2007-05-23 - FEA-MA- SOUTH MAUI COMMUNITY PARK PART II

HRS Chapter 343 Final
Environmental Assessment
prepared in support of

South Maui Community Park

TMK: (2) 2-2-002:042
Kihei • Maui • Hawai`i

May, 2007

Part II

Prepared for:
County of Maui
Department of Parks & Recreation
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Wailuku, HI 96793

CHRIS HART & PARTNERS

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Appendix – E
Preliminary
Engineering and Drainage
Reports

Established 1969

Preliminary Engineering Report

South Maui Community Park

Kihei, Maui, Hawaii
TMK: (2) 2-2-02:Por. of 42

Prepared For:

Department of Parks and Recreation
Department of Public Works and
Environmental Management
County of Maui
Wailuku, Maui, Hawaii

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Date: June 2006

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APPENDICES:

I. INTRODUCTION

A. OBJECTIVE:

This treatise has been prepared as a brief evaluation and summary of both existing infrastructure in the vicinity of the project site and anticipated project improvements.

B. SITE LOCATION:

Kihei, on the island of Maui, is located on the leeward side of Mount Haleakala, a dormant shield volcano rising to approximately 10,000 feet above mean sea level (M.S.L.). Piilani Village is a master-planned project district that ultimately was expected to include: single-family, multi-family, and commercial developments; parks; landscaped bike and jogging paths; drainage reserves; and, open spaces.

The South Maui Community Park site [TMK (2) 2-2-02:Por. 42] encompasses an area of approximately 44.833 Acres, that was originally planned for development as single and multi-family residential, open space, and park components, and is part of what is commonly referred to as Piilani Village - South, a portion of Piilani Village that lies to the south of Lipoa Street (see EXHIBIT A: Location Map).

Piilani Village - South is located in Kihei, on the island of Maui, and in the State of Hawaii. Located approximately 2,000 feet to the east (mauka) of South Kihei Road, it is situated immediately west (makai) of Piilani Highway, immediately east (mauka) of the proposed N-S Collector, and immediately south of Kihei Elementary and Lokelani Intermediate Schools (which abuts the south side of Lipoa St.).

The South Maui Community Park site is located at Tax Map Key parcel (2) 2-2-02:Por. 42. This rectangular-shaped parcel is abutted by:

- Piilani Highway on its east (mauka) side;
- East Welakahao Street on its southerly side (the recently completed Hope Chapel development, is located across East Welakahao Street, on the southerly side of East Welakahao St.);
- The Liloa Drive (N-S Collector) roadway reserve on its west (makai) side [a Maui Electric Company power substation, undeveloped lands, and the Kihei Franks Light Industrial Subdivision are located across this roadway reserve, on its west (makai) side]; and,
- Kihei Elementary and Lokelani Intermediate Schools on its north side.

The Keokea Gulch natural drainageway, aligned in an east to west direction, bisects the site close to its southerly end.

The majority of the site is situated to the north of Keokea Gulch and will comprise Phases I and II of the South Maui Community Park project (see EXHIBIT B: Site Concept Plan).

The balance of the site situated to the south of Keokea Gulch will consist of:

- A triangular, approximately 1.693 Acre site, situated at the southwesterly corner of Piilani Village - South, which is expected to be occupied by the previously approved Kihei Recycling and Redemption Center (by others).
- A roughly rectangular, approximately 1.748 Acre site, situated at the southeasterly corner of Piilani Village - South, at the corner of Piilani Highway and East Welakahao Street, which is expected to be occupied by Phase III of the South Maui Community Park project.

Piilani Village is approximately 3,000 feet inland and varies in elevation from approximately 10 feet to approximately 100 feet M.S.L. The South Maui Community Park project site varies in elevation from approximately 30 feet to approximately 100 feet M.S.L. (see EXHIBIT "C": Topographic Map and Grading Concept Plan).

The balance of Piilani Village - South (developed and permitted by others, and excluded from the scope of this treatise) consists of:

- Hope Chapel development located to the south (across East Welakahao St.) of the project site.
- Proposed Hale Mahaolu Senior Residence (currently under construction) located at the extreme south end (between Hope Chapel project and existing Keala Hills Subdivision).

C. PROJECT DESCRIPTION:

The South Maui Community Park project anticipates three (3) phases of construction as follows.

Phase I of the South Maui Community Park project proposes to construct the following:

- An approximately 23,500 sq. ft. gymnasium with a basketball court, seating capacity of approximately 1,096 seats, restrooms, and multipurpose conference rooms;
- A 7,200 sq. ft. annex building with multipurpose conference rooms;
- Up to two (2) soccer fields;
- One (1) softball field with supporting structures;
- A 650 sq. ft. restroom facility for the athletic fields;

- Supporting parking for up to approximately 305 vehicles;
- Subject to availability of funding, Phase I may also include mass grading, erosion control, and primary underground utilities for Phase II (see EXHIBIT "C": TOPOGRAPHIC MAP AND GRADING CONCEPT PLAN).

Phase II of the South Maui Community Park project proposes to construct the following:

- Up to two (2) additional soccer fields;
- One (1) softball field with supporting structures;
- One (1) baseball field with supporting structures;
- An amphitheater;
- A picnic pavilion adjacent to the amphitheater;
- Supporting parking for up to approximately 200 vehicles (with accommodations for overflow parking up to approximately 29 vehicles).

Phase III of the South Maui Community Park project is expected to be defined in more detail at a later date. Possible improvements anticipated at this time include, based on future recreational needs and availability of funds:

- Multipurpose courts;
- A restroom facility; and,
- Supporting parking.
- Mass-grading and erosion control for Phase III of the South Maui Community Park are expected to be done up front in conjunction with the construction of the Kihei Recycling and Redemption Center (by others).

In addition, typical anticipated supporting onsite infrastructure improvements for all phases generally include:

- Sidewalks and hiking trails;
- Roadway improvements consisting of: asphalt concrete paved driveways and parking; and, concrete curbing;
- Utility improvements (see Exhibit J - Conceptual Site Utility Plan) consisting of:

  - Grated drain and curb inlets; an underground drainage system; a subsurface, and, a subsurface perforated pipe detention drainage system;
  - An underground sanitary sewer system;
  - An underground potable water system that will serve potable water requirements, and also provide all or most of the anticipated fire protection water;

- An underground R1 recycled water system that will serve the recycled water landscape irrigation system, and also provide some of the anticipated fire protection water (where allowed by County agencies);

- Site electrical improvements consisting of an underground electrical system; driveway and parking lot lighting; and, play field lighting;
- Landscape improvements consisting of playing turf; ground cover; hedges; shade trees; and supporting recycled water landscape irrigation;

Anticipated offsite infrastructure improvements to be constructed with or by the North-South Collector Road Improvements Project (Lipoa St. to Auhana Road; by Department of Public Works, County of Maui):

- Intersection improvements along Liloa Drive (N-S Collector) for both driveway connections;
- Intersection improvements at the Liloa Drive / East Welakahao Street intersection;
- Underground sanitary sewerlines from upstream terminus of existing sewer system along Halekuai St. (in the Kihei Franks light industrial subdivision).

Intersection improvements along East Welakahao Street for the combined driveway connection for the proposed Kihei Recycling and Redemption Center and the future Phase III of the South Maui Community Park is expected to be constructed by the Department of Public Works, County of Maui, in conjunction with the construction (by others) of the Kihei Recycling and Redemption Center.

II. ROADWAY IMPROVEMENTS AND TRAFFIC ASSESSMENT

A. EXISTING CONDITIONS:

Piilani Highway borders the easterly (mauka) side of Piilani Village - South. Although a controlled access highway, access is permitted in the vicinity of the South Maui Community Park project site at the following general locations (see EXHIBIT A: Location Map):

1. Pi'ikea Avenue (Road "C"), which is signalized;
2. Lipoa Street, which is signalized; and,
3. East Welakahao St. (currently unsignalized).

Access is also generally available to Piilani Village South from South Kihei Road via Pi'ikea Avenue (Road "C"), Lipoa Street, Halekuai Street, and East Welakahao Street.

The Engineering Division, Department of Public Works and Environmental Management, is currently planning and designing the extension of Liloa Drive (N-S Collector) which, when completed, will link the bisecting east-west corridors (e.g., Lipoa St., Halekuai St., East Welakahao St., etc.).

B. PRELIMINARY TRAFFIC ASSESSMENT:

A preliminary traffic assessment has been conducted for the proposed project by Phillip Rowell and Associates (see *Traffic Impact Analysis Report for South Maui Park at Piilani*, by Phillip Rowell and Associates, dated December 2, 2005).

It is our understanding that, subject to available funding, the Department of Public Works and Environmental Management, County of Maui, is currently planning and designing the extension of Liloa Drive (N-S Collector) and expects to implement the recommended improvements along Liloa Drive (N-S Collector), and any identified intersections along Piilani Highway.

C. PROPOSED ROADWAY IMPROVEMENTS:

Anticipated offsite infrastructure improvements to be constructed in conjunction with, or by the proposed North-South Collector Road Improvements Project (Lipoa St. to Auhana Road; by Department of Public Works, County of Maui), include:

- Left-turn storage lanes at both project access driveway intersections along Liloa Drive (N-S Collector);
- Four-way stop intersection improvements at Liloa Drive / East Welakahao Street intersection;

Anticipated offsite improvements to be constructed by the Department of Public Works, County of Maui, when warranted and subject to availability of funds, to address regional traffic demands include:

- Second left turn lane along the eastbound (mauka-bound) connection of Pi'ikea Avenue (Road "C") to Piilani Highway; and,
- Signalization of East Welakahao Street / Piilani Highway intersection.

A dedicated, eastbound (mauka-bound) left turn lane along with appurtenant asphalt pavement widening, pavement markings and striping, and signage, at the proposed combined driveway connection for the Kihei Recycling and Redemption Center and future Phase III of the South Maui Community Park projects, is expected to be constructed by the Department of Public Works, County of Maui, in conjunction with the construction (by others) of the Kihei Recycling and Redemption

Center. This will be complemented by a future west (makai)-bound left turn storage lane for the Hope Chapel project, which is expected to be constructed by Hope Chapel in the future in conduction with its proposed Phase II improvements, which includes a driveway connection to East Welakahao Street, across the driveway proposed for the Kihei Recycling and Redemption Center (the proposed intersection improvements at East Welakahao Street are shown in EXHIBIT G - Proposed East Welakahao Street Intersection Improvements).

III. DRAINAGE SYSTEM:

A. TOPOGRAPHY AND EXISTING SITE CONDITIONS:

All development components within Piilani Village - South are located above the Kihei Flood Plain district. Runoff generally sheet flows across the site in an easterly (mauka) to westerly (makai) direction, ultimately being conveyed to low areas and wetlands.

Offsite drainage basins contributing runoff to the existing drainageways typically are relatively slender and a few may extend up towards the summit of Haleakala.

Keokea Gulch natural drainageway, aligned in an east to west direction, bisects Piilani South, including the South Maui Community Park project site, in an easterly to westerly (mauka to makai) direction, close to the southerly end of the project site. In addition there are several smaller drainageways bisecting Piilani Village - South, typically associated with culvert crossings at Piilani Highway.

The project site is presently undeveloped and is not being used for any particular purpose (see EXHIBIT F: Photographic Analysis of Existing Conditions).

The existing ground slopes in a southeasterly to northwesterly direction from elevation (+)90± feet M.S.L. to approximately (+)30± feet M.S.L., with an average slope of approximately 6.5% (see EXHIBIT C - Topographic Map and Grading Concept Plan).

The site is presently covered with buffelgrass (the density of which varies seasonally and with rainfall) and a scattering of kiawe trees (see EXHIBIT F - Photographic Analysis of Existing Conditions). Upon completion of the proposed grading and improvements, all disturbed areas that are still exposed (and not paved or otherwise landscaped) will be grassed as required to minimize soil erosion.

According to the "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii (August 1972)" (see EXHIBIT H: Soil Survey Map), the predominant soil type at the project site is Puuone Sand (PZUE) and Waiakoa (WID2). Puuone Sand is characterized as excessively drained, light grayish-brown, non-plastic, calcareous sand, underlain by light grayish-brown, non-plastic, cemented sands.

Permeability is rapid above the cemented layer, runoff slow and the hazard of wind erosion is moderate to severe.

This soil series are commonly geographically associated with Iao and Jaucas soils.

The Waiakoa (WID2) extremely stony silty clay loam, 3 to 25 percent slopes, eroded, is similar to Waiakoa very stony silty clay loam, 3 to 7 percent slopes, except that it is eroded and stones cover 3 to 15 percent of the surface. In most areas about 50 percent of the surface layer has been removed by erosion. Runoff is medium, and the erosion hazard is severe. This soil is often used for pasture and wildlife habitat.

A drainage study has been undertaken for the proposed project by Warren S. Unemori Engineering, Inc. (see *Drainage Report for South Maui Community Park*, by Warren S. Unemori Engineering, Inc., dated April 20, 2006).

A total of approximately 47.5 cfs (50 year - 1 hour storm) of onsite surface runoff is currently generated by the portion of the undeveloped project site north of Keokea Gulch (i.e., Drainage Basins D11 and D12), and continues downstream (see EXHIBIT D - Drainage Area Map).

Approximately 241 cfs (100 year - 24 hour storm) of offsite surface runoff currently discharges into the site from the existing 60" diameter culvert across Piilani Highway, and flows downstream along an existing drainageway.

The Engineering Division, Department of Public Works and Environmental Management, is currently planning and designing the extension of Liloa Drive (N-S Collector) which expects to install large-diameter culverts to intercept and convey the aforementioned runoff across and under the proposed roadway improvements.

A total of approximately 3.4 cfs (50 year - 1 hour storm) of onsite surface runoff is currently generated by the portion of the undeveloped project site south of Keokea Gulch (see previously approved "Drainage Report for Kihei Recycling and Redemption Center at South Maui Community Park", dated May 25, 2005).

Onsite surface runoff generally sheet flows in a southeasterly to northwesterly direction, into the existing Keokea Gulch natural drainageway, which abuts the northern edge of the project site.

Even after the Kihei Recycling and Redemption Center at South Maui Community Park is developed (by others), an onsite subsurface detention system (capacity based on 50 year - 1 hour runoff) being proposed with that project is expected to limit the peak onsite runoff being discharged to pre-development levels. Accordingly, it is expected that there will be no net increase in onsite peak surface runoff (based on a 50-year recurrence interval), even after that project is developed.

A 100-year inundation limits analysis (using the U.S. Army Corps of Engineers'·HEC-RAS water surface profile model for modeling both steady and unsteady, one-dimensional, gradually varied flow in both natural and man-made river channels) was undertaken for Keokea Gulch, based on a 100-year runoff of 8,008 c.f.s. (see EXHIBIT E: Keokea Gulch 100-Year Inundation Limits).

The Engineering Division, Department of Public Works and Environmental Management, is currently planning and designing the extension of Liloa Drive (N-S Collector) which expects to install large-diameter culverts or a bridge to intercept and convey the aforementioned runoff across and under the proposed roadway improvements.

Thus at Catch Points C.P.9 and C.P.10, along the downstream edge of the undeveloped project site, there currently is a total of approximately 255 c.f.s. and 5,129 c.f.s., respectively (100-year - 24 hour) of onsite and offsite surface runoff (see EXHIBIT D - Drainage Area Map, 2 of 2).

According to the Flood Insurance Rate Map, effective September 6, 1989, prepared by the United States Federal Emergency Managements Agency, Federal Insurance Administration, the project site is situated in an area designated as Zone C, which is prone to minimal flooding (see EXHIBIT I: Flood Insurance Rate Map).

Furthermore, the project site is not within a tsunami zone.

B. PROPOSED DRAINAGE IMPROVEMENTS:

In the absence of any onsite subsurface detention, the total onsite surface runoff generated after developing the project site (50 year - 1 hour runoff) would have been expected to be approximately:

- Drainage Basin D11: 59.2 c.f.s. (up from 38.2 c.f.s.)
- Drainage Basin D12: 13.3 c.f.s. (up from 9.3 c.f.s.)

However, an onsite subsurface detention system (capacity based on 50 year - 1 hour runoff) is being proposed to limit the peak onsite runoff being discharged to pre-development levels. Accordingly, there will be no net increase in onsite peak surface runoff, based on a 50-year recurrence interval and the total onsite and offsite peak surface runoff along the downstream edge of the project site is expected to remain (50 year - 24 hour):

- Catch Point C.P. 9: 255 c.f.s.; and,
- Catch Point C.P. 10: 5,129 c.f.s.

The corresponding 100 year - 24 hour peak runoff (for which the proposed Liloa Drive Extension culverts would be sized) are expected to be:

- Catch Point C.P. 9: 367 c.f.s.; and,
- Catch Point C.P. 10: 7,850 c.f.s. (8,008 c.f.s. from Transmeridian Report, is conservatively upheld for design)

The majority of the onsite surface runoff from the paved surfaces will be intercepted by drain inlets and be conveyed directly underground to the proposed subsurface detention system, which will have an overflow to the proposed Liiloa Drive Extension culvert crossings. The balance of the onsite surface runoff will sheetflow, as it is currently doing, to the adjoining proposed Liloa Drive Extension or adjoining existing Keokea Gulch natural drainageway.

All improvements are proposed outside of the 100-year inundation limits of the existing Keokea Gulch natural drainageway (see EXHIBIT E - Keokea Gulch 100-Year Inundation Limits).

IV. WASTEWATER SYSTEM

A. EXISTING CONDITIONS:

There are existing, recently installed, underground 8" diameter sewer lines:

- Along Halekuai Street (installed as part of the Kihei Franks Subdivision project), west (makai) of Phases I and II of the proposed project site; and,
- Along East Welakahao Street (extended up to Liloa Drive by the recent Hope Chapel project).

B. PROPOSED WASTEWATER IMPROVEMENTS:

Proposed Phases I and II:

The easterly (mauka) terminus of an existing underground sewerline along Halekuai Street (in the Kihei Franks Subdivision) will be extended to and along the proposed extension of Liloa Drive to service the project site. Improvements are expected to be installed in conjunction with the extension of Liloa Drive (N-S Collector) by the Engineering Division, Department of Public Works and Environmental Management to minimize disruption to traffic.

Proposed (future) Phase III:

The existing 8" sewerline that was recently extended up East Welakahao Street to the extension of Liloa Drive by the Hope Chapel project will be extended further east (mauka) when required for Phase III of the South Maui Community Park.

A 4" diameter R1 reclaimed water service lateral has already been extended from the County's 12" R1 reclaimed water transmission main along Liloa Drive (N-S Collector) to the Kihei Recycling and Redemption Center site to furnish R1 reclaimed water for landscape irrigation.

C. ANTICIPATED WASTEWATER DEMAND:

Based on projections provided by the mechanical consultant, anticipated wastewater generation for Phases I and II of the completed project are:

- Phase I: 68,400 gpd; and,
- Phase II: 82,400 gpd.

Phase III is anticipated to generate approximately 6,800 gpd..

V. WATER SYSTEM:

A. EXISTING CONDITIONS:

There is an existing 18" potable water distribution waterline, and a 12" reclaimed water transmission line, along the extension of Liloa Drive (N-S Collector).

B. PROPOSED WATER IMPROVEMENTS:

Proposed Phases I and II:

Potable waterlines (8" or larger in diameter, based on ultimate fire flow requirements for the project), will be installed along the primary access driveway loop and tied in to the County's existing 18" potable water distribution waterline along the extension of Liloa Drive at both proposed driveway connections. Potable water and fire protection will be provided from this proposed water system.

Irrigation lines will also be installed and tied in to the County's existing 12" reclaimed water transmission line along the extension of Liloa Drive. R1 reclaimed water will be used to provide landscape irrigation and secondary fire protection to the playfields and parking areas (where allowed by County agencies).

Proposed (future) Phase III:

A new waterline is expected to be installed along East Welakahao Street, from the County's existing 18" potable water distribution line to the project site, when required for Phase III of the South Maui Community Park. Potable water and fire protection will be provided from this proposed water system.

A 4" diameter R1 reclaimed water service lateral has already been extended from the County's 12" R1 reclaimed water transmission main along Liloa Drive (N-S Collector) to the Kihei Recycling and Redemption Center site to furnish R1 reclaimed water for landscape irrigation. R1 reclaimed water will be used to provide landscape irrigation and secondary fire protection to the playfields and parking areas (where allowed by County agencies).

C. ANTICIPATED DOMESTIC WATER DEMAND:

Based on projections provided by the mechanical consultant, anticipated potable water consumption for Phases I and II of the completed project are:

- Phase I: 68,400 gpd; and,
- Phase II: 82,400 gpd.

Peak domestic demand is expected to be approximately 140 gpm.

Phase III is anticipated to consume approximately 6,800 gpd. Peak demand is expected to be approximately 52 gpm.

D. ANTICIPATED RECLAIMED WATER (IRRIGATION) DEMAND:

Based on projections provided by the landscape architect, Phases I and II of the completed project are anticipated to consume approximately 160,000 gpd of R1 reclaimed water for landscape irrigation. Peak demand is expected to be approximately 350 gpm (based on an 8 hour water window).

Phase III is anticipated to consume approximately 2,500 gpd. Peak demand is expected to be approximately 100 gpm.

VI. ELECTRICAL, TELEPHONE AND CATV SERVICE

A. EXISTING CONDITIONS:

Maui Electric Company, Ltd.'s main 69kV overhead transmission line is located along the westerly (makai) edge of Piilani Village, with a substation located at the corner of East Welakahao St. and the Liloa Drive (N-S Collector) Roadway corridor.

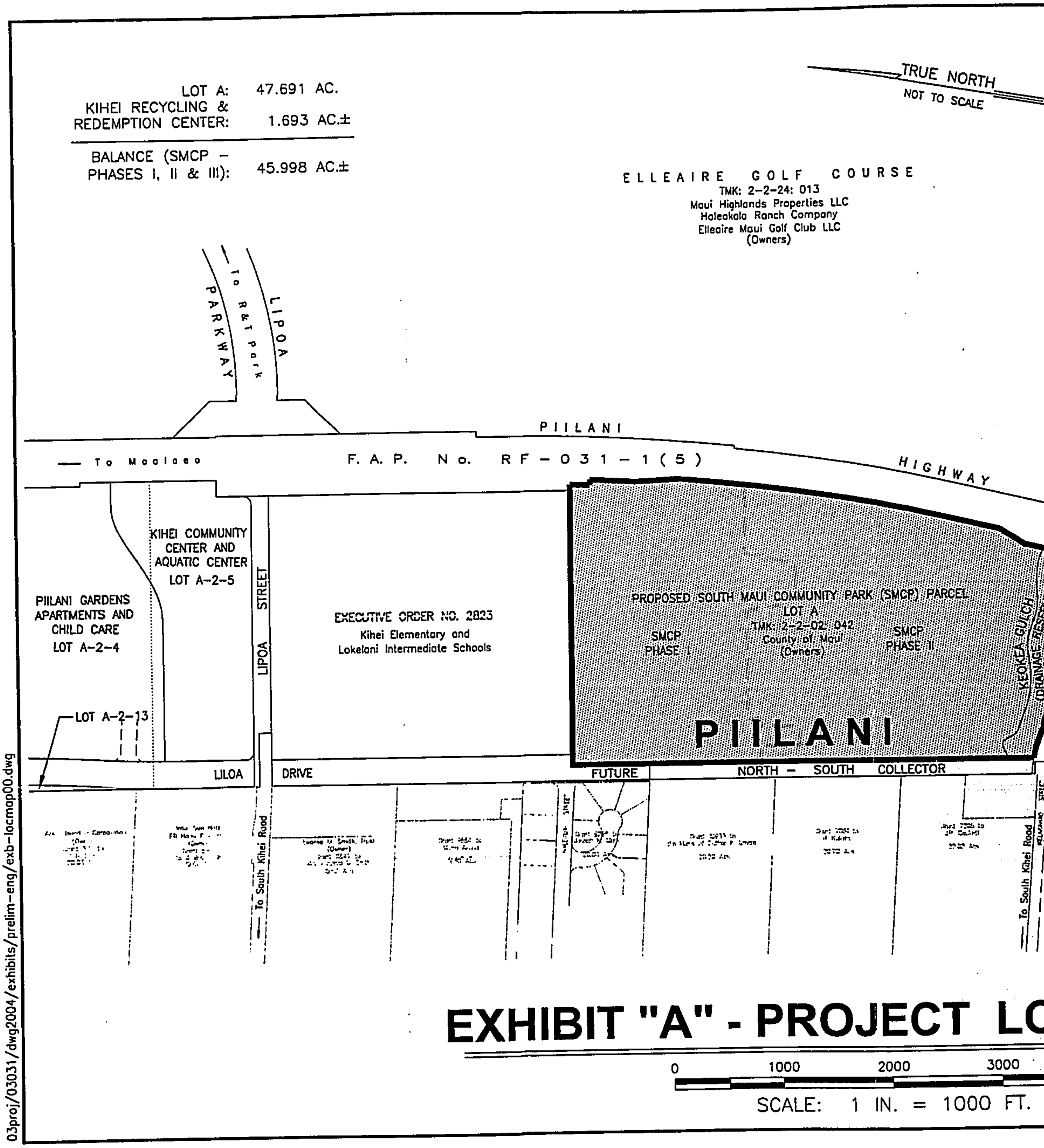
The Verizon telephone and Oceanic Time Warner Cable cable television distribution systems are also generally located along this utility corridor as well as along the existing E-W (mauka-makai) roadway connections leading to South Kihei Road (e.g, Lipoa St., Halekuai St., East Welakahao St., etc.).

B. PROPOSED IMPROVEMENTS:

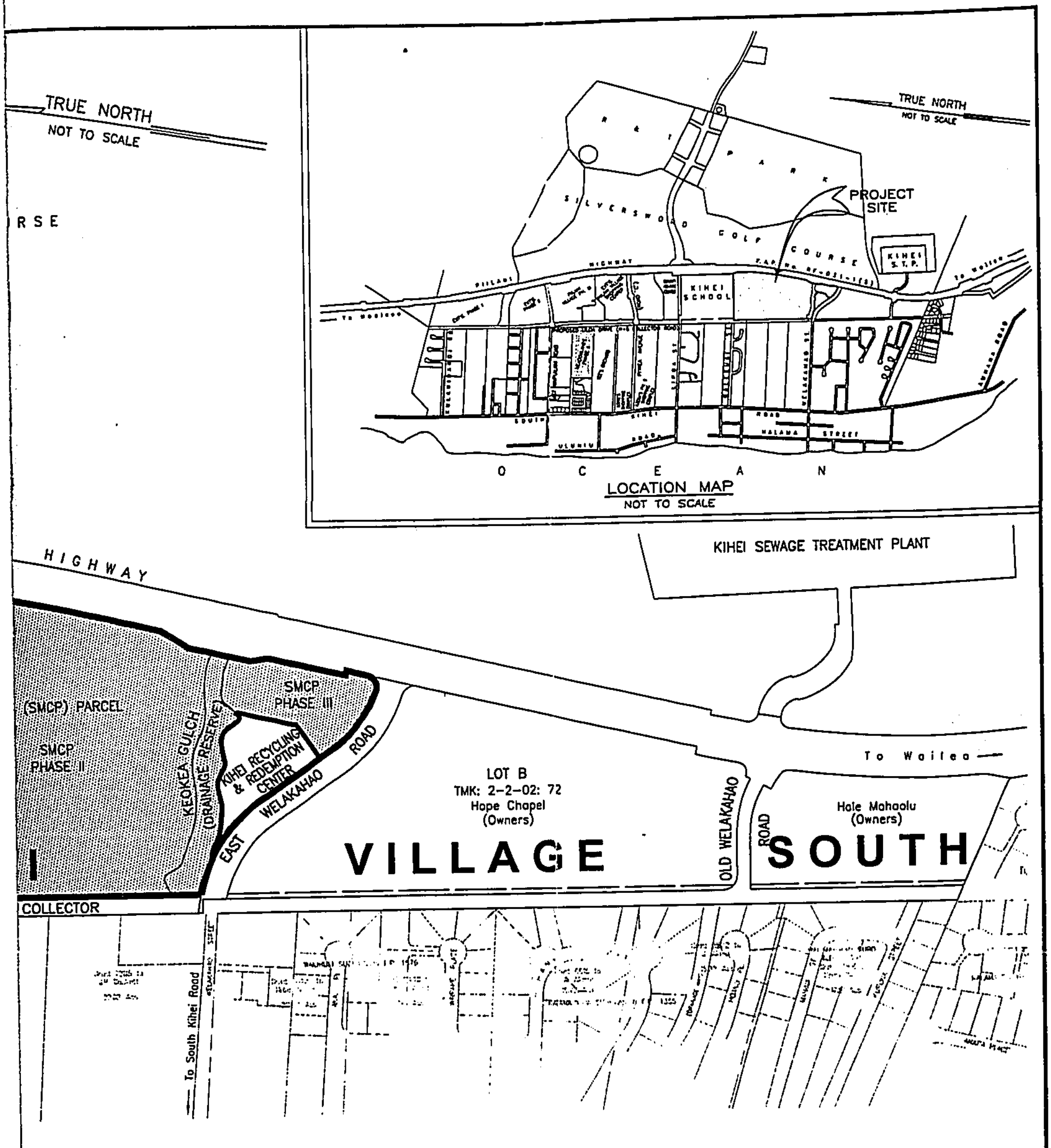
All new electrical, telephone and cable televisions distribution systems within the project are expected to be placed underground.

Lighting for the project is expected to be provided by pole-mounted lights, ranging in heights from, 15 ft. to 20 ft. high for access driveways and parking areas, to 60 ft. to 70 ft. high for the playfields.

EXHIBITS



LOT A: 47.691 AC.
KIHEI RECYCLING & REDEMPTION CENTER: 1.693 AC.±
BALANCE (SMCP - PHASES I, II & III): 45.998 AC.±
TRUE NORTH
NOT TO SCALE
ELLEAIRE GOLF COURSE
TMK: 2-2-24: 013
Maui Highlands Properties LLC
Haleakala Ranch Company
Elleaire Maui Golf Club LLC
(Owners)
LIPOA PARKWAY
To R&T Park
PIILANI
F. A. P. No. RF-031-1(5)
HIGHWAY
To Maalaea
KIHEI COMMUNITY CENTER AND AQUATIC CENTER
LOT A-2-5
PIILANI GARDENS APARTMENTS AND CHILD CARE
LOT A-2-4
LOT A-2-13
LIPOA STREET
EXECUTIVE ORDER NO. 2823
Kihei Elementary and Lokelani Intermediate Schools
PROPOSED SOUTH MAUI COMMUNITY PARK (SMCP) PARCEL
LOT A
TMK: 2-2-02: 042
County of Maui
(Owners)
SMCP PHASE I
SMCP PHASE II
KEOKEA GULCH
PIILANI
LILOA DRIVE
FUTURE NORTH - SOUTH COLLECTOR
To South Kihei Road
To South Kihei Road
EXHIBIT "A" - PROJECT LO
0 1000 2000 3000
SCALE: 1 IN. = 1000 FT.
03proj/03031/dwg2004/exhibits/prelim-eng/exb-locmap00.dwg



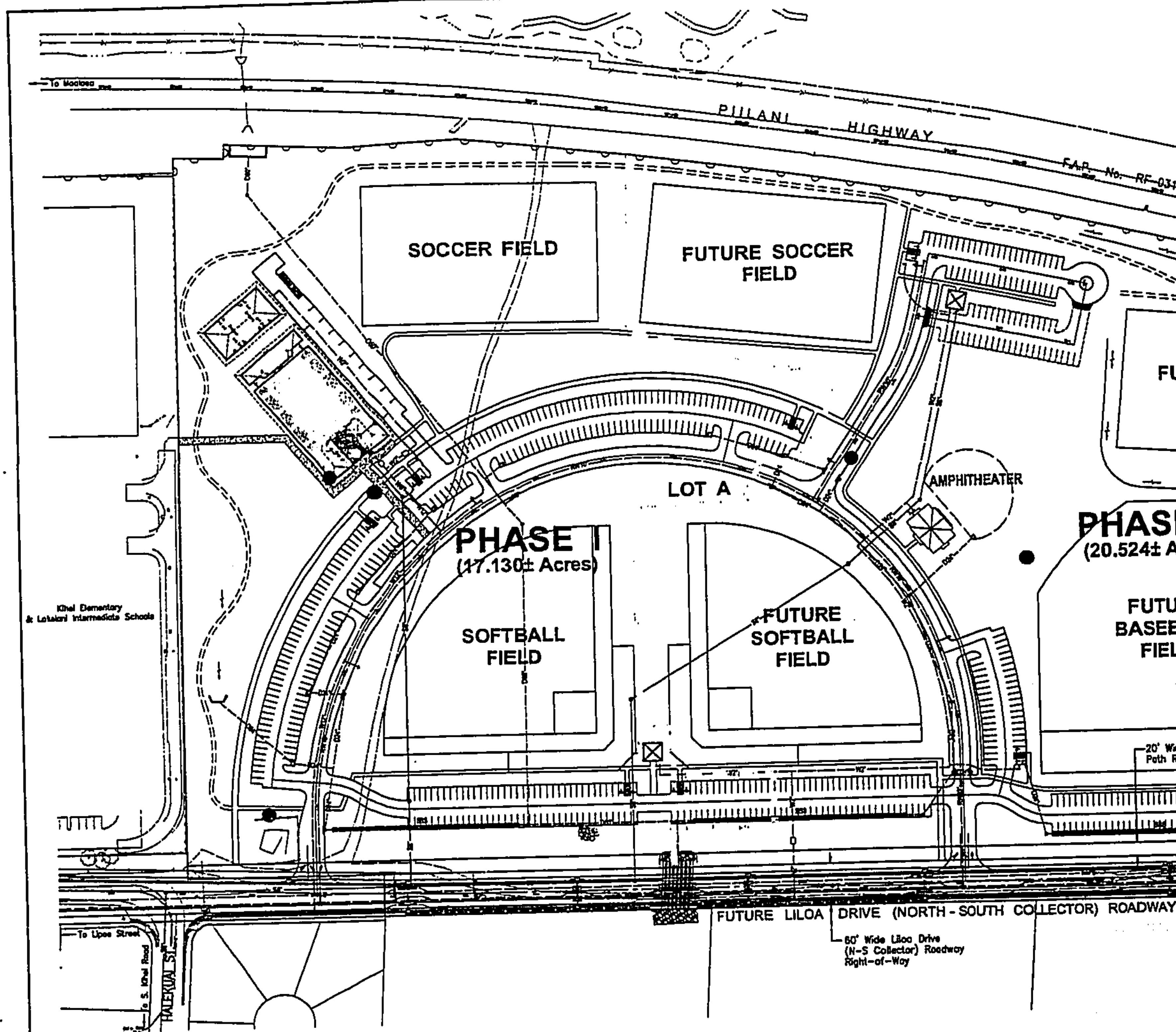
ECT LOCATION MAP

2000 3000 4000

N. = 1000 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

June 12, 2006



LEGEND:

- FUTURE SEWER MANHOLE
- GRATED INLET CATCH BASIN
- HEADWALL WITH WINGWALL
- RW3" RECLAIMED WATERLINE W/ SIZE
- D24" DRAINLINE W/ SIZE
- FS8" FUTURE SEWERLINE W/ SIZE
- FW2" FUTURE WATERLINE W/ SIZE
- EW8" EXISTING WATERLINE W/ SIZE
- ED24" EXISTING DRAINLINE W/ SIZE
- ES8" EXISTING SEWERLINE W/ SIZE
- EXISTING STREET LIGHT
- NO VEHICULAR ACCESS PERMITTED
- VEHICULAR ACCESS PERMITTED
- PROPOSED IMPROVEMENTS (BY OTHERS)
- FUTURE IMPROVEMENTS (BY OTHERS)
- SIDEWALK
- TOP BANK
- BOTTOM BANK
- CENTERLINE SWALE
- EXISTING ARCHAEOLOGICAL SITES
- 100 YEAR FEMA INUNDATION LIMITS (Q_{100} = 8,008 c.f.s.)
- CONCEPTUAL SCHEMATIC LAYOUT OF RECYCLING & REDEMPTION CENTER ONSITE IMPROVEMENTS (BY OTHERS)
- SELF-CONTAINED SOLAR POWERED AREA LIGHTING (SEE DET. SHT. C-8.1)

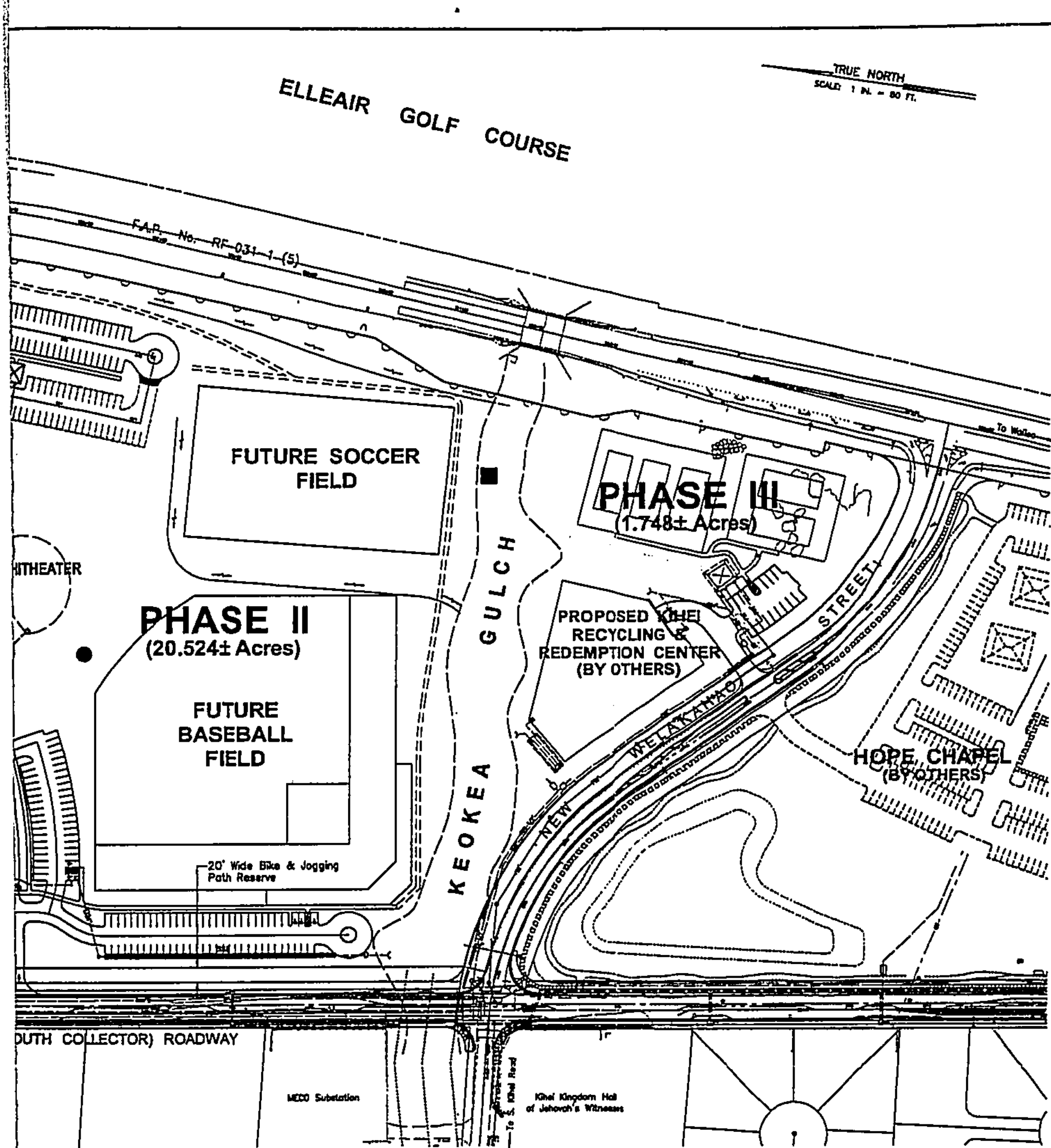
PARKING TABULATION

	PHASE I	PHASE II
STANDARD PARKING STALLS	307	193
COMPACT PARKING STALLS	0	0
VAN ACCESSIBLE STALLS	10	6
STANDARD ACCESSIBLE STALLS	0	1
TOTAL	317	200
FUTURE OVERFLOW PARKING	0	29

NOTES:

1. OVERHEAD AND UNDERGROUND UTILIT PROPOSED IMPROVEMENTS AND MAY RESPONSIBLE FOR CONTACTING THE WITHOUT LIMITATION MAUI ELECTRIC WARNER CABLE OF HAWAII), EXAMININ UTILITIES, AND CONFIRMING THE PRES PROPOSED IMPROVEMENTS. CONTRAC AND ANY REQUIRED RELOCATION, WIT
2. OWNERS OF ADJOINING LANDS, SHOW PROPERTY MAPPING BRANCH, & ARE

EXHIBIT "B" - SITE CONCEPT



NOTES:

1. OVERHEAD AND UNDERGROUND UTILITIES MAY EXIST ALONG, ACROSS, AND IN THE VICINITY OF THE PROPOSED IMPROVEMENTS AND MAY NOT BE SHOWN ON THE PLANS. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE RESPECTIVE COUNTY OR STATE AGENCIES, UTILITIES (INCLUDING WITHOUT LIMITATION MAUI ELECTRIC COMPANY, LTD., VERIZON HAWAII INC., AND OCEANIC TIME WARNER CABLE OF HAWAII), EXAMINING ANY AVAILABLE RECORD DRAWINGS, TONING OF UNDERGROUND UTILITIES, AND CONFIRMING THE PRESENCE OF ANY EXISTING UTILITIES ALONG AND ACROSS THE PROPOSED IMPROVEMENTS. CONTRACTOR SHALL NOTIFY AND COORDINATE CONSTRUCTION ACTIVITIES, AND ANY REQUIRED RELOCATION, WITH RESPECTIVE AGENCIES AND UTILITIES.
2. OWNERS OF ADJOINING LANDS, SHOWN ON PLAN, ARE TAKEN FROM RECORDS FILED IN THE REAL PROPERTY MAPPING BRANCH, & ARE SUBJECT TO VERIFICATION.

LETTER	DESCRIPTION	DATE

CLIFFORD N. MUKAI · LICENSED PROFESSIONAL ENGINEER · NO. 6467-C · HAWAII, U.S.A.

SIGNATURE — DATE

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

SOUTH MAUI COMMUNITY PARK
PROJECT NO.: P03/004 TAX MAP KEY: (2) 2-2-02:42
Waiohuli - Keokea (Kihei), Makawao, Maui, Hawaii

TITLE GENERAL SITE PLAN

DESIGNED BY	CHECKED BY	JOB NUMBER	SHEET
C.N.M.	C.N.M.	03031.00	1
D.P.T. (DRAWN BY)	W.S.U. (APPROVED BY)	April 19, 2006 (DATE)	OF SHEETS
SCALE: AS NOTED			

TE CONCEPT PLAN

JUNE 12, 2006

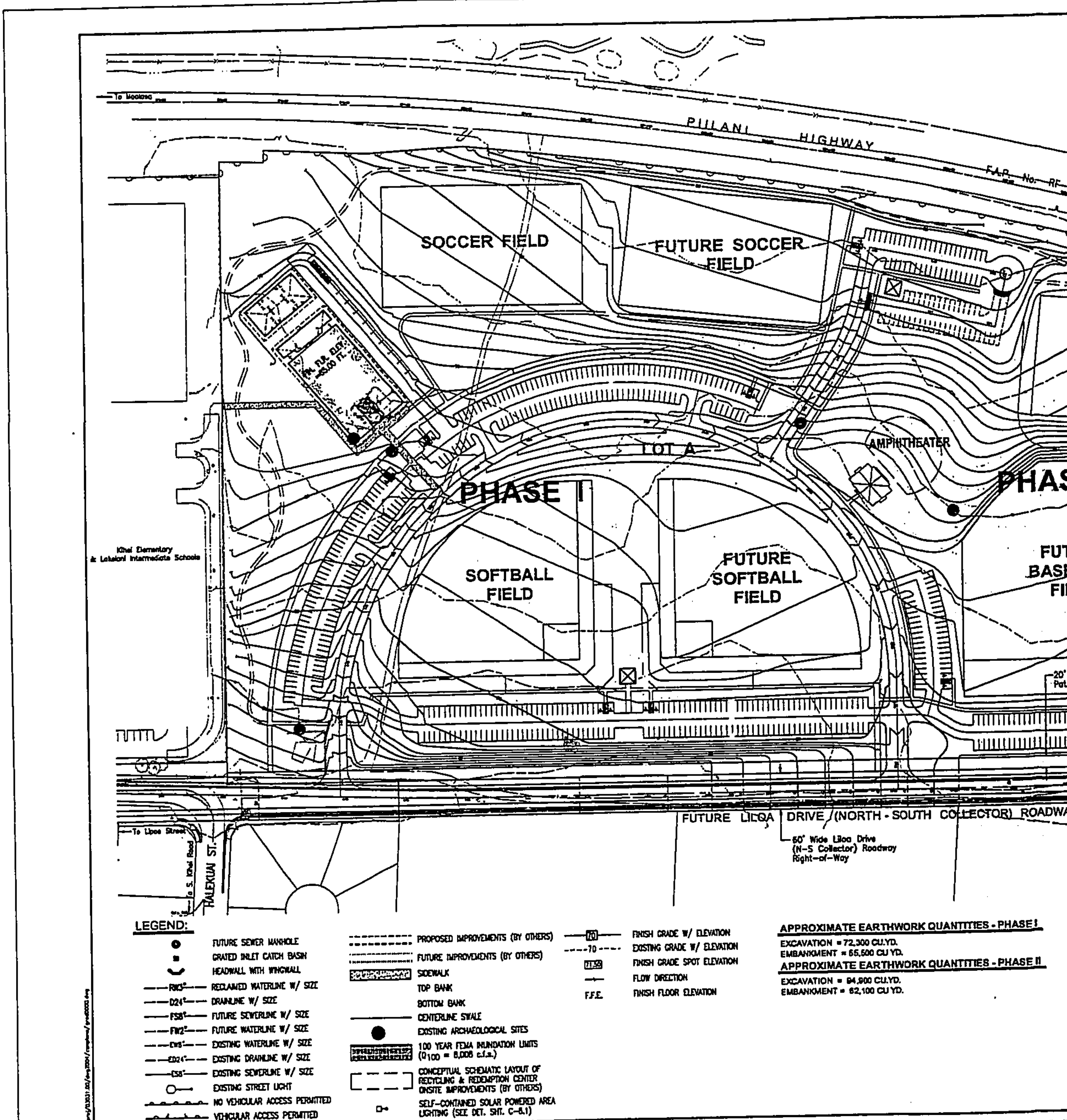
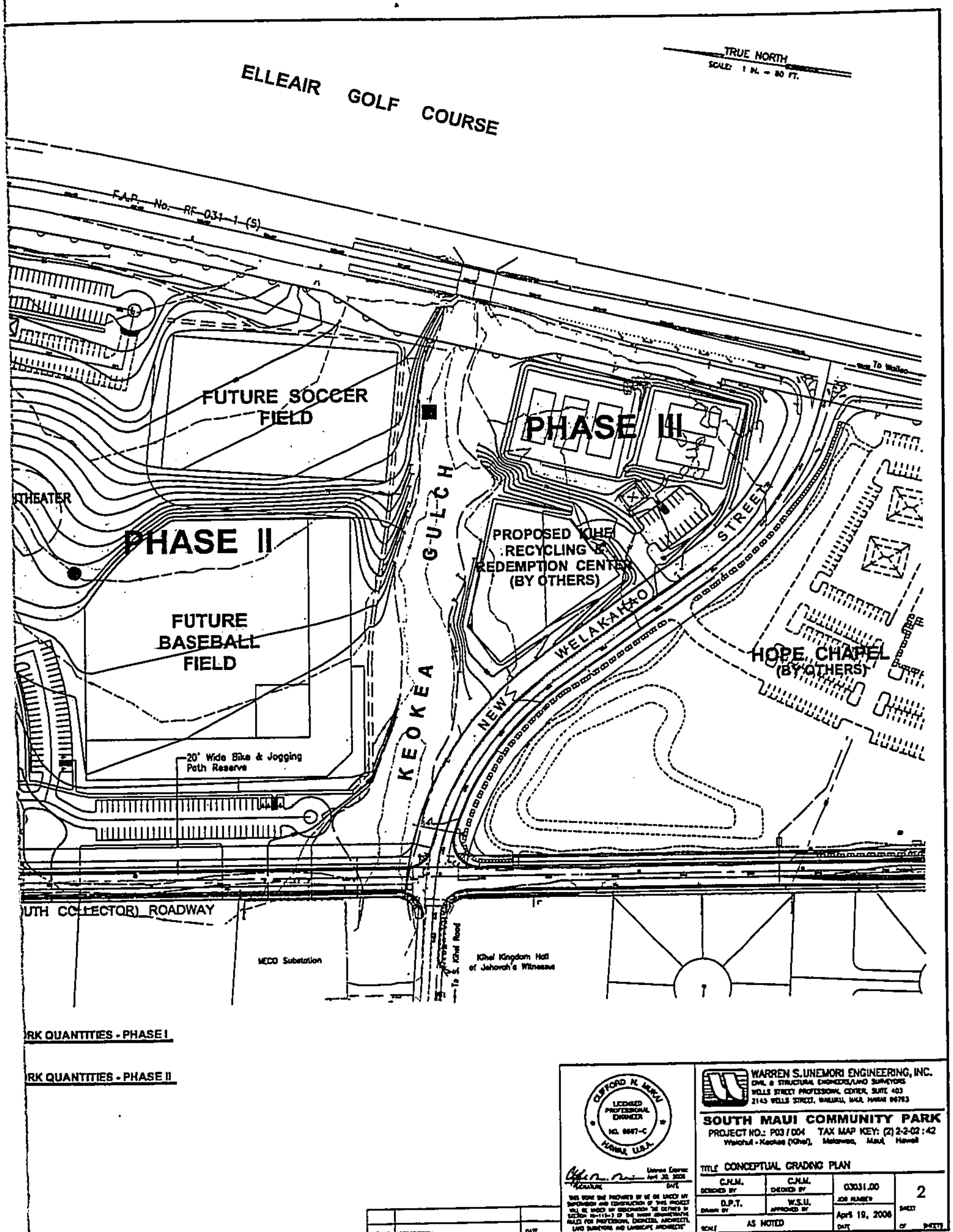


EXHIBIT "C" - TOPOGRAPHIC MAP & GRA



MAP & GRADING CONCEPT PLAN

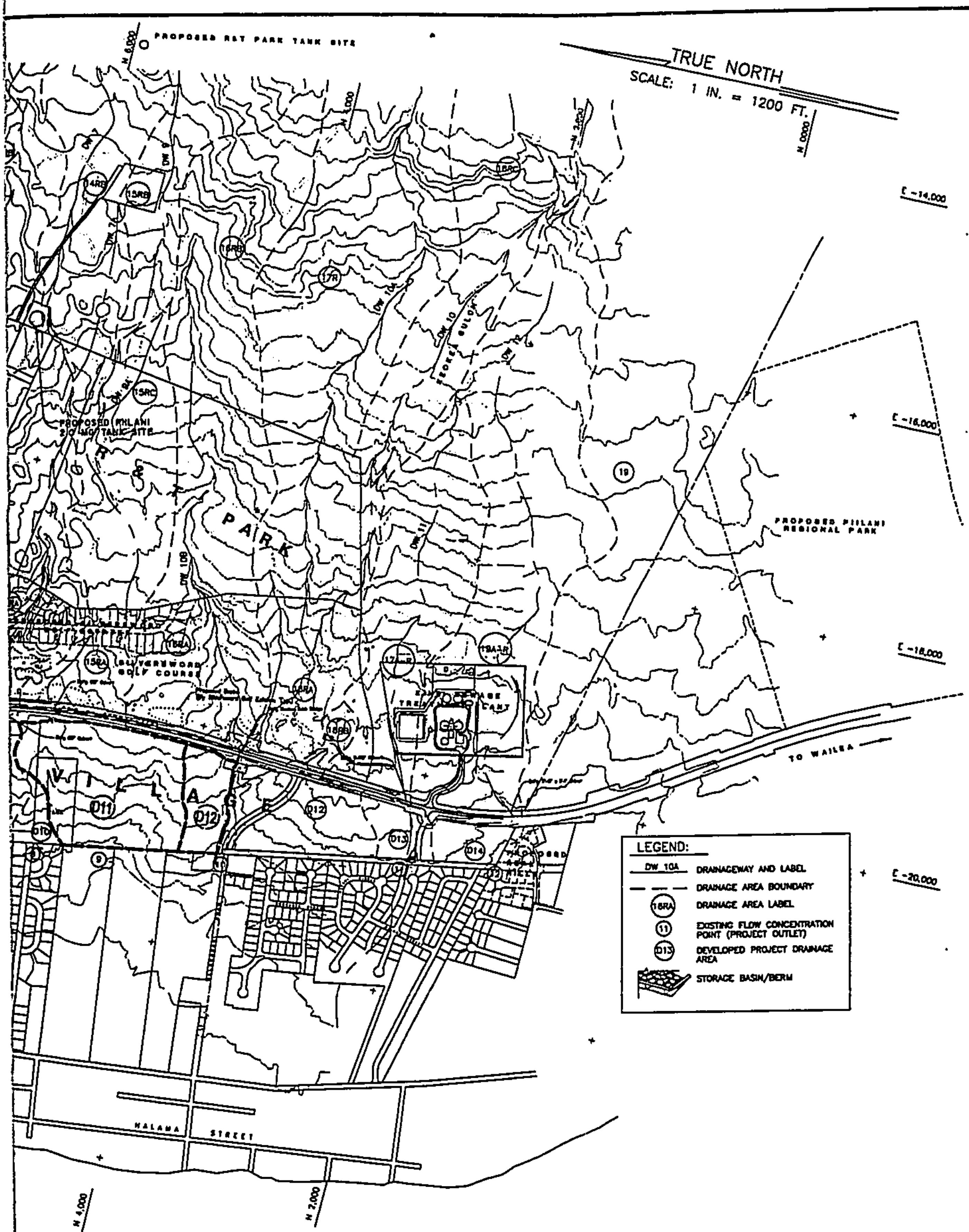
JUNE 12, 2006

EXHIBIT "D" - DRAINAGE ARE

0 1200 2400 3600

SCALE: 1 IN. = 1200 FT.

03proj/03031/dwg2004/exhibits/prelim-eng/exb-drn-area00.dwg



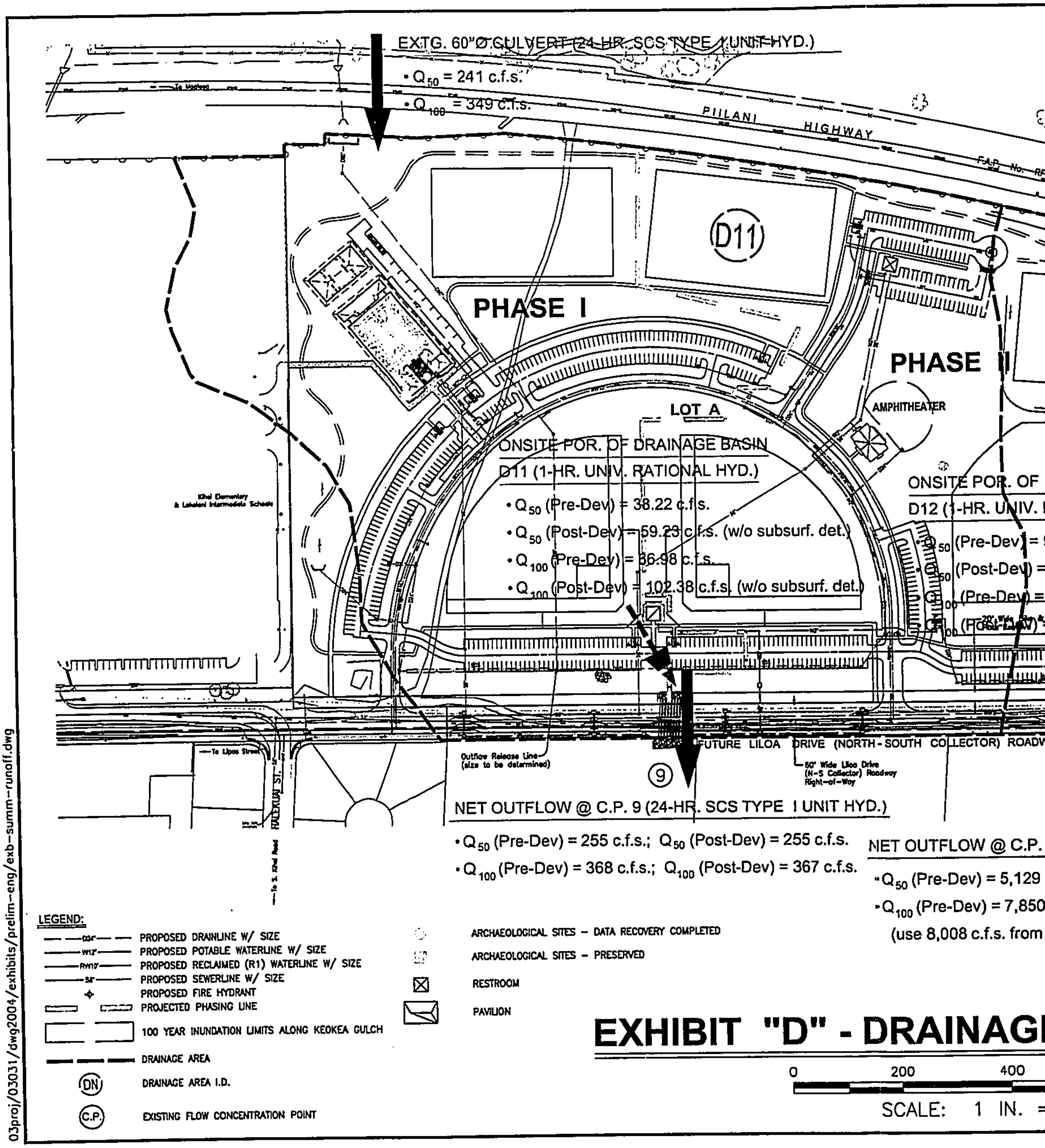
GE AREA MAP (1 OF 2)

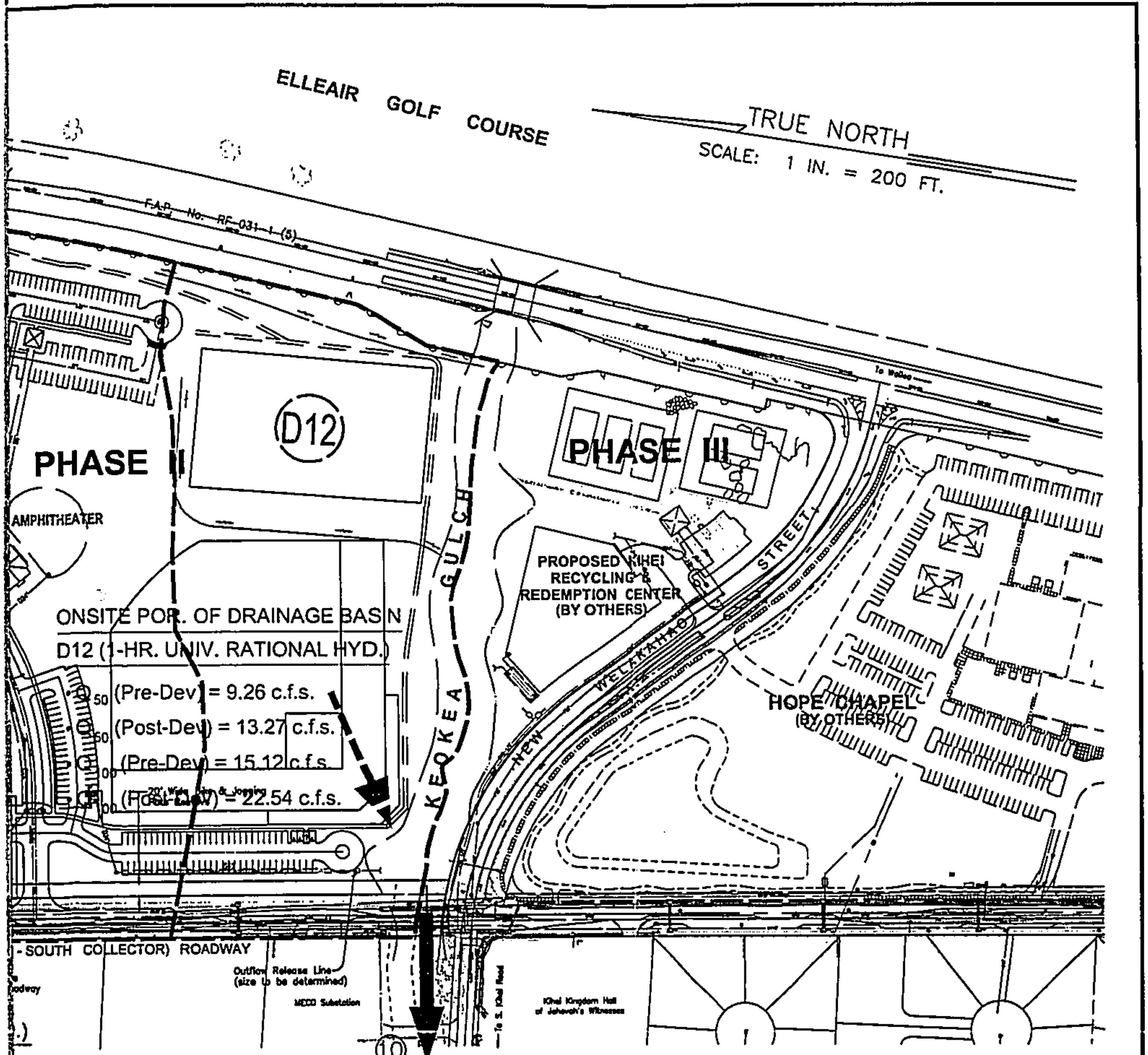
2400 3600 4800

N. = 1200 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

June 12, 2006


EXTG. 60"Ø CULVERT (24-HR. SCS TYPE I UNIT HYD.)
• Q50 = 241 c.f.s.
• Q100 = 349 c.f.s.
PIILANI HIGHWAY
D11
PHASE I
PHASE II
AMPHITHEATER
LOT A
ONSITE POR. OF DRAINAGE BASIN
D11 (1-HR. UNIV. RATIONAL HYD.)
• Q50 (Pre-Dev) = 38.22 c.f.s.
• Q50 (Post-Dev) = 59.23 c.f.s. (w/o subsurf. det.)
• Q100 (Pre-Dev) = 36.98 c.f.s.
• Q100 (Post-Dev) = 102.38 c.f.s. (w/o subsurf. det.)
ONSITE POR. OF
D12 (1-HR. UNIV.
FUTURE LILOA DRIVE (NORTH-SOUTH COLLECTOR) ROADW
Outflow Release Line (size to be determined)
9
NET OUTFLOW @ C.P. 9 (24-HR. SCS TYPE I UNIT HYD.)
• Q50 (Pre-Dev) = 255 c.f.s.; Q50 (Post-Dev) = 255 c.f.s.
• Q100 (Pre-Dev) = 368 c.f.s.; Q100 (Post-Dev) = 367 c.f.s.
NET OUTFLOW @ C.P.
• Q50 (Pre-Dev) = 5,129
• Q100 (Pre-Dev) = 7,850
(use 8,008 c.f.s. from
Kihei Elementary & Lokelani Intermediate Schools
LEGEND:
PROPOSED DRAINLINE W/ SIZE
PROPOSED POTABLE WATERLINE W/ SIZE
PROPOSED RECLAIMED (R1) WATERLINE W/ SIZE
PROPOSED SEWERLINE W/ SIZE
PROPOSED FIRE HYDRANT
PROJECTED PHASING LINE
100 YEAR INUNDATION LIMITS ALONG KEOKEA GULCH
DRAINAGE AREA
DN DRAINAGE AREA I.D.
C.P. EXISTING FLOW CONCENTRATION POINT
ARCHAEOLOGICAL SITES – DATA RECOVERY COMPLETED
ARCHAEOLOGICAL SITES – PRESERVED
RESTROOM
PAVILION
EXHIBIT "D" - DRAINAG
0 200 400
SCALE: 1 IN. =
03proj/03031/dwg2004/exhibits/prelim-eng/exb-summ-runoff.dwg



IET OUTFLOW @ C.P. 10 (24-HR. SCS TYPE I UNIT HYD.)

- Q_{50} (Pre-Dev) = 5,129 c.f.s.; Q_{50} (Post-Dev) = 5,129 c.f.s.
- Q_{100} (Pre-Dev) = 7,850 c.f.s.; Q_{100} (Post-Dev) = 7,850 c.f.s.

(use 8,008 c.f.s. from Transmeridian Rpt.)

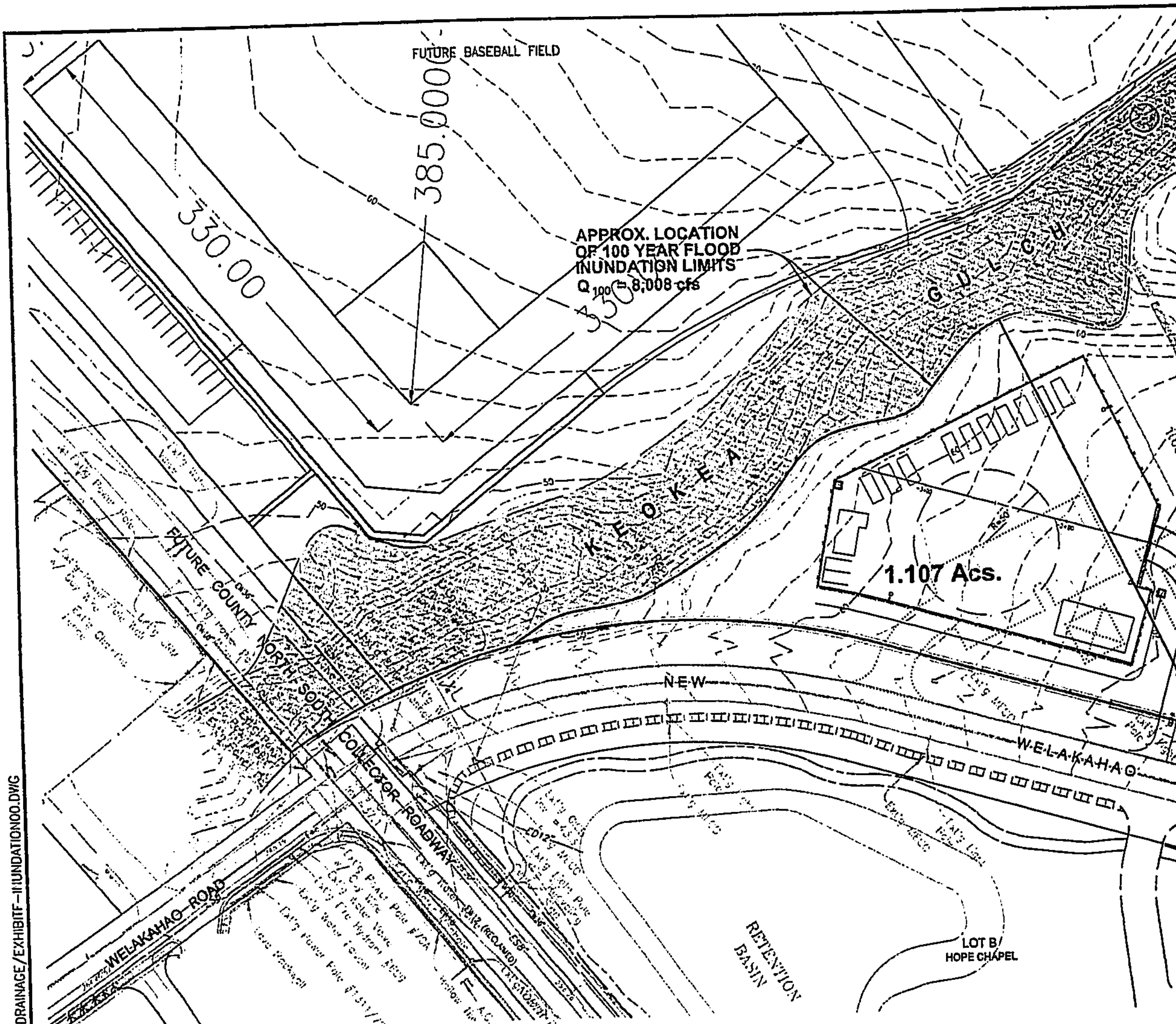
)RAINAGE AREA MAP (2 OF 2)

200 400 600 800

SCALE: 1 IN. = 200 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

June 12, 2006

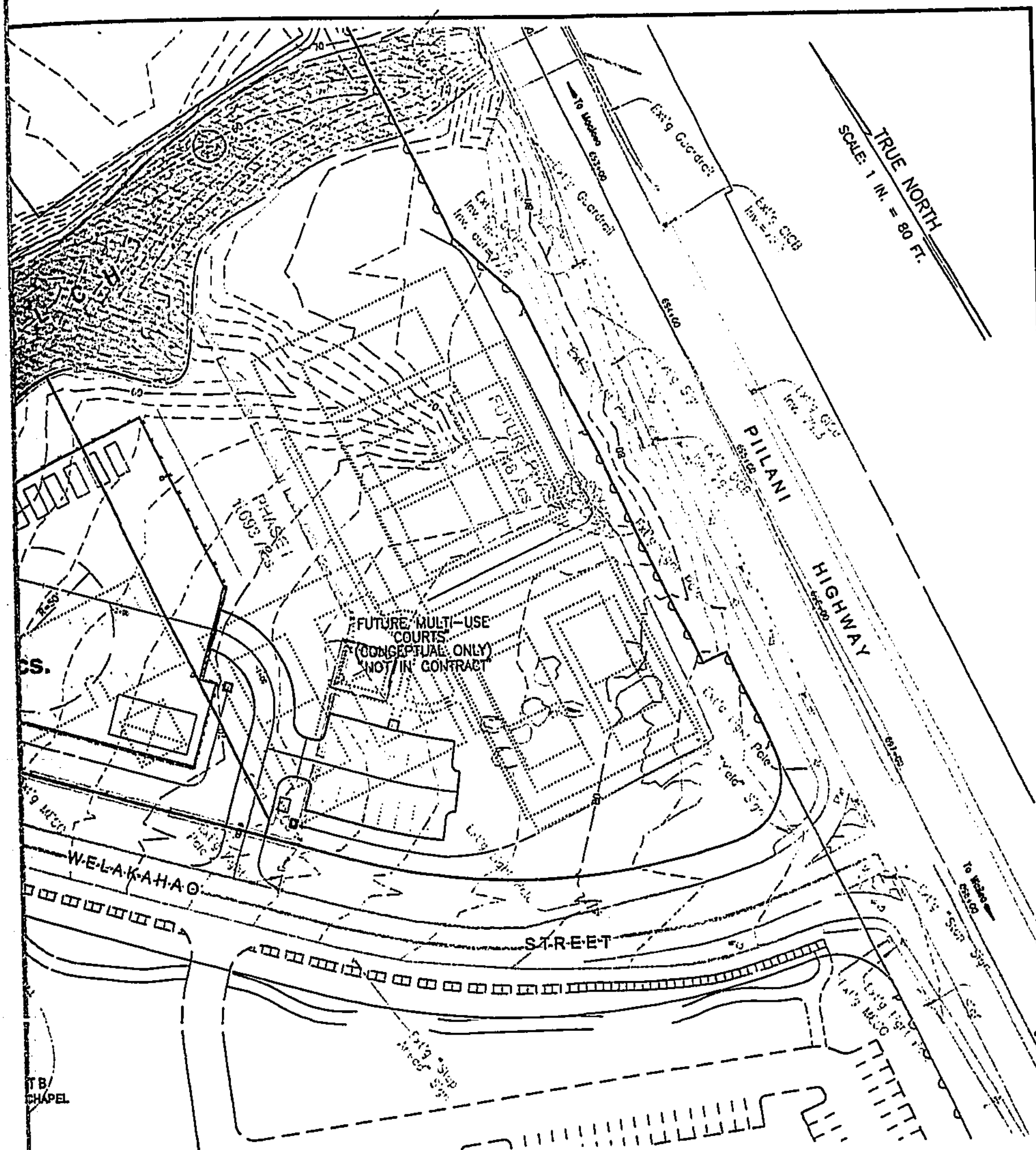


HEC-RAS 100-YEAR FLO
INUNDATION LIMITS ANALYSIS R

LEGEND:

- ARCHAEOLOGICAL SITE
- 100 YEAR FEMA INUNDATION LIMITS
- PROPOSED RECYCLING & REDEMPTION CENTER CONCEPTUAL PLAN (AND REQUIRED MODIFICATIONS TO ORIGINAL SOUTH MAUI PARK PLAN)

03PROJ/03031.90/DWG/EXHIBIT/DRAINAGE/EXHIBIT-II.IUNDATION00.DWG



-YEAR FLOOD
NALYSIS RESULTS

EXHIBIT "E"

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

May 25, 2005

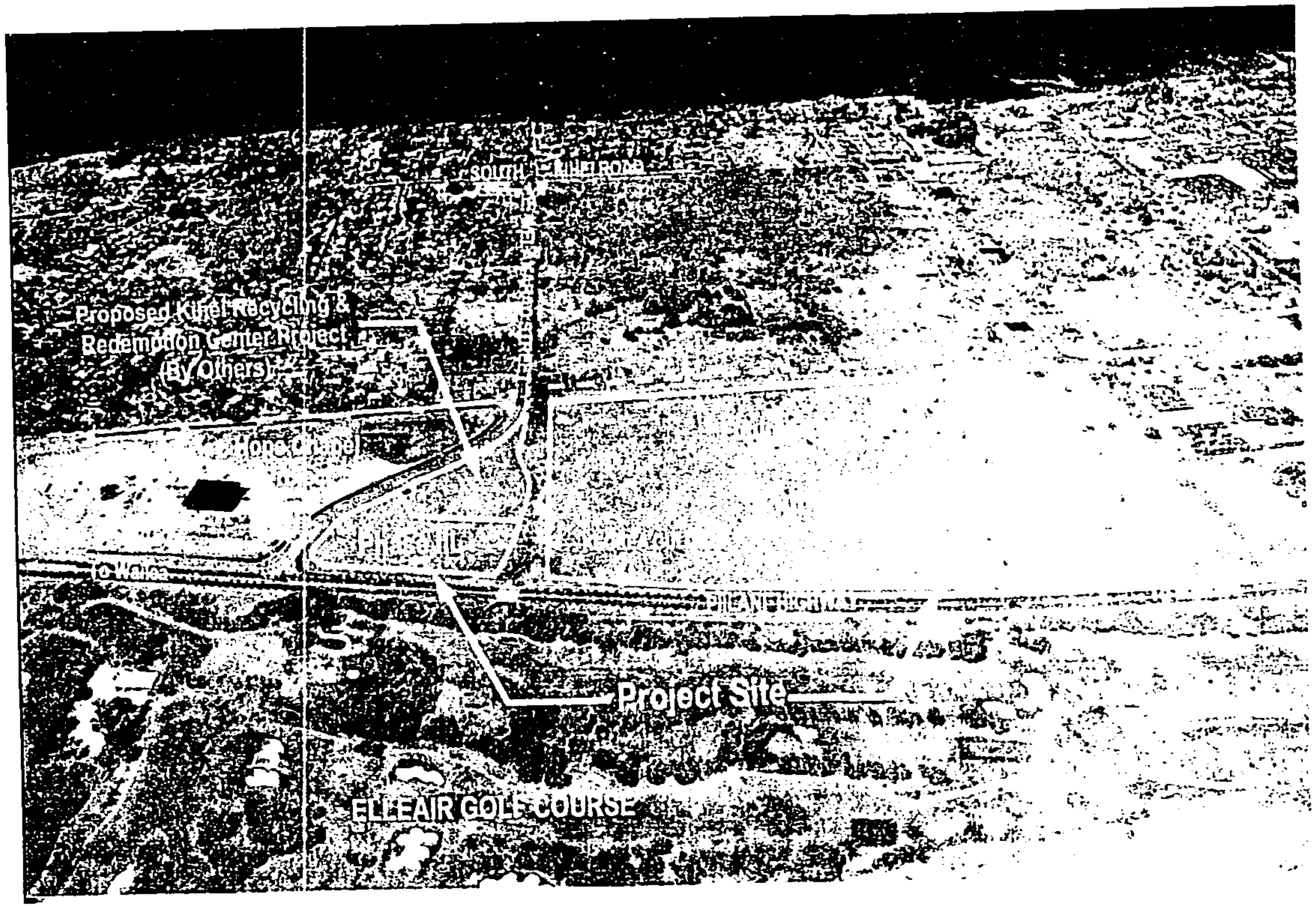


EXHIBIT "F" – PHOTOGRAPHIC ANALYSIS OF PROJECT SITE (1 of 3)

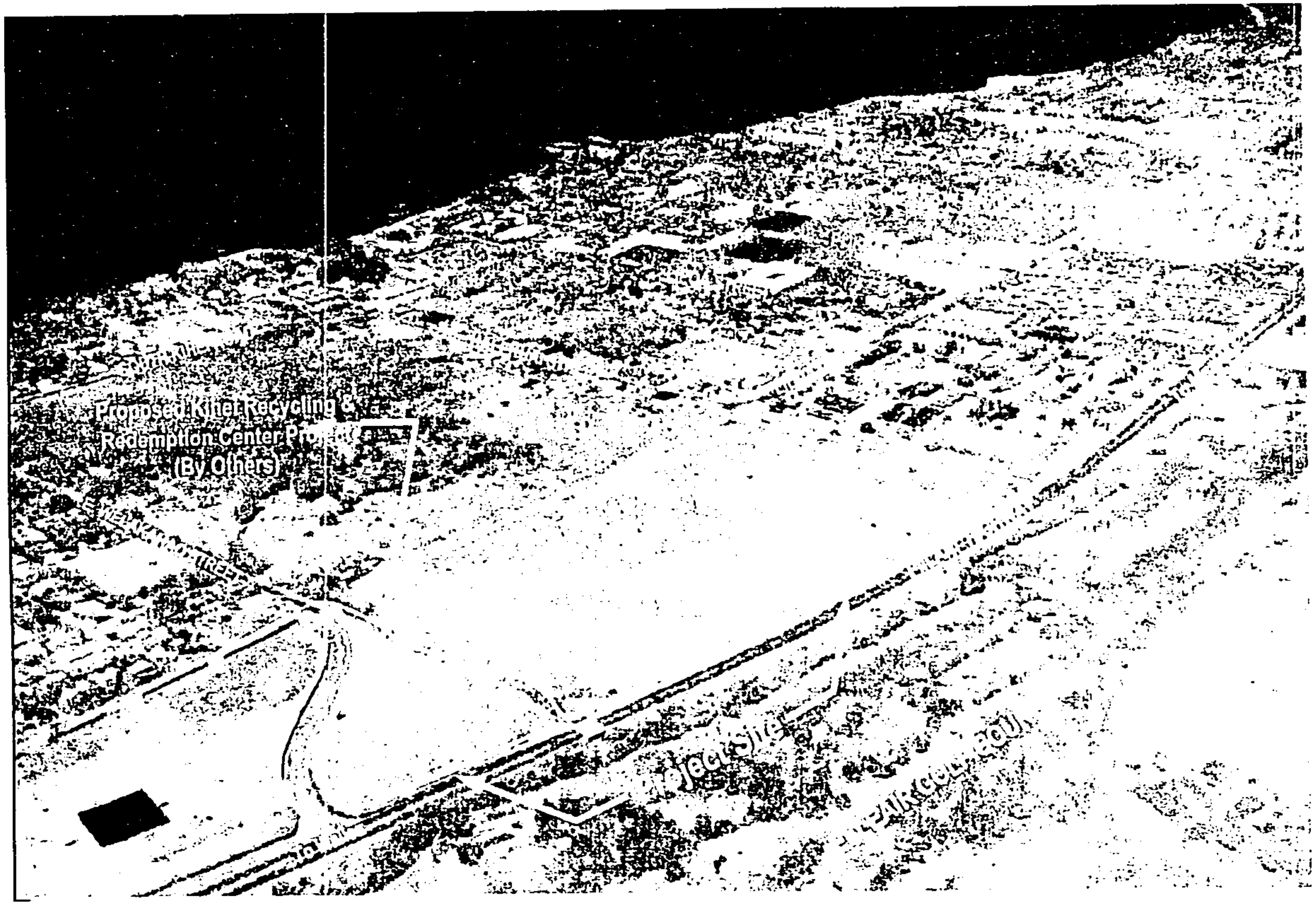
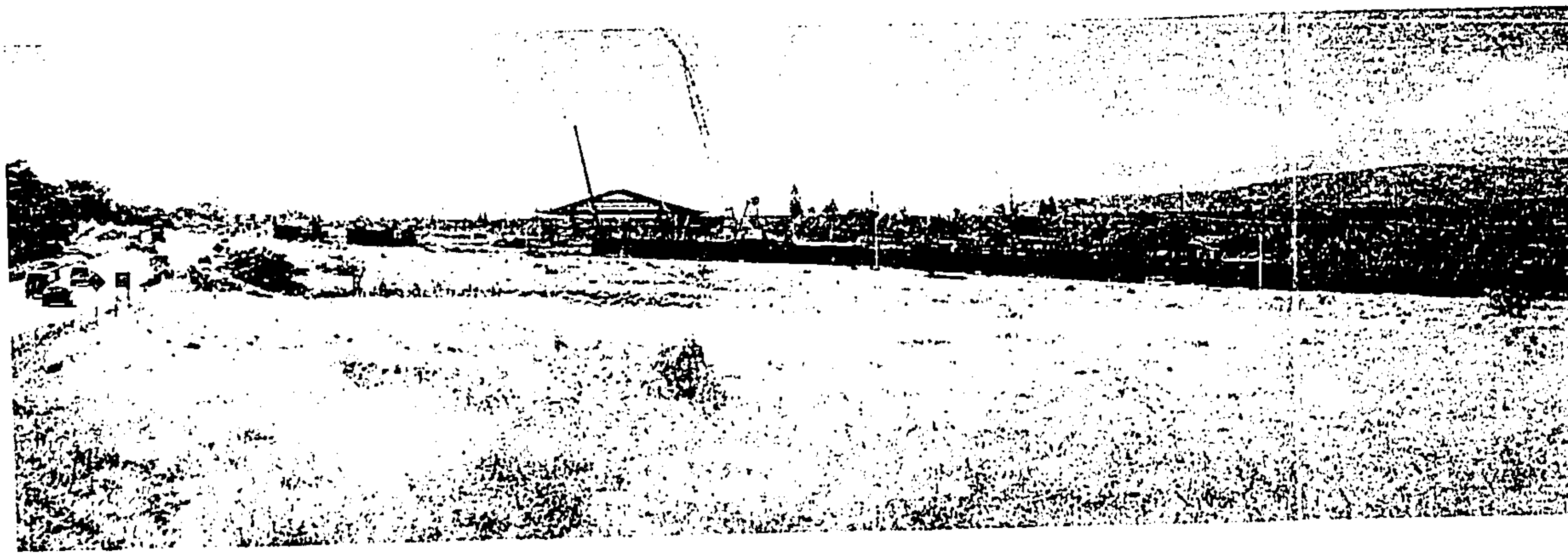
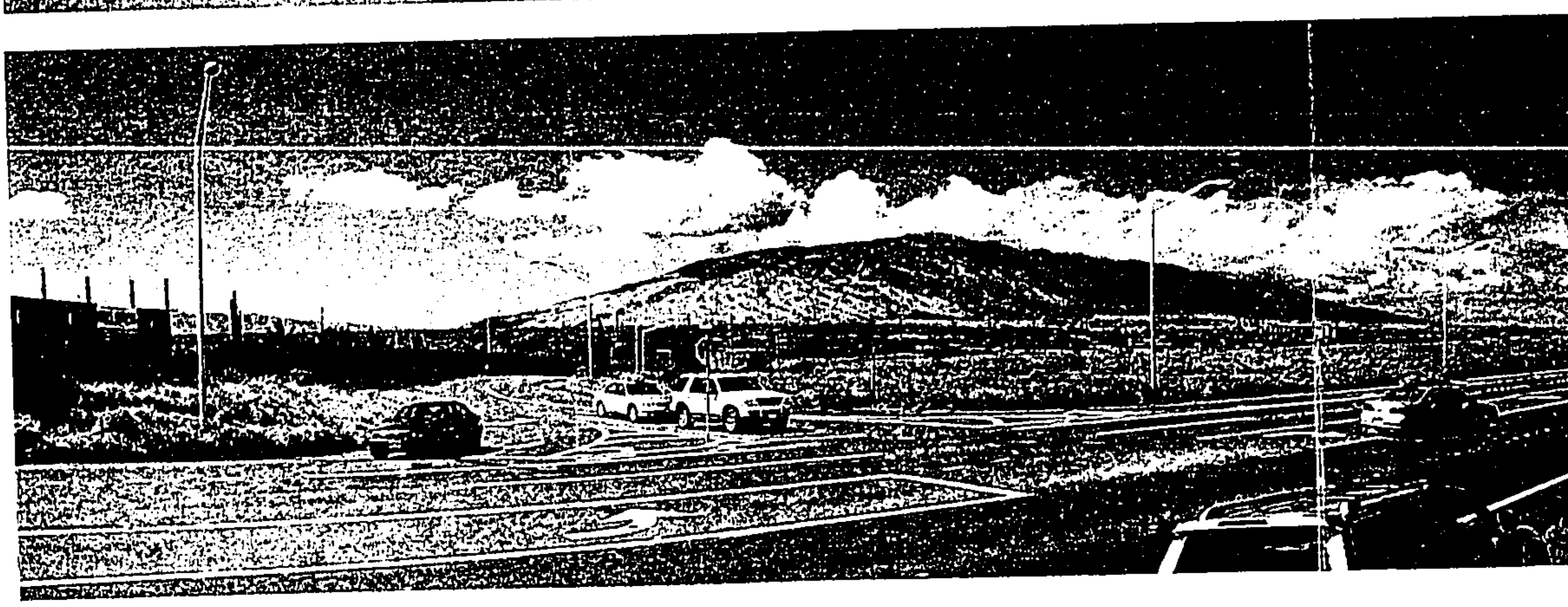


EXHIBIT "F" – PHOTOGRAPHIC ANALYSIS OF PROJECT SITE (2 of 3)





Looking South (towards Wailea; Hope Chapel and East Welakahao St. in Background)

Northwesterly View from Intersection of Piilani Hwy. and East Welakahao Street)

Looking South from East Welakahao Street (Kihei Elementary and Lokelani Intermediate Schools in Background; Keokea Bridge along Piilani Hwy. in Right Background)

<u>EXHIBIT F (3 of 3)</u>: Photographic Analysis of Existing Conditions

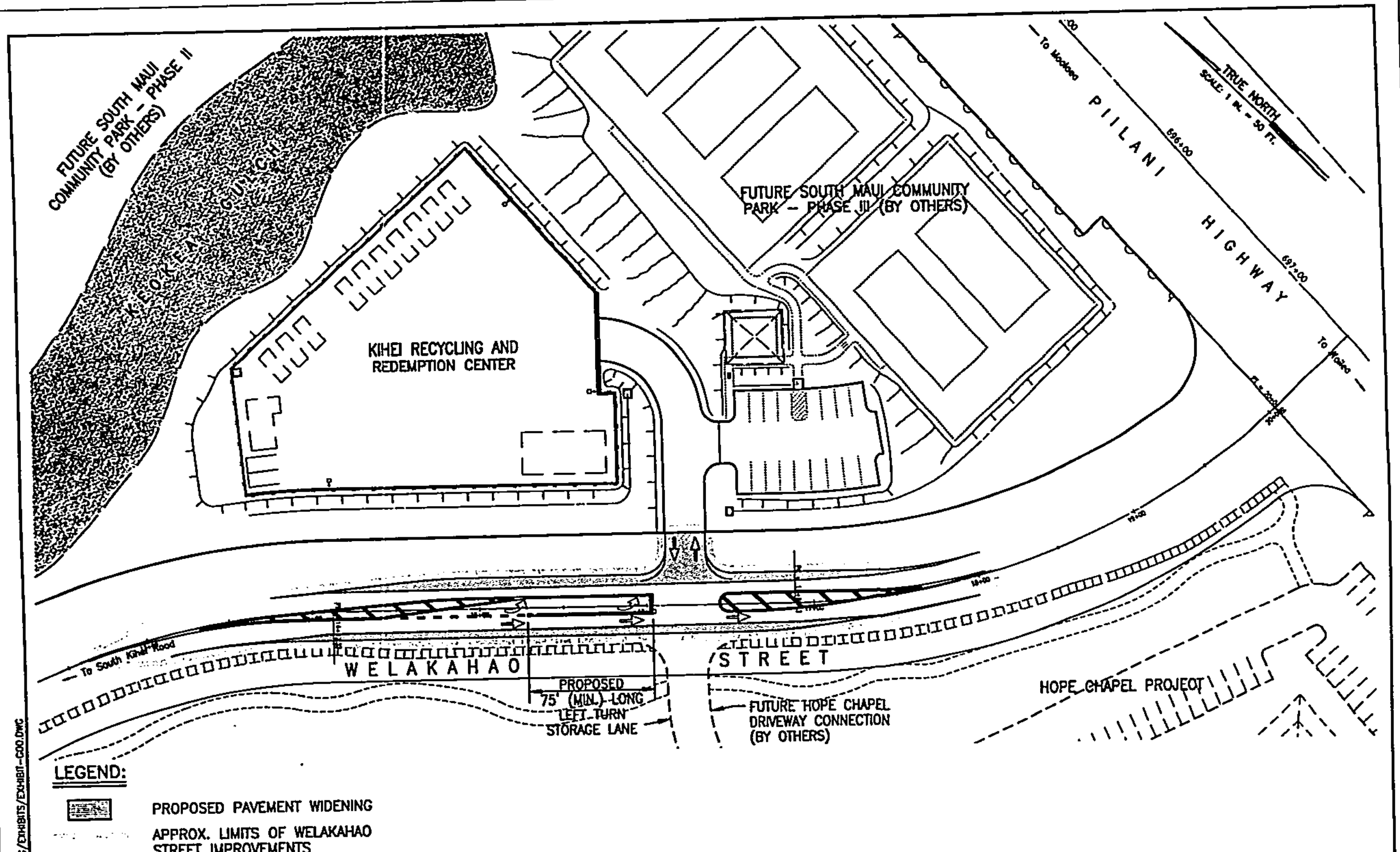


EXHIBIT "G" - PROPOSED WELAKAHAO STREET INTERSECTION IMPROVEMENTS

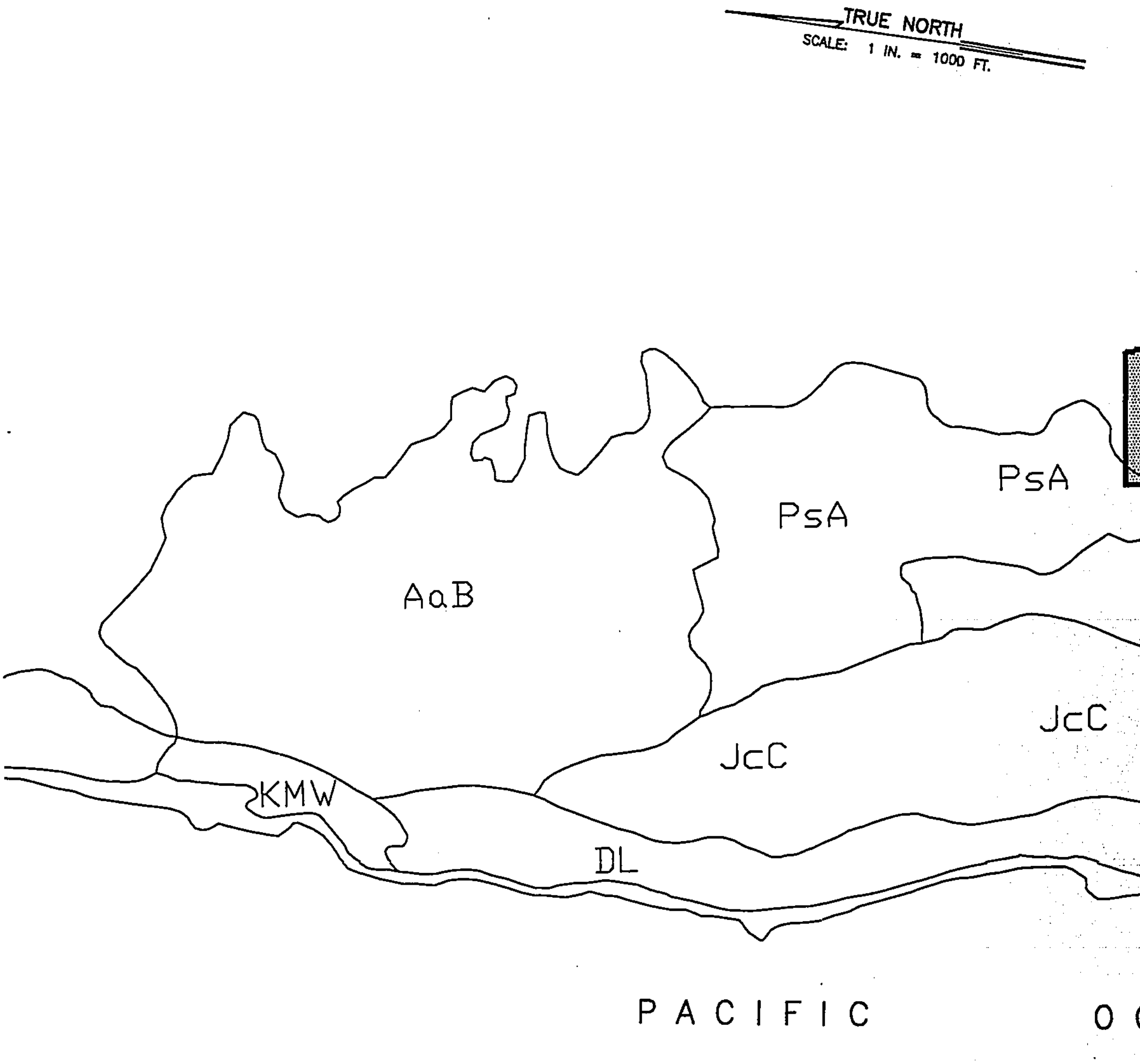
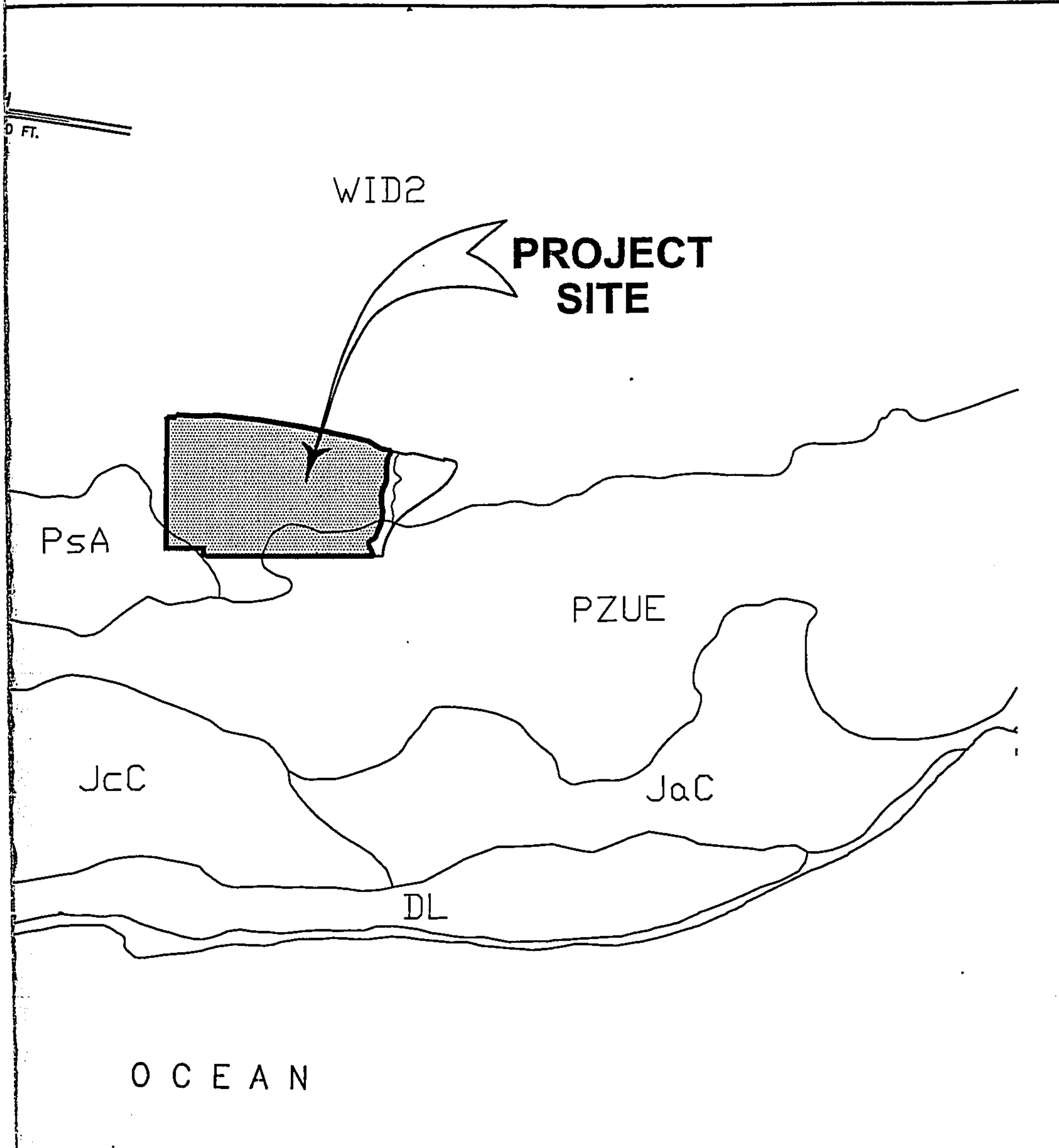


EXHIBIT "H" - SOILS S

0 1000 2000 300

SCALE: 1 IN. = 1000 F

03proj/03031/dwg2004/exhibits/prelim-eng/exb-soils00.dwg



DILS SURVEY MAP

2000 3000 4000

IN. = 1000 FT.

WARREN S. UNEMORI ENGINEERING, INC.

June 12, 2006

DOCUMENTS CAPTURED AS RECEIVED

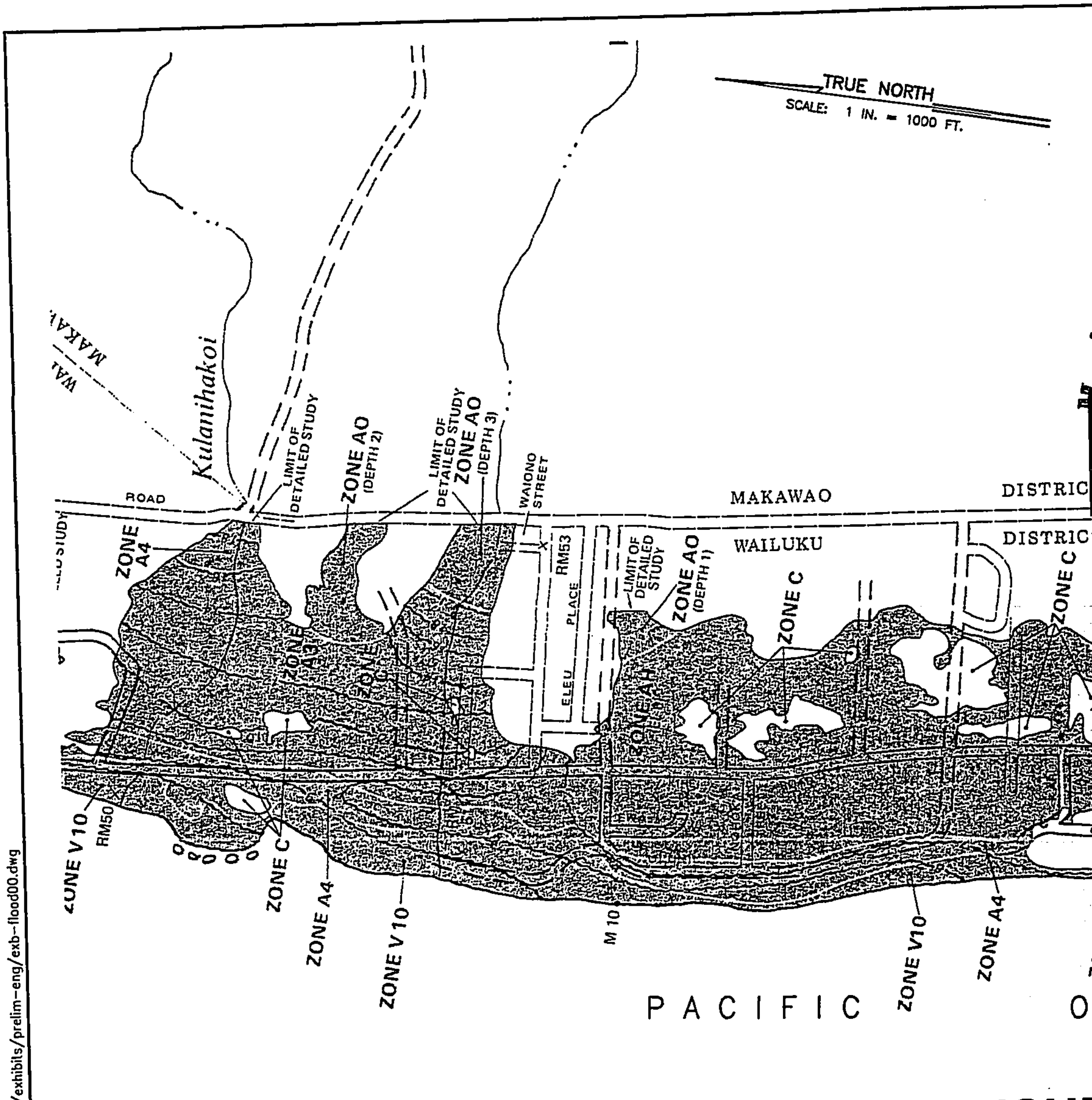
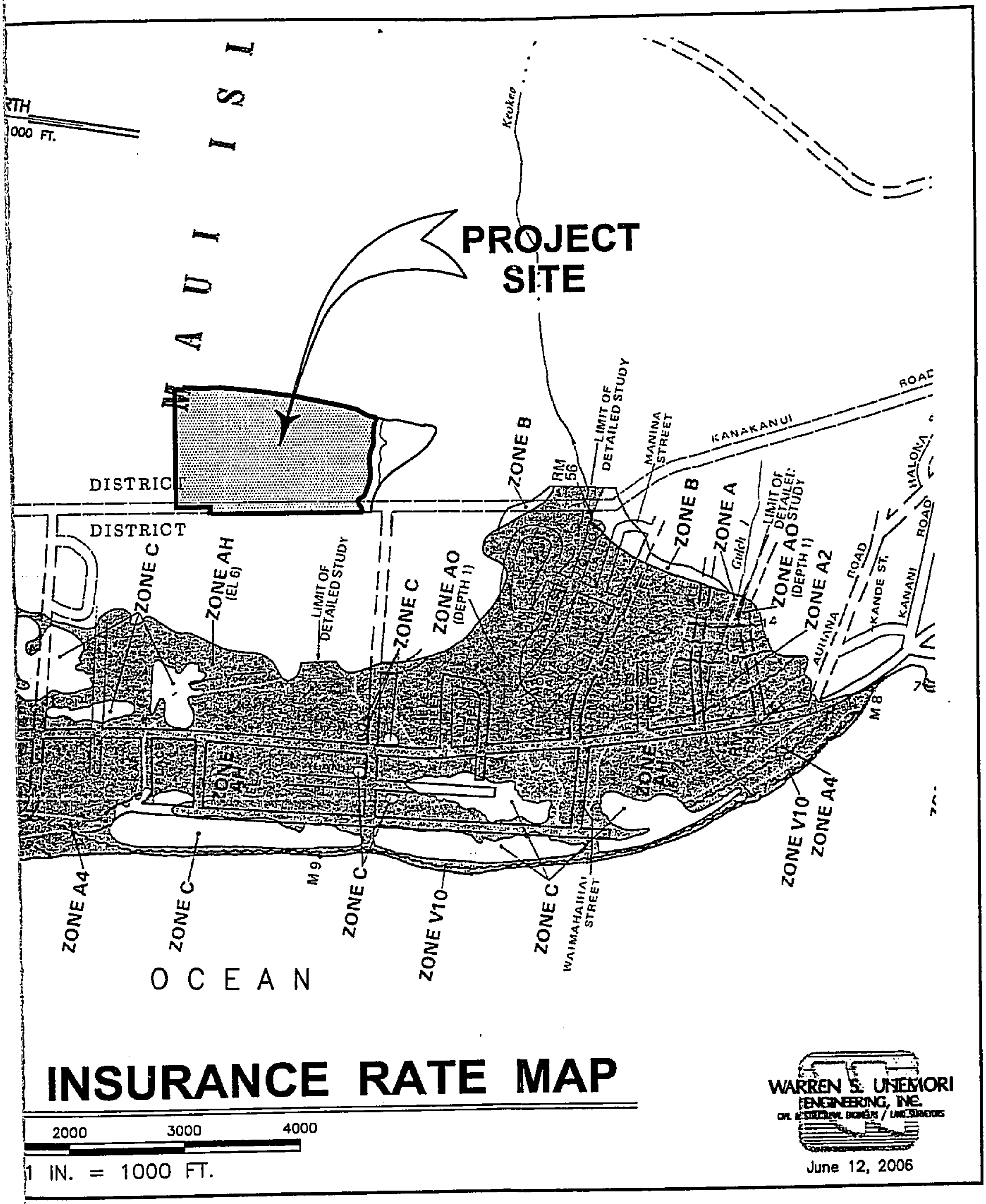
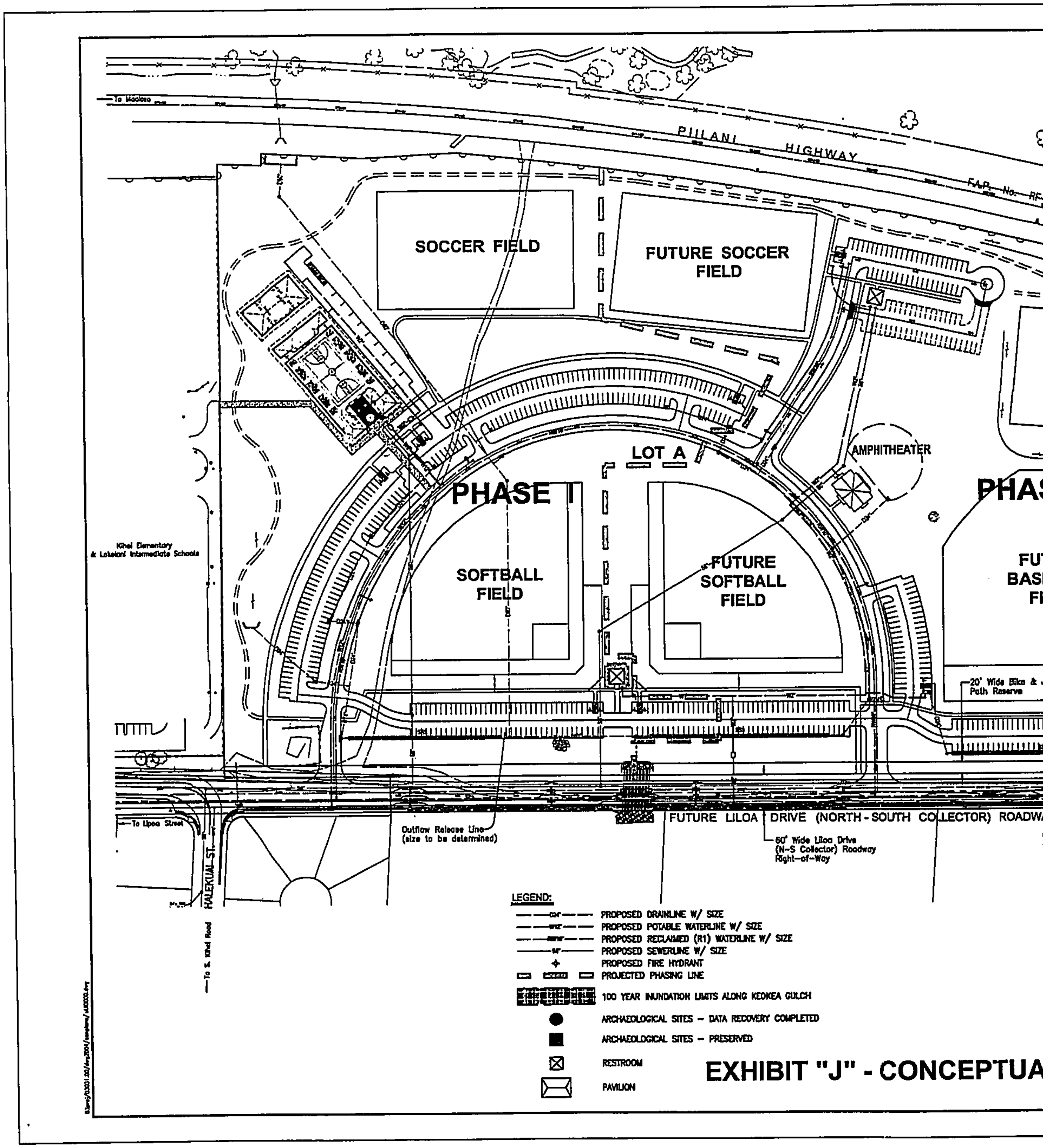


EXHIBIT "I" - FLOOD INSU

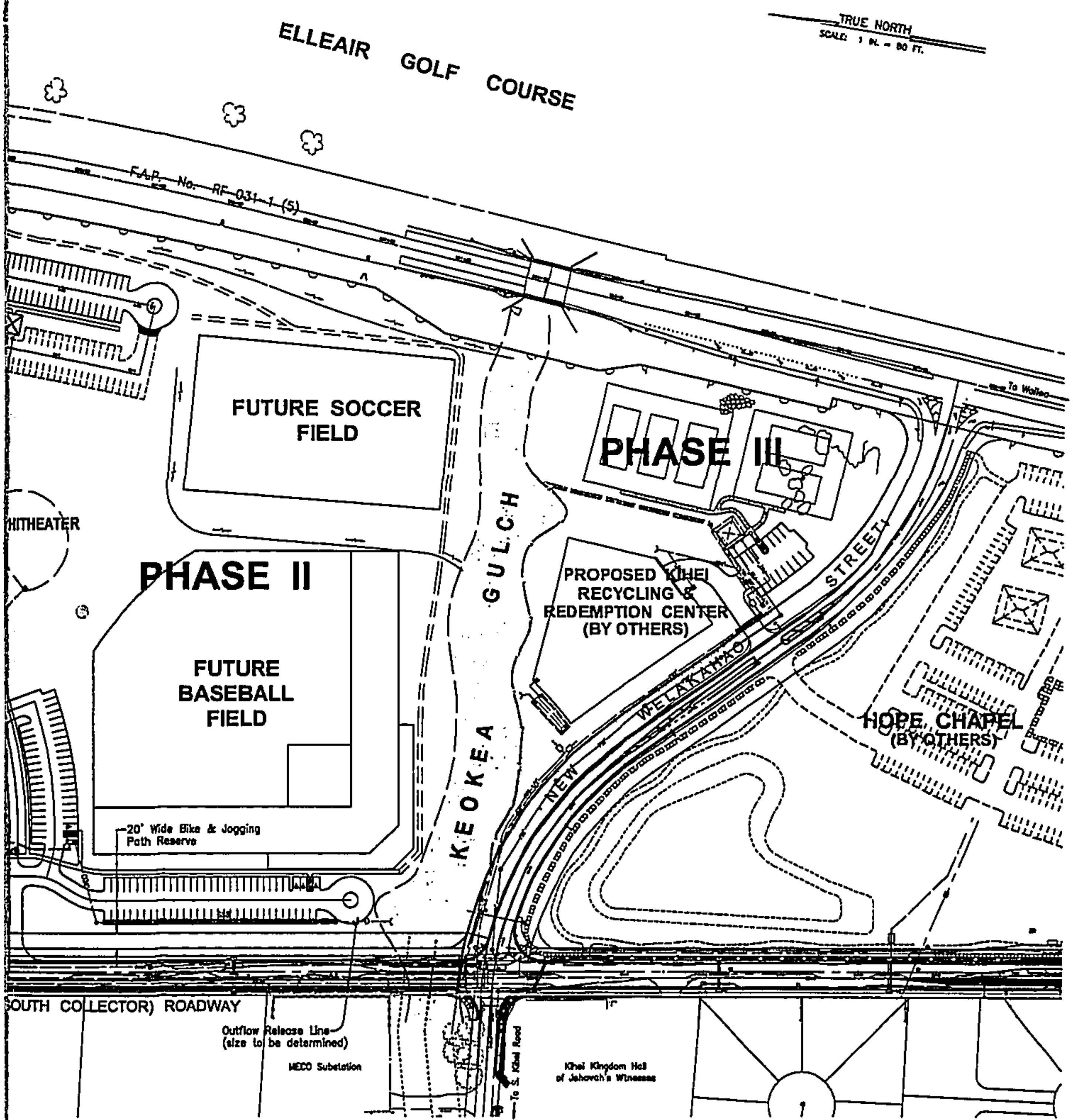
0 1000 2000

SCALE: 1 IN. = 1000


PROJECT SITE
MAUI ISL
DISTRICT
DISTRICT
ZONE C
ZONE AH (EL 6)
LIMIT OF DETAILED STUDY
ZONE C
ZONE AO (DEPTH 1)
ZONE B
RM 56
LIMIT OF DETAILED STUDY
MANINA STREET
KANAKANUI ROAD
ZONE B
ZONE A
LIMIT OF DETAILED STUDY
ZONE AO (DEPTH 1)
ZONE A2
ROAD
KANDE ST.
KANANI ROAD
HALONA
M8
ZONE V10
ZONE A4
ZONE A4
ZONE C
M9
ZONE C
ZONE V10
ZONE C
WAIMAHAIIAI STREET
OCEAN
INSURANCE RATE MAP
2000
3000
4000
1 IN. = 1000 FT.
WARREN S. UNEMORI ENGINEERING, INC.
June 12, 2006



To Maalaea
PIILANI HIGHWAY
SOCCER FIELD
FUTURE SOCCER FIELD
LOT A
AMPHITHEATER
PHASE I
SOFTBALL FIELD
FUTURE SOFTBALL FIELD
Kihei Elementary & Lokelani Intermediate Schools
20' Wide Bike & Path Reserve
To Lipoa Street
HALEKUAI ST.
To S. Kihei Road
Outflow Release Line (size to be determined)
FUTURE LILOA DRIVE (NORTH-SOUTH COLLECTOR) ROADWA
60' Wide Liloa Drive (N-S Collector) Roadway Right-of-Way
LEGEND:
PROPOSED DRAINLINE W/ SIZE
PROPOSED POTABLE WATERLINE W/ SIZE
PROPOSED RECLAIMED (R1) WATERLINE W/ SIZE
PROPOSED SEWERLINE W/ SIZE
PROPOSED FIRE HYDRANT
PROJECTED PHASING LINE
100 YEAR INUNDATION LIMITS ALONG KEOKEA GULCH
ARCHAEOLOGICAL SITES – DATA RECOVERY COMPLETED
ARCHAEOLOGICAL SITES – PRESERVED
RESTROOM
PAVILION
EXHIBIT "J" - CONCEPTUA



CONCEPTUAL SITE UTILITY PLAN

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

CLIFFORD N. MUKAI
LICENSED PROFESSIONAL ENGINEER
NO. 8667-C
HAWAII, U.S.A.

