APPENDIX G.
Preliminary Civil Engineering and Drainage and Erosion Control Report

PRELIMINARY

CIVIL ENGINEERING
AND
DRAINAGE AND SOIL EROSION CONTROL REPORT

FOR

KAHOMA RESIDENTIAL SUBDIVISION

LAHAINA, MAUI, HAWAII

TAX MAP KEY: (2) 4-5-10:005

PREPARED FOR:

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OCTOBER 19, 2007
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REVISED: NOVEMBER 8, 2010

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I. PURPOSE:

The purpose of this preliminary report is to investigate the infrastructure requirements for the proposed project. This report will present a brief description of the existing conditions and discuss anticipated improvements for roadway, drainage, water and sewer systems that are required by the appropriate governmental agencies.

II. PROPOSED PROJECT:

The proposed project involves the subdivision of a 16.683 acre property that is identified as Parcel 05 of Tax Map Key (2) 4-5-10. The conceptual subdivision layout is shown on Figure 8. It is subdivided into 76 lots that primarily include sixty eight (68) lots for single-family residences; one (1) for park use; one (1) for drainage pond; three (3) for access and utility purposes; and three (3) lots for roadway purposes. The single-family lots have areas ranging from 5,054 to 12,973 square feet.

Appurtenant to the proposed subdivision are grading, roadway, water, sewer and drainage systems that will be designed and constructed in accordance with the requirements of governmental agencies that review this type of development. The proposed improvements are discussed in their respective sections of this report.

III. LOCATION AND ACCESS:

A. LOCATION:

The project site is located in Lahaina, Maui, Hawaii. It is particularly situated on the southern side of Kahoma Stream Flood Control channel. Refer to Figures 1 and 2. Across the stream channel is Lahaina Business Park; while to the south of the proposed project are single-family residential subdivisions.

B. ACCESS:

Lui Street provides present access to the project site. This street joins Kalena Street which is in turn connected to Lahainaluna Road. Lahainaluna Road, which is the major access to the adjacent residential subdivisions, connects to Honoapiilani Highway that links West Maui to other parts of the island.

C. PROPOSED ROADWAY IMPROVEMENTS:

The future subdivision will be serviced internally by a 52-foot roadway that is planned to be privately owned and maintained. The upper (east) end will be connected to Lui Street, while the lower (west) end will tie into the existing old cane haul road that connects to Keawe Street. Refer to Figure 2. The existing road will be repaved to provide at least 20 feet wide pavement in compliance with Subsection 18.20.040B.3 of the Maui County Code.

A typical section of the proposed onsite roadway is shown on Figure 8. It includes a 6-foot wide concrete sidewalk along the northern side of the right-of-way; 9-foot wide planter on each side of the road; 4-foot wide bike lane along

each side of the 20-foot wide paved travelway; and concrete curbs. The proposed roadway will also include traffic calming features such as speed humps; signage; and pavement markings. It is also planned that parallel parking stalls (bubbled parking area) will be provided within the planter areas where space is available.

IV. EXISTING SOILS AND TOPOGRAPHY:

A. SOIL:

The U.S. Department of Agriculture Soil Conservation Service's Soils Survey of the Island of Kauai, Oahu, Maui, Molokai and Lanai [2], classifies the soils within the project site as Wahikuli Very Stony Silty Clay (WdB), 3 to 7 percent slopes and Rock Land (rRK) as shown on Figure 3. WdB, which occupies almost the entire site, is characterized as having moderate permeability, slow runoff and slight erosion hazard. It belongs to Wahikuli soil series that consist of well-drained soils on uplands on the island of Maui at elevations ranging from nearly sea level to 600 feet. These soils developed in material weathered from basic igneous rock.

rRK, which is found on the eastern tip of the project site, is made up of areas where exposed rock covers 25 to 90 percent of the land surface. This land type is nearly level to very steep.

B. TOPOGRAPHY:

The existing topography of the project site is shown on Figure 7.

The existing ground has elevations ranging from 32 feet to 145 feet above mean sea level. In general, the ground surface slopes down in a westerly direction from the east end to the west end of the project site, at an average slope of about 4½ percent.

V. WASTEWATER SYSTEM:

A. EXISTING:

The existing wastewater system serving the adjacent residential subdivisions and nearby developments is part of the County's Lahaina Sewerage System. A portion of the system that collects wastewater flows generated by existing developments in the vicinity of the project site is shown on Figure 5. The collected wastewater is transmitted by a series of force mains and gravity sewerlines to the Lahaina Wastewater Reclamation Facility above the intersection of Honoapiilani Highway and Lower Honoapiilani Road, about 5 miles north of the project site.

B. PROJECTED WASTEWATER FLOW:

Based on the Wastewater Flow Standards [8], the estimated average wastewater flow generated by the proposed development is as follows:

Single-Family Residence = 68 lots x 350 gpd = 23,800 gallons per day

Total Average Wastewater Flow = 23,800 gallons per day

C. PROPOSED WASTEWATER SYSTEM:

The proposed wastewater system will consist of onsite and offsite systems. The onsite system is conceptually laid out on Figure 9; while the offsite system is schematically shown on Figure 5A.

The proposed onsite system will consist of 6" and 8" PVC sewer pipes and sewer manholes. Each proposed lot will be served by a single service lateral in compliance with the requirements of the Wastewater Reclamation Division (WWRD) of the Department of Environmental Management.

The proposed offsite system will consist of 8" PVC sewer pipes that will convey the project's wastewater flow to the existing 10-inch sewerline on Keawe Street as shown on Figure 5A. The offsite 8" sewerline will be laid out along the old cane haul road. An easement is needed from Kaanapali Land Management Corporation, who owns the old cane haul road. It may also require approval from the U.S. Army Corps of Engineers for crossing and/or anchoring the sewerline to the existing bridge over the Kahoma Stream Channel.

VI. WATER SYSTEM:

A. EXISTING:

There are existing waterlines that currently serve the existing developments in the vicinity of the project site. Refer to Figure 6. The system consists of water mains with sizes ranging from 2-inch to 12-inch pipes. The system that serves the residential subdivisions south of the project is fed by the existing 0.5 and 1.0 M.G. concrete water reservoirs on the upper reaches of Lahainaluna Road; while water for the existing developments across Kahoma Stream Channel

is supplied by the 1.5 MG Wahikuli storage tank which is located above Wahikuli Road.

B. PROJECTED WATER REQUIREMENTS:

1. Domestic:

According to Table 100-18, Domestic Consumption Guidelines, of the Department of Water Supply (DWS) Standards, the average daily domestic demand for single-family residences is 600 gallons per unit, respectively. Hence the average daily demand for the proposed project is as follows:

Single Family	= 68 x 600 gals./lot	= 40,800 gpd
	Total Average Daily Demand	= 40,800 gpd

The maximum daily demand will be about 61,200 gpd which is 1.5 times the average daily demand (Table 100-20, Demand Factors).

2. Fire Flow:

The fire flow requirements (Table 100-19, Fire Flow Requirements) for the proposed single-family residential site is 1,000 gallons per minute (gpm). Fire hydrant will be at no more than 350 feet apart.

C. PROPOSED WATER SYSTEM IMPROVEMENTS:

With a relatively small residential development like this, the size of the distribution line is usually governed by the fire flow requirements. The needed

fire flow of 1,000 gpm for the single-family residential units will be used to size the main distribution line. Thus, an 8-inch waterline, which can deliver about 1,565 gpm at a velocity of 10 feet per second, is sufficient to provide the needed fire flow.

The conceptual water system is laid out on Figure 10. It consists of both onsite and offsite facilities. The onsite component includes 8-inch waterline, fire hydrants and service laterals. Individual single-family lots will be served by 5/8" water meters. The park site (Lot 70) will be served by a larger meter, tentatively 1½" meter, for both domestic and landscape watering purposes. Lot 69 which contains the drainage pond should also be provided with a water meter for irrigation. In keeping with the guidelines of the DWS Standards, the proposed fire hydrants will be spaced at no more than 350 feet apart.

Both ends of the onsite system will be tied-in to the existing waterline network serving the area. The upper end will be connected to the existing 8" and 4" waterlines at the intersection of Kahena and Kalena Streets through Lui Street. The lower end of the onsite system will be connected to the existing 12-inch waterline on Keawe Street via an 8-inch pipe across Kahoma Stream Channel and along the old cane haul road as shown on Figure 6. Similar with the offsite sewerline, this offsite waterline needs an easement from Kaanapali Land Management Corporation and may need approval by the U.S. Army Corps of Engineers.

VII. DRAINAGE, GRADING AND SOIL EROSION:

A. GENERAL:

The preliminary Drainage Study, in general, is based on the requirements, formulas, charts and tables of the Rules of the Design of Storm Drainage Facilities of the County of Maui [1] hereinafter referred to as County Drainage Standards; whereas, the Best Management Practices to control soil erosion are in accordance with the Construction Best Management Practices (BMPs) for the County of Maui [2] hereinafter referred to as "County Standard BMPs".

B. FLOODING HAZARD:

The site is found on Panels 0361E and 0362E map revised September 25, 2009, of the Flood Insurance Rate Map (FIRM) for the County of Maui. Refer to Figures 4 and 4A. The site is situated within Flood Designation Zone X where areas are subject to minimal flooding or areas determined to be outside the 0.2% annual chance flood plain. Therefore the proposed project does not need flood development permit as may be required by Chapter 19.62, Flood Hazard Areas, of the Maui County Code.

C. EXISTING DRAINAGE CONDITIONS:

The present onsite drainage flow pattern is generally characterized by sheet flow across the project site in a westerly direction discharging into Kahoma Stream channel at the upstream side of the existing cane haul bridge. The surface runoff enters the stream by flowing over the top of the concrete channel.

The site is part of the Kahoma Stream watershed.

D. STORM RUNOFF QUANTITIES:

Hydrologic calculations are given in Appendix A - Preliminary Drainage Calculations. According to the County Drainage Standards, the 10-year, 1-hour storm is used for design of surface drainage facilities such as roadway gutter flow, while the 50-year, 1-hour duration is used for the design of culverts and retention basins or drainage ponds.

Based on the preliminary drainage calculations (Appendix A), the overall project site is anticipated to increase the existing 1-hour rainfall storm as follows:

10-year Runoff Rate:	12.6 cfs, from 14.0 to 26.6 cfs
50-year Runoff Rate:	15.8 cfs, from 17.5 to 33.3 cfs
50-year Runoff Volume:	40,210 cf, from 44,675 to 84,885 cf

E. CONCEPTUAL DRAINAGE PLAN:

The drainage system scheme is laid out on Figure 11. The main feature of the proposed system is the construction of an onsite surface (open) retention basin or drainage pond that will be sized, at a minimum, to retain the 50-year, 1-hour storm runoff volume increase that is anticipated to be generated by the proposed project site. Storing the volume increase is expected to maintain the runoff volume leaving the project site below or at pre-development level.

Aside from the open-cut drainage pond, the proposed drainage system will also include catch basins and/or grated drain inlets to collect runoff; non-perforated pipes to convey runoff to the drainage pond; and drain manholes. It will also include the rerouting of the existing 30" and 36" drainlines between Lui Street and the Kahoma Stream Channel.

The proposed drainage pond will be constructed on Lot 69 as shown on Figure 11 while the conceptual grading plan is shown on Figure 12. The pond should be provided with the following:

1. Maintenance access where the side slopes are steeper than 4:1.
2. A chainlink fence along the perimeter.
3. Overflow spillway should the anticipated design storm is exceeded.
4. A freeboard of two (2) feet to provide a safety measure for the occurrence of a storm with intensity greater than the design storm.

F. GRADING REQUIREMENTS:

Grading for the proposed development will be performed in compliance with the applicable requirements of the Maui County Grading Ordinance. It is expected that grading will be essentially associated with the construction of the proposed roadways and developing building pads on each lot. This will involve grading almost the whole site that includes development of the drainage pond; cut and fill areas between the lots with minimum slopes at 2 horizontal to 1 vertical (2:1), if sufficient space is available; otherwise, grade adjustment walls will have to be constructed along the lot boundaries to obtain level surfaces for the future residential buildings especially on Lots 55 to 68.

A grading and grubbing permit must be obtained from the Development Services Administration (DSA) of the County of Maui prior to commencing land disturbance activities. Associated submittals for the permit application are Grading Plans, Soil Erosion Control Plan or Best Management Practices, Drainage Plan and Drainage Report.

