UNIVERSITY OF HAWAI'I WEST O'AHU

FINAL ENVIRONMENAL IMPACT STATEMENT

Submitted Pursuant to
Chapter 343, Hawai'i Revised Statutes
and
Title 11, Chapter 200, Hawai'i Administrative Rules

Prepared for:
State of Hawai'i
University of Hawai'i West O'ahu

Prepared by:

PBR HAWAII

This Final Environmental Impact Statement and all ancillary documents have been prepared under my direction or supervision and the information submitted, to the best of my knowledge, fully addresses document content requirements as set forth in Chapter 343, Hawai'i Revised Statutes and Section 11-200-17, Hawai'i Administrative Rules.

UH-14

Gene Awakuni, Chancellor
University of Hawai'i West Oahu

December 2006

UNIVERSITY OF HAWAII WEST OAHU

INFRASTRUCTURE STUDY

Ewa, Oahu, Hawaii

Prepared for:

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June 2006

Table of Content

		Page
SECTION 1	INTRODUCTION	1
1.1	General Background Information	1
1.2	Purpose and Scope	1
1.3	Related Studies	4
	1.3.1 Ewa Water Master Plan	4
	1.3.2 East Kapolei Development Master Plan Water System Study	4
	1.3.3 Wastewater Master Plan for East Kapolei	4
	1.3.4 University of Hawaii West Oahu Infrastructure Study	5
	1.3.5 Engineering Report for the Kapolei Interceptor Sewer	5
	1.3.6 Ewa Village Drainage Master Plan	5
	1.3.7 North-South Road and Kapolei Parkway Environmental Assessment	5
	1.3.8 Environmental Assessment of the Ewa Nonpotable Water System	5
1.4	Existing Site Conditions	6
	1.4.1 Climatology	6
	1.4.2 Topography	6
	1.4.3 Soils	6
1.5	Developed Site Conditions	7
SECTION 2	WATER SYSTEMS	10
2.1	Existing Supply System	10
2.2	Basis of Design	10
2.3	Proposed Onsite Water Systems	13
	2.3.1 UH West Oahu Land Uses for Water Demand Calculations	13
	2.3.2 Water Demands for Proposed Developments	14
	2.3.3 Storage Requirements	16
	2.3.4 Booster Pumps Requirements	16
	2.3.5 System Descriptions	17
SECTION 3	SANITARY SEWER SYSTEM	19
3.1	Existing Regional Sewer System	19
3.2	Basis of Design	19
3.3	Proposed Onsite Sanitary Sewer System	22
	3.3.1 Wastewater Flows for Proposed Developments	22
	3.3.2 System Description	22
SECTION 4	DRAINAGE SYSTEM	25
4.1	Existing Regional Condition	25
4.2	Existing Onsite Condition	25
4.3	Basis of Design	27

4.4 Proposed Drainage Improvements..... 28
4.4.1 Regional Drainage System..... 28
4.4.2 University Campus Onsite Drainage System..... 28
4.4.2.1 UH Campus Site Phase 1 Development..... 30
4.4.2.2 Full Build-out UH Campus Site..... 32
4.4.3 Private Development Land Onsite Drainage System..... 32

APPENDICES

APPENDIX A WATER DEMAND CALCULATIONS
APPENDIX B WASTEWATER FLOW CALCULATIONS
APPENDIX C DRAINAGE CALCULATIONS
APPENDIX D BELT COLLINS HAWAII'S REPORT

FIGURES

Figure 1.1 Location Map
Figure 1.2 Vicinity Map
Figure 1.3 Land Use Plan
Figure 2.1 Regional Potable Water Systems Supply
Figure 2.2 Onsite Water Systems
Figure 3.1 Existing Regional Sewer System
Figure 3.2 Onsite Sanitary Sewer System
Figure 4.1 Existing Regional Drainage Systems
Figure 4.2 Proposed Regional Drainage Systems
Figure 4.3 Phase 1 Campus Onsite Drainage System
Figure 4.4 Full Build-out Campus Onsite Drainage System

SECTION 1
INTRODUCTION

1.1 General Background Information

For the last decade, the population in the west Oahu region has been rapidly growing. To meet the increasing need for higher education in this region, the University of Hawaii Board of Regents has decided to relocate the University of Hawaii West Oahu campus from its current location within the Leeward Community College site in Pearl City to a permanent location, the UH West Oahu Makai Property, in the Ewa District (Figure 1.1).

The UH West Oahu Makai site, approximately 500 acres, is bordered to the north by Farrington Highway and to the east by the proposed North-South Road, with Villages of Kapolei Malanai subdivision and Kapolei Golf Course on the west, and the Department of Hawaiian Home Lands' (DHHL) vacant land on the south (Figure 1.2). The property was used previously for sugar cane production, but presently the majority of the site is used for vegetable cultivation.

The University's Long Range Development Plan (LRDP, July 2004) has built a framework for the development of the UH West Oahu campus that will ultimately accommodate 7,600 students. The initial phase of development is planned to accommodate 1,520 students (Phase 1). The LRDP includes a comprehensive master plan that encourages "town and gown" interaction between the University and the surrounding community. Per the revised Land Use Plan of the LRDP Update (May 2006), the campus occupies about 103.5 acres. The remainder of the 500 acres will be developed by the University or a private development partner. The development will include residential, mixed use (residential and commercial), student housing in possible lands for campus expansion, an elementary school, and parks.

1.2 Purpose and Scope

The purpose of this preliminary engineering study is to identify the utility improvements needed for the development of the UH West Oahu Makai property based on the LRDP.

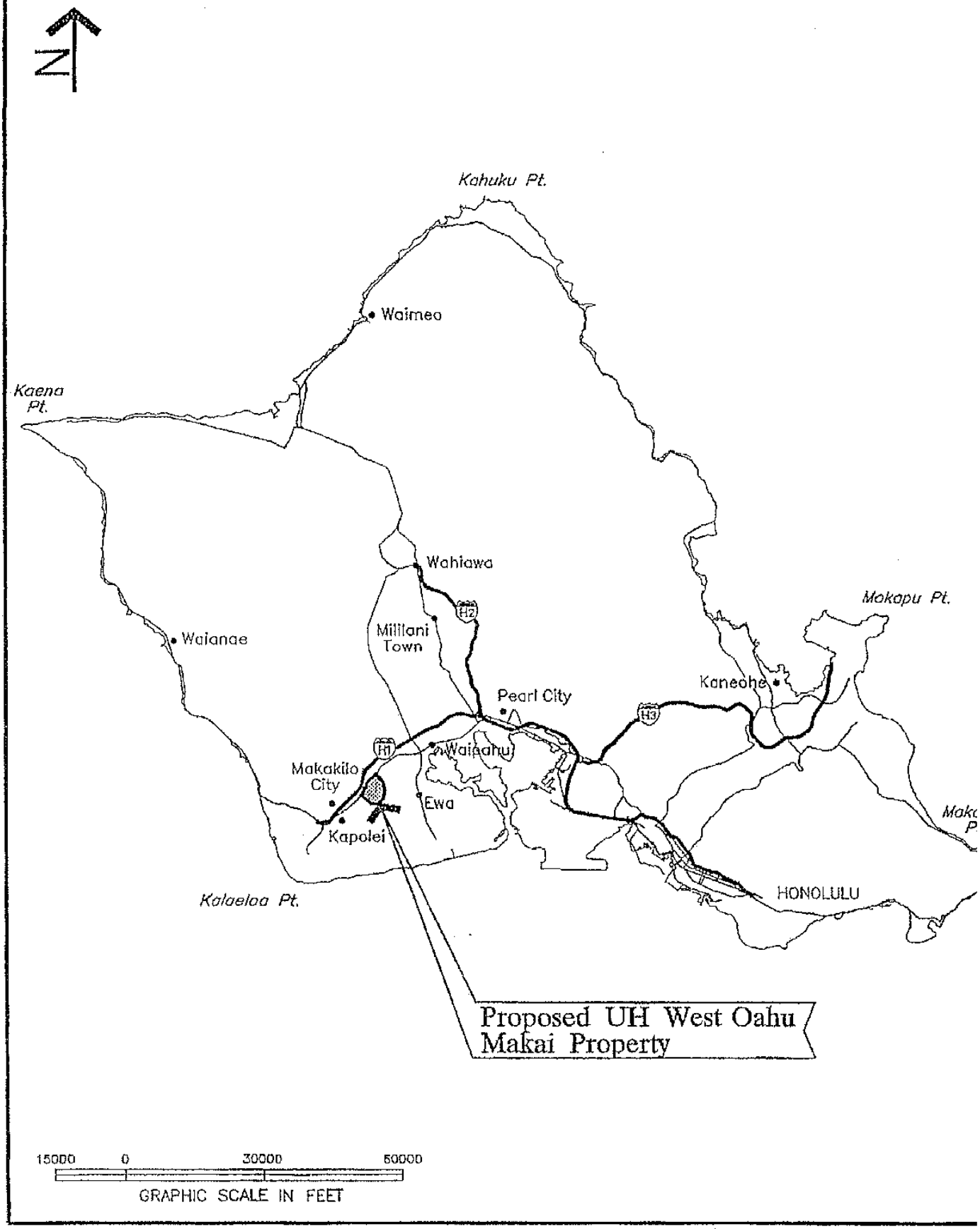

Fig. 1.1	Location Map	UNIVERSITY OF HAWAII WEST OAHU INFRASTRUCTURE STUDY EWA, OAHU, HAWAII Prepared By: ENGINEERING CONCEPTS, INC.