SOUTH MAUI COMMUNITY PARK
PROJECT NO.: P03/004 TAX MAP KEY: (2) 2-2-02:42
Waiohuli - Keokea (Kihei), Makawao, Maui, Hawaii

TITLE CONCEPTUAL UTILITY PLAN

C.N.M. DESIGNED BY	C.N.M. CHECKED BY	03031.00 JOB NUMBER	3 SHEET
D.P.T. DRAWN BY	W.S.U. APPROVED BY	April 19, 2006 DATE	
SCALE	AS NOTED		OF SHEETS

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION AS DEFINED IN SECTION 16-115-2 OF THE HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, LAND SURVEYORS AND LANDSCAPE ARCHITECTS

LETTER	DESCRIPTION	DATE

APPENDIX A: SUMMARY OF DRAINAGE ANALYSIS

Table 1

South Maui Community Park Summary of On-site and Off-site PondPack

Analysis Method	*Model #*	*Model Scope*	*Development Status*	*Qpeak (cfs)*	*Volume (ac-ft)*	*Required Storage (ac-ft)*
SCS Unit Hydrograph	1A	15RB, 15RC, 15RA, D11	D11 Pre-Development	255.29	103.916	
	1B	15RB, 15RC, 15RA, D11	D11 Post-Development	254.79	103.050	
	2A	16RB, 16RA, 17R, 18RC (Keokea Gulch), 18RA, D12	D12 Pre-Development	5128.91	1825.782	
	2B	16RB, 16RA, 17R, 18RC (Keokea Gulch), 18RA, D12	D12 Post-Development	5128.72	1825.500	
Universal Rational	3A	D11	D11 Pre-Development	38.22	2.365	
	3B	D11	D11 Post-Development	59.23	3.823	
	3C	D11	D11 Post-Development Storage Estimate Model	38.22		0.549*
	4A	D12	D12 Pre-Development	9.26	0.629	
	4B	D12	D12 Post-Development	13.27	0.850	
	4C	D12	D12 Post-Development Storage Estimate Model	9.26		0.097*

*Required Storage estimate calculated in PondPack based on Linear Estimate between inflow hydrograph and estimated outflow (target) line

APPENDIX A: SUMMARY OF DRAINAGE A

e 1

ınd Off-site PondPack Analysis for 50-Year Storm

e (ac-ft)	Required Storage (ac-ft)	Onsite CN	Onsite C	Comments	Length of 72" Subsurface System Required
.916		81	(N/A)		(N/A)
.050		77.95	(N/A)	Net Decrease in Onsite Qpeak and Volume	(N/A)
5.782		81	(N/A)		(N/A)
5.500		76.98	(N/A)	Net Decrease in Onsite Qpeak and Volume	(N/A)
365		(N/A)	0.300		(N/A)
823		(N/A)	0.477	Net Increase in Onsite Qpeak and Volume	(N/A)
	0.549*	(N/A)	0.477	Delta Qpeak = 0	680
529		(N/A)	0.300		(N/A)
350		(N/A)	0.423	Net Increase in Onsite Qpeak and Volume	(N/A)
	0.097*	(N/A)	0.423	Delta Qpeak = 0	125

d outflow (target) line

)F DRAINAGE ANALYSIS

APPENDIX B: Keokea Gulch 100-Year Inundation Limits Analysis

APPENDIX B: KEOKEA GULCH 100-YEAR INUNDATION LIMITS ANALYSIS

HEC-RAS Plan: Plan 01 River: KeokeaGulch Reach: PiilaniHighway Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
PiilaniHighway	900	PF 1	8008.00	63.00	72.389	76.44	85.98	0.056004	29.58	270.71	49.27	2.22
PiilaniHighway	850	PF 1	8008.00	60.20	68.505	73.07	82.72	0.072928	30.26	264.65	59.33	2.52
PiilaniHighway	800	PF 1	8008.00	58.60	67.695	71.36	78.79	0.050027	26.73	299.62	60.62	2.12
PiilaniHighway	750	PF 1	8008.00	56.90	66.729	70.06	76.10	0.037973	24.57	325.94	60.32	1.86
PiilaniHighway	700	PF 1	8008.00	55.20	65.035	68.17	74.19	0.035923	24.28	329.78	59.11	1.81
PiilaniHighway	650	PF 1	8008.00	52.70	58.445	61.26	71.03	0.101176	31.26	295.96	110.10	2.88
PiilaniHighway	600	PF 1	8008.00	48.80	56.499	59.51	66.62	0.055578	25.53	313.62	74.84	2.20
PiilaniHighway	550	PF 1	8008.00	47.40	56.653	59.37	63.95	0.025766	21.93	385.77	89.12	1.57
PiilaniHighway	500	PF 1	8008.00	45.80	55.013	57.43	62.55	0.029610	22.75	389.50	100.25	1.68
PiilaniHighway	450	PF 1	8008.00	44.60	54.359	56.59	61.05	0.021167	22.30	421.81	94.05	1.46
PiilaniHighway	400	PF 1	8008.00	43.70	51.881	54.39	59.60	0.035530	22.30	359.16	75.21	1.80
PiilaniHighway	350	PF 1	8008.00	43.00	51.831	53.61	57.55	0.024258	19.19	417.27	82.24	1.50
PiilaniHighway	300	PF 1	8008.00	41.00	52.386	52.79	56.22	0.011160	15.73	513.32	82.93	1.06
PiilaniHighway	250	PF 1	8008.00	40.80	47.920	50.20	54.98	0.034334	21.33	375.46	82.22	1.76
PiilaniHighway	200	PF 1	8008.00	37.90	45.165	47.66	53.08	0.038626	22.57	354.74	77.82	1.86
PiilaniHighway	150	PF 1	8008.00	36.40	49.404	47.16	51.36	0.004451	11.22	714.18	88.75	0.69
PiilaniHighway	131.7	PF 1	8008.00	36.00	48.995		51.25	0.005166	12.07	673.44	92.72	0.74
PiilaniHighway	100	PF 1	8008.00	35.10	48.940		51.04	0.004821	11.82	726.94	126.44	0.72
PiilaniHighway	50	PF 1	8008.00	34.60	49.070	49.07	50.68	0.003764	11.12	984.87	300.00	0.64
PiilaniHighway	0	PF 1	8008.00	33.10	42.461	45.42	49.71	0.028020	21.61	370.54	66.76	1.62
PiilaniHighway	-50	PF 1	8008.00	30.60	39.179	41.96	47.85	0.043606	23.63	338.89	74.26	1.95

Warren S. Unemori Engineering, Inc.
2145 Wells Street, Suite 403
Wailuku, Maui, Hawaii 96793
(808)242-4403 FAX: (808)244-4856

LETTER OF TRANSMITTAL

TO: SEY Engineers
1126 12th Avenue, #309
Honolulu, HI 96816

DATE: April 21, 2006
PROJECT: County of Maui - South Maui Park at Piilani
JOB NO.: 03031.00
RE: Revised Draft Drainage Report for South Maui Community Park.

ATTENTION: Mr. Scott A. Kunioka, P.E.

WE ARE SENDING YOU: [x] Attached [ ] Under Separate Cover

APR 24 2006

[ ] Shop Drawings [ ] Prints [x] Plans [ ] Samples [ ] Specifications

[ ] Copy of Letter [ ] Change Order [x] Reports [ ] Electronic Media

1 copy	Draft Drainage Report for South Maui Community Park (revised, dated April 19, 2006)
1 print each	Revised Grading and Site Utility Plans (dated April 19, 2006)

THESE ARE TRANSMITTED: For your use.

REMARKS: Pursuant to our telephone discussion on Wednesday, April 19, 2006, we are providing you with a revised draft Drainage Report that includes Appendix D, "Comparison of Peak 100-Year Flows for Keokea Gulch". As discussed therein, some of the higher values found in various other reports are due to simply algebraically adding the peak flows. A summary of onsite and offsite runoff is provided in Exhibit "F". The flow that has been adopted for South Maui Community Park project's 100-Year Inundation Limits considers the results of: (1) more detailed aerial photo topographic surveys; and, (2) correctly accounting for the fact that the peak flows do not all occur at the same instant. The Keokea Gulch HEC-RAS input data files has been emailed directly to your drainage subconsultant, Russell Arakaki at Park Engineering.

As previously discussed, we are assuming that the crossing ultimately utilized at Keokea Gulch will not change the widen the inundation limits at its inlet due to headwater effects, since the proposed South Maui Community Park improvements come right up to the inundation limits. Please do not hesitate to contact us if you have any further questions or comments.

COPY TO: Joe Krueger (w/ encl.)
Russell Arakaki (w/ encl.) - Park Engineering
Pat Matsui (w/ encl.)
David Sereda; Mike Summers (w/ encl.)
Calvin Higuchi (w/ 1 set plans only)
Phillip Rowell (w/ 1 set plans only)
Hilton Unemori (w/ 1 set plans only)
Alan Unemori (w/ reduced 11"x17" site & grading plan only)

By: [signature]
Clifford N. Mukai

V:\Projdata\03proj\03031 - South Maui Park Ph. I\Corrspdn\Trn\cnm - SEY 002.wpd (wp10/hplj5000)

If enclosures are not as noted, kindly notify us at once.

Established 1969

Drainage Report for

South Maui Community Park

Kihei, Maui, Hawaii
TMK: (2) 2-2-02 : Por. of 42

Prepared For: Department of Parks and Recreation
Department of Public Works and
Environmental Management
County of Maui
Wailuku, Maui, Hawaii

ALAN L. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 9354-C
HAWAII, U.S.A.

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

V:\projdata\03031.00\reports\drainage\cover000.cdr

Date: January 4, 2006
Revised: April 20, 2006

TABLE OF CONTENTS

TABLES

FIGURES

EXHIBITS

APPENDICES:

I. INTRODUCTION

The purpose of this report is to evaluate the existing drainage conditions and develop a grading and drainage plan for the proposed project.

II. PROPOSED PROJECT

A. Site Location:

The project site is located in Kihei, on the island of Maui, in the State of Hawaii, at the southernmost end of Tax Map Key parcel (2) 2-2-02:Por. 42 (see Figure 1: Location Map). This rectangular-shaped parcel is abutted by:

- Piilani Highway on its east (mauka) side;
- Kihei Elementary School and Lokelani Intermediate School on its north side;
- The future N-S Collector roadway reserve on its west (makai) side; and,
- Keokea Gulch natural drainageway on its south side..

The overall parcel, to the north of Keokea Gulch (up to Kihei Elementary and Lokelani Intermediate Schools at the north end), is expected to be developed by the County of Maui in the future as Phases I and II of the South Maui Community Park.

B. Project Description:

The South Maui Community Park project proposes to construct the following buildings and site improvements in Phase I (see Figure 1 for approximate demarcation between Phases I and II):

(1) 23,478 sq. ft. gymnasium

(2) 7,210 sq. ft. annex

(3) 12.990 acres of grassed areas, including a Soccer Field and a Softball Field

(4) 2.762 acres of roadway and parking lots

(5) 650 sq. ft. restroom

(6) 27,860 sq. ft. of concrete sidewalk

(7) Utility improvements consisting of grated drain inlets, an underground drainage system, an subsurface drainage system, and a recycled water landscape irrigation system

(8) Fire hydrants supplied by the existing 12" reclaimed water system from the Kihei Sewage Treatment Plan mauka (east) of Piilani Highway

The Phase II will include the following site improvements

(1) 2,420 sq. ft. Pavillion and grassed amphitheater

(2) 650 sq. ft. restroom

(3) 17.988 acres of grassed area, including two (2) Soccer Fields, one Softball Field and one Baseball Field

(4) 2.129 acres of roadway and parking

(5) 0.354 acres of concrete sidewalk

(6) Utility improvements consisting of grated drain inlets, an underground drainage system, another subsurface drainage system, and a recycled water landscape irrigation system

III. EXISTING CONDITIONS

A. Topography and Site Conditions:

The project site is presently undeveloped and is not being used for any particular purpose (see EXHIBIT A: Aerial Photo of Project Site).

The existing ground slopes in a southeasterly to northwesterly direction from elevation $^{(+)}$90± feet M.S.L. to approximately $^{(+)}$30± feet M.S.L., with an average slope of approximately 6.5%.

The site is presently covered with buffelgrass (the density of which varies seasonally and with rainfall) and a scattering of kiawe trees. Upon completion of the proposed grading and improvements, all disturbed areas that are still exposed (and not paved or otherwise landscaped) will be grassed as required to minimize soil erosion.

According to the "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii (August 1972)" (see EXHIBIT B - Soil Survey Map), the predominant soil type at the project site is Puuone Sand (PZUE) and Waiakoa (WID2). Puuone Sand is characterized as excessively drained, light grayish-brown, non-plastic, calcareous sand, underlain by light grayish-brown, non-plastic, cemented sands. Permeability is rapid above the cemented layer, runoff slow and the hazard of wind erosion is moderate to severe.

This soil series are commonly geographically associated with Iao and Jaucas soils

The Waiakoa (WID2) extremely stony silty clay loam, 3 to 25 percent slopes, eroded, is similar to Waiakoa very stony silty clay loam, 3 to 7 percent slopes, except that it is eroded and stones cover 3 to 15 percent of the surface. In most areas about 50 percent of the surface layer has been removed by erosion. Runoff is medium, and the erosion hazard is severe. This soil is used for pasture and wildlife habitat.

B. Drainage:

Two Drainage areas were originally delineated based on detailed aerial photos by R. M. Towill Corporation (under subcontract to WSUE) in February and March, 1995 for the purpose of developing the Piilani Village Master Plan.

Exhibit D shows the sub-basins which are *directly mauka of the project site*. There are two drainage ways which cross the project site - Drainageway D11 which crosses Piilani Highway at the northern portion of the project site through a 60" culvert, and Drainageway D12 which crosses Piilani Highway at the southern portion of the project beneath a highway bridge. Drainageway D12 is part of Keokea Gulch.

Drainageway D11 consists of offsite sub-basins 15RA (54.40 acres), 15RB (166.60 acres) and 15RC (2.40 acres) east (mauka) of Piilani Highway with a total contributing area of 223.40 acres. Pre-development flows entering the 60" culvert are predicted to be 255.29 cfs for the 50-year, 24-hour storm and 367.78 cfs for the 100-year, 24-hour storm (calculations are described in Section IV below). The onsite portion of Drainageway D11 contributes another 29.12 acres of sub-basin area.

Drainageway D12 consists of offsite sub-basins 16RA (65.50 acres), 16RB (57.70 acres), 17R (137.70 acres), 18RA (51.90 acres) and 18RC (Keokea Gulch 5,336.0 acres) east (mauka) of Piilani Highway with a total contributing area of 5,648.8 acres. Pre-development flows entering beneath the Keokea Bridge are predicted to be 5,128.91 cfs for the 50-year, 24-hour storm and 7,849.94 cfs for the 100-year, 24-hour storm (calculations are described in Section IV below). The onsite portion of Drainageway D12 contributes another 7.12 acres of sub-basin area.

C. Flood and Tsunami Zone:

According to the Flood Insurance Rate Map, effective September 6, 1989, prepared by the United States Federal Emergency Managements Agency, Federal Insurance Administration, the project site is situated in an area designated as Zone C, which is prone to minimal flooding (see EXHIBIT C: Flood Insurance Rate Map).

Furthermore, the project site is not within a tsunami zone.

IV. DRAINAGE PLAN

A. General:

A total of 72.5 c.f.s. (50 year - 1 hour runoff) of onsite surface runoff for subareas D11 (59.23 cfs) and D12 (13.27 cfs) will be generated by the developed project site. Accordingly, a net increase of 25.02 c.f.s. (21.01 cfs for D11 plus 4.01 cfs for D12) would have been expected as a result of the proposed improvements in the absence of any onsite subsurface detention (see APPENDIX C: Subsurface Drainage Detention System Calculations). However, an onsite subsurface detention system consisting of a 72" perforated pipe surrounded by crushed rock with a total length of 805 l.f. (680 l.f. for D11 plus 125 l.f. for D12 - capacity based on 50 year - 1 hour runoff) is being proposed to limit the peak onsite runoff being discharged to pre-development levels. Accordingly, there will be no net increase in onsite peak surface runoff, based on a 50-year recurrence interval

The majority of the onsite surface runoff from the paved surfaces will be intercepted by a grated drain inlet and be conveyed directly underground to the proposed subsurface detention system. The offsite flow for Drainageway D11, which enters the project site at the 60" culvert beneath Piilani Highway will be channeled separately through a separate drainage culvert running east-to-west through the project site to drainage point 9, where it is currently exiting in the undeveloped state.

The offsite flow for Drainageway D12, which enters the project site at the bridge spanning Keokea Gulch at Piilani Highway, will continue to flow within the limits of the Keokea Gulch natural drainageway.

All improvements are proposed outside of the 100-year inundation limits of the existing Keokea Gulch natural drainageway which is shown on Exhibit E, the Grading Plan.

B. Hydrology Calculations:

Hydrology calculations were undertaken pursuant to:

- "Rules for the Design of Storm Drainage Facilities for the County of Maui", Title MC-15, Chapter 4;
- "Rainfall Frequency Atlas of the Hawaiian Islands", Technical Paper No. 43, U.S. Department of Commerce, Weather Bureau; and,
- U.S. Department of Agriculture, Natural Resources Conservation Service [NRCS (formerly Soil Conservation Service or SCS)] procedure as described in the SCS

National Engineering Handbook, Section 4, Hydrology (NEH-4).

The Rational Method, pursuant to the "Rules for the Design of Storm Drainage Facilities for the County of Maui" was used in calculating the onsite runoff.

Rational Formula used: Q = CiA

Where: Q = Rate of Flow (cfs)
C = Runoff Coefficient
i = Rainfall Intensity (inches/hour)
A = Area (Acres)

Rational Method calculations are based on a 50-year recurrence interval, 1-hour duration storm.

The NRCS (formerly SCS) Unit Hydrograph method was used in calculating the anticipated runoff along the existing offsite subareas. NRCS method calculations are based on a 50-year recurrence interval, 24-hour storm as well as a 100-Year recurrence interval. The inundation limits within Keokea Gulch as shown in Exhibit E are based on a 100-year recurrence interval, 24-hour storm.

Both Offsite and Onsite drainage calculations were performed for each of the two Drainage areas originally delineated based on detailed aerial photos by R. M. Towill Corporation (under subcontract to WSUE) in February and March, 1995.

Table 1 presents a summary of the relevant hydrologic analysis performed as part of this Drainage Report study. Basically, a total of ten (10) PondPack models were created, as shown in Table 1. They can be briefly described as follows:

B.1 <u>Combined Offsite and Onsite Models</u>

Models 1A and 1B correspond to the combined offsite and onsite subareas in Drainageway D11 for Pre-development and Post-development conditions, respectively. These models include the offsite subareas "15RB", "15RC" and "15RA" as well as the onsite subarea "D11". Areas, Curve Numbers and Times of Concentration, Tc, for each of the offsite subareas were obtained from archived files provided by R. M. Towill Corporation (under subcontract to WSUE), who did the initial study for Piilani Village in February, 1995. These parameters are provided in Appendix A along with weighted average calculations for the SCS Curve Numbers for the "D11" onsite subarea in the Post-developed condition.

Figures 2A and 2B provide schematic diagrams of the PondPack input and results within the offsite and onsite drainageway for Models 1A and 1B, respectively, for the 50-year 24-hour storm. Figures 2C and 2D provide schematic diagrams of the PondPack input and results within the offsite and onsite drainageway for Models 1A and 1B, respectively, for the 100-year 24-hour storm.

The SCS Unit Hydrograph method was used together with both 50-year 24-hour and 100-year 24-hour rainfalls. Results summarized in Table 1 for the 50-year 24-hour rainfall indicate that by this method, there is a net decrease in the onsite peak flows and volumes due to the proposed site improvements. This occurs primarily since most of the barren arid undeveloped land will be transformed into large fields of flat irrigated grassed areas that comprise the soccer, baseball, and softball fields that should retain the onsite drainage runoff much more efficiently that the existing sloped parcel.

Results summarized in Table 2 for the 100-year 24-hour rainfall also predict a net decrease in the onsite peak flows and volumes due to the proposed site improvements.

Similarly, Models 2A and 2B correspond to the combined offsite and onsite subareas in Drainageway D12 for Pre-development and Post-development conditions, respectively. These models include the offsite subareas "16RB", "16RA", "17R", "18RC (Keokea Gulch)", "18RA" as well as the onsite subarea "D12". Areas, Curve Numbers and Times of Concentration, Tc, for each of the offsite subareas were obtained from archived files provided by R. M. Towill Corporation (under subcontract to WSUE), who did the initial study for Piilani Village in February, 1995. These parameters are provided in Appendix A along with weighted average calculations for the SCS Curves Numbers for the "D12" onsite subarea in the Post-developed condition.

Figures 3A and 3B provide schematic diagrams of the PondPack input and results within the offsite and onsite drainageway for Models 2A and 2B, respectively, for the 5-year 24-hour storm. Figures 3C and 3D provide schematic diagrams of the PondPack input and results within the offsite and onsite drainageway for Models 2A and 2B, respectively, for the 100-year 24-hour storm.

B.2 Onsite Models

Models 3A and 3B correspond to the onsite only Drainageway D11 for the Pre-development and Post-development conditions, respectively. For this analysis, the Universal Rational Method was used. A runoff coefficient for the Pre-development condition was assumed to be equal to C = 0.30, while the runoff coefficient for the Post-development condition was calculated using a weighted average basis, based on the impervious site improvements proposed for that site. These calculations are provided in detail in Appendix A.

As shown in Table 1, the Post-development onsite peak discharge of 59.23 cfs is 21.01 cfs higher than the Pre-development onsite peak discharge of 38.22 cfs. In order to estimate the storage volume required to keep the onsite peak discharge to less than or equal to the Pre-development levels, Model 3C was created.

Model 3C is a PondPack model in which the Pre-development peak discharge is specified as the target peak discharge after the site has been developed. PondPack then calculates the required storage to keep the Post-development peak discharges at levels not to exceed the target peak discharge. In this way, the Post-development peak discharge will not exceed the Pre-development peak discharge. By Table 1, it can be seen that for Model 3C, the required subsurface system storage volume was calculated to be 0.549 acre-feet. This requires a 72" subsurface drainage system that must be at least 680 feet long for the D11 onsite subarea. Calculations for the required length of the 72" subsurface drainage system are included in Appendix C.

Similarly, Models 4A and 4B correspond to the onsite only Drainageway D12 for the Pre-development and Post-development conditions, respectively. For this analysis, the Universal Rational Method was used. A runoff coefficient for the Pre-development condition was assumed to be equal to C = 0.30, while the runoff coefficient for the Post-development condition was calculated using a weighted average basis, based on the impervious site improvements proposed for that site. These calculations are provided n detail in Appendix A.

As shown in Table 1, the Post-development onsite peak discharge of 13.27 cfs is 4.01 cfs higher than the Pre-development onsite peak discharge of 9.26 cfs. In order to estimate the storage volume required to keep the onsite peak discharge to less than or equal to the Pre-development levels, Model 4C was created.

Model 4C is a PondPack model in which the Pre-development peak discharge is specified as the target peak discharge after the site has been developed. PondPack then calculates the required storage to keep the Post-development peak discharges at levels not to exceed the target peak discharge. In this way, the Post-development peak discharge will not exceed the Pre-development peak discharge. By Table 1, it can be seen that for Model 4C, the required subsurface system storage volume was calculated to be 0.097 acre-feet. This requires a 72" subsurface drainage system that must be at least 125 feet long for the D12 onsite subarea. Calculations for the required length of the 72" subsurface drainage system are included in Appendix C.

The hydrologic calculations for this project may be found in APPENDIX A - Hydrologic Calculations, APPENDIX B - PondPack Reports and Hydrographs, APPENDIX C - Subsurface Drainage Detention System Calculations and APPENDIX D - Comparison of Peak 100-year Flows for Keokea Gulch..

C. Conclusion:

All drainage improvements are expected to be implemented pursuant to County of Maui standards. Furthermore, a subsurface drainage detention system is being implemented such that there will be no net increase in onsite peak surface runoff, *based on a 50-year recurrence interval.*

Accordingly, it is our professional opinion that the proposed improvements are not expected to have an adverse effect on downstream properties.

V. REFERENCES

1. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* August 1972. United States Department of Agriculture, Soil Conservation Service.
2. *Flood Insurance Rate Map, Maui County, Hawaii.* Community-Panel Number 150003 0153C, September 17, 1997 and 150003 0161C, August 3, 1998. Federal Emergency Management Agency, Federal Insurance Administration.
3. *Drainage Master Plan for the County of Maui, State of Hawaii.* October 1971. R.M. Towill Corporation.
4. *Rainfall Frequency Atlas of the Hawaiian Islands, Technical Paper No. 43.* 1962. U.S. Department of Commerce, Weather Bureau.
5. *Rules for the Design of Storm Drainage Facilities in the County of Maui, Title MC-15, Chapter 4.* July 14, 1995. Department of Public Works, County of Maui.
6. *Modern Sewer Design.* 1980. American Iron and Steel Institute.

Prepared by:

Alan L. Unemori, P.E.

Reviewed by:

Clifford N. Mukai, P.E.

Table 1

South Maui Community Park Summary of On-site and Off-site Pondi

Analysis Method	*Model #*	*Model Scope*	*Development Status*	*Qpeak (cfs)*	*Volume (ac-ft)*	*Requir Storage (*
SCS Unit Hydrograph	1A	15RB, 15RC, 15RA, D11	D11 Pre-Development	255.29	103.916	
	1B	15RB, 15RC, 15RA, D11	D11 Post-Development	254.79	103.050	
	2A	16RB, 16RA, 17R, 18RC (Keokea Gulch), 18RA, D12	D12 Pre-Development	5128.91	1825.782	
	2B	16RB, 16RA, 17R, 18RC (Keokea Gulch), 18RA, D12	D12 Post-Development	5128.72	1825.500	
Universal Rational	3A	D11	D11 Pre-Development	38.22	2.365	
	3B	D11	D11 Post-Development	59.23	3.823	
	3C	D11	D11 Post-Development Storage Estimate Model	38.22		0.549
	4A	D12	D12 Pre-Development	9.26	0.629	
	4B	D12	D12 Post-Development	13.27	0.850	
	4C	D12	D12 Post-Development Storage Estimate Model	9.26		0.097

*Required Storage estimate calculated in PondPack based on Linear Estimate between inflow hydrograph and estimated outflow (target) line le 1

and Off-site PondPack Analysis for 50-Year Storm

ne (ac-ft)	Required Storage (ac-ft)	Onsite CN	Onsite C	Comments	Length of 72" Subsurface System Required
)3.916		81	(N/A)		(N/A)
)3.050		77.95	(N/A)	Net Decrease in Onsite Qpeak and Volume	(N/A)
25.782		81	(N/A)		(N/A)
25.500		76.98	(N/A)	Net Decrease in Onsite Qpeak and Volume	(N/A)
.365		(N/A)	0.300		(N/A)
823		(N/A)	0.477	Net Increase in Onsite Qpeak and Volume	(N/A)
	0.549*	(N/A)	0.477	Delta Qpeak = 0	680
629		(N/A)	0.300		(N/A)
850		(N/A)	0.423	Net Increase in Onsite Qpeak and Volume	(N/A)
	0.097*	(N/A)	0.423	Delta Qpeak = 0	125

ed outflow (target) line

Table 2

South Maui Community Park Summary of On-site and Off-site Pond

Analysis Method	*Model #*	*Model Scope*	*Development Status*	*Qpeak (cfs)*	*Volume (ac-ft)*	*Requi Storage*
SCS Unit Hydrograph	1A	15RB, 15RC, 15RA, D11	D11 Pre-Development	367.78	145.446	
	1B	15RB, 15RC, 15RA, D11	D11 Post-Development	367.32	144.498	
	2A	16RB, 16RA, 17R, 18RC (Keokea Gulch), 18RA, D12	D12 Pre-Development	7849.94	2677.283	
	2B	16RB, 16RA, 17R, 18RC (Keokea Gulch), 18RA, D12	D12 Post-Development	7849.76	2676.973	
Universal Rational	3A	D11	D11 Pre-Development	66.98	4.145	
	3B	D11	D11 Post-Development	102.38	6.607	
	4A	D12	D12 Pre-Development	15.12	1.028	
	4B	D12	D12 Post-Development	22.54	1.435	

le 2

nd Off-site PondPack Analysis for 100-Year Storm

ne (ac-ft)	Required Storage (ac-ft)	Onsite CN	Onsite C	Comments
5.446		81	(N/A)	
4.498		77.95	(N/A)	Net Decrease in Onsite Qpeak and Volume
7.283		81	(N/A)	
6.973		76.98	(N/A)	Net Decrease in Onsite Qpeak and Volume
145		(N/A)	0.300	
607		(N/A)	0.477	Net Increase in Onsite Qpeak and Volume
028		(N/A)	0.300	
435		(N/A)	0.423	Net Increase in Onsite Qpeak and Volume

DOCUMENTS CAPTURED AS RECEIVED

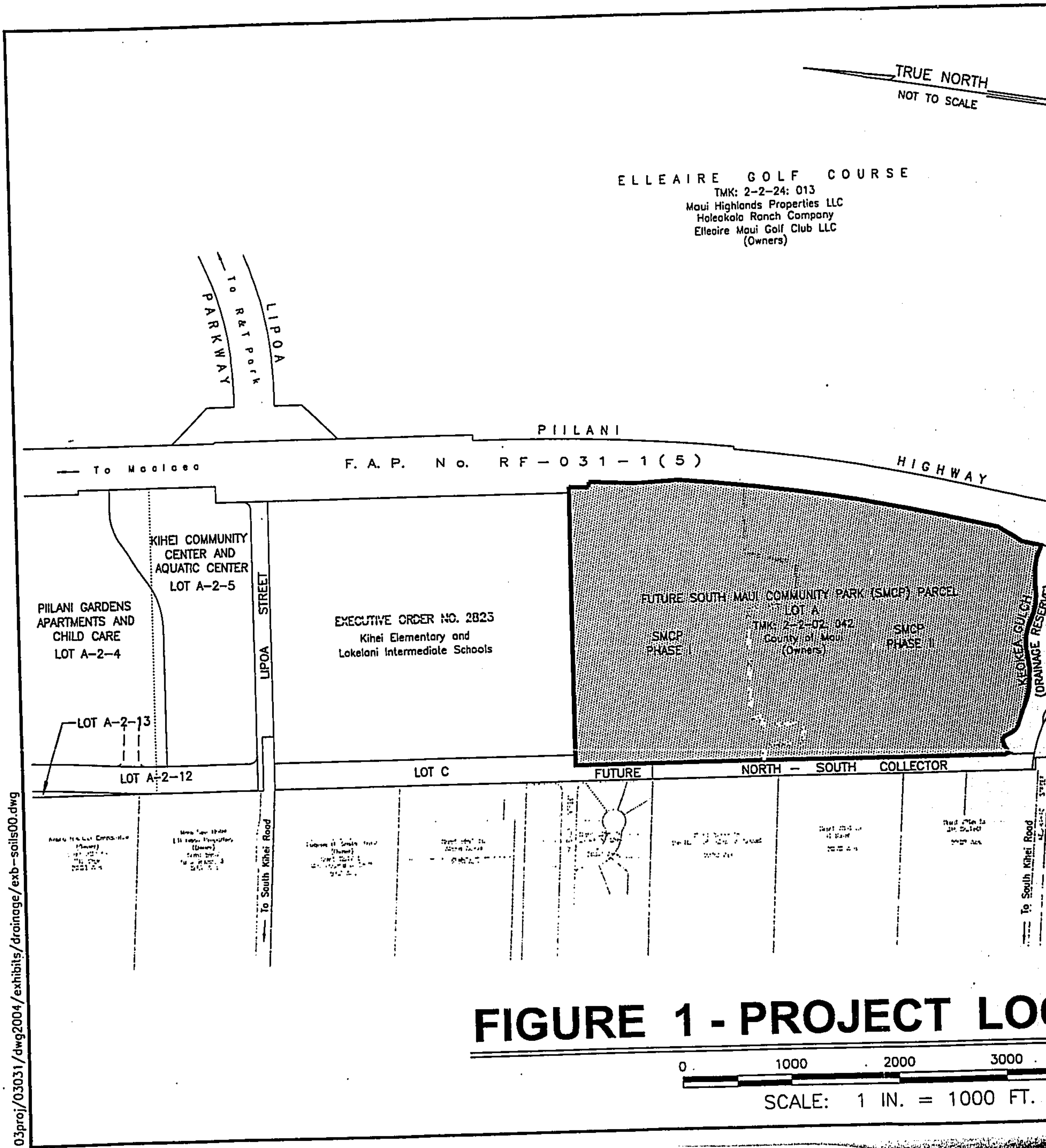
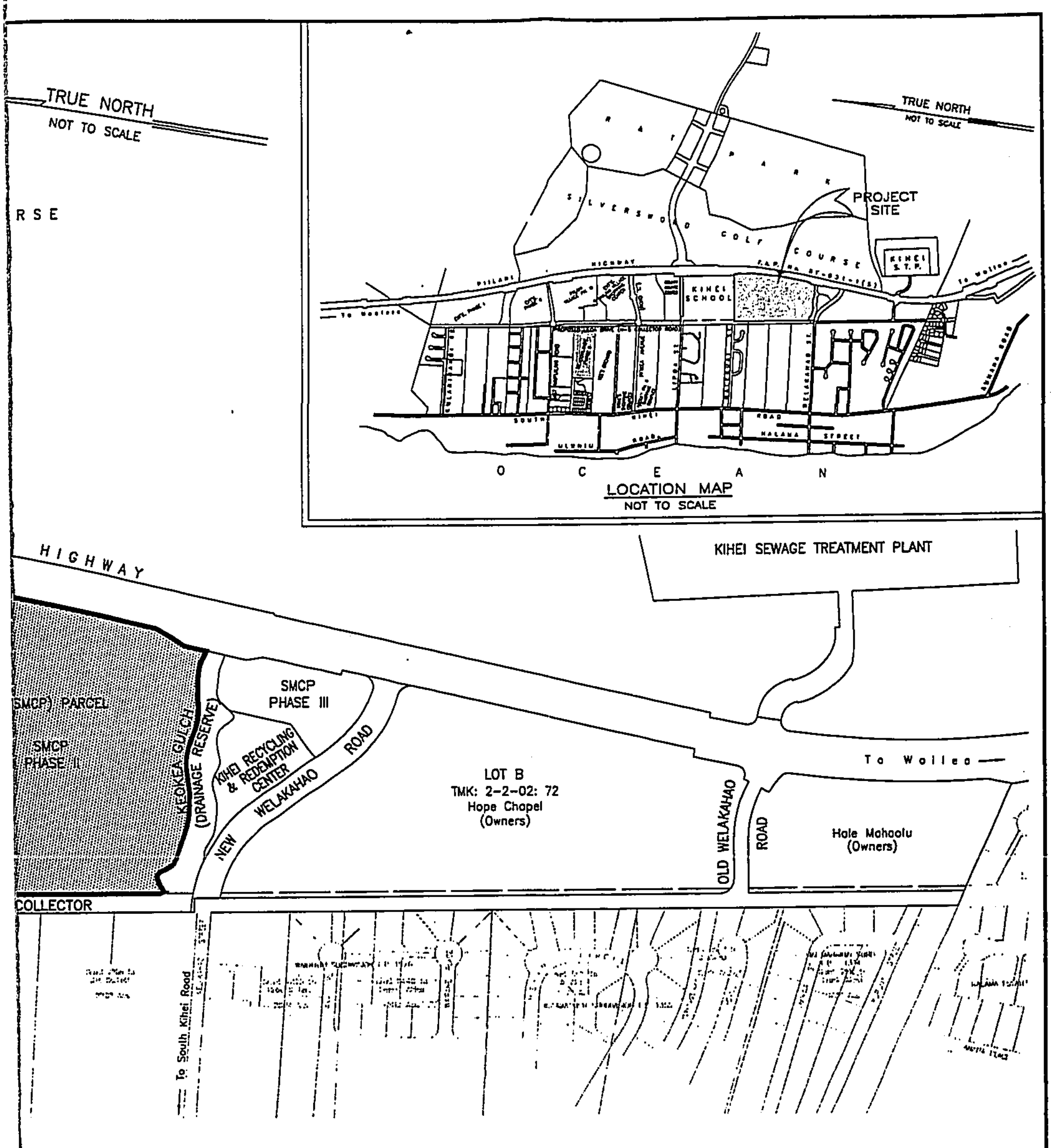


FIGURE 1 - PROJECT LOC



CT LOCATION MAP

000 3000 4000

. = 1000 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

January 4, 2006

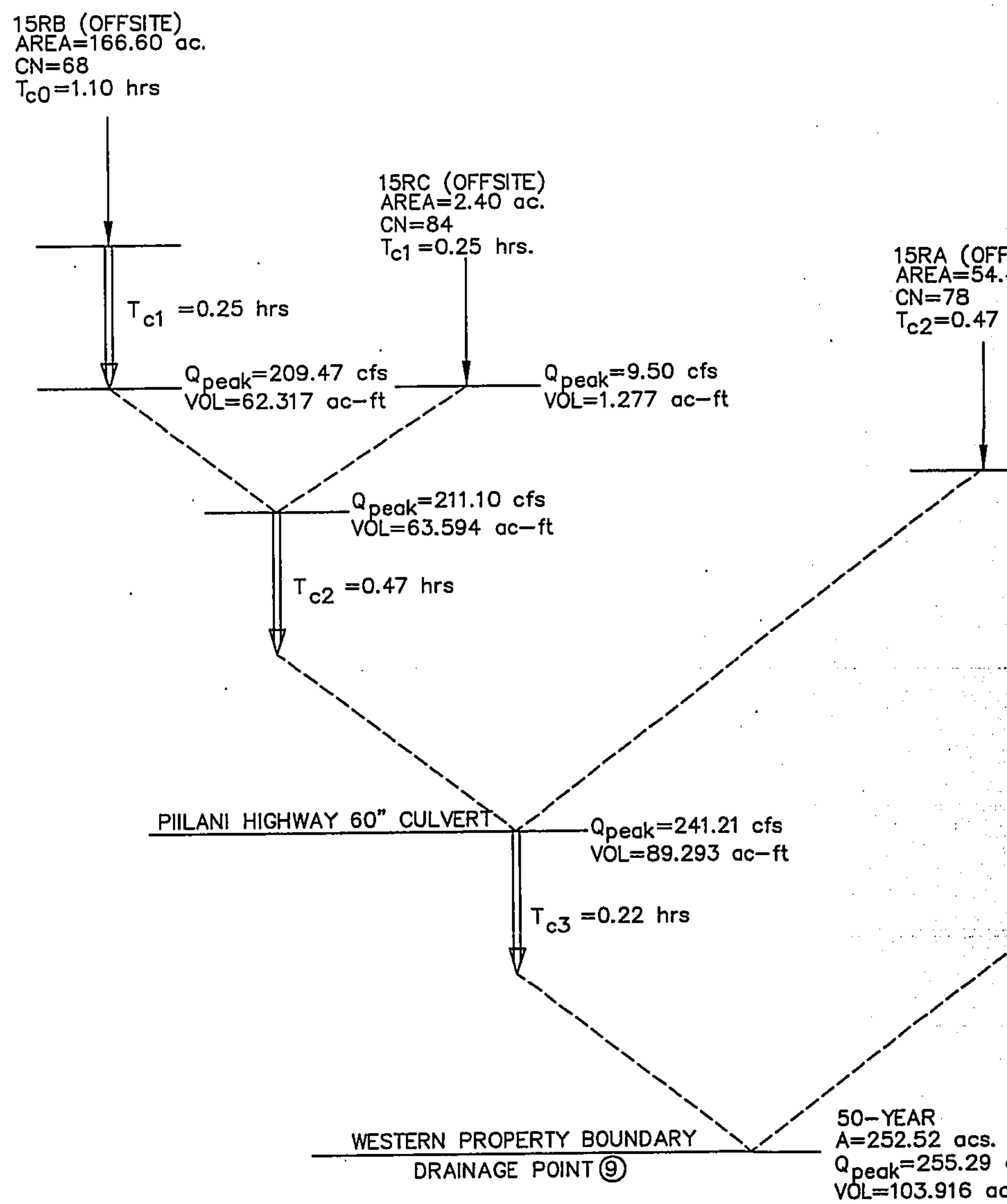
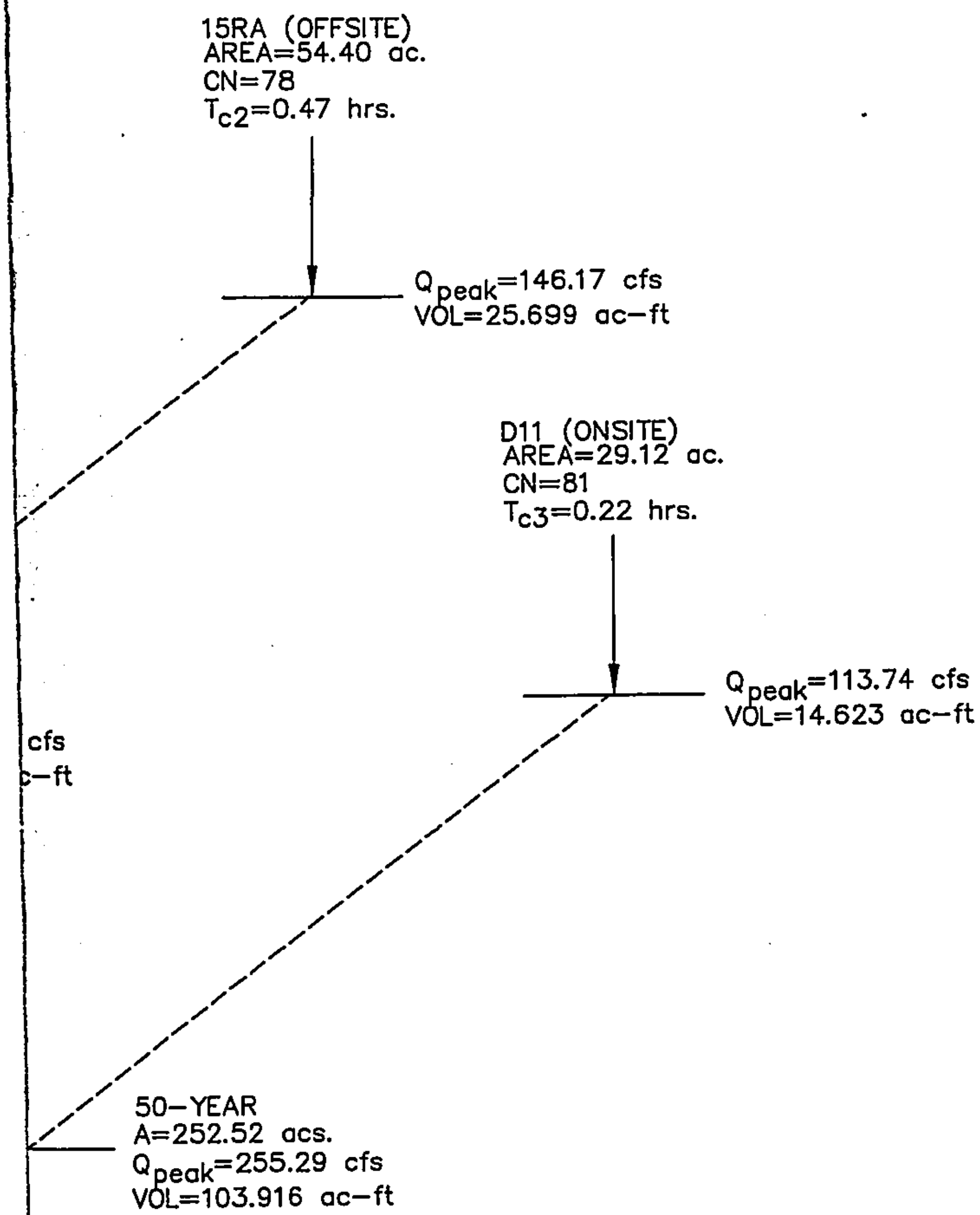


FIGURE 2A – TR-20 SCHEMATIC DIAGRAM OF
ONSITE PRE-DEVELOPMENT MODEL 1A (DRAINAGE



IAGRAM OF COMBINED OFFSITE AND
(DRAINAGEWAY D11) 50–YEAR STORM

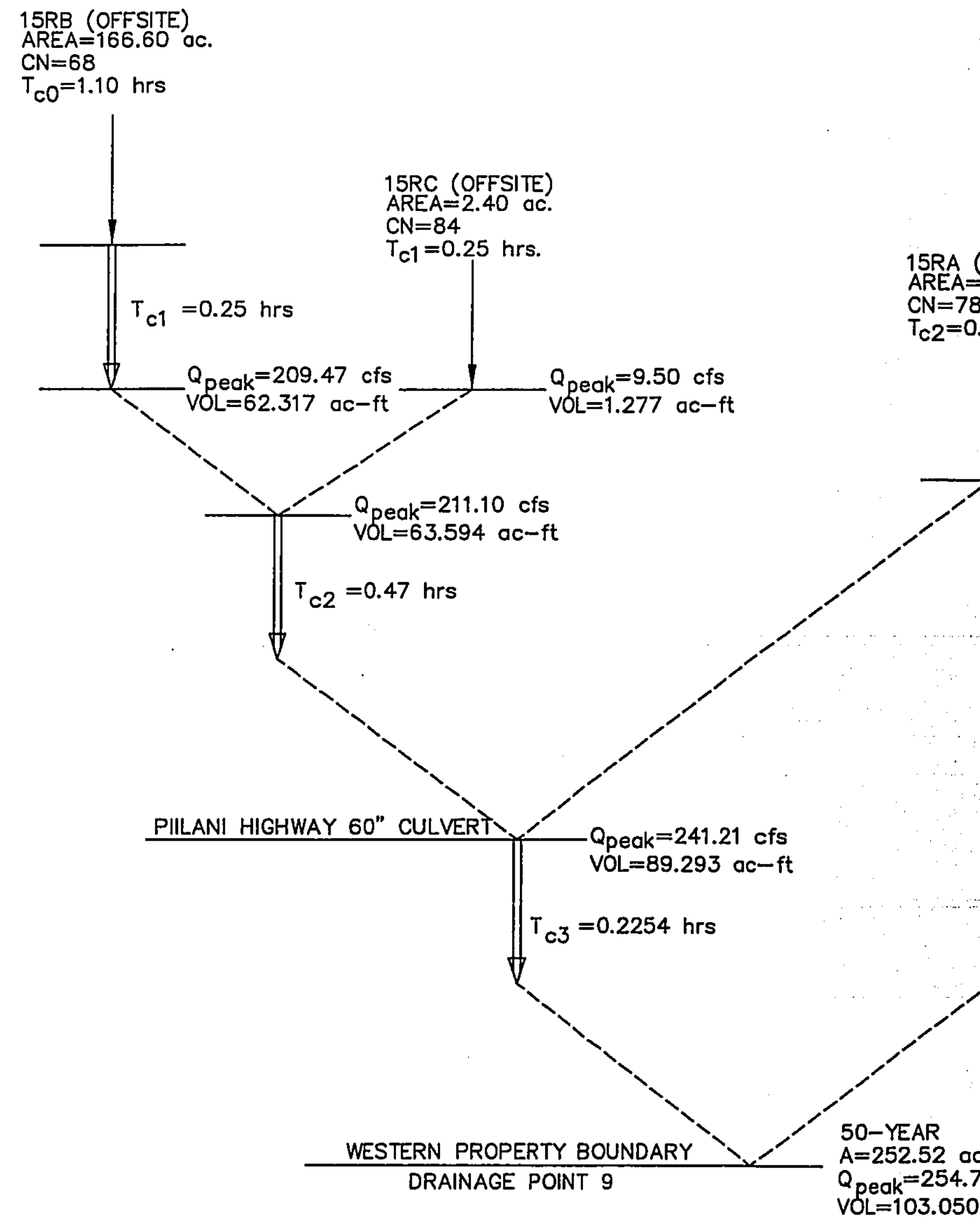
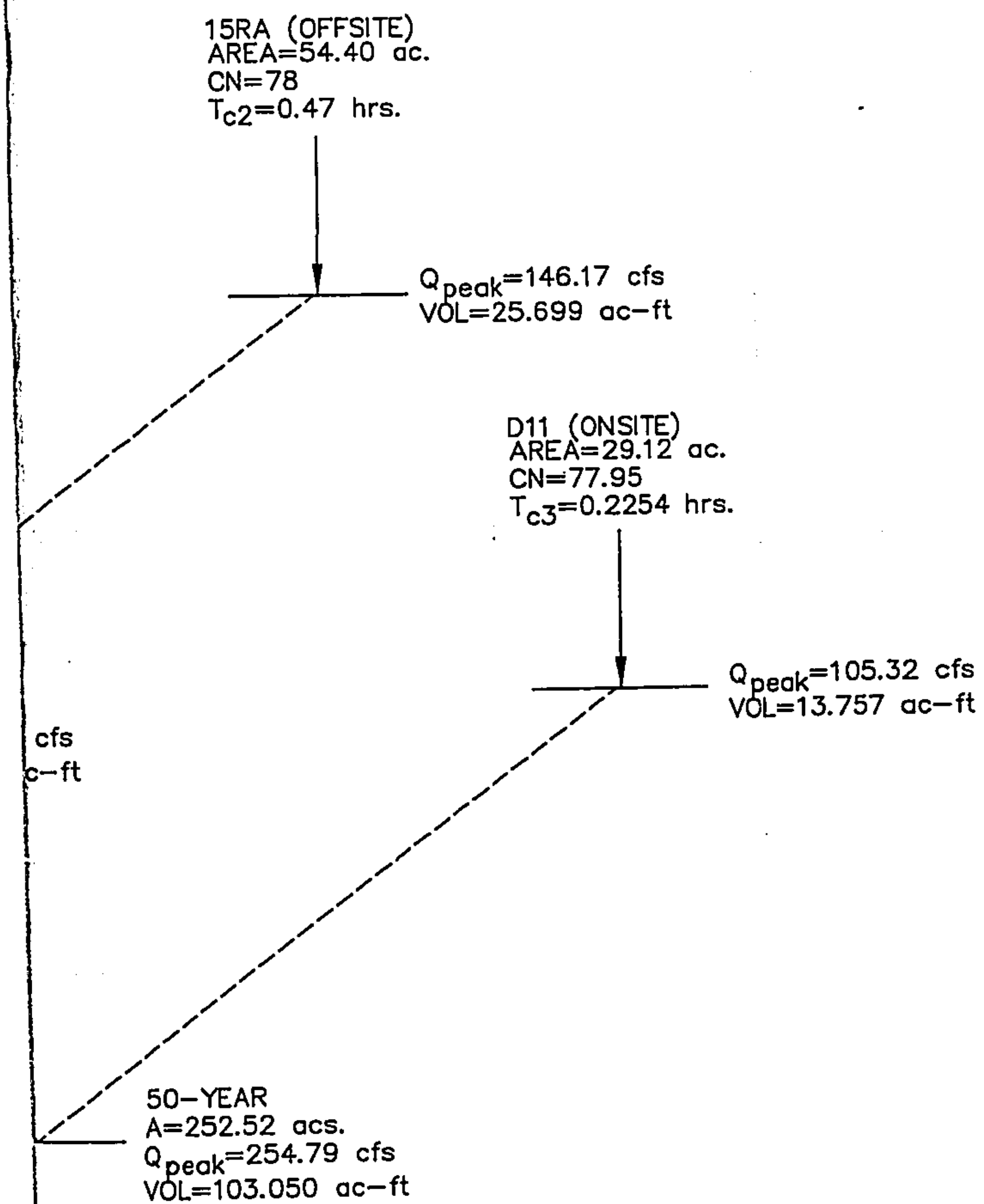


FIGURE 2B – TR-20 SCHEMATIC DIAGRAM O
ONSITE POST-DEVELOPMENT MODEL 1B (DRAINA



)IAGRAM OF COMBINED OFFSITE AND
B (DRAINAGEWAY D11) 50–YEAR STROM

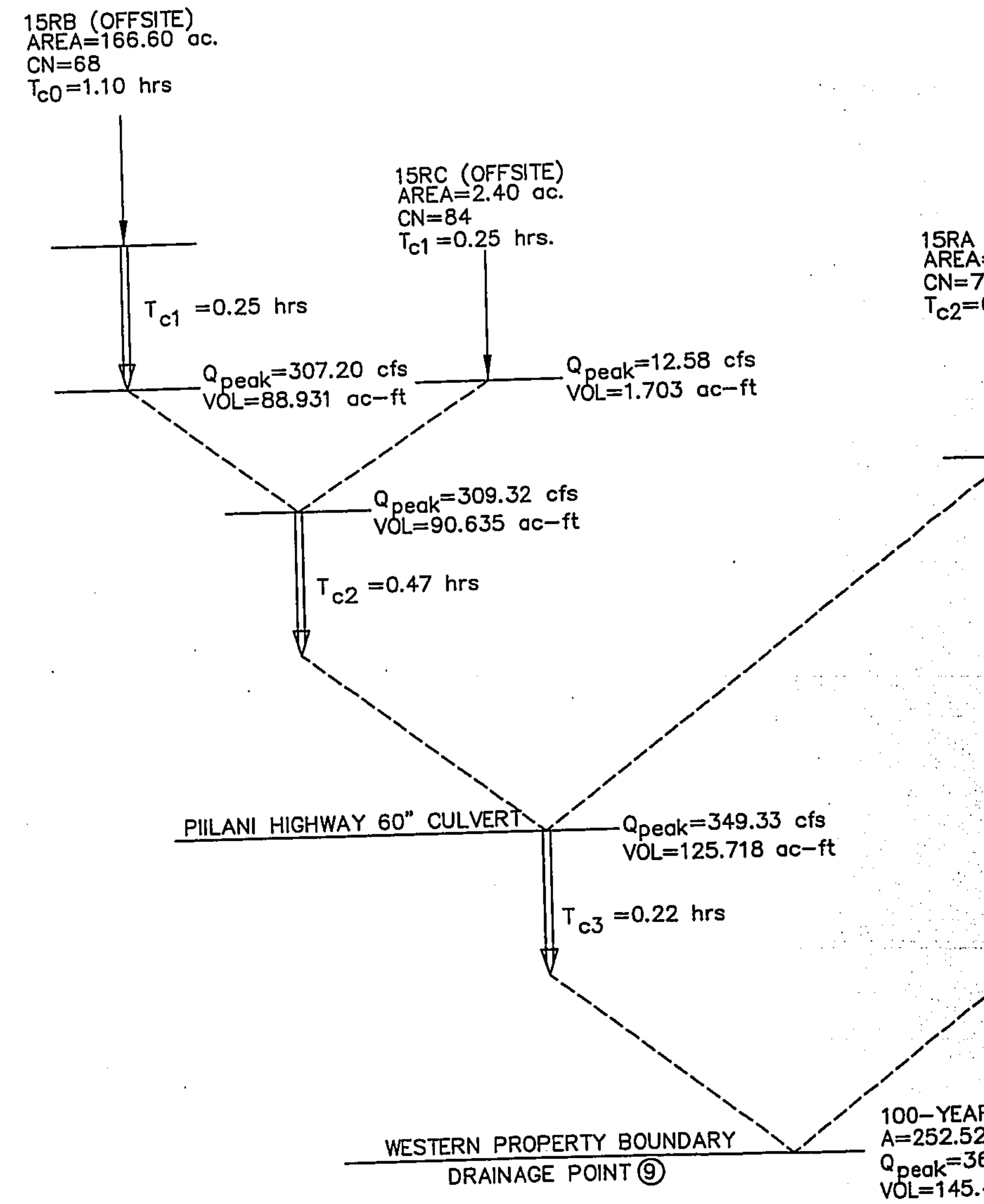


FIGURE 2C – TR–20 SCHEMATIC DIAGRAM
ONSITE PRE–DEVELOPMENT MODEL 1A (DRAINA

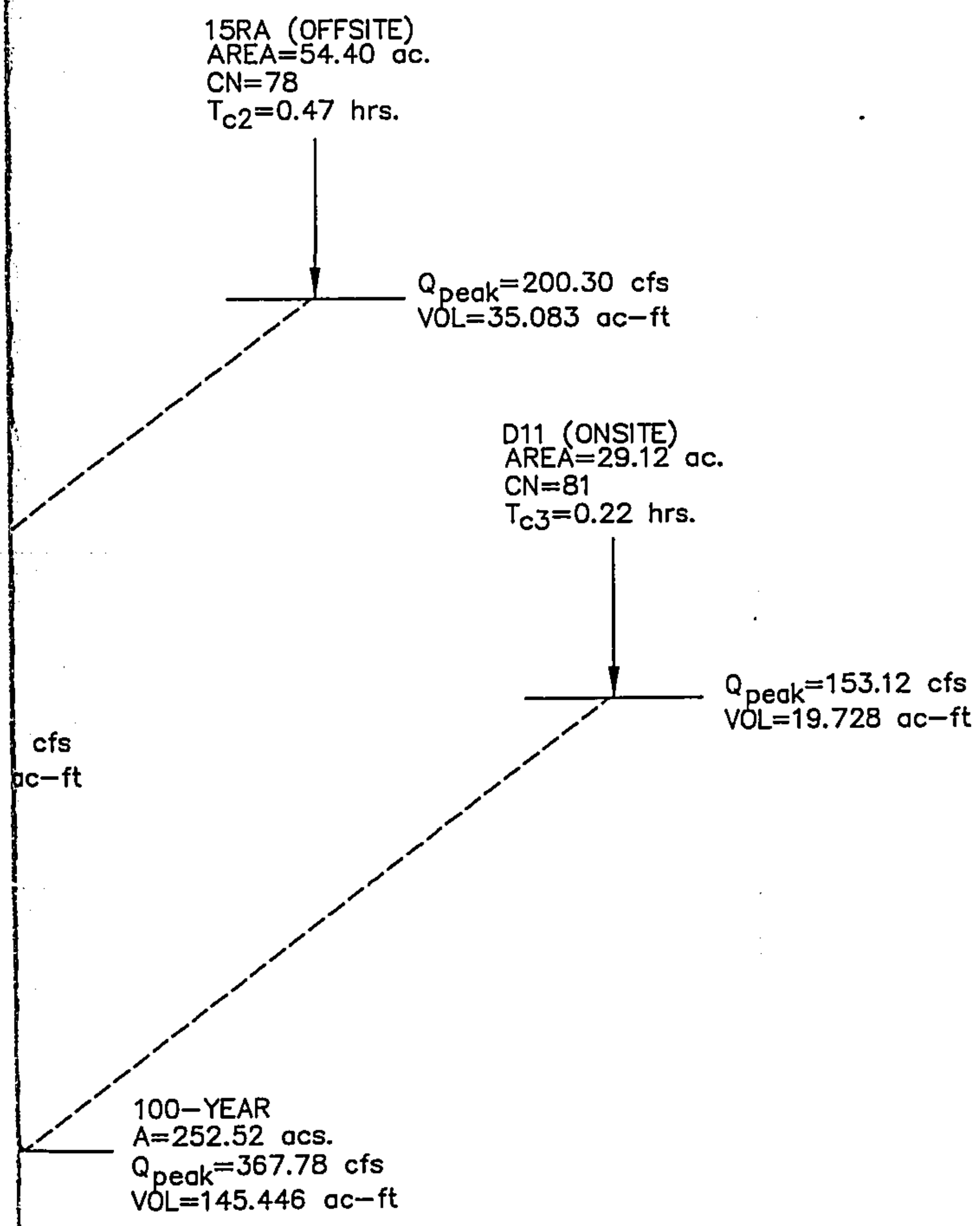


DIAGRAM OF COMBINED OFFSITE AND
(DRAINAGEWAY D11) 100–YEAR STORM

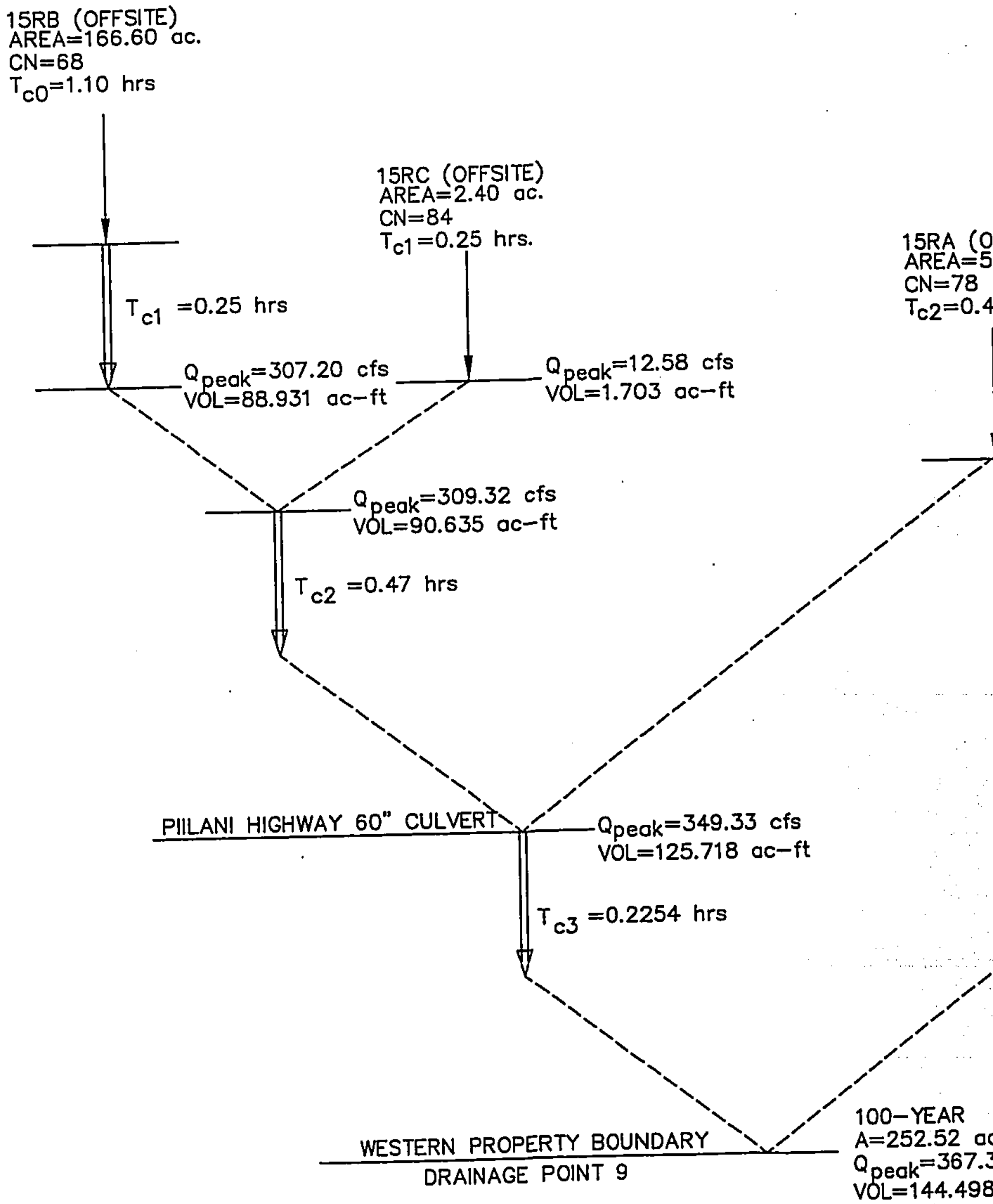


FIGURE 2D – TR-20 SCHEMATIC DIAGRAM O
ONSITE POST-DEVELOPMENT MODEL 1B (DRAINA

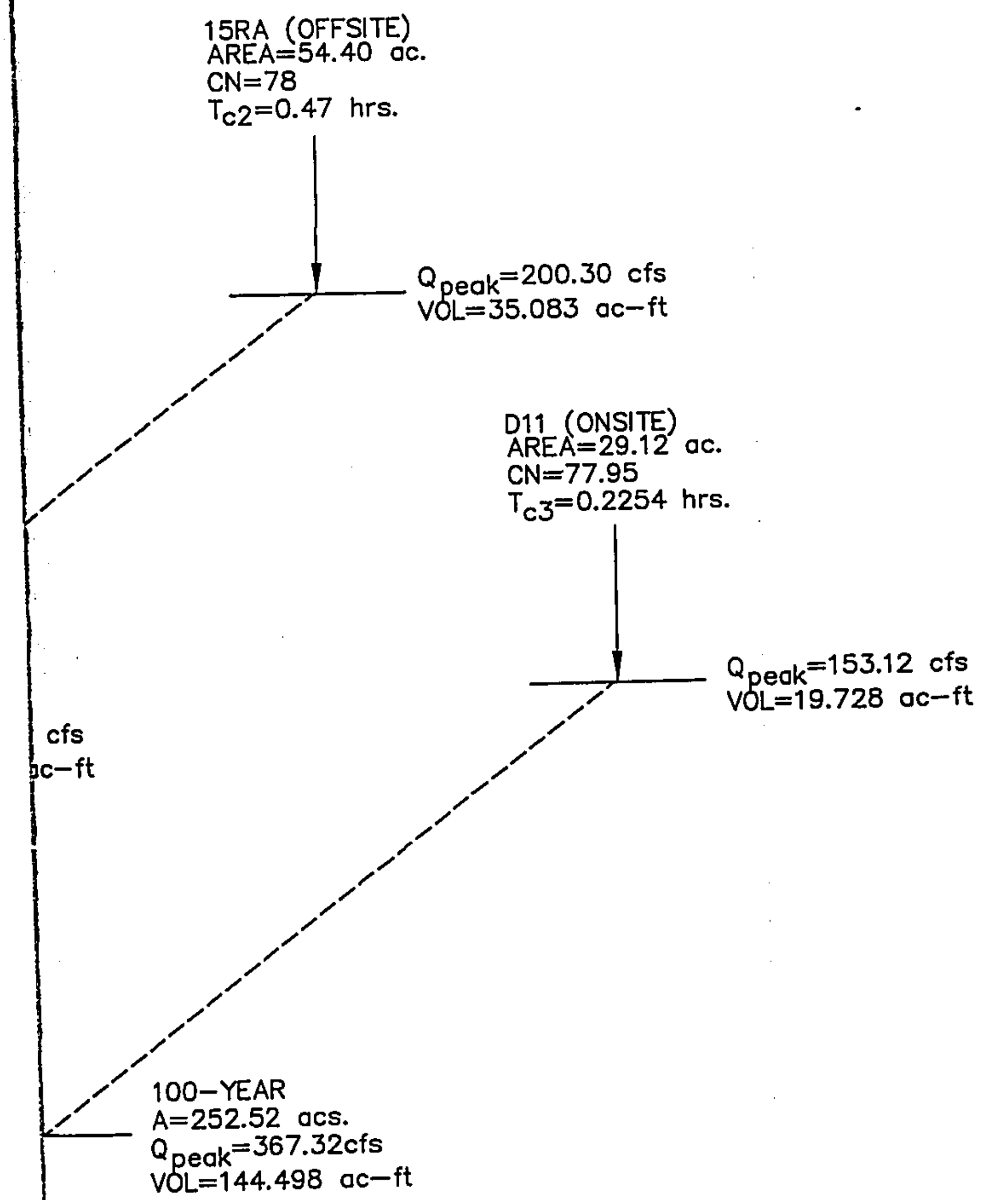


DIAGRAM OF COMBINED OFFSITE AND
3 (DRAINAGEWAY D11) 100-YEAR STORM

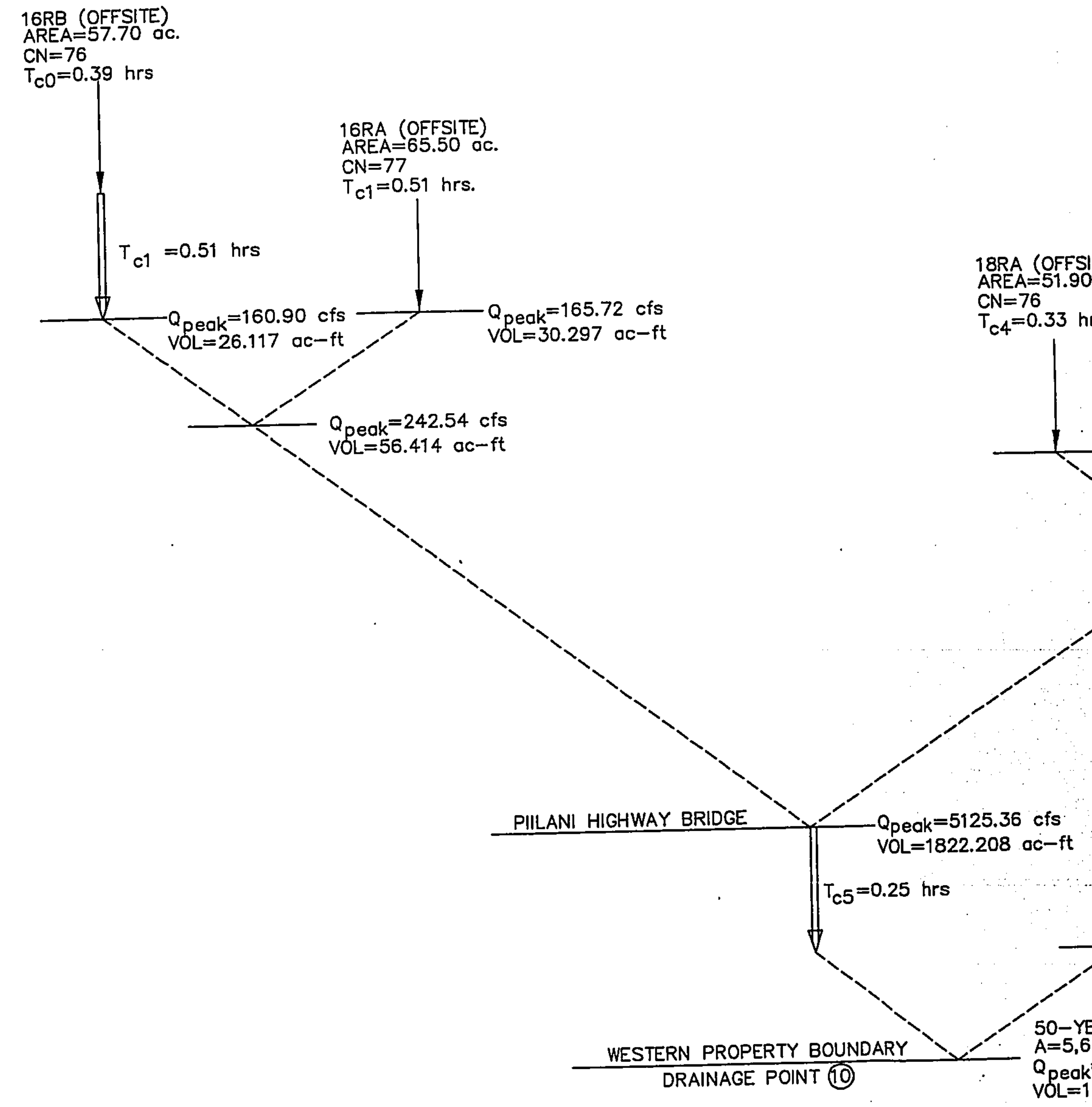
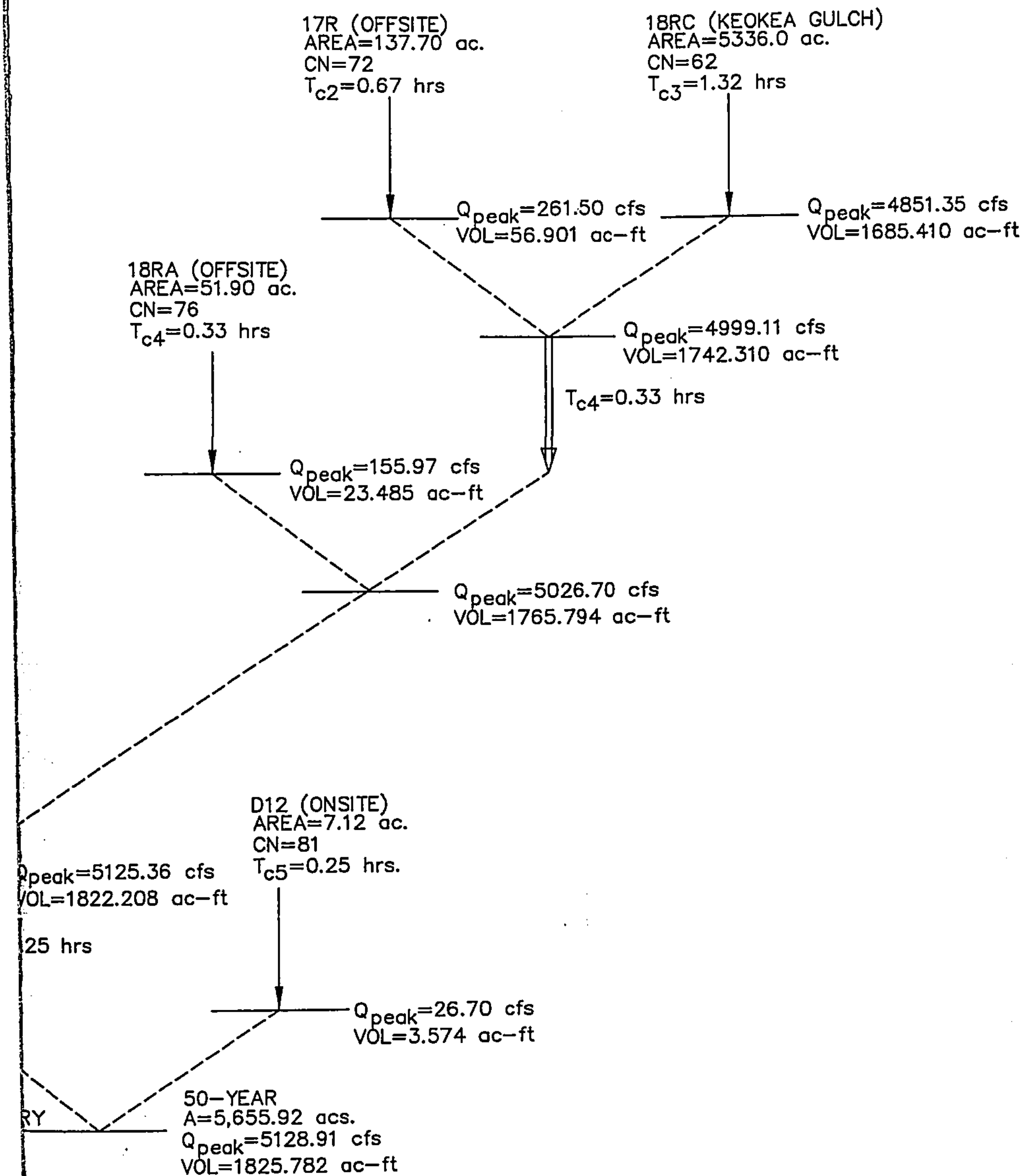


FIGURE 3A – TR–20 SCHEMATIC DIAGRAM O
ONSITE <u>PRE–DEVELOPMENT</u> MODEL 2A (DRAINAG



IAGRAM OF COMBINED OFFSITE AND
(DRAINAGEWAY D12) 50–YEAR STORM

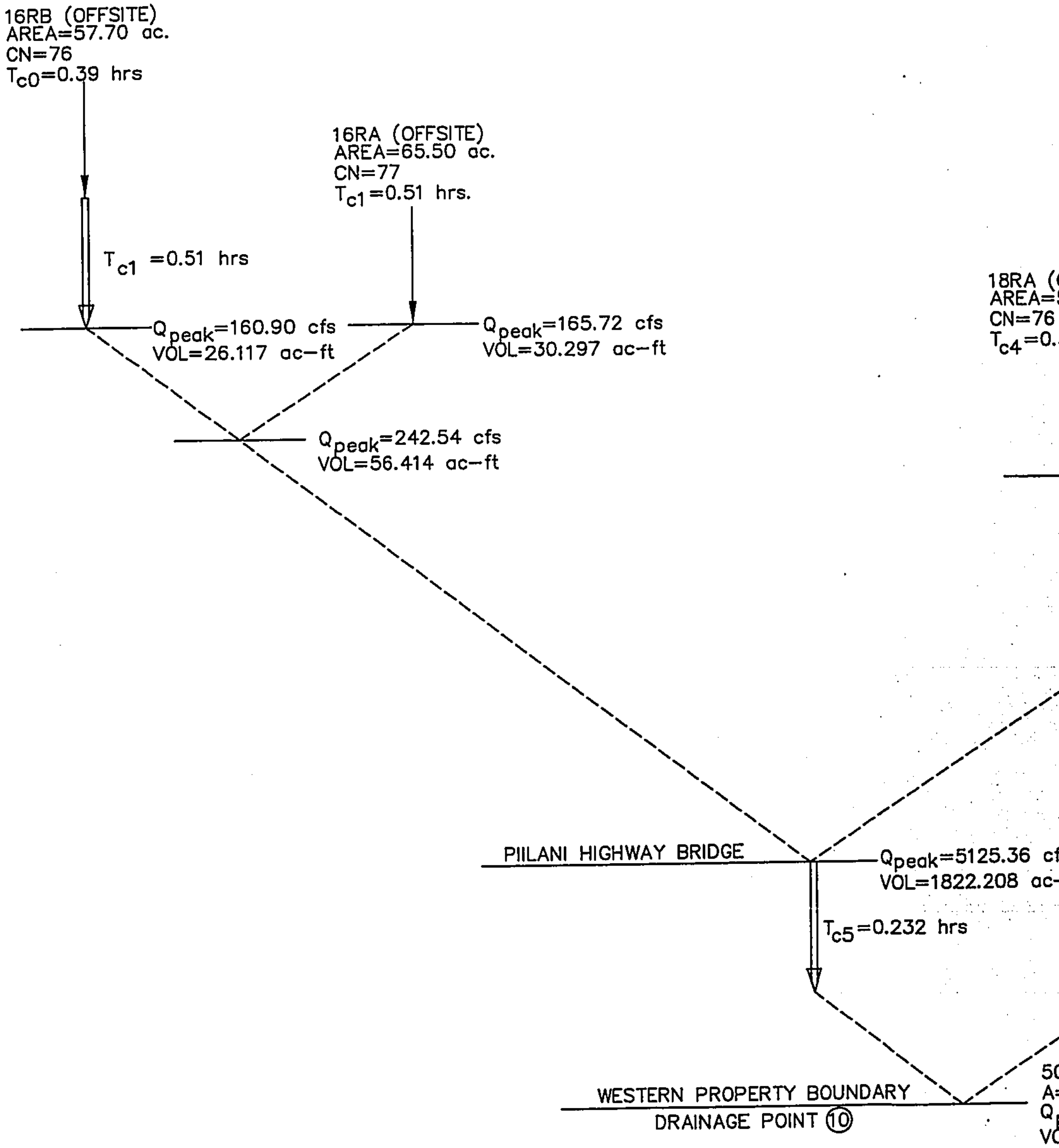
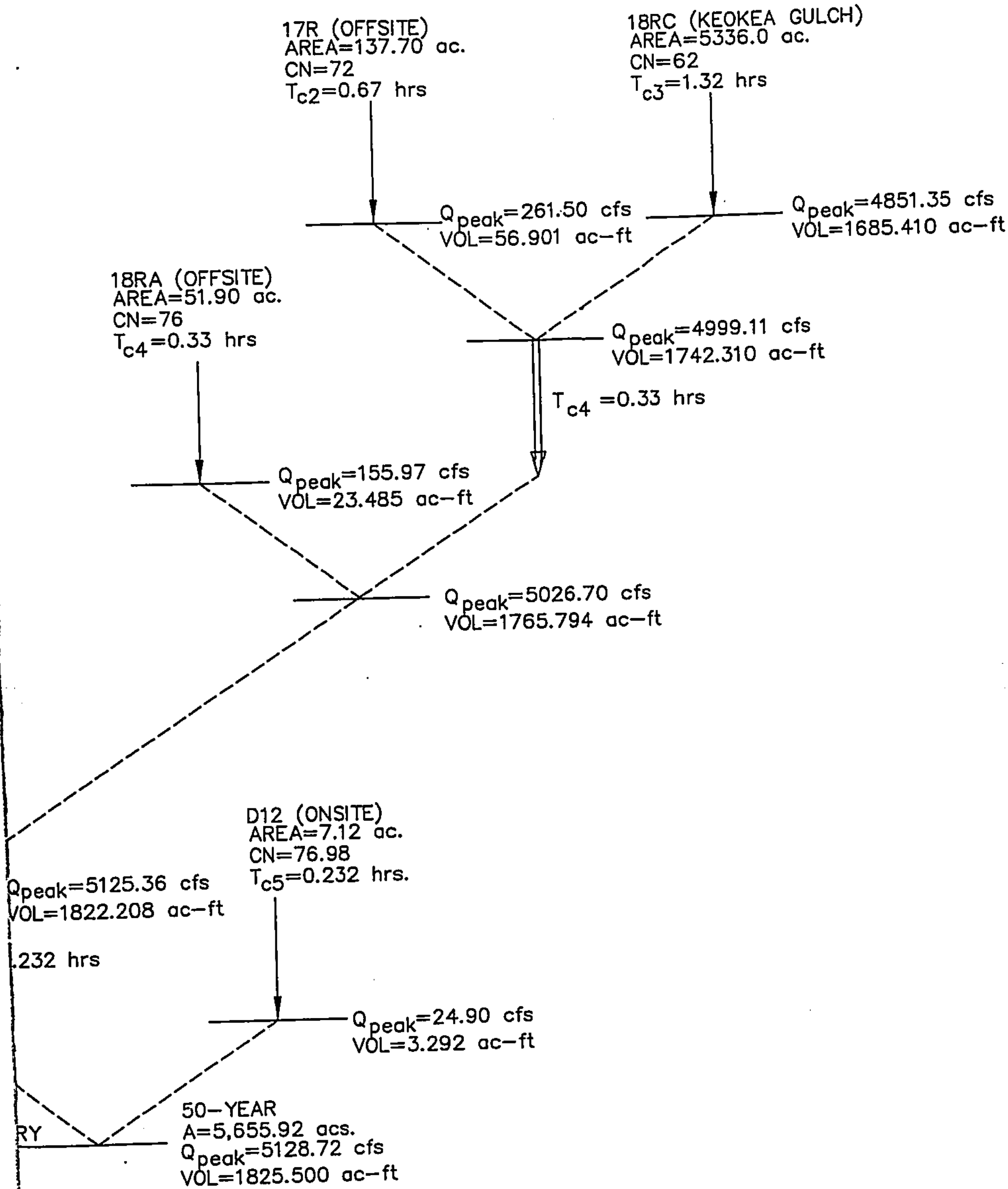


FIGURE 3B – TR–20 SCHEMATIC DIAGRAM
ONSITE <u>POST–DEVELOPMENT</u> MODEL 2B (DRAIN



IAGRAM OF COMBINED OFFSITE AND
3 (DRAINAGEWAY D12) 50-YEAR STORM

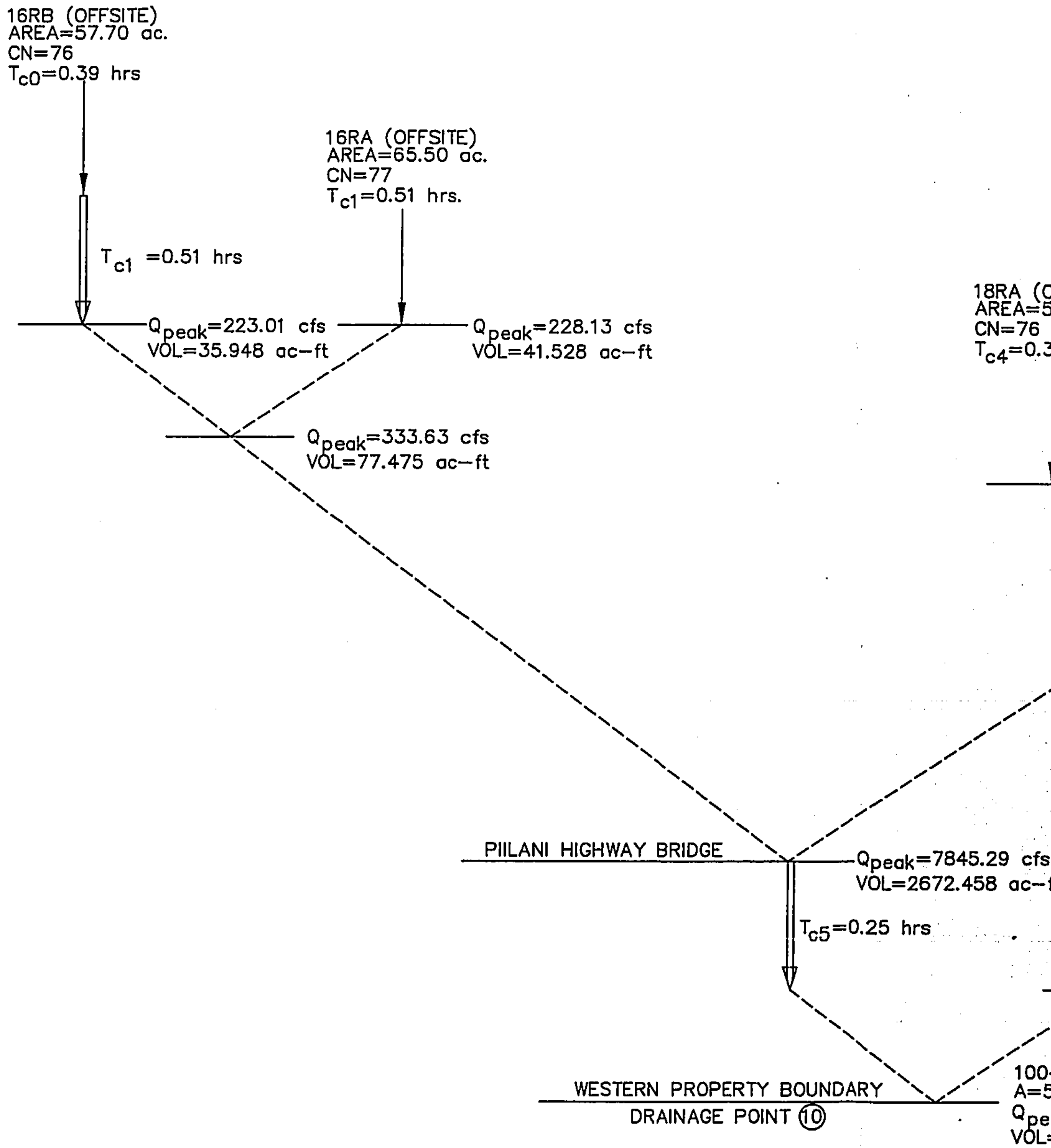
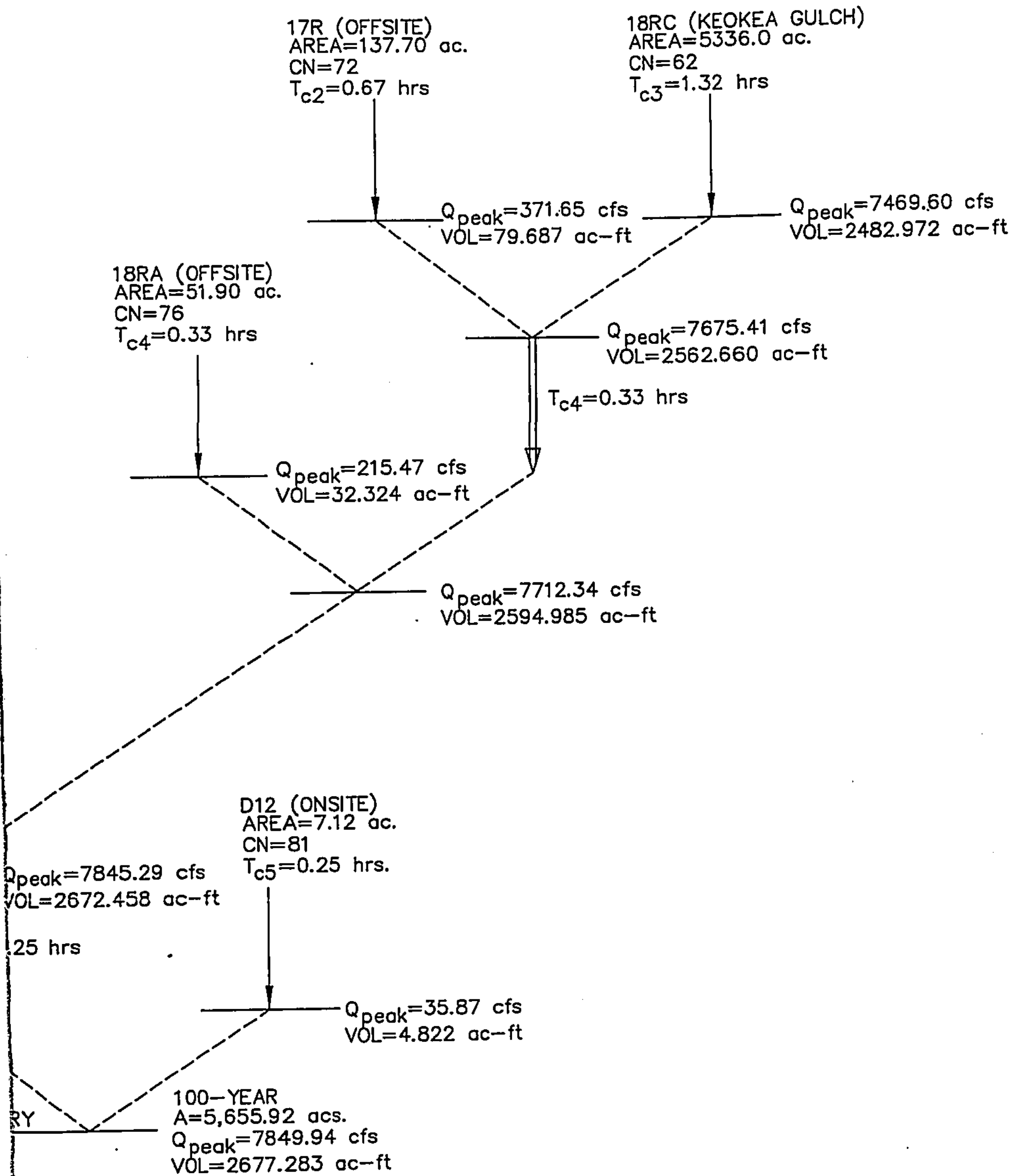


FIGURE 3C – TR-20 SCHEMATIC DIAGRAM O
ONSITE PRE-DEVELOPMENT MODEL 2A (DRAINAG



IAGRAM OF COMBINED OFFSITE AND
(DRAINAGEWAY D12) 100–YEAR STORM

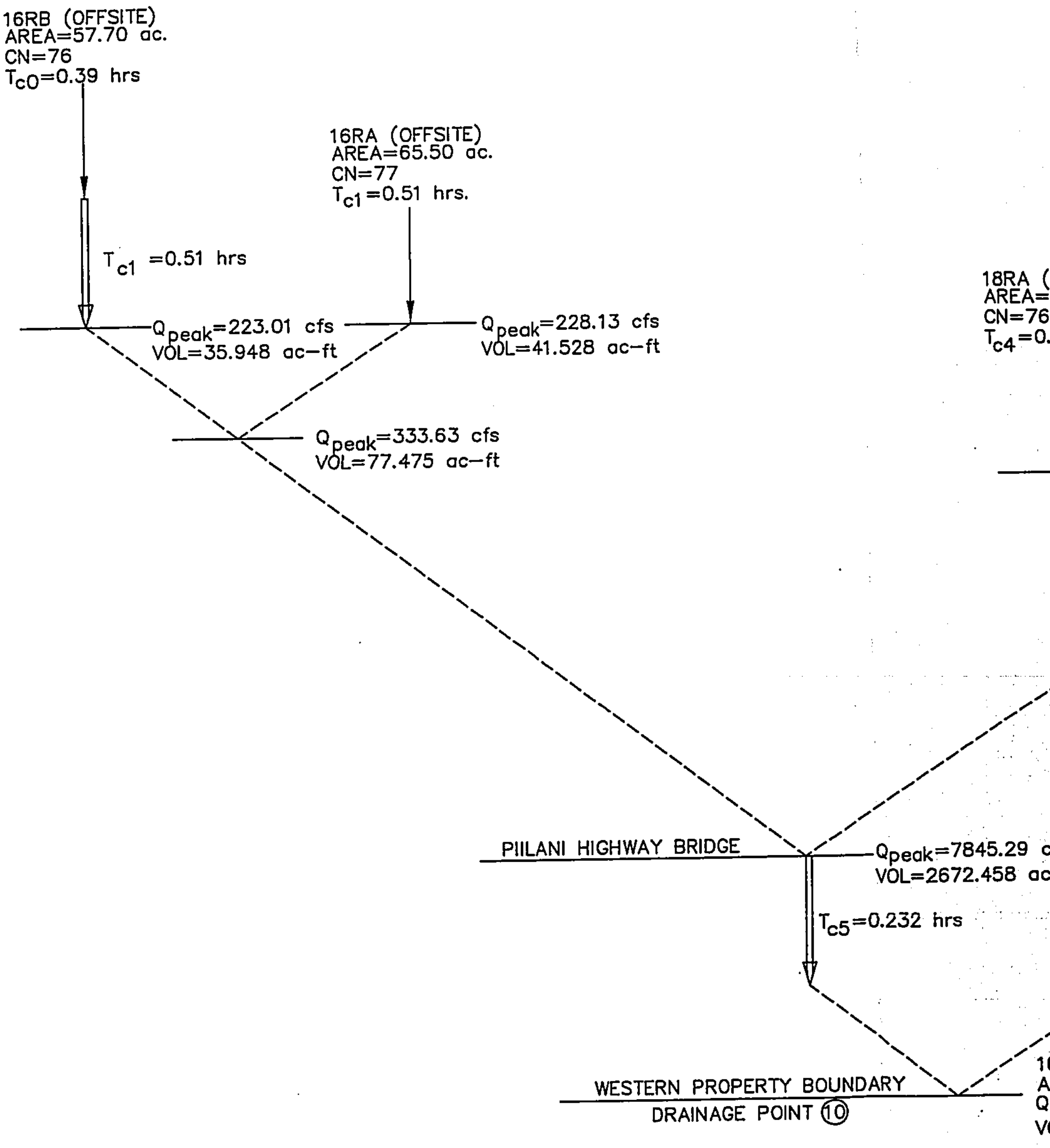
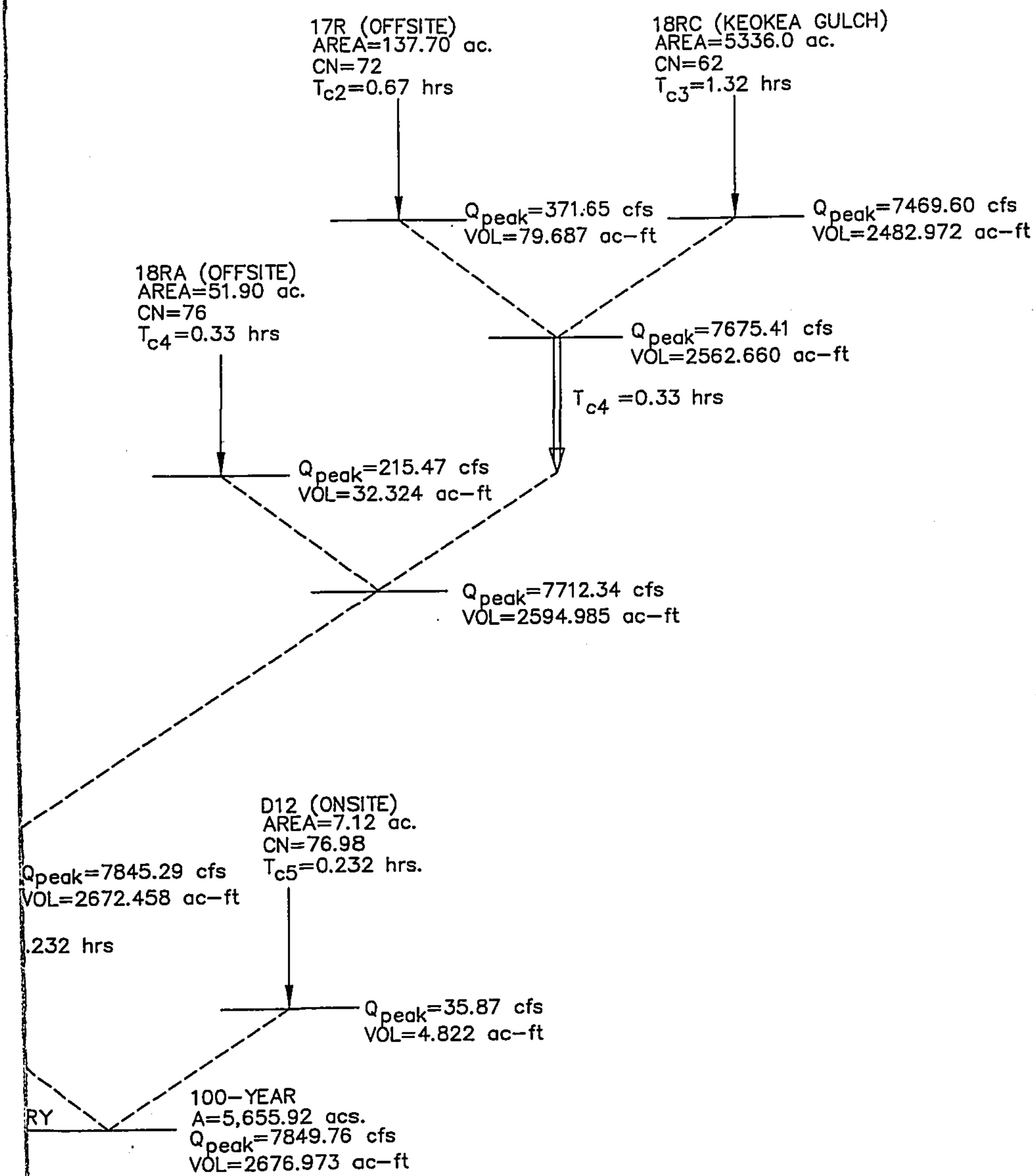


FIGURE 3D – TR–20 SCHEMATIC DIAGRAM
ONSITE POST–DEVELOPMENT MODEL 2B (DRAIN



IAGRAM OF COMBINED OFFSITE AND
(DRAINAGEWAY D12) 100-YEAR STORM

EXHIBITS

- A. Aerial Photo of Project Site
- B. Soil Survey Map
- C. Flood Insurance Rate Map
- D. Drainage Area Map
- E. Grading Plan
- F. Summary of Onsite and Offsite Runoff

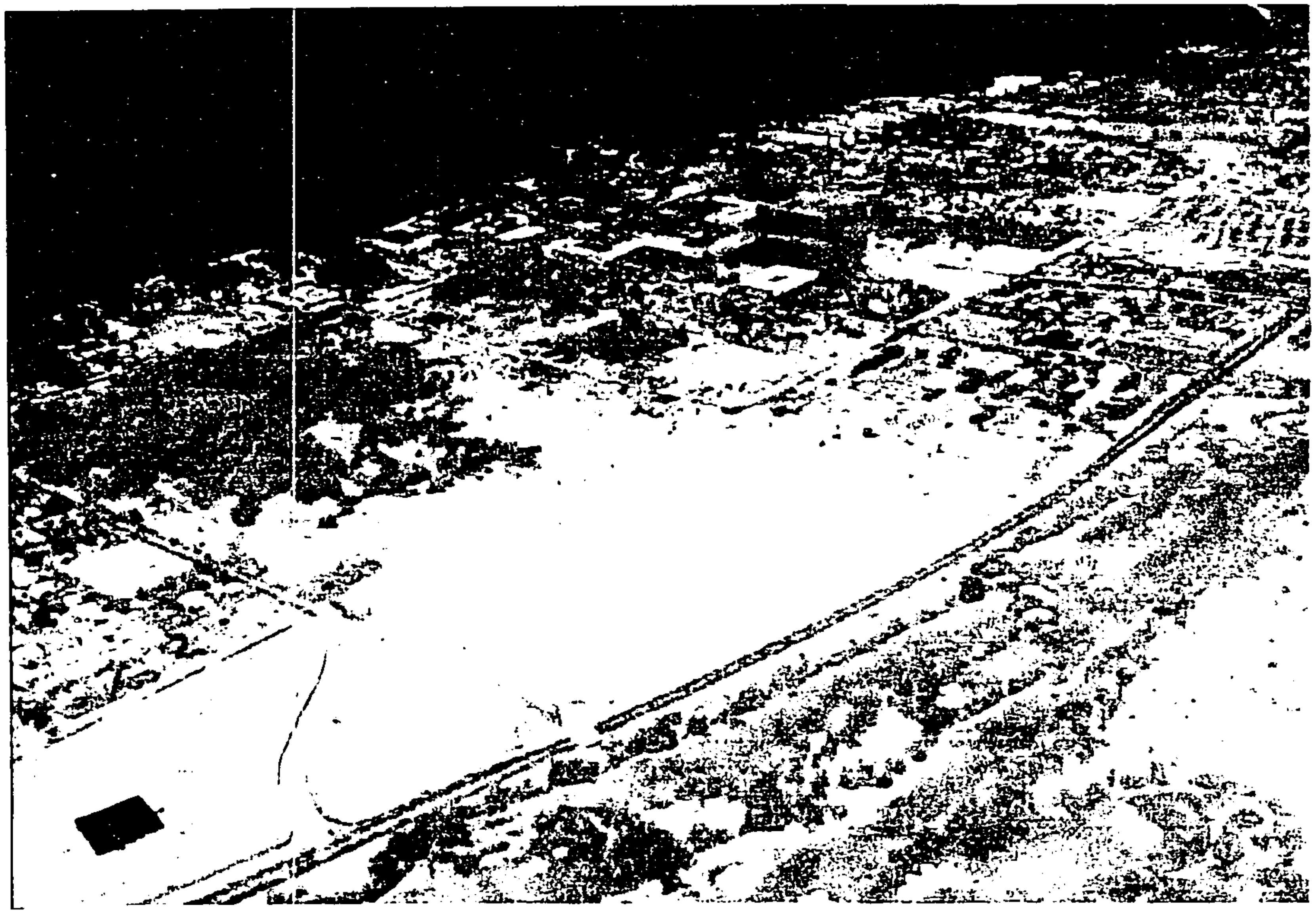


EXHIBIT A – AERIAL PHOTO OF PROJECT SITE

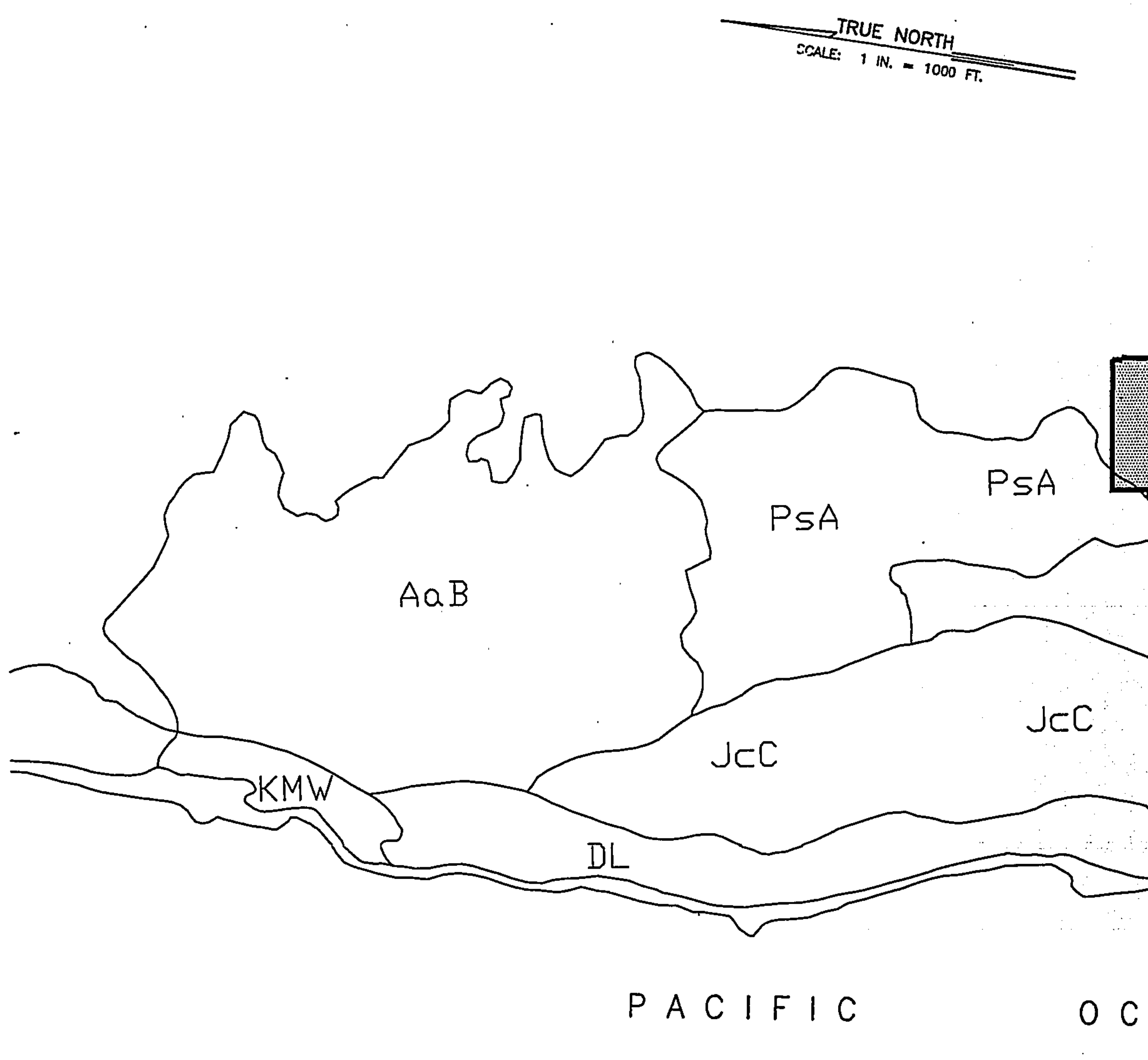
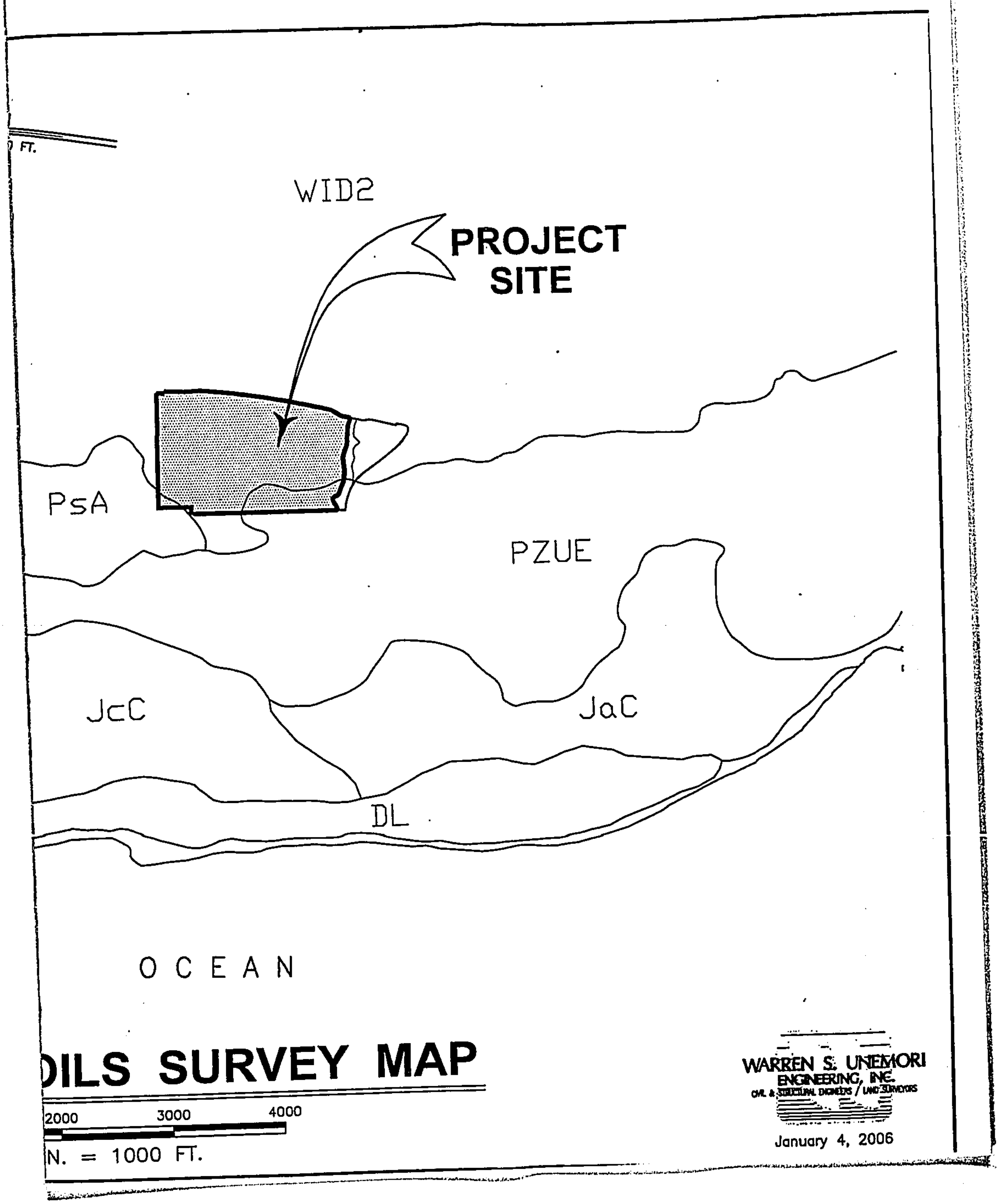


EXHIBIT "B" - SOILS SU

0 1000 2000 3000

SCALE: 1 IN. = 1000 FT.

03proj/03031/dwg2004/exhibits/drainage/exb-soils00.dwg


FT.
WID2
PROJECT SITE
PsA
PZUE
JcC
JaC
DL
OCEAN
OILS SURVEY MAP
2000
3000
4000
N. = 1000 FT.
WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS
January 4, 2006

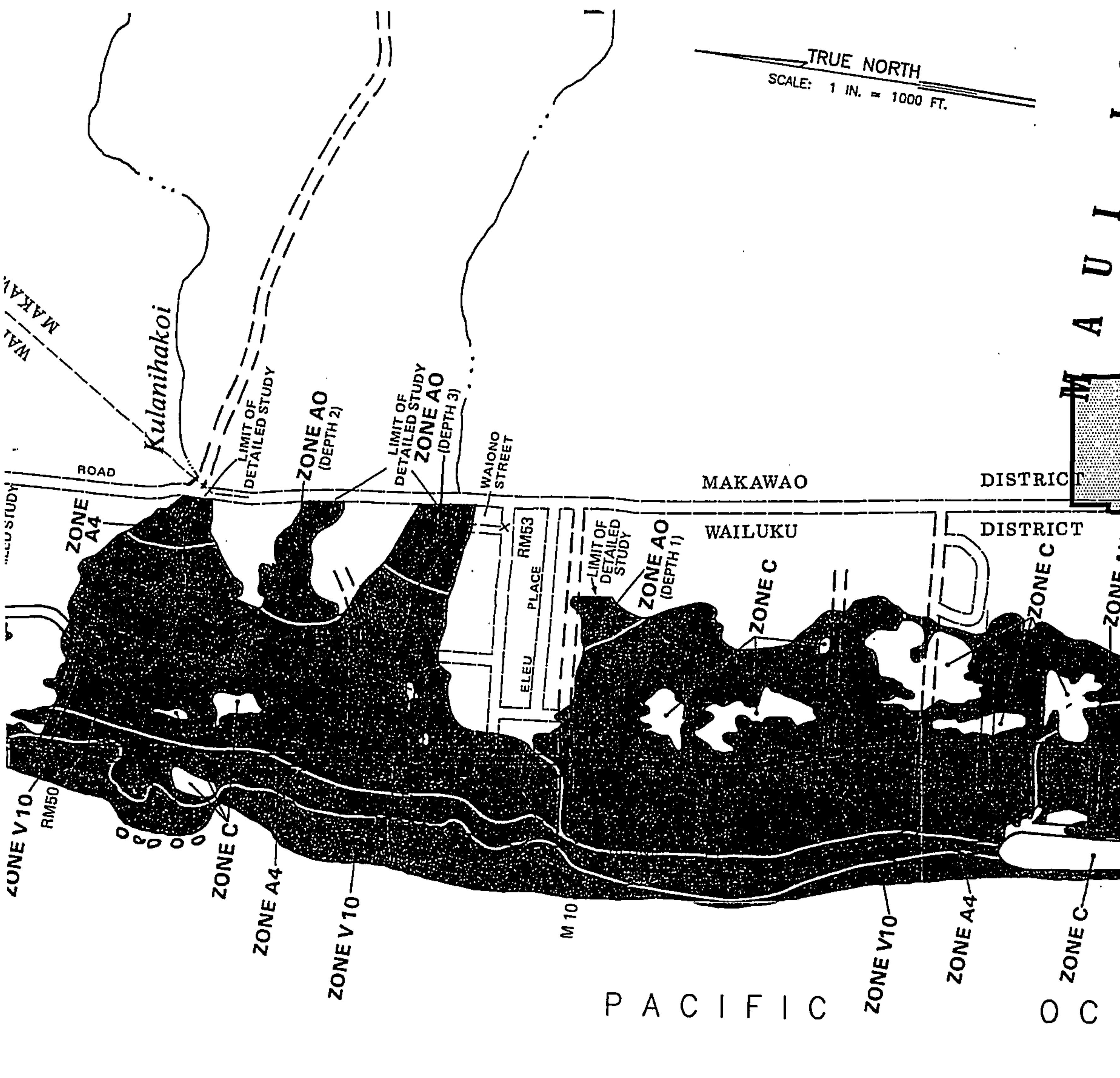


EXHIBIT "C" - FLOOD INSURA

0 1000 2000 3000

SCALE: 1 IN. = 1000 FT.

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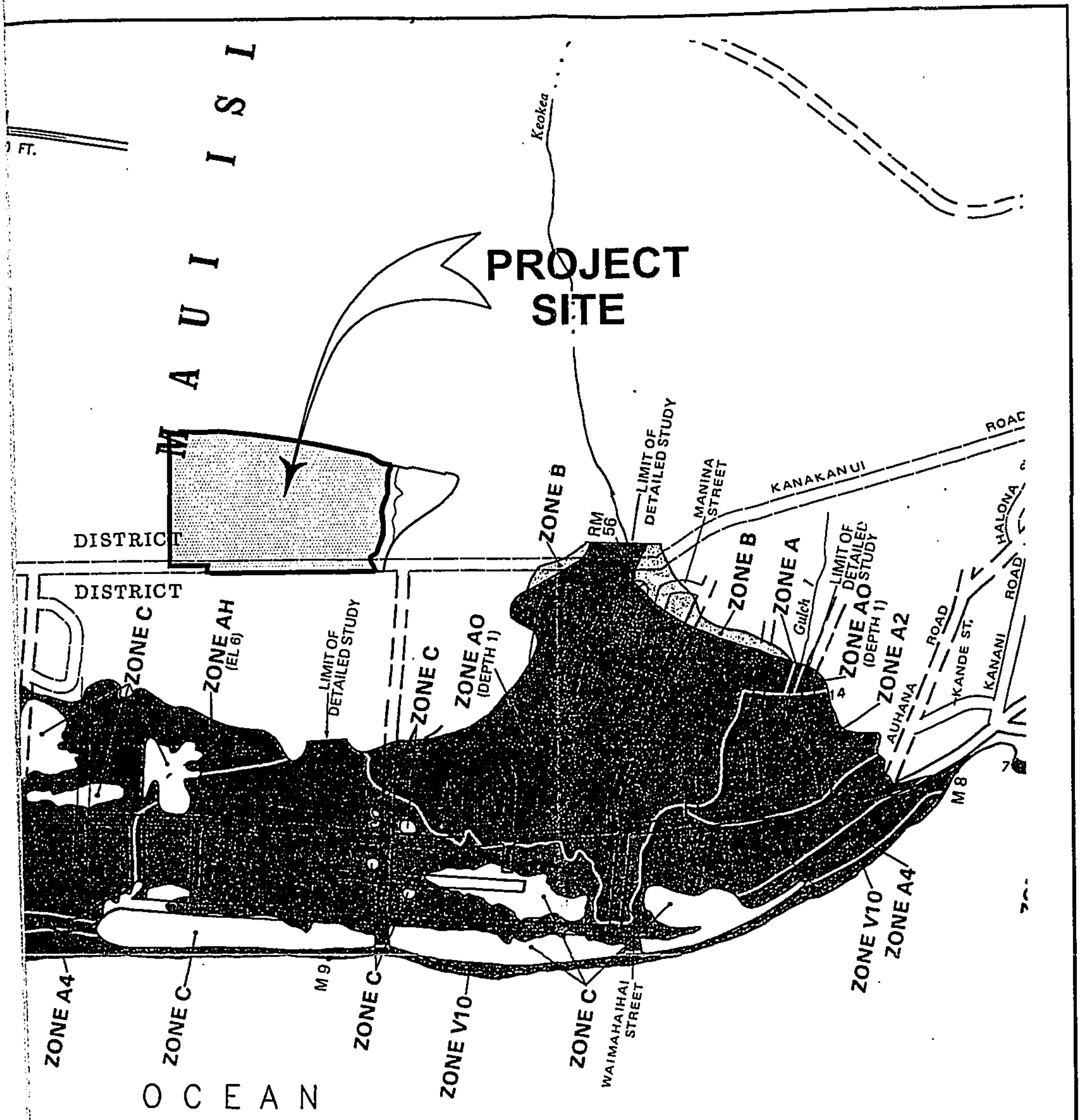


INSURANCE RATE MAP

2000 3000 4000

N. = 1000 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

January 4, 2006

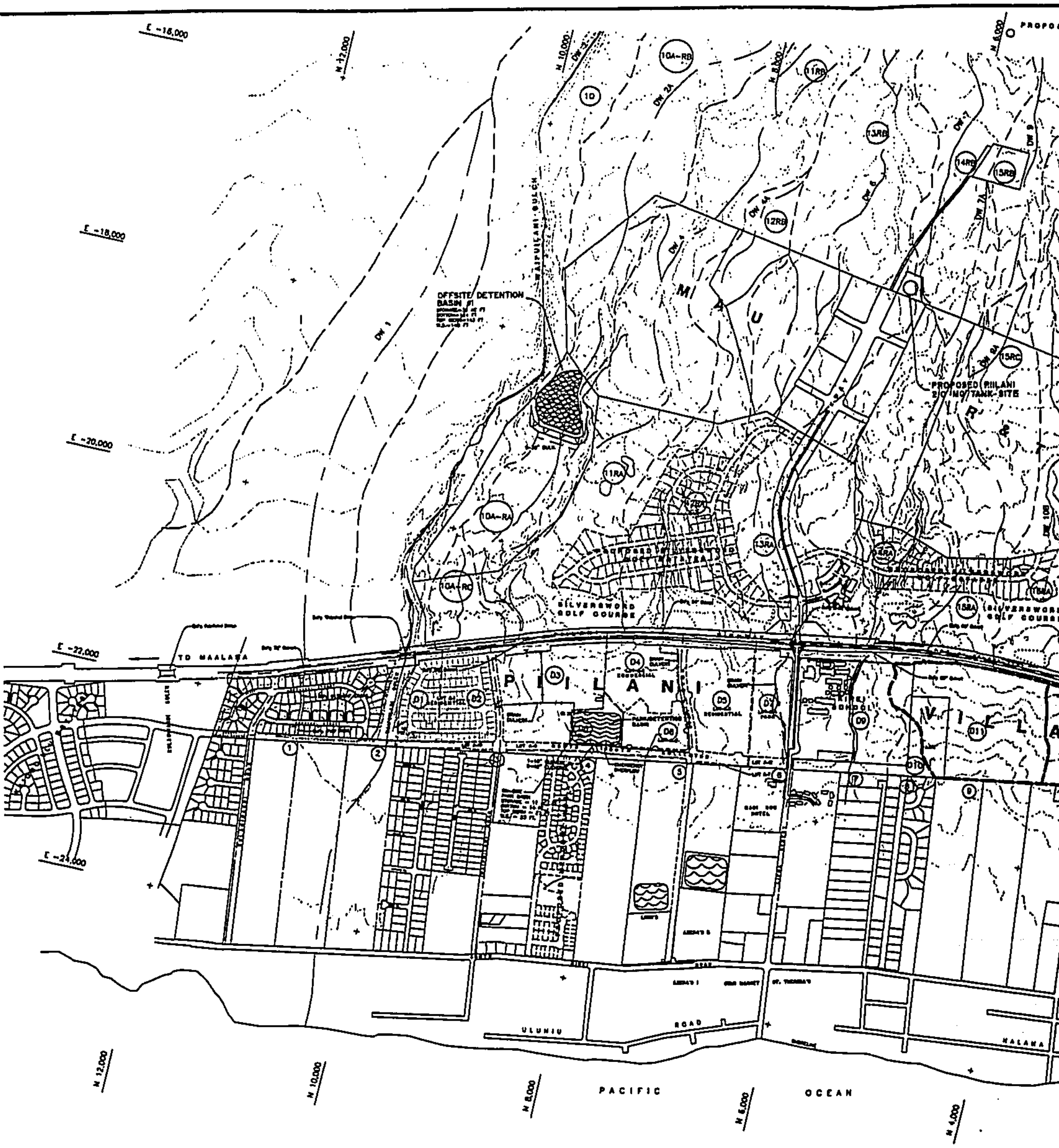
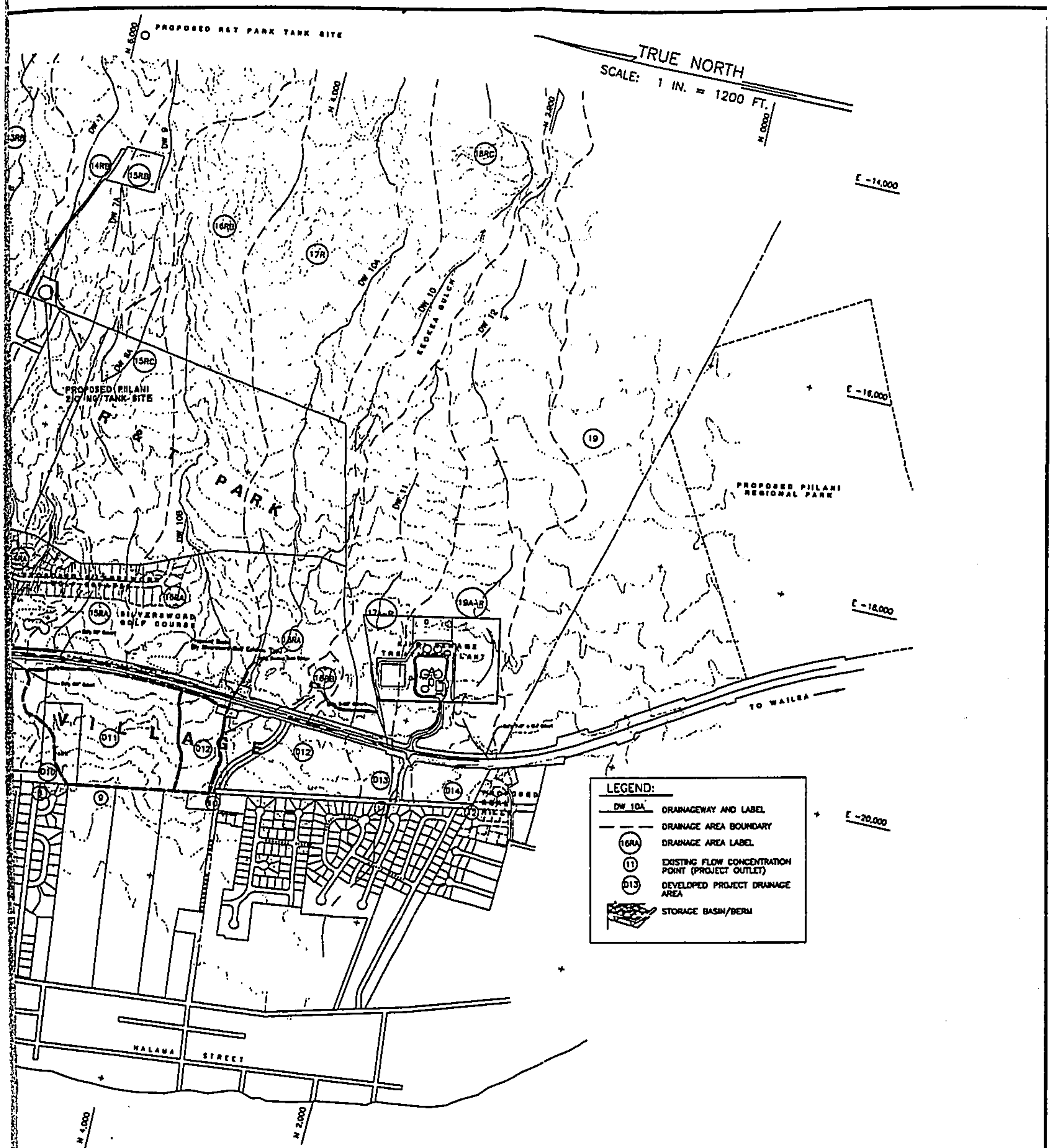


EXHIBIT "D" - DRAINAGE

0 1200 2400 3600

SCALE: 1 IN. = 1200 FT.