G. BEST MANAGEMENT PRACTICES:

Requirements for the temporary control of soil erosion and dust during site improvement will be outlined and shown on the construction plans during the design development for the project. Some of the temporary control measures will be as follows:

1. Installation of BMP such as silt fence, gravel bag berms or other approved sediment trapping devices at the downstream side of the grading area and sediment pits.
2. Installation of dust control fence surrounding the project site.
3. Control dust by means of water trucks or by installing temporary sprinkler systems or both if necessary.
4. Graded areas shall be thoroughly watered after construction activity has ceased for the day and for weekends and holidays.
5. All exposed areas shall be paved, grassed, or permanently landscaped as soon as finished grading is completed.
6. Storm runoff will be diverted away from graded areas to natural drainageways during construction by means of sand bag berms or lined temporary swales.
7. Time of construction will be minimized.
8. Only areas that are needed for new improvements will be cleared.
9. Early construction of drainage control features.
10. Construction of pit for proposed drainage ponds prior to mass grading of project site. The pits will be temporarily utilized as sediment catchment during construction.

11. Temporary control measures shall be in place and functional prior to construction and shall remain operational throughout the construction period or until permanent controls are in place.

The Contractor will also be required to submit a satisfactory soil erosion control plan to minimize soil erosion prior to an issuance of a grubbing and grading permit. Best Management Practices shall be in compliance with Section 20.08.035 of the Maui County Code (Ord. No. 2684) and County Standard BMPs.

The grading area is expected to be larger than 1.0 acre. Hence, NPDES General Permit Coverage Authorizing Discharges of Storm Water associated with construction activities will need to be obtained from the State Department of Health, Clean Water Branch, prior to any land disturbance at the project site.

H. CONCLUSION:

Based on this preliminary drainage study, the proposed development will increase the existing storm runoff due to addition of impervious surfaces such as building roofs, pavement and concrete walkways. Despite the increase in runoff, the proposed development is not anticipated to have adverse drainage effects on adjacent and downstream properties. In keeping with the guidelines of the County Drainage Standards, the proposed drainage improvements will include the impoundment of the 50-year, 1-hour storm runoff volume increase to be generated by the future development. The future onsite drainage pond will result in a zero runoff increase for the 50-year storm to downstream properties and will also have the effect of reducing the potential for sediments contained in the runoff from entering the ocean.

Soil erosion and dust control measures (BMPs) will be instituted during development of the proposed project. These measures will include BMPs in compliance with County Standard BMPs and Section 20.08.035 of the Maui County Code. Additionally, NPDES General Permit Coverage Authorizing Discharge of Storm Water Associated with Construction Activities will be obtained from the Clean Water Branch of the State Department of Health prior to any land disturbance. Conditions of the permit will be implemented during site construction.

IX. CONSTRUCTION PLAN APPROVALS:

Approval of construction plans and appropriate permits for site grading and infrastructural improvements of the proposed project will be obtained from the Department of Public Works; Department of Environmental Management; Department of Water Supply; Fire Prevention Bureau; State Department of Health, Wastewater and Clean Water Branches; and the U.S. Army Corps of Engineers. The various infrastructures will be designed in compliance with the applicable requirements of these governmental agencies.

X. REFERENCES:

1. Rules for the Design of Storm Drainage Facilities in the County of Maui, Title MC-15, Department of Public Works and Waste Management, County of Maui, Chapter 4.

2. Construction Best Management Practices (BMPs) for the County of Maui, Department of Public Works and Waste Management, May 2001.

3. Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii, prepared by U. S. Department of Agriculture, Soil Conservation Service, August 1972.

4. Erosion and Sediment Control Guide for Hawaii, prepared by U. S. Department of Agriculture, Soil Conservation Service, March 1981.

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

6. Flood Insurance Rate Maps for the County of Maui

7. Water System Standards, Department of Water Supply, County of Maui, 2002.

8. Wastewater Flow Standards, Wastewater Reclamation Division, Department of Public Works & Environmental Management, February 2, 2000.

APPENDIX A

KAHOMA RESIDENTIAL SUBDIVISION
LAHAINA, MAUI, HAWAII
TMK: (2) 4-5-10:005

PRELIMINARY DRAINAGE CALCULATIONS

December 2009
Revised: October 1, 2010
Revised: November 8, 2010

I. Reference: Rules for the Design of Storm Drainage Facilities in the County of Maui, April 14, 1995

II. Purpose: To determine the overall pre and post development storm runoff discharges.

III. Hydrologic Criteria:

A. 10-Year, 1-Hour: for design of surface facilities such as gutter

1-Hr. Rainfall Value = 2.0"

B. 50-Year, 1-Hour: for design of retention ponds and roadway culverts

1-Hr. Rainfall Value = 2.5"

IV. Runoff Quantity:

A. Runoff Discharge Rate & Volume:

1. Methodology:

Rational Method, Q = CIA

Where Q = Flow rate in cubic feet per second (cfs)

C = Runoff Coefficient

I = Rainfall intensity in inches per hour for a duration equal to the time of concentration

A = Drainage Area in Acres (See Figure 13)

Calculations employing this method were performed on computer using hydrologic software "Hydraflow Hydrographs 2004" by Intelisolve. The Standard Rational Method is used to calculate storm runoff peak discharge rates while the Modified Rational Method is employed to determine storm runoff volumes. The intensity duration frequency (IDF) curves were developed by inputting into the program the intensity values for 5, 15, 30 and 60 minutes duration corresponding to the 10-year and 50-year, 1-hour rainfall amounts as determined from Plate 2.

2. Runoff Coefficient, C:

Existing Condition:

C = 0.30 (Unimproved)

Future Condition:

C = 0.55 (Residential)

= 0.80 (Roadway)

= 0.22 (Park/Open Space)

Determine weighted runoff coefficient, C_W, of project site at developed conditions:

$$C_W = \frac{A_1 \times C_1 + A_2 \times C_2 + A_3 \times C_3}{A_1 + A_2 + A_3}$$

Where:

A_1 = 12.21 Acs. (Residential)

A_2 = 3.23 Acs. (Roadway)

A_3 = 1.44 Acs. (Open Space/Park)

$$C_w = \frac{12.21 \times 0.55 + 3.23 \times 0.80 + 1.44 \times 0.22}{16.88}$$

$$= \frac{9.616}{16.88}$$

$$= 0.57$$

3. Time of Concentration, Tc:

   Length of Flow = 2,600 ft.

   Average Slope = 4.5%

   Tc = 30 min. (Poor Grass)

4. Storm Runoff Quantity:

   (Refer to attached Hydrograph Report)

   1-Hour Storm Peak Discharge Rate:

	Existing	Future	Increase
10-Year	= 14.0 cfs	= 26.6 cfs	= 12.6 cfs
50-Year	= 17.5 cfs	= 33.3 cfs	= 15.8 cfs

5. Runoff Volume (50-Year, 1-Hour Storm):

   (Refer to attached Hydrograph Report)

Existing	Future	Increase
= 44,675 cf	= 84,885 cf	= 40,210 cf

The 50-year, 1-hour rainfall volume increase is the minimum volume to be retained onsite in order to attain zero runoff increase to adjacent/downstream properties.

V. Retention Pond:

In accordance with the County Drainage Standards, retention pond shall have a storage capacity to at least equal to the anticipated 50-year, 1-hour storm runoff volume increase for drainage areas less than 100 acres; however, in determining the storage capacity, soil percolation shall not be taken into account. Based on this guideline, the proposed project will require a minimum storage of 40,210 cf.

The conceptual grading plan of the proposed drainage pond is shown on Figure 12. Storage capacity of the proposed pond is given in the attached "Pond Report". Allowing for a freeboard of 2 feet; the design capacity of the proposed pond is about 46,510 cf resulting in an excess of 6,300 cf over the volume increase.

Pond Report

Hydraflow Hydrographs by Intelisolve

Thursday, Nov 4 2010, 3:39 PM

Pond No. 3 - Proposed Drainage Pond

Pond Data

Bottom LxW = 95.0 x 60.0 ft Side slope = 2.0:1 Bottom elev. = 0.00 ft Depth = 8.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)	
0.00	0.00	5,700	0	0	
0.40	0.40	5,951	2,330	2,330	
0.80	0.80	6,206	2,431	4,761	
1.20	1.20	6,467	2,534	7,296	
1.60	1.60	6,733	2,640	9,935	
2.00	2.00	7,004	2,747	12,683	
2.40	2.40	7,280	2,857	15,539	
2.80	2.80	7,561	2,968	18,507	
3.20	3.20	7,848	3,082	21,589	
3.60	3.60	8,139	3,197	24,786	
4.00	4.00	8,436	3,315	28,101	
4.40	4.40	8,738	3,435	31,536	
4.80	4.80	9,045	3,556	35,092	
5.20	5.20	9,357	3,680	38,772	
5.60	5.60	9,674	3,806	42,578	
6.00	6.00	9,996	3,934	46,512	CAP @ 2' FB = 46,510 CF
6.40	6.40	10,323	4,064	50,576	
6.80	6.80	10,656	4,196	54,771	
7.20	7.20	10,993	4,330	59,101	
7.60	7.60	11,336	4,466	63,567	
8.00	8.00	11,684	4,604	68,171	

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 7.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

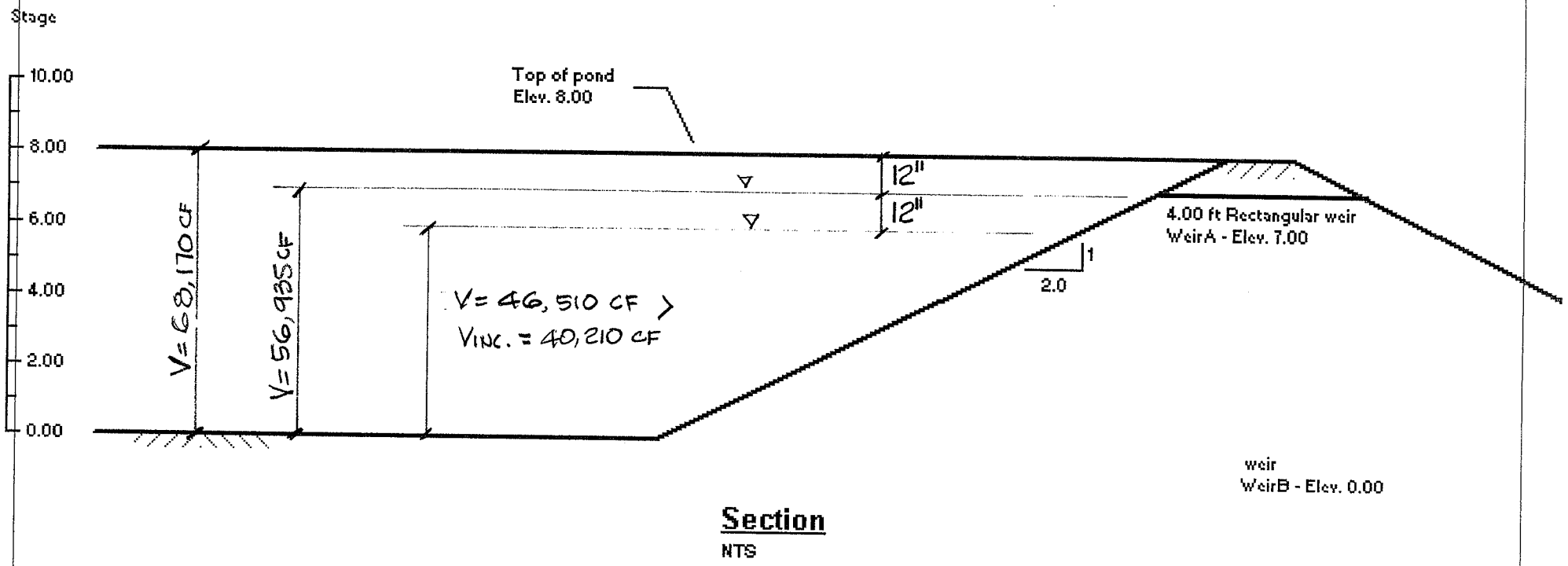
Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	0.00	---	---	---	---	0.00	---	---	---	---	0.00
0.40	2,330	0.40	---	---	---	---	0.00	---	---	---	---	0.00
0.80	4,761	0.80	---	---	---	---	0.00	---	---	---	---	0.00
1.20	7,296	1.20	---	---	---	---	0.00	---	---	---	---	0.00
1.60	9,935	1.60	---	---	---	---	0.00	---	---	---	---	0.00
2.00	12,683	2.00	---	---	---	---	0.00	---	---	---	---	0.00
2.40	15,539	2.40	---	---	---	---	0.00	---	---	---	---	0.00
2.80	18,507	2.80	---	---	---	---	0.00	---	---	---	---	0.00
3.20	21,589	3.20	---	---	---	---	0.00	---	---	---	---	0.00
3.60	24,786	3.60	---	---	---	---	0.00	---	---	---	---	0.00
4.00	28,101	4.00	---	---	---	---	0.00	---	---	---	---	0.00
4.40	31,536	4.40	---	---	---	---	0.00	---	---	---	---	0.00
4.80	35,092	4.80	---	---	---	---	0.00	---	---	---	---	0.00
5.20	38,772	5.20	---	---	---	---	0.00	---	---	---	---	0.00
5.60	42,578	5.60	---	---	---	---	0.00	---	---	---	---	0.00
6.00	46,512	6.00	---	---	---	---	0.00	---	---	---	---	0.00
6.40	50,576	6.40	---	---	---	---	0.00	---	---	---	---	0.00
6.80	54,771	6.80	---	---	---	---	0.00	---	---	---	---	0.00
7.20	59,101	7.20	---	---	---	---	1.19	---	---	---	---	1.19
7.60	63,567	7.60	---	---	---	---	6.19	---	---	---	---	6.19
8.00	68,171	8.00	---	---	---	---	13.32	---	---	---	---	13.32

