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STATE OF HAWAII



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STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS

P.O. BOX 1879

HONOLULU, HAWAII 96805

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February 24, 2004

DEPARTMENT OF ENVIRONMENTAL QUALITY CONTROL

To: Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control

From: *Ben Henderson*
Micah A. Kane, Chairman
Hawaiian Homes Commission

Subject: Finding of No Significant Impact (FONSI)
determination, Final Environmental Assessment, The
Home DePot Project, Hilo, Island of Hawaii

The Department of Hawaiian Home Lands has reviewed the comments received during the 30-day public comment period that began on November 23, 2003. The Hawaiian Homes Commission has determined that this project will not have significant environmental effects and has issued a Finding of No Significant Impact (FONSI) determination. Please publish this notice in the March 8, 2004 OEQC Environmental Notice.

We have enclosed a completed OEQC Publication Form, four (4) copies of the FEA. Should you have any questions, please call Linda Chinn, Acting Administrator of our Land Management Division, at (808) 587-6434.

Enc.

2004-03-08 FONSI
(THE) HOME DEPOT, HILO

MAR 8 2004
FILE COPY



THE HOME DEPOT HILO

FINAL ENVIRONMENTAL ASSESSMENT

Prepared For:

Department of Hawaiian Home Lands & The Home Depot USA, Inc.

Prepared By:



March 2004



THE HOME DEPOT HILO
FINAL ENVIRONMENTAL ASSESSMENT

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THE HOME DEPOT, HILO
Final Environmental Assessment

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1.0 INTRODUCTION

This environmental assessment is prepared in accordance with Chapter 343, Hawai'i Revised Statutes for the proposed The Home Depot, home improvement center in Hilo.

1.1 PROJECT SUMMARY

Project Name:	The Home Depot, Hilo
Applicant:	State of Hawai'i Department of Hawaiian Home Lands
Landowner:	State of Hawai'i Department of Hawaiian Home Lands
Location:	Corner of Makaala/Ohuohu Street and Railroad Avenue, in Waiakea, South Hilo, Island of Hawai'i, Hawai'i
Tax Map Key:	2-2-47:64 (portion)
Existing Use:	Vacant land within Pana'ewa Industrial Lots
Proposed Use:	Construction of The Home Depot, a home improvement retail center (Phase I), with an outparcel that could be used for a fast food restaurant or other allowed use (Phase II).
Project Area:	Approximately twelve (12) acres (The Home Depot - 10.68 acres and outparcel- 1.52 acres.)
Land Use Designations:	State Land Use: Urban General Plan: High Density Urban Zoning: Limited Industrial (ML-20)
SMA:	The subject property is not in the SMA.
Actions Requested:	Chapter 343, <i>Hawai'i Revised Statutes</i> compliance
Approving Agency:	State of Hawai'i Department of Hawaiian Home Lands

1.2 ENVIRONMENTAL COMPLIANCE

This environmental assessment is prepared in compliance of State of Hawai'i, Chapter 343, *Hawai'i Revised Statutes* for the use of state lands and in accordance with Hawai'i Administrative Rules, Title 11, Department of Health, Chapter 200.

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1.3 LOCATION

The Home Depot, Hilo will be located on an approximately twelve-acre site within the Pana'ewa Industrial Lots, a 140-acre industrial park owned by the State of Hawai'i Department of Hawaiian Home Lands (DHHL). The site is bound to the north by Makaala Street, to the east by Railroad Avenue, to the west by the Ohuohu Street Extension, and the existing Prince Kuhio Plaza employee parking lot borders the southwest end of the lot. The site is within the Pana'ewa Industrial Lots in Waiakea, South Hilo, within the County of Hawai'i (see Figure 1).

1.4 LAND OWNERSHIP

The State of Hawai'i Department of Hawaiian Home Lands (DHHL) owns the approximately twelve-acre The Home Depot, Hilo site. The property is identified as TMK: 2-2-47:64 (portion) (see Figure 2).

1.5 IDENTIFICATION OF THE APPLICANT

The applicant is State of Hawai'i Department of Hawaiian Home Lands.

State of Hawai'i Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, Hawai'i 96805

1.6 IDENTIFICATION OF APPROVING AGENCY

The State of Hawai'i Department of Hawaiian Home Lands is the approving agency for the environmental assessment.

1.7 IDENTIFICATION OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONSULTED

In the course of planning for this project, agencies (or agency documents), community individuals and organizations were consulted and/or provided information for the preparation of this environmental assessment.

County of Hawai'i Agencies

Department of Water Supply
Department of Public Works
Department of Environmental Management
Planning Department
Fire Department
Police Department

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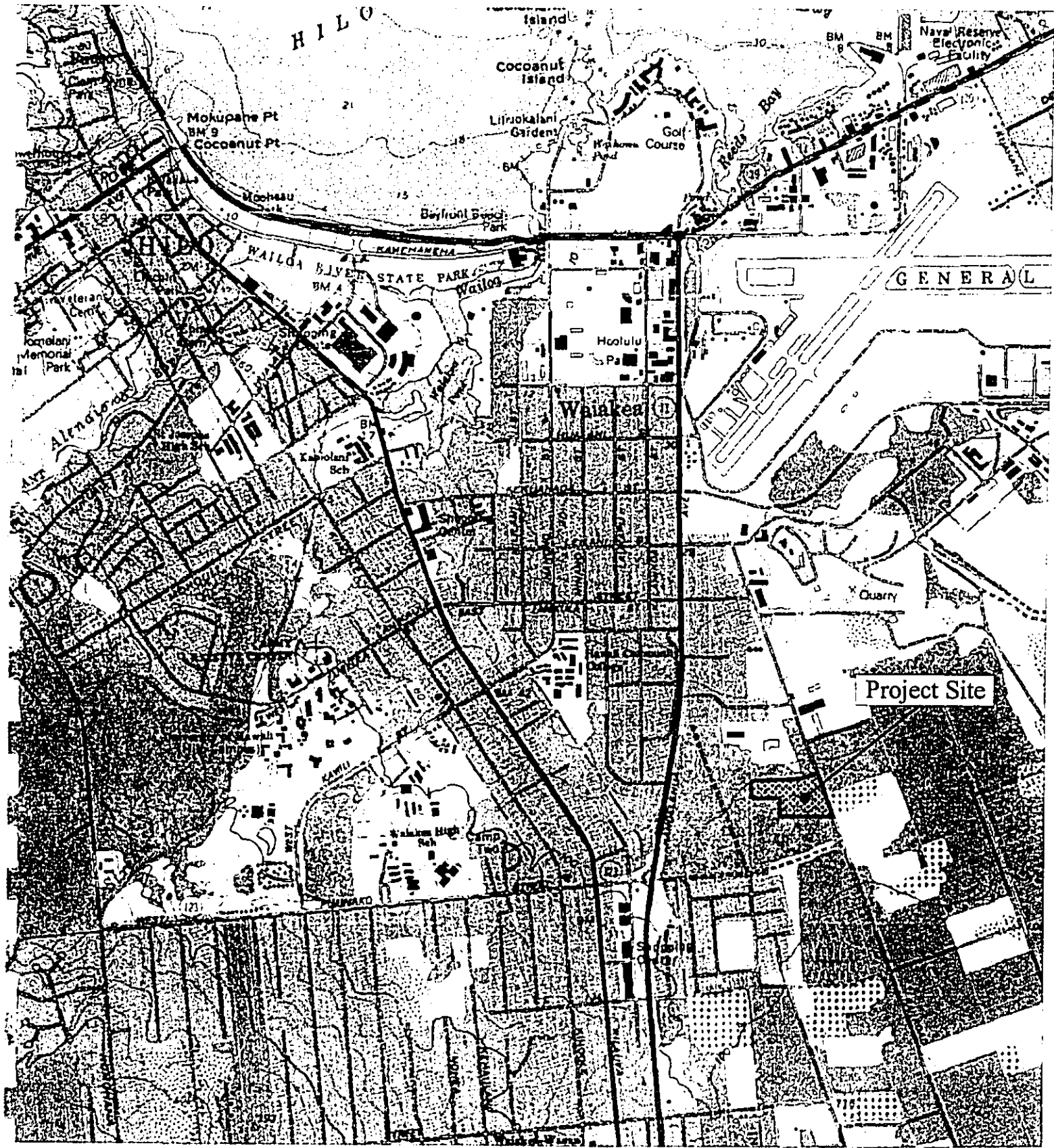
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County of Hawai'i Agencies

Department of Water Supply
Department of Public Works
Department of Environmental Management
Planning Department
Fire Department
Police Department



Legend

 Project Site



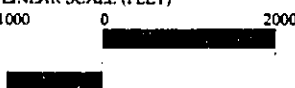
 Major Road




Figure 1
Location Map
The Home Depot, Hilo

Hilo, Hawaii

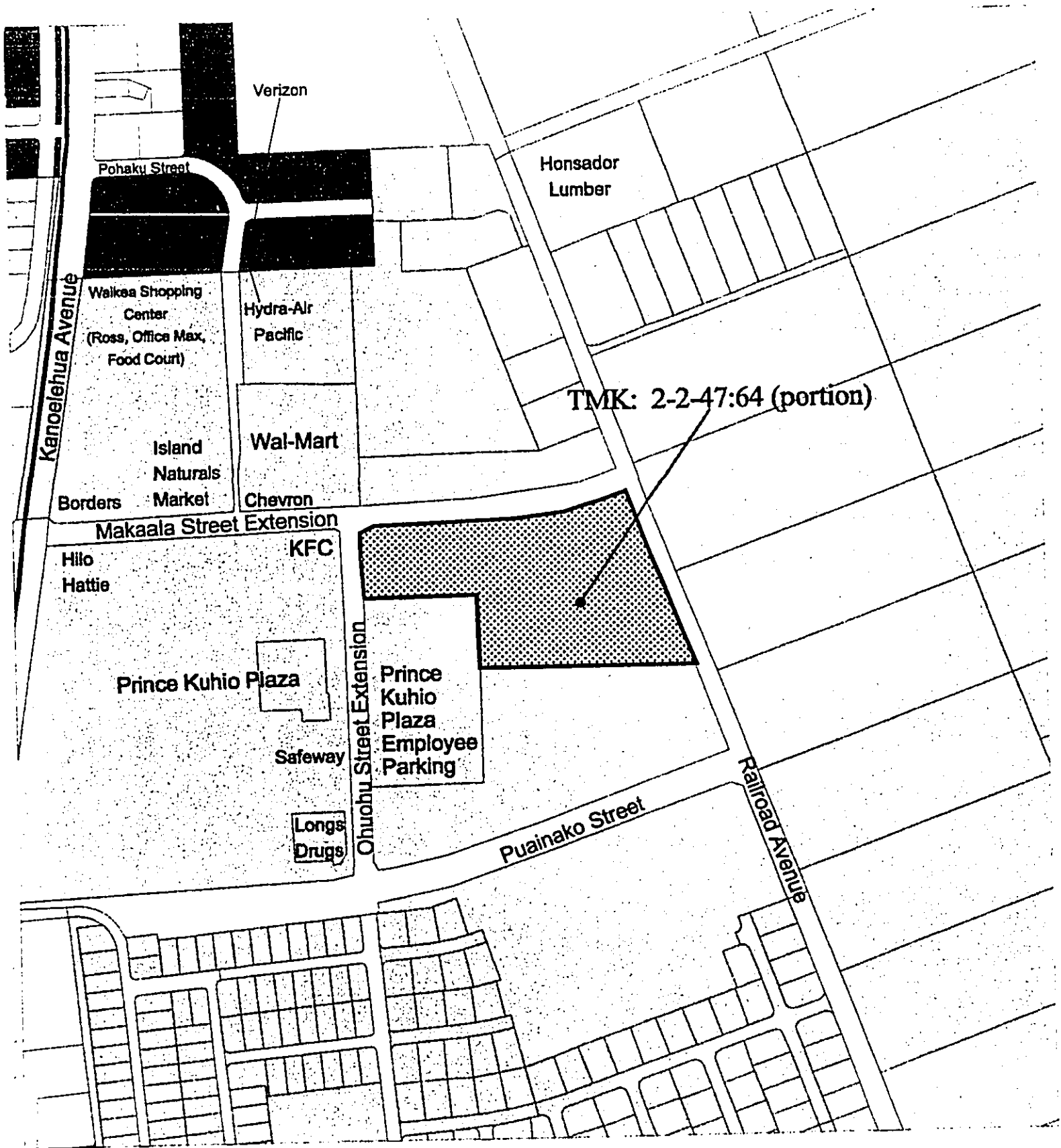
NORTH 

LINEAR SCALE (FEET)
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Source: United States Geologic Survey and County of Hawaii
 O: Hawaii Home Depot.GIS.projects.hilo.ca.apr



TMK: 2-2-47:64 (portion)

Legend






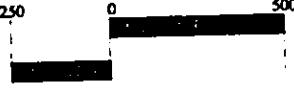
-  Project Site
-  Department of Hawaiian Homelands
-  State of Hawaii
-  Major Road

Figure 2
Tax Map Key/Surrounding Uses
The Home Depot, Hilo

Hilo, Hawaii

NORTH 

LINEAR SCALE (FEET)
250 0 500 

PBR
9/19/03

Source: Tax Map Key and County of Hawaii
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State of Hawai'i Agencies

Department of Hawaiian Home Lands
Department of Health - Office of Environmental Quality Control
Department of Transportation - Highways Division (Hilo Office)
Land Use Commission

Federal Agencies

Federal Emergency Management Agency

Private Companies

Hawai'i Electric Light Company, Inc.
Sandwich Isles Communications, Inc.

Community Individuals and Organizations

Pana'ewa Hawaiian Home Lands Community Association
Pualani Kanahale, Professor at UH Hilo, noted Kumu Hula of Hālau 'o Kekuhi, Co-founder of
The Edith Kanaka'ole Foundation
Jeno Enocencio, Cultural Specialist, Native Hawaiian Historic Preservation Council
Kalani Flores, Cultural Specialist, Instructor at Hawai'i Community College

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2.0 PROJECT DESCRIPTION

This section describes the proposed The Home Depot project, including a description of the store, construction activities, the preliminary development timetable, and approximate development costs.

2.1 BACKGROUND INFORMATION

2.1.1 State of Hawai'i Department Of Hawaiian Home Lands

The primary responsibilities of the State of Hawai'i Department of Hawaiian Home Lands (DHHL) are to serve its native Hawaiian beneficiaries and to manage its extensive land trust. The land trust consists of over 200,000 acres on the islands of Hawai'i, Maui, Moloka'i, Lāna'i, O'ahu, and Kaua'i.

DHHL provides direct benefits to native Hawaiians in many ways. Beneficiaries may receive 99-year homestead leases at \$1 per year for residential, agricultural, pastoral, or aquaculture purposes. These leases may be extended for an aggregate term not to exceed 199 years. Beneficiaries may receive financial assistance through direct loans or loan guarantees for home construction, home replacement or repair, or development of farms and ranches. DHHL also provides technical assistance to farmers and ranchers. In addition to administering the homesteading program, DHHL leases trust land not in homestead use at market value and issues revocable permits, licenses, and rights-of-entry. The income from these enterprises is used to supplement DHHL's programs, including continued homestead development.

The State of Hawai'i Department of Hawaiian Home Lands owns the fee simple interest in the subject property. The Hawaiian Homes Commission authorized the DHHL to general lease the property on August 27, 2002. The property is presently zoned ML-20, Limited Industrial District by the County of Hawai'i (County). The DHHL and the County share common goals in planning for the use of DHHL lands and consider DHHL properties exempt from County land use and zoning ordinances. However, DHHL and the County have agreed that all normal land use controls will be applied by Hawaii County to DHHL property according to the zoning district selected by DHHL and DHHL will follow all normal land use procedures, regulations, and standards applicable to the zoning district. DHHL and its lessees will go through normal County administrative variance procedures if they seek exemptions from standards.

2.1.2 The Home Depot

The Home Depot USA, Inc. was founded in 1978 in Atlanta, Georgia and has since become the world's largest home improvement retailer, operating more than 1,500 stores (The Home Depot, EXPO, and other subsidiary companies) across North America. The Home Depot caters to both do-it-yourselfers and professional customers who serve the home improvement construction and building maintenance market segments.

The Home Depot is credited with having revolutionized the home improvement industry by offering an unparalleled selection of products and services under one roof. Today, The Home Depot stores stock up to 35,000 different kinds of building materials and lawn and garden

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products. The Home Depot's unique services include free in-store clinics for honing home improvement skills as well as design and decorating consultation, truck and tool rental, home delivery, free potting and many others.

While The Home Depot is best known for its signature "orange box" store, it also operates several specialty subsidiaries that specialize in flooring, lighting, plumbing, and landscape supply. The EXPO Design Centers cater to design professionals with a wide array of home decorating products and services.

The Home Depot currently operates in 50 U.S. states and in the District of Columbia, eight Canadian provinces, and Mexico. In 1998, The Home Depot opened stores in Puerto Rico and recently opened two sourcing offices in China. The Home Depot currently has five stores in Hawai'i: Iwilei (O'ahu), Kahului (Maui), Pearl City (O'ahu), Kailua-Kona (Hawai'i), and Lihue (Kaua'i).

2.1.3 Project Development Goals And Objectives

The State of Hawai'i Department of Hawaiian Home Lands' goals and objectives for the property are to:

1. Generate general lease revenue to serve native Hawaiian beneficiaries as cited in the Hawaiian Homes Commission Act, 1920, as amended.
2. Facilitate commercial growth and provide employment opportunities for native Hawaiian beneficiaries.
3. Select a Lessee who will actively seek community support for the proposed commercial development from the native Hawaiian homestead association(s) and the general public. Such support may be evidenced by petitions or letters in favor of the proposed development and by providing in-depth information at community public meetings.

The construction of The Home Depot satisfies these goals and objectives as The Home Depot will generate revenue to serve native Hawaiian beneficiaries, facilitate commercial growth and provide employment opportunities for native Hawaiian beneficiaries, and The Home Depot will seek community support from the native Hawaiian homestead association(s) and the general public.

2.1.4 Description of the Property

The site has approximately 1,000 feet of frontage along Makaala Street, 220 feet of frontage along Ohuohu Street, and 1,003 feet of frontage along Railroad Avenue. The site has a gross land area of approximately 12 acres and until recently was heavily overgrown with thick, mature vegetation. Recently, portions of the site have been cleared. See Figure 3 for photographs of the property.

RECEIVED AS FOLLOWS



1. A view of the Home Depot site from the property across from Makaala St. KFC can be seen on the right.



2. Looking across Chuohu St. toward the Home Depot Site. The Prince Kuhio Plaza employee parking area is on the right.



3. A view from Railroad Ave. looking across the Home Depot Site.



4. Looking diagonally across the site from Railroad Ave. Makaala St. is in the background.

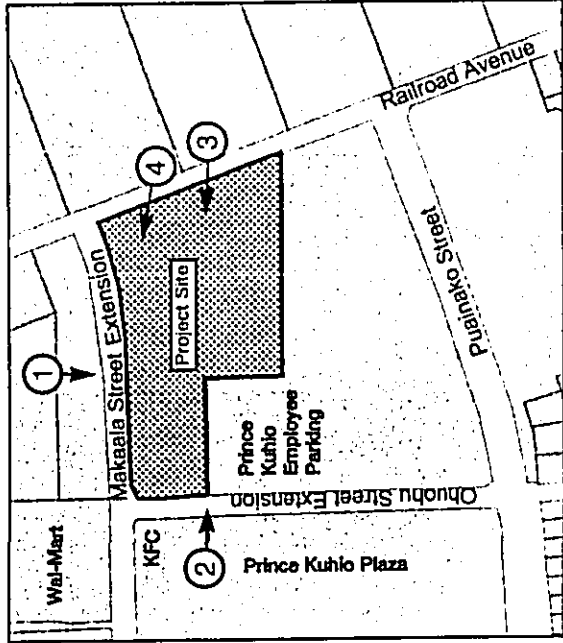


Figure 3
 Site Photographs
The Home Depot, Hilo
 Hilo, Hawaii
PBR

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2.1.5 Surrounding Land Uses

The property's immediate neighborhood is the Waiakea area of Hilo. A significant amount of land in this part of Hilo is owned and managed by the DHHL. The development of Prince Kuhio Plaza (managed by General Growth Properties) on nearby DHHL property shifted the historical commercial retail focus of Hilo to this area. Other major retail developments concentrated in the area include Waiakea Center (anchored by Wal-Mart and situated on DHHL property), KTA's Puinako Center, Puainako Town Center, and Ginger Patch Commercial Center. The site is adjacent to the Prince Kuhio Plaza's employees' parking lot along Ohuohu Street and within walking distance of both Prince Kuhio Plaza and Waiakea Center (see Figure 2).

2.2 DESCRIPTION OF THE PROJECT

The Home Depot (Phase I)

The Home Depot, Hilo will include a 102,948 square foot warehouse-style home improvement store, a 27,631 square foot garden center, and a parking lot with 492 parking stalls (see Figure 4).

The building will face Makaala Street with parking in front of the store. The rear of the building will feature a loading zone and a lumber off loading area. A driveway for these loading areas will exit onto Railroad Avenue.

The Home Depot signs will be provided on Makaala Street and on Railroad Avenue. The parking lot will include landscaping and a customer pick-up area at the front of the store.

All outdoor lighting of The Home Depot will comply with the Outdoor Lighting requirements of the Hawai'i County Code (Article 9). This will include the use of low-pressure sodium lamps, shielding of lights, and adherence to operating restrictions.

Outparcel (Phase II)

The site also includes an outparcel on the corner of Ohuohu Street and Makaala Street that could be used for a fast food restaurant, retail space, or other allowed use. Parking would also be included. A tenant for this outparcel has not been selected. The Home Depot store will be constructed first, with the potential additional use being constructed as Phase II of the project.

2.3 OPERATIONS

The operating hours for The Home Depot will be from 7 am to 9 pm, seven days a week.

2.4 SUSTAINABLE BUILDING DESIGN

The Office of Environmental Quality Control (OEQC) has issued "Guidelines for Sustainable Building Design in Hawai'i: A Planner's Checklist" (OEQC May 1999) and has requested that consideration be made in applying sustainable building techniques to projects. The OEQC Guidelines state, "[a] sustainable building is built to minimize energy use, expense, waste and

MAKAALA STREET EXTENSION

Potential
Fast-Food
Restaurant Site

(PHASE II)

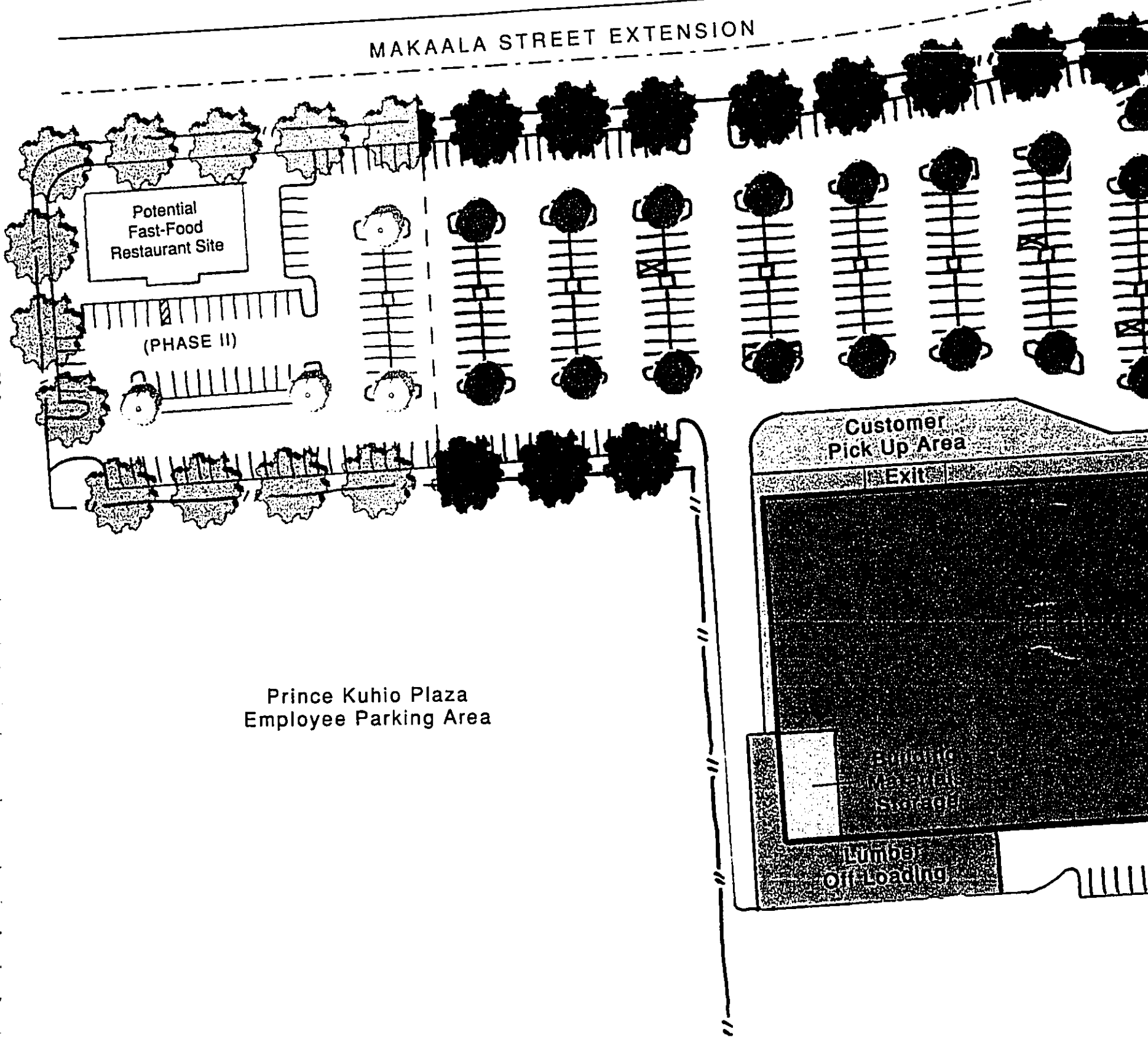
Prince Kuhio Plaza
Employee Parking Area

Customer
Pick Up Area

EXIT

Building
Material
Storage

Lumber
Off-Loading



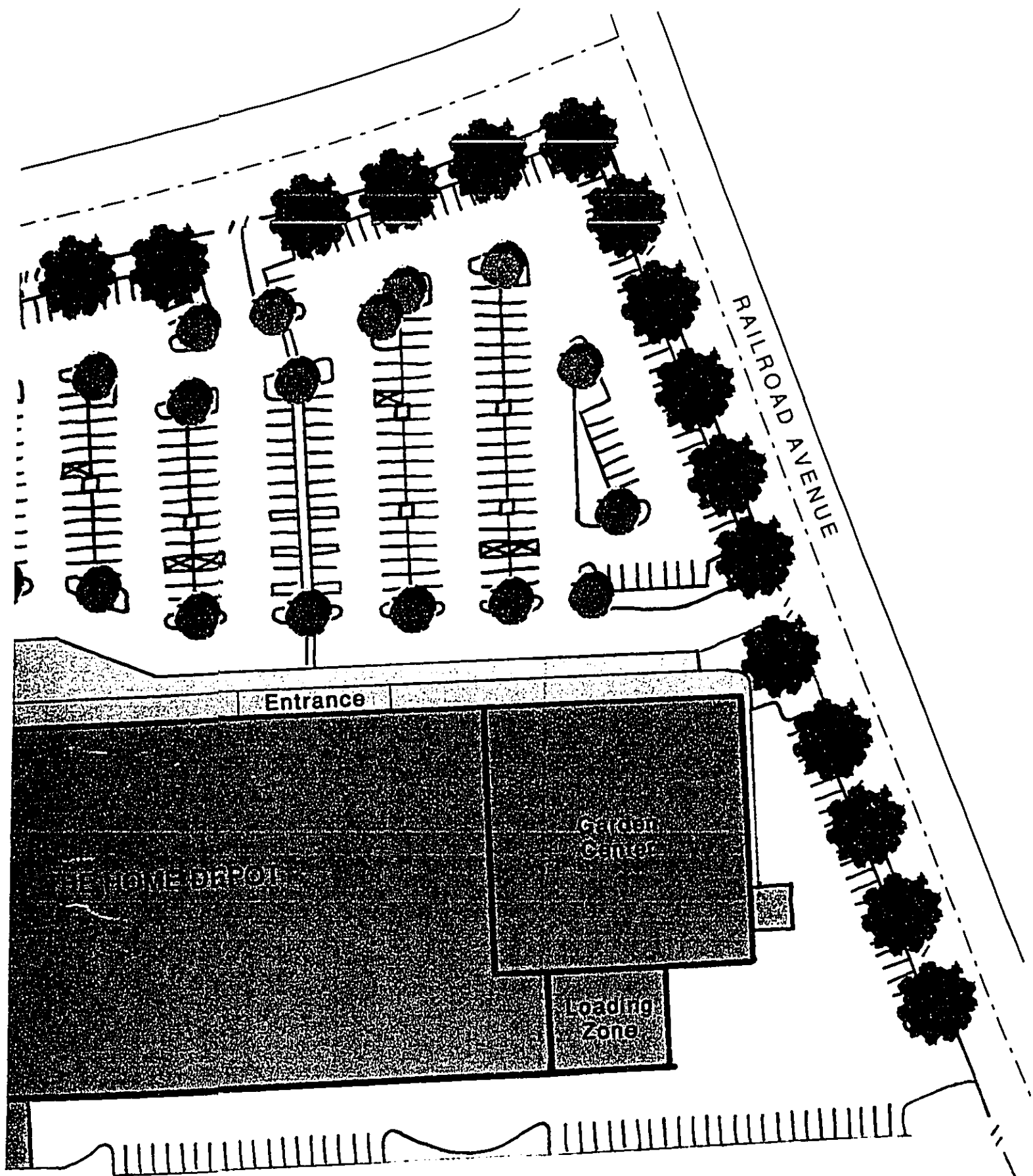
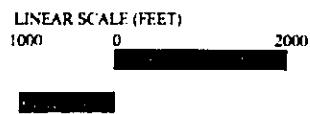


Figure 4
 Conceptual Site Plan
The Home Depot, Hilo



Hilo, Hawaii



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3.0 LAND USE CONFORMANCE

The Relevant State of Hawai'i and County of Hawai'i land use plans, policies, and ordinances are described below.

3.1 STATE OF HAWAI'I

3.1.1 State Land Use District

The State Land Use Law (Chapter 205, Hawai'i Revised Statutes (HRS)), establishes the State Land Use Commission (LUC) and gives this body the authority to designate all lands in the State into one of four districts: Urban, Rural, Agricultural, or Conservation.

The State Land Use District designation for The Home Depot site is Urban (see Figure 5). Home improvement centers are consistent with uses allowed within the Urban District.

3.1.2 State of Hawai'i Department of Hawaiian Home Lands

Several studies and policy documents of the DHHL have been prepared for the Pana'ewa area and the Pana'ewa Industrial Lots including: 1) *The Pana'ewa Plan* (Ming Chew Associates 1986); 2) *Hawaiian Home Lands: Land Assessment Studies, Phase 2 - Second Set of Priority Tracts* (PBR HAWAII 1993); and 3) *Pana'ewa Industrial Lots Master Plan* (Wilson Okamoto & Associates 1991).

The Home Depot project responds to the plans and policies of the DHHL.

3.2 COUNTY OF HAWAI'I

Relevant land use plans of the County of Hawai'i that pertain to The Home Depot, Hilo include the General Plan and the County zoning code.

3.2.1 General Plan

The Home Depot is consistent with the Hawai'i County General Plan, Land Use Pattern Allocation Guide (LUPAG) map, which designates The Home Depot site for "High Density Urban" uses (see Figure 6).

The County of Hawai'i Charter requires that The General Plan of Hawai'i County address the development-related needs and concerns of the citizens of Hawai'i County. In so doing, it must set forth the desired patterns and characteristics of future growth.

Specific general plan goals and policies applicable to The Home Depot project are discussed below.

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ECONOMIC

Goals:

- *Provide residents with opportunities to improve their quality of life.*
- *The County of Hawai'i shall provide an economic environment which allows new, expanded, or improved economic opportunities that are compatible with the County's natural and social environment.*

Policies:

- *The County of Hawai'i shall strive for an economic climate which provides its residents an opportunity for choice of occupation.*
- *The County of Hawai'i shall strive for diversification of its economy by strengthening existing industries and attracting new endeavors.*
- *The County of Hawai'i shall strive for full employment.*

Discussion: The Home Depot will provide opportunities for residents to improve the quality of their lives by creating approximately 125 new direct long-term employment opportunities in the Hilo region. In addition, indirect jobs will be created within industries supporting and supplying inventory, such as garden supplies, to the new store. The construction of the store will also provide short-term employment opportunities for the construction industry.

As a new business in the Hilo area, The Home Depot implements the policy calling for the County of Hawai'i to "strive for diversification of its economy by strengthening existing industries and attracting new endeavors." Further, the increased job opportunities created by The Home Depot will contribute to an economic climate which provides residents an opportunity for choice of occupation.

The Home Depot will provide new and expanded economic opportunities at a location that is consistent with the Hawai'i County General Plan, Land Use Pattern Allocation Guide (LUPAG) map, and therefore the County's natural and social environment as designated by the General Plan.

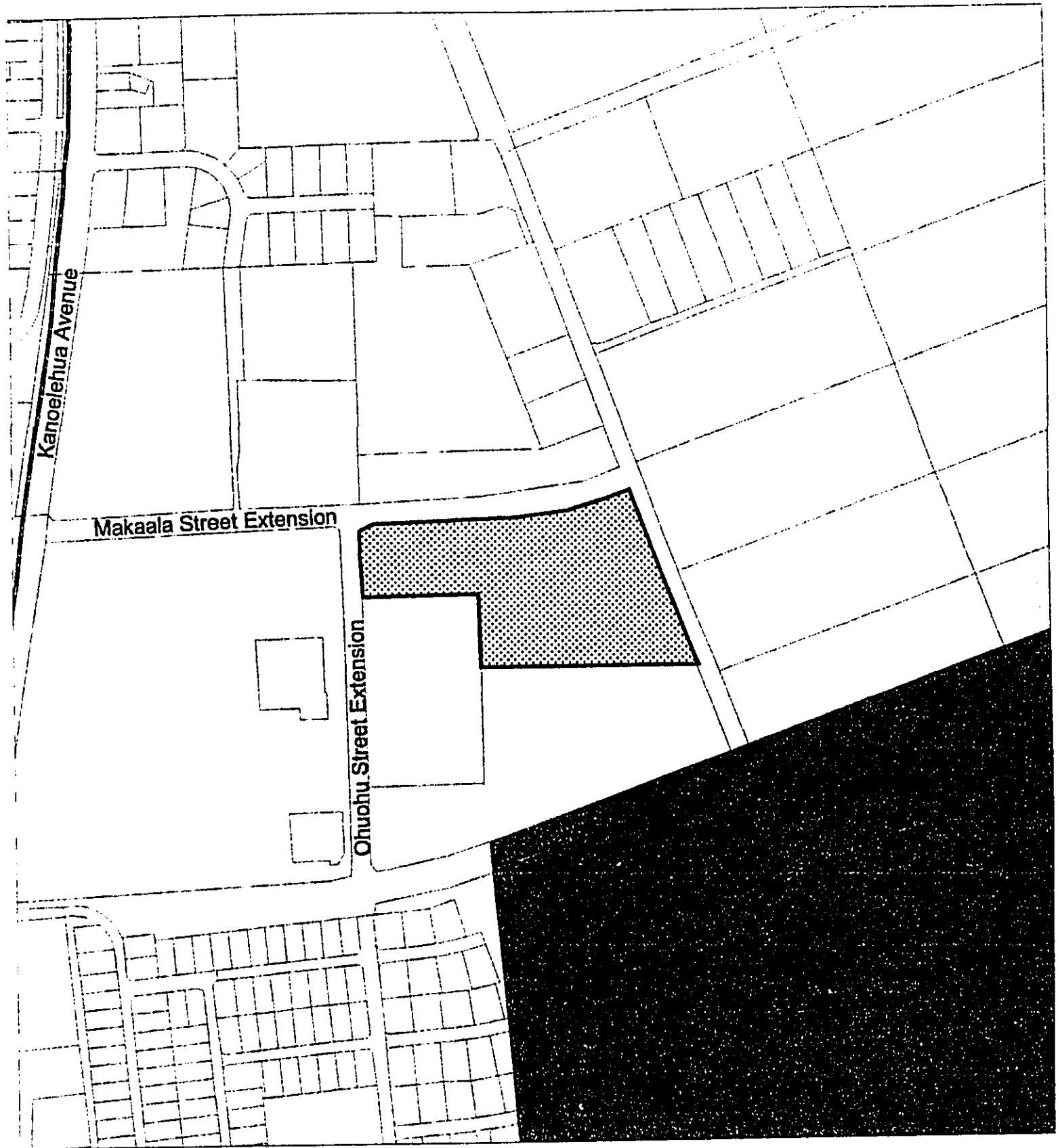
ENVIRONMENTAL QUALITY

Goal:

Maintain and, if feasible, improve the existing environmental quality of the island.

Policies:

- *The County of Hawai'i shall take positive action to further maintain the quality of the environment for residents both in the present and in the future.*



Legend





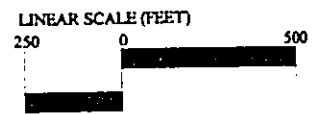
-  Project Site
-  Urban Land Use District
-  Agricultural Land Use District
-  Major Road

Figure 5
State Land Use Boundary Map
The Home Depot, Hilo

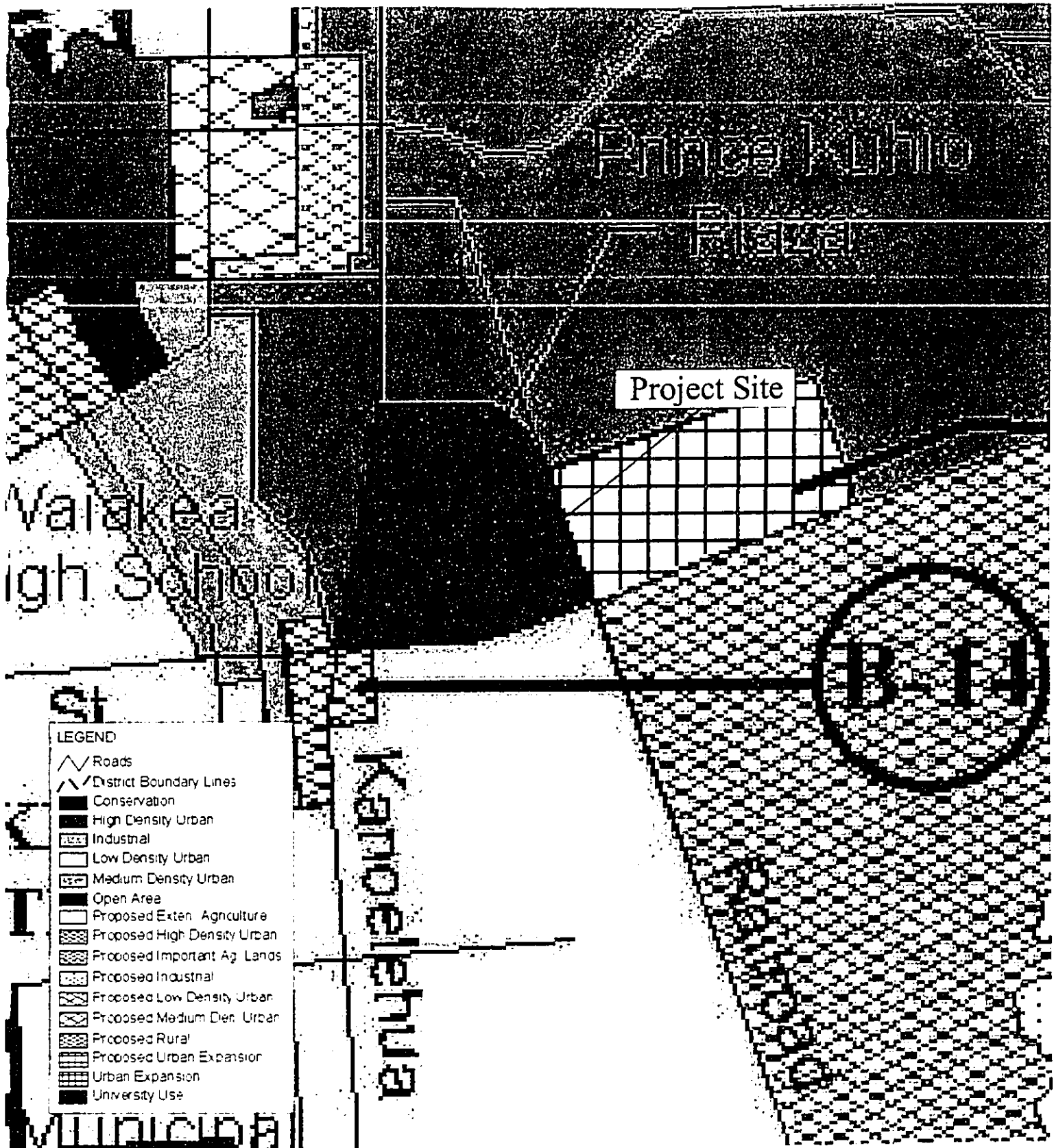


Hilo, Hawaii



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Source: State Land Use Commission and County of Hawaii
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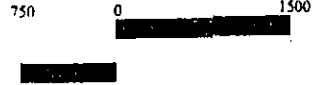
 Project Site

Figure 6
General Plan
The Home Depot, Hilo

NORTH



LINEAR SCALE (FEET)



Hilo, Hawaii



9/19 03

Source: State Land Use Commission and County of Hawaii
Q: Hawaii Home Depot GIS projects\hilo\ea apr

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- *Encourage the concept of recycling agricultural and municipal waste material.*

Standards:

- *Environmental quality controls are to be incorporated either as standards in appropriate ordinances or as conditions of approval.*
- *Federal and State environmental regulations shall be adhered to.*

Discussion: The Home Depot will adhere to all Federal, State, and County environmental regulations. The store will maintain the existing environmental quality of the site by providing proper management and maintenance of the property. All improvements, such as drainage improvements, will be designed to maintain, and if feasible, improve the existing environmental quality of the site.

To minimize the impacts to the night sky and nocturnal birds, all outdoor lighting of The Home Depot will comply with the Outdoor Lighting requirements of the *Hawai'i* County Code (Article 9). This will include the use of low-pressure sodium lamps, shielding of lights, and adherence to operating restrictions. In addition, to the extent practical, The Home Depot will recycle wastes, such as cardboard and other packaging materials.

FLOOD CONTROL AND DRAINAGE

Goals:

- *Protect human life.*
- *Prevent damage to man-made improvements.*

Policies:

- *All development-generated runoff shall be disposed of in a manner acceptable to the Department of Public Works.*
- *It is the responsibility of both the government and the private sector to maintain and improve existing drainage systems and to construct new drainage facilities.*

Discussion: All drainage improvements for The Home Depot will meet all County drainage requirements. This will include ensuring no increased runoff from the site over existing conditions and incorporating appropriate non-point source pollution controls.

