>3</b> 9	5.50 5.50	5.50 5.50	0.00	0.0	5.50	
ntion Throughs NB S3	2685 RB 23	6.50 6.50	6.50	0.00	9.0	6.50	
HINDE LEFT	2 S S	7.00	7.00	0.00	9.6	7.00	
ISCHILLYING	G INFORMATION	ATION					
HANE OF THE ENSIVESS HAVE OF THE HORTHYSO GATE AND TIME OF THE STHEE STHEE STHEEN INFORMATION	HE ENSTAUEST STE THE NORTHASOUTH OF TINE OF THE ANAL CRHATION 199	STATEST STREET REHASOUTH STREET. OF THE AMALYSIS ITON 1996 FR01.	HANAWAI 51 2/3/93 ; G	STRE IREE1 7:00 .HR.		3:00 H/O PROJ. NAH	포

LCVCL-OF-SCRVICE	
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Page-3

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RESERVE CAPACITY		326 433 939		319	876 797
RESERVE CAPACITY CAPACITY		221		351	
,		^^^		~ ~ ~	
SHARED CAPACITY C (pcph)		400 407 953		410 491 995	890 310
SHARED CAPACII C (PCPI		553		436	
1		^ ^ ^		~ ~ ^	
ACTUAL HOVEHEUT CAPACITY C (PCPh) H		400 437 953		418 491 995	550 310
POTEU- TIAL CAPACITY C (PCPh) P		410 497 553		432 501 995	690 810
FLO3- RATE V(PCph)		4 4 7		87 F	14
i10'2EstEn1	RINGR STREET	ив LEFT through řígat	nINGR STREET	SE LEFT THROUGH RIGHT	AGJU, STREET EB LEFT RB LEFT

## IDERTITYTHG INFORMATION

1305 MCH	: UNSIC	UNSICHALIZED INTERSECTIONS HINTYXXIITKYYYLLYYKXXIYKIX	INTERS	CTIONS	1905 NCH: UMSIGMALIZED INVERSECTIONS THUTSARITHEXISTITYERITHTENTIAL TREATMENT OF THE TREATMENT TO PAGE - 1	7.8
TOEATTF ATRIC		INFORMATION				•
PERSON	PPERICE RUMING	SPEED, NAJOR		CIREEI 30		
FEAX 100	FZIK HOUR FACTOR.			75		
ייאלפא 209	"XEA POPULATION.			10000		
היאב סי	TIIE EAST	EASTAUEST S	STREET	HAPILIHAU STREET	STREET	
sent of	THE HORTH/SOUTH STREET	H750UTH	SIRCET	HENAWAI SI	STREET	
man of	THE	AHALYS1		BSS		
CALE OF	OF THE ANAL	ANAL (SIS (SAZ/dd/yy)	1/1/pp/m	2/3/93		
Tine Ferion	lod aug	AUGLYZED		51:91 01 51:51	16:15	
OTHER IN	OTHER INFORMATION		1996 FR03.	Э. СОНН. РН РК.НВ.	. VOL. W/O PROJ. NAH	¥
CHTERSECTION	TIOH TYPE	멽	A96PO CONTROL			į
Tatezzzo	Chicaccotton TYPE:	1-re	(3			
CAJUR STREET		OIRECTION: EAST/WEST	EASTA	153		
Control	TYPE NOR	หอสานออบสอะ	\$100	SIGN		
CC#130L	TYPE 500	SCUTHEOUND:	\$106	S16H		
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	ü	9	5	85		
LEF1	95	=	47	77		
LaRid	311	270	^	යා		
RIGHT	33	63	13	7.7		
HUTSER (	GT LANES	LAKES AND LANE USAGE	E USAGE			i
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2B 1 LTR

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LAMES LAME USADE

-CONSTRUCTORS Page-2

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lui l					:						ŀ	GNP	<u> </u>					нан
ACCELERATION LANE FOR RICHT TURNS	=	T	ᄑ	z								FINAL CRITICAL (	5	5.50	5.50	6.50	7.00	PROJ.
						* HOTORCYCLES	0	0	•	0		SIGHT DIST. ADJUSTHERT	06. 0	9.60	0.00	0.00	0.00	SIREET IREET 15:15 TO 1
CURB RADIUS (ft) FOR RICHT TURNS	22	0.7	23	×		CONSTUATION VEHICLES		0	0	0		STED UE	!	5.5	5.50	6.50	7.60	HAULIN
RIGHT TURN ANGLE	30	6	90	90	z -	) T	0	0	0	0		IABULAR VALUES (Table 10-2)	5.50	5.20	5.50	6.50	7.65	10tt T STREET. UTH STREET GHALYSIS. 1996 PRO
PERCEUT	5.05	6.00	3.6	0.00	COMPOSITION	3.					S	IAB T		3	3 6	SE 58	85 C	EAST/UEST NOKTH/SOUTH
~ '	CHSTGOUND		NORTHEOUND	COULHECUND	VEHICLE CON		ENSTEGUND	JESTROUND	NOR THE GUND	SOUTHBOUND	CRITICAL GAPS		ATHOR RICHES		najor lefts	CLIOR THROUGHS RA RS SS	aingr Lefts	SECULTATION THE CASTAGEST STACKEST STAC

		-		-			İ				:
HOVESENT	FLOS- SATE V(PCPh)	POTEN- TIAL CAPACITY C (PCPh) P	ACTUAL HOVEHERIT CAPACITY C (PCFh) h	~ ~ ~ ~	SHARED CAPACITY C (PCPh)	e ta	E 0 0 1	ESE APPA	RVE CITY SH '	- :	S :
ESNOR STREET											
1751 50	53	305	202	^		233	^		224		J
THEOUGH	~	373	359	~	237	353	^	252	351	×	
RIGHT	16	950	950	^		920	^		933	^	
AINOR STREET											
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		332	24.5		363	367	^	289	357	Ž	
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5	::	716	216			716			603		
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ISCHIEFENG	INFORMATION	101									
HANG OF THE HANG OF THE OATE AND TEA	EAST/JES HORTH/SC	OF THE EAST/JEST STREET. OF THE HORTH/SOUTH STREET AND THE OF THE AMAY STR	HAPILIHAU STREET	LIHA WAI	U STREE STREET	FEET 22	91	1. 01		i	
	nTIC:	1992 FR0J. A96P0	ວ	. E	, <del>,</del> ,	. –		U/O PROJ.	ROJ.	11VH	77

OTHER INFORMATION.... 1996 PROJ. COHN. AM PK.HR. VOL. W/O PROJ. LHN
A96AO
INTERSECTION TYPE AND CONTROL HAME OF THE NORTH/SOUTH STREET..... LOWER HONDAPILLANI ROAD HAME OF THE EAST/WEST STREET...... NAPILIHAU STREET DATE OF THE AMALYSIS (ma/dd/yy)..... 10/3/92 TIME PERIOD AMALYZED..... 2/3/93 NAME OF THE ANALYST..... BSS IOENIIFYING INFORMATION AVERAGE RUNHING SPEED, MAJOR STREET.. 30 £ | HAJOR STREET DIRECTION: NORTH/SOUTH INTERSECTION TYPE: 1-INTERSECTION CONTROL TYPE MESTBOUND: STOP SIGN 8 B | E **æ** : TRAFFIC VOLUNES NUMBER OF LANES RIGHT LEFT 1HRU

ADJUSTHENT FACTORS	FACTORS				Page-2
	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (fl) FOR RIGHT TURNS		ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND		1			,
NESTBOUND	-4.00	06	50		æ
NORTHBOUND	0.0	90	20		r
SOUTHBOUND	0.00	20	20		z
VEHICLE CO	COMPOSITION	2			
	X SU ARG	SU TRUCKS % CC AND RV*S VE	COHBINATION VEHICLES	* HOTORCYCLES	<b>!</b>
<b>CASTEDUMA</b>	ľ			1	
NESTBOUND		0	0	0	
NORTHBOUND	_	0	0	0	
SOUTHBOUND	_	0	0	0	
CRITICAL (	GAPS				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	AT .	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT	FINAL CRITICAL GAP
HIHOR RIGHIS	HTS HB	5.50	5.50	0.00	5.50
HAJOR LEFTS	15 SB	5.00	5.00	0.00	5.00
NINOR LEFTS	15 WB	9.50	6.50	0.00	6.50
IDENTIFYING INFORNATION	NG THFOF	HATION		,	
NATE OF THE EAST/VEST NAME OF THE NORTH/SOU DATE AND TIME OF THE OTHER INFORMATION	THE EAST, THE NORTH TINE OF NFORMATION	OF THE EAST/WEST STREET OF THE NORTH/SOUTH STREET AND TIME OF THE ANALYSIS I INFORMATION 1996 PROJ. A9640	¦ ይ	HAPILIHAU STREET LOWER HONOAPIILANI 10/3/92 ; 2/3/93 HM. AM PK.HR. VOL.	ROAD W/O PROJ. LHM

LANES

Page-3 CAPACITY AND LEVEL-OF-SERVICE

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НОУЕНЕМТ	FLOW- 1 RATE V(PCPh) c	POTEH- TIAL CAPACITY C (pcph) P	ACTUAL HOVENENT CAPACITY C (pcph) H	SHAREO CAPACITY C (PCPh) SH	RESERVE CAPACITY C = C - v R SH	S01
MINOR STREET WB LEFT RIGHT HAJOR STREET	32 146	590 976	497	497	465 830	₫ ₫

IDENTIFYING INFORMATION

NAME OF THE EASI/WEST STREET..... NAPILIHAU STREET

NAME OF THE MORTH/SOUTH STREET.... LOWER HOHOAPIILANI ROAD

DATE AND TIME OF THE ANALYSIS..... 10/3/92; 2/3/93

OTHER INFORMATION... 1996 PROJ. COHN, AN PK.HR. VOL. W/O PROJ. LHN

A96AO

INTERSECTIONS	Page-1
יייייייייייייייייייייייייייייייייייייי	
AVERAGE RUNHING SPEED, MAJOR STREET 30	
PEAK HOUR FACTOR82	
AREA POPULATION 10000	
NAME OF THE EAST/VEST STREET NAPILIHAU STREET	
NAME OF THE NORTH/SOUTH STREET LOWER HONDAPITLANI ROAD	
HANE OF THE AHALYST 855	
DATE OF THE ANALYSIS (BE/dd/yy) 2/3/93	
. TIME PERIOD AMALYZED 15:30 TO 16:30	
OTHER INFORMATION 1996 PROJ. COMH. PH PK.HR. VOL. W/O PROJ. LH A9660 INTERSECTION TYPE AND CONTROL	E
	i
INTERSECTION TYPE: T-INTERSECTION	
HAJGR STREET DIRECTION: NORTH/SOUTH	
CONTROL TYPE WESTBOUND: STOP SIGN	

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SB LEFT

TRAFFIC VOLUMES

\$B 228 114 0 4B RIGHI 1<del>1</del>20

KUMBER OF LAKES

BS 1 里一 87 æ | :

ADJUSTHENT FACTORS Page-2

	PERCENT GRADE	PERCENT RIGHT TURN GRADE ANGLE		-
EASTBOUND		1		
WESTBOUND	-4.00	90	20	2
NOR THBOUND	0.00	90	20	z
SOUTHBOUND	00.0	90	20	z
VEHICLE COMPOSITION	1P051110N			

	* SU TRUCKS AND RV*S	* CONBINATION VEHICLES	* HOTORCYCLES	
EASTBOUND	;	;	;	
WESTBOUND	0	o	0	
ИОЯТНВОИНО	0	0	0	
<b>соитивоим</b>	0	0	0	
CRITICAL GAPS	Ñ			

	TABULAR VALUES (Table 10-2)	VALUES 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT	FINAL CRITICAL GAP	
TINDR RIGHTS UB		5.50	5.50	0.00	5.50	
AAJOR LEFTS SB		5.00	5.00	0.00	5.00	
AINOR LEFTS WB		6.50	6.50	00.0	6.50	
IDENTIFYING INFORMATION	IFORHATIO	_			IDENTIFYING INFORMATION	
VANE OF THE EASI/WEST STREET NAPILIHAU STREET HAME OF THE NORTH/SOUTH STREET LOWER HONDAPILLA DATE AND THE ANALYSIS 2/3/93 ; 15:30 TOTHER INFORMATION 1996 PROJ. COHM. PH PK.HR. VO A96PO	ASIZNEST ORTHZSOUT OF THE A	STREET H STREET. HALYSIS 1996 PROJ A96PO	LOWER 1 2/3/93	NAME OF THE EASI/MEST STREET NAPILIHAU STREET HAME OF THE NORTH/SOUTH STREET LOWER HONOAPIILANI ROAD DATE AND ITHE OF THE ANALYSIS 2/3/93; 15:30 TO 16:30 OTHER INFORMATION 1996 PROJ. COHM. PM PK.HR. VOL. W/O PROJ. A96PO	0AD :30 /0 PR0J. LHN	

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POTEN- ACTUAL   SHARED   RESERVE   RAIF   CAPACITY		,					
116 453 344 344 228 236 951 951 951 715 306 990 990 990 604  INFORMATION RORH-SOUTH STREET ROTH-SOUTH STREET ROTH-SOUTH	OVEHENT	FLOW- RATE v(pcph)	POTEN- IIAL CAPACITY C (PCPh) P	ACTUAL HOVEHENT CAPACITY C (PCPh)	SHARED CAPACITY C (pcph)	RESERVE CAPACIIY C = C - V R SH	507
116 453 344 344 228 236 951 951 951 715 306 990 990 990 604  EAST/WEST STREET RAPILITHU STREET ROST/WEST STREET LOWER HONOAPILITANI ROAD HORTH-SOUTH STREET LOWER HONOAPILITANI ROAD HORTH-SOUTH STREET LOWER HONOAPILITANI ROAD HATION 1996 PROD. COMM. PH PK.HR. VOL. W/O PROJ. LHR						 	•
116 453 344 344 228 236 951 951 951 715 306 990 990 990 604  INFORMATION  EASTAEST STREET  MORTH-SOUTH STR	INOR STREET						
306 990 990 604  INFORMATION  EAST/WEST STREET MAPILIHAU STREET  MORTH/SOUTH STREET LOWER HONDAPILLAMI ROAD  E. OF THE MANLYSIS 2/3493; 15:30 TO 16:30  MAION 1996 PROJ. COMM. PM PK.HR. VOL. W/O PROJ. LHR	VB LEFT RIGHT	116 236	453 951	344 951	344 951	228 715	O &
E	IAJOR STREET	_					
!	SB LEFT	306	990	066	066	684	Œ
!	DENTIFYING	INFORMAT	ION				
	IANE OF THE MANE OF THE DATE AND THE DATE AND THE DATE AND THE DATES THE DATES THE OR THE DATES THE OR THE DATES THE OR THE DATES THE OR THE DATES	EAST/NES NORTH/SC NE OF THE	ST STREET.  DUTH STREE  E ANALYSIS  1996 PR	1 LOWER 2/3/9	IHAU SIREET R HGNOAPIILAN N3 : 15:30 TO NA PK.HR. VOL	II ROAD 1 16:30 W/D PR0J.	善

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A Para	ANALYSTBSS	888	SS										
TIME	TINE	P	271/93 P.H. PEAK H 1997 PROJ.	73 PEAK HOUR PROJ. COH	ŕ	PH PK.HR.	HR. VO	VOL. 4,	W/O PR01.		HONA92PO	0	
;		VOL	VOLUMES	:					039	GEONETRY			}
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<b>SB</b>	0.0		2.00	z	0	0	0.90		0	>-	11.5		m
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	~		0.346		0.400	7	12.3	8					
84	_	LIR	0.972		0.400	4	40.5	ш		40.5	s		w
9	_		0.874		0.211	4	40.4	w		31.2	2		۵
	-	Œ	0.403		0.289	-	16.9	u					
<b>88</b>	_		0.096		0.211	2	21.7	U		34.6	9		۵
	_		0.952		0.289	m	37.7	٥					
	œ		0.127		0.209	-	15.3	U					

V/C = 0.653 t05 = C

Delay = 20.3 (sec/veh)

INTERSECTION:

1955 LIN: UMIGNALIZED	GLIZED IMTERECTIONS STATEMENT STATEMENT ST	IORS References	Fage-1	
TOTALL SING INCOMENTING	1204			
PREMACE RUPHING SPECO, MASOR	ID, RAJOR STREET.	0: :13		
PEAK HOUR FACTOR		5.		
SRES PSPURITOR		00001	00	
CAME OF THE EAST/UEST STREET	st street	und 1	HAPILIHAU STREET	
HAME OF THE HONTH/COUTH STREET	OUTH STREET	няно	HANNUAI STREET	
SEES OF THE AMALYST		:: :::		
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## APPENDIX

CAPACITY ANALYSIS COMPUTATIONS

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LOCALIZY ING LAFORMATION

NAME OF THE EASITALEST STACET..... NAPILITAU STRCET

AAME OF THE ROETH-SOUTH STREET.... HARBURL STREET

BATE AND TIME OF THE FAMILYSOUTH. STREET.... 2/3/93 ; 07:00 TO 03:00

OTHER INFORMATION... 1995 CUM. COMM. AN FY.HR. VOL. UZP FN.1 HARBY

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NAME OF THE CASIVAEST STREET..... HAPLEHAU STREET

ANNE OF THE ROSTHASOUTH STREET.... AANHANE STREET

OATE AND THE OF THE NUMERISTS.... 2/3/2/3 ; 35:15 TO 16:15

OTHER LINCORATION... 1995 CCM. COMM. FM PK.HR. VOL. KJP PH.1 HAHAD

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INOR LEFTS	FTS ue	6.50	6.50	0.00	6.50

AGENTIFYING THE CASIVEEST STREET..... HAPILIHAU STREET

HAND OF THE RASIVEST STREET..... LOWER HONOAPILLANT ROAD

SALE AND TING OF THE ANALYSIS.... 2/3/3/3 : 07:15 TO 62:15

SHEEK INFORMATION... 1995 CUM. COMM. AN PRIMA. WOL. U.P. FH.1 LANAS

SAM

CAPACITY AND LEVEL-OF-EERVICE	רכאנר-מ	F-SERVICE			P	Page-3
NOVENEA1	FLGS- RATE V(PCPA)	POTEN- TLOS- TIAL RATE CAPACITY VIPCPA) C (PCPA)	ACTUAL HOVEREAT CAPACITY C (SCPh) H	SHAKED C.P.ECIT. C. (DCPA) St.	4655872 CAPACITO	: nos
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LÖESTIT (ING TUFORMATION	Inf ORna!	T ON				
HARC OF THE EAST/MELT STREET HAPILIHAU STREET HARC OF THE BOSTH-SCUTH STREET LOWER HEAD, TLLKAL FOAD DATE AND TIME OF THE MALYIES 2/3/93 : 07:15 TO COITS OTHER THEORNATION 1995 CUR. COMM. 64 FL.HG. VOL. H.P PI	EAST/UES RORTH-SC E OF THE ATTOM	1 STREE1 UTH STREE1 AMALY 213 1955 CUR	######################################	WARG OF THE EASTWELT STREET MAPILINAU STREET MARE OF THE MARIN-SCUTH STREET LOWER HAND, TILEAU ESAG DATE AND TIME OF THE AMALYLIE 273793 : 07:15 TO 60:15 OTHER DAFORMATION 1995 CUR. GOHN, 64 FL.HA. VOL. H.P PH.I	7	Seus:1
		Z				

1985 HCH:	IS UNSI	GNALIZE	D INTER	UNSIGNALIZED INTERSECTIONS ************************************	1985 HCH: UMSIGNALIZED INTERSECTIONS	Page-1
IDENTIFYING	ING INF	INFORMATION	¥ !	i i i i i		
AVERAGE RUNNING SPEED,	RUNNING	SPEED,	HA.JOR	STREET	30	; ;
PEAK HOUR FACTOR	R FACTO				.82	
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INE PERIOD ANALYZED.	TOD ANAL			15	15:30 TO 16:30	
OTHER INFORMATION	ORMATIO		1995 CUM.	COMM.	U/P PH.I	LHM49
INTERSECTION TYPE	TION TYP	ONE	SPN CONTROL			
INTERSECTION TYPE:	TION 17P	E: 1-11	I-INTERSECTION	10M		į
HAJOR STREET		ECTIONS	DIRECTION: MORTH/SQUTH	у запти		
CONTROL TYPE		VESTBOUND:	ST0P	SIGN		
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ADJUSTHENT FACTORS

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	N SIREE! MOAPIILAN 15:30 TO C.HR. VOL.
	. HAPILIHA . LOWER HO . 2/3/33 ; OMH. PH PP
	REET STREET LYSIS 95 CUM. CO
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NAJOR STREET		DIRECTION: NORTH/SOUTH	10RTH/50	нти		
CONTROL TYPE		EASTBOUND:	STOP S1GN	*		
TRAFFIC VOL	VOLUMES					
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ятснт	13	:	42	0		
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	<b>.</b>	EB	93	2	88	
LANES		1 -	:	-		

Page-2 ADJUSTHENT FACTORS

PERCENT RIGHT TURN CURB RADIUS (ft) ACCELERATION LANE GRADE ANGLE FOR RIGHT TURNS FOR RIGHT TURNS 0.00 90 20 N 5 8 VEHICLE COMPOSITION 0.00 SOUTHBOUND 0.00 ноятнеоино WESTBOUND EASTEOUND

* COMBINATION * NOTORCYCLES	0 0	:	0	0	
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	EASTBOUND	WEST80UND	NORTHBOURD	SOUTHBOUND	POLITICAL CABO

FINAL CRITICAL GAP	5.50	5.00	9.50
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ADJUSTED VALUE	5.50	5.00	6.50
TABULAR VALUES (Table 10-2)	5.50	5.00	6.50
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NAME OF THE EAST/WEST STREET.... NEW ROAD
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Page-3 CAPACITY AND LEVEL-OF-SERVICE

<b>НО</b> VЕНЕИТ	FLOW- RATE v(pcph)	POTEN- TIAL CAPACITY C (pcph) P	ACTUAL HOVEHENT CAPACITY C (PCPh)	SHARED CAPACITY c (pcph) SH	RESERVE CAPACITY C = C - V LOS R SII	8 :
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1985 HCH: UNSIGNALIZEO INTERSECTIONS OTHER INFORMATION.... 1995 CUM. COMM. PH PK.HR. VOL. 4/P PH.1 HOME9 NAME OF THE NORTH/SOUTH STREET..... HONDAPILLANI BUY TIME PERIOD AMALYZED..... P.M. PEAK HOUR NAME OF THE EAST/WEST STREET..... NEW ROAD IDENTIFYING INFORMATION DATE OF THE ANALYSIS (BM/dd/yy)..... 2/3/93 AREA POPULATION..... 10000 MANE OF THE ANALYST...... BSS PEAK HOUR FACTOR.....9 AVERAGE RUNNING SPEED, HAJOR STREET.. 30 TRAFFIC VOLUMES HAJOR STREET DIRECTION: NORTH/SOUTH SB SPW
INTERSECTION TYPE AND CONTROL INTERSECTION TYPE: 1-INTERSECTION CONTROL TYPE EASTBOUND: STOP SIGN 뙆 8 8

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ADJUSTHENT FACTORS	FACTORS				Page-2
	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURKS		ACCELERATION LANG FOR RIGHT TURNS
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WESTBOUND	-	:	į		
HORTHBOUND	0.00	96	20		z
SOUTHBOUND	0.00	90	20		z
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	I US Z.	at	CONDINATION VEHICLES	* HOTORCYCLES	53
EASTBOUND		0	0	0	:
WESTBOUND	;	•	i	i	
KORTHBOUND		0	0	0	
SOUTHBOURD		0	0	0	
CRITICAL GA	GAPS				
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HAJOR LEFTS	92	5.00	5.00	0.00	5.00
HINOR LEFTS	8	6.50	6.50	0.00	6.50
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## 1985 HCH: SIGNALIZED INTERSECTIONS SUMMARY REPORT

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1985 HCH: SIGNALIZED INTERSECTIONS SUNNARY REPORT

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1985 HCM: UNSfühmliste	•	THTERSECTIONS	110%	1-1614 1-1614	
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OTHER INFORMATION		1996 Curl. Cohm.	COMM.	an Pries, vol. 47P PH.2 namas	
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AGJUSTHENT FACTORS

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CURE RADIUS (FL) FOR RIGHT TURNS		•	•			CONBINATION VEHICLES	0	0	0	0		ADJUSTED VALUE	Ň	5.50	5.50	6.50	6.50	7.00	rsp 2/3 CONH.
RIGHT TURN ANGLE	90	9.0	30	90		je ¦						2 VALUES e 10-2)	5.5	5.30	5.50	6.50	6.50	7.00	INFORMATION EASI/JUEST STREET NORTH/SOUTH STREET E OF THE AMALYSIS NATION 1996 CUM.
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CAPACITY AND LEVEL-OF-SERVICE	LEVEL-CI	-SERVICE							2	Fage-3	19.3
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identifying information	HANG OF THE EASTZWEST STREET HAPTLIHAU STREET HANG OF THE HARTHASGULH STREET HANGUALS STREET	DATE AND TINE OF THE AMALYSIS 2/3/93; 07:00 10 02:00	OTHER INFORMATION 1996 CUM. COMM. AM FK.HR. VOL. W.P PH.2 HANAP	ney
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PASS-1. PERTEVING INFORMATION	30	.07	10000	NAPILIHAU STREET	. MANAWAI SIREET	B55	2/3/32	15:15 T0 16:15	OTHER INFORMATION 1976 CUM. COMM. PM PK.HR. VOL. 11/P PM.2 NAHAY EPU INTERSECTION TYPE AND CONTROL											110 SB	1 1	רוא רוא	
UNSIGNALIZED INTERSECTIONS ************************************	HAJOR SIREET			;TREET	:		(xx/pp/as		1936 CUM. COMA EPU COMTROL	tu : FASI/UESI	7,000	0: 510F 510a	D: \$10P 51GH		65 65	1 40	6	15 22	ANC USAGE	89	2	,	
1925 HCM: UNSIGNALISED TITATION STREET IN IDENTIFYING INFORMATION	AYERAGE RUNNING SPEED, NAJOR STREET	FEAK HOUR FACTOR	אספר הספר הספר הספר הספר הספר הספר הספר ה	tians of the East/VEST STREET	HART OF THE HORTH/SOUTH STREET.	ASHE OF THE AMALYST	GATE OF THE CHALCES (BAZdd/yy).	TINE PERIGG ANALYZED	OTHER INFORMATION	INTERSELLTUN TYPE: 4-LEV Halab SIBEET NYPETTION: FAST/UEST		CONIZOL TIPE NORTHBOOND: STOP STOR	LONTROL TYPE SOUTHBOUND: \$10P SIGN	OLUMES	all all		211 270	S. 7.	NUNCER OF LAMES AND LANC USAGE	2	2	ig.	
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IDENTIFYING TAFORMATION
TABLE OF THE EAST/MESSI STREET... NAMBLIAL STREET
TABLE OF THE CAST/MESSISTET... NAMBLAS STREET
DATE AND THE OF THE ANALYSIS.... 2/3/93 : 15:15 10 16:15
GHER INFORMATION... 1906 COM. FOR PK. HA. VOL. W.P. PH.C. NAMA9
6 THE THEORMATION...