Proposed Drainage Pond

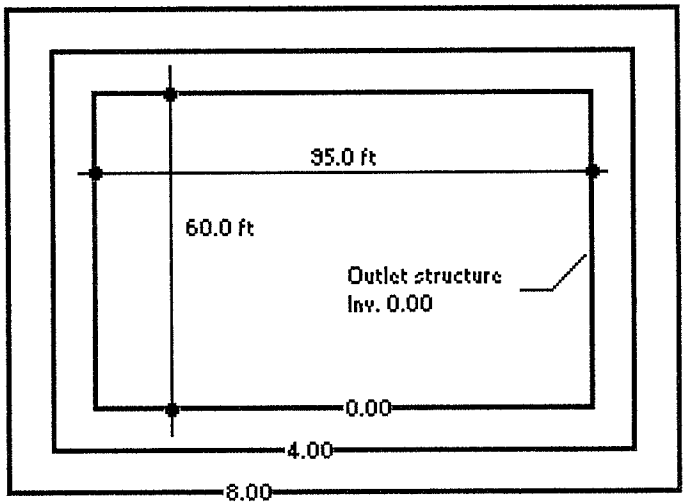


Section

NTS

Schematic only. Not for construction.

Proposed Drainage Pond



Plan View

NTS

Schematic only. Not for construction.

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

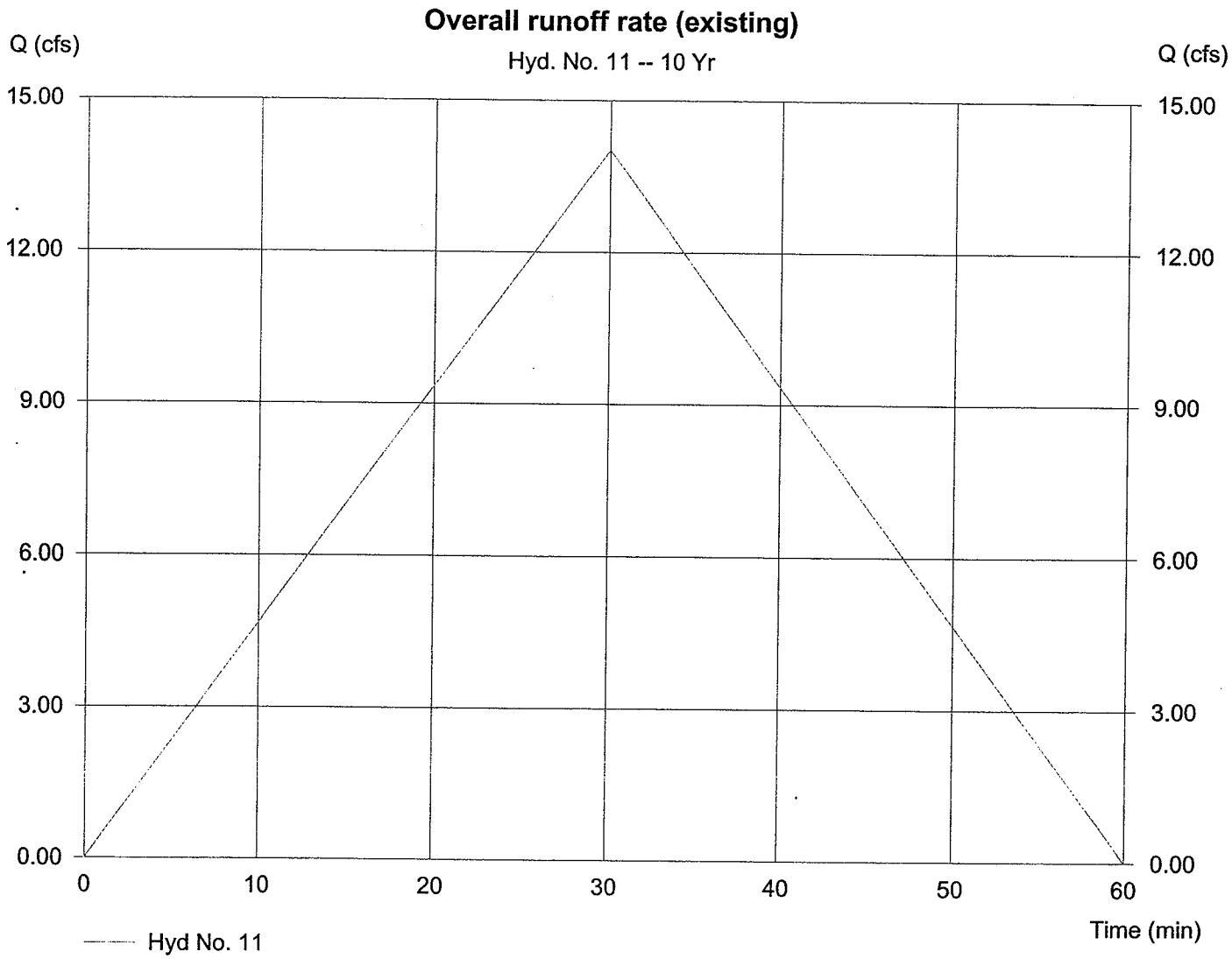
Wednesday, Oct 27 2010, 2:50 PM

Hyd. No. 11

Overall runoff rate (existing)

Hydrograph type	= Rational	Peak discharge	= 14.01 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 16.680 ac	Runoff coeff.	= 0.3
Intensity	= 2.800 in/hr	Tc by User	= 30.00 min
IDF Curve	= Lai O Lele 05-105.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 25,220 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

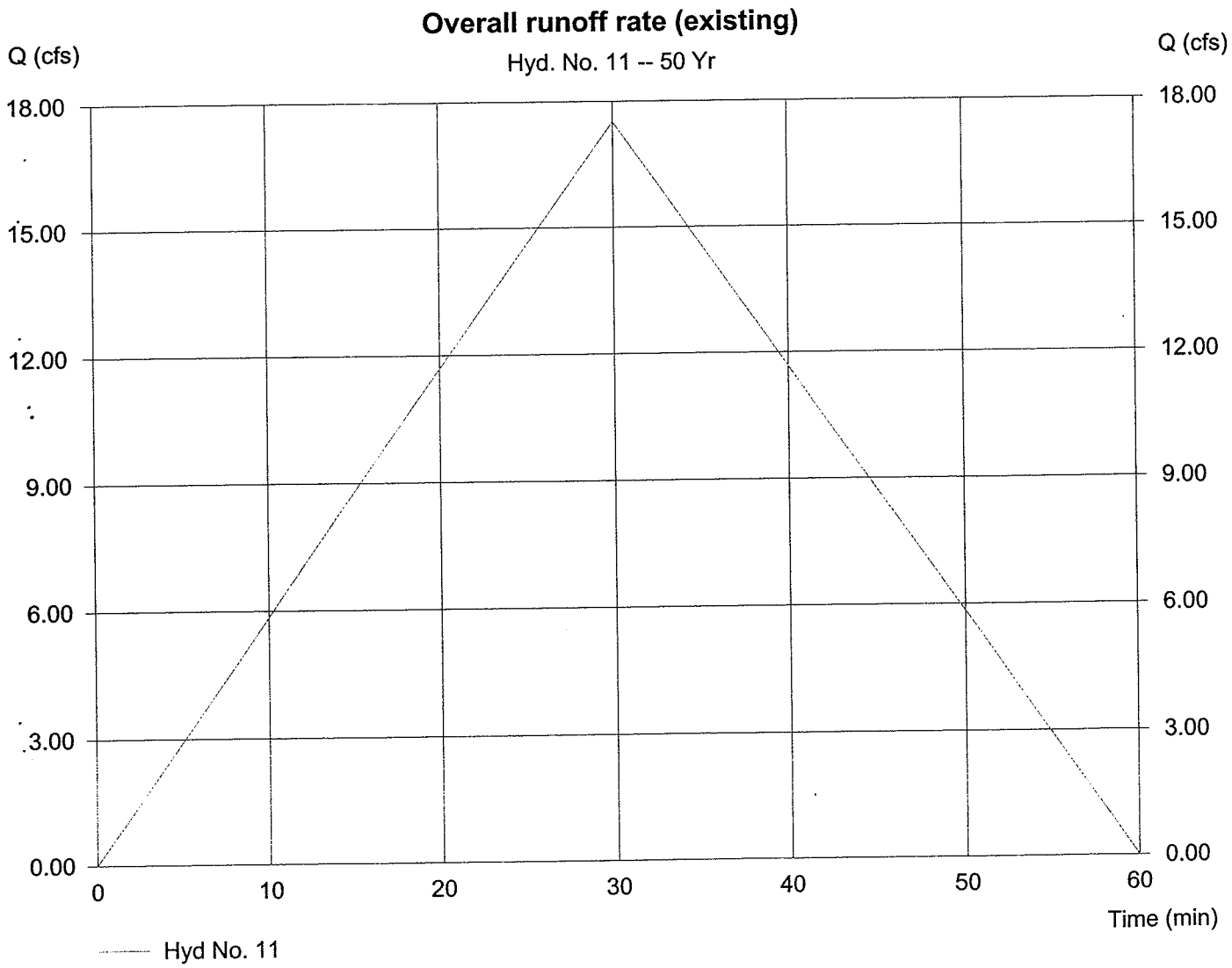
Wednesday, Oct 27 2010, 2:50 PM

Hyd. No. 11

Overall runoff rate (existing)

Hydrograph type	= Rational	Peak discharge	= 17.51 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 16.680 ac	Runoff coeff.	= 0.3
Intensity	= 3.500 in/hr	Tc by User	= 30.00 min
IDF Curve	= Lai O Lele 05-105.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 31,525 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

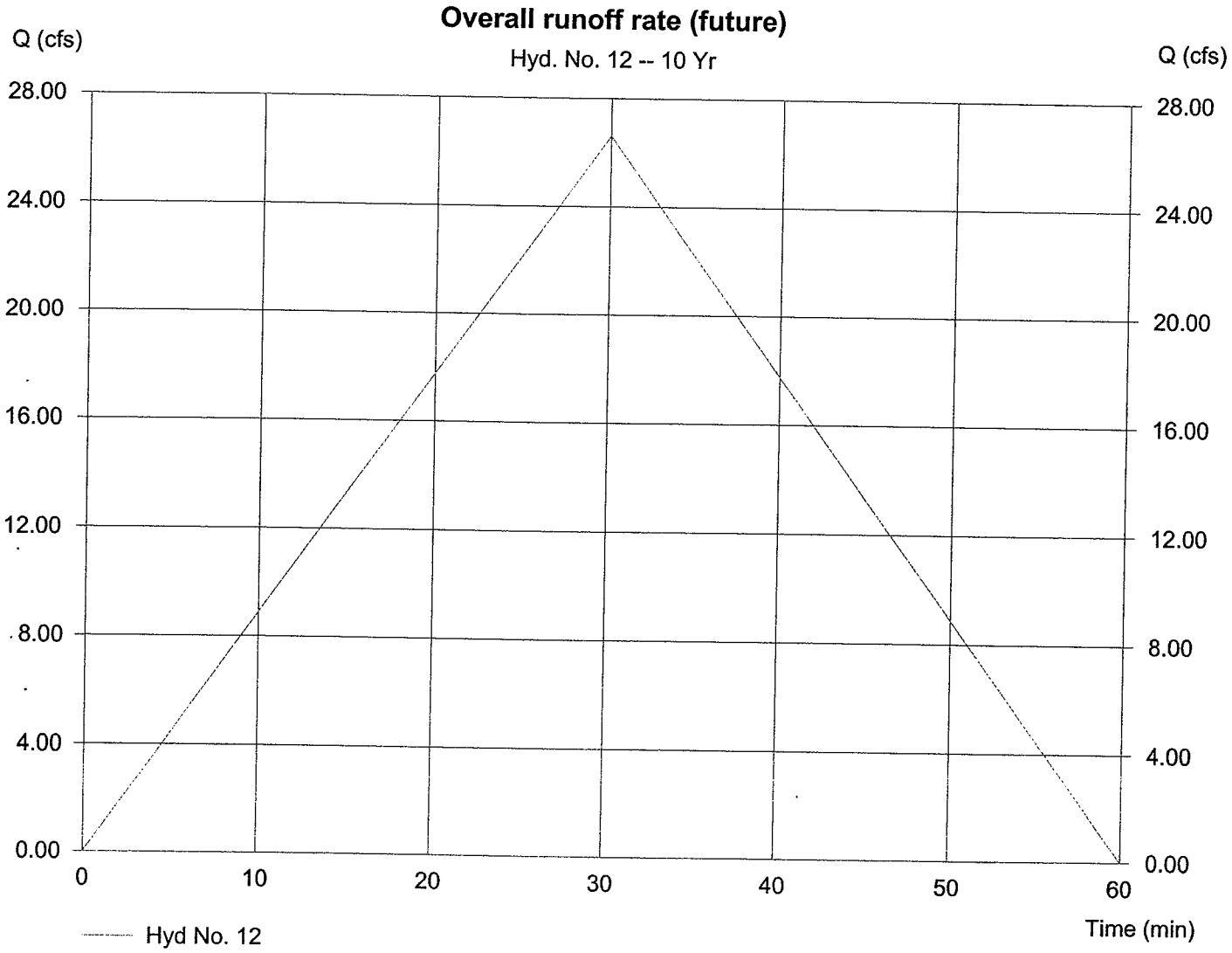
Wednesday, Oct 27 2010, 2:50 PM

Hyd. No. 12

Overall runoff rate (future)