HISTORIC SITES

Goals:

- *Protect and enhance the sites, buildings and objects of significant historical and cultural importance to Hawai'i.*

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- *Access to significant historic sites, buildings and objects of public interest should be made available.*

Policies:

- *The County of Hawai'i shall require both public and private developers of land to provide a historical survey prior to the clearing of development of land when there are indications that the land under consideration has historical significance.*
- *Public access to significant historic sites and objects shall be acquired.*

Discussion: An archaeological inventory survey did not identify any archaeological resources on the property. In the event that any archaeologically significant artifacts, bones, or other resources are uncovered during construction, work will cease in the area and the State Historic Preservation Division will be contacted. In addition, based on the interviews conducted for this assessment, the proposed The Home Depot is not expected to have any significant long-term impacts on cultural resources. For more information on archaeological resources see Section 4.2.1 and Appendix A. For more information on cultural resources see Section 4.2.2.

NATURAL RESOURCES AND SHORELINE

Goals:

- *Protect and conserve the natural resources of the County of Hawai'i from undue exploitation, encroachment and damage.*
- *Protect and promote the prudent use of Hawai'i's unique, fragile, and significant environmental and natural resources.*
- *Protect rare or endangered species and habitats native to Hawai'i.*
- *Ensure that alterations to existing land forms and vegetation, except crops, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of earthquake.*

Policies:

- *The County shall encourage public and private agencies to manage the natural resources in a manner that avoids or minimizes adverse effects on the environment and depletion of energy and natural resources to the fullest extent.*

Discussion: The General Plan's Land Use Pattern Allocation Guide (LUPAG) map, designates The Home Depot site for "High Density Urban" uses. The General Plan is a reflection of the community's needs and desires. Based on this General Plan designation, The Home Depot will not contribute to undue exploitation, encroachment and damage of the County's natural

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resources and will not impact the County's unique, fragile, and significant environmental and natural resources.

Alterations to the site for The Home Depot will be in full compliance with all Federal, State, and County environmental regulations to ensure minimum adverse effects to natural resources and to minimize the danger of floods, landslides, erosion, siltation, or failure in the event of an earthquake.

3.2.2 Hawai'i County Zoning

The Hawai'i County zoning designation for The Home Depot site is ML-20 (Limited Industrial District) (see Figure 7). Permitted uses in the ML-20 district include "home improvement centers."

All aspects of The Home Depot are in compliance with the Hawai'i County Zoning Code, ML-20 district. Buildings will not be taller than 45 feet, which is the height limit for the district.

3.2.3 Special Management Area

The Home Depot site is not in the Special Management Area (SMA).

3.3 APPROVALS AND PERMITS

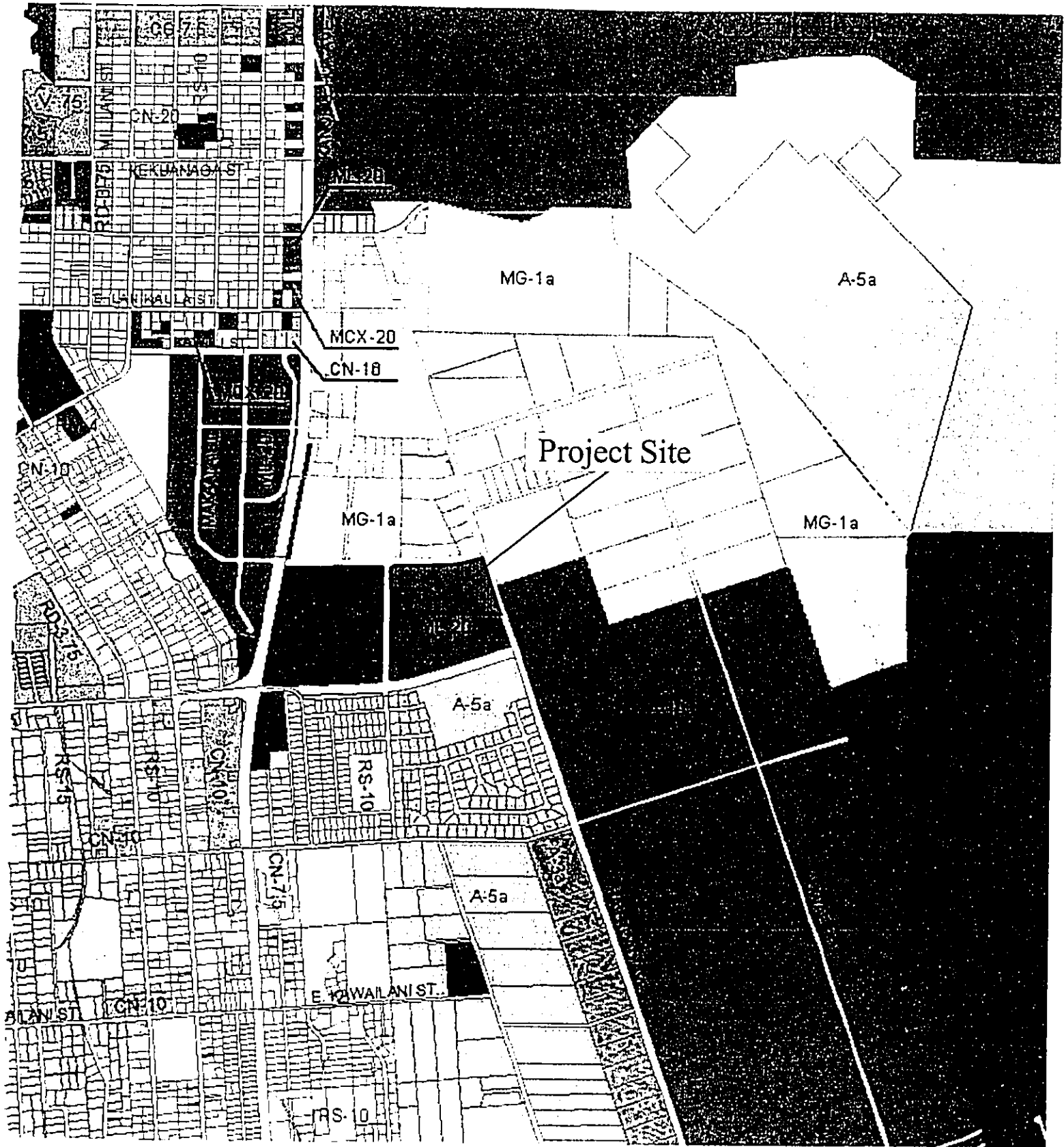
During the implementation stages of the project, the applicant will be working with the County review agencies for examination and approval of project plans and specifications.

Required Permits and Approvals

Permit/Approval	Responsible Agency
Chapter 343, HRS compliance	Department of Hawaiian Home Lands DOH Office of Environmental Quality Control
Grading/Building Permits	County Building Department
Driveway connection to County road	County Department of Public Works
Water	County Board of Water Supply

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




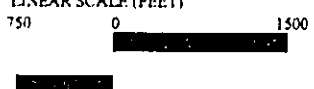

-  Project Site
-  ML 20 Zoning Designation
-  MG-1a Zoning Designation
-  A-5a Zoning Designation
-  A-10a Zoning Designation
-  CG-20 Zoning Designation

Figure 7
Zoning Map
The Home Depot, Hilo

Hilo, Hawaii

NORTH 

LINEAR SCALE (FEET)
750 0 1500 

 9/19/03

Source: County of Hawaii
Q: Hawaii Home Depot GIS projects huloeca.apr

4.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT, POTENTIAL IMPACTS OF THE PROPOSED ACTION, AND MITIGATIVE MEASURES

The environment surrounding the proposed The Home Depot site includes the physical or natural environment and the human or social environment. This section describes the existing conditions, potential impacts to the environment, and proposed mitigative measures.

4.1 PHYSICAL CHARACTERISTICS

4.1.1 Climate

The climate of the Pana'ewa region is generally warm and humid with average daily temperatures ranging from 68 to 80 degrees Fahrenheit in the winter months and 72 to 87 degrees Fahrenheit in the summer months. Average rainfall ranges from 125 to 150 inches per year, with the winter months receiving the majority of the rainfall.

Winds are dominated by trades from the northeast with southwestern winds associated with "Kona" storms occurring predominately in the winter months. In the absence of the trades or storm conditions, winds occasionally become light and variable and, at times, the diurnal heating and cooling of the island gives rise to onshore sea breezes during the day and offshore land breezes at night. Strong winds do occur at times in connection with storm systems moving through the area.

Potential Impacts and Mitigation Measures

The Home Depot is not expected to have an effect on climatic conditions. As such, no mitigative measures are proposed.

4.1.2 Topography/Geology

The Home Depot site is almost level, with an elevation of 83 feet above mean sea level. The terrain within The Home Depot site is composed of 'a'ā lava flows formed by Mauna Loa during the Holocene Epoch, dating back approximately 1,470 years. The geology of the site is classified as Ka'ū Basalt, which consists of lava flows, vent deposits, littoral deposits, and tephra-fall, deposits of tholeiitic basalt.

Potential Impacts and Mitigative Measures

Preparation of the site for The Home Depot will require some grading and leveling of the topography. All grading operations will be conducted in compliance with dust and erosion controls and other requirements of the County of Hawai'i Erosion and Sedimentation Control Ordinance (Chapter 10, HCC), which covers grading, and the provisions of Chapter 11-60.1, Hawai'i Administrative Rules, Section 11-60.1-33 on fugitive dust.

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Mitigation measures include the application of best management practices (BMPs), adherence to County regulations and standards, and implementation of standard control measures.

4.1.3 Soils

Three soil suitability studies have been prepared for lands in Hawai'i. These are the U.S. Department of Agriculture (USDA) *Soil Conservation Service Soil Survey* (SCS), the University of Hawai'i Land Study Bureau *Detailed Land Classification*, and the State of Hawai'i Department of Agriculture's *Agricultural Lands of Importance to the State of Hawai'i* (ALISH). The principal focus of these studies has been to describe the physical attributes of Hawai'i's lands and the relative productivity of different land types for agricultural production purposes.

Soil Conservation Survey.

According to the *United States Department of Agriculture Soil Conservation Service, Soil Survey of the Island of Hawai'i, State of Hawai'i, 1972*, the soils on the site are classified as Pāpa'i Extremely Stony Muck (rPAE) as shown in Figure 8. A brief description of this soil follows:

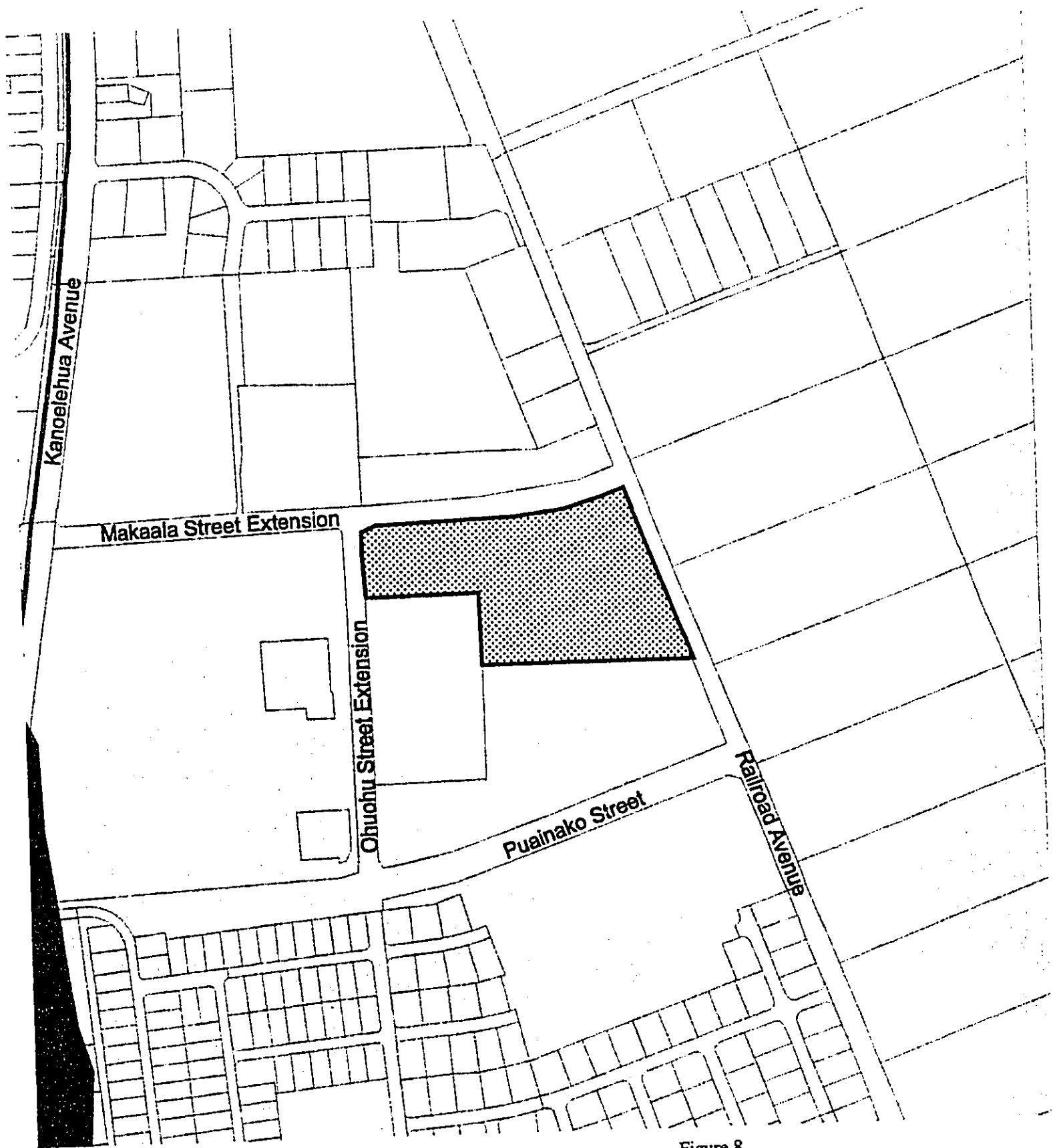
Pāpa'i Extremely Stony Muck (rPAE) - The Pāpa'i series consists of well-drained, thin, extremely stony organic soils over fragmented 'a'ā lava. This soil is on uplands at an elevation ranging from near sea level to 1,000 feet and receives from 90 inches to more than 150 inches of rainfall annually. In a representative profile, the surface layer is very dark brown extremely stony muck about 8 inches thick. Permeability is rapid, runoff is slow, and the threat of erosion hazard is slight.

Detailed Land Classification. The University of Hawai'i Land Study Bureau document titled "*Detailed Land Classification, Island of Hawai'i*" classifies soils of The Home Depot site as "Urban Land" (see Figure 9). This classification means the soils have not been rated for agricultural use because they are considered urban areas. For non urban areas the Detailed Land Classification classifies land based on a five-class productivity rating system using the letters A, B, C, D, and E, where A represents the highest class of productivity and E the lowest.

Agricultural Lands of Importance to the State of Hawai'i. The State of Hawai'i Department of Agriculture *Agricultural Lands of Importance to the State of Hawai'i (ALISH)* system of defining agricultural suitability has classified soils of The Home Depot as "other agricultural lands of importance to the State of Hawai'i" (see Figure 10). Other Important Agricultural Land is considered to have a statewide or local importance for agricultural use.

Potential Impacts and Mitigation Measures

The Home Depot site is within the County's General Industrial zoning district. Farming is not a permitted in the General Industrial zoning district, however, the processing of agricultural products is allowed. While most of the area in the vicinity is zoned for industrial uses, nearby DHHL lands are available for agricultural uses.



Legend





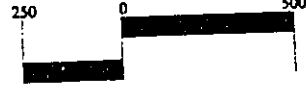
-  Project Site
-  Papai Extremely Stony Muck
(3 to 25 Percent Slopes)
-  Oloa Extremely Stony Silty Clay Loam
(0 to 20 Percent Slopes)
-  Major Road

Figure 8
Soil Conservation Service Soil Survey
The Home Depot, Hilo

Hilo, Hawaii

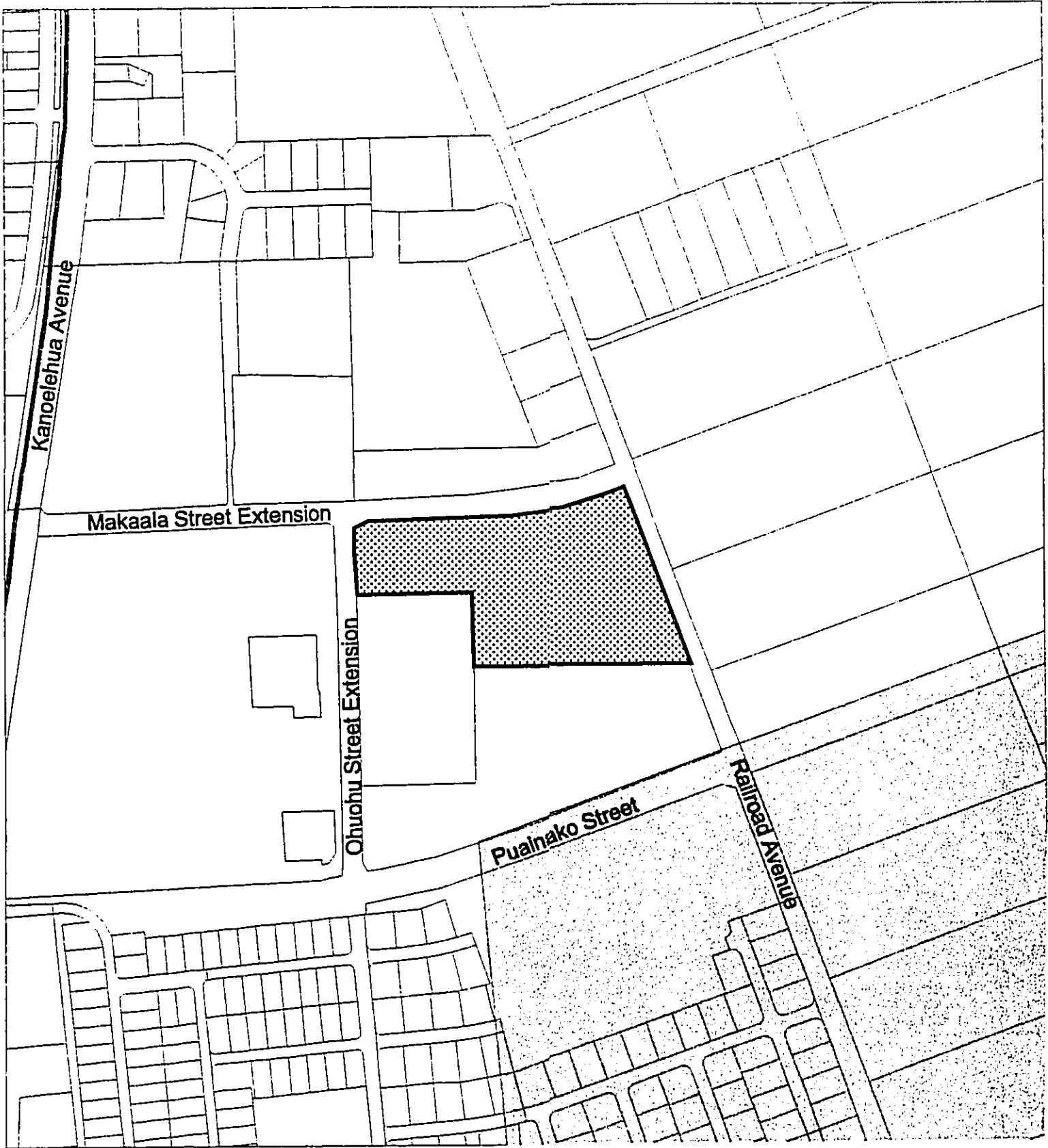


LINEAR SCALE (FEET)







9/19/03

Source: Soil Conservation Service and County of Hawaii
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Legend


-  Project Site
-  Type E
-  Urban Land (not classified)
-  Major Road

The Land Study Bureau rates land from A to E, A being the highest level of productivity and E the lowest.

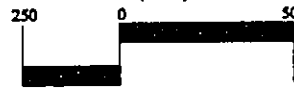
Figure 9
Detailed Land Classification
The Home Depot, Hilo


Hilo, Hawaii

NORTH



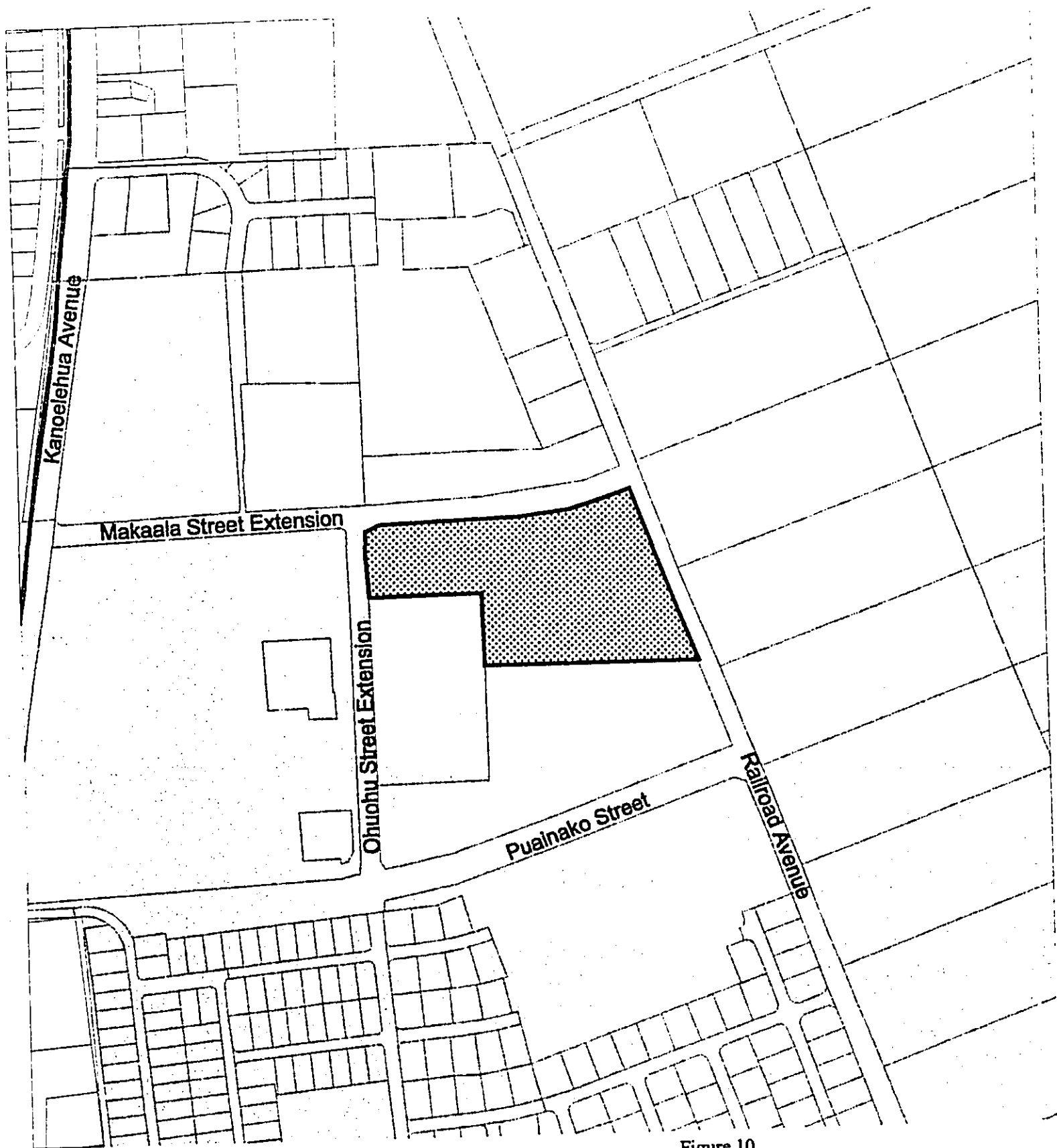
LINEAR SCALE (FEET)





9/19/03

Source: Land Study Bureau and County of Hawaii
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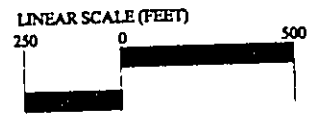
-  Project Site
-  Urban Land
-  Other Agricultural Lands of Importance to the State of Hawaii
-  Major Road

Figure 10
 Agricultural Lands of Importance to the State of Hawaii (ALISH)

The Home Depot, Hilo

Hilo, Hawaii



9/19/03

Source: State of Hawaii and County of Hawaii
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Given the agricultural limitations of the soils of the site, and the extent of other more suitable agricultural lands in the region, the curtailment of potential agricultural use on the site is not considered a significant impact.

4.1.4 Water

4.1.4.1 Surface Water Areas On-Site

There are no major surface water bodies on or running through the property, and none are located adjacent to the site. Stormwater runoff from The Home Depot site soaks into the ground. Storm water from the streets flows along the adjacent streets that have stormwater grates. It appears unlikely that stormwater currently discharges from the property.

4.1.4.2 Sources of Potable Water

Potable water is available to the site and the surrounding area from the County of Hawai'i. The Department of Water Supply confirmed the locations of water lines in the area.

4.1.4.3 Underground Wells in Area

There are 16 USGS wells and 15 State database wells within one mile of The Home Depot property. There are no public water supply system wells within one mile of The Home Depot property and no wells located on The Home Depot site.

4.1.4.4 Groundwater

The Home Depot site is located in the Northeast aquifer sector and is part of the Hilo aquifer system. The aquifer is basal (fresh water in contact with seawater), unconfined, and occurs as a flank aquifer type (horizontally extensive lavas). The groundwater was identified as being a currently used, fresh drinking water source. The aquifer has a high vulnerability to contamination and is considered irreplaceable. However, The Home Depot Site is located below the underground injection control (UIC) line. Therefore, the underlying aquifer would not be considered a drinking water source.

4.1.4.5 Wells

No private residential wells or other wells are located on the subject property.

4.1.5 Natural Hazards

The island of Hawai'i has a Zone 3 Seismic Probability Rating. Zone 3 areas are at risk from major earthquake damage, especially to structures that are poorly designed or built.

The Flood Insurance Rate Map indicates that the property is in Zone X (areas determined to be outside the 500 year flood plain) (see Figure 11).

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The United States Geologic Survey has identified lava flow hazard zones for the island of Hawai'i. The current map divides the Island into zones that are ranked on a scale of ascending risk from 1 to 9 based on the probability of coverage by lava flows. These zones are based chiefly on the location and frequency of both historic and prehistoric eruptions and also take into account the larger topographical features of the volcanoes that will affect the distribution of lava flows. Along with most of the Hilo area, the area in which The Home Depot site is located is designated as Lava Flow Hazard Zone 3. Zone 3 is considered less hazardous than Zone 2 (which is adjacent to and down slope of active risk zones), because of greater distance from recently active vents and/or because the topography makes it less likely that flows will cover these areas. The site is situated on a lava flow that occurred between 750 and 1,500 years ago. The nearest historic flow approached Hilo in 1880, terminating in the area of what is now the University of Hawai'i at Hilo Research and Technology Park, approximately four miles from the project site.

The State of Hawai'i has been affected by devastating hurricanes, 'Iwa in 1982 and 'Iniki in 1992. While it is difficult to predict these natural occurrences, it is reasonable to assume that future events could be likely given the recent record. The project area, as the rest of the island or state, is no more or less vulnerable to the destructive winds and torrential rains associated with hurricanes.

Potential Impacts and Mitigation Measures

The project will not exacerbate any hazardous conditions. All structures will be constructed for protection from earthquakes and destructive winds and torrential rainfall of tropical hurricanes in accordance with the Building Code adopted by the County of Hawai'i.

4.1.6 Flora

No threatened or endangered plant species are known to exist on The Home Depot site. The vegetation of the site includes a number of 'ohi'a (*Metrosideros polymorpha*) trees, 'ohi'a lehua trees (*Metrosideros collina*), and lama trees (*Diospyros sandwicensis*), which are native plants. However the majority of the vegetation is comprised of alien (i.e., introduced to Hawai'i by humans), species, including: strawberry guava (*Psidium cattleianum*), common guava (*Psidium guajava*), Christmas berry (*Schinus terebinthifolius*), octopus tree (*Schefflera actinophylla*), African tulip (*Spathodea campanulata*), papaya (*Carica Papay.*), hau (*Hibiscus macrophyllus*) pandanus (*Pandanus odoratissimus*), koa haole (*Leucaena leucocephala*), maile hohonu (*Ageratum conyzoides*) and numerous weedy and grass species, such as Clidemia (*Clidemia hirta*), and thimbleberry (*Rubus rosifolius*). Recently, some of the vegetation on the site has been cleared.

Potential Impacts and Mitigative Measures

Since there are no known threatened or endangered plant species on the site and the majority of the vegetation is alien species, impacts to the flora of the site are not considered significant. A cultural expert contacted in regard to this environmental assessment stated that 'ohi'a and lama trees are considered to have cultural significance. Mitigative measures to address this concern are discussed in Section 4.2.2 on Cultural Impacts. The Home Depot will include landscaping



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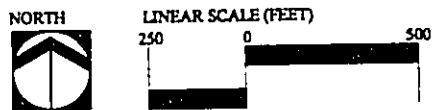
-  Project Site
-  Zone X: Areas of minimal flooding
-  Zone X500: Areas Inside of 500-year Floodplain
-  Zone A: Areas inside of 100-year Coastal Flood Zone
Base Flood Elevations Not Determined
-  Major Road

Figure 11
Flood Insurance Rate Map
The Home Depot, Hilo

Hilo, Hawaii



9/19/03

Source: Flood Insurance Rate Map and County of Hawaii
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within the parking lot and along street frontages. In addition, The Home Depot will also include a 27,631 square foot Garden Center, featuring plants and gardening supplies.

4.1.7 Fauna

Two mammalian species and nine avian species were detected on the The Home Depot site during a survey conducted by Reginald E. David in September 2003 (see Appendix B). One species detected, the Hawaiian Hawk (*Buteo solitarius*), or 'io is listed as an endangered species under both the U.S. Fish and Wildlife Service (USFWS) and the State of Hawai'i's endangered species programs.

The two mammalian species were the domestic dog (*Canis f. familiaris*) and the domestic cat (*Felis catus*). These mammals are deleterious to native ecosystems, and the endemic avian and plant species that inhabit them. The endangered Hawaiian hoary bat was not detected. Although no rodents were detected during the course of this survey, it is likely that roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*) use various resources found within The Home Depot site.

The findings of the mammalian survey are consistent with the results of other surveys conducted within the lowland areas of South Hilo within the recent past. Although no Hawaiian hoary bats were recorded during the course of the survey, it is likely that bats do use resources within the general area. Bats are regularly seen in and around Hilo, as well as along the coastline from Puna to North Hilo.

The nine avian species that were recorded during station counts are: Hawaiian Hawk (*Buteo solitarius*), Spotted Dove (*Streptopelia chinensis*), Zebra Dove (*Geopelia striata*), Hwamei (*Garrulax canorus*), Japanese White-Eye (*Zosterops japonicus*), Common Myna (*Acridotheres tristis*), House Finch (*Carpodacus mexicanus frontali*), Northern Cardinal (*Cardinalis cardinalis*), and Java Sparrow (*Padda oryzivora*). One species detected, the Hawaiian Hawk is listed as an endangered species under both the U.S. Fish and Wildlife Service (USFWS) and the State of Hawai'i's endangered species programs. The remaining eight species detected are alien to Hawai'i. It is also possible that small numbers of the endangered endemic Hawaiian Petrel (*Pterodroma sandwichensis*), or ua'u, and the threatened Newell's Shearwater (*Puffinus auricularis newelli*), or 'a'o, overfly the project site between the months of May and October.

The findings of the avian survey are consistent with the findings of other recent surveys conducted within the lowland areas of South Hilo. The fact the vegetation on the site was partially cleared prior to the onset of this survey likely resulted in fewer avian species and certainly many individual birds no longer being present on the site.

Potential Impacts and Mitigative Measures

To reduce the potential for interactions between nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures, all lighting will comply with the lighting requirements of the Hawai'i County Code, including shielding of external lights. This

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mitigation measure will serve the dual purpose of minimizing the threat of disorientation and downing of Hawaiian Petrels and Newell's Shearwaters, and lowering ambient glare to the astronomical observatories located on Mauna Kea.

It is unlikely that the construction of The Home Depot will have a negative impact on the endangered Hawaiian Hawk because the habitat currently found within the proposed project site is not ideal for this species. There are few trees in which hawks could perch, and the almost bare lava does not offer much in the way of cover for rodents, and other prey items usually consumed by this species. The site also lacks the medium to large stature 'ohi'a trees in which Hawaiian Hawks normally site their nests.

Although no Hawaiian hoary bats were recorded during the course of the survey, it is likely that bats do use resources within the general area. Bats are regularly seen in and around Hilo, as well as along the coastline from Puna to North Hilo. Unlike nocturnally flying seabirds, which often collide with man-made structures, bats are uniquely adapted to avoid collision with obstacles, man-made and natural. They navigate and locate their prey using ultrasonic echolocation, which is sensitive enough to allow them to locate and capture small insects at night.

4.2 HUMAN ENVIRONMENT

4.2.1 Archaeological and Historic Resources

No archaeological sites or features were identified on the proposed The Home Depot site during an archaeological inventory survey conducted by Haun and Associates in October of 2003 (see Appendix A). Prehistoric to early historic use of the area was probably limited because the focus of settlement in the Hilo area was along the coast and lower reaches of the Wailoa River. Historic use may have included sugar cane cultivation and cattle ranching.

The survey report notes that the site recently has been impacted by earthmoving activity. The report also notes that given the absence of soil and the extent of the earthmoving activity, the potential for buried cultural deposits is very unlikely.

Potential Impacts and Mitigative Measures

Based on the conclusions of the archaeological survey, no impacts to archaeological resources are anticipated. However, in the event that any archaeologically significant artifacts, bones, or other indicators are uncovered during construction, work will cease in the area and the State Historic Preservation Division will be contacted.

All construction plans will include the following language as normally recommended by the State Historic Preservation Division:

Should historic remains such as artifacts, burials, concentrations of shell or charcoal be encountered during the construction activities, work shall cease immediately in the immediate vicinity of the find and the find shall be protected from further damage. The contractor shall immediately contact the State Historic

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Preservation Division at 692-8015 which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary.

4.2.2 Cultural Impacts

History

The project area is situated on in the *ahupua'a* of Waiākea in South Hilo District. The *ahupua'a* is one of the largest districts covering over 95,000 acres. The *ahupua'a* extends along the coast from the west side of Hilo Bay to the Puna District boundary and inland to approximately 6,000 ft. elevation.

Hilo with its large bay, fishponds, wet taro fields, and abundant fresh water was a population center for commoners and royalty. Because of area resources, Hilo is associated with a number of Hawai'i's most prominent *ali'i* (chiefs) and is often mentioned in Hawaiian folklore and history. The chief of the Hilo region Kulukulu'a, who resided in Waiākea, was the first conquest of 'Umi-a-Liloa in his campaign to unify the districts of Hawai'i island (Kamakau, 1992). Kamehameha I and his court resided in Hilo in the 1890's.

Hilo is commonly mentioned as being a residence or as a favorite visiting place in famous stories such as: Hi'iaka and Pele, 'Ulu, Kawelo, Keaomelemele, and Kūapāka'a. In narratives recorded by Kepā Maly, the lands of Waiākea in Hilo were actually named after a high chief:

...the lands of Waiākea were named for the high chief Waiākea-nui-kumuhonua. The brother of Pi'ihonua-a-ka-lani and Pana'ewa-nui-moku-lehua. After departing from Pana'ewa, Ka-Miki mā met Haili-kula-manu, who was a guardian of Waiākea. Haili led Ka-Miki and his companions to his chief's compound at Kalepolepo [February 17, 1916]. Arrangements were made for Ka-Miki to compete with the 'ōlohe – experts of Waiākea, with the events to be held at the kahua [contest site] at Kalepolepo...

Waiākea was also the home of 'Ulu, a legendary man living in a time of famine. 'Ulu eventually died of starvation and was buried next to a fresh water spring. The next day, an 'ulu (breadfruit) tree filled with fruit stood where he was buried and put an end to the famine in Waiākea. In *Native Planters in Old Hawai'i*, Handy and Handy (1972) recorded the agricultural development of Waiākea and Hilo:

In lava-strewn South Hilo there were no streams whose valleys or banks were capable of being developed in terraces, but [taro] cuttings were stuck into the ground on the shores and islets for many miles along the course of the Wailuku River far up into the forest zone. In the marshes surrounding Waiākea Bay, east of Hilo, taro was planted in a unique way known as kanu kipi... On the lava-strewn plain of Waiākea and the slopes between Waiākea and the Wailuku River, dry taro was formerly planted wherever there was enough soil. There were forest plantation in Pana'ewa and in the lower fern-forest zone above Hilo Town and along the course of the Wailuku River (Handy & Handy, 1972).

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The proposed site for The Home Depot falls on the lower section of the legendary forest, Pana'ewa, also known as *Pana'ewa-nui-moku-lehua* (great Pana'ewa with lehua groves). Pana'ewa is the home of a *mo'o* (a deity taking the form of a reptile) who was destroyed by Hi'iaka, the favorite sister of the fire Goddess Pele (Pūku'i, et al, 1974). Hi'iaka was sent on a long and dangerous journey by her sister Pele to revive and fetch her deceased lover Lohi'au, whose spirit was on the island of Kaua'i. While she was still on the island of Hawai'i, Hi'iaka decided to take a shortcut through the Pana'ewa forest:

Two routes offered themselves for Hiiaka's choice, a makai road, circuitous but safe, the one ordinarily pursued by travelers; the other direct but bristling with danger, because it traversed the territory of the redoubtable with-mo'o, Pana-ewa. Hiiaka had deigned to appeal to the girl Pa-pulehu, she being a kamaaina, as if for information. When Hiiaka announced her determination to take the short road, the one of danger that struck through the heart of Pana-ewa, Papulehu drew back in dismay and expostulated: "That is not a fit road for us, or for any but a band of warriors. If we go that way we shall be killed."

After hours of fighting, Hiiaka eventually defeats Pana'ewa and his band of warriors:

The fate of Pana-ewa himself was most tragical. He no sooner had taken the form of a kukui tree than he found himself overlaid and entangled with meshes of parasitic growth; he could neither fight nor fly. The spot on which he stood sank and became a swamp, a lake, a sink; the foundations on which its bottom rested were broken up and fell away. Pana-ewa swallowed up in the gulf, was swept out to sea and perished in the waves...(A reef is pointed out in the ocean opposite Papa'i which is the remains of the body of Pana-ewa).

...The victory for Hiiaka was complete. Hawai'i for once, and for all time, was rid of that pestilential, man-eating, mo'o band headed by Pana-ewa who, from the time of Pele's coming, had remained entrenched in the beautiful forest-land that still bears the name - Pana-ewa (Emerson, 1915).

Existing Conditions

The following individuals were asked if they were aware of any cultural practices, or if there were any areas of cultural significance on the property: Mrs. Pualani Kanahale (Professor at UH Hilo, noted Kumu Hula of Hālau 'o Kekuhi, and co-founder of The Edith Kanaka'ole Foundation), Mr. Jenó Encencio (Cultural Specialist/Native Hawaiian Historic Preservation Council), and Kalani Flores (Cultural Specialist/Instructor at Hawai'i Community College). Mr. Flores deferred comment and suggested we contact the Edith Kanaka'ole Foundation.

Some of the trees, consisting of mainly 'ōhi'a and lama trees, have been cleared. Mrs Pualani Kanahale was not aware of any cultural significance on the property but mentioned that she noticed the property was being cleared:

I am unaware of any cultural site that exists there on that parcel of land. I do however know that the lama trees and 'ōhi'a trees are of cultural significance. We would like to ask to gather some of those trees before you continue clearing

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the property. This lower Pana'ewa forest was well known for the abundance of lapa growing there.

Both the 'ōhi'a lehua, and the lapa are commonly used in the Hula Community and often referenced in ancient Hawaiian history and folklore. Lapa is one of the plants of the Hula Goddess, Laka. The white part of the wood was placed on hula alters in the *hālau* (house of hula instruction) to symbolize and pay respect to Laka. This wood, which also represented enlightenment, was sometimes used to fence in sacred enclosures. The place name Kapālama (Kapā-fence, lapa-enlightenment) was an area in which was reserved for the education of *keiki ali'i* (children of chiefly rank). 'Ōhi'a lehua is another tree that is sacred to Laka, with its buds flowers are commonly used by *hālau hula* as well as lei makers.

Jeno Encencio, a native of Hilo and a member of the Native Hawaiian Historic Preservation Council, mentioned that he noticed that the land that was being cleared. Though Mr. Encencio does not know how old the trees on the property actually are, he noted that they do not look as mature as the undisturbed trees of the legendary Pana'ewa forest. Mr. Encencio thought that this parcel of land was dedicated to a Pana'ewa Farmer's Market. Mr. Encencio is not aware of any cultural significance located on The Home Depot property.

Potential Impacts and Mitigative Measures

Based on the interviews conducted for this assessment, the proposed The Home Depot is not expected to have significant long-term impacts on cultural resources. In response to Mrs. Kanahale's request to gather the wood of the 'ōhi'a and lapa trees, arrangements were made for her or members of her halau to access the site to identify the trees they wished to gather. The Home Depot then arranged for a tree cutter to cut down the identified trees. On December 3, 2003, approximately 40 trees from the site were cut into logs and delivered to Mrs. Kanahale.

4.2.3 Roads and Traffic

The Home Depot site is bound to the north by Makaala Street, to the east by Railroad Avenue, to the west by the Ohuohu Street Extension, and to the southwest by the existing Prince Kuhio Plaza employee parking lot. The site also includes an outparcel that could be used for a fast food restaurant, retail space, or other allowed use on the corner of Ohuohu Street and Makaala Street. Parking would also be included. A tenant for this outparcel has not been selected. The Home Depot store will be constructed first, with the potential additional use being constructed as Phase II of the project.

Railroad Avenue is a two-lane circulation roadway running parallel to and east of Kanoelehua Avenue. It provides access from an industrial area in the north to an agricultural park to the south.

Ohuohu Street is a two-lane local road that runs north to south behind the Prince Kuhio Plaza. It provides secondary access to the Prince Kuhio Plaza and a satellite parking lot, and connects East Makaala Street with East Puinako Street and the adjacent residential area to the south.

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East Makaala Street is a four-lane circulation road that runs east to west between Kanoelehua Avenue and Railroad Avenue. It provides primary access to the Prince Kuhio Plaza and the adjacent Waiakea Center with striped left turn lanes at their access points. East Puainako Street is another four-lane, east-west circulation road running parallel to and south of East Makaala Street. It also provides primary access to Prince Kuhio Plaza and the adjacent residential area.