03proj/03031/dwg2004/exhibits/drainage/exb-drn-area00.dwg



AINAGE AREA MAP

2400 3600 4800

N. = 1200 FT.

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

January 4, 2006

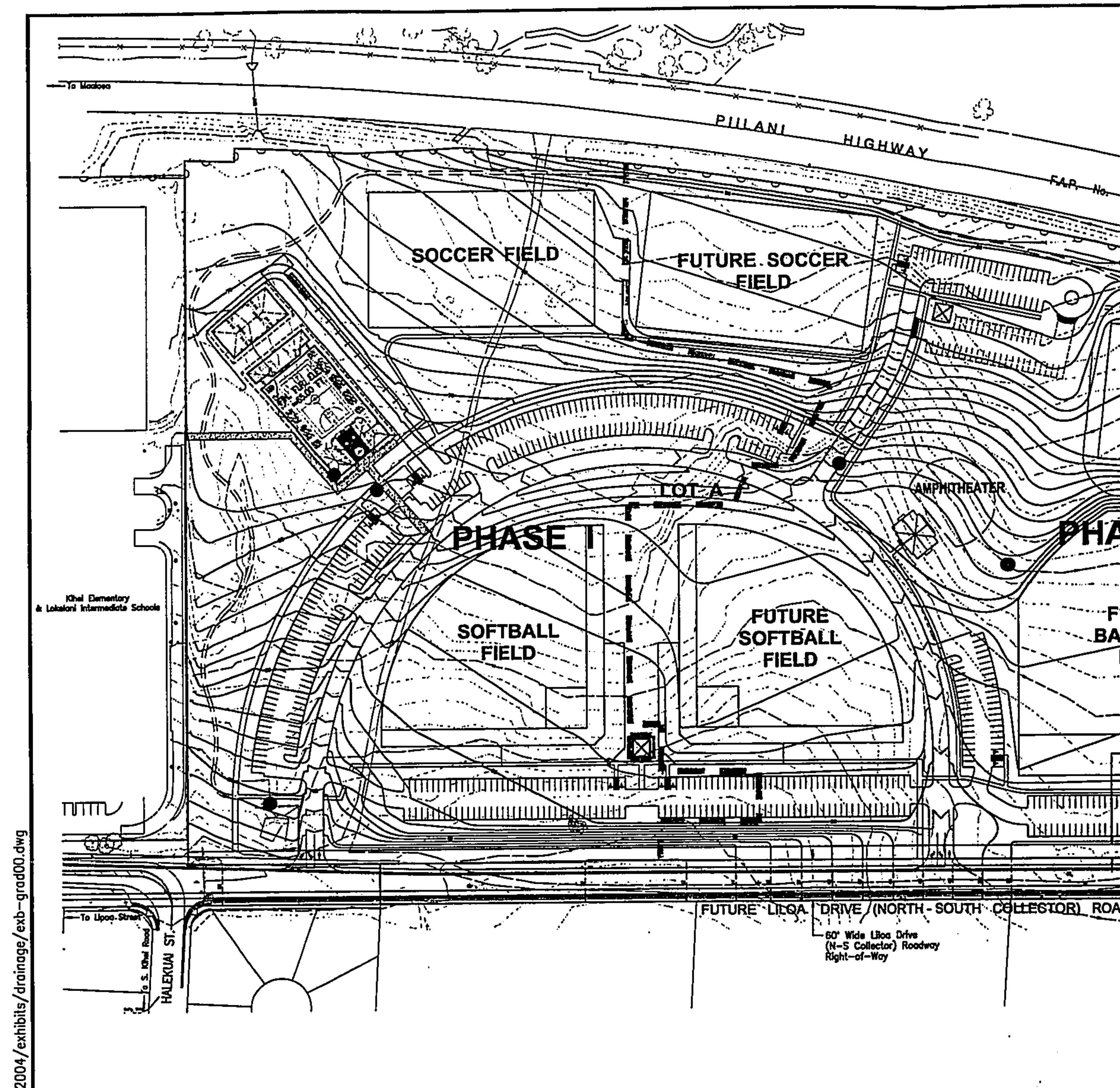
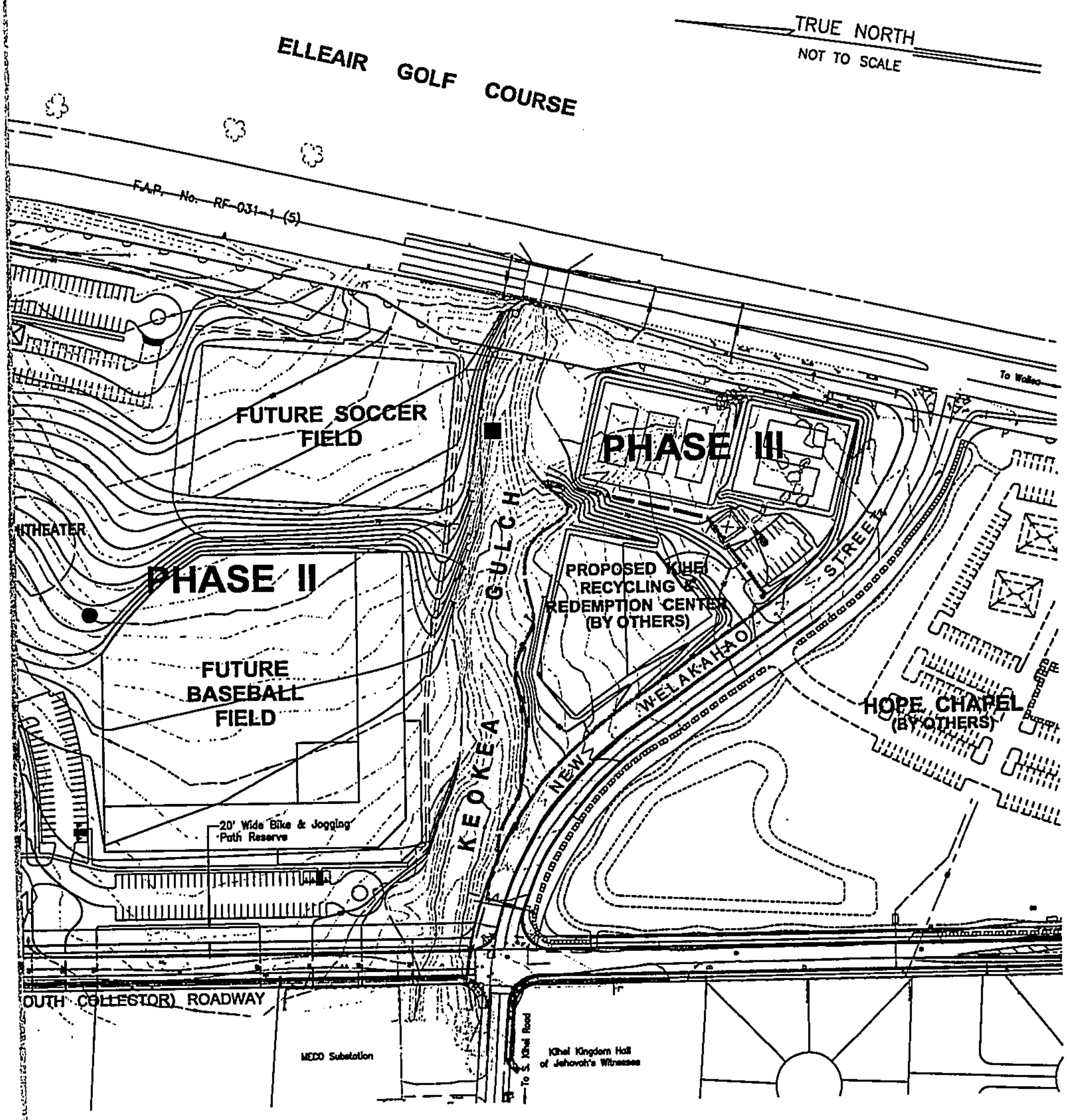


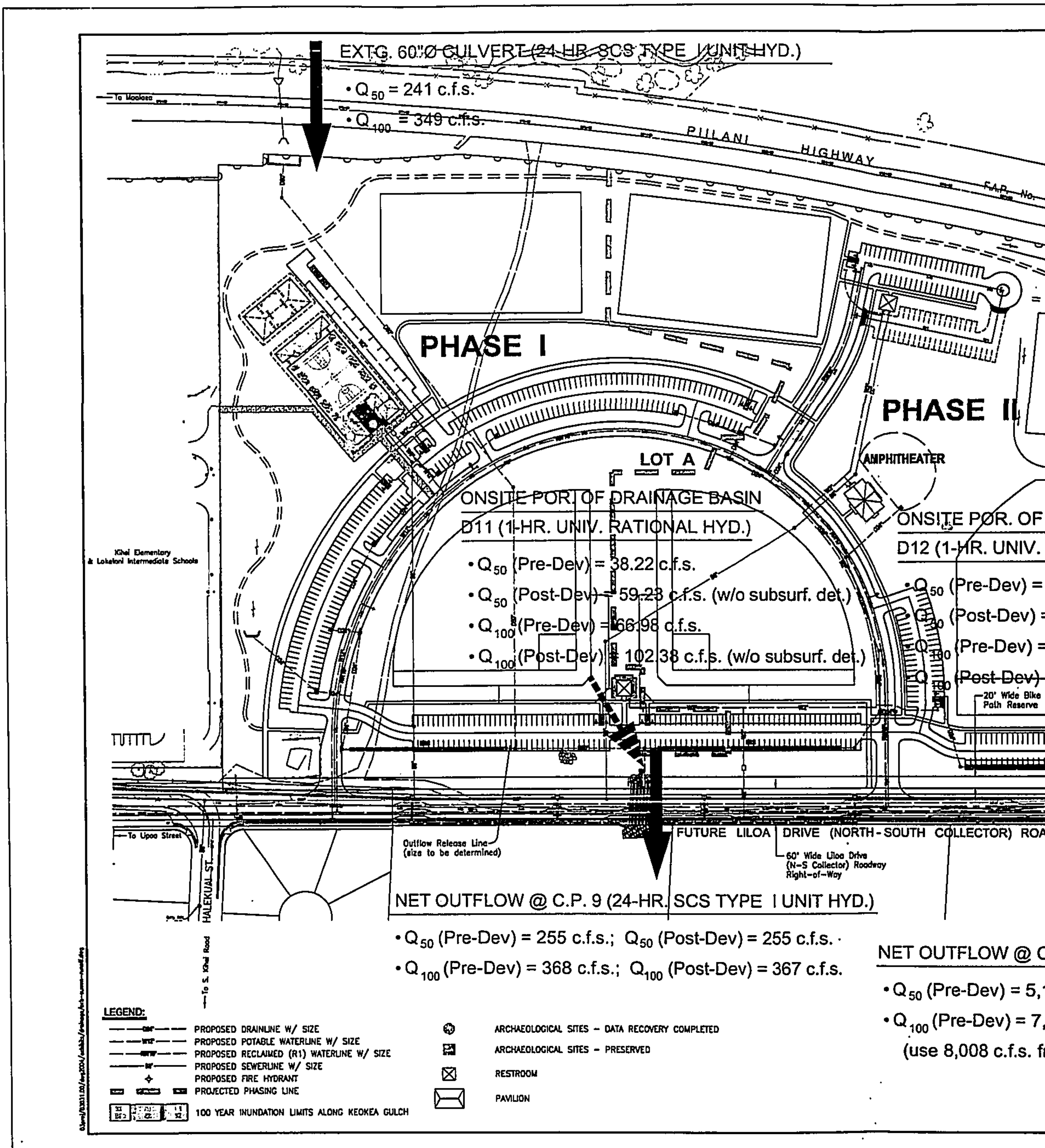
EXHIBIT "E" - GRADIN



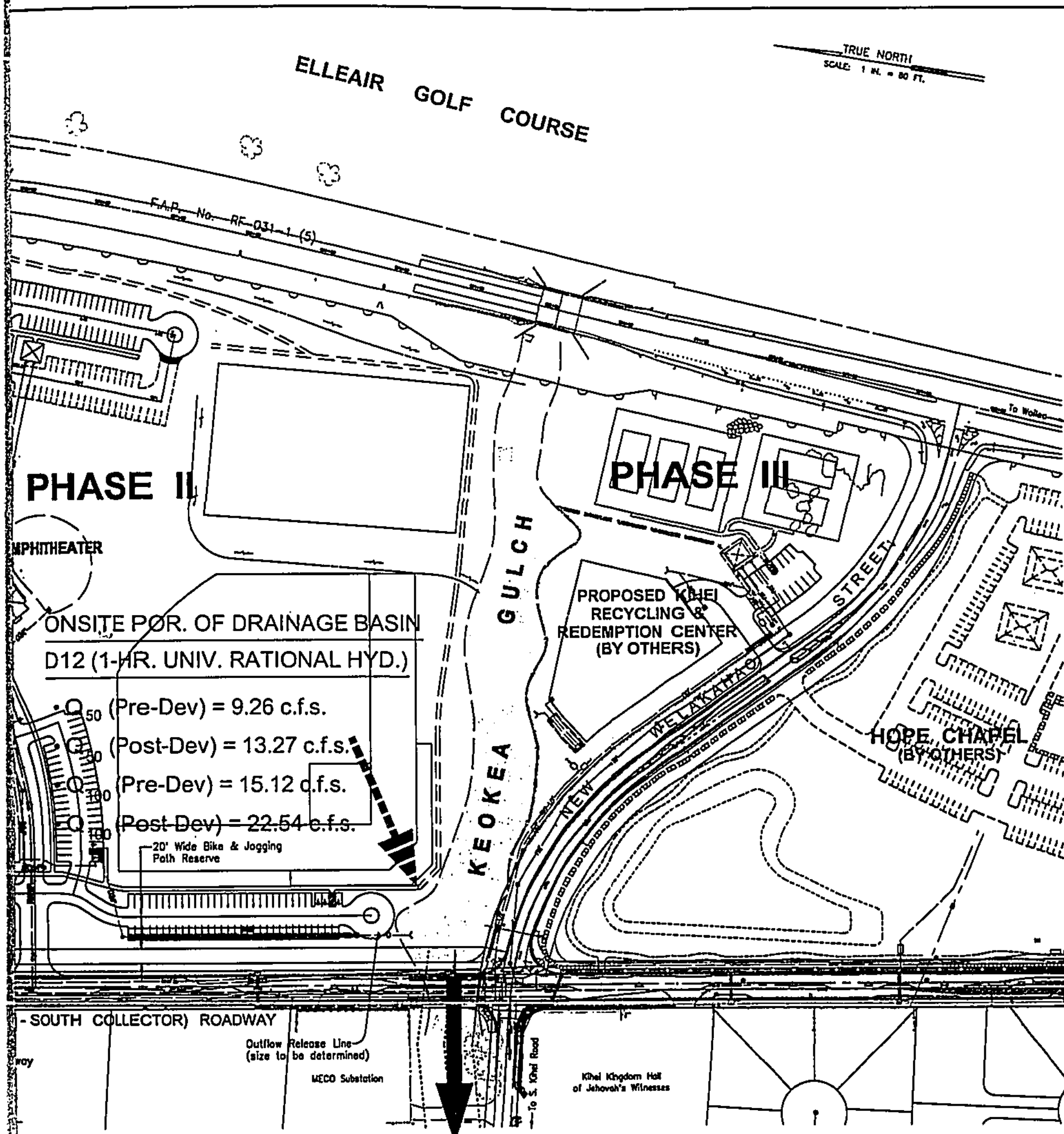
GRADING PLAN

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

April 20, 2006



EXTG. 60"Ø CULVERT (24-HR. SCS TYPE I UNIT HYD.)
• Q50 = 241 c.f.s.
• Q100 = 349 c.f.s.
PIILANI HIGHWAY
PHASE I
PHASE II
LOT A
AMPHITHEATER
ONSITE POR. OF DRAINAGE BASIN
D11 (1-HR. UNIV. RATIONAL HYD.)
• Q50 (Pre-Dev) = 38.22 c.f.s.
• Q50 (Post-Dev) = 59.23 c.f.s. (w/o subsurf. det.)
• Q100 (Pre-Dev) = 66.98 c.f.s.
• Q100 (Post-Dev) = 102.38 c.f.s. (w/o subsurf. det.)
ONSITE POR. OF
D12 (1-HR. UNIV.
• Q50 (Pre-Dev) =
• Q50 (Post-Dev) =
• Q100 (Pre-Dev) =
• Q100 (Post-Dev)
20' Wide Bike Path Reserve
Kihei Elementary & Lokelani Intermediate Schools
To Upoo Street
HALEKUAI ST.
To S. Kihei Road
Outflow Release Line (size to be determined)
FUTURE LILOA DRIVE (NORTH-SOUTH COLLECTOR) ROA
60' Wide Liloa Drive (N-S Collector) Roadway Right-of-Way
NET OUTFLOW @ C.P. 9 (24-HR. SCS TYPE I UNIT HYD.)
• Q50 (Pre-Dev) = 255 c.f.s.; Q50 (Post-Dev) = 255 c.f.s.
• Q100 (Pre-Dev) = 368 c.f.s.; Q100 (Post-Dev) = 367 c.f.s.
NET OUTFLOW @ C
• Q50 (Pre-Dev) = 5,
• Q100 (Pre-Dev) = 7,
(use 8,008 c.f.s. f
LEGEND:
PROPOSED DRAINLINE W/ SIZE
PROPOSED POTABLE WATERLINE W/ SIZE
PROPOSED RECLAIMED (R1) WATERLINE W/ SIZE
PROPOSED SEWERLINE W/ SIZE
PROPOSED FIRE HYDRANT
PROJECTED PHASING LINE
100 YEAR INUNDATION LIMITS ALONG KEOKEA GULCH
ARCHAEOLOGICAL SITES - DATA RECOVERY COMPLETED
ARCHAEOLOGICAL SITES - PRESERVED
RESTROOM
PAVILION



NET OUTFLOW @ C.P. 10 (24-HR. SCS TYPE I UNIT HYD.)

- Q_{50} (Pre-Dev) = 5,129 c.f.s.; Q_{50} (Post-Dev) = 5,129 c.f.s.
- Q_{100} (Pre-Dev) = 7,850 c.f.s.; Q_{100} (Post-Dev) = 7,850 c.f.s.
  (use 8,008 c.f.s. from Transmeridian Rpt.)

EXHIBIT "F"

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

SOUTH MAUI COMMUNITY PARK
PROJECT NO.: P03/004 TAX MAP KEY: (2) 2-2-02: 42
Waiohuli - Keokea (Kihei), Makawao, Maui, Hawaii

TITLE: SUMMARY OF ONSITE AND OFFSITE RUNOFF

DESIGNED BY: A.L.U.	CHECKED BY: C.N.M.	JOB NUMBER: 03031.00	SHEET —
DRAWN BY: D.P.T.	APPROVED BY: W.S.U.	DATE: April 19, 2006	OF SHEETS
SCALE: AS NOTED			

APPENDICES:

A. Hydrologic Calculations

B. PondPack Summary Reports and Hydrographs

C. Subsurface Drainage Detention System Calculations

D. Comparison of Peak 100-year Flows for Keokea Gulch

APPENDIX A: Hydrologic Calculations

South Maui Community Park Breakdown of Site Improvements by Phases

Phase I

Building Roofs	7,210 s.f.	
	23,478 s.f.	
	650 s.f.	
	31,338 s.f.	0.719 ac.
AC Pavement	120,321 s.f.	2.762 ac.
Concrete Sidewalk	24,993 s.f.	
	220 s.f.	
	2,647 s.f.	
	27,860 s.f.	0.640 ac.
Grassed Area	565,866 s.f.	12.990 ac.
Total	745,385 s.f.	17.111 ac.

Phase II

Building Roofs	2,420 s.f.	
	650 s.f.	
	3,070 s.f.	0.070 ac.
AC Pavement	92,754 s.f.	2.129 ac.
Concrete Sidewalk	3,092 s.f.	
	2,252 s.f.	
	661 s.f.	
	132 s.f.	
	9,298 s.f.	
	15,435 s.f.	0.354 ac.
Grassed Area	783,560 s.f.	17.988 ac.
Total	894,819 s.f.	20.542 ac.

South Maui Community Park Breakdown of Site Improvements by Phases

Phase III

Building Roofs	1,063 s.f.	0.024 ac.
AC Pavement	5,092 s.f.	0.117 ac.
Concrete Sidewalk	1,855 s.f.	0.043 ac.
Grassed Area	45,192 s.f.	1.037 ac.
Tennis Courts	21,580 s.f.	
	15,015 s.f.	
	36,595 s.f.	0.840 ac.
Total	89,797 s.f.	2.061 ac.

Recycling Center

Building Roofs	0 s.f.	0.000 ac.
AC Pavement	4,062 s.f.	0.093 ac.
Recycling Area	31,233 s.f.	0.717 ac.
Concrete Sidewalks	186 s.f.	0.004 ac.
Grassed Area	38245 s.f.	0.878 ac.
Total	73726 s.f.	1.693 ac.

South Maui Community Park Breakdown of Site Improvements by Drainage Areas

D11

Building Roofs	7,210 s.f.	
	23,478 s.f.	
	650 s.f.	
	2,420 s.f.	
	650 s.f.	
	34,408 s.f.	0.790 ac.
AC Pavement	194,477 s.f.	4.465 ac.
Concrete Sidewalk	26,298 s.f.	
	4,899 s.f.	
	220 s.f.	
	58 s.f.	
	132 s.f.	
	640 s.f.	
	661 s.f.	
	32,908 s.f.	0.755 ac.
Grassed Area	1,006,685 s.f.	23.110 ac.
Total	1,268,478 s.f.	29.120 ac.

D12

Building Roofs	0 s.f.	0.000 ac.
AC Pavement	2,596 s.f.	
	605 s.f.	
	10,758 s.f.	
	13,959 s.f.	0.320 ac.
Concrete Sidewalk	5,963 s.f.	0.137 ac.
Grassed Area	290,140 s.f.	6.661 ac.
Total	310,062 s.f.	0.7118 ac.

Worksheet for Weighted Average CN for Pre-Development Phases

Phase I Development								
Item	*Area (ft^2)*	*Subtotal Area (ft^2)*	*Subtotal Area (acres)*	*Total Area (acres)*	*CN*	*Area x CN*	*Sum of AreaxCN*	*CN*
D10	61,664	61,664	1.416	17.112	83	117.53	1498.778	87.59
D11	683,721	683,721	15.696		88	1381.25		
Phase II Development								
D11	584,758	584,758	13.424	20.542	88	1181.312	1836.168	89.39
D12	310,062	310,062	7.118		92	654.856		
Phase I and Phase II Development Combined								
			Subtotal Area (acres)	Total Area (acres)	Area x CN	Total Area x CN	Subtotal CN	Overall CN
Phase I			17.112	37.654	1,498.778	3334.95	87.59	88.57
Phase II			20.542		1,836.168		89.39	

Worksheet for Weighted Average CN for Developing Phases

Item	Area (ft^2)	Subtotal Area (ft^2)	Subtotal Area (acres)	Total Area (acres)	CN	Area x CN	Sum of AreaxCN	CN
Phase I Development								
Building Roofs	7,210	31,338	0.719	17.111	98	70.462	1365.122	78.78
	23,478							
	650							
AC Pavement	120,321	120,321	2.762		98	270.68		
Concrete Sidewalks	24,993	27,860	0.640		98	62.72		
	220							
	2,647							
Grassed Area	565,866	565,866	12.990		74	961.26		
Phase II Development								
Building Roofs	2,420	3,070	0.070	20.542	98	6.860	1581.306	76.98
	650							
AC Pavement	92,754	92,754	2.129		98	208.642		
Concrete Sidewalks	3,092	15,435	0.354		98	34.692		
	2,252							
	661							
	132							
	9,298							
Grassed Area	783,560	783,560	17.988		74	1331.112		

Worksheet for Weighted Average CN for Developing Phases

Item	Area (ft^2)	Subtotal Area (ft^2)	Subtotal Area (acres)	Total Area (acres)	CN	Area x CN	Sum of AreaxCN	CN
Phase III Development								
Building Roofs	1,063	1,063	0.024	2.061	98	2.352	177.090	85.92
AC Pavement	5,092	5,092	0.117		98	11.466		
Concrete Sidewalks	1,855	1,855	0.043		98	4.214		
Grassed Area	45,192	45,192	1.037		74	76.738		
Tennis Courts	21,580 15,015	36,595	0.840		98	82.320		
Phase I and Phase II Development Combined								
			Subtotal Area (acres)	Total Area (acres)	Area x CN	Total Area x CN	Subtotal CN	Overall CN
Phase I			17.111	37.653	1,365.122	2946.43	78.78	78.25
Phase II			20.542		1,581.306		76.98	

South Maui Community Park - Summary of Cumulative Peak Flows and Volumes by Universal Rational Method - On-Site Models Only

Model	Subarea	Area (acs)	Qpeak (cfs)	Qpeak (hr)	Volume (ac-ft)	Location	Comments
D11 Pre-Development	D11	29.12	38.22	0.65	2.365	On-Site	C = 0.300
D11 Post-Development	D11	29.12	59.23	0.70	3.823	On-Site	C = 0.477
D12 Pre-Development	D12	7.12	9.26	0.75	0.629	On-Site	C = 0.300
D12 Post-Development	D12	7.12	13.27	0.70	0.85	On-Site	C = 0.423

Worksheet for Weighted Average CN for Post-Development Phases

D11 Development								
Item	Area (ft^2)	Subtotal Area (ft^2)	Subtotal Area (acres)	Total Area (acres)	CN	Area x CN	Sum of AreaxCN	CN
Phase I	683,721	683,721	15.696	29.120	78.78	1236.53	2269.91	77.95
Phase II	584,758	584,758	13.424		76.98	1033.38		
D12 Development								
Phase I	0	0	0	7.118	0.00	0.00	547.940	76.98
Phase II	310,062	310,062	7.118		76.98	636.278		

South Maui Community Park - Summary of SCS Unit Hydrograph Analysis Parameters - Combined Off-Site and On-Site Models

Model	Subarea	Area (acs)	CN	Tc (hrs)	Downstream Subarea	Location	Comments
D11 Pre-Development	15RB	166.60	68	1.10	15RC	Off-Site	All parameters supplied by R M Towill Corp
	15RC	2.40	84	0.25	15RA	Off-Site	
	15RA	54.40	78	0.47	E9(D11)	Off-Site	
	E9(D11)	29.12	81	0.22	Outfall	On-Site	
D11 Post-Development	15RB	166.60	68	1.10	15RC	Off-Site	All Off-Site paramters supplied by R M. Towill Corp
	15RC	2.40	84	0.25	15RA	Off-Site	
	15RA	54.40	78	0.47	E9(D11)	Off-Site	
	E9(D11)	29.12	77.95*	0.2254**	Outfall	On-Site	*CN calculated by Weighted Area, **Tc calculated by PondPack SCS Lag Method
D12 Pre-Development	16RB	57.70	76	0.39	16RA	Off-Site	All parameters supplied by R M Towill Corp
	16RA	65.50	77	0.51	E10(D12)	Off-Site	
	17R	137.70	72	0.67	18RA	Off-Site	
	18RC (Keokea Gulch)	5336.00	62	1.32	18RA	Off-Site	
	18RA	51.90	76	0.33	E10(D12)	Off-Site	
	E10(D12)	7.12	81	0.25	Outfall	On-Site	

South Maui Community Park - Summary of SCS Unit Hydrograph Analysis Parameters - Combined Off-Site and On-Site Models

Model	Subarea	Area (acs)	CN	Tc (hrs)	Downstream Subarea	Location	Comments
D12 Post-Development	16RB	57.70	76	0.39	16RA	Off-Site	All Off-Site paramters supplied by R M. Towill Corp
	16RA	65.50	77	0.51	E10(D12)	Off-Site	
	17R	137.70	72	0.67	18RA	Off-Site	
	18RC (Keokea Gulch)	5336.00	62	1.32	18RA	Off-Site	
	18RA	51.90	76	0.33	E10(D12)	Off-Site	
	E10(D12)	7.12	76.98*	0.232**	Outfall	On-Site	*CN calculated by Weighted Area, **Tc calculated by PondPack SCS Lag Method

South Maui Community Park - Summary of Cumulative Peak Flows and Volumes - Combined Off-Site and On-Site Models

Model	*Subarea*	*Area (acs)*	*Qpeak (cfs)*	*Qpeak (hr)*	*Volume (ac-ft)*	*Location*	*Comments*
D11 Pre-Development	15RB	166.60	371.25	12.75	62.320	Off-Site	All parameters supplied by R M Towill Corp
	15RC	2.40	373.08	13.00	63.597	Off-Site	
	15RA	54.40	404.58	13.45	89.296	Off-Site	
	E9(D11)	29.12	416.67	13.65	103.919	On-Site	
D11 Post-Development	15RB	166.60	371.25	12.75	62.320	Off-Site	All Off-Site paramters supplied by R M. Towill Corp
	15RC	2.40	373.08	13.00	63.597	Off-Site	
	15RA	54.40	404.58	13.45	89.296	Off-Site	
	E9(D11)	29.12	416.39	13.65	103.053	On-Site	*CN calculated by Weighted Area, **Tc calculated by PondPack SCS Lag Method
D12 Pre-Development	16RB	57.70	294.02	12.30	26.105	Off-Site	All parameters supplied by R M Towill Corp
	16RA	65.50	424.98	12.75	56.399	Off-Site	
	17R	137.70	469.76	12.50	56.898	Off-Site	
	18RC (Keokea Gulch)	5336.00	4878.00	13.00	1034.232	Off-Site	
	18RA	51.90	5114.38	13.35	1114.608	Off-Site	
	E10(D12)	7.12	5234.31	13.60	1174.582	On-Site	

South Maui Community Park - Summary of Cumulative Peak Flows and Volumes - Combined Off-Site and On-Site Models

Model	Subarea	Area (acs)	Qpeak (cfs)	Qpeak (hr)	Volume (ac-ft)	Location	Comments
D12 Post-Development	16RB	57.70	294.02	12.30	26.105	Off-Site	All Off-Site paramters supplied by R M. Towill Corp
	16RA	65.50	424.98	12.75	56.399	Off-Site	
	17R	137.70	469.76	12.50	56.898	Off-Site	
	18RC (Keokea Gulch)	5336.00	4878.00	13.00	1034.232	Off-Site	
	18RA	51.90	5114.38	13.35	1114.608	Off-Site	
	E10(D12)	7.12	5234.17	13.60	1174.30	On-Site	*CN calculated by Weighted Area, **Tc calculated by PondPack SCS Lag Method

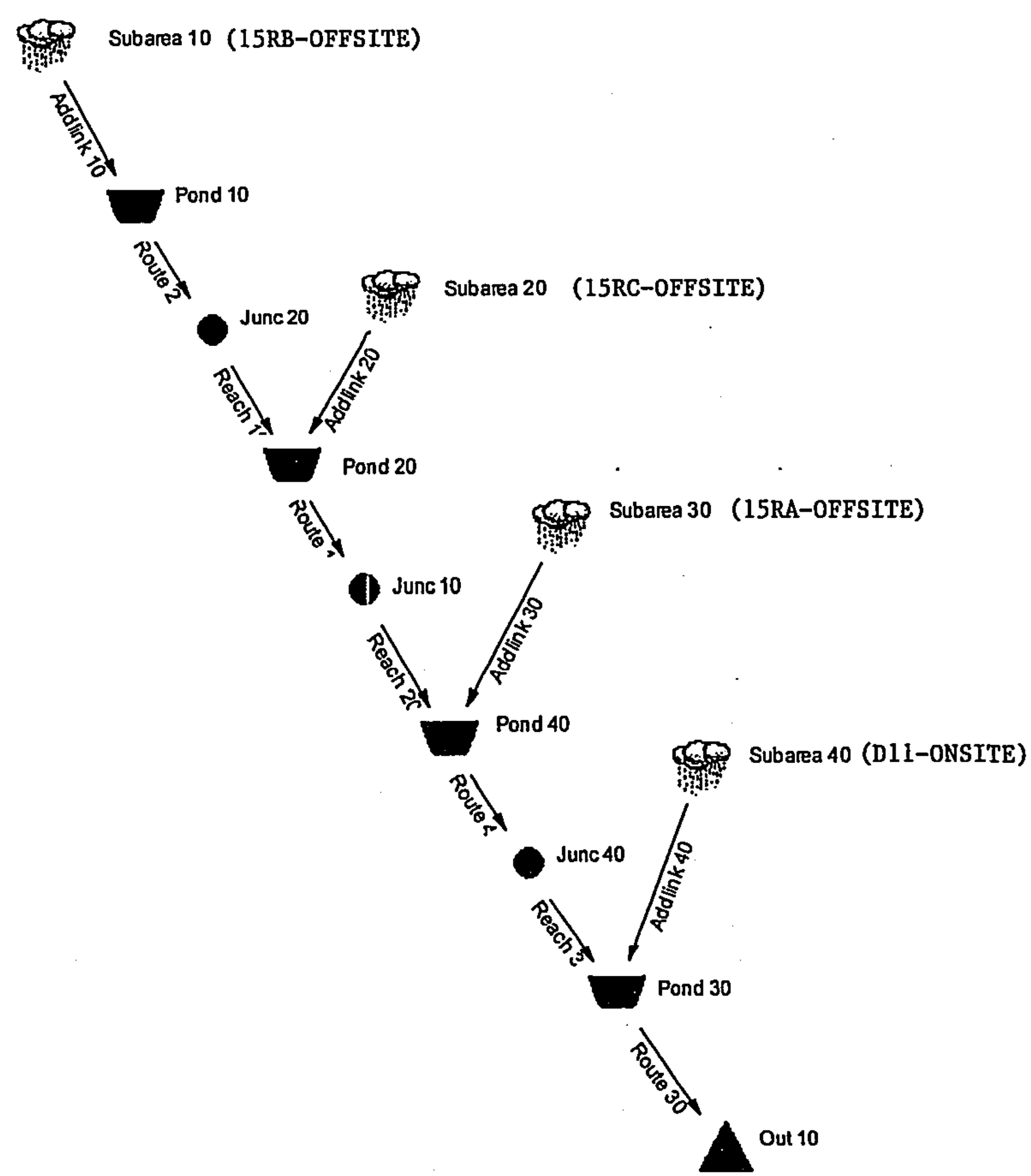
Worksheet for Weighted Average Rational C for Developing Phases

Item	Area (ft^2)	Subtotal Area (ft^2)	Subtotal Area (acres)	Total Area (acres)	C	Area x C	Sum of AreaxC	C
Phase I Development								
Building Roofs	7,210	31,338	0.719	17.111	0.95	0.683	8.397	0.524
	23,478							
	650							
AC Pavement	120,321	120,321	2.762		0.95	2.624		
Concrete Sidewalks	24,993	27,860	0.640		0.85	0.544		
	220							
	2,647							
Grassed Area	565,866	565,866	12.990		0.35	4.546		
Phase II Development								
Building Roofs	2,420	3,070	0.070	20.542	0.95	0.067	8.686	0.423
	650							
AC Pavement	92,754	92,754	2.129		0.85	2.023		
Concrete Sidewalks	3,092	15,435	0.354		0.85	0.301		
	2,252							
	661							
	132							
	9,298							
Grassed Area	783,560	783,560	17.988		0.35	6.296		

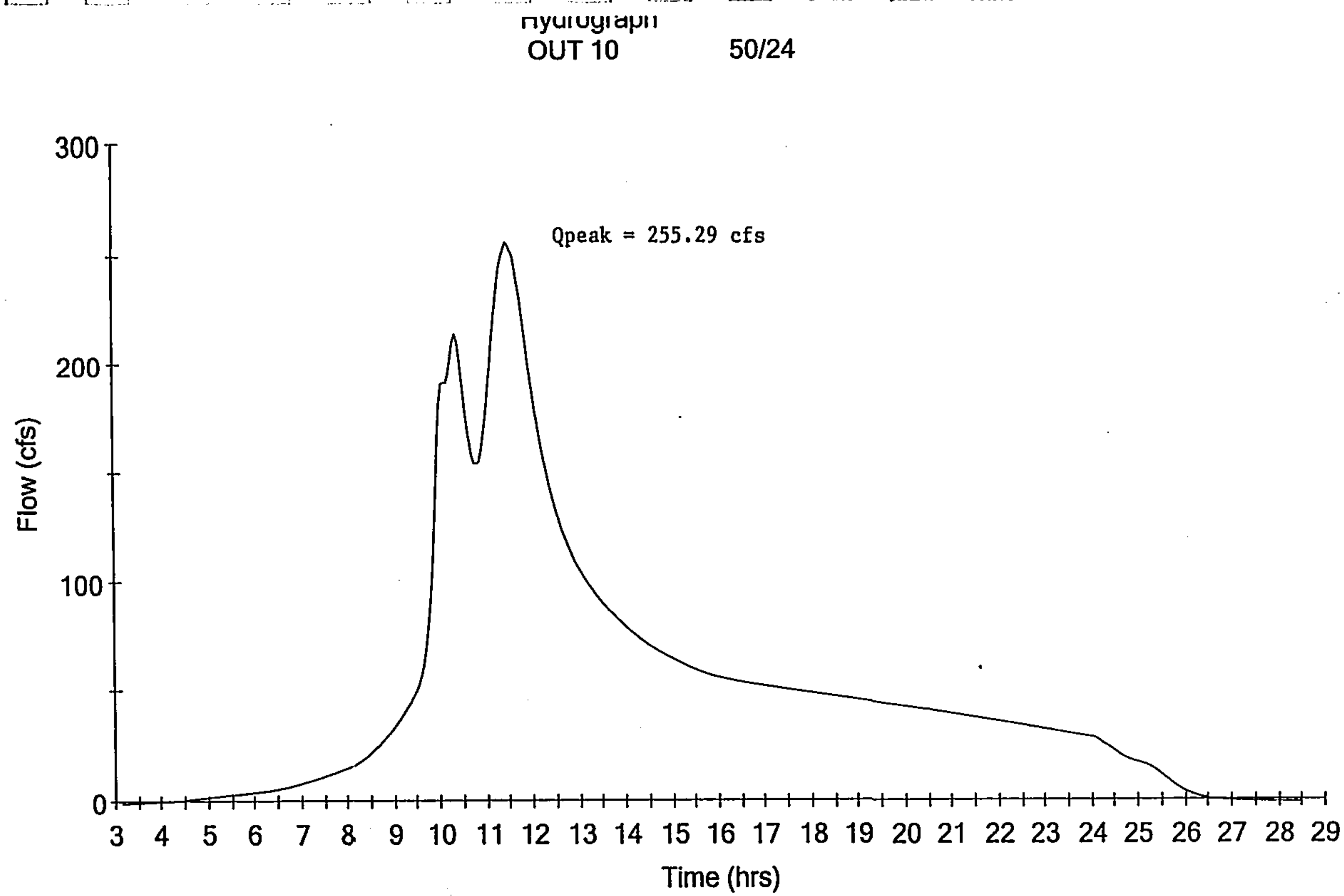
Worksheet for Weighted Average Rational C for Developing Phases

Item	Area (ft^2)	Subtotal Area (ft^2)	Subtotal Area (acres)	Total Area (acres)	C	Area x C	Sum of AreaxC	C
Phase III Development								
Building Roofs	1,063	1,063	0.024	2.061	0.95	0.023	1.331	0.646
AC Pavement	5,092	5,092	0.117		0.95	0.111		
Concrete Sidewalks	1,855	1,855	0.043		0.85	0.037		
Grassed Area	45,192	45,192	1.037		0.35	0.363		
Tennis Courts	21,580 15,015	36,595	0.840		0.95	0.798		
Phase I and Phase II Development Combined								
			Subtotal Area (acres)	Total Area (acres)	Area x C	Total Area x C	Subtotal C	Overall C
Phase I			17.111	37.653	8.397	17.083	0.524	0.454
Phase II			20.542		8.686		0.423	

APPENDIX B: PondPack Summary Reports and Hydrographs



SCHEMATIC DIAGRAM OF PONDPACK MODEL 1A FOR DRAINAGEWAY D-11



MODEL 1A PRE-DEVELOPMENT HYDROGRAPH (50-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 100yrKihei24

Return Event	Total Depth in	Rainfall Type	RNF ID
50/24	8.3000	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
JUNC 10		JCT	50	63.594		10.8000	211.10		
JUNC 20		JCT	50	62.317		10.5500	209.47		
JUNC 40		JCT	50	89.293		11.2500	241.21		
*OUT 10		JCT	50	103.916		11.4500	255.29		
POND 10	IN	POND	50	62.317		10.5500	209.47		
POND 10	OUT	POND	50	62.317		10.5500	209.47		
POND 20	IN	POND	50	63.594		10.8000	211.10		
POND 20	OUT	POND	50	63.594		10.8000	211.10		
POND 30	IN	POND	50	103.916		11.4500	255.29		
POND 30	OUT	POND	50	103.916		11.4500	255.29		
POND 40	IN	POND	50	89.293		11.2500	241.21		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 40	OUT	POND	50	89.293		11.2500	241.21		
SUBAREA 10		AREA	50	62.317		10.5500	209.47		
SUBAREA 20		AREA	50	1.277		10.0500	9.50		
SUBAREA 30		AREA	50	25.699		10.1500	146.17		
SUBAREA 40		AREA	50	14.623		10.0000	113.74		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 30	POND 30	IN	work_pad.hyg	ROUTE 30	50/24

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 30	50/24	103.916	11.4500	255.29

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	50/24	103.916	11.4500	255.29

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\work_pad.hyg
HYG ID = OUT 10
HYG Tag = 50/24

Peak Discharge = 255.29 cfs
Time to Peak = 11.4500 hrs
HYG Volume = 103.916 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
3.1500	.00	.00	.01	.03	.06
3.4000	.09	.13	.17	.21	.25
3.6500	.29	.33	.38	.42	.47
3.9000	.51	.56	.61	.67	.73
4.1500	.80	.88	.96	1.05	1.15
4.4000	1.25	1.35	1.45	1.56	1.67
4.6500	1.78	1.89	1.99	2.10	2.21
4.9000	2.32	2.43	2.54	2.65	2.76
5.1500	2.86	2.97	3.08	3.18	3.29
5.4000	3.40	3.50	3.61	3.71	3.82
5.6500	3.92	4.03	4.13	4.23	4.34
5.9000	4.44	4.54	4.64	4.75	4.85
6.1500	4.97	5.09	5.23	5.37	5.52
6.4000	5.67	5.83	6.01	6.19	6.39
6.6500	6.59	6.81	7.04	7.28	7.53
6.9000	7.78	8.06	8.35	8.65	8.96
7.1500	9.28	9.58	9.91	10.24	10.56
7.4000	10.92	11.26	11.60	11.96	12.31
7.6500	12.67	13.04	13.41	13.77	14.16
7.9000	14.55	14.95	15.36	15.78	16.23
8.1500	16.75	17.34	17.97	18.67	19.40
8.4000	20.19	21.04	21.95	22.91	23.93
8.6500	25.01	26.14	27.31	28.51	29.74
8.9000	31.00	32.30	33.63	34.99	36.40
9.1500	37.91	39.52	41.20	43.00	44.88
9.4000	46.85	48.99	51.24	53.93	57.79
9.6500	63.08	70.45	80.16	92.92	110.30
9.9000	135.19	161.98	181.87	190.84	191.57
10.1500	191.23	194.94	202.54	210.17	213.65
10.4000	209.70	201.68	191.44	180.25	170.58
10.6500	163.69	157.75	154.61	154.38	155.23

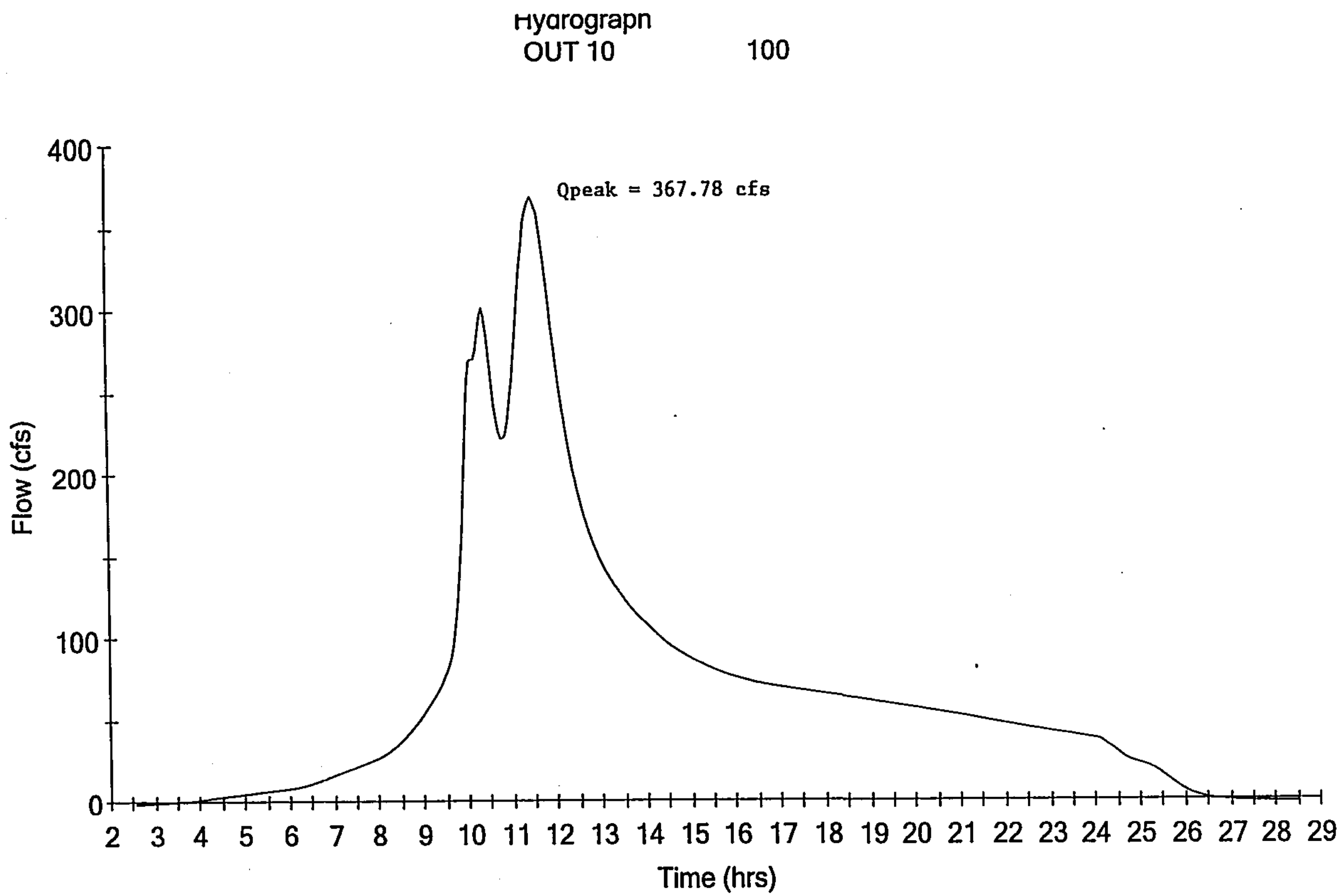
HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
10.9000	159.88	167.80	176.58	187.45	199.89
11.1500	212.88	223.64	233.40	243.42	248.46
11.4000	251.80	255.29	253.96	251.52	249.20
11.6500	243.11	236.49	229.94	221.23	212.40
11.9000	203.60	195.54	187.50	179.57	173.09
12.1500	166.63	160.34	155.12	149.90	144.87
12.4000	140.55	136.25	132.19	128.76	125.34
12.6500	122.14	119.35	116.57	113.99	111.69
12.9000	109.40	107.29	105.37	103.46	101.69
13.1500	100.03	98.37	96.84	95.38	93.92
13.4000	92.56	91.26	89.96	88.75	87.59
13.6500	86.42	85.33	84.27	83.20	82.20
13.9000	81.20	80.21	79.25	78.29	77.35
14.1500	76.44	75.56	74.70	73.88	73.08
14.4000	72.30	71.59	70.89	70.21	69.57
14.6500	68.93	68.32	67.71	67.12	66.53
14.9000	65.95	65.38	64.81	64.25	63.69
15.1500	63.14	62.60	62.06	61.55	61.05
15.4000	60.56	60.10	59.66	59.23	58.83
15.6500	58.45	58.08	57.74	57.43	57.11
15.9000	56.83	56.56	56.29	56.05	55.81
16.1500	55.57	55.36	55.15	54.94	54.74
16.4000	54.55	54.36	54.17	53.99	53.81
16.6500	53.64	53.46	53.29	53.12	52.95
16.9000	52.79	52.62	52.46	52.29	52.13
17.1500	51.97	51.81	51.65	51.49	51.33
17.4000	51.17	51.01	50.85	50.70	50.54
17.6500	50.38	50.22	50.06	49.90	49.74
17.9000	49.59	49.43	49.27	49.11	48.95
18.1500	48.79	48.63	48.47	48.31	48.15
18.4000	47.99	47.83	47.67	47.51	47.35
18.6500	47.18	47.02	46.86	46.70	46.53
18.9000	46.37	46.21	46.04	45.88	45.72
19.1500	45.55	45.39	45.22	45.06	44.89
19.4000	44.73	44.56	44.40	44.23	44.06
19.6500	43.90	43.73	43.56	43.40	43.23
19.9000	43.06	42.89	42.73	42.56	42.39
20.1500	42.22	42.05	41.88	41.71	41.55
20.4000	41.38	41.21	41.04	40.87	40.70
20.6500	40.53	40.36	40.18	40.01	39.84
20.9000	39.67	39.50	39.33	39.16	38.98
21.1500	38.81	38.64	38.47	38.30	38.12
21.4000	37.95	37.78	37.60	37.43	37.26
21.6500	37.08	36.91	36.73	36.56	36.39
21.9000	36.21	36.04	35.86	35.69	35.51

Type.... Node: Addition Summary
Event: 50 yr
Name.... OUT 10
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\D11PreDevelopment.ppw
Storm... TypeI 24hr Tag: 50/24

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
22.1500	35.34	35.16	34.99	34.81	34.63
22.4000	34.46	34.28	34.11	33.93	33.75
22.6500	33.58	33.40	33.22	33.05	32.87
22.9000	32.69	32.52	32.34	32.16	31.98
23.1500	31.81	31.63	31.45	31.27	31.09
23.4000	30.91	30.74	30.56	30.38	30.20
23.6500	30.02	29.84	29.66	29.48	29.30
23.9000	29.12	28.94	28.76	28.44	27.75
24.1500	26.85	26.02	25.38	24.82	24.22
24.4000	23.51	22.71	21.89	21.11	20.40
24.6500	19.79	19.28	18.87	18.49	18.12
24.9000	17.81	17.54	17.21	16.89	16.59
25.1500	16.10	15.62	15.13	14.42	13.71
25.4000	12.99	12.15	11.31	10.47	9.64
25.6500	8.81	8.00	7.26	6.52	5.83
25.9000	5.25	4.66	4.14	3.73	3.31
26.1500	2.95	2.66	2.36	2.11	1.90
26.4000	1.69	1.51	1.35	1.20	1.07
26.6500	.96	.85	.76	.68	.60
26.9000	.54	.48	.42	.38	.34
27.1500	.30	.27	.24	.21	.19
27.4000	.16	.14	.13	.11	.10
27.6500	.08	.07	.06	.05	.05
27.9000	.04	.03	.03	.02	.02
28.1500	.01	.01	.01	.00	.00
28.4000	.00	.00			



MODEL 1A PRE-DEVELOPMENT OUTLET HYDROGRAPH (100-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 100yr24hrKihei

Return Event	Total Depth in	Rainfall Type	RNF ID
100	10.5000	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
JUNC 10		JCT	100	90.635		10.8000	309.32		
JUNC 20		JCT	100	88.931		10.5500	307.20		
JUNC 40		JCT	100	125.718		11.2500	349.33		
*OUT 10		JCT	100	145.446		11.4500	367.78		
POND 10	IN	POND	100	88.931		10.5500	307.20		
POND 10	OUT	POND	100	88.931		10.5500	307.20		
POND 20	IN	POND	100	90.635		10.8000	309.32		
POND 20	OUT	POND	100	90.635		10.8000	309.32		
POND 30	IN	POND	100	145.446		11.4500	367.78		
POND 30	OUT	POND	100	145.446		11.4500	367.78		
POND 40	IN	POND	100	125.718		11.2500	349.33		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 40 OUT	POND	100	125.718		11.2500	349.33		
SUBAREA 10	AREA	100	88.931		10.5500	307.20		
SUBAREA 20	AREA	100	1.703		10.0500	12.58		
SUBAREA 30	AREA	100	35.083		10.1500	200.30		
SUBAREA 40	AREA	100	19.728		10.0000	153.12		

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 100yr24hrKihei

Return Event	Total Depth in	Rainfall Type	RNF ID
100	10.5000	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
JUNC 10		JCT	100	90.635		10.8000	309.32		
JUNC 20		JCT	100	88.931		10.5500	307.20		
JUNC 40		JCT	100	125.718		11.2500	349.33		
*OUT 10		JCT	100	145.446		11.4500	367.78		
POND 10	IN	POND	100	88.931		10.5500	307.20		
POND 10	OUT	POND	100	88.931		10.5500	307.20		
POND 20	IN	POND	100	90.635		10.8000	309.32		
POND 20	OUT	POND	100	90.635		10.8000	309.32		
POND 30	IN	POND	100	145.446		11.4500	367.78		
POND 30	OUT	POND	100	145.446		11.4500	367.78		
POND 40	IN	POND	100	125.718		11.2500	349.33		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 40 OUT	POND	100	125.718		11.2500	349.33		
SUBAREA 10	AREA	100	88.931		10.5500	307.20		
SUBAREA 20	AREA	100	1.703		10.0500	12.58		
SUBAREA 30	AREA	100	35.083		10.1500	200.30		
SUBAREA 40	AREA	100	19.728		10.0000	153.12		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ROUTE 30	POND 30 IN	work_pad.hyg	ROUTE 30	100

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 30	100	145.446	11.4500	367.78

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	100	145.446	11.4500	367.78

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\work_pad.hyg
HYG ID = OUT 10
HYG Tag = 100

Peak Discharge = 367.78 cfs
Time to Peak = 11.4500 hrs
HYG Volume = 145.446 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
2.5500	.00	.00	.01	.04	.07
2.8000	.11	.16	.21	.26	.32
3.0500	.38	.44	.49	.55	.61
3.3000	.68	.75	.82	.91	1.01
3.5500	1.12	1.24	1.37	1.50	1.64
3.8000	1.79	1.94	2.09	2.25	2.40
4.0500	2.56	2.73	2.89	3.05	3.20
4.3000	3.36	3.53	3.69	3.85	4.00
4.5500	4.16	4.32	4.47	4.62	4.78
4.8000	4.93	5.08	5.23	5.38	5.53
5.0500	5.68	5.82	5.97	6.11	6.26
5.3000	6.40	6.54	6.69	6.83	6.97
5.5500	7.11	7.25	7.40	7.54	7.69
5.8000	7.85	8.00	8.17	8.35	8.53
6.0500	8.72	8.94	9.18	9.44	9.74
6.3000	10.05	10.38	10.74	11.11	11.52
6.5500	11.95	12.39	12.85	13.34	13.84
6.8000	14.36	14.89	15.42	15.97	16.53
7.0500	17.10	17.68	18.25	18.80	19.37
7.3000	19.93	20.48	21.06	21.63	22.18
7.5500	22.75	23.32	23.88	24.46	25.03
7.8000	25.61	26.21	26.81	27.42	28.05
8.0500	28.69	29.39	30.17	31.05	32.00
8.3000	33.03	34.11	35.27	36.52	37.85
8.5500	39.26	40.74	42.30	43.93	45.59
8.8000	47.31	49.06	50.86	52.68	54.55
9.0500	56.46	58.44	60.55	62.79	65.13
9.3000	67.65	70.27	73.01	76.01	79.17
9.5500	82.92	88.31	95.67	105.87	119.26
9.8000	136.73	160.34	193.98	230.00	256.62
10.0500	268.67	269.90	269.89	275.29	285.73

Type.... Node: Addition Summary
Name.... OUT 10
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\D11PreDevelopment.ppw
Storm... TypeI 24hr Tag: 100

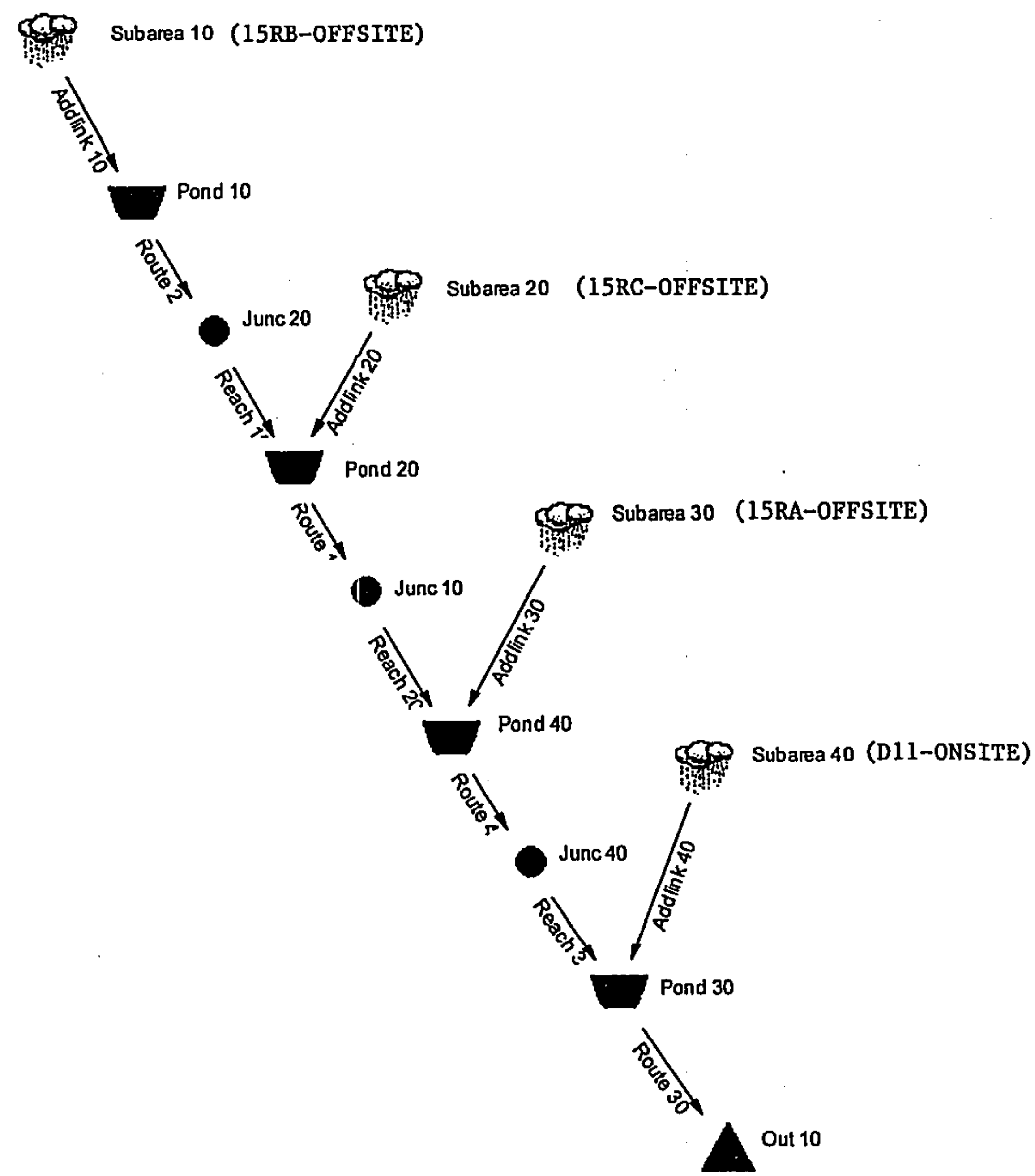
Event: 100 yr

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

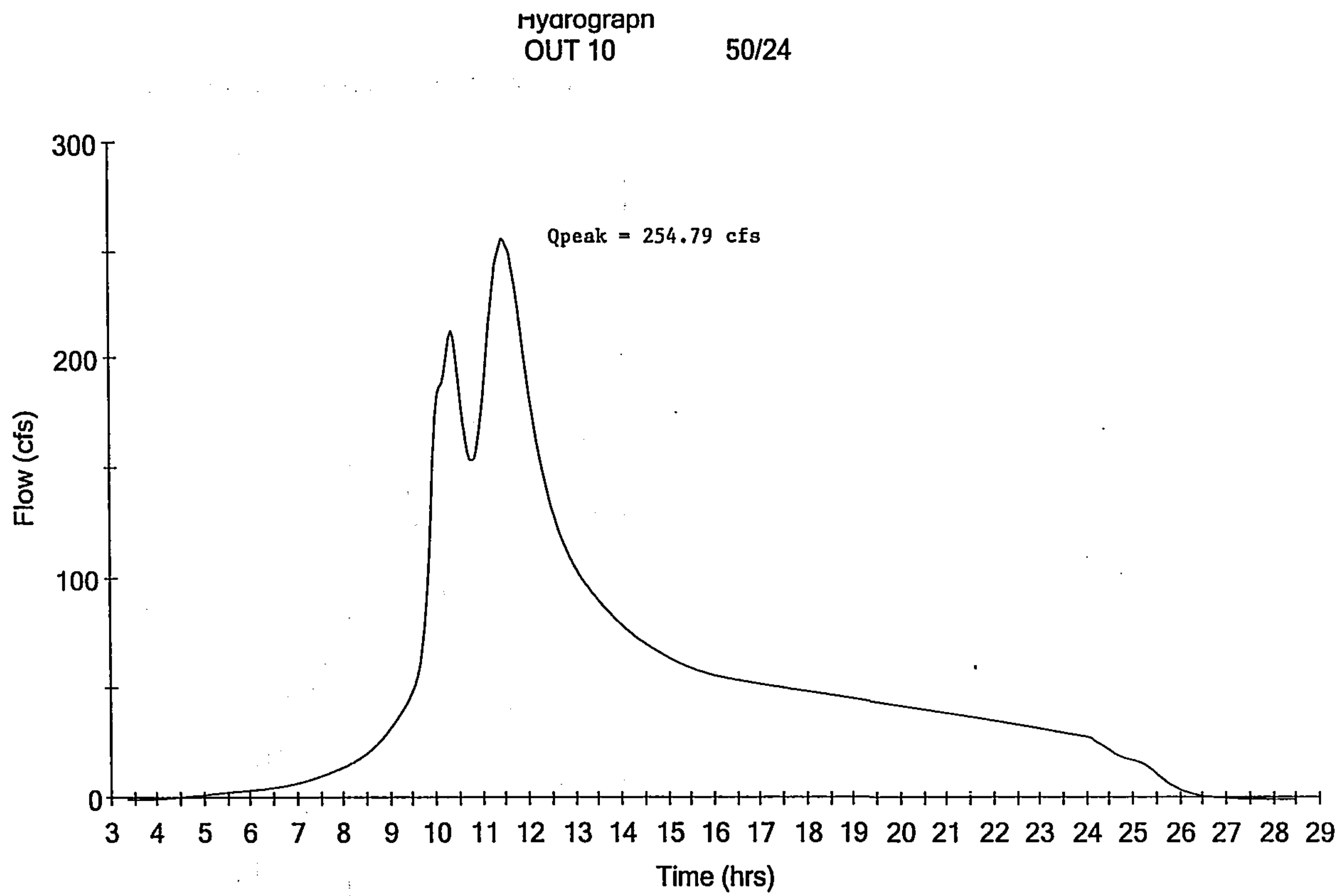
Time hrs					
10.3000	295.99	300.49	294.86	283.77	269.76
10.5500	254.52	241.51	232.48	224.81	221.19
10.8000	221.79	223.89	231.32	243.33	256.51
11.0500	272.46	290.51	309.30	324.60	338.34
11.3000	352.41	359.14	363.37	367.78	365.22
11.5500	361.03	357.00	347.60	337.44	327.37
11.8000	314.35	301.17	288.01	276.12	264.23
12.0500	252.53	243.00	233.50	224.27	216.61
12.3000	208.97	201.61	195.31	189.04	183.11
12.5500	178.13	173.16	168.50	164.46	160.43
12.8000	156.68	153.36	150.05	147.00	144.25
13.0500	141.49	138.94	136.57	134.20	132.01
13.3000	129.92	127.84	125.92	124.07	122.23
13.5500	120.53	118.88	117.23	115.70	114.21
13.8000	112.71	111.30	109.91	108.52	107.18
14.0500	105.84	104.53	103.27	102.04	100.83
14.3000	99.70	98.59	97.51	96.51	95.54
14.5500	94.60	93.70	92.82	91.97	91.13
14.8000	90.30	89.48	88.68	87.88	87.09
15.0500	86.31	85.53	84.77	84.03	83.29
15.3000	82.57	81.89	81.21	80.57	79.96
15.5500	79.36	78.81	78.29	77.77	77.30
15.8000	76.86	76.42	76.03	75.66	75.28
16.0500	74.95	74.62	74.29	73.99	73.70
16.3000	73.41	73.13	72.86	72.59	72.34
16.5500	72.09	71.84	71.59	71.35	71.11
16.8000	70.88	70.64	70.41	70.18	69.96
17.0500	69.73	69.50	69.28	69.06	68.84
17.3000	68.61	68.39	68.17	67.95	67.73
17.5500	67.52	67.30	67.08	66.86	66.64
17.8000	66.42	66.20	65.99	65.77	65.55
18.0500	65.33	65.11	64.89	64.67	64.45
18.3000	64.23	64.02	63.80	63.58	63.36
18.5500	63.14	62.91	62.69	62.47	62.25
18.8000	62.03	61.81	61.58	61.36	61.14
19.0500	60.92	60.69	60.47	60.25	60.02
19.3000	59.80	59.57	59.35	59.12	58.90
19.5500	58.67	58.45	58.22	58.00	57.77
19.8000	57.54	57.32	57.09	56.86	56.64
20.0500	56.41	56.18	55.96	55.73	55.50
20.3000	55.27	55.04	54.81	54.59	54.36
20.5500	54.13	53.90	53.67	53.44	53.21
20.8000	52.98	52.75	52.52	52.29	52.06
21.0500	51.83	51.60	51.36	51.13	50.90
21.3000	50.67	50.44	50.21	49.97	49.74

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
21.5500	49.51	49.28	49.04	48.81	48.58
21.8000	48.34	48.11	47.88	47.64	47.41
22.0500	47.18	46.94	46.71	46.47	46.24
22.3000	46.00	45.77	45.53	45.30	45.06
22.5500	44.83	44.59	44.36	44.12	43.89
22.8000	43.65	43.42	43.18	42.94	42.71
23.0500	42.47	42.23	42.00	41.76	41.52
23.3000	41.29	41.05	40.81	40.57	40.34
23.5500	40.10	39.86	39.62	39.38	39.15
23.8000	38.91	38.67	38.43	38.19	37.95
24.0500	37.53	36.63	35.46	34.38	33.56
24.3000	32.83	32.04	31.13	30.08	29.01
24.5500	28.00	27.08	26.27	25.61	25.07
24.8000	24.57	24.10	23.68	23.33	22.89
25.0500	22.47	22.07	21.42	20.78	20.13
25.3000	19.18	18.24	17.28	16.16	15.05
25.5500	13.93	12.82	11.71	10.64	9.66
25.8000	8.68	7.76	6.98	6.20	5.51
26.0500	4.96	4.40	3.92	3.53	3.14
26.3000	2.81	2.53	2.25	2.01	1.80
26.5500	1.60	1.43	1.28	1.13	1.02
26.8000	.91	.80	.72	.64	.56
27.0500	.51	.45	.40	.36	.32
27.3000	.28	.25	.22	.19	.17
27.5500	.15	.13	.11	.10	.08
27.8000	.07	.06	.05	.04	.04
28.0500	.03	.02	.02	.01	.01
28.3000	.01	.00	.00	.00	



SCHEMATIC DIAGRAM OF PONDPACK MODEL 1B FOR DRAINAGEWAY D11



MODEL 1B POST-DEVELOPMENT OUTLET HYDROGRAPH (50-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 100yrKihei24

Return Event	Total Depth in	Rainfall Type	RNF ID
50/24	8.3000	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
JUNC 10		JCT	50	63.594		10.8000	211.10		
JUNC 20		JCT	50	62.317		10.5500	209.47		
JUNC 40		JCT	50	89.293		11.2500	241.21		
*OUT 10		JCT	50	103.050		11.4500	254.79		
POND 10	IN	POND	50	62.317		10.5500	209.47		
POND 10	OUT	POND	50	62.317		10.5500	209.47		
POND 20	IN	POND	50	63.594		10.8000	211.10		
POND 20	OUT	POND	50	63.594		10.8000	211.10		
POND 30	IN	POND	50	103.050		11.4500	254.79		
POND 30	OUT	POND	50	103.050		11.4500	254.79		
POND 40	IN	POND	50	89.293		11.2500	241.21		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 40	OUT	POND	50	89.293		11.2500	241.21		
SUBAREA 10		AREA	50	62.317		10.5500	209.47		
SUBAREA 20		AREA	50	1.277		10.0500	9.50		
SUBAREA 30		AREA	50	25.699		10.1500	146.17		
SUBAREA 40		AREA	50	13.757		10.0000	105.32		

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: SCS Lag

Hydraulic Length	1032.00	ft
Runoff CN	78	
Slope	.065800	ft/ft
Avg.Velocity	1.27	ft/sec

Segment #1 Time: .2254 hrs

Total Tc: .2254 hrs

Tc Equations used...

==== SCS Lag ====

```
Tc = 0.000877 * (Lf**0.8) * ((1000/CN) - 9)**0.7) * (Sf**-0.5)

Where:  Tc = Time of concentration, hrs
        Lf = Flow length, ft
        CN = SCS Curve Number
        Sf = Slope, ft/ft
```

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 30	POND 30	IN	work_pad.hyg	ROUTE 30	50/24

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 30	50/24	103.050	11.4500	254.79

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	50/24	103.050	11.4500	254.79

```
TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\work_pad.hyg
HYG ID    = OUT 10
HYG Tag   = 50/24
-----------------------------------
Peak Discharge =      254.79 cfs
Time to Peak   =     11.4500 hrs
HYG Volume     =     103.050 ac-ft
-----------------------------------
```

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
3.3500	.00	.00	.00	.01	.01
3.6000	.01	.01	.02	.03	.04
3.8500	.07	.10	.13	.18	.23
4.1000	.28	.35	.42	.50	.59
4.3500	.68	.78	.88	.98	1.09
4.6000	1.19	1.30	1.40	1.51	1.62
4.8500	1.72	1.83	1.94	2.04	2.15
5.1000	2.25	2.36	2.47	2.57	2.68
5.3500	2.78	2.88	2.99	3.09	3.20
5.6000	3.30	3.40	3.50	3.61	3.71
5.8500	3.81	3.91	4.01	4.11	4.21
6.1000	4.32	4.43	4.55	4.67	4.81
6.3500	4.94	5.08	5.24	5.40	5.57
6.6000	5.76	5.95	6.16	6.37	6.60
6.8500	6.84	7.09	7.36	7.64	7.92
7.1000	8.23	8.54	8.84	9.16	9.49
7.3500	9.81	10.16	10.50	10.84	11.20
7.6000	11.55	11.90	12.27	12.64	13.01
7.8500	13.40	13.79	14.18	14.59	15.00
8.1000	15.45	15.96	16.51	17.12	17.78
8.3500	18.48	19.23	20.05	20.92	21.85
8.6000	22.84	23.88	24.98	26.12	27.29
8.8500	28.49	29.73	30.99	32.30	33.63
9.1000	35.02	36.49	38.05	39.68	41.44
9.3500	43.28	45.20	47.29	49.48	52.07
9.6000	55.75	60.72	67.51	76.55	88.40
9.8500	104.71	127.99	153.88	173.45	183.98
10.1000	186.93	188.48	193.31	201.02	208.97
10.3500	212.53	208.64	200.74	190.57	179.40
10.6000	169.79	162.96	157.03	153.91	153.70
10.8500	154.56	159.24	167.17	175.98	186.87

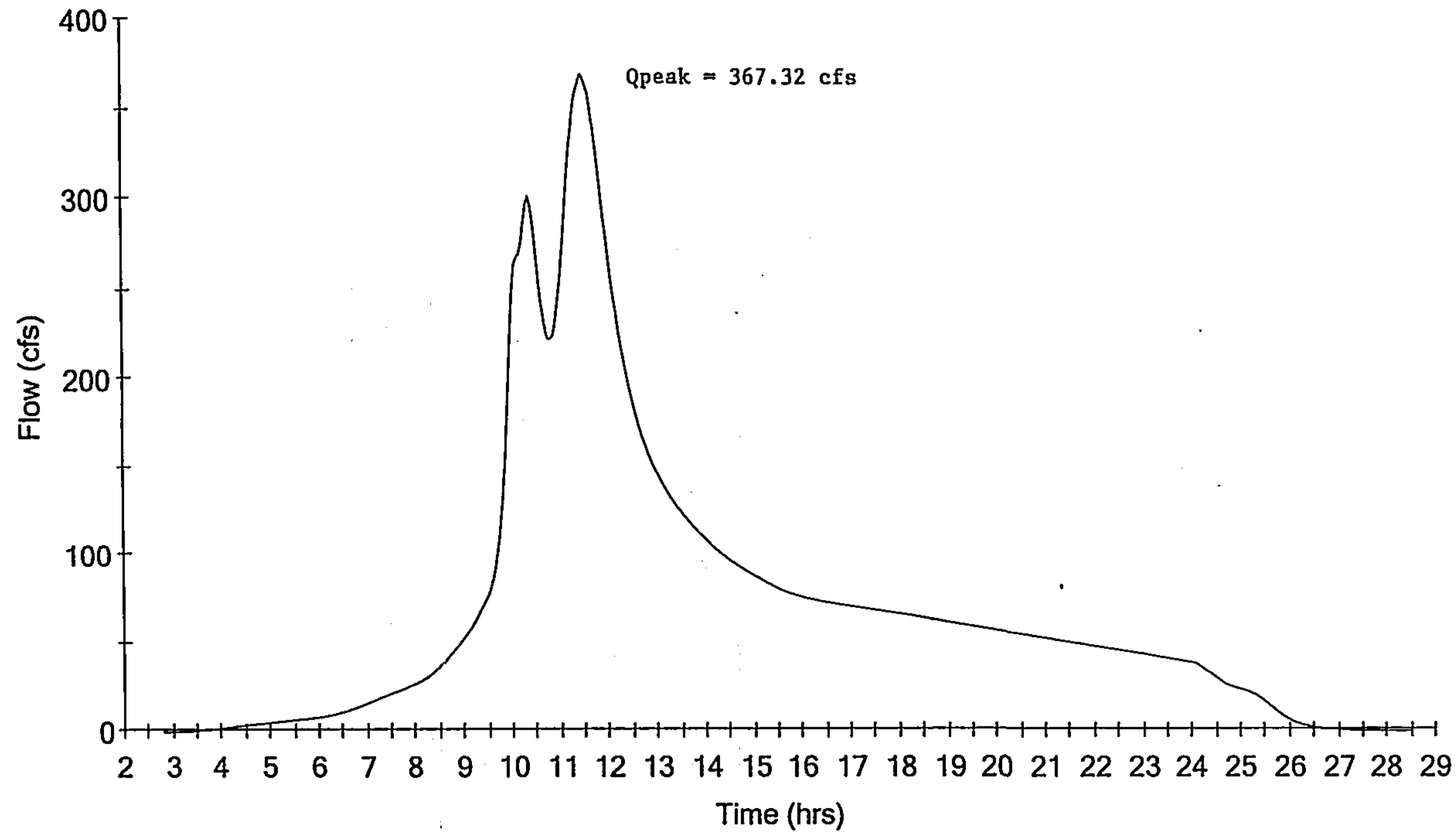
HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
11.1000	199.33	212.33	223.10	232.87	242.90
11.3500	247.95	251.30	254.79	253.48	251.04
11.6000	248.73	242.65	236.04	229.50	220.80
11.8500	211.98	203.18	195.14	187.10	179.18
12.1000	172.71	166.25	159.97	154.75	149.53
12.3500	144.51	140.20	135.90	131.84	128.42
12.6000	125.01	121.81	119.03	116.25	113.67
12.8500	111.38	109.10	106.99	105.08	103.17
13.1000	101.40	99.75	98.10	96.56	95.11
13.3500	93.65	92.30	91.00	89.71	88.51
13.6000	87.34	86.18	85.10	84.04	82.97
13.8500	81.97	80.98	79.99	79.03	78.08
14.1000	77.14	76.24	75.36	74.49	73.68
14.3500	72.88	72.10	71.39	70.69	70.01
14.6000	69.37	68.74	68.12	67.52	66.93
14.8500	66.34	65.76	65.19	64.62	64.06
15.1000	63.50	62.95	62.42	61.88	61.37
15.3500	60.87	60.38	59.92	59.49	59.05
15.6000	58.65	58.28	57.90	57.57	57.25
15.8500	56.94	56.66	56.39	56.12	55.88
16.1000	55.64	55.41	55.20	54.99	54.78
16.3500	54.58	54.39	54.20	54.02	53.84
16.6000	53.66	53.48	53.31	53.14	52.97
16.8500	52.80	52.64	52.47	52.31	52.15
17.1000	51.99	51.83	51.67	51.51	51.35
17.3500	51.19	51.03	50.87	50.71	50.56
17.6000	50.40	50.24	50.08	49.92	49.77
17.8500	49.61	49.45	49.29	49.13	48.98
18.1000	48.82	48.66	48.50	48.34	48.18
18.3500	48.02	47.86	47.70	47.54	47.38
18.6000	47.22	47.06	46.90	46.74	46.58
18.8500	46.41	46.25	46.09	45.93	45.76
19.1000	45.60	45.44	45.27	45.11	44.94
19.3500	44.78	44.62	44.45	44.29	44.12
19.6000	43.95	43.79	43.62	43.46	43.29
19.8500	43.12	42.96	42.79	42.62	42.46
20.1000	42.29	42.12	41.95	41.78	41.62
20.3500	41.45	41.28	41.11	40.94	40.77
20.6000	40.60	40.43	40.26	40.09	39.92
20.8500	39.75	39.58	39.41	39.24	39.07
21.1000	38.90	38.72	38.55	38.38	38.21
21.3500	38.04	37.86	37.69	37.52	37.34
21.6000	37.17	37.00	36.83	36.65	36.48
21.8500	36.30	36.13	35.96	35.78	35.61
22.1000	35.43	35.26	35.08	34.91	34.73

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
22.3500	34.56	34.38	34.21	34.03	33.86
22.6000	33.68	33.51	33.33	33.15	32.98
22.8500	32.80	32.62	32.45	32.27	32.09
23.1000	31.92	31.74	31.56	31.38	31.21
23.3500	31.03	30.85	30.67	30.49	30.32
23.6000	30.14	29.96	29.78	29.60	29.42
23.8500	29.24	29.07	28.89	28.70	28.38
24.1000	27.74	26.87	26.06	25.41	24.84
24.3500	24.23	23.52	22.72	21.89	21.11
24.6000	20.41	19.79	19.28	18.87	18.49
24.8500	18.12	17.81	17.54	17.21	16.89
25.1000	16.59	16.10	15.62	15.13	14.42
25.3500	13.71	12.99	12.15	11.31	10.47
25.6000	9.64	8.81	8.00	7.26	6.52
25.8500	5.83	5.25	4.66	4.14	3.73
26.1000	3.31	2.95	2.66	2.36	2.11
26.3500	1.90	1.69	1.51	1.35	1.20
26.6000	1.07	.96	.85	.76	.68
26.8500	.60	.54	.48	.42	.38
27.1000	.34	.30	.27	.24	.21
27.3500	.19	.16	.14	.13	.11
27.6000	.10	.08	.07	.06	.05
27.8500	.05	..04	.03	.03	.02
28.1000	.02	.01	.01	.01	.00
28.3500	.00	.00	.00		

Hydrograph
OUT 10 100



MODEL 1B POST-DEVELOPMENT OUTLET HYDROGRAPH (100-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 100yr24hrKihei

Return Event	Total Depth in	Rainfall Type	RNF ID
100	10.5000	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
JUNC 10		JCT	100	90.635		10.8000	309.32		
JUNC 20		JCT	100	88.931		10.5500	307.20		
JUNC 40		JCT	100	125.718		11.2500	349.33		
*OUT 10		JCT	100	144.498		11.4500	367.32		
POND 10	IN	POND	100	88.931		10.5500	307.20		
POND 10	OUT	POND	100	88.931		10.5500	307.20		
POND 20	IN	POND	100	90.635		10.8000	309.32		
POND 20	OUT	POND	100	90.635		10.8000	309.32		
POND 30	IN	POND	100	144.498		11.4500	367.32		
POND 30	OUT	POND	100	144.498		11.4500	367.32		
POND 40	IN	POND	100	125.718		11.2500	349.33		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 40	OUT	POND	100	125.718		11.2500	349.33		
SUBAREA 10		AREA	100	88.931		10.5500	307.20		
SUBAREA 20		AREA	100	1.703		10.0500	12.58		
SUBAREA 30		AREA	100	35.083		10.1500	200.30		
SUBAREA 40		AREA	100	18.780		10.0000	144.16		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 30	POND 30	IN	work_pad.hyg	ROUTE 30	100

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 30	100	144.498	11.4500	367.32

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	100	144.498	11.4500	367.32

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\work_pad.hyg
HYG ID = OUT 10
HYG Tag = 100

Peak Discharge = 367.32 cfs
Time to Peak = 11.4500 hrs
HYG Volume = 144.498 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

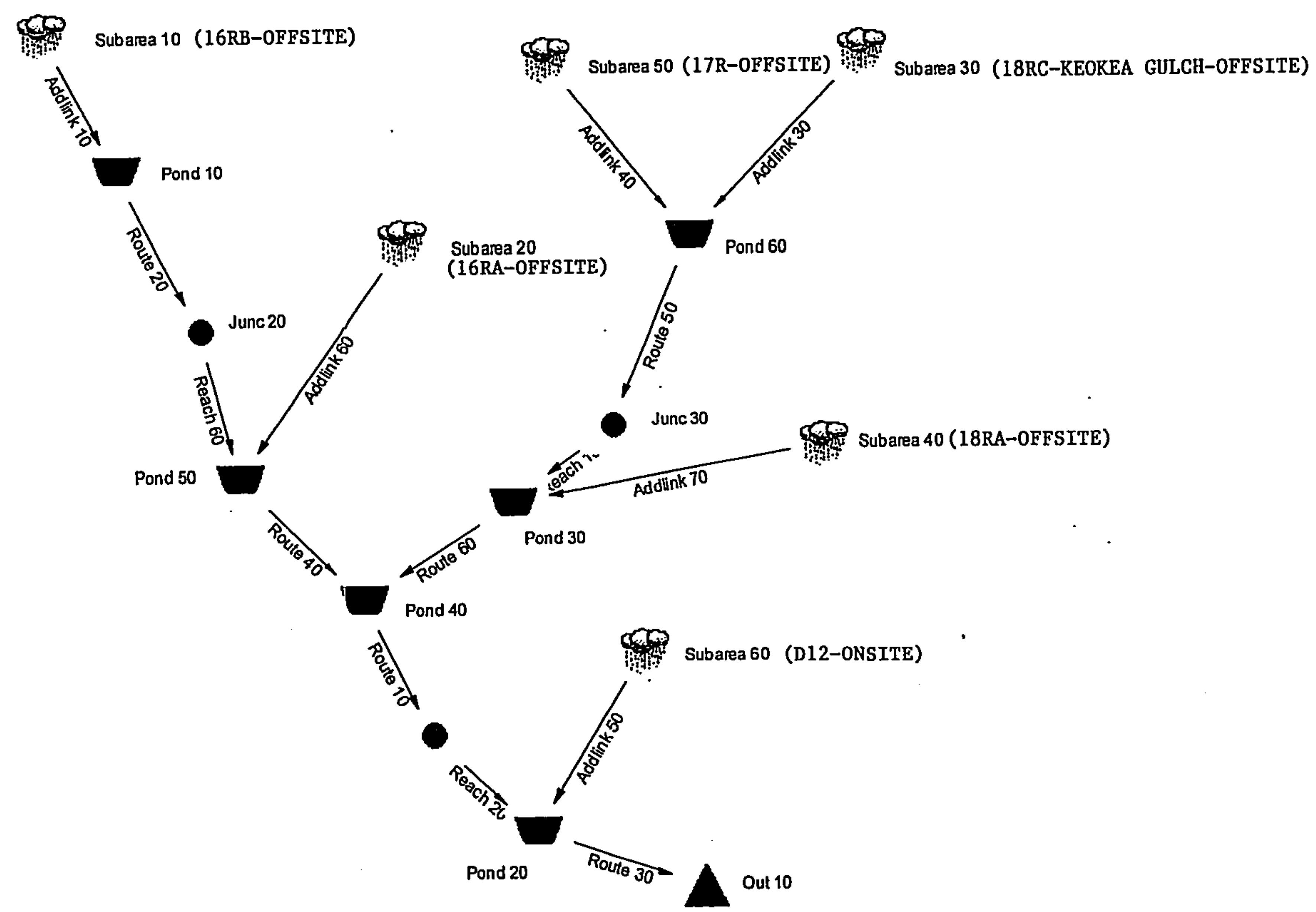
Time hrs					
2.8000	.00	.00	.00	.01	.01
3.0500	.01	.03	.05	.09	.13
3.3000	.18	.24	.31	.39	.48
3.5500	.58	.70	.82	.95	1.08
3.8000	1.22	1.37	1.51	1.66	1.82
4.0500	1.97	2.13	2.28	2.44	2.59
4.3000	2.75	2.91	3.07	3.22	3.38
4.5500	3.53	3.69	3.84	3.99	4.14
4.8000	4.29	4.44	4.59	4.74	4.89
5.0500	5.03	5.18	5.32	5.46	5.61
5.3000	5.75	5.89	6.03	6.17	6.32
5.5500	6.46	6.60	6.74	6.88	7.03
5.8000	7.19	7.34	7.51	7.69	7.87
6.0500	8.06	8.28	8.51	8.76	9.05
6.3000	9.35	9.67	10.02	10.38	10.77
6.5500	11.18	11.62	12.07	12.55	13.03
6.8000	13.54	14.05	14.58	15.12	15.67
7.0500	16.23	16.80	17.36	17.91	18.47
7.3000	19.03	19.59	20.16	20.73	21.28
7.5500	21.86	22.42	22.98	23.56	24.14
7.8000	24.71	25.32	25.92	26.53	27.16
8.0500	27.80	28.49	29.25	30.10	31.01
8.3000	32.00	33.05	34.17	35.39	36.68
8.5500	38.04	39.49	41.02	42.61	44.25
8.8000	45.94	47.66	49.43	51.23	53.07
9.0500	54.95	56.90	58.98	61.17	63.45
9.3000	65.94	68.52	71.21	74.16	77.25
9.5500	80.89	86.10	93.11	102.65	115.28
9.8000	131.74	154.24	186.10	221.30	247.66
10.0500	261.69	265.58	267.68	274.23	284.57
10.3000	295.11	299.61	293.98	282.99	269.03

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
10.5500	253.79	240.81	231.84	224.17	220.55
10.8000	221.17	223.27	230.72	242.75	255.96
11.0500	271.92	289.99	308.79	324.10	337.84
11.3000	351.92	358.66	362.90	367.32	364.77
11.5500	360.58	356.57	347.17	337.03	326.96
11.8000	313.95	300.77	287.63	275.74	263.86
12.0500	252.16	242.64	233.15	223.92	216.27
12.3000	208.63	201.27	194.98	188.71	182.79
12.5500	177.81	172.85	168.20	164.16	160.13
12.8000	156.39	153.08	149.77	146.72	143.97
13.0500	141.22	138.68	136.31	133.95	131.75
13.3000	129.68	127.60	125.68	123.84	122.00
13.5500	120.30	118.66	117.01	115.49	113.99
13.8000	112.50	111.10	109.71	108.32	106.98
14.0500	105.65	104.34	103.08	101.85	100.65
14.3000	99.52	98.40	97.32	96.33	95.36
14.5500	94.41	93.52	92.65	91.79	90.95
14.8000	90.12	89.31	88.51	87.71	86.92
15.0500	86.14	85.36	84.60	83.86	83.12
15.3000	82.41	81.73	81.04	80.41	79.80
15.5500	79.20	78.65	78.13	77.61	77.15
15.8000	76.71	76.27	75.88	75.50	75.13
16.0500	74.79	74.47	74.14	73.85	73.55
16.3000	73.26	72.99	72.72	72.45	72.20
16.5500	71.94	71.69	71.45	71.21	70.97
16.8000	70.74	70.51	70.27	70.05	69.82
17.0500	69.59	69.37	69.15	68.93	68.70
17.3000	68.48	68.26	68.04	67.83	67.61
17.5500	67.39	67.17	66.95	66.74	66.52
17.8000	66.30	66.08	65.86	65.65	65.43
18.0500	65.21	64.99	64.78	64.56	64.34
18.3000	64.12	63.90	63.68	63.46	63.24
18.5500	63.02	62.80	62.58	62.36	62.14
18.8000	61.92	61.70	61.48	61.26	61.03
19.0500	60.81	60.59	60.37	60.14	59.92
19.3000	59.70	59.47	59.25	59.02	58.80
19.5500	58.58	58.35	58.13	57.90	57.67
19.8000	57.45	57.22	57.00	56.77	56.54
20.0500	56.32	56.09	55.86	55.64	55.41
20.3000	55.18	54.95	54.73	54.50	54.27
20.5500	54.04	53.81	53.58	53.35	53.13
20.8000	52.90	52.67	52.44	52.21	51.98
21.0500	51.75	51.52	51.29	51.05	50.82
21.3000	50.59	50.36	50.13	49.90	49.66
21.5500	49.43	49.20	48.97	48.74	48.50

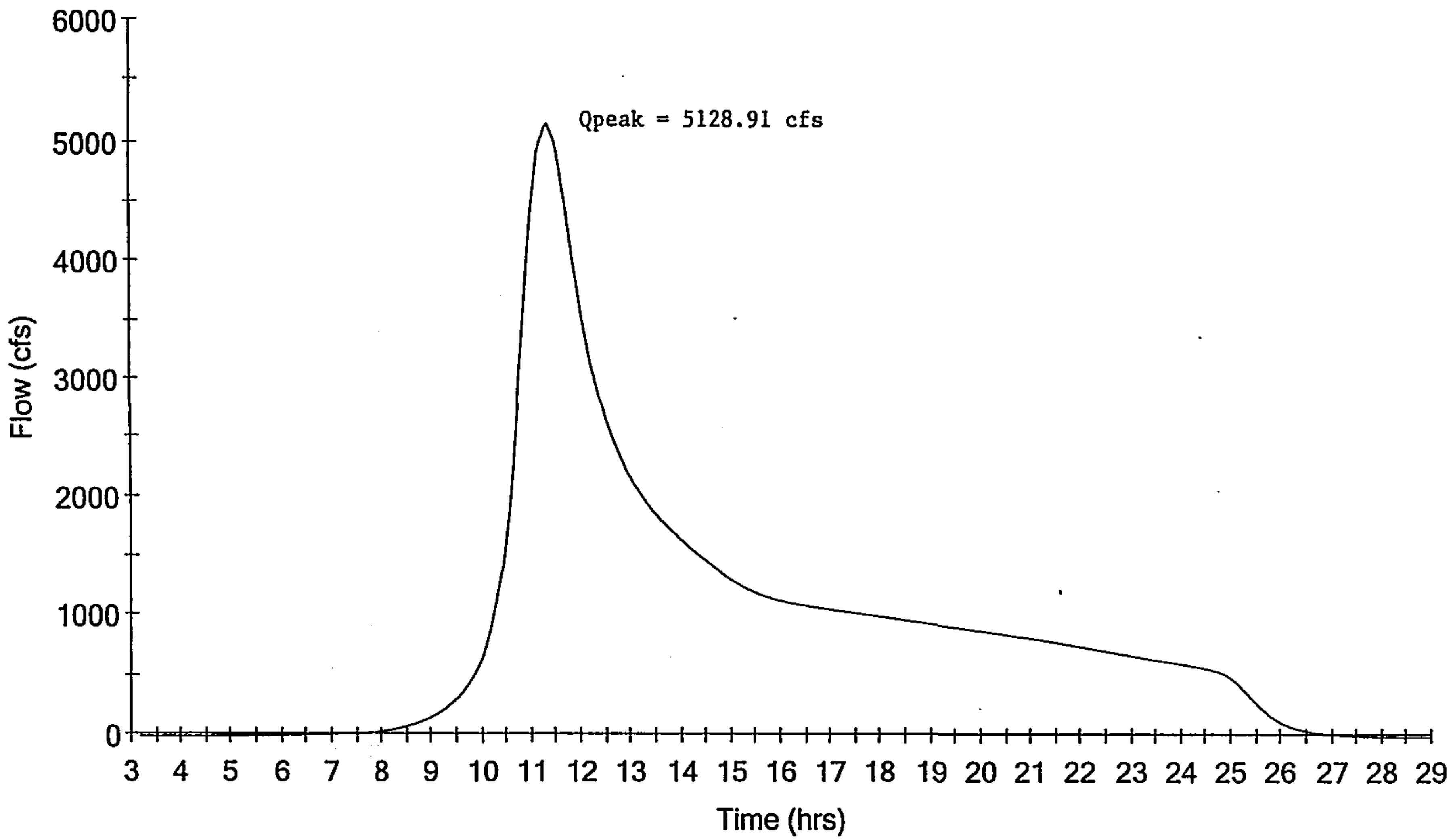
HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
21.8000	48.27	48.04	47.80	47.57	47.34
22.0500	47.11	46.87	46.64	46.40	46.17
22.3000	45.94	45.70	45.47	45.23	45.00
22.5500	44.76	44.53	44.29	44.06	43.82
22.8000	43.59	43.35	43.12	42.88	42.65
23.0500	42.41	42.17	41.94	41.70	41.46
23.3000	41.23	40.99	40.75	40.52	40.28
23.5500	40.04	39.81	39.57	39.33	39.09
23.8000	38.86	38.62	38.38	38.14	37.89
24.0500	37.47	36.64	35.51	34.45	33.60
24.3000	32.86	32.06	31.14	30.09	29.01
24.5500	28.00	27.08	26.27	25.61	25.07
24.8000	24.57	24.10	23.68	23.33	22.89
25.0500	22.47	22.07	21.42	20.78	20.13
25.3000	19.18	18.24	17.28	16.16	15.05
25.5500	13.93	12.82	11.71	10.64	9.66
25.8000	8.68	7.76	6.98	6.20	5.51
26.0500	4.96	4.40	3.92	3.53	3.14
26.3000	2.81	2.53	2.25	2.01	1.80
26.5500	1.60	1.43	1.28	1.13	1.02
26.8000	.91	.80	.72	.64	.56
27.0500	.51	.45	.40	.36	.32
27.3000	.28	.25	.22	.19	.17
27.5500	.15	.13	.11	.10	.08
27.8000	.07	.06	.05	.04	.04
28.0500	.03	.02	.02	.01	.01
28.3000	.01	.00	.00	.00	



SCHEMATIC DIAGRAM OF PONDPACK MODEL 2A FOR DRAINAGEWAY D12

Hydrograph
OUT 10 50/24



MODEL 2A PRE-DEVELOPMENT OUTLET HYDROGRAPH (50-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 50yrKihei24

Return Event	Total Depth in	Rainfall Type	RNF ID
50/24	8.3000	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
JUNC 20		JCT	50	26.117		10.1000	160.90		
JUNC 30		JCT	50	1742.310		10.7500	4999.11		
JUNC 60		JCT	50	1822.208		11.1000	5125.36		
*OUT 10		JCT	50	1825.782		11.3500	5128.91		
POND 10	IN	POND	50	26.117		10.1000	160.90		
POND 10	OUT	POND	50	26.117		10.1000	160.90		
POND 20	IN	POND	50	1825.782		11.3500	5128.91		
POND 20	OUT	POND	50	1825.782		11.3500	5128.91		
POND 30	IN	POND	50	1765.794		11.1000	5026.70		
POND 30	OUT	POND	50	1765.794		11.1000	5026.70		
POND 40	IN	POND	50	1822.208		11.1000	5125.36		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 40	OUT	POND	50	1822.208		11.1000	5125.36		
POND 50	IN	POND	50	56.414		10.6000	242.54		
POND 50	OUT	POND	50	56.414		10.6000	242.54		
POND 60	IN	POND	50	1742.310		10.7500	4999.11		
POND 60	OUT	POND	50	1742.310		10.7500	4999.11		
SUBAREA 10		AREA	50	26.117		10.1000	160.90		
SUBAREA 20		AREA	50	30.297		10.2000	165.72		
SUBAREA 30		AREA	50	1685.410		10.7500	4851.35		
SUBAREA 40		AREA	50	23.485		10.1000	155.97		
SUBAREA 50		AREA	50	56.901		10.3000	261.50		
SUBAREA 60		AREA	50	3.574		10.0500	26.70		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 30	POND 20	IN	work_pad.hyg	ROUTE 30	50/24

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 30	50/24	1825.782	11.3500	5128.91

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	50/24	1825.782	11.3500	5128.91

Type.... Node: Addition Summary
Event: 50 yr
Name.... OUT 10
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\D12PreDevelopment.ppw
Storm... TypeI 24hr Tag: 50/24

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\work_pad.hyg
HYG ID = OUT 10
HYG Tag = 50/24

Peak Discharge =	5128.91 cfs
Time to Peak =	11.3500 hrs
HYG Volume =	1825.782 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
3.2000	.00	.00	.01	.01	.02
3.4500	.03	.04	.04	.05	.06
3.7000	.07	.08	.09	.10	.11
3.9500	.12	.13	.14	.15	.17
4.2000	.18	.19	.22	.25	.30
4.4500	.37	.45	.55	.66	.79
4.7000	.92	1.05	1.19	1.34	1.49
4.9500	1.65	1.82	2.00	2.19	2.39
5.2000	2.59	2.80	3.00	3.22	3.43
5.4500	3.64	3.86	4.08	4.31	4.55
5.7000	4.80	5.07	5.34	5.62	5.92
5.9500	6.22	6.53	6.85	7.17	7.50
6.2000	7.84	8.18	8.53	8.88	9.24
6.4500	9.62	10.01	10.42	10.84	11.28
6.7000	11.73	12.20	12.68	13.18	13.70
6.9500	14.23	14.80	15.38	15.99	16.62
7.2000	17.27	17.94	18.63	19.35	20.08
7.4500	20.83	21.67	22.55	23.43	24.40
7.7000	25.68	26.97	28.26	30.08	32.15
7.9500	34.21	36.43	39.56	42.68	45.81
8.2000	49.72	54.06	58.41	62.93	68.50
8.4500	74.17	79.92	86.38	93.37	100.44
8.7000	107.69	115.93	124.27	132.72	141.98
8.9500	151.96	162.06	172.45	184.83	197.39
9.2000	210.11	224.40	240.17	256.06	272.15
9.4500	291.85	311.76	331.96	354.50	379.68
9.7000	405.37	431.90	464.22	498.89	536.66
9.9500	581.06	631.71	684.67	743.36	822.59
10.2000	911.47	1002.51	1106.32	1223.84	1328.03
10.4500	1423.12	1595.84	1787.00	1986.16	2230.78
10.7000	2545.29	2858.36	3164.98	3483.32	3791.02

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

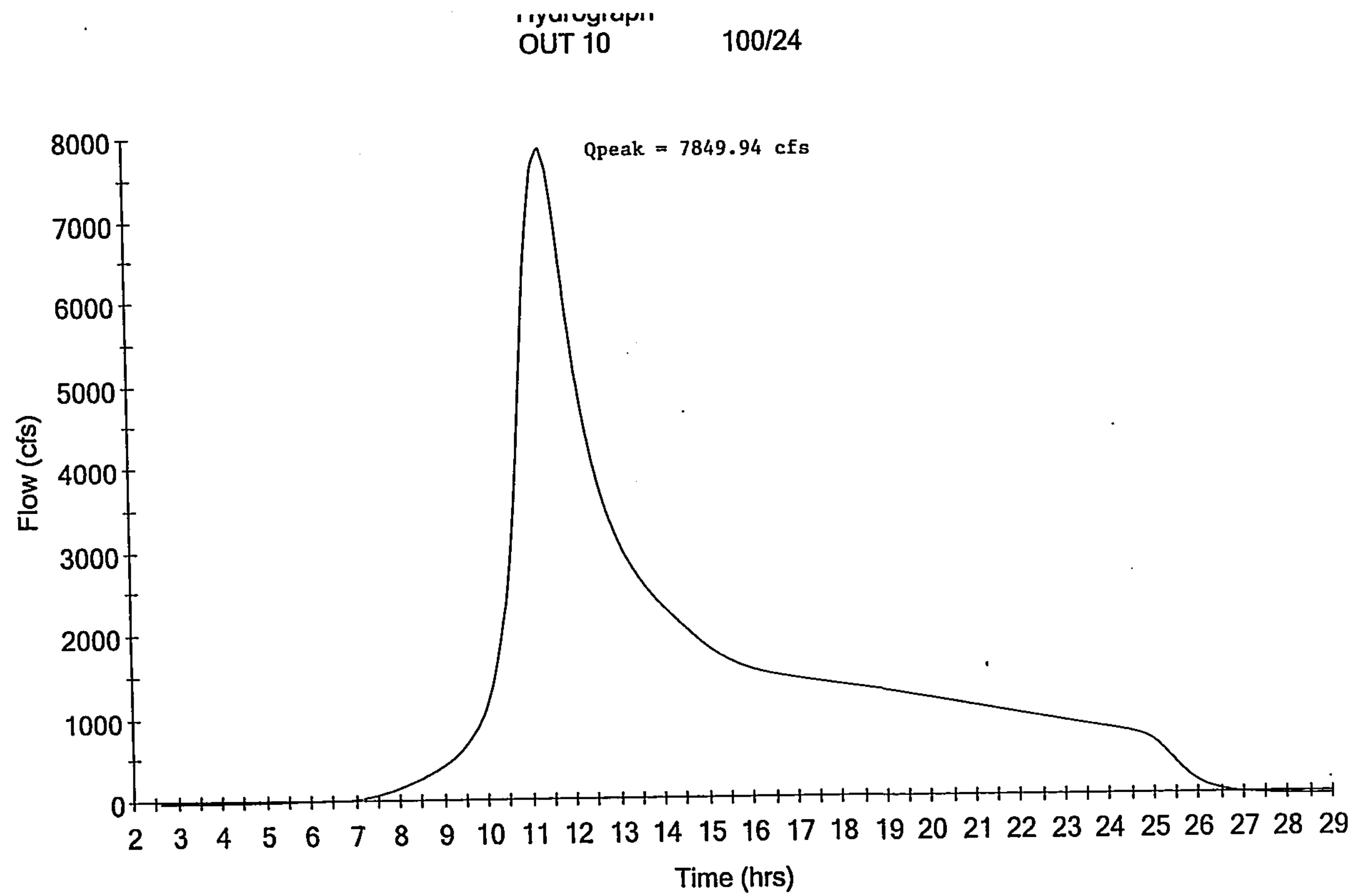
Time hrs					
10.9500	4084.71	4337.71	4524.87	4710.37	4899.39
11.2000	4980.39	5037.35	5097.80	5128.91	5079.39
11.4500	5032.46	4986.83	4879.01	4751.90	4626.47
11.7000	4493.22	4333.34	4174.33	4015.83	3872.70
11.9500	3735.54	3599.05	3468.54	3361.19	3254.10
12.2000	3147.27	3054.82	2969.13	2883.64	2800.67
12.4500	2730.65	2660.68	2590.79	2529.97	2474.25
12.7000	2418.64	2364.21	2318.19	2272.18	2226.23
12.9500	2184.97	2146.86	2108.79	2071.25	2039.36
13.2000	2007.49	1975.65	1946.32	1918.97	1891.63
13.4500	1864.43	1840.60	1816.78	1792.95	1770.56
13.7000	1749.48	1728.40	1707.32	1688.31	1669.30
13.9500	1650.29	1631.89	1614.17	1596.44	1578.72
14.2000	1561.66	1544.62	1527.59	1510.64	1493.79
14.4500	1476.97	1460.20	1443.60	1427.06	1410.55
14.7000	1394.39	1378.73	1363.09	1347.51	1333.09
14.9500	1318.90	1304.75	1291.11	1278.30	1265.53
15.2000	1252.82	1241.52	1230.52	1219.54	1209.14
15.4500	1199.97	1190.80	1181.65	1173.83	1166.35
15.7000	1158.87	1151.79	1145.72	1139.65	1133.58
15.9500	1128.29	1123.24	1118.20	1113.32	1108.98
16.2000	1104.64	1100.30	1096.31	1092.46	1088.61
16.4500	1084.83	1081.33	1077.83	1074.32	1070.98
16.7000	1067.72	1064.46	1061.22	1058.12	1055.02
16.9500	1051.92	1048.88	1045.89	1042.89	1039.90
17.2000	1036.97	1034.04	1031.10	1028.19	1025.30
17.4500	1022.41	1019.52	1016.64	1013.77	1010.90
17.7000	1008.03	1005.16	1002.29	999.42	996.54
17.9500	993.66	990.78	987.90	985.01	982.13
18.2000	979.24	976.34	973.44	970.54	967.62
18.4500	964.70	961.78	958.86	955.91	952.96
18.7000	950.01	947.06	944.08	941.11	938.14
18.9500	935.15	932.15	929.15	926.14	923.12
19.2000	920.10	917.07	914.02	910.97	907.91
19.4500	904.85	901.77	898.69	895.61	892.51
19.7000	889.40	886.30	883.19	880.07	876.94
19.9500	873.81	870.67	867.52	864.36	861.20
20.2000	858.03	854.85	851.67	848.48	845.28
20.4500	842.09	838.88	835.67	832.45	829.23
20.7000	826.00	822.76	819.52	816.27	813.01
20.9500	809.75	806.48	803.21	799.92	796.64
21.2000	793.36	790.06	786.76	783.46	780.15
21.4500	776.83	773.51	770.19	766.85	763.51
21.7000	760.17	756.82	753.46	750.11	746.75
21.9500	743.38	740.00	736.63	733.25	729.86

Type.... Node: Addition Summary
Name.... OUT 10
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\D12PreDevelopment.ppw
Storm... TypeI 24hr Tag: 50/24

Event: 50 yr

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
22.2000	726.47	723.08	719.67	716.27	712.86
22.4500	709.44	706.02	702.60	699.17	695.74
22.7000	692.30	688.86	685.42	681.96	678.51
22.9500	675.06	671.59	668.12	664.65	661.18
23.2000	657.69	654.21	650.73	647.23	643.74
23.4500	640.24	636.74	633.23	629.73	626.22
23.7000	622.70	619.17	615.65	612.12	608.58
23.9500	605.05	601.51	597.94	594.31	590.61
24.2000	586.90	583.21	579.39	575.28	570.76
24.4500	565.87	560.84	555.55	549.52	543.66
24.7000	537.91	529.68	520.64	511.30	500.40
24.9500	484.87	469.30	453.81	434.58	414.06
25.2000	393.84	373.36	351.32	329.39	307.66
25.4500	286.58	265.89	245.25	225.11	207.38
25.7000	189.67	172.02	157.01	143.55	130.09
25.9500	117.11	107.61	98.11	88.62	80.78
26.2000	74.05	67.33	60.75	55.85	50.95
26.4500	46.05	41.91	38.37	34.83	31.33
26.7000	28.79	26.24	23.70	21.52	19.69
26.9500	17.85	16.01	14.69	13.38	12.06
27.2000	10.92	9.97	9.02	8.07	7.37
27.4500	6.69	6.00	5.40	4.90	4.40
27.7000	3.91	3.54	3.18	2.83	2.51
27.9500	2.25	2.00	1.74	1.54	1.36
28.2000	1.17	1.00	.87	.73	.59
28.4500	.49	.40	.30	.22	.17
28.7000	.11	.06	.04	.02	.01
28.9500	.00				



MODEL 2A PRE-DEVELOPMENT OUTLET HYDROGRAPH (100-YEAR STORM)

CORRECTION

THE PRECEDING DOCUMENTS(S)

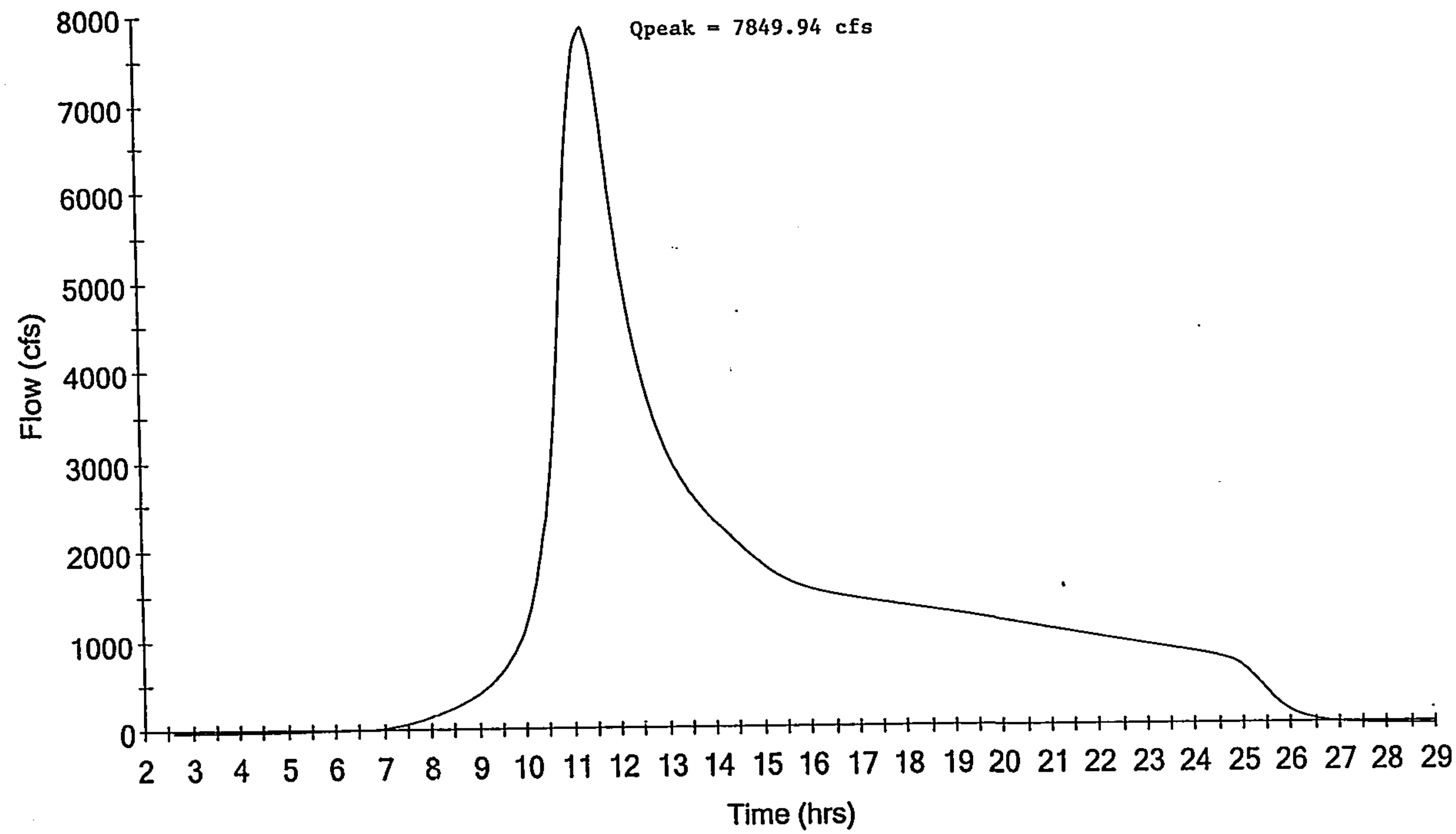
HAS BEEN REPHOTOGRAPHED

TO ASSURE LEGIBILITY

SEE FRAME(S)

IMMEDIATELY FOLLOWING

Hydrograph
OUT 10 100/24



MODEL 2A PRE-DEVELOPMENT OUTLET HYDROGRAPH (100-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 100yr24hrKihei