Hydrograph type	= Rational	Peak discharge	= 26.62 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 16.680 ac	Runoff coeff.	= 0.57
Intensity	= 2.800 in/hr	Tc by User	= 30.00 min
IDF Curve	= Lai O Lele 05-105.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 47,918 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

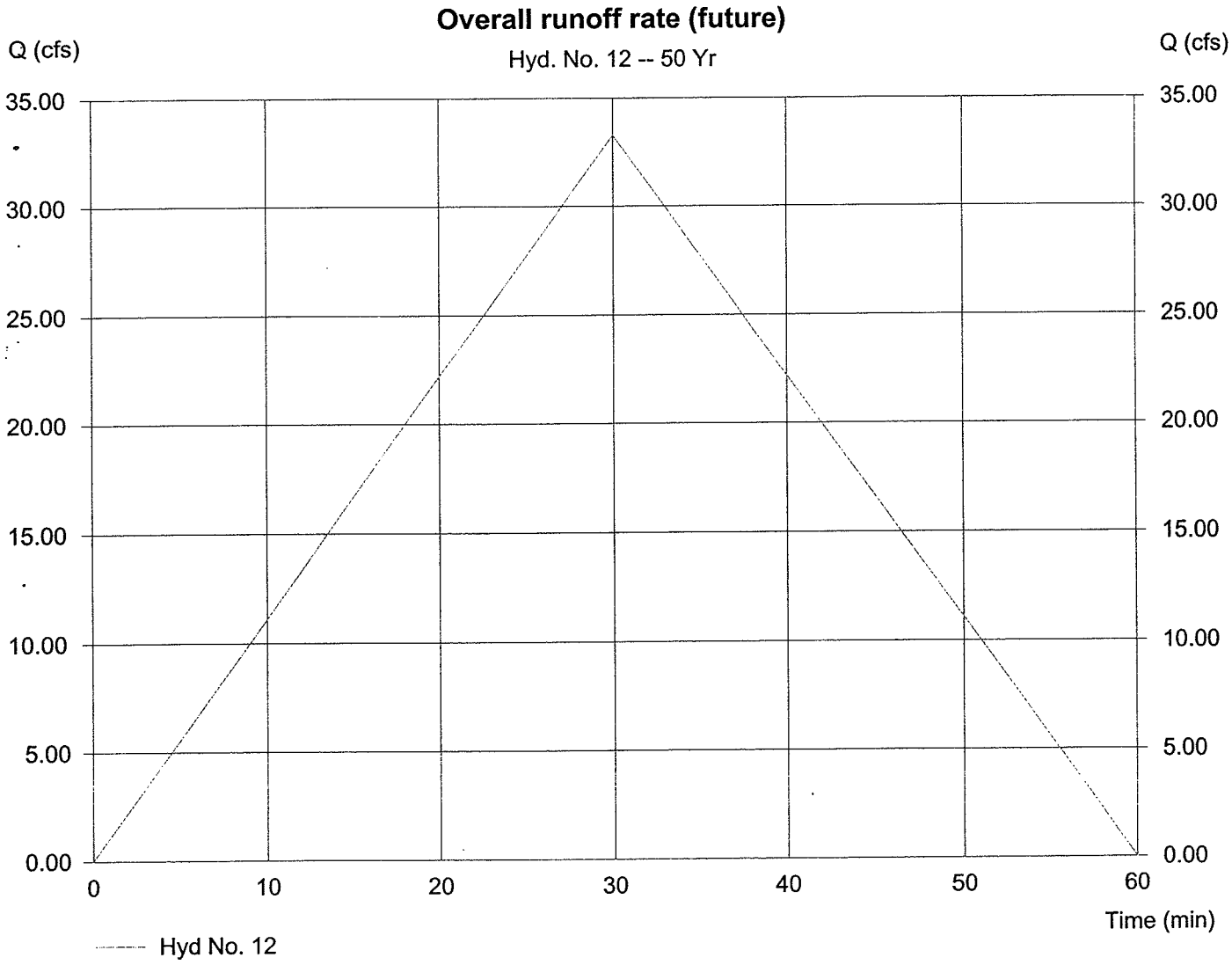
Wednesday, Oct 27 2010, 2:50 PM

Hyd. No. 12

Overall runoff rate (future)

Hydrograph type	= Rational	Peak discharge	= 33.28 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 16.680 ac	Runoff coeff.	= 0.57
Intensity	= 3.500 in/hr	Tc by User	= 30.00 min
IDF Curve	= Lai O Lele 05-105.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 59,898 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 27 2010, 2:50 PM

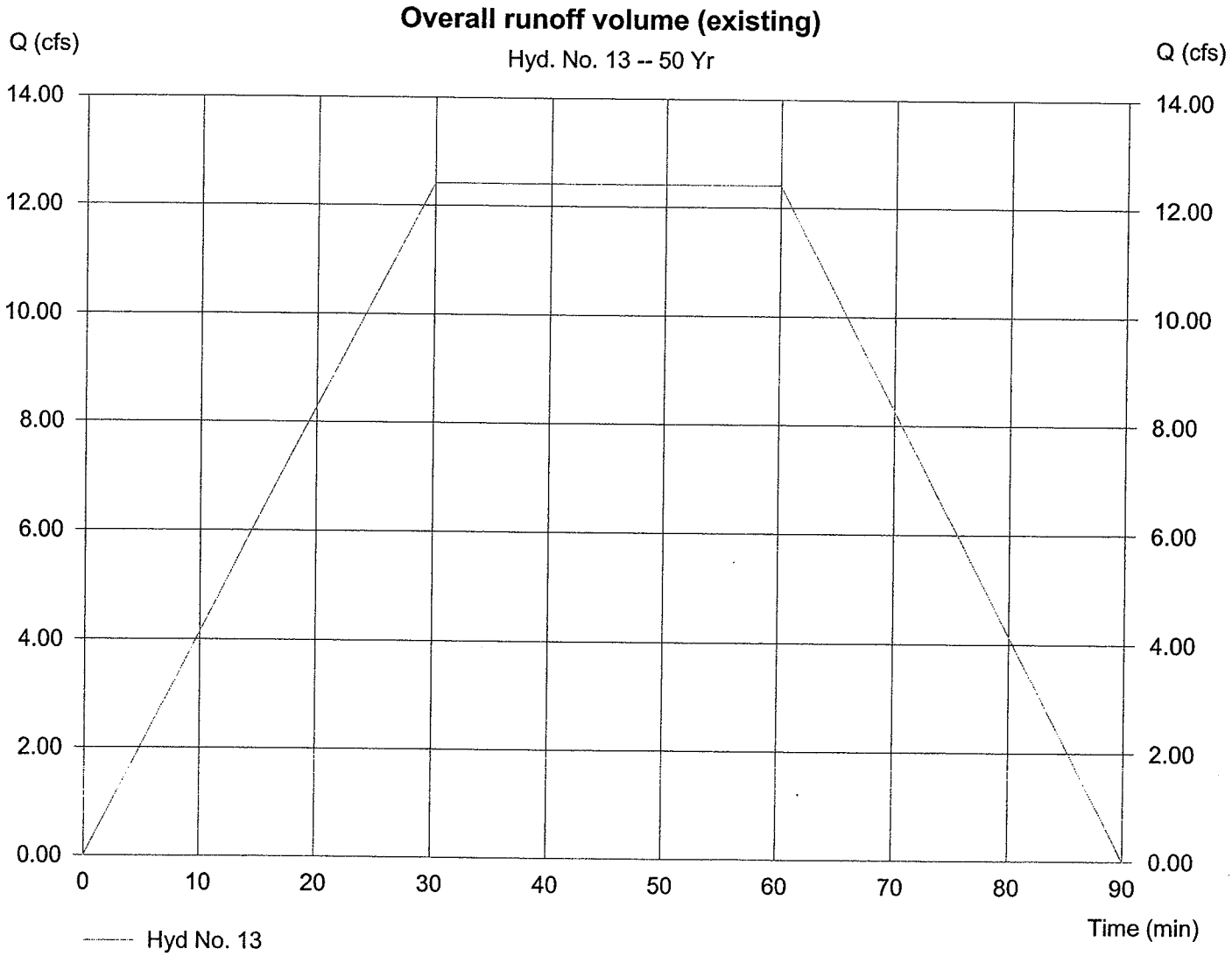
Hyd. No. 13

Overall runoff volume (existing)

Hydrograph type	= Mod. Rational	Peak discharge	= 12.41 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 16.680 ac	Runoff coeff.	= 0.3
Intensity	= 2.480 in/hr	Tc by User	= 30.00 min
IDF Curve	= Lai O Lele 05-105.IDF	Storm duration	= 2 x Tc

Hydrograph Volume = 44,676 cuft

≈ 44,675 CF



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Oct 27 2010, 2:51 PM

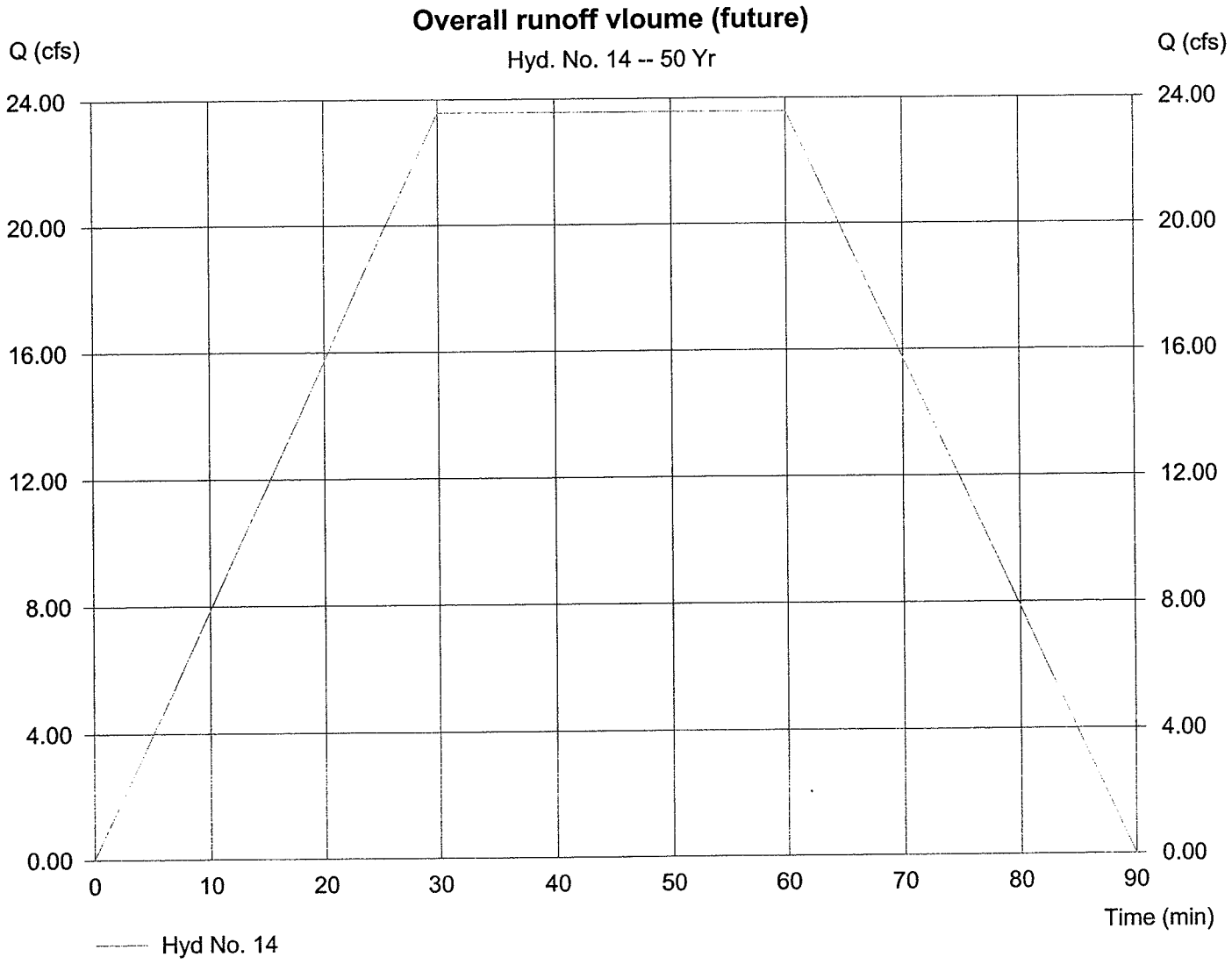
Hyd. No. 14

Overall runoff vloume (future)