1965 HCM: UNSIGNALIZEO INTERSECTIONS LIXLIZISTIZAZISTIZIZZZZZZZZZZZZZZZZZZZZZZZZZ	Page-:
IÙENIIFTING INFORMATION	
AVCRAGE SUMMING SPEED, NAJOR STREET 30	
FEAST MOUR FACTOR	
AREA POPULATION 10000	
WANG OF THE CASIZUESI STREET NAPILIHAU STREET	EET
HAME SF THE HORTH/SOUTH STREET LOWER HOHOAPIILANI ROAD	ILANI ROAD
HABE OF THE MINLYST BSS	
DATE OF THE ANALYSIS (50/dd/yy) 2/3/93	
TIME FERIOG ANALYZED 07:15 TO 03:15	s
OTHER INFORMATION 1996 CUM. COMM. AM PK.HR. VOL. U/P PH.2	. UZP PIL.2 LHMA9
INTERSECTION TYPE AND CONTROL	

## CONTROL TYPE WESTROUND: STOP SIGN

TRAFFIC VOLUMES

hajor street direction: north/south

INTERSECTION 1YPE: I-INTERSECTION

SB.	177	8	0
5	0	3	69
88	33	0	153
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Page-2 ADDUSTREAT FACTORS

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	PERCENT GRADE	RIGHT TURK ANGLE	CURE RADIUS (ft) FOR RIGHT TURKS	PERCENT RIGHT TURN CURE REDIUS (ft) ACCELERATION LANE GRAGE ANGLE FOR RIGHT TURNS FOR RIGHT TURNS
CASTBOUND		;	-	,
LESTEOURD	-4.60	90	o,	2
ИОЯТИВОИИО	0.00	90	92	Z.
SOUTHEOUND	0.00	90	20	=
VCHICLE COMPOSITION	1POST1 TO4			WHICLE COMPOSITION

EASTZOUND LESTBOUND NORTHBOUND SQUIMSOUND CRITICAL GAPS
---------------------------------------------------------

		IABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT	FINAL CRITICAL GAP
HINGR RIGHTS	9	5.50	5.50	0.00	5.50
MAJOR LEFTS	41	5.60	9.00	0.00	5.00
NIADA LCFTS	앞	6.50	6.50	0.00	6.50
IDENTIFYING INFORMATION	INF	)RrfAT10:4			
NAME OF THE NAME OF THE JANE AND TEN OTHER ENFORM	E 20 E 20 E 20 E 20 E 20 E 20 E 20 E 20	HAME OF THE EAST/WEST STREET NAPILIHAN STREET HAME OF THE NORTH/SOUTH STREET LOWER HONDAPITLANT ROAD DATE AND TIME OF THE ANALYSIS 2/3/93 : 07:15 TO 03:15 OTHER THFGRMATION 1996 CUM. CORM. AN PR. HR. VOL. U.P FIL.Z. LANA9	HAPILIN LOVER 9 2/3/93	100 518EE1 10000011LANI R 1007:15 TO 03 11.163. VOL. U.A	060 :15 P FII.2 LARA9

Fage-3	
SERVICE	
CAPACITY AND LEVEL-OF-SERVICE	

§ :		<b>α</b> « <b>τ</b>		a
RESERVE CAPACITY C = C - V R SH		456 310		392
SHARED CAPACITY C (pcph) SH		452 976		166
ACTUAL HOVENEAT CAFACITY & (PCPh) h		926 35F		166
FOICH- IIAL CAPACIIY C (PCPh) F		556 976		166
FLOW- 1 RATE V(PCPh) G		34 158		224
пбуенент	MINGR STREET	EB LEFT RIGHT	NAJOR STRUET	38 LEFT

IDCHIIFTING INFORMATION
HAME OF THE EASI/WEST STREET..... NAPILIHAU STREET
HAME OF THE WARH/SOUTH STREET.... LOWER HONDAPILLANT KOAD
GATE AND TIME OF THE GMALYSIS.... 2/3/33; 07:15 TO 03:15
OTHER INFORMATION... 1996 CUT. COMH, AN PK.HR. VOL. W/P PH.2 LHMA9
6AN

OTHER INFORMATION.... 1956 CUM. COMM. PM PX.HR. VOL. W/P PH.C. LHMA9 6/PW ENTERSECTION TYPE AND CONTROL 1905 HCM: UNSIGHALIZED INTERSECTIONS PAGE-1 NANE OF THE HORTH/SOUTH STREET...... LOWER HOMOAPIILA: FGAG HANE OF THE EAST/UCST STREET...... HAPILIHAU STREET TIME PERIOD AMALYZED.................. 15:30 TO 10:30 ISENIIT (145 INFORMATION DATE OF THE AMALYSIS (DA/Dd/77)..... 273/93 AREA FÜPULATION...... 10060 MANE OF THE AMELYST..... BSS PEAK HOUR FACTOR.......82 AVERAGE RUSHING SPEED, HAJOR STREET.. 30 88 | 58 NAJGR STREET DIRECTION: WORTH/SOUTH CONTROL TYPE WESTBOUND: STOP SIGN INTERSECTION 179E: 1-INTERSECTION IRAFFIC VOLUNES LEFT

RIGHT THRU

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ABJUSTHENT FACTORS	FACTORE				F. 1966-2
	SERCENT GRAŬĒ	AIGHT TURN ANGLE	CURE ENDIUS FOR RIGHT TO	(T.)	ACCELERATION LANE FGR RIGHT TURNS
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CRITICAL G	CAPS				
	IA C	IABULCR YALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT	FINAL GAP
ninoz Rights	글 글	5.50	5.50	6.00	25.5
MAJOR LEFT	53 35	5.60	5.00	6.90	5.00
HINDR LEFTS	en 31	£.50	6.50	0.00	05.9
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HARL OF THE EAST/VE HARE OF THE MOSIFVE GATE AND TING OF THE CINCE THE GRANTION	GF THE EAST/UEST GF THE HORTH/SOU AND TING OF THE THE ORTHALION	ST STREE OUTH STR E AUGLYS 1796 6PU		HAPILIHAU STREET LGUER HONDAPILIHUE 2/3/93 : 15:30 TO UT. FA FK.HR. VOL.	. 6040 16:30 u/P FH.2 LHH#9

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Faga-3	507		0.2		
Fac	RESERVE CAPACITY C = C - V R SH		212 705		£73
	SHARED CAPACITY C (pcph) SII		325 348		636
	ACTUAL HOVENCHI CAPACLIY C (pcph) H		325 946		60%
-SERVICE	FOIEH- \$103- 11AL PATE CAPACITY V(pcph) c (pcph)		439		939
רבאנר יפּג	FLGU- FRIC v(pcph)		57.77		326
CLERCITY AND LEVEL-OF-SERVICE	HOVERENT	NINOR STREET	NB LEFT RIGHT	NAJOR STREET	SO LEFT

IDENTIFYING INFORMATION

NAME OF THE EAST/VEST STREET.... NAPILIHAN STREET

NAME OF THE NORTH/SOUTH STREET.... LOWER HOWAPILLAND TO 16:30

GATE AND TIME OF THE OF THE OTHE YELS.... 2/3/93; 15:30 TO 16:30

GTHER INFORMATION... 1996 CUN. COMM. FM FK.HR. VOL. K/P PH.Z LHUM?

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1785 HCH: UMSIGHALIZEO INIER HIBBIRAHANINA	URSIGR	UNSIGNALIZED	INTERSECTIONS HERBERTHERS	11045	1-2554 1-2544	
IDEALIFICAC DAFORMALICA	LIFOR	ARI I ČR				
AVERAGE RUMING SPEED, AAJOR	UNING S	PEED, A		STREET	30	
PENK NOUN FACTOR	f AC 10R.				6.	
AREA POPULATION	ATION			:	10000	
HAME OF TH	E ENST/	WEST 53	THE ENSTYWEST STREET	:	NEW ROAD	
nane of Th	E NORTH	1/50UTH	THE NORTH/SOUTH STREET.	:	HONDAPIILANI HYY	
nane of II	THE ANALY	Artal YST			855	
DATE OF THE	E HANL	rs13 (as	ANALYSIS (BB/dd/yy)		2/3/93	
TEE FERIC	FERIOD GMALYZED	Y2ED		:	AII PEAK HOUR	
OTHER INFORMATION	RHATIGA EON TYPE	_	1996 CUM. 6AU CONTROL	CORFIE.	CONN. AM PX.UR. VOL. 2/P PH.2 HONE?	
INICESECTION TYPE: 1-INTERSECTION	MA1 KO1	E: 1-111	TERSECTI	õ		
EAJOR STREET DIRECTION: HORTH/SOUTH	EET DIR	EC110H:	RORTH/S	HJOO		
CONTROL T	TYPE EAS	EASTBOUND:	\$10P	SIGN		
TSAFFIC VOLUNES	01.01165					
	83	21	3	83		
LEFT	0	;	0	230		
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LANES

ADJUSTNENT FACIORS Page-2

	FERCENI GRADE	RIGHI TURN ANGLE	CURB ENDIUS (ft) FOR RIGHT TURNS	FERCENI SIGHT TURN CURB RADIUS (FL) ACCELERATION LANG GRADE ANGLE FOR RIGHT TURNS FOR RIGHT TURNS
EAST20070	0.00	96	0.7	=
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กลาหรอบหอ	0.00	06	20	z
3901880080	00.0	96	20	z
VEHICLE COMPOSITION	KOIIISEGE			

% HOTORCYCLES	0	;	0	0	
AND RV'S VEHICLES	0	;	0	o	
A SU TRUCKS AND RV'S	0	i	o	0	12
	CASTEOUGO	UESTBOUND	иоктивоию	зоитнасико	CRITICAL GAFO

	TABULA (Tab)	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST.	FINAL CRITICAL GAP
NINOR RIGHTS	E G	5.50	5.50	0.00	5.50
MAJOR LEFTS	왚	3.60	5.60	0.00	5.00
NINÛR LEFIS	68	6.50	6.50	0.00	6.50
IDENTIFYING INFORMATION	INF ORMATI	NO			LDENTIFYING INFORMATION
HANE OF THE EAST/VEST STREET HEW ROAD	EASTAVEST	STREET	NEW ROA	OI	

IDENTIFYING INFORMALIUM

RANE OF THE ENSIVEST STREET..... NEW ROAD

RANE OF THE HORIN/SOUR STREET.... HONOAPIILANI HEY

GALE AND TIME OF THE GRAL/SIS.... 2/3/93; AN PERX HOUR

GINCE INJURIATION... 1996 CUN. COMM. AN PK.HR. VOL. U/P PH.2 HONE?

CAPACITY AND LEVEL-OF-SERVICE	Lewel-0.	f-service			F.39c-3
וופאבטרמן	FLGJ- EATE V(Pupli)	roten- Flost- Hal. Eate capacity Vibupit) ( popit)	ACTUAL HOVEHENT CAPACITY ? (pcph) h	SHARED CAFACITY C (9CPh)	KESERVE CAPACITY C = C - V 1 R SH
ASHOR STREET					
EB LEFT	0	523	523	5.5	^ .
RIGH	6,7	660	660	) een	) 611 )A
NAJOR STREET					
1337 88	0	749	749	149	7.15 A
IDEALLY LING THE COUNTIES	IdCann	ic:			
AARE OF THE EASIVIEST STREET NEW ROAD PARE OF THE HORTH-SOUTH STREET HONDARILLANT HAY DATE AND TIME OF THE AMALYSIS 2/3/23; AN PESK HOUR OTHER THFORMATION 1996 CUM. COMM. AN FX.KK. VOL. W.P	EAST/JES NORTH/SU E OT THE ATION	J STREET UTH STREET ARALYSIS. 1996 CUR	NEU F HOROS 2/3/3	NEU ROND HONGAFILLANI HUY 2/3/23 ; NA PEKK NI, EN FK,NK, VOL	IANE OF THE EAST/JEST STREET NEW ROAD THAN OF THE HORTH/SOUTH STREET HONDOAFILLANT HAY DATE AND TIME OF THE ANALYSIS 2/3/73; AN PERK HOUR OTHER THFORMATION 1996 CUM. COMM. AM FX.NX. VOL. W/P PH.2 HOME9 6AU

1905 HCH: UNSIGHALIZED INTERSECTIONS IDENTIFYING THEORMATION OTHER INFORMATION.... 1996 CUM. COMM. PM PK.HR. VOL. M/P PH.2 HONE9 6PW
INTERSECTION TYPE AND CONTROL HAME OF THE HORTH/SOUTH STREET..... HOHONPIILANI HAY TING PGRIOD AVALYZED...... P.M. FGAK HOUR NAME OF THE EAST/WEST STREET..... NCW ROAD AREA FOPULATION..... 10000 ONTE OF THE AUALYSIS (Mardd/yy)..... 273795 HAIN, OF THE AMELYST...... BSS PEAK NOUR FACTOR......9 AVERAGE RUNHING SPEED, NAJOR STREET.. 20 **E** NAJOR STREET DIRECTION: NORTH/SOUTH 963 CONTROL TYPE EASTBOUND: STOP SIGN INTERSECTION TYPE: T-INTERSECTION E88 a | : TRAFFIC VOLUMES NUMBER OF LANCS FIGHT DIRU LEFI

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NORTHEOURD SOUTHEOUND

**EESTBOUND** 

CRITICAL GAPS

AUJUSTNENT FACTORS	FACTORS			
	PERCENT GRADE	RIGHI TURN ANGLE	CURB RADIUS (ft) FOR RIGHT TURNS	) ACCELERATION LANE FOR RIGHT TURNS
EASTBOUND	0.00	90	20	==
<b>PESTROUND</b>		;	;	,
31031iB0UtD	00.00	20	ន	z
SOUTHEOURD	0.00	90	83	z
VEHICLE COMPOSITION	POSITION			
CASTEOUND	R SU TRUCKS AND RV'S		* COMBINATION VEHICLES * HÖ O	# MVIORCYCLES
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	TABULAR VALUES (Table 10-2)	VALUES 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENE	FIMAL CRITICAL GAP
HINGR RIGHTS					
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najor LEFTS					
語		5.00	5.00	0.00	5.00
alaba LEFIS					
E G		6.50	6.50	00.00	6.50
IDENTIFYING INFORMATION	FORMATION				
NAME OF THE BASTAUEST STREET NEW ROAD NAME OF THE WORTH/SOUTH STREET HONOGRITHANT HUY	ST/UEST S RTH/SOUTH	TREET Street	HEW FOR	NEW ROAD HOWOAPIILAMI HUY	
UALE AND TIME OF THE ANALYSIS 2/3/93; P.M. PERK HOUR JIMER INFORMATION 1996 CUM. COMM. PM PK.HR. VOL. U/P PH.2 6Pu	OF THE ANI ION 1	ИАLYSIS 1996 СИН. 6РИ	2/3/93 COMM. PH PI	: P.M. PEAK HO K.HR. VOL. UZP	UR PH.2 HORE9

LANES

Page-3
CAPACI:: AND LCYZL-OF-SERVICE

RESERVE CAPACITY C * C - V LOS R SH		202	3.5		354
SHARED CAPACITY CAPACITY CAPACITY		202	295 )		354
ACTUAL HOVEHENT CAPACITY C (PCPh) n		202	295		35.5
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rugu- RAIC v(pcph)		0	77		ပ
печенеці	NENOR STREET	בג וכנו	RIGHT	HAJOR STREET	NB LEFT

IDENTIFYING INFORMATION  HANTE OF THE EAST/JEST STREET NEW ROAD  HANTE OF THE HOKTH/SJUTH STREET HONOAPIILANI MY  BATE AND TIME OF THE ANALYSIS 2/3/73 : P.N. PEAN HOUR  OTHER INFORMATION 1996 CUN. COMM. FN PK.IR. VOL. K/P PH.Z HONE9

## 1985 HCH: SIGNALIZED INTERSECTIONS

SUR	SUMMARY REPORT	12								
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AMALYST.  DATE  TIME  COMMENT.		2/1/93 P.H. PEAK 1996 CUM.			A PX.	PH PK.HR. VOL.		PH.4 1	W/P PH.4 HONA96P3	ღ	
		VOLUMES		,				GEONETRY			
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9	-3.00	2.00	z	0	0	0.0	9	<b>&gt;</b>	17	2	m
땅	0.00	2.00	z	0	0	0.0	0	<b>~</b>	11.5	2	m
SB	0.00	2.00	z	0	0	0.0	0	>	11.5	v,	е
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SB	_	0.076		0.233	×	20.5	ų	m	37.7		a
	-	0.963		0.278	¥	40.6	ш				

1765 1967	Ä	UNSIDARLISTEETEETETETETETETETE	INTERS	ECTIONS	1311111111111	Page-1
LOCHTIFYING	ING INFO	INFORMATION				
AVEENCE	AYEENCC RUNNING SPEED, MAJOR	SPEEE, I		STREET	30	
PEAK HOU	PEAK HUUR FACIOR				<b>5</b> 5.	
AREA POP	AREA POPULATION				10000	
HARE OF	THE ENSI	Enstalest s	SIREET	:	NAPILISAU STREET	
ווחחב טי	THE NORT	THE NORTH/SOUTH STREET	STREET	i	HANAWAI SIREET	
क्षण्य ६४	THE ANAL	ANALYST		:	BSS	
SALE OF	Ire and	אושראנונ (בש/dd/yy)	///pp/r		2/3/73	
1146 258	PCRIOD AMALYZED.	:	:	:	07:00 16 05:03	
OTHER IN	OTHER INTERNATION		1996 CUR.	. CON:1.	ah PX.HR. VOL. U/P PH.3	1 HANG 9
INTERSEC	INTERSECTION TYPE AND	,	CONTROL			
ภารสวาหา	INTERSCETICN TYPE: 4-LEG	É: 4-LE(				
haJ0R 51	MAJOR STREET DIRECTION: EAST/WEST	ECTION:	EASTZE	E51		
CVATROL	347.1	N381185UND:	îTûP	5164		
TOMEST	1 rPE 501	SOUTHBOUND:	S10P	SIGN		
TRAFFIC VOLUNES	עסרטענכ					
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RIGHT	23	£	9	72		
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	r CRCCHT GRAGE	KIGHT TURH ANGLE	CURB RADIUS (ft) FOR RIGHT TURHS	FERCENT KIGHT TURN CURB RADIUS (11) ACCELERATION LANE GRAGE ANGLE FOR RIGHT TURNS FOR RIGHT TURNS
CASTEGUNO	0.00	96	50	7
VEST80UND	0.00	90	02	=
иоктивоцив	0.00	90	20	≂
зоптивоеив	0.00	90	23	Z
VEHICLE COMPOSITION	POSITION			

	1 SU TRUCKS AND KV1S	% CONBINATION VEHICLES	* HOTORCYCLES	
EASTROUND	0	0	0	
นธรรธอบเต	5	0	0	
иоктнеочио	o	0	0	
รอบาเหลอนหม	0	0	0	
CRINICAL CAPS	ç			

	TABULAR VALUES (Table 19-2)	ADJUSTED VALUE	SIGHT OIST. ADJUSTHERT	FINAL CRITICAL GRP
HINCR RIGHTS		6	9	9
25	8.50	5.50	0.00	5.50
HAJOR LOFTS				
유	5.50	5.50	0.00	5.50
2		5.50	0.00	5.50
HIROR THROUGHS				
앞	€.50	6.50	0.00	6.50
ę,		6.50	0.00	. 05.9
RINOR LEFTS				
32	7.00	7.00	00.0	2.00
as		7.00	0.00	7.00

TOERTIFYING INFORMATION

PANE OF THE EASTAMEST STREET.... MAPILIHAN STREET
PANE OF THE MOSTH-SOUTH STREET... HANABAI STREET
BATE AND THE OF THE AMALYSIS.... 2/3/93; 07:00 10 08:00
OTHER THFORMATION... 1996 CUN. CONH. AN PK.HR. VOL. U/P PH.3 NAMA9

RESERVE CAFACITY C = C - V LUS R SH 298 ) C 473 )6 A 964 ) A 250 ) E 471 )A A 926 ) A Fage-3 4E +E 576 781 7 7 7 330 339 475 950 SHAREO CAPACITY C (PCPh) 398 477 595 204 304 7 733 200 ACTUAL HOVENERT CAPACITY C (PCPh) 398 477 995 FUGA- FOIEH- F FLOA- TIAL RAIE CAPACITY O V(PCPA) C (PCPA) CAPACITY AND LEVEL-67-SCRVICE 433 41.7 490 995 250 804 973 62 25 7.3 HG LEFT THROUGH RIGHT SG LEFT THROUGH RICHT ninor street najez sincer MINUR STREET 23 LEFT VB LEFT

ICENTIFYENG INFORMATION
HARE OF UNE CASTUMEST STREET..... HAPILITHAU STREET
HARE OF THE HORTH-SOUTH STREET.... HANGHAI STREET
GATE AND TIME OF THE GHALYSIS..... 273-93; 07:00 10 03:00
OTHER THEORMATION.... 1996 CUM. COHM. AN FELHR. VOL. L/P FH.3 NAMA9
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1935 NCH: UNSIGNALIZEO INTERSECTIONS A SELA SERENTA RESERVE SERVE ESTRES PRESERVE PROPERTY RESERVE SERVE	ANJUSTREET FA
IDENTIFIERS INCOMENTION	34
ANGRASE RUMHING SPEED, MAJOR SIREET. 30	EASTROUND
187	GESTEGURB
	ดเมออกมา
/uFST_S18EET	дипоснілоз
HAND OF THE MORTH/SOUTH STREET HANAUNI STREET	יכוונכרב כטווה
NAME OF THE ANALYST 655	
GATE OF THE AUALYSIS (CA/dd/xx) 2/3/93	
Ting FER10G ANALYZEO	6.05.1800//0
OTHER INFORMATION 1996 CUN. COMM. PM PX.HR. VOL. N/P PH.3 HAMA9	#C3120UNO
LP3 INTERSECTION TYPE AND CONTROL	GNOONIACH
	QN0-94160\$
INTERSECTION FIPE: 4-LES	CRITICAL GRE
NAJUS SIREET DIRECTION: EAST/WEST	
CONTROL 1:PZ HORIHBOUNG: SIJP SIGN	
CONTROL TYPE SGUTHGOUND: STOP SIGN	HINGS STONE
CAPFIC VOLUMES	1131 80EM1
80 ਰੂਸ਼ ਰੂਸ਼ 33	
LEFT 26 50 60 44	LINOR THROU
TIRU 211 270 9 3	
RIGHT od 63 16 22	NINOS LEFTS
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ADJUSTRERT	FACTORS				5-agr4
	PERCENT GRADC	RIGHT TURN ANGLE	CURP RADIUS (ft		ACCELERATION LANE FOR RIGHT TURNS
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2001050000	00.00	20	8		==
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	22 SE	UCK\$ ×	CONBINATION VEHICLES	# HOTORCYCLES	vo a
ะวราชิงับเข	!	0		0	
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поетнеочи		0	0	0	
30ประชาชน		0	0	0	
CRITICAL G	GAFS		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
	TA C	TABULAR VALUES (Table 10-2)	40.3UST.CD VALUE	SIGNI DISK. ADJUSTNEKI	FINAL CRITICAL GAP
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ringr thr	THROUGHS H3 SB	6.50	6.50 6.50	0.00	6.50
ninde lefts	5 등 6	7.00	7.00	0.00	7.00
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<b>БРАСТТУ БИ</b>

Page-3

	FLOJ 1	FOTEN- TIAL CAPACITY	ACTUAL NOVEMENT CAPACITY		SHARED CAPACITA	ED CITY		RESERVE CAPACITY	₩. 117				
เขาริการ	7(pcpii)	c (pepia) P	c (pcph) f	` ;	2H 2H	GFb)	o ;	C = C - V R SH	7		103		
HINOR STREET													
KG LEFT		269	237	^		237	^		162	^	~	`	
13005H	==	334	306	^	284	306	_	17.7	3.35	. <u>.</u>	ں ،	•	
16311		934	934	^		934	^	i	914 >	^	4		
MINDE STREET													
LEFI		271	241	^		2:1	^		135	^	G.		
ROUGH	27	333	306	~	317	306	^	223	,	ž	ں (	,	
LCIII		339	633	^		299	^		(1/3	^	45		
ENJOR STREET													
153	33	716	716			716			603		•		
133 LEFT	73	276	776			7.76			202		-		

IDENTIFYING INFORMATION

WANTE OF THE EASIZHEST STREET..... WAPLINAU STREET

WANTE OF THE WORTHZOUTH STREET.... HANAMAI STREET

SATE AND TIME OF THE WANTYSIS.... 2.2793 ; 15:15 TO LE:15

CHER INFORMATION... 1996 CUM. COMM. FM FR.HR. VOL. KZF FM.3. MANAS

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TRAFFIC VOLUMES	IOZUTIF LING INFORMATISH
	AVEPACE RUNHING SPEED, HAJCA STREET 30  FEAK HOUR FACTOR
	3007 10000 10000 104ER HONDAPILLANI ROAD ESS 2/3/93 0?:15 TO 03:13 H. AM PK.NA. VOL. W/P PH.3
UESTAOUNO: STOP	FI 30 87  10000  IGWER HONDAPILLANI ROAD  ESS  2/3/93  02:15 TO 03:15  OMH. AM FK.NA. VOL. W/P PII.3
IREET DIRECTION: NORTH TYPE WESTBOUND: STOP	** HAJCR STREET. 30
INTERSECTIUN IYPC: 1-INTERSECTION FAJOR STREET DIRECTION: NORTH/SOUTH CONTROL TYPE WESTADUND: STOP SICN	., HAJGR STREET 30
INTERSECTION TYPE AND CONTROL INTERSECTION TYPE: T-INTERSECTION INATOR STREET DIRECTION: NORTH/SOUTH CONTROL TYPE WESTBOUND: STOP SIGN	HOUR FACTOR
11. AM PK.hR. 40L. W/P PIL.3	GE RUNNING SPEED, HAJER STREET.       30         HOUR FACTOR.       .07         POPULATION.       .10000         OF THE EASIZUEST STREET.       .10000         OF THE HORITYSOUTH STREET.       .1000ER HORIDAPILLANI         CF THE MARLYST.       .655         OF THE ANALYSTS       .273793
07:15 TO 03:15 H. AM FK.IIR. VOL. W/P PIL.3	GE RUNNING SPEED, NAJER STREET       30         HOUR FACTOR
273793 07:15 TO 03:13 ff. aff FK.ha. VOL. W/P PH.3	NGUR FACTOR
273/93 07:15 TO 03:13 H. AM PK.NA. VOL. W/P PH.3	GE RUNNING SPEED, NAJOR STREET HOUR FACTOR
LOWER HONDAPIILANI ROAD ESS 2/3/93 07:15 TO 03:15 H. AH FK.NA. VOL. W/P PIL.3	STREET
LOWER HONOAPIILANI ROAD ESS 2/3/93 07:15 TO 03:13 H. AM FK.NA. VOL. W/P PH.3	ED, MAJOR STREET
10000 HAPILIHAU STREET LOWER HONOAPIILANI ROAD ESS 273793 07:15 TO 03:15 H. AN PK.NA. VOL. WZP PH.3	RUMILING SPEED, MAJOR STREET
07 10000 MAPILIHAU STREET LOWER HONOAPITLANT ROAD ESS 2/3/73 07:15 TO 03:13 H. AM FK.NA. VOL. W/P PH.3	
3007 10000 10000 104ER HOHOAPITLANI R9AD ESS 2/3/93 0?:15 T0 03:13 H. AN FK.NA. VOL. W/P PH.3	
##5  30 07  10000  ##PILIMAU STREET  LOWER HOHOAPITLANT ROAD  ESS  2/3/93  0?:15 TO 03:15  H. AM FK.NA. VOL. W/P PH.3	1905 HCH: UNSIGNALIZED INTERSECTIONS ************************************

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<b>a</b> . ~	PERCENT GRADE	RIGHT TURN ANGLE	CURB RADIUS (ft) FUR RIGHT TURNS		ACCELERATION LANE FOR RIGHT TURMS	JH LANE TURKS	1179400	CAPACITY AND LEVEL-OF-SERVICE	OF -34KVICE	. !
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VERICLE COMPOSITION	OSITION						NIMOR SIREET	133		
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EASTBOUND				!!	İ		SB LEFT	235	991	
UESTBOUND	-	•	0	Ģ						
иовтнвоиио	-	0	0	0					į	
зоитневшир	•	0	0	0			TOENTIEVI	IDENTIFYING INFORMATION	H011	
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	TABULA: (Tabl	TABULAR VALUES (Table 10-2)	ADJUSTER VALUÉ	SIGHT DIST. ADJUSTHEHT	ä	FIUAL CRITICAL GAP	OTHER INF	OTHER INFORMATION 1996 CUN. CON.	199¢ CI. 683	ェ
AINOR RIGHIS	E9	5.50	5.50	00.0	! !	5.50				
HAJOR LEFTS	8	5.00	5.00	0.00		5.00				
A11102 LEFTS	9	£.50	6.50	0.00	•	6.50				
IDENTIFYING INFORMATION	INFORMA)	11011								