The intersections in the vicinity of the project site are stop sign controlled. Ohuohu Street has stop signs at its intersections with East Makaala Street and East Puainako Street. The East Makaala Street and East Puainako Street approaches to Railroad Avenue are stop sign controlled. The East Makaala Street and East Puainako Street intersections with Kanoelehua Avenue are controlled by traffic signals.

Potential Impact and Mitigative Measures

A traffic impact analysis report conducted by M&E Pacific (see Appendix C) projects that the proposed The Home Depot store is expected to generate about 193 trips during the weekday morning peak hour, 375 trips during the weekday afternoon peak hour, and about 705 trips during the weekend peak hour. Phase II (assuming a fast food restaurant, the worst-case scenario) is expected to generate about 175 trips during the weekday morning peak hour, 117 trips during the weekday afternoon peak hour, and about 206 trips during the weekend peak hour. These projections are based on national average trip generation rates as reported in the Institute of Transportation Engineers *Trip Generation Handbook* (Sixth Edition, 1997).

Most of the trips that would be generated are expected to be new trips that would be added to the traffic stream. Only about 10 to 20 percent of these trips can be expected to be diverted trips; trips that are already in the area for other purposes and then go to the proposed The Home Depot store.

While The Home Depot would generate additional traffic, particularly during the afternoon peak hour and on Saturdays, impacts can be mitigated. The additional traffic is not expected to have an adverse impact upon the signalized intersections at Kanoelehua Avenue, although traffic signal cycle lengths would need to be increased. The unsignalized intersections on Railroad Avenue are forecasted not to be adversely affected. However, the two unsignalized intersections on Ohuohu Street are forecasted to be adversely affected on weekends. Appropriate mitigation measures include converting these intersections to all way stops and restriping the lanes.

4.2.4 Air Quality

Regional and local climate and various anthropogenic sources tend to affect air quality at any given location. Hawai'i's remote location in the Central Pacific distant from major sources of pollution means that air problems generally result from local sources. Air pollution is limited in the Hilo region and is generally diffused by trade winds. Air quality in the Hilo area therefore tends to be very good and is expected to be well within both State and Federal Air Quality Standards.

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Potential Impacts and Mitigative Measures

Construction of The Home Depot will not significantly impact air quality. Vehicular emissions will increase from construction equipment during the short construction period. However, State and Federal Air Quality Standards are not expected to be exceeded and no significant adverse impacts are anticipated.

Mitigation measures to minimize air quality impacts include dust control measures such as frequent watering during construction and rapid establishment of gravel and plant materials once grading is completed. Increased vehicular traffic will to The Home Depot is not expected to violate state or federal air quality standards.

4.2.5 Noise

There are no sensitive land uses, including residential homes in the vicinity of The Home Depot site. Noise in the vicinity of The Home Depot site is generally from traffic, and occasional overhead aircraft, adjacent industrial uses, and natural sounds associated with weather (e.g. wind and rain), and birds.

Potential Impacts and Mitigative Measures

During the construction period, the use of construction equipment is expected to increase the noise levels on the site. Proper mitigating measures (such as limiting construction to daylight hours) will be employed to minimize the noise impacts. All work will be monitored to comply with State Department of Health noise limits.

4.2.6 Social, Economic, and Employment Impacts

The proposed The Home Depot site is currently vacant. In its current vacant state it generates no direct revenue for landowner State of Hawai'i Department of Hawaiian Homes Lands and provides no employment opportunities for the residents of Hilo.

Potential Impacts and Mitigative Measures

The Home Depot will provide opportunities for residents to improve the quality of their lives by creating approximately 125 new direct long-term employment opportunities in the Hilo region. In addition, indirect jobs will be created within industries supporting and supplying inventory, such as garden supplies, to the new store. The construction of the store also will provide short-term employment opportunities for the construction industry.

DHHL, as the landowner, will lease the approximately twelve-acre parcel to The Home Depot. This lease will generate \$400,000 per year for the first ten years (\$4 million over 10 years) in revenue to serve DHHL's native Hawaiian beneficiaries.

In addition to generating revenue for the State of Hawai'i Department of Hawaiian Homelands, The Home Depot is committed to the communities its stores serve. The Home Depot had a national philanthropic budget of over \$25 million in 2002 and has traditionally focused its efforts

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in four key areas: 1) helping to build and rehabilitate affordable housing; 2) empowering at risk youth to realize their dreams; 3) protecting the environment; and 4) preparing communities for emergencies and assisting in responding and rebuilding.

In the four years that The Home Depot has been in Hawai'i, the retailer has made significant contributions to the community. Local contributions to Habitat for Humanity, Ka Hale A Ke Ola Homeless Resource Center (Maui), the Hawai'i Chapter of the American Red Cross, D.A.R.E. Hawai'i, and Pearl City Foundation total approximately \$365,000.

4.2.7 Infrastructure

Infrastructure improvements necessary for the project will be provided by connecting to existing infrastructure and utility easements.

4.2.7.1 Access

The site will be accessed from East Makaala Street, Railroad Avenue, and Ohuohu Street.

Potential Impacts and Mitigative Measures

The connection of the access driveway will be coordinated with the County.

4.2.7.2 Water System

Water service near the Pana'ewa Industrial Lots is provided by the County Department of Water Service (DWS). The water used in this area is supplied from the DWS 1.0 million gallon Pū'ainakō Reservoir located between Komohana and Kāwili Streets on Puainako Street. From this reservoir, an 18-inch transmission main runs along Pū'ainakō Street to Railroad Avenue, then 12-inch and 8-inch lines are used to service the local area.

Potential Impacts and Mitigative Measures

A request for a lateral connection for domestic service will be made to the Department of Water Supply's main which is located along Makaala Street. The average daily demand for water is estimated to be 4,700 gallons per day. A separate fire meter for onsite fire hydrants and sprinkler system will also be installed.

4.2.7.3 Wastewater Treatment and Disposal

There is an existing sewer line in the vicinity of The Home Depot site under Makaala Street. The full flow capacity of the Makaala Street sewer line is 1.95 cfs. Currently, Waiakea Center's design peak flow is approximately 1.58 cfs and is connected to the Makaala Street sewer line. Makaala Street sewer line is connected to the 36 inch line within Leilani Street and the County's Hilo Wastewater Treatment Plant. Both the sewer lines in the vicinity and the wastewater treatment plant have the capacity to accommodate additional flow.

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Potential Impacts and Mitigative Measures

The additional flow generated by The Home Depot can be accommodated within the Makaala Street sewer line and the construction of additional sewer lines will not be needed. The Home Depot is requesting approval from the County to connect to the Makaala Street sewer line.

Although a wastewater engineering report was prepared for the draft environmental assessment (Appendix D), the project engineer is currently in discussion with the County of Hawaii Wastewater Division on how to best calculate wastewater flows from The Home Depot Store. The County of Hawaii currently uses the wastewater standards of the City of County of Honolulu, however these standards do not account for big box stores with large parking areas. The project engineer will design the wastewater system as agreed upon per further discussion with the Wastewater Division.

4.2.7.4 Drainage Facilities

Stormwater runoff from The Home Depot site currently soaks into the ground. It appears unlikely that stormwater currently discharges from the property. Stormwater from the adjacent streets flow along the streets that have stormwater grates.

Potential Impacts and Mitigative Measures

Drainage improvements for The Home Depot will meet all State and County drainage requirements. This will include ensuring no increased runoff from the site over existing conditions and incorporating appropriate non-point source pollution controls.

The Home Depot will increase runoff within the site over current conditions due to impermeable surfaces from the buildings and the paved parking lot. An underground infiltration system located below the parking lot will collect the stormwater and will allow the runoff to percolate into the ground beneath The Home Depot.

4.2.7.5 Utilities

Overhead electrical and other communication utilities services for the project are available from the utility distribution system along Railroad Avenue. Electric power is available to the site by Hawai'i Electric Light Company, Inc.'s (HELCO) overhead utility lines along Railroad Avenue. According to HELCO, the site is served by their Kanoelehua Substation, which is currently eighty percent loaded.

Potential Impacts and Mitigative Measures

In their comment letter on the Draft EA, HELCO stated that based on the maximum demand reading for The Home Depot in Kona, the anticipated load for the facility is approximately 680 kW. They further stated that the Kanoelehua Substation and the off-site distribution system are adequate to serve the project, however a primary line extension will be needed to connect to the Railroad Avenue 12,470 volt distribution system. In addition, HELCO's current system peak

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load is 184,900 KW as of December 15, 2003 and their total generation system capability is 233,700 KW. Their reserve margin is twenty-six percent and they have adequate generation to serve the project.

Electrical utilities services will be provided to the project by overhead service. Pole-mounted fixtures for site lighting will be installed at the entrance and along side the buildings. Construction plans will be provided to the County for review and approval and will be in compliance with the specifications of the County. In addition, the project engineer will contact HELCO's Engineering Department to open a service request to insure timely service to the project.

Sandwich Isles Communications will provide the telephone service to The Home Depot.

4.2.8 Solid Waste Disposal

Solid waste generated will be disposed of at a County approved landfill. Where practical, The Home Depot will recycle wastes such as cardboard and other packaging materials.

4.2.9 Public Services

4.2.9.1 Fire Protection

Fire protection is provided by the County of Hawai'i Fire Department at 411 Kawaihine Station located approximately two miles (two minutes) from The Home Depot site. Existing fire hydrants are located on Railroad Avenue.

Potential Impacts and Mitigative Measures

There may be an occasional and unavoidable demand for fire protection services associated with The Home Depot. The Home Depot will comply with all fire safety requirements. The Home Depot will advise the Fire Department of project implementation and phasing to permit adequate planning and advance notice of project completion.

4.2.9.2 Police Protection

Police protection services in the Hilo area are provided from the County of Hawai'i Police Department located at its main station at 349 Kapi'olani Street approximately three miles (five minutes) from The Home Depot site.

Potential Impacts and Mitigative Measures

There may be an occasional and unavoidable demand for police protection services associated with the project, however, it is anticipated that the existing police service will be adequate and will not be adversely affected by the proposed development. The Home Depot building and other proposed structures (Phase II) will be designed with built-in security measures (e.g. intrusion door alarms).

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4.2.9.3 Health Care Services

Various health care services in Hilo provide primary patient care to adults, women, and children. All facilities currently provide outpatient care. The nearest hospital is Hilo Hospital at 1190 Waiānuenu Avenue approximately five miles (10 minutes) from The Home Depot by ambulance service. Ambulance service is available from the nearest fire station.

Potential Impacts and Mitigative Measures

There may be an occasional and unavoidable demand for health care services associated with the project. However, it is anticipated that the existing health care facilities will be adequate and will not be adversely affected by The Home Depot.

4.2.9.4 Proximity of Other Services

The Home Depot's immediate neighborhood is the Waiakea area of Hilo. A significant amount of land in this part of Hilo is owned and managed by the DHHL. The development of Prince Kuhio Plaza (managed by General Growth Properties) on DHHL property shifted the historical commercial retail focus of the area. Other major retail developments concentrated in this neighborhood include Waikea Center (anchored by Wal-Mart and situated on DHHL property), KTA's Puinako Center, Puainako Town Center, and Ginger Patch Commercial Center. The site is adjacent to the Prince Kuhio Plaza's employees' parking lot along Ohuohu Street and within walking distance of both Prince Kuhio Plaza and Waiakea Center.

4.2.10 Hazardous Materials

During the last several years, federal and state governments have developed legislation relating to environmental concerns. As a result of this legislation, laws and regulations have been promulgated that govern hazardous and toxic wastes and materials, and the manufacture, generation, use, storage, release, and disposal of such materials. As a consequence of these laws and regulations, numerous agencies collect and disseminate information for use in evaluating recognized environmental conditions (RECs).

Weston Solutions, Inc., prepared a Phase I Environmental Site Assessment of the proposed The Home Depot property. Weston Solutions, Inc. used Environmental Data Resources, Inc. to search major federal, state, and local regulatory agency lists. The Environmental Data Resources, Inc. database is consistent with the American Society of Testing and Materials (ASTM) standards.

Potential Impacts and Mitigative Measures

Weston Solutions, Inc. has determined that the proposed The Home Depot property presents a low potential for environmental risk as the site was not used previously for industrial purposes. Weston Solutions, Inc. recommends that car batteries observed on site be removed and disposed of properly and that if any staining is observed during removal of the batteries, that soil be excavated and properly disposed of at the time of development.

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5.0 ALTERNATIVES TO THE PROPOSED ACTION

In compliance with the provisions of Title 11, Department of Health, Chapter 200, Environmental Impact Statement Rules, Section 11-200-17(f), *the "known feasible" alternatives to the proposed project are limited to those that would allow the objectives of the project to be met, while minimizing potential adverse environmental impacts.* As such, several alternatives have been evaluated.

5.1 NO ACTION ALTERNATIVE

The "no action" alternative would result in the parcel remaining in its current vacant state which would yield little or no benefit to either the DHHL, DHHL beneficiaries, or the County or the State. The no action alternative will not accomplish the desired goals of optimally serving the beneficiaries of the DHHL by generating lease revenue nor will it provide employment opportunities.

5.2 OTHER DHHL LANDS

DHHL owns other property in the vicinity that could be used for The Home Depot. However, the selected site is the preferred alternative because of its proximity to other retail uses, such as Wal-Mart, and the Prince Kuhio Plaza (see Figure 2).

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6.0 DETERMINATION, FINDINGS, AND REASONS FOR SUPPORTING THE DETERMINATION

To determine whether the proposed action may have a significant impact on the environment, every phase and expected consequences, both primary and secondary, and the cumulative as well as short and long-term effects have been evaluated. Based on the analyses performed and research evaluated, the accepting agency (Department of Hawaiian Home Lands) has issued a Finding of No Significant Impact (FONSI) as summarized in this section.

6.1 SIGNIFICANCE CRITERIA

According to the Department of Health Rules (11-200-12), an applicant or agency must determine whether an action may have a significant impact on the environment, including all phases of the project, its expected consequences both primary and secondary, its cumulative impact with other projects, and its short and long-term effects. In making the determination, the Rules establish "Significance Criteria" to be used as a basis for identifying whether significant environmental impact will occur. According to the Rules, an action shall be determined to have a significant impact on the environment if it meets any one of the following criteria:

- (1) **Involves an irrevocable commitment to loss or destruction of any natural or cultural resources;**

No significant natural, archaeological, or cultural resources have been identified on The Home Depot site. As such, The Home Depot does not involve the irrevocable commitment to loss or destruction of any natural or cultural resources.

- (2) **Curtails the range of beneficial uses of the environment;**

The Home Depot site is within an industrial zoned area. The construction of the proposed The Home Depot facilities is consistent with and will implement the intent of the underlying County zoning. The site is vacant land surrounded by other industrial and urban uses.

- (3) **Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS; and any revisions thereof and amendments thereto, court decisions, or executive orders;**

The Home Depot will not conflict with the environmental policies set forth in the State Plan and Chapter 344, *Hawai'i Revised Statutes*.

- (4) **Substantially affects the economic or social welfare of the community or state;**

The Home Depot will have a positive impact on the economic and social welfare of the community by creating approximately 125 new direct long-term employment opportunities in the Hilo region. In addition, indirect jobs will be created within industries supporting and supplying inventory, such as garden supplies, to the new store. The construction of the store also will provide short-term employment opportunities for the construction industry.

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In addition, The Home Depot is committed to the communities its stores serve. Since The Home Depot has been in Hawai'i, the retailer has made significant contributions to the community. Local contributions to Habitat for Humanity, Ka Hale A Ke Ola Homeless Resource Center (Maui), the Hawai'i Chapter of the American Red Cross, D.A.R.E. Hawai'i, and Pearl City Foundation total approximately \$365,000.

(5) Substantially affects public health;

Public health may be temporarily affected by air and noise impacts during construction, however, these will be of a short-term duration, and insignificant, especially when weighed against the positive economic and social benefits associated with the project. The long-term operations of The Home Depot project will not have a significant impact on air quality and noise levels and will not generate pollutants that would impact public health in the surrounding area.

(6) Involves substantial secondary impacts, such as population changes or effects on public facilities;

The Home Depot is not expected to involve substantial secondary impacts associated with population growth. The anticipated market is existing residents of Hilo and the Hilo region. Employees are also expected to come from these areas.

The infrastructure demands on public facilities are not expected to be significant. In addition, the construction and operation of The Home Depot will generate new sources of direct and indirect revenue for individuals, the County of Hawai'i, and the State of Hawai'i by providing construction employment opportunities, new long-term jobs, and indirect employment in a range of industries.

(7) Involves a substantial degradation of environmental quality;

The Home Depot development will use vacant land and is not expected to degrade environmental quality on-site or in the surrounding neighborhood. Appropriate best management practices will provide safeguards for protection of water quality during the short-term construction period. There will be no significant degradation of air, water, or noise quality.

(8) Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions;

The project is small in scale (twelve acres) when contrasted with the overall land area available and appropriately zoned for general industrial use within the DHHL Pana'ewa Industrial Lots and within the other industrial parks in the Hilo region.

(9) Substantially affects a rare, threatened or endangered species or its habitat;

One species detected, the Hawaiian Hawk (*Buteo solitarius*), or 'io is listed as an endangered species under both the U.S. Fish and Wildlife Service (USFWS) and the State of Hawai'i's endangered species programs. It is unlikely that the construction of The Home Depot will have a

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negative impact on the endangered Hawaiian Hawk because the habitat currently found within the proposed project site is not ideal for this species. There are few trees in which hawks could perch, and the almost bare lava does not offer much in the way of cover for rodents, and other prey items usually consumed by this species. The site also lacks the medium to large stature 'ohi'a trees in which Hawaiian Hawks normally site their nests.

Although no endangered Hawaiian hoary bats were recorded during the course of the survey, it is likely that bats do use resources within the general area. Bats are regularly seen in and around Hilo, as well as along the coastline from Puna to North Hilo. Unlike nocturnally flying seabirds, which often collide with man-made structures, bats are uniquely adapted to avoid collision with obstacles, man-made and natural. They navigate and locate their prey using ultrasonic echolocation, which is sensitive enough to allow them to locate and capture small insects at night.

(10) Detrimentially affects air or water quality or ambient noise levels;

The Home Depot will not include any significant sources of air emissions or noise levels that would violate existing Federal or State standards. Wastewater flows will be disposed via an approved sewer system. The drainage system will be designed in compliance with County and State regulations to protect the groundwater quality and not adversely impact downstream properties. Sitework will be in accordance with grading permit conditions to minimize erosion, non-point source pollution, and dust.

(11) Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, freshwater, or coastal waters.

The Home Depot is located approximately three miles from the shore and is not located within a flood plain or other environmentally sensitive area. Shoreline, valleys, or ridges will not be impacted by the development.

(12) Substantially affects scenic vistas and view planes identified in county or state plans or studies;

The proposed The Home Depot will be designed and built to conform to the requirements of the County zoning and building codes and will not affect any identified scenic vistas and view planes.

(13) Requires substantial energy consumption.

The construction and operation of The Home Depot will not require substantially more energy consumption than would be required for projects of a similar type and scale. Energy conservation techniques, such as use of day lighting and energy efficient lighting, waste heat recovery with centralized air-conditioning, and the use of proper building orientation and landscaping, where practical, to reduce heat loads, will be evaluated as part of planning and design of The Home Depot.

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6.2 DETERMINATION

On the basis of impacts and mitigative measures examined in this document and analyzed under the above criteria, the Department of Hawaiian Home Lands has determined that the proposed The Home Depot will not have a significant effect on the local, County, or Statewide physical or human environments. Pursuant to Chapter 343, *Hawai'i Revised Statutes*, the Accepting Authority, which in this case is the State of Hawai'i Department of Hawaiian Home Lands, has issued a Finding of No Significant Impact (FONSI).

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**8.0 COMMENTS ON THE DRAFT ENVIORNMENTAL
ASSESSMENT & RESPONSES**

The Draft Environmental Assessment was sent to the following agencies, organizations, and individuals. Where indicated the agency, organization, or individual submitted comments.

	AGENCY	DEA Mail Date	Date of Comments
	STATE		
1	Department of Transportation	11/19/03	
2	Hilo Public Library	11/19/03	
3	Office of Environmental Quality Control	11/19/03	12/22/03
4	Office of Hawaiian Affairs	11/19/03	12/11/03
	COUNTY OF HAWAII		
5	Planning Department	11/19/03	12/12/03
6	Department of Public Works	11/19/03	
7	Department of Water Supply	11/19/03	12/30/03
8	Fire Department	11/19/03	12/3/03
9	Police Department	11/19/03	12/3/03
10	Hawaiian Electric Light Company	11/19/03	12/23/03
11	Department of Environmental Management	12/19/03	1/12/04
	COMMUNITY ORGANIZATIONS AND INDIVIDUALS		
12	Mrs. Pualani Kanahele	11/19/03	
13	Panaewa Hawaiian Home Lands Community Association	11/19/03	

The following pages contain comment letters received and responses.

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GOVERNOR OF HAWAII



STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

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TELEPHONE: (808) 541-1188
FACSIMILE: (808) 541-1188
E-mail: oeqc@hawaii.gov

December 22, 2003

Mr. Micah Kane, Chairman
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, Hawaii 96805

Dear Mr. Kane:

Subject: Draft Environmental Assessment for the Ifilo Home Depot

Thank you for the opportunity to review and comment on the subject document. We have no comments.

Should you have any questions please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson
Genevieve Salmonson
Director

c: PBR Hawaii

GENEVIEWE SALMONSON
DIRECTOR



LAND PLANNING
LANDMARK ARCHITECTURE
ENVIRONMENTAL STUDIES

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CONSULTANT

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DAVID M. HARRIS, ASLA
PRESIDENT

DAVID M. HARRIS, ASLA
PRESIDENT

January 28, 2004

Ms. Genevieve Salmonson, Director
State of Hawaii
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

SUBJECT: THE HOME DEPOT HILO DRAFT ENVIRONMENTAL
ASSESSMENT (TMK 2-2-47:64 PORTION)

Dear Ms. Salmonson:

Thank you for your letter dated December 22, 2003. I have reviewed your response and acknowledge that you have no comments.

Thank you for participating in the environmental review process.

Sincerely,

Tom Schnell

Tom Schnell, AICP
Associate

cc: Manny Nova/Department of Hawaiian Home Lands
Diane Kodama/M&E Pacific

C: Office of Environmental Quality Control
235 S. Beretania St. Ste 702
Honolulu, HI 96813

State Dept. of Hawaiian Homelands
P.O. Box 1879
Honolulu, HI 96813
ATTN: Manny Nova

FAX (808) 594-1963

11/16/03



STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
711 KAPUOLANI BOULEVARD, SUITE 600
HONOLULU, HAWAII 96813

PHONE (808) 594-1963

HRD03/1201

December 11, 2003

Mr. Tom Schnell
PBR Hawaii
Pacific Tower, Ste 650
1001 Bishop Street
Honolulu, HI 96813

Re: The Home Depot, Hilo, Draft EA

Dear Mr. Schnell:

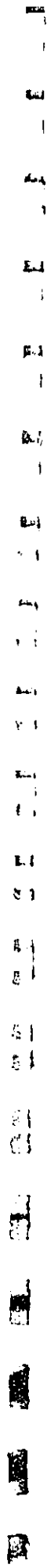
Thank you for the opportunity to review the above referenced document. OHA notes that there are no archaeological or traditional cultural places located on the property. We also note that the Department of Hawaiian Homelands will afford Mrs. Pualani Kanahale and members of her halau the opportunity to collect tama and ohia wood before the trees are cleared. We suggest that the property be landscaped using lama and ohia trees, which are native to the area.

Please note the Mr. Geno Innocencio is a member of the Native Hawaiian Historic Preservation Council, which is an advisory council to the OHA Board of Trustees. Mr. Innocencio is not an OHA Board member. The OHA Board member for the Island of Hawaii is Linda Deia Cruz who resides in the Panacea Hawaiian Homesteads.

Thank you for this opportunity to comment. Please contact Pua Aiu at 594-1931 or by e-mail at paiu@oha.org if you have further questions.

Sincerely,

Clyde W. Namu'o
Administrator





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January 28, 2004

Mr. Clyde W. Namu'o, Administrator
State of Hawaii
Office of Hawaiian Affairs
711 Kapi'olani Boulevard, Suite 500
Honolulu, Hawaii 96813

SUBJECT: THE HOME DEPOT HILO DRAFT ENVIRONMENTAL ASSESSMENT (TMK 2-2-47-64 PORTION)

Dear Mr. Namu'o:

Thank you for your letter dated December 11, 2003. We are providing the following responses to your comments.

1. We acknowledge your confirmation of no archaeological or traditional cultural sites existing on the property.
2. Mrs. Pualani Kanahelic and members of her halau received approximately 40 trees from the site cut into logs on December 3, 2003.
3. Your suggestion regarding use of native lapa and o'hia trees for landscaping will be forwarded to the project architect.
4. We understand that Mr. Jeno Encencio is a member of the Native Hawaiian Historic Preservation Council and is not an OHA Board member. The OHA Board member for the Island of Hawaii is Linda Dela Cruz.

Thank you for participating in the environmental review process.

Sincerely,

Tom Schnell, AICP
Associate

cc: Manny Nova/Department of Hawaiian Home Lands
Genevieve Salmonson/Office of Environmental Quality Control
Diane Kodama/M&E Pacific

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Harry Kim
Mayor



DEC 18

County of Hawaii

PLANNING DEPARTMENT
101 Puuhii Street, Suite 3 • Hilo, Hawaii 96720-3013
(808) 961-8288 • Fax (808) 961-8742

December 12, 2003

Mr. Tom Schnell
PBR Hawaii
Pacific Tower, Suite 650
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Schnell:

Subject: Draft Environmental Assessment (DEA) Comments
Project: The Home Depot, Hilo
Applicants: Department of Hawaiian Homelands
Location: TMK (3) 2-047-064 (por.), Waikeae, South Hilo, Island of Hawaii, Hawaii

This is in response to your request for comments dated November 23, 2003 on the DEA for the proposed project. Phase I of the proposal includes the construction of a new home improvement retail center consisting of a 102,948 square foot warehouse-style home improvement store, a 27,631 square foot garden center and a parking lot with 492 parking stalls. Phase II includes a 1.52 acre outparcel to be used for a fast food restaurant, retail space or other allowed use. The proposed project area consists of approximately 12 acres at the northern portion of the 24,987-acre lot, which is owned by the State of Hawaii, Department of Hawaiian Homelands.

The Planning Department appreciates having the opportunity to comment on the DEA for this project and offers the following:

1. The project site is situated in the State Land Use Urban district and is not in the Special Management Area.
2. The Hawaii County Zoning Map identifies the zoning for the subject property as Limited Industrial (ML-20). "Home Improvement Centers" is listed among the permitted uses listed for the ML district.

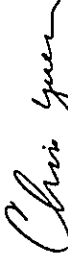
Christopher J. Yuen
Director

Roy R. Takemoto
Deputy Director

Mr. Tom Schnell
PBR Hawaii
Page 3
December 12, 2003

Should you have questions, please feel welcome to contact Larry Brown or Esther Imamura of my staff at 961-8288.

Sincerely,



CHRISTOPHER J. YOVAN
Planning Director

LMB:pak
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xc: DEM
Police Dept.
DHHL-Planning Office

Mr. Tom Schnell
PBR Hawaii
Page 2
December 12, 2003

3. The Hawaii County General Plan Land Use Pattern Allocation Guide (LUPAG) designation for the property is high density urban, rather than "Industrial", as specified on page 1 of the DEA. Lands designated as high density urban on the LUPAG map are suitable for commercial, multiple residential and related services (general and office commercial; multiple residential - up to 35 units per acre) uses.
4. A "Memorandum of Agreement" (MOA) between the County of Hawaii and the Department of Hawaiian Homelands that became effective on December 30, 2002. Section III of the MOA relates to planning and land use. The following subsections are iterated for their relevance to the proposed project.
 - III.D. "All normal land use controls will be applied by Hawaii County to DHHL property according to the zoning district selected by DHHL. Except as specifically provided in the Agreement (MOA), DHHL will follow all normal land use procedures, regulations, and standards applicable to the zoning district."
 - III.E. "All land use permit applications on Hawaiian home lands must be accompanied by written consent from DHHL before the County can begin processing those applications."
 - III.F. "The standards of the various zoning districts selected will apply to DHHL property. DHHL and its lessees will go through normal County administrative variance procedures if they seek exemptions from standards."In view of the above and as required by the Zoning Code, Plan Approval shall be required prior to the issuance of any building permits for the proposed project.
5. The list of County of Hawaii departments consulted does not include the Department of Environmental Management (DEM) or the County of Hawaii Police Department. DEM is responsible for solid waste and wastewater management in Hawaii County and was previously under the Department of Public Works. Due to the potential impacts on the wastewater and solid waste systems and management, the Planning Department recommends that the DEM be added to the list of consulting agencies. Due to the potential impact on crime and traffic enforcement in the area, the Planning Department recommends that the Police Department also be added to the list of consulting agencies.



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AND ZONING
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WALTER T. BROWN, ASLA
Secretary

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January 28, 2004

Mr. Christopher J. Yuen
Planning Director
County of Hawai'i
Planning Department
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720-3043

SUBJECT: THE HOME DEPOT HILO DRAFT ENVIRONMENTAL ASSESSMENT (TMK 2-2-47:64 PORTION)

Dear Mr. Yuen:

Thank you for your letter dated December 12, 2003. We are providing the following responses to your comments.

1. We acknowledge your confirmation of the project within the State Land Use Urban district and outside of the Special Management Area.
2. We also acknowledge that the Hawai'i County Zoning Map identifies the zoning for the property as Limited Industrial (ML-20), with "Home Improvement Centers" among permitted uses for the ML district.
3. The final EA will be revised to reflect that the Hawai'i County General Plan LUPAG designation for the property is High Density Urban, rather than Industrial. Lands designated as High Density Urban are suitable for commercial, multiple residential, and related service uses.
4. We acknowledge that sections III.D through III.F of the MOA are relevant to the project. Pursuant to the MOA, the Zoning Code, and your letter, we acknowledge that Plan Approval will be required before the issuance of any building permits for the project. This information will be noted in the final EA.
5. Per your recommendation, a copy of the draft EA was sent to the Department of Environmental Management on December 19, 2003. We received comments from the Department of Environmental Management dated January 12, 2004.
6. A copy of the draft EA was sent to the Hawai'i County Police Department on November 19, 2004. We received comments from the Police Department dated December 3, 2003.

Mr. Yuen
SUBJECT: HOME DEPOT DRAFT ENVIRONMENTAL ASSESSMENT
January 28, 2004
Page 2

Thank you for participating in the environmental review process.

Sincerely,

Tom Schnell, AICP
Associate

cc: Manny Nova/Department of Hawaiian Home Lands
Genevieve Salmonson/Office of Environmental Quality Control
Diane Kodama/M&E Pacific

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DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII

345 KEKUAHAKA STREET, SUITE 22 • HILO, HAWAII 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

December 30, 2003

JAN - 6

Mr. Tom Schnell
PBR Hawaii
Pacific Tower, Suite 650
1001 Bishop Street
Honolulu, HI 96813

WATER AVAILABILITY
THE HOME DEPOT, HILO
DRAFT ENVIRONMENTAL ASSESSMENT

We have reviewed the draft Environmental Assessment sent with your transmittal letter dated November 23, 2003, and we have the following comments and conditions

We anticipate that we will be able to provide water service to the subject development. However, we will need to know the calculated water usage for the completed project. Water usage calculations shall include all potential uses by the development. The calculated information shall be prepared and submitted by an engineer registered within the State of Hawaii. The Hawaii County Department of Water Supply (DWS) will make the final determination.

A water unit, as defined by the Department of Water Supply, is an average day usage of 400 gallons per day, (GPD) and a maximum day usage of 600 GPD. Statements provided previously by Greenberg Farrow Architecture in their letter of May 6, 2003, suggested that "The typical Home Depot store has a daily water usage of 2,000 GPD with a maximum of 2,500 GPD." However, a comparison check of the record file for the Kona Home Depot store shows it contains a letter from M&E Pacific, Inc., that indicated the water usage to be 5000 GPD for irrigation alone. Furthermore, a check of our customer service records shows that the actual usage at the Kona Home Depot store is, on average, more than 40,000 GPD, which is over 100 units of water. We request that the water calculations for the Hilo store should reflect actual conditions at that location and should not be based on any national average. We will be checking with the Kona store to make sure they are not experiencing problems with their system.

The information in your Draft Environmental Assessment on Page 26, under Section 4.2.2.2 Water System, should be changed to read: "...an 18-inch transmission main runs along Pu'ainaloa Street to Railroad Avenue, then 12-inch and 8-inch lines are used to serve the local area."

If you have any questions, please contact Mr. Lawrence Beck of our Water Resources and Planning Branch at 951-8070.

Sincerely yours,

Milton D. Pavao, P.E.
Manager

LEB:scs

copy -- Office of Environmental Quality Control
Ms. Carolyn Shaw, Greenberg Farrow Architecture

... Water brings progress...



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AND
ENVIRONMENTAL SERVICES

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PRESIDENT

January 28, 2004

Mr. Milton Pavao, P.E. Manager
Department of Water Supply, County of Hawaii
345 Kekuanooa Street, Suite 20
Hilo, Hawaii 96720

SUBJECT: THE HOME DEPOT HILO DRAFT ENVIRONMENTAL
ASSESSMENT (TMK 2-2-47-64 PORTION)

Dear Mr. Pavao:

Thank you for your letter dated December 30, 2003, regarding the Home Depot Hilo Draft Environmental Assessment (EA). We provide the following responses to your comments.

We acknowledge that the Department of Water Supply anticipates being able to provide water service to the Home Depot Hilo, but the Department will make the final determination based on water use calculations prepared and submitted by an engineer registered within the State of Hawaii.

The project civil engineer, M&E Pacific, submitted civil engineering drawings for the Home Depot Hilo project to the Department of Water Supply on December 11, 2003. Sheet 12 of the drawings (Utility Plan) shows water calculations. An engineer registered within the State of Hawaii prepared these calculations. The water calculations were based on information from other Home Depot stores in Hawaii, rather than a national average for Home Depot Stores. Please contact Diane Kodama of M&E Pacific (808 521-3051) if you require further information.

In the final EA the information in Section 4.2.7.7 (Water System) will be changed as noted in your letter.

Thank you for participating in the environmental review process.

Sincerely,

Tom Schnell, AICP
Associate

cc: Manny Nova/Department of Hawaiian Home Lands
Genevieve Salmonson/Office of Environmental Quality Control
Diane Kodama/M&E Pacific

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Harry Kim
Mayor



County of Hawaii
FIRE DEPARTMENT
25 Aspsall Street • Suite 103 • Hilo, Hawaii 96720
(808) 961-4297 • Fax (808) 961-4294

Darryl J. Oliveira
Fire Chief
Desmond K. West
Deputy Fire Chief

UHC 3

December 3, 2003

Mr. Tom Schnell
PBR Hawaii
1001 Bishop Street, Suite 650
Honolulu, HI 96813

Dear Mr. Schnell:

RE: THE HOME DEPOT, HILO
SOUTH HILO, ISLAND OF HAWAII
TAX MAP KEY: 2-2-47-64 (PORTION)

This responds to your request for comments on the above-referenced Draft Environmental Assessment.

We have no comments to offer at this time regarding the project.

Thank you for the opportunity to comment.

Sincerely,

DARRYL OLIVEIRA
Fire Chief

RK:ik

cc: Office of Environmental Quality Control
State Department of Hawaiian Home Lands



LAND PLANNING
LANDMARK ARCHITECTURE
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KAREN NORDMARK, ASLA
Associate

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Fire Chief
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Tel: (808) 961-4297
Fax: (808) 961-4294
E-mail: wjo@hilo.gov

January 28, 2004

Fire Chief Darryl Oliveira
Hawaii County Fire Department
25 Aspsall Street, Suite 103
Hilo, Hawaii 96720

SUBJECT: THE HOME DEPOT HILO DRAFT ENVIRONMENTAL
ASSESSMENT (TNIK 2-2-47-64 PORTION)

Dear Chief Oliveira:

Thank you for your letter dated December 3, 2003. I have reviewed your response and acknowledge that you have no comments.

Thank you for participating in the environmental review process.

Sincerely,

Tom Schnell, AICP
Associate

cc: Manny Nova/Department of Hawaiian Home Lands
Genevieve Salmonson/Office of Environmental Quality Control
Diane Kodama/M&E Pacific



Harry Kim
Mayor



County of Hawaii
POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawaii 96720-3998
(808) 935-3311 • Fax (808) 961-8169

U-1 4

Lawrence K. Mahuna
Police Chief
Harry S. Kubojiri
Deputy Police Chief

December 3, 2003

PBR Hawaii
Pacific Tower, Suite 650
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Sir:

Our staff reviewed your draft environment assessment report and suggests the placement of traffic signals at the intersection of Makaala Street and Railroad Avenue as well as Puinako Street and Railroad Avenue. This suggestion is based on speeding complaints along Railroad Avenue received by our department and we believe the addition of traffic signals would certainly slow the traffic in this area.

Thank you for the opportunity to provide input on this project which we feel will bring an added boost to the economy of East Hawaii.

Should there be any questions, please contact our S. Hilo District Commander, Captain Larry Weber, at 961-2214.

Sincerely,


LAWRENCE K. MAHUNA
POLICE CHIEF

JNS:lll



LAND PLANNING
LANDSCAPE ARCHITECTURE
INTERIOR DESIGN STUDIOS

WIL FRANK BLANDF. FASLA
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PETERSON

R. SUE DUNN, ASLA
FUTURE PROPERTY

RONALD E. CHAM, ASLA
ECONOMY PROPERTY

VINCE S. SAMPSON
PETERSON

JAMES LUNNAN, AICP
PETERSON
Hilo Office

CHRISTOPHER M. KALAMAK, AICP
SUNSHINE PROPERTY

THE SCHWELL, AICP
ALANSON

RENEE J. FROEL, ASLA
ALANSON

ELYN SHAW, ASLA
ALANSON

Professional Services
PBR Hawaii
Pacific Tower, Suite 650
1001 Bishop Street
Honolulu, Hawaii 96813
Tel: (808) 221-3633
Fax: (808) 221-1102
E-Mail: pbr@pbrhawaii.com

January 28, 2004

Chief Lawrence Mahuna
County of Hawaii
Police Department
349 Kapiolani Street
Hilo, Hawaii 96720-3998

SUBJECT: THE HOME DEPOT HILO DRAFT ENVIRONMENTAL ASSESSMENT (TMK 2-2-47:64 PORTION)

Dear Chief Mahuna:

Thank you for your letter dated December 3, 2003. We provide the following responses to your comments.

The traffic engineer for this project believes traffic signals would not be appropriate at the intersections of Railroad Avenue with Maka'ala Street and Pu'ainakō Street because: 1) traffic volumes would not warrant traffic signals, and 2) it is preferable to implement traffic calming measures to control speeding, rather than traffic signals.

Thank you for participating in the environmental review process.

Sincerely,



Tom Schnell, AICP
Associate

cc: Manny Nova/Department of Hawaiian Home Lands
Genevieve Salmons/Office of Environmental Quality Control
Diane Kodama/M&E Pacific

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DEC 23 2003



December 23, 2003

PBR Hawaii
Pacific Tower, Suite 650
1001 Blahop Street
Honolulu, Hawaii 96813
Attention: Mr. Tom Schnell

Gentlemen:

Subject: Home Depot Hilo
Draft Environmental Assessment
TMK: 2-2-47-64

Thank you for the opportunity to review the subject plans.

We do not have any objections to the EIS; however, have the following requirements and comments:

1. Section 4.2.7.5 Utilities - The project area is served from our Kanoolehuhua Substation, which is currently 80% loaded. Based on the maximum demand reading for Home Depot in Kona, the anticipated load for the facility is about 680 kW. Our Kanoolehuhua Substation and off-site distribution system are adequate to serve the project however, a primary line extension will be needed to connect to the Railroad Avenue 12,470 volt distribution system.
2. Distribution line easements must be granted to HELCO within the project on-site.
3. HELCO's current system peak load is 184,900 kW as of December 15, 2003 and our total generation system capability is 233,700 kW. Our reserve margin is 26% and has adequate generation to serve the project.
4. We strongly recommend that energy efficient and conservation features suitable to reduce the peak electrical demand are part of the development's plans. We recommend that this development take full advantage of waste heat recovery equipment to recycle and reuse the waste heat rejected by air conditioning and refrigeration equipment. If this equipment is incorporated in the development's original design, the amount of energy required will be substantially reduced.
5. The project consultants and engineers are urged to contact HELCO's Engineering Department as soon as practicable to open a service request to insure timely service to the project.

Should you have any questions, please contact me at (808) 969-0321 or Hal Kamigaki at (808) 969-0322.

Sincerely,

Clyde H. Nagata, P.E.
Manager, Engineering Department

CHN:HK:in
CC: H. Kamigaki
Tom Schnell (Facsimile 523-1402)



LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL SERVICES

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Victoria S. Sawa, ASLA
President

Lois L. Lumbard, AICP
President

HECO OFFICE

1610 KANOLEHUHUA AVENUE
KONA, HAWAII 96701

Tom Schnell, AICP
January 2003

Raymond T. Ihara, ASLA
3140/1111

Kenji Yamada, ASLA
1100/1111

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Fax: (808) 523-1402
E-mail: pbr@pbr.com

January 28, 2004

Mr. Clyde H. Nagata
Manager, Engineering Department
Hawaii Electric Light Company, Inc.
P.O. Box 1027
Hilo, Hawaii 96721-1027

SUBJECT: THE HOME DEPOT HILO DRAFT ENVIRONMENTAL ASSESSMENT (TMK 2-2-47-64 PORTION)

Dear Mr. Nagata:

Thank you for your letter dated December 23, 2003, regarding the Home Depot Hilo Draft Environmental Assessment (EA). We note that you have no objections to the EA. We provide the following responses to your comments:

1. Appropriate changes will be made in the Final EA to revise Section 4.2.7.5 Utilities to include the following:
 - The project area is served from the HELCO Kanoolehuhua Substation, which is currently eighty percent loaded.
 - The anticipated load for the facility is about 680 kW, based on the maximum demand reading for The Home Depot in Kona.
 - The Kanoolehuhua Substation and off-site distribution system are adequate to serve the project; however, a primary line extension will be required to connect to the Railroad Avenue 12,470-volt distribution system.
 - HELCO's current system peak load is 184,900 kW, as of December 15, 2003. Its total generation system capability is 233,700 kW and its reserve margin is twenty-six percent with adequate generation to serve the project.
2. The property owner, the Department of Hawaiian Home Lands, and the property lessee, The Home Depot, will be notified that distribution line easements must be granted to HELCO within the project on-site.
3. The Home Depot and the project engineer, M&E Pacific will be made aware that HELCO strongly recommends: 1) energy-efficient and conservation features suitable to reduce peak electrical demands; 2) waste heat recovery equipment to recycle and reuse the waste heat rejected by air conditioning and refrigeration equipment.
4. The project engineer, M&E Pacific, will contact HELCO's Engineering Department to open a service request to insure timely service to the project.