Hydrograph type	= Mod. Rational	Peak discharge	= 23.58 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 16.680 ac	Runoff coeff.	= 0.57
Intensity	= 2.480 in/hr	Tc by User	= 30.00 min
IDF Curve	= Lai O Lele 05-105.IDF	Storm duration	= 2 x Tc

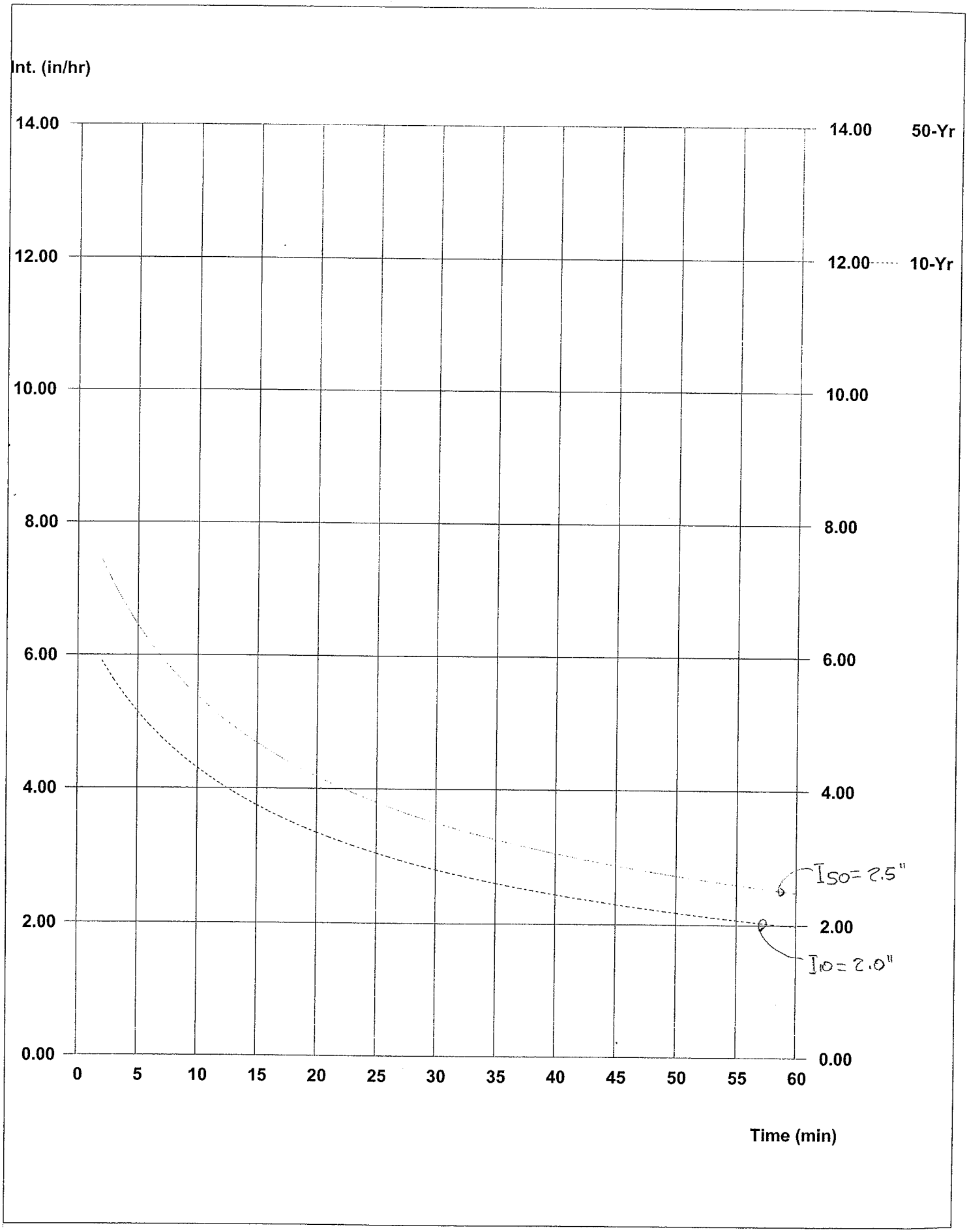
Hydrograph Volume = 84,884 cuft

≈ 84,885 CF



Hydrograph IDF Curves

IDF file: Lai O Lele 05-105.IDF



Hydraflow IDF Report

Return Period (Yrs)	Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	0.0000	0.0000	0.0000	--------
3	0.0000	0.0000	0.0000	--------
5	0.0000	0.0000	0.0000	--------
10	27.3279	9.9000	0.6180	--------
25	0.0000	0.0000	0.0000	--------
50	32.9258	9.5000	0.6097	--------
100	0.0000	0.0000	0.0000	--------

C:\Program Files\Hydraflow\Hydrographs 2004\Lai O Lele 05-105.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	5.15	4.30	3.75	3.35	3.04	2.80	2.60	2.44	2.30	2.18	2.07	1.98
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	6.45	5.38	4.68	4.18	3.80	3.50	3.25	3.05	2.88	2.73	2.60	2.48
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tc = time in minutes

Table 1

GUIDE FOR THE DETERMINATION OF RUNOFF COEFFICIENTS FOR BUILT-UP AREAS*

WATERSHED CHARACTERISTICS	EXTREME	HIGH	MODERATE	LOW
INFILTRATION	NEGLIGIBLE 0.20	SLOW 0.14	MEDIUM 0.07	HIGH 0.0
RELIEF	STEEP (> 25%) 0.08	HILLY (15 - 25%) 0.06	ROLLING (5 - 15%) 0.03	FLAT (0-5%) 0.0
VEGETAL COVER	NONE 0.07	POOR (< 10%) 0.05	GOOD (10 - 50%) 0.03	HIGH (50 - 90%) 0.0
DEVELOPMENT TYPE	INDUSTRIAL & BUSINESS 0.55	HOTEL - APARTMENT 0.45	RESIDENTIAL 0.40	AGRICULTURAL 0.15

NOTE: The design coefficient "c" must result from a total of the values for all four watershed characteristics of the site.

Table 2

RUNOFF COEFFICIENTS

Type of Drainage Area	Runoff Coefficient C
Parks, cemeteries	0.25
Playgrounds	0.35
Railroad yard areas	0.40
Unimproved areas	0.30
Streets:	
Asphaltic	0.95
Concrete	0.95
Brick	0.85
Driveway and walks	0.85
Roofs	0.95
Lawns:	
Sandy soil, flat, 2%	0.10
Sandy soil, avg., 2-7%	0.15
Sandy soil, steep, 7%	0.20
Heavy soil, flat, 2%	0.17
Heavy soil, avg., 2-7%	0.22
Heavy soil, steep, 7%	0.35

Table 3

MINIMUM RUNOFF COEFFICIENTS FOR BUILT-UP AREAS

Residential areas	C=0.55
Hotel, apartment areas	C=0.70
Business areas	C=0.80
Industrial areas	C=0.80

The type of soil, the type of open space and ground cover and the slope of the ground shall be considered in arriving at reasonable and acceptable runoff coefficients.

Table 4

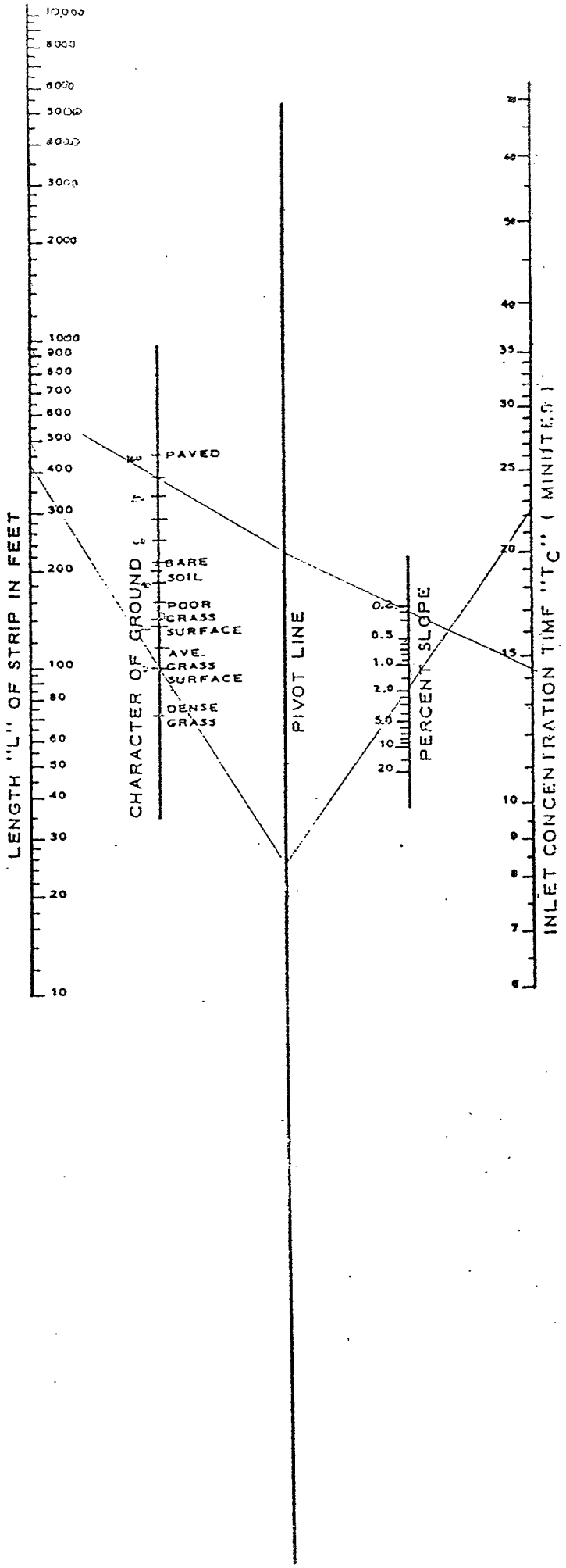
APPROXIMATE AVERAGE VELOCITIES OF RUNOFF FOR CALCULATING TIME OF CONCENTRATION

TYPE OF FLOW	VELOCITY IN FPS FOR SLOPES (in percent) INDICATED			
	0–3%	4–7%	8–11%	12–15%
OVERLAND FLOW:				
Woodlands	1.0	2.0	3.0	3.5
Pastures	1.5	3.0	4.0	4.5
Cultivated	2.0	4.0	5.0	6.0
Pavements	5.0	12.0	15.0	18.0
OPEN CHANNEL FLOW:				
Improved Channels	Determine Velocity by Manning's Formula			
Natural Channel* (not well defined)	1.0	3.0	5.0	8.0

**These values vary with the channel size and other conditions so that the ones given are the averages of a wide range. Wherever possible, more accurate determinations should be made for particular conditions by Manning's formula.*