Return Event	Total Depth in	Rainfall Type	RNF ID
100/24	10.5000	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
JUNC 20		JCT	100	35.948		10.1000	223.01		
JUNC 30		JCT	100	2562.660		10.7500	7675.41		
JUNC 60		JCT	100	2672.458		11.1000	7845.29		
*OUT 10		JCT	100	2677.283		11.3500	7849.94		
POND 10	IN	POND	100	35.948		10.1000	223.01		
POND 10	OUT	POND	100	35.948		10.1000	223.01		
POND 20	IN	POND	100	2677.283		11.3500	7849.94		
POND 20	OUT	POND	100	2677.283		11.3500	7849.94		
POND 30	IN	POND	100	2594.985		11.1000	7712.34		
POND 30	OUT	POND	100	2594.985		11.1000	7712.34		
POND 40	IN	POND	100	2672.458		11.1000	7845.29		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 40	OUT	POND	100	2672.458		11.1000	7845.29		
POND 50	IN	POND	100	77.475		10.6000	333.63		
POND 50	OUT	POND	100	77.475		10.6000	333.63		
POND 60	IN	POND	100	2562.660		10.7500	7675.41		
POND 60	OUT	POND	100	2562.660		10.7500	7675.41		
SUBAREA 10		AREA	100	35.948		10.1000	223.01		
SUBAREA 20		AREA	100	41.528		10.2000	228.13		
SUBAREA 30		AREA	100	2482.972		10.7500	7469.60		
SUBAREA 40		AREA	100	32.324		10.1000	215.47		
SUBAREA 50		AREA	100	79.687		10.3000	371.65		
SUBAREA 60		AREA	100	4.822		10.0500	35.87		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 30	POND 20	IN	work_pad.hyg	ROUTE 30	100/24

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 30	100/24	2677.283	11.3500	7849.94

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	100/24	2677.283	11.3500	7849.94

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\work_pad.hyg
HYG ID = OUT 10
HYG Tag = 100/24

Peak Discharge = 7849.94 cfs
Time to Peak = 11.3500 hrs
HYG Volume = 2677.283 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
2.6000	.00	.00	.01	.01	.02
2.8500	.03	.05	.06	.07	.08
3.1000	.10	.11	.12	.14	.15
3.3500	.16	.18	.19	.21	.23
3.6000	.26	.30	.37	.46	.58
3.8500	.72	.87	1.05	1.23	1.42
4.1000	1.62	1.83	2.05	2.28	2.53
4.3500	2.80	3.07	3.36	3.66	3.96
4.6000	4.27	4.58	4.90	5.23	5.57
4.8500	5.93	6.31	6.70	7.11	7.53
5.1000	7.97	8.41	8.88	9.34	9.82
5.3500	10.29	10.78	11.26	11.75	12.23
5.6000	12.72	13.21	13.70	14.20	14.69
5.8500	15.18	15.66	16.15	16.64	17.12
6.1000	17.61	18.10	18.59	19.09	19.62
6.3500	20.15	20.69	21.37	22.10	22.87
6.6000	23.77	24.96	26.18	27.42	29.25
6.8500	31.25	33.28	35.63	38.75	41.90
7.1000	45.09	49.22	53.66	58.13	62.94
7.3500	68.76	74.59	80.43	87.22	94.38
7.6000	101.54	108.95	117.38	125.81	134.23
7.8500	143.45	153.03	162.59	172.28	182.79
8.1000	193.28	203.77	214.76	226.02	237.30
8.3500	248.68	260.63	272.70	284.92	297.55
8.6000	310.54	323.67	336.99	351.16	365.48
8.8500	379.96	395.53	412.11	428.87	446.06
9.1000	466.56	487.34	508.32	532.01	558.19
9.3500	584.54	611.17	643.83	676.78	710.12
9.6000	747.14	788.29	830.12	873.07	924.78
9.8500	979.75	1039.00	1107.75	1185.62	1266.81
10.1000	1355.97	1475.44	1608.01	1743.07	1898.54

Type.... Node: Addition Summary
Name.... OUT 10
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\D12PreDevelopment.ppw
Storm... TypeI 24hr Tag: 100/24

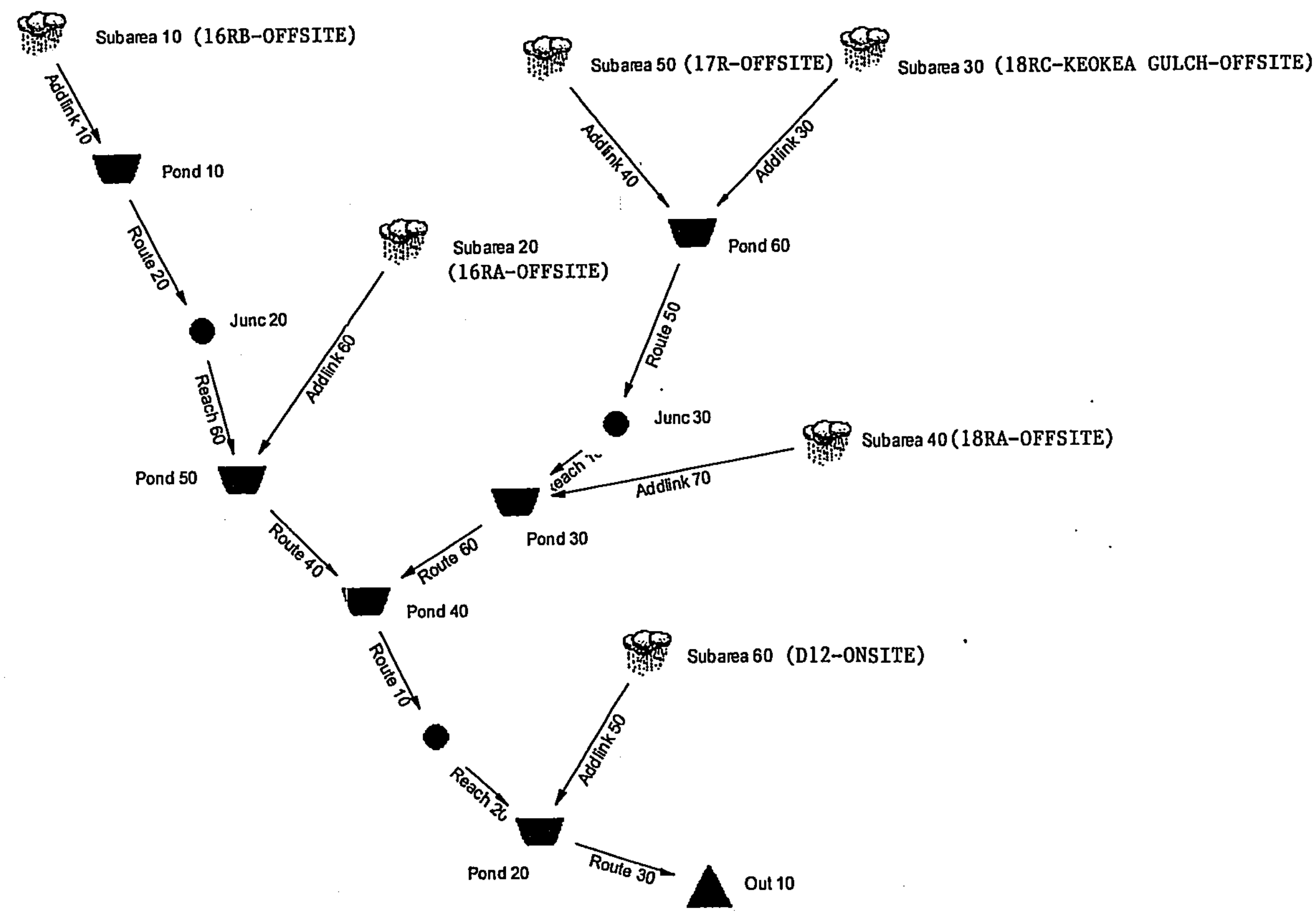
Page 10.14
Event: 100 yr

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

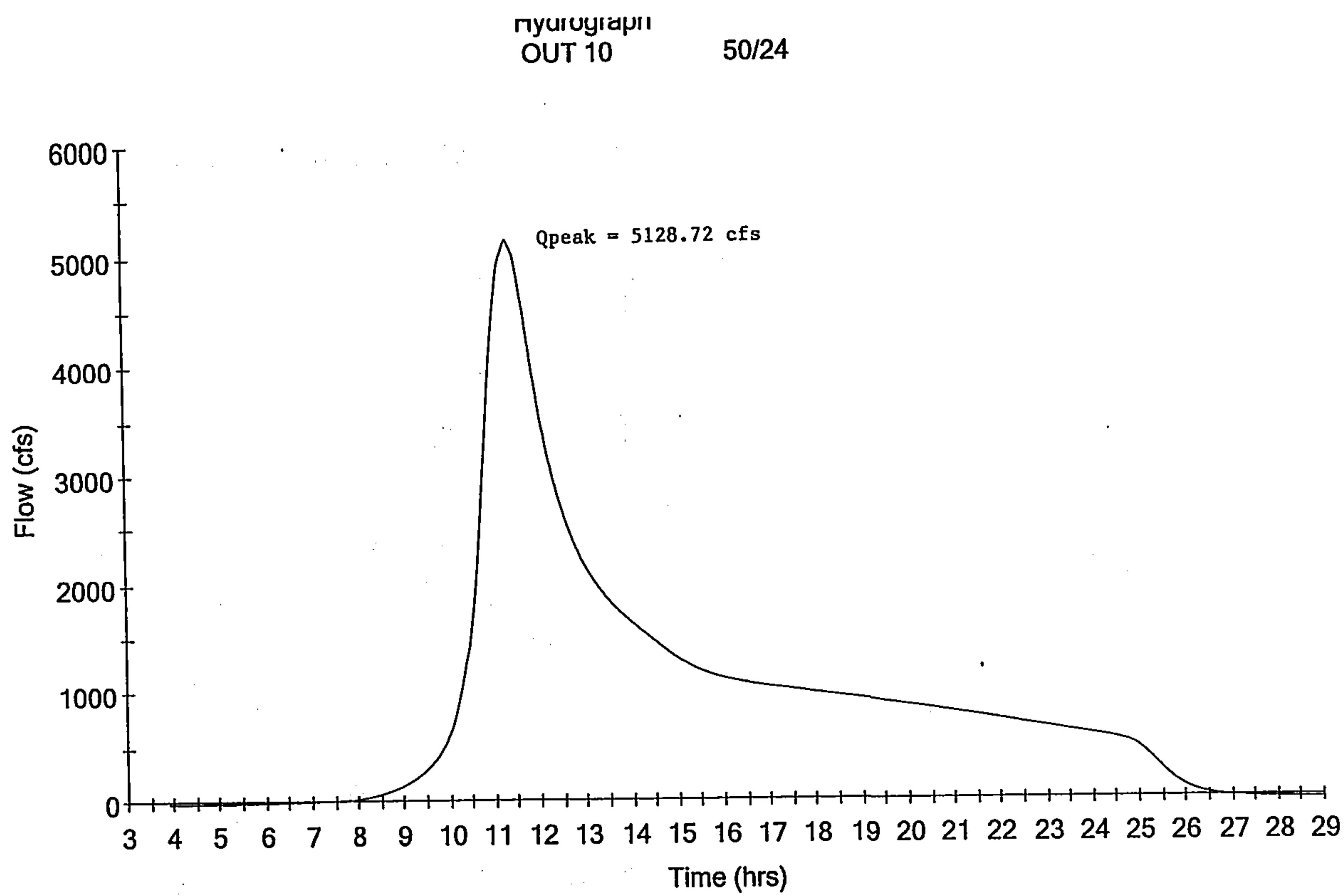
Time hrs					
10.3500	2077.53	2238.51	2387.35	2654.46	2948.76
10.6000	3254.23	3625.52	4099.01	4569.70	5031.07
10.8500	5503.40	5960.00	6397.28	6771.50	7040.17
11.1000	7306.76	7578.31	7683.05	7750.24	7822.42
11.3500	7849.94	7755.32	7664.36	7575.23	7393.91
11.6000	7183.97	6976.38	6758.21	6503.92	6250.85
11.8500	5998.51	5772.58	5556.90	5342.16	5136.98
12.1000	4968.97	4801.33	4634.04	4489.57	4355.81
12.3500	4222.34	4092.88	3984.10	3875.39	3766.80
12.6000	3672.48	3586.18	3500.03	3415.74	3344.77
12.8500	3273.84	3202.97	3139.52	3081.03	3022.61
13.1000	2965.01	2916.30	2867.62	2818.97	2774.29
13.3500	2732.71	2691.14	2649.81	2613.78	2577.75
13.6000	2541.72	2507.95	2476.26	2444.57	2412.89
13.8500	2384.48	2356.07	2327.66	2300.26	2273.94
14.1000	2247.63	2221.32	2196.14	2171.00	2145.87
14.3500	2120.91	2096.19	2071.51	2046.88	2022.66
14.6000	1998.52	1974.44	1950.92	1928.24	1905.59
14.8500	1883.00	1862.21	1841.75	1821.34	1801.67
15.1000	1783.21	1764.82	1746.49	1730.19	1714.33
15.3500	1698.48	1683.48	1670.21	1656.95	1643.71
15.6000	1632.37	1621.51	1610.65	1600.36	1591.50
15.8500	1582.64	1573.79	1566.04	1558.64	1551.24
16.1000	1544.09	1537.69	1531.30	1524.91	1519.03
16.3500	1513.34	1507.65	1502.07	1496.89	1491.71
16.6000	1486.52	1481.58	1476.75	1471.92	1467.13
16.8500	1462.54	1457.95	1453.36	1448.88	1444.45
17.1000	1440.02	1435.61	1431.28	1426.96	1422.63
17.3500	1418.35	1414.09	1409.83	1405.58	1401.37
17.6000	1397.15	1392.93	1388.72	1384.52	1380.33
17.8500	1376.13	1371.93	1367.73	1363.53	1359.33
18.1000	1355.13	1350.93	1346.73	1342.52	1338.31
18.3500	1334.10	1329.88	1325.65	1321.42	1317.19
18.6000	1312.94	1308.69	1304.43	1300.17	1295.89
18.8500	1291.61	1287.34	1283.04	1278.74	1274.43
19.1000	1270.12	1265.79	1261.46	1257.13	1252.77
19.3500	1248.40	1244.04	1239.67	1235.28	1230.88
19.6000	1226.49	1222.09	1217.67	1213.26	1208.84
19.8500	1204.40	1199.97	1195.53	1191.07	1186.61
20.1000	1182.14	1177.67	1173.18	1168.69	1164.19
20.3500	1159.69	1155.18	1150.67	1146.15	1141.62
20.6000	1137.08	1132.55	1128.00	1123.45	1118.89
20.8500	1114.33	1109.75	1105.17	1100.59	1096.00
21.1000	1091.40	1086.80	1082.20	1077.58	1072.96
21.3500	1068.35	1063.72	1059.08	1054.44	1049.80

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
21.6000	1045.15	1040.49	1035.83	1031.16	1026.48
21.8500	1021.81	1017.13	1012.44	1007.75	1003.05
22.1000	998.35	993.64	988.93	984.22	979.49
22.3500	974.77	970.04	965.30	960.55	955.81
22.6000	951.07	946.31	941.55	936.79	932.03
22.8500	927.25	922.48	917.71	912.91	908.12
23.1000	903.33	898.53	893.72	888.92	884.11
23.3500	879.30	874.48	869.66	864.84	860.01
23.6000	855.17	850.34	845.50	840.65	835.80
23.8500	830.95	826.09	821.23	816.37	811.47
24.1000	806.49	801.42	796.34	791.29	786.07
24.3500	780.47	774.34	767.73	760.94	753.80
24.6000	745.64	737.70	729.90	718.74	706.47
24.8500	693.82	679.06	658.04	636.98	616.00
25.1000	589.96	562.14	534.72	506.94	477.04
25.3500	447.27	417.77	389.16	361.06	333.04
25.6000	305.69	281.62	257.58	233.60	213.23
25.8500	194.95	176.67	159.05	146.14	133.24
26.1000	120.36	109.71	100.57	91.44	82.51
26.3500	75.85	69.19	62.54	56.92	52.11
26.6000	47.30	42.55	39.10	35.64	32.19
26.8500	29.23	26.73	24.24	21.74	19.95
27.1000	18.17	16.38	14.83	13.54	12.25
27.3500	10.96	10.01	9.08	8.15	7.33
27.6000	6.65	5.98	5.30	4.80	4.32
27.8500	3.84	3.41	3.06	2.71	2.36
28.1000	2.10	1.84	1.59	1.36	1.18
28.3500	.99	.81	.67	.54	.41
28.6000	.30	.23	.16	.08	.05
28.8500	.03	.01	.00		



SCHEMATIC DIAGRAM OF PONDPACK MODEL 2B FOR DRAINAGEWAY D12



MODEL 2B POST-DEVELOPMENT OUTLET HYDROGRAPH (50-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 50yrKihei24

Return Event	Total Depth in	Rainfall Type	RNF ID
50/24	8.3000	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
JUNC 20		JCT	50	26.117		10.1000	160.90		
JUNC 30		JCT	50	1742.310		10.7500	4999.11		
JUNC 60		JCT	50	1822.208		11.1000	5125.36		
*OUT 10		JCT	50	1825.500		11.3500	5128.72		
POND 10	IN	POND	50	26.117		10.1000	160.90		
POND 10	OUT	POND	50	26.117		10.1000	160.90		
POND 20	IN	POND	50	1825.500		11.3500	5128.72		
POND 20	OUT	POND	50	1825.500		11.3500	5128.72		
POND 30	IN	POND	50	1765.794		11.1000	5026.70		
POND 30	OUT	POND	50	1765.794		11.1000	5026.70		
POND 40	IN	POND	50	1822.208		11.1000	5125.36		

Type.... Master Network Summary

Name.... Watershed

File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\D12PostDevelopment.ppw

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 40	OUT	POND	50	1822.208		11.1000	5125.36		
POND 50	IN	POND	50	56.414		10.6000	242.54		
POND 50	OUT	POND	50	56.414		10.6000	242.54		
POND 60	IN	POND	50	1742.310		10.7500	4999.11		
POND 60	OUT	POND	50	1742.310		10.7500	4999.11		
SUBAREA 10		AREA	50	26.117		10.1000	160.90		
SUBAREA 20		AREA	50	30.297		10.2000	165.72		
SUBAREA 30		AREA	50	1685.410		10.7500	4851.35		
SUBAREA 40		AREA	50	23.485		10.1000	155.97		
SUBAREA 50		AREA	50	56.901		10.3000	261.50		
SUBAREA 60		AREA	50	3.292		10.0500	24.90		

Type.... Tc Calcs
Name.... SUBAREA 60

File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\D12PostDevelopment.ppw

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: SCS Lag

Hydraulic Length	1032.00 ft
Runoff CN	77
Slope	.065800 ft/ft
Avg.Velocity	1.24 ft/sec

Segment #1 Time: .2320 hrs

Total Tc: .2320 hrs

Tc Equations used...

==== SCS Lag ====

```
Tc = 0.000877 * (Lf**0.8) * ((1000/CN) - 9)**0.7) * (Sf**-0.5)

Where:  Tc = Time of concentration, hrs
        Lf = Flow length, ft
       CN  = SCS Curve Number
        Sf = Slope, ft/ft
```

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ROUTE 30	POND 20 IN	work_pad.hyg	ROUTE 30	50/24

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 30	50/24	1825.500	11.3500	5128.72

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	50/24	1825.500	11.3500	5128.72

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\work_pad.hyg
HYG ID = OUT 10
HYG Tag = 50/24

Peak Discharge = 5128.72 cfs
Time to Peak = 11.3500 hrs
HYG Volume = 1825.500 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
3.9000	.00	.00	.01	.01	.02
4.1500	.03	.04	.05	.08	.11
4.4000	.15	.22	.30	.40	.51
4.6500	.64	.77	.90	1.04	1.19
4.9000	1.34	1.50	1.67	1.85	2.03
5.1500	2.23	2.43	2.64	2.85	3.06
5.4000	3.27	3.48	3.70	3.92	4.15
5.6500	4.39	4.64	4.90	5.17	5.46
5.9000	5.75	6.05	6.36	6.68	7.00
6.1500	7.33	7.67	8.01	8.35	8.70
6.4000	9.06	9.43	9.82	10.22	10.65
6.6500	11.08	11.53	11.99	12.47	12.97
6.9000	13.48	14.01	14.58	15.16	15.77
7.1500	16.40	17.04	17.71	18.39	19.12
7.4000	19.85	20.59	21.43	22.31	23.19
7.6500	24.16	25.44	26.73	28.02	29.84
7.9000	31.90	33.96	36.19	39.31	42.44
8.1500	45.57	49.47	53.80	58.15	62.66
8.4000	68.23	73.88	79.63	86.07	93.05
8.6500	100.11	107.35	115.58	123.92	132.36
8.9000	141.60	151.58	161.67	172.05	184.42
9.1500	196.98	209.69	223.97	239.73	255.61
9.4000	271.69	291.36	311.27	331.45	354.01
9.6500	379.17	404.89	431.33	463.66	498.22
9.9000	535.97	580.18	630.27	682.87	740.97
10.1500	820.29	909.45	1000.87	1105.05	1222.79
10.4000	1327.17	1422.39	1595.20	1786.43	1985.66
10.6500	2230.34	2544.90	2858.01	3164.67	3483.03
10.9000	3790.74	4084.45	4337.46	4524.63	4710.14
11.1500	4899.17	4980.18	5037.15	5097.61	5128.72
11.4000	5079.20	5032.27	4986.65	4878.83	4751.73

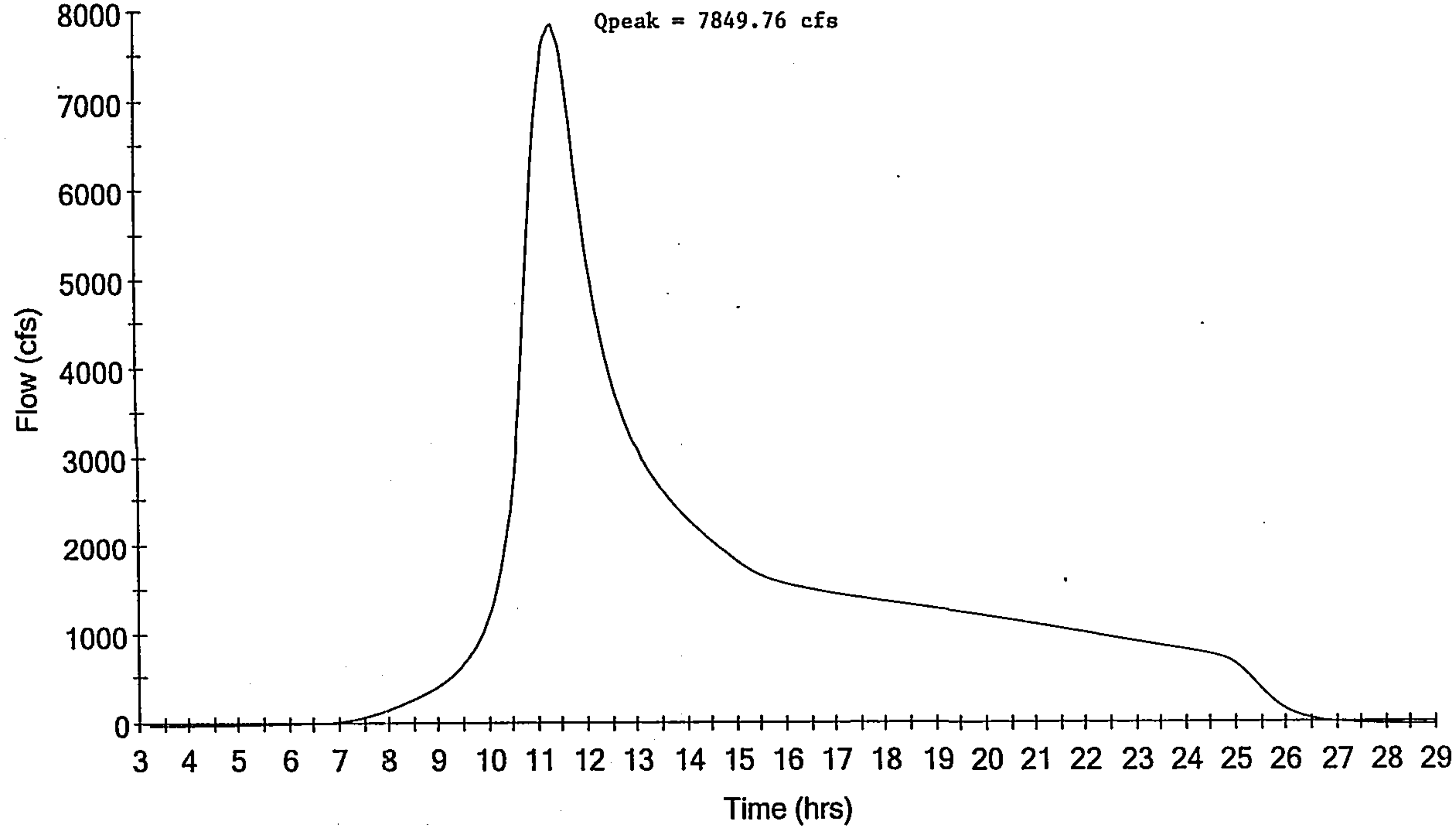
HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
11.6500	4626.30	4493.06	4333.18	4174.16	4015.67
11.9000	3872.54	3735.39	3598.90	3468.39	3361.04
12.1500	3253.96	3147.13	3054.69	2969.00	2883.51
12.4000	2800.54	2730.52	2660.55	2590.67	2529.85
12.6500	2474.14	2418.53	2364.09	2318.07	2272.07
12.9000	2226.12	2184.86	2146.75	2108.68	2071.14
13.1500	2039.26	2007.39	1975.55	1946.22	1918.87
13.4000	1891.53	1864.34	1840.51	1816.68	1792.86
13.6500	1770.47	1749.39	1728.31	1707.24	1688.23
13.9000	1669.22	1650.21	1631.81	1614.09	1596.36
14.1500	1578.64	1561.58	1544.55	1527.52	1510.57
14.4000	1493.72	1476.90	1460.13	1443.53	1426.99
14.6500	1410.49	1394.33	1378.67	1363.03	1347.44
14.9000	1333.03	1318.84	1304.69	1291.04	1278.24
15.1500	1265.47	1252.75	1241.45	1230.46	1219.47
15.4000	1209.08	1199.91	1190.74	1181.59	1173.77
15.6500	1166.29	1158.81	1151.73	1145.66	1139.59
15.9000	1133.52	1128.23	1123.19	1118.14	1113.27
16.1500	1108.93	1104.59	1100.25	1096.26	1092.41
16.4000	1088.56	1084.78	1081.27	1077.77	1074.27
16.6500	1070.93	1067.67	1064.41	1061.17	1058.07
16.9000	1054.97	1051.87	1048.83	1045.83	1042.84
17.1500	1039.85	1036.92	1033.99	1031.05	1028.14
17.4000	1025.25	1022.36	1019.47	1016.60	1013.72
17.6500	1010.85	1007.98	1005.11	1002.24	999.37
17.9000	996.49	993.62	990.74	987.86	984.97
18.1500	982.08	979.20	976.29	973.39	970.49
18.4000	967.58	964.66	961.74	958.81	955.87
18.6500	952.92	949.97	947.01	944.04	941.07
18.9000	938.10	935.10	932.11	929.11	926.10
19.1500	923.08	920.06	917.03	913.98	910.93
19.4000	907.87	904.81	901.73	898.65	895.57
19.6500	892.47	889.37	886.27	883.16	880.03
19.9000	876.90	873.78	870.63	867.48	864.33
20.1500	861.17	857.99	854.81	851.64	848.44
20.4000	845.25	842.05	838.85	835.63	832.41
20.6500	829.20	825.96	822.72	819.48	816.24
20.9000	812.98	809.71	806.45	803.17	799.89
21.1500	796.61	793.33	790.03	786.73	783.43
21.4000	780.12	776.80	773.48	770.16	766.82
21.6500	763.48	760.14	756.79	753.43	750.08
21.9000	746.72	743.35	739.98	736.60	733.22
22.1500	729.83	726.44	723.05	719.65	716.24
22.4000	712.83	709.42	705.99	702.57	699.15
22.6500	695.71	692.27	688.84	685.39	681.94

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
22.9000	678.49	675.04	671.57	668.10	664.63
23.1500	661.15	657.67	654.18	650.70	647.21
23.4000	643.71	640.22	636.72	633.21	629.70
23.6500	626.20	622.67	619.15	615.63	612.10
23.9000	608.56	605.03	601.49	597.91	594.27
24.1500	590.56	586.86	583.17	579.36	575.26
24.4000	570.75	565.86	560.84	555.55	549.52
24.6500	543.66	537.91	529.68	520.64	511.30
24.9000	500.40	484.87	469.30	453.81	434.58
25.1500	414.06	393.84	373.36	351.32	329.39
25.4000	307.66	286.58	265.89	245.25	225.11
25.6500	207.38	189.67	172.02	157.01	143.55
25.9000	130.09	117.11	107.61	98.11	88.62
26.1500	80.78	74.05	67.33	60.75	55.85
26.4000	50.95	46.05	41.91	38.37	34.83
26.6500	31.33	28.79	26.24	23.70	21.52
26.9000	19.69	17.85	16.01	14.69	13.38
27.1500	12.06	10.92	9.97	9.02	8.07
27.4000	7.37	6.69	6.00	5.40	4.90
27.6500	4.40	3.91	3.54	3.18	2.83
27.9000	2.51	2.25	2.00	1.74	1.54
28.1500	1.36	1.17	1.00	.87	.73
28.4000	.59	.49	.40	.30	.22
28.6500	.17	.11	.06	.04	.02
28.9000	.01	.00			

Hydrograph
OUT 10 100



MODEL 2B POST-DEVELOPMENT OUTLET HYDROGRAPH (100-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 100yr24hrKihei

Return Event	Total Depth in	Rainfall Type	RNF ID
100	10.5000	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
JUNC 20		JCT	100	35.948		10.1000	223.01		
JUNC 30		JCT	100	2562.660		10.7500	7675.41		
JUNC 60		JCT	100	2672.458		11.1000	7845.29		
*OUT 10		JCT	100	2676.973		11.3500	7849.76		
POND 10	IN	POND	100	35.948		10.1000	223.01		
POND 10	OUT	POND	100	35.948		10.1000	223.01		
POND 20	IN	POND	100	2676.973		11.3500	7849.76		
POND 20	OUT	POND	100	2676.973		11.3500	7849.76		
POND 30	IN	POND	100	2594.985		11.1000	7712.34		
POND 30	OUT	POND	100	2594.985		11.1000	7712.34		
POND 40	IN	POND	100	2672.458		11.1000	7845.29		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 40	OUT	POND	100	2672.458		11.1000	7845.29		
POND 50	IN	POND	100	77.475		10.6000	333.63		
POND 50	OUT	POND	100	77.475		10.6000	333.63		
POND 60	IN	POND	100	2562.660		10.7500	7675.41		
POND 60	OUT	POND	100	2562.660		10.7500	7675.41		
SUBAREA 10		AREA	100	35.948		10.1000	223.01		
SUBAREA 20		AREA	100	41.528		10.2000	228.13		
SUBAREA 30		AREA	100	2482.972		10.7500	7469.60		
SUBAREA 40		AREA	100	32.324		10.1000	215.47		
SUBAREA 50		AREA	100	79.687		10.3000	371.65		
SUBAREA 60		AREA	100	4.513		10.0000	34.23		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 30	POND 20	IN	work_pad.hyg	ROUTE 30	100

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 30	100	2676.973	11.3500	7849.76

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	100	2676.973	11.3500	7849.76

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\RMTData\work_pad.hyg
HYG ID = OUT 10
HYG Tag = 100

Peak Discharge = 7849.76 cfs
Time to Peak = 11.3500 hrs
HYG Volume = 2676.973 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

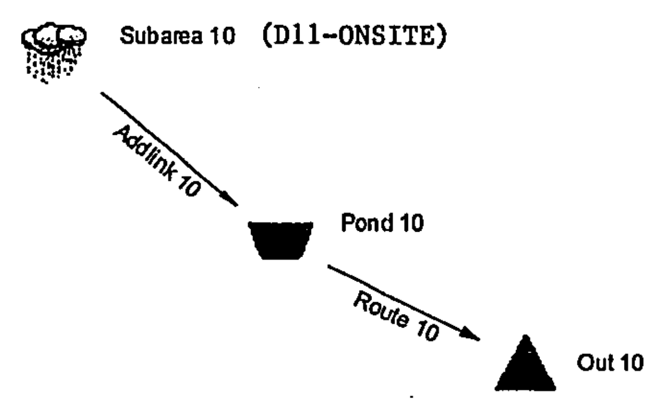
Time hrs					
3.2000	.00	.00	.01	.01	.02
3.4500	.03	.05	.07	.10	.14
3.7000	.20	.29	.40	.54	.70
3.9500	.87	1.05	1.24	1.44	1.64
4.2000	1.86	2.09	2.34	2.61	2.88
4.4500	3.17	3.47	3.77	4.07	4.38
4.7000	4.70	5.03	5.37	5.74	6.11
4.9500	6.50	6.91	7.33	7.76	8.21
5.2000	8.67	9.14	9.61	10.09	10.57
5.4500	11.06	11.54	12.03	12.52	13.01
5.7000	13.50	13.99	14.48	14.97	15.46
5.9500	15.94	16.43	16.91	17.40	17.89
6.2000	18.38	18.88	19.40	19.93	20.47
6.4500	21.14	21.87	22.63	23.54	24.72
6.7000	25.94	27.17	29.00	30.99	33.02
6.9500	35.37	38.48	41.63	44.82	48.95
7.2000	53.39	57.86	62.66	68.48	74.31
7.4500	80.15	86.94	94.10	101.26	108.67
7.7000	117.10	125.52	133.95	143.17	152.74
7.9500	162.31	172.00	182.50	193.00	203.49
8.2000	214.47	225.73	237.00	248.38	260.31
8.4500	272.38	284.58	297.20	310.18	323.30
8.7000	336.61	350.77	365.08	379.55	395.12
8.9500	411.69	428.44	445.62	466.12	486.89
9.2000	507.87	531.54	557.72	584.06	610.67
9.4500	643.32	676.26	709.59	746.66	787.79
9.7000	829.71	872.59	924.40	979.30	1038.64
9.9500	1107.23	1184.39	1265.07	1353.36	1472.82
10.2000	1605.67	1741.16	1897.07	2076.34	2237.53
10.4500	2386.53	2653.75	2948.13	3253.68	3625.04
10.7000	4098.60	4569.34	5030.75	5503.10	5959.72

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
10.9500	6397.02	6771.25	7039.92	7306.53	7578.09
11.2000	7682.84	7750.04	7822.23	7849.76	7755.13
11.4500	7664.18	7575.05	7393.74	7183.81	6976.21
11.7000	6758.05	6503.76	6250.70	5998.36	5772.43
11.9500	5556.75	5342.01	5136.84	4968.83	4801.20
12.2000	4633.90	4489.44	4355.69	4222.22	4092.75
12.4500	3983.97	3875.27	3766.68	3672.36	3586.07
12.7000	3499.92	3415.63	3344.66	3273.73	3202.86
12.9500	3139.41	3080.93	3022.51	2964.91	2916.20
13.2000	2867.52	2818.88	2774.19	2732.61	2691.05
13.4500	2649.72	2613.69	2577.66	2541.63	2507.86
13.7000	2476.17	2444.49	2412.80	2384.40	2355.99
13.9500	2327.58	2300.18	2273.86	2247.55	2221.24
14.2000	2196.06	2170.93	2145.80	2120.85	2096.12
14.4500	2071.45	2046.82	2022.60	1998.46	1974.37
14.7000	1950.86	1928.17	1905.52	1882.94	1862.15
14.9500	1841.69	1821.28	1801.61	1783.16	1764.76
15.2000	1746.43	1730.13	1714.27	1698.42	1683.42
15.4500	1670.15	1656.90	1643.66	1632.31	1621.45
15.7000	1610.59	1600.30	1591.44	1582.59	1573.73
15.9500	1565.98	1558.59	1551.19	1544.03	1537.64
16.2000	1531.25	1524.86	1518.98	1513.29	1507.60
16.4500	1502.02	1496.84	1491.65	1486.47	1481.53
16.7000	1476.70	1471.87	1467.08	1462.49	1457.90
16.9500	1453.31	1448.83	1444.40	1439.97	1435.56
17.2000	1431.23	1426.91	1422.58	1418.30	1414.05
17.4500	1409.79	1405.54	1401.32	1397.10	1392.89
17.7000	1388.68	1384.48	1380.28	1376.08	1371.88
17.9500	1367.69	1363.49	1359.29	1355.09	1350.89
18.2000	1346.69	1342.48	1338.27	1334.06	1329.84
18.4500	1325.61	1321.38	1317.15	1312.90	1308.65
18.7000	1304.39	1300.13	1295.85	1291.57	1287.30
18.9500	1283.00	1278.70	1274.40	1270.08	1265.75
19.2000	1261.42	1257.09	1252.73	1248.37	1244.00
19.4500	1239.63	1235.24	1230.85	1226.46	1222.05
19.7000	1217.64	1213.23	1208.81	1204.37	1199.93
19.9500	1195.50	1191.04	1186.57	1182.11	1177.63
20.2000	1173.14	1168.65	1164.16	1159.66	1155.14
20.4500	1150.63	1146.12	1141.59	1137.05	1132.52
20.7000	1127.97	1123.42	1118.86	1114.30	1109.72
20.9500	1105.14	1100.56	1095.97	1091.37	1086.77
21.2000	1082.17	1077.55	1072.93	1068.32	1063.69
21.4500	1059.05	1054.42	1049.78	1045.12	1040.46
21.7000	1035.80	1031.13	1026.46	1021.78	1017.10
21.9500	1012.41	1007.72	1003.03	998.32	993.62

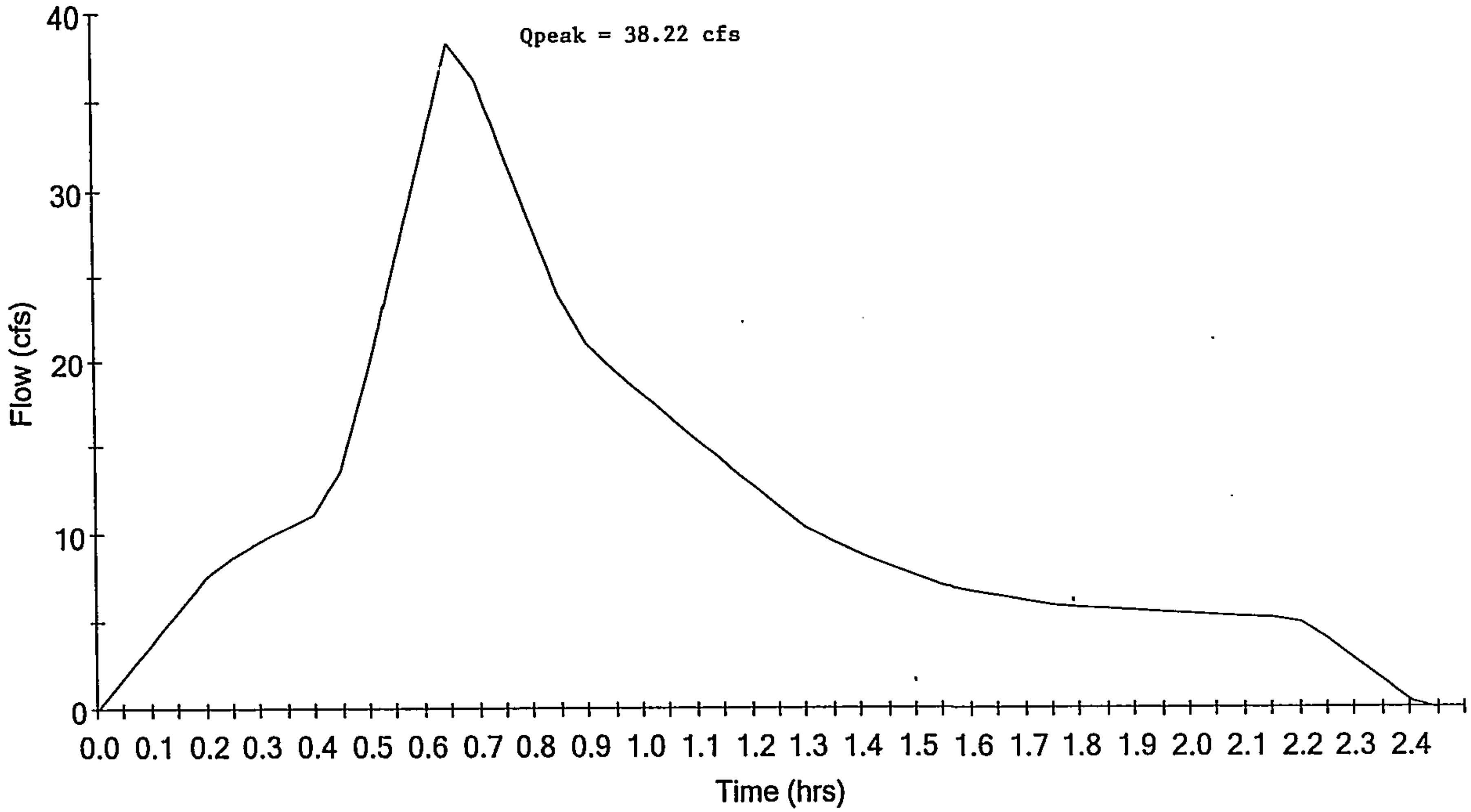
HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
22.2000	988.91	984.20	979.47	974.74	970.01
22.4500	965.27	960.53	955.79	951.04	946.28
22.7000	941.53	936.77	932.00	927.23	922.46
22.9500	917.68	912.89	908.10	903.31	898.51
23.2000	893.70	888.90	884.09	879.27	874.46
23.4500	869.64	864.81	859.98	855.15	850.32
23.7000	845.48	840.63	835.78	830.93	826.07
23.9500	821.21	816.35	811.44	806.44	801.36
24.2000	796.29	791.24	786.04	780.44	774.33
24.4500	767.72	760.94	753.79	745.64	737.70
24.7000	729.90	718.74	706.47	693.82	679.06
24.9500	658.04	636.98	616.00	589.96	562.14
25.2000	534.72	506.94	477.04	447.27	417.77
25.4500	389.16	361.06	333.04	305.69	281.62
25.7000	257.58	233.60	213.23	194.95	176.67
25.9500	159.05	146.14	133.24	120.36	109.71
26.2000	100.57	91.44	82.51	75.85	69.19
26.4500	62.54	56.92	52.11	47.30	42.55
26.7000	39.10	35.64	32.19	29.23	26.73
26.9500	24.24	21.74	19.95	18.17	16.38
27.2000	14.83	13.54	12.25	10.96	10.01
27.4500	9.08	8.15	7.33	6.65	5.98
27.7000	5.30	4.80	4.32	3.84	3.41
27.9500	3.06	2.71	2.36	2.10	1.84
28.2000	1.59	1.36	1.18	.99	.81
28.4500	.67	.54	.41	.30	.23
28.7000	.16	.08	.05	.03	.01
28.9500	.00				



SCHEMATIC DIAGRAM OF PONDPACK MODEL 3A FOR DRAINAGEWAY D11

Hydrograph
POND 10 OUT Dev 50



MODEL 3A PRE-DEVELOPMENT OUTLET HYDROGRAPH (50-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
Dev 50	I-D-F Curve	Kihei 50yr 1hr

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	50	2.365	R	.6500	38.22		
POND 10	IN	POND	50	2.365	R	.6500	38.22		
POND 10	OUT	POND	50	2.365	R	.6500	38.22		
SUBAREA 10		AREA	50	2.365	L	.6600	39.47		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
WARNING: Adding in hydrograph that is truncated on right...					
ROUTE 10	POND 10	IN	work_pad.hyg	ROUTE 10	Dev 50

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 10	Dev 50	2.365	.6500	38.22

TOTAL FLOW INTO: OUT 10

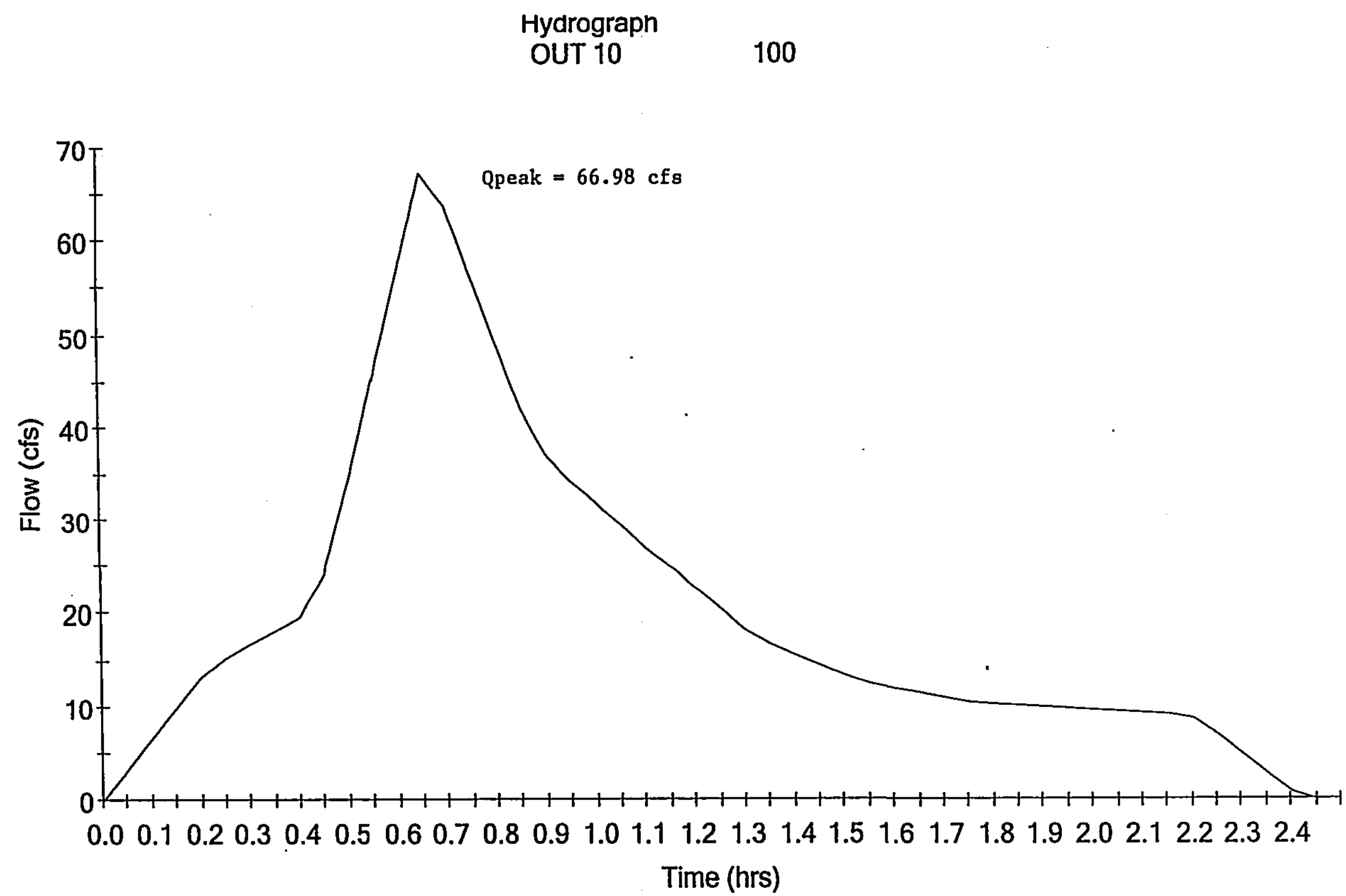
HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	Dev 50	2.365	.6500	38.22

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\work_pad.hyg
HYG ID = OUT 10
HYG Tag = Dev 50

Peak Discharge =	38.22	cfs
Time to Peak =	.6500	hrs
HYG Volume =	2.365	ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	1.88	3.77	5.65	7.54
.2500	8.73	9.58	10.39	11.20	13.76
.5000	19.38	25.66	31.94	38.22	36.17
.7500	32.05	27.92	23.79	21.00	19.43
1.0000	18.09	16.74	15.41	14.14	12.88
1.2500	11.63	10.37	9.52	8.86	8.24
1.5000	7.61	7.09	6.78	6.51	6.24
1.7500	5.97	5.85	5.76	5.67	5.58
2.0000	5.49	5.40	5.31	5.22	4.96
2.2500	3.97	2.80	1.63	.47	.05



MODEL 3A PRE-DEVELOPMENT OUTLET HYDROGRAPH (100-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
100	I-D-F Curve	100yr-1hrKihei

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	100	4.145	R	.6500	66.98		
POND 10	IN	POND	100	4.145	R	.6500	66.98		
POND 10	OUT	POND	100	4.145	R	.6500	66.98		
SUBAREA 10		AREA	100	4.146	L	.6600	69.19		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
WARNING: Adding in hydrograph that is truncated on right...				
ROUTE 10	POND 10 IN	work_pad.hyg	ROUTE 10	100

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 10	100	4.145	.6500	66.98

TOTAL FLOW INTO: OUT 10

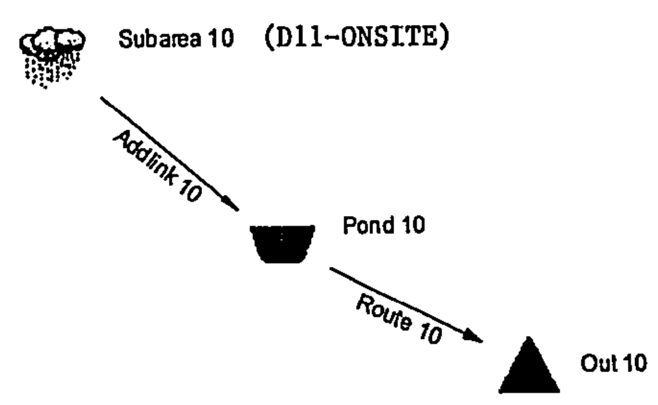
HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	100	4.145	.6500	66.98

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\work_pad.hyg
HYG ID = OUT 10
HYG Tag = 100

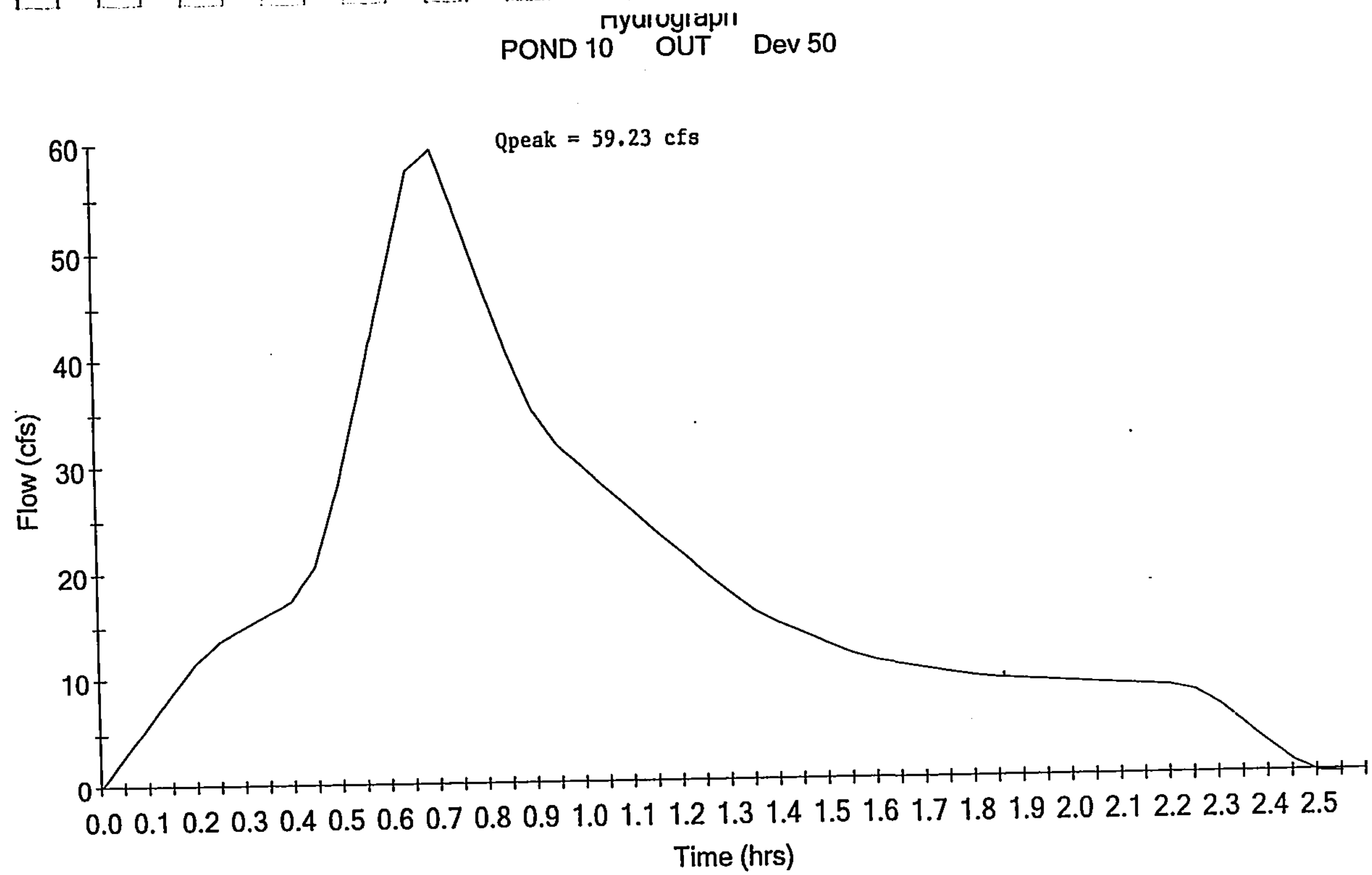
Peak Discharge = 66.98 cfs
Time to Peak = .6500 hrs
HYG Volume = 4.145 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	3.30	6.60	9.91	13.21
.2500	15.30	16.79	18.21	19.62	24.11
.5000	33.96	44.97	55.98	66.98	63.40
.7500	56.17	48.93	41.70	36.81	34.06
1.0000	31.70	29.34	27.01	24.78	22.58
1.2500	20.38	18.18	16.68	15.54	14.43
1.5000	13.33	12.43	11.89	11.42	10.94
1.7500	10.47	10.25	10.09	9.94	9.78
2.0000	9.62	9.47	9.31	9.15	8.69
2.2500	6.95	4.91	2.86	.82	.08



SCHEMATIC DIAGRAM OF PONDPACK MODEL 3B FOR DRAINAGEWAY D11



MODEL 3B POST-DEVELOPMENT OUTLET HYDROGRAPH (50-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
Dev 50	I-D-F Curve	Kihei 50yr 1hr

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	50	3.823		.7000	59.23		
POND 10	IN	POND	50	3.823		.7000	59.23		
POND 10	OUT	POND	50	3.823		.7000	59.23		
SUBAREA 10		AREA	50	3.822	L	.6760	62.25		

File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\POSTD11ONLYUNIVRAT.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .2254 hrs

Total Tc: .2254 hrs

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

Type.... Node: Addition Summary
Name.... OUT 10
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\POSTD11ONLYUNIVRAT.PPW
Storm... Kihei 50yr 1hr   Tag: Dev 50

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 10	POND 10	IN	work_pad.hyg	ROUTE 10	Dev 50

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 10	Dev 50	3.823	.7000	59.23

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	Dev 50	3.823	.7000	59.23

Type.... Node: Addition Summary
Name.... OUT 10
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\POSTD11ONLYUNIVRAT.PPW
Storm... Kihei 50yr 1hr   Tag: Dev 50

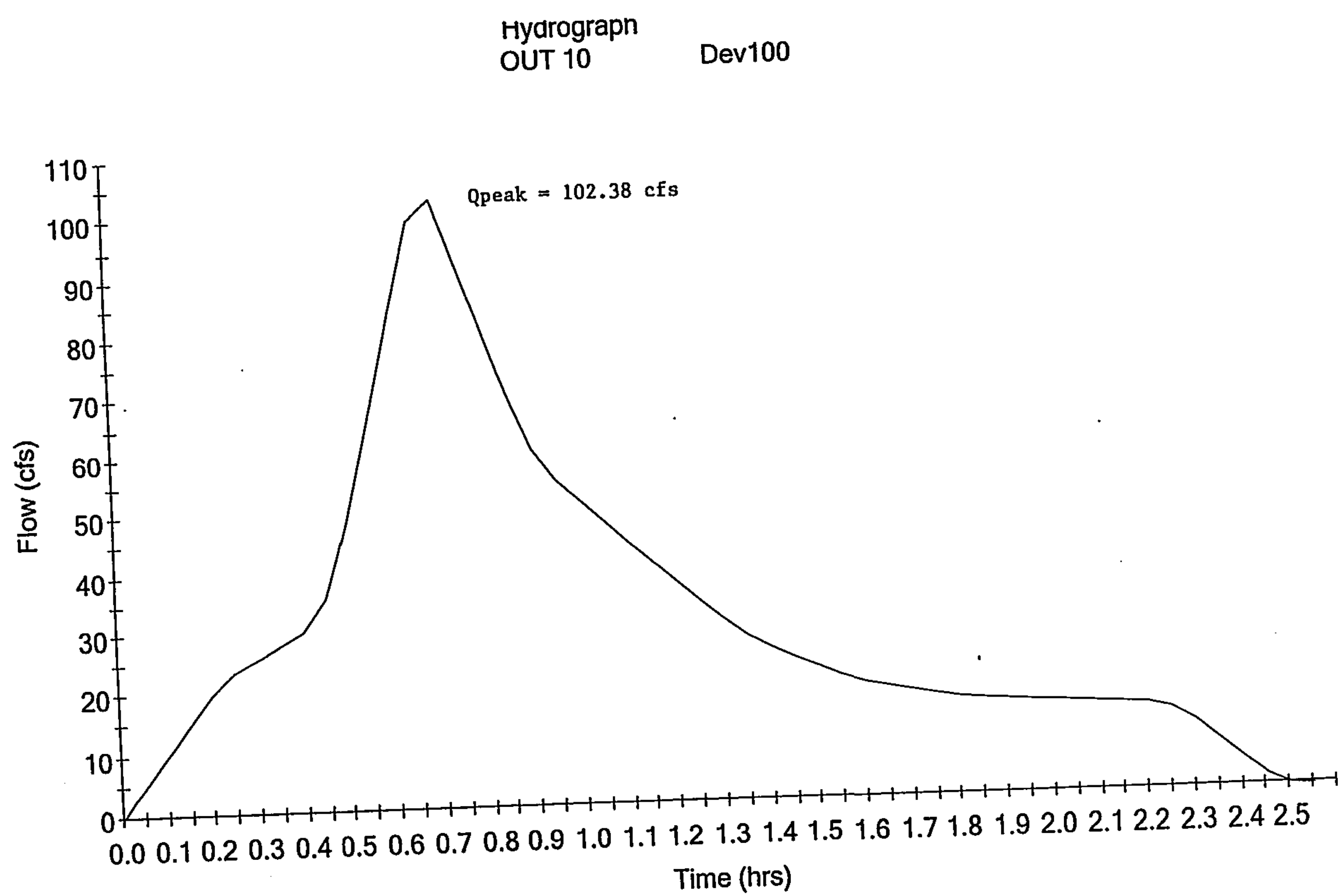
Event: 50 yr

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\work_pad.hyg
HYG ID = OUT 10
HYG Tag = Dev 50

Peak Discharge =	59.23 cfs
Time to Peak =	.7000 hrs
HYG Volume =	3.823 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	2.90	5.80	8.71	11.60
.2500	13.69	14.94	16.18	17.42	20.71
.5000	28.21	37.88	47.55	57.22	59.23
.7500	52.91	46.55	40.20	34.84	31.63
1.0000	29.56	27.49	25.41	23.41	21.47
1.2500	19.53	17.60	15.88	14.65	13.68
1.5000	12.72	11.75	11.04	10.61	10.20
1.7500	9.78	9.43	9.21	9.08	8.94
2.0000	8.80	8.66	8.52	8.39	8.25
2.2500	7.76	6.45	4.65	2.85	1.06
2.5000	.06	.00			



MODEL 3B POST-DEVELOPMENT OUTLET HYDROGRAPH (100-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
Dev100	I-D-F Curve	100yr-1hrKihei

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	100	6.607		.7000	102.38		
POND 10	IN	POND	100	6.607		.7000	102.38		
POND 10	OUT	POND	100	6.607		.7000	102.38		
SUBAREA 10		AREA	100	6.607	L	.6760	107.60		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 10	POND 10	IN	work_pad.hyg	ROUTE 10	Dev100

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 10	Dev100	6.607	.7000	102.38

TOTAL FLOW INTO: OUT 10

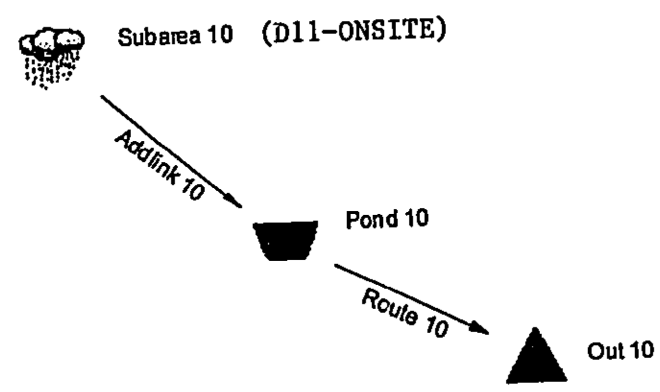
HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	Dev100	6.607	.7000	102.38

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\work_pad.hyg
HYG ID = OUT 10
HYG Tag = Dev100

Peak Discharge =	102.38	cfs
Time to Peak =	.7000	hrs
HYG Volume =	6.607	ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	5.02	10.03	15.05	20.05
.2500	23.67	25.82	27.97	30.12	35.79
.5000	48.75	65.47	82.19	98.91	102.38
.7500	91.45	80.46	69.48	60.23	54.67
1.0000	51.09	47.51	43.92	40.45	37.11
1.2500	33.76	30.42	27.46	25.32	23.65
1.5000	21.98	20.31	19.08	18.35	17.63
1.7500	16.91	16.30	15.93	15.69	15.45
2.0000	15.21	14.97	14.73	14.49	14.25
2.2500	13.41	11.14	8.04	4.93	1.83
2.5000	.11	.00			



SCHEMATIC DIAGRAM OF PONDPACK MODEL 3C FOR DRAINAGEWAY D11

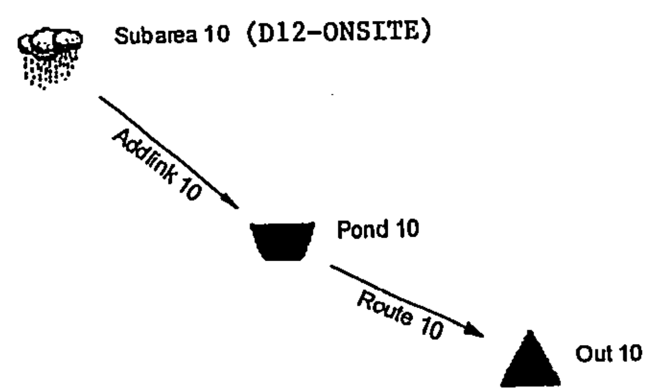
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\POSTD11STORAGEESTIMATEONLYUNIVRAT.PPW

DETENTION STORAGE ESTIMATES -- Target Peak Outflow Rate

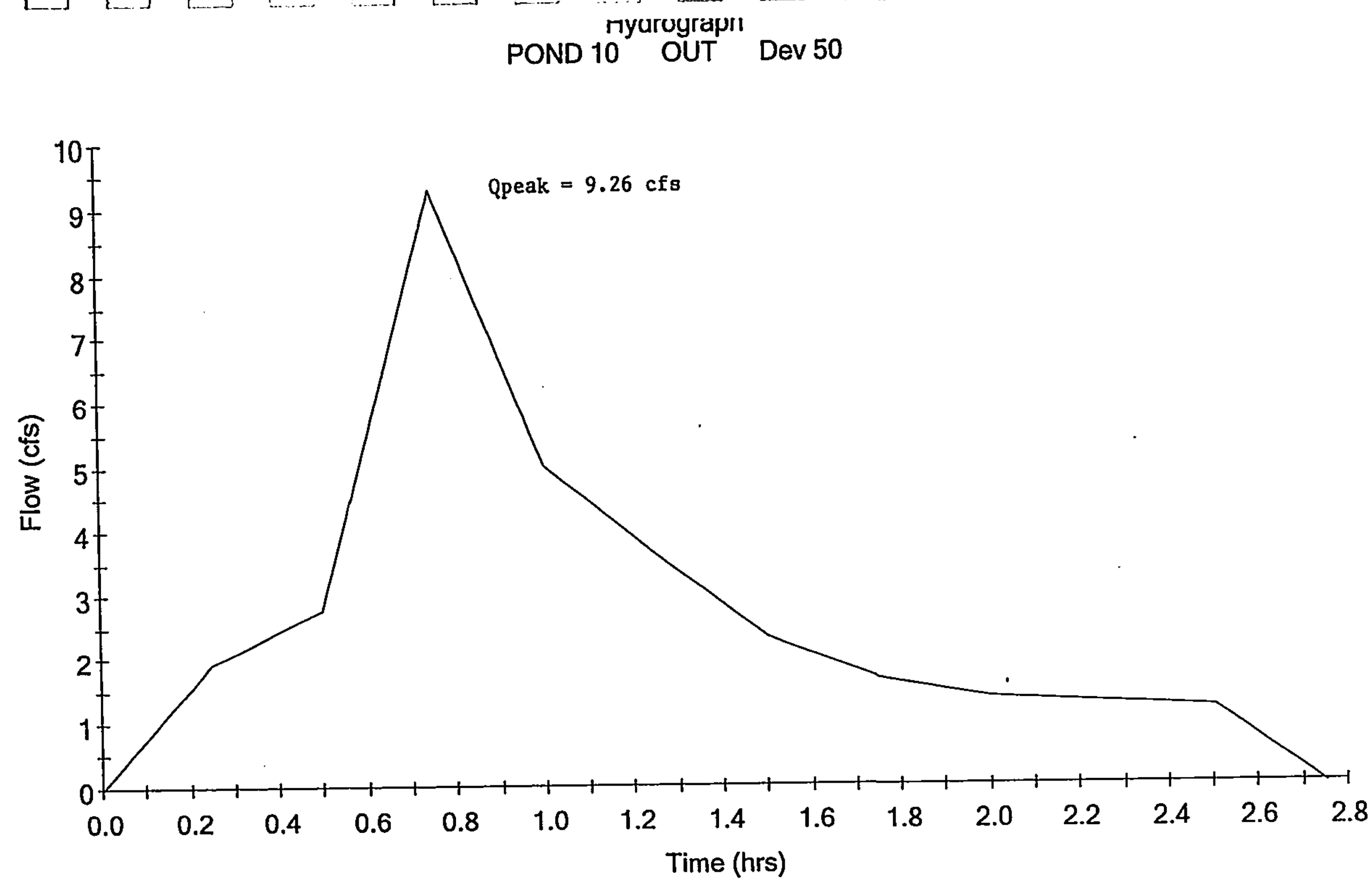
Return Events	Peak In (cfs)	Target (cfs)	Lower (ac-ft)	Linear (ac-ft)	Curvlinr (ac-ft)	Upper (ac-ft)	Total (ac-ft)
50	59.233	38.220	.304	.549	1.304	1.967	3.823

CALCULATION TIME RANGES

Return Events	Lower From (hrs)	Lower To (hrs)	Linear From (hrs)	Linear To (hrs)	Curvilinear From (hrs)	Curvilinear To (hrs)	Upper From (hrs)	Upper To (hrs)	Total From (hrs)	Total To (hrs)
50	.55	.87	.40	.87	.00	.87	.00	.87	.00	2.55



SCHEMATIC DIAGRAM OF PONDPACK MODEL 4A FOR DRAINAGEWAY D12



MODEL 4A PRE-DEVELOPMENT OUTLET HYDROGRAPH (50-YEAR STORM)

Type.... Master Network Summary
Name.... Watershed
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\PRED12ONLYUNIVRAT.PPW

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
Dev 50	I-D-F Curve	Kihei 50yr 1hr

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	50	.629		.7500	9.26		
POND 10	IN	POND	50	.629		.7500	9.26		
POND 10	OUT	POND	50	.629		.7500	9.26		
SUBAREA 10		AREA	50	.629		.7500	9.26		

Type.... Node: Addition Summary Page 6.01
Name.... OUT 10 Event: 50 yr
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\PRED12ONLYUNIVRAT.PPW
Storm... Kihei 50yr 1hr Tag: Dev 50

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 10	POND 10	IN	work_pad.hyg	ROUTE 10	Dev 50

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 10	Dev 50	.629	.7500	9.26

TOTAL FLOW INTO: OUT 10

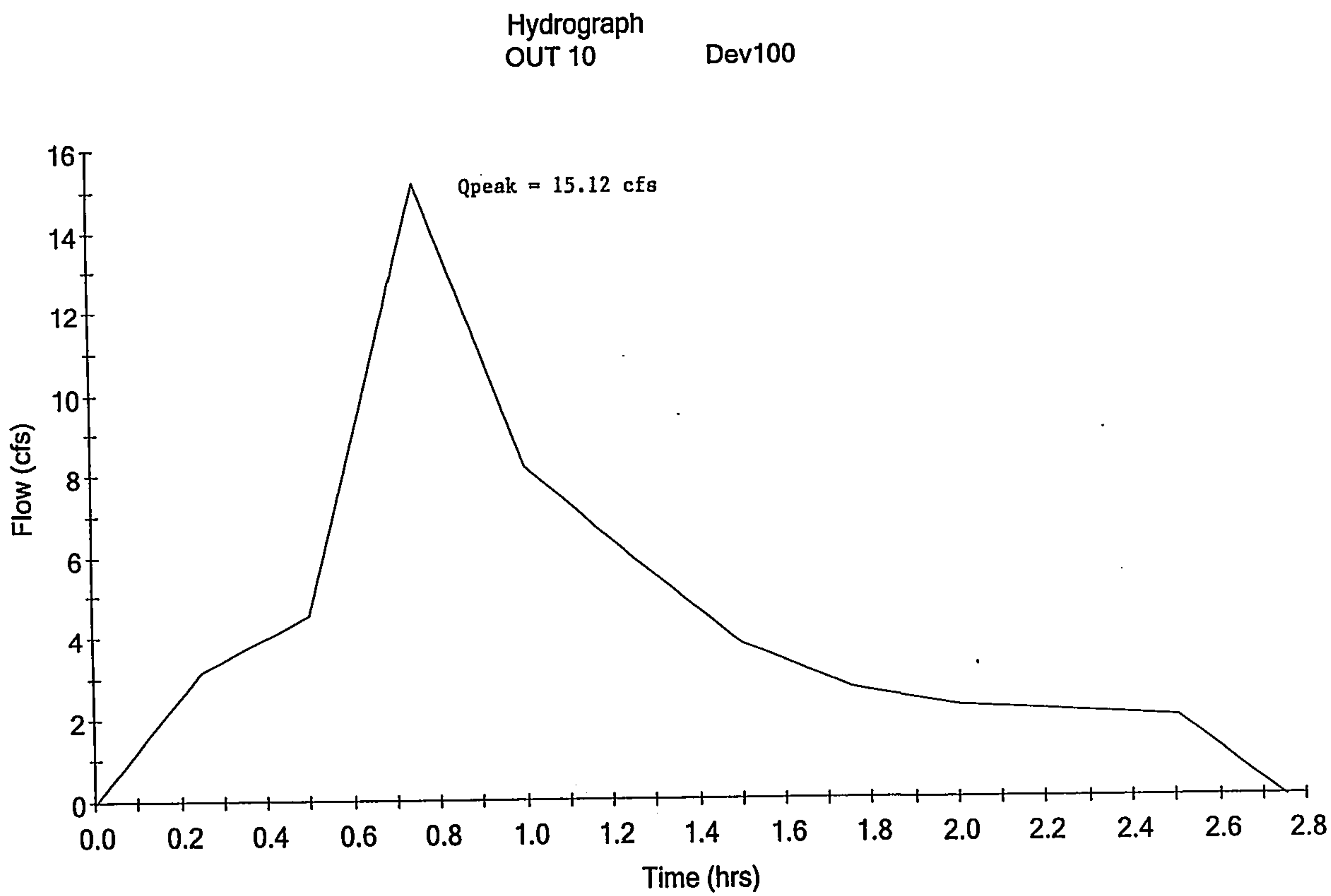
HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	Dev 50	.629	.7500	9.26

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\work_pad.hyg
HYG ID = OUT 10
HYG Tag = Dev 50

Peak Discharge =	9.26 cfs
Time to Peak =	.7500 hrs
HYG Volume =	.629 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	.39	.78	1.17	1.56
.2500	1.94	2.11	2.28	2.44	2.61
.5000	2.78	4.07	5.37	6.67	7.96
.7500	9.26	8.41	7.56	6.70	5.85
1.0000	5.00	4.72	4.44	4.17	3.89
1.2500	3.61	3.35	3.09	2.83	2.57
1.5000	2.31	2.19	2.06	1.93	1.80
1.7500	1.67	1.61	1.56	1.50	1.44
2.0000	1.39	1.37	1.35	1.33	1.31
2.2500	1.30	1.28	1.26	1.24	1.22
2.5000	1.20	.96	.72	.48	.24
2.7500	.00				



MODEL 4A PRE-DEVELOPMENT OUTLET HYDROGRAPH (100-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
Dev100	I-D-F Curve	100yr-1hrKihei

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	100	1.028		.7500	15.12		
POND 10	IN	POND	100	1.028		.7500	15.12		
POND 10	OUT	POND	100	1.028		.7500	15.12		
SUBAREA 10		AREA	100	1.028		.7500	15.12		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 10	POND 10	IN	work_pad.hyg	ROUTE 10	Dev100

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 10	Dev100	1.028	.7500	15.12

TOTAL FLOW INTO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	Dev100	1.028	.7500	15.12

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\work_pad.hyg
HYG ID = OUT 10
HYG Tag = Dev100

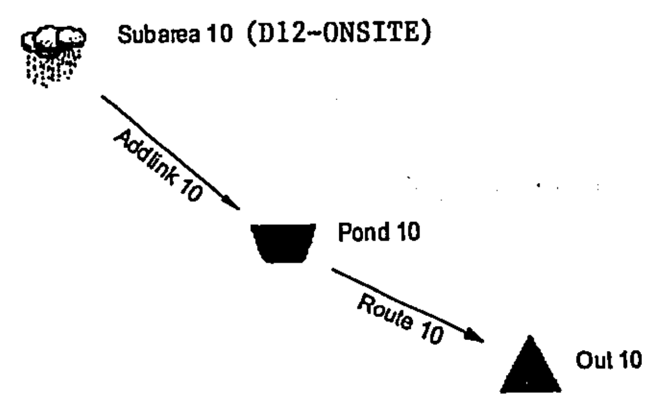
Peak Discharge = 15.12 cfs
Time to Peak = .7500 hrs
HYG Volume = 1.028 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

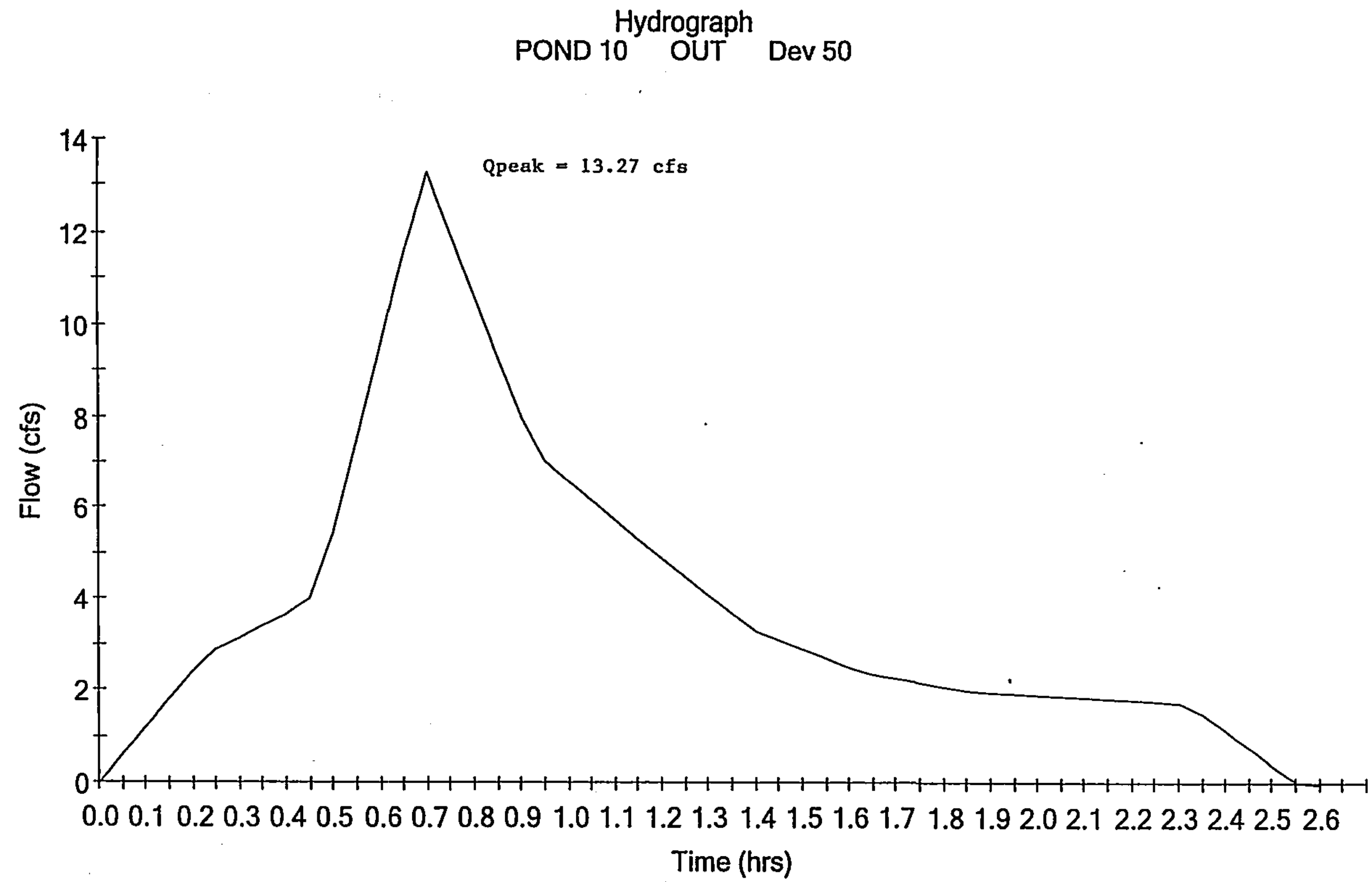
Time hrs					
.0000	.00	.64	1.27	1.91	2.54
.2500	3.18	3.45	3.72	3.99	4.26
.5000	4.54	6.65	8.77	10.89	13.00
.7500	15.12	13.73	12.34	10.95	9.56
1.0000	8.16	7.71	7.26	6.80	6.35
1.2500	5.90	5.47	5.05	4.63	4.20
1.5000	3.78	3.57	3.36	3.14	2.93
1.7500	2.72	2.63	2.54	2.45	2.36
2.0000	2.27	2.24	2.21	2.18	2.15
2.2500	2.12	2.09	2.06	2.03	2.00
2.5000	1.97	1.57	1.18	.79	.39
2.7500	.00				

Rainfall-Intensity-Duration Curve

Time, hrs	Intens., in/hr
.0830	19.0370
.1000	16.0340
.1170	13.8890
.1330	12.2800
.1500	11.0290
.1670	10.0270
.1830	9.2080
.2000	8.5250
.2170	7.9470
.2330	7.4520
.2500	7.0220
.3330	5.5190
.4170	4.6150
.5000	4.0120
.6670	3.2570
.8330	2.8010
1.0000	2.4960
2.0000	1.7160
3.0000	1.4350
4.0000	1.2800
5.0000	1.1750
6.0000	1.0950
8.0000	.9730
10.0000	.8750
12.0000	.7900
18.0000	.5680
24.0000	.3680



SCHEMATIC DIAGRAM OF PONDPACK MODEL 4B FOR DRAINAGEWAY D12



MODEL 4B POST-DEVELOPMENT OUTLET HYDROGRAPH (50-YEAR STORM)

Type.... Master Network Summary
Name.... Watershed
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\POSTD12ONLYUNIVRAT.PPW

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
Dev 50	I-D-F Curve	Kihei 50yr 1hr

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	50	.845		.7000	13.27		
POND 10	IN	POND	50	.845		.7000	13.27		
POND 10	OUT	POND	50	.845		.7000	13.27		
SUBAREA 10		AREA	50	.844	L	.6960	13.38		

File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\POSTD12ONLYUNIVRAT.PPW

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: User Defined

Segment #1 Time: .2320 hrs

Total Tc: .2320 hrs

Type.... Tc Calcs
Name.... SUBAREA 10   Tag: RAT

File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\POSTD12ONLYUNIVRAT.PPW

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

Type.... Node: Addition Summary
Name.... OUT 10
File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\POSTD12ONLYUNIVRAT.PPW
Storm... Kihei 50yr 1hr   Tag: Dev 50

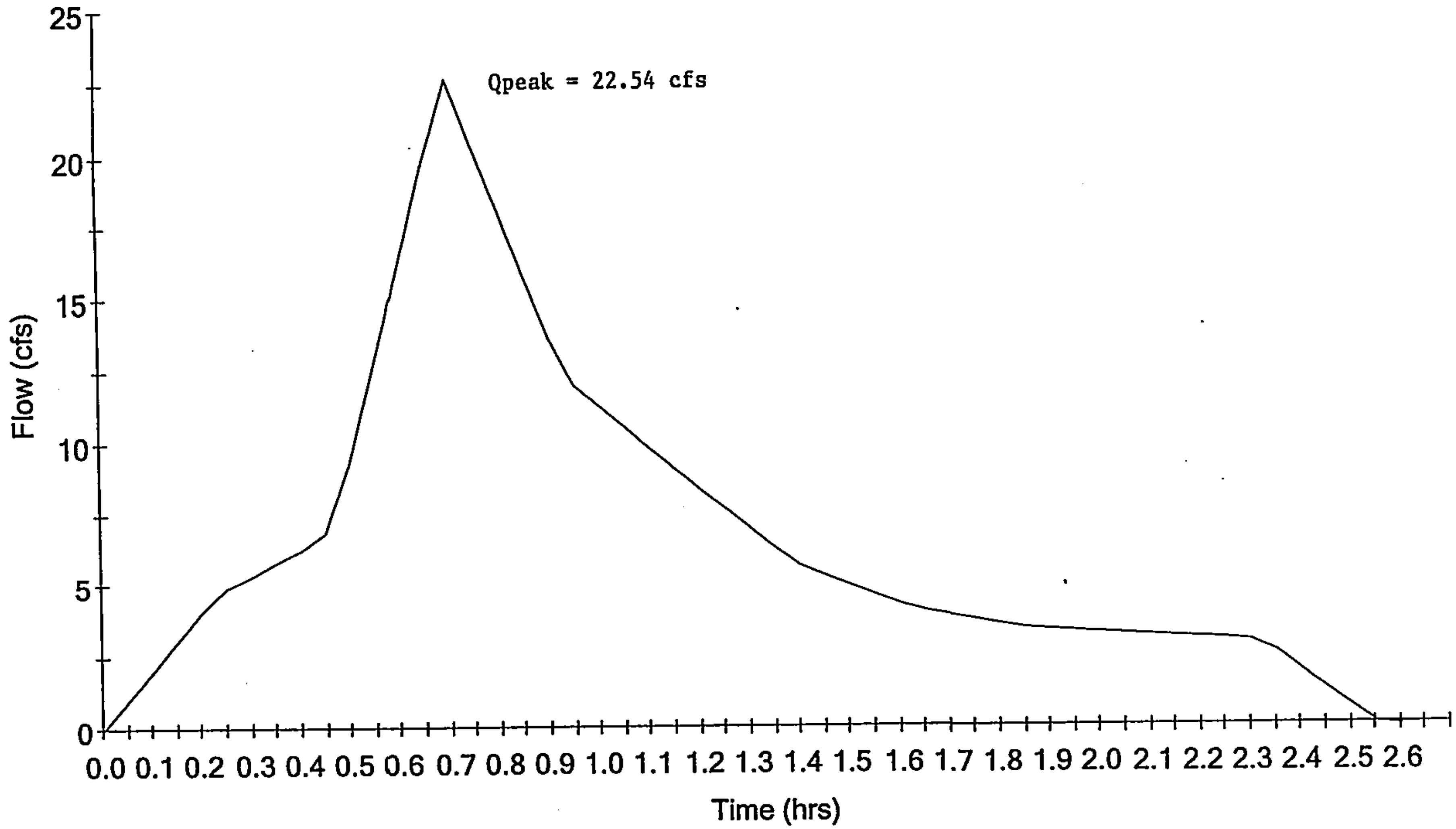
TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\work_pad.hyg
HYG ID = OUT 10
HYG Tag = Dev 50

Peak Discharge =	13.27 cfs
Time to Peak =	.7000 hrs
HYG Volume =	.845 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	.61	1.21	1.82	2.41
.2500	2.90	3.16	3.42	3.68	4.03
.5000	5.47	7.48	9.50	11.52	13.27
.7500	11.95	10.62	9.29	7.99	7.03
1.0000	6.60	6.17	5.74	5.31	4.89
1.2500	4.49	4.09	3.68	3.31	3.11
1.5000	2.91	2.71	2.51	2.36	2.28
1.7500	2.19	2.10	2.02	1.98	1.95
2.0000	1.92	1.89	1.87	1.84	1.81
2.2500	1.78	1.74	1.51	1.14	.76
2.5000	.39	.04	.00		

Hydrograph
OUT 10 Dev100



MODEL 4BPOST-DEVELOPMENT OUTLET HYDROGRAPH (100-YEAR STORM)

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID IDF Storms

Return Event	Rainfall Type	IDF ID
Dev100	I-D-F Curve	100yr-1hrKihei

MASTER NETWORK SUMMARY
Rational Method -- q/Qp

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	100	1.435		.7000	22.54		
POND 10	IN	POND	100	1.435		.7000	22.54		
POND 10	OUT	POND	100	1.435		.7000	22.54		
SUBAREA 10		AREA	100	1.433	L	.6960	22.72		

SUMMARY FOR HYDROGRAPH ADDITION
at Node: OUT 10

HYG Directory: V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\

Upstream Link ID	Upstream Node ID		HYG file	HYG ID	HYG tag
ROUTE 10	POND 10	IN	work_pad.hyg	ROUTE 10	Dev100

INFLOWS TO: OUT 10

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	ROUTE 10	Dev100	1.435	.7000	22.54

TOTAL FLOW INTO: OUT 10

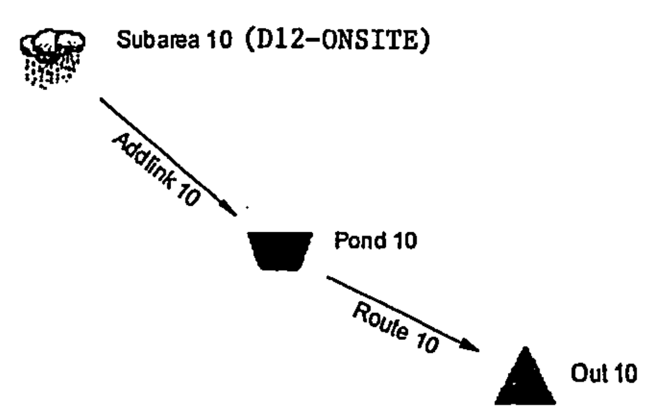
HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
work_pad.hyg	OUT 10	Dev100	1.435	.7000	22.54

TOTAL NODE INFLOW...
HYG file = V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\work_pad.hyg
HYG ID = OUT 10
HYG Tag = Dev100

Peak Discharge = 22.54 cfs
Time to Peak = .7000 hrs
HYG Volume = 1.435 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.00	1.03	2.06	3.08	4.10
.2500	4.93	5.37	5.81	6.25	6.85
.5000	9.28	12.71	16.14	19.57	22.54
.7500	20.29	18.03	15.78	13.57	11.94
1.0000	11.21	10.48	9.74	9.01	8.31
1.2500	7.63	6.94	6.26	5.62	5.28
1.5000	4.94	4.60	4.26	4.01	3.87
1.7500	3.72	3.57	3.43	3.36	3.32
2.0000	3.27	3.22	3.17	3.12	3.07
2.2500	3.02	2.95	2.57	1.93	1.30
2.5000	.66	.07	.00		



SCHEMATIC DIAGRAM OF PONDPACK MODEL 4C FOR DRAINAGEWAY D12

File.... V:\GENDATA\Users\alu\PondPackData\SouthMauiPark\UnvRtnl\POSTD12STORAGEESTIMATEONLYUNIVRAT.PPW

DETENTION STORAGE ESTIMATES -- Target Peak Outflow Rate

Return Events	Peak In (cfs)	Target (cfs)	Lower (ac-ft)	Linear (ac-ft)	Curvlinr (ac-ft)	Upper (ac-ft)	Total (ac-ft)
50	13.271	9.260	.043	.097	.233	.405	.845

CALCULATION TIME RANGES

Return Events	Lower From (hrs)	Lower To (hrs)	Linear From (hrs)	Linear To (hrs)	Curvilinear From (hrs)	Curvilinear To (hrs)	Upper From (hrs)	Upper To (hrs)	Total From (hrs)	Total To (hrs)
50	.59	.85	.45	.85	.00	.85	.00	.85	.00	2.60

APPENDIX C: Subsurface Drainage Detention System Calculations

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

Date: December 20, 2005

SUBSURFACE DRAINAGE SYSTEM ANALYSIS AND DESIGN

Project:	**South Maui Community Park** **Subsurface Drainage System - D11**
Location:	**Kihei, Maui, Hawaii**
Job Number:	**WSUE #03031.00**
Objective:	To determine the storage requirements for full attenuation of the post-development onsite surface runoff for the subject project. A recurrence interval of fifty (50) years is used.

I. Determine Accumulated Runoff Volume:

Volume (cf): 23,915

Volume obtained from the attached
Hydrolic Calculations: Post-Development - Napili

II. Establish Initial Trench Cross Section Parameters:

Cover Over Pipe (ft.):	1.00
Pipe Diameter (ft.):	6.00
Cradle Depth Below Pipe (ft.):	1.00
Cradle Thickness on Sides of Pipe (ft.):	1.00
Total Trench Depth (ft.):	8.0
Total Trench Width (ft.):	8.0
Gross Trench Cross Sectional Area (sf/lf):	64.0
Pipe Cross Sectional Area (sf/lf):	28.3
Trench Aggreg. Cross Sectional Area (sf/lf):	35.7

III. Determine Length of Pipe:

Assumed Initial Length of Pipe / Trench (ft.):	680.00

IV. Determine Storage Volume Provided:

Pipe Storage Capacity (cf):	19,226.5
Net Aggregate Cradle Storage Capacity (cf):	43,520.0
Gross Aggregate Cradle Volume (40% void ratio) (cf):	9,717.4
50% of void volume (cf):	4,858.7
Total Storage Capacity Provided (cf):	24,085.2

{Storage Provided = 24085 cf} > {Storage Required = 23915 cf}; therefore initial assumptions based on 680 l.f. of 72-inch diameter pipe are acceptable.

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

Date: December 20, 2005

SUBSURFACE DRAINAGE SYSTEM ANALYSIS AND DESIGN

Project:	South Maui Community Park Subsurface Drainage System - D12
Location:	Kihei, Maui, Hawaii
Job Number:	WSUE #03031.00
Objective:	To determine the storage requirements for full attenuation of the post-development onsite surface runoff for the subject project. A recurrence interval of fifty (50) years is used.

I. Determine Accumulated Runoff Volume:

Volume (cf):	4,225

Volume obtained from the attached
Hydrolic Calculations: Post-Development - Napili

II. Establish Initial Trench Cross Section Parameters:

Cover Over Pipe (ft.):	1.00
Pipe Diameter (ft.):	6.00
Cradle Depth Below Pipe (ft.):	1.00
Cradle Thickness on Sides of Pipe (ft.):	1.00
Total Trench Depth (ft.):	8.0
Total Trench Width (ft.):	8.0
Gross Trench Cross Sectional Area (sf/lf):	64.0
Pipe Cross Sectional Area (sf/lf):	28.3
Trench Aggreg. Cross Sectional Area (sf/lf):	35.7

III. Determine Length of Pipe:

Assumed Initial Length of Pipe / Trench (ft.):	125.00

IV. Determine Storage Volume Provided:

Pipe Storage Capacity (cf):	3,534.3
Net Aggregate Cradle Storage Capacity (cf):	8,000.0
Gross Aggregate Cradle Volume (40% void ratio) (cf):	1,786.3
50% of void volume (cf):	893.1
Total Storage Capacity Provided (cf):	4,427.4

{Storage Provided = 4427.4 cf} > {Storage Required = 4225 cf}; therefore initial assumptions based on 125 l.f. of 72-inch diameter pipe are acceptable.

APPENDIX D: Comparison of Peak 100-year Flows for Keokea Gulch

Comparison of Peak 100-year Flows for Keokea Gulch

SYNOPSIS

Review of the Draft version of this Drainage Study indicated that there may be a significant discrepancy between the 100-year peak flows in Keokea Gulch by previous Agency consultants. For example, in January, 1978, the **"Hydrology Report for Piilani Highway Island of Maui"** was completed by Trans-Meridian Engineers & Surveyors, Inc.

That Report (see ***Exhibit D-1***) shows a 100-year peak flow for Drainage Basin 18, labeled "Keokea" equal to 8,008 cfs. That Report also cites an estimate by the U. S. Army Corps of Engineers equal to 7,500 cfs. The Trans-Meridian Report used USGS Quad maps as the basis for delineating the drainage areas along the then-proposed Piilani Highway.

In the **"Drainage Master Plan for Kihei, Maui, Hawaii"** dated August, 1997, Norman Saito Engineering Consultants, Inc., states that the **"'Hydrology Report fo Piilani Highway, Island of Maui'** *(ref. H) was used as the basis for determining drainage areas mauka of Piilani Highway then adjusted based upon later more specific drainage reports*."

For the Keokea District, the Kihei Drainage Master Plan Report references the **"Preliminary Engineering Report for Kihei School Off-site Drainage, Kihei, Maui, Hawaii"**, dated September, 1992, by Ronald M. Fukumoto Engineering, Inc. It goes on to state that in the Kihei School Report, *"drainage areas for Piilani Basins 11, 12, 13, 14, 15, 17 & 18 were determined using aerial topographic maps. Drainage areas for Piilani Basins 12, 13, 14, 15 and 17 were revised and redesignated as 12R, 13R, 14R, 15R and 17R."*

In Figure 7-1 of the Kihei Drainage Master Plan Report (see ***Exhibit D-2***), the peak flows from Piilani Basins 16, 17 and 18 are shown "combined" at the Piilani Highway Keokea Bridge to give a total peak flow of 9055 cfs. On the other hand, inn Figure 7-3 of the Kihei Drainage Master Plan Report (see ***Exhibit D-3***), the peak flows for Piilani Basins 16, 17, 17A and 18 are shown "combined" at the Piilani Highway Keokea Bridge to give a total flow of 9453 cfs. Simple summation of each of the peak flows for these Basins is extremely conservative as it assumes all peak flows coincide at the same time.

The primary objective of the scope of work described herein is to take into account the phase lags in the peak flows for each of the Basins contributing runoff to the Piilani Highway Keokea Bridge to provide a more accurate estimate of the peak flow. The Hydrologic Analysis described in this Report was performed using the latest PondPack program (version 10.0), which was developed by Haestad Methods (now part of Bentley), and the salient results are reported herein.

APPROACH

In the late 1980's, Warren S. Unemori Engineering, Inc., was commissioned to develop the Piilani Village Master Plan. The project limits included the region approximately between Waipuilani Gulch to the north and the old Welakahao Road to the south. Drainage flow estimates were calculated with three primary objectives as follows:

(1) Obtain estimates of the peak flows mauka of Piilani Highway

(2) Obtain estimate of the peak additional flows makai of Piilani Highway

(3) Determine the number and sizes of Detention basins required both mauka and makai of Piilani Highway

By March, 1995, drainage calculations were completed based on detailed aerial photos which were taken up beyond elevation 650 ft. Weighted Curve Numbers (CN) based on the SCS Hydrograph method were calculated, and the extent of the subareas were delineated based on these detailed aerial photos and contours.

The basic approach followed in this study consisted of the following steps:

(1) Modify PondPack Model 2A (Drainageway D12) as necessary to replace the 50-year, 24-hour design storm (rainfall = 8.3 inches) with the 100-year, 24-hour design storm (rainfall = 10.5 inches).

(2) Explicitly model the hydrologic drainage network such that the lag times are reflected between each Subarea, and flows are combined with lag times included (see ***Exhibit D-4***).

(3) Run the PondPack analysis and summarize the results.

RESULTS

(1) ***Figure 4A*** provides a schematic diagram of the PondPack input and results within the offsite and onsite drainageway for Model 2A with the 100-year, 24-hour design storm. A peak flow equal to 7845.29 cfs is calculated at the Piilani Highway Keokea Bridge.

(2) ***Table D-1*** compares the corresponding results of the 1978 Trans-Meridian Study (including the U. S. Army Corps of Engineers Study), the 1997 Norman Saito Study (which includes modifications recognized in the 1992 Kihei School Drainage Study), and the WSUE PondPack analysis. It can be seen that the peak flow at the Piilani Highway Keokea Bridge is predicted to be 7845.29 cfs when the lag times of the contributing Basins are considered.

(3) *Exhibit D-5* shows the hydrograph at the Piilani Highway Keokea Bridge (Qpeak = 7845.29 cfs). *Exhibit D-6* similarly shows the hydrograph further downstream at the North-South Collector Road (Qpeak = 7849.94 cfs).

(4) The effects of the lag times are illustrated in *Exhibits D-7* through *D-12*, which show the peak flows for each of the individual Subareas in contrast to the total cumulative flow at the North-South Collector Road. It can be seen that the total cumulative flow at the North-South Collector Road is dominated by the hydrograph of Subarea 30 (18RC-Keokea Gulch-Offsite) as shown in *Exhibit D-9*.

(5) Conversely, the contribution of all of the other Subareas is quite insignificant. *Exhibit D-13* shows each of the hydrographs for each Subareas superimposed onto the total cumulative flow at the North-South Collector Road..

(6) *Exhibit D-14* is the printed "Master Network Summary" results of the PondPack analysis. The values shown are reflected in *Table D-1*.

(7) Note that if the peak flows for each of the contributing Subareas had been simply added together (as was done in the Kihei Drainage Master Plan Figure 7-3 - see *Exhibit D-3*), the predicted cumulative peak flow at Piilani Highway Keokea Bridge would be equal to *8507.81 cfs* vs. the PondPack calculated *7845.29 cfs* (228.13 + 223.01 + 371.6 + 215.47 + 7469.60) . This is an *8.4%* increase over the more accurate analysis estimate which considers lag times for each contributing Subarea.

CONCLUSIONS

Based on the results of the extensive hydrologic analysis reported herein using the latest available hydrologic curve numbers and areas based on detailed aerial photo surveys, the predicted estimate of peak flow at the Piilani Highway Keokea Gulch for a 100-year, 24-hour design storm is 7845.29 cfs. It should also be noted that the calculation of the 100-year design storm inundation limits for Keokea Gulch at the Kihei Recycling and Redemption Center was based on the more conservative design flow of 8008 cfs reported in the 1978 Trans-Meridian Drainage Study.

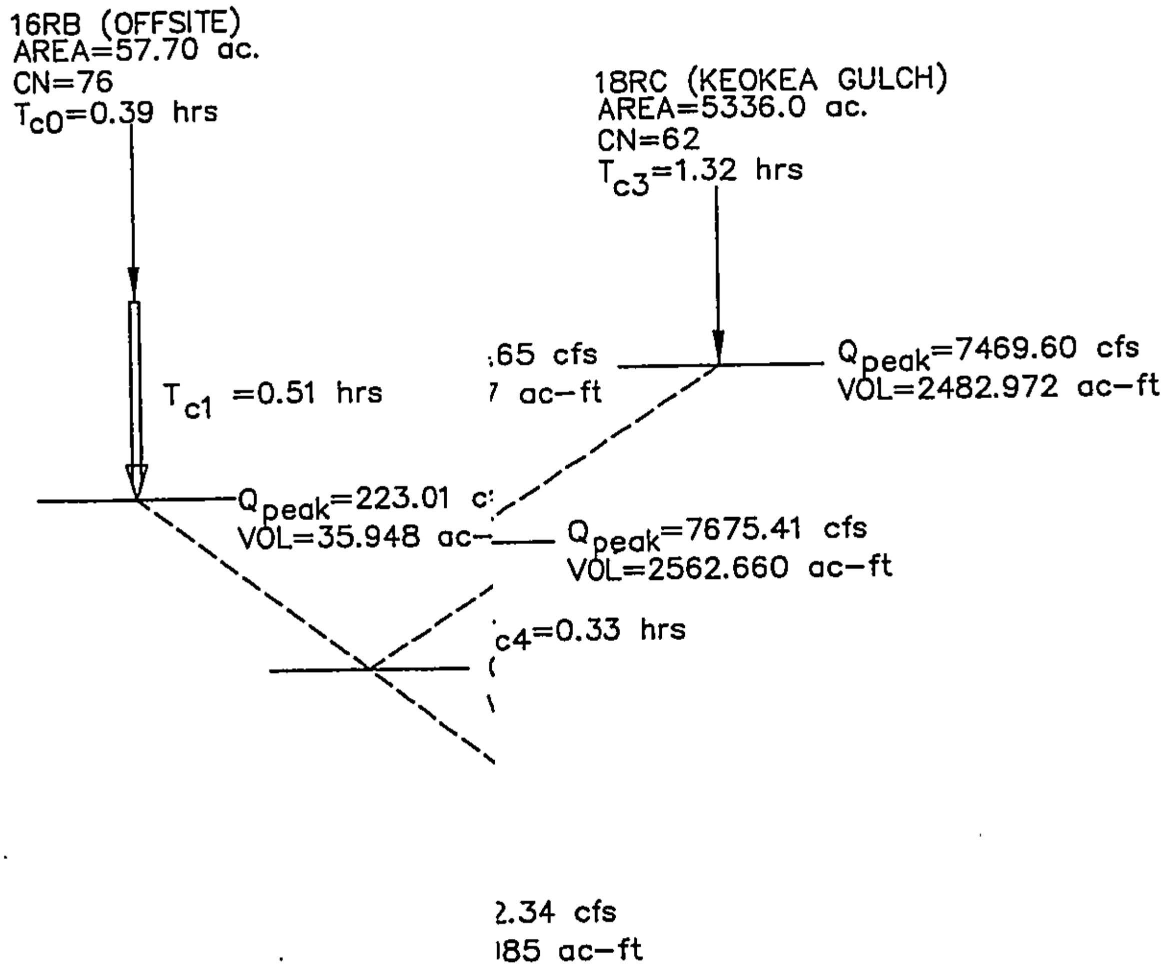


FIGURE 'FSITE AND
ONS12)

Table D-1
Comparison of Peak 100-Year Flows for Ke

1978 Trans-Meridian					Corps of Engineers		1997 Norman Saito		
SubArea	Area (acs)	Weighted CN	Rainfall (in)	Qpeak (cfs)	Area (acs)	Qpeak	SubArea	Area (acs)	Qpe (cf
16	N/A	N/A	N/A	214			16	84	21
17A	N/A	N/A	N/A	398			17A	N/A	39
17	537	72	6.1	833			17R	537	83
3 (Keokea Gulch)	5289	69	7.8	8008	5376	7500	18	5289	800
Total at Piilani lighway Keokea Bridge				9453			Total at Piilani Highway Keokea Bridge	5919+	9055/9

otal at Piilani Highway Keokea Bridge conservatively assumes all peaks coincide at the same time; ainfall based on 100-year, 6-hr storm; CN and Areas calculated using planimeters from USGS Quad aps; Results for smaller basins calculated by Rational Method

* Figure 7-1 shows 9055 cfs, Figure 7-3 sh 9453 cfs at Piilani Highway Keokea Bridg drainage results apparently identical to T Meridian values

able D-1

-Year Flows for Keokea Gulch

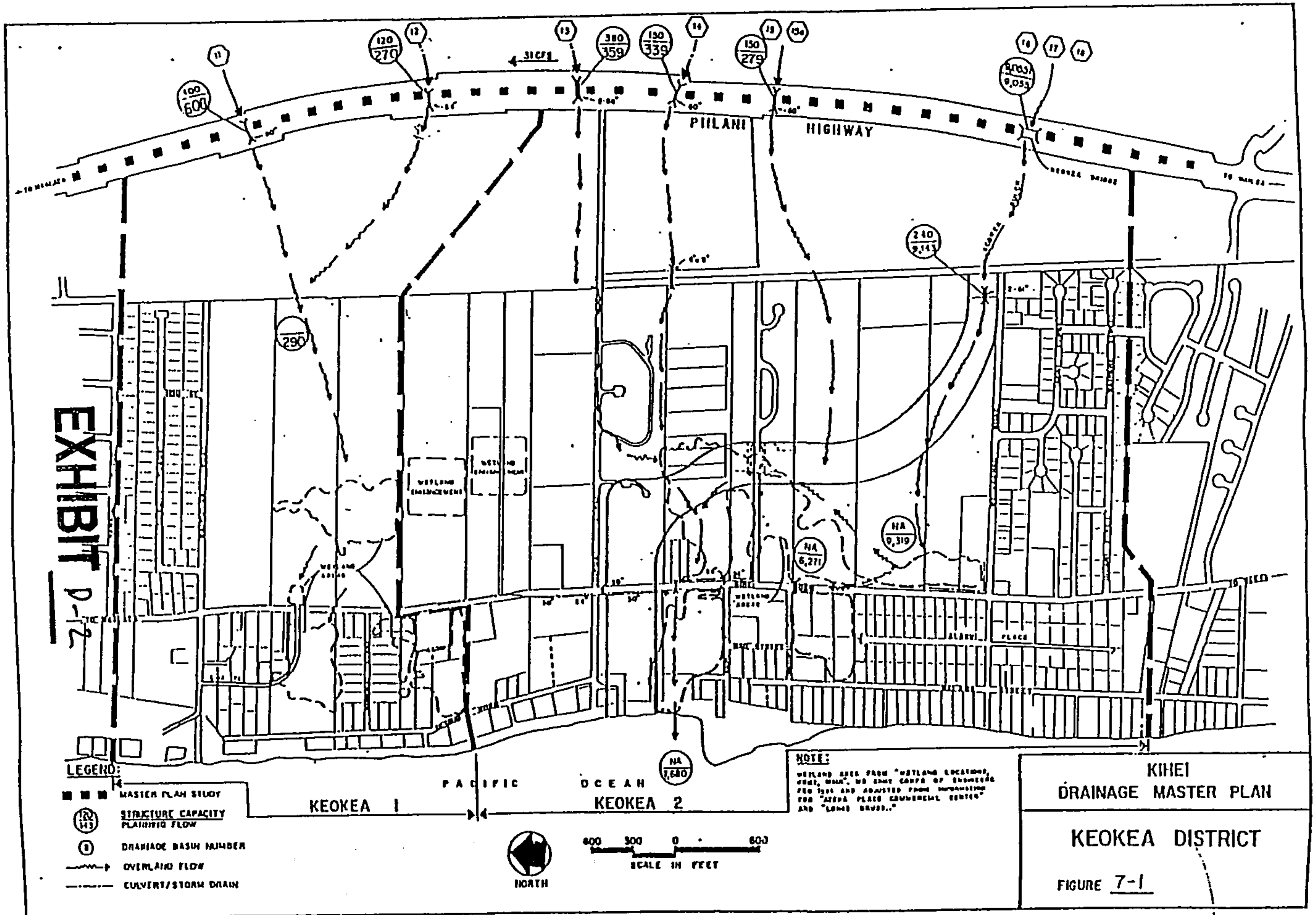
7 Norman Saito			2006 Warren S. Unemori Engineering, Inc. (WSUE)					
	Area (acs)	*Qpeak (cfs)*	*SubArea*	*Area (acs)*	*Weighted CN*	*Rainfall (in)*	*Qpeak (cfs)*	*Volume (ac-ft)*
	84	214	16RA	65.5	77	10.5	228.13	41.528
			16RB	57.7	76		223.01	35.948
	N/A	396						
	537	833	17R	137.7	72		371.65	79.687
			18RA	51.9	76		215.47	32.324
	5289	8008	18RC (Keokea Gulch)	5336	62		7469.60	2482.972
a	5919+	9055/9453*	Total at Piilani Highway Keokea Bridge	5648.8			7845.29**	2672.458
s 9055 cfs, Figure 7-3 shows i Highway Keokea Bridge; All apparently identical to Trans-			** Total shown considers phase lag time between peaks; Rainfall based on 100-year, 24-hr storm; CN and Areas Calculated by R.M. Towill (under subcontract to WSUE) based on Detailed Aerial Photo Survey Contours; Results for all subareas calculated using SCS Unit Hydrograph method in PondPack v. 10					

V. SUMMARY OF CALCULATED STORM RUNOFF

The following is a summary of the calculated storm runoff for the different drainage basins at the crossing with Piilani Highway as determined by the suggested methods of runoff determination. Drainage basins are shown on Figs. 14 and 15. Those drainage basins too small to be depicted on these figures are followed by an asterick (*).