Mr. Clyde H. Nagata
Manager, Engineering Department
Subject: The Home Depot Hilo Draft Environmental Assessment (TMK 2-2-47-64 Portion)
January 28, 2004
Page 2

Thank you for participating in the environmental review process.

Sincerely,



Tom Schnell, AICP
Associate

cc: Manny Nova/Department of Hawaiian Home Lands
Genevieve Salmonson/Office of Environmental Quality Control
Diane Kodama/M&E Pacific

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RECEIVED

JAN 14 2004

PBR HAWAII

Barbara Bell
Director



County of Hawaii

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
25 Lunalilo Street, Room 218 • Hilo, Hawaii 96720-4252
(808) 941-2083 • Fax (808) 941-2084

Harry Kim
Mayor

January 12, 2004

Mr. Tom Schnell, AICP
Associate
PBR Hawaii
Pacific Tower, Suite 650
1001 Bishop Street
Honolulu, HI 96813

RE: HOME DEPOT HILO DRAFT ENVIRONMENTAL ASSESSMENT

Dear Mr. Schnell,

Enclosed are our comments relating to Solid Waste and Wastewater regarding the subject Draft Environmental Assessment.

Please contact me if you require further clarification.



Barbara Bell
DIRECTOR

cc: Planning Department
SWD
WWD

4/30



WASTEWATER DIVISION
 DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
 108 RAILROAD AVENUE - HILO, HAWAII 96720
 (808) 961-8318 - FAX (808) 961-6444

MEMORANDUM:

DATE: January 12, 2004
TO: Chris Yuen, Planning Director
FROM: Peter Boucher, Division Chief
SUBJECT: Draft Environmental Assessment (DEA)
 Project: The Home Depot, Hilo
 Applicant: Department of Hawaiian Homelands
 Tax Map Key: (3) 2-047:064 (por.)

Wastewater Division has reviewed the subject DEA and has the following comment(s):

- The estimated wastewater flows as identified in Section 4.2.7.3 and Appendix D were not calculated based on the design standards as required by Chapter 11-62-24(b) HAR. Prior to the County authorizing connection to the existing sewer on Makaala Street, the Wastewater Division will require approval of a preliminary engineering report prepared in accordance with the Design Standards of the City and County of Honolulu.
- The developer should be advised that the County is in the process of planning a sewer improvement district, which would potentially service the subject parcel.

Should you have any questions, please contact me at 961-8338.

cc: Barbara Bell, Director



DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
SOLID WASTE DIVISION
 COUNTY OF HAWAII - 108 RAILROAD AVENUE HILO, HI 96720
 HILO (808) 961-8319 WAIMEA (808) 947-3011 KONA (888) 373-307

MEMORANDUM:

DATE: JANUARY 1, 2004
TO: BARBARA BELL, DEM DIRECTOR
CC: BOBBY GONSALVES, SWD OPERATIONS SUPERINTENDENT
 EILEEN O'HORA-WEIR, SWD RECYCLING PROGRAM COORDINATOR
FROM: LONO TYSON, SWD CHIEF *LT*
SUBJECT: HOME DEPOT DRAFT ENVIRONMENTAL ASSESSMENT

I have reviewed the "Home Depot Hilo - Draft Environmental Assessment," prepared by PDR Hawaii, and dated November 23, 2003 relative to issues that may impact this division. The following comments are provided:

- 1) Commercial operations, such as the subject development project, are prohibited from utilizing the County of Hawaii Transfer Stations.
- 2) The site identified in the subject development area currently is overgrown with a substantial amount of trees, bushes, and shrubs. The quantity of green waste likely to be generated during construction will likely exceed the capabilities of the County's green waste recycling program. Additionally, the quantity of green waste observed at this site will consume limited landfill airspace available at the South Hilo Sanitary Landfill. In accordance with County of Hawaii Code, Chapter 20, Article 3, Section 20-43(c), I strongly recommend that this waste be prohibited for disposal at the South Hilo Sanitary Landfill. Aggregates and construction/demolition waste should be routed to its fullest extent.
- 3) Section 4.2.8 of the subject document states that "solid waste generated will be disposed of at a County approved landfill" but does not specify which "County approved landfill" or by what means (i.e. self-haul, private hauler). I recommend that this information be provided, as it is likely that this project will generate significant quantities of waste into the future.
- 4) Section 4.2.8 of the subject document states that "Where practical, the Home Depot will recycle wastes such as cardboard and other packaging materials." As diversion of waste from the County's landfills is a top priority for the Department, we encourage Home Depot to incorporate recycling facilities (i.e. collection facilities) during the facility's planning stage. Additionally, Home Depot could realize reduced operating costs and significantly reduce this island's recycling costs by teaming with local recycling firms to "back-haul" cardboard/other recyclables via Home Depot shipping containers.
- 5) Section 4.2.10 states that "car batteries observed onsite be removed and disposed of properly and that if any staining is observed during removal of the batteries, that soil be excavated and properly disposed of at the time of development." Car batteries and contaminated soil present threats to landfill worker health and safety and are prohibited for disposal at County solid waste management facilities. I recommend that the project sponsor contact the State of Hawaii Department of Health's Solid and Hazardous Waste Branch relative to appropriate disposal options for these materials.

Memorandum



DATE: December 18, 2003
TO: Dora Beck, P.E.
 WWD Civil Engineer
FROM: Diana Kodama
SUBJECT: Home Depot - Hilo
COPIES: Harold Sugiyama, M&E Pacific - Hilo

In response to your memo dated November 18, 2003, we have the following:

- As discussed over the phone, our intent in the Preliminary Wastewater Engineering Report that we submitted, was to provide a more realistic flow for the store. We provided 3 methods of calculating average flow and then proceeded to use the City & County of Honolulu Wastewater standards to calculate the peak flow. The average flows calculated in each method had similar results and the highest of the 3 was used.
 The City & County standards base the flows on capita per acre and does not allow for large box stores with large parking areas. Attached is a sewer calculation for the proposed store using 40 capita per acre and 80 gallons per capita per day. The average flow is about 10 times the amount in the Preliminary Wastewater Engineering Report which we feel does not realistically depict the store.
- We will add the Dry W/I.
- We will use a minimum pipe size of 8 inches.
- We understand that 0.0060 is the minimum for 6" dia. pipe and 0.0044 for 8" dia. pipe.

Should you have any questions, please call me at 521-3051.

Sewer Flow Calculations

Project Title: Home Depot Hilo (P0000)
Location: Wahiawa, South Hilo, Hawaii
Item: SEWER FLOW CALCULATIONS
Prepared By: LDN
Checked By: DYK
Date: 12/17/2003
Date: 12/18/2003

- I. PURPOSE:** The objective of these calculations is to find the average & peak flows of a future Home Depot Store & Garden Center in Wahiawa, South Hilo, Hawaii.
- II. REFERENCE:** A. Design Standards, Volume 1, General Requirements for Wastewater Facilities, Design of Sewers and Pump Stations, Department of Wastewater Management, City & County of Honolulu, State of Hawaii, July 1992.
- III. CRITERIA:** A. Following the Design of Sewers in the Design Standards, Volume 1, General Requirements for Wastewater Facilities, Design of Sewers and Pump Stations, Department of Wastewater Management a basis of 40 capita per acre for neighborhood business and an average per capita flow of 80 gallons per day were used. The sewers are laid above the normal groundwater table, therefore in calculating the dry and wet weather infiltration/flow, 5 gallon per capita per day and 1250 gallon per acre per day were applied respectively.

IV. CALCULATIONS:

Average Daily Per Capita Flow
 40 capta per acre x 12.2 acres x 80 gallons per capita per day (gpcd)
 400,000 gallons per day (gpd)
 400,000 gpd / 1,440 minutes per day (min)
 278 gpm

Maximum Flow
 Max Flow = Avg. Flow x Flow Factor
 Max Flow = 0.009 x 8
 Max Flow = 0.185 mgd

Dry Weather Infiltration/Flow (DI)
 Dry W/I = 5 gpcd x 40 capta per acre x 12.2 acres
 Dry W/I = 2440 gpd
 Dry W/I = 0.00244 mgd

Design Average Flow
 Design Avg. Flow = Avg. Flow + Dry W/I
 Design Avg. Flow = 0.009 + 0.00244
 Design Avg. Flow = 0.01144 mgd

Design Maximum Flow
 Design Max. Flow = Max. Flow + Dry W/I
 Design Max. Flow = 0.188 mgd + 0.00244 mgd
 Design Max. Flow = 0.19744 mgd

Wet Weather Infiltration/Flow (WI)
 Wet W/I = 1250 gallon per acre per day (gpcd) x 12.2 acres
 Wet W/I = 15,250 gpd
 Wet W/I = 0.01525 mgd

Design Peak Flow
 Design Peak Flow = Design Max. Flow + Wet W/I
 Design Peak Flow = 0.19744 mgd + 0.01525 mgd
 Design Peak Flow = 0.21269 mgd

V. SUMMARY:

Design Average Flow = 0.01144 mgd = 0.00218 cfs
 Design Peak Flow = 0.21269 mgd = 0.31603 cfs



Appendix A

Archaeological Inventory Survey

Report 300-101003

ARCHAEOLOGICAL INVENTORY SURVEY
DHHL HOME DEPOT SITE AT PANAEWA
LAND OF WAIKAE, SOUTH HILO DISTRICT
ISLAND OF HAWAII (TMK: 2-2-47:POR. 64)

ARCHAEOLOGICAL INVENTORY SURVEY
DHHL HOME DEPOT SITE AT PANAEWA
LAND OF WAIKAE, SOUTH HILO DISTRICT
ISLAND OF HAWAII (TMK: 2-2-47:POR. 64)

By:
Alan E. Haun, Ph.D.
and
Dave Henry, B.S.

Prepared for:
PBR Hawaii
1001 Bishop Street
Pacific Tower, Suite 650
Honolulu, Hawaii 96813-3484

November 2003

Haun & Associates
Archaeological, Cultural, and Historical Resource Management Services
HCR 1 Box 4730, Keau, Hawaii 96749 Phone: 982-7755 Fax: 982-6343

Haun & Associates
Archaeological, Cultural, and Historical Resource Management Services
HCR 1 Box 4730, Keau, Hawaii 96749 Phone: 982-7755 Fax: 982-6343

SUMMARY

At the request of PBR Hawaii, on behalf of their client, the Department of Hawaiian Home Lands (DHHL) Haun & Associates conducted an archaeological inventory survey of the DHHL Home Depot Site at Paiehoa, a c. 11-acre parcel located in the Land of Waialea, South Hilo District, Island of Hawaii (TMK: 2-2-47:Por. 64). The objective of the survey was to satisfy historic preservation regulatory review inventory requirements of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD), as contained within Hawaii Administrative Rules, Title 13, DLNR, Subtitle 13, State Historic Preservation Rules.

No archaeological sites or features were identified during the survey. The parcel has been significantly impacted by bulldozing activity evidenced by a series of linear bulldozer cuts and possible berms, and secondary growth vegetation consisting predominantly of small grasses and *kau*. There are no historic sites on the property and given the extent of prior earthmoving the potential for buried cultural deposits is very unlikely. No further archaeological work is recommended for the property.

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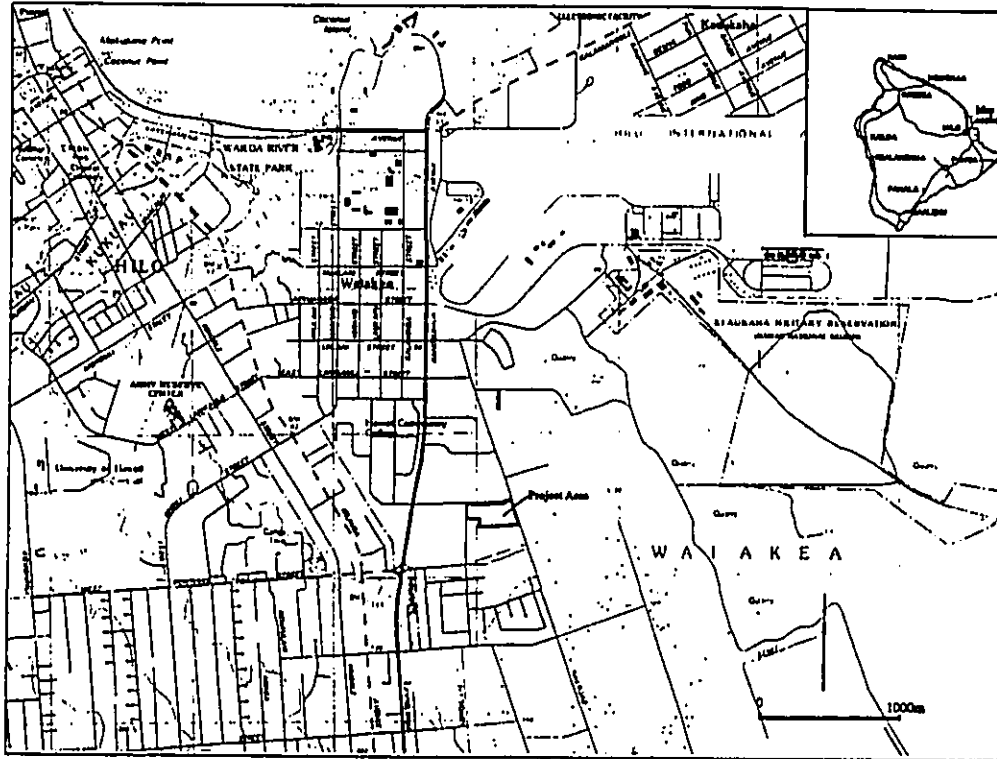


Figure 1. Portion of USGS Hilo Quadrangle showing Project Area

INTRODUCTION

At the request of PBR Hawaii, on behalf of their client, the Department of Hawaiian Home Lands (DHHL) Haun & Associates conducted an archaeological inventory survey of the DHHL Home Depot Site at Panewa, a c. 11-acre parcel located in the Land of Waiakea, South Hilo District, Island of Hawaii (TMK: 2-2-47:For. 64; Figure 1). The objective of the survey was to satisfy historic preservation regulatory review inventory requirements of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD), as contained within Hawaii Administrative Rules, Title 13, DLNR, Subtitle 13, State Historic Preservation Rules.

The survey fieldwork was conducted on October 8, 2003, under the direction of Dr. Alan Haun. Described in this final report are the project scope of work, field methods, background information, and survey findings.

Scope of Work

Based on DLNR-SHPD rules for inventory surveys, the following specific tasks were determined to constitute an appropriate scope of work for the project:

1. Conduct background review and research of existing archaeological and historical documentary literature relating to the project area and its immediate vicinity—including examination of Land Commission Awards, *ahupua'a* records, historic maps, archival materials, archaeological reports, and other historical sources;
2. Conduct a high intensity, 100% pedestrian survey coverage of the project area;
3. Conduct detailed recording of all potentially significant sites including sealed plan drawings, written descriptions, and photographs, as appropriate;
4. Conduct limited subsurface testing (manual excavation) at selected sites (a) to determine the presence or absence of potentially significant buried cultural deposits or features, and (b) to obtain suitable samples for radiocarbon age determination analyses;
5. Analyze background research and field data; and
6. Prepare and submit Final Report.

Project Area Description

The project area consists of a c. 11-acre, irregularly-shaped parcel located in the Land of Waiakea, South Hilo District, Island of Hawaii. The parcel is bordered on the north by Malakua Street, on the east by Railroad Avenue, on the west by Ohuohu Street and a parking lot and on the south by undeveloped land. The project area ranges in elevation from 95 ft to 100ft.

The project area has been extensively disturbed by recent and previous clearing activity (Figures 2 and 3). The parcel has been truncated by a series of east-west bulldozer swaths and associated linear berms of stones and soil. Vegetation in areas not recently disturbed consists of secondary growth species dominated by guava (*Psidium cattleianum* Sabine), *koa* (*Hibiscus macrophyllus* Roxb.), and ferns and vines, with scattered papaya (*Carica papaya* L.), pandanus (*Pandanus odoratissimus* L. f.), *koa hooke* (*Leucaena leucocephala* [Lam] de Wit), *maile hohono* (*Geranium conzoides* L.) and *olia liliua* (*Metrosideros colina*). The majority of the trees in the parcel are small, averaging 2" to 3" in diameter, although a few larger trees are present. Examples of the vegetation in the parcel are illustrated in Figures 2 and 3.



Figure 2. Project Area Overview, view to east



Figure 3. Project Area Overview, view to west

The soil within the project area is comprised of Papai extremely stony muck, on 3-25 % slopes (Sato et al. 1973:46). This soil is typified by a thin, very brown, well-drained, very stony organic soil over fragmented a'a lava. It has a rapid permeability, a slow runoff and a slight erosional hazard. Sato et al. indicate that this soil is most commonly used for woodland.

Field Methods

The project area was subjected to a 100% surface examination with surveyors spaced at 5-10 m intervals. Transects were oriented in a roughly east-direction parallel to Makaala Street. Ground surface visibility was good and the fieldwork was completed by three archaeologists in less than one day. No archaeological sites or features were identified during the study.

ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

Historical Documentary Research

The project area is situated in the *ahupua'a* of Waialea in South Hilo District. The *ahupua'a* is one of the largest in the district covering over 95,000 acres. The *ahupua'a* extends along the coast from the west side of Hilo Bay to the Puna District boundary and inland to approximately 6,000 ft. elevation. Much of the following is summarized from *Hilo Bay: A Chronological History* (Kelly et al. 1981), an extensive and thorough compendium of historical information about Hilo including Waialea.

Hawaiian traditional and legendary accounts attest to the longstanding importance of Waialea. The chief of the *Wao* region, *Kū'ūhū'ū*, who resided in Waialea, was the first conqueror of *Umi-a-Lihoa* in his campaign to unify the districts of Hawaii Island. Hilo with its large bay, fishponds, wet taro fields, and abundant freshwater was a population center for commoners and royalty. *Kamehameha I* and his court resided in Hilo in the 1790s. In preparation for his planned invasion of Kaula in 1802, *Kamehameha* built a canoe fleet at Hilo, reportedly consisting of 800 vessels. *Kamehameha* gave his favorite wife, *Kā'ahumanu*, the *hi'āpoo* of *Pi'opi'o* in Waialea.

Early historic accounts also document the importance of Hilo. In 1823, *Ellis* estimated the population to be 2,000 people in 400 houses. *Ellis* described the extensive use of *lanohalo* thatch in house construction in Hilo. *Laubala* was gathered from eastern Waialea beyond the *Waioa* River. He described the land as intensively cultivated with plantains, bananas, sugar cane, taro, potatoes, melons, coconuts, and breadfruit. Wet taro was grown in mounds (*lipi*) in marshlands. Hilo was a center for trade between the people of *Ka'u*, *Hamakua*, and Hilo. Between the 1790s and 1820s, sandalwood was cut and brought to Hilo for export. *Pulu* and *pia* (arrowroot) were also exported. *Ellis* also describes coastal fishing.

In 1824, a missionary station was established in Waialea. Soon after, churches and schools were established. Whalers began stopping at Hilo in the mid-1820s. In the 1830s, a sawmill was built, and two stores were opened. By the end of the decade, a sugar cane plantation and mill were established on Puna-hawai lands. In 1840, the *Wilkes Expedition* arrived in Hilo and constructed an observatory on Waialea Point on the east side of Hilo Bay.

The *Waioana 'Aina* database (2000) lists 51 parcels claimed by 37 claimants within Waialea in the mid-1800s (*Table 1*). All claims are for parcels situated to the northwest and west of the project area along the coast and immediately inland along the lower reaches of the *Waioa* River less than 0.5 mi inland (*Figure 4*). Twenty-six parcels were awarded to 24 claimants. *Chiefess Kamamalu* was awarded the entire *hi'āpoo* of *Pi'opi'o* under Land Commission Award (LCA) No. 7713. The remaining claims are for *kūleana* parcels ranging from 0.24 to 13.14 acres in area with an average of 3.6 acres. All, except five claims, were for single parcels. The testimonies for several awarded *kūleana* include claims for parcels that were not awarded.

The claim testimonies refer to 18 *hi'āpoo* land divisions. Five *hi'āpoo*, *Kalonoho*, *Alenoho*, *Kolea*, *Pi'opi'o* and *Peeahui*, are mentioned two or more times and apparently were linear strips of land extending inland

from the coast. *Ili* Kalooboo was situated next to the western *ahupua'a* boundary with Kukuau. Alerohoo was the next *ili* to the east followed by Koles, Pi'opi'o and Pweahoo. The latter two *ili* bordered the west bank of Waioa River and Fishpond. Six *ili* for LCAs on the east side of the river, from the river mouth inland, consist of Kamakola, Keawe Kapu, Kialoa, Hinanauwal, Puhua, and Kamahana. Kallihii was situated inland between Alerohoo and Koles. The geographic location of the remaining *ili* cannot be determined because they are mentioned in testimony for claims that were not awarded.

Land use described in the LCA claim testimony included agriculture, pasture, burial, and residence. Thirty-four houses are mentioned and LCA 2274 also describes the presence of a grave. Most of the claim testimony mentions cultivated fields. Crops include wet taro, sweet potatoes, breadfruit, coffee, and *hala* (*Pandanus* spp.) grove and fishponds are also mentioned.

By 1857, there were three sugar cane mills in the Hilo area. Large tracts of land were put in the cane cultivation and sugar cane was also grown by individuals around their houses. In 1861, a stone wharf was constructed at Waiakea landing on the west side of Waiakea Point. A sugar mill was established in Waiakea at the inland end of Waiakea Fishpond in the late 1870s. A railroad transport system was constructed for the Waiakea Mill between 1879 and 1880. By 1880, 1,400 acres of sugar cane were in cultivation and by the end of the decade over 5,600 acres were cultivated. In 1877, a 16 ft high tsunami struck the coast of Waiakea destroying all houses within 100 yards of the shore along with a wharf, storehouse, a quarantine hospital on Coconut Island, and a bridge.

Between the 1860s and 1880s there were two wharf facilities on the west side of Waiakea Point, one on the Waioa River, and on the west side of the bay at the foot of Waiamue Street. By the 1890s, the need for improved wharf facilities was recognized and the development of government harbor facilities began on the west side of Waiakea Point. A ship wharf was completed in 1899.

Between 1900 and the 1930s, the population of Hilo grew dramatically with the expansion of sugar cane cultivation, pineapple production, the timber industry, and other commercial developments. In the 1910s, the Hilo Railroad Company expanded the rail system to Puna and Hilo Town. A railroad wharf was built north of the mouth of the Waioa River. Between 1909 and 1913, the railroad was extended to North Hilo and Hamakua Districts.

The pending opening of the Panama Canal and anticipated increase in trans-Pacific shipping led to serious efforts to build a breakwater to protect shipping in Hilo Bay. Construction of the breakwater began in 1908. The breakwater was initially planned for a location just east of Coconut Island, but the plan was modified and the selected site was approximately 6,000 ft east of the island. The initial plans called for a 10,000 ft long breakwater along Blonde Reef. Stone for the structure was brought by railroad from quarries in Puna and Waiakea. The breakwater was completed in 1929.

By the 1910s, the existing railroad and government wharf facilities were inadequate to support shipping. In 1912, the Territorial Government contracted the construction of a new wharf approximately one mile east of Coconut Island and the dredging of the adjacent portion of the bay. The new wharf, designated Kuloa Wharf, was completed in 1916. From the beginning, the wharf was congested and plans for a second wharf were made. Construction of the wharf began in 1921 and it was completed in 1923. A third wharf was completed in 1927.

The following discussion of the development of the Hilo airport is summarized from Kelly et al. (1981) and Hinman and Bush (2000). In 1925, 100 acres were designated as the site for the Hilo Airport and \$10,000.00 was appropriated for its construction using prison labor. A 33-acre portion of the land came from an adjacent 216-acre parcel that was dedicated in 1914 for a National Guard of Hawaii rifle range. Progress on the facility was slow because the appropriation did not include funds for equipment. This was resolved in 1927 when an additional \$25,000.00 was appropriated. Much of the area had to be filled from Hilo Bay during construction of the new port facility. In 1928, the airport lands were increased by 41.45 ac to accommodate modification of the runway orientation relative to the prevailing trade winds. The airport was dedicated in February 1928. An additional 86 acres was added to the facility in 1929 to accom-

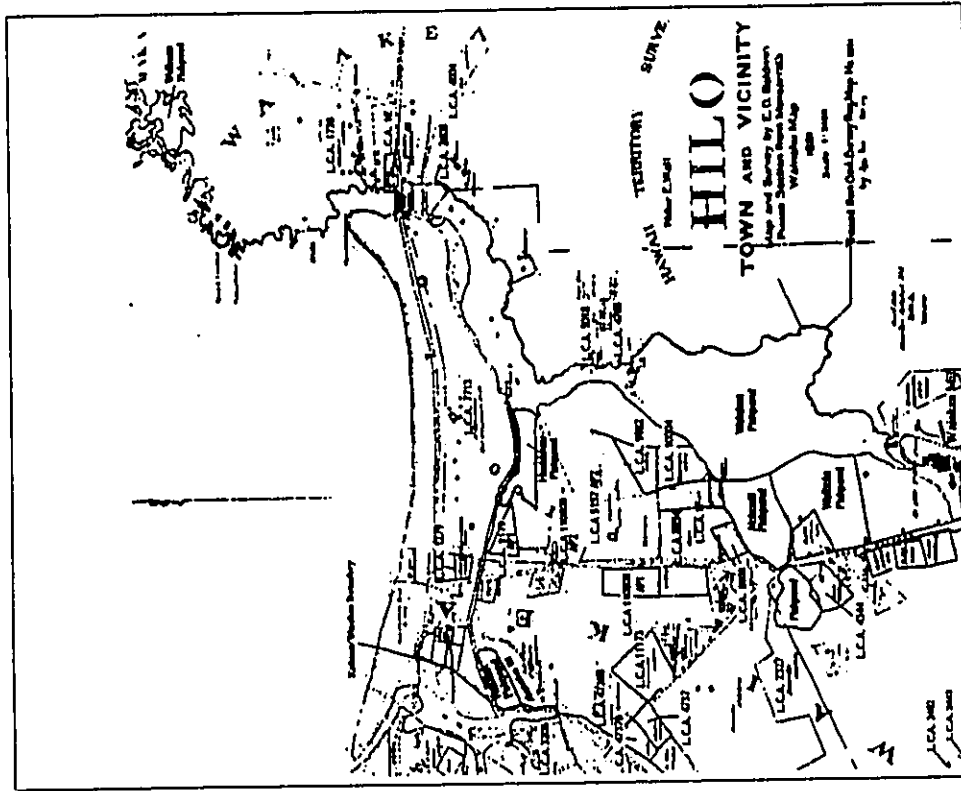
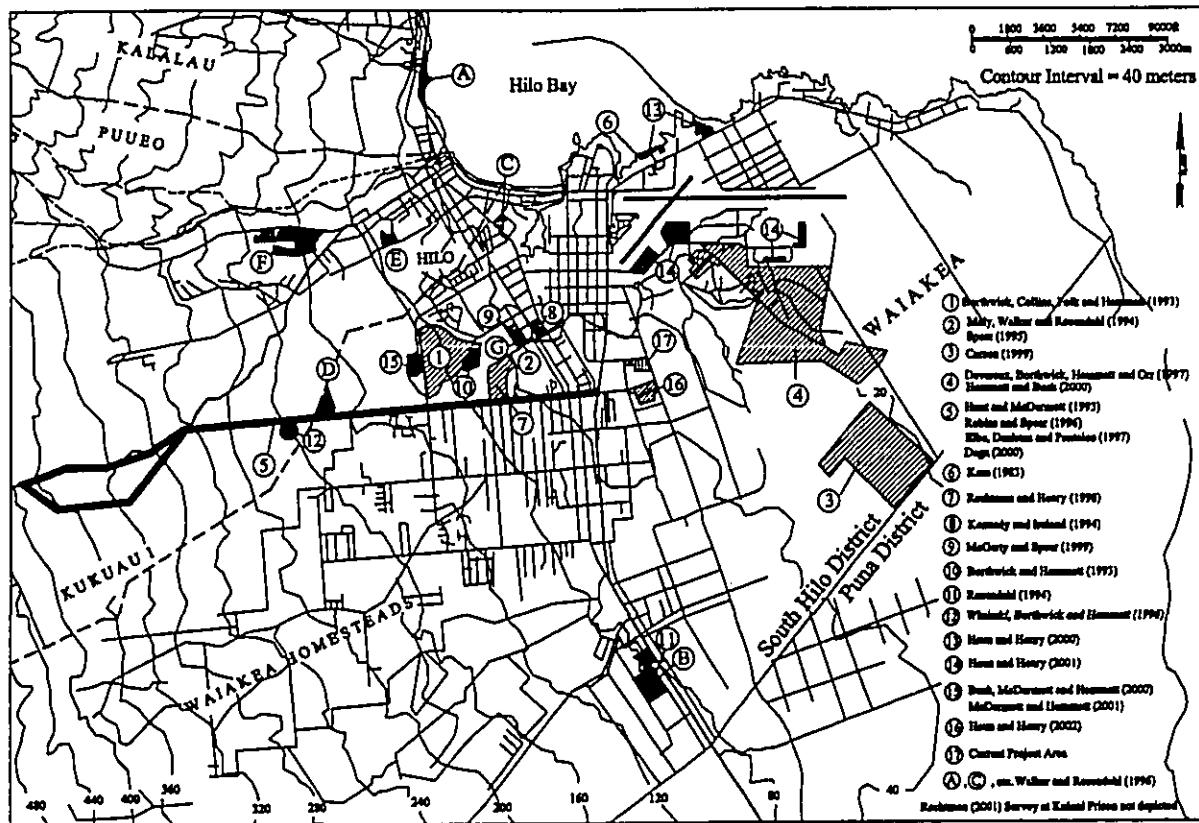


Figure 4. Portion of 1891 Map of Hilo (Modified from Kelly et al. 1981)



moderate further expansion. In October 1929, Inter-Island Airways, Ltd. began regular scheduled service between Hilo and Honolulu with three trips per week.

The airport was further expanded in the 1930s including the construction of a cross-wind runway, hangar, and a terminal building. Additional runways and taxiways were also completed. The expansion included portions of the adjacent Kaunakā Hawaiian Home Commission settlement where 30 homes were either demolished or relocated. In 1938, the National Guard facility, Kaunakā Military Reservation (KMR), provided additional lands for a temporary camp to house prison laborers working on the airport facilities. Following the outbreak of World War II, control of the airport and the Hawaii Army National Guard facilities was transferred to the U.S. Army, and further airport expansion occurred. The Hilo Airport was renamed General Lyman Field in 1943 in memory of General Albert Lyman. Lyman was a Hilo native, who served as the chief engineer for the U.S. Army Corps of Engineers Hawaiian Department. He died two days after President Roosevelt nominated him for promotion general.

In 1943 the Hilo Naval Air Station was authorized and facilities construction began beside the existing Hilo Army Air Base. The Naval Air Station facilities were completed in 1945. The station was placed on caretaker status shortly after World War II ended. The 7th Army Air Force was assigned to General Lyman Field in 1946 to support Air Force bases on Oahu. In 1947, the Hawaii National Guard was reactivated and obtained use of KMR facilities.

The airport was returned to civilian control in 1952. A new, \$600,000.00 airport facility was dedicated in 1958 and 92 additional acres of Hawaiian Home Commission land were set aside for airport expansion. In 1963, another 193 acres of Commission land was acquired through a land exchange. In the late 1960s, funds were allocated to expand the airport to accommodate jet planes. A new terminal and expanded airfield were dedicated in May 1976. By 1980, the Hilo Airport Division of the Hawaii Department of Transportation controlled 1,339 acres.

In summary, historical documentary research indicates that the coastal portion of Waiakea fronting Hilo Bay was intensively settled and cultivated. The area was an important political and economic center. The coast to the east of the bay was used for fishing and gathering *ʻāwaka* for fish. At least seven fishponds were present surrounded by residences, wet taro plots, and gardens cultivated with plantains, bananas, sugar cane, dryland taro, sweet potatoes, arrowroot, coconuts, and breadfruit.

In the early 1800s, missionaries established a mission station at Hilo because of its large population, abundant freshwater, and cultivation potential. Soon churches and schools were established. Whalers stopped at Hilo because of the protected anchorage and availability of freshwater and provisions. Sugar cane cultivation, cattle ranching, and trade in *pulu*, arrowroot, and sandalwood rapidly changed the traditional subsistence economy during the early to mid-1800s.

By the late 1800s, vast areas were in sugar cane production and large scale timber harvesting was underway. Transportation infrastructure including a railroad system and wharf facilities were established. The area underwent a dramatic increase in population as people came to the area to work for the plantations and other commercial developments. Between 1925 and 1976, the airport facilities, which surrounded the present survey areas, were developed.

Previous Archaeological Research

A search of the DLNR-SHPD archaeological report database and other sources identified 24 archaeological projects in Waiakea. Figure 5 shows the project locations and Table 7 summarizes the projects. Not included in the figure or table are the studies by Stokes and Dye (1991), which focused on major sites, primarily *heiau* throughout Hawaii Island, a survey of east Hawaii by Hudson (1932), the fishpond study of Kihuchi (1973), and the general, primarily archival, studies of McEldowney (1979) and Moniz (n.d.). None of the previous studies included the current project area. Stokes (Stokes and Dye 1991), relying in part on the earlier observations of Thurum, listed six *heiau* for the Hilo area; however, all were

destroyed at the time of Stokes fieldwork in 1906. Ohele Heiau, a *luakini* temple, was reported for Wai-
 akea.

The surveys in Table 2 cover over 1,600 acres of Waiakea between sea level and 5,100 ft elevation. The only traditional Hawaiian sites identified in the vicinity of the project area are an agricultural pit, the Puna Trail, and five *ahu* reported by Hammett and Bush (2000), a sinkhole containing a human burial identified by Bush et al. (2000), and a terraced depression and associated low wall identified by Haun and Henry (2001). Hammett and Bush attribute the absence of traditional sites to the massive ground disturbance of sugar cane cultivation and commercial and residential development of the Hilo area. Historic remains identified by the surveys consist of thirty-eight sites with over 350 features. Nearly all of the identified features are the result of stone clearing for sugar cane cultivation.

McEloway (1979) lists 53 traditional Hawaiian sites for Waiakea and 31 historic sites, primarily buildings. Most of the traditional sites were located by Hudson (1932) and Kikuchi (1973). The remaining six were identified during the Statewide Inventory. Nearly all were situated along the coast. The sites include 17 fishponds, seven burials, six platforms, five enclosures, three *heiau* including one previously identified by Stokes, three house foundations, three trail segments, two shrines, several miscellaneous features, and two complexes of platforms, enclosures, and terraces.

McEloway used the limited site inventory and historic documentary evidence to develop a land use and settlement pattern model for the Hilo area. The model consists of five elevationally-defined zones: Coastal Settlement, Upland Agricultural, Lower Forest, Rainforest, and Sub-Alpine or Montane. The Coastal Settlement Zone extended approximately 0.5 miles inland from the shoreline between sea level and 50 ft elevation. The zone was the most densely populated with both permanent and temporary habitations, high status chiefly residences, and *heiau*. Settlements were concentrated at Hilo Bay and sheltered bays and coves. Also present were fishponds and gardens where breadfruit, coconut, *kuku*, banana, *wauke*, sugar cane, sweet potato, and wet and dryland taro were cultivated. The ocean provided fish and other marine resources.

The Upland Agricultural Zone was situated between approximately 50 ft and 1,500 ft elevation. Settlement in the zone consisted of scattered residences among economically beneficial trees and agricultural plots of dryland taro and bananas. Lava tubes were utilized for shelter. A pattern of shifting cultivation is believed to have converted the original forest cover to parkland of grass and scattered groves of trees. Wetland cultivation of taro occurred along streams.

The Lower Forest Zone ranged from 1,500 ft to 2,500 ft elevation. Timber and other forest resources such as medicinal plants, *olona*, and birds were gathered from the zone. Site types consisted of temporary habitations, trails, shrines, and minor agricultural features in forest clearings and along streams. Sites in the Rainforest Zone (2,500-5,000 ft elevation) and Subalpine or Montane Zone (5,000-9,000 ft) were limited to trails and associated temporary habitations. These zones were used for intra-island travel and gathering of valued resources including hardwoods, birds, and stone for tool making.

PROJECT EXPECTATIONS

Prehistoric to early historic use of the project area was probably limited because the focus of settlement was along the coast and the lower reaches of the Waioa River. The project area is situated at the lower extent of McEloway's (1979) Upland Agricultural Zone that is characterized by scattered residences among agricultural plots and lava tubes used for shelter and burial. Historic use may have included sugar cane cultivation and cattle ranching.

Table 2. Summary of Previous Archaeological Research

Author(s)	Date	Study Type*	Elevation	Acres	Historic Use	No of sites	No of Fees	Traditional Features	Historic Features
Kam	1983	AR	0-5	0.5	None	1	1	<i>heiau</i>	
Borthwick, Collins, Folk and Hammett	1993	IN	140-330	183	Sugar cane	4	47		47
Borthwick and Hammett	1993	IN	120-140	11	Sugar cane	-	4		4
Maly, Walker and Rosendahl	1994	IN	70-80	4.5	Sugar cane	4	51		51
Spear	1995	DR	70-80		Sugar cane				
Walker and Rosendahl	1996	FI	0-480	129.6	Sugar cane/ developed	5	?		1
Rosendahl	1994	FI	250-290	11	?	1	1		
Kennedy and Ireland	1994	RN	70-80	8	?	0			
Hunt and McDermott/Elbe, Denham and Pantaleo	1993/ 1997	IN/EX	200-1500	106	Sugar cane	11	88		88
Robins and Spear	1996	IN	200-1500	264	Sugar cane	3	18		18
Dega	2000	IN	900-1000	36.3	Sugarcane	1	8		8
Winiarski, Borthwick and Hammett	1996	IN	450-500	5.23	?	0			
Devereux, Borthwick, Hammett and Orr/Hammett and Bush	1997/ 2000	RN/IN	40-80	503.6	Military	4	8	Pt, 5 <i>ahu</i> , and Puna Trail	3
Rechtman and Henry	1998	IN	120-205	40	Sugar cane	1	117		117
Carson	1999	IN	98-131	178	?	0			
McGerty and Spear	1999	IN	70	2.5	Sugar cane	1	13		13
Haun and Henry	2000	IN	0-15	20	Port	1	4		4
Haun and Henry	2001	IN	35-40	65.9	Ranching/Air Field	4	5	Terraced depression and wall	1
Bush, McDermott and Hammett/ McDermott and Hammett	2000/ 2001	IN	300-360	20	Sugarcane	1	1	Sinkhole w/burial	
Rechtman	2001	IN	5000-5100	5	Ranching	0			
Haun and Henry	2002	IN	85-100	28	?	0			
				Total		42	366	11	355

* AR=Archival Research, RN=Reconnaissance Survey, IN=Inventory Survey, DR=Data Recovery, EX=Excavation

FINDINGS

No archaeological sites or features were identified during the survey. The parcel has been extensively disturbed by at least two episodes of earthmoving activity, a recent one evidenced by minimally vegetated linear bulldozer cuts and berms of soil and stone, and an earlier episode represented by secondary growth vegetation consisting predominantly of small grasses and ferns, and by tracked machinery scars on loose stones and outcrops in areas not disturbed recently. Given the extent of prior disturbance and the near absence of soil the potential for buried cultural deposits is very unlikely. No further archaeological work is recommended for the property based on the survey findings.

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Appendix B

Faunal Survey

A Survey of Avian and Terrestrial Mammalian
Species on the Proposed Home Depot Site,
South Hilo District, Hawai'i.

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Introduction

This report summarizes the findings of a two day ornithological and mammalian survey of a portion of TMK 2-2-47: Parcel 64, located in Hilo, Hawaii. The lot surveyed is being considered as a site on which to construct a Home Depot store. The site is bound to the north by Maka'ala Street, to the east by Railroad Avenue and to the west by the Ohu'ohu Street Extension - the existing Prince Kūhiō Plaza employee parking lot borders the southwest end of the lot (Figure 1). Fieldwork was conducted on September the 7th and 8th 2003.

The primary purpose of the survey was to determine if there were any federally listed endangered, threatened, proposed, or candidate avian or mammalian species on, or in the immediate vicinity of, the proposed project site. In addition, we were asked to assess the probability of any use of the site by listed species, given the habitat present on the property.

Avian phylogenetic order and nomenclature follows *The American Ornithologists' Union Checklist of North American Birds 7th Edition* (American Ornithologists' Union 1998) and the 42nd, 43rd and 44th supplements to *Check-list of North American Birds* (American Ornithologists' Union 2000; Banks et al. 2002, 2003). Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Plant names follow *Manual of the Flowering Plants of Hawaii* (Wagner et al. 1990). Place names follow *Place Names of Hawaii* (Pukui et al. 1974).

General Site Description

The project site covers approximately 12.4 acres of a partially forested lot located in Waiākea, South Hilo District, Island of Hawaii. The area surveyed is almost level, with a mean elevation of ~ 80-feet above mean sea level (USGS 1995). The site is bound to the north by Maka'ala Street, to the east by Railroad Avenue and to the west by the Ohu'ohu Street Extension - the existing paved Prince Kūhiō Plaza employee parking lot borders the southwest end of the lot (Figure 1). The terrain within the project site is composed of a'a lava flows formed by Mauna Loa during the Holocene Epoch, dating back some 1470 years (USGS 1995; Wolfe and Morris 1996).

Approximately 75-80% of the vegetation on the site has recently been cleared - there are numerous bulldozed swatches running the length of the property. There are a number of scrubby 'ōhi'a (*Metrosideros polymorpha*) trees amongst the remaining vegetation, however the majority of the vegetation is comprised of alien (i.e., introduced to Hawaii by humans), species, including, but not limited to the following species: strawberry guava (*Psidium cattleianum*), common guava (*Psidium guajava*), Christmasberry (*Schinus terebinthifolius*), octopus tree (*Schefflera actinophylla*), African tulip (*Spathodea campamulata*), and numerous alien weedy and grass species, including *Clidemia*

Avian diversity was low. Two species, Japanese White-eye (*Zosterops japonicus*) and Zebra Dove (*Geopelia striata*) accounted for 58% of the total number of all birds recorded during station counts. An average of 34 birds were recorded per station count. No additional species were detected as incidental observations while transiting the site.