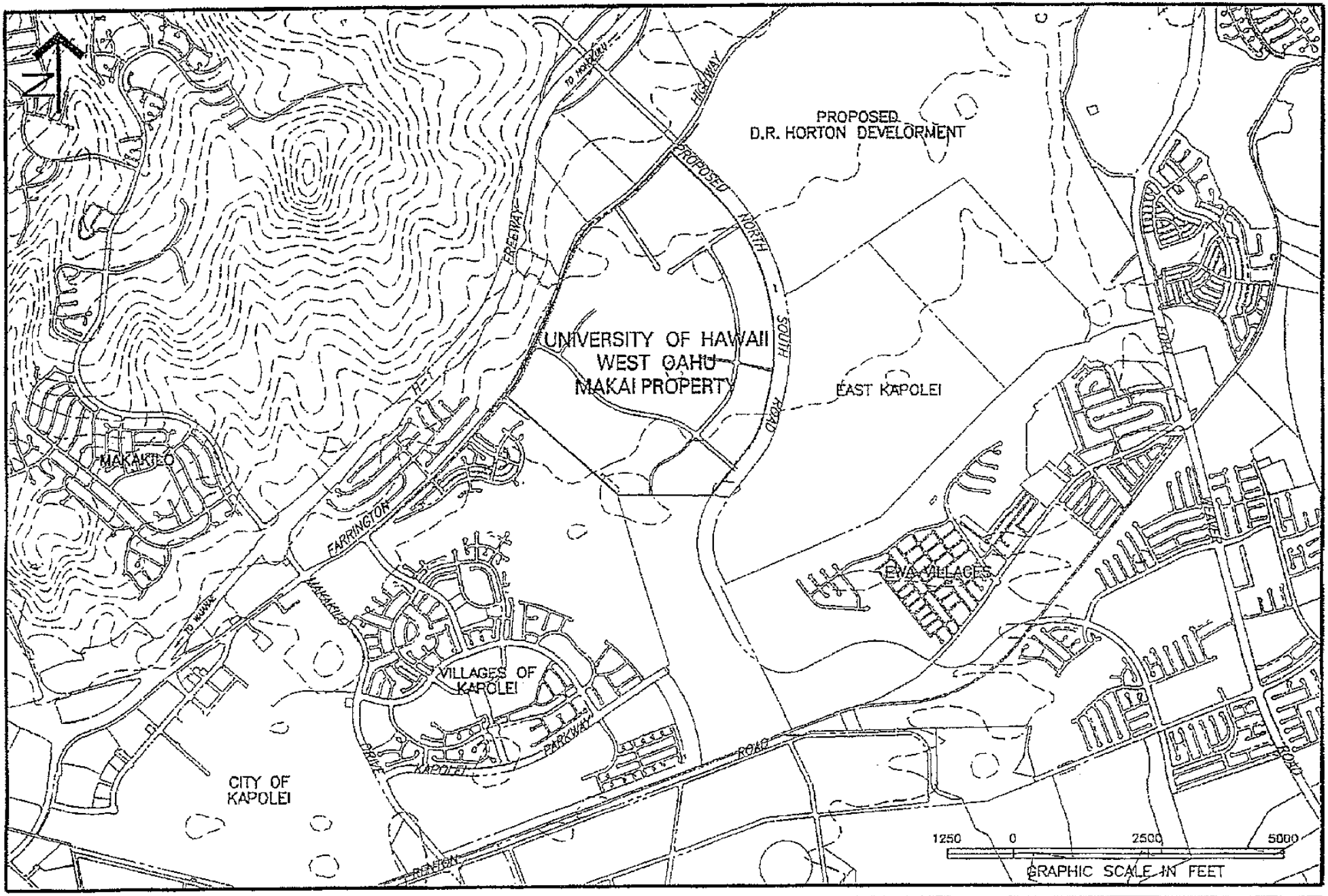

Fig. 1.2 Vicinity Map

UNIVERSITY OF HAWAII WEST OAHU
INFRASTRUCTURE STUDY
EWA. OAHU. HAWAII

This study outlines the required infrastructure systems at a master planning level. The scope of this study includes:

- Assessment of potable water demands.
- Assessment of non-potable water demands.
- Identification of possible water supply sources.
- Schematic layout of proposed main potable water systems.
- Assessment of wastewater contributions.
- Schematic layout of proposed sewage systems.
- Assessment of existing drainage conditions.
- Assessment of developed drainage conditions.
- Schematic layout of proposed onsite drainage facilities.

1.3 Related Studies

1.3.1 Ewa Water Master Plan

This master plan was prepared by Belt Collins for the Ewa Plain Water Development Corporation (August 1987).. It established guidelines for calculating water demands for future developments in the Ewa Plain.

1.3.2 East Kapolei Development Master Plan Water System Study

The master plan was prepared for DHHL by Akinaka & Associates, Ltd. (January 2005). The water demand calculated for UH West Oahu site was based on 100 percent potable water use and a different residential density compared with the current Land Use Plan in the LRDP.

1.3.3 Wastewater Master Plan for East Kapolei

Community Planning and Engineering, Inc. (formerly Community Planning, Inc.) prepared this master plan for DHHL. It used the same Land Use Plan as the water study in Section 1.3.2.

1.3.4 University of Hawaii West Oahu Infrastructure Study

This previous study was conducted by R. M. Towill Corporation for the University of Hawaii during an earlier iteration of the Land Use Plan. Since then, the land use and development plan have been revised.

1.3.5 Engineering Report for the Kapolei Interceptor Sewer

This report was prepared by Community Planning and Engineering, Inc. for a group of developers who are participating in the developments in Kapolei region: Estate of James Campbell, Housing and Community Development Corporation of Hawaii (HCDCH), Ko Olina Intangibles, LLC, and Finance Realty (January 2002). The Kapolei Interceptor proposed by this study was constructed and completed in October 2005.

1.3.6 Ewa Village Drainage Master Plan

R. M. Towill Corporation designed this master plan (April 1996) for the development of Ewa Villages, which is located southeast of the UH West Oahu Makai property. The plan laid out the requirements for the regional drainage facilities.

1.3.7 North-South Road and Kapolei Parkway Environmental Assessment

The assessment was prepared by Parsons Brinckerhoff Quade & Douglas Inc. for the proposed connector road between Ewa Beach and the H-1 Freeway. This road will be one of the main access routes to the UH West Oahu site and will serve as a utility corridor for the East Kapolei area. Phase 1A, a portion of the planned road from Kapolei Parkway to Farrington Highway, is currently under construction.

1.3.8 Environmental Assessment of the Ewa Nonpotable Water System

The Honolulu Board of Water Supply (BWS) plans to utilize non-potable water from the City's Water Reclamation Facility in Ewa and has developed the Ewa Nonpotable Master Plan (prepared by R. M. Towill Corporation). A 215-foot elevation non-potable water supply system is proposed in the master plan. The lower section of the UH West Oahu Makai property falls within the service zone of the 215-foot elevation system. Gray,

Hong Nojima & Associates, Inc. conducted the environmental assessment for the master plan.

1.4 Existing Site Conditions

1.4.1 Climatology

The climate in this area is warm and dry year-round, with prevailing northeasterly tradewinds. The average annual rainfall is about 23 inches. The tradewinds do not bring much rain to the region. Most of the rainfall occurs from October through April when southerly Kona winds cause heavy rain and thunderstorms.

Based on the data collected over 50 years at the Ewa Plantation, average daily temperatures in the area range from 65°Fahrenheit (F) to 84°F. The extreme temperatures experienced are a low of 47°F and a high of 93°F.

1.4.2 Topography

The site is located within the Ewa plain below the base of the Waianae mountain range. The ground is relatively flat, with slopes varying from one to two percent. Elevations vary from a high of 155 feet above mean sea level (MSL) at the intersection of Farrington Highway and the proposed North-South Road (at the northern property boundary), to a low of 75 feet above MSL adjacent to the DHHL property (at the southern property boundary).

Two dry gulches, Kaloi Gulch and Hunehune Gulch, run through the site. Hunehune Gulch converges with Kaloi Gulch in the lower portion of the site.

1.4.3 Soils

The soil survey published by the Soil Conservation Service (presently known as the Natural Resources Conservation Service) indicates that the site contains four soil types: predominantly Honouliuli clay (HxA and HxB), Waialua silty clay (WkA), Ewa silty clay (EaB and EwC), and Waipahu silty clay (WzA). These soils are characterized by moderate permeability, slow runoff, slight erosion hazard, moderate to high shrink-swell

potential, and low concrete corrosivity. The soils are categorized in Hydrologic Soil Group B.

1.5 Developed Site Conditions

The LRDP Land Use Plan (Figure 1.3) provides a vision for development of the UH West Oahu campus in conjunction with the surrounding lands within the 500-acre property. Approximately 110.5 acres of the property (including the initial 1,520-student campus) will be development in Phase 1. Ultimately, the UH West Oahu Lands will include a 7,600-student campus; University Village (student housing/mixed use or campus expansion); work force/affordable housing; a Hawaiian Electric Company, Inc. (HECO) substation; and roads. The Private Development lands will include single- and multi-family residential uses; mixed-use areas; a detention basin; an elementary school; a HECO substation; and roads.

Five access points are planned to serve the UH West Oahu Makai property, two from Farrington Highway and three from North-South Road. Currently, the State Department of Transportation is constructing the Phase 1A of the North-South Road. The North-South Road provides an important link between the UH West Oahu Makai property and the existing and proposed developments in the surrounding areas. It also provides a crucial connection to the H-1 Freeway. It is anticipated that the North-South Road and the interchange will be completed in about the same time frame as the opening of Phase 1 of UH West Oahu campus.

The City Department of Transportation Service (DTS) has planned to widen Farrington Highway from the existing 2-lane road to 4 lanes from Kapolei Golf Course to North-South Road, and widen the road to six lanes from North-South Road to Fort Weaver Road. However, the planned widening is not budgeted in the Fiscal Year 2006-2008 Transportation Improvement Program and will not likely be completed before the construction of the campus. The University is planning to construct the road improvements required for access at the two intersections with Farrington Highway. Discussion and coordination with DTS are required on this issue.