DRAINAGE BASIN NO.	STREAM	RATIONAL METHOD 50 YR. (cfs)	RATIONAL METHOD 100 YR. (cfs)	SCS METHOD 50 YR. (cfs)	SCS METHOD 100 YR. (cfs)	CORPS OF ENGINEERS (UP DATED) 50 YR. (cfs)	CORPS OF ENGINEERS (UP DATED) 100 YR. (cfs)
1	Waiakoa			5,648	7,655	5,700	7,600
2		134	139				
3		198	265				
4		260	352				
5		28	38				
6		95	124				
7				895	1,136		
8	Kulanihakoi			9,681	13,077	9,000	12,000
9		259	303				
10	Waipuilani			7,841	9,952	7,200	9,600
10A		30	30				
11				423	543		
12		132	161				
13				404	551		
14		169	216				
15		124	165				
15A		18	19				
16		169	214				
17				622	833		
17A		316	398				
18	Keokea			5,288	8,008	5,700	7,500
19				587	817		
19A		229	286				
20	C. Young			1,842	2,540		
21				399	624		
22				363	585		
22A		91	125				
23				391	544		
23A		84	104				
24	Liiliholo			3,004	3,831		
24A		57	71				
24B		85	102				

EXHIBIT D-1



KIHEI
DRAINAGE MASTER PLAN

KEOKEA DISTRICT

FIGURE 7-1

EXHIBIT D-12

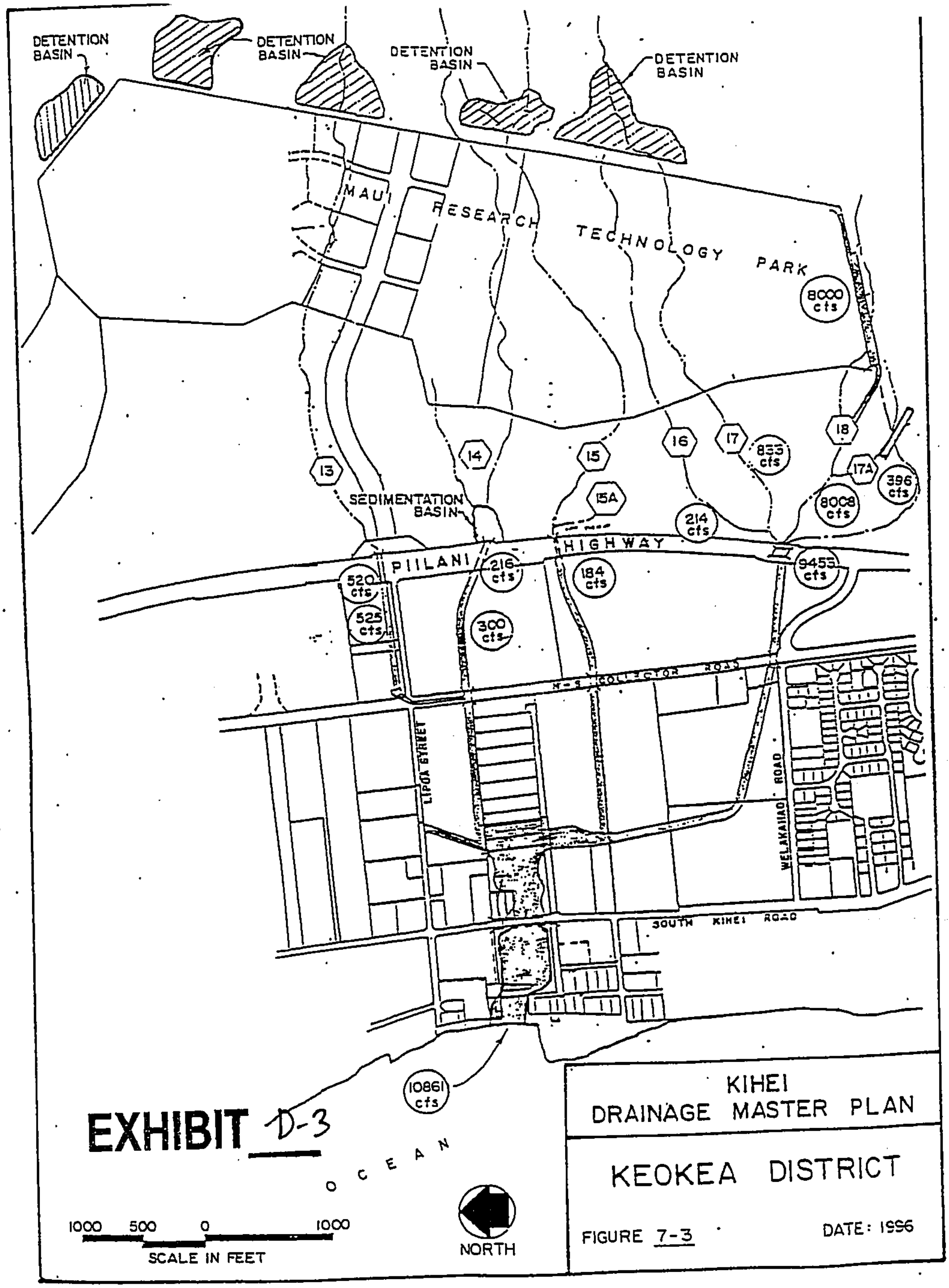

DETENTION BASIN
DETENTION BASIN
DETENTION BASIN
DETENTION BASIN
MAUI RESEARCH TECHNOLOGY PARK
8000 cfs
13
14
15
15A
16
17
17A
18
835 cfs
396 cfs
8008 cfs
SEDIMENTATION BASIN
214 cfs
PIILANI HIGHWAY
520 cfs
525 cfs
216 cfs
184 cfs
9455 cfs
300 cfs
N-S COLLECTOR ROAD
LIPOA STREET
WELAKAHAO ROAD
SOUTH KIHEI ROAD
10861 cfs
OCEAN
1000 500 0 1000
SCALE IN FEET
NORTH
KIHEI
DRAINAGE MASTER PLAN
KEOKEA DISTRICT
FIGURE 7-3
DATE: 1996

EXHIBIT D-3

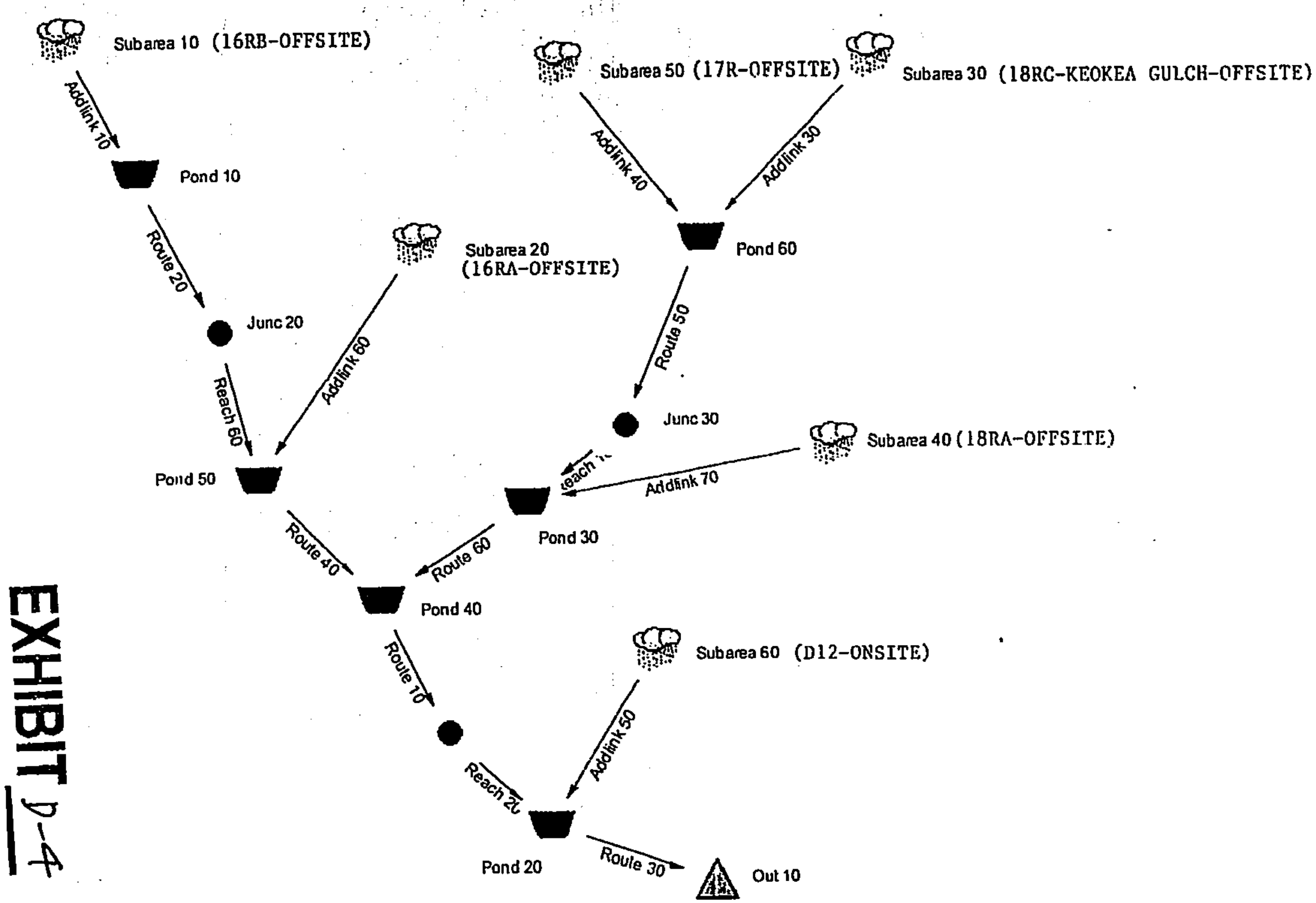
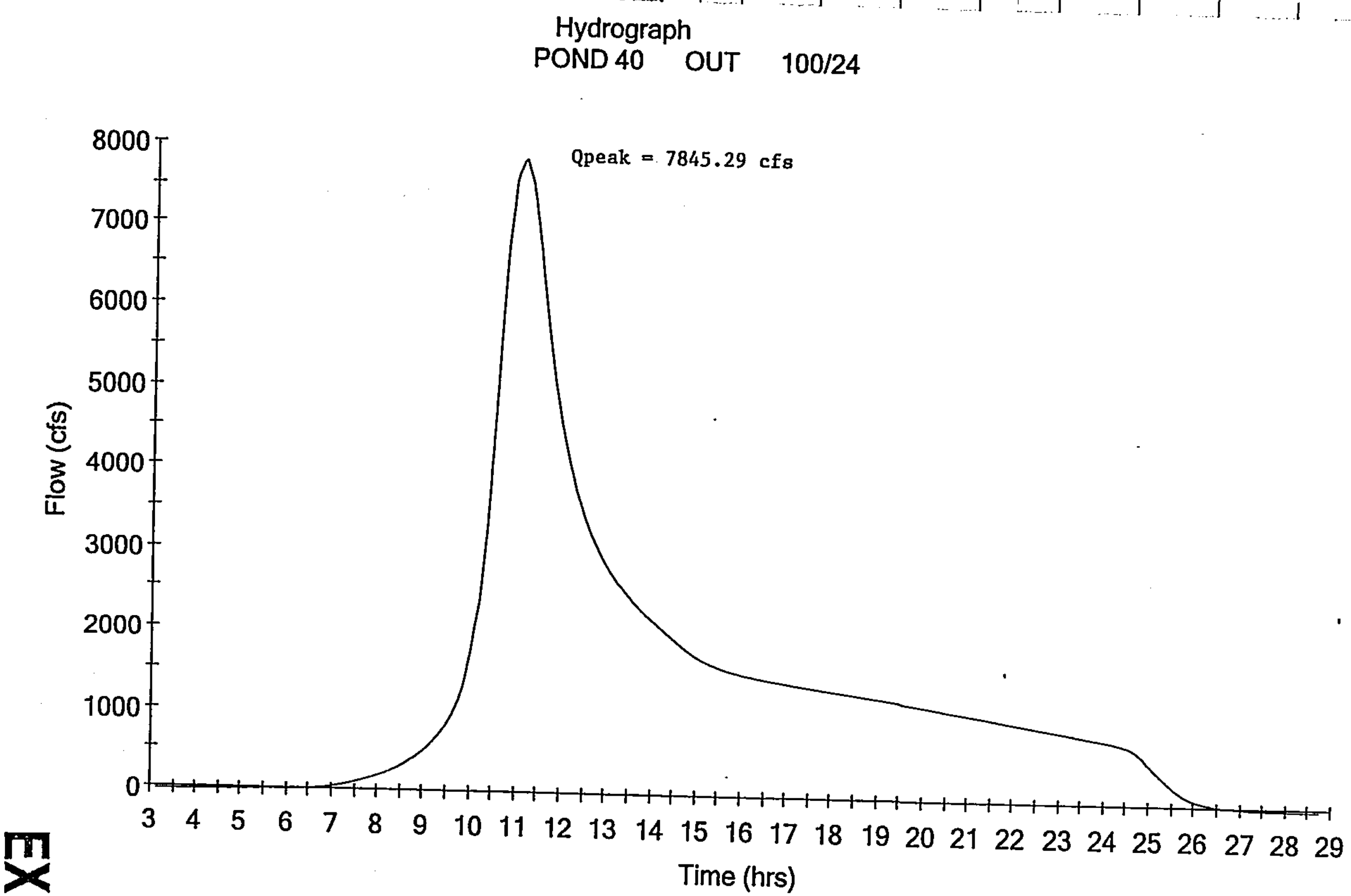


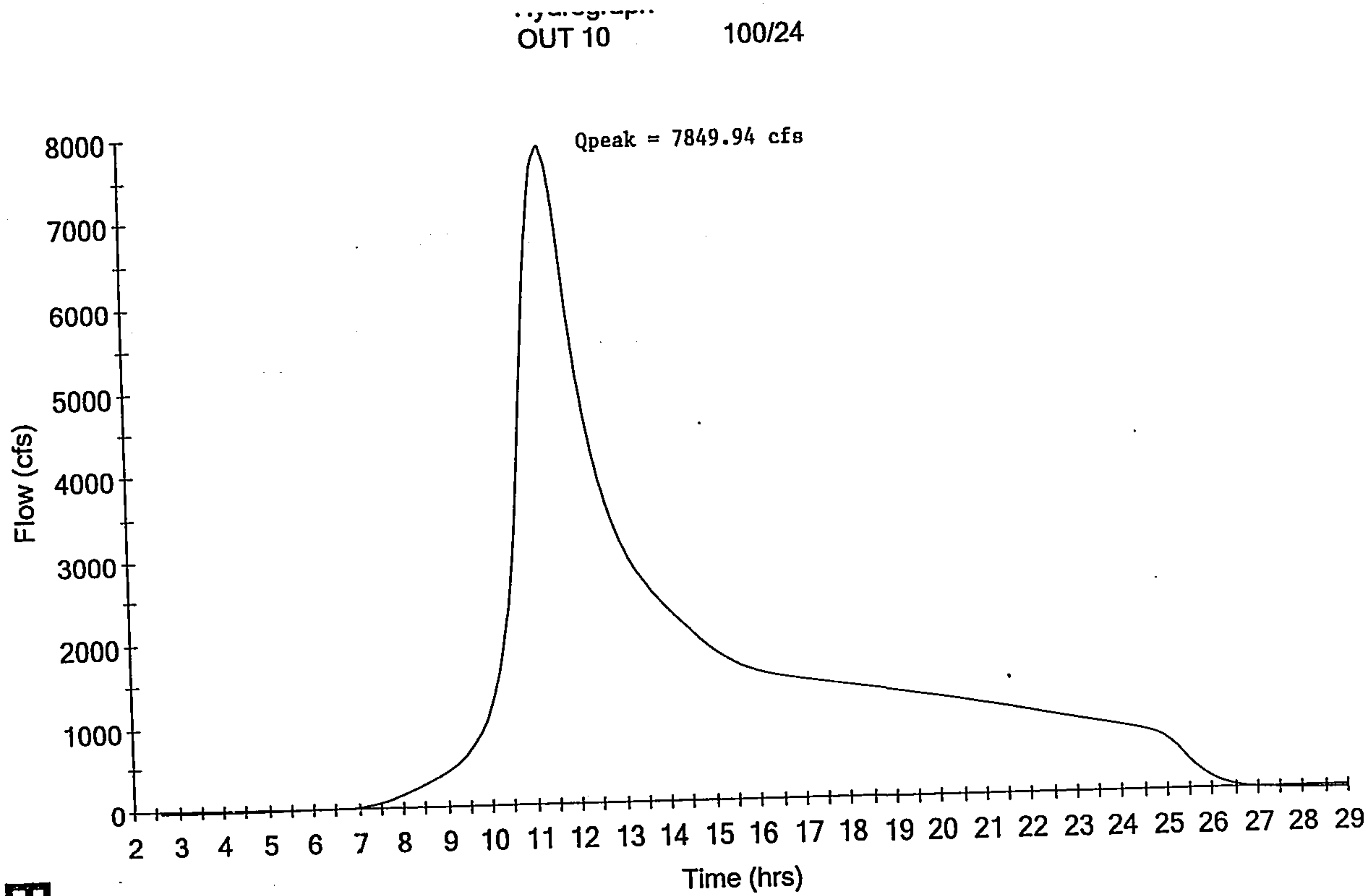
EXHIBIT D-4

SCHEMATIC DIAGRAM OF PONDPACK MODEL 2A FOR DRAINAGEWAY D12



100-YEAR, 24-HOUR HYDROGRAPH AT PIILANI HIGHWAY KEOKEA BRIDGE

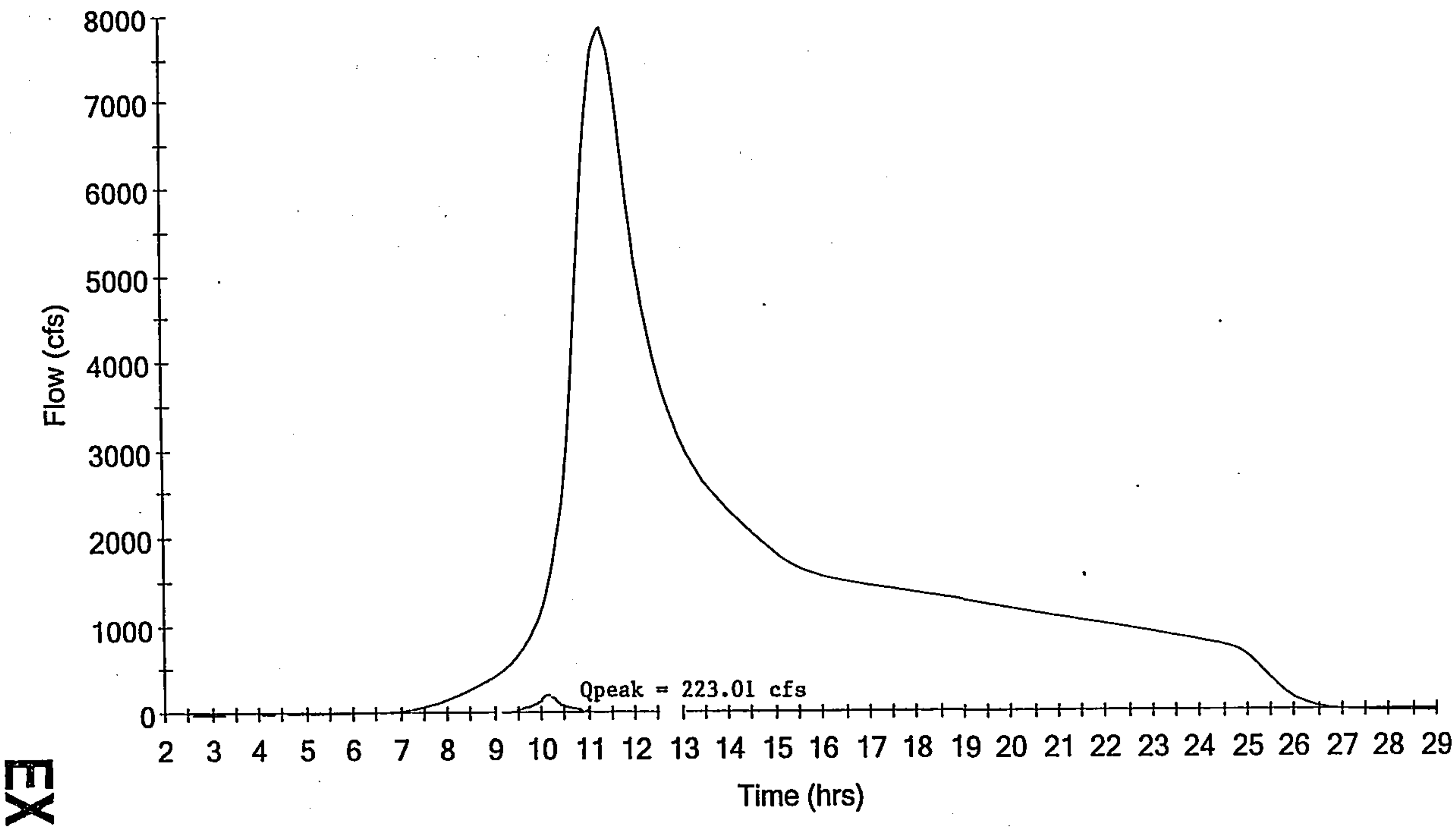
EXHIBIT D-5



100-YEAR, 24-HOUR HYDROGRAPH AT NORTH-SOUTH COLLECTOR ROAD

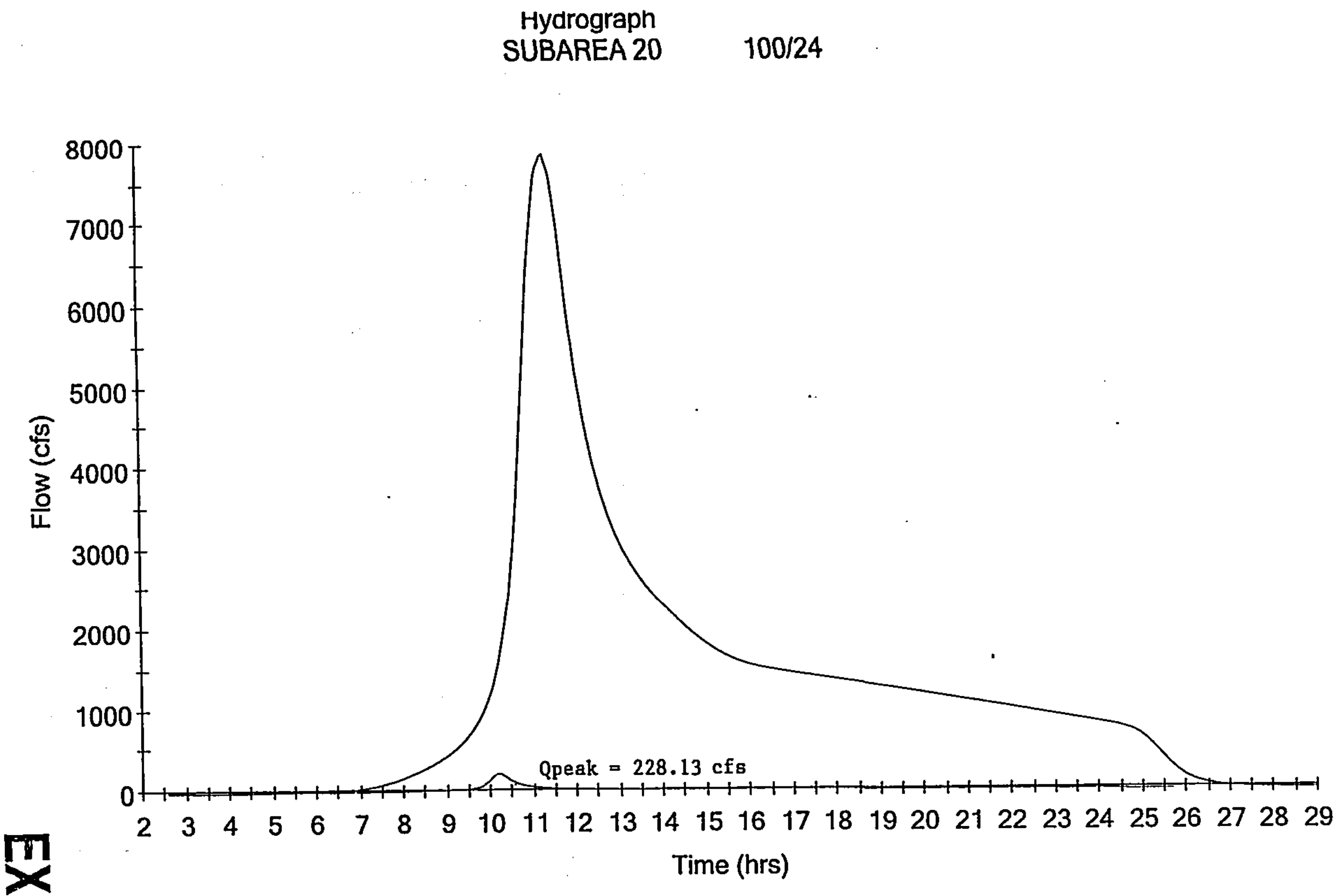
EXHIBIT D-6

Hydrograph
SUBAREA 10 100/24



100-YEAR, 24-HOUR HYDROGRAPH FOR SUBAREA 10 (16RB-OFFSITE)

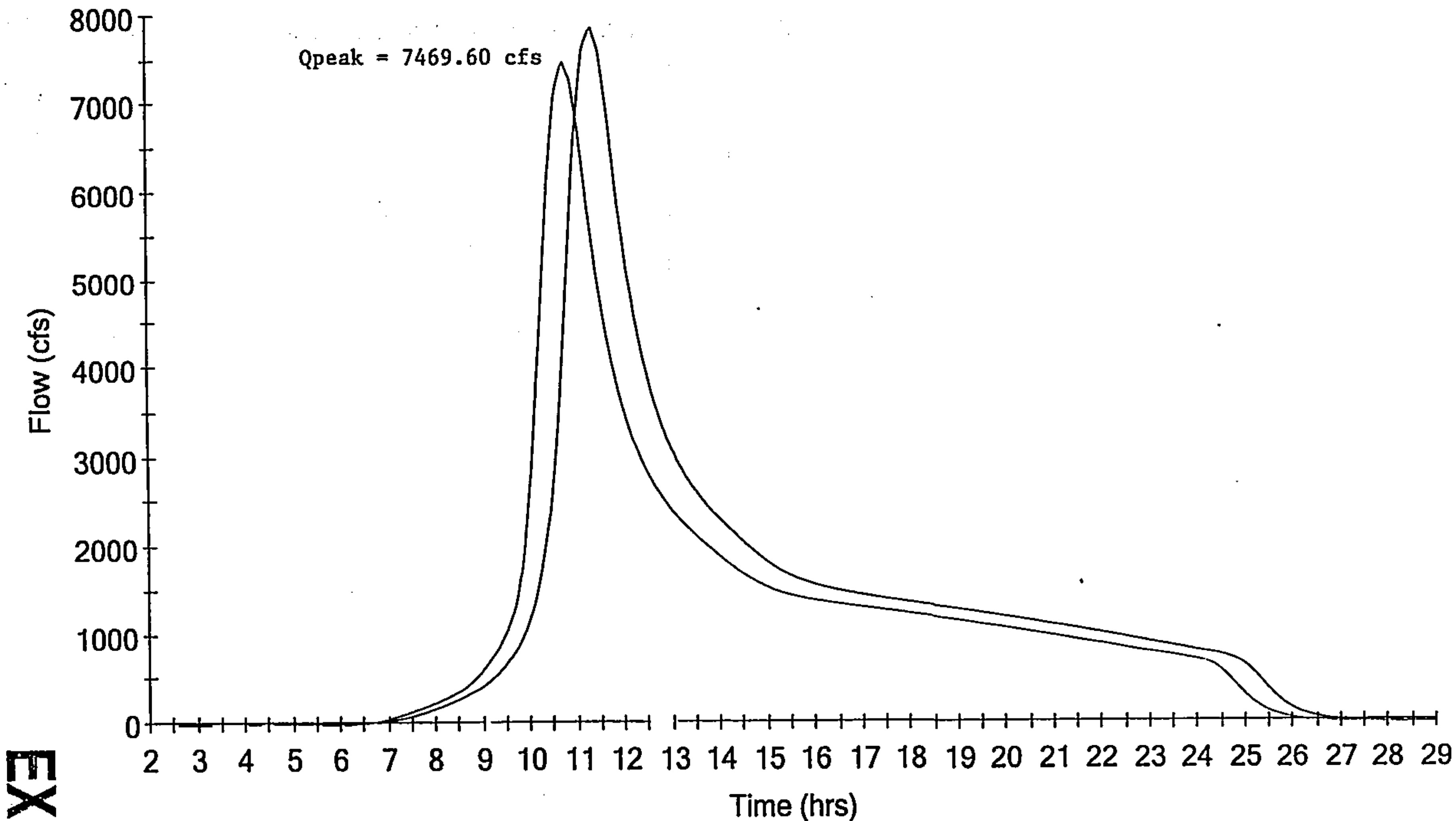
EXHIBIT D-7



100-YEAR, 24-HOUR HYDROGRAPH FOR SUBAREA 20 (16RA-OFFSITE)

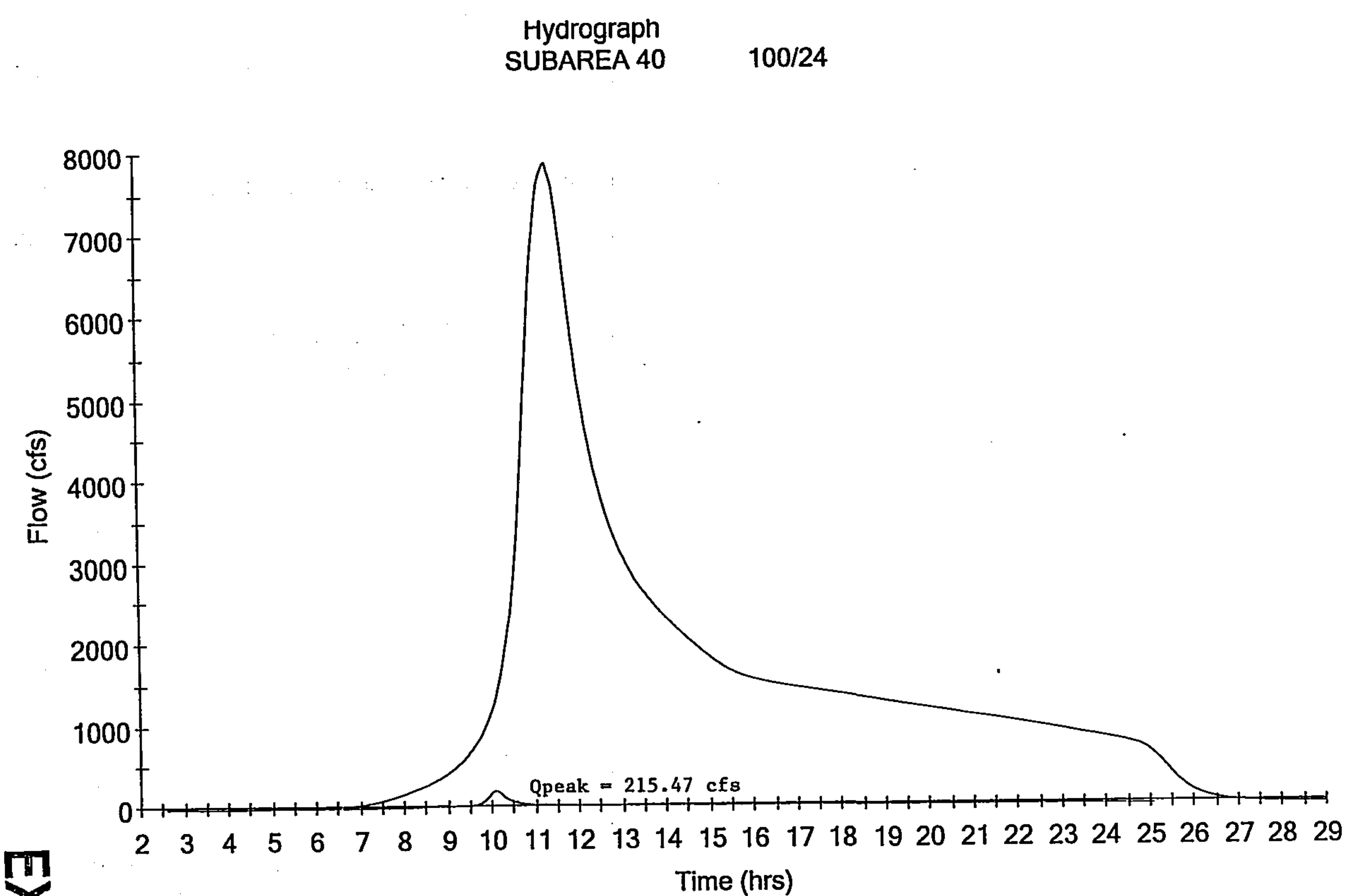
EXHIBIT D-8

Hydrograph
SUBAREA 30 100/24



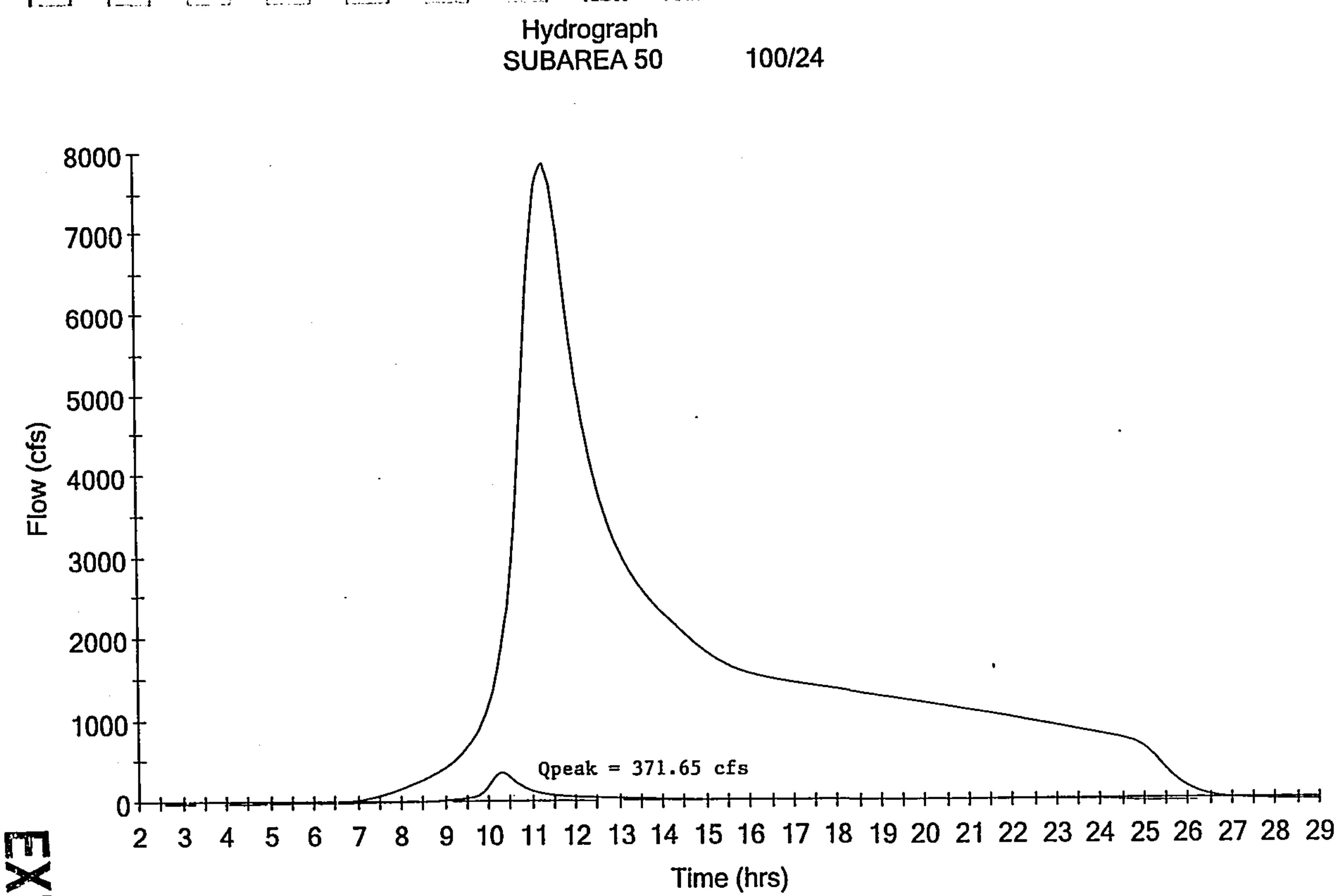
100-YEAR, 24-HOUR HYDROGRAPH FOR SUBAREA 30 (18RC-KEOKEA GULCH-OFFSITE)

EXHIBIT D-9



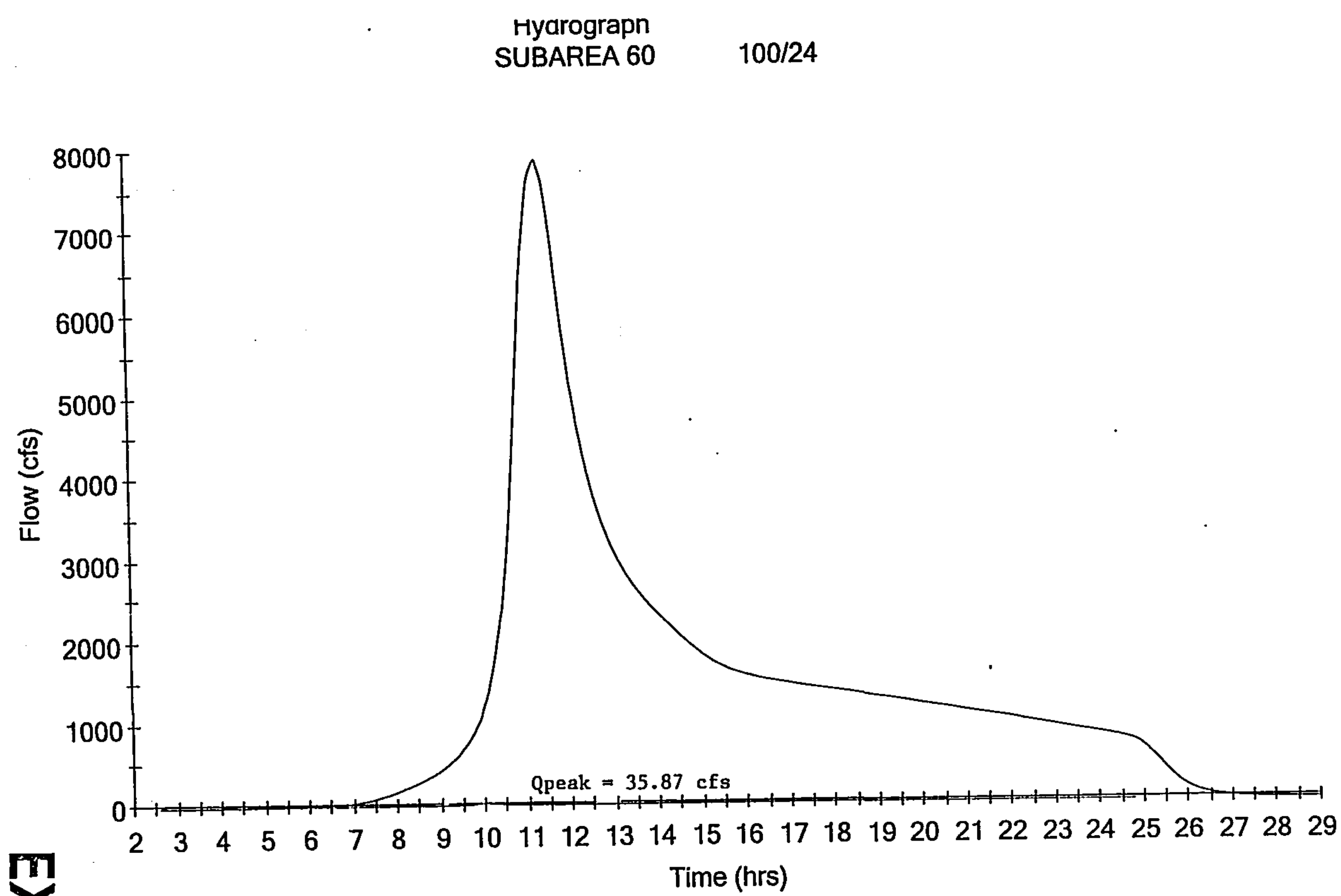
100-YEAR, 24-HOUR HYDROGRAPH FOR SUBAREA 40 (18RA-OFFSITE)

EXHIBIT D-10



100-YEAR, 24-HOUR HYDROGRAPH FOR SUBAREA 50 (17R-OFFSITE)

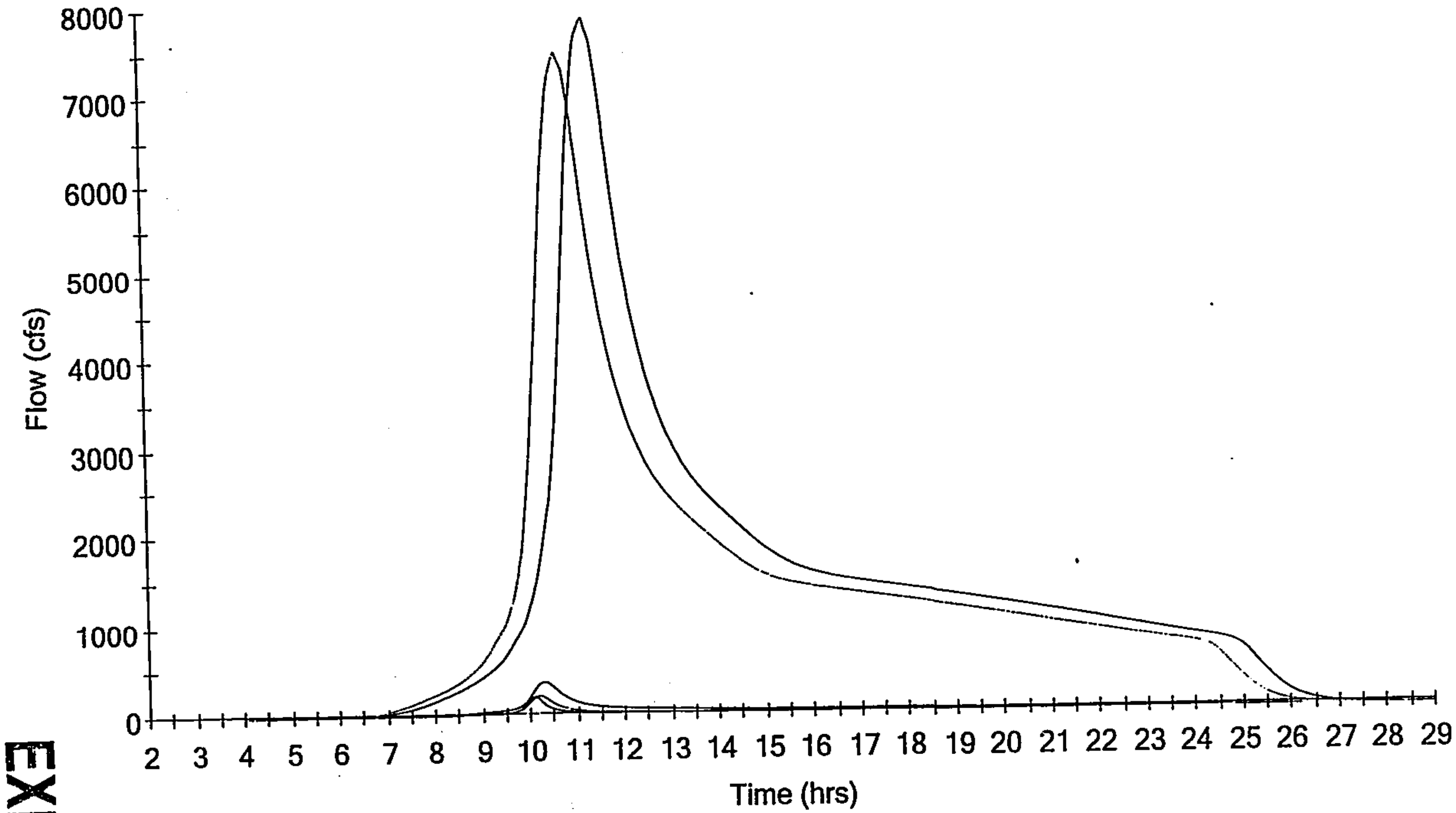
EXHIBIT D-11



100-YEAR, 24-HOUR HYDROGRAPH FOR SUBAREA 60 (D12-ONSITE)

EXHIBIT D-12

Hydrograph
SUBAREA 60 100/24



100-YEAR, 24-HOUR HYDROGRAPH FOR ALL SUBAREAS SUPERIMPOSED

EXHIBIT D-13

MASTER DESIGN STORM SUMMARY

Network Storm Collection: 100yrKihei24

Return Event	Total Depth in	Rainfall Type	RNF ID
100/24	10.5000	Synthetic Curve	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
JUNC 20		JCT	10	35.948		10.1000	223.01		
JUNC 30		JCT	10	2562.660		10.7500	7675.41		
JUNC 60		JCT	10	2672.458		11.1000	7845.29		
*OUT 10		JCT	10	2677.283		11.3500	7849.94		
POND 10	IN	POND	10	35.948		10.1000	223.01		
POND 10	OUT	POND	10	35.948		10.1000	223.01		
POND 20	IN	POND	10	2677.283		11.3500	7849.94		
POND 20	OUT	POND	10	2677.283		11.3500	7849.94		
POND 30	IN	POND	10	2594.985		11.1000	7712.34		
POND 30	OUT	POND	10	2594.985		11.1000	7712.34		
POND 40	IN	POND	10	2672.458		11.1000	7845.29		

EXHIBIT D-14

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 40	OUT	POND	10	2672.458		11.1000	7845.29		
POND 50	IN	POND	10	77.475		10.6000	333.63		
POND 50	OUT	POND	10	77.475		10.6000	333.63		
POND 60	IN	POND	10	2562.660		10.7500	7675.41		
POND 60	OUT	POND	10	2562.660		10.7500	7675.41		
SUBAREA 10		AREA	10	35.948		10.1000	223.01		
SUBAREA 20		AREA	10	41.528		10.2000	228.13		
SUBAREA 30		AREA	10	2482.972		10.7500	7469.60		
SUBAREA 40		AREA	10	32.324		10.1000	215.47		
SUBAREA 50		AREA	10	79.687		10.3000	371.65		
SUBAREA 60		AREA	10	4.822		10.0500	35.87		

Appendix F
Traffic Impact Assessment Report

TRAFFIC IMPACT ANALYSIS REPORT FOR

SOUTH MAUI PARK AT PIILANI

IN KIHEI, MAUI, HAWAII

Prepared For

WARREN S. UNEMORI ENGINEERING, INC.

Phillip Rowell and Associates
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December 2, 2005

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1. INTRODUCTION

Phillip Rowell and Associates has been retained to prepare a traffic impact analysis for a proposed regional park in Kihei, Maui, Hawaii. The purpose of this study is to identify the traffic impacts of the proposed project. This report will be incorporated into the Special Management Area (SMA) permit application and Environmental Assessment.

This introductory chapter discusses the location of the project, the proposed development, and the study methodology.

Purpose and Objectives of Study

1. Determine and describe the traffic characteristics of the proposed project.
2. Quantify and document the traffic related impacts of the proposed project.
3. Identify and evaluate traffic related improvements required to provide adequate access to and egress from the proposed project and to mitigate the project's traffic impacts.

Project Location and Description

The following is a summary of the project:

1. The project is located bounded by Piilani Highway on the east, Welakahao Street on the south, Liloa Street (North-South Collector Road) on the west and Kihei School on the north. This location is shown on Figure 1.

2. The project is a regional park to be developed in three phases. The components of each phase is summarized in Table 1. A site plan is provided as Appendix A.

Table 1 Summary Description of Project

Phase	Approximate Completion Date	Components	Parking Spaces
1	2010	Gymnasium (12,577 SF) and Assembly Rooms (5,000 SF) One (1) Soccer Field One Softball Field	295
2	2015	Two (2) Soccer Fields One (1) Softball Field One (1) Baseball Field	202
3	2020	Six (6) Multi-Use Courts	17
			514

Study Area

The study area is also shown in Figure 1. Generally, the study area is bounded by Piikea Avenue along the north, Piilani Highway along the east, Welakahao Road along the south and South Kihei Road along the west. The existing and future intersections studied are listed in Table 2 along with the characteristics of the intersection.

Table 2 Study Intersections

No	Intersection	Right-of-Way Control	Jurisdiction
1	Lipoa Street at South Kihei Road	Signalized	County
2	Lipoa Street at Liloa Street	Signalized	County
3	Lipoa Street at Piilani Highway	Signalized	State
4	Piikea Avenue at South Kihei Road	Signalized	County
5	Piikea Avenue at Piilani Highway	Signalized	State
6	Welakahao Road at South Kihei Road	Signalized	County
7	Piikea Avenue at Liloa Street	4-Way Stop	County
8	Halekuai Street at South Kihei Road	2-Way Stop	County
9	Halekuai Street at Liloa Street	2-Way Stop	County
10	Welakahao Road at Liloa Street	2-Way Stop	County
11	Welakahao Road at Piilani Highway	2-Way Stop	State

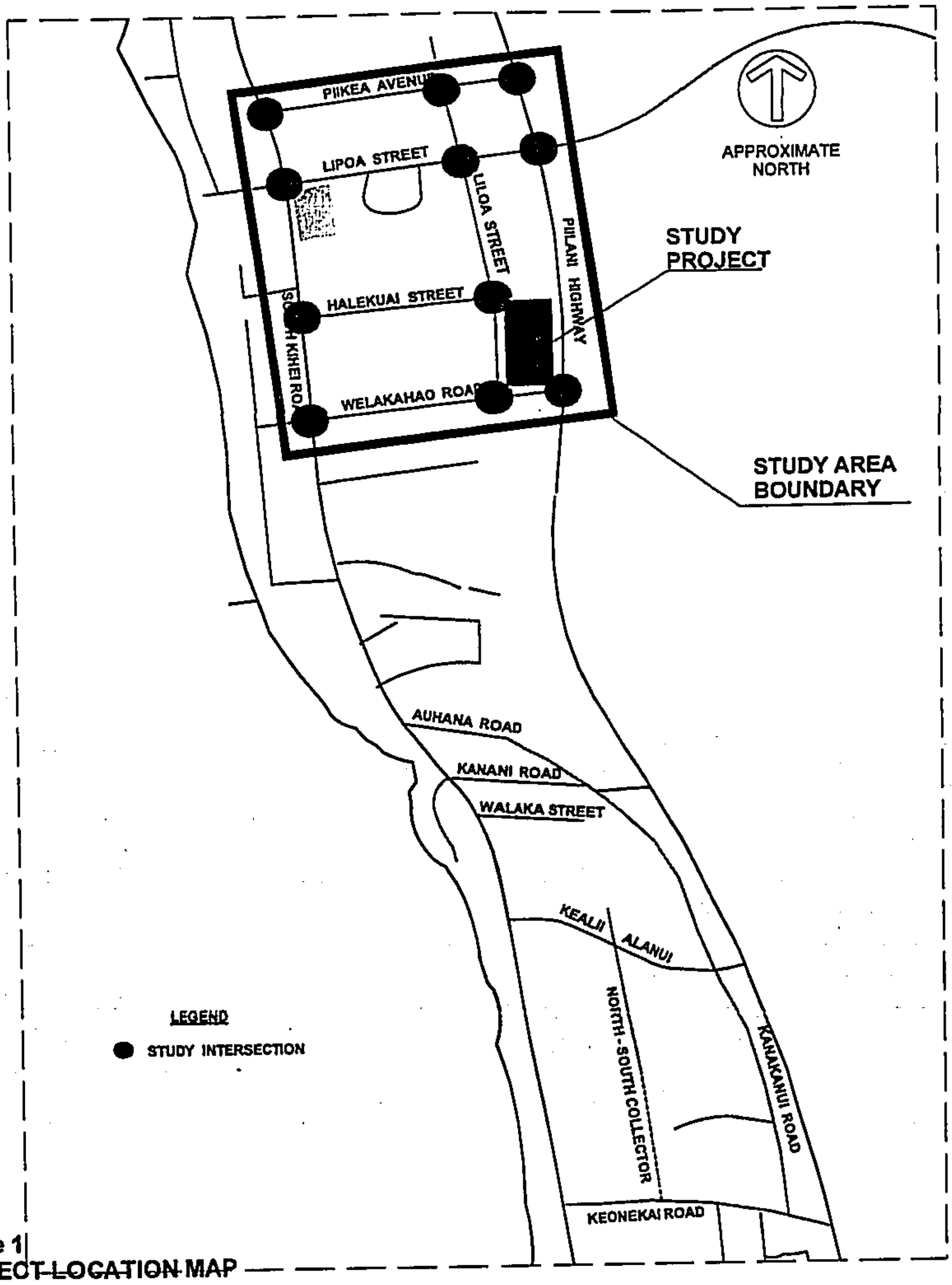

Figure 1
PROJECT LOCATION MAP

Study Methodology

The following is a summary list of the tasks performed:

1. A site reconnaissance was performed to identify existing roadway cross-sections, intersection lane configurations, traffic control devices, and surrounding land uses.

2. Existing peak-hour traffic volumes for the study intersections were obtained and summarized.

3. Existing levels-of-service of the study intersections was determined using the methodology described in the *Highway Capacity Manual.*

4. A list of related development projects within and adjacent to the study area that will impact traffic conditions at the study intersections was compiled. This list included both development projects and anticipated roadway improvement projects.

5. Future background traffic volumes at the study intersections without traffic generated by the study project were estimated.

6. Peak hour traffic that the proposed project will generate was estimated using trip generation analysis procedures recommended by the Institute of Transportation Engineers.

7. A level-of-service analysis for future traffic conditions with traffic generated by the study project was performed.

8. The impacts of traffic generated by the proposed project at the study intersections were quantified and summarized.

9. Locations that project generated traffic significantly impacts traffic operating conditions were identified.

10. Recommendations, improvements or modifications necessary to mitigate the traffic impacts of the project and to provide adequate access to and egress from the site were formulated.

11. A report documenting the conclusions of the analyses performed and recommendations was prepared.

Order of Presentation

Chapter 2 describes existing traffic conditions, the Level-of-Service (LOS) concept and the results of the LOS analysis of existing conditions.

Chapter 3 describes the process used to estimate 2010, 2015 and 2020 background traffic projections and the resulting background traffic projections.

Chapter 4 describes the methodology used to estimate the traffic characteristics of the proposed project.

Chapter 5 presents the 2010 background traffic projections, without and with the Phase 1 of the project and describes the traffic impacts of Phase 1.

Chapter 6 presents the 2015 background traffic projections, without and with the Phase 2 of the project and describes the traffic impacts of Phase 2.

Chapter 7 presents the 2020 background traffic projections, without and with the Phase 3 of the project and describes the traffic impacts of Phase 3.

Chapter 8 identifies and describes mitigation measures required to mitigate the impacts of the total overall project.

2. ANALYSIS OF EXISTING CONDITIONS

This chapter discusses the existing traffic conditions along the roadways and at the intersections adjacent to the proposed project. The level-of-service (LOS) concept and the results of the LOS analysis for existing conditions are also presented. The purpose of this analysis is to establish the base conditions for the determination of the impacts of the project which are described in a subsequent chapter.

Description of Existing Streets and Intersection Controls

The following is a summary of the major roadways in the study area:

Piilani Highway

Piilani Highway is a major State highway connecting Kihei and Wailea. In the vicinity of the proposed project, the highway is a four-lane, two-way facility with separate left turn lanes. The posted speed limit is 40 miles per hour (mph). The intersection of Piilani Highway at Lipoa Street Alanui and Piikea Avenue are signalized. The intersection with Welakahao Road is unsignalized.

South Kihei Road

In the vicinity of the project, South Kihei Road is a two-lane, two-way, north-south major roadway. At the intersections of South Kihei Road at Welakahao Road and South Kihei Road at Lipoa Street and South Kihei Road at Piikea Avenue, there are separate left turn storage lanes for traffic along South Kihei Road. These intersections are signalized.

Welakahao Road

Welakahao Road is a two-lane, two-way roadway between Piilani Highway and South Kihei Road with an east-west orientation.

Lipoa Street

Lipoa Street is a two-lane, two-way roadway between Piilani Highway and South Kihei Road. The intersections with South Kihei Road, Liloa Street and Piilani Highway are signalized. Lipoa Street continues east of Piilani Highway to the Silversword Golf Course and the Maui Technology Park.

Liloa Street

Liloa Street is the North-South Collector between Halekuai Street and Piilani Village Phase 2, which is located north of the Piilani Village Shopping Center. Liloa Street presently terminates at Halekuai Street. In the future, it will be extended to Auhana Road.

Piikea Avenue

Piikea Avenue is an east-west street between *South Kihei Road and Piilani Highway*. Between South Kihei Road and the eastern boundary of Long's Shopping Center, Piikea Avenue is four lanes wide, then two lanes wide to Liloa Street and four lanes from Liloa Street to Piilani Highway. The posted speed limit is 20 miles per hour.

The intersection of Piilani Avenue at Liloa Street is currently a four-way STOP sign controlled intersection. The Kihei Master Traffic Study recommended that the intersection be modified to a roundabout. We are not aware of a timetable for the implementation of this recommendation.

Existing Weekday and Peak Hour Traffic Volumes

The existing morning and afternoon peak hour traffic volumes are shown in Figures 2 and 3. These peak hour volumes are taken from traffic counts performed during January, 2004. The counts shown include buses, large vehicles and motorcycles. They do not include bicycles and mopeds.

The Traffic Summary Worksheets are presented as Appendix B.

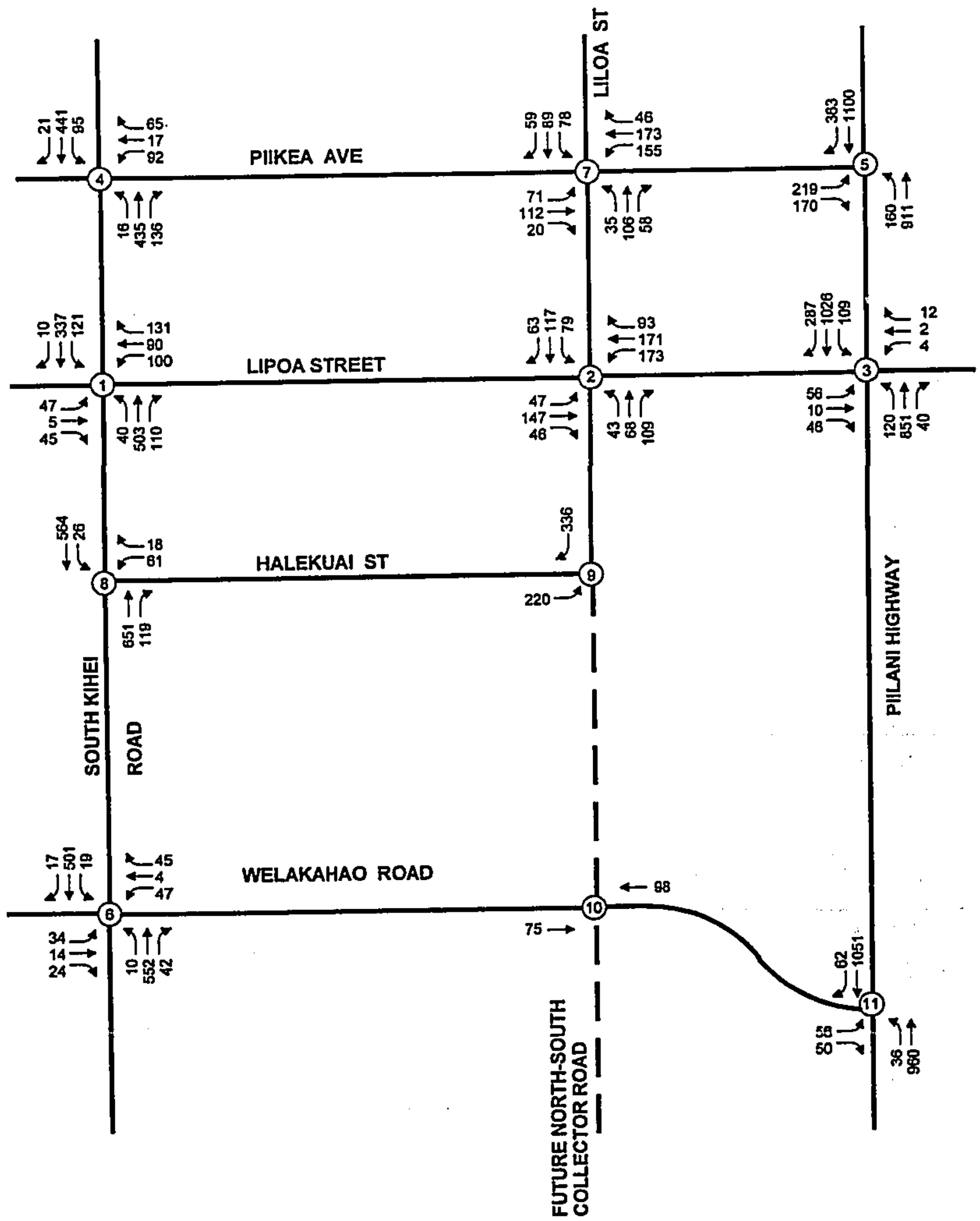

Figure 2
EXISTING (2005) AM PEAK HOUR TRAFFIC VOLUMES

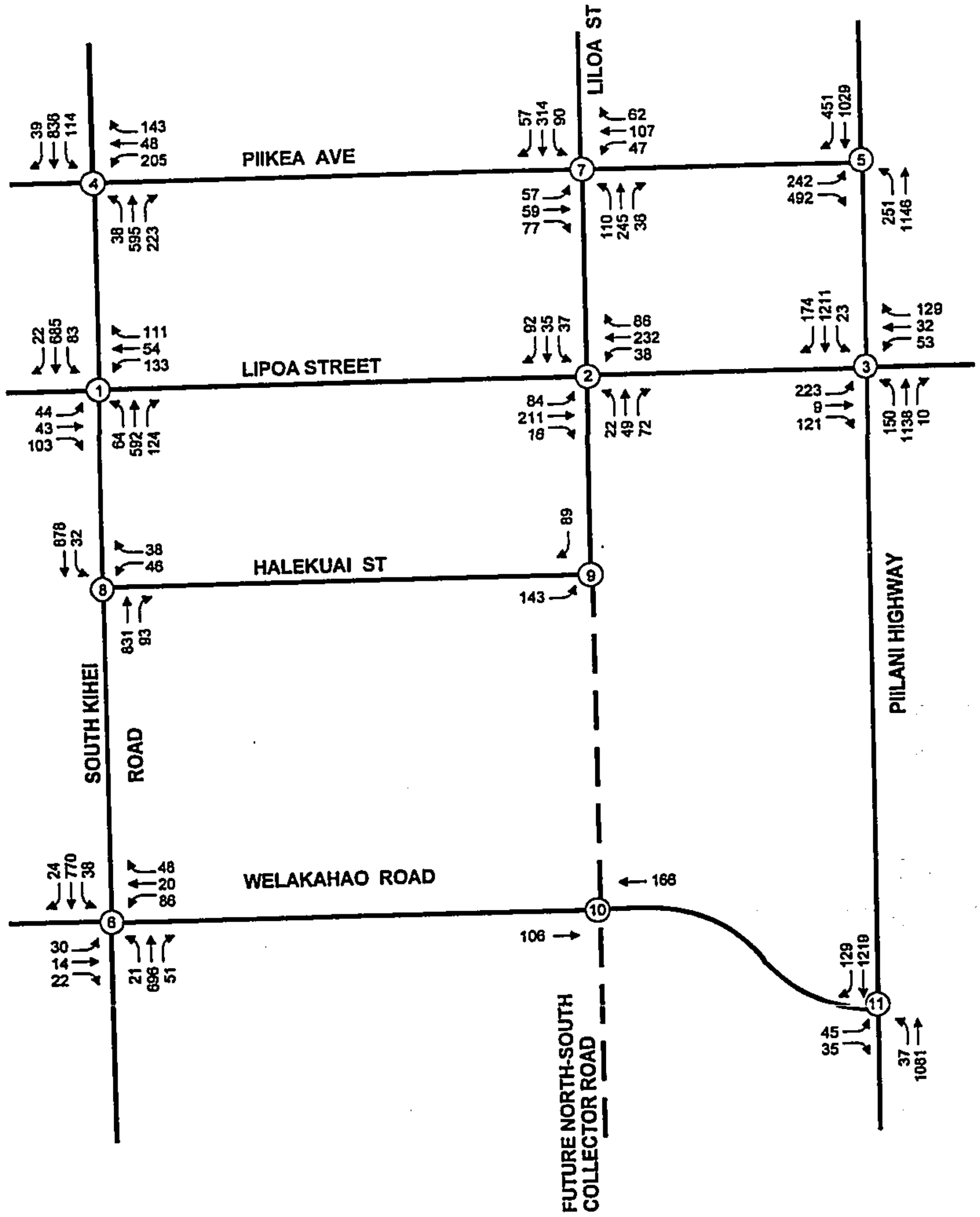

Figure 3
EXISTING (2005) PM PEAK HOUR TRAFFIC VOLUMES

Level-of-Service Concept

Signalized Intersections

The operations method described in the *2000 Highway Capacity Manual* (HCM) was used to analyze the operating efficiency of the signalized intersections. This method involves the calculation of a volume-to-capacity (V/C) ratio which is related to a level-of-service.

"Level-of-Service" is a term which denotes any of an infinite number of combinations of traffic operating conditions that may occur on a given lane or roadway when it is subjected to various traffic volumes. Level-of-service (LOS) is a qualitative measure of the effect of a number of factors which include space, speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience.

There are six levels-of-service, A through F, which relate to the driving conditions from best to worst, respectively. The characteristics of traffic operations for each level-of-service are summarized in Table 3. In general, LOS A represents free-flow conditions with no congestion. LOS F, on the other hand, represents severe congestion with stop-and-go conditions. ***Level-of-service D is typically considered acceptable for peak hour conditions in urban areas.***

Corresponding to each level-of-service shown in the table is a volume/capacity ratio. *This is the ratio of either* existing or projected traffic volumes to the capacity of the intersection. Capacity is defined as the maximum number of vehicles that can be accommodated by the roadway during a specified period of time. The capacity of a particular roadway is dependent upon its physical characteristics such as the number of lanes, the operational characteristics of the roadway (one-way, two-way, turn prohibitions, bus stops, etc.), the type of traffic using the roadway (trucks, buses, etc.) and turning movements.

Table 3 Level-of-Service Definitions for Signalized Intersections[1]

Level of Service	Interpretation	Volume-to-Capacity Ratio[2]	Stopped Delay (Seconds)
A, B	Uncongested operations; all vehicles clear in a single cycle.	0.000-0.700	<20.0
C	Light congestion; occasional backups on critical approaches	0.701-0.800	20.1-35.0
D	Congestion on critical approaches but intersection functional. Vehicles must wait through more than one cycle during short periods. No long standing lines formed.	0.801-0.900	35.1-55.0
E	Severe congestion with some standing lines on critical approaches. Blockage of intersection may occur if signal does not provide protected turning movements.	0.901-1.000	55.1-80.0
F	Total breakdown with stop-and-go operation	>1.001	>80.0

Notes:
(1) Source: *Highway Capacity Manual*, 2000.
(2) This is the ratio of the calculated critical volume to Level-of-Service E Capacity.

Unsignalized Intersections

Like signalized intersections, the operating conditions of intersections controlled by stop signs can be classified by a level-of-service from A to F. However, the method for determining level-of-service for unsignalized intersections is based on the use of gaps in traffic on the major street by vehicles crossing or turning through that stream. Specifically, the capacity of the controlled legs of an intersection is based on two factors: 1) the distribution of gaps in the major street traffic stream, and 2) driver judgement in selecting gaps through which to execute a desired maneuver. The criteria for level-of-service at an unsignalized intersection is therefore based on delay of each turning movement. Table 4 summarizes the definitions for level-of-service and the corresponding delay. A subsequent calculation to determine an overall LOS was made, and these results are presented in tables to summarize traffic conditions using parameters similar to those used for signalized intersections.

Table 4 Level-of-Service Definitions for Unsignalized Intersections(1)

Level-of-Service	Expected Delay to Minor Street Traffic	Delay (Seconds)
A	Little or no delay	<10.0
B	Short traffic delays	10.1 to 15.0
C	Average traffic delays	15.1 to 25.0
D	Long traffic delays	25.1 to 35.0
E	Very long traffic delays	35.1 to 50.0
F	See note (2) below	>50.1

Notes:
(1) Source: *Highway Capacity Manual*, 2000.
(2) When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvement of the intersection.

Level-of-Service Analysis of Existing Conditions

Signalized Intersections

The level-of-service of signalized intersections was determined using the operations method described in the *Highway Capacity Manual*. The results of this analysis for the signalized intersections in the study area are summarized in Table 5. Shown are the volume-to-capacity ratio, the average vehicle delay and the Level-of-Service of each intersection and each lane group.

The results of the level-of-service analysis indicate that all traffic movements currently operate at Level-of-Service D or better except at the intersections of Lipoa Street at Piilani Highway and Piikea Avenue at South Kihei Road. This is consistent with observed peak hour traffic conditions with the following exceptions:

1. At the intersection of Piikea Avenue at Piilani Highway, the queue for the eastbound to northbound left turn extends beyond the available storage length and into the intersection with the entrance to Piilani Village Shopping Center. This constrains traffic flow through the intersection of Piikea Avenue at Piilani Village Shopping Center.

2. Northbound traffic flow along South Kihei Road south of Piikea Avenue is congested during the afternoon peak hours. This congestion was observed as early as 3:30 PM and as late as 6:00 PM. Therefore, the north-south traffic flows are constrained.

The Level-of-service Analysis Worksheets are presented as Appendix C.

Table 5 Existing (2005) Levels-of-Service of Signalized Intersections

Intersection and Movement	AM Peak Hour			PM Peak Hour		
	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]
Lipoa Street at South Kihei Road	0.56	21.4	C	0.67	28.8	C
Eastbound Left & Thru	0.25	26.5	C	0.24	28.0	C
Eastbound Right	0.06	23.1	C	0.18	27.0	C
Westbound Left & Thru	0.61	33.7	C	0.59	36.9	C
Westbound Right	0.17	24.3	C	0.08	25.8	C
Northbound Left	0.18	30.5	C	0.43	50.7	C
Northbound Thru	0.67	21.8	C	0.80	32.0	C
Northbound Right	0.06	12.8	B	0.08	16.6	B
Southbound Left	0.30	25.2	C	0.25	34.8	C
Southbound Thru & Right	0.37	11.2	B	0.75	22.4	B
Lipoa Street at Liloa Street	0.39	18.0	B	0.28	23.7	C
Eastbound Left	0.08	12.0	B	0.14	16.2	B
Eastbound Thru & Right	0.44	25.7	C	0.38	29.2	C
Westbound Left	0.21	5.9	A	0.06	9.3	A
Westbound Thru	0.21	12.0	B	0.29	18.7	B
Westbound Right	0.18	11.8	B	0.06	16.0	B
Northbound Left	0.16	20.4	C	0.05	23.9	C
Northbound Thru	0.23	26.6	C	0.13	33.6	C
Northbound Right	0.17	26.1	C	0.02	32.3	C
Southbound Left	0.26	21.4	C	0.09	24.3	C
Southbound Thru	0.39	29.2	C	0.09	33.1	C
Southbound Right	0.09	25.0	C	0.16	34.2	C
Lipoa Street at Piilani Highway	0.49	14.1	B	0.69	47.1	D
Eastbound Left & Thru	0.23	27.1	C	0.44	44.3	D
Eastbound Right	0.04	24.5	C	0.09	37.4	D
Westbound Left	0.02	24.4	C	0.50	84.0	F
Westbound Thru	0.01	24.2	C	0.28	74.6	E
Westbound Right	0.04	24.6	C	0.50	86.1	F
Northbound Left	0.29	8.0	A	0.67	76.8	E
Northbound Thru & Right	0.53	14.0	B	0.68	30.2	C
Southbound Left	0.24	6.3	A	0.36	86.0	F
Southbound Thru	0.61	15.1	B	0.92	56.0	E
Southbound Right	0.30	12.0	B	0.04	28.9	C
Piikea Avenue at South Kihei Road	0.40	16.6	B	0.85	80.5	F
Westbound Left & Thru	0.27	27.1	C	1.54	286.0	F
Westbound Right	0.07	24.7	C	0.52	32.3	C
Northbound Left	0.07	31.1	C	0.39	47.5	D
Northbound Thru	0.52	16.9	B	0.66	17.4	B
Northbound Right	0.19	12.8	B	0.29	11.7	B
Southbound Left	0.30	30.8	C	0.45	36.8	D
Southbound Thru & Right	0.25	10.9	B	0.42	8.5	A
Piikea Avenue at Piilani Highway	0.60	15.9	B	0.64	16.1	B
Eastbound Left	0.56	29.8	C	0.56	27.9	C
Eastbound Right	0.34	25.7	C	0.45	28.0	C
Northbound Left	0.49	31.0	C	0.69	35.8	D
Northbound Thru	0.42	6.4	A	0.50	6.9	A
Southbound Thru	0.66	17.6	B	0.67	17.5	B
Southbound Right	0.54	17.1	B	0.44	15.2	B
Welakahao Street at South Kihei Road	0.48	11.6	B	0.65	16.9	B
Eastbound Left, Thru & Right	0.23	22.1	C	0.18	24.8	C
Westbound Left & Thru	0.18	21.6	C	0.33	27.2	C
Westbound Right	0.06	20.1	C	0.06	23.4	C
Northbound Left	0.02	4.8	A	0.12	12.1	B
Northbound Thru & Right	0.59	11.1	B	0.72	15.2	B
Southbound Left	0.05	5.6	A	0.18	11.5	B
Southbound Thru & Right	0.52	9.8	A	0.77	16.6	B

NOTES:
1. V/C denotes ratio of volume to capacity.
2. Delay is in seconds per vehicle.
3. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

Unsignalized Intersections

The results of the Level-of-Service analysis of the unsignalized intersections are summarized in Table 6. Shown are the control delays and Levels-of-Service of each movement. Volume-to-capacity ratios are not calculated for unsignalized intersections.

The intersection of Welakahao Road at Liloa Avenue was not included in the analysis of existing conditions because the peak hour traffic volumes approaching the intersection along Liloa Avenue were negligible. The intersection of Halekuai Street at Liloa Street was not included because only two movements are currently allowed. Both these intersections are included in the analysis of future conditions as Liloa Street will connect Halekuai Street and Welakahao Road.

Table 6 Existing (2005) Levels-of-Service Analysis for Unsignalized Intersections[1]

Intersection and Movement	AM Peak Hour Delay [1]	AM Peak Hour LOS [2]	PM Peak Hour Delay [1]	PM Peak Hour LOS [2]
Halekuai Street at South Kihei Road				
Southbound Left	9.8	A	10.5	B
Westbound Left	47.4	E	148.2	F
Westbound Right	13.6	B	17.1	C
Welakahao Road at Piilani Highway				
Northbound Left	11.0	B	12.9	B
Eastbound Left	22.8	C	27.4	D
Eastbound Right	13.0	B	14.0	B
Piikea Avenue at Liloa Street				
Eastbound Left, Thru & Right	11.7	B	12.4	B
Westbound Left, Thru & Right	13.6	B	13.3	B
Northbound Left, Thru & Right	12.4	B	15.9	C
Southbound Left, Thru & Right	12.0	B	21.8	C

NOTES:
(1) Delay in seconds per vehicle.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is based on delay.

The conclusion of the level-of-service analysis of existing conditions is that all movements currently operate at Level-of-Service D or better except the westbound Halekuai Street to southbound South Kihei Road, which operates at Level-of-Service E during the morning peak hour and Level-of-Service F during the afternoon peak hour.

Field Observations

The following is a summary traffic conditions observed during the traffic surveys and reconnaissance.

1. Northbound traffic along South Kihei Road between Piikea Avenue and Welakahao Road is constrained.
2. Eastbound traffic along Piikea Avenue at Piilani Highway backs up through the intersection at Piilani Shopping Center entrance.

3. PROJECTED BACKGROUND TRAFFIC CONDITIONS

The purpose of this chapter is to discuss the assumptions and data used to estimate 2010, 2015 and 2020 background traffic projections without the proposed project.

Future traffic growth consists of two components. The first is ambient background growth that is a result of regional growth and cannot be attributed to a specific project. The second component is estimated traffic that will be generated by other development projects in the vicinity of the proposed project.

Design Year for Traffic Forecasts

The design, or horizon, year of a project is the future year for which background traffic conditions are estimated. For the projects the size of the study project, the anticipated opening or completion year is suggested by the Institute of Transportation Engineers[1]. The anticipated completion year of each of the three phases is as follows:

Phase 1	2010
Phase 2	2015
Phase 3	2020

[1] Institute of Transportation Engineers, *Transportation and Land Development*, 2nd Edition, Washington, D.C., 2002, p. 3-13.

Background Traffic Growth

The *Maui Long Range Transportation Plan*[2] concluded that traffic in Maui would increase an average of 1.6% per year from 1990 to 2020. This growth rate was used to estimate the background growth between 2005 and the various design years for this project. The growth factor was calculated using the following formula:

$$F = (1 + i)^n$$

where F = Growth Factor
i = Average annual growth rate, or 0.016
n = Growth period in years

The background factor for each phase is as follows:

Phase 1 (2010)	1.0826
Phase 2 (2015)	1.1016
Phase 3 (2020)	1.2688

The growth factors were applied to all traffic movements at the study intersections.

Related Projects

The second component in estimating background traffic volumes is traffic resulting from other proposed projects in the vicinity. Related projects are defined as those projects that are likely to be constructed within the design period and would significantly impact traffic in the study area. Related projects may be development projects or roadway improvements.

The projects that were identified as related projects and the estimated number of peak hour trips generated by each are summarized in Table 5. The locations of these projects are shown on Figure 4. Traffic from these projects was assigned to the appropriate traffic movements at the study intersections.

[2] Kaku Associates, October 1996

Table 5 Trip Generation Summary of Related Projects

	Related Project	Description	AM Peak Hour Total	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out
A	Keala Village	49 Single Family Units	38	10	48	50	32	82
B	Cove Beach Condos	32 Multi-Family Units	21	5	26	27	15	42
C	Ke Alii Villas	160 Multi-Family Units	98	26	124	108	60	168
D	Kalama Heights	40 Senior Units	23	12	35	27	15	42
E	Hale Kanani	72 Multi-Family Units	48	12	60	60	34	94
F	Kamaole Hotel	280 Hotel Rooms	115	72	187	143	72	215
G	Kamaole Condos	65 Condo Units	29	5	34	35	23	58
H	Ke Alii Single Family	90 SF Units + 45 Ohana	89	21	110	116	75	191
I	Aloha Village	78 MF Units	34	6	40	42	27	69
J	Liloa Village	65 SF Units + 65 Ohana	19	64	83	68	38	106
K	Azeka Retail	Retail & Offices	145	75	220	190	356	546
L	Aina Development	Retail	47	51	98	40	32	72
M	Kai Ani Village	100 Condos + 10,000 SF Retail	24	54	78	49	30	79
N	Paradise Ridge	32 MF Units	3	11	14	11	6	17
O	Maui Dive Lodge	18 Apartments	3	7	10	7	5	12
P	Kamaole Homesteads	7 SF + 7 Ohana	2	7	9	7	4	11
Q	Kihei Farms 2 Subdivision	12 SF + 12 Ohana	3	12	15	13	6	19
R	Kihei Recycling Center	Relocate Recycling Center	5	5	10	31	31	62
S	Kihei Hope Chapel	Church & Classrooms	30	0	30	0	30	30
T	Not Used		0	0	0	0	0	0
U	Kihei Hanalei Condos	4 Condos	1	1	2	1	1	2
V	Hale Mahalou	113 Sr Housing Units	4	5	9	8	5	13
W	Not Used		0	0	0	0	0	0
X	Kalama Hills	12 SF + 12 Ohana	3	11	14	12	6	18
Y	Kamaole Apartment & Hotel Condominiums	96 Condos + 32 Timeshares	28	46	74	50	37	87
Z	North-South Collector Rd from Halekuai St to Auhana Rd							
	Totals		812	518	1,330	1,095	940	2,035

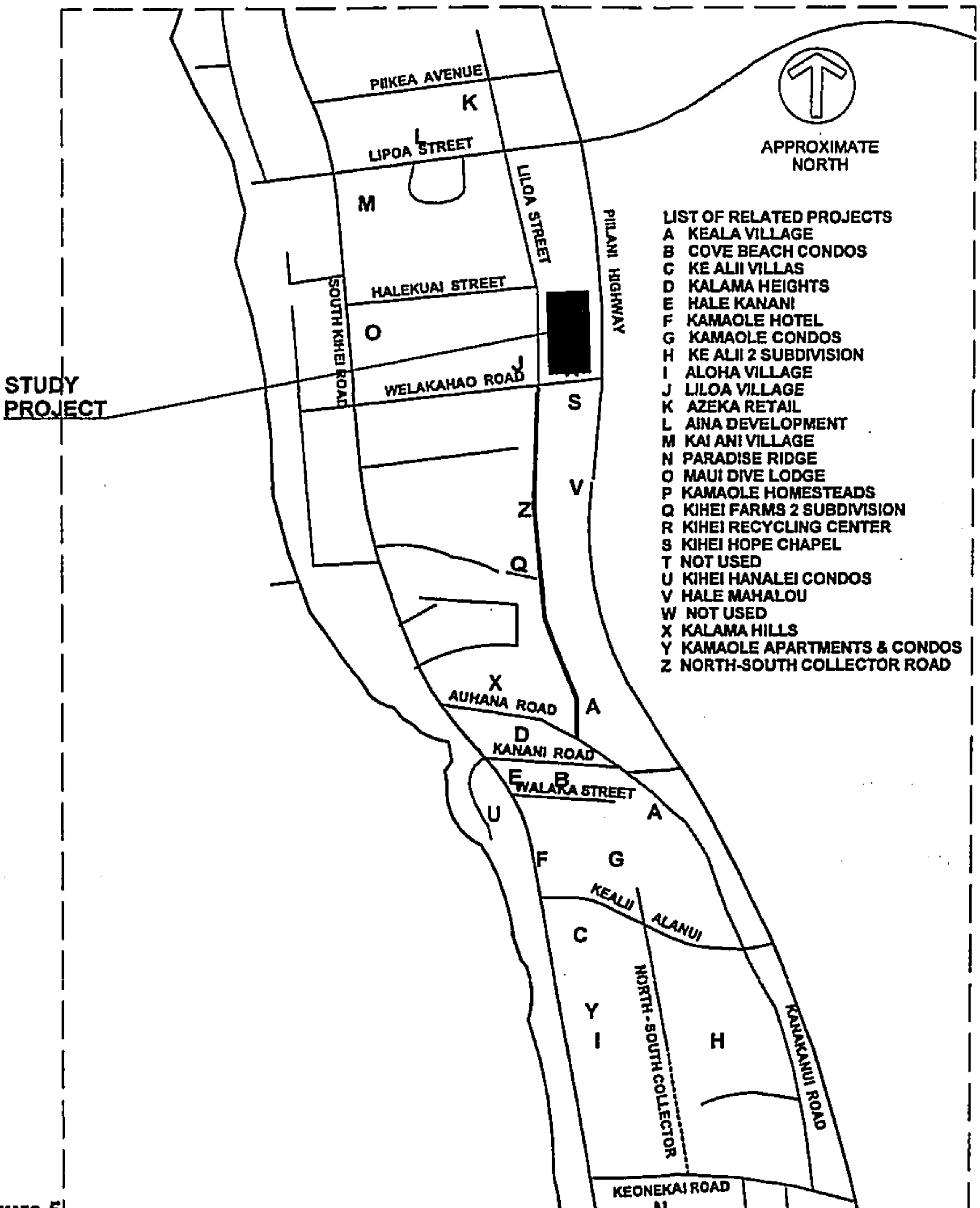

Figure 5
LOCATIONS OF RELATED PROJECTS

Extension of Liloa Street from Halekuai Street to Auhana Road was included as a related project. The amount of traffic that would be diverted from South Kihei Road and Piilani Highway was estimated and included in the background traffic projections.

4. PROJECT TRAFFIC CHARACTERISTICS

This chapter discusses the assumptions and methodology used to identify the traffic-related impacts of the proposed project. Generally, the process involves the determination of weekday peak-hour trips that would be generated by the proposed project, distribution and assignment of these trips on the approach and departure routes. The results of the level-of-service analysis of background plus project conditions are presented in the following chapter.

Trip Generation Analysis Assumptions

Future traffic volumes generated by a project are typically estimated using the procedures described in the *Trip Generation Handbook*,[3] published by the Institute of Transportation Engineers. This method uses trip generation rates to estimate the number of trips that a proposed project will generated during the morning and afternoon peak hours. The trip generation rates for various categories of parks are summarized in Table 8. No trip generation rat es are available for the shaded cells.

[3] Institute of Transportation Engineers, *Trip Generation Handbook*, Washington, D.C., 1998, p. 7-12

Table 8 Summary of Trip Generation Rate for Park Uses

		Trip Generation Rates for:								
Land Use Category		City Park		County Park	State Park			Regional Park		
Land Use Code		411		412	413			417		
Trips Based On		Acres	Picnic Sites	Acres	Acres	Picnic Sites	Employees	Employees	Acres	Picnic Sites
Time Period	Direction	Trip Generation Rates[1]								
Weekday	Total	1.79	5.87	2.28	0.65	9.95		79.77	4.57	61.82
AM Peak Hour	Total			0.52				7.23	.015	
	% In			71%				57%	57%	
	% Out			29%				43%	43%	
PM Peak Hour	Total			0.59				12.77	0.26	
	% In			35%				44%	44%	
	% Out			65%				56%	56%	
Saturday	Total			12.14	0.61	6.42	42.55	128.04	5.65	70.39
Saturday Peak Hour	*Total*			2.24	0.02	0.60	4.83	16.54	0.34	
	% In			59%	50%	50%	50%	48%	48%	
	% Out			41%	50%	50%	50%	52%	52%	
Sunday	Total			4.13	1.10	14.51		162.81	6.44	76.06
Sunday Peak Hour	Total			3.60	0.03	0.95	7.59	20.46	0.42	
	% In			47%	48%	48%	48%	34%	34%	
	% Out			53%	52%	52%	52%	66%	66%	

Notes:
(1) Source: Institute of Transportation Engineers, *Trip Generation 7th Edition*, Washington, D.C., 2003.

As shown, there are no trip generation rates for a park comparable to the proposed project. Accordingly, the number of peak hour trips that the project will generated was estimated by performing a trip generation analysis for the various components of each phase.

The Institute of Transportation Engineers reference provides trip generation data for soccer fields and tennis courts. These data were used to estimate the peak hour trips generated by the soccer fields and multi-use courts. For the remaining uses, the gymnasium and assembly rooms and the baseball/softball field, the trip generation analysis was performed using standard assumptions of usage, vehicle occupancy and directional distribution.

Based on observations of traffic conditions of comparable recreation facilities in Maui, it was observed that the peak hour of the parks uses do not coincide with the peak hour of the adjacent roadways. For instance, the peak hourly traffic associated with many recreational uses occurs on a Saturday or Sunday. If the adjacent roadway facility is designed for the weekday peak hour, the roadway will not be able to accommodate peak hourly traffic into and out of the park. Accordingly, an additional calculation was made to estimate the number of off-peak hour trips.

The assumptions used to perform the trip generation analysis of each of the proposed uses are summarized in the following paragraphs.

Gymnasium and Assembly Rooms

Traffic to and from the gymnasium and assembly rooms will be during the off-peak hours as it is anticipated that these facilities will be used for special events and meeting. No regular events have been noted and if regular events are anticipated, they should be scheduled to start and end during off-peak periods. This means that these facilities will not generate any trips during the peak hours.

However, when there is an event at these facilities, a significant amount of traffic may be generated. Based on information provided by the project's architect, the gymnasium will have a floor area of 12,577 square feet (sf) and the allowable occupancy is one person per 7.5 sf. Therefore, the maximum number of persons in the gymnasium will be 1,677 persons. Also based on information provided by the project's architect, the assembly rooms will have a floor area of 5,000 sf. As the allowable occupancy is one person per 15 square feet, the maximum number of persons allowed is 333. In summary, when both the gymnasium and assembly rooms are in use at the same time, there may be up to 2010 persons in these facilities at any one time.

The assumptions used to estimate the peak hourly traffic generated by the gymnasium and assembly rooms are:

1. 50% of the attendees will arrive during the one hour before the event.
2. The inbound/outbound ratio will be 85/15.
3. The vehicle occupancy will be 2.8 persons per vehicle.

Baseball and Softball Fields

1. There will be two teams per field.
2. There will be twelve players per team.
3. There will be two coaches per team.
4. There will be four officials per team.
5. There will be 1.25 persons per vehicle.
6. The arrivals for one game will overlap the departures for the previous game.

Using these assumptions, there will be 25 inbound trips and 25 outbound trips during the peak hours of the adjacent street and the peak hour of the project.

Soccer Fields

The soccer field will have traffic characteristics comparable to a soccer complex, for which the Institute of Transportation Engineers references provide trip generation data. These rates are as follows:

Period and Direction	Trips per Field or Percent
AM Peak Hour of Adjacent Street	2.90
% Inbound	54%
% Outbound	46%
PM Peak Hour of Adjacent Street	21.77
% Inbound	33%
% Outbound	67%

It was assumed that the PM peak hour of the adjacent street is also the peak hour of the project.

Multi-Use Courts

The multi-use courts will have traffic characteristics comparable to tennis courts, for which the Institute of Transportation Engineers references provide trip generation data. These rates are as follows:

Period and Direction	Trips per Field or Percent
AM Peak Hour of Adjacent Street	1.83
% Inbound	Not Available
% Outbound	Not Available
PM Peak Hour of Adjacent Street	3.67
% Inbound	Not Available
% Outbound	Not Available

It was assumed that the PM peak hour of the adjacent street is also the peak hour of the project.

Trip Generation Analysis

The trip generation analysis is summarized in Table 9.

Table 9 Trip Generation of Proposed Project

	AM Peak Hour			PM Peak Hour			Basis of Design		
	Total	In	Out	Total	In	Out	Total	In	Out
Phase 1									
Gym & Assembly Rooms	0	0	0	0	0	0	425	360	65
1 Soccer Field	3	2	1	22	7	15	22	7	15
1 Baseball Field	7	4	3	50	16	34	50	16	34
Phase 1 Totals	10	6	4	72	23	49	497	383	114
Phase 2									
Pavilion	0	0	0	0	0	0	0	0	0
2 Soccer Fields	6	4	2	44	14	30	44	14	30
2 Baseball Fields	14	8	6	100	32	68	100	32	68
Phase 2 Totals	20	12	8	144	46	98	144	46	98
Phase 3									
Multi-Use Courts	11	6	5	22	7	15	96	48	48
PROJECT TOTALS	41	24	17	238	76	162	737	477	260

Trip Distribution and Assignments

The project generated traffic was distributed along the logical approach and departure routes, considering the adjacent land uses and adjacent roadway network. The distribution plan was then used to assign project generated traffic to the appropriate traffic movements at the study intersections. The resulting peak hour trip assignments are shown in Figures 5 through 10.

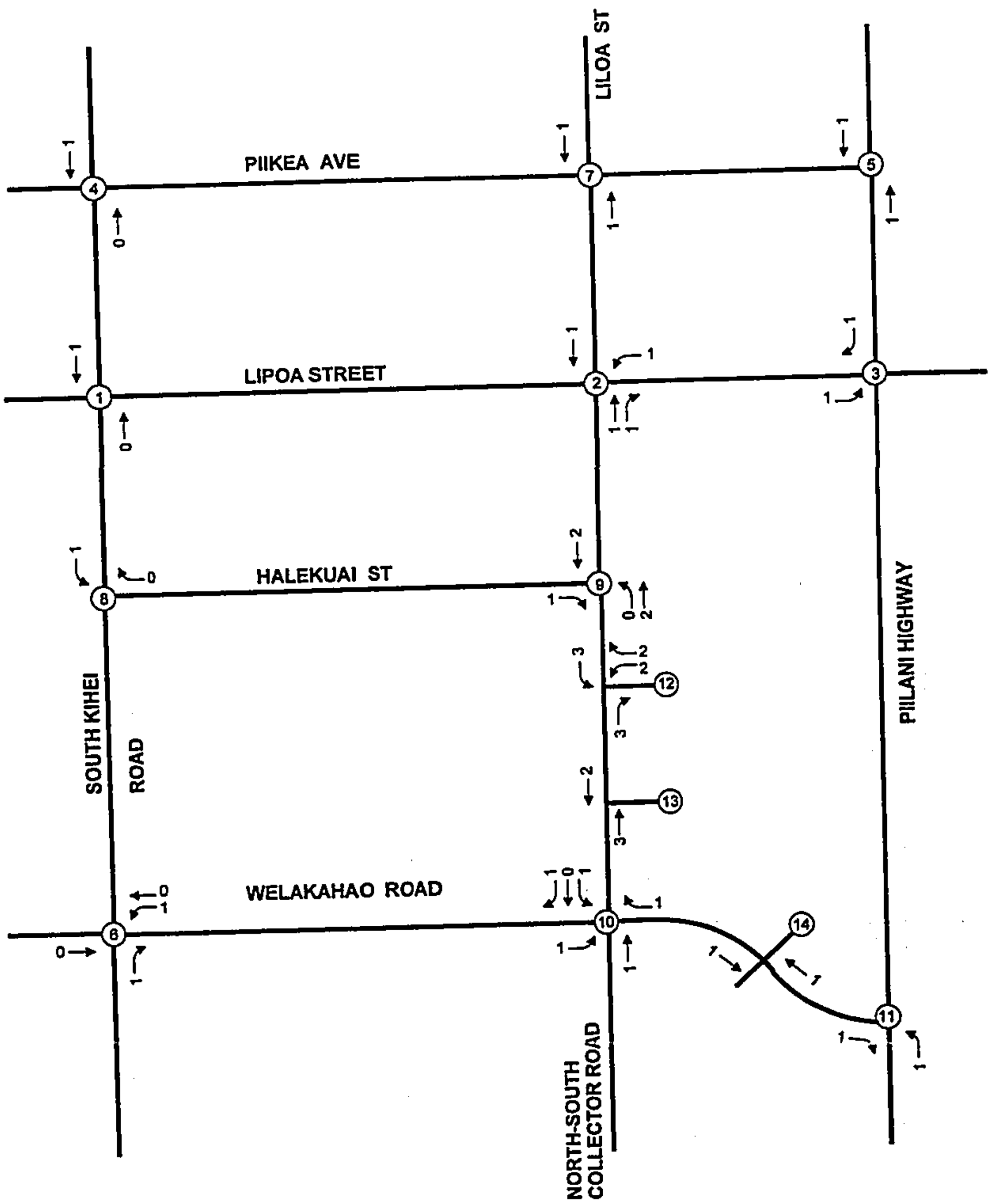

Figure 5
AM PEAK HOUR TRAFFIC ASSIGNMENTS FOR PHASE 1

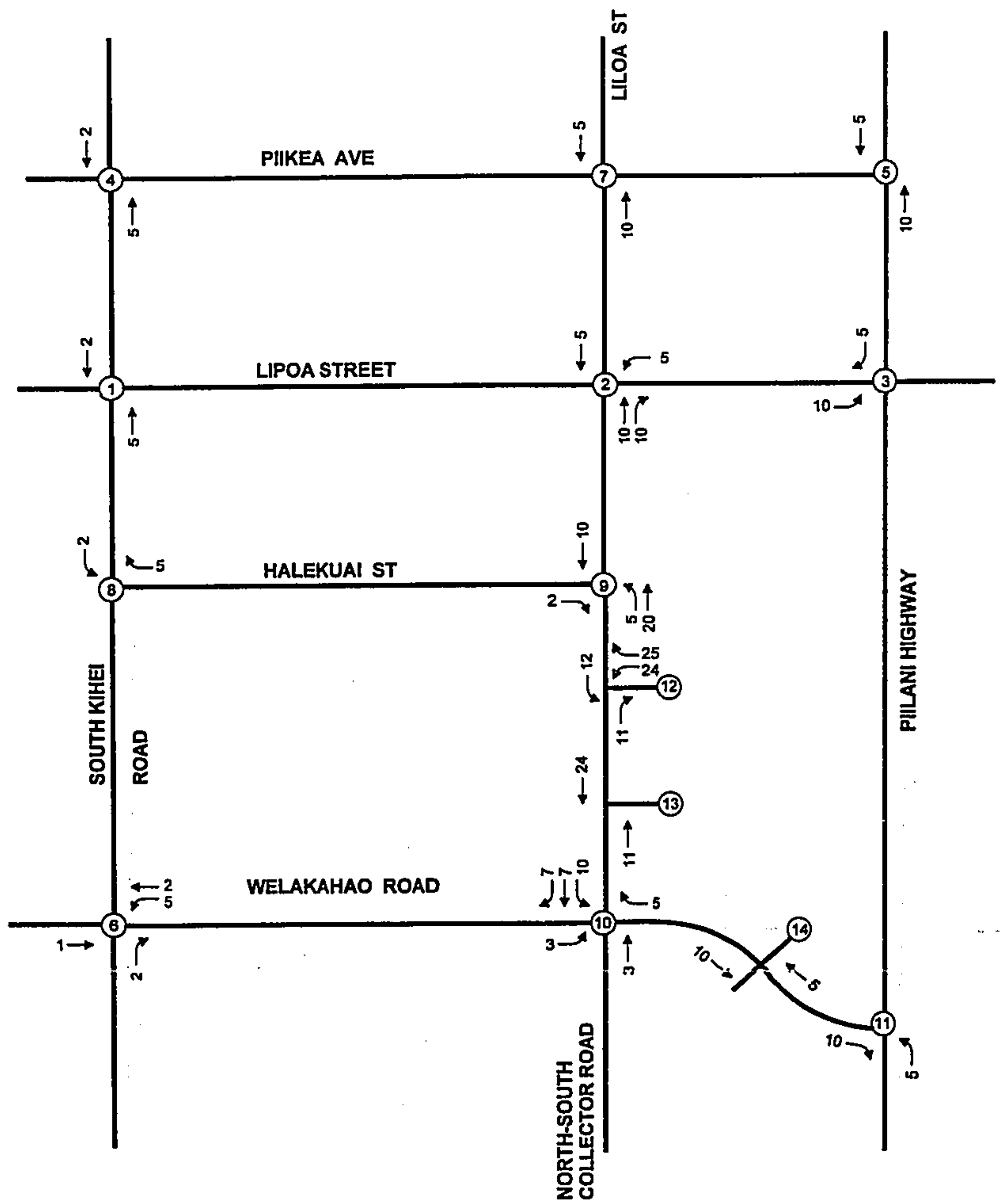

Figure 6
PM PEAK HOUR TRAFFIC ASSIGNMENTS FOR PHASE 1

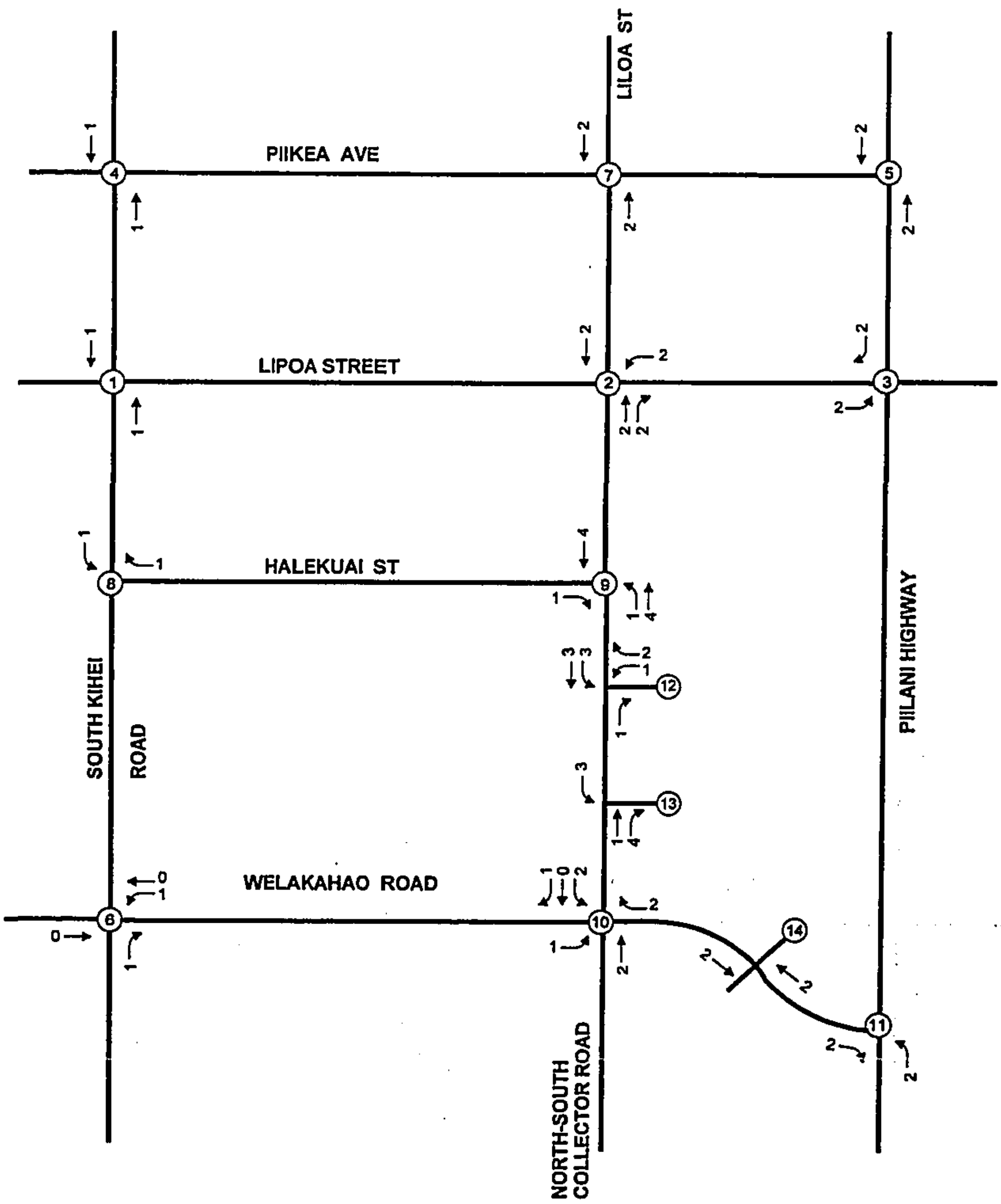

Figure 7
AM PEAK HOUR TRAFFIC ASSIGNMENTS F0R PHASE 2

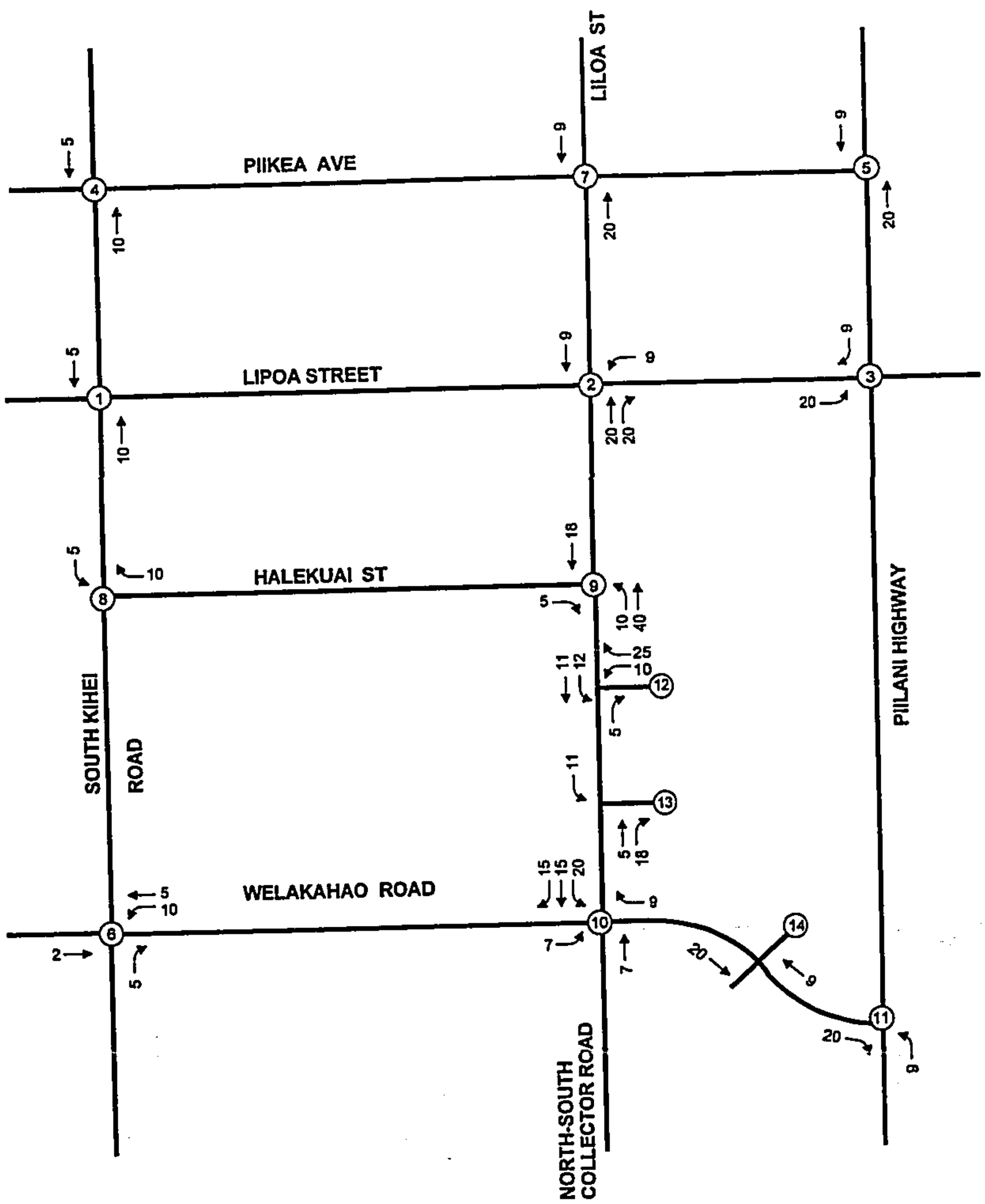

Figure 8
PM PEAK HOUR TRAFFIC ASSIGNMENTS FOR PHASE 2

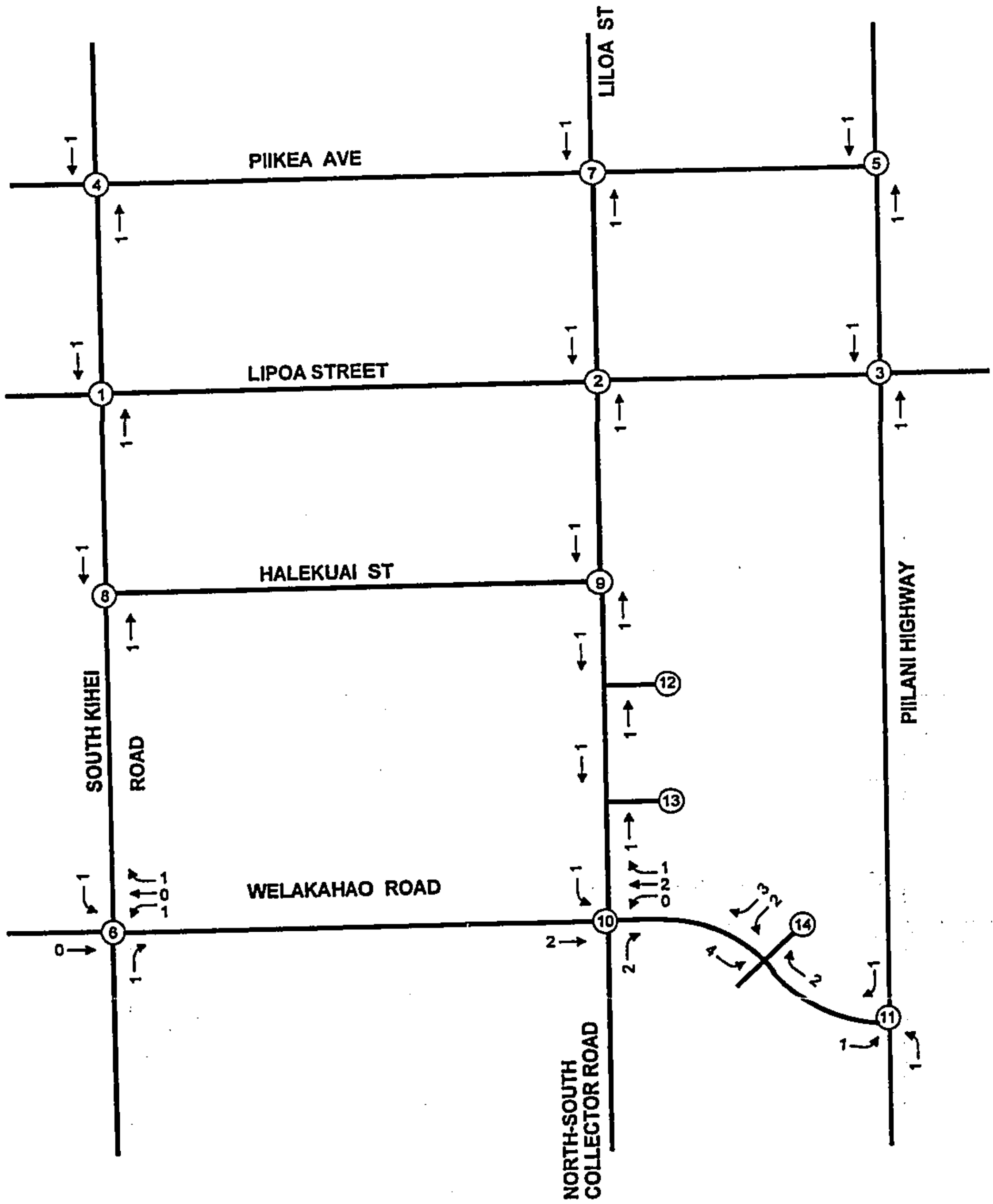

Figure 9
AM PEAK HOUR TRAFFIC ASSIGNMENTS FOR PHASE 3

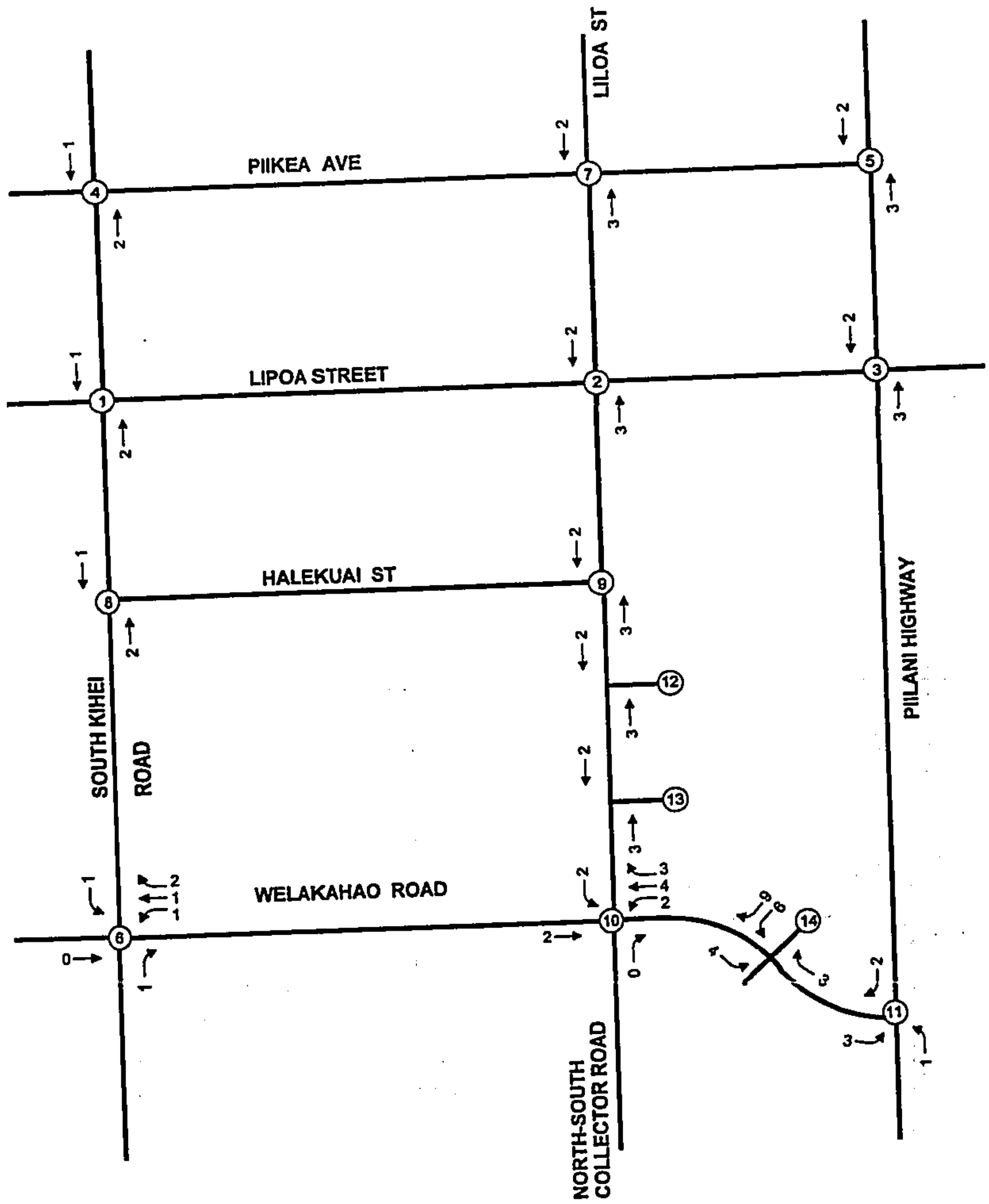

Figure 10
PM PEAK HOUR TRAFFIC ASSIGNMENTS FOR PHASE 3

5. TRAFFIC ANALYSIS - PHASE 1

The purpose of this chapter is to present 2010 background and 2010 background plus project traffic projections and the results of the impact analysis, which identifies the project-related impacts for 2010 conditions. Any mitigation measures necessary and feasible are identified and discussed in Chapter 8.

As discussed in Chapter 3, the North-South Collector Road is a related project that may or may not be completed by 2010. The traffic study for the North-South Collector Road indicated that the roadway will be completed by 2005 or 2006. However, it is probable that the North-South Collector Road will not be operational by 2010. Accordingly, a second 2010 scenario without the North-South Collector Road has been analyzed. This scenario is referred to as Phase 1a.

2010 Background Traffic Projections

2010 background traffic projections were calculated by expanding existing traffic volumes by the appropriate growth rate (1.0826) and then superimposing traffic generated by related projects. The resulting 2010 background traffic projections are summarized in Figures 11 and 14.

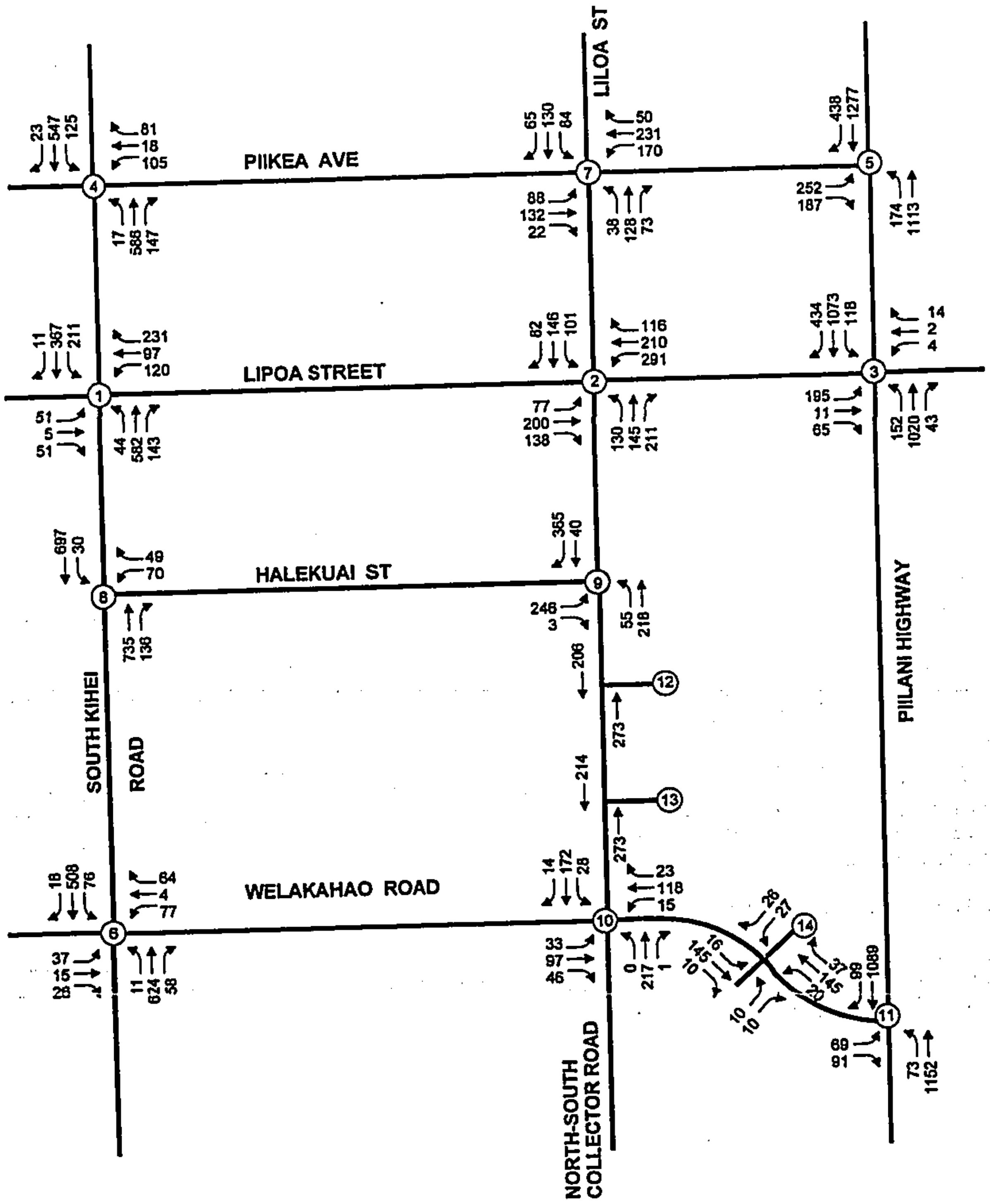

Figure 11
2010 BACKGROUND AM PEAK HOUR TRAFFIC PROJECTIONS WITH NORTH-SOUTH COLLECTOR ROAD

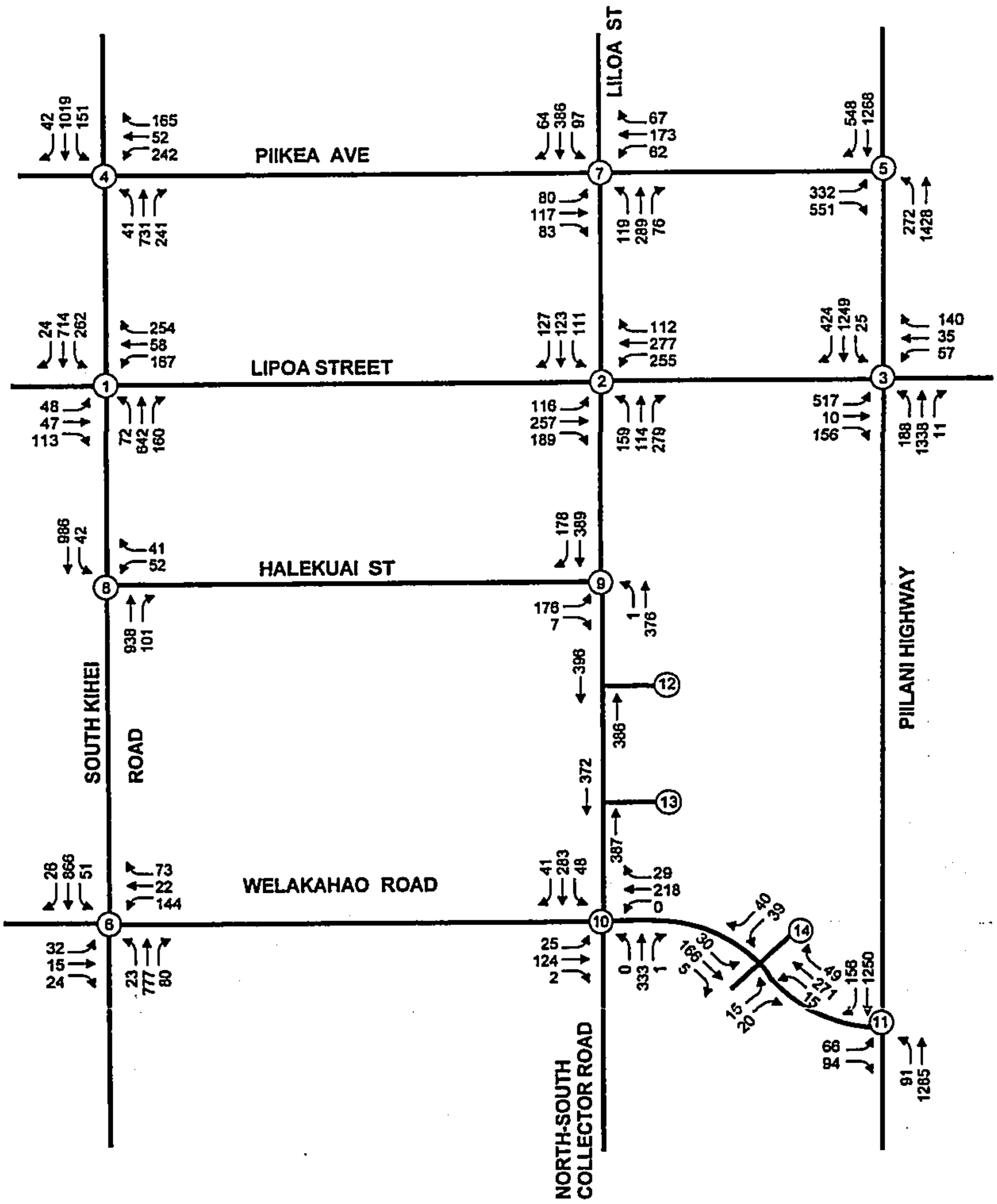

Figure 12
2010 BACKGROUND PM PEAK HOUR TRAFFIC PROJECTIONS WITH NORTH-SOUTH COLLECTOR ROAD

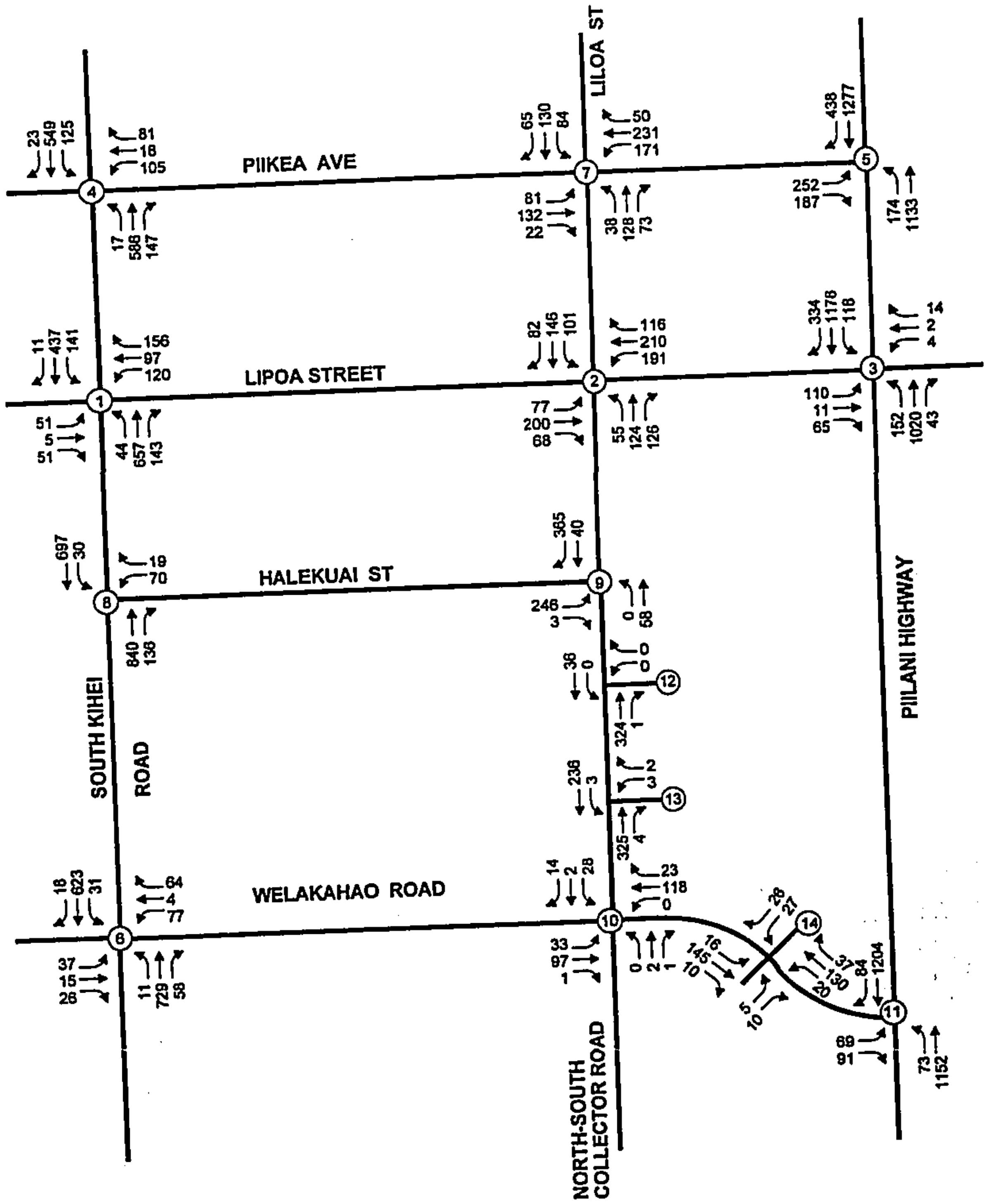

Figure 13
2010 BACKGROUND
AM PEAK HOUR TRAFFIC PROJECTIONS WITHOUT NORTH-SOUTH COLLECTOR

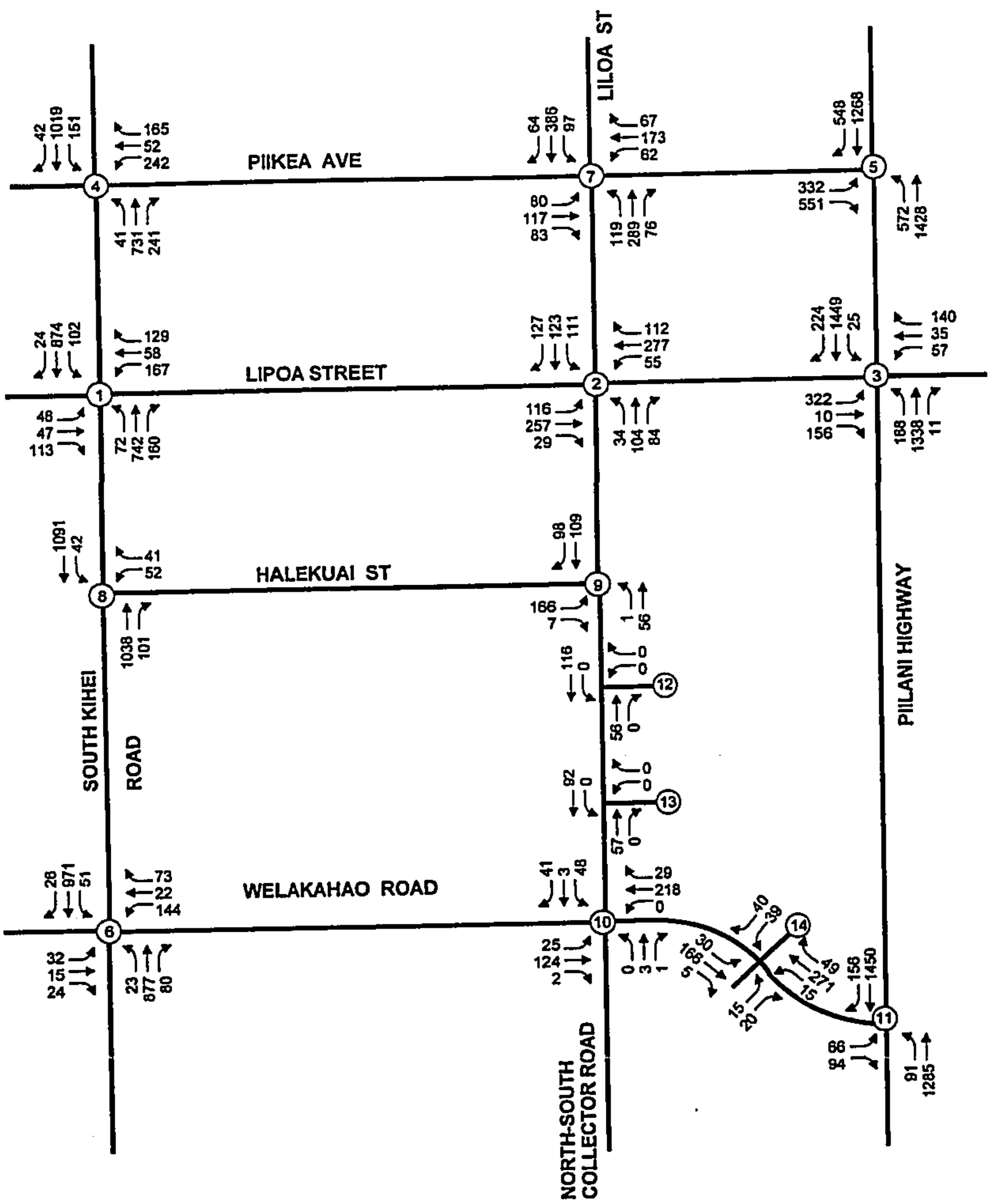

Figure 14
2010 BACKGROUND
PM PEAK HOUR TRAFFIC PROJECTIONS WITHOUT NORTH-SOUTH COLLECTOR ROAD

2010 Background Plus Project Projections

Background plus project traffic conditions are defined as 2010 background traffic conditions plus project related traffic. 2010 background plus project traffic projections were estimated by superimposing the peak hourly traffic generated by the proposed project on the 2010 background peak hour traffic volumes presented previously. The traffic projections for 2010 background plus project conditions are shown on Figures 15 and 18. The traffic projection worksheets are presented as Appendix D.