CAPACITY AND LEVEL-OF-SERVICE	רבעבר-0	F-SERVICE			œ.	Page-3
НОУСИЕИТ	FLO3- RAIL V(PCph)	FOIER- FLOJ- ITAL RRIE (GPACITY V(PCPh) C (PCPh)	ACTUAL HOVENENT CAPACITY C (PCPh)	SHARED CAPACIIY C (PCPh)	AESERVE CAPACIIY C * C - V R SH	50,
nINOR STREET						
UB LEFT RICHT	35 162	525 976	491 976	926 167	456	4.4
HAJOR STREET						
Se LEFI	333	991	156	165	992	•
IDENTIFYING INFORMATION	INFORMAT	HOI				
HANE OF THE EAST/UEST STREET NAPILIHAU STREET HANE OF THE HISTH/SOUTH STREET LOWER HONOAPILLANI EJAD GATE AND THE OF THE ANALYSIS 2/3/93; 07:15 TO 03:15 OTHER INFORMATION 1994 CUM. COMM. AN PK.HR. VOL. W/P PH.3	EAST/UES HORTH/SO E OF THE ATION	STREET UTH STREET AMALYSIS. 1996 CUM	LOUER 2/3/9. 1. COUN. AN	HAU STREET HUNGAPIILAN 1:07:15 TO FK.HR. VOL.	£.3	LHBA9

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C10R5 Page-2

ABJUSTHENT FACTORS

PERCENT RIGHT TURN CURB GADIUS (FL) ACCELERATION LANG GRADE ANGLE FOR RIGHT TURNS FOR REGAT TURNS

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-4.03 0.00 \* HOTGRCYCLES

\* COHBINATION VCHICLES

# SU TRUCKS AND RV'S

EASTEOUND

VEHICLE COMPOSITION

รอบกาเขอบหต 0.00

HORTHEOUND

				FIUNL CRITICAL GNP	5.50	\$.00	6.50		АБ 30 7 РН.5 СИНА9
0	0	0		SIGHT DIST. ADJUSTHENT	0.00	0.00	0.00		NAPILINAU STREET LOVER HONDAPILLANI ROAD 2/3/93 ; 15:30 TO 16:30 111. PH PK.HR. VOL. W/P FI
0	0	0		•	5.50	5.00	6.50		#PILIP 1 LOWER P 2 2/3/43 1. COHII. PH F
0	0	0		TABULAR VALUES (Table 10-2)	5.50	5.00	95.9	эвнатой	I/WEST STREET.  THYSOUTH STREE  THE ANALYSIS.  M 15% CU
<b>WESTEOUND</b>	ОИЛОЗЦИВОЛИ	รอบโหลอบหอ	CRIFICAL GAPS		KINDR RIGHTS UB	HAJOR LEFTS	MINOR LEFTS NB	IDENTIFYING INFORMATION	NANT OF THE EASTVUEST STREET NAPILINAU STREET NANE OF THE NORTH-SOUTH STREET LOWER HONOSPITIANI ROAD DATE AND TIME OF THE ANALYSIS 2/3/93; 15:30 TO 16:30 OTHER LAGORINSTON 15% CUM. COMM. PM PK.MR. VOL. W/P PH.S 6P3

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## Page-3 CAPACITY AND LEVEL-OF-SERVICE

HOVEHENT NINGR STREET	FLOU- RAIE V(pcph)	FLOB- ITAL RATE CAPACITY V(PCPh) C (PCPh) P	ACTUAL HOVEHENT CAPACITY C (pcph) n	SHARED CAPACITY C (PCPh) SH	RESERVE CAPACITY C = C - V R SH	. 58
	113	419	307 948	307	109	0 4
	334	939	989	695	èċο	Œ

## LOENTIFYING INFORMATION

			LHHA9	
	ROAD	15:20	4/P PH.3	
MANE OF THE EAST/VEST STREET NAPILIHAU STREET	MANE OF THE NURTHYSOUTH STREET LOUGR HONGAPILLANT ROAD	DATE AND TIME OF THE AMALYSIS 2/3/73 ; 15:30 TO 16:30	GINER INFORMATION 1996 CUM. COMM. PM PK.MP. VOL. W/P PH.3 LYMA9	
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CVEHENT	FLOM- RAIC V(pcph)	POTENT TIME CAPECITY C (PCPh) P	ACTUAL HOVEHENT CAPACITY C (PCPh) R	i	SHARED CAPACITY C (PCPh) SH	COLTY CFh)	20° 4	RESERVE CAPACITY C = C - V	<u>,                                    </u>	1.05	ю I
AINOS STREET											
RE LEFT THROUGH	នូ។	400	379 465	~ ~	405	379	~ ~	402	320 451	, <u>, , , , , , , , , , , , , , , , , , </u>	- R
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HINOR STREET											
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HAJOR STREET	_										
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וחרייו לג וווער זיינ פרואיו זסוי	HANGE OF THE EAST-WEST STREET HADLLINNU STREET HANG OF THE HASTIL-SOUTH STREET HANNUAL STREET DATE AND THE OF THE MALYSIS 2/2/73 : A.H. PERK HOUR ETHER INFORMATION 255 CUN. CORM. 64 FA.HE. VOL. U.P PH.4. HANNA
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1285 HCH: UNSIGNALIZED INTERSECTIONS					Per Lastica Loui
	55	1 E1	CURE KADIUS (TT)	_	FOR RIGHT TURNS
IOCHTIF CING THFORMATION	CASTBOURD 0	0.00	ន		=
AVZANEC RUMHING SPEED, MAJOR STREET 30	UCST20UND (	0.03 50	20		æ
FEIX 100UP FACTOR	NORTHBOUND	06 00-0	3		2
AREA POPULATION	0 0000000000000000000000000000000000000	0.00	23		æ
NATE OF THE ENSIVEEST STREET NAPILIHAU STREET	VEHICLE COMPOSITION	.1110ri			
MANE OF THE HIGHTH-COUTH STREET HAMANAI STREET		RUCKS RV*S	2 CONBINATION VEHICLES	* HÖTGRCYCLES	(2)
(////pp/ae	EALTGOUND	0	0	0	
IINT CCRICO ANGLYZEO P.B. FINK HOUR	uCSTB0UND	o	0	0	
OTHES INFORMATION 1977 CUM. COMM. PM PK.HR. VOL. W/P PH.4 WAHA9	מספווופסהאס	o	0	0	
7PU THICKSECTION TYPE AND CONTROL	30UTH36U43	9	o	o	
	כאווונטר פיים				
INICASECIION 1YPC: 4-LEG					
EAJER SINCET DIRECTION: EAST/WEST		TABULMR VALUES (Table 10-2)	ADJUSTED VALUE	SIGNT DIST. ADJUSTAENT	
CONTRUL TUPE MURTHBOUND: STOP SIGN	21408 E16415				
CONTROL TYPE SOUTHBOUND: 510P 516N		113 5.50 53 5.50	5.56 5.50	0.00 0.00	5.50 5.30
TRAFFIC VOLUMES	ANJOR LEFTS	53 5.50 1.8	5.50	0.00	5.50
LECT 27 77 67 45	2000311 30014 2000311 30014 85		6.50 6.50	0.00	6.50
F186U 216 276 10 9 RIGH1 75 66 10 23	EIROR LEFTS		7.00	0.00	7.00
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почепеля	7LOM- KAIL V(pcph)	601EN- 11AL CAPACITY c (pcph) P	ACTUAL HOVEHENT CAPACITY C (PCPh) H	40,55	SHARE CAPAC (PC	SHARED CAPACITY C (pcph)	٠ ;	RESERVE CAPACITY C = C - V R OH	1		103
LINOR STREET											
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RIGHT		394	634	_		C24	^		365	~	Œ
ANJOR STREET											
23 LÉFT 93 LEFT	34	706 757	706 7 <u>\$</u> 7			706 757			229		<b>∉</b> €

IDENTIFYING INFORNATION

WANG OF THE ENSIVEST STREET.... NAPILINAU STREET

WANG OF THE NORTH/SOUTH STREET.... NANAMAL STREET

DATE AND TIME OF THE ANALYSIS.... 2/3/33; P.N. PENK HOUR

ÖTHER INFORMATION... 1992 CUM. EN FK.KR. VOL. U/P PH.4 HAHS9

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1905 HGh:	1: UNS.	GNALIZE	O INTER	UNDIGNALIZEO INTERSECTIONS		Page-1
10cmlf'y Lag	Ing Inf	INFORMATION	=			
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PEAC HOUR FACTOR	ie facto	:		:		
AREA POPULATIGA	ULATIGA			:	00001	
NAME OF	THE EAS	EAST/REST	STREET.	= :::::::::::::::::::::::::::::::::::::	NAPILINAU STREET	
HANE OF	111E 110R	THE HORTH/SOUTH STREET	1 STREE	:	LOWER HONOAPIILANI ROAD	
BANE OF	THE ANA	AMALYST		80	855	
UATE OF	THE ATTA	THE AMALYSIS (BAZdd/yy).	(4/fp/m	:	2/3/33	
IINE PEK	PESIOD AMALYZED.			A	K.M. PEHS NOUR	
OTHER INFORMATION.	FORMATIO	:	1997 CUM.	сони.	M/P PH. 1	LHMA9
INTERSECTION	TICH TYPE	GraD	78N CONTROL			
IMICRECTION TAPE: 1-INTERSECTION	IICa La	41-1 :30	HERSEET	Ica		-
ANJOR CIREET		DIRECTION:	NORTH/SOUTH	SOUTH		
COMERGE	TYPE UES	UESTBOUND:	3109	потс		
TORCFIC	VOLUNCS					
	63	97.7	52	eg		
LEFT	:	35	0	105		
:HRU	!	0	20	6;		
RIGHT	;	163	20	0		
10 830H0H	LANES	; ; ;	1			
	u	9	53	흈	<b>83</b>	; ; ;
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		RICHT TURN ANGLE	CURB RADIUS (11) FOR RIGHT TURKS		ACCELERATION LANE FOR RIGHT TURNS
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иов тнеоино	00.00	06	52		z
SOUTHCOURD	0.00	90	20		z
	a 30 TRUCKS	4.7	* CONDINATION	10 10 X 3 00 TOH 3	
	Alic KV V	1	;	10101	1010AC1CE5
CASTOOUND	1		;	;	
UCST60UND	0		0		•
NORTHGOUND	٥		0		0
SOUTHEGUND	•		0		•

		INBULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTHENT	FINAL CRITICAL GAP	
HINDR RICHTS	9	5.50	5.50	0.00	5.50	
MJOR LEFTS	63	\$.09	\$.00	. 00.0	8.60	
מואסט רכרוט	엹	6.50	6.50	00.0	6.50	
IDENTIFYING INFORMATION	311	<b>0519110</b> #				
HANE OF THE MAKE OF THE DATE AND TH	돈	HANE OF THE EAST/JEST STREET HAPILIHAU STREET HANE OF THE HORHH/SOUTH STREET LOUER HOHOAPIILANI ROAD DATE AND TIME OF THE GHAL/SIS 2/3/93 : A.H. PEAK HOUR	HAPILIN LOUER 1	HAU STREET HOHOAPIILANI : A.N. PEAK	ROAD	

CRITICAL GAPS

OTHER INFORMATION.... 1797 CUN. COHN, AN PK.HR. VOL. K.P FIL.4 LINA9

11.	CAPACITY AND LEVEL-OF-SERVICE	רנהנר-0	F-SERVICE			Fa	Fage-3
36 576 479 479 479 441 174 973 973 573 79 79 224 991 591 991 991 755 ENSITUES STREET NADILIHAU STREET HORTH/SOUTH STREET NOWR HOUGAPILLANI ROAD E OF THE ANALYSIS 2/3/9/3 1 A.H. PEAN HOUR ANTION 1997 CUH. COHH. AN PK.HR. VG., C.F. FILLS	183	fL03- RAIE V(pcph)	FOTEH- IIAL CAPACITY C (PCPh) P	ACTUAL HOVEHENT CAPACITY C (PCPh) H	SHAREO CAPACITY C (PCPh)	RESCRUE CAPACIIN C = C - V R SH	501
36 576 479 479 479 449 174 973 973 973 79 444 224 991 591 991 755 EASITUEST STREET HAPILIHAU STREET HONTH/SOUTH STREET 2/3/9/3 1.0, 1002 E GF THE GHALYSIS 2/3/9/3 1.0, 1002 ANTION 1997 CUIL COHM. AN PK.HR. VGC. 427 1002 200 100 200	SIRCET						
224 991 591 991 755  INFORMATION ENSITYEET STREET HORTH/SOUTH STREET CF THE ANALYSIS 2/3/93; A.H. PEAK HOUR ANALYSOUTH STREET ANALYSIS 2/3/93; A.H. PEAK HOUR ANALYSIS 2/3/93; A.H. PEAK HOUR ANALYSIS 2/3/93; A.H. PEAK HOUR	LZFT RIGHT	36	576 973	479	479	443	4E 4E
75 MI ROAD AX HOUR . USF FILLS	STREET						
MI ROAD AX HOUR	LEFT	224	991	165	T66	757	• 1
	FYING OF THE CS THE AND LITH	INFORMAT ENSTANES RORTHYSO E GF THE	TON T STREET UTH STREET AMALYSIS. 1997 CUP	NAPIL 1 LOWCR 2.379	IHAU STREET HONGAPILLANI 3 : A.H. PEAK PK.HR. VG	•	CHRAS

1905 HCM: UMSIGHALIZED INTERSECTIONS OTHER INFORMATION... 1997 CUM. COMM. PM PK.IN. VOL. K.P PH.4 LHNA9 HANG OF THE HORIHZSOUTH STREET..... LOWER HONDAPIILANI ROAD ANNÉ OF THE ENSTAUEST STREET..... MAPILINAU STREET TING PERIOD AMALYZED...... P.H. PEAK HOUR **НREA РОРИСАТІОВ**..... 10000 UATE OF THE ANALYSIS (BA/dd/yy)..... 2/3/93 IGENTIFYING LUFGRNATION NAME OF THE ANALYST..... 855 MYGAMGE KUIWING SPEED, NAJOR STREET.. 30 TRACFIC VOLURES 88 | 38 116 MAJOR STREET DIRECTION: NORTH/SOUTH INTERSECTION TYPE: T-INTERSECTION CONTROL TYPE UESTBOUND: STOP SIGN INTERSECTION TYPE AND CONTROL 66 43 쭏 E | 011 237 B | 1 RIGHT THRU 1757 ₩ ;

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LANES	83   :
AUNDER OF LANES	LANES

HARE OF THE EAST/LUEST STREET..... HAPILIHAU STREET
HARE OF THE HOAPH/SOUTH STREET.... LOWER HOHOAPITLAHI KOAD
DATE AND TIME OF THE ANALYSIS..... 2/3/73 ; P.H. PEAK HOUR
OTHER INFORMSTION.... 1797 CUM. COMM. FM FK.HR. VOL. W/P PH.4 LHIMA9

IDENTIFYING INFORMATION

	PERCENT	œ	CURG RADIUS (ft) FOR RIGHT TURNS	JS (ft) TURNS	ACCELERATION LANE FOR KIGHT TURNS	LAKE
EASTEOUND		;			,	1
EES360040	-4.00	96	50	_	z	
NORTHBOUND	0.00	90	2	_	z	
SOUTHEOUND	0.00	90	20	_	=	
VEHICLE CORPOSITION	POSITION					
	1 SU 1	SU TRUCKS % CO	* COMBINATION VEHICLES	* HOTORCYCLES	OVCLES	
CASTEDUNO						
<b>UESTEGUND</b>		0	0			
NGRTHEOUND			0		0	
SOUTHEOUND		0	o		6	
CRITICAL CAPS	PS	1				
	TABUI (Tal	N 01	ADJUSTED VALUE		St. FIRML	 AL GAP
HIRGR RIGHTS	, g	5.50	5.50	0.00	5.50	
MAJOR LEFTS	82	5.50	5.50	0.00	5.56	ت
ninea LEFTS	9	2.00	2.00	0.00	7.00	٥

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ADJUSTNICKT FACTORS

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CAPACITY AND LEVEL-OF-SERVICE	רנייבר-טי	r-52801CC						Pa	Page-3	<b>.</b> .
novenert	FLON- RATE v(pcph)	POTEN- FLON- TIAL RAIE CAPACITY V(pcph) c (pcph)	ACTUAL HOVEHEAT CAPACITY C (FCPh)	SHARED CAPACITY C (PCPh)	6117 (48	E	RESERVE CRPACITY C = C - V LOS R SH	≥ ?	1 603	
KINOR STREET										
LE LEFT	121	368	255	× 513	255	^ ^	137	134 > 0	, š	
RIGHI	260	995	\$65	. ^	935	. ~		735 ) a		æ
NAJOR STREET										
1337 85	343	910	910		910			295		45

IDENTIFITIG INCORNATION

NAME OF THE CAST/AEST STREET..... UAPILINAU STREET

NAME OF THE LONDIN/SOUTH STREET..... COWER HONORPILLAUM ROAD

DATE AND TIME OF THE ANALYSIS..... 2/3/3/3 ; P.A. "E-AK HÜNR

OTHER THEORNATION.... 1997 CUM. FOIN, PH PK.HR. VOL. M/P FH.4 LHMAP

1905 HCH:	UNCION	UNSIGNALIZED	INTERSECTIONS	CTIONS	P1905 HCH: UHCIGHALIZEO INFERSECTIONS 1127-13121711111111111111111111111111111
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HANC OF T	THE EAST/WEST STREET	ינכטו או	REET		NEW ROAD
riant of 13	THE NORTH/SOUTH STREET.	H-SOUTH	STREET	:	HONOAPILLANI HUF
וולחב פר ד	TIE AMALYST	rst			925
DATE OF TO	THE SMALTSIS (BAZZDZZZ).	(515 (e.	///pp/s		2/3/93
TIME PERIOD ANALYZEG.	מם אמערי				AN PEAK HOUR
OTHER INFORMATION INTERSECTION TYPE AND	DRN61 IGA IGA TYPE		1937 CUH 7AK CONTROL	CUM. COMM.	64 FK.H2, VOL, 2/6 PH.4 HONE?
INTERSECTION TYPE:	ICH LYPE	M-1 :3	1-INJERSECTION	104	4 4 4 4 1 1 1 1 4 4 1 1 1 1 4 4 1 1 1 1
najor street		DIRECTION:	R021H750U1H	SOUTH	
CONTROL 1	TYPE EAS	EASTBOUND:	STOP	SIGN	
IEAFFIC V	POLUNCS				
	93	ns.	82	ខ្លួ	
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แชกปีเลิ 60	LANES				

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ADJUSTICEL C.CTORS

	PERCENT GRADE	PERCENT RIGHT TURN GRADE ANGLE		-
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uco rosum	:	;	;	•
N0R1:180U:10	0.00	. 00	50	<b>.</b>
SOUTHSOUND	0.00	90	50	z
VEHICLE COMPOSITION	TPOSITION			VEHICLE COMPOSITION

	TABULAR (Table	TABULMR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT DIST. ADJUSTNENT	FINAL CRITICAL GAP
HINDS RIGHTS	ני	5.50	5.50	0.00	5.50
NAJOR LEFTS	2	5.00	5.00	00.0	2.00
nINOR LEFTS	9	6.50	6.50	0.00	6.50
IDENTIFYING INFORMATION	10FORNATIO	<b>75</b>			

to +

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CAPACITY AND LEVEL-OF-SERVICE	LEVEL-07	-SERVICE	,	į		1	Page-2	: :
поченен	FLOH- ANTC V(PCFh)	POTEN- FLOM- ITAL KAIE CAPALITA V(PCPh.) C (PCPh.)	ACTUAL HOVENEUR CAPACITY C (PCPh)	, i	SHARED CAPACITY C (pcph) SH	AESERVE CAPACITY C = C - V LOS R SH	!	; i
ninoR staeet								
בפ רנגו	Ç	514	\$14	^ -	514	~ .	514 >	48
210:11	\$\$	959	059	~ ~	059	255	555 2	. A
NAJOR STREET								
RB LEFT	0	736	735		736	R	238	æ

IDENTIFILMS INFORMATION	HANE OF THE EAST-WEST STREET NEW ROND	mand of the HorthySouth SIRECI HSHOAPILLANI NUY	GATE AND IING OF THE ANALYSIS 2/3/93; AN PEAK HOUS	GTHER INTORRATION 1997 CUN. COMM. AN PK.HR. VOL. U/P PH.4 HGKE9	741
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1935 HCh: UNSIGNALIZCO INTERSECTIONS	URSIG	IAL 12CO	INTERS	ECTIONS	•	Page-1 ************************************
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AYCKACE RUMUING SPCED, NAJOR STREET	murag .	SPCED. 1	1AJOR S	12EE 1	ន	
PCAR BOUR FACTOR	FACTOR				o;	
"AE, POPULATION	.ation.				10000	
KSME OF THE EAST/UEST STREET.	HE EAST	2 183W	IRčE1	:	HEW ROAD	50
HARE OF TH	IE NORT	THE HORTH/SOUTH STREET	STREET			HONDAPIILANI HUY
महत्तह एते प्र	THE AMALYST	Y51			. ESS	
GALE OF THE ANALYSIS (GB/dd/yy)	HE ANAL	rsıs (a	ry/pp/a		2/3/93	
TIHE PERIOD ANALYZED	OD ANAL	YZED			P.H. P.	P.H. PEAK HOUR
OTHER INFORMATION 1997 7PU INTERSECTION TYPE AND CONTR	ORHATIU IGH IYP	11 17. 7. 2. E. AND C.		. Conn	E.	CUM, COMM, OM PK.CC. VOL. WZP PH.4 HONE9 Rul
INIERSECTION THE: 1-INTERSECTION	ten 1 if	E: 1-IH	TERSECT	ION		
MAJOS STRZET BIRECTION: MORTH/SQUTH	2ET DIS	ECT IOR:	PORTH.	SOUTH		
CONTROL TIPE CASTBOUND: STOP SIGN	CK3 391	,T80UND:	Stüp	SIGH .		
TARFIC VOLUMES	OLUMES					
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The state of		;	0	1003		
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HUNCES OF	סנ ראוננ					
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LANES	;	-	:			1

AGJUSTINENT FACTORS	rac toks				f392+2
-	PCRCEUS GRADE	RIGHT TÜÄN ANGLÜ	CURE RADIUS (1)	_	ACCCLERATION LANE FOR RIGHT TURK!
CHOUGHS	0.00	90	20		=
BESTCOURD	;	;	}		•
иовтисочно	0.00	9.0	20		7.
SOUTHGOURS	0.00	90	0.2		2
יבאזכרב כסמ	CONPOSITION				
	7, 5U AND	10 M	COMBINATION VEHICLES	s HOJOKOKOTES	
EAS IBOURD		9	0	0	
UESTEGUND	•	:	;	ł	
ลตราเธดบหอ		0	0	0	
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CALTHER C	Caro				
	1 ) ( T	TABULAR VALUES (Table 10-2)	ADJUSTED VALUE	SIGHT OLSI. ADJUSTNCHI	FIRST GAP
nimaž ričnis	2 2	5.50	5.50	0.03	5.50
najėR LETTS	. 55 55	5.00	9.00	0.00	5.00
AINOR LEFTS	5	6.50	6.50	0.00	6.50
ISCHTIFYING INFORMATION	i IrifoR	-0RHATICH			
name of the eastrues mane of the morth/so date and time of the other information	OF THE HORTH/SOU AND THE HORTH/SOU AND THE OF THE I	1 STREE UTH STR ARAL 13 . 1997 7PU	: : : 5	HUY . PEAK VOL.	HOUR W/P FH.4 HONE9

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ао̀ ЧЕНЕ И 1	FLOU- RAIE v(pcph)	FOTEN- FLOU- 11AL RATE CAPACITI V(PCPh) C (PCPh) P	ACTUAL HOVENENT CAPACITY C (PCPh) E	SHARED CAPACITY C (pcph)	SHARED CAPACITY (PCPh) SH	RES CAP A	RESERVE CAPACIIY C + C - V LÜS R SH	, ,	:S :
NINOR STREET									
E8 L271	0	194	194	^	194 )			<u> </u>	ü
RIGHT	0,	386	982	\$32 • • • • • • • • • • • • • • • • • • •	206	~ ~ ~		345 3 C	ı,
naJOR STRCET									
us Left	0	343	343		143		343	~	Œ

IDENTIF FING INFORMATION

WARE OF THE EASTWICST STREET.... NEW ROAD

WHITE OF THE WAILLYSOUTH STREET.... HOWGAFILLANT HWY

DATE AND TIME OF THE AMALYSIS.... 2/22/3 : F.M. PEAK HOUR

OTHER INFORMATION.... 2/22/92 : F.M. PEAK HOUR

PHUS THEORMATION.... 2/22/92 : F.M. PEAK HOUR

### Appendix I

Supplemental Traffic Impact Report

CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934 CAL ENGALERS · SURVEYORS AUSTIN, TSUTSUMI & ASSOCIATES, INC.

TES & LANGELOGIC, PE SEMENT SEMENTAL PE NAME NACATALA, PE NAME NACATALA, PE NAME NACATALA PE

#97.39

₹. ¥ ᅻ July 21, 1997

FILE

Napithau Villages Joint Venture Napitihau Corporation Pioneer Plaza, Suite 1560 900 Fort Street Mall Honolulu, Hawaii 96813 Attention: Mr. Kmo 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 Honoapiliani Highway and Napilihau Street, and assesses the potential impact of traffic generated by Phase I of Napilihau Villages.

turn only ingress and egress from Honoapillani Highway, the improvement of the intersection of Street on northbound Honoapillani Highway, and pro-rata share of the construction of the traffic Phase I consists of the 76 multi-family dwelling units and includes the construction of the right-Napilihau Street and Hanawai Street, and extension of the left-turn storage lane to Napilihau signal system to be installed at the Honoapillani Highway/Napilihau Street intersection.

### Current Traffic Conditions

The Honoapiilani Highway/Napiilhau Street Intersection is a 4-legged (cross) intersection with STOP control on Napilihau Street. Honoapillani Highway is the major roadway with tuli channelization for the left-tum 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 Honoapiilan! 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

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Napilihau Corporation Attention: Mr. Kimo Lee, Project Manager Napilihau Villages Joint Venture

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.

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 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 Honoapillani Highway. However, the westbound (makai) 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	Weekday
AM Peak Hour	9	28	trip ends
PM Peak Hour	28	14	445

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 When the vehicular trips generated by Phase I are superimposed upon the current traffic volumes at the Honoapillani Highway/Napilihau Street intersection, it was found to have intersection with the vehicular traffic generated by the project are attached to this letter.

### Conclusions

The following are the condusions of this Supplemental TIR:

Total traffic volumes during the peak hour of traffic at the Honoapillani 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. -

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Napilihau Villages Joint Venture Napilihau Corporation Attention: Mr. Kimo Lee, Project Manager

July 21, 1997

 However, the intersection continues to operate satisfactority with an acceptable Level of Service 'C'. Left-turn movements from Honoapillani Highway can be executed with very fittle delay.

- The additional traffic volume resulting from Phase I of the Napitihau Villages has
  negligible impact on the operations of the Honoapillani Highway/Napitihau Street
  intersection. The trips generated by Phase I are equivalent to the day-to-day
  fluctuation of traffic on Honoapillani Highway.
- Although traffic volumes at the Honoapillani 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.

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### <u>Recommendations</u>

The following are the recommendations of this supplemental TIR:

- 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:
- The extension to the left-furn storays lane on northbound Honoapiilani Highway be deferred and re-examined when Phase II of the Napiithau Villages is developed and ready for occupancy, or

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- The left-turn storage lane be extended when a traffic signal system is installed at the Honoapillanl Highway/Napilihau Street intersection.
- 2. Any pro-rata share cost assessment for the installation of a traffic signal system at the intersection of Honoapillani 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).

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Napithau Villages Joint Venture Napithau Corporation Attention: Mr. Kimo Lee, Project Manager

July 21, 1997

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
Honoapillari Highway/Napillhau Street Intersection have not been implemented.

Very truly yours,

AUSTIN, TSUTSUM! & ASSOCIATES, INC.