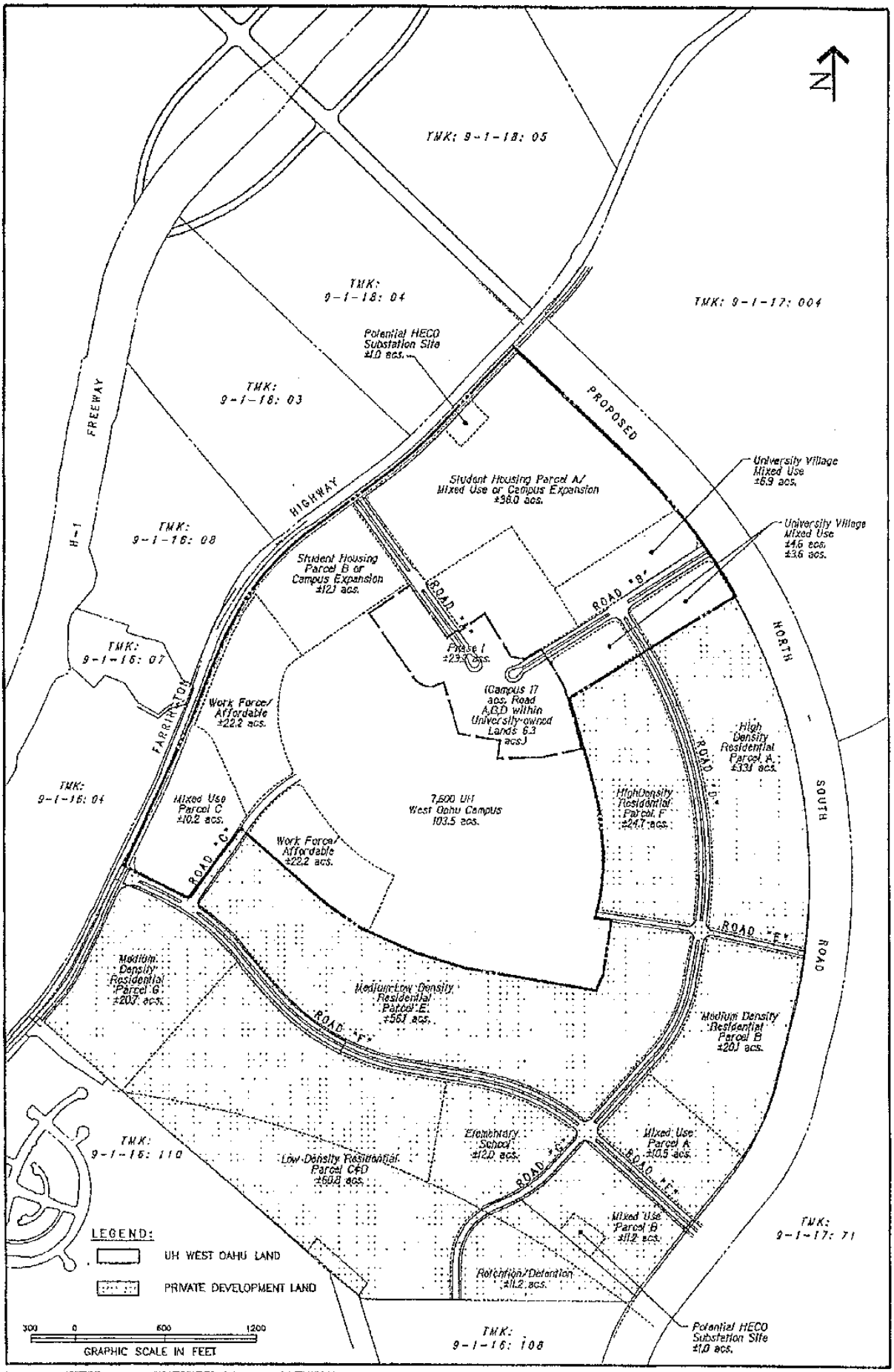

Fig. 1.3 **Land Use Plan**

UNIVERSITY OF HAWAII WEST OAHU INFRASTRUCTURE STUDY
EWA, OAHU, HAWAII
Prepared By: ENGINEERING CONCEPTS, INC.

A hierarchical network of roadways will be provided within the property. Road A, Road B, Road D, Road E, and Road F will service the regional roadway network, providing access from the UH West Oahu Makai property to the surrounding Ewa/Kapolei region. Road C and Road G are planned as collector roadways, providing access to the various land uses within the property. Road A and Road B are envisioned as the major entry roadways to the campus. A pedestrian/bikeway network is integrated with the roadways. Accessible routes are planned throughout the campus.

The finish grades will generally follow the existing terrain. According to a preliminary assessment by Geolabs, Inc. (based on soil literature review and site visual observations), the upper 3 feet of soils at the site may have been disturbed by past agriculture land use and would need to be properly engineered to support of planned new structures. It is anticipated that over-excavation and replacement of the excavated material with compacted fill may be required. The assessment letter report addressed the concerns on the potential shrink/swell effects, low California Bearing Ratio (CBR) value, and the development of shrinkage cracks in the ground due to the dry weather conditions in Ewa. A final geotechnical engineering report must be completed prior to the design phase of this project.

The following sections of this preliminary engineering study will discuss the required water system, sanitary sewer, and drainage system for the development of the UH West Oahu campus.

SECTION 2
WATER SYSTEMS

2.1 Existing Supply System

The UH West Oahu campus lies within the Board of Water Supply's (BWS) 215-foot and 440-foot service zones. Based on discussion with BWS, water is available to both service zones from the 215-foot system. The existing 30-inch and 36-inch potable water transmission mains in Farrington Highway are providing water to the Kapolei 215-foot reservoirs and the Barbers Point 215-foot reservoirs via the Honouliuli Line Booster and the Kapolei Line Booster. A 4-million gallon (MG) 215-foot reservoir has been planned and designed for the East Kapolei developments, which covers portions of the UH West Oahu site. Presently, there are no 440-foot system facilities in the vicinity to support the East Kapolei developments. A new system will need to be constructed for the development. The water will be conveyed from the 215-foot water system to the proposed 440-foot reservoir through booster pumps. Figure 2.1 depicts the existing and proposed regional potable water systems.

The BWS has planned to utilize the R-1 reclaimed water from the Honouliuli Wastewater Treatment Plant, which is currently producing 12 mgd of R-1 quality effluent, as a nonpotable water source for the Ewa Plain. To accomplish this, BWS plans to construct a reservoir with a spillway elevation at 215 feet and install irrigation systems along the North-South Road corridor.

2.2 Basis of Design

The onsite water systems proposed in this report for the UH West Oahu campus will be designed in conformance with the BWS Water System Standards (2002) and based on the guidelines established in Ewa Water Master Plan. The criteria are summarized in Table 2.1. This table provides both potable and nonpotable average daily demands for various land uses. The average daily demands are derived by applying a 1.2 factor to the average daily water use as defined in the Table 2.1.

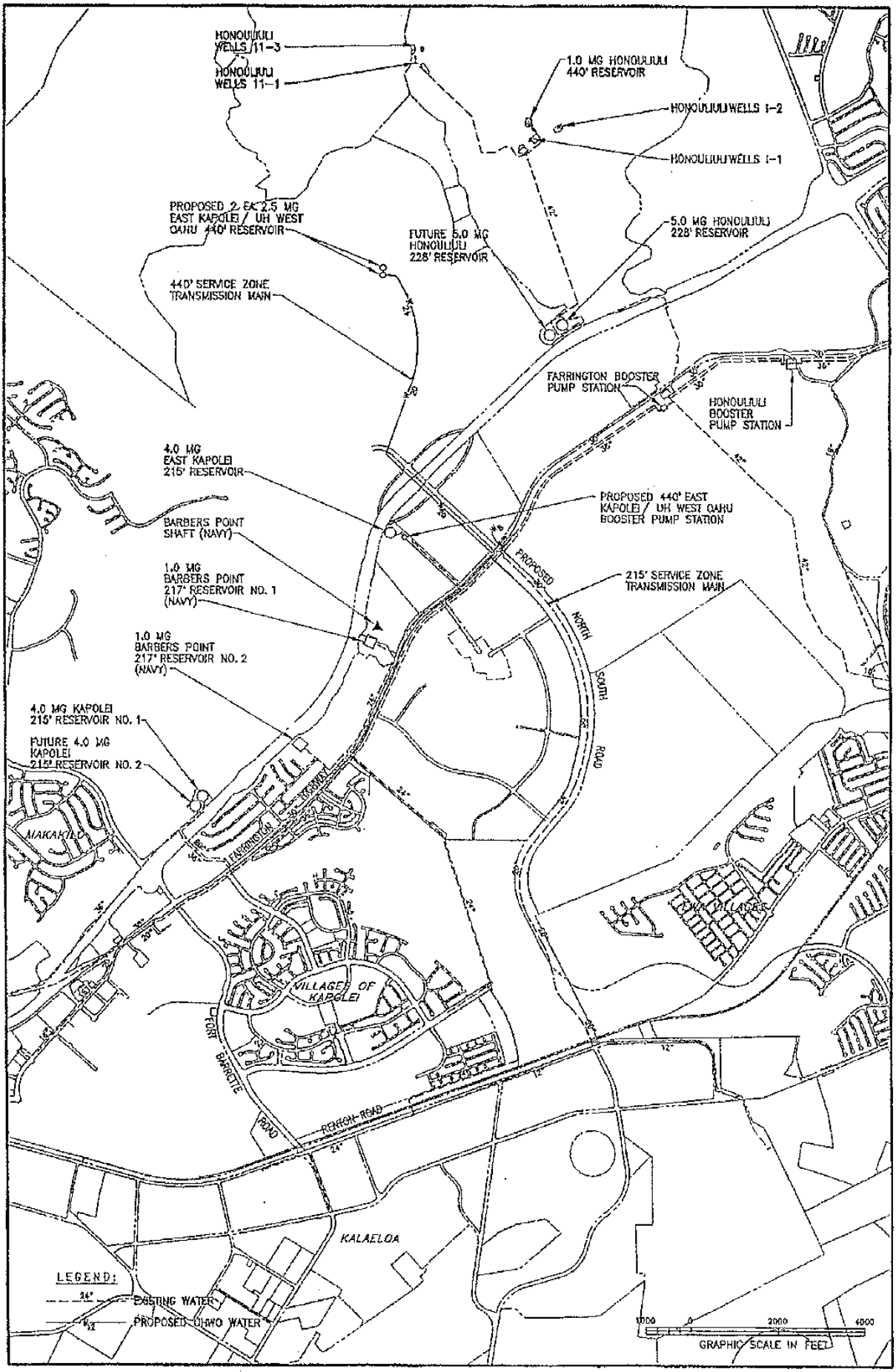

Fig. 2.1	Regional Potable Water Systems Supply	UNIVERSITY OF HAWAII WEST OAHU INFRASTRUCTURE STUDY EWA, OAHU, HAWAII Prepared By: ENGINEERING CONCEPTS, INC.