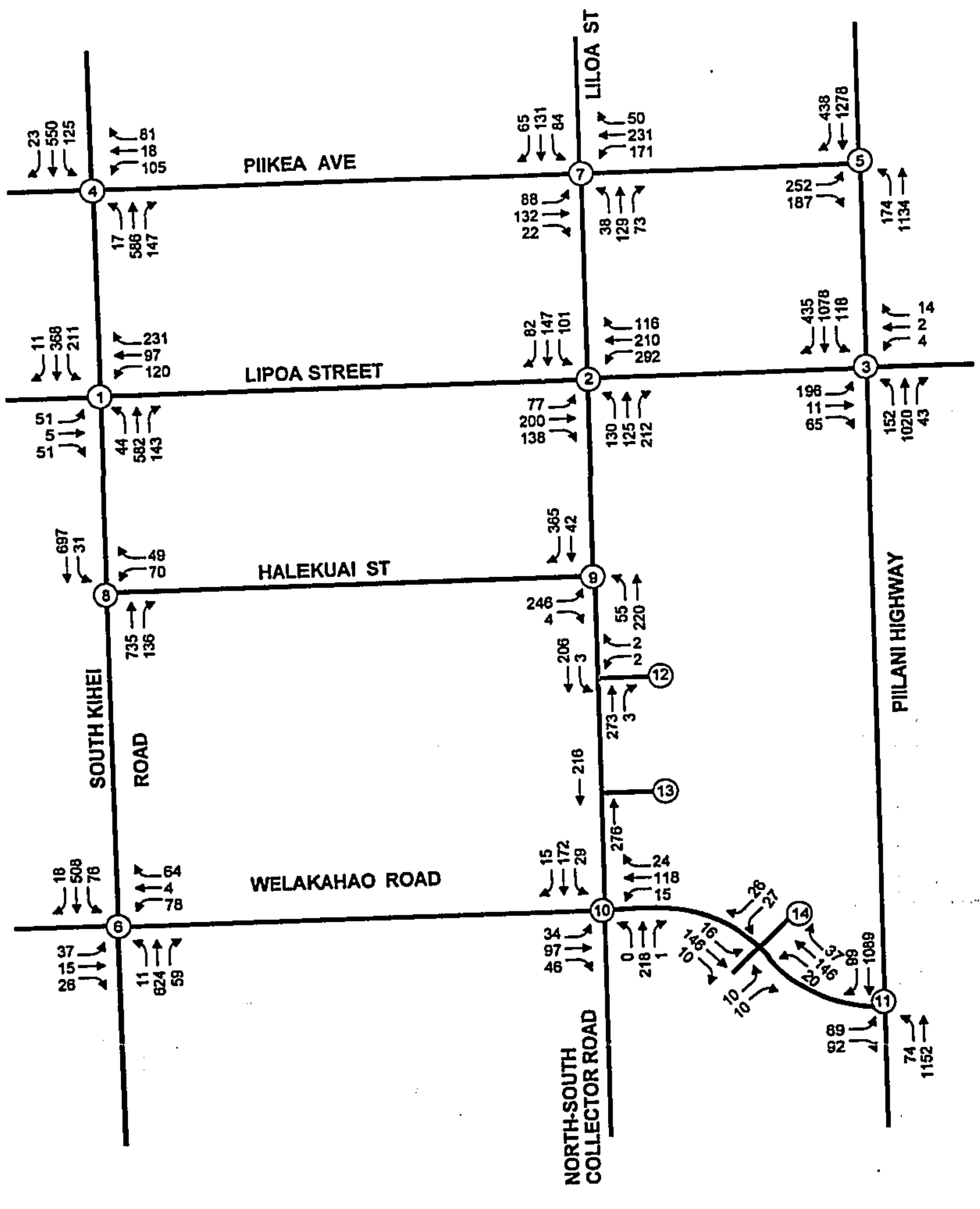

Figure 15
2010 BACKGROUND AM PEAK HOUR TRAFFIC PROJECTIONS WITH NORTH-SOUTH COLLECTOR ROAD

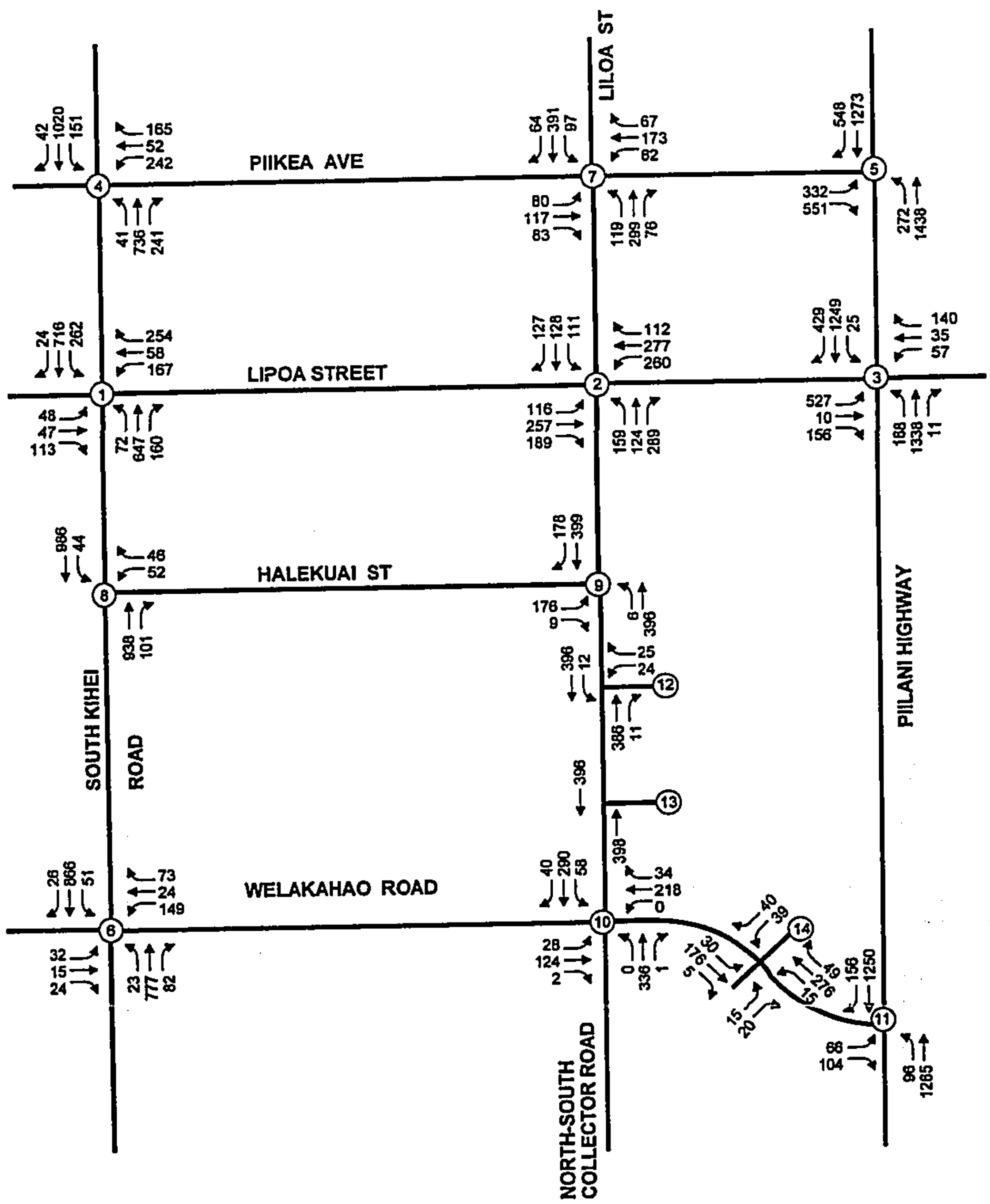

Figure 16
2010 BACKGROUND PM PEAK HOUR TRAFFIC PROJECTIONS WITH NORTH-SOUTH COLLECTOR ROAD

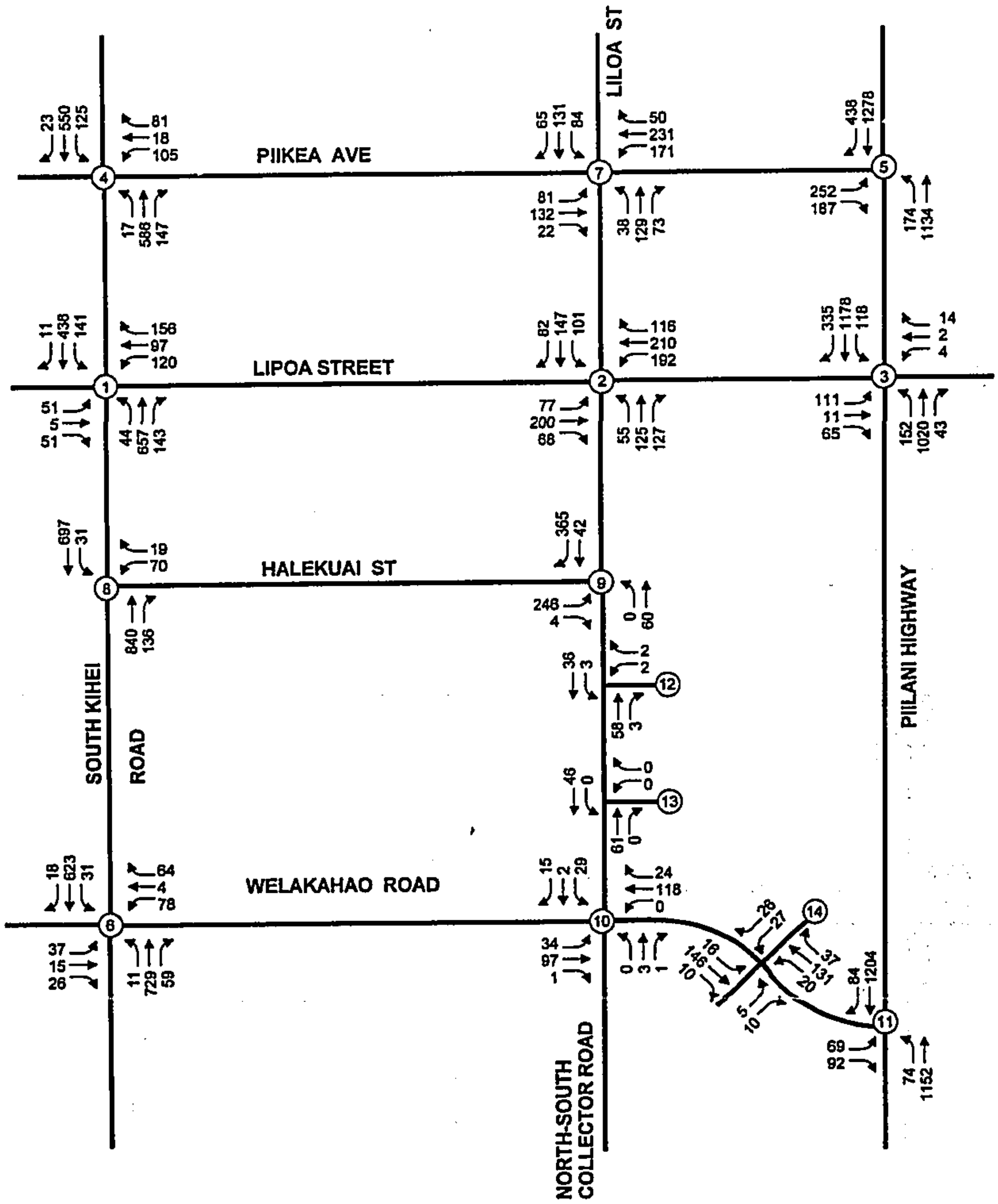

Figure 17
2010 BACKGROUND PLUS PROJECT PHASE 1
AM PEAK HOUR TRAFFIC PROJECTIONS WITHOUT NORTH-SOUTH COLLECTOR ROAD

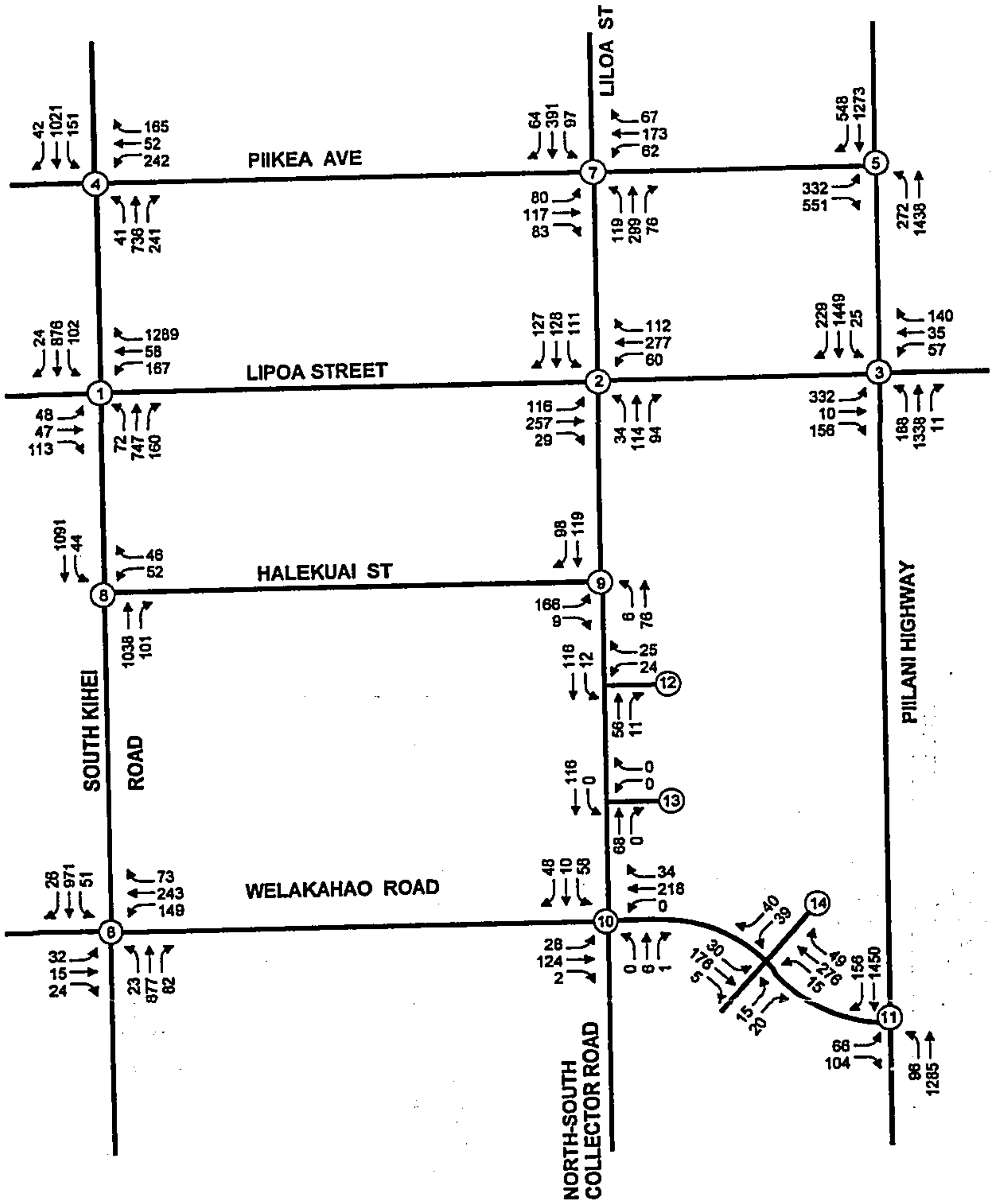

Figure 18
2010 BACKGROUND PLUS PROJECT PHASE 1
PM PEAK HOUR TRAFFIC PROJECTIONS WITHOUT NORTH-SOUTH COLLECTOR ROAD

Project Related Traffic Impacts for Phase 1 With the North-South Collector Road

The impact of the project was assessed by analyzing the changes in traffic volumes and levels-of-service at the study intersections.

Changes in Total Intersection Volumes

An analysis of the changes in traffic volumes at the study intersections is summarized in Table 10. All the changes as a result of project generated traffic are less than 5%. The conclusion of this analysis is that more than 95% of the increase in traffic volumes between 2005 and 2010 are the result of background growth and related projects.

Table 10 Analysis of Changes of Total Intersection Approach Volumes - Phase 1 [1]

Intersection	Period	Existing	2010 Background	Background Plus Project	Background Growth [2] Volume	Background Growth [2] % of 2005 to 2010 Growth	Project Trips [3] Volume [4]	Project Trips [3] % of 2005 to 2010 Growth
Lipoa Street at South Kihei Road	AM	1539	1913	1914	374	99.7%	1	0.3%
	PM	2058	2561	2568	503	98.6%	7	1.4%
Lipoa Street at Liloa Street	AM	1156	1826	1830	670	99.4%	4	0.6%
	PM	974	2119	2149	1145	97.4%	30	2.6%
Lipoa Street at Piilani Highway	AM	2546	3136	3138	590	99.7%	2	0.3%
	PM	3273	4150	4165	877	98.3%	15	1.7%
Piikea Avenue at South Kihei Road	AM	1318	1651	1652	333	99.7%	1	0.3%
	PM	2241	2684	2691	443	98.4%	7	1.6%
Piikea Avenue at Piilani Highway	AM	2923	3461	3463	538	99.6%	2	0.4%
	PM	3611	4399	4414	788	98.1%	15	1.9%
Welakahao Road at South Kihei Road	AM	1309	1518	1520	209	99.1%	2	0.9%
	PM	1820	2133	2142	313	97.2%	9	2.8%
Piikea Avenue at Liloa Street	AM	1002	1205	1207	203	99.0%	2	1.0%
	PM	1261	1613	1628	352	95.9%	15	4.1%
Halekuai Street at South Kihei Road	AM	1439	1717	1718	278	99.6%	1	0.4%
	PM	1918	2160	2167	242	97.2%	7	2.8%
Halekuai Street at Liloa Street	AM	556	927	932	371	98.7%	5	1.3%
	PM	232	1127	1164	895	96.0%	37	4.0%
Welakahao Road at Liloa Street	AM	173	764	769	591	99.2%	5	0.8%
	PM	272	1104	1139	832	96.0%	35	4.0%
Welakahao Road at Piilani Highway	AM	2215	2573	2575	358	99.4%	2	0.6%
	PM	2546	2942	2957	396	96.4%	15	3.6%

Notes:
(1) Volumes shown are total intersection approach volumes or projections.
(2) Background versus existing.
(3) Background plus project versus background.
(4) Project generated traffic

Level-of-Service Analysis for Signalized Intersections

The level-of-service analysis was performed for background and background plus project conditions and then compared. The incremental difference of the volume-to-capacity ratios between the two conditions is the impact of the project. The assumptions used for the level-of-service analysis are:

1. The existing right-of-way controls and intersection configurations will be maintained.

2. The traffic signal timing is optimized for background plus project conditions.

3. Level-of-Service D is considered an acceptable level-of-service for peak hour operating conditions[4].

The level-of-service analysis concluded that all the signalized intersections will operate at Level-of-Service D, or better, during peak hour conditions except the intersection of Lipoa Street at Piilani Highway during the afternoon peak hour period. The afternoon volume-to-capacity ratio of the overall intersections is 0.93 without and with the project. The proposed project adds traffic to the eastbound to northbound left turn and the southbound to westbound right turn and therefore only impact, these two movements.

The volume-to-capacity ratio of the eastbound to northbound left turn increases from 1.00 to 1.02 and the delay increases from 89.8 seconds per vehicle to 94.8 seconds per vehicle. This represents an increase in delay of 5.0 seconds, 5%, per vehicle. Mitigation for this movement should be considered.

The volume-to-capacity ratio of the southbound to westbound right turn will be 0.47 without and with the project. This volume-to-capacity ratio implies a higher level-of-service than the average vehicle delay, which is used to define the level-of-service of the intersection and lane group. The average vehicle delay increases from 37.1 to 37.3 seconds per vehicle. This represents an increase in delay of 0.2 seconds per vehicle, or 0.5%. As there is no change in the volume-to-capacity ratio and the volume-to-capacity ratio implies Level-of-Service B, the conclusion is that the delay, and therefore the level-of-service, is the result of the traffic signal cycle length and phasing and not the result of insufficient capacity.

The results of the level-of-service analysis does not indicate a problem at the intersection of Piikea Avenue at Piilani Highway noted during the traffic survey. Based on observations, the queue for the eastbound to northbound left turn consistently backs up into the intersection of Piikea Avenue at the Piilani Shopping Center entrance. Even though this problem is not the result of project generated traffic, mitigation should be identified.

It should also be noted that the level-of-service for 2010 conditions indicates improved conditions at the intersections along South Kihei Road. This is because the North-South Collector Road will attract approximately 250 trips from South Kihei Road during the morning peak hour and 200 trips during afternoon peak hour.

[4] Institute of Transportation, *Traffic Access and Impact Studies for Site Development, A Recommended Practice*, 1991, page 5.

Table 11 Levels-of-Service of Signalized Intersections - Phase 1

	AM Peak Hour								PM Peak Hour							
	2010 Background Without Project			2010 Background With Project			Change		2010 Background Without Project			2010 Background With Project			Change	
Intersection and Movement	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]
Lipoa Street at S Kihei Rd	0.69	24.8	C	0.69	24.8	C	0.00	0.00	0.76	32.0	C	0.77	32.1	C	0.01	0.10
Eastbound Left & Thru	0.31	28.3	C	0.31	28.3	C	0.00	0.00	0.27	28.6	C	0.27	28.6	C	0.00	0.00
Eastbound Right	0.08	23.2	C	0.08	23.2	C	0.00	0.00	0.20	27.2	C	0.20	27.2	C	0.00	0.00
Westbound Left & Thru	0.71	38.6	D	0.71	38.6	D	0.00	0.00	0.69	41.6	D	0.69	41.6	D	0.00	0.00
Westbound Right	0.46	29.3	C	0.46	29.3	C	0.00	0.00	0.40	30.5	C	0.40	30.5	C	0.00	0.00
Northbound Left	0.20	30.8	C	0.20	30.8	C	0.00	0.00	0.46	51.8	D	0.46	51.8	D	0.00	0.00
Northbound Thru	0.78	25.8	C	0.78	25.8	C	0.00	0.00	0.82	33.4	C	0.82	33.8	C	0.00	0.40
Northbound Right	0.11	13.2	B	0.11	13.2	B	0.00	0.00	0.13	17.1	B	0.13	17.1	B	0.00	0.00
Southbound Left	0.53	29.4	C	0.53	29.4	C	0.00	0.00	0.76	50.8	D	0.76	50.8	D	0.00	0.00
Southbound Thru & Right	0.40	11.6	B	0.40	11.6	B	0.00	0.00	0.75	22.1	C	0.75	22.2	C	0.00	0.10
Lipoa Street at Liloa Street	0.65	25.1	C	0.65	25.2	C	0.00	0.10	0.75	31.7	C	0.76	32.0	C	0.01	0.30
Eastbound Left	0.14	12.5	B	0.14	12.5	B	0.00	0.00	0.21	16.8	B	0.21	16.8	B	0.00	0.00
Eastbound Thru & Right	0.84	42.6	D	0.84	42.6	D	0.00	0.00	0.82	45.1	D	0.82	45.1	D	0.00	0.00
Westbound Left	0.43	9.0	A	0.43	9.0	A	0.00	0.00	0.50	17.6	B	0.51	17.6	B	0.01	0.20
Westbound Thru	0.27	12.5	B	0.27	12.5	B	0.00	0.00	0.35	19.5	B	0.35	19.5	B	0.00	0.00
Westbound Right	0.10	11.1	B	0.10	11.1	B	0.00	0.00	0.09	16.4	B	0.09	16.4	B	0.00	0.00
Northbound Left	0.54	29.6	C	0.54	29.7	C	0.00	0.10	0.44	29.6	C	0.45	29.8	C	0.01	0.20
Northbound Thru	0.42	29.9	C	0.43	30.0	C	0.01	0.10	0.30	36.1	D	0.32	36.5	D	0.02	0.40
Northbound Right	0.58	35.5	D	0.59	35.6	D	0.01	0.10	0.66	46.6	D	0.69	48.1	D	0.03	1.50
Southbound Left	0.39	23.9	C	0.39	23.9	C	0.00	0.00	0.30	27.2	C	0.31	27.3	C	0.01	0.10
Southbound Thru	0.50	31.6	C	0.50	31.7	C	0.00	0.10	0.32	36.5	D	0.33	36.7	D	0.01	0.20
Southbound Right	0.17	26.1	C	0.17	26.1	C	0.00	0.00	0.27	35.9	D	0.27	35.9	D	0.00	0.00
Lipoa Street at Piilani Hwy	0.65	17.2	B	0.65	17.2	B	0.00	0.00	0.93	58.1	E	0.93	58.9	E	0.00	0.80
Eastbound Left & Thru	0.77	46.4	D	0.77	46.7	D	0.00	0.30	1.00	89.8	F	1.02	94.8	F	0.02	5.00
Eastbound Right	0.10	25.2	C	0.10	25.2	C	0.11	0.00	0.16	38.7	D	0.16	38.7	D	0.00	0.00
Westbound Left	0.04	25.1	C	0.04	25.1	C	0.00	0.00	0.53	86.1	F	0.53	86.1	F	0.00	0.00
Westbound Thru	0.01	24.2	C	0.01	24.2	C	0.00	0.00	0.31	75.4	E	0.31	75.4	E	0.00	0.00
Westbound Right	0.04	24.6	C	0.04	24.6	C	0.00	0.00	0.62	94.8	F	0.62	94.8	F	0.00	0.00
Northbound Left	0.38	9.9	A	0.38	9.9	A	0.00	0.00	0.83	92.0	F	0.83	92.0	F	0.00	0.00
Northbound Thru & Right	0.64	15.5	B	0.64	15.5	B	0.00	0.00	0.80	34.7	C	0.80	34.7	C	0.00	0.00
Southbound Left	0.29	8.4	A	0.29	8.4	A	0.00	0.00	0.39	87.8	F	0.39	87.8	F	0.00	0.00
Southbound Thru	0.64	15.6	B	0.64	15.6	B	0.00	0.00	0.95	60.3	E	0.95	60.3	E	0.00	0.00
Southbound Right	0.50	14.7	B	0.50	14.7	B	0.00	0.00	0.47	37.1	D	0.47	37.3	D	0.00	0.20
Piikea Avenue at S Kihei Rd	0.53	18.6	B	0.53	18.6	B	0.00	0.00	0.75	20.2	C	0.76	20.3	C	0.01	0.10
Westbound Left & Thru	0.31	27.6	C	0.31	27.6	C	0.00	0.00	0.74	39.9	D	0.74	39.9	D	0.00	0.00
Westbound Right	0.12	25.2	C	0.12	25.2	C	0.00	0.00	0.36	28.7	C	0.36	28.7	C	0.00	0.00
Northbound Left	0.07	31.2	C	0.07	31.2	C	0.00	0.00	0.42	49.2	D	0.42	49.2	D	0.00	0.00
Northbound Thru	0.70	21.1	C	0.70	21.1	C	0.00	0.00	0.81	22.9	C	0.81	23.2	C	0.00	0.30
Northbound Right	0.21	13.0	B	0.21	13.0	B	0.00	0.00	0.31	11.9	B	0.31	11.9	B	0.00	0.00
Southbound Left	0.39	32.5	C	0.39	32.5	C	0.00	0.00	0.59	41.4	D	0.59	41.4	D	0.00	0.00
Southbound Thru & Right	0.32	11.5	B	0.32	11.5	B	0.00	0.00	0.52	9.4	A	0.52	9.4	A	0.00	0.00
Piikea Avenue at Piilani Hwy	0.71	18.3	B	0.71	18.3	B	0.00	0.00	0.79	19.3	B	0.79	19.4	B	0.00	0.10
Eastbound Left	0.63	32.0	C	0.63	32.0	C	0.00	0.00	0.76	35.9	D	0.76	35.9	D	0.00	0.00
Eastbound Right	0.38	26.4	C	0.38	26.4	C	0.00	0.00	0.61	29.9	C	0.61	29.9	C	0.00	0.00
Northbound Left	0.52	31.8	C	0.52	31.8	C	0.00	0.00	0.75	39.0	D	0.75	39.0	D	0.00	0.00
Northbound Thru	0.51	7.2	A	0.51	7.2	A	0.00	0.00	0.63	8.2	A	0.63	8.3	A	0.00	0.10
Southbound Thru	0.83	22.4	C	0.83	22.4	C	0.00	0.00	0.82	21.8	C	0.82	21.9	C	0.00	0.10
Southbound Right	0.64	19.3	B	0.64	19.3	B	0.00	0.00	0.58	17.8	B	0.58	17.8	B	0.00	0.00

Table 11 (Continued) Levels-of-Service of Signalized Intersections - Phase 1

	AM Peak Hour								PM Peak Hour							
	2010 Background Without Project			2010 Background With Project			Change		2010 Background Without Project			2010 Background With Project			Change	
Intersection and Movement	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)
Welakahao Road at S Kihei Rd	0.61	12.8	B	0.61	12.9	B	0.00	0.10	0.77	21.8	C	0.78	21.9	C	0.01	0.10
Eastbound Left, Thru & Right	0.25	22.4	C	0.25	22.4	C	0.00	0.00	0.21	25.3	C	0.22	25.4	C	0.01	0.10
Westbound Left & Thru	0.30	23.4	C	0.30	23.5	C	0.00	0.10	0.52	31.7	C	0.55	32.4	C	0.03	0.70
Westbound Right	0.12	20.7	C	0.12	20.7	C	0.00	0.00	0.13	24.1	C	0.13	24.1	C	0.00	0.00
Northbound Left	0.03	4.8	A	0.03	4.8	A	0.00	0.00	0.22	18.8	B	0.22	18.8	B	0.00	0.00
Northbound Thru & Right	0.68	12.9	B	0.68	12.9	B	0.00	0.00	0.83	19.9	B	0.84	20.0+	C	0.01	0.10
Southbound Left	0.25	8.6	A	0.26	8.7	A	0.01	0.10	0.39	21.2	C	0.39	21.5	C	0.00	0.30
Southbound Thru & Right	0.52	10.0-	A	0.52	10.0-	A	0.00	0.00	0.86	21.5	C	0.86	21.5	C	0.00	0.00

NOTES:
1. V/C denotes ratio of volume to capacity.
2. Delay is in seconds per vehicle.
3. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

Level-of Service Analysis for Unsignalized Intersections

The results of the level-of-service analysis is the unsignalized intersection in the study area are summarized in Table 12.

Piikea Avenue at Liloa Street

The intersection of Piikea Avenue at Liloa Street is presently an all-way STOP sign controlled intersection. During the morning peak hour, all movements operate at Level-of-Service C or better, without and with the project. During the afternoon peak hour, the northbound approach will operate at Level-of-Service E without and with the project and the southbound approach will operate at Level-of-Service F without and with the project.

It is our understanding that the viability of converting this intersection to a roundabout is being studied. Therefore, a level-of-service analysis for this intersection as a roundabout was performed. The analysis concluded that the intersection will operate at Level-of-Service A, with a maximum volume-to-capacity ratio of 0.60, during the morning peak hour. During the afternoon peak hour, the intersection will operate at Level-of-Service C, with a maximum volume-to-capacity ratio of 0.72.

Halekuai Street at South Kihei Road

At the intersection of Halekuai Street at South Kihei Road, all movements will operate a Level-of-Service D or better.

Traffic along South Kihei Road will operate at Level-of-Service A or B during both peak periods without and with the project. Traffic turning right from Halekuai Street to northbound South Kihei Road will operate at Level-of-Service C during both peak periods without and with the project.

Halekuai Street at Liloa Street

All traffic movements will operate at Level-of-Service C or better during both peak periods at the intersection of Halekuai Street at Liloa Street.

Welakahao Road at Liloa Street

All traffic movements will operate at Level-of-Service D or better during both peak periods except the southbound left turn which will operate at Level-of-Service E during the afternoon peak hour. Mitigation is required.

Welakahao Road at Piilani Highway

The eastbound to northbound left turn will operate at Level-of-Service D during the morning peak hour and Level-of-Service E during the afternoon peak hour, without and with the project. Mitigation should be assessed.

Table 12 Levels-of-Service of Unsignalized Intersections - Phase 1

	AM Peak Hour				PM Peak Hour			
	2010 Background Without Project		2010 Background With Project		2010 Background Without Project		2010 Background With Project	
Intersection and Movement	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Pilkea Avenue at Liloa Street								
Eastbound Left	12.2	B	12.2	B	14.3	B	14.3	B
Eastbound Thru & Right	13.0	B	13.0	B	18.8	C	18.9	C
Westbound Left	14.1	B	14.2	B	13.5	B	13.5	B
Westbound Thru & Right	17.4	C	17.4	C	22.4	C	22.6	C
Northbound Left	11.1	B	11.1	B	14.7	B	14.7	B
Northbound Thru & Right	14.6	B	14.6	B	40.6	E	44.2	E
Southbound Left	12.1	B	12.1	B	13.6	B	13.7	B
Southbound Thru & Right	14.2	B	14.2	B	79.0	F	83.6	F
Halekual Street at South Kihei Road								
Southbound Left	9.5	A	9.5	A	10.4	B	10.4	B
Westbound Left	21.1	C	21.2	C	26.5	D	26.8	D
Westbound Right	15.7	C	15.7	C	18.8	C	19.1	C
Halekual Street at Liloa Street								
Northbound Left	8.3	A	8.3	A	8.7	A	8.7	A
Eastbound Left	18.0	C	18.1	C	19.5	C	20.4	C
Eastbound Right	9.5	A	9.5	A	11.4	B	11.5	B
Welakahao Road at Liloa Street								
Eastbound Left	7.5	A	7.6	A	7.8	A	7.8	A
Westbound Left	7.5	A	7.5	A	7.5	A	7.5	A
Northbound Left	14.9	B	14.9	B	22.1	C	23.4	C
Northbound Thru & Right	16.4	C	16.5	C	26.9	D	28.3	D
Southbound Left	17.0	C	17.1	C	32.9	D	37.9	E
Southbound Thru & Right	15.1	C	15.1	C	22.6	C	24.2	C
Welakahao Road at Piilani Highway								
Northbound Left	12.7	B	12.8	B	14.8	B	15.0	B
Eastbound Left	33.0	D	33.0	D	40.6	E	41.3	E
Eastbound Right	15.1	C	15.1	C	16.4	C	16.9	C

NOTES:
(1) Delay is average vehicle delay per vehicle in seconds.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is base on average vehicle delay for unsignalized intersections.

Analysis of Project Driveways With North-South Collector Road - Phase 1

The results of the level-of-service analysis for the project driveways are summarized in Table 13. The control delay and level-of-service is shown for each controlled lane group. Results are not shown for 2010 background conditions for Drive A as this driveway will be constructed as part of Phase 1. Results are also not shown for Drive B as it will not be constructed until Phase 2. Background conditions are shown for Drive C as the driveway will be constructed as part of the Kihei Recycling Relocation Project. The analysis also assumes that there will be separate left turn storage lanes for all left turns from Liloa Street and Welakahao Road into the project.

As shown all movements will operate at Level-of-Service B or better, indicating good conditions.

Table 13 Levels-of-Service of Project Driveways - Phase 1

	AM Peak Hour				PM Peak Hour			
	2010 Background Without Project		2010 Background With Project		2010 Background Without Project		2010 Background With Project	
Intersection and Movement	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Drive A at Liloa Street								
Southbound Left			7.8	A			8.2	A
Westbound Left & Right			10.9	B			14.5	B
Drive B at Liloa Street								
Southbound Left								
Westbound Left & Right								
Drive C at Welakahao Road								
Eastbound Left	7.6	A	7.6	A	8.0	A	8.0	A
Westbound Left	7.6	A	7.6	A	7.6	A	7.6	A
Northbound Left & Right	10.7	B	10.7	B	12.1	B	12.2	B
Southbound Left & Right	11.0	B	11.0	B	13.5	B	13.7	B

NOTES:
(1) Delay is average vehicle delay per vehicle in seconds.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is base on average vehicle delay for unsignalized intersections.

Project Related Traffic Impacts for Phase 1 Without the North-South Collector Road

The impact of the project was assessed by analyzing the changes in traffic volumes and levels-of-service at the study intersections.

Changes in Total Intersection Volumes

An analysis of the changes in traffic volumes at the study intersections is summarized in Table 14. All the changes as a result of project generated traffic are less than 5%, except at the intersection of Halekuai Street and Liloa Street and Welakahao Road at Liloa Street during the afternoon peak hour. The changes at these intersection are 15.3% and 13.6% respectively. The conclusion of this analysis is that more than 95% of the increased traffic volumes between 2005 and 2010 are the result of background growth and related projects. When compared with Table 10, it is also concluded that the projects' impacts are significant if the North-South Collector Road is not constructed between Halekuai Street and Auhana Road.

Table 14 Analysis of Changes of Total Intersection Approach Volumes - Phase 1a (1)

					Background Growth (2)		Project Trips (3)	
Intersection	Period	Existing	2010 Background	Background Plus Project	Volume	% of 2005 to 2010 Growth	Volume (4)	% of 2005 to 2010 Growth
Lipoa Street at South Kihei Road	AM	1539	1913	1914	374	99.7%	1	0.3%
	PM	2058	2536	2543	478	98.6%	7	1.4%
Lipoa Street at Liloa Street	AM	1156	1496	1500	340	98.8%	4	1.2%
	PM	974	1429	1459	455	93.8%	30	6.2%
Lipoa Street at Piilani Highway	AM	2546	3051	3053	505	99.6%	2	0.4%
	PM	3273	3955	3970	682	97.8%	15	2.2%
Piikea Avenue at South Kihei Road	AM	1318	1651	1652	333	99.7%	1	0.3%
	PM	2241	2684	2691	443	98.4%	7	1.6%
Piikea Avenue at Piilani Highway	AM	2923	3461	3463	538	99.6%	2	0.4%
	PM	3611	4399	4414	788	98.1%	15	1.9%
Welakahao Road at South Kihei Road	AM	1309	1693	1695	384	99.5%	2	0.5%
	PM	1820	2338	2347	518	98.3%	9	1.7%
Piikea Avenue at Liloa Street	AM	1002	1205	1207	203	99.0%	2	1.0%
	PM	1261	1613	1628	352	95.9%	15	4.1%
Halekuai Street at South Kihei Road	AM	1439	1792	1793	353	99.7%	1	0.3%
	PM	1918	2365	2372	447	98.5%	7	1.5%
Halekuai Street at Liloa Street	AM	556	712	717	156	96.9%	5	3.1%
	PM	232	437	474	205	84.7%	37	15.3%
Welakahao Road at Liloa Street	AM	173	319	324	146	96.7%	5	3.3%
	PM	272	494	529	222	86.4%	35	13.6%
Welakahao Road at Piilani Highway	AM	2215	2673	2675	458	99.6%	2	0.4%
	PM	2546	3142	3157	596	97.5%	15	2.5%

Notes:
(1) Volumes shown are total intersection approach volumes or projections.
(2) Background versus existing.
(3) Background plus project versus background.
(4) Project generated traffic

Level-of-Service Analysis for Signalized Intersections

The level-of-service analysis concluded that all the study intersections will operate at Level-of-Service D, or better, during peak hour conditions except the intersection of Lipoa Street at Piilani Highway during the afternoon peak hour period. The afternoon volume-to-capacity ratio of the overall intersections is 0.86 without and with the project.

The volume-to-capacity ratio of the eastbound to northbound left turn will be 0.63 without and with the project. This volume-to-capacity ratio implies a higher level-of-service than the average vehicle delay, which is used to define the level-of-service of the intersection and lane group. The average vehicle delay will be 50.1 without and with the project. There is no change in the volume-to-capacity ratio or delay as a result of project generated traffic.

The volume-to-capacity ratio of the southbound to westbound right turn will be 0.13 without and with the project. This volume-to-capacity ratio implies a higher level-of-service than the average vehicle delay, which is used to define the level-of-service of the intersection and lane group. The average vehicle delay will be 30.2 without the project and 30.2 with the project. There is no change in the volume-to-capacity ratio and the delay changes only 0.1 second as a result of project generated traffic.

It should be noted that since the North-South Collector Road is not constructed in this scenario, the constrained flow along South Kihei Road previously noted will continue.

Table 15 Levels-of-Service of Signalized Intersections - Phase 1a

	AM Peak Hour								PM Peak Hour							
	2010 Background Without Project			2010 Background With Project			Change		2010 Background Without Project			2010 Background With Project			Change	
Intersection and Movement	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)
Lipoa Street at S Kihei Rd	0.69	26.4	C	0.69	26.3	C	0.00	-0.10	0.80	38.1	D	0.80	38.5	D	0.00	0.40
Eastbound Left & Thru	0.31	28.3	C	0.31	28.3	C	0.00	0.00	0.27	28.6	C	0.27	28.6	C	0.00	0.00
Eastbound Right	0.08	23.2	C	0.08	23.2	C	0.00	0.00	0.20	27.2	C	0.20	27.2	C	0.00	0.00
Westbound Left & Thru	0.71	38.6	D	0.71	38.6	D	0.00	0.00	0.69	41.6	D	0.69	41.6	D	0.00	0.00
Westbound Right	0.24	25.3	C	0.24	25.3	C	0.00	0.00	0.12	26.2	C	0.12	26.2	C	0.00	0.00
Northbound Left	0.20.	30.8	C	0.20	30.8	C	0.00	0.00	0.46	51.8	D	0.46	51.8	D	0.00	0.00
Northbound Thru	0.88	32.9	C	0.88	32.9	C	0.00	0.00	0.95	47.4	D	0.95	48.5	D	0.00	1.10
Northbound Right	0.11	13.2	B	0.11	13.2	B	0.00	0.00	0.13	17.1	B	0.13	17.1	B	0.00	0.00
Southbound Left	0.35	25.9	C	0.35	25.9	C	0.00	0.00	0.29	35.5	D	0.29	35.5	D	0.00	0.00
Southbound Thru & Right	0.48	12.6	B	0.48	12.6	B	0.00	0.00	0.91	33.4	C	0.91	33.6	C	0.00	0.20
Lipoa Street at Liloa Street	0.50	21.2	C	0.50	21.2	C	0.00	0.00	0.42	26.4	C	0.43	26.6	C	0.01	0.20
Eastbound Left	0.14	12.5	B	0.14	12.5	B	0.00	0.00	0.21	16.8	B	0.21	16.8	B	0.00	0.00
Eastbound Thru & Right	0.64	30.7	C	0.64	30.7	C	0.00	0.00	0.49	31.4	C	0.49	31.4	C	0.00	0.00
Westbound Left	0.26	6.7	A	0.26	6.8	A	0.00	0.10	0.09	10.0-	A	0.09	10.0+	B	0.00	0.00
Westbound Thru	0.27	12.5	B	0.27	12.5	B	0.00	0.00	0.35	19.5	B	0.35	19.5	B	0.00	0.00
Westbound Right	0.10	11.1	B	0.10	11.1	B	0.00	0.00	0.09	16.4	B	0.09	16.4	B	0.00	0.00
Northbound Left	0.23	21.4	C	0.23	21.5	C	0.00	0.10	0.09	24.5	C	0.10	24.5	C	0.01	0.00
Northbound Thru	0.42	29.9	C	0.43	30.0	C	0.01	0.10	0.27	35.7	D	0.30	36.1	D	0.03	0.40
Northbound Right	0.25	27.2	C	0.25	27.2	C	0.00	0.00	0.06	32.8	C	0.09	33.2	C	0.03	0.40
Southbound Left	0.39	23.9	C	0.39	23.9	C	0.00	0.00	0.30	27.0	C	0.30	27.2	C	0.00	0.20
Southbound Thru	0.50	31.6	C	0.50	31.7	C	0.00	0.10	0.32	36.5	D	0.33	36.7	D	0.01	0.20
Southbound Right	0.17	26.1	C	0.17	26.1	C	0.00	0.00	0.27	35.9	D	0.27	35.9	D	0.00	0.00
Lipoa Street at Piilani Hwy	0.61	16.1	B	0.61	16.1	B	0.00	0.00	0.86	69.5	E	0.86	69.5	E	0.00	0.00
Eastbound Left & Thru	0.45	31.5	C	0.45	31.6	C	0.00	0.10	0.63	50.1	D	0.63	50.1	D	0.00	0.00
Eastbound Right	0.10	25.2	C	0.10	25.2	C	0.00	0.00	0.16	38.7	D	0.16	38.7	D	0.00	0.00
Westbound Left	0.02	24.5	C	0.02	24.5	C	0.00	0.00	0.53	86.1	F	0.53	86.1	F	0.00	0.00
Westbound Thru	0.01	24.2	C	0.01	24.2	C	0.00	0.00	0.31	75.4	E	0.31	75.4	E	0.00	0.00
Westbound Right	0.04	24.6	C	0.04	24.6	C	0.00	0.00	0.62	94.8	F	0.62	94.8	F	0.00	0.00
Northbound Left	0.40	12.0	B	0.40	12.0	B	0.00	0.00	0.83	92.0	F	0.83	92.0	F	0.00	0.00
Northbound Thru & Right	0.64	15.5	B	0.64	15.5	B	0.00	0.00	0.80	34.7	C	0.80	34.7	C	0.00	0.00
Southbound Left	0.29	8.4	A	0.29	8.4	A	0.00	0.00	0.39	87.8	F	0.39	87.8	F	0.00	0.00
Southbound Thru	0.70	16.8	B	0.70	16.6	B	0.00	0.00	1.11	104.9	F	1.11	104.9	F	0.00	0.00
Southbound Right	0.36	12.8	B	0.37	12.8	B	0.01	0.00	0.13	30.2	C	0.13	30.3	C	0.00	0.10
Piikea Avenue at S Kihei Rd	0.53	18.6	B	0.53	18.6	B	0.00	0.00	0.75	20.2	C	0.76	20.3	C	0.01	0.10
Westbound Left & Thru	0.31	27.6	C	0.31	27.6	C	0.00	0.00	0.74	39.9	D	0.74	39.9	D	0.00	0.00
Westbound Right	0.12	25.2	C	0.12	25.2	C	0.00	0.00	0.36	28.7	C	0.36	28.7	C	0.00	0.00
Northbound Left	0.07	31.2	C	0.07	31.2	C	0.00	0.00	0.42	49.2	D	0.42	49.2	D	0.00	0.00
Northbound Thru	0.70	21.1	C	0.70	21.1	C	0.00	0.00	0.81	22.9	C	0.81	23.2	C	0.00	0.30
Northbound Right	0.21	13.0	B	0.21	13.0	B	0.00	0.00	0.31	11.9	B	0.31	11.9	B	0.00	0.00
Southbound Left	0.39	32.5	C	0.39	32.5	C	0.00	0.00	0.59	41.4	D	0.59	41.4	D	0.00	0.00
Southbound Thru & Right	0.32	11.5	B	0.32	11.5	B	0.00	0.00	0.52	9.4	A	0.52	9.4	A	0.00	0.00
Piikea Avenue at Piilani Hwy	0.71	18.3	B	0.71	18.3	B	0.00	0.00	0.79	19.3	B	0.79	19.4	B	0.00	0.10
Eastbound Left	0.63	32.0	C	0.63	32.0	C	0.00	0.00	0.76	35.9	D	0.76	35.9	D	0.00	0.00
Eastbound Right	0.38	26.4	C	0.38	26.4	C	0.00	0.00	0.61	29.9	C	0.61	29.9	C	0.00	0.00
Northbound Left	0.52	31.8	C	0.52	31.8	C	0.00	0.00	0.75	39.0	D	0.75	39.0	D	0.00	0.00
Northbound Thru	0.51	7.2	A	0.51	7.2	A	0.00	0.00	0.63	8.2	A	0.63	8.3	A	0.00	0.10
Southbound Thru	0.83	22.4	C	0.83	22.4	C	0.00	0.00	0.82	21.8	C	0.82	21.9	C	0.00	0.10
Southbound Right	0.64	19.3	B	0.64	19.3	B	0.00	0.00	0.58	17.8	B	0.58	17.8	B	0.00	0.00

Table 15 (Continued) Levels-of-Service of Signalized Intersections - Phase 1a

	AM Peak Hour								PM Peak Hour							
	2010 Background Without Project			2010 Background With Project			Change		2010 Background Without Project			2010 Background With Project			Change	
Intersection and Movement	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)
Welakahao Road at S Kihei Rd	0.64	15.1	B	0.65	15.1	B	0.01	0.00	0.84	30.9	C	0.84	31.0	C	0.00	0.10
Eastbound Left, Thru & Right	0.25	22.4	C	0.25	22.4	C	0.00	0.00	0.21	25.3	C	0.22	25.3	C	0.01	0.00
Westbound Left & Thru	0.30	23.4	C	0.30	23.5	C	0.00	0.10	0.52	31.7	C	0.53	31.8	C	0.01	0.10
Westbound Right	0.12	20.7	C	0.12	20.7	C	0.00	0.00	0.13	24.1	C	0.13	24.1	C	0.00	0.00
Northbound Left	0.03	6.0	A	0.03	6.0	A	0.00	0.00	0.23	24.3	C	0.23	24.3	C	0.00	0.00
Northbound Thru & Right	0.79	16.2	B	0.79	16.3	B	0.00	0.10	0.93	28.7	C	0.93	28.9	C	0.00	0.20
Southbound Left	0.14	9.6	A	0.14	9.6	A	0.00	0.00	0.50	33.4	C	0.50	33.5	C	0.00	0.10
Southbound Thru & Right	0.64	11.9	B	0.64	11.9	B	0.00	0.00	0.98	33.6	C	0.98	33.6	C	0.00	0.00

NOTES:
1. V/C denotes ratio of volume to capacity.
2. Delay is in seconds per vehicle.
3 LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

Level-of Service Analysis for Unsignalized Intersections

The results of the level-of-service analysis is the unsignalized intersection in the study area are summarized in Table 16.

Piikea Avenue at Liloa Street

The intersection of Piikea Avenue at Liloa Street is presently an all-way STOP sign controlled intersection. During the morning peak hour, all movements operate at Level-of-Service C or better, without and with the project. During the afternoon peak hour, the northbound approach will operate at Level-of-Service E without and with the project and the southbound approach will operate at Level-of-Service F without and with the project.

It is our understanding that the viability of converting this intersection to a roundabout is being studied. Therefore, a level-of-service analysis for this intersection as a roundabout was performed. The analysis concluded that the intersection will operate at Level-of-Service A, with a maximum volume-to-capacity ratio of 0.52, during the morning peak hour. During the afternoon peak hour, the intersection will operate at Level-of-Service B, with a maximum volume-to-capacity ratio of 0.52.

Halekuai Street at South Kihei Road

At the intersection of Halekuai Street at South Kihei Road, all movements will operate a Level-of-Service D or better.

Halekuai Street at Liloa Street

All traffic movements will operate at Level-of-Service B or better during both peak periods at the intersection of Halekuai Street at Liloa Street.

Welakahao Road at Liloa Street

All traffic movements will operate at Level-of-Service B or better during both peak periods at the intersection of Welakahao Road at Liloa Street.

Welakahao Road at Piilani Highway

At the intersection of Welakahao Road at Piilani Highway, the northbound left and the eastbound right will operate at Level-of-Service B during the morning peak hour and Level-of-Service C during the afternoon peak hour, without and with the project. The eastbound to northbound left turn will operate at Level-of-Service E during the morning peak hour and Level-of-Service F during the afternoon peak hour, without and with the project. Mitigation will be required.

Table 16 Levels-of-Service of Unsignalized Intersections - Phase 1a

	AM Peak Hour				PM Peak Hour			
	2010 Background Without Project		2010 Background With Project		2010 Background Without Project		2010 Background With Project	
Intersection and Movement	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Piikea Avenue at Liloa Street								
Eastbound Left	12.0	B	12.0	B	14.3	B	14.3	B
Eastbound Thru & Right	13.0	B	13.0	B	18.8	C	18.9	C
Westbound Left	14.1	B	14.1	B	13.5	B	13.5	B
Westbound Thru & Right	17.3	C	17.3	C	22.4	C	22.6	C
Northbound Left	11.1	B	11.1	B	14.7	B	14.7	B
Northbound Thru & Right	14.5	B	14.6	B	40.6	E	44.2	E
Southbound Left	12.1	B	12.1	B	13.6	B	13.7	B
Southbound Thru & Right	14.1	B	14.2	B	79.0	F	83.6	F
Halekuai Street at South Kihei Road								
Southbound Left	10.0+	B	10.0+	B	11.0	B	11.0	B
Westbound Left	22.7	C	22.8	C	30.7	D	30.9	D
Westbound Right	16.5	C	16.5	C	21.3	C	21.7	C
Halekuai Street at Liloa Street								
Northbound Left	8.2	A	8.2	A	7.6	A	7.7	A
Eastbound Left	13.1	B	13.1	B	11.2	B	11.4	B
Eastbound Right	9.5	A	9.5	A	9.1	A	9.2	A
Welakahao Road at Liloa Street								
Eastbound Left	7.5	A	7.6	A	7.8	A	7.8	A
Westbound Left	7.4	A	7.4	A	7.5	A	7.5	A
Northbound Left	10.8	B	10.8	B	12.4	B	12.8	B
Northbound Thru & Right	10.4	B	10.6	B	11.4	B	11.9	B
Southbound Left	11.0	B	11.0	B	12.5	B	12.9	B
Southbound Thru & Right	9.3	A	9.3	A	10.0	B	10.4	B
Welakahao Road at Piilani Highway								
Northbound Left	13.6	B	13.7	B	17.5	C	17.7	C
Eastbound Left	38.6	E	38.6	E	55.3	F	56.7	F
Eastbound Right	16.4	C	16.4	C	19.2	C	19.8	C

NOTES:

(1) Delay is average vehicle delay per vehicle in seconds.

(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is base on average vehicle delay for unsignalized intersections.

Analysis of Project Driveways Without North-South Collector Road

The results of the level-of-service analysis for the project driveways are summarized in Table 17. The control delay and level-of-service is shown for each controlled lane group. Results are not shown for 2010 background conditions for Drive A as this driveway will be constructed as part of Phase 1. Results are also not shown for Drive B as it will not be constructed until Phase 2. Background conditions are shown for Drive C as the driveway will be constructed as part of the Kihei Recycling Relocation Project. The analysis also assumes that there will be separate left turn storage lanes for all left turns from Liloa Street and Welakahao Road into the project.

As shown all movements will operate at Level-of-Service B or better, indicating good conditions.

Table 17 Levels-of-Service of Project Driveways - Phase 1a

	AM Peak Hour				PM Peak Hour			
	2010 Background Without Project		2010 Background With Project		2010 Background Without Project		2010 Background With Project	
Intersection and Movement	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Drive A at Liloa Street								
Southbound Left			7.3	A			7.4	A
Westbound Left & Right			8.8	A			9.4	A
Drive B at Liloa Street								
Southbound Left								
Westbound Left & Right								
Drive C at Welakahao Road								
Eastbound Left	7.6	A	7.6	A	8.0	A	8.0	A
Westbound Left	7.6	A	7.6	A	7.8	A	7.6	A
Northbound Left & Right	10.1	B	10.1	B	12.1	B	12.2	B
Southbound Left & Right	10.9	B	10.9	B	13.5	B	13.7	B

NOTES:
(1) Delay is average vehicle delay per vehicle in seconds.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is base on average vehicle delay for unsignalized intersections.

Conclusions of the Level-of-Service Analysis for Phase 1

The conclusion of the level-of-service analysis for Phases 1 and 1a is that mitigation will be required at the following intersections:

1. Welakahao Road at Liloa Street
2. Welakahao Road at Piilani Highway

6. TRAFFIC ANALYSIS - PHASE 2

The purpose of this chapter is to present 2015 background traffic projections, 2015 background plus Phase 2 traffic projections and the results of the impact analysis, which identifies the project-related impacts for 2015 conditions. Mitigation measures are discussed in Chapter 8.

2015 Background Traffic Projections

2015 background traffic projections were calculated by expanding existing traffic volumes by the appropriate growth rate (1.1720) and then superimposing traffic generated by related projects. The resulting 2015 background traffic projections are summarized in Figures 19 and 20. The projections shown also include trips generated by Phase 1 of the South Maui Park project

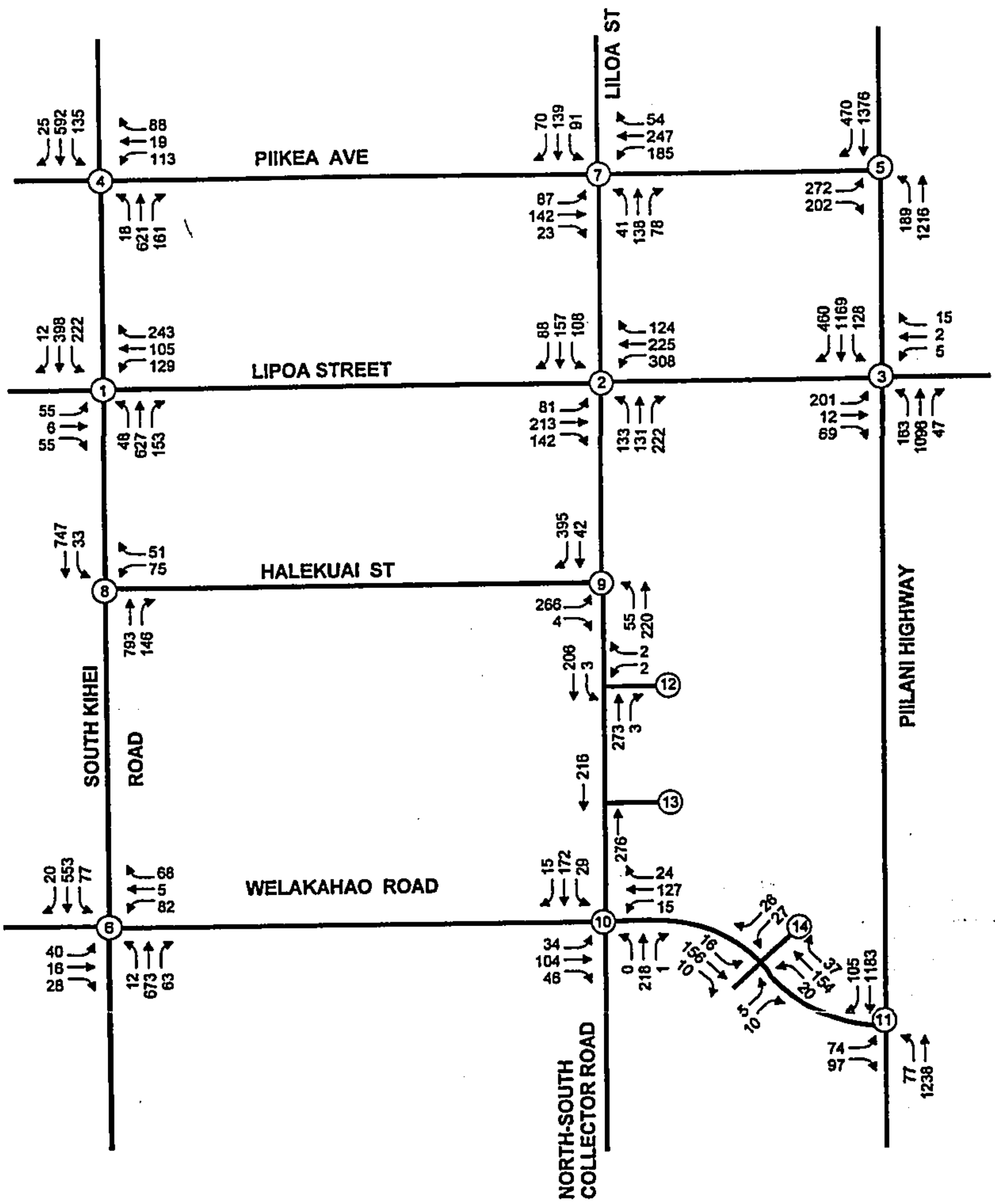

Figure 19
2015 BACKGROUND AM PEAK HOUR TRAFFIC PROJECTIONS

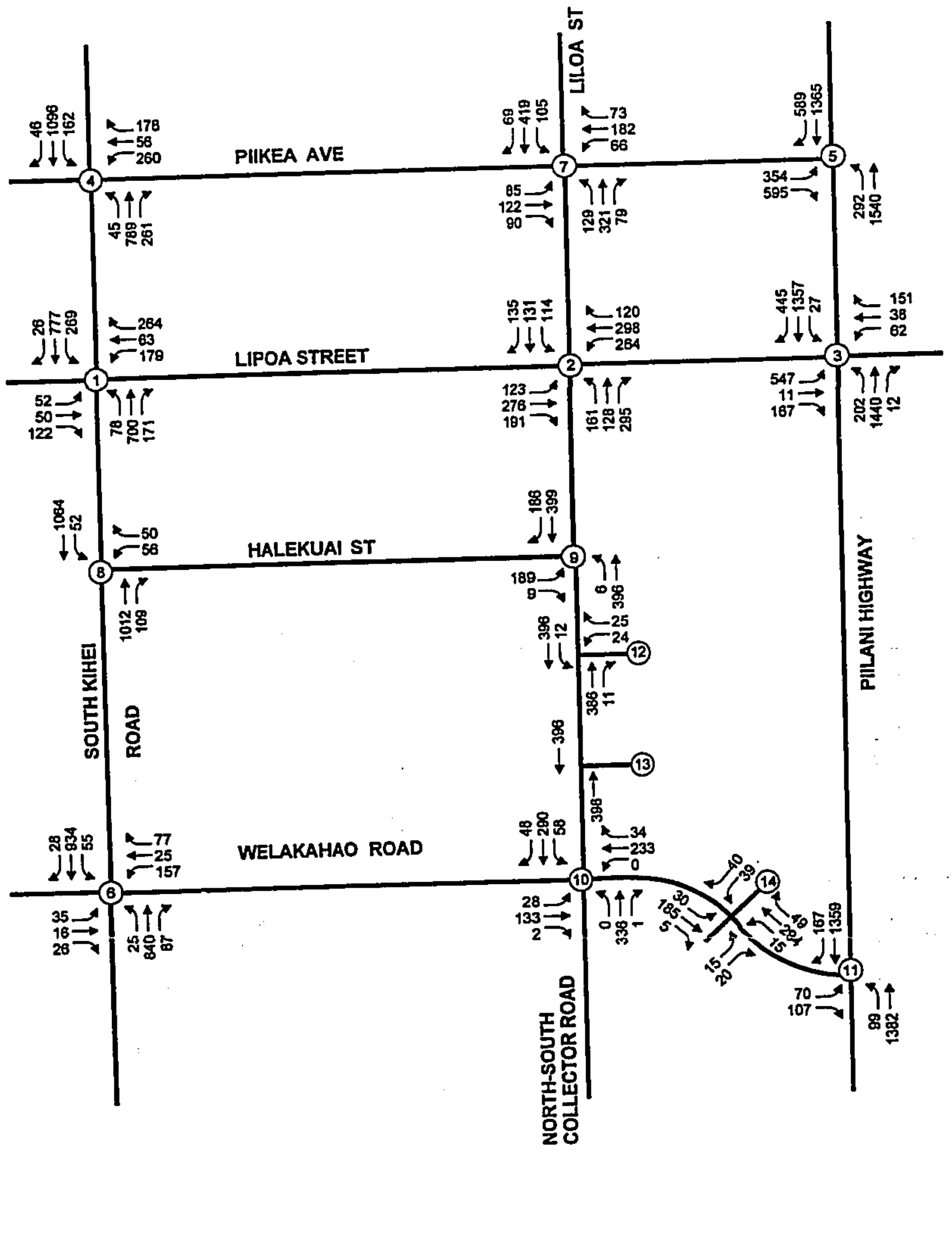

Figure 20
2015 BACKGROUND PM PEAK HOUR TRAFFIC PROJECTIONS

2015 Background Plus Project Projections

Background plus project traffic conditions are defined as 2015 background traffic conditions plus project related traffic. 2015 background plus project traffic projections were estimated by superimposing the peak hourly traffic generated by the proposed project on the 2015 background peak hour traffic volumes presented in Chapter 3. The traffic projections for 2015 background plus project conditions are shown on Figures 21 and 22. The traffic projection worksheets are presented as Appendices H and I.

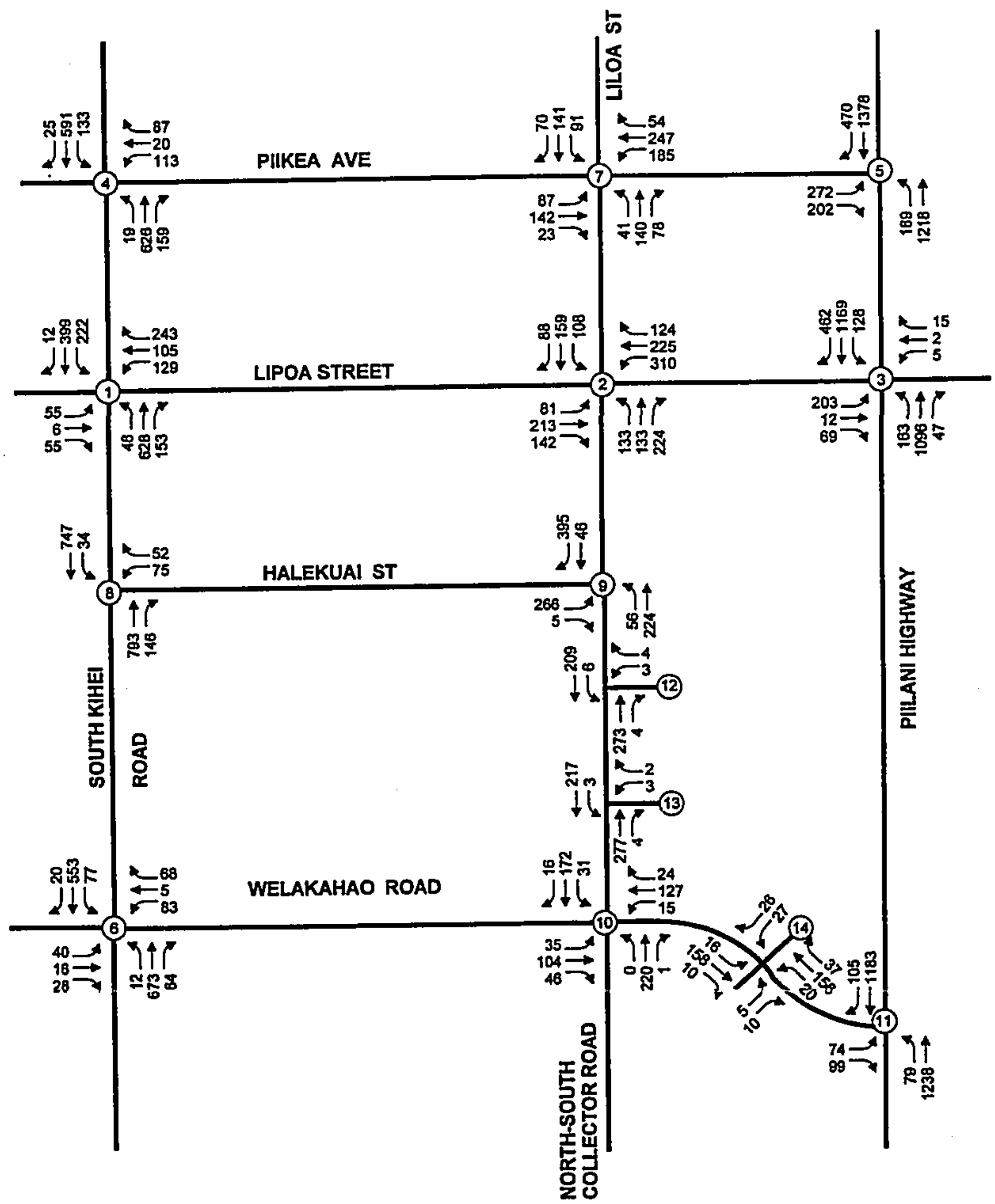

Figure 21
2015 BACKGROUND PLUS PROJECT PHASE 2 AM PEAK HOUR TRAFFIC PROJECTIONS

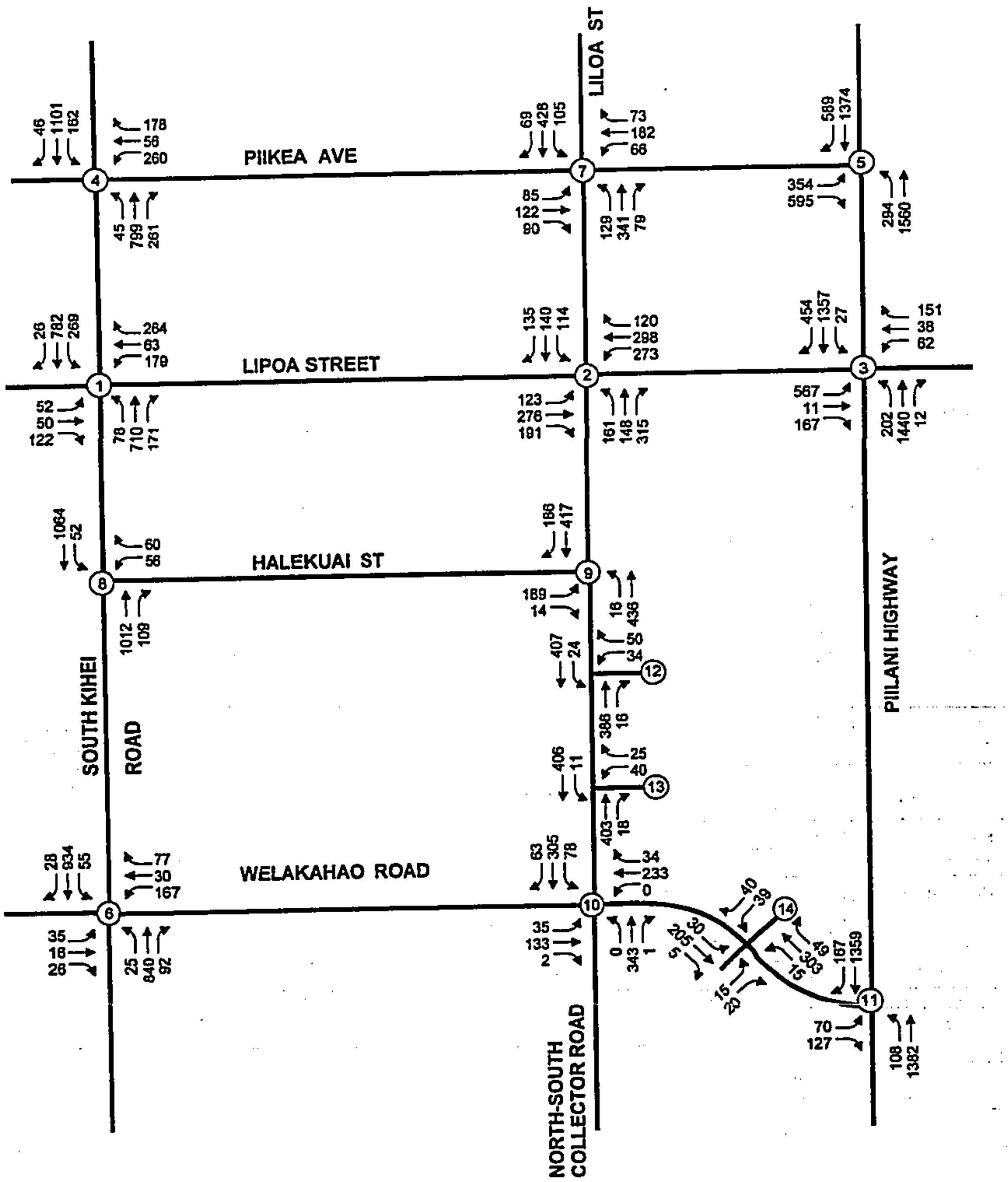

Figure 22
2015 BACKGROUND PLUS PROJECT PHASE 2 PM PEAK HOUR TRAFFIC PROJECTIONS

Project Related Traffic Impacts for Phase 2

The impact of the project was assessed by analyzing the changes in traffic volumes and levels-of-service at the study intersections.

Changes in Total Intersection Volumes

An analysis of the changes in traffic volumes at the study intersections is summarized in Table 18. During the morning peak hour, all the increases are less than 2.3% . During the afternoon peak hour, the traffic volume at the intersesctions of Piikea Avenue at Liloa Street increases 5.7%, the traffic at Halekuai Street at Liloa Street increases 7.1% and the traffic at Welakahao Road at Liloa Street increases 6.7%. All remaining increases are less than 5%. The conclusion of this analysis is that more than 95% of the increased traffic volumes between 2005 and 2015 are the result of background growth and related projects.

Table 18 Analysis of Changes of Total Intersection Approach Volumes - Phase 2 (1)

Intersection	Period	Existing	2015 Background	Background Plus Project	Background Growth (2) Volume	Background Growth (2) % of 2005 to 2015 Growth	Project Trips (3) Volume (4)	Project Trips (3) % of 2005 to 2015 Growth
Lipoa Street at South Kihei Road	AM	1539	2053	2055	514	99.6%	2	0.4%
	PM	2058	2751	2766	693	97.9%	15	2.1%
Lipoa Street at Liloa Street	AM	1156	1931	1940	775	98.9%	9	1.1%
	PM	974	2236	2294	1262	95.6%	58	4.4%
Lipoa Street at Piilani Highway	AM	2546	3367	3371	821	99.5%	4	0.5%
	PM	3273	4459	4488	1186	97.6%	29	2.4%
Piikea Avenue at South Kihei Road	AM	1318	1771	1773	453	99.6%	2	0.4%
	PM	2241	2893	2908	652	97.8%	15	2.2%
Piikea Avenue at Piilani Highway	AM	2923	3725	3729	802	99.5%	4	0.5%
	PM	3611	4737	4766	1126	97.5%	29	2.5%
Welakahao Road at South Kihei Road	AM	1309	1637	1639	328	99.4%	2	0.6%
	PM	1820	2305	2325	485	96.0%	20	4.0%
Piikea Avenue at Liloa Street	AM	1002	1295	1299	293	98.7%	4	1.3%
	PM	1261	1740	1769	479	94.3%	29	5.7%
Halekuai Street at South Kihei Road	AM	1439	1845	1847	406	99.5%	2	0.5%
	PM	1918	2338	2353	420	96.6%	15	3.4%
Halekuai Street at Liloa Street	AM	556	982	992	426	97.7%	10	2.3%
	PM	232	1185	1258	953	92.9%	73	7.1%
Welakahao Road at Liloa Street	AM	173	785	791	612	99.0%	6	1.0%
	PM	272	1163	1227	891	93.3%	64	6.7%
Welakahao Road at Piilani Highway	AM	2215	2774	2778	559	99.3%	4	0.7%
	PM	2546	3184	3213	638	95.7%	29	4.3%

Notes:
(1) Volumes shown are total intersection approach volumes or projections.
(2) Background versus existing.
(3) Background plus project versus background.
(4) Project generated traffic

Level-of-Service Analysis for Signalized Intersections

The level-of-service analysis was performed for background and background plus project conditions and then compared. The incremental difference of the volume-to-capacity ratios between the two conditions is the impact of the project.

The assumptions used for the level-of-service analysis are:

1. The existing right-of-way controls and intersection configurations will be maintained.

2. The traffic signal timing is optimized for background plus project conditions.

3. Level-of-Service D is considered an acceptable level-of-service for peak hour operating conditions[5].

The level-of-service analysis concluded that all the study intersections will operate at Level-of-Service D, or better, during peak hour conditions except the intersection of Lipoa Street at Piilani Highway during the *afternoon peak hour period. The afternoon volume-to-capacity ratio of the overall intersection is 1.00* without and 1.01 with the project. The proposed project adds traffic to the eastbound to northbound left turn and the southbound to westbound right turn and therefore only impact these two movements.

The volume-to-capacity ratio of the eastbound to northbound left turn increases from 1.06 to 1.09 and the delay increases from 106.4 seconds per vehicle to 118.5 seconds per vehicle. This represents an increase in delay of 12.1 seconds, or 11%, per vehicle. Mitigation for this movement should be considered.

The volume-to-capacity ratio of the southbound to westbound right turn will be 0.50 without and 0.52 with the project. This volume-to-capacity ratio implies a higher level-of-service than the average vehicle delay, which is used to define the level-of-service of the intersection and lane group. The average vehicle delay increases from 38.1 to 38.5 seconds per vehicle. This represents an increase in delay of 0.4 seconds per vehicle, or 0.19%. As the change in the volume-to-capacity ratio is small and the volume-to-capacity ratio implies Level-of-Service B, the conclusion is that the delay, and therefore the level-of-service, is the result of the traffic signal cycle length and phasing and not the result of insufficient capacity.

As already noted, the results of the level-of-service analysis does not indicate a problem at the intersection of Piikea Avenue at Piilani Highway. Based on observations, the queue for the eastbound to northbound left turn consistently backs up into the intersection of Piikea Avenue at the Piilani Shopping Center entrance. Even though this problem is not the result of project generated traffic, mitigation should be identified.

[5] Institute of Transportation, *Traffic Access and Impact Studies for Site Development, A Recommended Practice*, 1991, page 5.

Table 19 Levels-of-Service of Signalized Intersections - Phase 2

	AM Peak Hour								PM Peak Hour							
	2015 Background Without Project			2015 Background With Project			Change		2015 Background Without Project			2015 Background With Project			Change	
Intersection and Movement	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)
Lipoa Street at S Kihei Rd	0.75	27.0	C	0.75	27.0	C	0.00	0.00	0.82	35.2	D	0.83	35.7	D	0.01	0.50
Eastbound Left & Thru	0.39	31.2	C	0.39	31.2	C	0.00	0.00	0.31	29.5	C	0.31	29.5	C	0.00	0.00
Eastbound Right	0.09	23.4	C	0.09	23.4	C	0.00	0.00	0.22	27.5	C	0.22	27.5	C	0.00	0.00
Westbound Left & Thru	0.78	44.4	D	0.78	44.4	D	0.00	0.00	0.75	46.2	D	0.75	46.2	D	0.00	0.00
Westbound Right	0.50	30.1	C	0.50	30.1	C	0.00	0.00	0.42	31.0	C	0.42	31.0	C	0.00	0.00
Northbound Left	0.22	31.0	C	0.22	31.0	C	0.00	0.00	0.50	53.3	D	0.50	53.3	D	0.00	0.00
Northbound Thru	0.84	29.5	C	0.84	29.6	C	0.00	0.10	0.89	39.8	D	0.90	41.3	D	0.01	1.50
Northbound Right	0.12	13.4	B	0.12	13.4	B	0.00	0.00	0.14	17.3	B	0.14	17.3	B	0.00	0.00
Southbound Left	0.56	30.1	C	0.56	30.1	C	0.00	0.00	0.78	52.2	D	0.78	52.2	D	0.00	0.00
Southbound Thru & Right	0.44	12.0	B	0.44	12.0	B	0.00	0.00	0.81	25.3	C	0.82	25.6	C	0.01	0.30
Lipoa Street at Liloa Street	0.69	26.7	C	0.69	26.8	C	0.00	0.10	0.78	33.4	C	0.80	34.3	C	0.02	0.90
Eastbound Left	0.15	12.5	B	0.15	12.5	B	0.00	0.00	0.22	17.0	B	0.22	17.0	B	0.00	0.00
Eastbound Thru & Right	0.88	47.5	D	0.88	47.5	D	0.00	0.00	0.86	48.5	D	0.86	48.5	D	0.00	0.00
Westbound Left	0.45	9.4	A	0.46	9.5	A	0.01	0.10	0.54	21.5	C	0.56	22.4	C	0.02	0.90
Westbound Thru	0.29	12.7	B	0.29	12.7	B	0.00	0.00	0.37	19.9	B	0.37	19.9	B	0.00	0.00
Westbound Right	0.11	11.2	B	0.11	11.2	B	0.00	0.00	0.10	16.5	B	0.10	16.5	B	0.00	0.00
Northbound Left	0.57	31.5	C	0.58	31.9	C	0.01	0.40	0.46	30.0	C	0.47	30.3	C	0.01	0.30
Northbound Thru	0.45	30.4	C	0.45	30.6	C	0.00	0.20	0.33	36.7	D	0.39	37.7	D	0.06	1.00
Northbound Right	0.63	37.3	D	0.64	37.8	D	0.01	0.50	0.71	49.1	D	0.77	53.3	D	0.06	4.20
Southbound Left	0.43	24.8	C	0.43	24.9	C	0.00	0.10	0.32	27.5	C	0.34	27.9	C	0.02	0.40
Southbound Thru	0.53	32.6	C	0.54	32.9	C	0.01	0.30	0.34	36.8	D	0.37	37.3	D	0.03	0.50
Southbound Right	0.19	26.4	C	0.19	26.4	C	0.00	0.00	0.29	36.3	D	0.29	36.3	D	0.00	0.00
Lipoa Street at Piilani Hwy	0.70	18.2	B	0.70	18.3	B	0.00	0.10	1.00	66.8	E	1.01	68.6	E	0.01	1.80
Eastbound Left & Thru	0.79	48.6	D	0.80	49.6	D	0.01	1.00	1.06	106.4	F	1.09	118.5	F	0.03	12.10
Eastbound Right	0.11	25.4	C	0.11	25.4	C	0.00	0.00	0.19	39.1	D	0.19	39.1	D	0.00	0.00
Westbound Left	0.05	25.4	C	0.05	25.4	C	0.00	0.00	0.57	89.0	F	0.57	89.0	F	0.00	0.00
Westbound Thru	0.01	24.2	C	0.01	24.2	C	0.00	0.00	0.33	76.2	E	0.33	76.2	E	0.00	0.00
Westbound Right	0.05	24.7	C	0.05	24.7	C	0.00	0.00	0.73	107.2	F	0.73	107.2	F	0.00	0.00
Northbound Left	0.43	12.5	B	0.43	12.5	B	0.00	0.00	0.90	101.9	F	0.90	101.9	F	0.00	0.00
Northbound Thru & Right	0.68	16.5	B	0.68	16.5	B	0.00	0.00	0.86	38.1	D	0.86	38.1	D	0.00	0.00
Southbound Left	0.33	10.1	B	0.33	10.1	B	0.00	0.00	0.41	89.6	F	0.41	89.6	F	0.00	0.00
Southbound Thru	0.70	16.7	B	0.70	16.7	B	0.00	0.00	1.04	80.2	F	1.04	80.2	F	0.00	0.00
Southbound Right	0.53	15.3	B	0.53	15.3	B	0.00	0.00	0.50	38.1	D	0.52	38.5	D	0.02	0.40
Piikea Avenue at S Kihei Rd	0.56	19.4	B	0.57	19.4	B	0.01	0.00	0.81	22.2	C	0.82	22.5	C	0.01	0.30
Westbound Left & Thru	0.33	28.0	C	0.33	28.0	C	0.00	0.00	0.80	43.6	D	0.80	43.6	D	0.00	0.00
Westbound Right	0.13	25.4	C	0.13	25.4	C	0.00	0.00	0.39	29.4	C	0.39	29.4	C	0.00	0.00
Northbound Left	0.08	31.3	C	0.08	31.3	C	0.00	0.00	0.46	51.0	D	0.46	51.0	D	0.00	0.00
Northbound Thru	0.74	22.7	C	0.74	22.8	C	0.00	0.10	0.87	27.3	C	0.88	28.3	C	0.01	1.00
Northbound Right	0.22	13.1	B	0.22	13.1	B	0.00	0.00	0.34	12.2	B	0.34	12.2	B	0.00	0.00
Southbound Left	0.42	33.0	C	0.42	33.0	C	0.00	0.00	0.64	43.2	D	0.64	43.2	D	0.00	0.00
Southbound Thru & Right	0.34	11.7	B	0.34	11.7	B	0.00	0.00	0.56	9.9	A	0.56	9.9	A	0.00	0.00
Piikea Avenue at Piilani Hwy	0.76	20.3	C	0.76	20.3	C	0.00	0.00	0.85	21.7	C	0.85	21.9	C	0.00	0.20
Eastbound Left	0.68	33.9	C	0.68	33.9	C	0.00	0.00	0.81	39.6	D	0.81	39.6	D	0.00	0.00
Eastbound Right	0.42	27.2	C	0.42	27.2	C	0.00	0.00	0.72	34.7	C	0.72	34.7	C	0.00	0.00
Northbound Left	0.56	33.0	C	0.56	33.0	C	0.00	0.00	0.81	43.1	D	0.81	43.6	D	0.00	0.50
Northbound Thru	0.55	7.5	A	0.55	7.5	A	0.00	0.00	0.68	8.9	A	0.69	9.1	A	0.01	0.20
Southbound Thru	0.89	26.2	C	0.90	26.3	C	0.01	0.10	0.88	25.1	C	0.89	25.5	C	0.01	0.40
Southbound Right	0.68	20.7	C	0.68	20.7	C	0.00	0.00	0.63	19.2	B	0.63	19.2	B	0.00	0.00

Table 19 (Continued) Levels-of-Service of Signalized Intersections - Phase 2

	AM Peak Hour								PM Peak Hour							
	2015 Background Without Project			2015 Background With Project			Change		2015 Background Without Project			2015 Background With Project			Change	
Intersection and Movement	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)
Welakahao Road at S Kihei Rd	0.65	13.9	B	0.65	14.0	B	0.00	0.10	0.83	27.4	C	0.85	27.8	C	0.02	0.40
Eastbound Left, Thru & Right	0.27	22.7	C	0.27	22.7	C	0.00	0.00	0.25	25.9	C	0.26	26.1	C	0.01	0.20
Westbound Left & Thru	0.32	23.7	C	0.32	23.8	C	0.00	0.10	0.58	33.5	C	0.63	35.2	D	0.05	1.70
Westbound Right	0.13	20.9	C	0.13	20.9	C	0.00	0.00	0.14	24.2	C	0.14	24.2	C	0.00	0.00
Northbound Left	0.03	5.2	A	0.03	5.2	A	0.00	0.00	0.25	23.6	C	0.25	23.6	C	0.00	0.00
Northbound Thru & Right	0.74	14.4	B	0.74	14.5	B	0.00	0.10	0.90	25.4	C	0.91	25.9	C	0.01	0.50
Southbound Left	0.30	10.4	B	0.30	10.5	B	0.00	0.10	0.54	33.9	C	0.54	34.2	C	0.00	0.30
Southbound Thru & Right	0.57	10.7	B	0.57	10.7	B	0.00	0.00	0.93	28.2	C	0.93	28.2	C	0.00	0.00

NOTES:
1. V/C denotes ratio of volume to capacity.
2. Delay is in seconds per vehicle.
3. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

Level-of Service Analysis for Unsignalized Intersections

The results of the level-of-service analysis is the unsignalized intersection in the study area are summarized in Table 20.

Piikea Avenue at Liloa Street

The intersection of Piikea Avenue at Liloa Street is presently an all-way STOP sign controlled intersection. During the morning peak hour, all movements operate at Level-of-Service C or better, without and with the project. During the afternoon peak hour, the northbound approach will operate at Level-of-Service F without and with the project and the southbound approach will operate at Level-of-Service F without and with the project.

It is our understanding that the viability of converting this intersection to a roundabout is being studied. Therefore, a level-of-service analysis for this intersection as a roundabout was performed. The analysis concluded that the intersection will operate at Level-of-Service A, with a maximum volume-to-capacity ratio of 0.57, during the morning peak hour. During the afternoon peak hour, the intersection will operate at Level-of-Service D, with a maximum volume-to-capacity ratio of 0.79.

Halekuai Street at South Kihei Road

At the intersection of Halekuai Street at South Kihei Road, all movements will operate a Level-of-Service D or better.

Traffic along South Kihei Road will operate at Level-of-Service A or B during both peak periods without and with the project. Traffic turning right from Halekuai Street to northbound South Kihei Road will operate at Level-of-Service C during both peak periods without and with the project.

Halekuai Street at Liloa Street

All traffic movements will operate at Level-of-Service C or better during both peak periods at the intersection of Halekuai Street at Liloa Street.

Welakahao Road at Liloa Street

All traffic movements will operate at Level-of-Service C or better during the morning peak hour. During the afternoon peak hour, the southbound left will operate at Level-of-Service E without the project and Level-of-Service F with the project. Mitigation is required.

Welakahao Road at Piilani Highway

At the intersection of Welakahao Road at Piilani Highway, the northbound left and the eastbound right will operate at Level-of-Service B during the morning peak hour and Level-of-Service C during the afternoon peak hour, without and with the project. The eastbound to northbound left turn will operate at Level-of-Service E during the morning peak hour and Level-of-Service F during the afternoon peak hour, without and with the project. Mitigation is required.

Table 20 Levels-of-Service of Unsignalized Intersections - Phase 2

Intersection and Movement	AM Peak Hour				PM Peak Hour			
	2015 Background Without Project		2015 Background With Project		2015 Background Without Project		2015 Background With Project	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Piikea Avenue at Liloa Street								
Eastbound Left	12.5	B	12.6	B	14.8	B	14.9	B
Eastbound Thru & Right	13.9	B	14.0	B	20.6	C	20.8	C
Westbound Left	15.3	C	15.4	C	13.9	B	14.0	B
Westbound Thru & Right	19.8	C	19.9	C	25.3	D	25.7	D
Northbound Left	11.5	B	11.5	B	15.6	C	15.6	C
Northbound Thru & Right	15.9	C	16.1	C	59.6	F	71.4	F
Southbound Left	12.7	B	12.7	B	14.4	B	15.5	B
Southbound Thru & Right	15.5	C	15.6	C	122.9	F	134.8	F
Halekuai Street at South Kihei Road								
Southbound Left	9.8	A	9.8	A	10.9	B	10.9	B
Westbound Left	23.5	C	23.6	C	31.3	D	31.3	D
Westbound Right	16.9	C	17.0	C	21.3	C	22.1	C
Halekuai Street at Liloa Street								
Northbound Left	8.4	A	8.5	A	8.7	A	8.8	A
Eastbound Left	19.5	C	19.9	C	21.5	C	23.9	C
Eastbound Right	9.6	A	9.6	A	11.5	B	11.8	B
Welakahao Road at Liloa Street								
Eastbound Left	7.6	A	7.6	A	7.8	A	7.9	B
Westbound Left	7.5	A	7.5	A	7.5	A	7.5	B
Northbound Left	15.3	C	15.3	C	24.9	C	28.4	D
Northbound Thru & Right	16.9	C	17.0	C	30.9	D	34.4	D
Southbound Left	17.6	C	17.8	C	43.3	E	65.3	F
Southbound Thru & Right	15.6	C	15.5	C	26.0	D	30.8	D
Welakahao Road at Piilani Highway								
Northbound Left	13.7	B	13.7	B	16.6	C	17.0	C
Eastbound Left	40.8	E	40.8	E	53.3	F	55.1	F
Eastbound Right	16.3	C	16.4	C	18.5	C	19.6	C

NOTES:
(1) Delay is average vehicle delay per vehicle in seconds.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is base on average vehicle delay for unsignalized intersections.

Analysis of Project Driveways - Phase 2

The results of the level-of-service analysis for the project driveways are summarized in Table 21. The control delay and level-of-service is shown for each controlled lane group. Results are not shown for Drive B as it will not be constructed until Phase 2. Background conditions are shown for Drive C as the driveway will be constructed as part of the Kihei Recycling Relocation Project. The analysis also assumes that there will be separate left turn storage lanes for all left turns from Liloa Street and Welakahao Road into the project.

As shown all movements will operate at Level-of-Service C or better, indicating good conditions.

Table 21 Levels-of-Service of Project Driveways - Phase 2

	AM Peak Hour				PM Peak Hour			
	2015 Background Without Project		2015 Background With Project		2015 Background Without Project		2015 Background With Project	
Intersection and Movement	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Drive A at Liloa Street								
Southbound Left	7.8	A	7.8	A	8.2	A	8.2	A
Westbound Left & Right	10.9	B	10.8	B	14.5	B	15.3	C
Drive B at Liloa Street								
Southbound Left			7.8	A			8.2	A
Westbound Left & Right			11.2	B			16.5	C
Drive C at Welakahao Road								
Eastbound Left	7.6	A	8.1	A	7.7	A	8.1	A
Westbound Left	7.6	A	7.6	A	7.6	A	7.7	A
Northbound Left & Right	10.3	B	12.5	B	10.3	B	12.9	B
Southbound Left & Right	11.2	B	14.1	B	11.2	B	14.5	B

NOTES:
(1) Delay is average vehicle delay per vehicle in seconds.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is base on average vehicle delay for unsignalized intersections.

Conclusions of the Level-of-Service Analysis for Phase 2

The conclusion of the level-of-service analysis for Phases 1 and 1a is that mitigation will be required at the following intersections:

1. Welakahao Road at Liloa Street
2. Welakahao Road at Piilani Highway

In addition to the locations identified by the level-of-service analysis, inadequate conditions were observed at the intersection of Piikea Avenue at Piilani Highway.

Potential mitigation measures are discussed in Chapter 8.

7. TRAFFIC ANALYSIS - PHASE 3

The purpose of this chapter is to present 2020 background traffic projections, Phase 1 project traffic assignments, 2020 background plus Phase 3 traffic projections and the results of the impact analysis, which identifies the project-related impacts for 2020 conditions. Any mitigation measures necessary and feasible are identified and other access, egress and circulation issues are discussed.

2020 Background Traffic Projections

2020 background traffic projections were calculated by expanding existing traffic volumes by the appropriate growth rate (1.2688) and then superimposing traffic generated by related projects. The resulting 2020 background traffic projections are summarized in Figures 23 and 24.

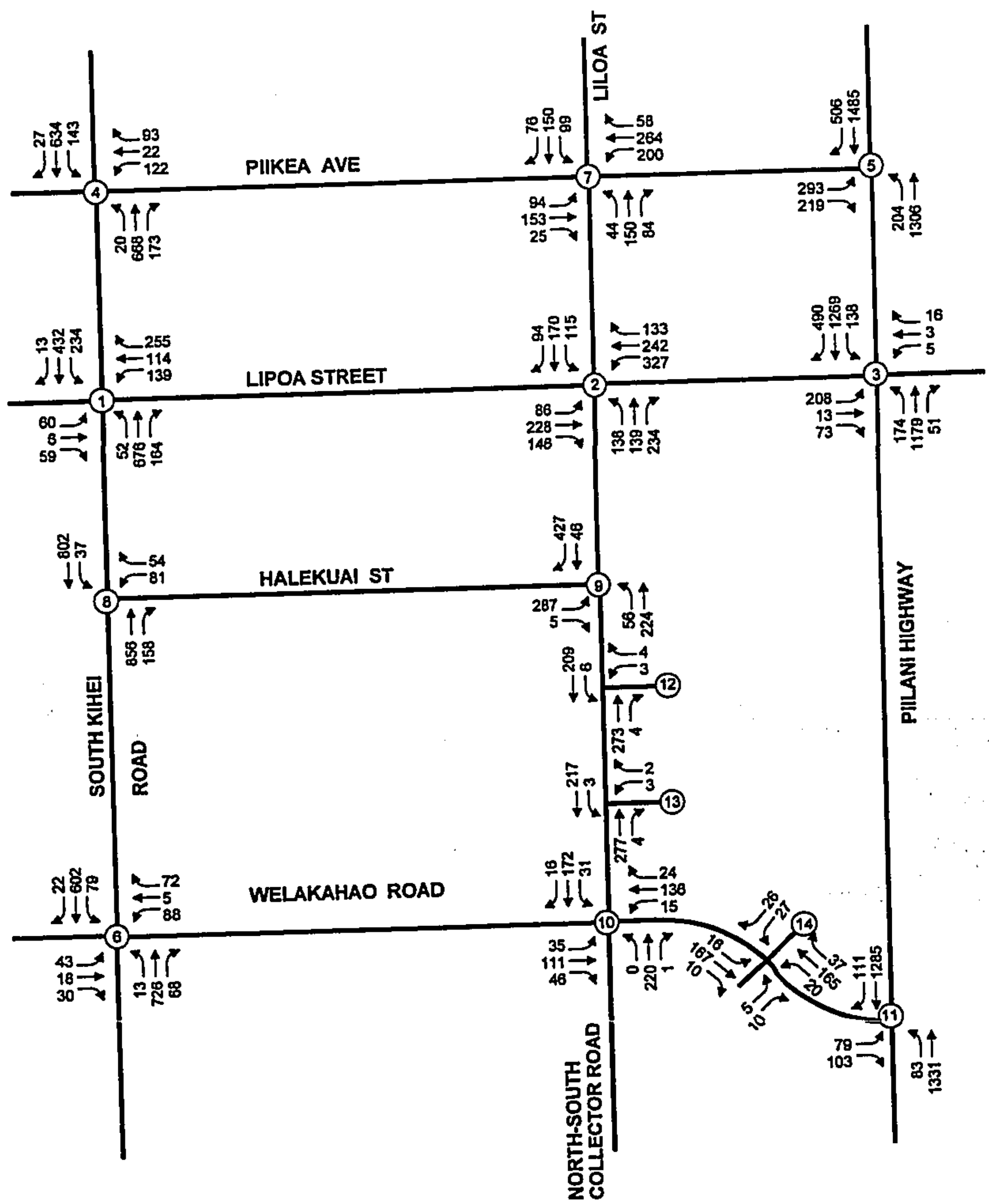

Figure 23
2020 BACKGROUND AM PEAK HOUR TRAFFIC PROJECTIONS

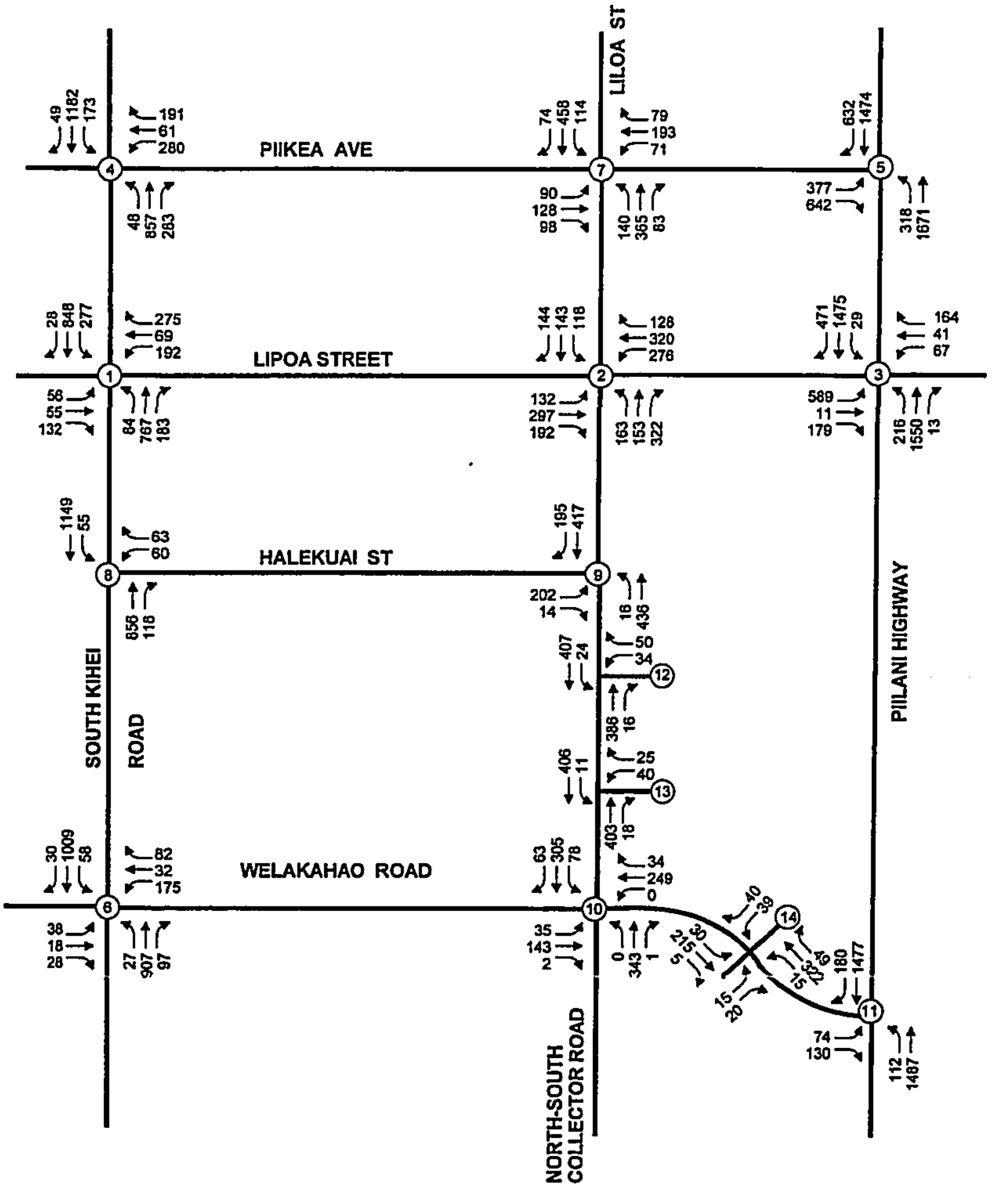

Figure 24
2020 BACKGROUND PM PEAK HOUR TRAFFIC PROJECTIONS

2020 Background Plus Project Projections

Background plus project traffic conditions are defined as 2020 background traffic conditions plus project related traffic. 2020 background plus project traffic projections were estimated by superimposing the peak hourly traffic generated by the proposed project on the 2020 background peak hour traffic volumes presented in Chapter 3. The traffic projections for 2020 background plus project conditions are shown on Figures 25 and 26. The traffic projection worksheets are presented as Appendices K and L.

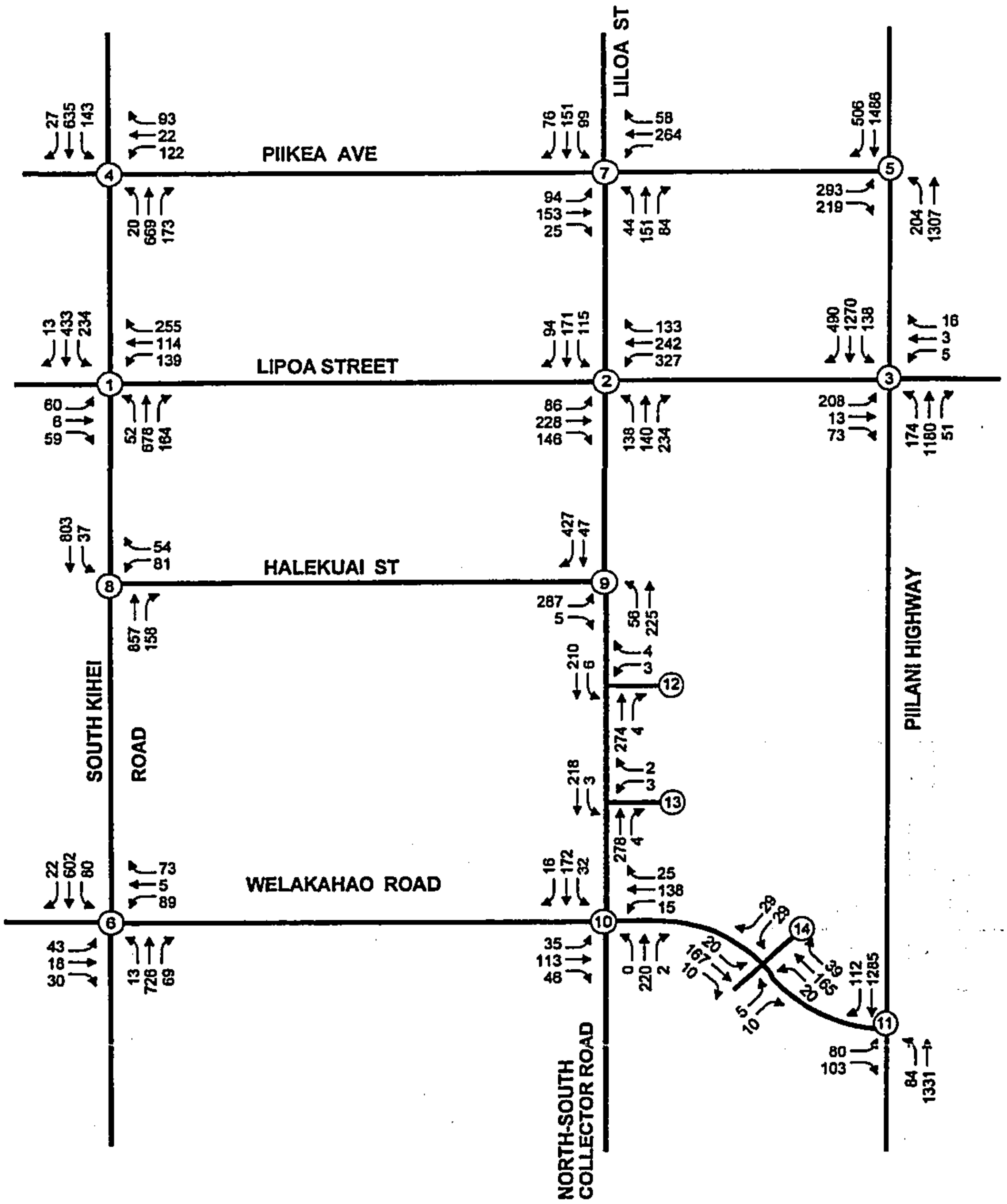

Figure 25
2020 BACKGROUND PLUS PROJECT PHASE 3 AM PEAK HOUR TRAFFIC PROJECTIONS

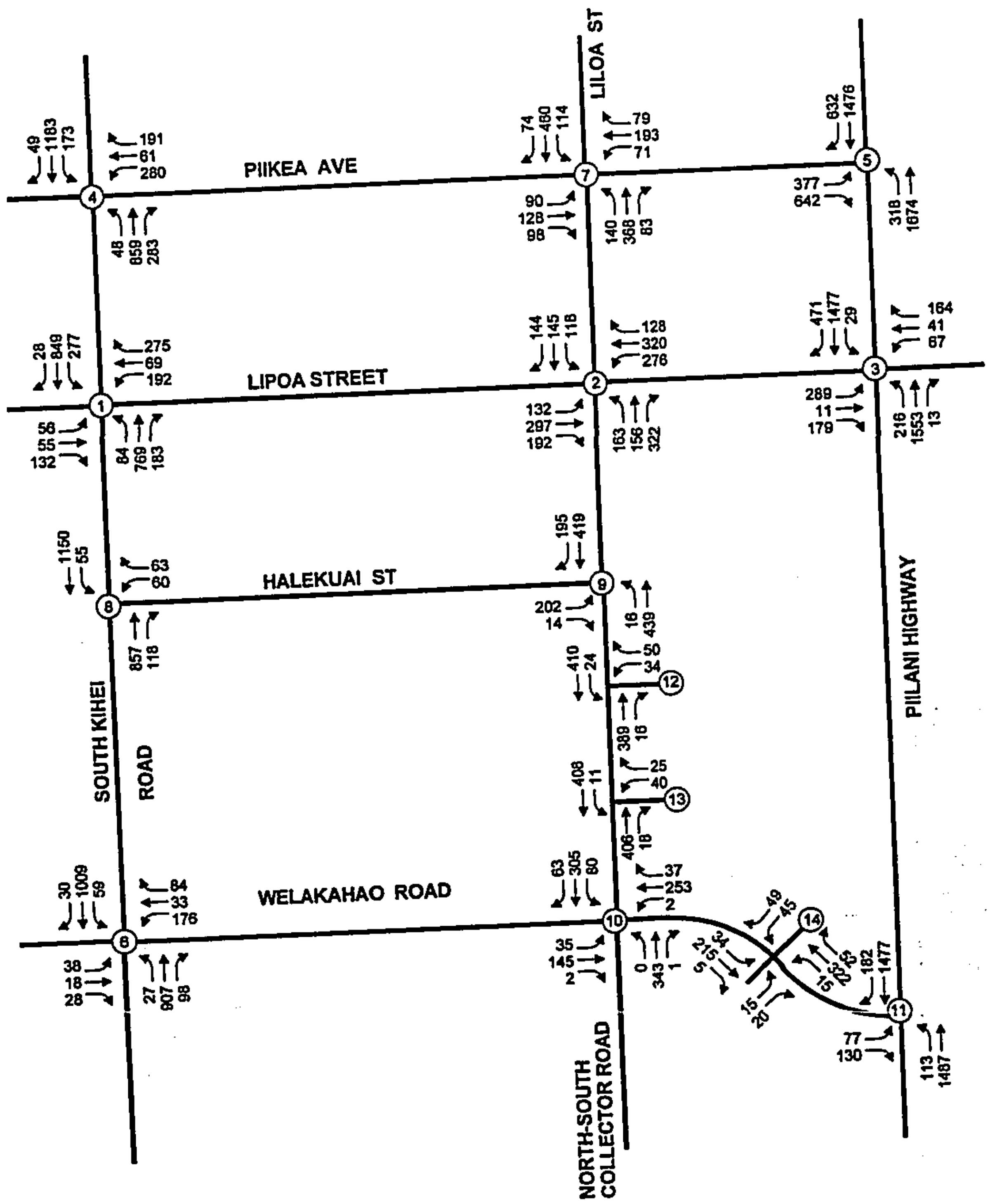

Figure 26
2020 BACKGROUND PLUS PROJECT PHASE 3 PM PEAK HOUR TRAFFIC PROJECTIONS

Project Related Traffic Impacts for Phase 3

The impact of the project was assessed by analyzing the changes in traffic volumes and levels-of-service at the study intersections.

Changes in Total Intersection Volumes

An analysis of the changes in traffic volumes at the study intersections is summarized in Table 22. All the changes as a result of project generated traffic are less than 2%. The conclusion of this analysis is that more than 98% of the increased traffic volumes between 2005 and 2010 are the result of background growth and related projects.

Table 22 Analysis of Changes of Total Intersection Approach Volumes - Phase 3 (1)

Intersection	Period	Existing	2010 Background	Background Plus Project	Background Growth (2) Volume	Background Growth (2) % of 2005 to 2010 Growth	Project Trips (3) Volume (4)	Project Trips (3) % of 2005 to 2010 Growth
Lipoa Street at South Kihei Road	AM	1539	2204	2207	665	99.6%	3	0.4%
	PM	2058	2966	2969	908	99.7%	3	0.3%
Lipoa Street at Liloa Street	AM	1156	2052	2054	896	99.8%	2	0.2%
	PM	974	2388	2393	1414	99.6%	5	0.4%
Lipoa Street at Piilani Highway	AM	2546	3619	3621	1073	99.8%	2	0.2%
	PM	3273	4805	4810	1532	99.7%	5	0.3%
Piikea Avenue at South Kihei Road	AM	1318	1902	1904	584	99.7%	2	0.3%
	PM	2241	3124	3127	883	99.7%	3	0.3%
Piikea Avenue at Piilani Highway	AM	2923	4013	4015	1090	99.8%	2	0.2%
	PM	3611	5114	5119	1503	99.7%	5	0.3%
Welakahao Road at South Kihei Road	AM	1309	1766	1770	457	99.1%	4	0.9%
	PM	1820	2501	2507	681	99.1%	6	0.9%
Piikea Avenue at Liloa Street	AM	1002	1397	1399	395	99.5%	2	0.5%
	PM	1261	1893	1898	632	99.2%	5	0.8%
Halekuai Street at South Kihei Road	AM	1439	1988	1990	549	99.6%	2	0.4%
	PM	1918	2537	2540	619	99.5%	3	0.5%
Halekuai Street at Liloa Street	AM	556	1045	1047	489	99.6%	2	0.4%
	PM	232	1280	1285	1048	99.5%	5	0.5%
Welakahao Road at Liloa Street	AM	173	807	814	634	98.9%	7	1.1%
	PM	272	1253	1266	981	98.7%	13	1.3%
Welakahao Road at Piilani Highway	AM	2215	2992	2995	777	99.6%	3	0.4%
	PM	2546	3460	3466	914	99.3%	6	0.7%

Notes:
(1) Volumes shown are total intersection approach volumes or projections.
(2) Background versus existing.
(3) Background plus project versus background.
(4) Project generated traffic

Level-of-Service Analysis for Signalized Intersections

The level-of-service analysis was performed for cumulative and cumulative plus project conditions and then compared. The incremental difference of the volume-to-capacity ratios between the two conditions is the impact of the project. The assumptions used for the level-of-service analysis are:

1. The existing right-of-way controls and intersection configurations will be maintained.
2. The traffic signal timing is optimized for background plus project conditions.
3. Level-of-Service D is considered an acceptable level-of-service for peak hour operating conditions[6].

The level-of-service analysis concluded that all the study intersections will operate at Level-of-Service D, or better, during peak hour conditions except the intersection of Lipoa Street at Piilani Highway during the afternoon peak hour period. The afternoon volume-to-capacity ratio of the overall intersections is1.09 without and with the project. The proposed project adds traffic to the northbound to southbound through movements only.

There is no change in the volume-to-capacity ratio of the northbound through movement as a result of project generated traffic. The volume-to-capacity ratio of the northbound through movement will be 0.92 without and with the project's traffic. The delay increases by only 0.2 seconds per vehicle from 44.0 to 44.2 seconds per vehicle.