Table 1

Avian Species Detected During Station Counts Home Depot - Hilo Site		
Common Name	Scientific Name	ST RA
HA WKS - Accipitridae		
Hawaiian Hawk ('Io)	<i>Buteo solitarius</i>	EE 0.20
PIGEONS & DOVES - Columbidae		
Spotted Dove	<i>Siretopelia chinensis</i>	A 3.60
Zebra Dove	<i>Geopelia striata</i>	A 6.80
BABBLERS - Timaliidae		
Hwamei	<i>Garrulax canorus</i>	A 1.20
SILVEREYES - Zosteropidae		
Japanese White-Eye	<i>Zosterops japonicus</i>	A 12.80
STARLINGS - Sturnidae		
Common Myna	<i>Acridotheres tristis</i>	A 2.00
CARDULINE FINCHES & ALLIES - Fringillidae		
House Finch	<i>Carpodacus mexicanus frontalis</i>	A 5.20
SALTATORS, CARDINALS & ALLIES - Cardinalidae		
Northern Cardinal	<i>Cardinalis cardinalis</i>	A 1.40
ESTRILDID FINCHES		
Java Sparrow	<i>Padda oryzivora</i>	A 0.60

KEY TO TABLE 1

ST Status
 EE Endangered Endemic (i.e., native and unique to Hawai'i) Species
 A Alien (i.e., introduced to the Hawaiian Islands by humans) Species
 RA Relative Abundance = number of birds detected divided by number of stations counted (5)

Discussion

A one-time survey can not provide a total picture of the wildlife utilizing any given area. Certain species will not be detected for one reason or another. Seasonal variations in populations coupled with seasonal usage and availability of resources will cause different usage patterns throughout a year or, in fact, over a number of years.

The findings of the mammalian survey are consistent with the results of other surveys conducted within the lowland areas of South Hilo within the recent past (David 1996, 1998a, 1998b, 1998c, 2001a, 2001c, 2003a, 2003b). Although no Hawaiian hoary bats were recorded during the course of the survey, it is likely that bats do use resources within the general area. Bats are regularly seen in and around Hilo, as well as along the coastline from Puna to North Hilo (David 1992, 1995, 1996, 1997, 1998 a, 1998b, 1998c, 1999a, 1999b, 2000, 2001a, 2001c, 2003a, 2003b, Cooper and David 1995, Menard 2001).

Unlike nocturnally flying seabirds, which often collide with man-made structures, bats are uniquely adapted to avoid collision with obstacles, man-made and natural. They navigate and locate their prey using ultrasonic echolocation, which is sensitive enough to allow them to locate and capture small insect prey at night.

Although no rodents were detected during the course of this survey, it is likely that roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*) use various resources found within the project site. Without conducting a trapping program, it is difficult to assess the population densities of these often hard-to-see mammals.

The findings of the avian survey are consistent with the findings of other recent surveys conducted within the lowland areas of South Hilo (David 1996, 1998a, 1998b, 1998c, 2001a, 2001b, 2001c, 2003a, 2003b). The fact the vegetation on the site was partially cleared prior to the onset of this survey likely resulted in fewer avian species and certainly many individuals birds no longer being present on the site.

That we recorded an endangered Hawaiian Hawk over-flying the site was not unexpected. This species is readily seen in and around Hilo (David 1996, 1998b, 2001a, 2001b, 2002a, 2003a, 2003b, Klaviter 2000). Though the habitat currently found within the proposed project site not ideal for this species as there are few trees in which hawks could perch, and the almost bare bulldozed lava does not offer much in the way of cover for rodents, and other prey items usually consumed by this species. The site also lacks the medium to large stature 'ohi'a trees in which Hawaiian Hawks normally site their nests.

The Hawaiian Hawks the only extant falconiform in Hawai'i. It is currently endemic to the island of Hawai'i. Sub-fossil remains indicate that it was also formerly found on

Moloka'i, and Kaua'i (Olson & James 1982, 1991, 1997). Several incidental unconfirmed sightings of this species exist from Kaua'i (Dole 1879, Beaglehole, 1980) and Maui (Banko 1980c). This species was first mentioned in the western literature by Cook and King in 1784, and was scientifically described by Peale in 1848, from a specimen collected in "Kealakua" (Medway 1981, Peale 1848).

The Hawaiian Hawk was first listed as endangered by the U.S. Fish and Wildlife Service (USFWS) in 1967 (Federal Register 1967). The USFWS published a proposal to down-list the species from endangered to threatened in 1993 (Federal Register 1993), and without down-listing the species retracted their 1993 proposal in 1994 (Federal Register 1994). Currently it is listed as an endangered species under both the federal and State of Hawaii's endangered species programs (DLNR 1998, Federal Register 1999a, 1999b, 2001, 2002).

Hawaiian Hawks are found in nearly all vegetation habitats that still have some large tree components. Densities are highest in mature native species dominated forests with grassy under stories. This habitat with high amounts of forest edges supports large populations of game birds, and the four species of introduced rodents known from the island; it also provides numerous perches and nesting sites (Klavitter 2000). Much of this habitat has been created by logging, land clearing and cattle grazing. It appears that Hawaiian Hawks can coexist with, and may have in fact benefited from anthropogenic land clearing activities - this is not to say that more clearing is going to result in more hawks, but does indicate that the species can coexist with anthropogenic natural resource extraction and, or clearing activities, as long as natural resource management plans ensure the continued recruitment of native trees and the regeneration of native species dominated forests.

Current population estimates based on John Klavitter's research, extrapolates that there are currently 1,457 Hawaiian Hawks, which in his estimation is equal to, or higher than what was present in pre-contact times (Klavitter 2000).

Hawaiian Hawks, like many other Hawaiian endemic avian species have low mortality $\leq 9\%$, and reproductive rates; lay only one egg per season, fledge one chick and live ~ 20 years (Klavitter 2000). Hawaiian Hawks breeding season starts in late March, chicks hatch in May, and begin fledging in July (Griffin *et al.* 1998). Although hawks use resources in most forest habitats, they usually pick 'ohi'a trees in which to nest. Of 112 nests found during the 1998, and 1999 nesting seasons, 82% of the nests were located in 'ohi'a trees (Klavitter 2000).

The eight other avian species detected during station counts are alien species that one would expect to record within disturbed, alien species dominated, lowland areas in the South Hilo District.

It is also possible that small numbers of the endangered endemic Hawaiian Petrel (*Pterodroma sandwichensis*)¹, or *ua'u*, and the threatened Newell's Shearwater (*Puffinus auricularis newelli*), or *'a'o*, overfly the project site between the months of May and October (Banko 1980a, 1980b, Day *et al.* 2003, Harrison 1990).

Hawaiian Petrels were formerly common on the Island of Hawaii (Wilson and Evans 1890-1899). This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea (Henshaw 1902), as well as at the mid to high elevations of Mount Hualalai. It has, within recent historic times, been reduced to relict breeding colonies located at high elevations on Mauna Loa and, possibly, Mount Hualalai (Banko 1980a, Banko *et al.* 2001, Cooper and David 1995, Cooper *et al.* 1995, David, Unpublished Field Notes 1986-1995, 1999, Harrison 1990, Hue *et al.* 2001). Newell's Shearwaters were formerly common on the Island of Hawaii (Wilson and Evans 1890-1899). This species breeds on Kaua'i, Hawaii and Moloka'i in extremely small numbers. Newell's Shearwater populations have dropped precipitously since the 1980s (Banko 1980b, Day and Cooper, in press). This pelagic species nests high in the mountains in burrows excavated under thick vegetation, especially *uluhe* fern. There are numerous records of this species having been seen, heard, or collected in and close to Hilo (Banko 1980a, Conant 1980, David, pers. obs., Day *et al.* 2003, Kepler *et al.* 1979.)

The primary cause of mortality in both these species is thought to be predation by alien mammalian species at the nesting colonies (Ainley *et al.* 2001, Cooper and Day 1995, 1998, Day and Cooper 1997, Hue *et al.* 2001). Collision with utility structures is considered to be the second most significant cause of mortality of these seabird species in Hawaii. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds often collide with manmade structures, and if they are not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Ainley *et al.* 1995, 1997, 2001, Cooper and Day 1995, 1998, Day and Cooper 1997). There is no habitat within the site suitable as nesting habitat for either of these listed seabird species.

The principal potential impact that development of the project site poses to Hawaiian Petrels and Newell's Shearwaters is the increased threat that birds will be downed after becoming disoriented by exterior lighting that may be required in conjunction with the construction and operation of a Home Depot outlet and associated infrastructure.

¹ The Hawaiian endemic endangered sub-species of the Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*) has been elevated to a full species based on the differences in vocalizations, and morphology between it, and the nominate Galapagos species (*Pterodroma p. phaeopygia*). The new common and scientific names for the Hawaii breeding species are Hawaiian Petrel (*Pterodroma sandwichensis*) (Banko *et al.* 2002)

Recommendation

To reduce the potential for interactions between nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures, it is recommended that any external lighting planned in conjunction with this development be shielded (Reed *et al.* 1985). This mitigation would serve the dual purpose of minimizing the threat of disorientation and downing of Hawaiian Petrels, and Newell's Shearwaters, while at the same time complying with the County of Hawaii's current planning policy which recommends the shielding of exterior lights, so as to lower the ambient glare caused by unshielded lighting to the astronomical observatories located on Mauna Kea.

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Appendix C

Traffic Impact Analysis Report

TRAFFIC IMPACT ANALYSIS REPORT
HOME DEPOT HILO



THIS WORK WAS PREPARED BY ME
OR UNDER MY SUPERVISION

Warren M. Yamamoto

Expiration Date: 4/30/04

By:

M&E Pacific, Inc.

November 2003

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**TRAFFIC IMPACT ANALYSIS REPORT
HOME DEPOT HILO**

A Home Depot store is being proposed in Hilo, Hawaii. This report documents the methodology and results of a study that was conducted to identify the traffic-related impacts associated with the project. The study included a review of existing roadway and traffic conditions, forecast of future conditions, and analysis of the forecast volumes to determine the need for any mitigating measures.

PROJECT DESCRIPTION

A Home Depot store is being proposed in Hilo, Hawaii, on a site identified as Tax Map Key (3)2-2-47-64. The project site is bordered by Railroad Avenue, Ohuohu Street and East Makaala Street in the area behind the Prince Kuhlo Plaza. The location of the project site in relationship to the local road system is shown on Figure 1. The project site also includes a 1.2 acre outparcel at the corner of Ohuohu Street and East Makaala Street that would be leased for other commercial uses. Possible uses could include a fast food restaurant or auto parts store. Customers to this commercial use would utilize the Home Depot entry ways and parking lot.

The proposed store would include a 103,000 square foot home improvement center and 27,600 square foot garden shop. Two entry ways are proposed on East Makaala Street, and one each on Railroad Avenue and Ohuohu Street. The proposed site plan is shown on Figure 2. The proposed project is scheduled for occupancy in about January 2005.

Based on the location of the proposed project in relation to the roadway system, this study analyzed the traffic impacts at the following intersections:

- o Kanoelehua Avenue/East Puainako Street
- o Kanoelehua Avenue/East Makaala Street
- o East Puainako Street/Ohuohu Street
- o East Puainako Street/Railroad Avenue
- o East Makaala Street/Ohuohu Street
- o East Makaala Street/Railroad Avenue

These study intersections are identified on Figure 1.

EXISTING CONDITIONS

A survey of the existing roadway and traffic conditions was made.

Existing Roadways

The proposed Home Depot store would be located in an area adjacent to other major retailers. Primary access to this retail area from other areas of Hilo is provided by Kanoelehua Avenue and Puainako Street.

Kanoelehua Avenue is a major arterial that provides north-south access between Hilo and the Keaau and Volcano districts. It is a five lane divided arterial in the vicinity of the project site with turning lanes and traffic signals at major cross streets, including the East Puainako Street and East Makaala Street intersections. It is under the jurisdiction of the State Department of Transportation and is designated as State Route 11.

Two major east-west roadways provide access to the retail areas between Kanoelehua Avenue and Railroad Avenue: East Puainako Street and East Makaala Street. East Puainako Street is a four lane facility from Railroad Avenue to Kilauea Street. The General Plan classifies Puainako Street as a primary

arterial with a minimum right-of-way width of 120 feet. East Makaala Street is another four lane facility between Railroad Avenue to Kanoelehua Avenue. It becomes a two lane roadway south of Kanoelehua Avenue. Both roadways have striped left turn lanes at access points to the major retail centers.

The intersection of Kanoelehua Avenue and East Puainako Street was recently improved as part of the Puainako Street improvement project. All four approaches have separate left turn and right turn lanes, with the northbound approach having two left turn lanes. The northbound Kanoelehua Avenue approach has two through lanes while the southbound approach has three. The eastbound East Puainako Street approach has a single through lane while the westbound approach has two. The intersection is controlled by an eight phase traffic signal. The left turn movements from Kanoelehua Avenue can only be made on a protected left turn phase, while left turns from East Puainako Street can be made on protected and permitted phases.

The intersection of Kanoelehua Avenue and East Makaala Street has also been improved to serve the retail center. The northbound approach of Kanoelehua Avenue approach has two through lanes and separate left and right turn lanes, while the southbound approach has three through lanes and two left turn lanes. The southbound approach of East Makaala Street has a left turn lane, a shared left/through lane, and a right turn lane. The northbound approach has a shared left/through lane and a right turn lane. The intersection is controlled by a six phase traffic signal. The left turn movements from Kanoelehua Avenue can only be made on a protected left turn phase, while each approach of East Makaala Street moves on separate phases.

Railroad Avenue is a two lane roadway running parallel to and east of Kanoelehua Avenue. It provides access from an industrial area in the north to an agricultural park to the south. Chuohu Street is a two lane local road that runs north to south behind the Prince Kuhio Plaza. It provides secondary access to the Prince Kuhio Plaza and a satellite parking lot, and connects East Makaala Street with East Puainako Street and the adjacent residential area to the south.

The four study intersections including Chuohu Street and Railroad Avenue are stop sign controlled. Chuohu Street has stop signs at its approaches to East Makaala Street and East Puainako Street. The East Makaala Street and East Puainako Street approaches to Railroad Avenue are stop sign controlled.

Traffic Volumes

Traffic turning movement counts were taken at the six study intersections between September 4 and October 25, 2003. Traffic turning movement counts require traffic surveyors to station themselves by each study intersection and record each vehicle movement as through or turning movements by 15 minute intervals. Traffic counts were taken during the morning (6:30 to 8:30 a.m.) and afternoon (3:30 to 5:30 p.m.) peak periods on weekdays. Traffic counts were also taken on Saturdays between 10:00 a.m. and 2:00 p.m. The worksheets for the traffic counts are included in the Appendix. Due to the length of the Saturday count period, the traffic counters were given two 15 minute period breaks. The volumes for these two periods were averaged from the traffic volumes before and after the break periods and have been shaded.

The resultant peak hour movements are summarized on Figure 3. Figure 3A shows the morning peak hour volumes from 7:15 to 8:15 a.m., while Figure 3B shows the afternoon peak volumes between 4:00 and 5:00 p.m. The highest Saturday volumes shown on Figure 3C were recorded between 11:00 a.m. and 12:00 noon. Traffic volumes over five vehicles per hour (vph) are rounded to the

nearest five.

The dominant direction of travel on Kanoelehua Avenue is northbound in the morning peak and southbound in the afternoon peak. The traffic volumes on East Puainako Street and East Makaala Street are highest on Saturdays.

The State Department of Transportation takes traffic counts every two years at selected roadway sections on the Island of Hawaii. One of these count stations is at the Kanoelehua Avenue/East Puainako Street intersection (Station 18-G). Traffic counts were available for five years: 1994, 1996, 1998, 2000 and 2002. The data and graph on Figure 4 shows the trend in two-way daily traffic volumes on each leg of the intersection.

Daily two-way traffic volumes on the south leg of Kanoelehua Avenue was at its highest level in 1994, decreased in 1996, increased to 2000, and then leveled off in 2002 at levels that are still below the 1994 volumes. The leg shows an average annual increase of 2.1% from 1998 to 2002. Traffic volumes on the north leg decreased from 1994 to 1998, increased to its highest value in 2000, and then declined in 2002. The north leg shows a 1.7% increase over the 1998 to 2002 period. Both legs of East Puainako Street show constantly declining traffic volumes from 1996 to 2002.

TRAFFIC FORECAST

The proposed project is scheduled for occupancy in about 15 months from the time this report was prepared. During this period, ambient traffic can be expected to increase due to regional growth and new projects in the area. The traffic that would be generated from the proposed project was then added to the ambient traffic forecast to obtain the total with project traffic forecast.

Ambient Traffic Forecast

The historical growth rate of traffic was used to forecast regional traffic growth. The current through volumes on Kanoelehua Avenue from Figure 3 were increased by 4%, representing about a two year forecast period based on the 2.1% traffic growth rate observed on the south leg of Kanoelehua Avenue. The longer forecast period would allow time for project traffic to develop to a steady level. Despite the decreasing trend in traffic on East Puainako Street, the current traffic volumes on the other study area roadways were increased by 1%.

The Department of Hawaiian Home Lands is currently constructing 40 homes at the corner of East Puainako Street and Railroad Avenue. The procedure of trip generation, distribution, and assignment was used to forecast the number of trips that would be added by the 40 homes onto the study intersections. The trip generation and distribution data for these new homes are included in Table 1 of the Project Generated Traffic section. This forecast was added to the regional growth ambient traffic forecast to obtain the combined ambient traffic forecast shown on Figures 5. Traffic volumes over five vehicles per hour (vph) are rounded to the nearest five.

Project Generated Traffic

The traditional procedure of trip generation, distribution, and assignment was used to forecast the number of trips that would be generated by the proposed project, the distribution of these trips, and the specific intersection turning movements that would be utilized. In addition to the proposed Home Depot Store, a 3,500 square foot fast food restaurant was assumed for the outparcel which is being leased separately. This type of land use generates a high number of trips and represents a "worst case scenario" for possible traffic impacts.

The trip generation step forecasts the volume of vehicle trips that would be generated by the proposed projects during the three analysis periods. The Institute of Transportation Engineers Trip Generation Handbook (Sixth Edition, 1997) has trip generation equations or rates to calculate the number of morning, afternoon, and Saturday peak hour trips that would be generated by various land uses. For the two proposed and one constructed land uses, unit rates are given. The handbook also provides the percentage of inbound and outbound trips in each peak hour.

The following unit rates for a "home improvement superstore" were used for the Home Depot: 1.48 for the morning, 2.87 for the afternoon, and 5.4 for Saturday. The proposed 130,600 square feet Home Depot store is expected to generate 104 inbound and 89 outbound trips in the morning peak, 176 inbound and 199 outbound trips in the afternoon peak, and 374 inbound and 331 outbound trips in the Saturday peak. The trip generation analysis for the proposed Home Depot is summarized on Table 1.

The fast food restaurant assumed for the outparcel would also be a significant traffic generator. The following unit rates for a "fast food restaurant with drive through window" were used: 1.48 for the morning, 2.87 for the afternoon, and 5.4 for Saturday. It would generate 175 and 117 hourly trips in the morning and afternoon peak hours, respectively, and 206 trips in the Saturday hour, as shown on Table 1.

TABLE 1
TRIP GENERATION AND DISTRIBUTION SUMMARY

Analysis Period	Trip Generation Direction	Trips	Trip Distribution North		Trip Distribution West		Trip Distribution South	
			Percent	Number	Percent	Number	Percent	Number
AM	Home Depot Total	183						
	Inbound (54%)	104	19	20	31	32	40	42
	Outbound (49%)	89	32	28	35	31	22	20
PM	Home Depot Total	375						
	Inbound (47%)	176	30	53	26	46	23	41
	Outbound (53%)	199	22	44	22	44	35	70
SAT	Home Depot Total	705						
	Inbound (53%)	374	30	112	21	78	29	108
	Outbound (47%)	331	24	80	24	80	32	106
AM	Fast Food Total	175						
	Inbound (51%)	89	19	17	31	28	40	36
	Outbound (49%)	86	32	28	35	31	22	20
PM	Fast Food Total	117						
	Inbound (52%)	61	30	18	26	16	23	14
	Outbound (48%)	56	22	12	22	12	35	20
SAT	Fast Food Total	206						
	Inbound (51%)	105	30	18	26	16	23	14
	Outbound (49%)	101	24	24	24	24	32	32
AM	Housing Total	30						
	Inbound (26%)	8	19	1	31	2	40	3
	Outbound (75%)	23	32	7	35	8	22	5
PM	Housing Total	40						
	Inbound (64%)	26	34	9	30	8	26	7
	Outbound (36%)	15	25	4	25	4	40	6
SAT	Housing Total	30						
	Inbound (54%)	18	33	5	24	4	32	5
	Outbound (46%)	14	27	4	27	4	35	5

The trip distribution step divides the generated trips by directions of travel to/from the project site. The three primary directions of travel were north and south via Kanoelehua Avenue, and west via East Puainako Street. The existing traffic counts shown on Figures 3 show the distribution of vehicles using each of these three directions of travel. The proportion of trips in each direction of travel was based on the combined percentages of turning movements from the traffic counts

LEVEL OF SERVICE ANALYSIS

The concept of level of service is used to quantify the quality of traffic flow on roadway facilities. The Transportation Research Board has developed procedures to calculate level of service value(s) by measuring traffic volumes against the capacities of different types of roadway facilities. Their Highway Capacity Manual 2000 (HCM2000) describes the various procedures developed for freeways, highways, signalized and unsignalized intersections, etc. A comparison of levels of service for the different forecast scenarios can give an indication of the traffic impacts of ambient traffic growth and the proposed project.

The methodology for analyzing signalized intersections calculates the levels of service for individual approaches and the intersection as a whole based on the average stopped delay per vehicle. The results range from level of service A (best with average delays less than five seconds) to F (worst with average delays longer than 80 seconds), as described below:

Level of Service	Control Delay per Vehicle (Seconds/Vehicle)
A	<10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	>80.0

Many jurisdictions consider levels of service A to D as acceptable for areas like Hilo, with levels of service E and F indicating the need for mitigating measures. The County of Hawaii recommends a minimum level of service C for proposed projects, while recognizing that many of their signalized intersections are already at level of service D.

at the two Kanoelehua Avenue. Separate distributions were developed for each analysis period and inbound and outbound directions of travel. Ten percent of the morning generated trips and 20 percent of the afternoon and Saturday generated trips were assumed to be internal to the study area. These trips would go between two retailers in the study area and not leave. The trip distribution percentages and resultant volumes are summarized on Table 1. The percentage and number of internal trips are not included in the table.

The trip assignment step assigns the distributed trips as turning movements to the study intersections. Several assumptions were made to realistically spread the trips over the study area. A small percent of the north and south traffic were assigned to Railroad Avenue. Also, 20 percent of the west traffic was assigned to East Makaala Street. A small amount of traffic was assigned to alternate routes (when available) so that all trips would not be assigned to the primary route. Twenty percent of the Home Depot trips and all of the restaurant generated trips were assumed to be diverted trips. Diverted trips are those trips that are passing by a retail center and decide to turn into it. These types of trips are common at retail centers and can range up to 40 percent of a retail center's traffic. These trips are very noticeable in the current traffic volumes on Figures 3. The results of the trip assignment procedure for the proposed project are graphically shown on Figures 6. The traffic volumes are not rounded.

Total Forecast Volumes

The project generated volumes from Figures 6 were added to their respective ambient traffic forecasts from Figures 5 to obtain the total with project traffic forecasts shown on Figures 7. Traffic volumes over five vph are rounded to the nearest five.

**TABLE 2
SIGNALIZED INTERSECTION
LEVEL OF SERVICE ANALYSIS**

INTERSECTION APPROACH	AM PEAK HOUR			PM PEAK HOUR			SATURDAY PEAK HOUR		
	EXISTING	AMBIENT	TOTAL	EXISTING	AMBIENT	TOTAL	EXISTING	AMBIENT	TOTAL
	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY
KANOELEHUA AVENUE/EAST PUAINAKO STREET INTERSECTION									
OVERALL	D 38.4	D 40.7	D 38.9	C 29.7	C 31.4	D 39.6	C 30.1	C 31.0	D 42.0
E. Puainako St EB	C 26.9	C 27.5	C 28.2	C 28.6	C 30.3	C 34.8	C 33.9	C 34.1	D 48.3
E. Puainako St WB	C 23.5	C 22.9	C 23.4	C 28.3	C 30.9	D 43.1	C 32.1	C 32.5	D 40.1
Kanoelehua Ave NB	D 46.1	D 50.3	D 47.4	C 26.5	C 27.0	C 30.6	C 31.5	C 33.3	D 47.3
Kanoelehua Ave SB	C 32.3	C 31.4	C 31.4	C 32.5	C 34.2	D 44.6	C 25.1	C 28.0	C 34.4
KANOELEHUA AVENUE/EAST MAKAAALA STREET INTERSECTION									
OVERALL	D 39.2	D 44.6	D 41.2	D 37.8	D 39.3	D 41.2	D 42.7	D 43.2	D 50.7
E. Makaan St EB	D 39.3	D 39.4	D 42.4	D 52.0	D 52.8	D 46.7	D 49.8	D 54.5	D 52.2
E. Makaan St WB	D 36.6	D 36.9	D 37.7	D 41.0	D 43.0	D 47.9	D 36.6	D 39.8	D 51.9
Kanoelehua Ave NB	D 42.8	D 51.3	D 45.1	D 37.7	D 39.1	D 40.3	D 53.4	D 50.4	E 57.8
Kanoelehua Ave SB	C 30.2	C 30.5	C 32.2	C 32.6	C 34.1	D 37.1	D 36.6	D 37.6	D 44.5

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The procedure used for analyzing unsignalized intersections calculates vehicle delays and levels of service based on the distribution of gaps in traffic on the major street and driver judgment in selecting gaps through which to execute turns. For two way stop intersections where only the minor street approaches are controlled by a stop sign, levels of service are calculated for the critical turning movements including outbound movements from the stop-controlled approach, and left turns from the main road to the minor road. The procedure does not calculate an overall intersection level of service. For all way stops where each incoming approach is controlled by a stop sign, levels of service are calculated for each approach and the intersection as a whole.

The Highway Capacity Manual defines the relationship between level of service and delay (in seconds/vehicle) for unsignalized intersections as shown below:

Level of Service	Delay (Seconds/Vehicle)
A	<10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	>50.1

Levels of service A to E are considered acceptable for unsignalized intersections. Level of service F (with average delays longer than 50 seconds) is considered undesirable and would indicate the need for mitigation.

The results of the level of service analyses are summarized on Table 2 for signalized intersections and on Table 3 for unsignalized intersections. The existing, ambient forecast and total with project forecast levels of service and delays for each analysis period are placed side-by-side so that changes in levels of service can be identified.

**TABLE 3
UNIGNALIZED INTERSECTION (CONTINUED)
LEVEL OF SERVICE ANALYSIS**

INTERSECTION APPROACH	AM PEAK HOUR			PM PEAK HOUR			SATURDAY PEAK HOUR		
	EXISTING	AMBIENT	TOTAL	EXISTING	AMBIENT	TOTAL	EXISTING	AMBIENT	TOTAL
	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY
EAST MAKAALA STREET/RAILROAD AVENUE INTERSECTION									
Makaala St EB right turn	A 9.2	A 9.2	A 9.2	B 11.3	B 11.4	B 11.6	A 9.9	A 9.9	A 10.0
Makaala St EB left turn	B 12.4	B 12.5	B 12.7	C 15.1	C 15.3	C 15.9	B 12.9	B 13.0	B 13.7
Railroad Ave NB left turn	A 7.7	A 7.7	A 7.7	A 8.5	A 8.5	A 8.6	A 8.0	A 8.0	A 8.1
EAST MAKAALA STREET/OHUOHU AVENUE INTERSECTION									
Ohuohu St NB	A 9.9	A 9.9	B 11.7	B 14.4	B 14.6	D 25.7	B 14.6	C 15.5	F 159.0
Makaala St WB left turn	A 7.5	A 7.5	A 7.7	A 8.0	A 8.0	A 8.5	A 8.0	A 8.0	A 9.2
EAST MAKAALA STREET/OHUOHU AVENUE INTERSECTION WITH 3 WAY STOP									
Overall			A 8.9			B 10.8			B 12.9
Makaala St EB			A 8.4			B 10.3			B 12.9
Makaala St WB			A 9.2			B 11.3			B 13.5
Ohuohu St NB			A 9.1			B 10.9			B 12.4

**TABLE 3
UNIGNALIZED INTERSECTION
LEVEL OF SERVICE ANALYSIS**

INTERSECTION APPROACH	AM PEAK HOUR			PM PEAK HOUR			SATURDAY PEAK HOUR		
	EXISTING	AMBIENT	TOTAL	EXISTING	AMBIENT	TOTAL	EXISTING	AMBIENT	TOTAL
	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY	LOS DELAY
EAST PUAINAKO STREET/RAILROAD AVENUE INTERSECTION									
Puainako St EB right turn	A 9.1	A 9.1	A 9.1	B 10.4	B 10.4	B 10.6	A 9.7	A 9.7	A 9.9
Puainako St EB left turn	B 12.9	B 12.9	B 13.3	B 13.3	B 13.4	B 13.8	B 12.7	B 12.8	B 13.6
Railroad Ave NB left turn	A 7.8	A 7.8	A 7.7	A 8.2	A 8.2	A 8.3	A 7.9	A 7.9	A 8.0
EAST PUAINAKO STREET/OHUOHU AVENUE INTERSECTION									
Ohuohu St NB	B 13.4	B 13.6	C 17.2	B 13.6	B 13.9	C 19.3	C 17.4	C 17.7	F 91.7
Ohuohu St SB	B 10.2	B 10.2	B 10.3	B 11.6	B 12.0	B 14.9	B 12.0	B 12.3	D 25.4
Puainako St EB left turn	A 7.5	A 7.5	A 7.7	A 7.6	A 7.6	A 7.8	A 7.7	A 7.7	A 8.3
Puainako St WB left turn	A 7.5	A 7.5	A 7.5	A 7.5	A 7.5	A 7.5	A 7.5	A 7.5	A 7.5
EAST PUAINAKO STREET/OHUOHU AVENUE INTERSECTION WITH 4 WAY STOP									
Overall			A 9.0			B 10.3			B 14.2
Puainako St EB			A 9.5			B 10.3			C 17.6
Puainako St WB			A 8.7			A 9.7			B 10.5
Ohuohu St NB			A 9.1			A 9.2			A 9.4
Ohuohu St SB			A 8.2			B 10.9			B 12.7

The Kanoelehua Avenue/East Puainako Street intersection is currently at level of service D in the morning peak and is forecast to remain the same with the ambient and total with project forecast traffic volumes. The intersection shows an overall level of service D due to the high northbound through and left turn volumes that cause the approach to operate at level of service D. All the other approaches are operating at level of service C.

The intersection is operating at level of service C during the afternoon and Saturday analysis periods and is forecast to remain the same with the ambient forecast volumes. The level of service would change to level of service D for the total with project conditions. For all three analyses periods, the traffic signal cycle length would have to be increased to accommodate the additional traffic generated by the proposed project. This would indicate that the proposed project would have a slight traffic impact at this intersection but traffic conditions would remain acceptable.

The Kanoelehua Avenue/East Makaala Street intersection is currently at level of service D in all three analysis periods and is forecast to remain the same with the ambient and total with project forecast traffic volumes. As with the former intersection, the traffic signal cycle length would have to be increased to maintain the same level of service with the additional traffic. The cycle lengths at both intersections should be matched so that the traffic signals on Kanoelehua Avenue can be run in a progression mode during the peak periods.

Table 3 shows the levels of service on the critical turning movements of the unsignalized study intersections. The two study intersections on Railroad Avenue are forecast to operate at levels of service B or better with the project, indicating that the project would not have an adverse traffic impact. No improvements are contemplated.

The East Puainako Street/Ohuohu Street intersection shows levels of service C or better for the weekday morning and afternoon peak hour total with project forecasts, indicating no traffic-related impacts from the proposed project during these two periods. However, the northbound approach of Ohuohu Street changes to level of service F for the Saturday total with project forecast due to the high weekend volumes. The movement would remain at level of service F even if traffic from the fast food restaurant were eliminated.

To mitigate this adverse impact, the intersection could be converted into a four way stop with stop signs on all approaches. The eastbound approach of East Puainako Street would be restriped a left turn and a through/right turn lanes. With these changes, all four approaches would be operating at level of service C or better. Traffic signals would not be warranted to mitigate a weekend only problem.

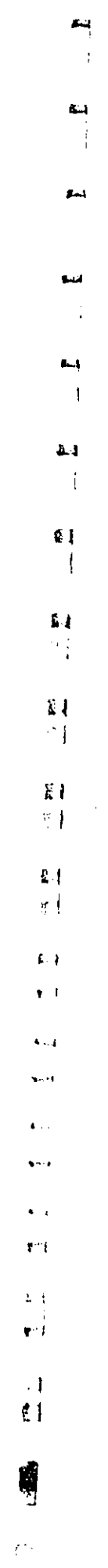
A similar finding can be made for East Makaala Street/Ohuohu Street intersection. The northbound approach of Ohuohu Street is forecast to change to level of service F only for the Saturday total with project forecast. As in the previous case, converting the intersection to an all-way (three way) stop would significantly improve traffic operations. The eastbound approach of East Makaala Street could be restriped into a through and a right turn lanes, and the westbound approach could be restriped into a through and a left turn lanes.

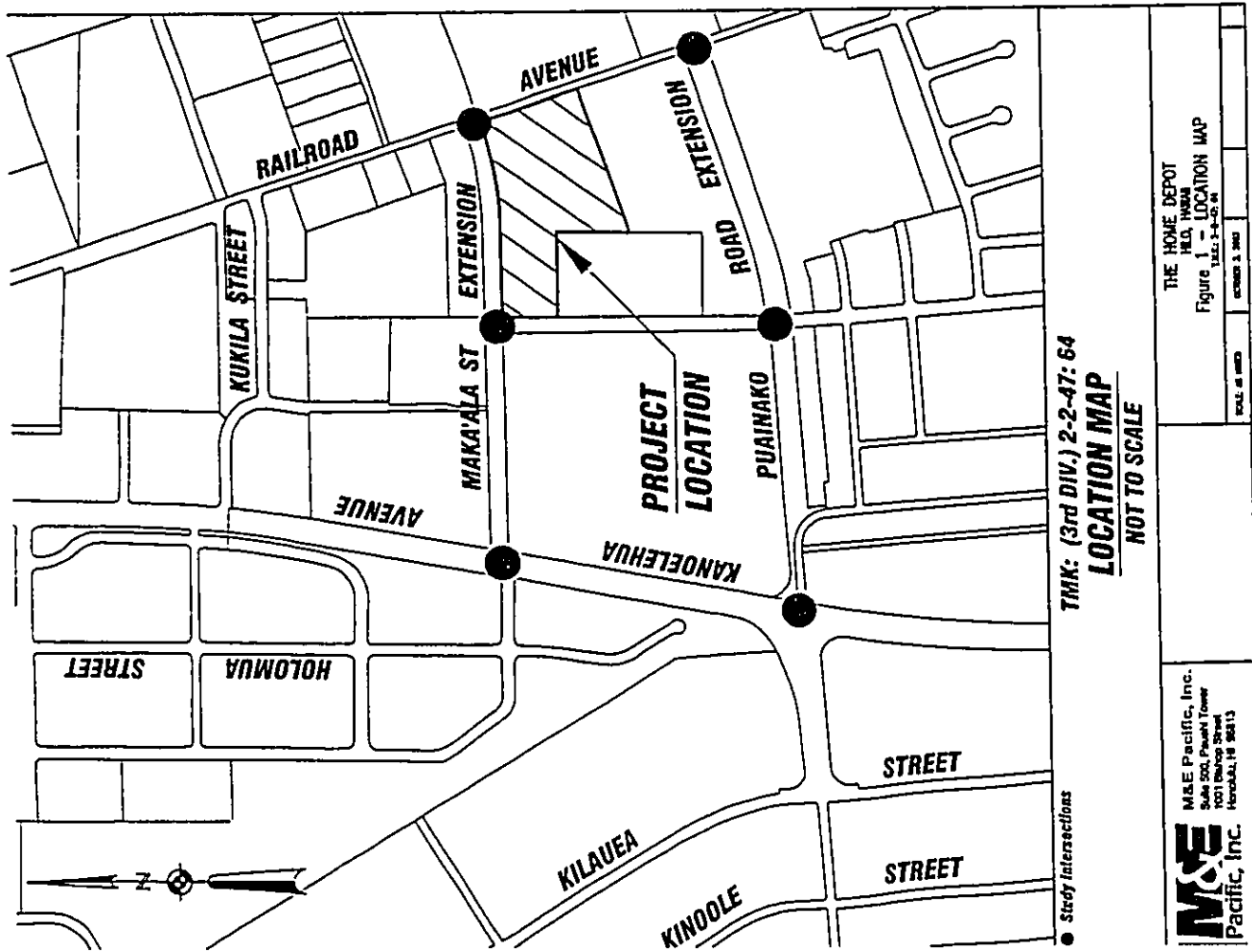
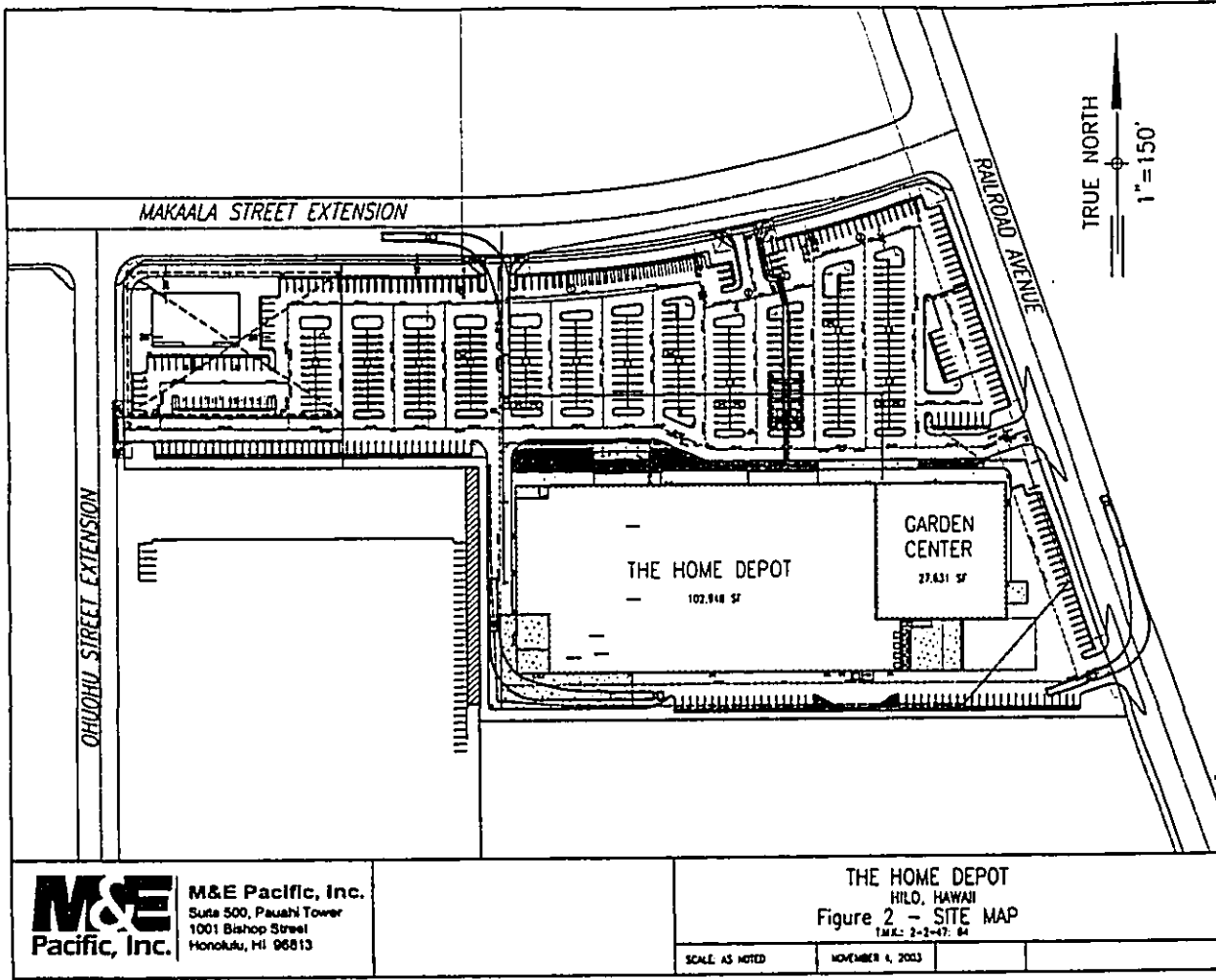
CONCLUSIONS

The proposed project would generate a large volume of traffic, particularly during the afternoon peak hour and on Saturdays. This additional traffic is not expected to have an adverse impact upon the signalized intersections at Kanoelehua

Avenue, although traffic signal cycle lengths would need to be increased. The unsignalized intersections on Railroad Avenue are forecast not to be adversely affected. However, the two unsignalized intersections on Ohuehu Street are forecast to be adversely affected on the weekends. Converting these two intersections to all way stops and restriping the lanes would mitigate the problem.