TABLE 2.1
WATER SYSTEM DESIGN CRITERIA

Land Use	Unit Demand	All Potable System	Dual System			
			Avg. Water Use		Avg. Daily Demand	
			Potable	Non-Potable	Potable	Non-Potable
Residential						
-Single Family	GPD/Unit	500	345	155	414	186
-Multi-Family Low Rise	GPD/Unit	400	276	124	331	149
-Multi-Family High Rise	GPD/Unit	300	207	93	248	112
Commercial, Offices	GPD/Acre	3,000	1,800	1,200	2,160	1,440
Resort	GPD/Unit	350	203	147	244	176
	GPD/Acre	4,000	2,320	1,680	2,784	2,016
Parks	GPD/Acre	4,000	600	3,400	720	4,080
School	GPD/Student	60	35	25	42	30
UH West Oahu[6]	GPD/Student	60	60		60	
Industrial	GPD/Acre	4,000	1,184	2,816	1,421	3,379
Commercial / Industrial	GPD/1,000 Ft^2	100	60	40	72	48
Commercial / Residential	GPD/1,000 Ft^2	120	83	37	100	44

PIPELINE, STORAGE, AND WELL PUMP SIZING CRITERIA

1. Demand Factors
   a. AVERAGE DAY DEMAND. For land uses to be served by a dual system, a 1.2 factor is applied to the AVERAGE WATER USE rates to derive the AVERAGE DAY DEMAND. For land uses served only by the potable system, AVERAGE WATER USE and AVERAGE DAY DEMAND are identical.
   b. MAXIMUM DAY DEMAND = (1.5) x AVERAGE DAY DEMAND.
   c. PEAK HOUR RATE = (3.0) x AVERAGE DAY DEMAND.
2. Fire protection can be met in either the potable or non-potable system subject to meeting all present fire protection standards.
3. Reservoir Size
   a. The potable reservoir volume shall be equivalent to MAXIMUM DAY DEMAND.
   b. The non-potable reservoir volume shall be equivalent to AVERAGE DAY DEMAND.
4. Potable and non-potable pipelines shall be sized for PEAK HOUR flow rates with a minimum residual pressure of 40 psi and maximum velocity in the main of 6 feet per second. Hydraulic analyses will utilize tank spillway elevations as the initial hydraulic grade line elevations. Pipelines providing fire protection shall also be sized for MAXIMUM DAY flow plus fire flow with a residual of 20 psi at the critical fire hydrant. Hydraulic analyses will use three-quarters full tank water surface elevations as initial hydraulic grade line elevations.
5. Well pumps for potable and non-potable systems shall provide MAXIMUM DAY in an operating time of 16 hours.
6. For the UH West O'ahu campus, 60 GPD/Student was used because the proposed use of the campus is for an extended day.

SOURCE: "Ewa Water Master Plan", prepared by Belt Collins for the Ewa Plain Water Development Corporation, August, 1987.

2.3 Proposed Onsite Water Systems

The proposed water systems for the UH West Oahu campus are part of the East Kapolei regional system. The regional water system outlined in the East Kapolei Development Master Plan Water System Study (Akinaka & Associates, January 2005) is sized for the ultimate East Kapolei development and also to accommodate the future demand of the Kalaeloa area. The construction of the 215-foot reservoir and its transmission main in the North-South Road is imminent with the onset of phase 1 of the DHHL project.

According to BWS, potable and nonpotable water sources will be available for the 215-foot system. A dual system is planned for the 215-foot service zone. About half of the UH West Oahu Makai property lies in this service zone, while the majority of the campus site is in 440-foot service zone. Application of a dual system for the 440-foot service zone is currently being discussed with BWS.

2.3.1 UH West Oahu Land Uses for Water Demand Calculations

The water demands of UH West Oahu Makai property are based on the current Land Use Plan (Figure 1.3) of LRDP Update dated May 2006. The land use information is summarized in Table 2.2.

TABLE 2.2
UH West Oahu Makai Property Land Use Summary

Land Use	Residential Units	Approx. Area (acres)
UH West Oahu Campus Site		103.5
Work Force/Affordable Housing (Multi-Family)	355	22.2
Student Housing/Mixed Use (FAR 0.2) or Campus Expansion	876	50.1
Mixed Use (FAR 0.25)	470	47.0
High Density Residential (Multi-Family)	925	57.8
Medium Density Residential (Multi-Family)	489	40.8
Medium/Low Density Residential (Single Family)	561	56.1
Low Density Residential (Single Family)	365	60.8
Elementary School		12
Detention Basin		11.2
HECO Substations		2
Roads and Farrington Highway Expansion		36.8

2.3.2 Water Demands for Proposed Developments

Planning for the project is ongoing and land uses and densities have not yet been finalized. For the purpose of this study the following assumptions are applied in the calculations.

1) According to the LRDP Update dated April 20, 2006, the UH West Oahu campus population is defined as 8,640 at the full built-out, 7,600 students plus 1,040 faculty and staff.

2) Based on the information provided by the Department of Education, the total population for the proposed elementary school is assumed 610, including 550 students and 60 faculty and staff.

3) As mentioned earlier, the UH West Oahu Makai property falls within two water service zones, the 440-foot service zone and the 215-foot service zone. The 115-foot contour was initially used as the boundary between the two zones. However, a preliminary hydraulic analysis indicated that the upper limits of the 215-foot service zone would experience low pressure during the peak flows. Therefore, it is assumed in the study that the 440-foot system will serve the entire UH West Oahu campus plus some areas in the Private Development Lands.

4) Water demands for other proposed developments in East Kapolei region are obtained from the East Kapolei Development Master Plan Water System Study.

5) The supply to Kalaeloa Development District is a projection by BWS. No storage for Kalaeloa is considered in this study.

Based on conventional development, the estimated water demands in million gallons per day (MGD) for the proposed developments on the UH West Oahu Makai property are listed below:

	Potable			Non-Potable		
Service Zone	Ave. Day (MGD)	Max. Day (MGD)	Peak (MGD)	Ave. Day (GPD)	Max. Day (GPD)	Peak (GPD)
440-foot System	1.971	2.956	5.912	0	0	0
215-foot System	0.613	0.919	1.837	0.334	0.501	1.002
Total	2.584	3.875	7.749	0.334	0.501	1.002

The total water demand for ultimate developed East Kapolei is summarized as following:

	Potable			Non-Potable		
Service Zone	Ave. Day (MGD)	Max. Day (MGD)	Peak (MGD)	Ave. Day (GPD)	Max. Day (GPD)	Peak (GPD)
440-foot System						
UH West Oahu	1.971	2.956	5.912	0	0	0
Offsite Developments	1.069	1.603	3.206	0	0	0
440' Sub Total	3.040	4.559	9.118	0	0	0
215-foot level						
UH West Oahu	0.613	0.919	1.838	0.334	0.501	1.002
DHHL	1.711	2.567	5.134	0	0	0
215' Sub Total	2.324	3.486	6.972	0.334	0.501	1.002
East Kapolei Total	5.364	8.045	16.090	0.334	0.501	1.002
Kalaeloa (215')	2.00	3.00	6.00	0	0	0
Grand Total	7.364	11.045	22.090	0.334	0.501	1.002

The list above shows that the projected average daily demand for the East Kapolei area is approximately 5.36 MGD. With the estimated demand for Kalaeloa added to the 215-foot system, the average daily demand for potable water is about 7.36 MGD. A detailed breakdown is included in Appendix A. It should be noted that the UH West Oahu campus development is striving for LEED silver certification and if water saving measures are implemented, water usage may end up less than currently estimated.

2.3.3 Storage Requirements

For the 215-foot potable water system, based on the estimated demands and the criteria on storage specified in Table 2.2, the required storage for the developments on UH West Oahu Makai property is 0.92 MG, which is already included in the master planned 4-MG storage for the East Kapolei development. For the 440-foot system, 4.56 MG storage is needed. In conformance with BWS Standards, one 5.0-MG reservoir or two 2.5-MG reservoirs will be constructed.

It should be noted that the total storage for the 440-foot system for East Kapolei area is about 2.5 MG higher than previously projected in the East Kapolei Development Master Plan Water System Study. The increase is due to the larger service area and a higher residential density for the UH West Oahu Makai property.

Although the proposed residential densities on the UH West Oahu Makai property increased, potable water demand in the 215-foot system actually decreased compared to the previous demand projected in the Master Plan study. This is a result of the implementation of a dual water system in 215-foot service zone.

Discussions with the BWS regarding the nonpotable system are ongoing. Requirements for the nonpotable system from BWS and coordination with adjacent developments are necessary to deliver the 0.33 MG of nonpotable water to the site.

2.3.4 Booster Pumps Requirements

The estimated maximum daily demand on the 440-foot system is 4.55 MG. The criteria stated in the Table 2.2 for pump sizing requires meeting the maximum daily demand over a 16-hour period. The total pump capacity needed is about 5,000 gallon per minute (gpm). In accordance with BWS Standards, two pumps will be needed to provide the required 5,000 gpm pumping rate with a third pump as a standby.

2.3.5 System Descriptions

The 500-acre UH West Oahu Makai property falls within two service zones, the 215-foot and 440-foot service zones. Development on the property will require upgrades to the existing Kapolei 215-foot potable water system, and the construction of new 440-foot potable and 215-foot non-potable water systems.

Upgrades to the existing 215-foot potable water system, which includes installing a 4-MG reservoir and a transmission main in North-South Road, will be completed with the ongoing developments in the area. The new 440-foot system, including construction of one 5MG reservoir or two 2.5MG reservoirs and a transmission main in North-South Road will be constructed concurrently with the development of UH West Oahu campus. The construction of the 215-foot non-potable water system is expected to be completed by the BWS before the completion of the campus site.

The onsite potable water systems will connect to the transmission mains in the North-South Road and Farrington Highway. The systems consist of pipes from 8 to 24 inches in diameter laid out in loops to provide some redundancy (Figure 2.2).

The possibility of expanding the 440-foot system to service adjacent developments is currently being studied. This will require an analysis of the existing 215-foot system, along with the re-approval of the current Water Master Plan for the 440-foot system.