The volume-to-capacity ratio of the southbound to westbound right turn will be 1.12 without the project and 1.13 with the project. The average vehicle delay increases from 112.7 to 113.2 seconds per vehicle. This represents an increase in delay of 0.5 seconds per vehicle, or 0.5%. As the changes in the volume-to-capacity ratio and average vehicle delay is minimal, no mitigation is recommended.

The results of the level-of-service analysis does not indicate a problem at the intersection of Piikea Avenue at Piilani Highway. Based on observations, the queue for the eastbound to northbound left turn consistently backs up into the intersection of Piikea Avenue at the Piilani Shopping Center entrance. Even though this problem is not the result of project generated traffic, mitigation should be identified.

[6] Institute of Transportation, *Traffic Access and Impact Studies for Site Development, A Recommended Practice*, 1991, page 5.

Table 23 Levels-of-Service of Signalized Intersections - Phase 3

	AM Peak Hour								PM Peak Hour							
	2020 Background Without Project			2020 Background With Project			Change		2020 Background Without Project			2020 Background With Project			Change	
Intersection and Movement	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)
Lipoa Street at S Kihei Rd	0.81	30.6	C	0.81	30.7	C	0.00	0.10	0.89	41.8	D	0.90	42.0	D	0.01	0.20
Eastbound Left & Thru	0.48	36.0	D	0.48	36.0	D	0.00	0.00	0.36	30.7	C	0.36	30.7	C	0.00	0.00
Eastbound Right	0.10	23.5	C	0.10	23.5	C	0.00	0.00	0.24	27.8	C	0.24	27.8	C	0.00	0.00
Westbound Left & Thru	0.86	53.4	D	0.86	53.4	D	0.00	0.00	0.84	54.7	D	0.84	54.7	D	0.00	0.00
Westbound Right	0.54	31.0	C	0.54	31.0	C	0.00	0.00	0.45	31.5	C	0.45	31.5	C	0.00	0.00
Northbound Left	0.24	31.4	C	0.24	31.4	C	0.00	0.00	0.54	55.0-	D	0.54	55.0-	D	0.00	0.00
Northbound Thru	0.91	35.8	D	0.91	36.1	D	0.00	0.30	0.98	53.7	D	0.98	54.2	D	0.00	0.50
Northbound Right	0.14	13.5	B	0.14	13.5	B	0.00	0.00	0.16	17.5	B	0.16	17.5	B	0.00	0.00
Southbound Left	0.59	30.9	C	0.59	30.9	C	0.00	0.00	0.80	54.2	D	0.80	54.2	D	0.00	0.00
Southbound Thru & Right	0.47	12.5	B	0.47	12.5	B	0.00	0.00	0.89	30.9	C	0.89	31.0	C	0.00	0.10
Lipoa Street at Liloa Street	0.71	27.9	C	0.71	27.9	C	0.00	0.00	0.83	36.0	D	0.83	36.1	D	0.00	0.10
Eastbound Left	0.15	12.6	B	0.15	12.6	B	0.00	0.00	0.24	17.2	B	0.24	17.2	B	0.00	0.00
Eastbound Thru & Right	0.91	51.4	D	0.91	51.4	D	0.00	0.00	0.90	53.1	D	0.90	53.1	D	0.00	0.00
Westbound Left	0.47	9.8	A	0.47	9.8	A	0.00	0.00	0.58	26.0	C	0.58	26.0	C	0.00	0.00
Westbound Thru	0.30	12.9	B	0.30	12.9	B	0.00	0.00	0.40	20.3	C	0.40	20.3	C	0.00	0.00
Westbound Right	0.12	11.3	B	0.12	11.3	B	0.00	0.00	0.12	16.6	B	0.12	16.6	B	0.00	0.00
Northbound Left	0.60	33.3	C	0.61	33.4	C	0.01	0.10	0.47	30.5	C	0.48	30.6	C	0.01	0.10
Northbound Thru	0.46	30.8	C	0.47	30.8	C	0.01	0.00	0.40	37.9	D	0.41	38.1	D	0.01	0.20
Northbound Right	0.66	39.0	D	0.66	39.0	D	0.00	0.00	0.79	54.9	D	0.79	54.9	D	0.00	0.00
Southbound Left	0.45	25.4	C	0.45	25.5	C	0.00	0.10	0.35	28.2	C	0.36	28.2	C	0.01	0.00
Southbound Thru	0.57	33.6	C	0.57	33.7	C	0.00	0.10	0.37	37.4	D	0.38	37.5	D	0.01	0.10
Southbound Right	0.21	26.7	C	0.21	26.7	C	0.00	0.00	0.32	36.8	D	0.32	36.8	D	0.00	0.00
Lipoa Street at Piilani Hwy	0.75	19.5	B	0.75	19.6	B	0.00	0.10	1.09	84.4	F	1.09	84.6	F	0.00	0.20
Eastbound Left & Thru	0.82	51.8	D	0.82	51.8	D	0.00	0.00	1.14	133.7	F	1.14	133.7	F	0.00	0.00
Eastbound Right	0.12	25.5	C	0.12	25.5	C	0.00	0.00	0.21	39.5	D	0.21	39.5	D	0.00	0.00
Westbound Left	0.05	25.4	C	0.05	25.4	C	0.00	0.00	0.62	92.9	F	0.62	92.9	F	0.00	0.00
Westbound Thru	0.01	24.2	C	0.01	24.2	C	0.00	0.00	0.37	77.4	E	0.37	77.4	E	0.00	0.00
Westbound Right	0.05	24.7	C	0.05	24.7	C	0.00	0.00	0.87	128.7	F	0.87	128.7	F	0.00	0.00
Northbound Left	0.47	15.1	B	0.47	15.1	B	0.00	0.00	0.96	114.2	F	0.96	114.2	F	0.00	0.00
Northbound Thru & Right	0.74	17.6	B	0.74	17.7	B	0.00	0.10	0.92	44.0	D	0.92	44.2	D	0.00	0.20
Southbound Left	0.37	12.0	B	0.37	12.0	B	0.00	0.00	0.46	92.7	F	0.46	92.7	F	0.00	0.00
Southbound Thru	0.75	18.1	B	0.75	18.1	B	0.00	0.00	1.12	112.7	F	1.13	113.2	F	0.01	0.50
Southbound Right	0.57	16.1	B	0.57	16.1	B	0.00	0.00	0.55	39.4	D	0.55	39.4	D	0.00	0.00
Piikea Avenue at S Kihei Rd	0.61	20.4	C	0.61	20.4	C	0.00	0.00	0.88	25.8	C	0.88	25.9	C	0.00	0.10
Westbound Left & Thru	0.36	28.4	C	0.36	28.4	C	0.00	0.00	0.86	49.6	D	0.86	49.6	D	0.00	0.00
Westbound Right	0.15	25.6	C	0.15	25.6	C	0.00	0.00	0.43	30.2	C	0.43	30.2	C	0.00	0.00
Northbound Left	0.08	31.4	C	0.08	31.4	C	0.00	0.00	0.49	52.5	D	0.49	52.5	D	0.00	0.00
Northbound Thru	0.79	25.0	C	0.79	25.1	C	0.00	0.10	0.95	36.3	D	0.95	36.6	D	0.00	0.30
Northbound Right	0.24	13.3	B	0.24	13.3	B	0.00	0.00	0.37	12.6	B	0.37	12.6	B	0.00	0.00
Southbound Left	0.45	33.7	C	0.45	33.7	C	0.00	0.00	0.68	45.4	D	0.68	45.4	D	0.00	0.00
Southbound Thru & Right	0.37	11.9	B	0.37	11.9	B	0.00	0.00	0.60	10.5	B	0.60	10.5	B	0.00	0.00
Piikea Avenue at Piilani Hwy	0.82	24.2	C	0.82	24.2	C	0.00	0.00	0.91	26.3	C	0.91	26.3	C	0.00	0.00
Eastbound Left	0.73	36.3	D	0.73	36.3	D	0.00	0.00	0.87	44.7	D	0.87	44.7	D	0.00	0.00
Eastbound Right	0.47	28.2	C	0.47	28.2	C	0.00	0.00	0.84	43.6	D	0.84	43.6	D	0.00	0.00
Northbound Left	0.61	34.6	C	0.61	34.6	C	0.00	0.00	0.88	51.0	D	0.88	51.0	D	0.00	0.00
Northbound Thru	0.59	8.0	A	0.59	8.0	A	0.00	0.00	0.74	10.0-	A	0.74	10.0-	A	0.00	0.00
Southbound Thru	0.97	34.6	C	0.97	34.7	C	0.00	0.10	0.95	32.6	C	0.96	32.7	C	0.01	0.10
Southbound Right	0.74	22.6	C	0.74	22.6	C	0.00	0.00	0.70	21.1	C	0.70	21.1	C	0.00	0.00

Table 23 (Continued) Levels-of-Service of Signalized Intersections - Phase 3

	AM Peak Hour								PM Peak Hour							
	2020 Background Without Project			2020 Background With Project			Change		2020 Background Without Project			2020 Background With Project			Change	
Intersection and Movement	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)	LOS(3)	V/C(1)	Delay(2)
Welakahao Road at S Kihei Rd	0.69	15.4	B	0.70	15.5	B	0.01	0.10	0.91	38.7	D	0.91	38.9	D	0.00	0.20
Eastbound Left, Thru & Right	0.30	23.2	C	0.30	23.2	C	0.00	0.00	0.29	26.8	C	0.29	26.9	C	0.00	0.10
Westbound Left & Thru	0.34	24.1	C	0.34	24.2	C	0.00	0.10	0.66	37.0	D	0.67	37.5	D	0.01	0.50
Westbound Right	0.14	21.0	C	0.15	21.1	C	0.01	0.10	0.15	24.4	C	0.16	24.5	C	0.01	0.10
Northbound Left	0.04	5.8	A	0.04	5.8	A	0.00	0.00	0.26	25.3	C	0.26	25.3	C	0.00	0.00
Northbound Thru & Right	0.80	16.6	B	0.80	16.7	B	0.00	0.10	0.98	37.3	D	0.98	37.5	D	0.00	0.20
Southbound Left	0.36	13.4	B	0.37	13.5	B	0.01	0.10	0.56	38.6	D	0.58	40.4	D	0.02	1.80
Southbound Thru & Right	0.62	11.5	B	0.62	11.5	B	0.00	0.00	1.00	42.5	D	1.00	42.5	D	0.00	0.00

NOTES:
1. V/C denotes ratio of volume to capacity.
2. Delay is in seconds per vehicle.
3. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

Level-of Service Analysis for Unsignalized Intersections

The results of the level-of-service analysis is the unsignalized intersection in the study area are summarized in Table 24.

Piikea Avenue at Liloa Street

The intersection of Piikea Avenue at Liloa Street is presently an all-way STOP sign controlled intersection. During the morning peak hour, all movements operate at Level-of-Service C or better, without and with the project. During the afternoon peak hour, the northbound approach will operate at Level-of-Service F without and with the project and the southbound approach will operate at Level-of-Service F without and with the project.

It is our understanding that the viability of converting this intersection to a roundabout is being studied. Therefore, a level-of-service analysis for this intersection as a roundabout was performed. The analysis concluded that the intersection will operate at Level-of-Service A, with a maximum volume-to-capacity ratio of 0.63, during the morning peak hour. During the afternoon peak hour, the intersection will operate at Level-of-Service B, with a maximum volume-to-capacity ratio of 0.87.

Halekuai Street at South Kihei Road

At the intersection of Halekuai Street at South Kihei Road, all movements will operate a Level-of-Service D or better.

Traffic along South Kihei Road will operate at Level-of-Service A or B during both peak periods without and with the project. Traffic turning right from Halekuai Street to northbound South Kihei Road will operate at Level-of-Service C during both peak periods without and with the project.

Halekuai Street at Liloa Street

All movements will operate at Level-of-Service D, or better, during both peak hours.

Welakahao Road at Liloa Street

The northbound approach will operate at Level-of-Service E during the afternoon peak hour and the southbound approach will operate at Level-of-Service F during the afternoon peak hour. All movements will operate at Level-of-Service C, or better, during the morning peak hour.

Welakahao Road at Piilani Highway

At the intersection of Welakahao Road at Piilani Highway, the eastbound to northbound left turn will operate at Level-of-Service F during both peak hours, without and with the project generated traffic.

Table 24 Levels-of-Service of Unsignalized Intersections - Phase 3

	AM Peak Hour				PM Peak Hour			
	2020 Background Without Project		2020 Background With Project		2020 Background Without Project		2020 Background With Project	
Intersection and Movement	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Piikea Avenue at Liloa Street								
Eastbound Left	13.3	B	13.3	B	15.3	C	15.3	C
Eastbound Thru & Right	15.3	C	15.3	C	22.7	C	22.7	C
Westbound Left	16.9	C	17.0	C	14.3	B	14.3	B
Westbound Thru & Right	23.9	C	24.0	C	29.0	D	29.0	D
Northbound Left	11.9	B	11.9	B	16.6	C	16.6	C
Northbound Thru & Right	18.2	C	18.3	C	99.4	F	101.7	F
Southbound Left	13.4	B	13.4	B	15.3	C	15.3	C
Southbound Thru & Right	17.4	C	17.4	C	178.9	F	180.8	F
Halekuai Street at South Kihei Road								
Southbound Left	10.1	B	10.2	B	10.1	B	10.1	B
Westbound Left	27.1	D	27.3	D	32.4	D	32.4	D
Westbound Right	18.5	C	18.5	C	18.1	C	18.2	C
Halekuai Street at Liloa Street								
Northbound Left	8.6	A	8.6	A	8.9	A	8.9	A
Eastbound Left	21.8	C	21.9	C	25.3	D	25.5	D
Eastbound Right	9.7	A	9.7	A	11.8	B	11.8	B
Welakahao Road at Liloa Street								
Eastbound Left	7.6	A	7.6	A	7.9	A	7.9	A
Westbound Left	7.5	A	7.6	A	7.5	A	7.5	A
Northbound Left	15.7	C	15.8	C	30.7	D	31.9	D
Northbound Thru & Right	17.6	C	17.7	C	38.3	E	40.4	E
Southbound Left	18.4	C	18.7	C	83.3	F	99.3	F
Southbound Thru & Right	15.9	C	16.0	C	34.1	D	35.8	E
Welakahao Road at Piilani Highway								
Northbound Left	15.1	C	15.1	C	19.4	C	19.5	C
Eastbound Left	53.9	F	54.5	F	76.3	F	82.1	F
Eastbound Right	18.0	C	18.0	C	22.1	C	22.1	C

NOTES:
(1) Delay is average vehicle delay per vehicle in seconds.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is base on average vehicle delay for unsignalized intersections.

Analysis of Project Driveways - Phase 3

The results of the level-of-service analysis for the project driveways are summarized in Table 25. The control delay and level-of-service is shown for each controlled lane group. The analysis also assumes that there will be separate left turn storage lanes for all left turns from Liloa Street and Welakahao Road into the project.

As shown all movements will operate at Level-of-Service C or better, indicating good conditions.

Table 25 Levels-of-Service of Project Driveways - Phase 3

	AM Peak Hour				PM Peak Hour			
	2020 Background Without Project		2020 Background With Project		2020 Background Without Project		2020 Background With Project	
Intersection and Movement	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Drive A at Liloa Street								
Southbound Left	7.8	A	7.8	A	8.2	A	8.2	A
Westbound Left & Right	10.8	B	10.8	B	15.3	C	15.4	C
Drive B at Liloa Street								
Southbound Left	7.8	A	7.8	A	8.2	A	8.3	A
Westbound Left & Right	11.2	B	11.3	B	16.5	C	16.6	C
Drive C at Welakahao Road								
Eastbound Left	7.7	A	7.7	A	8.2	A	8.2	A
Westbound Left	7.6	A	7.6	A	7.7	A	7.7	A
Northbound Left & Right	10.4	B	10.5	B	13.2	B	13.4	B
Southbound Left & Right	11.4	B	11.5	B	15.0+	C	15.5	C

NOTES:
(1) Delay is average vehicle delay per vehicle in seconds.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is base on average vehicle delay for unsignalized intersections.

Conclusions of the Level-of-Service Analysis for Phase 3

The conclusion of the level-of-service analysis is that mitigation is required at the following intersections:

1. Welakahao Road at Liloa Street
2. Welakahao Road at Piilani Highway

In addition to the locations identified by the level-of-service analysis, inadequate conditions were observed at the intersection of Piikea Avenue at Piilani Highway.

Potential mitigation measures are discussed in Chapter 8.

8. MITIGATION AND RECOMMENDATIONS

Based on the findings of the level-of-service analysis, field observations during the traffic surveys and input during the review process, mitigation measures are required at the following locations:

1. Welakahao Road at Liloa Street
2. Welakahao Road at Piilani Highway
3. Piikea Avenue at Piilani Highway

The purpose of this chapter is to summarize the results of an assessment of potential mitigation measures and the describe the recommended mitigation. The locations requiring mitigation are discussed separately.

Standards and Assumptions for Mitigation Measures

The purpose of the mitigation measures is to improve the level-of-service up to an acceptable level-of-service. Level-of-Service D is considered the lowest acceptable level-of-service. Therefore, mitigation measures are identified for those locations where project generated traffic results in reduction of the level-of-service below Level-of-Service F.

Welakahao Road at Liloa Street

Without mitigation, the northbound and southbound movements at this intersection will operate at levels-of-services E and F, respectively. Potential mitigation measures include (1) conversion from a two-way STOP to a four-way STOP, (2) convert from a two-way STOP to a roundabout and (3) installation of traffic signals.

Conversion to a four-way STOP will improve the levels-of-service such that all movements will operate at Level-of-Service B, or better, during the morning peak hour and Level-of-Service D, or better, during the afternoon peak hour.

A traffic signal warrant analysis concluded that the peak hour warrant for a traffic signal is not satisfied. It was also concluded that a traffic signal would be difficult to coordinate with existing traffic signals at South Kihei Road and Piilani Highway. Given this operational constraint and the expense, it was concluded that a traffic signal is not a viable mitigation measure.

Based on input from the project's Civil Engineer, a roundabout is not a viable alternative because of existing development in the southwest and northwest quadrants, planned development in the southeast quadrant and an existing gully in the northeast quadrant that would require a major (and expensive) drainage structure. The cost of a roundabout is comparable to that of a traffic signal.

In conclusion, conversion to a four-way STOP sign controlled intersection is the most cost effective and will result in Level-of-Service D, or better, which is an acceptable level-of-service.

Welakahao Road at Piilani Highway

Without mitigation, left turns from eastbound Welakahao Road to northbound Piilani Highway will operate at Level-of-Service F during the morning and afternoon peak hours. The warrants for a traffic signal were assessed for the intersection of Welakahao Road at Piilani Highway. The conclusions of the warrant analysis are:

4. The peak hour warrant for a traffic signal is not satisfied for existing conditions.

5. The peak hour warrant for 2010 background conditions without the project is satisfied.

6. As the peak hour warrant for 2010 background conditions without the project also satisfied, 2010 conditions with the project, 2015 conditions without and with the project and 2020 conditions without and with the project are also satisfied.

Piikea Avenue at Piilani Highway

The conclusion of the level-of-service analysis is that all movements at this intersection will operate at Level-of-Service D during the afternoon peak hour for 2020 conditions. Level-of-Service D is considered an acceptable level-of-service. However, during the traffic surveys and field reconnaissance, it was observed that the queue for the eastbound to northbound left turn backs up through the adjacent intersection at the Piilani Shopping Center entrance. To mitigate this problem, it is recommended that the median island along Piikea Avenue be modified to provide a second eastbound to northbound left turn lane.

Appendix – G
Operating and Maintenance Manual for Storm Drainage System

O&M MANUAL FOR STORM DRAINAGE SYSTEM

FOR

KIHEI RECYCLING & REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK

KIHEI, MAUI, HAWAII
TMK: (2) 2-2-002 : Por. 042

Prepared For:

Solid Waste Division
Department of Public Works and Environmental Management
County of Maui

Prepared By:

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS / LAND SURVEYORS

WELLS STREET PROFESSIONAL CENTER, SUITE 403
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PHONE: (808) 242-4403 FAX: (808) 244-4856

November 6, 2006

O&M MANUAL FOR STORM DRAINAGE SYSTEM

I. OBJECTIVE:

This manual briefly describes the storm drainage system for the Kihei Recycling and Redemption Center (KR&RC) at South Maui Community Park (see Figures 1 and 2) and identifies routine operations and maintenance (O&M) procedures for the drainage system.

II. GENERAL DESCRIPTION OF DRAINAGE SYSTEM:

The storm drainage system installed for KR&RC typically consists of (please refer to Figure 3):

- Grated drain inlets that intercept runoff from the paved and landscaped surfaces, and roadside drainage swales.
  - The grated drain inlets incorporate Kristar Flo-Gard + Plus Catch Basin Filter Inserts (see Figure 4).
    - As described in the manufacturer literature, the inserts are "designed to capture sediment, debris, trash & oils/grease from low (first flush) flows. A (dual) high-flow bypass allows flows to bypass the device while retaining sediment and larger floatables (debris & trash) and allows sustained maximum design flows under extreme weather conditions".
- Underground drainlines that convey runoff from the drain inlets to the subsurface drainage system or drainage outlet.
- A subsurface drainage system that consists of an underground 48" diameter perforated pipe with internal baffles to intercept silt and debris (see Figure 5) before the onsite runoff is released into the adjoining, existing Keokea Gulch natural drainageway located immediately to the north of the KR&RC (see Figure 2).

III. GENERAL MAINTENANCE AND PRECAUTIONS:

- Silt, debris, and other foreign materials, including construction runoff or washwater from construction of improvements and from day to day operations of the KR&RC, should not be allowed to enter the storm drain system.
- In landscaped areas adjacent to drain inlets, topsoil should not be allowed to enter the drain inlets.
  - Regular maintenance should ensure that adjacent topsoil and groundcover are typically depressed approximately one inch below the top of the drain inlets and plantings pruned back and groundcover trimmed so as not to obstruct the drain inlet openings.

This checklist should be filled out at each time an inspection and any maintenance is required and kept on file with the Solid Waste Division, County of Maui.

List of Figures:

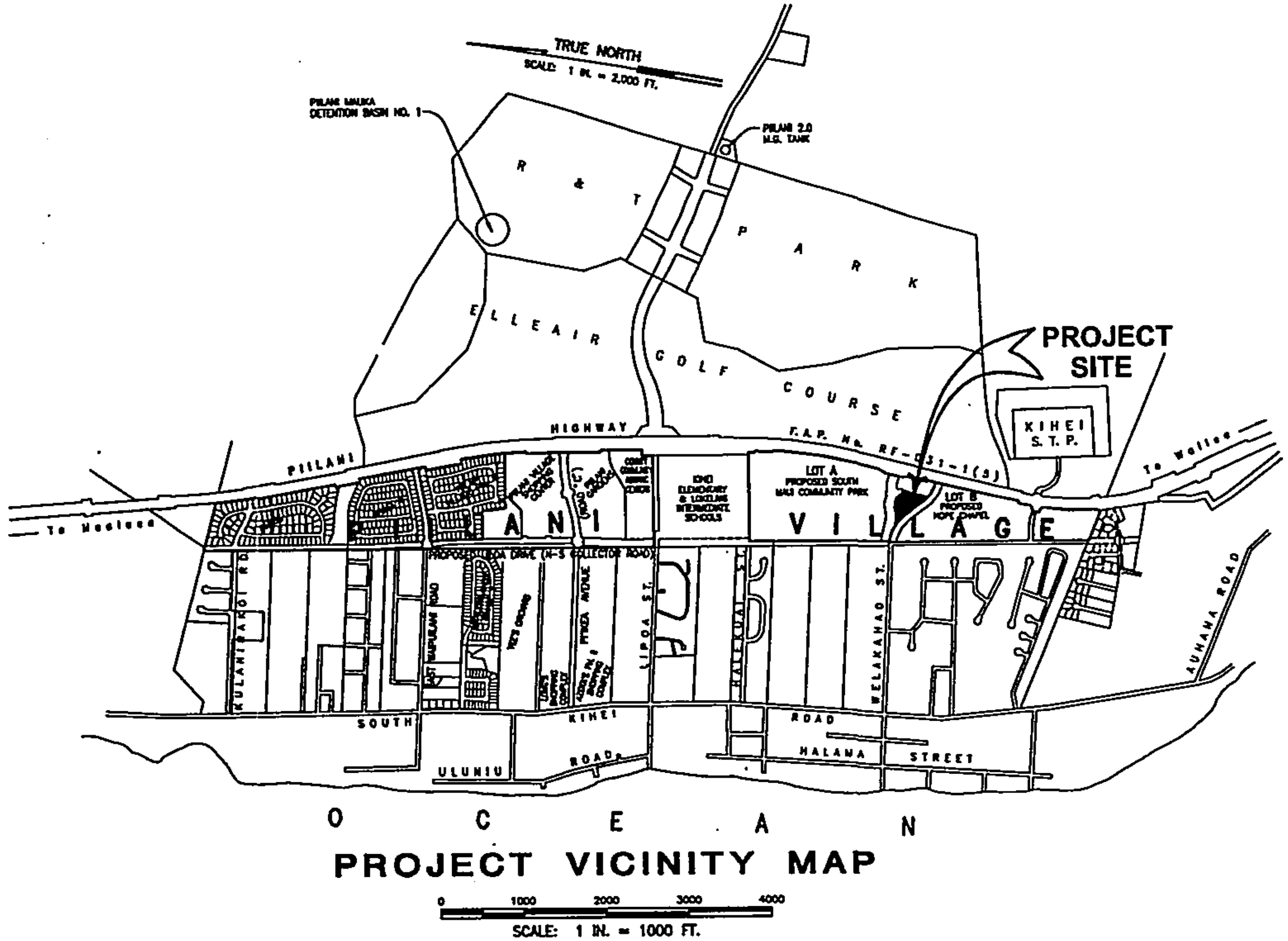
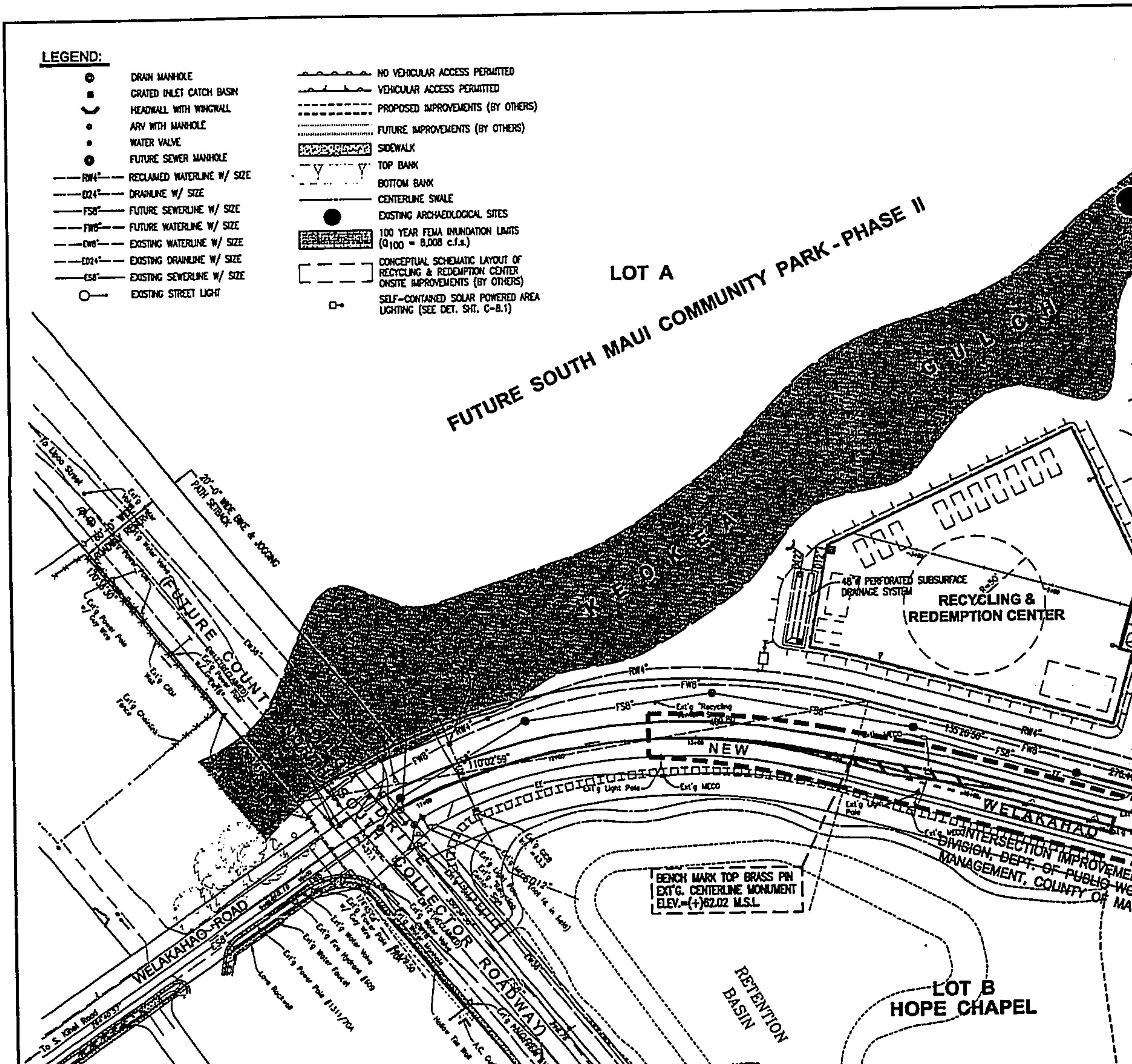


FIGURE 1: Project Vicinity Map



NOTES:

1. OVERHEAD AND UNDERGROUND UTILITIES MAY EXIST ALONG, ACROSS, AND IN THE VICINITY OF PROPOSED IMPROVEMENTS AND MAY NOT BE SHOWN ON THE PLANS. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE RESPECTIVE COUNTY OR STATE AGENCIES, UTILITIES (INCLU WITHOUT LIMITATION MAUI ELECTRIC COMPANY, LTD., VERIZON HAWAII INC., AND OCEANIC TIME WARNER CABLE OF HAWAII), EXAMINING ANY AVAILABLE RECORD DRAWINGS, TONING OF UNDERG UTILITIES, AND CONFIRMING THE PRESENCE OF ANY EXISTING UTILITIES ALONG AND ACROSS TH PROPOSED IMPROVEMENTS. CONTRACTOR SHALL NOTIFY AND COORDINATE CONSTRUCTION ACTI AND ANY REQUIRED RELOCATION, WITH RESPECTIVE AGENCIES AND UTILITIES.
2. OWNERS OF ADJOINING LANDS, SHOWN ON PLAN, ARE TAKEN FROM RECORDS FILED IN THE R PROPERTY MAPPING BRANCH, & ARE SUBJECT TO VERIFICATION.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR SECURING ALL REQUIRED COUNTY PERMITS (INCLUD
   - FENCE & GATE
   - LIGHT POLE & APPURTENANCES
4. SEE SHEET C-6 FOR DRIVEWAY PROFILE.
5. SEE SHEET C-9.1 & C-9.2 FOR EROSION CONTROL PLAN. A01

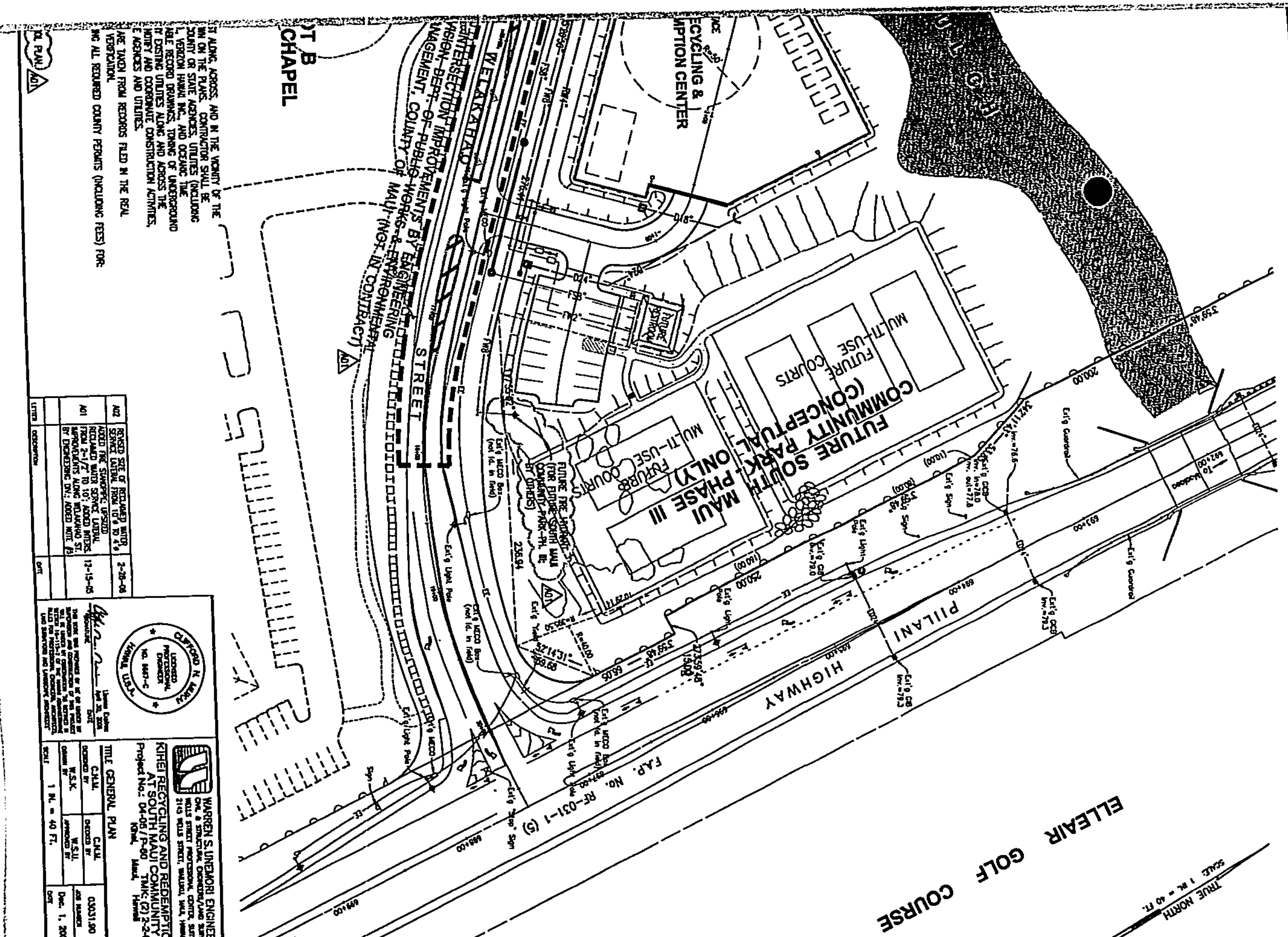


FIGURE 2: GENERAL PLAN

12-15-2005

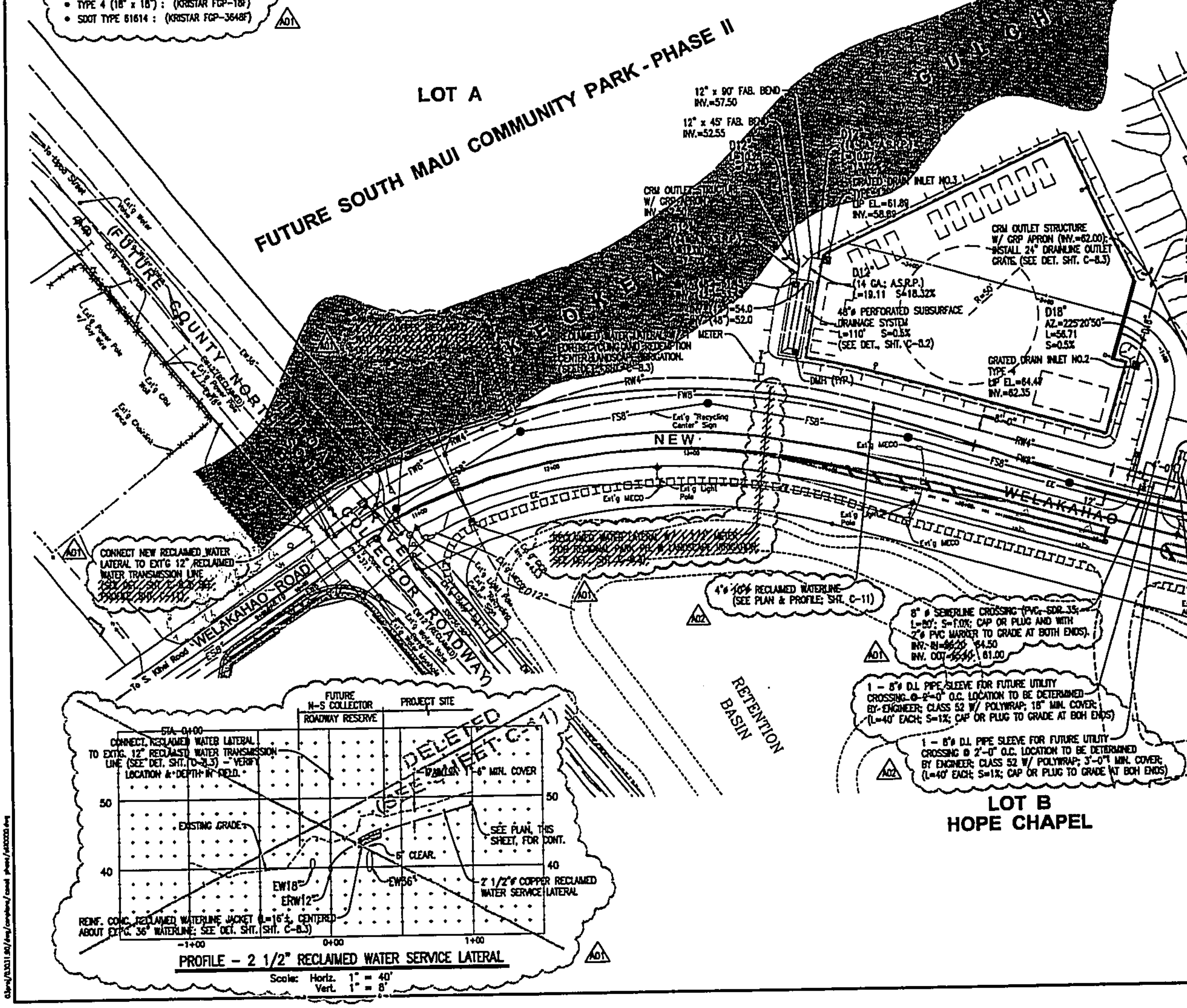
NOTES:

1. ALL RECLAIMED WATER IMPROVEMENTS SHALL CONFORM TO ALL REQUIREMENTS CONTAINED IN:
   - "GUIDELINES FOR THE TREATMENT AND USE OF RECYCLED WATER" BY THE DEPARTMENT OF HEALTH, STATE OF HAWAII, DATED MAY 15, 2002, AND ALL AMENDMENTS THERETO; AND,
   - "RULES FOR RECLAIMED WATER SERVICE" BY THE COUNTY OF MAUI, DATED JUNE 1997, AND ALL AMENDMENTS THERETO.
2. SEE SHT. C-1 FOR ADDITIONAL NOTES PERTAINING TO RECLAIMED WATERLINE.
3. OVERHEAD AND UNDERGROUND UTILITIES MAY EXIST ALONG, ACROSS, AND IN THE VICINITY OF THE PROPOSED IMPROVEMENTS AND MAY NOT BE SHOWN ON THE PLANS. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE RESPECTIVE COUNTY OR STATE AGENCIES, UTILITIES (INCLUDING WITHOUT LIMITATION MAUI ELECTRIC COMPANY, LTD., VERIZON HAWAII INC., AND OCEANIC TIME WARNER CABLE OF HAWAII), EXAMINING ANY AVAILABLE RECORD DRAWINGS, TONING OF UNDERGROUND UTILITIES, AND CONFIRMING THE PRESENCE OF ANY EXISTING UTILITIES ALONG AND ACROSS THE PROPOSED IMPROVEMENTS. CONTRACTOR SHALL NOTIFY AND COORDINATE CONSTRUCTION ACTIVITIES, AND ANY REQUIRED RELOCATION, WITH RESPECTIVE AGENCIES AND UTILITIES.
4. KRISTAR FLO-GARD +PLUS CATCH BASIN FILTER INSERTS SHALL BE INSTALLED AS FOLLOWS:
   - TYPE 1 (24" x 24") : (KRISTAR FGP-24F)
   - TYPE 4 (18" x 18") : (KRISTAR FGP-18F)
   - SDOT TYPE 61614 : (KRISTAR FGP-3648F)

A01

LEGEND:

	DRAIN MANHOLE
	GRATED INLET CATCH BASIN
	HEADWALL WITH WINGWALL
	ARV WITH MANHOLE
	WATER VALVE
	FUTURE SEWER MANHOLE
RW4"	RECLAIMED WATERLINE W/ SIZE
D24"	DRAINLINE W/ SIZE
FS8"	FUTURE SEWERLINE W/ SIZE
FW8"	FUTURE WATERLINE W/ SIZE
EW8"	EXISTING WATERLINE W/ SIZE
ED24"	EXISTING DRAINLINE W/ SIZE
ES8"	EXISTING SEWERLINE W/ SIZE
	EXISTING STREET LIGHT
	NO VEHICULAR ACCESS PERMITTED
	VEHICULAR ACCESS PERMITTED
	PROPOSED IMPROVEMENTS (BY OTHERS)
	FUTURE IMPROVEMENTS (BY OTHERS)
	SIDEWALK
	TOP BANK
	BOTTOM BANK
	CENTERLINE SWALE
	EXISTING ARCHAEOLOGICAL SITES
	100 YEAR FEMA INUNDATION LIMITS (Q_{100} = 8,008 c.f.s.)
	CONCEPTUAL SCHEMATIC LAYOUT OF RECYCLING & REDEMPTION CENTER ONSITE IMPROVEMENTS (BY OTHERS)
	SELF-CONTAINED SOLAR POWERED AREA LIGHTING (SEE DET. SHT. C-8.1)



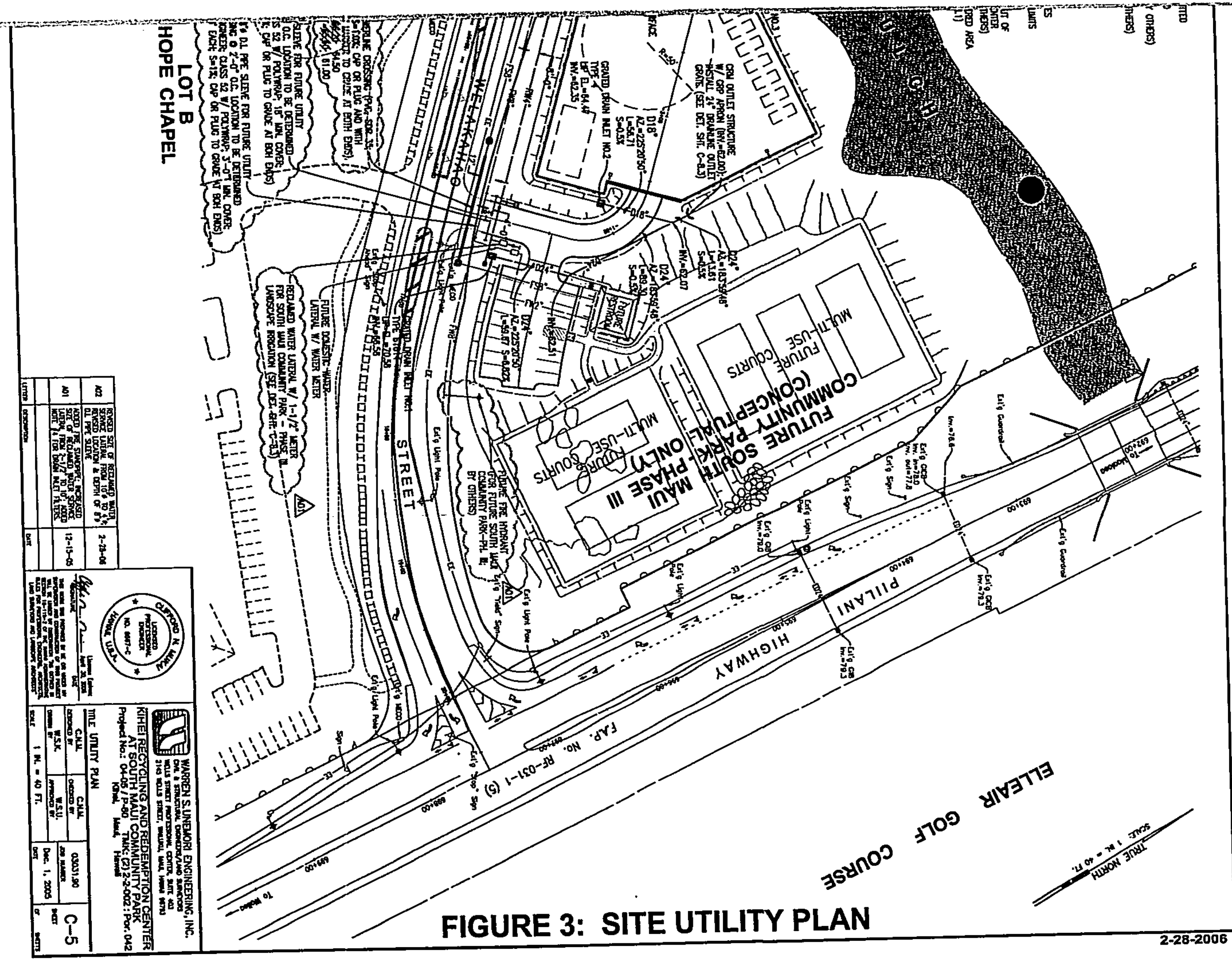


FIGURE 3: SITE UTILITY PLAN

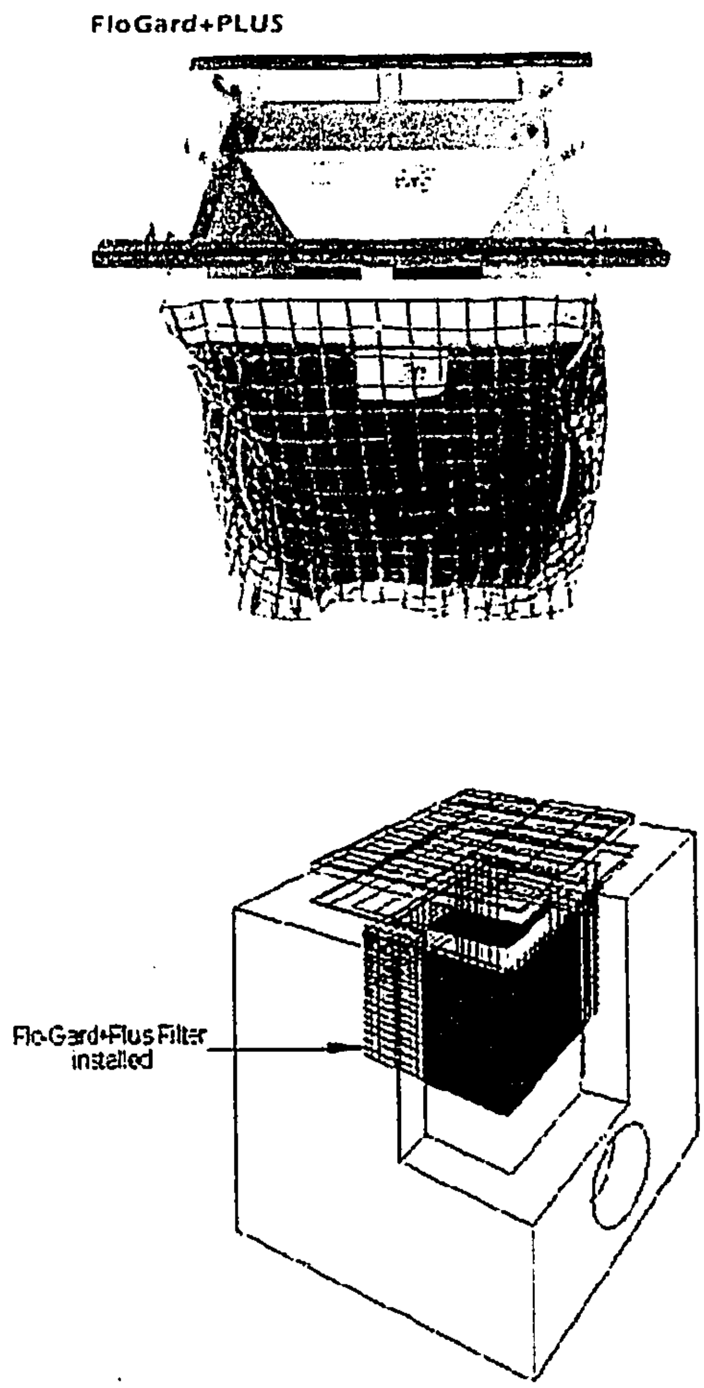


FIGURE 4: Kristar Flo-Gard + Plus Filter

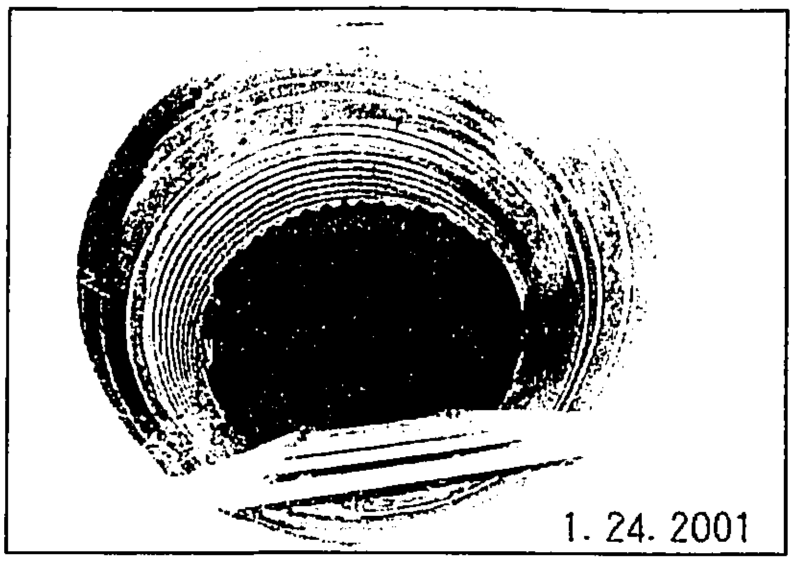


FIGURE 5a: 48" Diam. Sub-surface Drainage System

Typical interior of access manhole with ladder to invert of subsurface drainage system chamber.

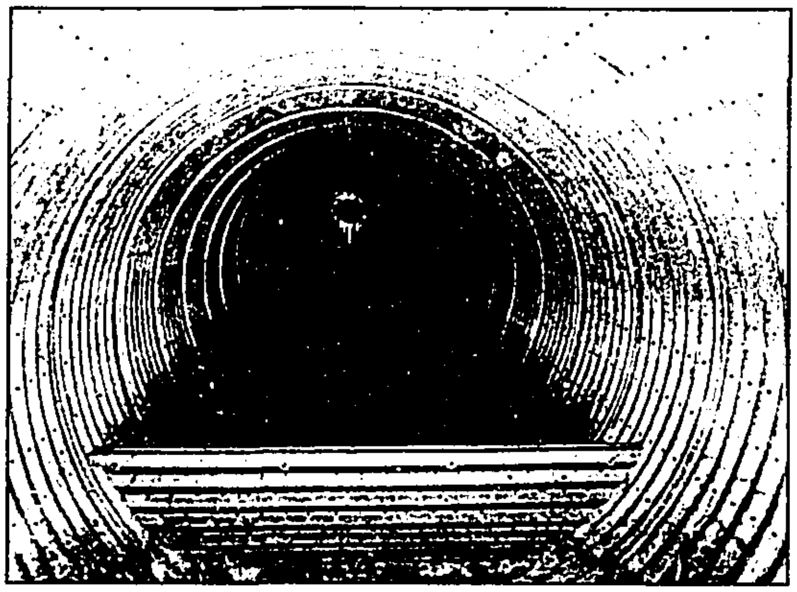


FIGURE 5b: 48" Diam. Sub-surface Drainage System

Interior of perforated subsurface drain pipe with lateral baffles across invert.

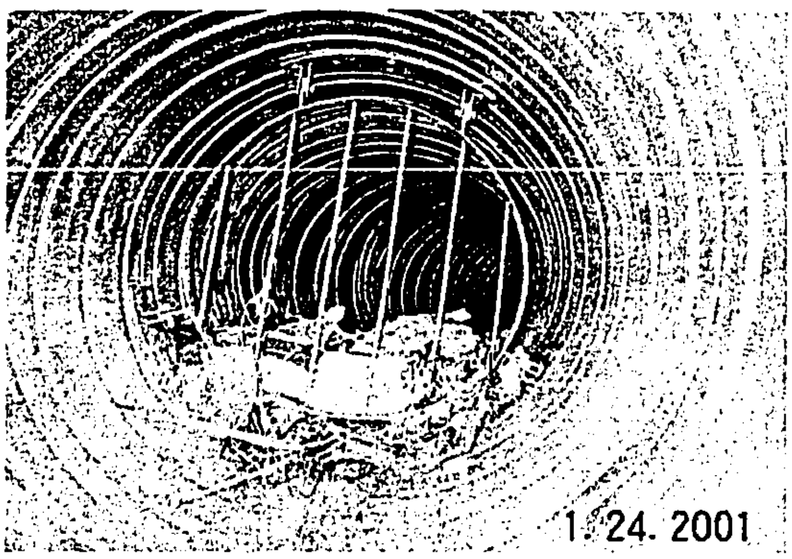


FIGURE 6: Drainline Outlet (drainlines 12" diam. or less may not have grate)

Close up of interior of outlet where drainage system daylights to existing drainageway (showing bolted, stainless steel grate, where occurs).

RECORD OF ANNUAL MAINTENANCE FOR STORM DRAIN SYSTEM

This form should be filled in, signed, and kept on file by the Solid Waste Division, Department of Public Works and Environmental Management, County of Maui. Please indicate below that all items have been inspected and addressed by placing a check mark (✔) in the box immediately to the left of each item described and sign and date at the bottom of this sheet.

- ☐ Completed visual inspection of all drain inlets within landscaped areas (topsoil confirmed to be below top of drain inlet and plantings pruned back and groundcover trimmed).

- ☐ Completed visual inspection of all drain inlets and storm drain manholes and removal of all accumulated silt in excess of one (1) inch and debris.

  Describe any need for additional maintenance (if none, state "None"):

  ____
  ____
  ____

- ☐ Completed visual inspection of interior of 48" diameter subsurface drainage system and removal of all accumulated silt in excess of four (4) inches and debris.

- ☐ Completed manufacturer's recommended maintenance and procedures in conjunction with this inspection. Verified that manufacturer's recommended maintenance and procedures are being performed (including minimum frequency). Attach documentation to this report for current year.

- ☐ Completed visual inspection of all downstream drainline outlets where they daylight to existing grade, at the adjoining, existing Keokea Gulch natural drainageway and removal of any accumulated debris at outlet. Verified any removed outlet grates have been replaced and properly secured.

  Describe any need for informing County of Maui for additional maintenance (if none, state "None"):

  ____
  ____
  ____

- ☐ Check here to note any additional comments below:

  ____
  ____
  ____
  ____

Visual inspection and confirmation by (sign and print name below):

Signature: ________________________________

Print Name: **(indicate date above)**

FIGURE 7

List of Appendices:

Appendix A: Manufacturer's Recommended Maintenance and Procedures (secure latest version and all applicable amendments from manufacturer, prior to undertaking any required maintenance)

Appendix B: Construction Plans (reduced copies)

Appendix A: Manufacturer's Recommended Maintenance and Procedures (secure latest version and all applicable amendments from manufacturer, prior to undertaking any required maintenance)

GENERAL SPECIFICATIONS FOR MAINTENANCE OF *FLO-GARD™+PLUS CATCH BASIN INSERT FILTERS*

SCOPE:

Federal, State and Local Clean Water Act regulations and those of insurance carriers require that stormwater filtration systems be maintained and serviced on a recurring basis. The intent of the regulations is to ensure that the systems, on a continuing basis, efficiently remove pollutants from stormwater runoff thereby preventing pollution of the nation's water resources. These Specifications apply to the Flo-Gard™ +Plus Catch Basin Insert Filter.

RECOMMENDED FREQUENCY OF SERVICE:

Drainage Protection Systems (DPS) recommends that installed Flo-Gard™ +Plus Catch Basin Insert Filters be serviced on a recurring basis. Ultimately, the frequency depends on the amount of runoff, pollutant loading and interference from debris (leaves, vegetation, cans, paper, etc.); however, it is recommended that each installation be serviced a minimum of three times per year, with a change of filter medium once per year. DPS technicians are available to do an on-site evaluation, upon request.

RECOMMENDED TIMING OF SERVICE:

DPS guidelines for the timing of service are as follows:

1. For areas with a definite rainy season: Prior to, during and following the rainy season.
2. For areas subject to year-round rainfall: On a recurring basis (at least three times per year).
3. For areas with winter snow and summer rain: Prior to and just after the snow season and during the summer rain season.
4. For installed devices not subject to the elements (washracks, parking garages, etc.): On a recurring basis (no less than three times per year).

SERVICE PROCEDURES:

1. The service shall commence with collection and removal of sediment and debris (litter, leaves, papers, cans, etc.) and broom sweeping around the drainage inlet. Accumulated materials shall be placed in a DOT approved container for later disposal.
2. The catch basin shall be visually inspected for defects and possible illegal dumping. If illegal dumping has occurred, the proper authorities and property owner representative shall be notified as soon as practicable.
3. The catch basin grate shall be removed and set to one side. Using an industrial vacuum, the collected materials shall be removed from the liner. (Note: DPS uses a truck-mounted vacuum for servicing Flo-Gard ™ +Plus catch basin inserts.)
4. When all of the collected materials have been removed, the filter medium pouches shall be removed by unsnapping the tether from the D-ring and set to one side. The filter liner, gaskets, stainless steel frame and mounting brackets, etc. shall be inspected for continued serviceability. Minor damage or defects found shall be corrected on-the-spot and a notation made on the Maintenance Record. More extensive deficiencies that affect the efficiency of the filter (torn liner, etc.), if approved by the customer representative, will be corrected and an invoice submitted to the representative along with the Maintenance Record.
5. The filter medium pouches shall be inspected for defects and continued serviceability and replaced as necessary and the pouch tethers re-attached to the liner's D-ring. See below.
6. The grate shall be replaced.

Appendix B: Construction Plans (reduced copies)

Construction Plans for ...

KIHEI RECYCLING & REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK

PROJECT NO.: 04-05 / P-60   TAX MAP KEY: (2) 2-2-02 : 42

Waiohuli - Keokea (Kihei), Makawao, Maui, Hawaii

Prepared for . . .

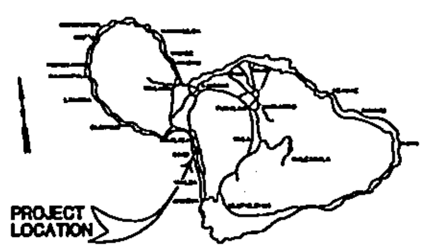
SOLIDWASTE DIVISION
DEPARTMENT OF PUBLIC WORKS
AND ENVIRONMENTAL MANAGEMENT
COUNTY OF MAUI
WAILUKU, MAUI, HAWAII

DEPARTMENT OF PARKS AND RECREATION
COUNTY OF MAUI
WAILUKU, MAUI, HAWAII

Prepared By . . .

WARREN S. UNEMORI ENGINEERING, INC.
Civil & Structural Engineers - Land Surveyor
Wells Street Professional Center - Suite 403
2145 Wells Street -Wailuku, Maui, Hawaii 96793

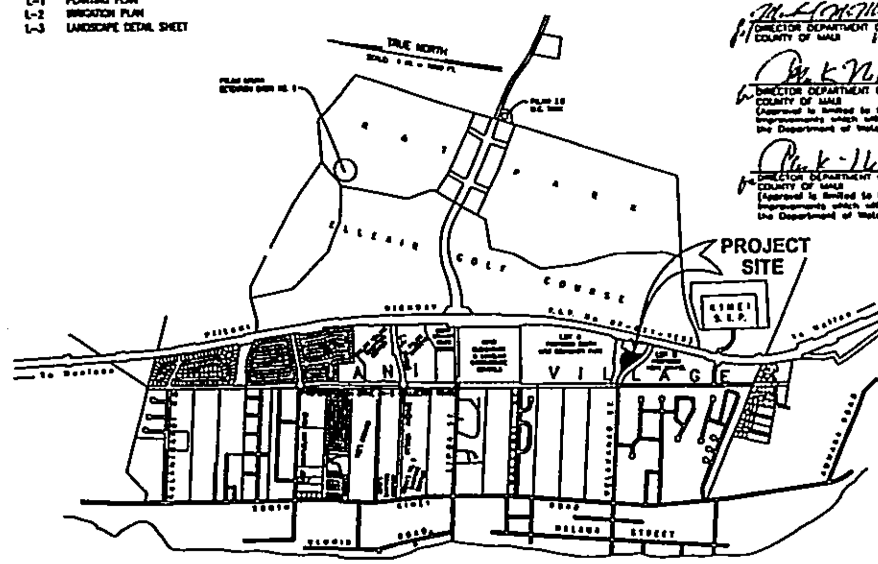
CHRIS HART & PARTNERS
LANDSCAPE ARCHITECTURE AND PLANNING
1955 MAIN STREET, SUITE 200
WAILUKU, MAUI, HI 96793-1706



ISLAND OF MAUI
NOT TO SCALE

INDEX OF DRAWINGS:

T-1	TITLE SHEET & LOCATION MAP
T-2	STANDARD PLANS SUMMARY
C-1	CONSTRUCTION NOTES
C-2	GENERAL PLAN
C-3	SITE PLAN
C-4	GRADING PLAN
C-5	UTILITY PLAN
C-6	PROFILES
C-7	SIGNING & STRIPING PLAN
C-8.1 - C-8.4	MISCELLANEOUS DETAILS
C-9.1 - C-9.2	EROSION CONTROL PLAN, DETAILS & NOTES
C-10	TRAFFIC CONTROL PLAN
C-11	PLAN & PROFILE: 4" 3?% RECLAIMED WATERLINE ALONG WELAKAHAO ST.
L-1	PLANTING PLAN
L-2	IRRIGATION PLAN
L-3	LANDSCAPE DETAIL SHEET



PROJECT VICINITY MAP
SCALE: 1 IN. = 1000 FT.

APPROVED BY:

DIRECTOR DEPARTMENT OF PUBLIC WORKS, COUNTY OF MAUI — DATE 6/2/05

DIRECTOR DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI (Approval is limited to the Water System improvements which will be dedicated to the Department of Water Supply) — DATE 5/26/05

RE-APPROVED BY:

DIRECTOR DEPARTMENT OF PUBLIC WORKS, COUNTY OF MAUI — DATE 3/30/06

DIRECTOR DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI (Approval is limited to the Water System improvements which will be dedicated to the Department of Water Supply) — DATE

DIRECTOR DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI (Approval is limited to the Water System improvements which will be dedicated to the Department of Water Supply) — DATE

REVISED: FEB. 28, 2006   BID SET: APRIL 22, 2005

STANDARD PLANS SUMMARY

Standard Plan No.	Title	Date
B-01	Notes and Miscellaneous Details	07/01/86
B-02		
B-03	Typical Structure Excavation and Backfill Pay Limits	07/01/86
B-04		
B-05		
B-06	Concrete Box Girder	07/01/86
B-07	Concrete Box Girder	07/01/86
B-08	Concrete Box Girder	07/01/86
B-09		
B-10		
B-11		
B-12	Prestressed Concrete Piles	r07/16/90
B-13	Prestressed Concrete Piles	r07/16/90
D-01 ●	Chain Link Fence With Toprail	r03/06/87
D-02 ●	Chain Link Fence Without Toprail	r07/26/90
D-03	Wire Fence With Metal Posts	07/01/86
D-04 ●	Typical Details of Curbs and/or Gutters	07/01/86
D-05	Typical Details of Reinforced Concrete Drop Driveway	07/01/86
D-06	Centerline and Reference Survey Monument	07/01/86
D-07	Street Survey Monument	07/01/86
D-08 ●	Landscaping Shrub and Tree Planting	07/01/86
D-09	Field Office	07/01/86
D-10	Field Office	07/01/86
D-11	Project Site Laboratory	07/01/86
D-12	Project Site Laboratory	07/01/86
D-13	Field Office & Project Site Laboratory	07/01/86
H-01	Type A, B, C and D Catch Basin	07/01/86
H-02	Type A1, B1, C1, and D1 Catch Basin	07/01/86
H-03	Type A2, B2, C2, and D2 Catch Basin	07/01/86
H-04	Typical Reinforcing Details for Catch Basins	07/01/86
H-05	Type A, B, and C Storm Drain Manhole	07/01/86
H-06	Type D and E Storm Drain Manhole	07/01/86
H-07	Type F Storm Drain Manhole	07/01/86
H-08	Catch Basin and Manhole Casting	07/01/86
H-09	Type A-9 and A-9P Frames and Grates	07/01/86
H-10	Type A-9B Frames and Grates	07/01/86
H-11 ●	Type 61814 and 61214 Grated Drop Inlet	07/01/86
H-12	Type 61818 Grated Drop Inlet	07/01/86
H-13 ●	61214, 61814 & 61818 Steel Frames and Grates	07/01/86
H-14	61214B Steel Frame and Grates	07/01/86
H-15	61814B Steel Frame and Grates	07/01/86
H-16 ●	Concrete and Cement Rubble Masonry Structures	r10/16/90
H-17	Inlet Structures	r10/16/90
H-18	Flared End Section for Culverts	07/01/86
H-19	Outlet Structures	r02/15/91
H-20	Concrete Spillway Inlet	07/01/86
H-21	18" Slotted C.M.P. Drain	07/01/86
H-22 ●	C.M.P. Coupling Details Standard Joint	r10/16/90
H-23 ●	Hat Shaped Coupling Band	r10/16/90

Standard Plan No.	Title	Date
TE-01 ●	Miscellaneous Sign Details	07/01/86
TE-02 ●	Galvanized Flanged Channel Sign Post Mounting	07/01/86
TE-03	Galvanized Square Tube Sign Post Mounting	07/01/86
TE-04 ●	Regulatory Signs	r09/01/87
TE-05	Warning Signs	07/01/86
TE-06	Miscellaneous Signs	r11/03/89
TE-07	Reserved	07/01/86
TE-08 ●	Construction Signs	r09/01/87
TE-09	Miscellaneous Intersection Signs	r03/06/87
TE-10	Reserved	07/01/86
TE-11	Bike Route Sign and Supplementary Plates	07/01/86
TE-12	State Route Marker and Auxiliary Markers	07/01/86
TE-13	Interstate Route Marker	07/01/86
TE-14	State Route Marker and Border Detail for Guide Signs	07/01/86
TE-15	Route Marker Assemblies	07/01/86
TE-16	Miscellaneous Reflector Markers	07/01/86
TE-17	Type II Object Markers	07/01/86
TE-18	Mileposts	07/01/86
TE-19	Reserved	07/01/86
TE-20	Overhead Sign Supports	07/01/86
TE-21	Overhead Sign Support, Box Truss Type, Aluminum	07/01/86
TE-22	Foundation Details and Schedules	07/01/86
TE-23	Supports for Ground Mounted Guide Signs	r11/03/89
TE-24	Breakaway Sign Supports for Ground Mounted Guide Signs	07/01/86
TE-25	Laminated Aluminum Sign Panels (Overhead)	07/01/86
TE-26	Laminated Aluminum Sign Panels (Ground Mounted)	07/01/86
TE-27	Solid Aluminum Extruded Sign Panel and Accessory Details	07/01/86
TE-28	Guide Signs Luminaire Mountings	07/01/86
TE-29	Reserved	07/01/86
TE-30	Raised Pavement Markers and Striping	r05/08/90
TE-31	Miscellaneous Pavement Markings	r05/08/90
TE-32	Miscellaneous Pavement Markings	r05/08/90
TE-33	Miscellaneous Pavement Markings	r11/03/89
TE-34	Reserved	07/01/86
TE-35 ●	Pavement Alphabets, Numbers & Symbols	07/01/86
TE-36 ●	Pavement Alphabets, Numbers & Symbols	07/01/86
TE-37	Reserved	07/01/86
TE-38	Traffic Signal System, Miscellaneous Details	r11/03/89
TE-39	Traffic Signal System, Miscellaneous Details	07/01/86
TE-40	Loop Detectors	r11/03/89
TE-41	Pullboxes	07/01/86
TE-42	Type III Traffic Signal Standard	07/01/86
TE-43	Concrete Pullbox (3' x 3')	07/01/86
TE-44	Reserved	07/01/86

Standard Plan No.	Title	Date
TE-45	Reserved	07/01/86
TE-46	Reserved	07/01/86
TE-47	Reserved	07/01/86
TE-48	Reserved	07/01/86
TE-49	Reserved	07/01/86
TE-50	Guardrail Details & Notes; Strong Post w/ Beam Guardrail	r03/01/99
TE-51	Metal Guardrail	r09/01/87
TE-52	Metal Guardrail with Rubrail	r11/03/89
TE-53	Metal Guardrail with Rubrail at Obstruction	r09/01/87
TE-54	Beam Type Guardrail with Rubrail at Obstruction (Shoulder Installation)	r11/03/89
TE-55	Metal Guardrail Connection to Concrete Barrier	r11/03/89
TE-56	Concrete Barrier Transition	07/01/86
TE-57	Guardrail Type 3, Thrie Beam	r11/03/89
TE-57A	Guardrail Type 3, Modified Thrie Beam	11/03/89
TE-58	Type "A" Flare	r03/01/99
TE-59	Type "A" Flare	r03/01/99
TE-60	Type "A" Flare	r03/01/99
TE-61	Flout-350 Flared Energy Absorbing Terminal	r03/01/99
TE-62	Breakaway Cable Terminal (BCT)	r09/01/87
TE-63	Guardrail Type 4 (Rigid Barrier)	r09/01/87
TE-64	Portable Concrete Guardrail	r11/03/89
TE-65	Guardrail Type 4, Miscellaneous	r09/01/87
TE-66	Barricades	07/01/86
TE-67	Delineation & Pavement Markings at Bridges	07/01/86
TE-68	Curb Ramp Detail	r05/01/98
TE-69	Curb Ramp Detail	r05/01/98

NOTE:
STANDARD PLANS APPLICABLE TO THIS PROJECT ARE INDICATED BY A "●" NEXT TO STANDARD PLAN NO. (D-07●)

DATE	REVISION
02/15/91	REVISED STANDARD PLANS H-19
10/16/90	REVISED STANDARD PLANS H-16, H-17, H-22 & H-23.
07/26/90	REVISED STANDARD PLANS D-02
07/16/90	REVISED STANDARD PLANS B-12, B-13
05/08/90	REVISED STANDARD PLANS TE-30, TE-31, & TE-32.
11/03/89	REVISED STANDARD PLANS TE-06, TE-23, TE-30, TE-31, TE-32, TE-33, TE-38, TE-40, TE-52, TE-54, TE-55, TE-57, TE-58, TE-61, TE-64, TE-68 & TE-69, ADDED TE-57A TO STANDARD PLANS.
09/01/87	REVISED STANDARD PLANS TE-04, TE-06, TE-08, TE-32, TE-51, TE-53, TE-54, TE-55, TE-57, TE-58, TE-62, TE-63, TE-65 AND TE-69.
03/06/87	REVISED STANDARD PLANS D-01, TE-09, TE-40, TE-50, TE-51, TE-57, TE-58, TE-61, TE-63 AND TE-64.

WARREN S. UNEMORI ENGINEERING, INC.

KIHEI RECYCLING AND REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK

Project #s.: 04-08 / P-80 TMK: (2) 3-3-002 : Par. 042

Kihei, Maui, Hawaii

TITLE STANDARD PLANS SUMMARY

C.A.H. | C.A.H. | W.S.K. | W.S.U.

AS NOTED

T-2

12-15-2005

CONSTRUCTION NOTES:

PUBLIC WORKS (FOR ALL WORK WITHIN COUNTY RIGHT-OF-WAY):

1. THE CONTRACTOR SHALL OBTAIN THE FOLLOWING PERMITS FROM THE DEVELOPMENT SERVICES ADMINISTRATION (D.S.A.) OF THE DEPARTMENT OF PUBLIC WORKS (D.P.W.), COUNTY OF MAUI, BEFORE ANY WORK IS BEGUN:
   A. "WORK TO PERFORM ON COUNTY HIGHWAY PERMIT", TWO (2) WEEKS PRIOR TO COMMENCEMENT OF WORK ON COUNTY ROADWAYS.
   B. "DRIVEWAY PERMIT", TWENTY-FOUR HOURS PRIOR TO COMMENCEMENT OF WORK ON ANY DRIVEWAY.
   C. "GRADING PERMIT", FOUR (4) WEEKS PRIOR TO COMMENCEMENT OF ANY CLEARING AND GRUBBING. A SATISFACTORY DUST AND EROSION CONTROL PLAN AND/OR OUTLINE SHALL BE SUBMITTED BY THE CONTRACTOR.
2. EACH PHASE OF ROAD CONSTRUCTION IS TO BE APPROVED BY THE D.P.W., D.S.A., PRIOR TO WORKING ON THE NEXT PHASE OF ROAD CONSTRUCTION.
3. THE LATEST REVISIONS OF THE STANDARD DETAIL DRAWINGS AND STANDARD SPECIFICATIONS OF THE DEPARTMENT OF PUBLIC WORKS SHALL BE INCLUDED AS PART OF THE CONSTRUCTION PLANS.
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. [illegible]
10. [illegible]
11. [illegible]

EXISTING UTILITIES:

1. [illegible]
2. [illegible]
3. [illegible]

ENVIRONMENTAL PROTECTION:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

COMPACTION REQUIREMENTS:

1. [illegible]
   A. [illegible]
   B. [illegible]
   C. [illegible]
   D. [illegible]
   E. [illegible]
2. [illegible]
3. [illegible]

WASTEWATER NOTES:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. [illegible]
10. [illegible]
11. [illegible]
12. [illegible]
13. [illegible]
14. [illegible]
15. [illegible]
16. [illegible]
17. [illegible]
18. [illegible]
19. [illegible]

CLEARING AND GRUBBING:

1. [illegible]

EXISTING GRADES:

1. [illegible]

EROSION CONTROL:

[illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]

EXCAVATION:

[illegible]

NOTE:

[illegible]

RECYCLED WATER SYSTEM NOTES:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. [illegible]
10. [illegible]
11. [illegible]
12. [illegible]
13. [illegible]
14. [illegible]
15. [illegible]
16. [illegible]
17. [illegible]
18. [illegible]

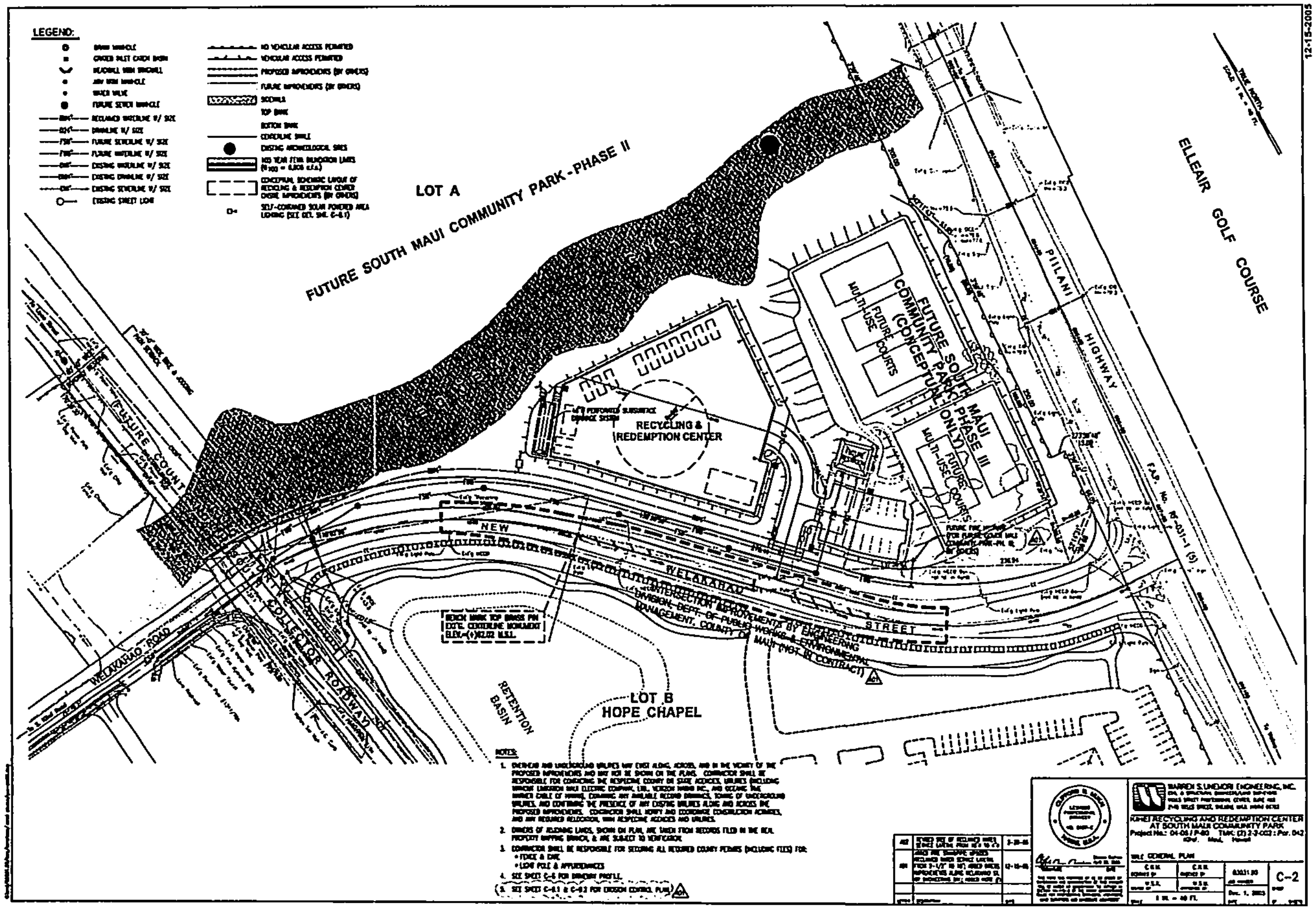
WARREN S. UNEMORI ENGINEERING, INC.

KIHEI RECYCLING AND REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK

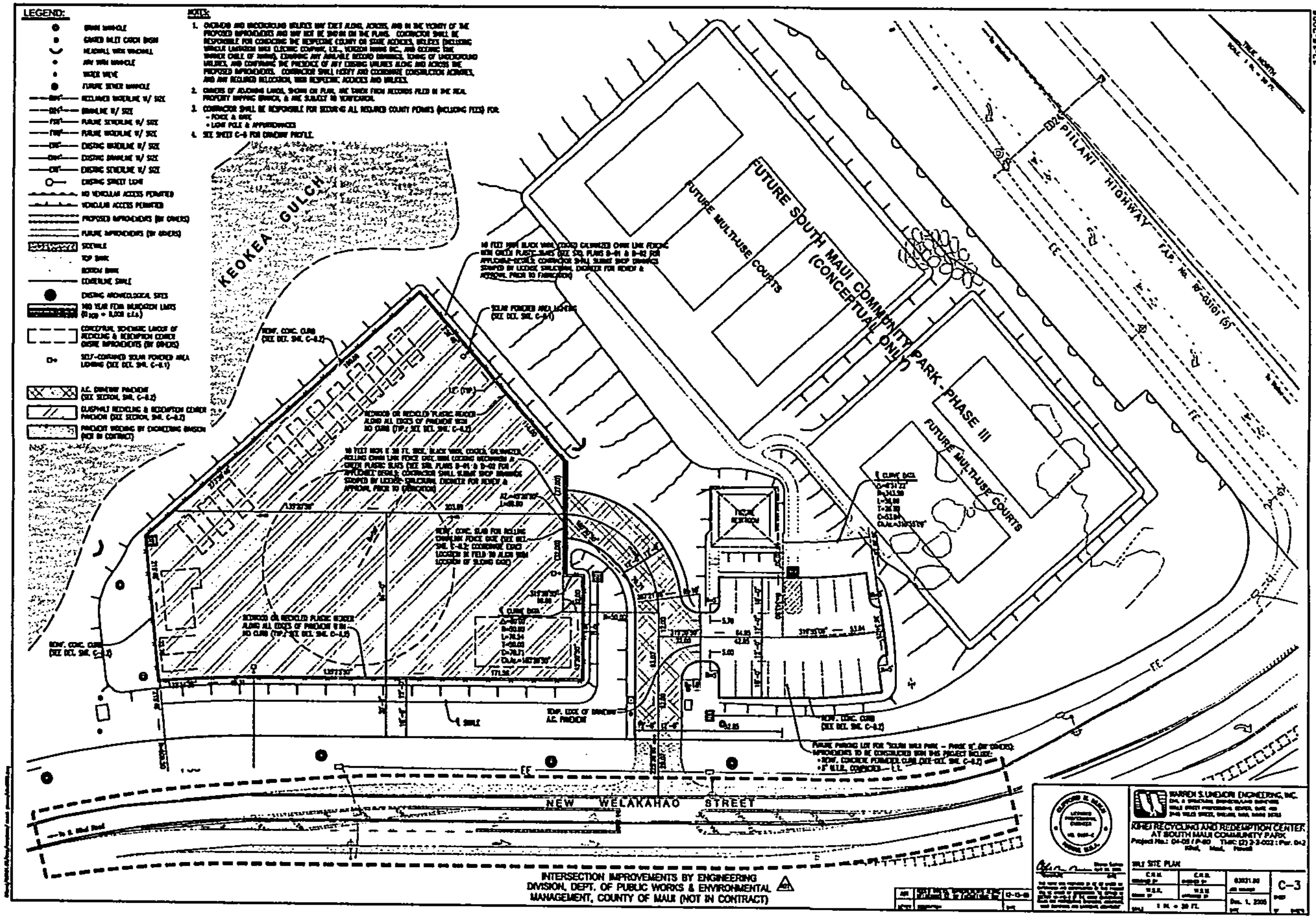
Project No.: 04-06 / P-60 TMK: (2) 2-2-002 : Par. 042

TITLE: CONSTRUCTION NOTES

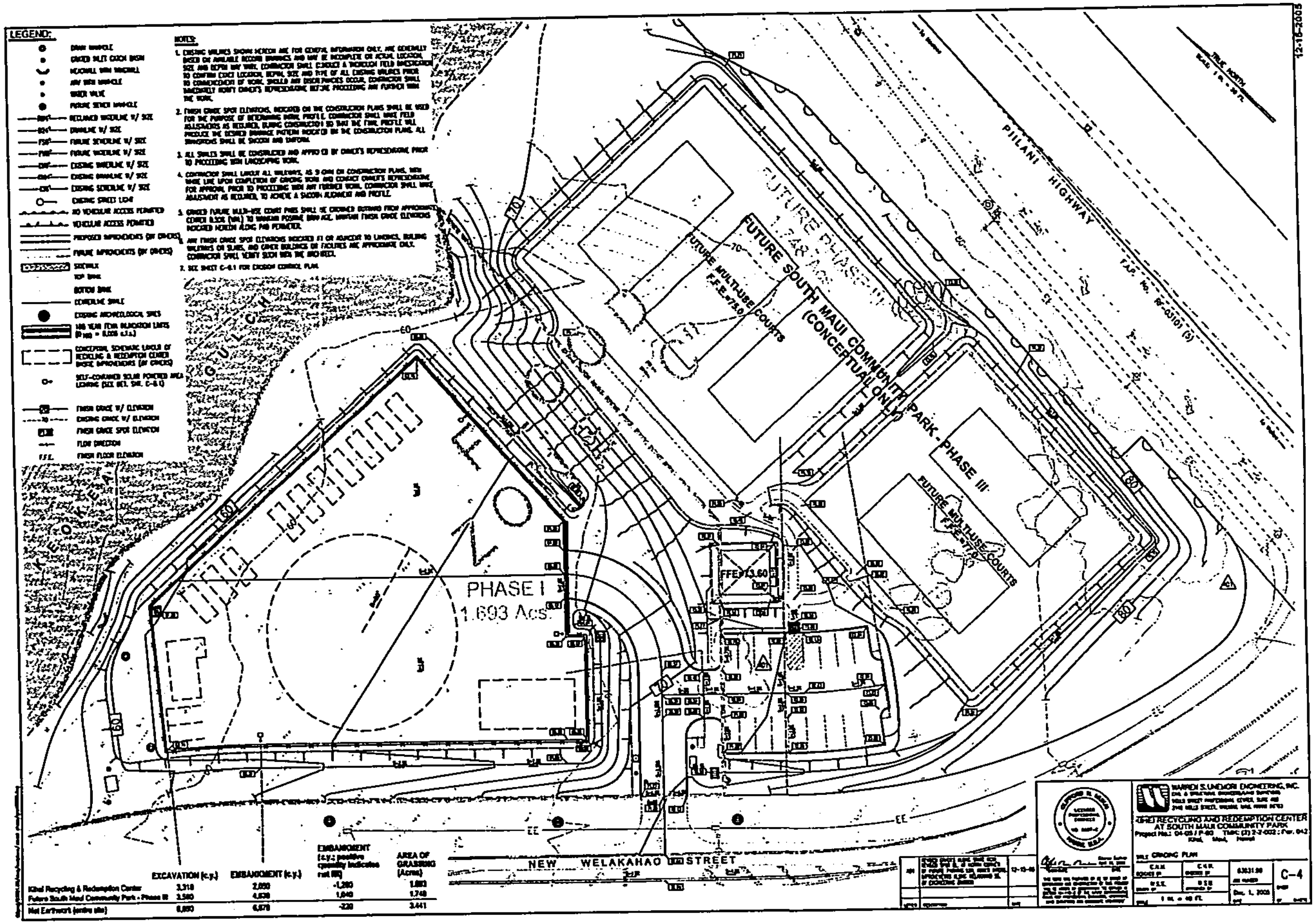
C.H.N.	C.H.N.	030130	C-1
W.S.U.	W.S.U.	Dec. 1, 2005	
AS NOTED			



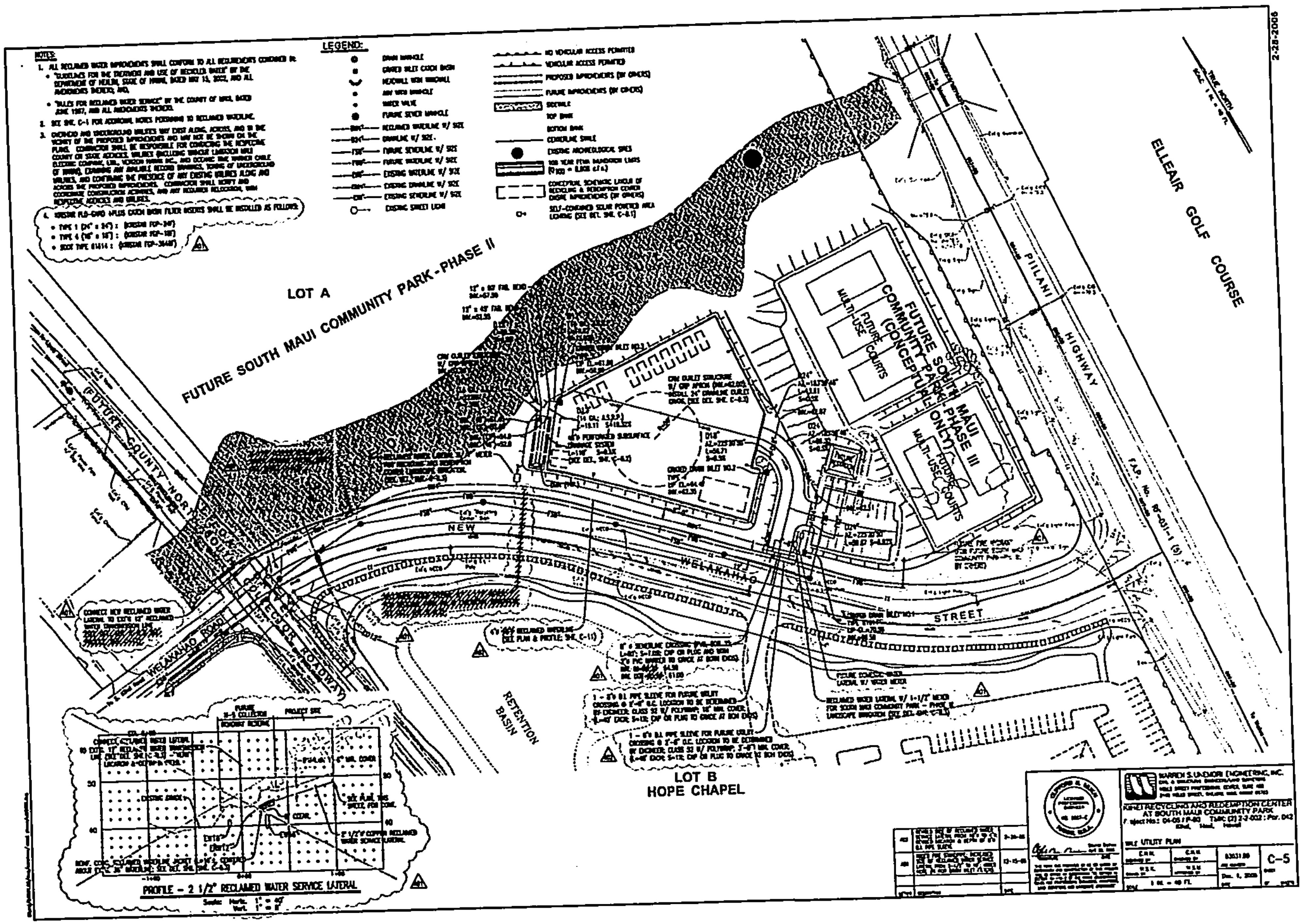
12-15-2005
LEGEND:
ELLEAIR GOLF COURSE
PIILANI HIGHWAY
LOT A
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE II
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE III (CONCEPTUAL ONLY)
FUTURE MULTI-USE COURTS
RECYCLING & REDEMPTION CENTER
NEW WELAKAHAO STREET
WELAKAHAO ROAD
FUTURE COUNTY COLLECTOR ROADWAY
RETENTION BASIN
LOT B
HOPE CHAPEL
NOTES:
C-2



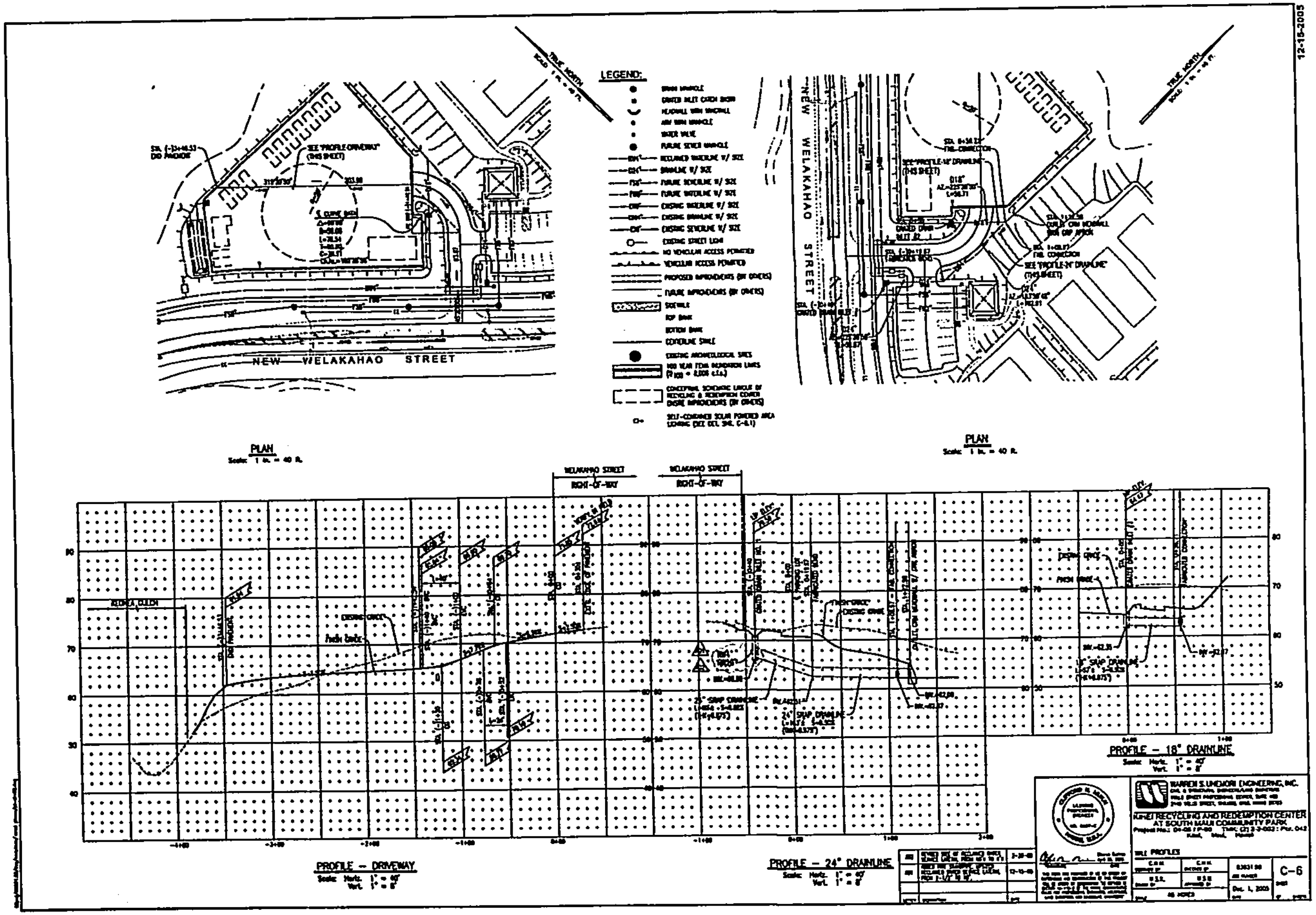
12-15-2005
LEGEND:
NOTES:
KEOKEA GULCH
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE III
(CONCEPTUAL ONLY)
FUTURE MULTI-USE COURTS
FUTURE MULTI-USE COURTS
PIILANI HIGHWAY
NEW WELAKAHAO STREET
INTERSECTION IMPROVEMENTS BY ENGINEERING
DIVISION, DEPT. OF PUBLIC WORKS & ENVIRONMENTAL
MANAGEMENT, COUNTY OF MAUI (NOT IN CONTRACT)
WARREN S. UNEMORI ENGINEERING, INC.
KIHEI RECYCLING AND REDEMPTION CENTER
AT SOUTH MAUI COMMUNITY PARK
SITE PLAN
C-3



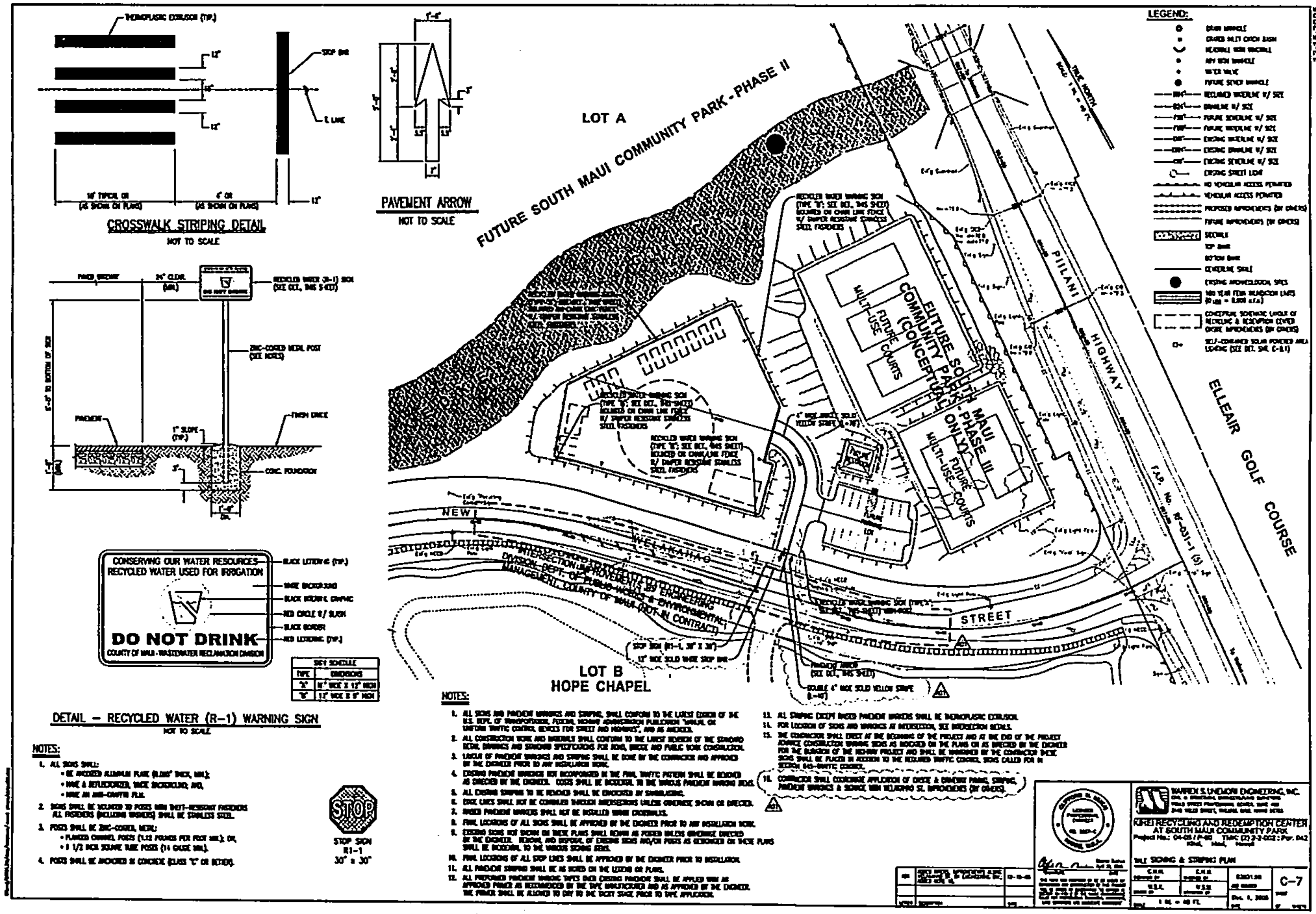
12-16-2005
LEGEND:
NOTES:
PIILANI HIGHWAY
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE III
(CONCEPTUAL ONLY)
FUTURE MULTI-USE COURTS
F.F.E.=75.0
PHASE I
1.693 Acs.
FFE=73.60
NEW WELAKAHAO STREET
EXCAVATION (c.y.)
EMBANKMENT (c.y.)
AREA OF GRADING (Acres)
Kihei Recycling & Redemption Center 3,318 2,050 1,693
Future South Maui Community Park - Phase III 3,580 4,630 1,748
Net Earthwork (entire site) 6,890 6,678 3,441
WARREN S. UNEMORI ENGINEERING, INC.
KIHEI RECYCLING AND REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK
GRADING PLAN
C-4



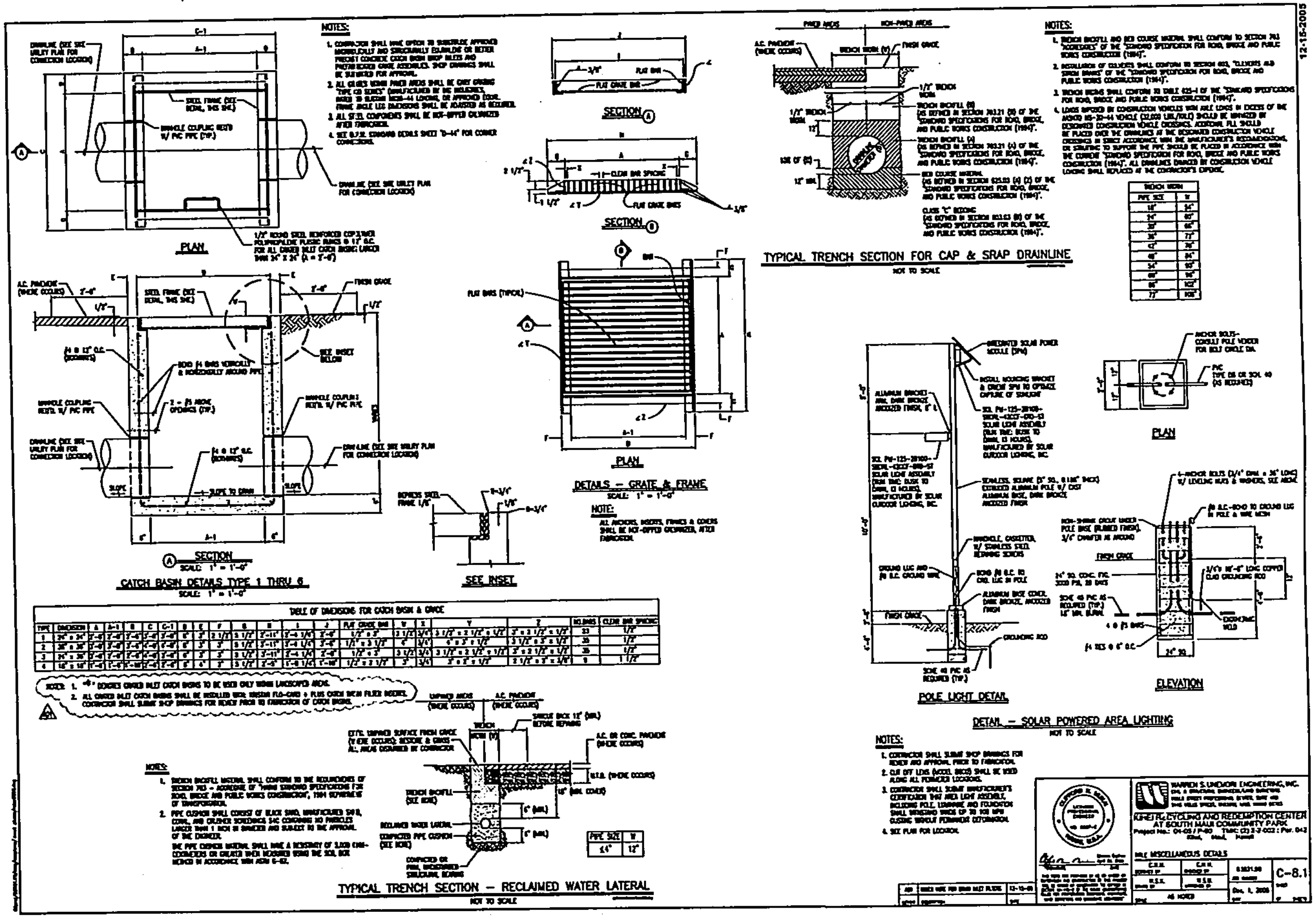
2-28-2006
TRUE NORTH
ELLEAIR GOLF COURSE
PIILANI HIGHWAY
LEGEND:
NOTES:
LOT A
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE II
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE III (CONCEPTUAL ONLY)
FUTURE MULTI-USE COURTS
NEW WELAKAHAO STREET
FUTURE COUNTY NORTH-SOUTH COLLECTOR ROADWAY
WELAKAHAO ROAD
RETENTION BASIN
LOT B
HOPE CHAPEL
PROFILE - 2 1/2" RECLAIMED WATER SERVICE LATERAL
WARREN S. UNEMORI ENGINEERING, INC.
KIHEI RECYCLING AND REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK
C-5

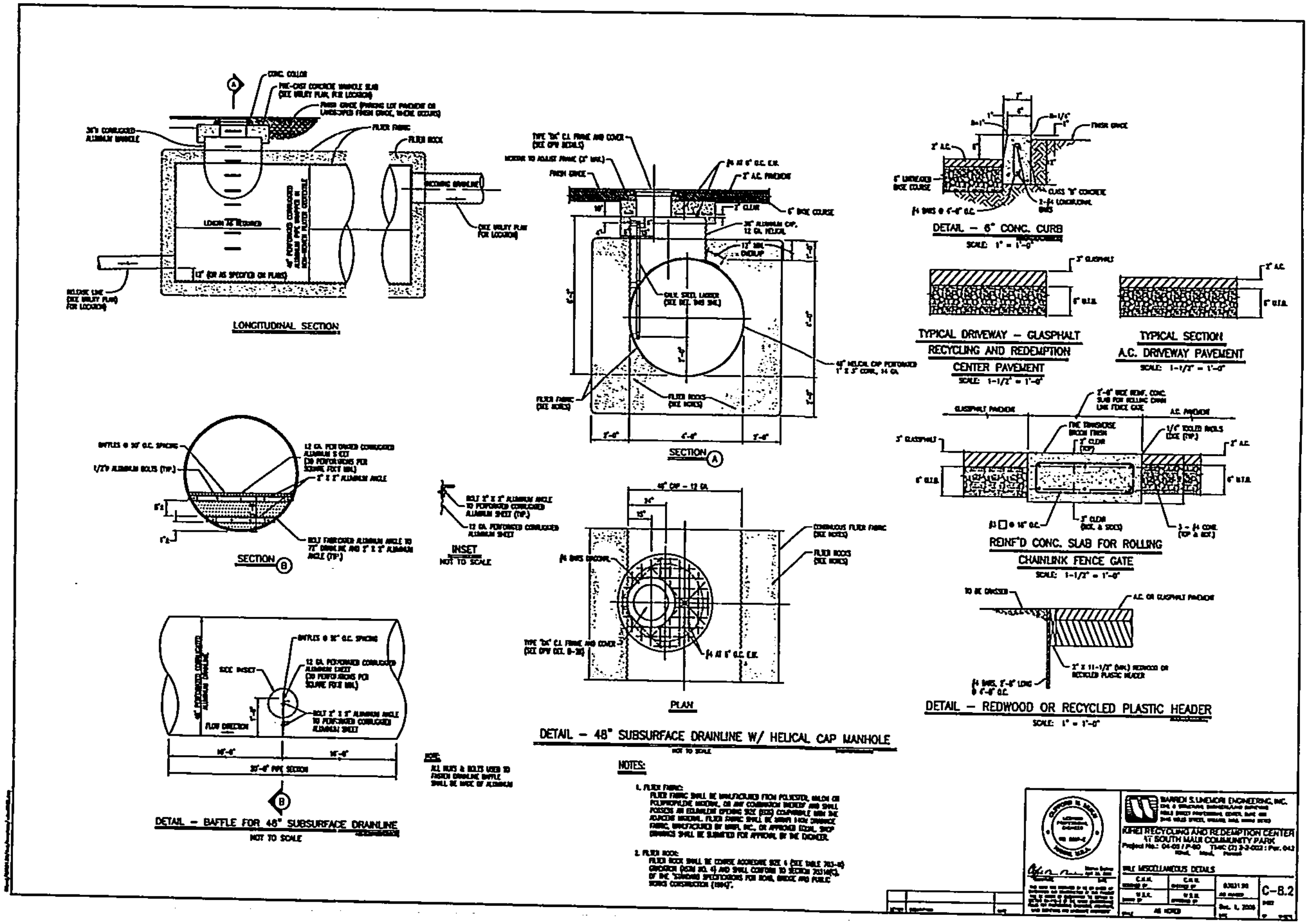


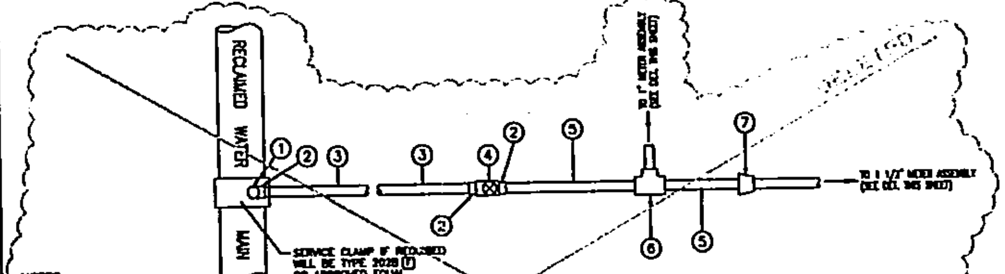
12-15-2005
LEGEND:
TRUE NORTH
NEW WELAKAHAO STREET
PLAN
Scale: 1 in. = 40 ft.
PLAN
Scale: 1 in. = 40 ft.
WELAKAHAO STREET
RIGHT-OF-WAY
WELAKAHAO STREET
RIGHT-OF-WAY
PROFILE – DRIVEWAY
Scale: Horiz. 1" = 40'
Vert. 1" = 8'
PROFILE – 24" DRAINLINE
Scale: Horiz. 1" = 40'
Vert. 1" = 8'
PROFILE – 18" DRAINLINE
Scale: Horiz. 1" = 40'
Vert. 1" = 8'
WARREN S. UNEMORI ENGINEERING, INC.
KIHEI RECYCLING AND REDEMPTION CENTER
AT SOUTH MAUI COMMUNITY PARK
PROFILES
Dec. 1, 2005
C-6



12-15-2005
LEGEND:
LOT A
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE II
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE III (CONCEPTUAL ONLY)
FUTURE MULTI-USE COURTS
FUTURE MULTI-USE COURTS
PIILANI HIGHWAY
ELLEAIR GOLF COURSE
NEW WELAKAHAO STREET
LOT B
HOPE CHAPEL
CROSSWALK STRIPING DETAIL
NOT TO SCALE
PAVEMENT ARROW
NOT TO SCALE
CONSERVING OUR WATER RESOURCES
RECYCLED WATER USED FOR IRRIGATION
DO NOT DRINK
DETAIL - RECYCLED WATER (R-1) WARNING SIGN
NOT TO SCALE
NOTES:
STOP
STOP SIGN
R1-1
30" x 30"
NOTES:
WARREN S. UNEMORI ENGINEERING, INC.
KIHEI RECYCLING AND REDEMPTION CENTER
AT SOUTH MAUI COMMUNITY PARK
SIGNING & STRIPING PLAN
1 IN. = 40 FT.
C-7


PLAN
SECTION
CATCH BASIN DETAILS TYPE 1 THRU 6
SCALE: 1" = 1'-0"
SECTION (A)
SECTION (B)
PLAN
DETAILS – GRATE & FRAME
SCALE: 1" = 1'-0"
SEE INSET
TABLE OF DIMENSIONS FOR CATCH BASIN & GRATE
TYPICAL TRENCH SECTION FOR CAP & SRAP DRAINLINE
NOT TO SCALE
PLAN
POLE LIGHT DETAIL
ELEVATION
DETAIL – SOLAR POWERED AREA LIGHTING
NOT TO SCALE
TYPICAL TRENCH SECTION – RECLAIMED WATER LATERAL
NOT TO SCALE
WARREN S. UNEMORI ENGINEERING, INC.
KIHEI RECYCLING AND REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK
MISCELLANEOUS DETAILS
C-8.1
12-15-2005


LONGITUDINAL SECTION
SECTION A
PLAN
DETAIL – 48" SUBSURFACE DRAINLINE W/ HELICAL CAP MANHOLE
NOT TO SCALE
SECTION B
INSET
NOT TO SCALE
DETAIL – BAFFLE FOR 48" SUBSURFACE DRAINLINE
NOT TO SCALE
DETAIL – 6" CONC. CURB
SCALE: 1" = 1'-0"
TYPICAL DRIVEWAY – GLASPHALT RECYCLING AND REDEMPTION CENTER PAVEMENT
SCALE: 1-1/2" = 1'-0"
TYPICAL SECTION A.C. DRIVEWAY PAVEMENT
SCALE: 1-1/2" = 1'-0"
REINF'D CONC. SLAB FOR ROLLING CHAINLINK FENCE GATE
SCALE: 1-1/2" = 1'-0"
DETAIL – REDWOOD OR RECYCLED PLASTIC HEADER
SCALE: 1" = 1'-0"
NOTES:
BARRETT S. UMEMORI ENGINEERING, INC.
KIHEI RECYCLING AND REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK
SITE MISCELLANEOUS DETAILS
C-8.2



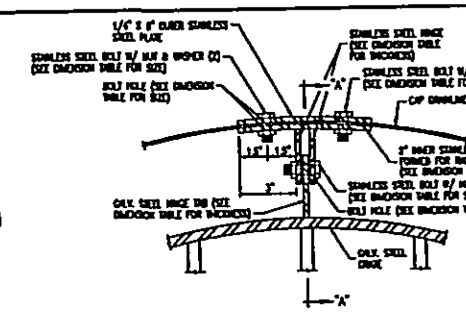
NOTES:
1. ALL FITTINGS AND MATERIALS LISTED BY BRAND NAMES OR APPROVED EQUAL.
2. SEE PLATE M23 FOR TRANSPONDER BRACKET INSTALLATION.
3. ALL COMPONENTS OF THE RECLAIMED WATER LATERAL SHALL CONFORM TO WASTEWATER AND EFFLUENT NOTES ON SHEET C-1.

[F] DENOTES FORD METER BOX MANUFACTURING CO.'S NO.

TYPE	METER SIZE	① CORP. STOP	② COPPER ADAPTER	③ COPPER SERVICE TUBING	④ BRONZE BALL VALVE	⑤ COPPER SERVICE TUBING	⑥ COPPER TEE	⑦ REDUCER
S	N/A	2" x 2 1/2" AWWA THREAD x FEMALE I.P.T. (FB 1100)	2 1/2" MALE I.P.T. x COPPER	2 1/2"	2 1/2" FEMALE I.P.T.	2 1/2" x 12"	2 1/2" x 2 1/2" x 1 1/2" C x C x C	2 1/2" x 2" REDUCER C x C

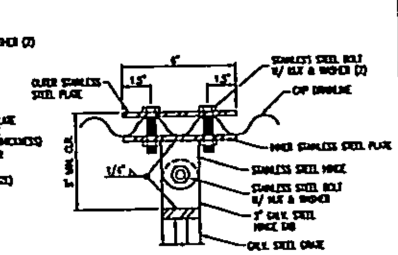
TYPE "S" 2 1/2" RECLAIMED WATER SERVICE LATERAL

NOT TO SCALE



DETAIL - GRATE SUPPORT

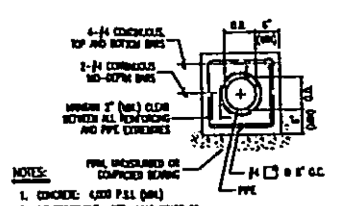
NOT TO SCALE



SECTION "A"-"A"

NOT TO SCALE

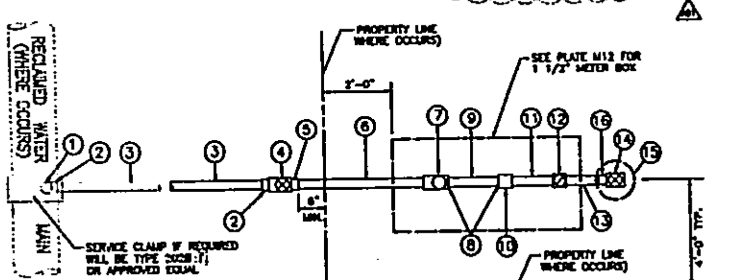
NOTES:
1. ALL FASTENING AND SUPPORTING MEMBERS ATTACHED TO DRAINLINE SHALL BE ASTM A312 TYPE 304 STAINLESS STEEL.
2. ALL BOLTS, NUTS & WASHERS SHALL BE ASTM A312 TYPE 304 STAINLESS STEEL.
3. GRATE ASSEMBLY SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION.
4. CONTRACTOR TO VERIFY ALL DIMENSIONS IN FIELD PRIOR TO FABRICATION.
5. CONTRACTOR TO SUBMIT 6 SHOP DRAWINGS FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.
6. GRATE TO BE INSTALLED 6" INSIDE OF OUTLET END OF PIPE.



NOTES:
1. CONCRETE: 4,000 P.S.I. (MIN.)
2. REINFORCEMENT: ASTM A615 GRADE 60

TYP. SECTION - REINF. CONC. RECLAIMED WATERLINE JACKET

SCALE: 1/2" = 1'-0"



NOTES:
1. ALL FITTINGS AND MATERIALS LISTED BY BRAND NAMES OR APPROVED EQUAL.
2. SEE PLATE M23 FOR TRANSPONDER BRACKET INSTALLATION.
3. ALL COMPONENTS OF THE RECLAIMED WATER LATERAL SHALL CONFORM TO WASTEWATER AND EFFLUENT NOTES ON SHEET C-1.
4. UPON INSPECTION & APPROVAL OF LATERAL, CONTRACTOR SHALL INSTALL 1 1/2" BADGER RECORDALL DISC (TURBO IF ANTICIPATED FLOW IS ABOVE 120 GPM) METER WITH ALL REQUIRED RECLAIMED WATER MARKINGS, OR APPROVED EQUAL.

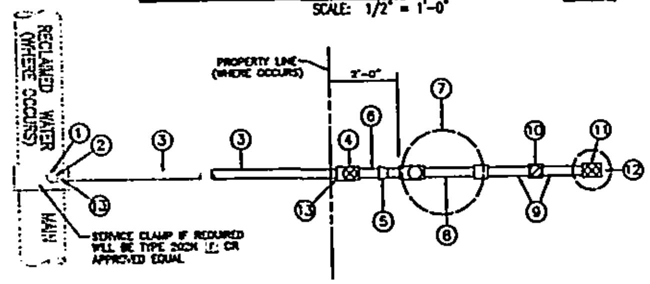
[F] DENOTES FORD METER BOX MANUFACTURING CO.'S NO.