By Let A Kawahigest. TED S. KAWAHIGASHI, P.E. President

Attachments: Existing Traffic Volume/LOS Computations LOS Computations with Phase I Traffic

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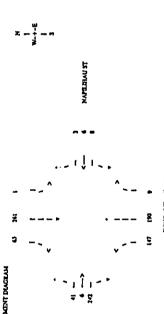
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	M-N.I-LT3-TE3-LTD	_		:	:		:					
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CONTACTE_VITAL   1   1   10   13   24   12   13   13   13   13   13   13   13	VOLUME ADMITHENTS MOVEMENT HO.	 	į .	:			į	:	;	!	 	
1   10   15   15   15   15   15   15	HOURLY FLOW RATE, VITE	7	7 8			٠:	<b>-</b> .		٠.		~	
NOM MINON STR   Vet = 17 Vit = Vet = 17 Vit = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet = Vet =	VOLUME, + (popu)	_	5 5 5		• •	2 =						
Veb = 12 V5 + V2 = 131 V5 + V2 = 131 Pape   Vell = 12 V6 + V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 = V5   V6 =	STEP 1: RT FROM LIDIOR ST	-   F	<u> </u>			1	İ	. !	:	-	   	
CONT.   CLATEGO   111 PAP   CLATEGO   112 PAP   CLATEGO   112 PAP   CLATEGO   112 PAP   CLATEGO   112 PAP   CLATEGO   112 PAP   CLATEGO   112 PAP   CLATEGO   112 PAP   CLATEGO   112 PAP   CLATEGO   112 PAP   CLATEGO   113 PAP   CLATEGO   113 PAP   CLATEGO   113 PAP   CLATEGO   113 PAP   CLATEGO   113 PAP   CLATEGO   114 PAP   CLATEGO   114 PAP   CLATEGO   114 PAP   PAP   114 PAP   PAP   114 PAP   PAP   114 PAP   PAP   114 PAP   PAP   PAP   114 PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PAP   PA	Conductor Plane	 !		:		_						
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### Appendix J

State Department of Transportation Letter Dated August 11, 1997 (A)

BENJAMIN J. CAYETANO



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KAZUTIAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
Brian K. Minaai
GLENN M. OKIMOTO

IN REPLY REFER TO:

AUSTIN, TSUTSUMI & ASSOCIATES, INC. Honolulu, Hawaii 96817-503

#### STATE OF HAWAII DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION

MAUI DISTRICT 650 PALAPALA DRIVE KAHULUI, HAWAII 95732

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,

istrict Engineer, Maui

/fmc

### Appendix K

Update of Traffic Impact Analysis Report for Napilihau Villages

AUSTIN, TSUTSUMI & ASSCCIATES, INC. ON ENGNESSES SPONTING THE ENGINEERING PRACTICE PCUNCED BY N. A. B. AUSTIN IN 1924

February 18, 1998

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Mr. Wayne Tanigawa BRJ Napil, Inc. 1001 Bishop Street Pauzhi Tower, Suite 1570 Honolulu, Hawaii 96813

Dear Mr. Tanigawa:

Subject: Traffic Impact Analysis Report for Naplilhau Villages

We have enclosed a copy of the updated Traffic Impact Analysis Report (TIAR) for Napühau Villages to be included in the Final Environmental Assessment (EA). However, Napühau Villages to be included in the Final Environmental Assessment (EA). However, developed as fee simple multi-family townhouses. As stated in the Advanced Draft EA, developed as fee simple multi-family townhouses. 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 Review of the trip generation rates indicate that the rental multi-family townhouses more trips then the fee simple townhouses. Since the TIAR uses the rental multi-family townhouses used to 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. à

TED S. KAWAHIGASHI, P.E.

Enclosure

oc: Mr. Michael Munakiyo - Munekiyo, Arakawa & Hiraga, Inc. w/o encl.

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TRAFFIC IMPACT ANALYSIS REPORT NAPILI, MAUI, HAWAII NAPILIHAU VILLAGES FOR

**Prepared For** 

NAPILIHAU VILLAGES

FEBRUARY 1998

Prepared By

Austin, Tsutsumi & Associates, Inc. Civil Engineers • Surveyors 501 Sunner Street, Suite 321 Honolulu, Havaii 96317-5031 Telephone: (898) 533-3646 Faccimile: (808) 526-1267 Honolulu • Wailulu, Hawaii

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Civil Engineers • Surveyors 501 Sumner Street, Suite 521 Honolutu, Hawaii 96817-5031

### Prepared By

Austin, Tsutsumi & Associates, Inc.

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# TRAFFIC IMPACT ANALYSIS REPORT

### FOR

## NAPILIHAU VILLAGES

## NAPILI, MAUI, HAWAII

## INTRODUCTION

# A. Purpose and Scope of Study

comply with the ruling Napilihau Villages Joint Venture is in the process of preparing the environmental documents. Therefore, the purpose of this study is On November 5, 1997, the State of Hawaii Supreme Court ruled that an emironmental assessment would be need for the Napilihau Villages. In order to to update the February 1993 Traffic Impact Report for the proposed Napilihau A Traffic Impact Report was conducted for Napilihau Villages, dated February 1993, which assessed the traffic impacts resulting from the proposed development. Villages for inclusion with the environmental documents.

### 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.
- An assessment of existing roadway and traffic conditions. ત
- Development of trip generation characteristics for the proposed development. က်
- 4. Development of traffic projections.
- Identification and assessment of traffic impacts resulting from the trips generated by the proposed development, superimposed over the projected traffic conditions.

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- 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 Honoapiliani Highway and Lower Honoapilianl Road and is bordered on the north by Napilihau Street. More specifically, the project is identified as TMK: 4-3-3:109, 110, 122 and 123. Figure 1 shows the location of the project.

D. Project Description

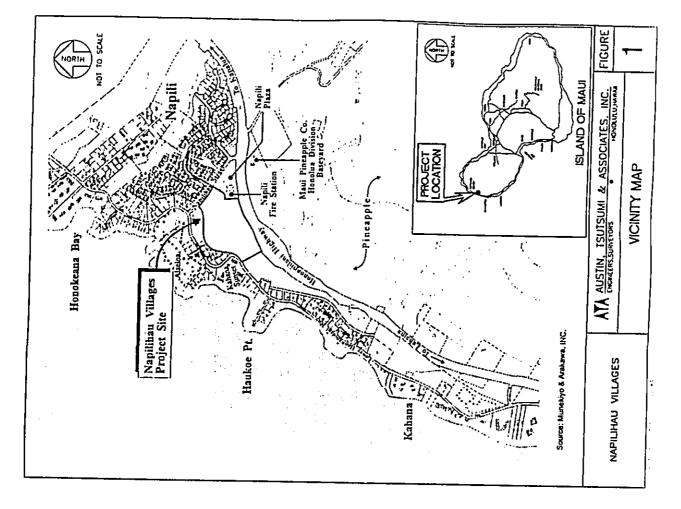
Napithau Villages Joint Venture, is proposing to develop 296 multi-family residential units on a 16.5-acre site in Napiti. The project site is bounded by Honoapitiani Highway, Napiti Plaza Shopping Center and the Napiti Fire Station on the mauke side, Lower Honoapitiani Road on the makai side, and Napitihau Street on the north side.

Access to the development will be via Hanawai Street from Napilihau Street and a new driveway connection onto Honoapiliani 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.

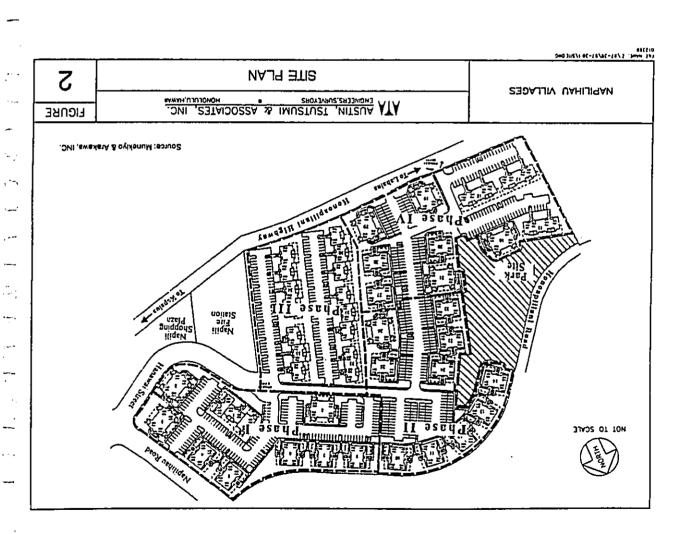
The project is proposed to be developed in the following four (4) phases:

Year	2000 2000 2000 2000 2000 2000	
Units	88 88 88	987
Phase	-= <u>=</u>	Total

Phases I, Ill and IV of the proposed project are planned to be sold as feesimple multi-family townhouses. Phase II is planned as an affordable rental project. Figure 2 shows the site plan for the proposed project.



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# II. EXISTING CONDITIONS

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### 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 Honcapiliani Highway, at its intersection with Napilihau Street, is Maul 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 290-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.

### Roadway System ø

The primary roadways in the immediate vicinity of the project are: Honoapiilani Highway, Napilihau Street and Lower Honoapiilani Road.

Honoapillani Highway is a State arterial highway, which provides the regional circulation from Kapalua through West Maul and linkage to Central and South Maui. It is a high-quality, two-tane highway with all major intersections channelized with separata left-tum storage lanes and deceleration/acceleration Napikhau Street is a County two-lane collector road connecting Honpapillani Highway and Lower Honoapillani Road. Left-tum storage lanes are provided at its intersections with cross streets and parking is permitted along the north curb.

Lower Honoapillani Road is a County two-lane collector road that winds through Napili, Kahana and Honokowal, generally following the coastline. In the immediate vicinity of the project, Lower Honoapillani Road is narrow, with limited shoulder areas.

local streets connecting to Napilihau Street and serving residential areas north of Other streets in the area include Hanawai Street and Kohil Street, which are Napilihau Street.

#### Traffic ن

## 1. Traffic Volumes

Weekday AM and PM peak period traffic turning movement counts were conducted on Tuesday, May 15, 1997 at the Honoapillani 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 Honoapillani Road.

traffic occurred between 7:00 AM and 8:00 AM at the Napilihau Street and Napilihau Street Intersoctions with Honoapiliani Highway and Hanawai Street occurred between 6:45 AM and 7:45 AM. The AM peak hour of commuter 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 Lower Honoapiilani Road intersection.

three Napilhau Street intersections. The Honoapilani Highway intersection occurred between 3:00 PM and 4:00 PM, the Hanawai Street intersection occured between 3:45 PM and 4:45 PM and the Lower Honoapiilani Road Similarly, the PM peak hour of continuter traffic varied slightly, at the intersection occurred between 3:30 PM and 4:30 PM.

Transportation (SDOT) were obtained for the Honoapillani Highway and Napithau Street intersection. Review of the 1997 machine counts indicates discrepancies within the count. Therefore, the 1997 counts were Machine counts from the State of Hawaii, Department of 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.

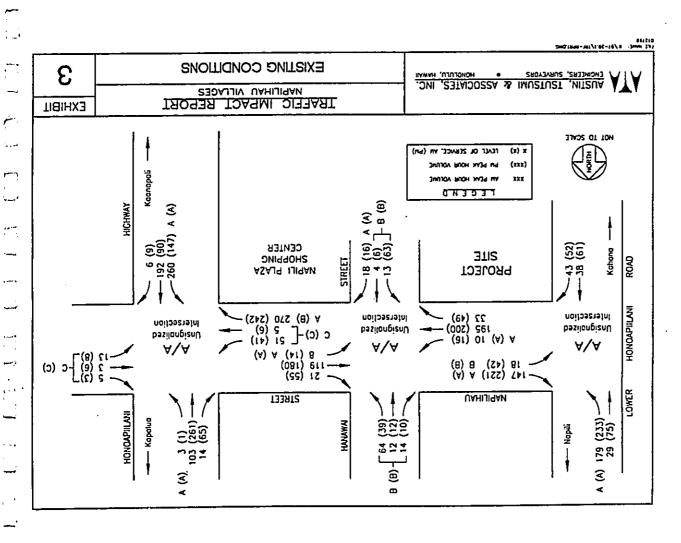
### Roadway Improvements તં

Napilihau Street left-tum storage lane to a minimum length of 120 leet at its intersection with Hanawal Street. Construction of the recommended 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) improvement has been completed by the developer.

### Existing Level of Service Analysis ઌ૽

Capacity Manual - Special Report 209 were utilized for this study. Level of 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 Service definitions for unsignalized intersections are provided in Appendix Figure 3 also shows the LOS results at the study intersections.

under existing conditions. However, review of the traffic signal warrants Analysis indicates that the three intersections are operating at LOS C or better during both peak hours of traffic as unsignalized intersections contained in the Manual on Uniform Traffic Control Devices (MUTCD),



indicates that the intersection of Honoapillani 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.

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# 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

k Hour	% In	67%	%99
PM Peak Hour	Rate	0.64	0.69
k Hour	₽ %	17%	30%
AM Peak Hour	Rate	0.54	0.58
Avg.	Weekday Trip Rate	6.78	9.95
	Units	na	ao
	Land Usa	Residential Condo	Low-Rise Rental Apartment

## 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

			AM Peak Hour	k Hour	PM Peak Hour	t Hour
Phase No.	Dwelling Units	Weekday Trip Ends	Enter, Trips	Exit, Trips	Enter, Trips	Exit, Trips
_	92	515	2	34	33	16
=	88	181	6	37	36	19
=	89	221	9	28	22	13
2	80	538	7	36	34	17
TOTAL	582	2,272	83	135	130	59

## 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 Honoapilani 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 1999, 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 Tsutsuml & Associates, Inc.

## D. Trip Distribution

Since the driveway accessing Honoapillani 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 Honoapillani Highway would have to exit the property via Hanawai Street. With the completion of the driveway onto Honoapillani Highway, it is estimated that 75% of the traffic with destinations to the south on Honoapillani Highway would most likely exit the site via the new right-turn only driveway at Honoapillani Highway; with the remaindor via Hanawai Street. Traffic with destinations north of the site would exit the development via Hanawai Street and 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, Honoapillani Highway and Lower Honoapillani 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/Honoapillani Highway
- Napilihau Street/Hanawai Street
- Napilihau Street/Lower Honoapiliani Road
- New driveway to development/Honoapiliani 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.

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# B. Roadway Improvements

SDOT is currently in the process of developing the plans for the Honoapillani Highway widening. Plans call for widening Honoapillani Highway to four lanes between Kaanapali Parkway to Honokowal 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 bottlenack at the intersection of Honoapillani Highway and Kaanapali Parkway and would also facilitate traffic flow on Honoapillani Highway.

The County of Maui is also in the process of developing the plans for Phase III of the Lower Honoapillari Road improvements. The plans call for improving Lower Honoapillari 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 Honoapillani 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 Honoapillari Highway and Napilihau Street has been constructed. However, the analysis assumes the improvements to Lower Honoapillari Highway have not been implemented. The capacity analysis computations are appended in Appendix C.

## 1. Base Year 1998

The signalized intersection of Napilihau Street/Honoapiliani Highway and the unsignalized intersections of Napilihau Street/Hanawal Street and Napilihau Street/Lower Honoapiliani Road would continue to operate at acceptable LOS's during the AM and PM peak hours of traific. Figure 4 shows the projected traffic volumes and LOS.

BASE YEAR (WITHOUT PROJECT) LEVEL-OF-SERVICE SUMMARY

W PRANT 1996

Base Year 2000

Base Year 2000

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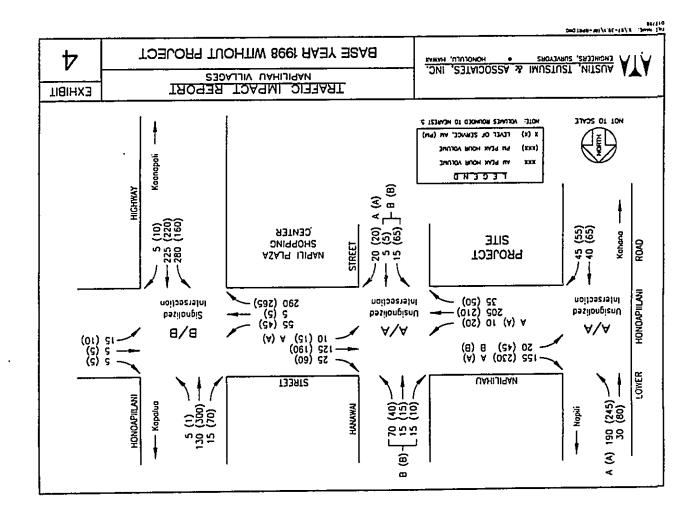
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## 2. Base Year 2000

The Napilihau Street/Honoapiliani Highway signalized intersection, the Napilihau Street/Hanawai Street unsignalized intersection and the Napilihau Street/Lower Honoapiliani Road unsignalized intersection would continue to operate satisfactority in the Year 2000 without the proposed development. Figure 5 shows the projected traffic volumes and LOS.

## 3. Base Year 2002

Napitihau Street/Honoapitlani Highway, Napitihau Street/Hanawai Street and Napitihau Street/Lower Honoapitlani Road intersection would also continue to operate satisfactority 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 1999, 2000, and 2002 with the proposed project. The capacity analysis computations are contained in Appendix C.

### 1. Phase I - 1998

Napilihau Street/Honoapilani Highway intersection is estimated to operate satisfactority 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 Honoapiliani Road would continue to operate satisfactority, 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.

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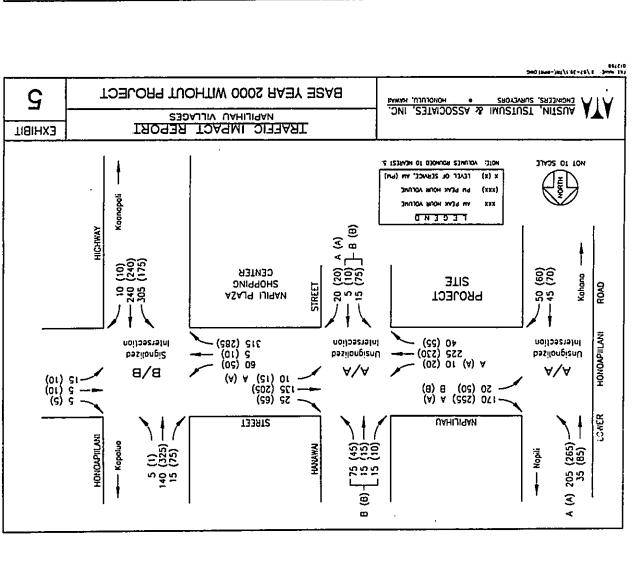
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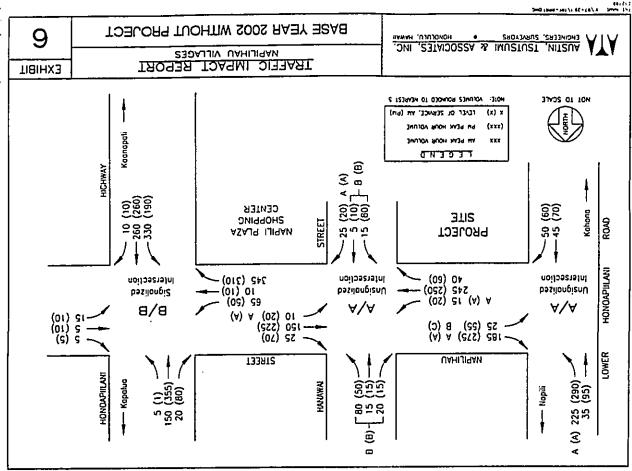
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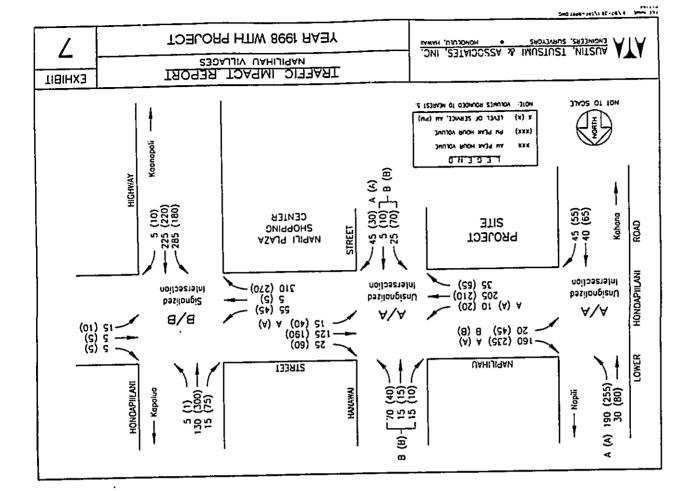


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Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Series   Contributed May Ser	Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Control   Cont													
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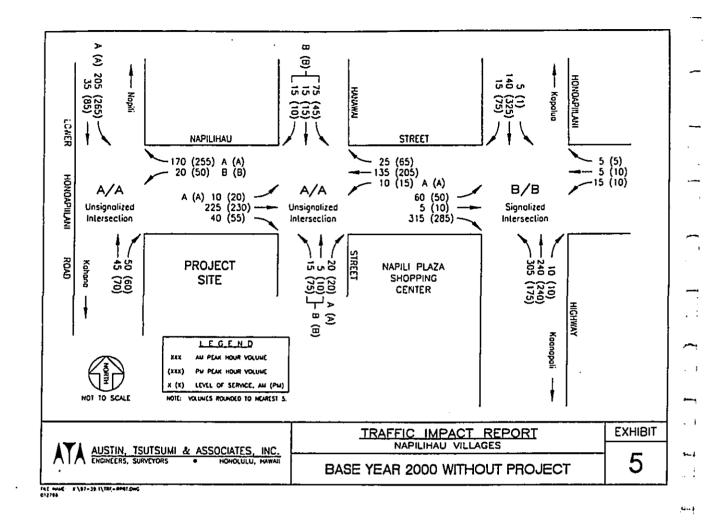
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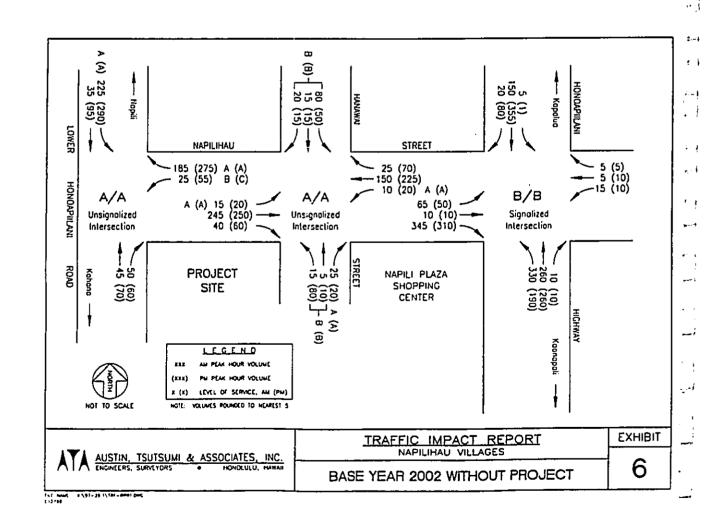
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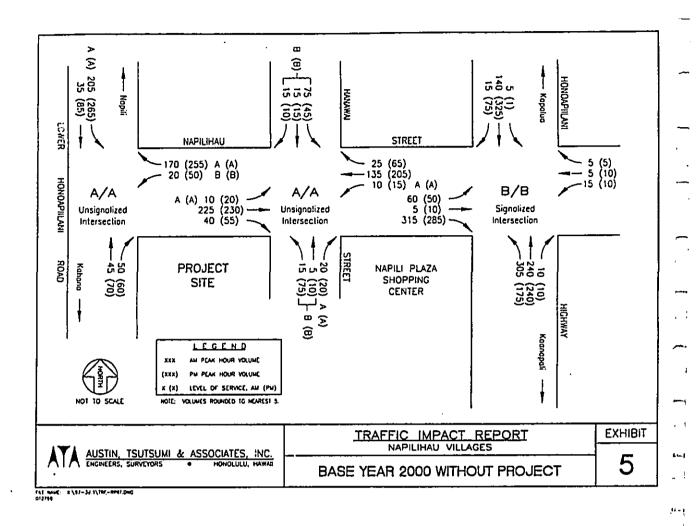
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### CORRECTION

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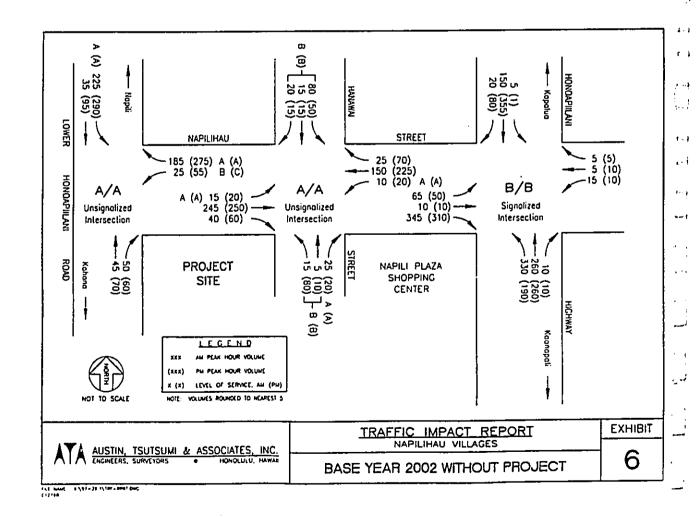
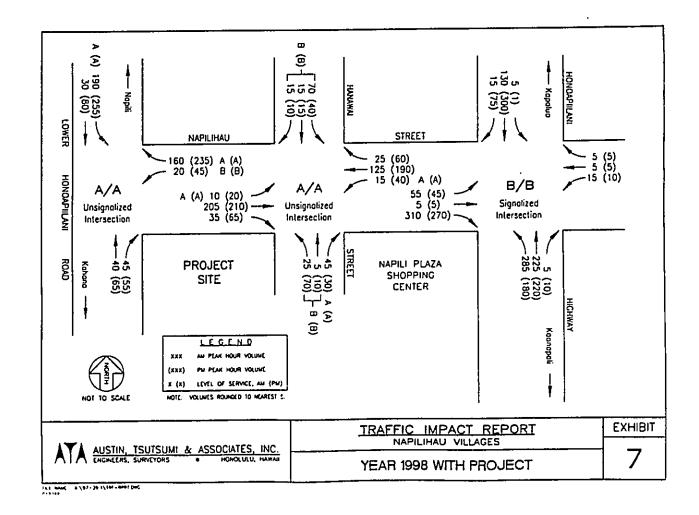


TABLE 4 WITH PROJECT LEVEL-OF-SERVICE SUMMARY

		Yes	1998			Yea	2000			You	2002	
	AM Pos		PM Per	k Hour	AM Pos		PM Pot	A Hour	AM Pos		PM Pos	
	Delay (Seconds)	Level of	Dolay (Seconds)	Lavel of Service	Delay (Seconds)	Luvul of Sorvice	Delay (Seconds)	Level of Service	Dolay (5econds)	Level of Socyica	Dulay (Seconds)	Lovel of Socylco
Honospilani Highway and Napilihau												
Stroot - Signatured Intersection												_
Northbound Approach	10.7	В	9.3	B	10.8	В	9.7	8	11 5	₽	10.2	В
Southbound Approach	10.7	В	10.6	B	11.2	В	11.5	В	11.3	8	11.9	Ð
Eastbound Approach	7.6	Ē	8.0	В	7.6	В	7.9	B	7.8	В	8.1	B B B
Westbound Approach	14.9	B	14.8	B	14.9	B	14.9	В	14.9	В	14.9	₿
Overall Intersection	9.7	В	9.5	8	9.6	В	9.9	В	10.3	В	10.3	B
Nacibbau Street and Hanawai Street												
Unsignatized Intersection												
Northbound Approach												
Shared Left/Through	6.6	В	96	B	7.5	В	12.9	C	8.3	В	16.3	C
Right	3.6	Ā	36	Ā	3.7	A	38	A	3.9	A	3.9	A .
Southbound Approach												
Shared Left/Through/Right	7.2	В	8.3	В	8.1	В	10.3	C	86	В	12.0	С
Easibound Left Turn	2.5	Ā	2.9	Ā	2.5	Ā	2.9	A	2.6	A	30	A
Westbound Left Turn	2.6	Ä	3.0	Ä	2.9	Ä	3.3	A	30	A	3.5	A
Overall Intersection	1.9	Ā	2.1	Ä	2.3	٨	2.7	A	2.3	<b>A</b>	3.3	A
Lower Honospillani Road and												
Napilihau Street - Unalgrafized Inte	rsection											
Southbound Left Turn	2.7	A	30	A .	2.8	A	3.2	A .	2.9	A	3.3	A .
Westbound Approach												
Left Turn	6.1	В	8.8	8	6.7	В	10.3	C	7.0	8	11.6	C
Right Turn	3.3	Ā	3.7	A	34	A	3.9	A .	35	A	4.1	A
Overall intersection	2.4	A .	2.8	A	2.5	A .	30	<b>A</b>	2.6	٨	32	A
Honospillani Highway and New												
Driveway												_
Easibound Right Turn	NA	NA	N/A	NA	5.0	8	5.7	В	5.5	В	62	В

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## Phases II and IV - 2000

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Napilihau Street/Honoapilani Highway intersection is estimated to continue to operate satisfactority 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/Hanawal Street will continue to operate satisfactority, with traffic exiting Hanawal Street experiencing a slight increase in delay, LOS C, during the PM peak hours of traffic.