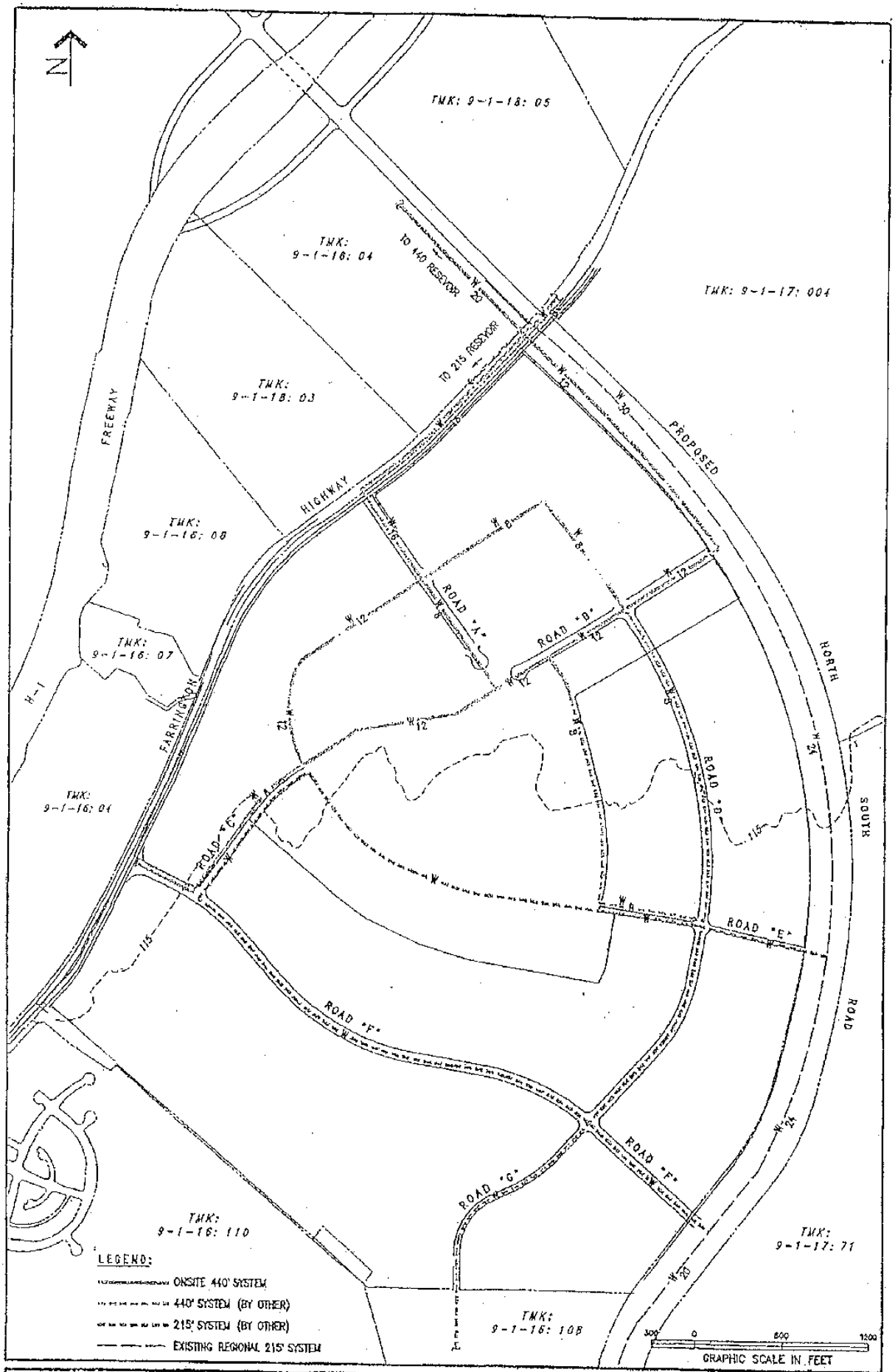

Fig. 2.2 Onsite Water Systems

UNIVERSITY OF HAWAII WEST OAHU INFRASTRUCTURE STUDY
EWA, OAHU, HAWAII
Prepared By: ENGINEERING CONCEPTS, INC.

SECTION 3
SANITARY SEWER SYSTEM

3.1 Existing Regional Sewer System

The UH West Oahu Makai property is within the service area of the Honouliuli Wastewater Treatment Plant (WWTP), which has a treatment capacity of 38 million gallon per day (mgd) and future plans to expand its capacity to 51 mgd. Currently, two existing regional interceptor sewers, the Makakilo Interceptor Sewer and the recently completed Kapolei Interceptor Sewer, are transporting wastewater from existing developments located west of the UH West Oahu Makai property to the WWTP (Figure 3.1). The average wastewater flow allocation in the interceptor sewers for the East Kapolei development is 3.118 mgd.

Presently, there is no sewer service to the UH West Oahu Makai property. A 30-inch stub-out was provided with the installation of the Kapolei Interceptor Sewer for future connection.

3.2 Basis of Design

The criteria set forth in the Design Standards of the Department of Wastewater Management, City and County of Honolulu, 1993, is used as the basis for developing wastewater requirements. Table 3.1 summarizes the sewer rates used for calculating average daily flow and the hydraulic design criteria.

Based on the boring data for the adjacent North-South Road (Geotechnical Engineering Exploration North-South Road, Phase 1A, F.A.I. Project No. STP-8930 (1), Ewa, Oahu, Hawaii, September 10, 2004), it is reasonable to assume that groundwater is not expected at the planned depth of the sewer lines. Consequently, the weather infiltration/inflow for the above groundwater condition is used in the flow calculations.

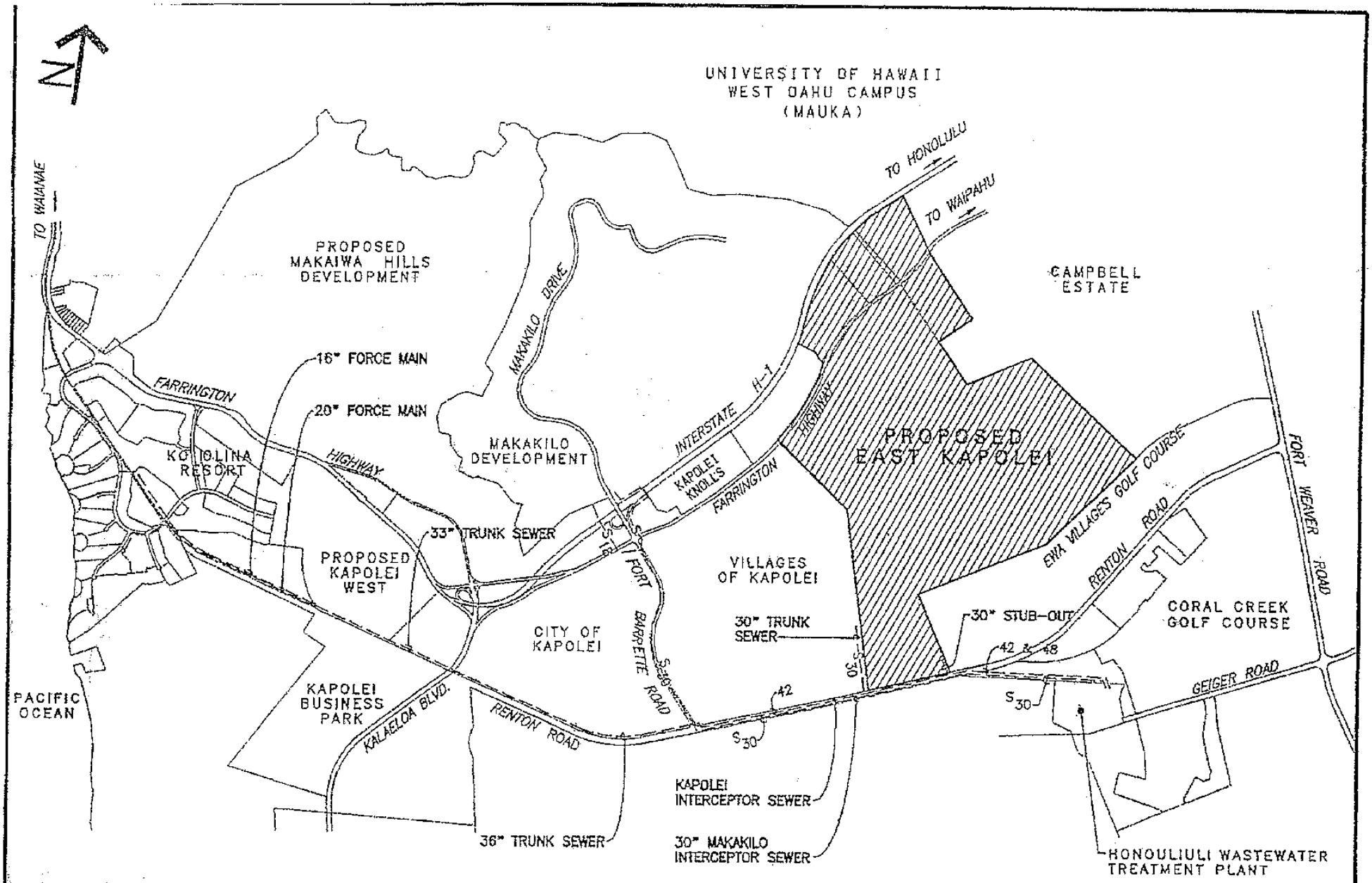

Fig. 3.1 Existing Regional Sewer System

UNIVERSITY OF HAWAII WEST OAHU
INFRASTRUCTURE STUDY
EWA, OAHU, HAWAII

TABLE 3.1

SEWER SYSTEM DESING CRITERIA

Sewer Demand Rates

(Average daily per capita flow = 80 gallon per capita per day (gpcd))

Single-Family Residential	4 persons/unit
Multi-Family Residential	2.8 persons/unit
Student Housing	3 persons/unit
Community Business	140 persons/acre
Neighborhood Business	40 persons/acre
Parks	5 persons/acre
School	25 gals/person/day

Maximum Flow = average daily flow x max flow factor

Dry Weather Infiltration/Inflow (I/I) = 5 gal/person/day (above ground water table)

Wet Weather Infiltration/Inflow (I/I) = 1250 gal/acre/day (above ground water table)

Design Average Flow = average daily flow + dry weather I/I

Design Maximum Flow = maximum flow + dry weather I/I

Design Peak Flow = design maximum flow + wet weather I/I

Hydraulic Criteria

Design based on Manning's Formula:

$$\text{Velocity} = \frac{1.486\, r^{2/3} s^{1/2}}{n}$$

n=0.013 for all pipes larger than 18 inches in diameter

n=0.015 for all pipes 18 inches and smaller in diameter

Pipe Capacity: Based on 85% actual pipe capacity.