Plate 1

Overland Flow Chart



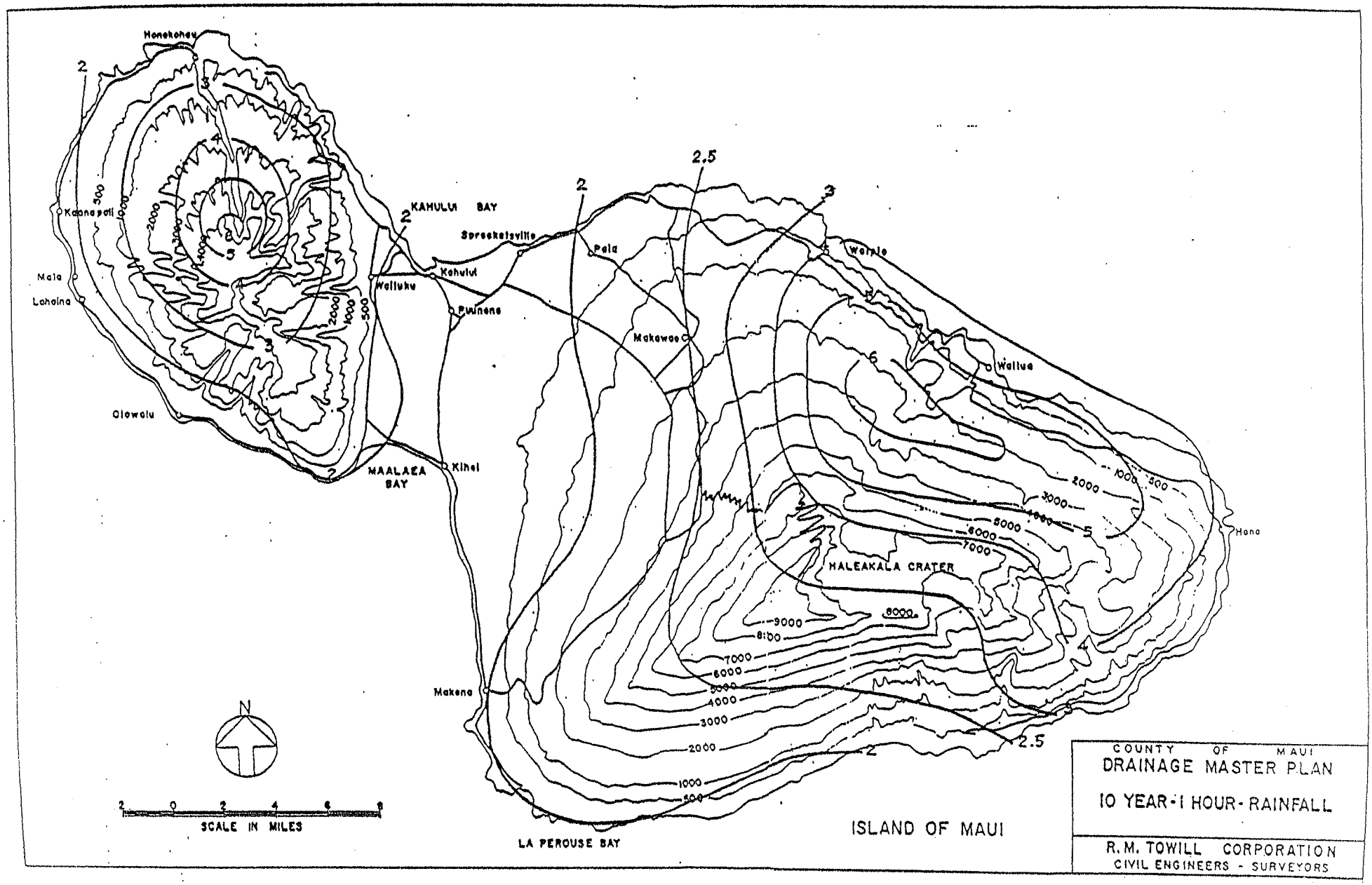

Honokohau
Kaanapali
Lahaina
Mala
Olowalu
KAHULUI BAY
Spreckelsville
Kahului
Wailuku
Puunene
Paia
Makawao
Waiehu
Wailua
Hana
MAALAEA BAY
Kihei
HALEAKALA CRATER
Makena
LA PEROUSE BAY
ISLAND OF MAUI
N
2 0 2 4 6 8
SCALE IN MILES
COUNTY OF MAUI
DRAINAGE MASTER PLAN
10 YEAR-1 HOUR-RAINFALL
R.M. TOWILL CORPORATION
CIVIL ENGINEERS - SURVEYORS

Plate 2

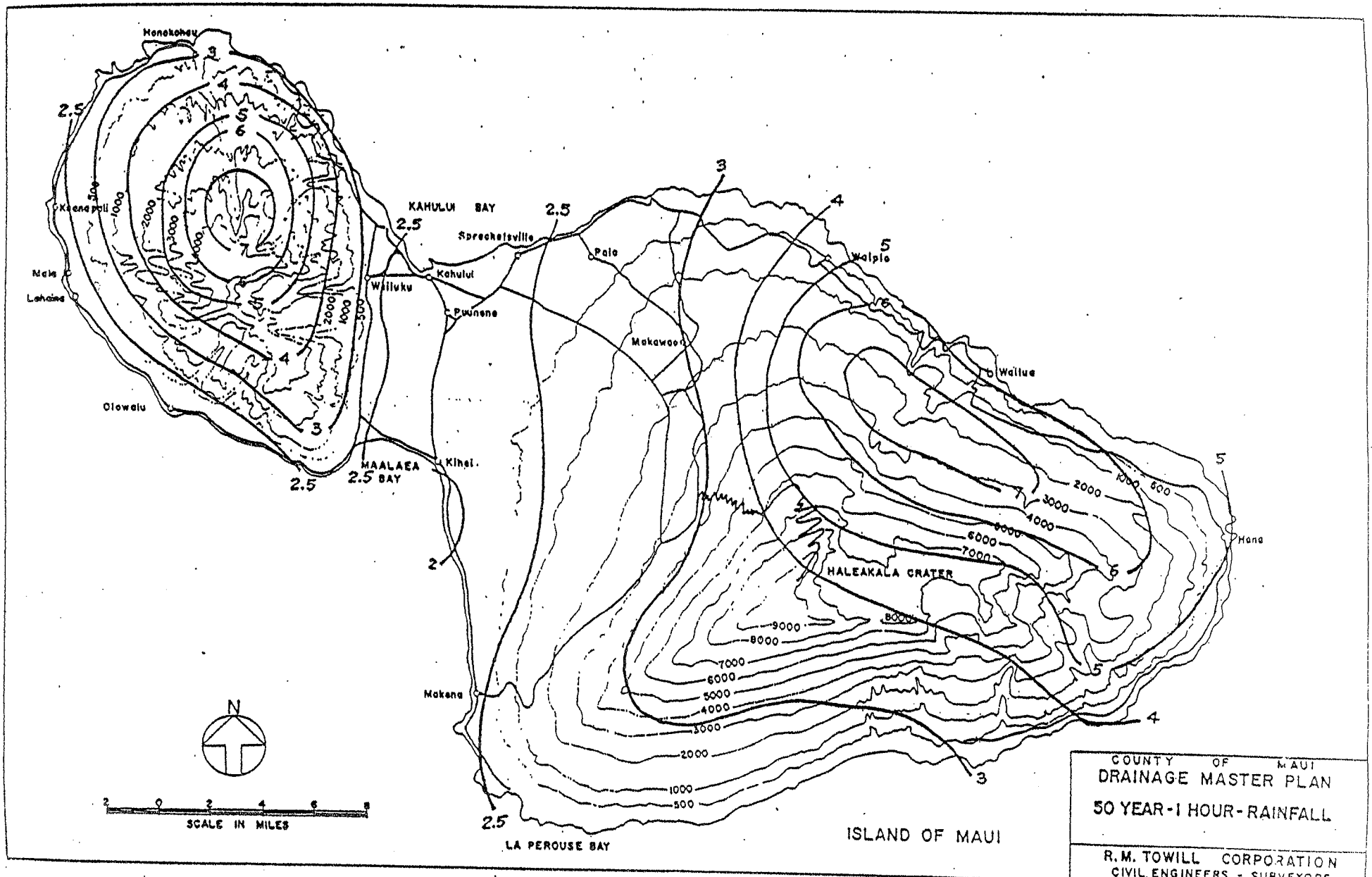
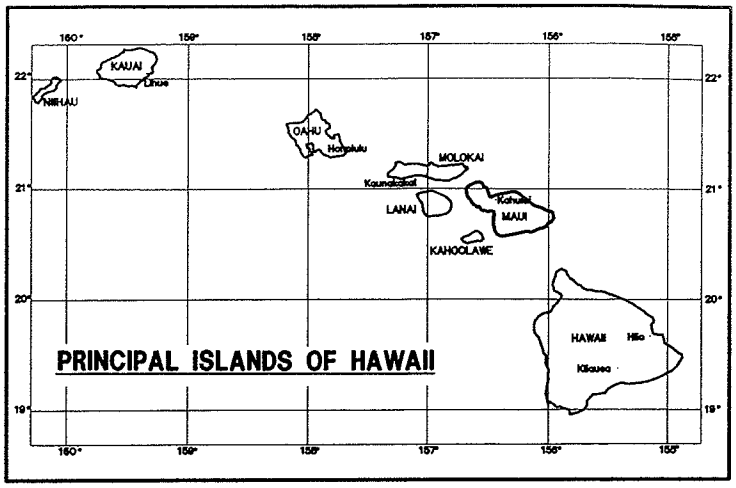
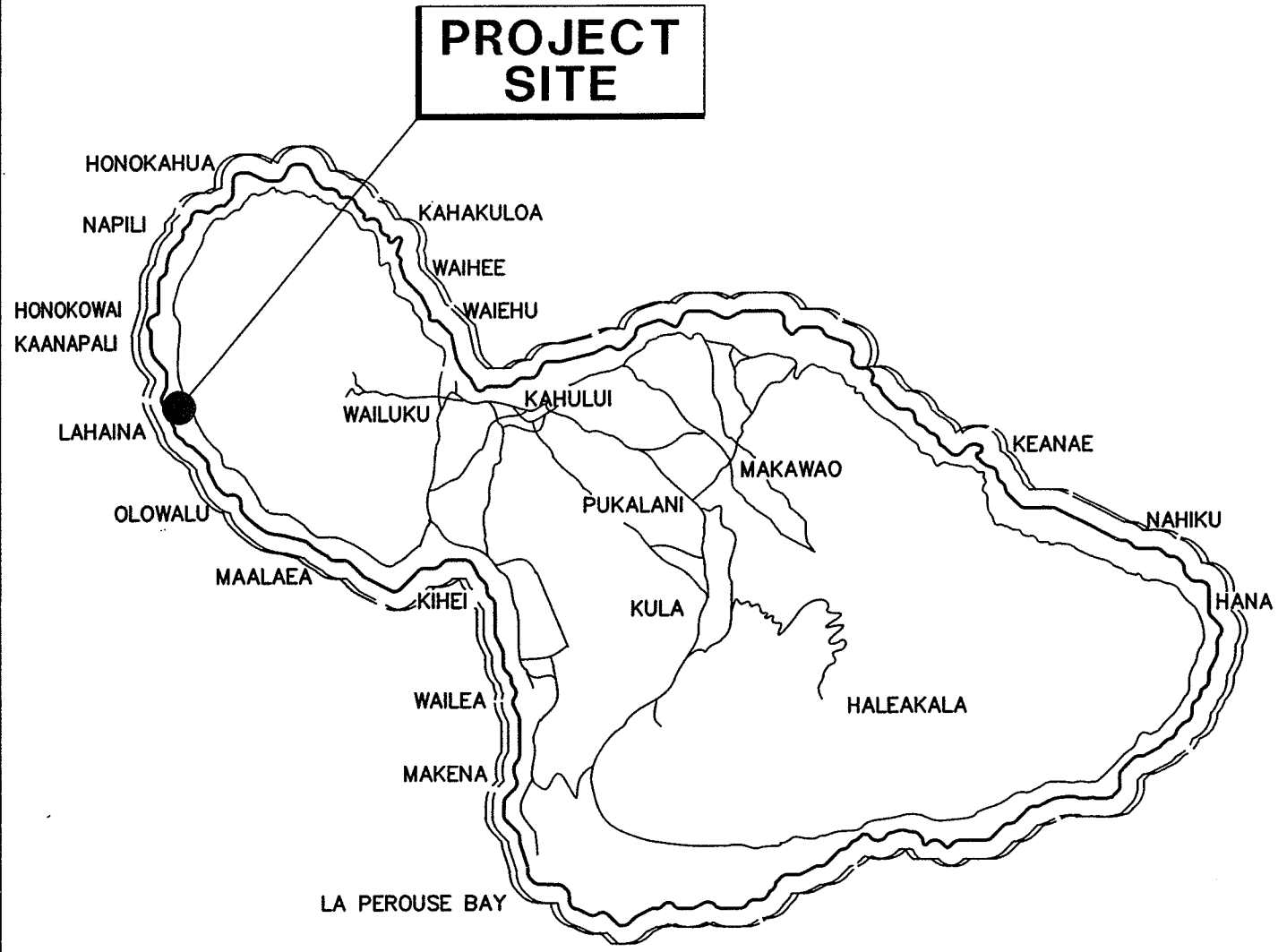