Napilihau Street/Lower Honoapilani Road intersection is estimated to operate satisfactority as an unsignalized intersection, with left turns exiting Napilinau 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 Honoapillani Highway would operate with little or no delay to exiting traffic.

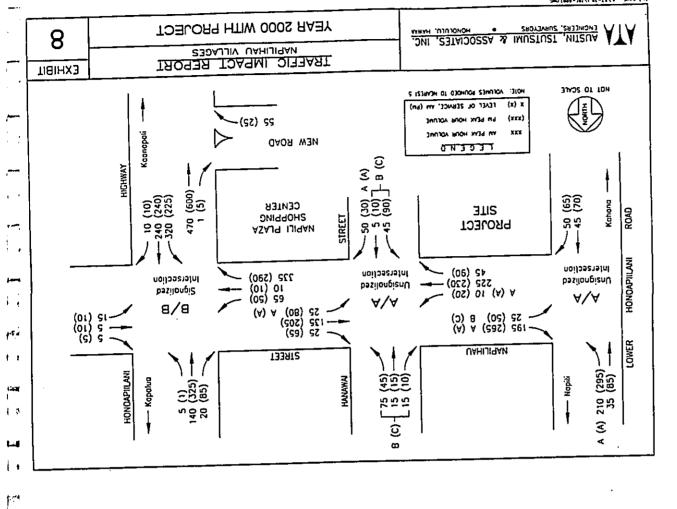
Figure 8 shows the projected traffic volumes and LOS.

## 3. Phase III - 2002

The signalized intersection of Napilihau Street/Honoapillanl Highway would continue to operate satisfactority at LOS B during both the AM and PM peak hours of traffic with the buildout of the proposed development.

Napiihau Street/Hanawai Street intersection is estimated to operate satisfactority with exiting traffic experiencing some delay at LOS C.

Analysis also indicates that the Napitihau Street/Lower Honoapitlani Road intersection will continue to operate satisfactority with felt-turn vehicles from Napitihau Street experiencing some delay at LOS C.



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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.

## CONCLUSIONS

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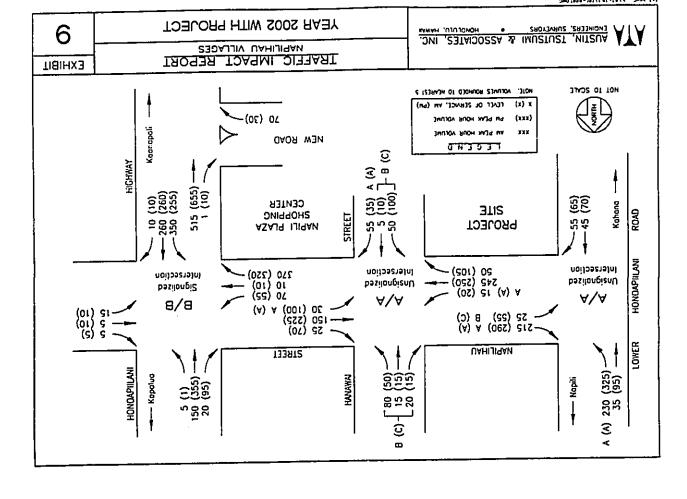
The following are the conclusions of this traffic study:

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

- Widening of Honoapillani Highway to four lanes from Kaanapali Parkway to Honokowai Channel Bridge.
- Installing a traffic signal system at the Honoapiliani Highway and Napilihau Street intersection.
- Improving the intersection of Lower Honoapillari Road and Napilihau Street to provide a left-turn storage lane on Lower Honoapillari Road to accommodate existing traffic conditions.



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The following roadway improvements are recommended to accommodate the additional traffic generated by the proposed development:

- State Department of Transportation requirements for acceleration and 1. The new driveway at Honoapillani Highway be designed in accordance with deceleration lanes and channelization to effect the turn restrictions.
- The laft-turn storage lane on northbound Honoapillani Highway at Napilihau Street be extended provide to a minimum storage length of 250 feet which includes storage and deceleration. તં

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- Transportation Research Board, Highway Capacity Manual, Special Report 209, 1994.
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- Pacific Planning & Engineering, Inc., <u>Traffic Impact Assessment Report for ML8P NHLC</u> Subdivision, July 26, 1991. 4
- The Traffic Management Consultant, Traffic Impact Analysis Report for the Proposed Honokowai Commercial Development, TMK: 44-1:02, 11 & 12, May 22, 1992.

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APPENDICES

**APPENDIX A** 

TRAFFIC COUNT DATA

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Vehicle group 1

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73 233 282	81/15/98 63:45pm	684	<del>-</del>	- z	230	→ ; ← <b>19</b>	Louer Honoapiilani R
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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, fustration, 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

Expected Delay to Minor Street Traffic	Little or no delay Shori traffic delays Average traffic delays Long traffic delays Very long traffic delays Extreme traffic delays
Level of Service	∢вооши
Stopped Delay for Vehicle (Seconds)	\$5.0 \$110 10.0 10.110 20.0 20.110 30.0 30.110 45.0 > 45.0

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## 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 Critena for Unsignalized Intersections

Stopped Delay for Vehicle (Seconds)	5.0 5.1 to 15.0 15.1 to 25.0 25.1 to 40.0 40.1 to 60.0 > 60.0
Level of Service	≺⊞OOmr

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 features may begin to appear in this level. The number of fengths. Individual cycle features 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 vic 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 vic ratios. Individual cycle failure are frequent occurrences.

Level-of-ServiceF 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 vic. 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

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Two-way Stop-controlled Intersection

	Nor	Northbound	멀	Sou	Southbound	nd	Eastbound	ound	-	West	Westbound	
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No. Lanes	-	14	1 < 0	-	-	- 2 - 1	0 > 1			0 > 1 < 0		0 v
Volumes	260	260 195	ះ ហ	ហ	105	15	20	r.	270	15	ហ	Ŋ
PHF	.95	. 95	.95	.95	.95	.95	Se.	.95	ę.	.95	. 95	26.
Grade		0			0			0	_		0	
MC's (*)									_			
SU/RV's (*)												
CA, 8 (%)												
PCE's	1.10			1.10		_	01.1 01.1 01.1 01.1 01.1 01.1	10 1	?	1.10	. 20 .	10

#### Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	
Through Traffic Minor Road Left Turn Minor Road	6.50	3.30

HCS: Unsignalized Intersections Release 2.1e HHNS-A.HC0 Page 2

RT from Minor S	•	
; ~	208	111
••	80	C1
_	1086	1216
D. Or Quederfiee State:		• 1
rom Major S		
ng Flows:		127
pacity	96	**
movement Lapacity: (pcpn) Prob. of Queue-Free State:		1491
Step 3: TH from Minor Street	WB	EB
flicting Flows: (vph)		. 0
ntial Capacity: (pcph)	519	528
Capacity Adjustment Factor due to Impeding Movements		1
ocab)		. 7
ŭ	ıσ	0.99
4: LT from Minor St	WB	8
F104	1 7	610
pacity:	760	694
major LI, Minor IH Impedance Factor:	-	1
edance F	0.83	0.83
ustment		
to impeding Mov	0.62	0.83
:11;	1,41	388

## Intersection Performance Summary

ppr De Sec		i ;	12.4	1.7	
	U	æ	U	ıζıζ	1
95% Queue Length (veh)	0.6	1.2	0.3	0.0 8.0	
Avg. Total Delay (sec/veh)	11.0	4.0	12.4	3.0	;
Shared Cap (pcph) (	391		320		
Move Cap (pcph)	988		244 412 1086	1491	1
Flow Rate (pcph)	58	312	13 6 6	301	,
Movement	ᆈᄄ	æ	되무없	<b>11</b>	
Move	田田	EB	<b>444</b>	SB	

3.0 sec/veh Intersection Delay =

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Stop/Yield
Volumes
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Grade
MC's (%)
SU/N's (%)
PCF's (%)

#### Adjustment Factors

1.10

12.10

Vehicle	Critical Follow-u	Follow-up
Maneuver	Gap (tg) Time (tf	Time (tf)
Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road		2.10 2.60 3.30 3.40

HCS: Unsignalized Intersections Release 2.1e HHMS-P.HCO Page 2

Worksheet for TWSC Intersection	ersection	
p 1:	H.B	83
	206	274
apacity:	1089	1006
Capacity:	1089	1006
9	0.99	0.72
Step 2: LT from Major Street	es	N.
Conflicting Flows: (vph)	211	342
'	1360	1178
Movement Capacity: (pcph) Prob. of Oueue-Free State:	1360	0.85
TH from Minc	EH.	EB
Conflicting Flows: (vph)	706	644
apacity:	465	501
due to Impeding Movements	0.85	0.85
ent	396	427
Queue-Free	0.98	0.99
Step 4: LT from Minor Street	<b>8</b>	盟
Conflicting Flows: (vph)	770	678
Potential Capacity: (pcph)	379	429
major Li, minor in Impedance Factor:	0.84	0.84
Adjusted Impedance Factor:	0.88	0.88
Impeding	0.63	0.87
Movement Capacity: (pcph)	239	374

## Intersection Performance Summary

Approach Delay (sec/veh)	ď	;	11.4	1.5
LOS	υ	æ	U	A A
95% Queue Length (veh)	0.5	1.3	0.1	0.0
d Total C Delay I (sec/veh)	11.0	5.0	11.4	3.6
Shared Cap (pcph) (	379		339	
Move Cap (pcph)	374	1006	239 > 396 > 1089 >	1178
Flow Rate (pcph)	46	284	12 6 6	174
Movement	.J.F	<b>-</b> 1≭	거무료	22
Mov		38	몆몆몆	88

2.5 sec/veh Intersection Delay -

## Napilihau Villages Traffic Impact Report Existing AM Peak Hour

# SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

# Intersection Parameters for Int # 0 . Honoapiilani Hwy/Napilihau St

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		EB OO. NOME 20 0		HT.	, ,	!	0.	2.0		오	2.0	16.0	1,00	1.00	1.00	NORM 1627	
							00.	2,0	, , ,	2	4.0	20.0	1.00	1.00	1.00	NORM 1583	
				ដូវ	200	75.7	00.	2.0	٠ س	ջ	4.0	0.0	1,00	1.00	1.00	NORM 1770	
		NON E		E	767	12.0	00.	2.0		8	5.0	10.0	1,00	1.00	1.00	NORM 1854	
		-		R	p C	.0	00.	2.0		ջ	4.0	2.0	1300	1.00	1.00	NORM 0	
				5	3°	. 0	00.	2.0	06.	2	4.0	2.0	200	1.00	1.00	NORM 0	
		MONE 20 20 0		H	٦ ¢	12.0	00	2.0	0 .	2	5.0	16.0		1.00	1.00	NORM 1398	
				RT	n		8	2.0	06. 1	2	4.0	2.0	200	1.00	1.00	NORM 0	
0000				LT.	m (	14.0	0.	5.0	6.	2	4.0	2.0		1.00	1.00	NORM 1770	
NONCBI 3.6		SB .0 .0 NONE 20 0 0		F	103	0.71 1	0.	5.0	06.	2	5.0	13.0	1900	1.00	1.00	NORM 1863	
- 00	eters		neters	RT	14	12.0	60.	2.0	.90	2	0	5.0	1900	1.00	1.00	NORM 1583	
METROAREA · LOSITIME LEVELOFSERVICE NODELOCATION	Approach Parameters	APPLABELS GRADES PEDLEVELS PARKINGSIDES PARKVOLUMES BUSVOLUMES RIGHTTURNONREDS	Movement Parameters	MOVLABELS	VOLUMES	WIDTHS	ITTLIZATIONS	TRUCKPERCENTS	PEAKHOURFACTORS	ACTIBATIONS	REOCLEARANCES	MINIMUMS	IDEALSATFLOWS	DELAYFACTORS	NSTOPFACTORS	GROUPTYPES	

#### Phasing Parameters

LEADLAGS OFFSET PEDTIME		
NO	10.00 5.00 2	
NO YES	19.00 5.00 8	
NO YES	12.00 .00 3	
NO VES	5.00 4.00	0
SEQUENCES PERMISSIVES OVERLAPS	GREENTIMES YELLOWTIMES CRITICALS	EXCESS

NONE 1 0

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Napilihau Villages Traffic Impact Report Existing AM Peak Hour

02/11/98 15:48:15

# SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapillani Hwy/Napilihau St Degree of Saturation (v/c) .33 Vehicle Delay 9.4 Level of Service B.

	Ped= .0 sec = .0:	HCM   L  90% Max: Delay   S   Queue	10.4 B	<u>ឝ្</u> ឌភ្		5.3 *B+ 83 ft   14.3 ft	14.8 B	8   *B	7.4 B+	B+ 114 f C+ 43 f
<u> </u>	23.3	۷/د	ii ii ii ii ii ii	.029 .175		.544		.082		.194
Phase 4	7. 16.0 18. 5.0 18. 5.0 18. 75.0	Adj volume	(1 	114		220		23		300
- + + + + + + + + + + + + + + + + + + +	1 = 1 =	Rate OE	1			1020		280		871 325
Phase + + + + + + + + + + + + + + + + + + +	G/C= .317 G= 19.0" Y+R= 5.0" OFF=35.0%	Service @C (vph)		490 586 114		986		200   213		834
+++	12.0° 12.0° 15.0°	Used		.350		. 550		200		. 550
Phase + + + + + + + + + + + + + + + + + + +	G/C= 12 G= 12 Y+R= OFF=15 G= 46.0	g/C Regd		.026 .096 .007		.206		. 038		235
Phase 1	G/C= .083 G= 5.0° Y+R= 4.0° OFF= .0\$	Width/  Lanes	Approach	$\left \begin{array}{c} 12/1\\ 12/1\\ 12/1\\ 12/1\end{array}\right $	Approach	TH+RT   12/1   LT   12/1	roach	LT+TH+RT  12/1   .0	roach	12/1
Sq 61   // /   // /     // /     // /     // /     // /     // /     // /   // /   // /   // /   // /   // /   // /   // /   // /   // /   // /   // /   // / / /   // /   // / / / / / /   // / / / / / / / / / / / / / / / / / /		Lane	SB Appr	표표	NB Appr	TH+RT	WB Approach	LT+TH+RT	EB Approach	RT LT+TH

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02/11/99 15:50:34	pilihau St 6 Level of Service B•						k Ped= .0 sec = .0%	HCM L 90% Max	9.7 B+		10.6 B	—— 44.		* 8 8 1	B. 3	340 7.0 B+ 113 ft   159   15.1   C+
	alysis Summary Honcapiilani Hwy/Napilihau Vehicle Delay 9.6 Level	<del></del>   ,		>	10.0"	OFF=75.01	c = 23.3 <b>¢</b>	Adj v/c		1 4 4 0		110   .109 163   .369	! ! ! !		- ;	269 .3 53 .1
	is Summary apiilani H iicle Delay	phase		÷÷÷>			=14.0 sec	Rate A		633 2 745 2 169 2	, , , , , , , , , , , , , , , , , , ,	1011   1		ii II — II 6	299	792
	Capacity Analysis nt # 0 - Honoapi (v/c) .30 Vehici	Phase 3	. + + :	4 4 4	G/C= .367 G= 22.0	<b>H</b> H	76.7 <b>%</b> Y=	Service F &C (vph)	• • • • •	575 686 114		977   1 368	) 		230	747
Existing	- Capaci Int # n (v/c)	e 2 -	+ +	\$ + + < + + +	;		Sec a	used		400		. 550		# # # # # # # # # # # # # # # # # # #	.200	500
	.4] for atio	Phase		* * * *	=5/5 =5/5	Y+K= .U" OFF=15.0%	G= 46.0	g/6 Reqd		. 197 - 197 - 003	1	094		11 11 11 11	1.03.	215
Napilihau Villages Traffic Impact Report pm Peak Hour	SIGNAL94/TEAPAC[V1 L1 Intersection Averages Degree of Satur	Phase 1	+ + +	***	1	Y+R= 4.0" OFF= .0%	= 60 sec	Width/	oach	12/1   12/1   12/1	Approach	RT 12/1			RT   12/1	12/1
Napilihau Traffic I PM Peak H	SIGNAL94/ Intersect Dec	Sq 61		North +	.		·iΰ	Lane	SB Approach	u	NB Appr	nt.		WB Approach	LT+TH+RT	E Approach
/11/98 :50:24							7 <b>.</b>			4.0 5.0 0.00 1.00 0.00				NONE 1	0	
02/1) 15:50	lau St			EB .0 NONE 20	00		RT TH 242 6 2.0 12.0	***	•	4.0 5.0 5.0 16.0 1900 1900	ーーズ	H		NONE.	o.	
	neter Values Honoapiilani Hwy/Napilihau			NB . 0 NONE 25	00			1 1 .00 .00 2.0 2.0	06. 6. 6.	4.0 5.0 4.0 5.0 10.0 5.0 1900 1900 1900 1	1.00 1.00 1.00 1.00 NORM NORM	1837 1770		LEADLAGS OFFSET	PEDTIME	
	of Parameter Values # 0 - Honoapiilan			KB .0 NONE 20	00		RT TH LT	.00 .00	90 . 90 . 90 . 90 . 90 . 90 . 90 . 90 .	5.0 4.0 16.0 5.0 1900 1900	1000	1494 0		NO NO	22.00 10.00 5.00 5.00	
							5-9			5.0 1900 1					9.00	
sing	nary Int	Bo.ao		·-			م منہ ہو۔	9404	000	0000	900	Ę (C				
Napilihau Villages Traffic Impact Report Existing ph Peak Hour	4] - Summary sters for Int	NONCED 3.0	Approach Parameters	SB .0 NONE	200	Movement Parameters	RT TH 65 261		06.	ACTUATIONS NO NO NO NO NO NO NO NO NO NO NO NO NO	1.00 1.00	1863	parameters	125	5.00.4 00.00.	<b>σ</b> Φ

No. Lanes Stop/Yield Volumes PHF Grade MC's (1) CV's (2) PCE's

#### Adjustment Pactors

1.10 1.10 1.10 | 1.10 1.10 1.10 1.10

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Follow-up Time (tf)	3 3 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Critical Gap (tg)	6.00 6.00 6.50
Vehicle Critical Follow-I Maneuver Gap (tg) Time (t	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

HCS: Unsignalized Intersections Release 2.1e NSHS-A.HCO Page 2

Worksheet for TMSC Intersection

Step 1: RT from Minor Street	en.	in ı
Conflicting Flows: (vph) Potential Capacity: (pcph)	222 1069	136
Movement Capacity: (pcph) Prob. of Queue-Free State:	1069	0.99
: LT from Major Street	WB	EB
-	240	147
ີ ຍ	1317	0.99
TH from	NB	SB
icting Flows: (vph)	388	395
ial Capacity: (pcph) tv Adiustment Factor	683	119
due to Impeding Movements	0.98	0.98
of Queue-Free State:	66.0	0.98
is is	ex S	es
cring Flows: (vph)	392	389
Potential Capacity: (pcph) Major IT Minor TH	N	630
ance Factor:	96.0	0.98
Impedance F	0.97	0.98
icy Adjustment ractor to Impeding Movements	96.0	0.96
Capacity	602	909

## Intersection Performance Summary

(veh)	0.0 A	0.6 B 6.4	0.0 A 0.1 0.0 A 0.1	1 5 coc/ush
Shared Total Cap Delay (pcph) (sec/veh)	3.4	6.4	2.2	1
	> 616 > 616	× 668		
Move Cap (pcph)	673 1069	608 667 1181	1459	
Flow Rate (pcph)	15 4 21	74 17	12	
Мочешепс	되는때	니타요	44	
Mov	22 E	SB	品品	

1.5 sec/veh Intersection Delay =

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### 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-P.HC0 Page 2

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	SB	218 1074 1074 0.99	E3	247 1307 1307 0.99	SB	513	0.97 571 0.98	SB	498	0.96	0.95
Intersection	NB	237 1050 1050 0.98	WB	263 1285 1285 0.99	NB	516 585	0.97 569 0.99	NB	499	0.95	0.95
Worksheet for TWSC Inte	Step 1: RT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 2: LT from Major Street	in a significant	Step 3: TH from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Capacity Adiustment Factor	Impeding Mov Capacity: ( Queue-Free	Step 4: LT from Minor Street	Conflicting Flows: (vph) Potential Cipacity: (pcph) Major IT: for TH	E Facto Impedan	Impeding Mov

## Intersection Performance Summary

Approach Delau	(sec/veh)		7.3			7.1	0.2	0.2	
201		£	. (	æ		m	Ø	Æ	494/0
95% Queue Length	(veh)	9.0	•	0.0	,	0.4	0.0	0.0	1.7 sec/veh
Avg. Total Delav	(sec/veh)	8.2		3.5	1	7.1	2.8	2.8	* 26
Shared	(bcbh) (		•			> 580			tion Del
Move	(bcph)	517	569	1050	519	1074	1307	1285	Intersection Delay =
Flow	(bcbh)	73	۲,	7	45	14	19	17	H
	Movement	ı	<b>⊢</b> c	×.	11	<b>⊣ α</b> ;	, i	ي	
	Mov	贸	2	9	88	SB	EB	Æ	

HCS: Unsignalized Intersections Release 2.1e NSLHR-A.HC0 Page 1
Center For Microcomputers In Transportation
University of Florida
512 Well Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378
Streets: (N-S) Lower Honoapiilani
Major Street Direction... NS
Length of Time Analyzed... 15 (min)
Analyst...... 1/16/98
Other Information.... Existing Traffic Conditions AM Peak Hou
Two-way Stop-controlled Intersection

				H C		11 11 11	H (		H	# ;	* * * * * * * * * * * * * * * * * * * *	H .
	Ž J	Northbound	2 ex	Į,	sournbound	2 2	7	rascoonna T	<u>م</u> «	I we	westbound	o ~
No. Lanes		-	0	¦ 。	4	0	0		¦	-	0	-
Scop/ Held Volumes PHF		9 8 13	4 60.	18	147	<b>Z</b> ,				179		29
Grade MC's (%)		0			0						0	1
SU/KV'S (1) CV'S (1) PCE'S				1.10						1.10		1.10

#### Adjustment Factors

	Critical Follow-1 Gap (tg) Time (t)	Follow-up Time (tf)
Right Turn Winor Road Through Traffic Minor Road Left Turn Minor Road	6 6 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	14. 100.4.

HCS: Unsignalized Intersections Release 2.1e NSLHR-A.HC0 Page 2

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	89	1 1 1 1 1 1	118	; ; ; ;	83	;	,
ection	WB	62 1288 1288 0.97	SB	1562 1562 0.99 1700 0.99	WB	236 773 0.99 0.99	0.99
Works	Step 1: RT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 2: LT from Major Street	ows: (ity: (ity: () Free Rlow Rate State	from Mi	ing Flows: ( Capacity: Minor TH Ce Factor: Impedance F	due to Impeding Movements Movement Capacity: {pcph}

## Intersection Performance Summary

Approach Delay (sec/veh)	) ( ( ) ( ) ( )	6.0	0.3
1.05	æ	4	Æ
95% Queue Length (veh)	1.2	0.0	0.0
<b>a</b> .	6.5	2.9	2.3
Shared Cap (pcph)			
Move Cap (pcph)	762	1288	1562
Flow Rate (pcph)	207	34	21
Movement	J	œ	ı,
Move	9	æ	SB

2.8 sec/veh Intersection Delay =

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E 1

	Westbound		0	166	18.	0		1.10
	Wes		-	42	. 95			1.10
	nd	œ	0					
	Eastbound	-	0					
	Ea	٦ .	0					
*****	puno	× ;	0	z s	ın c			
	Southbound		۲ م	3 7	5 . 95			0
	٠ د	3	۰.	233	. 95			1.10
医化环苯甲基苯苯	Northbound	¥ ;	1 < 0	61 52	. 95 . 0	•		
	Nort	;	0					_
一一一一一一一一一一一一一一个一个一个一个一个一个一个一个一个一个一个一个一			No. Lanes	Volumes	Grade	MC'B (%)	SU/RV'S (*) CV'S (*)	PCE's

#### Adjustment Factors

	2.10 2.60 3.30 3.40
Critical Gap (tg)	Road
Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor I Left Turn Minor Road

HCS: Unsignalized Intersections Release 2.1e NSLHR-P.HC0 Page 2

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Worksheet for TWSC Intersection	section		
Step 1: RT from Minor Street	WB	EB	
Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	92 1244 1244 0.79		
Step 2: LT from Major Street	SB	NB	
Conflicting Flows: {vph} Potential Capacity: {pcph} Wovement Capacity: {pcph} Prob. of Queue-Free State: TH Saturation Flow Rate: {pcphp} RI Saturation Flow Rate: {pcphp} Wajor IT Shared Lane Prob. of Queue-Free State:	119 1504 1504 1700		
Step 4: LT from Minor Street	FB	EB	
Conflicting Flows: (vph) Potential Capacity: (pcph) Major LT. Minor TH	416 608		
Impedance Factor: Adjusted Impedance Factor: Capacity Adjustment Factor	0.81		
Impeding Mov Capacity:	0.81		

## Intersection Performance Summary

Approach Delay (sec/veh)		4.3 E.	2.2
ros	М	æ	ø
95% Queue Length (veh)	0.3	6.0	0.7
Shared Total Cap Delay (pcph) (sec/veh)	8.1	3.6	2.9
Shared Cap (pcph) (			
Move Cap (pcph)	494	1244	1504
Flow Rate (pcph)	48	256	270
Movement	ыī	œ	ב
Move	MB I	異	SB

Intersection Delay = 2.7 sec/veh

198 Napilihau Village 109 Traffic Impact Re 109 AM Peak Hour
02/11/98 15:34:09
1998
Year
Base
Napilihau Villages Traffic Impact Report Base Year 1998
Napi

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values
Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

METROAREA	NONCBD			
LOSITIME LEVELOFSERVICE NODELOCATION	0 0 0			
Approach Parameters	cers			
APPLABELS	SB	H.B	SN SN	<b>EB</b>
GRADES	o, c	o.	o.	o.
PEDLEVELS	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

MOVEMENT PARAMETER  MOVLABELS  VOLUMES  MIDTHS  12.0  ILANES  12.0  TRUCKPERCENTS  2.0  PREACTENTORS  3  ACTUATIONS  ACTUATIONS  MINIMUMS  1000  DELAYFACTORS  1.00  DELAYFACTORS  1.00  NSTOPFACTORS  1.00  NSTOPFACTORS  1.00  NSTOPFACTORS  1.00  NSTOPFACTORS  1.00  NSTOPFACTORS  1.00  NSTOPFACTORS  1.00  NSTOPFACTORS  1.00  NSTOPFACTORS  1.00  NSTOPFACTORS  1.00  NSTOPFACTORS  1.00  NSTOPFACTORS  1.00	RT TH 15.0 12.0 12.0 12.0 12.0 12.0 2.0 2.0 2.0 2.0 3 3 NO NO 5.0 13.0 1900 1900 1.00 1.000	12.0 12.0 12.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	R	TH 12.0 2.0 2.0 2.0 3.0 3.0 5.0 5.0 1.90 1.00 1.00	11.000 0.00.00.00.00.00.00.00.00.00.00.00.	77 2.00 2.00 3.00 1.00 1.00 1.00 1.00	7H 225 12.0 12.0 2.0 2.0 90 .90 .90 .90 .90 .90 .90 .90 .90	LT 280 12.0 0.00 2.0 .90 .90 4.0 4.0 4.0 1.00 1.00	RT 290 12.00 . 90 . 90 . 90 . 90 . 90 . 90 . 190 . 190 . 190 . 100 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.00 . 1.0	7H 12.01 2.00 2.00 2.00 90 1900 1100 1100 1100	11.00 . 00 . 00 . 00 . 00 . 00 . 00 . 00
	_			NORM	NORM		NORM		NORM	NORM	NORM
OMS.				1398	0		1856		1583	1584	0

	NONE	00.	۰.				
	LEADLAGS	OFFSET	PEDTIME				
	OX.	YES		10.00	5.00	'n	
	8	YES	30	19.00	5.00	æ	
	8	YES	120	12.00	00.	m	
meters	02 NO	YES	9	2.00	4.00	o,	0
Phasing Parameters	SEQUENCES PERMISSIVES	OVERLAPS	CYCLES	GREENTIMES	YELLOWTIMES	CRITICALS	EXCESS

NONE 1 0

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1998
Year
Base
ges Report
u Villages Impact Rep Hour
Napilihau Traffic I AM Peak H

02/11/98

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.