Source:

Design Standards of the Department of Wastewater Management, Volume 1, City and County of Honolulu, July 1993 (currently referred to as Department of Planning and Permitting, Wastewater Branch).

3.3 Proposed Onsite Sanitary Sewer System

A wastewater master plan for the East Kapolei area, including the UH West Oahu Makai property, was prepared by Community Planning and Engineering, Inc. The master plan indicated the area to be sewed by a major trunk line in the North-South Road, which collects wastewater from the adjacent developments. The trunk sewer conveys the flows to the Kapolei Interceptor Sewer.

In the wastewater master plan, the major trunk system was planned to be placed entirely within the North-South Road. However, as a result of value engineering, it was decided to realign a portion of the trunk sewer through the UH West Oahu Makai property to reduce costs associated with constructing two parallel lines. The proposed sewer systems within the UH West Oahu Makai property are depicted in Figure 3.2.

3.3.1 Wastewater Flows for Proposed Developments

Based on the defined land uses on the UH West Oahu Makai property presented in Table 2.2 and the defined school population, the calculated equivalent population is 19,603. The estimated flows from UH West Oahu Makai property are listed below:

Average Wastewater Flow at 80 gpcd = 1.68 mgd

Maximum Flow = 3.19 mgd

Design Average Flow = 1.79 mgd

Design Maximum Flow = 3.29 mgd

Design Peak Flow = 3.95 mgd

3.3.2 System Description

The major trunk sewer line enters the UH West Oahu Makai property from Farrington Highway, runs down along Road D, then exits the property to the North-South Road through Road F. The line, ranging in size from 24 to 30 inches in diameter, carries the wastewater from the properties located to the north of the UH West Oahu Makai property and the flows from the UH West Oahu Makai property to the 30-inch trunk line in the

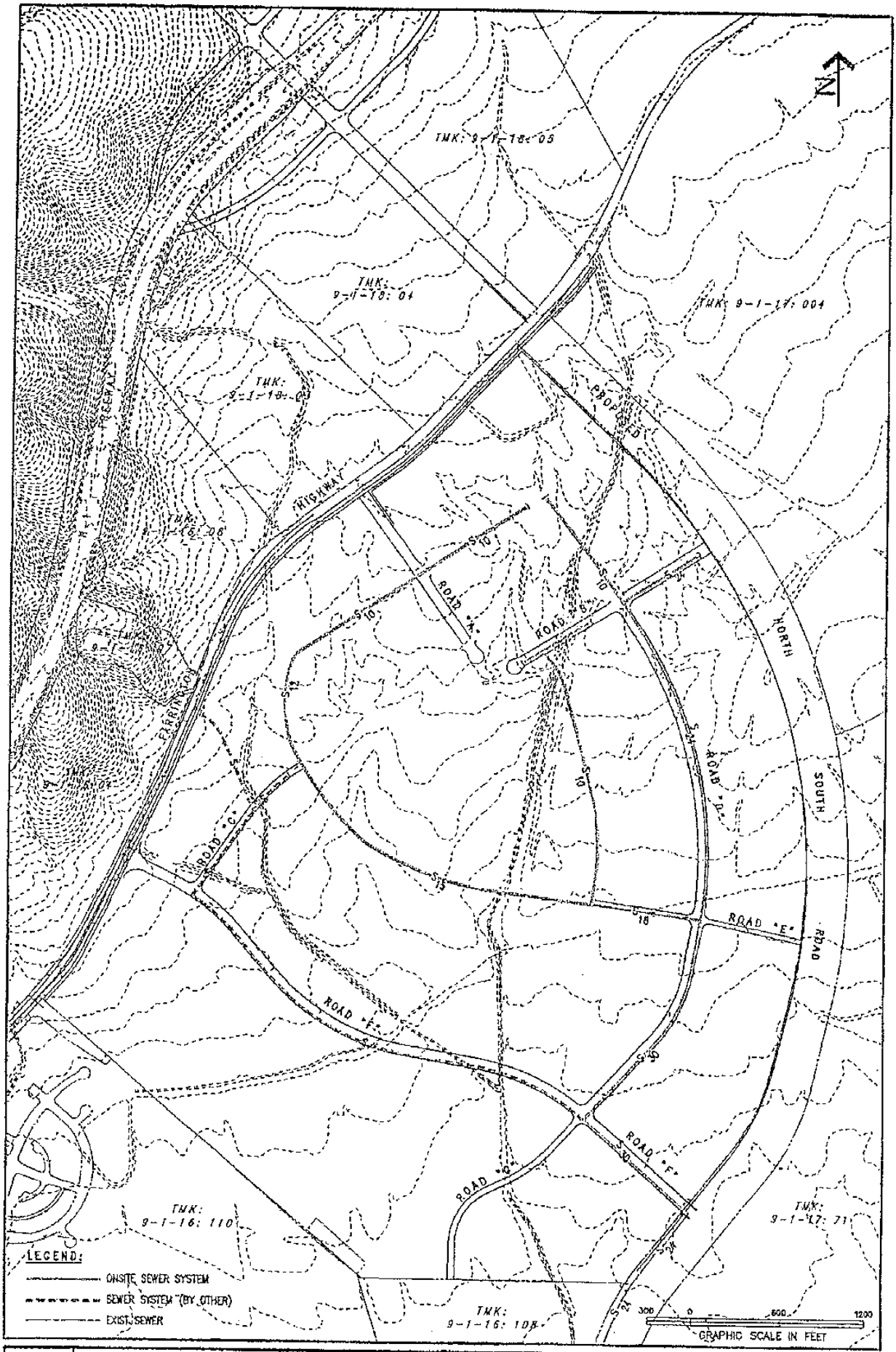

Fig. 3.2	Onsite Sanitary Sewer System	UNIVERSITY OF HAWAII WEST OAHU INFRASTRUCTURE STUDY EWA, OAHU, HAWAII Prepared By: ENGINEERING CONCEPTS, INC.

North-South Road. Smaller sewers (8 to 18 inches) branch off from the major trunk line to serve the site.

In the system hydraulic analysis (see Appendix B), the slopes of the pipes are assumed to match the existing grades based on the City's GIS information or controlled to meet the 85 percent pipe capacity requirement. Under assumed slopes, the flow velocities in all pipes meet the requirements of minimum 2 feet per second (fps) and maximum 10 fps.

SECTION 4
DRAINAGE SYSTEM

4.1 Existing Regional Condition

The proposed UH West Oahu Makai property is situated within the middle reaches of the Kaloi Gulch Watershed, with the West Loch watershed to the east and the Villages of Kapolei watershed to the west. Figure 4.1 depicts the current regional drainage pattern. Hunehune Gulch, a tributary to Kaloi Gulch, also runs through the site.

The Ewa Village Drainage Master Plan (R. M. Towill 1998) conducted a detailed hydrologic study for the East Kapolei and Ewa Villages tributary area. The study indicated that almost all the runoff from the area above the Ewa Villages are intercepted by the Ewa Villages Golf Course, which was sized with sufficient capacity to convey the 100-year peak flow from the Plate 6 of the City's drainage standards. The Ewa Villages Golf Course was designed as a detention/retention/water quality facility for the entire tributary area under the developed condition. However, at this time, discharge from the golf course is controlled due to the limited downstream channel capacity. Therefore, before the ultimate drainage improvement is completed, the discharges form the golf course will need to be maintained at the existing condition and this means that the discharge from UH West Oahu Makai property shall be limited to the existing releasing rate.

Presently, the area above the Ewa Villages is undeveloped and the runoff from this area is mainly carried by Kaloi Gulch and Hunehune Gulch. Both of the gulches are characterized as intermittent drainageways. The flows are ephemeral in response to storm events that are significant enough to generate direct runoff. The gulches were formerly used as irrigation ditches.

4.2 Existing Onsite Condition

Kaloi Gulch and Hunehune Gulch are currently running across the proposed UH West Oahu Makai property. Kaloi Gulch enters the site from the east at about 900 feet south of