Honokohau
Kaanapali
Napili
Lahaina
Olowalu
KAHULUI BAY
Sprecklesville
Kahului
Wailuku
Puunene
Pala
Makawao
Walpio
Wailua
Hana
MAALAEA BAY
Kihei
Makena
HALEAKALA CRATER
LA PEROUSE BAY
ISLAND OF MAUI
N
SCALE IN MILES
COUNTY OF MAUI
DRAINAGE MASTER PLAN
50 YEAR - 1 HOUR - RAINFALL
R. M. TOWILL CORPORATION
CIVIL ENGINEERS - SURVEYORS

Plate 3





LOCATION MAP
ISLAND OF MAUI

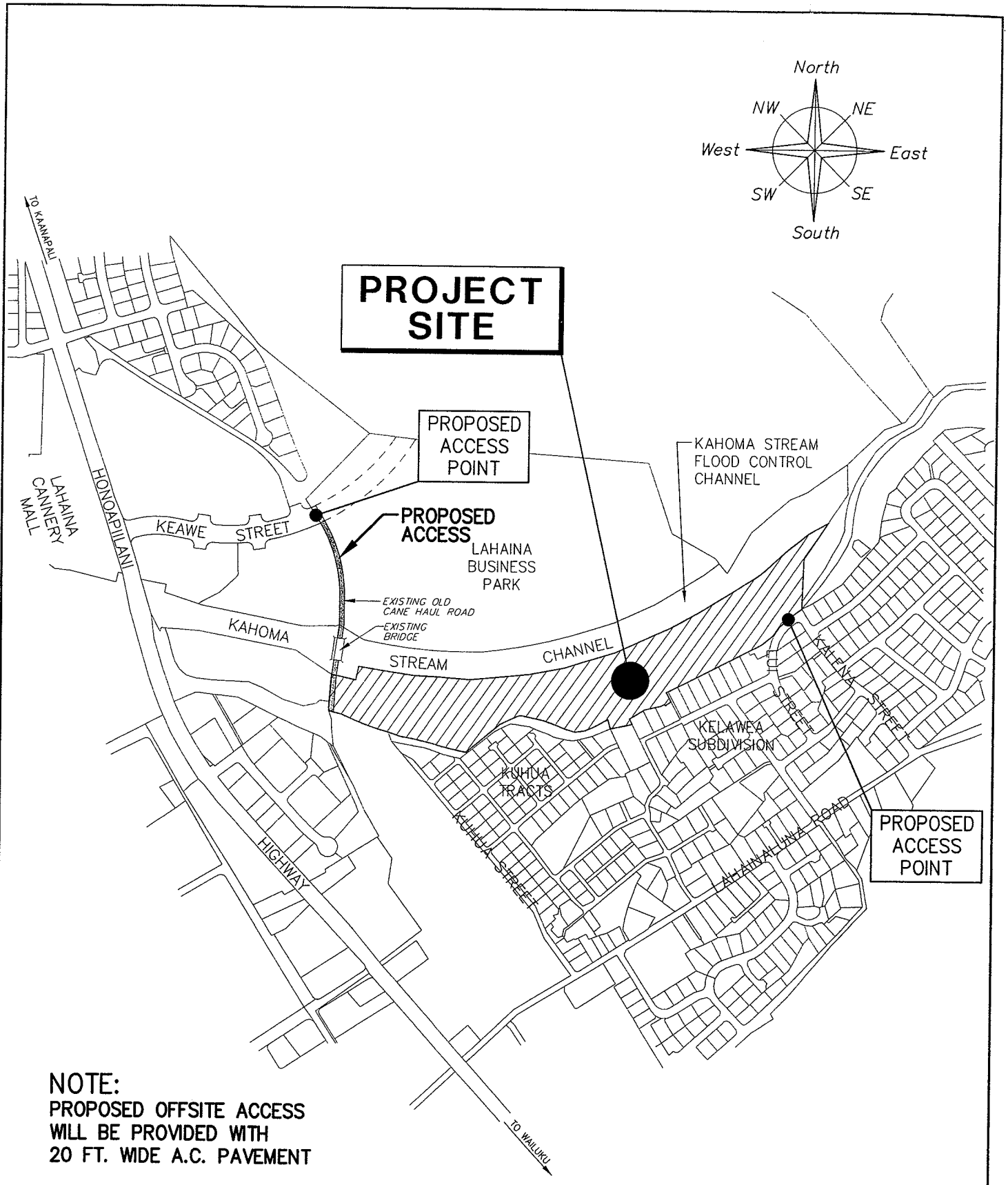
FIGURE 1

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO. 05-105

2005\05-105\WMLCI SUBD EXHIBIT MAPS.dwg (Layout1)



NOTE:
PROPOSED OFFSITE ACCESS WILL BE PROVIDED WITH 20 FT. WIDE A.C. PAVEMENT

VICINITY MAP

NOT TO SCALE

DATE: DECEMBER 08, 2009

FIGURE 2

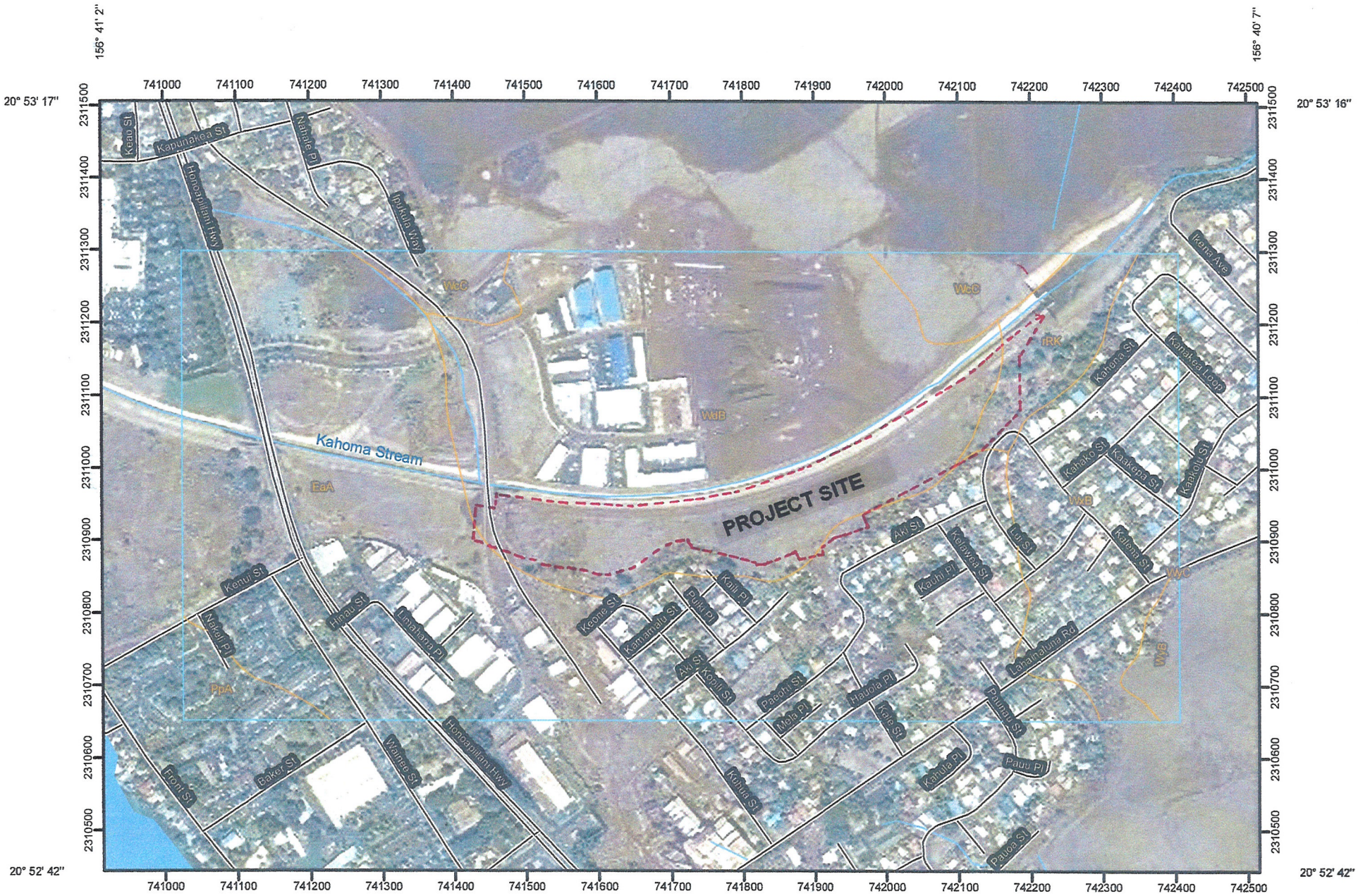
(Vicinity) Z:\DRAW1\2005\05-105\WMLCI_SUBD_EXHIBIT_MAPS_DEC2009.dwg 08-DEC-2009 : Revised BY:Nancy