FIGURES

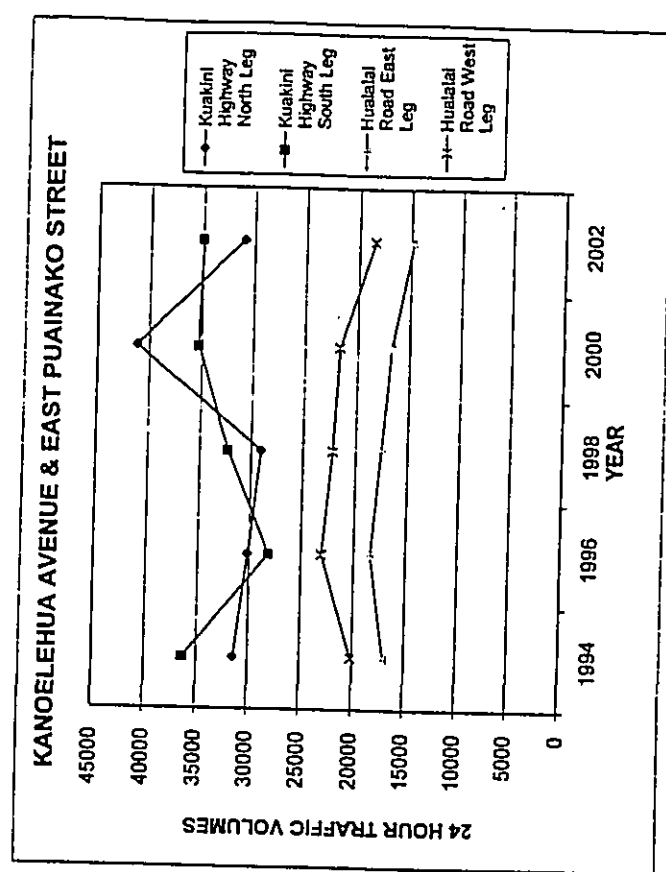




24 HOUR TWO WAY TRAFFIC VOLUMES

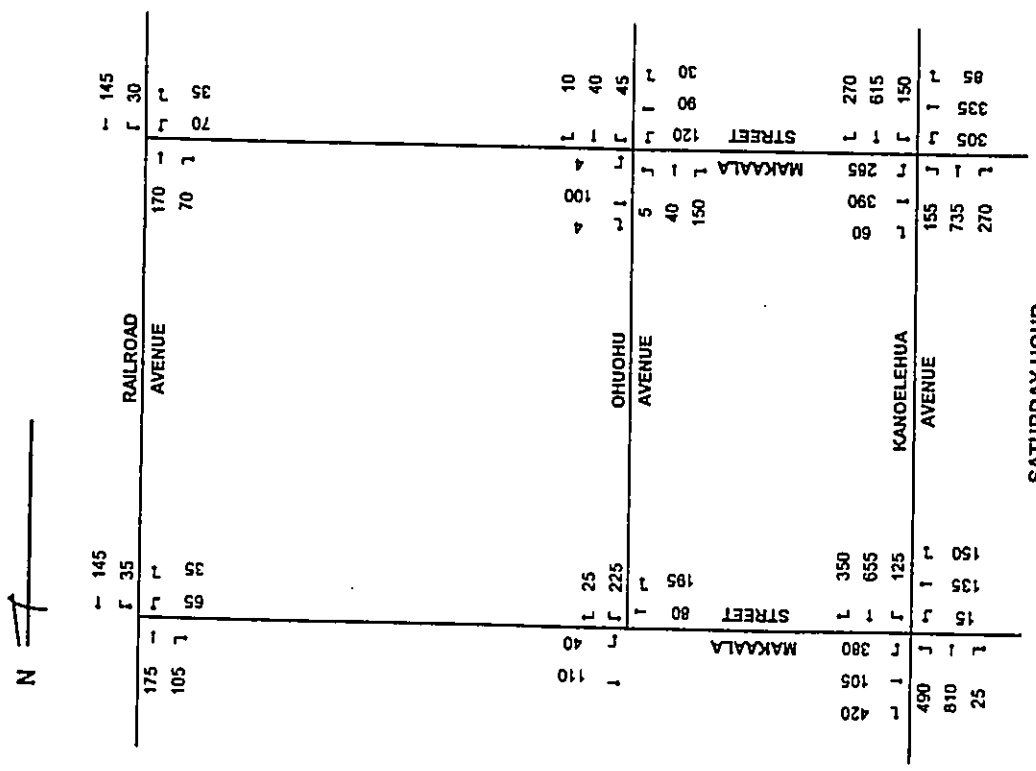
YEAR	KANOELEHUA AVENUE		PUAINAKO STREET	
	NORTH	SOUTH	EAST	WEST
1994	31399	36328	16973	20164
1996	30146	28078	18418	23093
1998	29004	32255	17508	22174
2000	41178	35332	16695	21704
2002	30953	34077	14769	18440

Source: State of Hawaii Department of Transportation



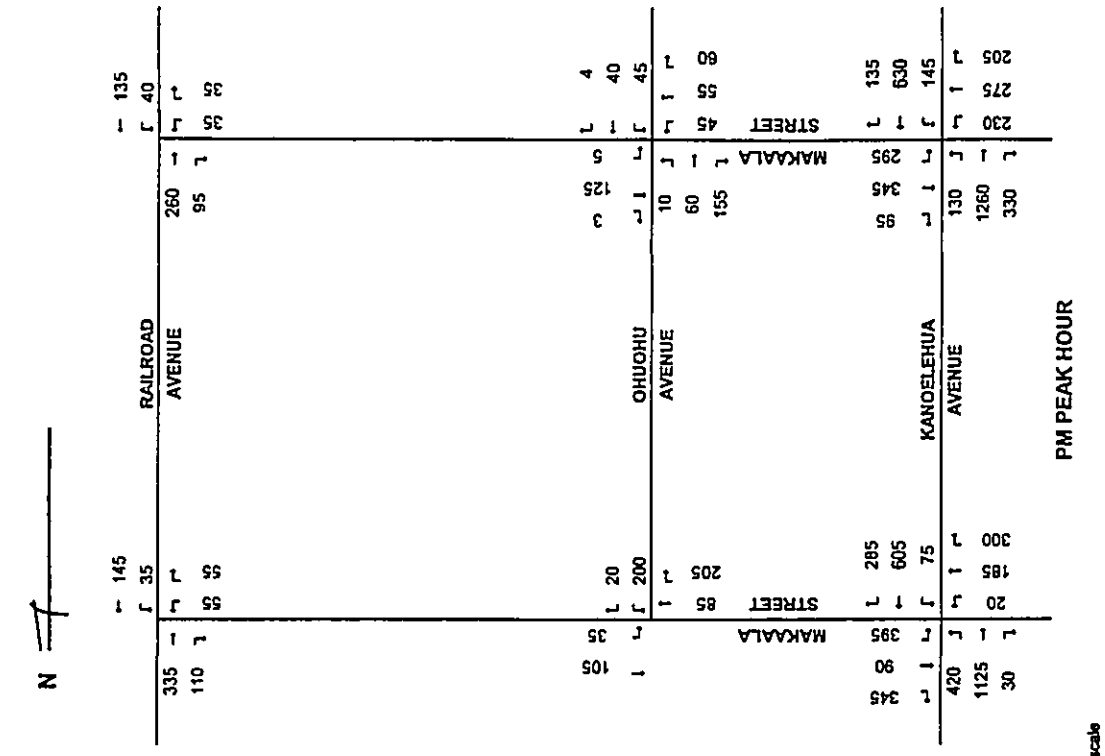
HISTORICAL TREND IN DAILY TRAFFIC VOLUMES
KANOELEHUA AVENUE AT PUAINAKO STREET

FIGURE 4

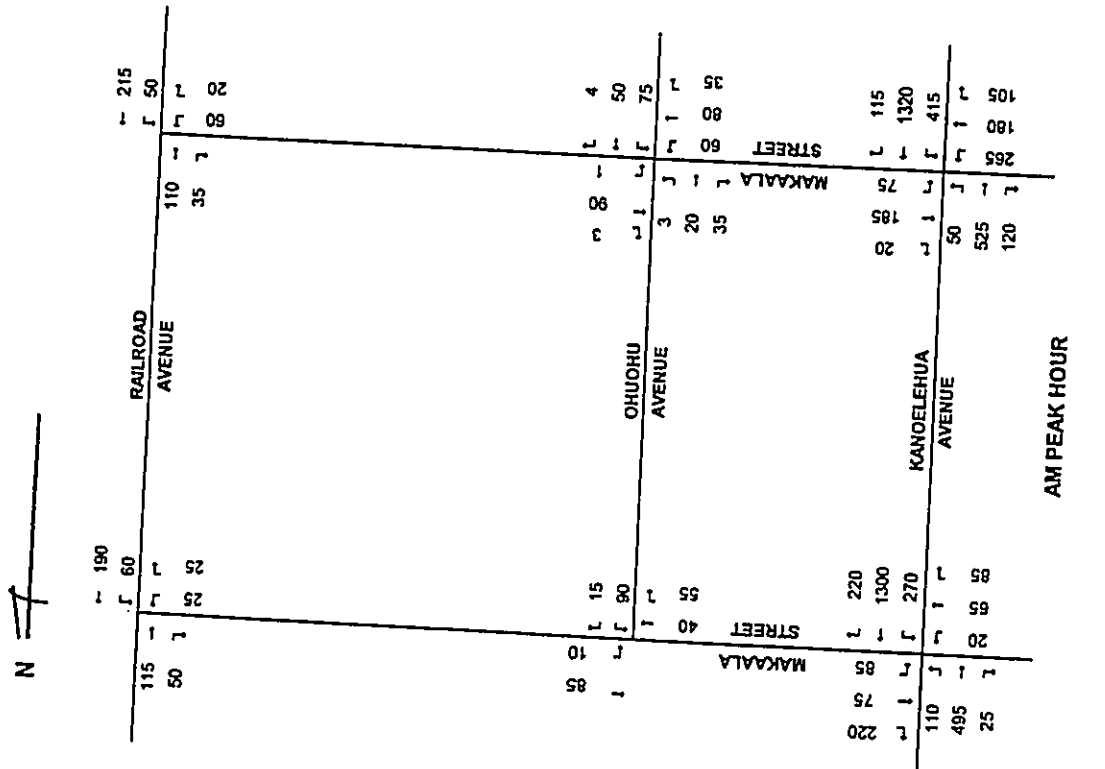


EXISTING TRAFFIC VOLUMES
FIGURE 3C

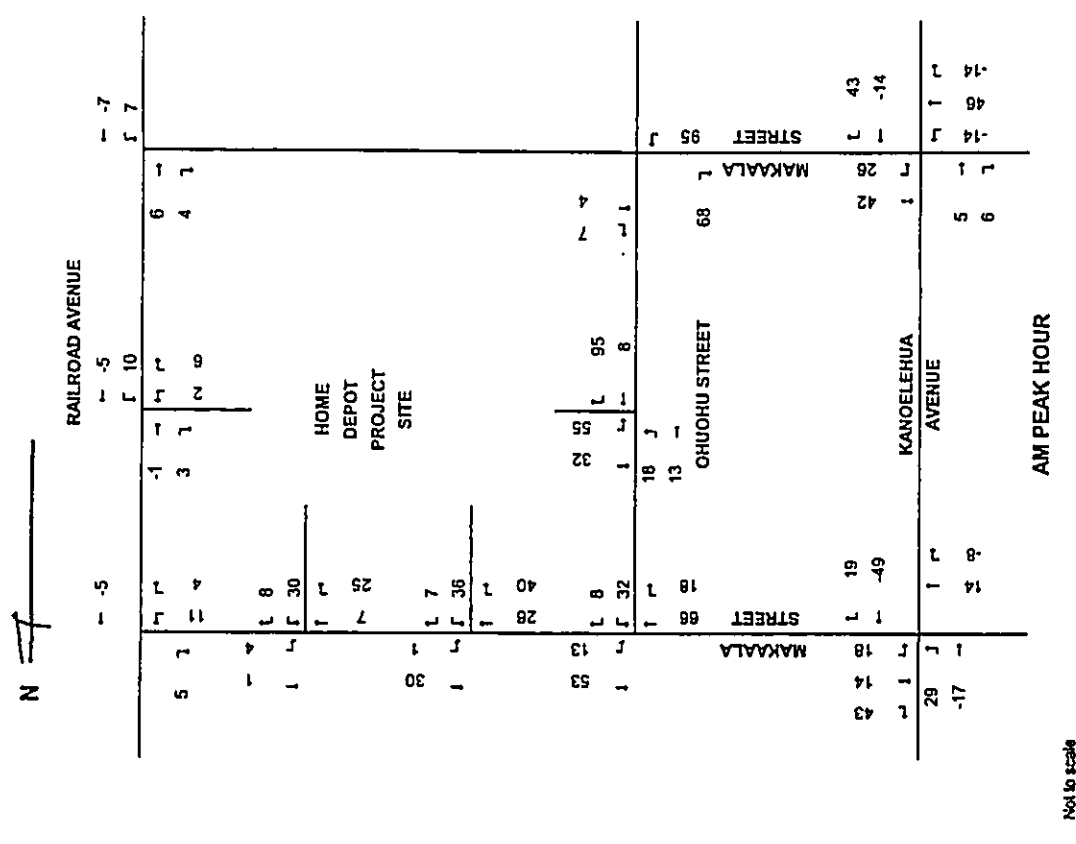
Not to scale



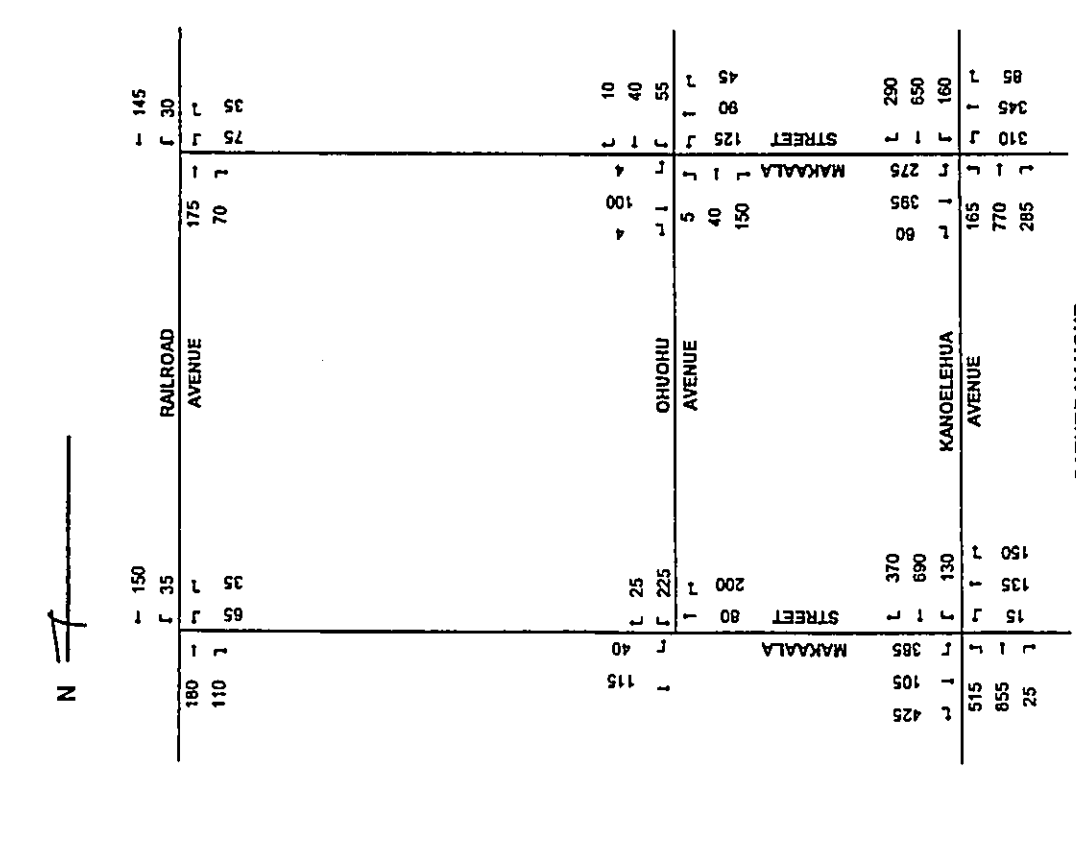
AMBIENT TRAFFIC FORECAST
FIGURE 5B



AMBIENT TRAFFIC FORECAST
FIGURE 5A



PROJECT GENERATED TRIP ASSIGNMENT
FIGURE 6A

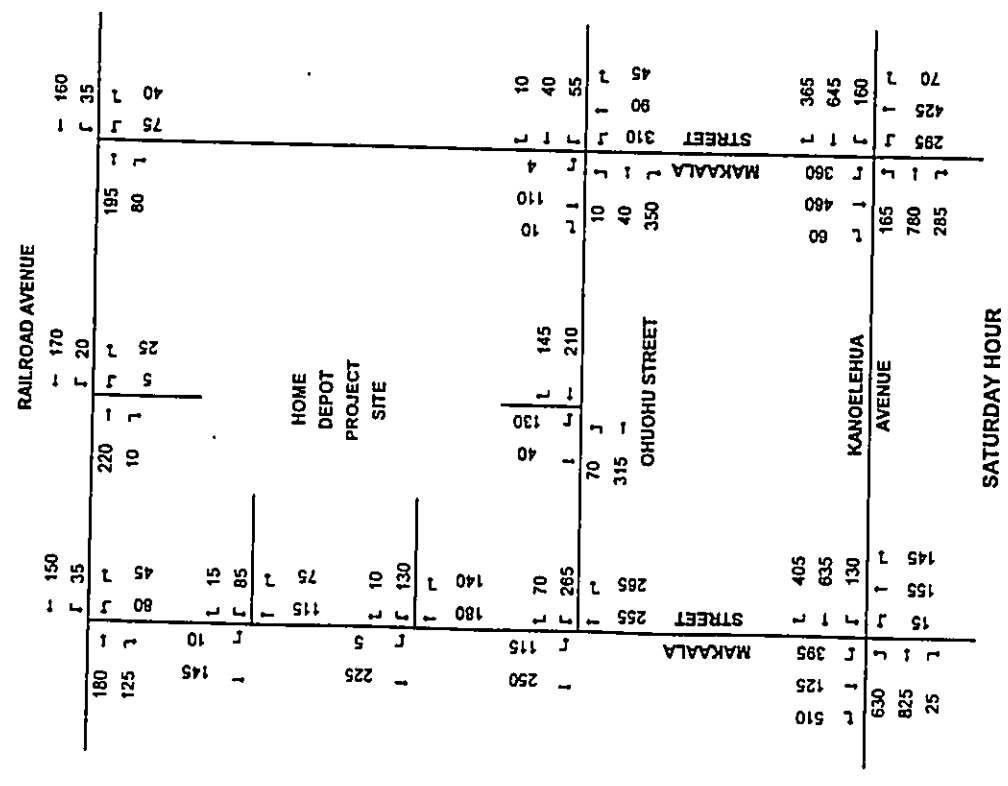


AMBIENT TRAFFIC FORECAST
FIGURE 5C

Not to scale

Not to scale

N

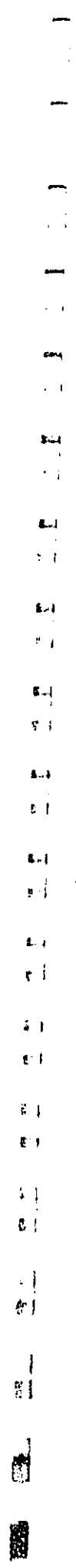


Not to scale

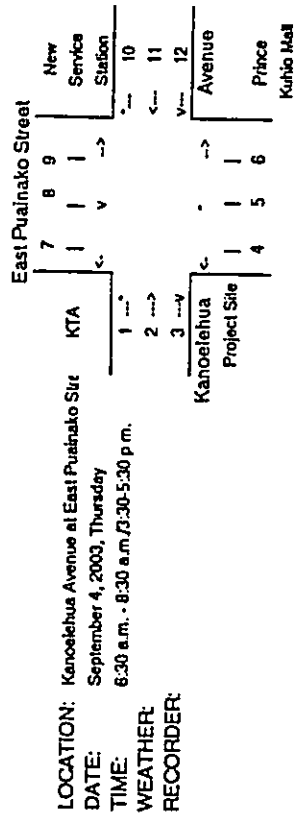
TOTAL WITH PROJECT FORECAST
FIGURE 7C

APPENDIX A

TRAFFIC TURNING MOVEMENT COUNTS



TRAFFIC TURNING MOVEMENT COUNT
Home Depot at Hilo TIAR



LOCATION: Kanoiehuhu Avenue at East Puainako Str
DATE: September 4, 2003, Thursday
TIME: 8:30 a.m. - 8:30 a.m./3:30-5:30 p.m.
WEATHER: sunny
RECORDER: R. Beauchamp, D. Volpe

TIME PERIOD	MOVEMENT NUMBER												TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	
6:30-6:45	60	199	30	13	28	9	35	31	41	14	66	2	528
6:45-7:00	68	270	15	7	36	7	25	41	68	17	74	2	630
7:00-7:15	109	279	16	20	41	13	37	36	57	23	83	5	719
7:15-7:30	117	319	20	17	40	4	27	40	58	34	137	9	822
7:30-7:45	135	373	23	21	57	6	15	32	61	22	118	12	875
7:45-8:00	88	326	26	17	39	1	35	52	74	28	98	10	794
8:00-8:15	56	241	38	14	38	8	27	54	70	30	148	17	741
8:15-8:30	59	202	36	19	31	7	13	41	41	44	109	12	614
6:30-8:30	692	2209	204	128	310	55	214	327	470	212	833	69	5723
7:15-8:15	396	1259	107	69	174	19	104	178	263	114	501	48	3232
PHIF	0.83				0.78			0.85					0.85

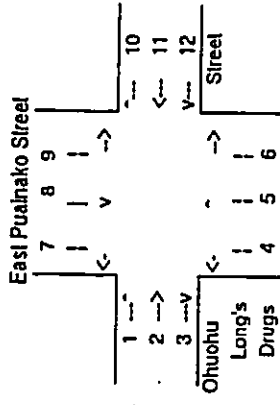
3:30-3:45	42	161	38	51	84	20	48	77	64	74	233	21	913
3:45-4:00	59	205	39	87	78	33	48	65	56	73	255	20	1018
4:00-4:15	35	166	25	61	66	26	58	70	61	75	262	28	933
4:15-4:30	40	161	36	84	84	22	46	65	60	89	286	21	994
4:30-4:45	30	143	28	70	92	26	59	67	56	63	320	31	985
4:45-5:00	35	130	34	74	95	21	41	63	49	89	334	41	1006
5:00-5:15	29	125	36	73	83	16	47	79	54	61	301	26	950
5:15-5:30	43	87	24	68	69	18	66	55	70	72	295	31	898
3:30-5:30	313	1178	260	568	651	182	413	541	470	616	2286	219	7697
4:00-5:00	140	600	123	289	337	95	204	265	226	316	1202	121	3918
PHIF	0.91				0.95			0.95					0.88

LOCATION: Kanoiehuhu Avenue at East Puainako Street
DATE: October 25, 2003; Saturday
TIME: 10:00 am - 2:00 pm
WEATHER: sunny
RECORDER: R. Beauchamp, D. Volpe

TIME PERIOD	MOVEMENT NUMBER												TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	
10:00-10:15a	45	189	63	51	98	14	15	74	73	48	160	32	882
10:15-10:30a	55	208	50	45	90	10	18	79	59	58	188	31	891
10:30-10:45a	40	164	51	45	58	15	25	103	94	64	168	26	853
10:45-11:00a	41	164	52	45	58	15	24	109	91	64	183	27	873
11:00-11:15a	37	191	63	63	73	14	22	85	82	65	189	33	917
11:15-11:30a	38	155	70	72	102	18	20	84	78	68	185	38	926
11:30-11:45a	34	118	77	81	130	21	19	82	74	71	181	44	932
11:45-12:00p	45	153	61	51	84	6	22	86	72	68	180	41	869
12:00-12:15p	40	183	67	122	98	12	29	68	58	68	184	33	962
12:15-12:30p	32	138	51	68	90	16	30	85	72	65	203	50	900
12:30-12:45p	30	122	50	69	84	17	29	95	90	67	178	32	863
12:45-1:00p	27	143	52	82	96	17	37	89	76	67	195	35	916
1:00-1:15p	24	165	54	95	107	17	44	82	62	67	211	38	966
1:15-1:30p	19	97	41	79	72	13	40	74	63	51	225	37	811
1:30-1:45p	21	123	38	59	80	11	30	79	68	58	186	28	781
1:45-2:00p	13	137	52	65	84	10	24	80	66	73	214	30	848
10:00a-2:00p	539	2450	892	1092	1404	226	428	1354	1178	1022	3030	555	14170
10:00-11:00a	181	725	216	186	304	54	82	365	317	234	699	116	3479
11:00a-12:00p	152	617	271	267	389	59	83	337	306	272	735	156	3644
12:00p-1:00p	129	586	220	341	368	62	125	337	296	267	760	150	3641
1:00-2:00p	77	522	185	298	343	51	138	315	259	249	836	133	3406
11-12 PHF	0.89				0.77			0.96					0.98

Shaded values were averaged from adjacent counts.

TRAFFIC TURNING MOVEMENT COUNT
Home Depot at Hilo TIAR



LOCATION: East Puainako Street @ Ohuohu Street
DATE: October 23, 2003, Thursday
TIME: 6:30 a.m. - 8:30 a.m./3:30-5:30 p.m.
WEATHER: Clear
RECORDER: P. Farias

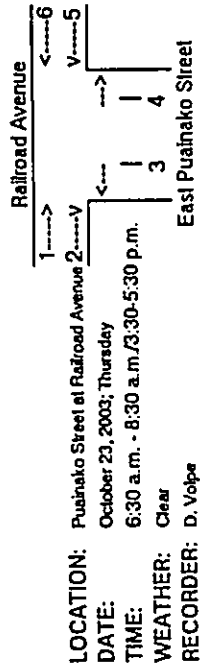
TIME PERIOD	MOVEMENT NUMBER												TOT
	1	2	3	4	5	6	7	8	9	10	11	12	
6:30-6:45	3	3	1	7	16	4	4	8	1	1	12	10	70
6:45-7:00	0	4	6	15	30	8	0	22	0	1	6	13	105
7:00-7:15	0	6	6	15	13	6	0	30	1	1	9	15	102
7:15-7:30	0	0	5	14	15	3	1	20	1	2	9	19	89
7:30-7:45	2	10	11	14	22	9	1	20	0	2	13	21	125
7:45-8:00	1	4	11	19	18	9	1	26	0	0	15	11	115
8:00-8:15	0	4	10	14	24	8	0	22	0	0	8	8	98
8:15-8:30	0	12	9	19	22	5	0	14	1	0	16	6	104
6:30-8:30	6	43	59	117	160	52	7	162	4	7	88	103	808
7:15-8:15	3	18	37	61	79	29	3	88	1	4	45	59	427
PHF	0.63							0.85					0.75
3:30-3:45	1	8	42	16	21	7	2	33	4	0	12	12	158
3:45-4:00	1	11	41	12	15	8	1	31	5	3	15	8	151
4:00-4:15	4	12	36	14	18	10	1	38	4	1	13	9	160
4:15-4:30	2	9	27	6	14	14	1	31	2	1	8	9	124
4:30-4:45	1	17	41	15	15	9	0	32	0	0	7	12	149
4:45-5:00	3	18	48	10	7	9	1	24	1	2	11	7	141
5:00-5:15	2	16	33	14	12	15	1	27	1	1	8	15	145
5:15-5:30	5	15	42	24	15	6	1	23	1	1	8	14	155
3:30-5:30	19	106	310	111	117	78	8	239	18	9	82	86	1183
4:00-5:00	10	56	152	45	54	42	3	125	7	4	39	37	574
PHF	0.92							0.78					0.87

LOCATION: East Puainako Street @ Ohuohu Street
DATE: October 25, 2003, Saturday
TIME: 10:00 am - 2:00 pm
WEATHER: sunny
RECORDER: R. Beauchamp, D. Volpe

TIME PERIOD	MOVEMENT NUMBER												TOT
	1	2	3	4	5	6	7	8	9	10	11	12	
10:00-10:15a	6	4	14	14	16	3	1	25	1	0	5	10	99
10:15-10:30a	1	11	28	33	20	11	1	26	0	0	15	9	155
10:30-10:45a	1	10	30	31	21	5	1	16	3	0	15	10	143
10:45-11:00a	2	6	37	37	16	5	1	20	3	0	14	6	147
11:00-11:15a	2	16	28	30	22	5	2	24	2	0	10	12	153
11:15-11:30a	1	11	35	34	22	5	1	21	1	3	8	12	154
11:30-11:45a	1	6	41	37	23	5	1	18	0	6	7	11	156
11:45-12:00p	1	7	44	21	21	17	0	38	1	0	14	9	173
12:00-12:15p	1	8	43	25	23	14	2	17	2	2	2	9	155
12:15-12:30p	3	11	37	19	21	13	0	15	2	3	20	13	157
12:30-12:45p	2	12	36	31	14	7	0	18	3	1	9	8	141
12:45-1:00p	1	13	40	28	15	8	1	16	2	1	9	6	140
1:00-1:15p	1	14	44	25	16	9	1	14	0	1	9	4	138
1:15-1:30p	1	9	25	27	15	8	2	15	5	1	14	9	131
1:30-1:45p	0	11	31	19	20	12	0	18	1	0	8	13	133
1:45-2:00p	2	14	39	24	10	15	2	15	1	2	17	10	151
10:00a-2:00p	26	163	552	435	295	142	16	316	27	20	183	151	2326
10:00-11:00a	10	31	109	115	73	24	4	87	7	0	49	35	544
11:00a-12:00p	5	40	148	122	88	32	4	101	4	9	39	44	636
12:00p-1:00p	7	44	156	103	73	42	3	66	9	7	47	36	593
1:00-2:00p	4	48	139	95	61	44	5	62	7	4	48	36	553
11-12 PHF	0.93							0.93					1.00

Shaded values were averaged from adjacent columns.

TRAFFIC TURNING MOVEMENT COUNT
Home Depot at Hilo TIAR



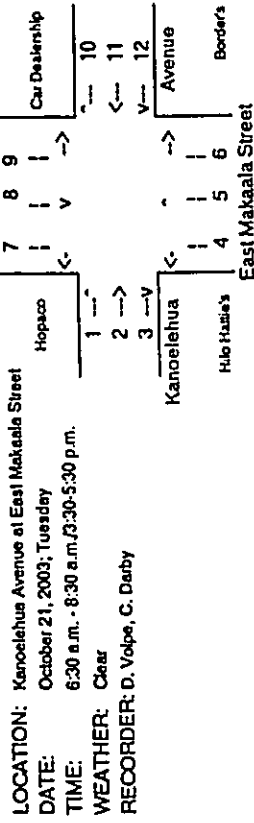
TIME PERIOD	1	2	3	4	5	6	TOTAL
6:30-6:45	19	7	17	3	8	37	91
6:45-7:00	14	9	23	7	14	31	98
7:00-7:15	24	15	8	7	16	50	120
7:15-7:30	19	5	10	5	16	48	103
7:30-7:45	21	6	20	9	10	70	136
7:45-8:00	28	11	17	2	16	58	132
8:00-8:15	40	13	14	6	7	36	116
8:15-8:30	34	9	18	8	5	42	116
6:30-8:30	199	75	127	47	92	372	912
7:15-8:15	108	35	61	22	49	212	487
PHF	0.67		0.72		0.82		
3:30-3:45	81	33	13	7	8	45	187
3:45-4:00	63	28	12	9	7	51	170
4:00-4:15	64	31	11	10	9	43	168
4:15-4:30	53	21	11	7	14	28	134
4:30-4:45	76	20	9	9	9	26	149
4:45-5:00	62	20	2	8	6	35	133
5:00-5:15	52	22	3	14	8	18	117
5:15-5:30	35	14	11	11	11	28	110
3:30-5:30	486	189	72	75	72	274	1168
4:00-5:00	255	92	33	34	38	132	584
PHF	0.90		0.80		0.82		

LOCATION: Puainako Street at Railroad Avenue
DATE: October 25, 2003; Saturday
TIME: 10:00 am - 2:00 pm
WEATHER: clear
RECORDER: C. Darby

TIME PERIOD	1	2	3	4	5	6	TOTAL
10:00-10:15a	29	22	13	10	6	31	111
10:15-10:30a	46	17	19	4	9	43	138
10:30-10:45a	41	15	13	5	7	44	125
10:45-11:00a	38	16	13	6	5	36	114
11:00-11:15a	47	19	18	6	9	40	139
11:15-11:30a	42	16	20	8	8	35	129
11:30-11:45a	37	13	21	10	7	29	117
11:45-12:00n	45	22	13	9	6	40	135
12:00-12:15p	46	15	14	13	4	35	127
12:15-12:30p	41	15	14	11	3	37	121
12:30-12:45p	39	15	13	6	6	32	111
12:45-1:00p	37	11	10	8	6	32	104
1:00-1:15p	34	7	6	11	7	32	97
1:15-1:30p	43	10	12	6	11	25	107
1:30-1:45p	40	8	11	10	8	29	106
1:45-2:00p	32	14	5	7	5	26	89
10:00a-2:00p	637	235	215	130	107	548	1870
10:00-11:00a	154	70	58	25	27	154	488
11:00-12:00n	171	70	72	33	30	144	520
12:00-1:00p	163	56	51	38	19	136	463
1:00-2:00p	149	39	34	34	31	112	399
11-12 PHF	0.90		0.94		0.95		

Stop and values were averaged from adjacent counts

TRAFFIC TURNING MOVEMENT COUNT
Home Depot at Hilo TIAR



LOCATION: Kanoelehua Avenue at East Makaala Street
 DATE: October 21, 2003, Tuesday
 TIME: 6:30 a.m. - 8:30 a.m./3:30-5:30 p.m.
 WEATHER: Clear
 RECORDER: D. Volpe, C. Darby

TIME PERIOD	MOVEMENT NUMBER												TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	
6:30-6:45	20	207	51	15	2	17	6	8	0	3	76	15	420
6:45-7:00	45	247	53	22	10	47	6	11	4	2	84	14	545
7:00-7:15	38	225	58	19	15	34	14	5	3	3	87	24	525
7:15-7:30	59	307	37	24	16	39	11	12	4	3	117	18	647
7:30-7:45	68	335	52	16	18	53	22	19	4	6	136	22	751
7:45-8:00	81	335	51	18	25	49	19	16	7	8	123	31	763
8:00-8:15	50	258	71	26	13	69	33	17	7	7	96	34	681
8:15-8:30	27	149	49	26	35	37	28	25	5	6	116	35	538
6:30-8:30	388	2063	422	166	134	345	139	113	34	38	835	193	4870
7:15-8:15	258	1235	211	84	72	210	85	64	22	24	472	105	2842
PHF	0.91				0.85						0.93		

3:30-3:45	32	163	64	73	23	73	72	46	11	14	208	82	861
3:45-4:00	27	161	70	72	30	69	56	44	12	9	232	90	872
4:00-4:15	18	123	69	75	25	88	71	58	6	5	233	93	864
4:15-4:30	18	125	77	103	26	93	72	39	4	10	238	97	902
4:30-4:45	22	176	46	102	15	83	86	47	4	9	296	103	999
4:45-5:00	16	156	80	111	21	76	68	38	5	6	298	106	981
5:00-5:15	15	137	67	113	15	85	54	42	2	9	236	88	863
5:15-5:30	15	126	64	129	13	71	47	44	3	3	264	90	869
3:30-5:30	163	1167	537	778	168	638	526	358	47	65	2005	749	7201
4:00-5:00	74	580	272	391	87	340	297	182	19	30	1065	399	3736
PHF	0.92				0.92						0.91		

LOCATION: Kanoelehua Avenue at East Makaala Street

DATE: Saturday, 18 OCT 03
 TIME: 10:00 am - 2:00 pm
 WEATHER: clear and warm
 RECORDER: D. Volpe, T. Waiiani

TIME PERIOD	MOVEMENT NUMBER												TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	
10:00-10:15a	28	157	66	53	27	108	44	36	3	10	172	109	813
10:15-10:30a	33	149	69	61	20	68	30	35	3	7	155	108	739
10:30-10:45a	29	162	92	66	25	77	44	41	7	10	207	106	866
10:45-11:00a	20	155	72	84	21	89	38	32	2	5	158	74	750
11:00-11:15a	32	167	89	101	25	109	36	29	5	7	235	119	954
11:15-11:30a	28	170	90	100	29	108	37	31	3	2	218	118	934
11:30-11:45a	25	174	92	98	33	107	49	41	3	6	174	139	941
11:45-12:00p	41	145	81	80	17	98	28	34	5	9	183	113	834
12:00-12:15p	20	166	70	106	22	82	41	44	5	2	201	135	894
12:15-12:30p	19	168	80	86	19	112	43	36	6	12	214	132	927
12:30-12:45p	12	146	80	92	20	101	32	29	4	4	155	110	785
12:45-1:00p	19	157	84	95	20	99	25	22	0	4	200	103	829
1:00-1:15p	26	168	89	100	20	95	34	23	2	3	201	115	877
1:15-1:30p	10	185	95	94	22	99	25	32	2	8	239	128	939
1:30-1:45p	12	160	78	100	13	111	24	24	4	5	176	86	793
1:45-2:00p	18	150	84	100	18	101	21	15	2	6	177	98	790
10:00a-2:00p	372	2579	1311	1417	351	1565	551	505	56	100	3065	1793	13665
10:00-11:00a	110	623	299	264	93	342	156	145	15	32	692	397	3168
11:00a-12:00p	126	656	352	379	104	422	150	135	16	24	810	489	3663
12:00p-1:00p	70	637	314	380	81	394	141	131	15	22	770	480	3435
1:00p-2:00p	66	663	346	394	73	407	104	94	10	22	793	427	3399
PHF	0.98				0.96						0.81		0.92

Speed values were averaged from adjacent counts.

TRAFFIC TURNING MOVEMENT COUNT
Home Depot at Hilo TIAR

LOCATION: Makaala Street at Chuohu Street
 DATE: October 16, 2003; Thursday
 TIME: 6:30 a.m. - 8:30 a.m./3:30-5:30 PM
 WEATHER: Clear and rain
 RECORDER: C. Darby

Makaala Street
 Chuohu Street

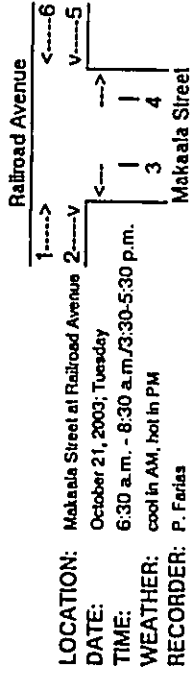
TIME PERIOD	1	2	3	4	5	6	TOTAL
6:30-6:45	7	10	13	0	2	7	39
6:45-7:00	4	11	7	3	2	13	40
7:00-7:15	10	13	24	2	4	20	73
7:15-7:30	6	8	21	5	0	17	57
7:30-7:45	11	18	21	3	3	20	76
7:45-8:00	13	13	20	4	5	30	85
8:00-8:15	12	15	24	2	1	15	69
8:15-8:30	7	18	36	2	3	16	82
6:30-8:30	70	106	166	21	20	138	521
7:15-8:15	42	54	86	14	9	82	287
PHF							
3:30-3:45	27	52	63	8	10	50	210
3:45-4:00	19	42	33	7	10	33	144
4:00-4:15	21	47	54	7	12	32	173
4:15-4:30	21	51	48	9	7	22	158
4:30-4:45	21	45	50	3	7	20	146
4:45-5:00	21	58	42	2	11	30	164
5:00-5:15	20	49	34	4	4	27	138
5:15-5:30	18	62	44	5	7	17	153
3:30-5:30	168	406	368	45	68	231	1286
4:00-5:00	84	201	194	21	37	104	641
PHF							
	0.90		0.88			0.86	

LOCATION: Makaala Street at Chuohu Street
 DATE: Saturday, 18 OCT 03
 TIME: 10:00 AM - 2:00 PM
 WEATHER: Clear
 RECORDER: C. Darby

TIME PERIOD	1	2	3	4	5	6	TOTAL
10:00-10:15a	14	36	37	5	3	21	116
10:15-10:30a	16	49	55	8	13	27	168
10:30-10:45a	14	42	65	10	8	14	153
10:45-11:00a	16	44	56	7	3	22	148
11:00-11:15a	14	43	48	5	9	29	148
11:15-11:30a	17	47	56	5	10	31	166
11:30-11:45a	21	51	63	6	11	33	185
11:45-12:00n	28	55	56	8	8	19	174
12:00-12:15p	18	57	59	5	9	24	172
12:15-12:30p	23	51	57	6	15	25	177
12:30-12:45p	24	36	66	4	9	23	162
12:45-1:00p	21	37	64	4	8	20	154
1:00-1:15p	18	38	63	5	7	17	148
1:15-1:30p	18	46	52	5	11	23	155
1:30-1:45p	18	38	58	5	8	27	154
1:45-2:00p	23	34	47	4	7	23	138
10:00a-2:00p	303	704	902	92	139	378	2518
10:00-11:00a	60	171	213	30	27	84	585
11:00-12:00n	80	196	223	24	38	112	673
12:00-1:00p	86	181	246	19	41	92	665
1:00-2:00p	77	156	220	19	33	90	595
11-12 PHF	0.83		0.89			0.91	

Shaded values were averaged from adjacent counts

TRAFFIC TURNING MOVEMENT COUNT
Home Depot at Hilo TIAR



LOCATION: Makaala Street at Railroad Avenue
DATE: October 21, 2003, Tuesday
TIME: 6:30 a.m. - 8:30 a.m./3:30-5:30 p.m.
WEATHER: cool in AM, hot in PM
RECORDER: P. Farias

TIME PERIOD	1	2	3	4	5	6	TOTAL
6:30-6:45	13	5	4	1	5	44	72
6:45-7:00	27	5	13	1	16	58	120
7:00-7:15	24	17	6	3	16	54	120
7:15-7:30	23	11	4	4	16	48	106
7:30-7:45	32	9	3	11	13	59	127
7:45-8:00	20	11	9	4	23	45	112
8:00-8:15	39	17	7	7	8	34	112
8:15-8:30	37	10	3	9	17	34	110
6:30-8:30	215	85	49	40	114	376	879
7:15-8:15	114	48	23	26	60	186	457
PHF	0.72					0.85	
3:30-3:45	83	35	7	14	9	36	184
3:45-4:00	62	20	12	13	12	42	161
4:00-4:15	91	30	21	20	6	41	209
4:15-4:30	56	23	15	9	14	31	148
4:30-4:45	100	30	15	14	9	39	207
4:45-5:00	82	24	5	11	5	31	158
5:00-5:15	75	22	8	14	8	26	153
5:15-5:30	60	22	8	23	9	22	144
3:30-5:30	609	206	91	118	72	268	1364
4:00-5:00	329	107	56	54	34	142	722
PHF	0.84					0.94	

LOCATION: Makaala Street at Railroad Avenue
DATE: Saturday, 18 OCT 03
TIME: 10:00 AM - 2:00 PM
WEATHER: Clear
RECORDER: P. Farias

TIME PERIOD	1	2	3	4	5	6	TOTAL
10:00-10:15a	45	18	12	12	7	41	135
10:15-10:30a	52	30	8	9	7	38	144
10:30-10:45a	42	13	16	7	5	38	121
10:45-11:00a	44	23	13	10	7	27	124
11:00-11:15a	38	31	16	4	7	47	143
11:15-11:30a	45	30	15	8	9	39	146
11:30-11:45a	61	29	15	12	11	30	158
11:45-12:00n	31	17	20	13	6	31	118
12:00-12:15p	48	18	15	15	9	10	140
12:15-12:30p	41	23	15	7	13	31	130
12:30-12:45p	50	22	20	10	9	39	150
12:45-1:00p	42	21	15	9	7	39	133
1:00-1:15p	35	20	11	9	4	39	118
1:15-1:30p	49	24	19	8	4	36	140
1:30-1:45p	24	24	9	11	6	20	94
1:45-2:00p	39	23	13	14	9	34	132
10:00a-2:00p	686	366	232	152	121	569	2126
10:00-11:00a	183	84	49	38	26	144	524
11:00-12:00n	175	107	66	37	33	147	565
12:00-1:00p	181	84	65	35	39	149	553
1:00-2:00p	147	91	52	42	23	129	484
11-12 PHF	0.78					0.83	