	.3* Ped= .0 sec = .01	v/c   Delay   S   Queue	10.7 B .031 9.7 B+ 25 ft .221 10.5 B 79 ft	10.5 B	1 1 1 1	7.5 B+
Phase 4	/C= .167 +R= 5.0* FF=75.0\$	Adj	144	256	29	322
Phase w	G/C= .317 G, G= 19.0* G, Y+R= 5.0* Y. OFF=35.0\$ O1 76.7\$ Y=14.0	Service Rate @C (vph) @E	490 SS4 586 652	-! <b>!!</b>	213   280   29   .104	834 871 246 317
Phase 2	G/C= .200 G= 12.0* Y+R= .0* OFF=15.0*	g/C Regd Used	027   .350	-	.045   .200	249 .550
Sq 61 Phase 1	G/C= .083   G G= 5.0°   G Y+R= 4.0°   Y OFF= .0\$   C	Lane   Width/   Group   Lanes   Re	SB Approach RT   12/1   .027 TH   12/1   .114	roach RT   12/1	ch   12/1	EB Approach

02/11/93 15:36:31	Service B.					<b>.</b> 0.	90% Max	11 12 90 18 11 14 14 14	و دبانية بن	10 12 13 14 15 16 17 17 18	97 ft   113 ft			11 11 11 12 13 14	124 £
	44					o sec	'nω	# ii	ள்ள <del>ப்</del>	E2 II	<u> </u>	æ	E .	ŧ.	±0
						Ped= .0	HCM Delay	10.0	8.6 10.3 18.5	9.2	14.6	14.8		4.8	17.1
	ry Hwy/Napilihau ay 9.3 Level	:-:-	:::			23.3\$	۷/د	1 1 1 1	.123 .447 .006	11 11 11 11 11 11 11 11 11 11 11 11 11			.079		371
	Summary   ani Hk   Delay	Phase 4			G/C= .167 G= 10.0" Y+R= 5.0" OFF=75.0%	sec =	Adj Volume	1 1 1			255 178		23		294
	alysis Summary Honoapiilani H Vehicle Delay			^		Y=14.0	Rate		633 745 169		1018 442	;	292		327
1998	ity An 0 - .34	Phase + +	+ + : + <u>+</u>	>	G/C= .367 G= 22.0" Y+R= 5.0" OFF=30.0%	76.78	Service @C (vph)		575 686 114		368		224		747
Base Year	- Capac : Int # on (v/c)	2 6 2		^ + + + · + + +	G/C= .150 G= 9.0" Y+R= .0"	) sec *	c used		100		. 250		200		. 200
ort Bas	SIGNAL94/TEAPAC[V1 L1.4] · Capac Intersection Averages for Int # Degree of Saturation (V/c)	Phase		* * * *	i ——	G= 46.0	g/C Regd		. 220		179		LT+TH+RT  12/1   .036   .200		.063
Napilihau Villages Traffic Impact Report PM Peak Hour	SIGNAL94/TEAPAC(V1 L1.4) Intersection Averages fo Degree of Saturati	Phase 1	+ 4	***	C= .083	S	Width/ Lanes	ч	12/1	:	12/1	ŧ.	12/1	4	LT+TH   12/1   .063
hau Vil c Impa ik Hour	.94/TE section Degre	i_i_			G/C= X+R= OFF=		d'n.	SB Approach	TH TH LT	NB Approach	TH+RT LT	WB Approach	LT+TH+RT	EB Approach	TH.
Napiliha Traffic PM Peak	SIGNAI Intere	Sq 61	-	Morth 			Lane	SB Ap	#	IIB Ap		WB Ap	11	EB A	LT+TH
8 9						45 6	2.0	96 E 28	4.0 5.0 1900 1.00	1.00 1.00 NORM	0	NONE	H 0		
02/11/98 15:35:46				80.088	00	Hwa					37				
02 15	ihau St			EB .0 .0 ONON 20		RT 7 265 12.0 12.	l	•	444		1583 1637	NONE	0.0		
	//Napil					400	-dg	000	900	995	0	•			
	H.					LT 160						LAGS	INE INE		
	es ani			NB .0 NONE	00	TH 220	2.00.2	8.28	5.0 30.0 1900 1.00	1.00 NORM	1851	LEADLAGS	OFFSET PEDTIME		
	Values apiilani			NB • 0 0 0 NONE 20	00	RT TH 10 220	.00 .00 2.0 2.0	. 90 . 80 . 08	5.0 30.0 5.0 30.0 1900 1900	1.00 1.00 1.00 1.00 NORM NORM	0 1851	LEADLAGS	OFFSET PEDTIME		
	ameter Values - Honoapiilani Hwy/Napilihau			N		LT RT TH 10 10 220	2.0 2.0 2.0	. 90 . 90 . 90 . 90 . 90 . 90 . 90 . 90	5.0 5.0 10.0 1900 1900 1900	1.00 1.00 1.00 1.00 1.00 1.00 NORM NORM NORM	0 0 1851			5.00 5.00 5.00	
86	of Param # 0 -			WB NB .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0		RT TH 10 220	2.0 2.0 2.0 2.0	06. 06. 06. 06. 06. 08. 3 1 1 1 0N ON ON ON	5.0 4.0 4.0 5.0 16.0 5.0 5.0 10.0 1900 1900 1900 1900	1.00 1.00 1.00 1.00 1.00 1.00 1.00 NORM NORM NORM NORM	1458 0 0 1851	Ç	res ves	66. 6	
ear 1998	ary of Param Int # 0 -			N		RT TH LT RT TH 5 5 10 10 220 0 12.0	2.0 2.0 2.0 2.0 2.0	06. 06. 06. 06. 06. 00. 00. 00. 0N. ON ON ON	4.0 5.0 4.0 4.0 5.0 5.0 10.0 1900 1900 1900 1.00 1.00 1.00 1.	1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	0 1458 0 0 1851	Ç	YES YES	22.00 5.00 8	
Base Year 1998	- Summary of Paran rs for Int # 0 -	NONCBD 3.0 3.0 5. 3.0 0 0	ហ	N	200	TH LT RT TH LT RT TH 300 1 5 5 10 10 220 13 0 12 0 12 0	. co . co . co . co . co . co . co . co	06. 96. 96. 96. 96. 96. 96. 96. 96. 98. 98. 98. 98. 98. 98. 98. 98. 98. 98	5.0 4.0 4.0 5.0 4.0 4.0 5.0 13.0 5.0 15.0 5.0 15.0 5.0 10.0 19.0 19.0 19.0 19.0 19.0 19.0 1.00 1.0	1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	1863 1770 0 1458 0 0 1851	19 NO NO NO	YES YES YES	9.00 22.00 1 .00 5.00	
es eport Base Year 1998	- Summary of Paran rs for Int # 0 -	NONCBD 3.0 C 3.0 0 0	neters	WB . 0 . 0 . 0 . 0 . 0 . 0 . 0 . 0 . 0 .	200	LT RT TH LT RT TH 15 5 10 10 220 12.0	. co . co . co . co . co . co . co . co	06. 96. 96. 96. 96. 96. 96. 96. 96. 98. 98. 98. 98. 98. 98. 98. 98. 98. 98	5.0 4.0 4.0 5.0 4.0 4.0 5.0 13.0 5.0 15.0 5.0 15.0 5.0 10.0 19.0 19.0 19.0 19.0 19.0 19.0 1.00 1.0	1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	1863 1770 0 1458 0 0 1851	19 NO NO NO	YES YES YES YES OF THE TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL T	22.00 5.00 8	
Villages pact Report Base Year 1998 ur	- Summary of Paran rs for Int # 0 -	NON C	h Parameters	SB W3 C C C C C C C C C C C C C C C C C C	NREDS 0 0 C	TH LT RT TH LT RT TH 300 1 5 5 10 10 220 13 0 12 0 12 0		S :90 :90 :90 :90 :90 :90 :90 :90 :90 :90	5.0 13.0 5.0 4.0 5.0 4.0 4.0 5.0 5.0 15.0 5.0 15.0 5.0 15.0 5.0 15.0 5.0 15.0 1	1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	FLOWS 1583 1863 1770 0 1458 0 0 1851 Parameters	10 NO NO NO	YES YES YES YES 60 120 30	5 5.00 9.00 22.00 1 5 4.00 .00 5.00	
Napilihau Villages Traffic Impact Report Base Year 1998 PM Peak Hour	Summary of Param for Int # 0 -	õ	Approach Parameters	WB . 0 . 0 . 0 . 0 . 0 . 0 . 0 . 0 . 0 .	REDS 0 0	ELS RT TH LT RT TH LT RT TH S220 S 70 300 1 5 5 10 10 220 C 10 10 0 12 0 0 12 0	. co . co . co . co . co . co . co . co	RS .90 .90 .90 .90 .90 .90 .90 .90 .90 .90	5.0 13.0 5.0 4.0 5.0 4.0 4.0 5.0 5.0 15.0 5.0 15.0 5.0 15.0 5.0 15.0 5.0 15.0 1	CTORS 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.0	FLOWS 1583 1863 1770 0 1458 0 0 1851 Parameters	10 NO NO NO	YES YES YES YES (60 120 30	5 5.00 9.00 22.00 1 5 4.00 .00 5.00	

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No. Lanes 1 1 0 1 1 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 2 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1
1.10	1.10 1.10	01.1 01.1 01.1 01.1 01.1

Adjustment Factors

	2.10 3.30 3.40
Critical Gap (tg)	Road
Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

HCS: Unsignalized Intersections Release 2.1e F8NSHS-A.HCO Page 2

Worksheet for TWSC Intersection

NB SB	234 145 1054 1169 1054 1169 0.98 0.98	• •	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	NB SB	414 420 662 657	98 99 050 66	RN SB	418 414 606 610	0.96 0.97 0.98	0.95 0.96
Step 1: RT from Minor Street	licting Flows: (vph) ntial Capacity: (pcp) ment Capacity: (pcph) of Queue-Free State	Step 2: LT from Major Street	onflicting Flows otential Capacity ovement Capacity rob. of Queue-Fr	tep 3: TH from Mino		Impeding Mor Capacity: Queue-Free	tep 4: L	Conflicting Flows: (vph) Potential Capacity: (pcph)	dance.	Impeding Mov

Intersection Performance Summary

6.8 0.1 0.2		0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A 0.0 A		644	576 > 593 6.3 650 > 3.5 1054 3.5 646 > 644 6.8 1169 > 141 2.5	18 23 81 18 18 12 12	288 288 288 388 288 388 26 37 37 37 37 37 37 37 37 37 37 37 37 37	4
6.8	œ	0.7	6.8	644	585 646 1169	81 18 18		<b>して</b> 氏
4. V	æ	0.0	3.5			23 23		<b>⊣</b> 64
1	Ø	1	6.3			18		1
0.00	ros	$\alpha \gamma \sim 1$	Avg.   Total   Delay   (sec/veh)	hared Cap pcph)	Move Cap (pcph)	Flow Rate (pcph)	Movement	E

1.7 sec/veh Intersection Delay

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#### Adjustment Factors

Vehicle	Critical	Follow-up
Maneuver	Gap (tg)	Time (tf)
	5.00 5.50 6.00	2.10

# HCS: Unsignalized Intersections Release 2.1e FBNSHS-P.HCO Page 2

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	SB	232 1056 1056 0.99	田	263 1285 1285 0.98	SB	542 567	0.97 549 0.97	SB	529 523	0.96	0.95
Intersection	NB NB	248 1037 1037 0.98	N.B.	274 1269 1269 0.99	뜊	563	0.97 545 0.99	뜊	530 522	0.94	0.94
Worksheet for TWSC Inters		Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	tep 2: LT from	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 3: TH from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Capacity Addustment Factor	Impeding Mov Capacity: ( Queue-Free	Step 4: LT from Minor Street	00	dance Facto	>- 1

## Intersection Performance Summary

Approach Delay (sec/veh)		n.	7.5	000	
1,05	æ	æ	æ	ææ	
95\$ Oueue Length (veh)	9.0	0.0	9.0	0.0	
Avg. Shared Total Cap Delay (pcph) (sec/veh)	8.7	3.6	7.5	2.9	
Shared Cap (pcph) (	495		554		
Move (Cap (pcph)		1037	495 > 549 > 1056 >	1285 1269	
Flow Rate (pcph)	75	33°	46 18 12	23 18	
Movement	<b>-</b> 1€	- 않	구두또	7,2	
Мочеп	2	9 9	8888	出品	

Intersection Delay = 1.8 sec/veh

HCS: Unsignalized Intersections Release 2.1e F8NSLHRA.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 Honoapillani
Major Street Direction... NS
Length of Time Analyzed... 18 (min)
Date of Analysis... 1/16/98
Other Information... Nathout Project 1998
Two-way Stop-controlled Intersection

When Northbound | Eastbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound | Westbound

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Westbound		1 0	20	?		1.10	
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Eastbound	H	0					1
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Southbound	H	7	30				
So	<b>1</b>	1 < 0 0 > 1	190			1.10	
Pil	7 :	0	4.0				
Northbound	1	7	40 95	0			
Ñ	3	0					
Northbound   Southbound   Eastbound   Westbound		No. Lanes Stop/Yield	Volumes	Grade MC's (%)	SU/RV'S (%)	PCE's	

#### Adjustment Factors

Follow-up Time (cf)	2.10 2.60 3.30 3.40
Critical Gap (tg)	5.00 6.00 6.50
Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

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FRNSLHRA HCO	•
Release 2.1e	
d Intersections	
HCS: Unsignalized	

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ction WB EB	66 1282 1282 0.86	SB	89 1555 1555 0.86 1700 0.86	WB EB	298 712 0.86 0.86 0.86
Morksheet for TMSC Intersection Step 1: RI from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 2: LT from Major Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Movement Capacity: (pcph) The Sourcation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) Anjor LT Shared Lane Prob.	Step 4: LT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Major LT, Minor TH Impedance Factor: Adjusted Impedance Factor: Capacity Adjustment Factor Capacity Adjustment Factor Movement Capacity: (pcph)

## Intersection Performance Summary

Approach Delay (sec/veh)	)   	3.6	2.3	
	æ	æ	æ	c/veh
95t Queue Length (veh)	0.0	0.5	0.5	2.4 sec/veh
Avg. Total Delay Sec/veh)	6.1	3.3	2.7	lay =
Shared Cap (pcph)				ion De
Move Shared Cap Cap (pcph) (pcph) (s	609	1282	1555	Intersection Delay
Flow Rate (pcph)	23	179	220	_
Movement	ıı	œ	.7	
Mov	曼	Æ	SB	

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Center For Microcomputers in Transportation
University of Florida
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Adjustment Factors

/ehicle faneuver	Left Turn Major Road Aight Turn Minor Road S.50 Ihrough Traffic Minor Road 6.00 Left Turn Minor Road 6.50
Critical Gap (tg)	5.00 6.00 6.00
Follow-up Time (cf)	2.10 2.60 3.30 3.40

HCS: Unsignalized Intersections Release 2.1e FBNSLHRP.HCO Page 2

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Step 1: Rr from Minor Street WB EB  Conflicting Flows: (vph) Potential Capacity: (pcph) Potential Capacity: (pcph) Prob. of Queue-Free State: Step 2: Lr from Major Street St  Conflicting Flows: (vph) Prob. of Queue-Free State: Ry Saturation Flow Rate: (pcphpl) Prob. of Queue-Free State: Rr Saturation Flow Rate: (pcphpl) Prob. of Queue-Free State: Conflicting Flows: (vph) Adjor Lr Shared Lame Prob. Ochouse-Free State: Rr Saturation Flow Rate: (pcphpl) Major Lr Shared Lame Prob. Ochouse-Free State: Radjust Rr State: Conflicting Flows: (vph) Adjusted Inpedance Factor: Capacity: (pcph) Major Lr Minor TH Impedance Factor: Capacity: (pcph) Adjusted Impedance Factor: Capacity Adjustment Factor: Capacity Adjustment Factor: Capacity: (pcph) Movement Capacity: (pcph) Movement Capacity: (pcph)	Worksheet for TWSC Intersection		
(vph) 1236 (pcph) 1236 (pcph) 1236 (vph) 126 (vph) 1493 (pcph) 1493 (pcph) 1493 (pcph) 1493 (pcph) 1493 (pcph) 1493 (pcph) 1700 (pcph) 0.80 (vph) 439 (pcph) 590 (pcph) 590 (pcph) 6.80	jor	1	_
cting Flows: (vph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcphp) La Capacity: (pcphp) La Capacity: (pcphp) La Capacity: (pcphp) La La Flows: (vph) La Capacity: (pcph) La Minor Street La Minor TH La Minor TH La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph) La Capacity: (pcph)	"	97 1236 1236 0.78	
cting Flows: (vph) 126 ial Capacity: (pcph) 1493 int Capacity: (pcph) 1493 of Queue-Free State: (pcphpl) 1700 intation Flow Rate: (pcphpl) 1700 intation Flow Rate: (pcphpl) 1700 intation Flow Rate: (pcphpl) 1700 intation Flow Rate: (pcphpl) 1700 intation Flow Rate: (pcphpl) 1700 intation Flow Rate: (pcphpl) 1700 interior Flows: (vph) 590 intation Flows: (pcph) 590 intation Flow: (pcph) 590 inty Adjustment Factor: 0.80 ity Adjustment Factor: 0.80 ity Adjustment Factor: 0.80 ity Adjustment Factor: 0.80 ity Adjustment Factor: 0.80 ity Adjustment Factor: 0.80	LT from Major		<b>.</b> .
Flows: (vph)	ctring Flows: (vph) ial Capacity: (pcph) nn Capacity: (pcph) of Queue-Free State: uration Flow Rate: tIT Shared Lane Prob	126 1493 1493 0.81 1700	
Flows: (vph) inor TH factor: pedance Factor: justment Factor eding Movements	LT from Minor	WB	<b>co</b> •
	Flows: apacity: inor TH Factor: pedance ijustment eding Mc	439 590 0.80 0.80 472	

Intersection Performance Summary

Approach Delay (sec/veh)	4.5		2.2
LOS	æ	4	æ
ouene Length (veh)	0.3	6.0	0.8
3	8.6	3.7	3.0
Shared Cap (pcph) (			
Move Cap (pcph)	472	1236	1493
Flow Rate (pcph)	52	266	284
Movement	H L	WB R	SB L
Ξ		.5	U)

Intersection Delay = 2.7 sec/veh

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	Year
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ges	Report
Villages	Impact Report
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Nap	Tra

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# SIGNAL94/TEAPAC(V1 L1.4) - Summary of Parameter Values

St			EB .0 .0 NONE 20 20
0 - Honoapiilani Hwy/Napilihau St			NB
Honoapiilani			ON.
0			WB NONE 20 0
# 14			
Intersection Parameters for Int #	NONCBD 3.0 C S	meters	SB . 0 . 0 . 0 . 0 . 0 . 0 . 0
Intersection	METROAREA LOSTTIME LEVELOFSERVICE NODELOCATION	Approach Parameters	APPLABELS GRADES GRADES PEDLEVELS PARKINGSIDES PARKINGLUMES BUSVOLUMES RIGHTTURNONREDS

## Movement Parameters

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MOVLABELS	VOLUMES	HIDTHS	LANES	UTILIZATIONS	TRUCKPERCENTS	PEAKHOURFACTORS	ARRIVALTYPES	ACTUATIONS	REOCLEARANCES	MINIMUMS	IDEALSATFLOWS	FACTORS	DELAYFACTORS	NSTOPFACTORS	GROUPTYPES	SATURATIONFLOWS

#### Parameters Phasing

HONE 00	)			
LEADLAGS OFFSET PEDTIME				
NO YES	10.00	2.00	'n	
NO YES	18.00	2.00	<b>30</b>	
NO YES	13.00	0.	~	
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SEQUENCES PERMISSIVES OVERLAPS CYCLES	GREENTIMES	YELLOHTIMES	CKITICALS	EXCESS

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## 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

Incersection Averages for Int # 0 - Honoapiilani Hwy/Napilihau St Degree of Saturation (v/c) .38 Vehicle Delay 9.6 Level of Service E.

	Ped= .0 sec = .01	HCM L 90% Max.	11.3 8	11.1 B 25 ft 18.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 25.5 ft 2	10.4	5.5   *B+   106 ft.   14.5   *B   195 ft.	14.9 B	14.9  *B   25 ft	7.3		
Phase 4	G/C= .167 G= 10.0" Y+R= 5.0" OFF=75.0%	e Adj v/c	# # # # # # # # # # # # # # # # # # #	1 156 .251 6 .034		018   278   .273   560   339   .605		277   29   .105		350 390	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Phase 3	G/C= .300 G= 18.0* Y+R= 5.0* OFF=36.7\$	Service Rate @C (vph) @E	# # # # # # # # # # # # # # # # # # #	553 621 114 169		984 1		211		<u>i — i</u>	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Phase 2	G= 46.0 sec	g/C Regd Used	ij-	011 100		-:	1 1 1 1 1 1 1 1	-2		• • ;	
Sq 61 Phase 1	G/C= .083 G= 5.08 Y+R= 4.0* OFF* .0\$	Lane Width/ Group Lanes	roach	TH 12/1	NB Approach	TH+RT 12/1   LT 12/1	WB Approach	LT+TH+RT 12/1	EB Approach	RT 12/1	

02/11/95 15:39:41	lihau St Level of Service B.				Ped= .0 sec = .0:	HCM L 90% Max Delay S Queue	10.2 B	.7 B+ 42 E .6 B 183 E .5 °C+ 25 E	9.3 B+	*B+ 106 f	14.9 B	•B   25 £	8.7 B+	7.3 B+ 134 ft 15.3 C+ 45 ft
	alysis Summary Honoapiilani Hwy/Napilihau Vehicle Delay 9.6 Leve	Phase 4	****	C C 167 G C 10.0" X+R* 5.0"	OFF=7	Rate Adj V/c		633 83 .131 745 361 .485 169 1 .006		1018   278   .273 442   194   .439		1 28 1 .		92   317   .40 23   67   .20
Year 2000	pacity An # 0 - /c) .37	Phase 3	* * * * * * * * * * * * * * * * * * *	50   G/C= .367 0°   G= 22.0°	II	Service   @C (vph		400 575 6 400 686 7 100 114 1		550   984   10 250   368   4		0   227		747
orc Base	, ñ8	1   Phase	* * * * * * * * * * * * * * * * * * * *	.083 G/C= .15(	.0%   OFF=15	idth/ g/C Lanes Regd Used		3		12/1   .191   .5 12/1   .151   .5		.042   .		1 .245
Napilihau Villages Traffic Impact Rep PM Peak Hour	SIGNAL94/TEAPAC[V1 L1.4] Intersection Averages fo Degree of Saturati	Sq 61   Phase	North C**	* i n n	OFFE C= 60 s	Lane Width/ Group Lanes		TH 12	NB Approach	TH+RT 12	WB Approach	[LT+TH+RT] 12	EB Approach	<u> </u>
02/11/98 15:39:01	30 St .		EB .0 NONE	000	TH 10 12.0	2.0 2.0 2.0 2.0 2.0 2.0 30 .90 .90	w Öö.	~~~	1.00 NORM 1614		NONE NONE	0		
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	Values apiilani Hwy/Napilihe		NB .0 ONONE	0000	RT TH LT 10 240 175 .0 12.0 12.0 1	2.0 2.0 2.0 2.0 2.0 2.0 30 .50 .30	3 3 3 NO NO NO 4.0 5.0 4.0	5.0 10.0 5.0 1900 1900 1900 1.00 1.00 1.00	1.00 1.00 1.00 NORM NORM NORM 0 1852 1770			PEDTIME		
2000	ıry of Parameter Values ınt # 0 - Honoapiilani Hwy/Napilihau			20 0 0 0	RT TH LT RT TH LT 5 10 10 10 240 175 10 10 10 12.0 12.0 12.0 12.0 12.0 12.0	0 1 0 1 1 .00 .00 .00 .00 .00 2.0 2.0 2.0 2.0 2.0 2.0 .90 .90 .90 .90 .90	3 3 3 3 3 3 3 3 3 3 3 3 8 NO NO NO NO NO NO NO NO NO NO NO NO NO	5.0 16.0 5.0 5.0 10.0 5.0 1900 1900 1900 1900 1900 1900 1900 19	1.00 1.00 1.00 1.00 1.00 1.00 1.00 NORM NORM NORM NORM NORM NORM NORM NORM		NO LEADLAGS VFS OFFSET		5 8	
Napilihau Villages Traffic Impact Report Base Year 2000 PM Peak Hour	ummary of Parau or Int # 0 -	3.0 3.0 0	WB .0 0 NONE		TH LT RT TH LT RT TH LT 325 1 5 10 10 10 240 175 12:0 12:0 .0 12:0 12:0 1	1 1 0 1 0 1 1 .00 .00 .00 .00 .00 .00 .00 .00 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 .50 .90 .90 .90 .90 .90 .90	3 3 3 3 3 3 3 3 3 3 3 3 3 N NO NO NO NO NO NO NO NO NO NO NO NO N	5.0 13.0 5.0 5.0 16.0 5.0 5.0 10.0 5.0 1900 1900 1900 1900 1900 1900 1900 19	1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	eters	NO NO LEADLAGS	120 30 9.00 22.00 10.00		

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#### Adjustment Factors

Critical Follow-up Gap (tg) Time (tf)	5.00 2.10 5.50 2.60 6.00 3.30 6.50 3.40
Vehicle Crit Maneuver Gap	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road 6.50 3.40

HCS: Unsignalized Intersections Release 2.1e F0NSHS-A.HC0 Page 2

Intersection	 !
for TWSC	
Worksheet	Chart 1. Of Know William Charter

## Intersection Performance Summary

	Approach Delay (sec/veh)		3.T	7.3	0.1	
,	1.05	B	4	æ	Æ	doy/or
	95% Queue Lengch (veh)	0.0	0.0	0.8	000	1 7 cor/vah
	Avg. 99 Shared Total Que Cap Delay Ler (pcph) (sec/veh) (ve	6.6	3.6	7.3	2.2	- 26
	Shared Cap (pcph) (	268	^	613		rion Del
		551	1025	558 618 1156	1426 1262	Intersection Delay -
	Flow Rate (pcph)	18	23°	87 18 18	12	-
	Movement		NB R	SB L SB T SB R	1 1 1 1	
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1.7 sec/veh Intersection Delay

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Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Fh: (904) 392-0378
Streets: (N-5) Hanawai Street
Major Street Direction... EM
Length of Time Analysis... I/16/98
Other Information... I/16/98
Other Information... I/16/98
Other Information... I/16/98
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#### Adjustment Factors

Critical Follow-up Gap (tg) Time (tf)	
	Road
Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

# HCS: Unsignalized Intersections Release 2.1e FOMSHS-P.HCO Page 2

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R   B   _ ''.	NB 271 1009	250 1034
Capacity: (pcph) Queue-Free State: T from Major Street	1009 0.98 WB	1034 0.99 EB
ng Flows: (vph) Capacity: (pcph) Capacity: (pcph) Queue-Free State:	300 1233 1233 0.99	284 1255 1255 0.98
from Minor Street	ez.	SB
ng Flows: (vph) Capacity: (pcph) Adiustment Factor	592 533	587 537
>	0.97 £15 0.98	0.97 519 0.97
Minor Street	NB	53
g Flows: (vph) Capacity: (pcph)	572 494	574
£ 1	0.93	0.94
Aujetument Farcot Impeding Movements Capacity: (pcph)	0.94	0.94

## Intersection Performance Summary

Approach Delay (sec/veh)			8.3	00	
1,08	m.	K	m	44	2.1 sec/veh
951 Queue Length (veh)	0.8	0.0	9.0	0.0	2.1 se
Avg. Shared Total Q Cap Delay L (pcph) (sec/veh) (	9.7	3.7	8.3	3.0	ay =
Shared Cap (pcph) (	> 470	^	515		Intersection Delay
Move Cap (pcph)	464	1000	461 519 1034	1255	Intersec
Flow Rate (pcph)	87	32	52 18 12	23	,
Movement	-31	<b>⊣</b> ₽4	3 H K	44	
Α̈́O	2	2 2	SB	品品	