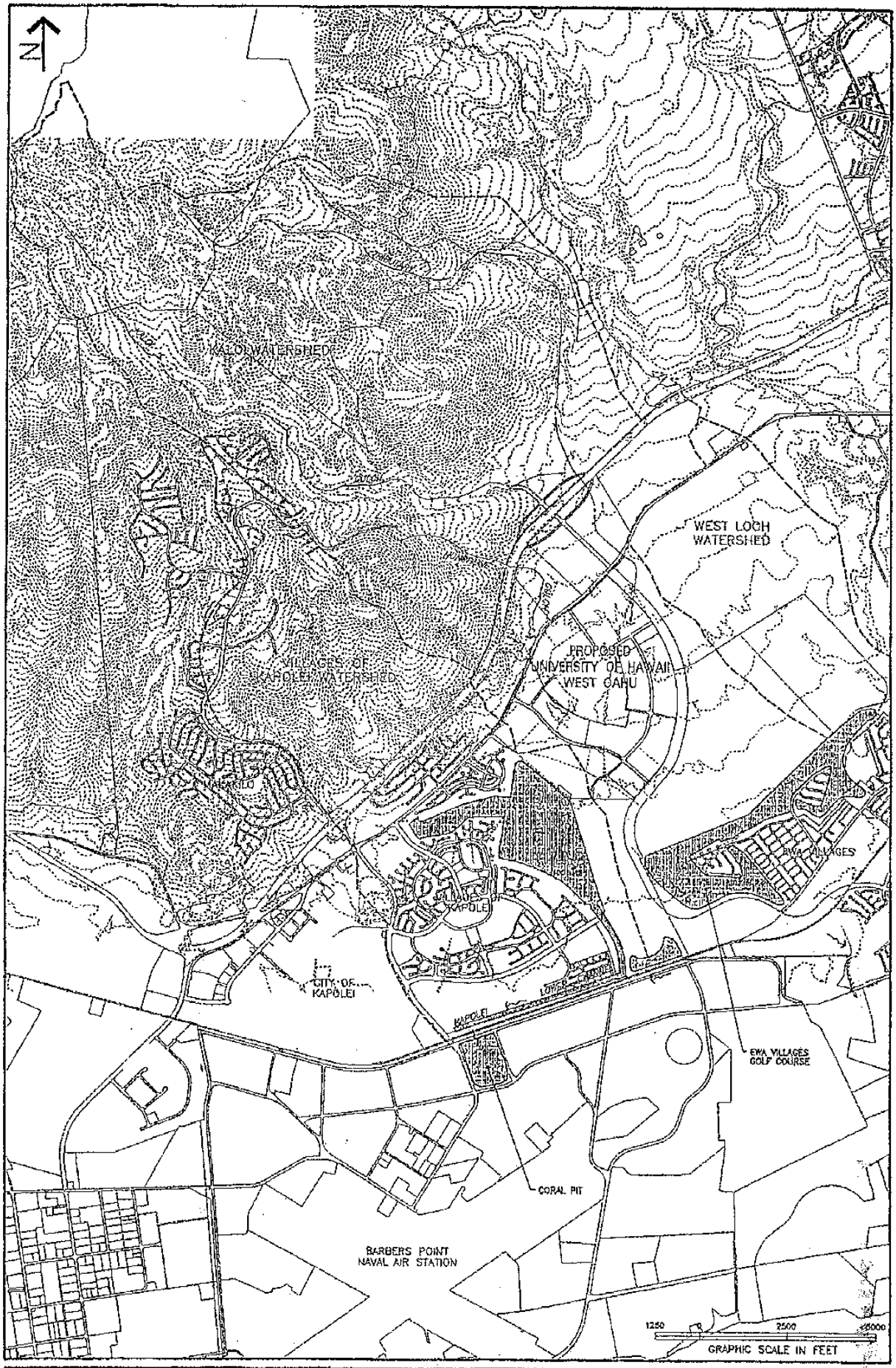

Fig. 4.1 **Existing Regional Drainage Systems**

Base Source: R.M. TOWILL "EWA VILLAGES DRAINAGE MASTER PLAN"

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EWA, OAHU, HAWAII

Prepared By: ENGINEERING CONCEPTS, INC.

Farrington Highway. Hunehune Gulch comes into the site from the north at approximately 1,200 feet west of the intersection of Farrington Highway and the proposed North-South Road. The Hunehune Gulch merges with the Kaloi Gulch approximately 1,200 feet above the southern boundary of the site. The Kaloi Gulch continues downstream passing through DHHL land and into the northwest corner of the Ewa Village Golf Course via a 20 ft. x 8 ft. concrete box culvert. This culvert was sized to the capacity of the existing Kaloi Gulch gully.

There are no existing drainage improvements on the site and no well defined existing drainageway except the two gulches. The runoffs generated onsite primarily sheet flow overland. The Kaloi Gulch was previously used as an irrigation ditch. In many areas the banks of the gulch were built up to carry irrigation water to the lower land. Thus, overflow from the gulch in these areas usually cannot return to the ditch because the built-up banks are higher than the adjacent ground.

4.3 Basis of Design

The drainage analyses in this study are in conformance with the design guidelines specified in the Storm Drainage Standards of the City and County of Honolulu Department of Planning and Permitting (Standards). The design criteria are summarized as following:

Onsite Pipe/Culvert System Design Storm Recurrence Interval Tm:

Tm = 10 years for area under 100 acres;

Tm = 50 years for areas with sump conditions or backup effect; and

Tm = 100 years for areas greater then 100 acres.

Runoff Calculation:

Rational Method for area equal or smaller than 100 acres;

Plate 6 of Standards for area greater than 100 acre.

Rainfall Intensity for Rational Method Analysis:

i = 1.85 in/hr for Tm = 10 years;

i = 2.3 in/hr for Tm = 50 years.

24-hour Rainfall for Detention/Water Quality Volume Analysis:

P_{24} = 7.7 inches for 10-year event;

P_{24} = 12.3 inches for 100-year event.

4.4 Proposed Drainage Improvements

4.4.1 Regional Drainage System

The regional drainage pattern shown on Figure 4.1 will be altered by the construction of a drainage channel along the east side of the proposed North-South Road (currently Phase 1A is under construction). The channel will divert the flow in Kaloi Gulch away from the UH West Oahu Makai property and discharge the water into a detention basin located at the downstream end of the channel immediately above the Ewa Village Golf Course (Figure 4.2).

For Hunehune Gulch, Belt Collins Hawaii conducted an off-site drainage study and proposed a box drain system to divert the flow in the gulch to an onsite detention pond located at the southeast corner of the UH West Oahu Makai property. The flow would then discharge into the regional detention basin through box culverts under the North-South Road. Coordination between the University and its private development partner is required to determine an efficient way of integrating drainage systems. Belt Collins Hawaii's study is included in Appendix D of this report.

4.4.2 University Campus Onsite Drainage System

The proposed onsite drainage system for the UH campus area (not including private development land) will consist of grate inlets in parking lots and landscaped areas, curb inlets along the roadways, underground pipe/box drains, and a detention/water quality basin with a flow control structure.

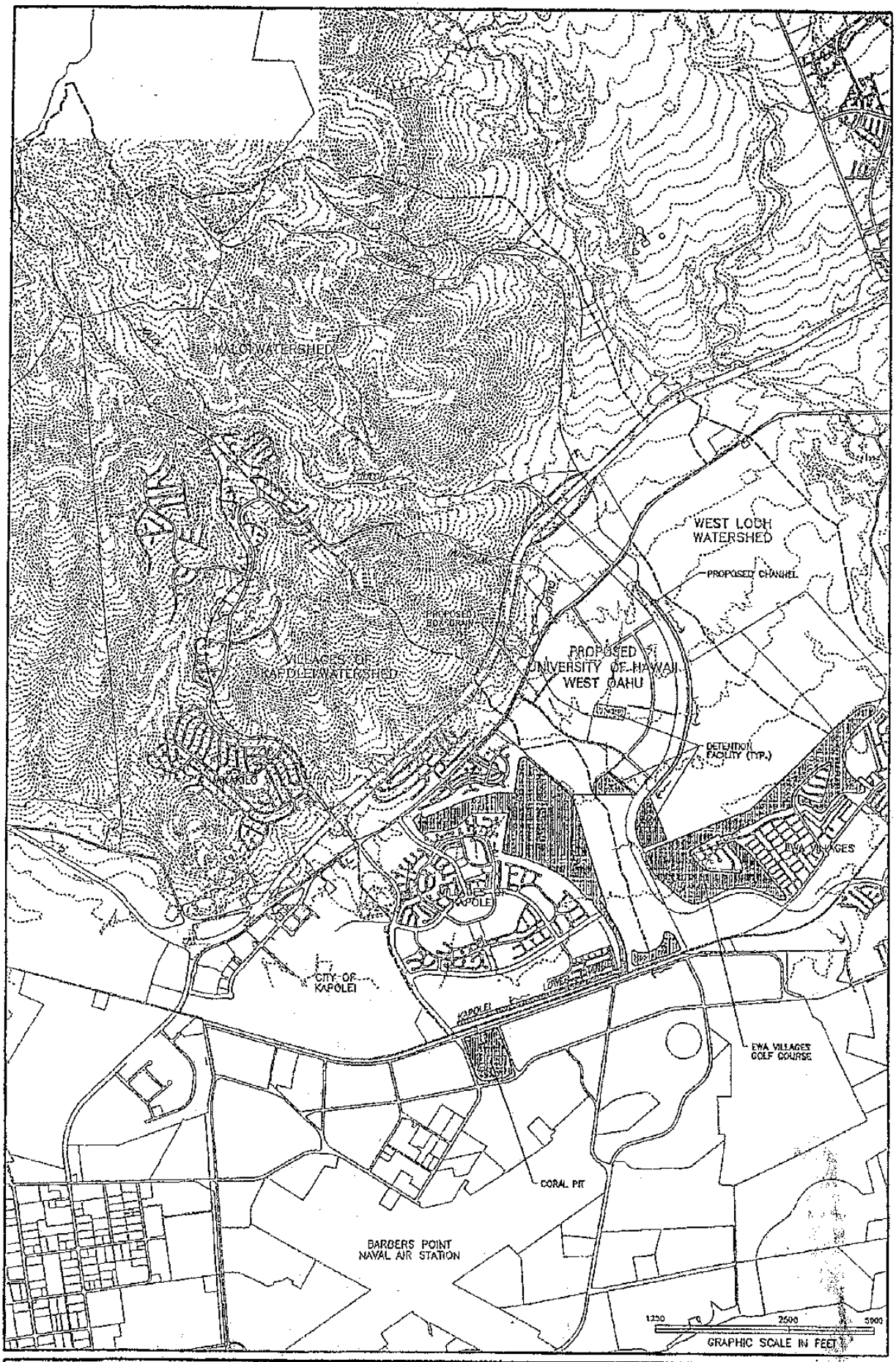

Fig. 4.2	Proposed Regional Drainage Systems	UNIVERSITY OF HAWAII WEST OAHU INFRASTRUCTURE STUDY EWA, OAHU, HAWAII
	Base Source: R.M. TOWILL "EWA VILLAGES DRAINAGE MASTER PLAN"	Prepared By: ENGINEERING CONCEPTS, INC.

4.4.2.1 UH Campus Site Phase 1 Development

For the Phase 1 campus development, only a small portion of the permanent drainage system will be constructed (Figure 4.3). The pipe system will not be extended to the detention basin in this phase. The collected runoff will be discharged overland, filtered through the ground vegetation, natural depressions and ultimately flow to Kaloi Gulch which leads to the detention pond. Temporary loose riprap protections should be provided at all discharge points to prevent erosion.

The detention basin and the cutoff swales will be constructed to catch all the runoffs from the developed Phase 1 area, plus the runoffs from a portion of undeveloped campus site above the detention basin. The planned basin area for the Phase 1 development is about 5 acres. The basin will serve two purposes: 1) attenuate the increased peak flows due to the increase of the impervious areas from the construction of buildings, roadways, parking lots and walkways; and 2) meet the City's water quality requirements. Since runoff is not to exceed the existing discharge rate from the site prior to the completion of the drainage improvement in Oneula Beach Park, the increased runoff will be detained in the detention basin and released into the existing Kaloi Gulch at a rate equal or less than the existing discharge rate through a two-stage weir, which will be designed to meet the 10-year and 100-year flows. This detention basin will be expanded and a discharge system will be constructed when the remainder of the campus site is developed.