Siteed values were averaged from adjacent counts

APPENDIX B

**SIGNALIZED INTERSECTION
LEVEL OF SERVICE (LOS) CALCULATIONS**

**SIGNALIZED AND UNSIGNALIZED INTERSECTION
LEVEL OF SERVICE (LOS) CALCULATIONS**

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information		Site Information																				
Analyst	WY	Jurisdiction/Date										10/31/03										
Agency or Company	EDWB Street	PUAINAKO S																				
Analysis Period/Year	2003JAMEX	KANOELEHUA																				
Comment	2002 EXISTING AM PEAK HOUR																					
Intersection Data																						
Area type	Other	Analysis period	2.5	h	Signal type	Actuated/Field	% Back of queue	70														
Volume (veh/h)	263	178	104	69	174	19	396	1259	107	48	501	114										
RTOR volume (veh/h)	50	50	50	50	10	10	50	50	50	50	50	50										
Peak hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92										
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2										
Start-up lost time, s (s)	2	2	2	2	2	2	2	2	2	2	2	2										
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2										
Arrival type, A1	3	3	3	3	3	3	3	3	3	3	3	3										
Approach pedestrian volume (p/h)	10	10	10	10	10	10	10	10	10	10	10	10										
Approach bicycle volume (bc/h)	0	0	0	0	0	0	0	0	0	0	0	0										
Left/right parking (Y or N)	N	/	N	/	N	/	N	/	N	/	N	/										
Signal Phasing Plan																						
L: L	T	TH	R	RT	P	Phs																
Phase 1							Phase 2		Phase 3		Phase 4		Phase 5		Phase 6		Phase 7		Phase 8			
EB	L		L		L		L		L		L		L		L		L		L			
WB	L		L		L		L		L		L		L		L		L		L			
MB	L		L		L		L		L		L		L		L		L		L			
SB	L		L		L		L		L		L		L		L		L		L			
Green (s)	6.2	13.7	23.9	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	
Yellow + All red (s)	4	1	6.4	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	
Cycle (s)	95	Last time per cycle (s)		5	Critical w/t Ratio		0.98															
Intersection Performance																						
Lane group configuration	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	
No. of lanes	1	1	1	2	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Flow rate (veh/h)	266	193	59	75	189	10	430	1368	62	52	545	70										
Capacity (veh/h)	448	568	479	398	1082	483	830	1383	767	111	1225	536										
Adjusted saturation flow (veh/h)	1770	1863	1571	1770	3547	1583	3437	3547	1583	1770	3074	1567										
w/t ratio	.639	.34	.122	.189	.175	.02	.519	.99	.081	.471	.445	.13										
g/C ratio	.402	.305	.305	.402	.305	.305	.402	.305	.402	.305	.402	.342										
Average back of queue (veh)	6.6	4.4	1.2	1.4	2.1	2	5.8	26.5	1	1.6	5	1.4										
Uniform delay (s)	24.4	26.7	24.8	18.9	25.3	24.1	32.6	30	13.4	44.8	31.9	22.4										
Incremental delay (s)	0	0	0	0	0	0	0	0	0	0	0	0										
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0	0										
Delay (s)	27.4	26.7	24.8	18.9	25.3	24.1	33.2	31.7	13.4	47.3	32.1	22.4										
LOS	C	C	C	B	C	C	C	D	B	D	C	C										
Approach delay (s/MUS)	26.9	/	C	23.5	/	C	46.1	/	D	32.3	/	C										
Intersection delay (s/LDS)	38.4												/									
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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information		Site Information																				
Analyst	WY	Jurisdiction/Date										10/31/03										
Agency or Company	EDWB Street	PUAINAKO S																				
Analysis Period/Year	2003 AMAM	KANOELEHUA																				
Comment	2003 AMBIENT AM PEAK HOUR																					
Intersection Data																						
Area type	Other	Analysis period	2.5	h	Signal type	Actuated/Field	% Back of queue	70														
Volume (veh/h)	266	182	105	74	184	22	416	1322	114	51	526	120										
RTOR volume (veh/h)	50	50	50	50	10	10	50	50	50	50	50	50										
Peak hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92										
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2										
Start-up lost time, s (s)	2	2	2	2	2	2	2	2	2	2	2	2										
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2										
Arrival type, A1	3	3	3	3	3	3	3	3	3	3	3	3										
Approach pedestrian volume (p/h)	10	10	10	10	10	10	10	10	10	10	10	10										
Approach bicycle volume (bc/h)	0	0	0	0	0	0	0	0	0	0	0	0										
Left/right parking (Y or N)	N	/	N	/	N	/	N	/	N	/	N	/										
Signal Phasing Plan																						
L: L	T	TH	R	RT	P	Phs																
Phase 1							Phase 2		Phase 3		Phase 4		Phase 5		Phase 6		Phase 7		Phase 8			
EB	L		L		L		L		L		L		L		L		L		L			
WB	L		L		L		L		L		L		L		L		L		L			
MB	L		L		L		L		L		L		L		L		L		L			
SB	L		L		L		L		L		L		L		L		L		L			
Green (s)	6.2	13.7	23.9	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	3.6	30.2	
Yellow + All red (s)	4	1	6.4	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	
Cycle (s)	97	Last time per cycle (s)		5	Critical w/t Ratio		.729															
Intersection Performance																						
Lane group configuration	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	
No. of lanes	1	1	1	2	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Flow rate (veh/h)	289	198	60	80	200	13	452	1437	70	55	572	76										
Capacity (veh/h)	427	580	489	381	1104	493	847	1411	783	113	1250	548										
Adjusted saturation flow (veh/h)	1770	1863	1571	1770	3547	1583	3437	3547	1583	1770	3074	1567										
w/t ratio	.677	.341	.122	.181	.181	.026	.534	1.018	.089	.49	.457	.139										
g/C ratio	.39	.311	.311	.39	.311	.311	.39	.311	.311	.311	.39	.349										
Average back of queue (veh)	6.7	4.4	1.2	1.5	2.2	2	5.9	28.8	1	1.6	5.2	1.5										
Uniform delay (s)	25.2	25.7	23.9	19.3	24.4	23.2	31.7	29.2	12.6	43.9	31	21.6										
Incremental delay (s)	4.2	0	0	0	0	0	0	0	0	0	0	0										
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0	0										
Delay (s)	29.4	25.7	23.9	19.3	24.4	23.2	32.4	27.8	12.6	47	31.2	21.6										
LOS	C	C	C	B	C	C	C	D	B	D	C	C										
Approach delay (s/MUS)	27.5	/	C	22.9	/	C	50.3	/	D	31.4	/	C										
Intersection delay (s/LDS)	40.7												/									
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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information
 Agency WY
 Agency or Company
 Analysis Period/Year 2003 PMAM
 Comment 2003 AMBIENT PM PEAK HOUR
 Site Information
 Jurisdiction/Date
 EMB Street
 H&S Street
 PUAINAKO S
 KANOELEHUA

Intersection Data

Area type: Other
 Object: 25
 Analysis period: 25 h
 Signal type: Actuated Field
 % Back of queue: 70

Volume (veh/h)	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
228	274	206	297	334	97	147	630	134	132	1262	331	
92	92	92	92	92	92	92	92	92	92	92	92	100
2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3
10	0	0	0	0	0	0	0	0	0	0	0	10
N	I	N	N	I	N	N	I	N	N	I	N	I

Signal Phasing Plan

L	LT	I	TH	R	RT	P	Pebs
Phase 1							
Phase 2							
Phase 3							
Phase 4							
Phase 5							
Phase 6							
Phase 7							
Phase 8							

Intersection Performance

Lane group configuration	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
No. of lanes	1	1	1	2	1	2	2	1	1	1	3	1
Flow rate (veh/h)	248	298	115	323	363	51	160	685	91	143	1372	251
Capacity (veh/h)	445	389	329	392	741	331	1096	817	164	1568	822	
Adjusted saturation flow (veh/h)	1770	1863	1573	1770	3547	1583	3437	3547	1560	1770	5074	1569
g/C ratio	0.57	0.65	0.35	0.23	0.49	0.154	0.5	0.625	0.112	0.473	0.75	0.06
Average back of queue (veh)	4.31	2.09	2.09	4.11	2.09	2.09	0.93	3.09	5.24	0.93	3.09	5.24
Uniform delay (s)	4.8	2.8	2.5	8	4.4	1.1	2.1	8.1	1.2	4.5	14	3.7
Incremental delay (s)	16.7	32.1	29.1	18.6	30	27.8	37.1	25.5	10.4	38.3	28.2	11.6
Total queue delay (s)	0	0	0	0	0	0	0	0	0	0	0	0
Delay (s)	18.3	40.9	29.1	31.8	30.5	27.8	38.3	26.6	10.4	75.2	34.1	11.6
LOS	B	D	C	C	C	C	D	C	B	B	C	B
Approach delay (s)/LOS	30.3	I	C	30.9	I	C	27	I	C	34.2	I	C
Intersection delay (s)/LOS	31.4 / C											

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information
 Agency WY
 Agency or Company
 Analysis Period/Year 2003 PMTO
 Comment 2003 TOTAL PM PEAK HOUR
 Site Information
 Jurisdiction/Date
 EMB Street
 H&S Street
 PUAINAKO S
 KANOELEHUA

Intersection Data

Area type: Other
 Object: 25
 Analysis period: 25 h
 Signal type: Actuated Field
 % Back of queue: 70

Volume (veh/h)	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
218	321	196	343	387	97	147	630	161	132	1288	331	
92	92	92	92	92	92	92	92	92	92	92	92	100
2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3
10	0	0	0	0	0	0	0	0	0	0	0	10
N	I	N	N	I	N	N	I	N	N	I	N	I

Signal Phasing Plan

L	LT	I	TH	R	RT	P	Pebs
Phase 1							
Phase 2							
Phase 3							
Phase 4							
Phase 5							
Phase 6							
Phase 7							
Phase 8							

Intersection Performance

Lane group configuration	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
No. of lanes	1	1	1	2	1	2	2	1	1	1	3	1
Flow rate (veh/h)	237	349	104	373	421	51	160	685	99	143	1400	251
Capacity (veh/h)	450	420	355	386	800	357	369	1013	288	190	1450	793
Adjusted saturation flow (veh/h)	1770	1863	1572	1770	3547	1583	3437	3547	1558	1770	5074	1568
g/C ratio	0.57	0.65	0.35	0.23	0.49	0.154	0.5	0.625	0.112	0.473	0.75	0.06
Average back of queue (veh)	4.52	2.26	2.26	4.52	2.26	2.26	1.07	2.86	5.06	1.07	2.86	5.06
Uniform delay (s)	4.8	10.3	2.4	12.5	5.5	1.1	2.2	9.2	1.4	4.3	17.7	4.1
Incremental delay (s)	16.9	34.4	29.9	20.2	31.7	28.8	38.9	29.4	12.1	40.4	32.8	13.5
Total queue delay (s)	0	0	0	0	0	0	0	0	0	0	0	0
Delay (s)	18.1	47.6	29.9	57.2	32.3	28.8	39.3	31.2	12.1	56.2	49	13.5
LOS	B	D	C	C	C	C	D	C	B	C	B	D
Approach delay (s)/LOS	34.8	I	C	43.1	I	D	30.6	I	C	44.6	I	D
Intersection delay (s)/LOS	39.6 / D											

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information		Site Information	
Agency	WY	Jurisdiction/Date	1001101
Agency or Company	2003 SAAM	EB/WS Street	PUIAIKAKO S
Analysis Period/Year	2003 AMBIENT SATURDAY HOUR	MB/SB Street	KANOELEIUA
Comments	2003 EXISTING SATURDAY HOUR		

Intersection Data	
Area type	Other
Analysis period	25 h
Signal type	Actuated-Field
% Back of queue	70

Volume (veh/h)	306	337	83	267	389	59	132	617	271	156	735	272
RTOR volume (veh/h)	50	50	50	50	50	50	50	50	50	50	50	50
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, t_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10	10	10	10	10	10	10	10	10	10	10	10
Approach bicycle volume (b/h)	0	0	0	0	0	0	0	0	0	0	0	0
Left/right parking (Y or N)	N	N	N	N	N	N	N	N	N	N	N	N

Signal Phasing Plan	
L: LT	T: TH
R: RT	P: Pch
Phase 1	Phase 2
Phase 3	Phase 4
Phase 5	Phase 6
Phase 7	Phase 8

Green (s)	7.7	3	22	9	23
Yellow + All red (s)	4	2	6.3	4	7
Cycle (s)	88	4	2	6.3	4
Lost time per cycle (s)	10.3	10.3	10.3	10.3	10.3
Critical v/c Ratio	1.13	1.13	1.13	1.13	1.13

Intersection Performance													
Lane group configuration	EB	T	R	L	T	R	L	T	R	L	T	R	SB
No. of lanes	1	1	1	1	2	1	2	1	1	1	3	1	
Flow rate (veh/h)	313	366	36	290	423	42	165	671	240	170	799	187	
Capacity (veh/h)	404	487	411	335	977	414	301	887	661	296	1557	754	
Adjusted saturation flow (veh/h)	1770	1863	1572	1770	3547	1583	3437	3547	1559	1770	5074	1568	
v/c ratio	.823	.752	.087	.867	.456	.102	.549	.256	.363	.374	.313	.248	
g/C ratio	.443	.261	.261	.443	.261	.261	.261	.261	.261	.261	.261	.261	
Average back of queue (veh)	8.1	9.5	7	7.7	4.9	8	2.3	9.2	4.3	4.2	6.4	2.9	
Uniform delay (s)	19.3	29.9	24.6	19.4	27.3	24.7	38.5	30.5	17.3	33.8	25.1	13.5	
Incremental delay (s)	12.9	6.5	0	20.6	2	0	2.1	3.8	0	2.7	3	0	
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0	0	
Delay (s)	32.2	36.4	24.6	40	27.5	24.7	40.6	34.3	17.3	36.5	25.4	13.5	
LOS	C	D	C	D	C	D	C	D	C	B	D	C	
Approach delay (s)/LOS	33.9	I	C	32.1	I	C	31.5	I	C	25.1	I	C	
Intersection delay (s)/LOS	30.1	C	30.1	C	31.5	I	C	25.1	I	C	25.1	C	

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information		Site Information	
Agency	WY	Jurisdiction/Date	1001101
Agency or Company	2003 SAAM	EB/WS Street	PUIAIKAKO S
Analysis Period/Year	2003 AMBIENT SATURDAY HOUR	MB/SB Street	KANOELEIUA
Comments	2003 EXISTING SATURDAY HOUR		

Intersection Data	
Area type	Other
Analysis period	25 h
Signal type	Actuated-Field
% Back of queue	70

Volume (veh/h)	309	344	84	275	397	52	160	648	289	167	772	285
RTOR volume (veh/h)	50	50	50	50	50	50	50	50	50	50	50	50
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, t_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10	10	10	10	10	10	10	10	10	10	10	10
Approach bicycle volume (b/h)	0	0	0	0	0	0	0	0	0	0	0	0
Left/right parking (Y or N)	N	N	N	N	N	N	N	N	N	N	N	N

Signal Phasing Plan	
L: LT	T: TH
R: RT	P: Pch
Phase 1	Phase 2
Phase 3	Phase 4
Phase 5	Phase 6
Phase 7	Phase 8

Green (s)	7.7	3	22	10	23
Yellow + All red (s)	4	2	6.3	4	7
Cycle (s)	89	4	2	6.3	4
Lost time per cycle (s)	10.3	10.3	10.3	10.3	10.3
Critical v/c Ratio	1.14	1.14	1.14	1.14	1.14

Intersection Performance													
Lane group configuration	EB	T	R	L	T	R	L	T	R	L	T	R	SB
No. of lanes	1	1	1	1	2	1	2	1	1	1	3	1	
Flow rate (veh/h)	336	374	37	299	432	46	174	704	260	182	839	201	
Capacity (veh/h)	414	481	406	342	917	409	297	877	671	292	1539	763	
Adjusted saturation flow (veh/h)	1770	1863	1572	1770	3547	1583	3437	3547	1559	1770	5074	1568	
v/c ratio	.812	.777	.091	.874	.471	.112	.585	.287	.387	.421	.345	.264	
g/C ratio	.449	.258	.258	.449	.258	.258	.258	.258	.258	.258	.258	.258	
Average back of queue (veh)	8.2	10	7	8.1	5.1	9	2.4	10.1	4.7	4.7	6.9	3.1	
Uniform delay (s)	18.6	30.6	25.1	18.6	27.9	25.2	39.1	31.5	17.3	34.6	25.9	13.5	
Incremental delay (s)	11.6	7.9	0	21.3	3	0	3	5.5	.1	4	.4	0	
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0	0	0	
Delay (s)	30.2	38.5	25.1	39.9	28.2	25.2	42.1	37	17.4	38.6	26.3	13.5	
LOS	C	D	C	D	C	D	C	D	C	D	B	C	
Approach delay (s)/LOS	34.1	I	C	32.5	I	C	33.3	I	C	26	I	C	
Intersection delay (s)/LOS	31	C	31	C	31.5	I	C	26	I	C	26	C	

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information		Site Information	
Analyst	WY	Jurisdiction/Date	11/27/03
Agency or Company		EB/WB Street	PUANAKO.S
Analysis Period/Year	2005 SATO	NB/SB Street	KANOELIHUA
Comments	2005 TOTAL SATURDAY HOUR		

Intersection Data		Analysis period		Signal type		Actualized Field		% Back of queue	
Area type	Other	25	h						70
Volume (veh/h)	LI	TH	RT	LI	TH	RT	LI	TH	RT
RTOR volume (veh/h)	293	425	69	360	461	59	160	643	363
Peak-hour factor	.50								
Heavy vehicles (%)	.92								
Start-up lost time, s (t)	2								
Extension of effective green, s (t)	2								
Arrival type, AI	3								
Approach pedestrian volume (p/h)	10								
Approach bicycle volume (bc/h)	0								
Left/right parking (Y or N)	N / N / N / N / N / N / N / N / N / N								

Signal Phasing Plan		P-Phas		Phase 1		Phase 2		Phase 3		Phase 4		Phase 5		Phase 6		Phase 7		Phase 8			
L	LI	TH	R	RT	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L		
EB																					
NB																					
SB																					
Green (s)	7.7		3		22		8		10		27										
Yellow + All red (s)	4		2		6.3		1		4		7										
Cycle (s)	102						7.3														
Intersection Performance		Lost time per cycle (s)		7.3		Critical Wt Ratio		.824													

Lane group configuration		EB		WB		NB		SB		
Lane group configuration	L	T	R	L	T	R	L	T	R	
No. of lanes	1	1	1	2	1	2	1	1	1	
Flow rate (veh/h)	318	462	21	391	501	42	174	699	286	
Capacity (veh/h)	430	493	416	403	1426	636	259	765	554	
Adjusted saturation flow (veh/h)	1770	1863	1571	1770	3547	1583	3437	3547	1555	
wt ratio	.741	.937	.05	.97	.351	.067	.67	.914	.516	
g/C ratio	.412	.265	.265	.52	.402	.402	.075	.216	.356	
Average back of queue (veh)	8.3	16.5	.5	14.4	5.5	.8	2.9	12.9	6.9	
Uniform delay (s)	22.5	36.7	27.9	29.5	21.2	18.7	45.9	39.1	25.9	
Incremental delay (s)	6.8	25.7	0	37	0	0	6.6	15.4	.8	
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	
Delay (s)	29.3	62.4	27.9	66.5	21.2	18.7	52.5	54.5	26.7	
LOS	C	E	C	E	C	B	D	D	C	
Approach delay (s)/LOS	48.3 / D		40.1 / D		47.3 / D		34.4 / C		D	
Intersection delay (s)/LOS	42		/		/		/		D	

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information		Site Information	
Analyst	WY	Jurisdiction/Date	10/21/03
Agency or Company		EB/WB Street	EAST MAKAA
Analysis Period/Year	2003 AMEX	NB/SB Street	KANOELIHUA
Comments	2003 EXISTING AM PEAK HOUR		

Intersection Data		Analysis period		Signal type		Pre-timed		% Back of queue	
Area type	Other	25	h						70
Volume (veh/h)	LI	TH	RT	LI	TH	RT	LI	TH	RT
RTOR volume (veh/h)	22	64	85	84	72	210	258	1235	211
Peak-hour factor	.40								
Heavy vehicles (%)	.92								
Start-up lost time, s (t)	2								
Extension of effective green, s (t)	2								
Arrival type, AI	3								
Approach pedestrian volume (p/h)	0								
Approach bicycle volume (bc/h)	0								
Left/right parking (Y or N)	N / N / N / N / N / N / N / N / N / N								

Signal Phasing Plan		P-Phas		Phase 1		Phase 2		Phase 3		Phase 4		Phase 5		Phase 6		Phase 7		Phase 8			
L	LI	TH	R	RT	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L		
EB																					
NB																					
SB																					
Green (s)	7		7		28.8		15		11												
Yellow + All red (s)	4		2		6.2		7		7												
Cycle (s)	95						20														
Intersection Performance		Lost time per cycle (s)		20		Critical Wt Ratio		.665													

Lane group configuration		EB		WB		NB		SB		
Lane group configuration	L	T	R	L	T	R	L	T	R	
No. of lanes	1	1	1	1	1	1	1	1	1	
Flow rate (veh/h)	93	49	61	108	147	280	1342	175	114	
Capacity (veh/h)	212	413	279	290	357	335	1411	617	253	
Adjusted saturation flow (veh/h)	1832	1571	1770	1837	1541	1770	3447	1551	3437	
wt ratio	.441	.118	.219	.374	.411	.836	.951	.284	.451	
g/C ratio	.116	.263	.158	.158	.232	.189	.398	.398	.074	
Average back of queue (veh)	2.6	1.1	1.5	2.9	3.7	9.3	25.2	3.5	1.7	
Uniform delay (s)	39.1	26.6	34.9	35.8	31	37.1	27.7	19.4	42.2	
Incremental delay (s)	6.5	.6	1.8	3.7	3.5	21.3	14.8	1.1	5.7	
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	
Delay (s)	45.6	27.2	36.7	39.5	34.5	58.4	42.5	20.5	47.9	
LOS	D	C	D	D	C	E	D	C	D	
Approach delay (s)/LOS	39.3 / D		36.6 / D		42.8 / D		30.2 / C		D	
Intersection delay (s)/LOS	39.2		/		/		/		D	

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information
 Analyst: WY
 Agency or Company: EAST MAKAA
 Analysis Period/Year: 2005 AM/MT
 Comment: 2005 TOTAL AM PEAK HOUR

Site Information
 Jurisdiction/Date: EAST MAKAA
 EB/WB Street: KANOELERUA
 NB/SB Street: KANOELERUA

Intersection Data

Area type	Other	Analysis period		h	Signal type								Prelim'd	% Back of queue	70
		EB	WB		LT	TH	RT	LT	TH	RT	LT	TH			
Volume (veh/h)		22	79	78	103	87	263	270	1251	241	140	478	25		
RTOR volume (veh/h)			40				125				60		5		
Peak hour factor		.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	
Heavy vehicles (%)		2	2	2	2	2	2	2	2	2	2	2	2	2	
Start-up lost time, t ₁ (s)		2	2	2	2	2	2	2	2	2	2	2	2	2	
Extension of effective green, e (s)		2	2	2	2	2	2	2	2	2	2	2	2	2	
Arrival type, AT		3	3	3	3	3	3	3	3	3	3	3	3	3	
Approach pedestrian volume (p/h)		0	0	0	0	0	0	0	0	0	0	0	0	0	
Approach bicycle volume (b/h)		0	0	0	0	0	0	0	0	0	0	0	0	0	
Leaving parking (Y or N)		N	N	N	N	N	N	N	N	N	N	N	N	N	

Signal Phasing Plan

L	U	T	R	RT	P	Ph	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB							R							
WB							R			LTR				
NB							L	LTR	TR					
SB							L							
Green (s)							7	7	28.8	15	11			
Yellow + All red (s)							4	2	6.2	7	7			
Cycle (s)							55			20				

Intersection Performance

Lane group configuration	EB								WB								NB								SB							
	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R					
No. of lanes	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					
Flow rate (veh/h)	110	41	75	132	150	293	1360	197	152	541																						
Capacity (veh/h)	213	413	279	290	357	335	1411	617	253	1524																						
Adjusted saturation flow (veh/h)	1836	1571	1770	1837	1541	1770	3547	1551	3437	5028																						
w/c ratio	.516	.1	.268	.453	.42	.875	.964	.319	.601	.355																						
g/C ratio	.116	.263	.158	.158	.232	.189	.398	.398	.074	.303																						
Average back of queue (veh)	3.1	.9	1.9	3.6	3.8	10.1	26.1	4	2.4	4.5																						
Uniform delay (s)	39.5	26.5	35.2	36.3	31.1	37.4	27.9	19.2	42.6	25.8																						
Incremental delay (s)	8.7	.5	2.3	.5	3.6	25.8	16.7	1.4	10.1	.6																						
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0																						
Total queue delay (s)	48.2	27	37.5	41.3	34.7	63.2	44.6	21.1	52.7	26.4																						
Delay (s)	D	C	D	D	C	B	D	C	B	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D						
LOS	D	C	D	D	C	B	D	C	B	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D						
Approach delay (s)/LOS	42.4	/	D	/	D	/	D	/	45.1	/	D	/	D	/	D	/	D	/	D	/	D	/	D	/	D	/						
Intersection delay (s)/LOS	41.2	/		/		/		/		/		/		/		/		/		/		/		/		/						

Lost time per cycle (s) 20 Critical w/c Ratio .385

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information
 Analyst: WY
 Agency or Company: EAST MAKAA
 Analysis Period/Year: 2005 AM/AM
 Comment: 2005 AMBIENT AM PEAK HOUR

Site Information
 Jurisdiction/Date: EAST MAKAA
 EB/WB Street: KANOELERUA
 NB/SB Street: KANOELERUA

Intersection Data

Area type	Other	Analysis period		h	Signal type								Prelim'd	% Back of queue	70
		EB	WB		LT	TH	RT	LT	TH	RT	LT	TH			
Volume (veh/h)		22	65	85	73	220	270	1300	222	111	495	25			
RTOR volume (veh/h)			40				75			50		5			
Peak hour factor		.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92		
Heavy vehicles (%)		2	2	2	2	2	2	2	2	2	2	2	2		
Start-up lost time, t ₁ (s)		2	2	2	2	2	2	2	2	2	2	2	2		
Extension of effective green, e (s)		2	2	2	2	2	2	2	2	2	2	2	2		
Arrival type, AT		3	3	3	3	3	3	3	3	3	3	3	3		
Approach pedestrian volume (p/h)		0	0	0	0	0	0	0	0	0	0	0	0		
Approach bicycle volume (b/h)		0	0	0	0	0	0	0	0	0	0	0	0		
Leaving parking (Y or N)		N	N	N	N	N	N	N	N	N	N	N	N		

Signal Phasing Plan

L	U	T	R	RT	P	Ph	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB							R							
WB							R			LTR				
NB							L	LTR	TR					
SB							L							
Green (s)							7	7	28.8	15	11			
Yellow + All red (s)							4	2	6.2	7	7			
Cycle (s)							55			20				

Intersection Performance

Lane group configuration	EB								WB								NB								SB							
	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R					
No. of lanes	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						
Flow rate (veh/h)	95	50	62	110	158	293	1413	187	121	560																						
Capacity (veh/h)	212	413	279	290	357	335	1411	617	253	1524																						
Adjusted saturation flow (veh/h)	1832	1571	1770	1837	1541	1770	3547	1551	3437	5028																						
w/c ratio	.446	.121	.222	.379	.442	.875	1.001	.303	.476	.367																						
g/C ratio	.116	.263	.158	.158	.232	.189	.398	.398	.074	.303																						
Average back of queue (veh)	2.6	1.1	1.6	2.9	4	10.1	29.1	3.7	1.8	4.7																						
Uniform delay (s)	39.2	26.6	34.9	35.8	31.2	37.4	28.6	19.6	42.2	26																						
Incremental delay (s)	6.6	.6	1.8	3.7	3.9	25.8	24.3	1.3	6.3	.7																						
Initial queue delay (s)	0	0	0	0	0	0	0	0	0	0																						
Total queue delay (s)	45.8	27.2	36.7	39.5	35.1	63.2	52.9	20.9	48.5	26.7																						
Delay (s)	D	C	D	D	D	B	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D							
Approach delay (s)/LOS	39.4	/	D	/	D	/	D	/	44.6	/	D	/	D	/	D	/	D	/	D	/	D	/	D	/	D	/						
Intersection delay (s)/LOS	44.6	/		/		/		/		/		/		/		/		/		/		/		/		/						

Lost time per cycle (s) 20 Critical w/c Ratio .385

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information		Site Information	
Agency	WY	Articulation/Dist	10/2003
Agency or Company		EW/SB Street	EAST MAKAA
Analysis Period/Year	2003 PM/EX	NS/SB Street	KANOELEHUA
Comment	2003 EXISTING PM PEAK HOUR		

Intersection Data	
Area type	Other
Analysis period	.25 h
Signal type	Prelim
% Back of queue	70

Volume (veh/h)	19	182	297	391	87	340	74	510	272	399	1065	30
RTOR volume (veh/h)												
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, s (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, s (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	0	0	0	0	0	0	0	0	0	0	0	0
Approach bicycle volume (b/h)	0	0	0	0	0	0	0	0	0	0	0	0
Left/Right parking (Y or N)	N	I	N	N	I	N	N	I	N	N	I	N

Signal Phasing Plan	
L: L T TH	R: R
P: Pch	
Phase 1	Phase 2
Phase 3	Phase 4
Phase 5	Phase 6
Phase 7	Phase 8

EB	LT	RT	WB	LT	TR	SB	LT	TR
WB	L	R	L	TR	L	R	L	TR
NS	L	R	L	TR	L	R	L	TR
SB	L	R	L	TR	L	R	L	TR
Green (s)	7	5	19.8	17	11			
Yellow + All red (s)	4	1	6.2	7	7			
Cycle (s)	85							
Lost time per cycle (s)	19							
Critical wt Ratio	.695							

Intersection Performance				
Line group configuration	EB	WB	NS	SB
No. of lanes	1	1	2	3
Flow rate (veh/h)	218	214	285	235
Capacity (veh/h)	240	462	354	362
Adjusted saturation flow (veh/h)	1852	1571	1770	1809
wt ratio	.912	.463	.805	.649
g/C ratio	.129	.294	.2	.2
Average back of queue (veh)	7.3	4.7	8.2	6
Uniform delay (s)	36.5	24.5	32.4	31.3
Incremental delay (s)	39.1	3.3	17.5	8.7
Initial queue delay (s)	0	0	0	0
Delay (s)	75.6	27.8	49.9	40
LOS	B	C	D	C
Approach delay (s/LOS)	52	I	D	41
Intersection delay (s/LOS)	37.8			

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information		Site Information	
Agency	WY	Articulation/Dist	10/21/03
Agency or Company		EW/SB Street	EAST MAKAA
Analysis Period/Year	2003 PM/AM	NS/SB Street	KANOELEHUA
Comment	2003 AMBIENT PM PEAK HOUR		

Intersection Data	
Area type	Other
Analysis period	.25 h
Signal type	Prelim
% Back of queue	70

Volume (veh/h)	19	184	300	395	88	395	77	606	285	421	1123	32
RTOR volume (veh/h)												
Peak-hour factor	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92
Heavy vehicles (%)	2	2	2	2	2	2	2	2	2	2	2	2
Start-up lost time, s (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, s (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	0	0	0	0	0	0	0	0	0	0	0	0
Approach bicycle volume (b/h)	0	0	0	0	0	0	0	0	0	0	0	0
Left/Right parking (Y or N)	N	I	N	N	I	N	N	I	N	N	I	N

Signal Phasing Plan	
L: L T TH	R: R
P: Pch	
Phase 1	Phase 2
Phase 3	Phase 4
Phase 5	Phase 6
Phase 7	Phase 8

EB	LT	RT	WB	LT	TR	SB	LT	TR
WB	L	R	L	TR	L	R	L	TR
NS	L	R	L	TR	L	R	L	TR
SB	L	R	L	TR	L	R	L	TR
Green (s)	7	5	19.8	17	11			
Yellow + All red (s)	4	1	6.2	7	7			
Cycle (s)	85							
Lost time per cycle (s)	19							
Critical wt Ratio	.764							

Intersection Performance				
Line group configuration	EB	WB	NS	SB
No. of lanes	1	1	2	3
Flow rate (veh/h)	221	217	288	237
Capacity (veh/h)	240	462	354	362
Adjusted saturation flow (veh/h)	1852	1571	1770	1809
wt ratio	.921	.47	.813	.656
g/C ratio	.129	.294	.2	.2
Average back of queue (veh)	7.5	4.8	8.4	6.1
Uniform delay (s)	36.6	24.6	32.5	31.3
Incremental delay (s)	40.7	3.4	18.2	9
Initial queue delay (s)	0	0	0	0
Delay (s)	77.3	28	50.7	40.3
LOS	E	C	D	D
Approach delay (s/LOS)	52.8	I	D	43
Intersection delay (s/LOS)	39.3			

**UNSIGNALIZED INTERSECTION
LEVEL OF SERVICE (LOS) CALCULATIONS**

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET												
Analysis Summary						Site Information						
General Information						Site Information						
Analysis WY	2003					Jurisdiction	RAILROAD AVENUE					
Agency of Competency	2003 AMEX					Major Street	EAST PUAINAKO STREET					
Analysis Period/Year	2003 EXISTING AM PEAK HOUR					Minor Street						
Comment												
Input Data												
Lane Configuration	SB	NB	EB	WB								
Lane 1 (path)	TR	LT	R	L								
Lane 2												
Lane 3												
Movement	1 (RT)	2 (TH)	3 (PT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	108	35	49	212	61	22						
PHF	.9	.9	.9	.9	.9	.9						
Proportion of heavy vehicles, HV	3	3	3	3	3	3						
Flow rate	120	39	54	236	68	24						
Flare storage (ft of veb)												
Median storage (ft of veb)												
Signal upstream of Movement 2	B		Movement 5		A							
Length of study period (h)	2.5											
Output Data												
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	w/c	Queue Length (ft)	Control Delay (s)	LOS	Approach Delay and LOS					
1 R	24	906	.076	<1	9.1	A	11.8					
2 L	61	519	.117	<1	12.9	B	B					
3												
WB 1												
WB 2												
WB 3												
①												
②	54	1414	.038	<1	7.6	A						

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET													
Analysis Summary													
General Information				Site Information									
Analyst	WY											11/2/03	
Agency or Company	RAILROAD AVENUE												
Analysis Period/Year	EAST PUANAKO STREET												
Comment	2005 PM TO 2005 TOTAL PM PEAK HOUR												
Input Data													
Lane Configuration	SB	NB	EB	WB									
Lane 1 (curb)	TR	LT	R	L									
Lane 2													
Lane 3													
Movement	1 (LT)	2 (RT)	3 (PT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (PT)	10 (LT)	11 (TR)	12 (PT)	WB
Volume (veh/h)	272	99	41	137	33	41							
PHF	.9	.9	.9	.9	.9	.9							
Proportion of heavy vehicles, HV	3	3	3	3	3	3							
Flow rate	302	110	46	152	37	46							
Flare storage (ft of veb)						0							
Median storage (ft of veb)						0							
Signal operation of Movement 2	R										Movement 5	R	
Length of study period (h)	.25												
Output Data													
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	wt	Queue Length (veh)	Control Delay (s)	LDS	Approach Delay and LOS						
1 R	46	685	.067	<1	10.6	B	11.9						
EB 2 L	33	443	.074	<1	13.8	B	B						
3													
1													
WB 2													
3													
	46	1141	.04	<1	8.3	A							

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET													
Analysis Summary													
General Information				Site Information									
Analyst	WY											10/2/03	
Agency or Company	RAILROAD AVENUE												
Analysis Period/Year	EAST PUANAKO STREET												
Comment	2003 EXISTING SATURDAY HOUR												
Input Data													
Lane Configuration	SB	NB	EB	WB									
Lane 1 (curb)	TR	LT	R	L									
Lane 2													
Lane 3													
Movement	1 (LT)	2 (RT)	3 (PT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (PT)	10 (LT)	11 (TR)	12 (PT)	WB
Volume (veh/h)	171	70	30	144	72	34							
PHF	.9	.9	.9	.9	.9	.9							
Proportion of heavy vehicles, HV	3	3	3	3	3	3							
Flow rate	190	78	33	160	80	38							
Flare storage (ft of veb)						0							
Median storage (ft of veb)						0							
Signal operation of Movement 2	R										Movement 5	R	
Length of study period (h)	.25												
Output Data													
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	wt	Queue Length (veh)	Control Delay (s)	LDS	Approach Delay and LOS						
1 R	38	608	.047	<1	9.7	A	11.7						
EB 2 L	80	546	.146	1	12.7	B	B						
3													
1													
WB 2													
3													
	33	1290	.026	<1	7.9	A							

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary		Site Information	
General Information		Site Information	
Analysis WY	11/2/03	Jurisdiction/Date	
Agency or Company	EAST PUAINAKO ST	Major Street	
Analysis Period/Year	2005 TOAM	Minor Street	
Comment	2005 TOTAL AM PEAK		
Input Data			
Lane Configuration	EB	WB	NB
Lane 1 (curb)	TR	TR	LTR
Lane 2	LT	LT	
Lane 3			
Movement	1 (LT) 2 (TR) 3 (RT) 4 (LT) 5 (TR) 6 (RT) 7 (LT) 8 (TR) 9 (RT) 10 (LT) 11 (TR) 12 (RT)		SB
Volume (veh/h)	108	80	34
PIV	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3
Flow rate	120	89	38
Flare storage (f of veh)			
Median storage (f of veh)			
Signal operation of Movement 2			
Length of study period (h)	2.5		
Output Data			
Lane Movement	Flow Rate (veh/h)	Capacity (veh/s)	wt
1 LTR	143	437	.328
2			
3			
1 LTR	140	824	.17
2			
3			
EB	120	1465	.082
WB	1	1450	.001
Queue Length (feet)	Central Delay (s)	LOS	Approach Delay and LOS
17.2	17.2	C	17.2
10.3	10.3	B	10.3
<1	7.7	A	B
<1	7.5	A	A

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary		Site Information	
General Information		Site Information	
Analysis WY	10/20/03	Jurisdiction/Date	
Agency or Company	EAST PUAINAKO ST	Major Street	
Analysis Period/Year	2003 PM/EX	Minor Street	
Comment	2003 EXISTING PM PEAK		
Input Data			
Lane Configuration	EB	WB	NB
Lane 1 (curb)	TR	TR	LTR
Lane 2	LT	LT	
Lane 3			
Movement	1 (LT) 2 (TR) 3 (RT) 4 (LT) 5 (TR) 6 (RT) 7 (LT) 8 (TR) 9 (RT) 10 (LT) 11 (TR) 12 (RT)		SB
Volume (veh/h)	45	54	42
PIV	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3
Flow rate	50	60	47
Flare storage (f of veh)			
Median storage (f of veh)			
Signal operation of Movement 2			
Length of study period (h)	2.5		
Output Data			
Lane Movement	Flow Rate (veh/h)	Capacity (veh/s)	wt
1 LTR	84	503	.167
2			
3			
1 LTR	242	785	.308
2			
3			
EB	50	1431	.035
WB	8	1475	.005
Queue Length (feet)	Central Delay (s)	LOS	Approach Delay and LOS
<1	7.6	A	13.6
<1	7.5	A	B
			11.6
			B

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information **Site Information**

Analyst: WY Jurisdiction/Date: 10/21/03
 Agency or Company: Major Street: EAST PUAINAKO ST
 Analysis Period/Year: 2005 PM/AM Minor Street: OHIOHUI ST
 Comment: 2005 AMBIENT PM PEAK

Input Data

Input Data

Line Configuration	EB	WB	NB	SB
Line 1 (cont)	TR	TR	LTR	LTR
Line 2	LT			
Line 3				

Input Data

Movement	1 (LD)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	45	55	59	7	126	3	47	42	4	10	62	154
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	50	61	66	8	140	3	52	47	4	11	69	171
Flare storage (# of vehs)												
Median storage (# of vehs)												

Signal operation of Movement 2: _____ Movement 5: _____

Length of study period (h): .25

Output Data

Line Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB 1 LTR	84	488	.172	1	13.9	B	11.9
NB 2							
NB 3							
SB 1 LTR	251	767	.327	1	12	B	12
SB 2							
SB 3							
EB ①	50	1430	.035	<1	7.6	A	
NB ②	8	1450	.005	<1	7.5	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information **Site Information**

Analyst: WY Jurisdiction/Date: 11/2/03
 Agency or Company: Major Street: EAST PUAINAKO ST
 Analysis Period/Year: 2005 PM/AM Minor Street: OHIOHUI ST
 Comment: 2005 AMBIENT PM PEAK

Input Data

Input Data

Line Configuration	EB	WB	NB	SB
Line 1 (cont)	TR	TR	LTR	LTR
Line 2	LT			
Line 3				

Input Data

Movement	1 (LD)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	111	55	59	7	132	6	47	42	4	17	62	248
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	123	61	66	8	147	7	52	47	4	19	69	276
Flare storage (# of vehs)												
Median storage (# of vehs)												

Signal operation of Movement 2: _____ Movement 5: _____

Length of study period (h): .25

Output Data

Line Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB 1 LTR	84	335	.25	1	19.3	C	19.3
NB 2							
NB 3							
SB 1 LTR	364	723	.504	3	14.9	B	14.9
SB 2							
SB 3							
EB ①	123	1417	.087	<1	7.8	A	
NB ②	8	1450	.005	<1	7.5	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information **Site Information**

Analyst: WY Jurisdiction/Date: 11/2/03
 Agency or Company: EAST PUAHAKO ST
 Analysis Period/Year: 2005 SATO Major Street: EAST PUAHAKO ST
 Comment: 2005 TOTAL SATURDAY TR Minor Street: OHUOHU ST

Input Data

Lane Configuration	EB		WB		NB		SB					
	TR	LTR	TR	LTR	TR	LTR	TR	LTR				
Lane 1 (curb)												
Lane 2												
Lane 3												
Movement	1 (LT)	2 (TR)	3 (RT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (RT)	10 (LT)	11 (TR)	12 (RT)
Volume (veh/h)	311	89	44	4	112	10	55	40	9	12	42	351
PIV	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	346	99	49	4	124	11	61	44	10	13	47	390
Flare storage (f of veh)												
Median storage (f of veh)												
Signal upstream of Movement 2	Movement 5											
Length of study period (h)	.25											

Output Data

Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	wt	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
1 LTR	102	132	.775	5	91.7	F	91.7
NB 2							F
3							F
1 LTR	450	612	.735	6	25.4	D	25.4
SB 2							D
3	346	1439	.24	1	8.3	A	
4	4	1424	.003	<1	7.5	A	

CHAPTER 17 - AWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information **Site Information**

Analyst: WY Jurisdiction/Date: 11/2/03
 Agency or Company: EAST PUAHAKO ST
 Analysis Period/Year: 2005 AMMIT EB-WB Street: EAST PUAHAKO ST
 Comment: 2005 AM W/4 WAY STOP NB-SB Street: OHUOHU ST

Input Data

Lane code (Lane 1 is curb lane)	EB		WB		NB		SB	
	TR	L	TR	L	TR	L	TR	L
Left turn		108						
Through	80		40	53	50		18	
Right turn	34		10		4		105	
Peak-hour factor	.9	.9	.9	.9	.9	.9	.9	.9
% Heavy vehicles	3	3	3	3	3	3	3	3