No. Lanes Scop/Yield Volumes PHF Grade MC's (%) SU/RV's (%) CV's (%)

Adjustment Factors

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/ehicle /aneuver	Left Turn Major Road Light Turn Minor Road Prough Traffic Minor Road Left Turn Minor Road
Critical Gap (tg)	5.50 6.00 6.50
Follow-up Time (tf)	2.10 3.30 3.40

HCS: Unsignalized Intersections Release 2.1e FONSLHRA.HCO Page 2

	EB		RI		· 日日:	
ection	EW.	74 1270 1270 0.84	. 85	100 1536 1536 0.85 1700	E.M.	326 685 0.84 0.84
Worksheet for TWSC Intersection	Step 1: RT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 2: LT from Major Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State: TH Saturation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) Major LT Shared Lane Prob. of Queue-Free State:	Step 4: IT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Major LT, Minor TH Impedance Factor: Adjusted Impedance Factor: Capacity Adjustment Factor due to Impeding Movements Movement Capacity: (pcph)

Intersection Performance Summary

Approach Delay (sec/veh)	3.7		4.5
103	В	Æ	4
95% Queue Length (veh)	0.0	9.0	9.0
Avg. Shared Total Cap Delay (pcph) (sec/veh)	6.5	3.4	2.8
Shared Cap (pcph) (	! ! ! !		
Move Cap (pcph)	577	1270	1536
Flow Rate (pcph)	23	197	238
Movement	B L	24	h
Move	9	E E	SB

2.4 sec/veh Intersection Delay =

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HCS: Unsignalized Intersections Release 2.1e FONSLHRP.HCO Page 1

Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378
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Two-way Stop-controlled Intersection

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#### Adjustment Factors

Vehicle Critical Follow-up Maneuver Gap (tg) Time (tf)	5.00 5.50 6.00 6.50 3.40 3.40
Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

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Worksheet for TWSC Intersection	Step 1: RT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 2: LT from Major Street	icting Flows: (vph) tial Capacity: (pcph) ent Capacity: (pcph) of Queue-Free State	TH Saturation Flow Rate: (pcphp1) RT Saturation Flow Rate: (pcphp1) Major LT Shared Lane Prob. of Queue-Free State:	Step 4: LT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph)	Impedance Factor: Adjusted Impedance Factor:	Capacity Adjustment Factor due to Impeding Movements Movement Capacity, (p.ch)

## Intersection Performance Summary

Approach Delay (sec/veh)		4. B.	2.3
<b>108</b>	m	æ	~
95% Queue Length (veh)	0.4	1.1	6.0
Avg. 1 Total Delay (sec/veh)	9.4	3.9	3.1
Shared Cap (pcph)			
Move Cap (pcph)	439	1224	1475
Flow Rate (pcph)	58	295	307
Movement	.1	œ	.a
Move	E.	ΨB	SB

Intersection Delay = 2.9 sec/veh

	2002	
:	Year	
	Base	
	Report	
u Villages	Impact	Hour

SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values Napilihau Traffic I

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

NONCBD	, a o	eters	i
METROAREA	LEVELOFSERVICE NODELOCATION	Approach Parameters	

## Movement Parameters APPLABELS GRADES PEDLEVELS PARKINGSIDES PARKINGSIDES BUSVOLUMES RIGHTTURNONREDS

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CLEAKANCES LIMUMS ALSATFLOWS TORS AYFACTOR AYFACTORS UPTYPES URPTYPES	5.0 1900 1.00 1.00 1.00 NORM	13.0 13.0 1.00 1.00 1.00 1.00 1.00	1900 1900 1.00 1.00 NORM	2:00 1:00 1:00 1:00 1:00 1:00	1500 1500 1500 1500 1500 1362	1,000 1,000 1,000 1,000 1,000 1,000 1,000	2.00.1 00.1 00.1 00.1	1900 1900 1.000 1.000 1.000 1.000 1.000 1.000	5.0 1900 1.00 1.00 1.00 1770	1.000 1.000 1.000 1.000 1.000 1.000 1.000	16.0 1900 1.00 1.00 NORM 1584	1.00 1.00 1.00 NORM

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Phasing Parameters	SEQUENCES PERMISSIVES OVERLAPS CYCLES GREENTIMES CRITICALS EXCESS	

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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+

. —	1	.3% Ped* .0 sec = .0%	v/c   HCM   L   90% H	B 6		10.3	.294   5.6  *B+   114 ft   .622   14.2   *B   206 ft	;	.107   14.9  *B   25 ft	7.2	
Phase 4	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	G/C= 167 G/C= 100 G/C= 100 Y+R= 5.0 OFF=75.0 0 SeC = 23	Adj Volume		167		300	• • • •	29 –	}	
Phase 3	*** ***	G/C= .283 G= 7.0 Y+R= 5.0 OFF=38.3%	ce Rac		434 501 520 590 114 169		985 1019 523 590		206   272		AC9   C9R
Phase 2	, +++ , +++ , +++	3/Cm . 233 14Rm . 0# 14Rm . 0# 16Fm . 0 8C = 46.0 8CC = 46.0	g/C Regd Used		 		.333		LT+TH+RT  12/1   .046   .200   206   272		286   583
Phase 1	++^ *** ++>	7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	!==:	ų	12/1	ch	12/1	ц	12/1   .0		12/1   286
Sq 61   P	/i/ North	7	Lane Group	SB Approach	TH TI	NB Approach	TH+RT	WB Approach	LT+TH+RT	। ਜ਼ੀ।	- RT

02/12/98 11:09:03		Hwy/Napilihau Sr Ny 9.8 Level of Service B.								Ped= .0 sec = .0%	HCM L 901 Max	11.3 B	9.2   8+   46 ft   11.7   B   205 ft   18.5   •C+   25 ft	. :	**************************************	.4  •B   130	14.9	8.4 B+	7.0
	ary	i Hwy/11a Iay 9.	4	-				10.0	5.5	- 23.3\$	e   v/c	; 1 1 1 1			.294	447			421
	s Summary		Phase		•	**	<u></u>	G/C= 10	Y+R= 5.0" OFF=75.0%	.0 sec	Adj Volume		394		300	~ i	28		344
	Analysi	- Honoa 0 Vehi	Se 3	<u> </u>			• •	.35	5.0"	Y=14	ice Rate		714		1019	<b>-</b> ,	295	!	918
Year 2002	Capacity Analysis	nc # 0 (v/c) .4	Phase		+ + >		_	້ ບໍ່ວ່າ ປ່ອ	##. ##.	= 76.7\$	Service F OC (vph)		547 653 114		985	667	227		776
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	[V1 L1.4]	Averages for of Saturation								G= 46	Regd 9/0	# # # #	. 252	1	.203		.042		.073
villag Impact P	TEAPAC		Phase 1	+ +	. 4	**	- !	G/C= .083 G= 5.0" Y+R= 4.0"	OFF . 04	eo sec	Width/ Lanes	ch # u = e ii	12/1	4 0	12/1	Ę	15	ü	12/1
Napilihau Villages Traffic Impact Report PM Peak Hour	SIGNAL94/TEAPAC(V1	Intersection Degree	Sq 61	•	<del>-</del>	North	_ i.	0 0 ×	-	ű	Lane	0 1	표대	NB Approach	TH+RT LT	WB Approach	LT+TH+RT	EB Approach	LT+TH
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002	y of Parameter Values L # 0 - Honoabiilani Hwv/Napilihau	• •					00		TH LT RT TH	12.0 .0 .0 12.0	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	NO NO NO NO NO NO NO 5.0 4.0 5.0 5.0 5.0 5.0 5.0	1.00 1.00 1.00 1.00	NORM NORM NORM NORM NORM 1473 0 0 1853 1770		NO	10.00 5.00		
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Adjustment Factors

Follow-up Time (tf)	2.10 2.60 3.30 4.40
Critical Gap (tg)	
vehicle Maneuver	Left Turn Major Road 5.00 2.10 Right Turn Minor Road 5.50 2.60 Through Traffic Minor Road 6.00 3.40 Left Turn Minor Road 6.50

HCS: Unsignalized Intersections Release 2.1e F2NSHS-A.HCO Page 2

Worksheet for TWSC Intersection

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NB NB	9 1
279 1000 1000 0.97	171 1134 1134 0.96
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300 1233 1233 0.99	
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490	
0.98 589 0.99	0.98 585 0.97
NB	es.
496 547	492 549
0.95	0.97
0.94 514	0.95
	279 1000 1000 1000 1000 1233 1233 1233 1233

Intersection Performance Summary

Approach Delay (sec/veh)		n 7	8.0	0.1	
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	0.0	0.0	6.0	0.0	, 0 .
	7.1	3.7	8.0	2.9	
Shared Cap (pcph)	531		583		
Move Cap (pcph)	514 >	\$89 ×	520 3 585 3 1134 3	1401	
Flow Rate (pcph)	18	29	23 23 23	18	
Movement	נ	Hα	ឯ৮ଝ	22	
Mov	NB N	22	SSB	留里	

1.9 sec/veh Intersection Delay

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												:

#### Adjustment Factors

	3.30 3.40 3.40
Vehicle Maneuver Gap (tg)	5.00 5.50 6.00 6.50
Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Left Turn Minor Road

HCS: Unsignalized Intersections Release 2.1e F2NSHS-P.HC0 Page 2

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Worksheet f		Minor
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Step 1: RT from Minor Street	RN	
onflicting Flow otential Capaci	4000 4000 4000	274
ment Capacity:	983	1006
<u>.</u>	0.98	0.98
ep 2: LT from Major 9	e.v	• • •
ng Flows:	326	311
Potential Capacity: (pcph)	1199	2
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
due to Impeding Movements	96.0	96.0
cph)	480	
Sta	0.98	Ō
tep 4: LT from Minor S	SN.	85
cting Flows:	626	626
Potential Capacity: (pcph)	460	460
e Factor:	0.93	ġ,
Adjusted Impedance Factor: Capacity bdjustment Barror		0.95
Repeding Mc Capacity:	0.93	0.93
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## Intersection Performance Summary

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	1.0	0.0	0.7	00.0
Avg. Total Delay sec/veh)	11.0	3.7	9.0	3.0
Shared Cap (pcph) (	432		493	
Move Cap (pcph)		983	478 483 1006	1219
Flow Rate (pcph)	122	2 3	1388	23
Movement	러는	œ	그는 또	aa
MOV	99	<b>9</b> 6	S SB	留是

2.3 sec/veh Intersection Delay =

	Follow-up Time (tf)	2.10 3.30 3.40
Adjustment Factors	Critical Gap (tg)	5.00 6.00 6.50
Adjustmen	Vehicle	Left Turn Major Road 5.00 2.10  Edit Turn Minor Road 6.00 3.30  Left Turn Minor Road 6.50 3.40  Left Turn Minor Road 6.50
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	EB	1	NB		EB	
section	47B	74 1270 1270 0.83	SB	1000 1536 1536 0.83 1700	WB	348 666 0.83 0.83 550
Worksheet for TWSC Intersection	Step 1: RI from Minox Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 2: LT from Major Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State: TH Saturation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) Ajoure LT Shared Lane Prob. of Queue Free State:	Step 4: LT from Minor Street	ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatrict ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatricular ntiatri

			Inters	Intersection Performance Summary	formand	e Summa	<u>}</u>	
Movement	ent	Flow Rate (ocph)	Move S Cap (pcph)	shared Cap (pcph) (1	Avg. Total Delay sec/veh)	95% Queue Length (veh)		Approach Delay (sec/veh
MB L		29	550		6.9	0.0	E E	3.8
HB R		215	1270		3.4	0.7	æ	
SB 1	-	261	1536	•	2.8	0.7	4	2.4
			Intersec	Intersection Delay		2.5 sec/veh	c/veh	

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Adjustment rations		5.50 6.00 6.50
	Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

HCS: Unsignalized Intersections Release 2.1e F2NSLHRP.HC0 Page 2	Release 2.1e	F2NSLHRP.HC0	Page 2
Worksheet for TWSC Intersection	section		
Step 1: RT from Minor Street	WB	83	
Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	106 1224 1224 0.74		
Step 2: LT from Major Street	SB	NB	
Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State: TH Saturation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) Major Lf Shared Lane Prob.	137 1475 1475 0.77 1700		
of Queue-Free State: Step 4: LT from Minor Street	WB	EB	
Conflicting Flows: (vph) Potential Capacity: (pcph) Major LT, Minor TH Impedance Factor: Adjusted Impedance Factor: Capacity Adjustment Factor due to Impeding Movements Movement Capacity: (pcph)	510 536 0.76 0.76 0.76		

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Service Services

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Approach Delay (sec/veh)		;	2.4	
507	Ü	4	æ	c/veh
95% Queue Length (veh)	9.0	1.2	1.0	3.1 sec/veh
Avg 95 e Shared Total Que Cap Delay Let h) (pcph) (sec/veh) (ve	10.5	4.0	3.2	ay =
Shared Cap (pcph) (	! ! !			tion Del
Move Cap (pcph)	406	1224	1475	Intersection Delay
Flow Rate (pcph)	64	318	336	-
Movement	B L	e;	1	
Move	£	品	SB	

Intersection Performance Summary

Napilihau Villages Traffic Impact Rep AM Peak Hour	Napilihau Villages Traffic Impact Report Year 1998 with Project AM Peak Hour	wich Pro	oject	•		02/1 15:2	02/11/98 15:27:22	Napilih Traffic AM Peak	Napilihau Villages Traffic Impact Report AM Peak Hour	Year	1998 wit	with Project	ш			02/ 15:	02/11/95 15:27:34
SIGNAL94/TEAPAC(V1 L1.4) Intersection Paramete METROAREA	រដ្ឋ	O #F	arameter O - Honox	ameter Values - Honoapiilani Hwy/Napilihau	//Napilih	hau St		SIGNAL9 Interse D	SIGNAL94/TEAPAC[V1 L1.4] Intersection Averages fo Degree of Saturati	for I	Capacity nt # 0 (v/c)	y Analysis 0 - Honoa .37 Vehi	Capacity Analysis Summary .nt # 0 - Honoapiilani Hv (v/c) .37 Vehicle Delay	Y Hwy/Napilihau Ny 9.7 Leve	ihau St Level of	E Service	# #
LEVELOFSERVICE	00 00							Sq 61	Phase 1	Phase	2   Ph	Phase 3	Phase 4	!-!			
Approach Parameters	ameters								+ +		+ +		:	•			
APPLABELS GRADES PEDLEVELS PARKINGSIDES	SB · 0 O O	X	EF O. O. SWO	EN O O O O		83.0 N		North	<b>4</b> ••		÷ .	^ · ·	*** > ^ + + + + + + + + + + + + + + + + + +	::			
PARKVOLUMES BUSVOLUMES	N		000	0 0		0 0		- '	>	* * *		•	>	— <u>:</u>			
RIGHTTURNONREDS Movement Parameters	o ameters		0	0		0			• RJ 44	G/C= G= 12 Y+R=		G/C= .317 G= 19.0= Y+R= 5.0=	G/C= .167 G= 10.0* Y+R= 5.0*	<b>C11</b>			
MOVIABELS VOLUMES	ESS	er Frence	TH LT.	TR.	LT 285	RT TH	LT 55	-10	OFF# .0%	G= 46.0 sec	- [ "	OFF=35.0% [ O]	FF=75.0	-: E	Ped= .0	Sec	0.
MIDIHS	12.0	0.0			12.0	~	o o		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		- 1		-			:
UTILIZATIONS TRUCKPERCENTS PEAKHOURFACTORS	2.0 2.0	2.06	2.0 2.0 2.0 2.0 .90 .50	2.08	2.0	.00 .00 2.0 2.0 .90 .90	2.0	Lane Group	Width/ up Lanes	g/C Regd Us	Used Se	Service Rate &C (vph) &E	e Adj Volume	v/c	HCM Delay	1 80 S	90% Max Queue
ARRIVALTYPES ACTUATIONS REOCLEARANCES		~ço		wõo.	E O			SB Approa	មូ	}						æ	
MINIMUMS IDEALSATFLOWS FACTORS DELAYFACTORS		1900	16.0 5.0 1900 1900 1.00 1.00	1,000	1900	5.0 16.0 1900 1900 1.00 1.00	rd rd r		12/1	027	350 45	490   554 586   652 114   169	144	.031 .034	10.5	+ B + C + C + C + C + C + C + C + C + C	25 ft   25 ft
NSTOPFACTORS GROUPTYPES SATURATIONFLOWS	1.00 1.00 NORM NORM 1583 1863	NORM NORM	00 1.00 ORM NORM	1.00 1.00 NORM NORM	NORM NORM				Approach			; ; ;			10.7	:	
Phasing Parameters	meters	•			2		,		TH+RT 12/1   LT   12/1	179   522.	300 40	987   1021 461   531	256	.251	5.4	*B+  97	97 ft.  187 ft.
SEQUENCES PERMISSIVES OVERLADS		N N	N N	LEADLAGS	LAGS	NONE	NONE	WВ Аррх	Approach	1	1				14.9	-	
CYCLES	5.00 12.00	19.00	10.00	PEDT	IME	30	10	LT+TH+RT	LT+TH+RT  12/1	. 045	200   2	213   280	29	104	14.9	13 - 2	25 ft.
YELLOWTIMES CRITICALS EXCESS			ა. ია					EB Approach	roach		-				7.6	÷	
	,											834   871		_ 195 _			1 Fr 1

	Ped= .0 sec = .0%	HCH L 90% Max Delay S Queue	10.7 B	9.7 B+ 25 ft 10.5 B 79 ft 18.5 +C+ 25 ft	10.7 B	5.4  *B+   97 fc     14.9  *B   187 fc	14.9 B	14.9   25 ft	7.6 B+	15.3   C+  45 fc
-	5.04	1 v/c		·—		251		104		344   .395   67   .211
Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase Phase	G/C= .167 G= 10.0 Y+R= 5.0 OFF=75.0 .0 sec = 2	e Adj Volume		144		256		29		
	715 00.00 V=14	vice Rate (vph) eE		554 652 169		1021		045   200   213   280		317
	G/C= .31 G= 19.0 Y+R= 5.0 OFF=35.0	Service   &C (vph)	1	490 586 114	1	987		213	-	834
Phase 2   Phase 4   Phase 4   Phase 5   Phase 5   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase 6   Phase	G/C= .200 G/C= .200 Y+R= .0* OFF=15.0\$	a/c Used	ļ			/1 .179 .550   /1 .222 .300		.200		2/1   .262   .550   2/1   .074   .200
-	l #	Regd	# # # # #	·		. 179		.045		
Phase 1	+R= 4 +R= 4 FF= 60 Se	Width/ Lanes	ach	12/1	1	1221	ach	r  12/1		12/1
Sq 61	15	Lane	SB Approach	표대	NB Approach	TH+RT T	WB Approach	LT+TH+RT	EB Approach	ETTERETE

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02/12/95 11:14:52	ihau St Level of Service B.				.0 sec01	A L 90% Max.	-	9.2   B+  43 ft  10.9   B   173 ft  18.5   C+  25 ft	Ħ.	5.4   B+ 97 ft   14.2   98   124 ft	m	.8  *B   25 fc	<b>#</b>	6.7 B+ 122 ft   15.1 C+ 38 ft
	انdeW/wapil 9.5	;-;-	****		01    23.31 Ped=	v/c   Belay	10	.137   9.2   .456   10.9   .006   18.5	9		14	0.079   14.8		367 6
n	Summa: illani e Dela	Phase	* ; * >	G/C= .167 G= 10.0° Y+R= 5.0°		e Adj Volume				255		_ 23		300
Year 1998 with Project	4 10	Phase 3	1 * * *	G/C= .350 G= 21.0* Y+R= 5.0*	7	Service Rate ec (vph) @E		1 607 2 4 169		4   1018 9   .472		4   292		6 818
198 with	pacity	4 	++>	0/0 4*	— i н	Ser		547 653 114		984	- -	į i	1	776
Year 19	il Ca For Int Elon (v	Phase 2	* + + + * + + + * + +	10.0	OFF=15.0%	g/c   Used	# # #		# # # # # # # # # # # # # # # # # # #	. 550		1	# # #	.200
ort	VI LI.			<u> </u>	— ქ ან	Regd	# # #		H 4 11 11 11	1.179		036	11 11 11 11	.063
u Villag Impact R Hour	TEAPAC( ion Ave	Phase 1	+ ^ * * * *	G/C= .083 G= 5.0* Y+R= 4.0*	OFF= .0%	Widch/ Lanes	H	12/1 12/21 12/1	ch ======	12/1	ch	12/1	ch	12/1
Napilihau Villages Traffic Impact Rep PM Peak Hour	SIGNAL94/TEAPAC[V1 L1.4] - Capac Intersection Averages for Int # Degree of Saturation (v/c)	Sq 61	North	-5 -5 -6 -7 -7 -7	- : J	Lane Group	SB Approach	THE THE	NB Approach	TH+RT LT	WB Approach	LT+TH+RT	EB Approach	LT+TH
2/98 4:35					F1.	.00 2.0 .90	ო <u>წ</u> მ.	5.0 1.00	1.00 NORM 0		NONE	0		
02/12/98 11:14:35	ihau St		EB .0 .0 NONE 20	•	RT TH 270 5 12.0 12.0	0.4.			1.00 1.00 NORM NORM 1583 1637		NONE	0.		
	ameter Values - Honoapiilani Hwy/Napilihau		NB .0 .0 NONE 20	0	RT TH LT 10 10 10 10 10 10 10 10 10 10 10 10 10	2.0 2.0	NO NO 5.0 4.0	10.0 5.0 1900 1900 1.00 1.00 1.00 1.00	1.00 1.00 1.00 NORM NORM NORM 0 1851 1770		LEADLAGS OFFSET	PEDTIME		
Project	f Par 0		WB . 0 . 0 NONE 20 0	0	RT TH LT 5 5 10 0 12.0 .0	2.00		16.0 5.0 1900 1900 1.00 1.00 1.00 1.00	1.00 1.00 NORM NORM 1458 0		NO NO ES YES	H	90.0 8	
198 with	nary Int				•			• •	1.00 1.00 NORM NORM 1770 0			20 30		
es eport Year 19	ra BČB	00 0	SB	0 meters	TH 300 12.0	9.28		1900 1900 1.00	1.00 1.00 1 NORM NORM N 1583 1863 1	neters	61 NO YES Y	60 120 5.00 10.00		
Napilihau Villages Traffic Impact Report Year 1998 with Project PM Peak Hour	SIGNAL94/TEAPAC(V1 L1.4] - Summ Intersection Parameters for HETRCAREA NONCED LOSTTIME 3.0	LEVELOFSERVICE C NODELOCATION 0	APPLABELS GRADES PEDLEVELS PARKINGSIDES PARKVOLUMES BUSVOLUMES	RIGHTTURNONREDS Movement Parameters	MOVILABELS VOLUMES WIDTHS LANES	UTILIZATIONS TRUCKPERCENTS PEAKHOURFACTORS	ACTUATIONS REQCLEARANCES	MINIMUMS IDEALSATELOWS FACTORS DELAYFACTORS	NSTOPFACTORS GROUPTYPES SATURATIONFLOWS	Phasing Parameters	SEQUENCES PERMISSIVES OVERLAPS	CYCLES GREENTIMES VETTOUTHER	CRITICALS EXCESS	

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01.10 01.1 | 01.1 | 01.1 | 01.1 | 10 205 35 .95 .95 .95 1.10 No. Lanes Stop/Yield Volumes PHF Grade HC's (\*) SU/RV's (\*) CC's (\*)

Adjustment Factors

Vehicle Critical Follow-up Maneuver Gap (tg) Time (tf)	Road 5.00 2.10 Road 5.50 2.60 Winor Road 6.50 3.40
Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road

HCS: Unsignalized Intersections Release 2.1e PBNSHS-A.HCO Page 2

Worksheet for TWSC Int	Intersection	
1: RT from M.	SN.	SB
Flows: (vph pacity: (pch acity: (pcp ue-Free Sta	234 1054 1054 0.95	145 1169 1169 0.98
H	H'B	
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	253 1299 1299 0.99	158 1441 1441 0.99
rom Minor St	- Z (	SB
licting Flows: (vph) ntial Capacity: (pcph	65	4.0
to Impeding Movent Capacity: (	0.0 643 69.0	639
T from Minor S	8N	
Conflicting Flows: (vph) Potential Capacity: (pcph)	422 603	
Lr, Minor in Jance Factor: Led Impedance F	0.95	0.97
Capacity Adjustment Factor due to Impeding Movements Movement Capacity: (pcph)	0.95 571	0.93 552

Intersection Performance Summary

Approach Delay (sec/veh)	α , 77		7.2	0.1	
	B	«	m	44	dev/2
	0.1	0.0	0.7	0.0	1 9 ser/veh
Avg.   Total   Delay  (sec/veh)	6.6	3.6	7.2	ии 0.83	1
	> 582	٨	> 615 > 615		rion Dal
Move Cap (pcph)		1054	552 x 639 x 1169 x	1441	Tatorracrica Delay
Flow Rate (pcph)	29	25	81 18 18	12	<b>P</b>
Movement	1 82	HK	거유점	고급	
Move	E	26	SBS	£ EB	

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Center For Highest In Transportation
Center For Highest In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 312611-2083
Fh: (904) 392-0378
Streets: (N-S) Hanawai Street
Major Street Direction ... EM
Length of Time Analysis ... | /16/98
Date of Analysis ... | /16/98
Two-way Stop-controlled Intersection

Two-way Stop-controlled Intersection

Two-way Stop-villed Intersection

Two-way Stop-villed Intersection

Two-way Stop-villed Intersection

Stop/Yield

Stop/Yield

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## Adjustment Factors

Vehicle	Critical	Follow-up
Maneuver	Gap (tg)	Time (tf)
Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road 6.6	6.50 6.50 6.50	23.50 23.00 23.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00 43.00

HCS: Unsignalized Intersections Release 2.1e P8NSHS-P.HCO Page 2

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Intersection	NB		8.8	1248 1248 0.96	NB NB	541	0.95 512 0.98		563	0.91	0.92 461
Worksheet for TWSC Inters	or Stree	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 2: LT from Major Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	tep 3: TH from Minor	ing Flows: (	apacity due to ovement rob. of	tep 4: LT from Minor St		Factor: Impedance	Capacity Adjustment factor due to Impeding Movements Movement Capacity: (pcph)

## Intersection Performance Summary

Approach Delay (sec/veh)	8.0	8.3	0.2
10s		Ф	a a
95% Oueue Length (veh)	0.0	0.5	0.0
Avg. Total Delay (sec/veh)	3.6	8.3	3.0
	467	510	
ove ap cph)	461 > 512 > 1028	450 > 510 > 1056 >	1285 1248
Flow Rate (pcph)	91 35 35	46 18 12	23 46
Movement	리는때	기타목	aa
Move	安安民	S 888	EB WB

Intersection Delay = 2.1 sec/veh

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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 Honoapillani
Major Street Direction... NS
Langth of Time Analyzed... 1/16/Min)
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Analyst... 1/ 11.10 1.10 No. Lanes Stop/Yield Volumes PHF Grade MC's (%) SU/RW's (%) CV's (%) PCE's

#### Adjustment Factors

/ehicle /aneuver	Follow-up Time (tf)
Left Turn Major Road Right Turn Minor Road Firough Traffic Minor Road Fit Turn Minor Road Fit Turn Minor Road Fit Turn Minor Road	2.10 2.60 3.30 3.40

HCS: Unsignalized Intersections Release 2.1e PBNSLHRA.HCO Page 2

	8		NB	!	8		
section	WB	66 1282 1282 0.86	SB	89 1555 1555 0.86 1700	WB	712	0.86
Worksheet for TWSC Intersection	Step 1: RT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) prob. of Queue-Free State:	Step 2: LT from Major Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. od Queue-Free State: TH Saturation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) Major LT Shared Lane Prob. of Queue-Free State:	Step 4: LT from Minor Street	licting ntial C	Impedance Factor: Adjusted Impedance Factor: Capacity Adjustment Factor due to Impeding Movements Movement Capacity: (pcph)