Using TR-55 computer program, the calculated peak flows and estimated detention volume required for 10-year and 100-year storm events are for Phase 1 development are listed as follows:

Storm	Existing Peak	Developed Peak	Detention Volume
10-year	189 cfs	320 cfs	6.5 ac-ft
100-year	359 cfs	582 cfs	11.4 ac-ft

For water quality control, the calculated water quality design volume (WQDV) for the Phase 1 development per the procedure in the City's Standards is 1.75 acre-feet. This

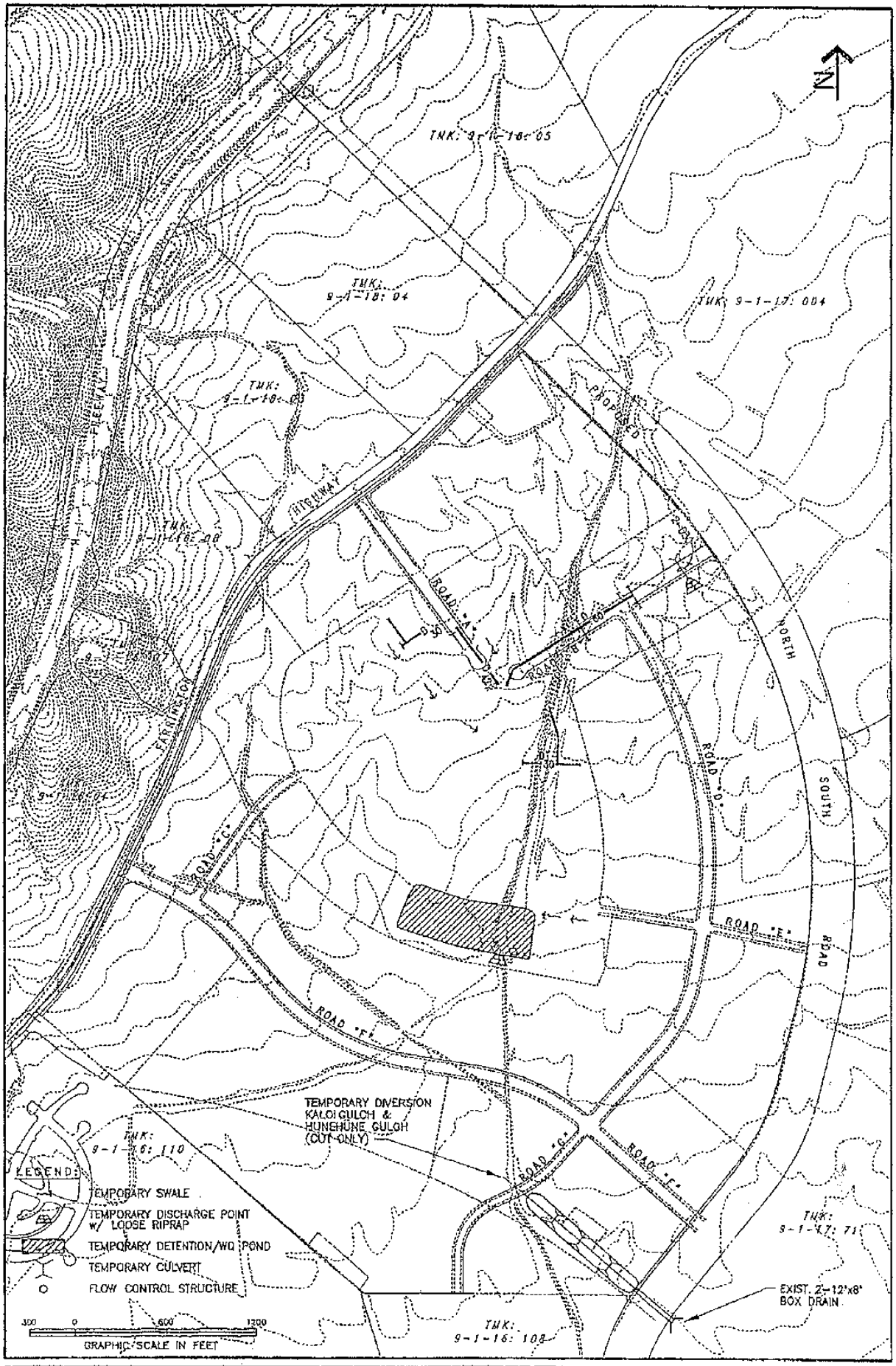

Fig. 4.3	Phase 1 Campus Onsite Drainage System	UNIVERSITY OF HAWAII WEST OAHU INFRASTRUCTURE STUDY EWA, OAHU, HAWAII Prepared By: ENGINEERING CONCEPTS, INC.

volume of water will be released at a controlled rate through a temporary discharge structure to meet the required release time period.

4.4.2.2 Full Build-out UH Campus Site

Figure 4.4 shows the proposed drainage system for the full build-out campus condition. The pipe system will be completed to carry all the runoff from the site into the enlarged 10-acre detention basin. The calculated peak runoffs and estimated detention volumes for the entire campus site are listed as follows:

Storm	Existing Peak	Developed Peak	Detention Volume
10-year	340 cfs	849 cfs	23.6 ac-ft
100-year	644 cfs	1462 cfs	36.9 ac-ft

The calculated water quality design volume WQDV for the UH West Oahu Lands is 12 acre-feet per the City's Standards.

A release structure will be designed to control the discharge rates to the existing peak flows for the 10-year and 100-year storm events. A perforated pipe riser will be designed to meet the City specified the releasing time period for water quality control.

The calculations for the detention volumes and the water quality volumes are included in Appendix C of this report. The calculations and the drainage system layout are based on the land use plan and site plan dated April 20, 2006, both plans were prepared by PBR HAWAII for the University of Hawaii - West Oahu Long Range Development Plan at the master planning level. More detailed analysis of the drainage systems will be needed during the design phase.

4.4.3 Private Development Land Onsite Drainage System

The proposed onsite drainage systems for the private developments lands have been prepared by Belt Collins Hawaii and are provided in the Appendix D.

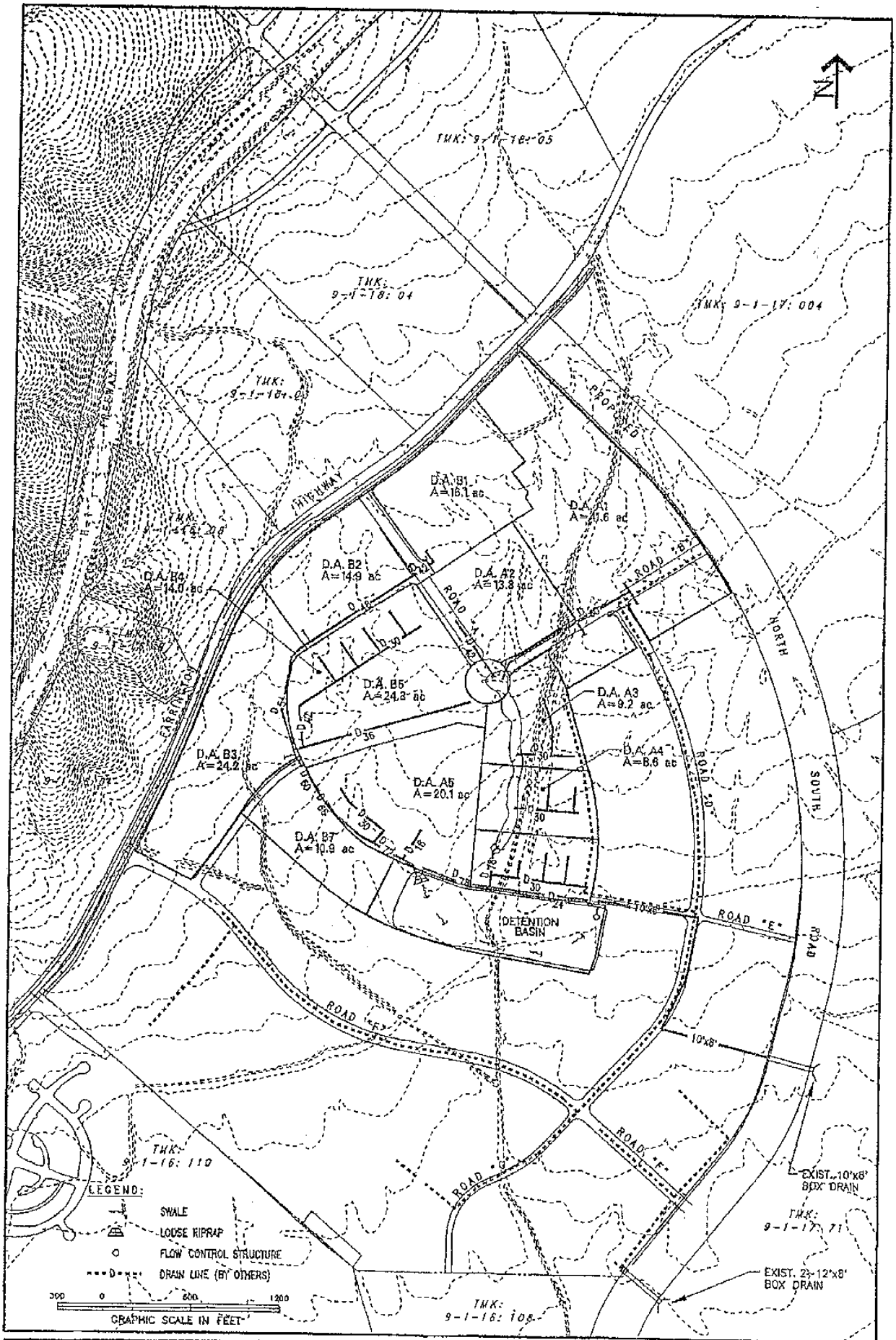

Fig. 4.4 **Full Build–Out Campus Onsite Drainage System**

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APPENDIX A

WATER DEMAND CALCULATIONS