Outputs

	EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Total lane flow rate (veh/h)	127	120	56	60	143	140	140	140
Departure headway, h _d (s)	5.17	5.89	5.4	5.55	4.88	4.34	4.34	4.34
Degree of saturation, x	.182	.196	.083	.093	.194	.169	.169	.169
Mean-up time, m (s)	2.3	2.3	2.3	2.3	2	2	2	2
Service time, t _s (s)	2.87	3.59	3.1	3.25	2.88	2.34	2.34	2.34
Capacity (veh/h)	688	604	642	624	722	807	807	807
Delay (s) (Equation 17-55)	9	10	8.6	8.8	9.1	8.2	8.2	8.2
Level of service (FHWA 17-72)	A	A	A	A	A	A	A	A
Delay (s), approach	9.5		8.7		9.1		8.2	
Level of service, approach	A		A		A		A	
Delay (s), intersection	9							
Level of service, intersection	A							

CHAPTER 17 - AWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET													
Analysis Summary													
General Information				Site Information									
Analysis WY	11/20/03			Jurisdiction/Date		EAST PUAINAKO ST		11/20/03		EB-WB Street		EAST PUAINAKO ST	
Agency or Company	2005 PM/MT			NB-SB Street		OHUOHU ST		2005 PM/MT		EB-WB Street		EAST PUAINAKO ST	
Analysis Period/Year	2005 PM W/4 WAY STOP			NB-SB Street		OHUOHU ST		2005 PM W/4 WAY STOP		EB-WB Street		EAST PUAINAKO ST	
Comment													
Input Data													
Lane code (Lane 1 is curb lane)	EB		WB		NB		SB		L	L	L	L	L
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2					
TR	111		7	47					17				LTR
Left-turn	55		70	62	42				57				
Through	59		6		4				248				
Right-turn	.9	.9	.9	.9	.9	.9	.9	.9	.9				
Peak-hour factor	3	3	3	3	3	3	3	3	3				
% Heavy vehicles													
Outputs													
Total lane flow rate (veh/h)	EB		WB		NB		SB		L	L	L	L	L
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2					
127	123	84	77	103					358				
Departure headway, h _d (s)	5.56	6.44	6.01	6.11	5.25				4.43				
Degree of utilization, u	.196	.221	.141	.13	.151				.441				
Move-up time, m (s)	2.3	2.3	2.3	2.3	2	2	2	2	2				
Service time, s (s)	3.26	4.14	3.71	3.81	3.25				2.43				
Capacity (veh/h)	641	551	577	549	667				802				
Delay (s) [Equation 17-55]	9.6	11	9.7	9.7	9.2				10.9				
Level of service (Exhibit 17-22)	A	B	A	A	A				B				
Delay (s), approach	10.3		9.7		9.2		10.9						
Level of service, approach	B		A		A		B						
Delay (s), intersection	10.3												
Level of service, intersection	B												

CHAPTER 17 - AWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET													
Analysis Summary													
General Information				Site Information									
Analysis WY	11/20/03			Jurisdiction/Date		EAST PUAINAKO ST		11/20/03		EB-WB Street		EAST PUAINAKO ST	
Agency or Company	2005 SAMIT			NB-SB Street		OHUOHU ST		2005 SAMIT		EB-WB Street		EAST PUAINAKO ST	
Analysis Period/Year	2005 SA W/4 WAY STOP			NB-SB Street		OHUOHU ST		2005 SA W/4 WAY STOP		EB-WB Street		EAST PUAINAKO ST	
Comment													
Input Data													
Lane code (Lane 1 is curb lane)	EB		WB		NB		SB		L	L	L	L	L
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2					
TR	311		4	55					12				LTR
Left-turn	89		60	52	40				42				
Through	44		10		9				351				
Right-turn	.9	.9	.9	.9	.9	.9	.9	.9	.9				
Peak-hour factor	3	3	3	3	3	3	3	3	3				
% Heavy vehicles													
Outputs													
Total lane flow rate (veh/h)	EB		WB		NB		SB		L	L	L	L	L
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2					
148	346	78	62	116					450				
Departure headway, h _d (s)	5.95	6.69	6.67	6.81	5.34				4.42				
Degree of utilization, u	.244	.642	.144	.118	.171				.552				
Move-up time, m (s)	2.3	2.3	2.3	2.3	2	2	2	2	2				
Service time, s (s)	3.65	4.39	4.37	4.51	3.34				2.42				
Capacity (veh/h)	653	538	521	516	714				841				
Delay (s) [Equation 17-55]	10.6	20.6	10.5	10.4	9.4				12.7				
Level of service (Exhibit 17-22)	B	C	B	B	A				B				
Delay (s), approach	17.6		10.5		9.4		12.7						
Level of service, approach	C		B		A		B						
Delay (s), intersection	14.2												
Level of service, intersection	B												

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary	
General Information	
Analyst	WY
Agency or Company	RAILROAD AVE
Analysis Period/Year	2003 AMEX
Comment	2003 EXISTING AM PEAK IIR
Site Information	
Jurisdiction/Date	10/31/03
Major Street	RAILROAD AVE
Minor Street	EAST MAKAALA ST

Input Data												
Line Configuration	SB	NB	EB	WB								
Line 1 (L/R)	TR	LT	R									
Line 2			L									
Line 3												
Movement												
	1 (L)	2 (TR)	3 (RT)	4 (L)	5 (TR)	6 (RT)	7 (L)	8 (TR)	9 (RT)	10 (L)	11 (TR)	12 (RT)
Volume (veh/h)		114	48	60	186		23		26			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		127	53	67	207		26		29			
Flare storage (f of veh)							0		0			
Median storage (f of veh)							0		0			

Signal operation of Movement 2	
Signal operation of Movement 2	Movement 5
Length of study period (h)	2.5

Output Data							
Line Movement	Flow Rate (veh/h)	Capacity (veh/h)	w/c	Queue Length (feet)	Control Delay (s)	LOS	Approach Delay and LOS
1 R	29	890	.033	<1	9.2	A	10.6
EB 2 L	23	508	.045	<1	12.4	B	B
3							
WB 2							
3							
①							
④	67	1389	.048	<1	7.7	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary	
General Information	
Analyst	WY
Agency or Company	RAILROAD AVE
Analysis Period/Year	2003 AMAM
Comment	2003 AMBIENT AM PEAK IIR
Site Information	
Jurisdiction/Date	10/31/03
Major Street	RAILROAD AVE
Minor Street	EAST MAKAALA ST

Input Data												
Line Configuration	SB	NB	EB	WB								
Line 1 (L/R)	TR	LT	R									
Line 2			L									
Line 3												
Movement												
	1 (L)	2 (TR)	3 (RT)	4 (L)	5 (TR)	6 (RT)	7 (L)	8 (TR)	9 (RT)	10 (L)	11 (TR)	12 (RT)
Volume (veh/h)		115	48	61	189		23		26			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		128	53	68	210		26		29			
Flare storage (f of veh)							0		0			
Median storage (f of veh)							0		0			

Signal operation of Movement 2	
Signal operation of Movement 2	Movement 5
Length of study period (h)	2.5

Output Data							
Line Movement	Flow Rate (veh/h)	Capacity (veh/h)	w/c	Queue Length (feet)	Control Delay (s)	LOS	Approach Delay and LOS
1 R	29	889	.033	<1	9.2	A	10.7
EB 2 L	23	503	.046	<1	12.5	B	B
3							
WB 2							
3							
①							
④	68	1388	.049	<1	7.7	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET													
Analysis Summary													
General Information				Site Information									
Analyst	WY			Jurisdiction/Date	11/2/03								
Agency or Company				Major Street	RAILROAD AVE								
Analysis Period/Year	2005 AMTO			Minor Street	EAST MAKAKALA ST								
Comment	2005 TOTAL AM PEAK HIR												
Input Data													
Line Configuration	SB	NB	EB	WB									
Line 1 (Lanes)	TR	LT	R										
Line 2			L										
Line 3													
Movement	1 (LT)	2 (TR)	3 (RT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (RT)	10 (LT)	11 (TR)	12 (RT)	
Volume (veh/h)	115	51	61	184	34	30							
PHF	.9	.9	.9	.9	.9	.9							
Proportion of heavy vehicles, HV	3	3	3	3	3	3							
Flow rate	128	57	68	204	38	33							
Flare storage (# of veh)						0							
Median storage (# of veh)													
Signal operation of Movement 2 _____ Movement 5 _____													
Length of study period (h) _____ .25 _____													
Output Data													
Line Movement	Flow Rate (veh/h)	Capacity (veh/h)	wt	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS						
1 R	33	887	.037	<1	9.2	A	11.1						
2 L	38	505	.075	<1	12.7	B	B						
3													
WB 2													
3													
	①												
	①	68	.049	<1	7.7	A							

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET													
Analysis Summary													
General Information				Site Information									
Analyst	WY			Jurisdiction/Date	10/31/03								
Agency or Company				Major Street	RAILROAD AVE								
Analysis Period/Year	2003 PMEX			Minor Street	EAST MAKAKALA ST								
Comment	2003 EXISTING PM PEAK HIR												
Input Data													
Line Configuration	SB	NB	EB	WB									
Line 1 (Lanes)	TR	LT	R										
Line 2			L										
Line 3													
Movement	1 (LT)	2 (TR)	3 (RT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (RT)	10 (LT)	11 (TR)	12 (RT)	
Volume (veh/h)	329	107	34	142	56	54							
PHF	.9	.9	.9	.9	.9	.9							
Proportion of heavy vehicles, HV	3	3	3	3	3	3							
Flow rate	366	119	38	158	62	60							
Flare storage (# of veh)						0							
Median storage (# of veh)													
Signal operation of Movement 2 _____ Movement 5 _____													
Length of study period (h) _____ .25 _____													
Output Data													
Line Movement	Flow Rate (veh/h)	Capacity (veh/h)	wt	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS						
1 R	60	627	.096	<1	11.3	B	13.2						
2 L	56	412	.136	<1	15.1	C	B						
3													
WB 2													
3													
	①												
	①	38	.035	<1	8.5	A							

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET															
Analysis Summary															
General Information				Site Information											
Analyst		WY		Jurisdiction/Date		10/31/03		Major Street		RAILROAD AVE		Minor Street		EAST MAKKAALA ST	
Agency or Company		2005 PM/AM		Major Street		RAILROAD AVE		Minor Street		EAST MAKKAALA ST		Signalization		WB	
Analysis Period/Year		2005 AMBIENT PM PEAK HR		Major Street		RAILROAD AVE		Minor Street		EAST MAKKAALA ST		Signalization		WB	
Comment		2005 AMBIENT PM PEAK HR		Major Street		RAILROAD AVE		Minor Street		EAST MAKKAALA ST		Signalization		WB	
Input Data															
Lane Configuration		SB		NB		EB		WB		WB		WB		WB	
Lane 1 (ft)		TR		LT		R		L		L		L		L	
Lane 2															
Lane 3															
Movement		1 (LT)	2 (TR)	3 (RT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (RT)	10 (LT)	11 (TR)	12 (RT)		
Volume (veh/h)		334	107	34	145	57	55								
PHF		.9	.9	.9	.9	.9	.9								
Proportion of heavy vehicles, HV		3	3	3	3	3	3								
Flow rate		371	119	38	161	63	61								
Flare storage (# of vehs)							0								
Median storage (# of vehs)							0								
Signalization of Movement 2 _____ Movement 5 _____															
Length of study period (h) _____ 2.5 _____															
Output Data															
Lane Movement		Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS							
1 R		61	623	.098	<1	11.4	B	13.3							
2 L		57	407	.14	<1	15.3	C	B							
3															
WB 1															
WB 2															
3															
①															
④		38	1068	.035	<1	8.5	A								

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET															
Analysis Summary															
General Information				Site Information											
Analyst		WY		Jurisdiction/Date		11/2/03		Major Street		RAILROAD AVE		Minor Street		EAST MAKKAALA ST	
Agency or Company		2005 PM/TO		Major Street		RAILROAD AVE		Minor Street		EAST MAKKAALA ST		Signalization		WB	
Analysis Period/Year		2005 TOTAL PM PEAK HR		Major Street		RAILROAD AVE		Minor Street		EAST MAKKAALA ST		Signalization		WB	
Comment		2005 TOTAL PM PEAK HR		Major Street		RAILROAD AVE		Minor Street		EAST MAKKAALA ST		Signalization		WB	
Input Data															
Lane Configuration		SB		NB		EB		WB		WB		WB		WB	
Lane 1 (ft)		TR		LT		R		L		L		L		L	
Lane 2															
Lane 3															
Movement		1 (LT)	2 (TR)	3 (RT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (RT)	10 (LT)	11 (TR)	12 (RT)		
Volume (veh/h)		316	128	34	142	63	59								
PHF		.9	.9	.9	.9	.9	.9								
Proportion of heavy vehicles, HV		3	3	3	3	3	3								
Flow rate		373	142	38	158	70	66								
Flare storage (# of vehs)							0								
Median storage (# of vehs)							0								
Signalization of Movement 2 _____ Movement 5 _____															
Length of study period (h) _____ 2.5 _____															
Output Data															
Lane Movement		Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS							
1 R		66	611	.108	<1	11.6	B	13.8							
2 L		70	401	.174	1	15.9	C	B							
3															
WB 1															
WB 2															
3															
①															
④		38	1045	.036	<1	8.6	A								

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary		Site Information				
General Information		Site Information				
Agency	WY	Jurisdiction/Date	10/21/03			
Agency or Company		Major Street	RAILROAD AVE			
Analysis Period/Year	2003 SAEX	Minor Street	EAST MAKAKALA ST			
Comment	2003 EXISTING SATURDAY HR					
Input Data						
Lane Configuration	SB	NB	EB			
Lane 1 (curb)	TR	LT	R			
Lane 2			L			
Lane 3			L			
Movement						
Volume (veh/h)	1 (LT) 2 (TR) 3 (RT) 4 (LT) 5 (TR) 6 (RT) 7 (LT) 8 (TR) 9 (RT) 10 (LT) 11 (TR) 12 (RT)					
Volume (veh/h)	175 107 33 147	66	37			
PHF	.9 .9 .9 .9	.9	.9			
Proportion of heavy vehicles, HV	3 3 3 3	3	3			
Flow rate	194 119 37 163	73	41			
Pure storage (f of veh)			0			
Median storage (f of veh)			0			
Signal upstream of Movement 2 _____ R _____ Movement 5 _____ A						
Length of study period (h) _____ 25 _____						
Output Data						
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	Queue Length (feet)	Control Delay (s)	LOS	Approach Delay and LOS
1 R	41	782	<1	9.9	A	11.8
2 L	66	519	<1	12.9	B	
3					B	
WB 2						
3						
	37	1241	<1	8	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary		Site Information				
General Information		Site Information				
Agency	WY	Jurisdiction/Date	10/21/03			
Agency or Company		Major Street	RAILROAD AVE			
Analysis Period/Year	2003 SAAM	Minor Street	EAST MAKAKALA ST			
Comment	2003 AMBIENT SATURDAY HR					
Input Data						
Lane Configuration	SB	NB	EB			
Lane 1 (curb)	TR	LT	R			
Lane 2			L			
Lane 3			L			
Movement						
Volume (veh/h)	1 (LT) 2 (TR) 3 (RT) 4 (LT) 5 (TR) 6 (RT) 7 (LT) 8 (TR) 9 (RT) 10 (LT) 11 (TR) 12 (RT)					
Volume (veh/h)	178 108 33 149	66	37			
PHF	.9 .9 .9 .9	.9	.9			
Proportion of heavy vehicles, HV	3 3 3 3	3	3			
Flow rate	198 120 37 166	73	41			
Pure storage (f of veh)			0			
Median storage (f of veh)			0			
Signal upstream of Movement 2 _____ R _____ Movement 5 _____ A						
Length of study period (h) _____ 25 _____						
Output Data						
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	Queue Length (feet)	Control Delay (s)	LOS	Approach Delay and LOS
1 R	41	778	<1	9.9	A	11.8
2 L	66	515	<1	13	B	
3					B	
WB 2						
3						
	37	1237	<1	8	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary		Site Information					
General Information		Jurisdiction/Date					
Agency	WY	Major Street	RAILROAD AVE				
Agency or Company		Minor Street	EAST MAKAALA ST				
Analysis Period/Year	2005 SATO						
Comment	2005 TOTAL SATURDAY HIR						
Input Data							
Lane Configuration	SB	NB	WB				
Lane 1 (curb)	TR	LT	R				
Lane 2			L				
Lane 3							
Movement	1 (LT) 2 (TR) 3 (TR)	4 (LT) 5 (TR) 6 (TR)	7 (LT) 8 (TR) 9 (TR) 10 (LT) 11 (TR) 12 (TR)				
Volume (veh/h)	182 124 33	149	82 43				
PHF	.9 .9 .9	.9	.9				
Proportion of heavy vehicles, HV	3 3 3	3	3				
Flow rate	202 138 37	166	91				
Flare storage (# of veh)			0				
Median storage (# of veh)			0				
Signal upstream of Movement 2 _____ Movement 5 _____							
Length of study period (h) _____ 2.5 _____							
Output Data							
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	Wt	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
1 R	48	765	.063	<1	10	A	12.4
2 L	91	506	.18	1	13.7	B	B
3							
WB 1							
WB 2							
WB 3							
①	37	1214	.03	<1	8.1	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary		Site Information					
General Information		Jurisdiction/Date					
Agency	WY	Major Street	EAST MAKAALA ST				
Agency or Company		Minor Street	OHUOHU STREET				
Analysis Period/Year	2003 EXAM						
Comment	2003 EXISTING AM PEAK HOUR						
Input Data							
Lane Configuration	EB	WB	NB				
Lane 1 (curb)	TR	T	LR				
Lane 2	T	LT					
Lane 3							
Movement	1 (LT) 2 (TR) 3 (TR)	4 (LT) 5 (TR) 6 (TR)	7 (LT) 8 (TR) 9 (TR) 10 (LT) 11 (TR) 12 (TR)				
Volume (veh/h)	42 54 9	82	86 14				
PHF	.9 .9 .9	.9	.9				
Proportion of heavy vehicles, HV	3 3 3	3	3				
Flow rate	47 60 10	91	96				
Flare storage (# of veh)			0				
Median storage (# of veh)			0				
Signal upstream of Movement 2 _____ Movement 5 _____							
Length of study period (h) _____ 2.5 _____							
Output Data							
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	Wt	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
1 LR	112	848	.132	<1	9.9	A	9.9
2							
3							
WB 1							
WB 2							
WB 3							
①	10	1475	.007	<1	7.5	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary		Site Information										
General Information		Site Information										
Analyst	WY	Jurisdiction/Date	10/31/03									
Agency or Company	EAST MAKAALA ST	Major Street	EAST MAKAALA ST									
Analysis Period/Year	2003 EX/PM	Minor Street	OHIUOHU STREET									
Comment	2003 EXISTING PM PEAK HOUR											
Input Data												
Lane Configuration	EB	WB	NB SB									
Lane 1 (ft/s)	TR	T	LR									
Lane 2	T	LT										
Lane 3												
Movement												
	1 (LT)	2 (TR)	3 (RT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (RT)	10 (LT)	11 (TR)	12 (RT)
Volume (veh/h)	84	201	37	104	194					21		
PIV	.9	.9	.9	.9	.9					.9		
Proportion of heavy vehicles, HV	3	3	3	3	3					3		
Flow rate	93	223	41	116	216					23		
Flare storage (ft of veto)										0		
Median storage (ft of veto)										0		
Signal upstream of Movement 2												
Length of study period (h)	.25			R			Movement 5			R		
Output Data												
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS					
1 LR	239	620	.386	2	14.4	B	14.4					
NB 2												
3							B					
1												
SB 2												
3												
①	41	1233	.033	<1	8	A						
④												

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary		Site Information										
General Information		Site Information										
Analyst	WY	Jurisdiction/Date	10/31/03									
Agency or Company	EAST MAKAALA ST	Major Street	EAST MAKAALA ST									
Analysis Period/Year	2005 AM/PM	Minor Street	OHIUOHU STREET									
Comment	2005 AMBIENT PM PEAK HOUR											
Input Data												
Lane Configuration	EB	WB	NB SB									
Lane 1 (ft/s)	TR	T	LR									
Lane 2	T	LT										
Lane 3												
Movement												
	1 (LT)	2 (TR)	3 (RT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (RT)	10 (LT)	11 (TR)	12 (RT)
Volume (veh/h)	85	203	37	105	198					21		
PIV	.9	.9	.9	.9	.9					.9		
Proportion of heavy vehicles, HV	3	3	3	3	3					3		
Flow rate	94	226	41	117	220					23		
Flare storage (ft of veto)										0		
Median storage (ft of veto)										0		
Signal upstream of Movement 2												
Length of study period (h)	.25			R			Movement 5			R		
Output Data												
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS					
1 LR	243	617	.394	2	14.6	B	14.6					
NB 2												
3							B					
1												
SB 2												
3												
①	41	1230	.033	<1	8	A						
④												

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET											
Analysis Summary			Site Information								
General Information			Site Information								
Agency	WY	11/20/03	Jurisdiction/Date	EAST MAKAALA ST		WB		NB		SB	
Agency or Company	2005 TOPM		Major Street	EAST MAKAALA ST		T		LR			
Analysis Period/Year	2005 TOTAL PM PEAK HOUR		Minor Street	OHUOHU STREET		LT					
Comment											
Input Data			Input Data								
Lane Configuration	EB		WB		NB		SB				
Lane 1 (cont)	TR		T		LR						
Lane 2	T		LT								
Lane 3											
Movement			Movement								
1 (LT)	2 (TR)	3 (RT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (RT)	10 (LT)	11 (TR)	12 (RT)
Volume (veh/h)	174	235	63	204	216	35					
PHF	.9	.9	.9	.9	.9	.9					
Proportion of heavy vehicles, HV	3	3	3	3	3	3					
Flow rate	193	261	70	227	240	39					
Flare storage (# of vehs)	0										
Median storage (# of vehs)	0										
Signal upstream of Movement 2	B		B		B		B		B		
Length of study period (h)	.25										
Output Data			Output Data								
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	w/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS				
1 L.R.	279	445	.627	4	25.7	D	25.7				
2											
3							D				
NB 1											
NB 2											
NB 3											
SB 1											
SB 2											
SB 3											
①	70	1096	.064	<1	8.5	A					
②											

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET											
Analysis Summary			Site Information								
General Information			Site Information								
Agency	WY	10/31/03	Jurisdiction/Date	EAST MAKAALA ST		WB		NB		SB	
Agency or Company	2003 EXSA		Major Street	EAST MAKAALA ST		T		LR			
Analysis Period/Year	2003 EXISTING SATURDAY HOUR		Minor Street	OHUOHU STREET		LT					
Comment											
Input Data			Input Data								
Lane Configuration	EB		WB		NB		SB				
Lane 1 (cont)	TR		T		LR						
Lane 2	T		LT								
Lane 3											
Movement			Movement								
1 (LT)	2 (TR)	3 (RT)	4 (LT)	5 (TR)	6 (RT)	7 (LT)	8 (TR)	9 (RT)	10 (LT)	11 (TR)	12 (RT)
Volume (veh/h)	80	196	38	112	223	24					
PHF	.9	.9	.9	.9	.9	.9					
Proportion of heavy vehicles, HV	3	3	3	3	3	3					
Flow rate	89	218	42	124	248	27					
Flare storage (# of vehs)	0										
Median storage (# of vehs)	0										
Signal upstream of Movement 2	B		B		B		B		B		
Length of study period (h)	.25										
Output Data			Output Data								
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	w/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS				
1 L.R.	250	622	.402	2	14.6	B	14.6				
2											
3							B				
NB 1											
NB 2											
NB 3											
SB 1											
SB 2											
SB 3											
①	42	1244	.034	<1	8	A					
②											

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET												
Analysis Summary			Site Information									
General Information			Analysis Data									
Agency	WY	Jurisdiction/Date	EB			WB			NB			SB
Agency or Company	2005 AMSA	EAST MAKAALA ST	TR	T	T	TR	T	T	TR	T	T	SB
Analysis Period/Year	2005 AMBIENT SATURDAY HOUR	OHIUOHU STREET	T	LT	LT	LT	LT	LT	LT	LT	LT	LT
Comment												
Input Data												
Lane Configuration	EB	WB	NB	SB								
Lane 1 (carh)	TR	T	T	SB								
Lane 2	T	LT	LT	LT								
Lane 3												
Movement	1 (LT)	2 (TR)	3 (BT)	4 (LT)	5 (TR)	6 (BT)	7 (LT)	8 (TR)	9 (BT)	10 (LT)	11 (TR)	12 (BT)
Volume (veh/h)		81	198	38	113	227	24					
PHF		.9	.9	.9	.9	.9	.9					
Proportion of heavy vehicles, HV		3	3	3	3	3	3					
Flow rate		90	220	42	126	252	27					
Flare storage (f of veh)							0					
Median storage (f of veh)												
Signal upstream of Movement 2	A			A			A			A		
Length of study period (h)	.25											
Output Data												
Lane Movement	Flow Rate (veh/h)	Capacity (veh/h)	w/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS					
NB 1 LR	279	618	.452	2	15.5	C	15.5					
NB 2												
NB 3												
SB 1												
SB 2												
SB 3												
①	42	1240	.034	<1	8	A						
②												
③												
④												
⑤												
⑥												
⑦												
⑧												
⑨												
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CHAPTER 17 - AWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET																
Analysis Summary		Site Information														
General Information		Site Information														
Analyst	WY	Arbitration Date										11/2/03				
Agency or Company		EB-WB Street										EAST MAKAALA ST				
Analysis Period/Year	2005.AMMIT	NB-SB Street										OHIUOHU ST				
Comment	2005 AM W/4 WAY STOP															
Input Data																
Lane code (Lane 1 is curb lane)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
TR	T	T	T	LT	LR											
Volume (veh/h)	0	108	136	0	22	123										
Left-turn																
Through																
Right-turn																
Peak-hour factor	.9	.9	.9	.9	.9	.9										
% Heavy vehicles	3	3	3	3	3	3										
Outputs																
Total lane flow rate (veh/h)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	81	120	151	24	161											
Departure headway, h_d (s)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	4.45	5.15	5.17	5.67	4.77											
Degree of utilization, z	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	.1	.172	.217	.038	.214											
Move-up time, m (s)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	2.3	2.3	2.3	2.3	2											
Service time, s_s (s)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	2.15	2.85	2.87	3.37	2.77											
Capacity (veh/h)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	800	686	679	632	732											
Delay (s) (Equation 17-53)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	7.6	8.9	9.3	8.6	9.1											
Level of service (Equation 17-27)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	A	A	A	A	A											
Delay (s), approach	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	8.4	9.2	9.2	9.1												
Level of service, approach	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	A	A	A	A	A											
Delay (s), Intersection	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	8.9	8.9	8.9	8.9												
Level of service, Intersection	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	A	A	A	A	A											

CHAPTER 17 - AWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET																
Analysis Summary		Site Information														
General Information		Site Information														
Analyst	WY	Arbitration Date										11/2/03				
Agency or Company		EB-WB Street										EAST MAKAALA ST				
Analysis Period/Year	2005.PRMIT	NB-SB Street										OHIUOHU ST				
Comment	2005 PM W/4 WAY STOP															
Input Data																
Lane code (Lane 1 is curb lane)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
TR	T	T	T	LT	LR											
Volume (veh/h)	0	114	204	0	63	216										
Left-turn																
Through																
Right-turn																
Peak-hour factor	.9	.9	.9	.9	.9	.9										
% Heavy vehicles	3	3	3	3	3	3										
Outputs																
Total lane flow rate (veh/h)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	261	127	227	70	279											
Departure headway, h_d (s)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	5	5.71	5.77	6.28	4.93											
Degree of utilization, z	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	.362	.201	.363	.172	.382											
Move-up time, m (s)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	2.3	2.3	2.3	2.3	2											
Service time, s_s (s)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	2.7	3.41	3.47	3.98	2.93											
Capacity (veh/h)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	716	647	613	588	750											
Delay (s) (Equation 17-53)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	10.5	9.8	11.7	9.8	10.9											
Level of service (Equation 17-27)	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	B	A	B	A	B											
Delay (s), approach	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	10.3	11.3	11.3	10.9												
Level of service, approach	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	B	B	B	B	B											
Delay (s), Intersection	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	10.8	10.8	10.8	10.8												
Level of service, Intersection	EB		WB		NB		SB		EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	B	B	B	B	B											

CHAPTER 17 - AWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary												
General Information			Site Information									
Analyst	WY	Arbitration/Date	EB		WB		NB		SB		Date	
Agency or Company		EB-WB Street	WB Street		NB Street		SB Street				11/20/03	
Analysis Period/Year	2003 SAMIT	WB-SB Street	NB Street		SB Street							
Comment	2003 SA W/4 WAY STOP											
Input Data												
Line code (Lane 1 is curb lane)	EB		WB		NB		SB					
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Left-turn	TR	T	T	LT	LR							
Through	0	235	249	0								
Right-turn	266			68								
Peak-hour factor	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
% Heavy vehicles	3	3	3	3	3	3	3	3	3	3	3	3
Outputs												
	EB		WB		NB		SB					
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Total lane flow rate (veh/h)	296	261	277	130	371							
Departure headway, h _d (s)	5.39	6.1	6.22	6.73	4.79							
Degree of utilization, z	.443	.443	.478	.243	.493							
Move-up time, m (s)	2.3	2.3	2.3	2.3	2							
Service time, s (s)	3.09	3.8	3.92	4.43	2.79							
Capacity (veh/h)	703	618	587	559	981							
Delay (s) (Equation 17-55)	12.3	13.6	14.5	11.6	12.4							
Level of service (Equation 17-27)	B	B	B	B	B							
Delay (s), approach	12.9		13.5		12.4							
Level of service, approach	B		B		B							
Delay (s), intersection	12.9											
Level of service, intersection	B											



Appendix D

Wastewater Engineering Report

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THE HOME DEPOT

Hilo, Hawaii

PRELIMINARY WASTEWATER ENGINEERING REPORT

Prepared for:

Home Depot USA, Inc.
3800 West Chapman Avenue, 5th Floor
Orange, California 92868

Prepared by:

M&E Pacific
Pauahi Tower Suite 500
1001 Bishop Street
Honolulu, Hawai'i 96813

October 2003

SECTION 1

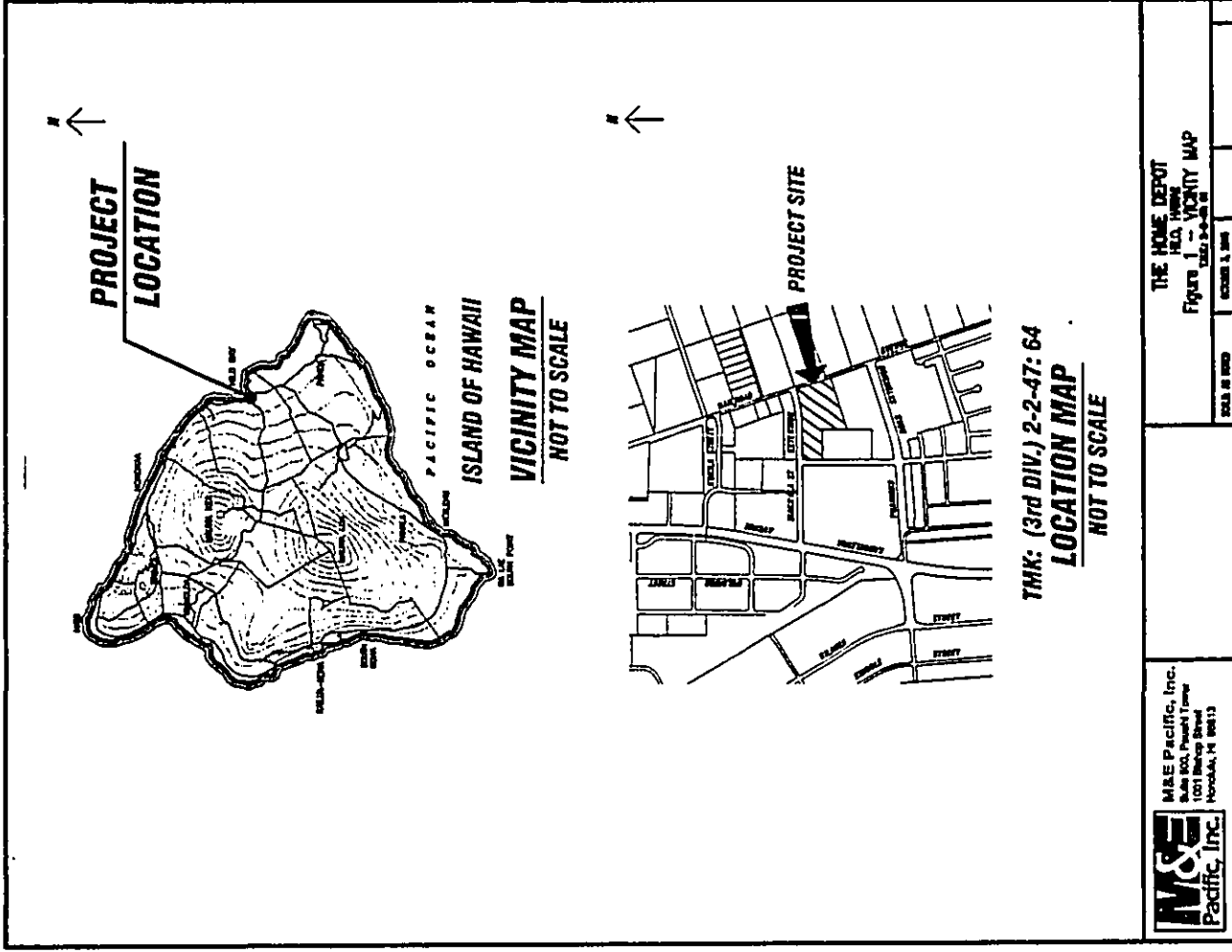
INTRODUCTION

1.1 PURPOSE

The objective of this preliminary engineering report is to analyze and evaluate the effects of the proposed Home Depot project. Home Depot would like to obtain government approval for the sewer connection for the proposed project. This report calculates the projected sewer flows generated by the store.

1.2 GENERAL INFORMATION

- A. The Home Depot store is being developed by Home Depot USA. The store will consist of 115,000 square feet of floor space and will retail building products.
- B. Owner: Home Depot USA, Inc.
3800 West Chapman Avenue, 5th Floor
Orange, California 92868
- Contact: Jon Stephani
Project Manager
- C. The project will be located on the property bordered by Makaala Street, Ohuohu Street and Railroad Avenue.
- D. Vicinity Map (See Figure 1 in Page 2a.)



SECTION 2

ESTIMATED FLOWS

2.1 BACKGROUND

The Home Depot is located on the eastern side of the Island of Hawaii in the Hilo District. The project is bordered by Makaala Street, Obunhu Street and Railroad Avenue (See Figure 1). The Tax Map Key (TMK) for the property is 2-2-47: 64. We are proposing to connect to the existing sewer line in Makaala Street. We understand that the sewer system in this area is connected to the 36-inch line within Leilani Street and the County's Hilo Wastewater Treatment Plant, both of which have capacity to accommodate additional flow. We feel that Home Depot's contribution will not be large due to the type of facility. The other alternative is to connect to a system in Railroad Avenue which would heavily encumber the project. Home Depot needs the store to open by January 2005.

2.2 METHODOLOGY

For comparison, we are using the fixture unit counts from the Home Depot store in Kaloko Industrial Park and the Metcalf & Eddy tables. Metcalf & Eddy standards provide data based on the number of parking stalls and number of employees. The Hawaii Administrative Rules (HAR) for individual wastewater systems are directed toward residential housing. The City & County of Honolulu Wastewater Standards is based on acreage and do not account for big box stores with an excessive parking area. Therefore, calculations for a large retail store using the HAR or the City & County Wastewater Standards will result in flows that will be unreasonable. The UPC guidelines are focused on buildings and are a more practical method of calculations for this building. We have used this method to determine the septic tank size for Home Depot in Kaloko Industrial Park.

2.2.1 CRITERIA

The criteria used to wastewater flows are summarized as follows:
Home Depot Statistics show 125 employees and 1400 customers in one day.
Maximum Fixture Units = 134.3
Shopping Center = 2 gals/parking space (Ref. 5, Table 2-3)
Employee = 10 gal/employee (Ref. 5, Table 2-3)

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2.3 ESTIMATED FLOWS

Calculation of Average flows using different methodologies:

1. From Table I-2, Uniform Plumbing Code, Capacity of Septic Tanks based on Fixture Units
Maximum Fixture Units = 134.3
100 Fixture Units = 3500 gallons
Extra fixture units over 100, 25 gallons per fixture unit
Minimum Septic Tank Capacity = $3500 + (34.3 \times 25) = 4357.5$ gpd
2. Metcalf & Eddy Method (Table 2-3, Ref. 5)
Shopping Center = 2 gals/parking space
Employee = 10 gal/employee
 $(2 \times 501) + (10 \times 125) = 2,252$ gallons
3. Waiakea Center Method (Ref. 6)
Walmart Unit Flow Rate = 0.04 gpd/sf of floor area
Floor Area = 130,579 sf
 $0.04 \times 130,579 = 5223.16$

Using an average flow of 5225 gpd, we have calculated the design average flow and design peak flow using the City & County of Honolulu Wastewater Standards: (see appendix for calculations)

$$\begin{array}{rcl} \text{Design Average Flow} & = & 0.007 \text{ cfs} \\ \text{Design Peak Flow} & = & 0.06 \text{ cfs} \end{array}$$

2.4 SUMMARY

With the above calculations the maximum projected sewer flow is approximately 5225gpd. In reviewing the existing 12" sewerline within Makaala Street, the full flow capacity of the line is 1.95 cfs (see appendix for calculations) and the Design Peak Flow for Waiakea Center is approximately 1.58 cfs. Home Depot will add a Design Peak Flow of 0.06 cfs which makes the total flow 1.64 cfs.
If Home Depot needed a separate line with a projected flow of 0.06 cfs, we would require a 6" line which is a minimum size pipe that we would use with a flow depth of 22%.
We do not feel that the projected flow would validate Home Depot to construct a sewer system within Railroad Avenue and are requesting approval to connect to the system in Makaala Street. We understand that the sewer system in this area is connected to the 36-inch line within Leilani Street and the County's Hilo Wastewater Treatment Plant, both of which have capacity to accommodate additional flow.

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REFERENCES

1. Hawaii Administrative Rules, Title 11, Department of Health, Chapter 62, Wastewater Systems
2. Uniform Plumbing Code (UPC), 1994
3. Memorandum from Mechanical Enterprises, mechanical consultant, September 19, 2001, Fixture Unit Count
4. Manual of Septic-Tank Practice, U.S. Department of Public Health, Education and Welfare, 1972
5. "Wastewater Engineering", Third Edition, Metcalf & Eddy
6. "Design Standards, Volume 1, General Requirements for Wastewater Facilities, Design of Sewers and Pump Stations", Department of Wastewater Management, City & County of Honolulu, State of Hawaii, July 1993
7. "Preliminary Engineering Report – Basis of Design for Waiakea Center Off-Site Sewer Improvements", November 8, 1995, Autstin, Tsutsumi & Associates, Inc.

APPENDIX

SUMMARY
 DESIGN AVE FLOW = 0.005 MGD = 0.007 CFS
 DESIGN PEAK FLOW = 0.041 MGD = 0.06 CFS

PURPOSE: DETERMINE THE QUANTITY OF SUMMER FLOW GENERATED BY THE ILLINOIS DEPOT STATION

REF. 1 "DESIGN STANDARDS MANUAL" GENERAL REQUIREMENTS FOR WASTEWATER FACILITIES CITY & COUNTY OF ILLINOIS, JULY 1993

2. MICHIGANIC ENJOY PASSES, SAINT LOUIS & WATG. SYSTEMS FACILITIES, ILLINOIS DEPOT STATION

CURTAIN LA. 1. SUMMER QTD

CALCULATIONS.

Ave FLOW = 5225 GPD = 0.005 MGD

MAX WASTEWATER FLOW FACTOR = 5

MAX FLOW = 5225 x 5 = 0.026 MGD

DRY WEATHER VI = 0

WUC TO VI BEING BASED ON PRECIPITATION.

DESIGN AVE. FLOW = 0.005 MGD + DRY VI = 0.005 MGD

DESIGN MAX FLOW = 0.026 MGD + DRY VI = 0.026 MGD

WET WEATHER VI = 1250 GPD

1250 x 12.2 AMUS = 15250 GPD = 0.015 MGD

DESIGN PEAK FLOW = DES MAX FLOW + WET VI = 0.026 MGD + 0.015 = 0.041 MGD

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	Circular Channel
Flow Element	Circular Channel
Method	Manning's Formu
Solve For	Channel Depth

Input Data	
Manning's Coeff.	0.010
Slope	0.00000 ft/ft
Diameter	6 in
Discharge	0.06 cfs

Results	
Depth	0.11 ft
Flow Area	3.2e-2 ft ²
Wetted Perim	0.49 ft
Top Width	0.41 ft
Critical Depth	0.12 ft
Percent Full	22.0 %
Critical Slope	0.004195 ft/ft
Velocity	1.87 ft/s
Velocity Head	0.05 ft
Specific Energy	0.16 ft
Froude Number	1.19
Maximum Disc	0.81 cfs
Discharge Full	0.56 cfs
Slope Full	0.000068 ft/ft
Flow Type	Subcritical

DEPTH OF FLW FOR
6" PIPE @
MIN SLOPE = 0.11'
≈ 22% FULL

Worksheet for Circular Channel

Project Description	
Worksheet	Downspout - 1
Flow Element	Circular Chann
Method	Manning's Form
Solve For	Channel Slope

Input Data	
Manning's Coeff.	0.015
Depth	0.45 ft
Diameter	6 in
Discharge	0.06 cfs

Results	
Slope	0.000134 ft/ft
Flow Area	0.2 ft ²
Wetted Perim	1.25 ft
Top Width	0.30 ft
Critical Depth	0.12 ft
Percent Full	90.0 %
Critical Slope	0.009438 ft/ft
Velocity	0.32 ft/s
Velocity Head	1.81e-3 ft
Specific Energy	0.45 ft
Froude Number	0.07
Maximum Disc	0.06 cfs
Discharge Full	0.06 cfs
Slope Full	0.000152 ft/ft
Flow Type	Subcritical

6" PIPE @ 90%
MIN. S = 0.000134 < 0.0060
∴ OKAY

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	Circular Channel
Flow Element	Circular Channel
Method	Manning's Formu
Solve For	Full Flow Capacit
Input Data	
Mannings Coeffk.	0.015
Slope	0.04000 ft/R
Diameter	12 in.
Results	
Depth	1.00 ft
Discharge	1.95 cfs
Flow Area	0.8 ft ²
Wetted Perime	3.14 ft
Top Width	0.00 ft
Critical Depth	0.00 ft
Percent Full	100.0 %
Critical Slope	0.06045 ft/R
Velocity	2.49 ft/s
Velocity Head	0.10 ft
Specific Energy	1.10 ft
Froude Number	0.00
Maximum Disch	2.10 cfs
Discharge Full	1.95 cfs
Slope Full	0.04000 ft/R
Flow Type	N/A

FULL FLOW CAPACITY
OF EXISTING 12"
IN MAFAALA ST.
FOR WAJAJAKIA CENTER
= 1.95 CFS