## Intersection Performance Summary

Approach Delay (sec/veh)	3.6	æ	A 2.3	veh
Queue Length (veh)	0.0	9.5	9.0	2.4 sec/veh
Shared Total Cap Delay (pcph) (sec/veh)	6.1	3.3	2.7	elay =
Share Cap (pcph)				tion D
Move Cap (pcph)	609	1282	1555	Intersection Delay
Flow Rate (pcph)	23	185	220	
Movement	ı	œ	ı	
Mov	¥B	Æ	SB	

Intersection Delay =

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HCS: Unsignalized Intersections Release 2.1e PBNSLHRD.HCO Page I Center For Hicrocomputers In Transportation University of Florida S12 Weil Hall Gainesville, FL 32611-2083 FH 1904) 392-0378 Florida Streets: [N-S] Lower Honoapillani Rajor Street Direction. NS Length of Time Analyzed. 15 (min) Analysis. 1/16/98 Date of Analysis. 1/16/98 Other Information. 15 (min) Analysis. 1/16/98 Other Information. 15 (min) Analysis. 1/16/98 Other Information. 15 (min) Analysis. 1/16/98 Other Information. 15 (min) Analysis other Information. 15 (min) Analysis of Analysis. 1/16/98 Other Information. 15 (min) Analysis of Analysis. 1/16/98 Other Information. 15 (min) Analysis of Analysis. 1/16/98 Other Information. 15 (min) Analysis of Analysis of Analysis. 1/16/98 Other Information. 15 (min) Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of Analysis of An

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road Right Turn Minor Road	ហហៈ	22.10 .60 .60
Through Traffic Minor Road Left Turn Minor Road	6.50	3.40

HCS: Unsignalized Intersections Release 2.1e PBNSLHRP.HCO Page 2

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section KB EB	97 1236 1236 0.78	SB	126 1493 1493 1700 1700	WB EB	449 582 0.79 0.79 461
Worksheet for TWSC Intersection Step 1: RT from Minor Street	licting Flow ntial Capaci nent Capacit	tep 2: LT from Ma	onflicting Flows: (vph) ocential Capacity: (pcph) ovenent Capacity: (pcph) ovenent Capacity: (pcph) flow of Queue-Free State: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate: (flow Rate) Rate: (flow Rate: (flow Rate) Rate: (flow Rate) Rate: (flow Rate) Rate: (flow Rate) Rate: (flow Rate) Rate: (flow Rate) Rate: (flow Rate) Rate: (flow Rate) Rate Rate Rate Rate Rate Rate Rate Rate	SE	Conflicting Flows: (vph) Potential Capacity: (pcph) Major LT, Minor TH Impedance Factor: Adjusted Impedance Factor: Capacity Adjustment Factor due to Impeding Movements Movement Capacity: (pcph)

Intersection Performance Summary

Avg. 95%

Rate Cap Cap Delay Length LOS Delay

Movement (pcph) (pcph) (sec/veh) (sec/veh)

#B L 52 461 8.8 0.3 B 4.5

HB R 272 1236 3.7 0.9 A

0.8 A 2.8 sec/veh

Intersection Delay \*

3.0

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Napilihau Villages Traffic Impact Report Year 2000 with Project AM Peak Hour

02/11/98 15:20:53

# SIGNAL94/TEAPAC[V1 L1.4] - Summary of Parameter Values

Napilihau Villages Traffic Impact Report Year 2000 with Project AM Peak Hour

Intersection Parameters for Int # 0 - Honoapiilani Hwy/Napilihau St

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			go.°	NONE 20	00	
			<u> </u>	NONE	00	
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# SIGNAL94/TEAPAC[V1 L1.4] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Honoapillani Hwy/Napilihau St Degree of Saturation (v/c) .40 Vehicle Delay 9.8 Level of Service B+ 61 | Phase 1 | Phase 2 | Phase 3 | Phase 4

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7 7	+++	13.0*	Used		333		.550   984   .317   491		1.046   .200   .206   .272	
Phase 2	* * * * * * *	G/C= .217 G/C= .217 G/C= .217 Y+R= .0 OFF=15.0\$	g/c Reqd		033		191		.046	
Phase 1	++4 ***	5.083 5.01 4.01	ldth/	æ	12/1 12/1 12/1		12/1	 	12/1	
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Sq 61	North		Lane	SB Ap	년투달	NB Ap	# #	WB Ap	LT+1	

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775	Napilihau Traffic I PM Peak H	SIGNAL94/TEAPAC(V1	Inters	METROAREA LOSTIIME LEVELOFSERVICE	NODELOCATION	APPLABELS GRADES PEDLEVELS PARKINGSIDES	FARNOLUMES BUSVOLUMES RIGHTTURNONREDS	Movement	MOVLABELS VOLUMES WIDTHS	LANES UTILIZATIONS TRUCKPERCENTS	PEAKHOURFACTORS ARRIVALTYPES ACTUATIONS	REQCLEARANCES MINIMUMS IDEALSATFLOWS FACTORS	DELAYFACTORS NSTOPFACTORS GROUPTYPES	SATURATIONFLOWS	SEQUENCES	OVERLAPS	GREENTIMES YELLOWTIME CRITICALS	EXCESS

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HCS: Unsignalized Intersections Release 2.1e PoNSHS-A.HC0 Fage 2

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Intersection	NB	260	1022	1022	66.0	WB.	284	1255	1255	0.98	88 88	337	107	4	0.97	602	0.99	erx		468	267	0.94	0.95		0.94	755
Worksheet for TWSC Inte	cter 1: RT from Minor Street		Conflicting Flows: (vpm)	.~	ė	Step 2: LT from Major Street		Conflicting Flows: (vpn)	Potential Capacity: (pcpi)	້ພ	,		licting Flows: (	apacity:	Adjustme	6	ent	יייייייייייייייייייייייייייייייייייייי	Step 4: LT from Minor Street		Conflicting ficial (pcph)	Minor TH	lance Factor:	Adjusted Impedance ractor		ent Capacity

## Intersection Performance Summary

Approach Delay (sec/veh)	8.1	0.1	-
10S	, m	AA .	ec/vel
95% Queue Length (veh)	6.0	0.0	2.3 sec/veh
Shared Total q Cap Delay I (pcph) (sec/veh) (	8.1 8.1	2.5	lay =
	> 567		Intersection Delay
Move Cap (pcph) 532 :	1022 509 > 595 > 1156 >	1426 1255	Interse
Flow Rate (pcph)	58 87 18	12 29	
Movement NB L	α コモ¤	: 11	•
Move	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	3 出星	

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### Adjustment Factors

cal Follow-up Eg) Time (tf)	
Critical Gap (tg)	
Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

# HCS: Unsignalized Intersections Release 2.1e PONSHS-P.HCO Page 2

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Worksheet for TWSC Inte	Intersection	
Step 1: RT from Minor Street	NB	SB
Conflicting Flows: (Vph)  Potential Capacity: (pcph)  Movement Capacity: (pcph)  Movement Capacity: (pcph)  Movement Capacity: (pcph)	290 987 987 0.96	250 1034 1034 0.99
2: LT from Majo	WB	EB
licting Flows: (1 ntial Capacity:	337	284 1255 1255 0.98
Prob. of Queue-Free State:	25.50 EB	SB
licting Flow	678 481	692
Adjustment mpeding Mov Capacity: (	0.91 435 0.97	0.91 428 0.96
4: H	NB	SB
lict	658	436
nor TH actor: edance F	0.87	0.88
	0.89	362

## Intersection Performance Summary

Approach Delay (sec/veh)	10.8	10.3	0.2	
10s	UA	υ	a a	2.7 sec/veh
95 <b>t</b> Queue Length (veh)	1.3	0.7	0.0	2.7 S
Shared Total Qu Cap Delay Le (pcph) (sec/veh) (	12.9	10.3	3.3	lay =
Shared Cap (pcph)	395	432		cion De
Move Cap (pcph)	391	382 > 428 > 1034 >	1255	Intersection Delay
Flow Rate (pcph)	105	52 12 12	23	
Movement	1261	X 11 K	74	
Move	異異	8 88 88 88 88 88	留壁	

HCS: Unsignalized Intersections Release 2.1e PONSLHPA.HCO Page 1

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Streets (N-S) Lower Honoapillani
Ength of Time Analyzed. NKN
Analyst. RKN
Date of Analyzed. NKN
Date of Analysis. 1/16/98

Two-way Stop-controlled Intersection

Northbound Southbound Eastbound Hestbound
Northbound Southbound Southbound F L T R
L L T R

No. Lanes
Stop/Yield
Volumes
PHF

Grade

CV S(\*)
SURV'S (\*)
SURV'S (\*)
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SURV'S (\*)
PCE'S

T 10 110 1.10

Adjustment Factors

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HCS: Unsignalized Intersections Release 2.1e PONSLHRA.HCO Page 2

	EB		E		8		
Intersection	WB	74 1270 1270 0.82	SB	1536 1536 0.84 1700	WB	332 680 0.84 0.84 570	
Worksheet for TWSC Inters	Step 1: RT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 2: LT from Major Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State: TH Saturation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) Amjor LT Shared Lane Prob. of Queue-Free State:	Step 4: LT from Minor Street	ne tritte	

Summary	
Performance	
Intersection	

Approach Delay (sec/veh)	3.8		2.4
105	Ø	Æ	æ
95% Queue Length (veh)	0.0	0.7	9.0
Avg. Shared Total Cap Delay (pcph) (sec/veh)	6.7	3.4	2.8
Shared Cap (pcph)			
Move Cap (pcph)	570	1270	1536
Flow Rate (pcph)	29	226	243
Movement	HB L	WB R	SB L

Intersection Delay = 2.5 sec/veh

.le PONSLHRP.HCO Page	Streets: (N-S) Lower Honoapillani Major Street Direction Length of Time Analyzed 15 (min) Analyst	×	0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
ons Release 2.1e	iilani NS NS NS KKW 1/16/98 1/16/98 Alture Traffic Co With Project 2000	Southbound L T R	0 × 1 0 N 295 85 95	
HCS: Unsignalized Intersections Release 2 ####################################	Streets: (N-S) Lower Honoapillani Major Street Direction NS Length of Time Analyzed 15 (min) Analyst	Northbound L	1 0 M 70 65 70 65 .95 .95	
HCS: Unsignalized Interpression of Florida University of Florida S12 Weil Hall Ft. 326. Ph. (904) 392-0378	Streets: (N-S) Lower Honoap Major Street Direction Length of Time Analyzed Analyse Date of Analysis Other Information		No. Lanes 0 Stop/Yield Volumes PHF Grade	MC's (%) SU/RV's (%)

### Adjustment Factors

Vehicle	Critical	Follow-up
Maneuver	Gap (tg)	Time (tf)
Left Turn Major Road 5.00 5.10 Right Turn Minor Road 5.50 3.30 Through Traffic Minor Road 6.50 3.30 1.eft Turn Minor Road 6.50 3.40	6.00 6.00 6.00	2.10 3.30 3.40

HCS: Unsignalized Intersections Release 2.1e PONSLHRP.HCO Page 2

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ection	WB.	108 1221 1221 0.75	gy S	142 1467 1467 0.75 0.75 858 508 538 0.75 0.75
44	Step 1: RT from Minor Street	Flows: (vph) apacity: (pcp) pacity: (pcph) eue-Free Stat	Step 2: LT from Major Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State: TH Saturation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) Anjor IT Shared Lane Prob. of Queue-Free State: Step 4: LT from Minor Street Conflicting Flows: (vph) Potential Capacity: (pcph) Major LT, Minor TH Impedance Factor: Capacity Adjustment Factor: Capacity Adjustment Factor Gue to Impedance Factor: Capacity Adjustment Factor Gue to Impedance Factor: Capacity Adjustment Factor

## Intersection Performance Summary

	Approach	Delay	(sec/veh)	11111111	t	0.0		2.5	
		203			υ	4		4	
954	Quene	Length	(veh)		0.5	1.1	  - 	1.0	
Avq.	Total	Delay	(sec/veh)		10.3	6.6	<b>.</b>	3.2	
	Shared	Cap	2	11111					
	Move	Cap	(bcbh)	1	406	1221		1467	
	Flow	Rate	(bcbh)		58	702		342	
			Movement		-1	ρ	:	ដ	
			Š	;	Ŧ	9	?	SB	

Intersection Delay = 3.0 sec/veh

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1.10 3 No. Lanes Stop/Yield Volumes PHF Grade MC's (%) SU/RV's (?) PCE's (%)

Follow-up Time (tf) 2.10 2.60 3.30 3.40 Critical Gap (tg) 5.50 Adjustment Factors Vehicle Maneuver Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

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HCS: Unsignalized Intersections Release 2.1e POHHND-A.HCO Page 2

			782	782	36.0
section	H.B				76.0
Worksheet for TWSC Intersection	Step 1: RT from Minor Street	!	CONTINCTING FIGURE: (VEN)	Movement Capacity: (pcph)	Prob. of Queue-Free State:

Intersection Performance Summary

Approach Delay (sec/veh)	
883	m
95% Queue Length (veh)	0.2
Avg. Total Delay [sec/veh)	5.0
Shared Cap (pcph)	
Move Cap (pcph)	782
Flow Rate (pcph)	64
Movement	EB R

0.5 sec/veh Intersection Delay =

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	Follow-up Time (tf)	3 3 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Adjustment Factors		6.00 6.00 6.50
Adjus	Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

Page 2	
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Worksheet for TWSC Intersection	section	
Step 1: RT from Minor Street	AB AB	ដា
Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:		640 655 655 655 655

	Approach Delay (sec/veh)	, .
ቷ	1.05	ф
ce Summa	95% Queue Length (veh)	0.0
Intersection Performance Summary	Avg. Shared Total Cap Delay (pcph) (sec/veh)	5.7
ction P	Shared Cap (pcph) (	
Interse	Move Cap (pcph)	959
	Flow Rate (pcph)	29
	Movement	EB R

0.2 sec/veh

Intersection Delay =

02/12/58 11:18:05	of Service E		0 sec = .0;	L 90¢ Max S Queue	B 25 ft	B 114 ft	B 25 ft	
	lihau Sc Level		Ped= .(		10.3 11.2 18.5	11.6	41	7.8
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roject	Analysis - Honoapi 14 Vehicl	^	<u> </u>	Rate ) @E	528 621 169	1019	270	# H H H H H H H H H H H H H H H H H H H
2002 with Project	ity o	+++>	G/C= .300 G= .300 Y+R= 5.0" OFF=36.7%	Service ©C (vph	953	985	202	
Year 2002	, he is	^ + + +	3.0* 3.0* 5.0\$	g/C Used	.333	.550	1.200	
ärt	V1 L1.4] rages fo Saturati	+>	G= 46	Regd	.033	.203	.046	#
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Napilihau Villages Traffic Impact Rep AM Peak Hour	SIGNAL94/TEAPAC(V1 Intersection Avera Degree of Sa Sq 61   Phase 1	!		1301 4	TH	NB Approach		EB Approach
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Napilihau Villages Traffic Impact Report AM Peak Hour	SIGNAL94/TEAPAC[V1 L1.4] - Summ Intersection Parameters for METROAREA LOSTTIME LOSTTIME LOSTTIME S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOFESENICE S.O LEVELOF	Approach Parameters APPLABELS GRADES PEDLEVELS PARKINGSIDES PARKOLUMES BUSYOLUMES	AREDS C Param	LANES UTILIZATIONS TRUCKPERCENTS PEAKHOURFACTORS ARRIVALTYPES ACTUATIONS REOCLEARANCES		GROUPTYPES SATURATIONFLOWS 1583 Phasing Parameters	SEQUENCES PERMISSIVES OVERLAPS CYCLES GREENTIMES YELLOWTIMES	EXCESS

02/12/98 11:22:23	St	Level of Service B			Ped= .0 sec = .0.	HCM L 901 Max Delay S Queue	11.9 B		10.2 B	.6  *B+   114 £	14.9 B 14.9 (*B   25 ft.	6.6   B+   140 ft   15.3   C+   49 ft
2002 with Project	Capacity Analysis Summary nt # 0 - Honoapiilani Hwy/Napilihau	ישו	****  ****  ****  ****  ****  ****  ****	G/C* .333 G/C* .167 G= 20.0" G= 10.0" Y+R= 5.0" Y+R= 5.0° OFF=33.3*	14.0 sec = 23.3%	Service Rate Adj eC (vph) @E  Volume   v/c		394 .57	1.1.2 经企业 化二氯甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基	85   1019   300   .294   29   501   283   .565	293   28   096	804   844   356   .422   .224
Year	ı ы	1 1	****	G/C183 G= 11.0° Y+R= .0° OFF=15.0%	G= 46.0 sec =	Regd Used		.105   .367     .252   .367     .003   .100	**************************************	.203 .550 98 .203 .283 422	.042   .200	. 269   . 533   . 8
Napilihau Villages Traffic Impect Report PM Peak Hour	SIGNAL94/TEAPAC(V1 L1.4) Intersection Averages fo		North +++ *	G/C= .083 G= 5.0* Y+R= 4.0* OFF= .0\$	ו טו	Lane   Width/   Group   Lanes	SB Approach	222	NB Approach	TH+RT 12/1	WB Approach [LT+TH+RT] 12/1	EB Approach
02/12/98 11:22:13	Lihau St		EB 0 . 0 . 0 . 0 . 0 . 0 . 0 . 0 . 0	, <b>o</b>	RT TH LT 320 10 55 12.0 12:0 .0	2.0 2.0 2.0 2.0 2.0 2.0 .90 .90 .90	Ž.	1900	.00 ORM 506		NCNE NONE .00 1	
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Napilihau Villages Traffic Impact Report PM Peak Hour	SIGNAL94/TEAPAC(V1 L1.4) Intersection Paramete	METROAREA LOSTTIME LEVELOFSERVICE HODELOCATION	Approach Parameters APPLABELS GRADES PEDLEVELS PARKINGSIDES PARKINGSIDES RISYOLIMES	Z #	MOVLABELS VOLUMES WIDTHS LANES	UTILIZATIONS TRUCKPERCENTS PEAKHOURFACTORS ARRIVALTYPES	ACTUATIONS REQCLEARANCES	HINIMUMS IDEALSATFLOWS FACTORS DELAYFACTORS	NSTOPFACTORS GROUPTYPES SATURATIONFLOWS	Phasing Pa	SEQUENCES PERMISSIVES OVERLAPS CYCLES GREENTIMES	CRITICALS EXCESS

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### Adjustment Factors

Vehicle	Critical	Foilow-up
Maneuver	Gap (tg)	Time (tf)
Left Turn Major Road Right Turn Minor Road S.50 Through Traffic Minor Road 6.00 Left Turn Minor Road 6.50	5.00 6.00 6.50	1

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ion	NB SB	284 171 994 1134 994 1134 0.94 0.98	WB EB	311 184 1219 1401 1219 1401 0.97 0.99	RB SB	516 530 585 575	0.96 0.96 561 551 0.99 0.97	NB SB	522 535 528 519	0.93 0.95 0.94 0.96	0.93 0.90
Worksheet for TWSC Intersection	Step 1: RT from Minor Street	flicting Flows: (vph) ential Capacity: (pcph) ement Capacity: (pcph) b. of Queue-Free State:	2: LT £	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 3: TH from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Capacity Adiustment Factor	Impeding Movements Capacity: (pcph) Queue-Free State:	Step 4: LT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph)	Factor: Impedance Factor:	ractor

## Intersection Performance Summary

	Approach Delay (sec/veh)		1.0	8.6	0.1	
•	201	B	¥	æ	ææ	2.3 sec/veh
	95% Queue Length (veh)		0.1	6.0	0.0	2.3 se
	Avg. Shared Total Cap Delay (pcph) (sec/veh)	8.3	3.9	8.6	3.0	ay =
	Shared Cap (pcph) (	495		538		ion Del
	Move (Pcph)	489 >	4 \$66 866	466 > 551 > 1134 >	1401 1219	Intersection Delay
	Flow Rate (pcph)	88	64	81 18 23	18 35	н
	Movement	17 6	→ D\$	ㅋ누ㄸ	בר	
	Hove	21	2 2	SBS	品	

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### Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	ш [-
Left Turn Major Road Right Turn Major Road 5.50 Through Traffic Minor Road 6.00 Left Turn Minor Road 6.50	5.00 6.00 6.50	2.10 2.60 3.30 3.40

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Worksheet for TWSC Intersection	rsection	
	NB	SB
Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	318 955 955 0.96	274 1006 1006 0.98
Step 2: LT from Major Street	WB	留
onflicting Flo otential Capac ovement Capaci rob. of Queue-	374 1137 1137 0.90	311 1219 1219 0.98
Step 3: TH from Minor Street	NB	SB
Conflicting Flows: (vph) Potential Capacity: (pcph) Capacity Adjustment Factor due to Impeding Movements Movement Capacity: (pcph) Prob. of Chana Free Care.	756 438 0.88 386	774 428 0.88 377
4: LT from Min		SB
icting Flow	734 398	742
ce Factor: Impedance F	0.84	0.85
Capacity Adjustment Factor due to Impeding Movements Movement Capacity: (pcph)	0.86 343	0.85

## Intersection Performance Summary

Approach Delay (sec/veh)	13.3	12.0	0.0
S01	υ «	υ	44
954 Queue Length (veh)	1.7	1.0	0.0
Avg. Total Delay (sec/veh)	16.3	12.0	3.5
Shared Cap (pcph) (	347	394	
Move Cap (pcph)	343 × 386 × 955	335 × 377 × 1006 ×	1219
Flow Rate (pcph)	116	58 18	23 116
Movement	구단목	되는요	교교
Move	222	888	器架

Intersection Delay = 3.3 sec/veh

No. Lanes Scop/Yield Volumes PHF Grade MC's (%) SU/RV's (%) CC's (%)

Adjustment Factors

1.10 1.10

Follow-up Time (tf)	
Critical Gap (tg)	
Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

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	EB		NB		8			
Intersection	WB	76 1267 1267 0.80	SB	105 1528 1528 0.83 1700	WB	355	0.82	543
orksheet for TWSC	: =	Flows: (vph apacity: (pcp pacity: (pcp eue-Free Sta	Step 2: LT from Major Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State: TH Saturation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) Major LI Shared Lane Prob. of Queue-Free State:	Step 4: LT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Major IT. Minor TH	Impedance Factor: Adjusted Impedance Factor:	Capacity Adjustment ractor due to Impeding Movements Movement Capacity: (pcph)

Intersection Performance Summary

	2.6 sec/veh	2.6 se		Intersection Delay		3	â
2.5	4	0.7	2.9	1528	266	ב	SB
	æ	0.8	3.5	1267	249	œ	品
9.6	m	0.0	7.0	543	29	14	皇
Delay (sec/veh)	SOI	Length (veh)	-		Rate (pcph)	Movement	<u>8</u>
Approach		954 Queue	Avg. red Total	Move Shared	Flow		

2 7.5 中 2 2 17.0 Ħ <u>F</u> 

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### Adjustment Factors

Critical Follow-up Gap (tg) Time (tf)	
Vehicle Maneuver	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

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•	83		EN.		EB	
ction	WB	108 1221 1221 0.72	SB	142 1467 1467 0.74 1700	i =	550 509 0.73 0.73 370
¥4	Step 1: RT from Minor Street	Conflicting Flows: (vph) Potential Capacity: (pcph) Movement Capacity: (pcph) Prob. of Queue-Free State:	Step 2: LT from Major Street	Conflicting Flows: (Vph) Potential Capacity: (pcph) Prowement Capacity: (pcph) Prob. of Queue-Free State: TH Saturation Flow Rate: (pcphpl) RT Saturation Flow Rate: (pcphpl) Major LT Shared Lane Prob. of Queue-Free State:	nor	Conflicting Flows: (vph) Potential Capacity: (pcph) Major LT, Minor TH Impedance Factor: Adjusted Impedance Factor: Capacity Adjustment Factor due to Impeding Movements Movement Capacity: (pcph)

## Intersection Performance Summary

Approach Delay (sec/veh)	ני	;	2.6	
S01	ပ	Æ	4	c/veh
95% Queue Length (veh)	9.0	1.3	1.2	3.2 sec/veh
Shared Total Cap Delay (pcph) (sec/veh)	11.8	4.4	3.3	lay =
Shared Cap (pcph)				tion De
Move Cap (pcph)	370	1221	1467	Intersection Delay
Flow Rate (pcph)	64	336	376	-
Movement	1	æ	L1	
¥0v	星	MB.	SB	

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### Adjustment Factors

Follow-up Time (tf)	2.10 2.60 3.30 3.40
Critical Gap (tg)	8.50 6.00 5.50 5.50
Vehicle Critical Follow-U Maneuver Gap (tg) Time (tf	Left Turn Major Road Right Turn Minor Road Through Traffic Minor Road Left Turn Minor Road

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HCS: Unsignalized Intersections Release 2.1e P2HHND-A.HCO Page 2

Worksheet for TWSC Intersection	
Step 1: RT from Minor Street	WB
Conflicting Flows: (vph)	885
Potential Capacity: (pcph)	739
	739
Onene	0.89

## Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Lengch (veh)	507	Approach Delay (sec/veh)
EB R	83	739		5.5	0.3	æ	n n

Intersection Delay = 0.7 sec/veh

HCS: Unsignalized Intersections Release 2.1e P2HHND-P.HC0 Page 2 Flow Move Shared Total Queue Approach Rate Cap Delay Length LOS Delay (pcph) (pcph) (sec/veh) (veh) (sec/veh) reet Intersection Performance Summary Worksheet for TWSC Intersection Intersection Delay = Step 1: RT from Minor Street Conflicting Flows: (vph)
Potential Capacity: (pcph)
Movement Capacity: (pcph)
Prob. of Queue-Free State: 34 Movement EB R 2 Center For Microcomputers In Transportation
University of Florida
512 Weil Hall
Gainesville, FL 32611-2083
Ph: (904) 392-0378
Streets: (N-S) Honoapillani Highway
Major Street Direction. NS
Length of Time Analyzed. 15 (min)
Analyst. ...
Two-way Stop-controlled Intersection

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N ¥. IL AL 1.10 田田 門籍 (£) (£) No. Lanes Stop/Yield Volumes PHF Grade MC's (%) SU/RV's (%) FCE's 1 

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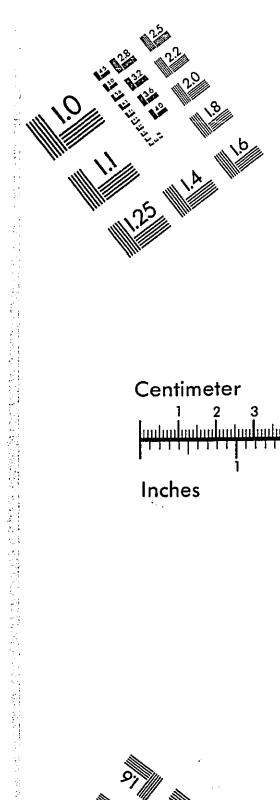
Vehicle Maneuver Left Turn Major Road Right Turn Minor Road Through Traffic Winor Road	Critical Follow-up Gap (tg) Time (tf) 5.00 5.50 2.60 6.50 3.30	Follow-up Time (cf) 2.10 3.30 3.40
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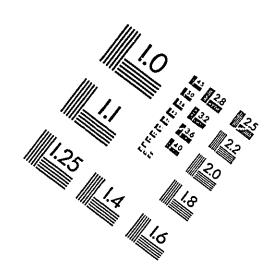
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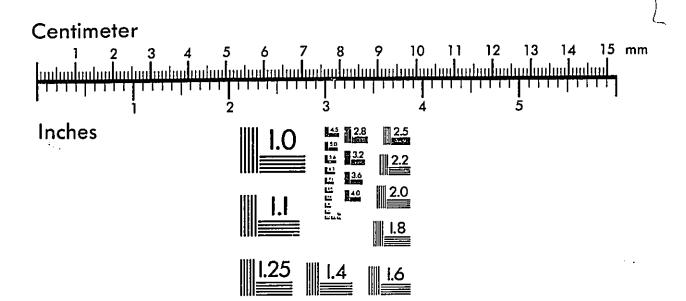


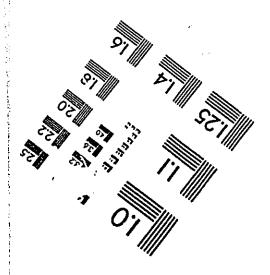


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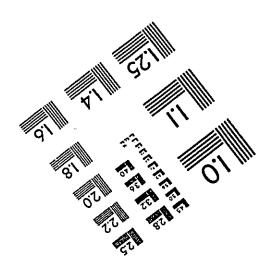
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