TYPE	METER SIZE	① CORP. STOP	② COPPER ADAPTER	③ COPPER SERVICE TUBING	④ BRONZE BALL VALVE	⑤ BRASS BUSHING	⑥ BRASS NIPPLE	⑦ METER VALVE
C	1 1/2"	2" AWWA THREAD x FEMALE I.P.T. (FB 1000-7)	2" MALE I.P.T. x COPPER	2"	2" FEMALE I.P.T. B 11-777	1 1/2" FEMALE I.P.T. x 2" MALE I.P.T. C 18-87	1 1/2" x 48" (OR LENGTH TO FIT)	1 1/2" FEMALE I.P.T. x FLANGE BF 13-666

⑧ STAINLESS STL. BOLT/NUT	⑨ METER IDLER	⑩ METER COUPLING	⑪ BRASS NIPPLE	⑫ BRASS CHECK VALVE	⑬ BRASS NIPPLE	⑭ BRONZE BALL VALVE	⑮ PLASTIC VALVE BOX	⑯ DIELECTRIC COUPLING
5/8" x 2 1/2" TYPE 304	1 1/2" x 13" FLG. x FLG. ONE END PLUGGED (AS REQ'D.)	1 1/2" FLG. x LOK-PAK	1 1/2" x 6"	1 1/2" IN-LINE SPRING HS 11-666	1 1/2" x 14"	1 1/2" FEMALE I.P.T. B 11-666 HB-675	10" AMETEK 10-181-014 W/ GREEN COVER 10-181-015	1 1/2" BRASS WITH ADAPTER AND CLOSE NIPPLE

TYPE "C" (1 1/2" METER) RECLAIMED WATER LATERAL INSTALLATION

NOT TO SCALE



NOTES:
1. FOR COPPER TUBE INSTALLATION, DELETE INSERTS ⑬.
2. ALL FITTINGS AND MATERIALS LISTED BY BRAND NAMES OR APPROVED EQUAL.
3. ALL COMPONENTS OF THE RECLAIMED WATER LATERAL SHALL CONFORM TO WASTEWATER AND EFFLUENT NOTES ON SHEET C-1.
4. UPON INSPECTION & APPROVAL OF LATERAL, CONTRACTOR SHALL INSTALL 1" BADGER RECORDALL DISC METER WITH ALL REQUIRED RECLAIMED WATER MARKINGS, OR APPROVED EQUAL.

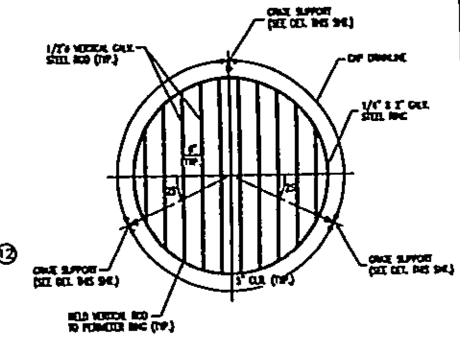
[F] DENOTES FORD METER BOX MANUFACTURING CO.'S NO.

TYPE	METER SIZE	① CORP. STOP	② PACK JOINT COUPLING	③ SERVICE TUBING	④ BALL VALVE	⑤ REDUCING COUPLING	⑥ BRASS NIPPLE
B	1"	1-1/4" x 1-1/2" AWWA THREAD x MALE I.P.T. (F-600)	1-1/2" FEMALE I.P.T. x P.J. (C14-66)	1-1/2" COPPER P.E. TUBING CLASS 160	1-1/2" x 1-1/2" P.J. x P.J. B-44-666	1-1/2" x 1" F.I.P. x F.I.P. C11-64	1-1/2" x 6"

⑦ C.I. METER BOX	⑧ METER IDLER	⑨ BRASS NIPPLE	⑩ BRASS CHECK BOX	⑪ BRONZE BALL VALVE	⑫ PLASTIC VALVE BOX	⑬ PLASTIC STIFFENER
1" FEM. I.P.T. INLET-OUTLET (No. 4) VOICEBOX	1" x 10-3/4" W/ ONE END PLUGGED (AS REQ'D.)	1" x 6"	1" HAMMOND (904) OR STOCKHAM (B-310)	1" HAMMOND OR STOCKHAM	10" AMETEK (10-181-014) W/ PURPLE COVER (10-181-015)	1-1/2" STAINLESS STL. INSERT (34)

TYPE "B" (1" METER) RECLAIMED WATER LATERAL INSTALLATION

NOT TO SCALE



DIMENSION TABLE FOR GRATE SUPPORT					
PIPE SIZE	BOLT SIZE	BOLT HOLE	S.S. HINGE THICKNESS	GALV. STEEL HINGE TAB THICKNESS	INNER S.S. PLATE THICKNESS
24"	1/2"	5/8"	1/4"	1/4"	1/4"

DETAIL - 24" DRAINLINE OUTLET GRATE

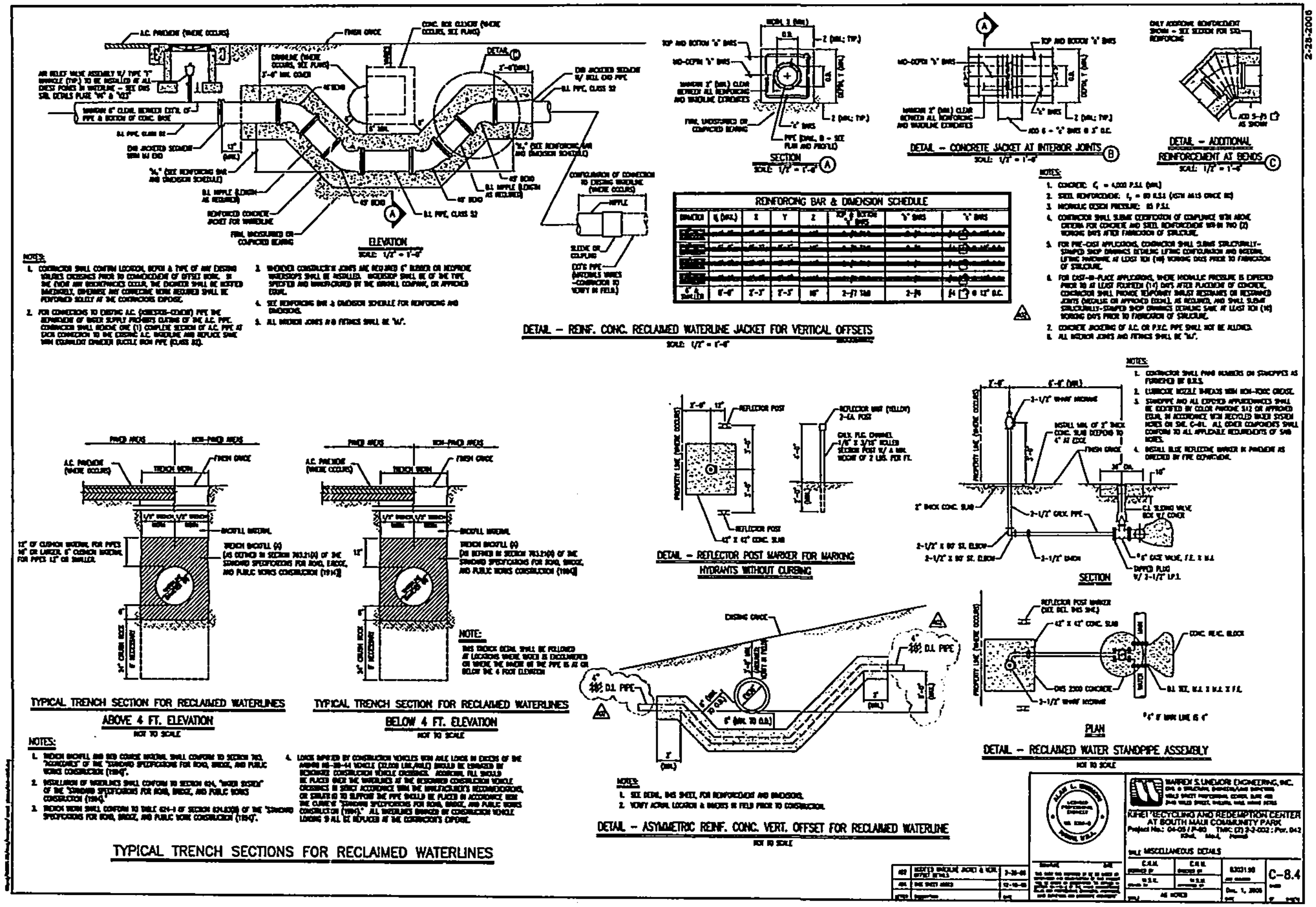
NOT TO SCALE

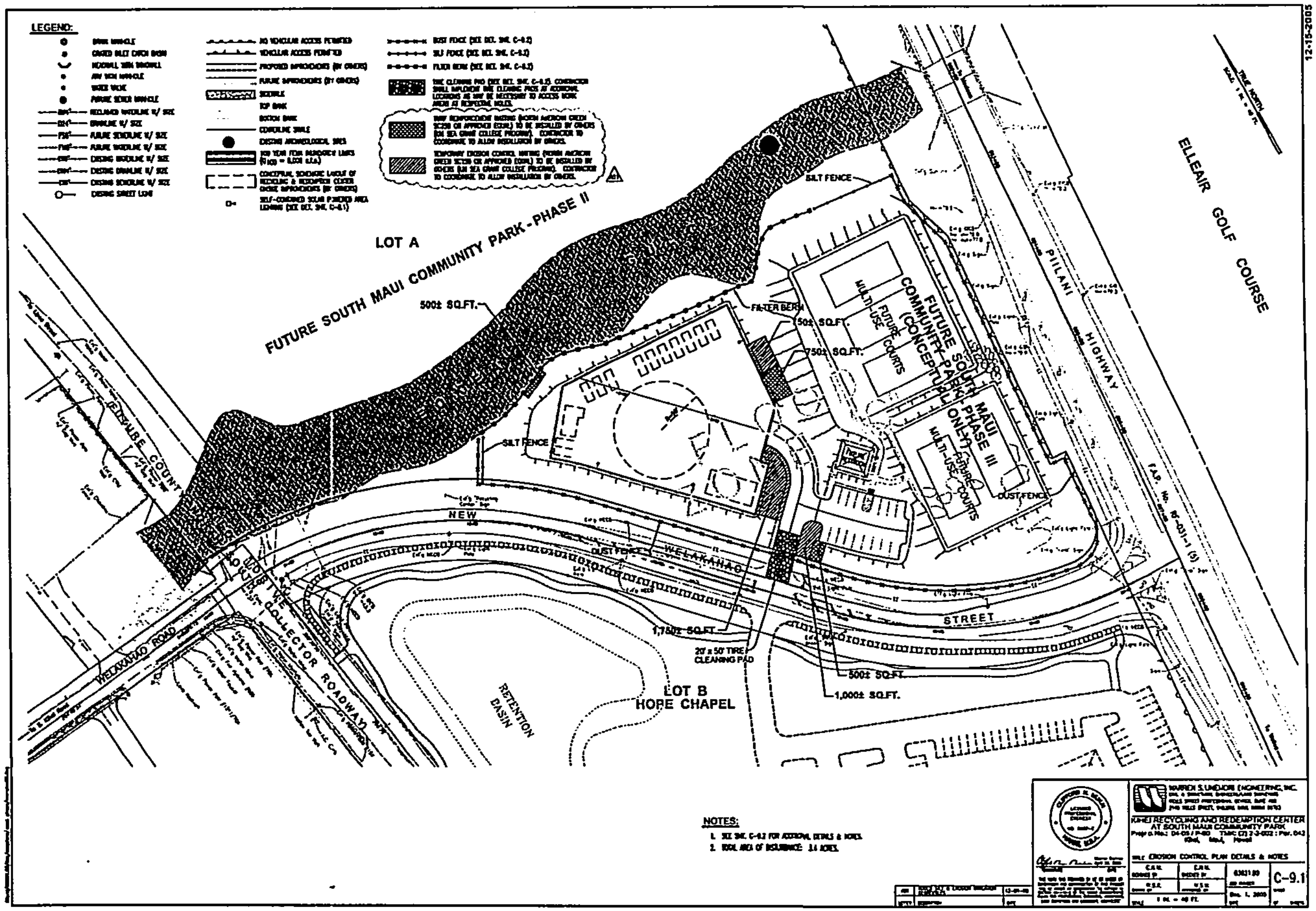
KIHEI RECYCLING AND REDEMPTION CENTER
AT SOUTH MAUI COMMUNITY PARK

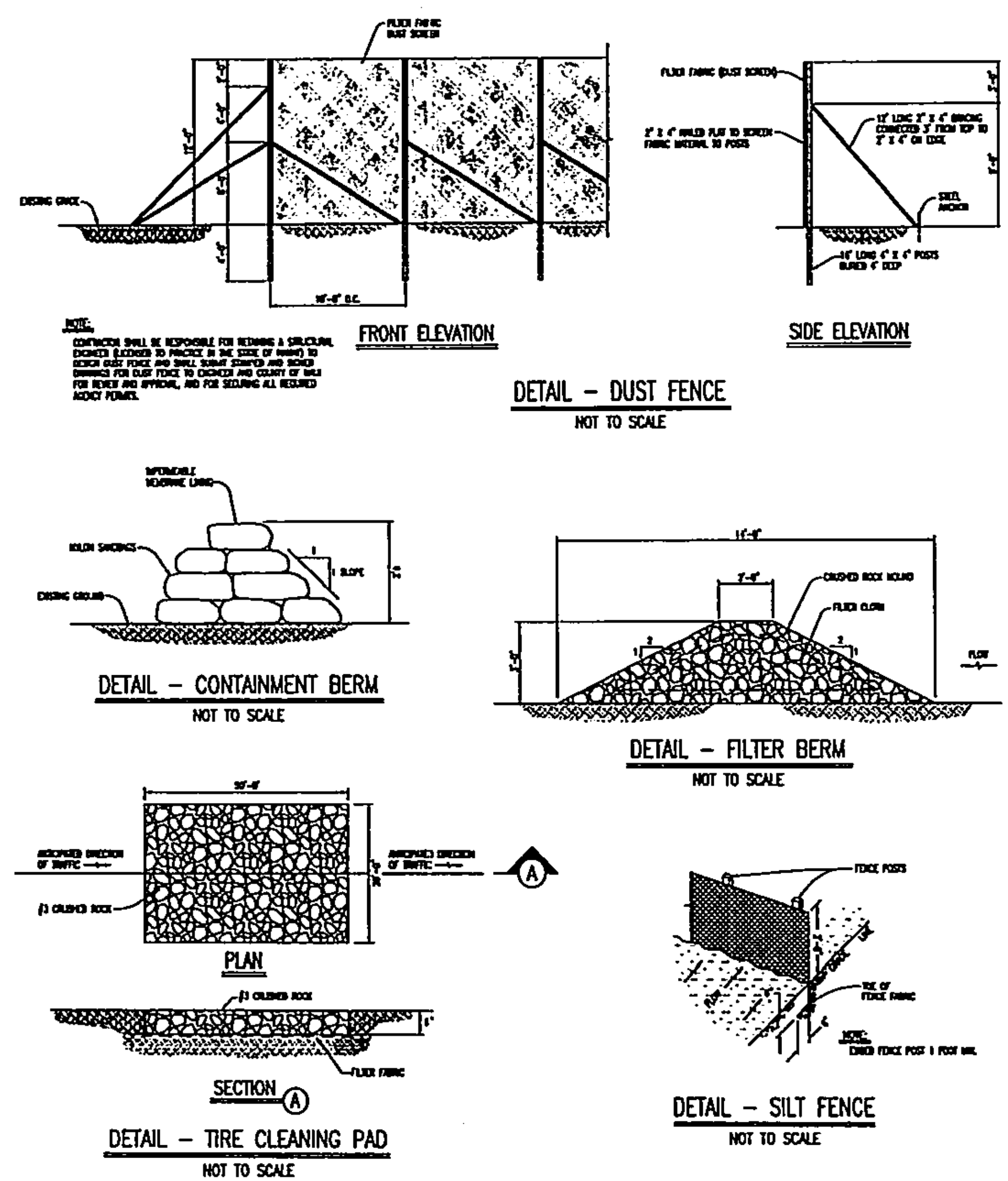
TITLE: MISCELLANEOUS DETAILS

AS NOTED

C-8.3


2-28-2006
ELEVATION
SCALE: 1/2" = 1'-0"
SECTION
SCALE: 1/2" = 1'-0"
DETAIL - CONCRETE JACKET AT INTERIOR JOINTS
SCALE: 1/2" = 1'-0"
DETAIL - ADDITIONAL REINFORCEMENT AT BENDS
SCALE: 1/2" = 1'-0"
REINFORCING BAR & DIMENSION SCHEDULE
DETAIL - REINF. CONC. RECLAIMED WATERLINE JACKET FOR VERTICAL OFFSETS
SCALE: 1/2" = 1'-0"
TYPICAL TRENCH SECTION FOR RECLAIMED WATERLINES
ABOVE 4 FT. ELEVATION
NOT TO SCALE
TYPICAL TRENCH SECTION FOR RECLAIMED WATERLINES
BELOW 4 FT. ELEVATION
NOT TO SCALE
DETAIL - REFLECTOR POST MARKER FOR MARKING HYDRANTS WITHOUT CURBING
DETAIL - ASYMMETRIC REINF. CONC. VERT. OFFSET FOR RECLAIMED WATERLINE
NOT TO SCALE
PLAN
DETAIL - RECLAIMED WATER STANDPIPE ASSEMBLY
NOT TO SCALE
TYPICAL TRENCH SECTIONS FOR RECLAIMED WATERLINES
WARREN S. UNEMORI ENGINEERING, INC.
KIHEI RECYCLING AND REDEMPTION CENTER
AT SOUTH MAUI COMMUNITY PARK
MISCELLANEOUS DETAILS
C-8.4


12-15-2005
LEGEND:
ELLEAIR GOLF COURSE
PIILANI HIGHWAY
LOT A
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE II
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE III (CONCEPTUAL ONLY)
FUTURE MULTI-USE COURTS
FUTURE MULTI-USE COURTS
SILT FENCE
SILT FENCE
DUST FENCE
DUST FENCE
FILTER BERM
500± SQ.FT.
50± SQ.FT.
750± SQ.FT.
1,750± SQ.FT.
500± SQ.FT.
1,000± SQ.FT.
20' x 50' TIRE CLEANING PAD
NEW WELAKAHAO STREET
LOT B
HOPE CHAPEL
RETENTION BASIN
WELAKAHAO ROAD
COLLECTOR ROADWAY
NOTES:
KIHEI RECYCLING AND REDEMPTION CENTER
AT SOUTH MAUI COMMUNITY PARK
EROSION CONTROL PLAN DETAILS & NOTES
1 IN. = 40 FT.
C-9.1



NOTE:
CONTRACTOR SHALL BE RESPONSIBLE FOR RETAINING A STRUCTURAL ENGINEER (LICENSED TO PRACTICE IN THE STATE OF HAWAII) TO DESIGN DUST FENCE AND SHALL SUBMIT STAMPED AND SIGNED DRAWINGS FOR DUST FENCE TO ENGINEER AND COUNTY OF MAUI FOR REVIEW AND APPROVAL, AND FOR SECURING ALL REQUIRED AGENCY PERMITS.

DETAIL – DUST FENCE
NOT TO SCALE

DETAIL – CONTAINMENT BERM
NOT TO SCALE

DETAIL – FILTER BERM
NOT TO SCALE

DETAIL – TIRE CLEANING PAD
NOT TO SCALE

DETAIL – SILT FENCE
NOT TO SCALE

GRADING:

1. THE CONTRACTOR SHALL OBTAIN A "GRADING PERMIT" FROM THE DEVELOPMENT SERVICES ADMINISTRATION (D.S.A.), DEPT. OF PUBLIC WORKS & ENVIRONMENTAL MANAGEMENT (D.P.W.E.M.), FOUR (4) WEEKS PRIOR TO COMMENCEMENT OF ANY CLEARING AND GRUBBING. A SATISFACTORY DUST AND EROSION CONTROL PLAN SHALL BE SUBMITTED BY THE CONTRACTOR FOR APPROVAL PRIOR TO ISSUANCE OF THE GRADING PERMIT.
2. THE CONTRACTOR SHALL REMOVE ALL SILT AND DEBRIS RESULTING FROM HIS WORK AND DEPOSITED IN DRAINAGE FACILITIES, ROADWAYS AND OTHER AREAS. THE COST INCURRED FOR ANY NECESSARY REMEDIAL ACTION BY THE DIRECTOR OF PUBLIC WORKS, CHIEF SANITARIAN (DEPARTMENT OF HEALTH) SHALL BE BORNE BY THE CONTRACTOR.
3. THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL KEEP THE PROJECT AREA AND SURROUNDING AREAS FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION CONTROL STANDARDS AND REGULATIONS OF THE STATE DEPT. OF HEALTH.
4. ALL GRADING OPERATIONS SHALL BE PERFORMED IN CONFORMANCE WITH THE APPLICABLE PROVISIONS OF THE WATER POLLUTION CONTROL AND WATER QUALITY STANDARDS OF PUBLIC HEALTH REGULATIONS, STATE DEPT. OF HEALTH AND THE COUNTY GRADING ORDINANCE.
5. CONSTRUCTION DEBRIS AND WASTES SHALL BE DEPOSITED AT APPROPRIATE SITES. THE DISPOSAL SITE MUST FULFILL THE REQUIREMENTS OF THE GRADING ORDINANCE.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CONSTRUCTION SCHEDULE.
8. IF THE CONTRACTOR IS NOT ABLE TO SATISFACTORILY CONTROL DUST EMISSIONS FROM THE PROJECT SITE, ALL CONSTRUCTION WORK SHALL CEASE EXCEPT FOR WATERING AND OTHER STABILIZATION EFFORTS.
9. PRIOR TO ISSUANCE OF THE GRADING PERMIT, THE CONTRACTOR SHALL MEET WITH THE D.S.A. AND PROVIDE INFORMATION ON THE SOURCE OF WATER FOR DUST CONTROL, AND JUSTIFY THE NUMBER OF WATER TRUCKS TO BE USED FOR THE CLEARING, GRUBBING, AND LOADING OPERATIONS.

THE EARTHWORK QUANTITIES SHOWN ARE IN PLACE VOLUME. THE CONTRACTOR SHALL VERIFY QUANTITIES AND SHALL BE RESPONSIBLE FOR PROVIDING MATERIALS TO COMPLETE GRADING AND EMBANKMENT AS PER THE GRADING PLAN.

APPROXIMATE EARTHWORK QUANTITIES

EXCAVATION:	6,890 C.Y.
EMBANKMENT:	6,670 C.Y.
NET: (EXCAVATION)	220 C.Y.
AREA OF GRASSING:	3.4 ACRES

TEMPORARY EROSION CONTROL MEASURES

1. TEMPORARY GROUND COVER SHALL BE APPLIED WITHIN A PERIOD OF 30 CALENDAR DAYS AFTER THE SITE HAS BEEN GRADED, OR RAISED OF VEGETATION, OR IF FINAL GRADING OF THE SITE WILL BE SUSPENDED FOR MORE THAN 30 CALENDAR DAYS. ALL COST FOR MAINTAINING AND REMOVING TEMPORARY EROSION CONTROL MEASURES WILL BE BORNE BY THE CONTRACTOR.
2. THE CONTRACTOR MAY USE HYDRO-MULCH TO APPLY THE TEMPORARY GROUND COVER.
3. TEMPORARY GROUND COVER SHALL CONSIST OF 2,000 LBS. PER ACRE WOOD CELLULOSE FIBER MULCH AND 65 LBS. PER ACRE TACKIFIER.

TEMPORARY EROSION CONTROL MEASURES

1. THE CONTRACTOR SHALL GRASS ALL EXPOSED AREAS THAT HAVE BEEN CONSTRUCTED TO FINAL GRADES WITHIN A PERIOD OF 30 CALENDAR DAYS. ALL COSTS FOR MAINTAINING AND WATERING PERMANENT EROSION CONTROL MEASURES WILL BE BORNE BY THE CONTRACTOR.
2. THE CONTRACTOR MAY USE HYDRO-MULCH TO APPLY THE PERMANENT GROUND COVER.
3. PERMANENT BERMUDA GROUND COVER SHALL CONSIST OF 75 LBS. PER ACRE, BERMUDA GRASS, 30 LBS. PER ACRE RYE GRASS, 1,000 LBS. PER ACRE GYPSUM BASED BINDER, 2,000 LBS. PER ACRE WOOD CELLULOSE FIBER MULCH, AND 400 LBS. PER ACRE, 16-20-16 FERTILIZER.
4. PERMANENT BERMUDA GROUND ALONG SWALES, DRAINAGEWAYS SHALL CONSIST OF 100 LBS. PER ACRE BERMUDA GRASS, 30 LBS. PER ACRE RYE GRASS, 1,500 LBS. PER ACRE WOOD CELLULOSE FIBER MULCH, 400 LBS. PER ACRE 16-20-16 FERTILIZER, AND PERMANENT EROSION CONTROL / TURF REINFORCEMENT MATTING.

NOTE:
SHOULD HISTORIC SITES SUCH AS WALLS, PLATFORMS, PAVEMENTS AND MOUNDS, OR REMAINS SUCH AS ARTIFACTS, BURIALS, CONCENTRATION OF CHARCOAL OR SHELLS ARE ENCOUNTERED DURING CONSTRUCTION WORK, WORK SHALL CEASE IN THE IMMEDIATE VICINITY OF THE FIND AND THE FIND SHALL BE PROTECTED FROM FURTHER DAMAGE. THE CONTRACTOR SHALL IMMEDIATELY CONTACT THE STATE HISTORIC PRESERVATION DIVISION ([illegible]), WHICH WILL ASSESS THE SIGNIFICANCE OF THE FIND AND RECOMMEND AN APPROPRIATE MITIGATION MEASURE, IF NECESSARY.

IF HUMAN REMAINS ARE ENCOUNTERED DURING CONSTRUCTION, ALL ACTIVITIES IN THE VICINITY OF THE FIND SHALL CEASE AND THE REMAINS SHALL BE PROTECTED FROM FURTHER DAMAGE. THE STATE HISTORIC PRESERVATION DIVISION ([illegible]) SHALL BE NOTIFIED IMMEDIATELY TO ASSESS THE SITUATION AND DETERMINE THE APPROPRIATE MITIGATION MEASURE. CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING THE MITIGATION PLAN.

ALL EARTHWORK SHALL BE DONE IN STRICT ACCORDANCE WITH ALL RECOMMENDATIONS BY SOILS ENGINEER AND SHALL BE DONE UNDER THE OBSERVATION OF SOILS ENGINEER.

BEST MANAGEMENT PRACTICES

1. EROSION AND SEDIMENT CONTROL
   A. CONSTRUCTION MANAGEMENT TECHNIQUES
      A MAXIMUM OF 15 ACRES, SHALL BE ALLOWED TO BE EXPOSED AT ONE TIME. SINCE THE PROPOSED PROJECT IS NOT GREATER THAN THE ALLOWABLE MAXIMUM, PHASING OF THE GRADING WORK WILL NOT BE REQUIRED.
   B. STABILIZATION TECHNIQUES
      EXISTING GROUND COVER WILL NOT BE DESTROYED, REMOVED OR DISTURBED MORE THAN 20 CALENDAR DAYS PRIOR TO THE START OF GRADING OPERATIONS.
      AREAS THAT REMAIN UNFINISHED FOR MORE THAN 21 CALENDAR DAYS SHALL BE HYDROMULCHED TO PROVIDE TEMPORARY SOIL STABILIZATION BY NO LATER THAN THE 14TH DAY AFTER LAST DISTURBANCE.
      AFTER ACHIEVING FINISHED GRADES, ALL SLOPES AND EXPOSED AREAS SHALL BE PERMANENTLY STABILIZED BY HYDROMULCHING WITH GRASS SEED AS SOON AS PRACTICABLE.
   C. STRUCTURAL PRACTICES
      SILT FENCES OR FILTER BERMS SHALL BE CONSTRUCTED ALONG THE ENTIRE DOWNSTREAM SIDE OF THE ACTIVE CONSTRUCTION ZONE IN AREAS WHERE ONSITE RUNOFF FLOWS INTO ADJOINING PROPERTIES.
   D. SCHEDULE FOR IMPLEMENTING CONTROLS
      EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IN PLACE AND FUNCTIONAL BEFORE EARTH MOVING OPERATIONS BEGIN, AND WILL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
2. DUST CONTROLS
   THE CONTRACTOR SHALL KEEP THE PROJECT AREA AND SURROUNDING AREAS FREE FROM DUST NUISANCE. THE FOLLOWING MITIGATIVE MEASURES WILL BE INCORPORATED:
   A. USE TEMPORARY AREA SPRINKLERS IN NON-ACTIVE CONSTRUCTION AREAS WHEN GROUND COVER IS REMOVED.
   B. CONSTRUCT DUST FENCES ALONG PROJECT SITE BOUNDARIES AFFECTED BY PREVAILING WIND DIRECTION.
   C. STATION A WATER TRUCK ON SITE AT ALL TIMES DURING CONSTRUCTION PERIOD TO PROVIDE FOR IMMEDIATE SPRINKLING, AS NEEDED, IN ACTIVE CONSTRUCTION ZONES OR WHENEVER NEEDED ON THE CONSTRUCTION SITE (WEEKENDS AND HOLIDAYS INCLUDED).
   D. GRADED AREAS SHALL BE THOROUGHLY WATERED AFTER CONSTRUCTION ACTIVITIES HAVE CEASED FOR THE DAY AND ON WEEKENDS.
   E. IF THE CONTRACTOR IS NOT ABLE TO SATISFACTORILY CONTROL DUST EMISSIONS FROM THE PROJECT SITE, ALL CONSTRUCTION WORK SHALL CEASE EXCEPT FOR WATERING AND OTHER STABILIZATION EFFORTS.
   F. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RESPONDING TO FUGITIVE DUST AND WATER BORNE SILT COMPLAINTS FROM NEIGHBORING PROPERTIES AND SHALL PROVIDE ADDITIONAL MITIGATION MEASURES AS NECESSARY.
3. OTHER CONTROLS
   A. CONTRACTOR SHALL INSTALL DANDY BEACH BAG OR DANDY BAG (OR APPROVED EQUAL) AT ALL NEW AND EXISTING INLETS AND DISCHARGE POINTS WHICH MAY RECEIVE RUNOFF FROM CONSTRUCTION ACTIVITY.
   B. MAINTENANCE AND FUELING OF CONSTRUCTION EQUIPMENT WILL BE PERFORMED ONLY IN DESIGNATED AREAS ENCLOSED BY A CONTAINMENT BERM CONSTRUCTED SO AS TO CONTAIN SPILLS AND PREVENT STORM WATER RUNOFF FROM CARRYING POLLUTANTS INTO STATE WATERS OR DOWNSTREAM PROPERTIES.
4. INSPECTION AND MAINTENANCE PROCEDURES
   ALL CONTROL MEASURES SHALL BE INSPECTED AND REPAIRED AS NECESSARY BY THE CONTRACTOR. INSPECTIONS SHALL BE PERFORMED AT LEAST WEEKLY IN DRY PERIODS, AND WITHIN 24 HOURS AFTER ANY RAINFALL 0.5 INCHES OR GREATER OVER A 24-HOUR PERIOD. CONTROL MEASURES SHALL BE CHECKED DAILY DURING PERIODS OF PROLONGED RAINFALL. A DAILY LOG CONTAINING A RECORD OF INSPECTIONS AND REPAIRS SHALL BE MAINTAINED AND KEPT ON SITE.

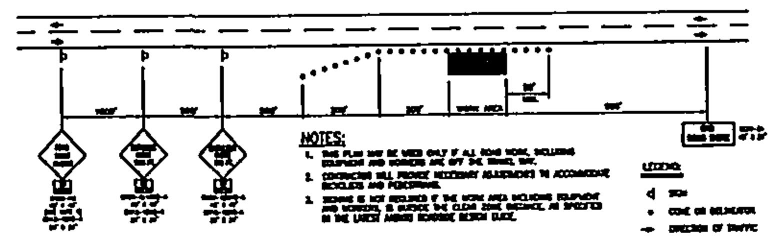
WARREN S. UNEMORI ENGINEERING, INC.

KIPA'I RECYCLING AND REDEMPTION CENTER
AT SOUTH MAUI COMMUNITY PARK
Project No.: 04-08 / P-80 TMK (2) 2-2-002 : Par. 042
Kihei, Maui, Hawaii

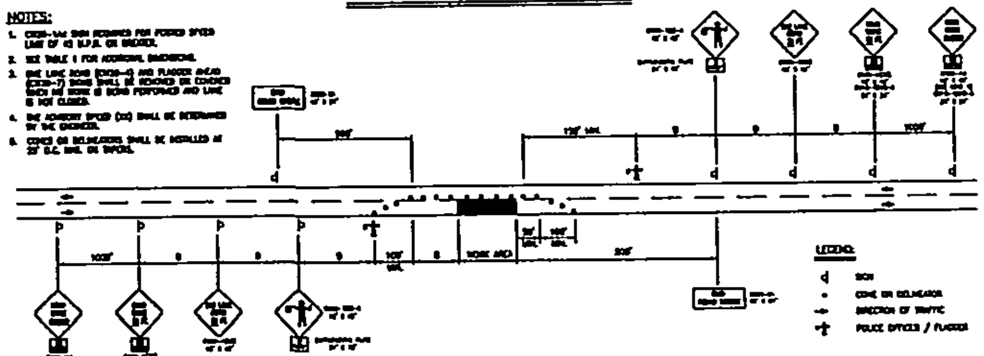
TITLE: EROSION CONTROL PLAN, DETAILS & NOTES

AS NOTED

C-9.2



WORK ON SHOULDER OR ROADSIDE



TWO-LANE HIGHWAY – ONE LANE CLOSED

FIGURE 1 – TRAFFIC CONTROL PLAN

GENERAL NOTES FOR TRAFFIC CONTROL PLAN

[illegible]

TABLE 1 FOR TRAFFIC CONTROL PLAN							
POSTED SPEED LIMIT ① (M.P.H.)	SIGN SPACING (L) (FEET)	TAPER LENGTH (T) (FEET)		LONGITUDINAL BUFFER SPACE (B) (FEET)	SPACING OF CONES OR DELINEATORS (FEET) ③		
		W = 12' OR LESS ②	W = GREATER THAN 12' ②		TAPER	TANGENT	WORK AREA
[illegible]	[illegible]	[illegible]	W x 17	[illegible]	[illegible]	[illegible]	10
[illegible]	[illegible]	[illegible]	W x 17	[illegible]	[illegible]	[illegible]	10
[illegible]	[illegible]	[illegible]	W x [illegible]	[illegible]	[illegible]	[illegible]	10
[illegible]	[illegible]	[illegible]	W x [illegible]	120	[illegible]	[illegible]	10
[illegible]	[illegible]	[illegible]	W x [illegible]	170	[illegible]	[illegible]	10
[illegible]	[illegible]	[illegible]	W x [illegible]	220	[illegible]	[illegible]	10
[illegible]	[illegible]	[illegible]	W x [illegible]	[illegible]	[illegible]	[illegible]	10
[illegible]	[illegible]	[illegible]	W x [illegible]	335	[illegible]	[illegible]	10

NOTE:

[illegible]

TYPICAL TRAFFIC CONTROL PLAN WITHIN COUNTY RIGHT-OF-WAY

NOT TO SCALE

WARREN S. UNEMORI ENGINEERING, INC.

KIHEI RECYCLING AND REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK

Project No.: 04-08 / P-80 TMK: (2) 2-2-002 : Por. 042

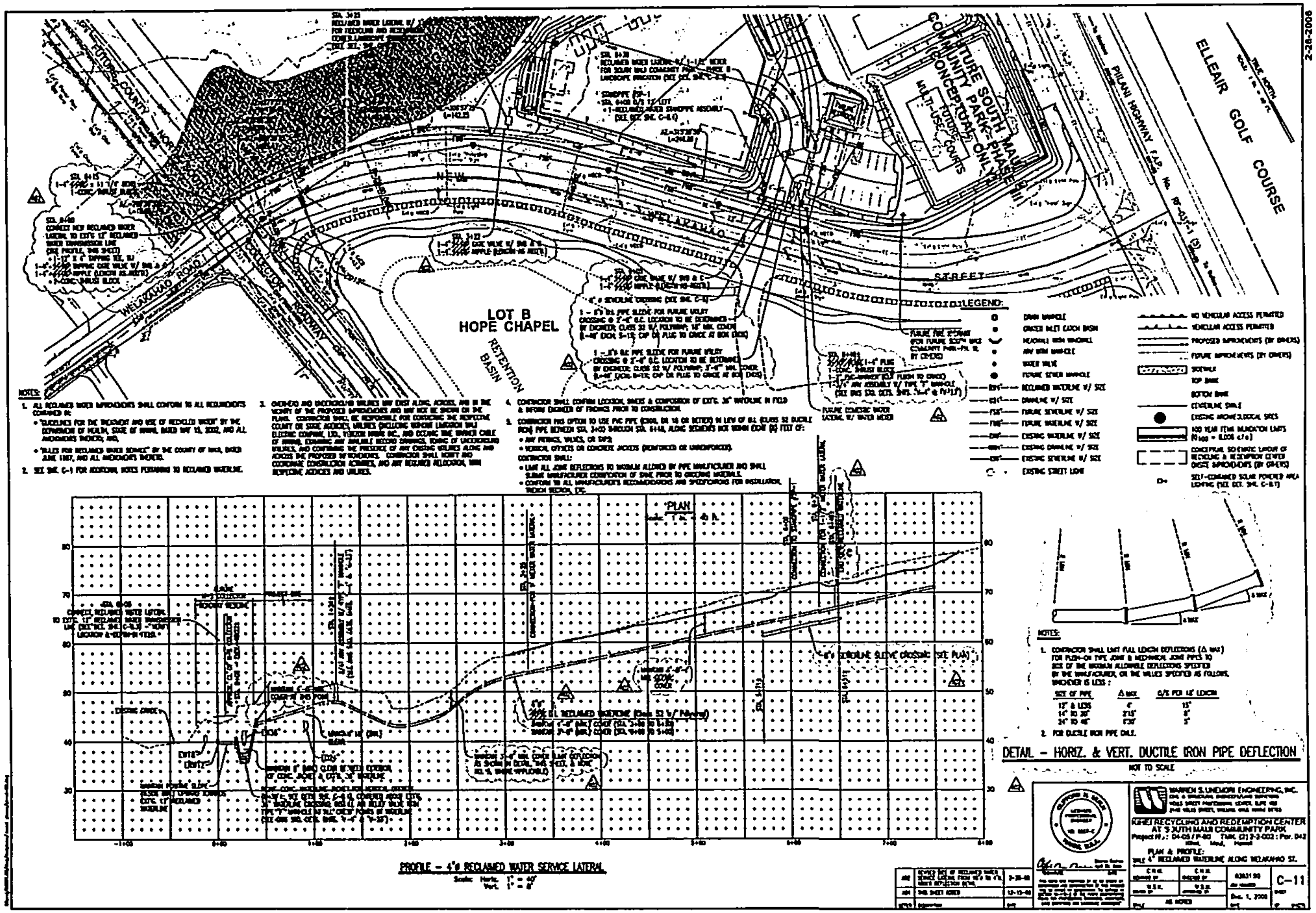
Kihei, Maui, Hawaii

TITLE: TRAFFIC CONTROL PLAN

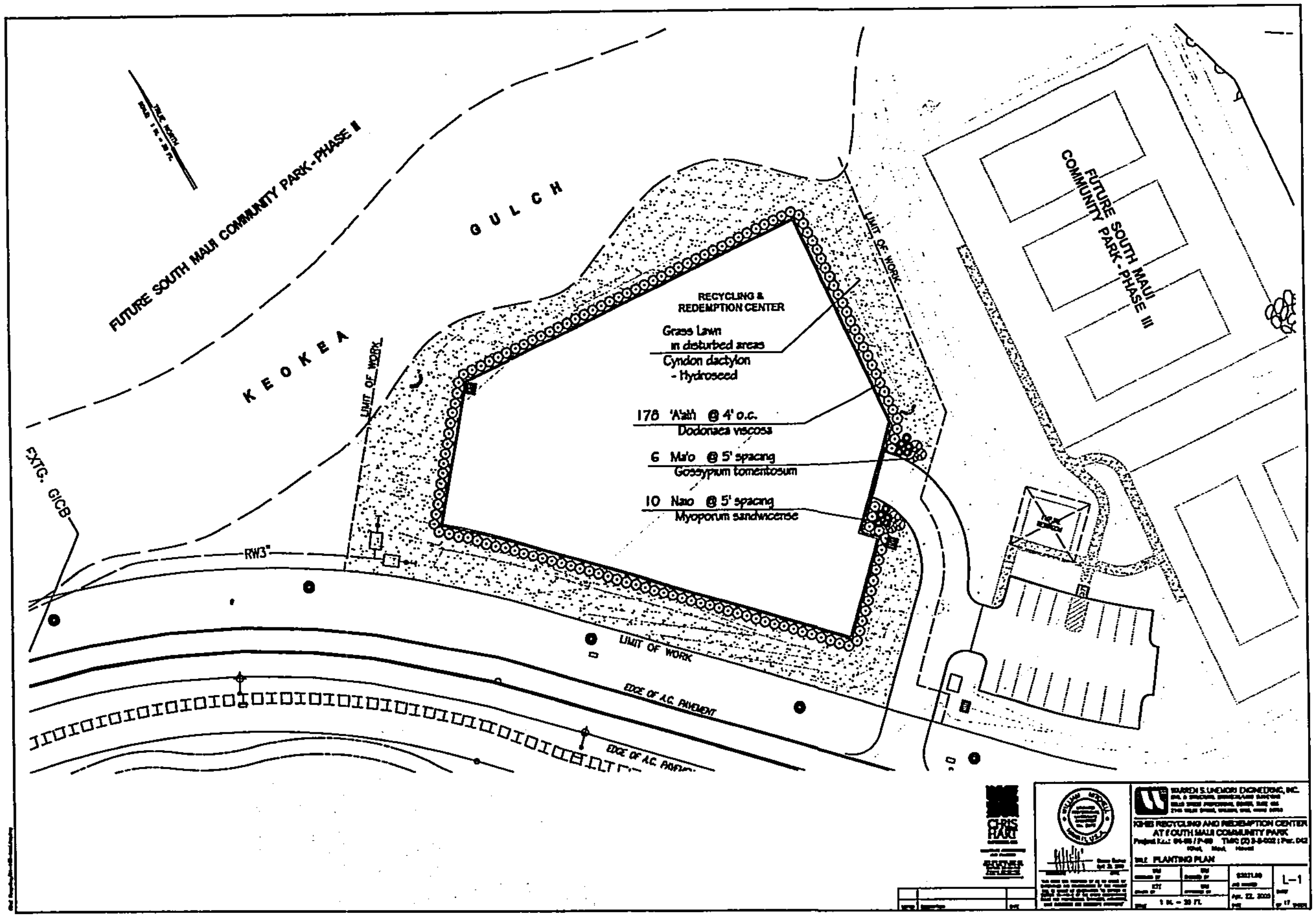
SCALE: AS NOTED

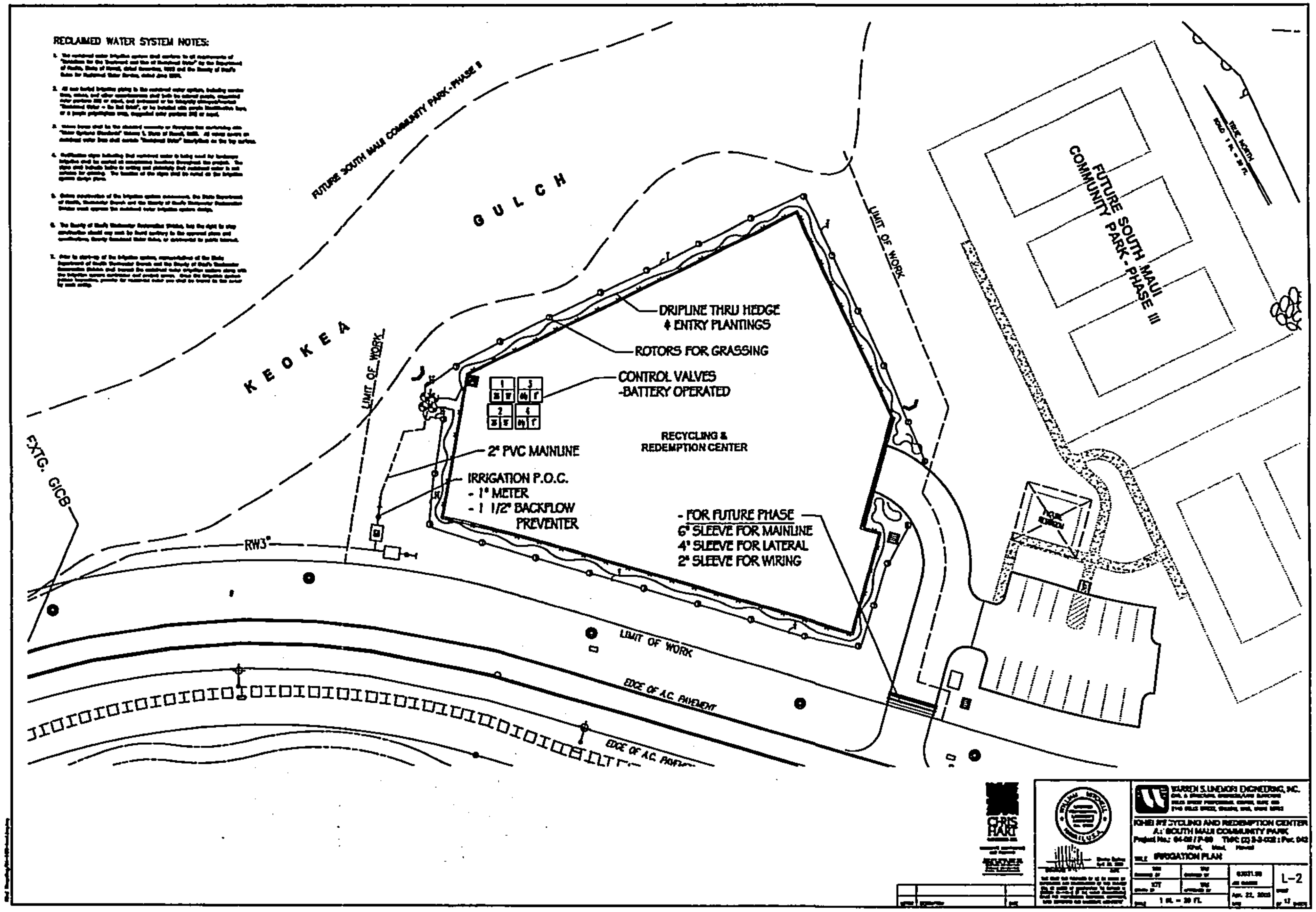
C-10

12-13-2005

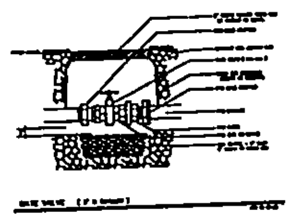


2-28-2006
ELLEAIR GOLF COURSE
PIILANI HIGHWAY
FUTURE SOUTH MAUI COMMUNITY PARK-PHASE III (CONCEPTUAL ONLY)
FUTURE MULTI-USE COURTS
STREET
LOT B
HOPE CHAPEL
RETENTION BASIN
WELAKAHAO ROAD
FUTURE COUNTY
LEGEND:
PLAN
DETAIL - HORIZ. & VERT. DUCTILE IRON PIPE DEFLECTION
NOT TO SCALE
PROFILE - 4"Ø RECLAIMED WATER SERVICE LATERAL
KIHEI RECYCLING AND REDEMPTION CENTER
AT SOUTH MAUI COMMUNITY PARK
C-11

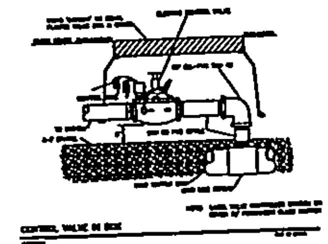

FUTURE SOUTH MAUI COMMUNITY PARK - PHASE III
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE II
KEOKEA GULCH
LIMIT OF WORK
RECYCLING & REDEMPTION CENTER
Grass Lawn in disturbed areas
Cyndon dactylon - Hydroseed
178 'A'ali'i @ 4' o.c.
Dodonaea viscosa
6 Ma'o @ 5' spacing
Gossypium tomentosum
10 Naio @ 5' spacing
Myoporum sandwicense
EDGE OF A.C. PAVEMENT
EXTG. GICB
RW3"
KIHEI RECYCLING AND REDEMPTION CENTER
AT SOUTH MAUI COMMUNITY PARK
PLANTING PLAN
1 IN. = 20 FT.
L-1



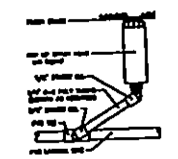
RECLAIMED WATER SYSTEM NOTES:
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE II
KEOKEA GULCH
LIMIT OF WORK
FUTURE SOUTH MAUI COMMUNITY PARK - PHASE III
TRUE NORTH
DRIPLINE THRU HEDGE
& ENTRY PLANTINGS
ROTORS FOR GRASSING
CONTROL VALVES
-BATTERY OPERATED
RECYCLING &
REDEMPTION CENTER
2" PVC MAINLINE
IRRIGATION P.O.C.
- 1" METER
- 1 1/2" BACKFLOW
PREVENTER
- FOR FUTURE PHASE
6" SLEEVE FOR MAINLINE
4" SLEEVE FOR LATERAL
2" SLEEVE FOR WIRING
EXTG. GICB
RW3"
LIMIT OF WORK
EDGE OF A.C. PAVEMENT
EDGE OF A.C. PAVEMENT
CHRIS HART
IRRIGATION PLAN
L-2



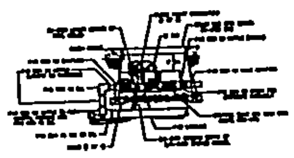
GATE VALVE



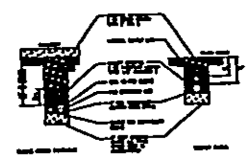
CONTROL VALVE IN BOX



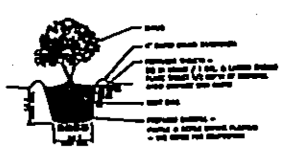
POP-UP SPRAY HEAD



IRRIGATION CONTROL ZONE KIT



PIPE SLEEVE & TRENCH DETAIL



SHRUB PLANTING DETAIL

RECLAIMED WATER SYSTEM NOTES:

PLANT LEGEND:

IRRIGATION LEGEND:

GENERAL NOTES:

PLANTING & IRRIGATION DETAILS, NOTES & LEGENDS

CHRIS HART

WARREN S. UNEMORI ENGINEERING, INC.

KIHEI RECYCLING AND REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK

Kihei, Maui, Hawaii

LANDSCAPE DETAIL SHEET

N/A

Apr. 22, 2005

L-3

Appendix H
Agency Comments and Letters of Response

Index of Agency Comment Letters

FROM : FAX NO. :8082701775 Nov. 30 2006 08:26AM P1

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 223
FORT SHAFTER, HAWAII 96858-5440

RECEIVED
NOV 30 2006
CC: Jason
02/120

'06 NOV 29 P12:01

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

REPLY TO ATTENTION OF: CEPOH-EC-T

November 28, 2006

Civil Works Technical Branch

Ms. Colleen Suyama, Staff Planner
County of Maui
Department of Planning
250 South High Street
Wailuku, Maui, Hawaii 96793

Dear Ms. Suyama:

Thank you for the opportunity to review and comment on the Special Management Area Application and Draft Environmental Assessment (DEA) for the South Maui Community Park Project, Kihei, Maui (Tax Map Key 2-2-2: 42). The flood hazard information provided on Page 20 of the DEA is correct.

The documents have been forwarded to our Regulatory Branch to determine Department of the Army permit requirements. They will respond to your office under separate cover. Should you require additional information, please call Ms. Jessie Dobinchick of my staff at 438-8876.

Sincerely,

James Pennaz

James Pennaz, P.E.
Chief, Civil Works Technical Branch

CHRIS HART
& PARTNERS, INC.

February 22, 2007

Mr. James Pennaz, P.E.
U.S. Army Engineer District, Honolulu
Building 223
Fort Shafter, HI 96858-5440

Dear Mr. Pennaz:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your November 28, 2006 letter, confirming that the flood hazard information provided on Page 20 of the DEA/SMA is correct.

We note from your letter that the DEA/SMA documents have been forwarded to the Department of Army (DOA) Regulatory Branch to determine DOA permit requirements, and we look forward to their response.

Thank you for your consideration of this application. Should you have any further questions, please contact me, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

FROM :   FAX NO. :8082701775   Jan. 04 2007 03:09PM P13

DOCUMENTS CAPTURED AS RECEIVED

1742

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
210 Imi Kala St. Ste 209
Wailuku, HI 96793
808-244-3100

'06 DEC 14 P3:40

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

December 12, 2006

Ms. Colleen Suyama
Planning Department
County of Maui
250 S. High St.
Wailuku, HI 96793

Dear Ms. Suyama:

Subject: South Maui Community Park; TMK: 2-2-002: 042

We have no comment in this matter.

Thank you for the opportunity to comment.

Sincerely,

Ranae Ganske-Cerizo
District Conservationist

CHRIS
HART
& PARTNERS, INC.

February 22, 2007

Ms. Ranae Ganske-Cerizo, District Conservationist
Natural Resources Conservation Service
210 Imi Kala Street, Suite 209
Wailuku, HI 96793

Dear Ms. Ganske-Cerizo:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your December 12, 2006 letter, which states that NRCS does not have any comments to offer on the proposed South Maui Community Park project at this time.

Thank you for your consideration of this application. Should you have any further questions, please contact me, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

DOCUMENTS CAPTURED AS RECEIVED

FROM : FAX NO. :8082701775 Jan. 04 2007 03:07PM P8

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M. D.
DIRECTOR OF HEALTH

LORRIN W. PANG, M. D., M. P. H.
DISTRICT HEALTH OFFICER

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2102

'06 DEC 20 A10:04

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

December 19, 2006

Mr. Michael W. Foley
Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawai'i 96793

Attention: Colleen Suyama

Dear Mr. Foley:

Subject: **South Maui Community Park**
TMK: (2) 2-2-002: 042
SM1 2006/0028

Thank you for the opportunity to comment on the South Maui Community Park. The following comments are offered:

1. National Pollutant Discharge Elimination System (NPDES) permit coverage is required for this project. The Clean Water Branch should be contacted at 808 586-4309.

2. The noise created during the construction phase of the project may exceed the maximum allowable levels as set forth in Hawaii Administrative Rules (HAR), Chapter 11-46, "Community Noise Control". A noise permit may be required and should be obtained before the commencement of work.

It is strongly recommended that the Standard Comments found at the Department's website: www.state.hi.us/health/environmental/env-planning/landuse/landuse.html be reviewed, and any comments specifically applicable to this project should be adhered to.

Should you have any questions, please call me at 808 984-8230.

Sincerely,

Herbert S. Matsubayashi
District Environmental Health Program Chief

CHRIS HART & PARTNERS, INC.

February 22, 2007

Mr. Herbert S. Matsubayashi
District Environmental Health Program Chief
State of Hawaii
Maui District Health Office
54 High Street
Wailuku, Hawaii 96793

Dear Mr. Matsubayashi:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your December 19, 2006 letter. We are pleased to address your comments as follows:

1. **National Pollutant Discharge Elimination System (NPDES) Permit.** The applicant is aware that a NPDES permit is required for this project. The Clean Water Branch will be contacted regarding the NPDES coverage.

2. **Noise.** Activities associated with the construction phase of the project will comply with the Department of Health's Administrative Rules, Chapter 11-46, "Community Noise Control." We note that a noise permit may be required prior to commencement of work.

LANDSCAPE ARCHITECTURE AND PLANNING
1955 MAIN STREET, SUITE 200 • WAILUKU, MAUI, HAWAII 96793-1706 • PHONE: 808-242-1955 • FAX: 808-242-1956

3. **Department of Health Standard Comments.** Standard comments found at the Department of Health website have been reviewed and made available to the applicant and project team. Development activities will adhere to any comments specifically applicable to the proposed project.

Thank you for your consideration of this application. Should you have any questions, please contact myself, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner.

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
DEPUTY DIRECTOR

DEAN NAKANO
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 26, 2006

'06 DEC 28 P2:16
DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

County of Maui
Department Planning
250 High Street
Wailuku, Hawaii 96793

Attention: Colleen M. Suyama

Gentlemen:

Subject: South Maui Community Park, Kihei, Maui, Tax Map Key: (2) 2-2-2:42

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to the DLNR Divisions for their review and comment:

Engineering Division
Division of Forestry & Wildlife
Division of State Parks
Division of Water Resource Management

Based on the attached responses, the Department of Land and Natural Resources has no comment to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

Russell Y. Tsuji
Administrator

Cc: Central Files

CHRIS HART
& PARTNERS, INC.

February 22, 2007

Mr. Russell Tsuji, Administrator
State of Hawaii
Department of Land and Natural Resources
Land Division
Building 223
Fort Shafter, HI 96858-5440

Dear Mr. Tsuji:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your December 26, 2006 letter, which states that the Department of Land and Natural Resources (DLNR) has no comment to offer on the proposed project.

Thank you for your consideration of this application. Should you have any further questions, please contact me, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

LANDSCAPE ARCHITECTURE AND PLANNING
1955 MAIN STREET, SUITE 200 • WAILUKU, MAUI, HAWAII 96793-1706 • PHONE: 808-242-1955 • FAX: 808-242-1956

LINDA LINGLE
GOVERNOR

RODNEY K. HARAGA
DIRECTOR

Deputy Directors
FRANCIS PAUL KEENO
BARRY FUKUNAGA
BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

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

IN REPLY REFER TO:
STP 8.2370

'07 JAN -4 P1:39
DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

RECEIVED
JAN 05 2007
CHRIS HART & PARTNERS
Landscape Architecture

cc: Mike + Jason
02/120

January 2, 2007

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

Dear Mr. Foley:

Subject: South Maui Community Park
Special Management Area Permit (SM1 20060028) and
Project District Phase 2 Approval with Draft Environment Assessment (DEA)
TMK: (2) 2-2-002: 042

We have the following comments on the subject proposed park:

1. The build out of the park, coupled with the adjoining redemption/recycling center site, will have an impact on our highway facilities (Piilani Highway). Serious consideration for times and events when all of the park and center facilities are in use should be given when planning for necessary road, traffic and intersection improvements, including providing for adequate on-site parking to handle the high use.

2. In our earlier letter (STP 8.1904) dated September 29, 2005 regarding the redemption/recycling center, we indicated a concern to your department about the traffic in the area. The addition of the subject park, which is intended to serve a major portion of Kihei, does add to these concerns.

3. We recommend that the respective County departments discuss and coordinate the incremental/phased build out of the park complex and recycling center and implementation of local road improvements with our Highways Division, through the Highways Maui District Office. The Highways Planning Branch should also be notified so that they too can participate in such discussions or meetings.

This will ensure that necessary improvements for the highway and on the county road legs, such as but not limited to those indicated in the TIAR for the subject park (at the intersections with Piilani Highway, particularly from Lipoa Street and Welakahao Road) and other related infrastructure elements, will be coordinated.

We appreciate the opportunity to provide our comments.

Very truly yours,

Francis Paul Keeno

for RODNEY K. HARAGA
Director of Transportation

CHRIS HART & PARTNERS, INC.

February 22, 2007

Mr. Rodney K. Haraga
Director of Transportation
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Haraga:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your letter dated January 2, 2007, regarding the above-referenced project. We are pleased to address your comments as follows:

1. We understand from your letter that the build out of the project will have an impact on the highway facilities of Piilani Highway. Serious consideration will be given for times and events when all park and center facilities are in use when planning for necessary road, traffic and intersection improvements, including providing for adequate on-site parking to handle the high use.

2. We acknowledge that you have stated your concern about traffic in the area in your previous letter, dated September 29, 2005, regarding the redemption/recycling center. We understand from your January 2, 2007 letter that the addition of the subject park adds to these concerns. A copy of the September 29, 2005 letter and the traffic engineer's responses are attached.

3. The Applicant will continue to discuss and coordinate the incremental/phased build-out of the project with the Highways Division, Maui Office and the Highways Planning Branch.

LANDSCAPE ARCHITECTURE AND PLANNING
1955 MAIN STREET, SUITE 200 • WAILUKU, MAUI, HAWAII 96793-1706 • PHONE: 808-242-1955 • FAX: 808-242-1956

Thank you for your consideration of the application. Should you have any questions, please contact myself, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

Date: October 10, 2005

MEMORANDUM:

TO: Applicant/Consultant Alan (Fax: 244-4856)
FROM: Planner Colleen Suyama, Maui Planning Department

SUBJECT: Kihei Redemption and Recycling Center

Transmitted herewith for your information are the agency communications for the above referenced application(s).

☐ No comments or concerns.

☒ Agencies have comments or concerns which shall be addressed before we continue processing of the application(s). Please communicate directly with the agencies and copy all communications to this office. Application(s) will be held in abeyance pending resolution of the comments or concerns.
Department of Transportation Comments dated September 29, 2005

Thank you for your cooperation. If additional clarification is required, please contact me at 270-7735.

enclosures
cc: Project File
(K:\WP_DOCS\PLANNING\PH2\2005\0008_KiheiRecycling\AddressDOTComments.wpd)

EXHIBIT "4"

DOCUMENTS CAPTURED AS RECEIVED

Oct-10-05 11:22am From-DEPT OF PLANNING COUNTY OF MAUI 808-242819 T-906 P.02/05 F-492

LINDA LINGLE
GOVERNOR

RODNEY K. HARAGA
DIRECTOR

Deputy Directors
BRUCE Y. MATSUI
BARRY FUKUNAGA
BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

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

IN REPLY REFER TO:
STP 8.1904

September 29, 2005

'05 OCT -7 P2:51
DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

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

Dear Mr. Foley:

Subject: Kihei Recycling and Redemption Center at South Maui Community Park
Special Management Area Use Permit (SM1 20050020)
Project District Application & Amendment (PH2 2005/0006)

Thank for the opportunity to review the subject applications for a new location of the present recycling and redemption facility. We have the following comments:

1. We are supportive of the County's recycling efforts and need to relocate to the proposed site.

2. We have concerns, however, related to: (a) the distance between Piilani Highway and the project's proposed driveway and intersection, (b) the cumulative impact from all the uses in and around this area on Welakahao Road and its connection to Piilani Highway, and (c) the potential impact of installing traffic signals near the intersection of the project and Welakahao Road and at the Welakahao Road/Piilani Highway intersection:

   (1) With the plans for the proposed recycling center and the future South Maui Community Park showing a connection to Welakahao Road, earlier concerns and suggested conditions (see attached letter dated October 21, 2002 pertaining to the Kihei Hope Chapel development) regarding impact on Welakahao Road and Piilani Highway remain valid and are applicable to the recycling center. These concerns need to be addressed and resolved.

   (2) The traffic report and plans for the subject project reflect needed roadway improvements such as storage, deceleration, and acceleration lanes at the project's driveway and intersection with Welakahao Road. Nevertheless, the cumulative impact from all uses in the project and surrounding areas (including the park and the church) upon the

Welakahao Road/Piilani Highway intersection must be assessed in greater detail, particularly because of the Welakahao Road/Piilani Highway intersection is in such close proximity to the project intersection with Welakahao Road.

(3) Also, the impact of installing traffic signals at the project/Welakahao Road intersection and at the Welakahao Road/Piilani Highway intersection need to be analyzed.

We agree with the traffic report that traffic measures and roadway improvements should be sized and configured to accommodate the projected future growth around the subject intersections. This is to provide sufficient capacity to avoid frequent or multiple reconstructions or revisions of recently completed roadway improvements.

Therefore, while we have no objection to the proposed road and traffic improvements identified in the traffic report and project plans, we recommend that the County also consider, review and/or impose conditions to address the following:

a. Total cumulative impacts to Welakahao Road from the recycling center, the park and the church along with the projected traffic from the surrounding community using Welakahao Road;

b. The potential impact of signalizing the project/Welakahao Road and Welakahao Road/Piilani Highway intersections; and

c. County participation, based on the park and recycling center, in the costs for necessary roadway and intersection improvements.

Our primary intent is to ensure that the roadway and intersection improvements, particularly the intersections leading from the recycling center to Piilani Highway are sufficient to accommodate the anticipated project impact. Our intent is also to ensure that such improvements are sufficiently sized and configured to allow additional improvements to be made, as needed to address the impacts to Piilani Highway.

We appreciate the opportunity to provide comments.

Very truly yours,

Rodney Haraga

RODNEY K. HARAGA
Director of Transportation

Attach.

STP 8.0496

October 21, 2002

Mr. John E. Min
Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Min:

Subject: Kihei Hope Chapel
Applications for Special Management Area Use Permit (SM1 2002/0008)
Project District Phase II Approval (PH2 2002/0002, and
Special Use Permit (CUP 2002/0003)
TMK: 2-2-002: 072

This letter is a follow-up to our August 1, 2002, letter (STP 8.0407) on the subject project based on additional information received from the applicant and on discussions with the developer's traffic consultant, Julian Ng on October 18, 2002. The following are our revised comments:

1. In their October 18, 2002, letter (attached) to our department, the developer clarified that the church and ancillary facilities will not generate significant amounts of peak hour traffic volumes on weekdays.

   Based on this additional information, our concerns over weekday project generated traffic impacts have been addressed. However, should traffic congestion result from a deviation in the operations as proposed, the applicant should be required to provide measures to mitigate project generated traffic as determined by our Highways District Engineers.

2. The developer should be required to prepare and submit an updated TIAR to the DOT for review and approval prior to proceeding with Phase 2 of the development. This updated TIAR will identify project generated traffic impacts and measures needed to mitigate project-generated impacts.

3. We are concerned with the potential traffic impact of the project on Piilani Highway and at the intersection of Piilani Highway and Welakahao Road due to the high volume of project-generated vehicles projected to enter and exist the site prior to and following Sunday services.

The developer should be required to monitoring traffic operations at the Piilani Highway/Welakahao Road intersection two months after opening of the facility or upon the request of the Maui District Engineer. The developer should also be required to work with DOT to mitigate any project-generated impacts at this intersection that may be found as a result of this monitoring effort. Mitigation measures may include, but not be limited to, off-duty police officers directing traffic and/or the installation of a traffic signal.

4. The developer should be required to pay their fair share of regional transportation improvements.

We appreciate the opportunity to provide comments.

Very truly yours,

for BRIAN K. MINAAI
Director of Transportation

Unemori, Alan L.

From:	Mukai, Clifford N.
Sent:	Monday, October 10, 2005 1:56 PM
To:	Phillip Rowell (E-mail)
Cc:	Milton Arakawa (E-mail); Irene Cordell (E-mail); Colleen Suyama (E-mail); Unemori, Alan L.
Subject:	KIHEI RECYCLING & REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK: Immediate respone needed for SDOT comments.
Importance:	High
Attachments:	2005-10-10 (Letter from Planning & SDOT).pdf

Project: KIHEI RECYCLING & REDEMPTION CENTER AT SOUTH MAUI COMMUNITY PARK
Job No.: 03031.00

To: PHILLIIP ROWELL
From: CLIFFORD MUKAI

Date: OCTOBER 10, 2005

Phillip,

Alan Unemori just received additional agency review comments from Department of Planning that requires an immediate response from you directly to the generating agency [on behalf of applicant, which is the Solid Waste Division, with cc's to Department of Planning (Attention: Colleen Suyama), Solid Waste Division (Attention: Irene Cordell), and WSUE (Attention: Alan Unemori)], as indicated on the attached cover letter from the Department of Planning (see attached PDF file).

The SMA Hearing has been scheduled for Monday, October 24, 2005, at 7:00 pm. Please provide a draft response by Wednesday, October 12, 2005 (email a PDF file to our office so we can circulate to the County for review and comments). Final response can be issued on Friday, October 14, 2005.

Also, please ensure that you have completed the TIAR for South Maui Community Park prior to the SMA for the Kihei Recycling and Redemption Center. Thank you in advance for your prompt attention on this matter. Please do not hesitate to contact Alan Unemori or myself if you have any questions or comments.

Thanks!
Clifford Mukai
Warren S. Unemori Engineering, Inc.

2005-10-10 (Letter from Planni...

WARREN S. UNEMORI ENGINEERING, INC.
Civil & Structural Engineers / Land Surveyors

Wells Street Professional Center
2145 Wells Street, Suite 403
Wailuku, Maui, Hawaii 96793

Office: (808) 242-4403

EXHIBIT "B"

Responses to Comments from SDOT dated September 29, 2005

I have completed the traffic projections for the South Maui Park TIAR. These projections include traffic generated by 24 proposed projects between Pikea Avenue and Keonekai Road, including extension of Liloa Street (aka North-South Collector Road) from Halekuai Street to Auhana Road. A listing of these projects and the 2020 traffic projections are attached. As shown, the peak hour left turns from eastbound Welakahao Road to northbound Piilani Highway is less than 90 vehicles per hour. Using a maximum cycle length of 180 seconds, the average number of vehicles queue along Welakahao is 4.5 vehicles, or approximately 115 feet. The 95th percentile queue is 9 vehicles (225 feet). The scaled distance along Welakahao Road from the project entrance to the stop line at Piilani Highway is 350 feet. Therefore, it appears that there is sufficient storage length for the worse case condition. The 180 second cycle length is the maximum anticipated. The actual cycle length will most likely be less, with a correspondingly shorter queue.

I recommended separate left turn lanes for left turns from Welakahao Road into the project and the church parking lot. However, I did not recommend deceleration and acceleration lanes for right turns into and out of the project. The proposed alignment of Welakahao Road is such that the posted speed limit should not be more that 25 miles per hour. Deceleration and acceleration lanes will not be necessary because of the low speed of vehicles along this section of Welakahao Road.

Traffic signals were not recommended for the intersection of Welkahao Road at the project entrance.

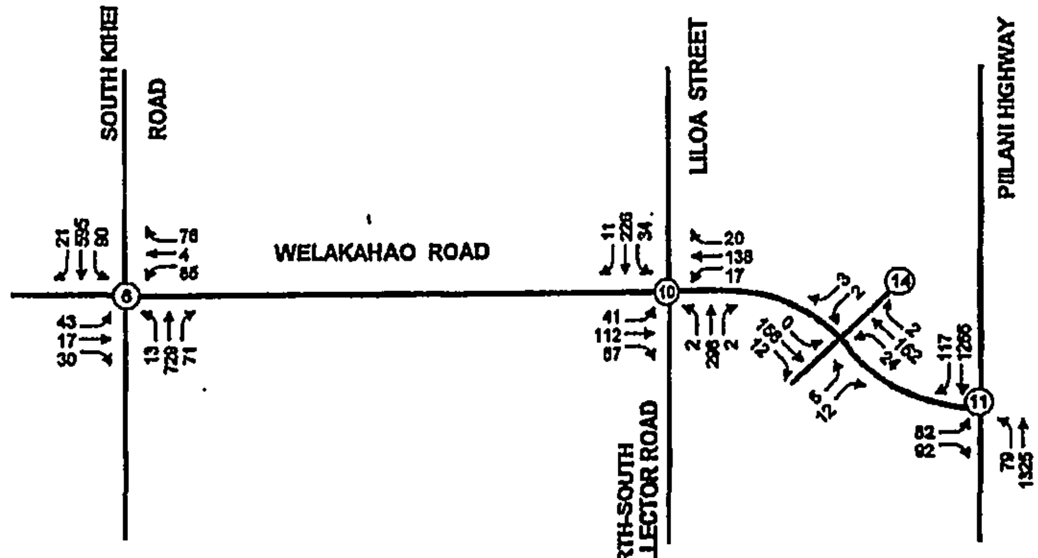
Lastly, we are assessing alternative for the intersection of Welakahao Road at Liloa Street (aka North-South Collector Road) for 2020 cumulative conditions as part of the South Maui Community Park TIAR. The assessment includes all-way stop sign control as well as a traffic signal warrant analysis. The draft report with recommendations will be completed in approximately 10 days.

Given the above, it should be understood that the recycling center is a very small generator in the area. The traffic impacts of relocating the recycling center from the current location along the south side of Welakahao Road to the proposed location along the north side of the road means that the impacts are localized to the section of Welakahao between the two driveway locations. The impacts of the South Maui Community Park are more widespread and will address the concerns raised in SDOT's letter in more detail.

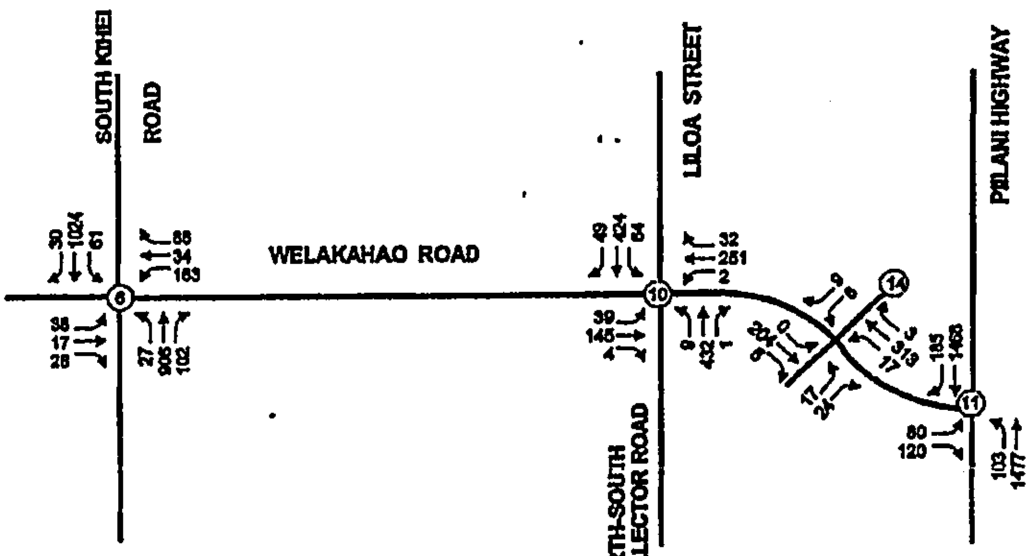
EXHIBIT "C"

Table 5 Trip Generation Summary of Related Projects

	Related Project	Description	AM Peak Hour Total	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out
A	Keala Village	49 Single Family Units	38	10	48	50	32	82
B	Cove Beach Condos	32 Multi-Family Units	21	5	26	27	15	42
C	Ke Alii Villas	160 Multi-Family Units	98	26	124	108	60	168
D	Kalama Heights	40 Senior Units	23	12	35	27	15	42
E	Hale Kanani	72 Multi-Family Units	48	12	60	60	34	94
F	Kamaole Hotel	280 Hotel Rooms	115	72	187	143	72	215
G	Kamaole Condos	65 Condo Units	29	5	34	35	23	58
H	Ke Alii Single Family	90 SF Units + 45 Ohana	89	21	110	116	75	191
I	Aloha Village	76 MF Units	34	6	40	42	27	69
J	Liloa Village	65 SF Units + 65 Ohana	19	64	83	68	38	106
K	Azeka Retail	Retail & Offices	145	75	220	190	356	546
L	Aina Development	Retail	47	51	98	40	32	72
M	Kai Ani Village	100 Condos + 10,000 SF Retail	24	54	78	49	30	79
N	Paradise Ridge	32 MF Units	3	11	14	11	6	17
O	Maui Dive Lodge	18 Apartments	3	7	10	7	5	12
P	Kamaole Homesteads	7 SF + 7 Ohana	2	7	9	7	4	11
Q	Kihei Farms 2 Subdivision	12 SF + 12 Ohana	3	12	15	13	6	19
R	Kihei Recycling Center	Relocate Recycling Center	5	5	10	31	31	62
S	Kihei Hope Chapel	Church & Classrooms	30	0	30	0	30	30
T	Not Used		0	0	0	0	0	0
U	Kihei Hanalei Condos	4 Condos	1	1	2	1	1	2
V	Hale Mahaolu	113 Sr Housing Units	4	5	9	8	5	13
W	Not Used		0	0	0	0	0	0
X	Kalama Hills	12 SF + 12 Ohan	3	11	14	12	6	18
Y	Kamaole Apartment & Hotel Condominiums	98 Condos + 32 Timeshares	26	48	74	50	37	87
Z	North-South Collector Rd from Halekuai St to Auhana Rd							
	Totals		812	518	1,330	1,095	940	2,035



AM PEAK HOUR



PM PEAK HOUR

WELAKAHAO ROAD 2020 BACKGROUND PLUS PHASE 1, 2 & 3
AM / PM PEAK HOUR TRAFFIC PROJECTIONS WITH NORTH-SOUTH COLLECTOR ROAD

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
Comptroller

KATHERINE H. THOMASON
Deputy Comptroller

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING
AND GENERAL SERVICES
SURVEY DIVISION
P.O. BOX 119
HONOLULU, HAWAII 96810-0119

Response Refer to:
Ma-478(06)

December 15, 2006

'06 DEC 18 P1:49
DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

MEMORANDUM

TO: Michael W. Foley, Planning Director
Maui County Planning Department

ATTN.: Colleen M. Suyama, Staff Planner

FROM: Reid K. Siarot, State Land Surveyor
DAGS, Survey Division

SUBJECT: I.D.: SM1 20060028
TMK: 2-2-02: 42
Project Name: South Maui Community Park
Applicant: Chris Hart & Partners Inc.

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

Should you have any questions, please call me at 586-0390.

CHRIS HART
& PARTNERS, INC.

February 22, 2007

Mr. Reid K. Siarot
State Land Surveyor
State of Hawaii
Department of Accounting and General Services
Survey Division
P.O. Box 119
Honolulu, Hawaii 96810-0119

Dear Mr. Siarot:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your letter dated December 15, 2006, stating that no Government Survey Triangulation Stations or Benchmarks are affected, and that DAGS Survey Division has no objections to the proposed project.

Thank you for your consideration of this application. Should you have any further questions, please contact me, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner

LANDSCAPE ARCHITECTURE AND PLANNING
1955 MAIN STREET, SUITE 200 • WAILUKU, MAUI, HAWAII 96793-1706 • PHONE: 808-242-1955 • FAX: 808-242-1956

Mr. Reid K. Siarot
February 22, 2007
Page 2

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

DISABILITY AND COMMUNICATION ACCESS BOARD

919 Ala Moana Boulevard, Room 101 • Honolulu, Hawaii 96814
Ph. (808) 586-8121 (V/TDD) • Fax (808) 586-8129

RECEIVED
APR 18 2007
CHRIS HART & PARTNERS
Landscape Architecture & Planning
cc: Jason 02/120

April 17, 2007

Mr. Jason Medema
Planner
Chris Hart & Partners
1955 Main Street
Suite 200
Wailuku, HI 96793

Regarding: South Maui Community Park Application for Special Management Area Permit Project District Phase 2 and Draft Environmental Assessment

Dear Mr. Medema,

The Disability and Communication Access Board would like to thank you for the opportunity to review the South Maui Community Park Application for Special Management Area Permit Project District Phase 2 and Draft Environmental Assessment. The purpose of this review is to ensure that the project will take into account accessibility design requirements for persons with disabilities.

The following general statement should be included in the application for Special Management Area Permit Project District Phase 2 and Draft Environmental Assessment:

> *"All buildings, facilities, and sites shall conform to applicable federal, state, and county accessibility guidelines and standards. Hawaii Revised Statutes §103-50 requires all State of Hawaii or County government buildings, facilities, and sites to be designed and constructed to conform to the Americans with Disabilities Act Accessibility Guidelines and other applicable design standards as adopted and amended by the Disability and Communication Access Board. The law further requires all plans and specifications prepared for the construction of State of Hawaii or County government buildings, facilities, and sites to be reviewed by the Disability and Communication Access Board for conformance to those guidelines and standards."*

We strongly encourage the use of the following accessibility guidelines, published by the U.S. Access Board. These accessibility guidelines are not yet enforceable by the U.S. Department of Justice under the Americans with Disabilities Act (ADA), nor have they been adopted by state rules under Hawaii Revised Statutes §103-50. However, these accessibility guidelines provide guidance for a minimal level of accessibility for those elements not addressed by the enforceable ADA Accessibility Guidelines:

- Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas, Final Report, published September 30, 1999
- ADA Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; Public Rights-of-Way, published November 23, 2005

There are certain portions of South Maui Community Park Application for Special Management Area Permit Project District Phase 2 and Draft Environmental Assessment that should be reassessed.

- The accessible parking tabulation, shown in Figure 8 General Site Plan, does not appear to comply with the ADA Accessibility Guidelines Section 4.1.2(5). On sites with multiple lots, the number of accessible parking is required to be calculated lot-by-lot.

The above reflects the Disability and Communication Access Board's advice and recommendations for the South Maui Community Park Application for Special Management Area Permit Project District Phase 2 and Draft Environmental Assessment.

Should you have any further questions, feel free to contact Mr. Gary Batcheller, Facility Access Specialist at (808) 586-8121.

Sincerely,

Francine Wai

FRANCINE WAI
Executive Director

c: Pat Matsui
Director
County of Maui
Department of Parks and Recreation

CHRIS HART & PARTNERS, INC.

May 2, 2007

Ms. Francine Wai
Director
Disability and Communication Access Board
919 Ala Moana Blvd., Rm. 1
Honolulu, Hawaii 96814

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Dear Ms. Wai:

Thank you for your April 17, 2007 letter providing comments on the proposed project. We are pleased to address your comments as follows:

1. **Accessibility Guidelines.** We note that you strongly encourage the use of the following guidelines in the design of the Park: "Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas, Final Report, September 30, 1999;" and "ADA Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act; Public Rights-of-Way, November, 2005." The aforementioned documents were furnished to the landscape architect in preparation of the Park design, and any future changes to the Park design will reference these documents as well.

2. **Accessible Parking Tabulations.** We note your comment that the accessible parking tabulation for Phase 1 of the project shown in Figure 8, General Site Plan, does not appear to comply with the ADA Accessibility Guidelines (ADAAG) Section 4.1.2(5). In the final construction documents, one accessible stall will be added to the parking area serving the gymnasium and one will be added to the area serving the softball fields, which will bring the parking tabulation into compliance with the ADAAG.

LANDSCAPE ARCHITECTURE AND PLANNING
1955 MAIN STREET, SUITE 200 • WAILUKU, MAUI, HAWAII 96793-1706 • PHONE: 808-242-1955 • FAX: 808-242-1956

Thank you for your consideration of this document. Should you have any questions, please contact myself, or Mr. Jason Medema, Planner, at (808) 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner

cc. Mr. Patrick Matsui, County of Maui, Department of Parks and Recreation
Mr. Clifford Mukai, Warren S. Unemori Engineering, Inc.
Project File

LINDA LINGLE
GOVERNOR OF HAWAII

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us

January 17, 2007

Mr. Glenn T. Correa
Department of Parks and Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku, Hawai'i 96793

Subject: South Maui Community Park

1. Please describe the previous use of the property. Is there a potential for the site to be contaminated from its previous use. For example, some previous agricultural lands have been contaminated from pesticide use.
2. Please describe the impacts of the future recycling and redemption center.
3. OEQC recommends that the project be built following in accordance with the US Green Building Council's LEED guidelines for new construction.

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

Sincerely,

for Genevieve Salmonson
Director

c: Chris Hart

RECEIVED
JAN 23 2007
CHRIS HART & PARTNERS
Landscape Architecture & Planning
cc: Jason, Miku
02/120

CHRIS
HART
& PARTNERS, INC.

May 2, 2007

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

RE: HRS 343 *Draft Environmental Assessment* (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Dear Ms. Salmonson:

Thank you for your January 17, 2007 letter providing comments on the proposed project. We are pleased to address your comments as follows:

1. **Previous Use of the Property.** According to application documents submitted for the previously approved "Application for Special Management Area (SMA) Permit and Phase II Project District Approval, Piilani Project District" (approval letter dated January 11, 1989): "The subject property is unimproved pasture lands covered by scrub grasses and Keawe. The property was used for limited grazing until 1979 when the highway separated it from the mauka grazing lands." The site history suggests no use of agricultural chemicals and therefore no risk of contamination.

2. **Impacts of the Recycling Center.** The adjacent Kihei Recycling and Redemption Center received approval in 2005 for a Special Management Area Use Permit and Project District Phase 2 application (SMI 20050020)/(PH2 2005/0006). The Recycling and Redemption center was also issued a Finding of No Significant Impact in 2005 as part of a HRS 343 Environmental Assessment. In addition, Phase III of the Park is being master planned in conjunction with the Recycling Center, and the final Traffic Impact Analysis Report for the Park incorporates traffic from the Recycling Center into its

background traffic calculations. The Recycling and Redemption Center is not expected to have any significant impacts.

3. **LEED Standards.** The Applicant is aware of the LEED Green Building Rating System, and principles consistent with the intent of LEED will be incorporated into the design of the Park wherever possible.

Thank you for your consideration of this document. Should you have any questions, please contact myself, or Mr. Jason Medema, Planner, at (808) 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner

cc. Mr. Patrick Matsui, County of Maui, Department of Parks and Recreation
Mr. Clifford Mukai, Warren S. Unemori Engineering, Inc.
Project File

PHONE (808) 594-1888

FAX (808) 594-1865

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

HRD06/2822

December 15, 2006

Colleen Suyama, Staff Planner
County of Maui
Department of Planning
250 South High Street
Wailuku, Maui 96793

RE: Application for Special Management Area Permit (SMAP) and Draft Environmental Assessment (DEA) in support of South Maui Community Park, Kihei, Maui; TMK 2-2-002:042

Dear Ms. Suyama,

The Office of Hawaiian Affairs (OHA) is in receipt of your request for comments for the above referenced SMAP application and DEA. The applicant seeks to construct a park complex on 44.833 acres of currently undeveloped land within the Special Management Area. The proposed park complex will include a 1096-seat gymnasium; three soccer fields; two softball fields; one baseball field; five multi-use courts; a pavilion and amphitheater; 480 bleacher seats; three comfort stations; an unspecified number of stand-alone restroom buildings; an accessory building and storage area for park maintenance equipment; approximately 1.5 miles of bicycle and walking paths; and parking for 534 vehicles.

OHA appreciates that the DEA presents an analysis of alternative design and facility configurations, as required by the Office of Environmental Quality Control. We are also pleased with the proposed use of recycled water, instead of scarce groundwater resources, for irrigation purposes. Although we recognize that this project will greatly benefit the South Maui community, we do have concerns with several aspects of the SMAP and DEA, as discussed below.

Impacts to Cultural Resources

We appreciate that a Cultural Impact Assessment (CIA) was prepared for the DEA, as required by Act 50, Session Laws of Hawaii, 2000, and we agree with the recommendation at page 14 that "Cultural Advisors be consulted during the planning process." We are also pleased that various Hawaiian organizations were contacted by letter; however, the CIA does not present the results of this consultation. The CIA only summarily concludes, and the DEA repeats, that "Hawaiian rights related to gathering, access or other customary activities within the project area will not be affected and there will be no direct adverse effect upon cultural practices or beliefs as long as coastal access is insured." CIA at page 14, DEA at page 30. Also, there is a detailed description of an interview methodology, but there is no indication that interviews were actually conducted.

We request that the applicant amend the DEA to fully address and support its conclusion that there will be no adverse effects to Native Hawaiians rights. The Maui County Department of Planning, as a county agency, is mandated by Hawai'i Const. article XII, section 7, "to preserve and protect customary and traditional practices of Native Hawaiians." Ka Pa'akai O Ka 'Aina v. Land Use Comm'n, 94 Haw. 31, 45 (2000). To do this, the Department, assisted by the applicant, must first identify any rights. If it concludes that there is no practice of traditional and customary rights in the project area, that conclusion must be clearly supported. In addition, we request that the procedures for the recommended consultation with Cultural Advisors be clarified, then implemented.

On a side note, we take exception to the statement made on page 1 of the CIA, "Beginning in 1850 with establishment of Hawaii Revised Statutes (HRS) 7-1, native Hawaiians were given access rights to undeveloped private property and waterways in order to gather specific natural resources for customary uses." Gathering and access rights existed long before HRS § 7-1 codified them. The right to subsistence, to collect food and other materials required to survive, was guaranteed to all *ahupua'a* tenants by their *ali'i*, or chiefs. When the concept of private property was introduced to Hawai'i in the mid-nineteenth century, King Kamehameha III made clear, through HRS § 7-1, that Hawaiians could continue to practice their gathering rights, as they had for centuries past.

Archeological Resources

We also appreciate that the applicant has proposed to preserve the five historical features that comprise Historic Site 2512. Although the Archeological Preservation Plan (APP) does state that OHA was consulted, we are unable to locate any correspondence in our office. We offer our comments and concerns now. First, it is unclear why site 2512 was chosen for preservation. We request an analysis stating why Site 2512 was chosen for preservation over the other documented sites. Second, we request that the permanent buffer be increased from 10 feet to 50 feet, to better protect these significant historical properties. We also ask the applicant to ensure that, at a minimum, a vegetative boundary will encircle the site to protect it from the increased traffic the park and ball fields will bring to the area.

Finally, as recognized in the DEA, because these are dune lands, there is a high possibility that Native Hawaiian burials may be uncovered during construction. We request assurance from the applicant that if *iwi kūpuna* or other cultural deposits are uncovered, work will stop and the applicant will contact the State Historic Preservation Division immediately. We also suggest that the applicant employ a cultural monitor during ground disturbance and construction to ensure that any discoveries are not inadvertently mishandled, as proposed by the applicant on page 62 of the DEA.

Thank you for your continued correspondence and the opportunity to comment. If you have any further questions or concerns please contact Koa Kaulukukui at (808) 594-0244 or koalanik@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

c: County of Maui
Department of Parks and Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku, Hawai'i 96793

Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813

Thelma Shimaoka
OHA Maui Office
140 Ho'ohana Street, Suite 206
Kahului, Hawai'i 96732

CHRIS HART & PARTNERS, INC.

April 5, 2007

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

Dear Mr. Namu'o:

RE: RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042..

Thank you for your letter dated December 15, 2006, regarding the above-referenced project. In response to your letter, we offer the following comments based in part on a meeting between archaeologist Mike Dega, Ph.D., of Scientific Consultant Services, Inc,. and Jesse York of OHA on January 24, 2007.

Impacts to Cultural Resources

1. Consultation was sought by the project archaeologist from the Director of Native Rights, Land and Culture, Office of Hawaiian Affairs on O'ahu; the Maui branch of the Office of Hawaiian Affairs; the Central Maui Hawaiian Civic Club; Kīhei Community Association; and the Maui Planning Department. None of the native Hawaiian organizations, the Community Association, or the Maui Planning Department that is mandated "to preserve and protect customary and traditional practices of Native Hawaiians" (94 Haw. 31, 45 2000) responded with information concerning the potential for cultural resources to occur in the project area (TMK 2-2-002:042), or with additional suggestions for further contacts. Therefore, no interviews were conducted for this property, as there were no interviewees identified. The Draft Environmental Assessment (EA) has been amended with a revised Cultural Impact Assessment (CIA) further addressing this issue. The revised CIA will be included as a component of the Final EA.

Archaeological Resources

1. Site 2512 was selected for preservation due to its important prehistoric function (possible ceremonial structure). All the sites had been subject to Inventory Survey and focused data recovery. Other documented sites in the project area were primarily related to habitation and were poorly preserved. OHA agreed that Site 2512 would remain protected and the others would not be preserved. OHA also noted they encourage preservation in all forms.

2. SCS proposed maintaining the buffer surrounding Site 2512 zone at 10 feet around the site, but agreed to add a vegetative boundary (i.e. naupaka hedge or similar vegetative barrier). The southern flank of the site will not require an immediate buffer zone or vegetative boundary because it borders a very steep drainage. OHA concurred with these proposed actions.

3. SCS suggested that no cultural monitor or archaeological monitor is necessary during construction on this parcel. The SHPD had previously concurred that no monitoring was required. SCS noted that the aforementioned "dune lands" only occur in the northwestern corner of the parcel, in an area previously subject to intensive excavation work by SCS (and leading to primarily negative results). A majority of the project area is composed of a thin sequence of silty clays overlying bedrock. OHA agreed that no monitors were necessary during construction noted that the contractor must cease all activities in the area should *iwi kupuna* or other significant cultural materials be identified during construction. The applicant concurs with this condition.

Thank you for your consideration of the application. Should you have any questions, please contact myself, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

CHARMAINE TAVARES
Mayor

MILTON M. ARAKAWA, A.I.C.P.
Director

MICHAEL M. MIYAMOTO
Deputy Director

Telephone: (808) 270-7845
Fax: (808) 270-7955

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

DAVID TAYLOR, P.E.
Wastewater Reclamation Division

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

TRACY TAKAMINE, P.E.
Solid Waste Division

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
AND ENVIRONMENTAL MANAGEMENT
200 SOUTH HIGH STREET, ROOM 322
WAILUKU, MAUI, HAWAII 96793

February 20, 2007

MEMO TO: JEFFREY S. HUNT, A.I.C.P., PLANNING DIRECTOR

FROM: MILTON M. ARAKAWA, A.I.C.P., DIRECTOR OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT

SUBJECT: APPLICATION FOR SPECIAL MANAGEMENT AREA PERMIT, PROJECT DISTRICT PHASE 2 AND HRS CHAPTER 343 DRAFT ENVIRONMENTAL ASSESSMENT FOR SOUTH MAUI COMMUNITY PARK
TMK: (2) 2-2-002:042
SM1 2006/0028
PH2 2006/0005

We reviewed the subject application and have the following comments:

1. Although wastewater system capacity is currently available as of December 13, 2006, the developer should be informed that wastewater system capacity cannot be ensured until the issuance of the building permit.

2. Wastewater contribution calculations are required before building permit is issued.

3. Developer is not required to pay assessment fees for this area at the current time.

4. Developer is required to fund any necessary off-site improvements to collection system and wastewater pump stations.

5. Plans should show the installation of a service manhole near the property line prior to connection to the County sewer.

6. Commercial kitchen facilities within the proposed project shall comply with pre-treatment requirements (including grease interceptors, sample boxes, screens, etc.).

7. Non-contact cooling water, condensate, etc. should not drain to the wastewater system.

8. Indicate on the plans the ownership of each easement (in favor of which party). Note: County will not accept sewer easements that traverse private property.

9. A recycled water main is located within Liloa Street/North-South Collector Road. *The project shall connect to the existing reclaimed* waterline and utilize the reclaimed water for irrigation purposes. Also, the project's irrigation system shall be designed to Department of Health and County of Maui standards to accept the reclaimed water service.

10. Plans for reclaimed water usage will require further review, permits, and Department of Health approval.

11. That a maintenance access shall be provided into Keokea Gulch. Maintenance activities would include, but be limited to landscape maintenance and debris removal, which may become critical after the North-South Collector Road is built over Keokea Gulch.

12. Improve the adjoining half of Welakahao Road to County standards to include, but not be limited to pavement widening, construction of curb, gutter and sidewalk, street lights and relocation of utilities underground.

13. All structures such as walls, trees, etc., shall be removed or relocated from the road-widening strip. The rear boundaries of the road-widening strip shall be clearly marked to determine if said structures have been properly removed and relocated.

14. A verification shall be provided by a Registered Civil Engineer that the grading and runoff water generated by the project will not have an adverse effect on the adjacent and downstream properties.

15. A detailed and final drainage report and Best Management Practices (BMP) Plan shall be submitted with the grading plans for

review and approval prior to issuance of grading permits. The drainage report shall include hydrologic and hydraulic calculations and the schemes for disposal of runoff waters. It must comply with the provisions of the "Rules and Design of Storm Drainage Facilities in the County of Maui" and must provide verification that the grading and runoff water generated by the project will not have an adverse effect on adjacent and downstream properties. The BMP plan shall show the location and details of structural and non-structural measures to control erosion and sedimentation to the maximum extent practicable.

16. All existing features such as structures, driveways, drainage ways, edge of the pavement, etc. shall be shown on the project plat plan.

17. The 100-year flood inundation limits shall be shown on the project site plans. Lot geometrics cannot be approved until such data is submitted and reviewed.

18. A detailed final Traffic Impact Assessment Report for the entire development shall be submitted for our review and approval. The report shall also address regional traffic impacts and include assessments from the local community police officer.

19. Preliminary construction plan submittal shall include a completed technical assistance review performed by the Disability and Communication Access Board (DCAB) for compliance with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) for all facilities. All technical and structural infeasible assessments shall be the responsibility of the developer and an agreement waiving the County of Maui of any future liability, including redesign and reconstruction for said facility, shall be recorded with the State Bureau of Conveyances.

20. The plans submitted for this project do not adequately show sufficient detail to determine whether the project is compliant with building codes. We will review the project for building code requirements during the building permit application process.

If you have any questions regarding this memorandum, please call Michael Miyamoto at 270-7845.

MMA:MMM:jso
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CHRIS HART & PARTNERS, INC.

March 26, 2007

Mr. Milton W. Arakawa, A.I.C.P.
Director
Department of Public Works
and Environmental Management
200 South High Street, Room 322
Wailuku, Maui, Hawaii 96793

Dear Mr. Arakawa:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your February 20, 2007 letter. We are pleased to address your comments as follows:

1. Wastewater System Capacity. The applicant understands that wastewater system capacity cannot be ensured until the issuance of the building permit.

2. Wastewater Contribution Calculations. The applicant acknowledges that wastewater contribution calculations are required before the building permit is issued. This issue will be addressed during the building permit process.

3. Assessment Fees. The Applicant notes that it is not required to pay assessment fees at this time.

4. Off-Site Improvements. The applicant understands that the developer is required to fund necessary off-site improvement costs to the collection system and wastewater pump stations.

5. Installation of Service Manhole. Final construction plans will show the installation of a service manhole near the property line prior to connection of County sewer.

6. Kitchen Facilities. The applicant acknowledges that any future kitchen facilities must comply with pretreatment requirements including grease interceptors, sample boxes, screens, etc.

7. Non-Contact Cooling Water. The applicant acknowledges that non-contact cooling water, condensate, etc. should not drain to the wastewater system.

8. Sewer Easements. The applicant understands that the County will not accept sewer easements that traverse private property. Final construction plans will identify ownership of all easements that affect the subject property.

9. Recycled Water Main. The project will connect to the existing reclaimed water line on site for irrigation purposes. The project's irrigation system shall be designed to Department of Health and County of Maui standards to accept reclaimed water service.

10. Recycled Water. The applicant acknowledges that plans for reclaimed water usage will require further review, permits and Department of Health approval.

11. Maintenance Access to Keokea Gulch. Maintenance access will be provided to Keokea gulch for maintenance and debris removal purposes.

12. Road Improvements to Welakahao Road. Road widening requirements for the portion of Welakahao Road adjoining the park will be met as part of the construction of Phase III of the project.

13. Structures Removed from Road-Widening Strip. All structures such as walls, trees, etc. will be removed from the road widening strip. The rear boundaries of the road widening strip will be clearly marked to determine if said structures have been properly removed and relocated.

14. Runoff. Verification shall be provided by the project engineer that the grading and runoff water generated by the project will not adversely affect the adjacent and downstream properties.

15. Drainage Report. A detailed and final drainage report and Best Management Practices will be submitted with the grading plans.

16. All existing features such as structures, driveways, drainageways, edge of the pavement, etc. shall be shown on the project plat plan.

17. Flood Inundation The 100-year flood inundation limits will be shown on the project site plans. The applicant notes that lot geometrics cannot be approved until such data is submitted and reviewed.

18. TIAR. A final Traffic Impact Assessment Report will be provided as part of the Final EA.

19. ADA Accessibility. Preliminary construction plan submittal shall include a completed technical assistance review performed by the Disability and Communication Access Board (DCAB) for compliance with the Americans with Disabilities Act Accessibility Guidelines (ADAAG).

20. Building codes. The applicant understands that review of the project for building code compliance will occur during the building permit process.

Thank you for your consideration of the application. Should you have any questions, please contact myself, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

FOR:

Michael J. Summers
Senior Planner

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

CHARMAINE TAVARES
MAYOR

CARL M. KAUPALOLO
CHIEF

NEAL A. BAL
DEPUTY CHIEF

COUNTY OF MAUI
DEPARTMENT OF FIRE AND PUBLIC SAFETY
FIRE PREVENTION BUREAU

780 ALUA STREET
WAILUKU, HAWAII 96793
(808) 244-9161
FAX (808) 244-1363

March 1, 2007

Mr. Dan Shupack, Staff Planner
Department of Planning
250 South High Street
Wailuku, Hawaii 96793

Subject: South Maui Community Park, SM1 2006/0028, PH2 2006/0005
TMK (2)2-2-002:042

Dear Mr. Shupack,

Thank you for the opportunity to comment on the proposed SMA project application. If the project is approved to proceed, our office will be looking at various items during the building permit process. The roadway allows for two entrances that connect within the park. This design is much appreciated as it allows for large vehicles to avoid turning around. The roadway design also assists with the unlikely event of an evacuation by allowing two separate exits.

Some of the topics that will be looked at during the building permit process include;

1. The roadway width since injuries to sports participants will occur. Adequate clearance for emergency vehicles is a must.

2. Fire hydrant spacing and GPM flow. The use of reclaimed water (purple fire hydrants) for fire protection is available in the area and we do not have any objections to its use on this project. Fire fighting personnel from the Kihei Fire Station would like the pressure of this system to be increased as it has been less than desirable in the past along Welakahao. A residual pressure of at least 75 psi would be adequate.

Please feel free to contact Lt. Scott English at 244-9161 if there are any questions or concerns.

Sincerely,

Valeriano F. Martin
Captain
Fire Prevention Bureau

CHRIS HART & PARTNERS, INC.

March 16, 2007

Mr. Valeriano F. Martin
Captain
Fire Prevention Bureau
County of Maui
Department of Fire and Public Safety
200 Dairy Road
Kahului, Maui, Hawaii 96732

Dear Mr. Martin:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your letter dated March 1, 2007 regarding the above-referenced project.

Based upon your letter, we understand that your office will be reviewing the roadway widths of the project during the building permit application process to ensure that adequate roadway widths exist for emergency vehicles.

We also note from your letter that reclaimed water is available for fire protection in the area, and that you do not have any objections to its use..

In response to your comment regarding increasing GPM flow of the fire protection system, minimum design pressures used throughout Maui have characteristically been 20 psi. If 75 psi is required to be able to use reclaimed water, the onsite system will need to be boosted. It is likely that the pressure will be boosted at irrigation heads, which should somewhat increase system pressure overall.

It was our previous understanding that until the County builds a second tank on the reclaimed water source, there is no way to keep the system up during routine maintenance of storage facilities. Thus, for the time being, we are assuming that the gym

LANDSCAPE ARCHITECTURE AND PLANNING
1955 MAIN STREET, SUITE 200 • WAILUKU, MAUI, HAWAII 96793-1706 • PHONE: 808-242-1955 • FAX: 808-242-1956

area will have hydrants off the County's potable water system and the balance (playfields, parking, etc.) will have hydrants off of the County's reclaimed water system.

Thank you for your consideration of this application. Should you have any questions, please contact myself, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

for

Michael J. Summers
Senior Planner

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File ✓

POLICE DEPARTMENT
COUNTY OF MAUI

ALAN M. ARAKAWA
MAYOR

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

THOMAS M. PHILLIPS
CHIEF OF POLICE

GARY A. YABUTA
DEPUTY CHIEF OF POLICE

OUR REFERENCE
YOUR REFERENCE

December 12, 2006

MEMORANDUM

TO	:	MICHAEL W. FOLEY, PLANNING DIRECTOR
FROM	:	THOMAS M. PHILLIPS, CHIEF OF POLICE
SUBJECT	:	I.D. : SM1 20060028
		TMK : (2) 2-2-002:042
		Project Name : South Maui Community Park
		Applicant : Chris Hart & Partners Inc.

___ No recommendation or comment to offer.

_x_ Refer to enclosed comments and/or recommendations.

We are returning the Application which was submitted for our review. As always, thank you for giving us the opportunity to comment on this project.

AC Wayne T. Ribao

Assistant Chief Wayne T. Ribao
For: THOMAS M. PHILLIPS
Chief of Police

Enclosures

COPY

TO : THOMAS PHILLIPS, CHIEF OF POLICE, COUNTY OF MAUI

VIA : CHANNELS

FROM : BRAD HICKLE, POLICE OFFICER III, DISTRICT VI KIHEI

SUBJECT : SPECIAL MANAGEMENT AREA PERMIT (SMA) FOR THE SOUTH MAUI COMMUNITY PARK, TMK (2) 2-2-002:042

APPLICANT INFORMATION:

The application was prepared for the County of Maui, Department of Parks and Recreation by Chris Hart & Partners, Inc.

The applicant is requesting the Special Management Area Permit for the proposed development of a Regional South Maui Community Park on a 44,833 acre parcel.

The South Maui Community Park will consist of 1096 seat gymnasium, three soccer fields, two softball fields, one baseball field, five tennis courts, 3 tot lots, pavilion and amphitheater, 3 comfort stations, accessory building for maintenance equipment and on and off site infrastructure improvements.

IMPACT ON POLICE:

As mentioned in this report. There are approximately 35 budgeted uniformed patrol officers working in the South Maui district. Based upon the population, the facilities assessment identifies a need for approximately 75 uniformed officers.

At present, the Kihei District Station facilities are inadequate to accommodate a staff of this size and a larger district station and additional officers are a primary concern to continue to meet the needs of this growing community.

Any new development can create an opportunity for an increase in crime and criminal activities. I suspect a development of this size could easily place an additional burden on Police services in South Maui. With this in mind I am making the following recommendations.

RECOMMENDATIONS:

The South Maui beach parks are widely used as gathering places by families. BBQ's are made and many times alcohol is consumed. Discussions have been made by concerned citizens in the past and it has been suggested that alcohol be banned from the beach parks. These recommendations have created a lot of opposition from the general public who use the beach parks. The proposed regional park however is not a Beach Park.

RECOMMENDATIONS:

Taking into consideration that the proposed Regional South Maui Community Park is not a Beach Park and the fact that this park is bordered by no less than two schools to the north and two churches to the south, a major highway to the east and a future residential housing area to the west, it is suggested that alcohol be forbidden and banned in this park.

The primary purpose and overall theme of this park appears to be the promotion of athletic activities for our youth. A gymnasium, ballparks, tennis courts and proposed future soccer fields are not places where alcohol should be consumed.

The banning of alcoholic beverages in this park will not only help to create a wholesome environment for our youths but should also help to eliminate police calls for service as alcohol is a definite contributing factor to police calls for service in our existing beach parks.

It is further recommended that this application be returned to the County of Maui, Department of Planning for final review and considerations.

Respectfully Submitted,

Officer Brad Hickle Bh
12/06/06 1845 hours

Noted: I concur with Ofc. HICKLE's recommendations that alcoholic beverages not be permitted within the proposed park. The development of this park would benefit members of the Kihei community, however, allowing the use of alcohol upon its premises would further contribute to other criminal activities and cause an increase to police services.

A/Lt. Wade ANZAI #9243
12/09/06 @ 1335 hours.

Noted: Concur with the review and recommendations presented by Officer Brad HICKLE. The proposed development of the South Maui Community Park will definitely benefit the community. However, the prohibition of consuming alcoholic beverages within the park boundaries would definitely enhance the purpose of the proposed park.

A/Capt. Gregory B. HONIE 7444
12/11/06 @ 0830 hours

CONCUR WITH KIHEI DISTRICT'S RECOMMENDATIONS

AC Wayne [illegible]
12/12/06

CHRIS HART
& PARTNERS, INC.

February 22, 2007

Mr. Thomas M. Phillips
Chief of Police
Police Department
County of Maui
55 Mahalani Street
Wailuku, Hawaii 96793

Dear. Mr. Phillips:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your letter dated December 12, 2006, regarding the above-referenced project.

We note from your letter that, due to the proposed park's close proximity to schools and churches, and its primary orientation towards promoting athletic activities for South Maui's youth, it does not constitute an appropriate location for the consumption of alcohol. We note also that alcohol consumption is a contributing factor to police calls for service in South Maui's existing beach parks. In order to provide a clean and healthy environment for children and minimize the project's impact on police services in South Maui, the consumption of alcohol will be prohibited in the South Maui Community Park.

Thank you for your consideration of this application. Should you have any further questions, please contact myself, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

FROM : FAX NO. :8082701775 Jan. 04 2007 03:05PM P1

ALAN M. ARAKAWA
Mayor

GEORGE Y. TENGAN
Director

ERIC H. YAMASHIGE, P.E., L.S.
Deputy Director

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2155
www.mauiwater.org

'06 DEC 28 A9:31

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

RECEIVED
JAN 0 5 2007

CHRIS HART & PARTNERS
Landscape Architecture & Planning

CC: Mike + Jason
02/120

December 13, 2006

Michael W. Foley, Planning Director
Department of Planning
County of Maui
250 South High Street
Wailuku HI 96793

Re: I.D.: SM1 2006/0028
TMK: 2-2-02:042
Project Name: South Maui Community Park

Dear Mr. Foley:

Thank you for the opportunity to provide comments on this project proposal.

Source Availability and Consumption

The project area is served by the Central Maui System. The main sources of water for this system are the designated Iao aquifer, Waihee aquifer, the Iao tunnel and the Iao-Waikapu Ditch. New source development projects include Waikapu South well and Maluhia well. Daily demand for 44.83 acre park use would be 76,216 gallons based on system standards. Higher demand from gymnasium with showers and other proposed facilities should be offset by use of reclaimed water for irrigation. Potable demand estimated in the application material to 157,600 gallons for all three phases appears high. Demand could be significantly reduced with reclaimed water use for all non-potable uses, including toilet flushing at comfort stations. Domestic and irrigation calculations will be reviewed in the building permit process to determine meter sizing. Potable water availability may not be available until new sources are on line.

System Infrastructure

An 18-inch and a 36-inch transmission line is fronting the West side of the property. There is one fire hydrant located on Welakahao Street. Fire flow calculations will be reviewed in the building permit process. Should the applicant opt to utilize reclaimed water for toilet flushing at comfort stations, separate plumbing should be color coded. Backflow preventors must be installed at the meters. Please contact our engineering division at 270-7835 for any questions on this matter.

Michael W. Foley
South Maui Community Park
Page 2

Conservation
The application material states that low flow fixtures will be used in restrooms, and xeriscaping and water efficient irrigation will be utilized. In order to further reduce demand in the Central System, we encourage the applicant to include the following water conservation measures in the project design and construction:
Use of brackish and/or reclaimed water sources for all non-potable water uses, including irrigation and dust control during construction. As stated above, the Department would support reclaimed water use for toilet flushing.
Use Climate-adapted Plants: We note that several native plants are selected in the landscaping plan for this project. Native plants adapted to the area conserve water and protect the watershed from degradation due to invasive alien species. The project is located in the "Maui County Planting Plan" - Plant Zone 3.
Eliminate Single-Pass Cooling: Single-pass, water-cooled systems should be eliminated per Maui County Code Subsection 14.21.20. Although prohibited by code, single-pass water cooling is still manufactured into some models of air conditioners, freezers, and commercial refrigerators.
Maintain Fixtures to Prevent Leaks: A simple, regular program of repair and maintenance can prevent the loss of hundreds or even thousands of gallons a day.

Pollution Prevention
The project overlies the Kamaole aquifer. DWS strives to protect the integrity of surface and groundwater resources by encouraging the applicant to utilize Best Management Practices (BMPs) designed to minimize infiltration and runoff from construction and vehicle operations. We have attached sample BMPs for principle operations for reference. Additional mitigation measures are enumerated below and should be implemented during construction:
1. Prevent cement products, oil, fuel and other toxic substances from falling or leaching into the water.
2. Properly and promptly dispose of all loosened and excavated soil and debris material from drainage structure work.
3. Retain ground cover until the last possible date.
4. Stabilize denuded areas by sodding or planting as soon as possible. Replanting should include soil amendments, fertilizers and temporary irrigation. Use high seeding rates to ensure rapid stand establishment.
5. Avoid fertilizers and biocides, or apply only during periods of low rainfall to minimize chemical run-off.
6. Keep run-off on site.

Should you have any questions, please call our Water Resources and Planning Division at 244-8550.

Sincerely,

George Y. Tengan, Director
cmb

c: engineering division
applicant

C:\WPdocs\Permcomm\South Maui Community Park SM.wpd

CHRIS HART & PARTNERS, INC.

March 26, 2007

Mr. Jeffrey Eng
Director
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Hawaii 96793-6109

Dear Mr. Eng:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your letter dated December 13, 2006, regarding the above-referenced project.

In response to your letter, we offer the following comments:

1. Source Availability and Consumption. The Applicant acknowledges that potable water availability may not be available until new sources are on line. The Applicant also notes from your letter that domestic and irrigation calculations will be reviewed during the building permit process to determine meter sizing.

   In response to your comment that estimated potable water demand for the project appears high, the water demand analysis was based on sewage and water flow data from Lahaina Civic Center, Eddie Tam Memorial Gym, Keopuolani Park and War Memorial Complex. These facilities were used as a basis of comparison because each of them has a gymnasium and park facility similar to the proposed South Maui Community Park. Please see the attached letter from the mechanical engineer. It is possible that the use of reclaimed water for irrigation and other water efficiency measures during the project's

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operating phase may produce an actual potable water demand that is lower than the estimated demand.

2. System Infrastructure. The Applicant understands that the subject property is served by one 18-inch and one 36-inch transmission line fronting the west side of the property, as well as one fire hydrant located on Welakahao Street. Fire flow calculations will be provided for review during the building permit process. Backflow preventors will be installed at all meters.

3. Conservation Measures. The Applicant proposes to implement the following water conservation measures into the project:
   - Installing water conserving, low flow fixtures.
   - Use of reclaimed water for irrigation.
   - Incorporating water efficient landscaping into the landscape design.
   - Eliminate single-pass cooling.
   - Maintaining fixtures to prevent leaks.
   - Utilizing properly planned and efficient irrigation systems, including using drip-irrigation instead of above-ground spray heads, where appropriate, and using rain sensor technology that shuts off the automatic irrigation system during rain events, preventing over-watering by automated systems.
   - Using non-invasive, climate-appropriate plants and climate-appropriate native plants, so as to reduce the amount of water required to maintain plant health.

   In addition, the Applicant notes from your letter that the Department of Water Supply would not oppose reclaimed water use for toilet flushing.

4. Pollution Prevention. The project will implement Best Management Practices (BMPs) to eliminate pollutants from runoff and infiltration, as will be required by the grading permit. The issue of pollution prevention will be further addressed during the construction document phase of the project.

   As advised in your letter, the following additional mitigation measures will be implemented during construction:

   - Prevent cement products, oil, fuel, and other toxic sustances from leaching into the water.
   - Properly and promptly dispose of all loosened and excavated soil and debris material form drainage structure work.
   - Retain ground cover until the last possible date
   - Stabilize denuded areas by sodding or planting as soon as possible. Replanting will include soil amendments, fertilizers and temporary

irrigation. High seeding rates will be used to ensure rapid stand establishment.

- Avoid fertilizers and biocides, or when necessary apply only during periods of low rainfall to minimize chemical runoff.
- Keep runoff on site.

Thank you for your consideration of this application. Should you have any questions, please contact myself, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

FOR:

Michael J. Summers
Senior Planner

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

Maui Electric Company, Ltd. • 210 West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96733-6898 • (808) 871-8461

RECEIVED
MAR 19 2007
CHRIS HART & PARTNERS
Landscape Architecture & Planning
cc: Mike-Jordan
02/120

March 15, 2007

Chris Hart & Partners, Inc.
Attention: Michael J. Summers, Senior Planner
1955 Main Street, Suite 200
Wailuku, Hawaii 96793

Subject: South Maui Community Park Project
Kihei, Maui, Hawaii 96753
TMK: (2) 2-2-002:042

Dear Mr. Summers,

Thank you for allowing us to comment on the "Pre-Consultation for Environmental Assessment and Special Management Area permit" for the subject project, which was received on March 13, 2007.

In reviewing our records and the information received, Maui Electric Company (MECO) has no objection to the project at this time. However, the addition of this project's anticipated load demand may have an impact to our system. Therefore, we highly encourage the developer's electrical consultant to submit the electrical demand requirements and project time schedule as soon as practical so that service can be provided on a timely basis.

In addition, may we suggest that the developer and/or their consultant make contact with Sage Kiyonaga of our Demand Side Management (DSM) group at 872-3283 to review potential energy conservation and efficiency opportunities for their project.

Should you have any other questions or concerns, please call Mark Suehiro at 872-3273.

Sincerely,

Fred Oshiro
for Neal Shinyama
Manager, Engineering

NS/ms:lh
cc: Sage Kiyonaga – MECO DSM

CHRIS
HART
& PARTNERS, INC.

April 12, 2007

Mr. Neal Shinyama, Engineering Manager
Maui Electric Company
210 West Kamehameha Avenue
PO Box 398
Kahului, HI 96733-6898

Dear Mr. Shinyama:

RE: HRS 343 Draft Environmental Assessment (DEA) and Special Management Area (SMA) Permit for the proposed South Maui Community Park project, on property situated west of Piilani Highway, Kihei, Maui, Hawaii; TMK No: (2) 2-2-002:042.

Thank you for your March 15, 2007 letter. We are pleased to address your comments as follows:

We note from your letter that MECO has no objection to the project at this time, but that the addition of the project's anticipated load demand may have an impact to your system. The Applicant's electrical consultant will be encouraged to submit electrical demand requirements and a project time schedule as soon as practical so that service may be provided on a timely basis. The Applicant will also be encouraged to contact your Demand Side Management (DSM) group to review potential energy conservation and efficiency opportunities for the project.

Thank you for your consideration of this application. Should you have any further questions, please contact myself, or Mr. Jason Medema, Staff Planner, at 242-1955.

Sincerely yours,

Michael J. Summers

Michael J. Summers
Senior Planner

cc. Mr. Jeff Hunt, Director, Department of Planning
Mr. Patrick Matsui, Maui County Parks Department
Mr. Clifford N. Mukai, Warren S. Unemori Engineering
Project File

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