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO. 05-105

Soil Map—Island of Maui, Hawaii



SOILS MAP

USDA Natural Resources Conservation Service

Web Soil Survey
National Cooperative Soil Survey

12/2/2009

FIGURE 3

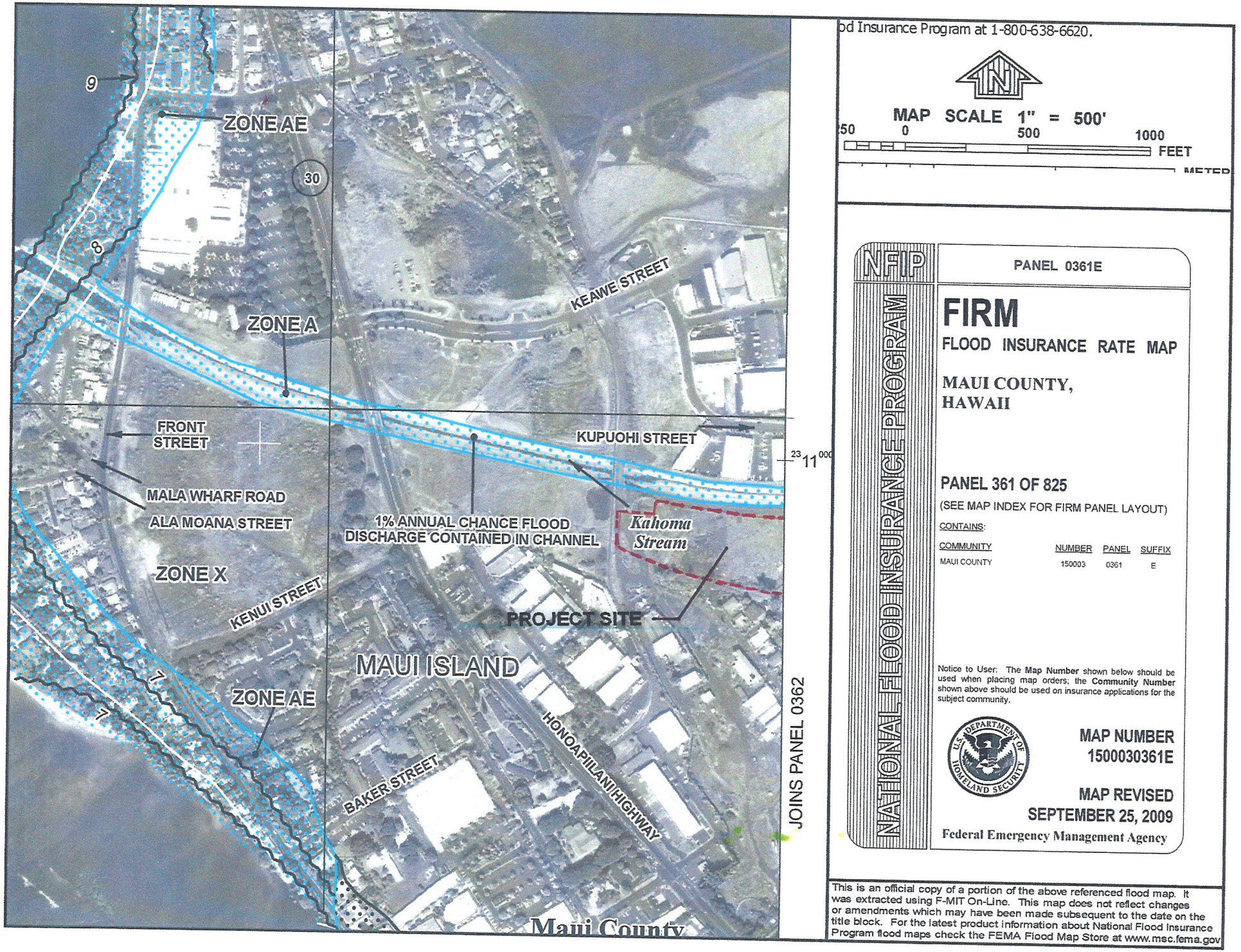
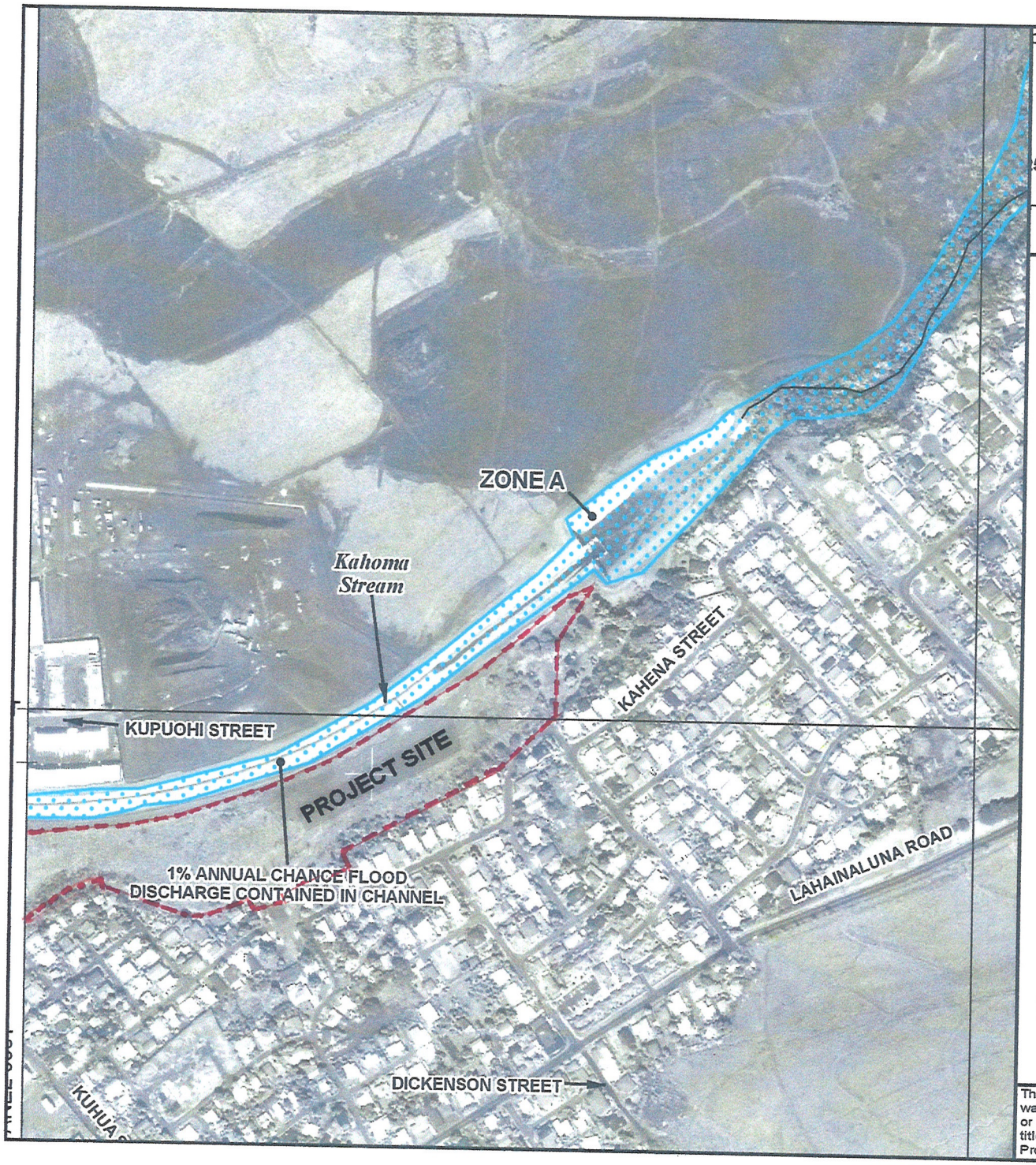

od Insurance Program at 1-800-638-6620.
MAP SCALE 1" = 500'
50 0 500 1000
FEET
METER
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0361E
FIRM
FLOOD INSURANCE RATE MAP
MAUI COUNTY, HAWAII
PANEL 361 OF 825
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
MAUI COUNTY 150003 0361 E
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
1500030361E
MAP REVISED
SEPTEMBER 25, 2009
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov
ZONE AE
ZONE A
ZONE X
ZONE AE
KEAWE STREET
KUPUOHI STREET
FRONT STREET
MALA WHARF ROAD
ALA MOANA STREET
KENUI STREET
1% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CHANNEL
Kahoma Stream
PROJECT SITE
MAUI ISLAND
HONOAPIILANI HIGHWAY
BAKER STREET
JOINS PANEL 0362
Maui County
2311000
9
8
7
7
30

FIGURE 4



od Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

50 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0362E

FIRM

FLOOD INSURANCE RATE MAP

MAUI COUNTY, HAWAII

PANEL 362 OF 825

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MAUI COUNTY	150003	0362	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

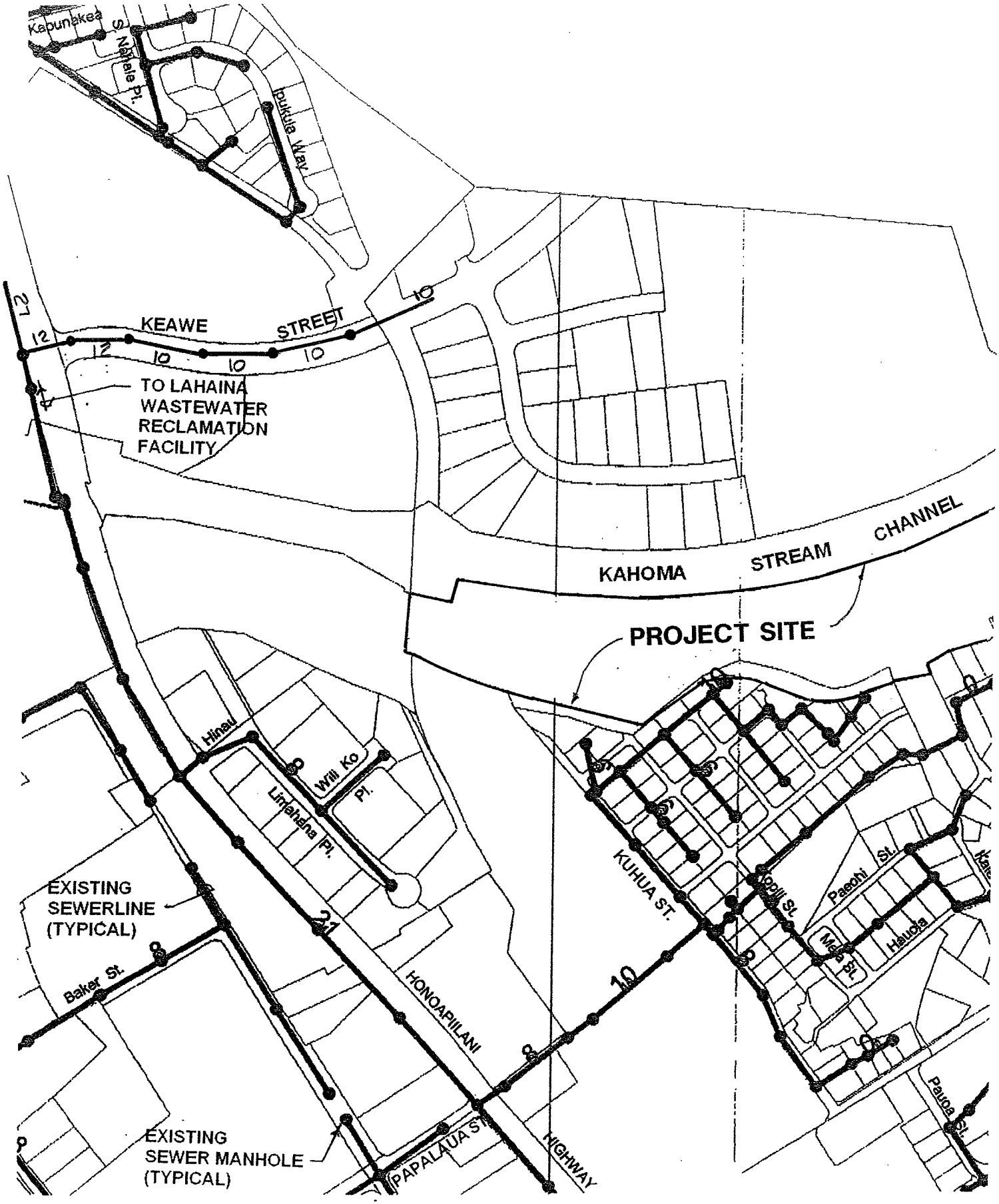
MAP NUMBER
1500030362E

MAP REVISED
SEPTEMBER 25, 2009

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

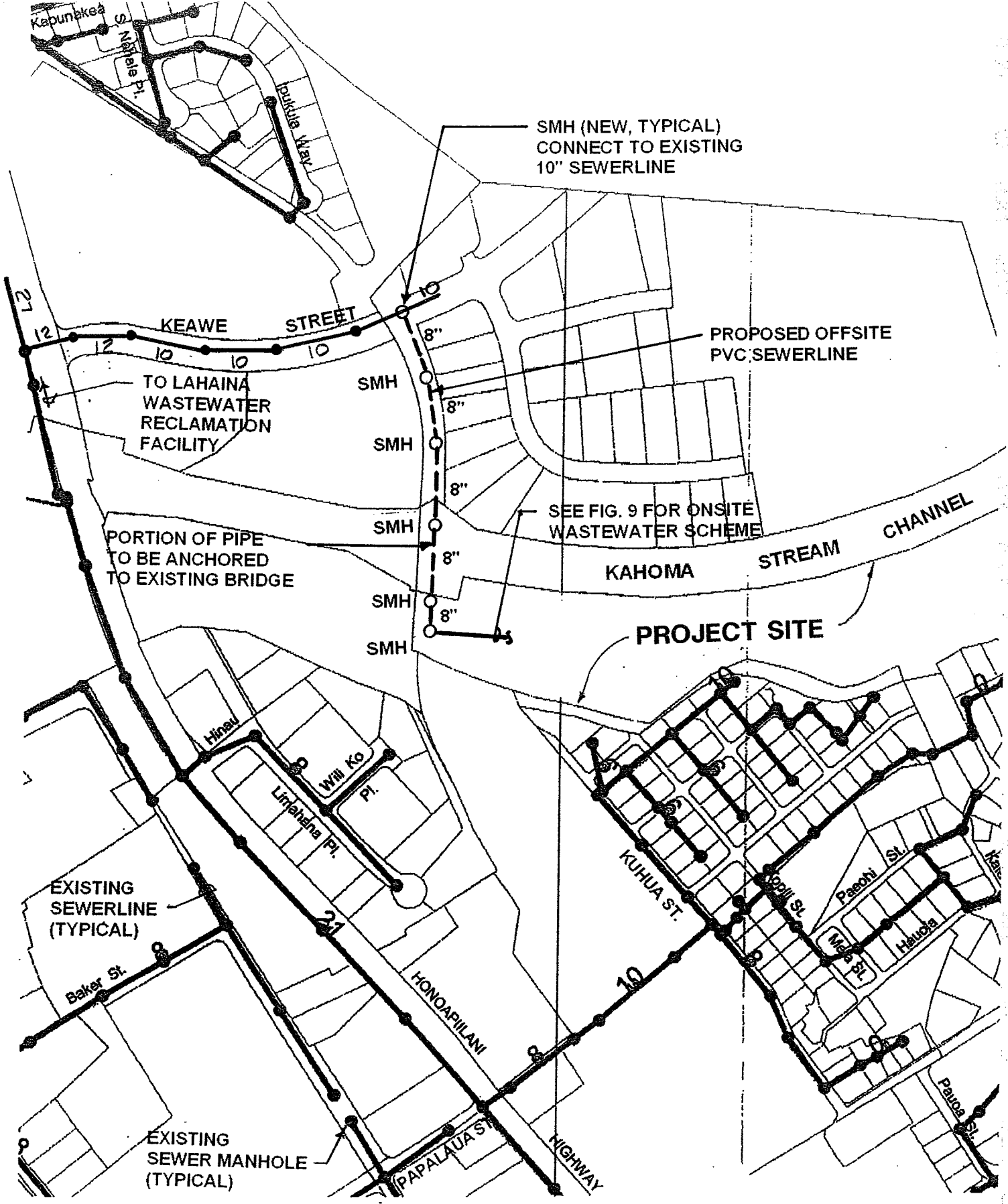
FIGURE 4A



EXISTING COUNTY WASTEWATER SYSTEM

Not to Scale

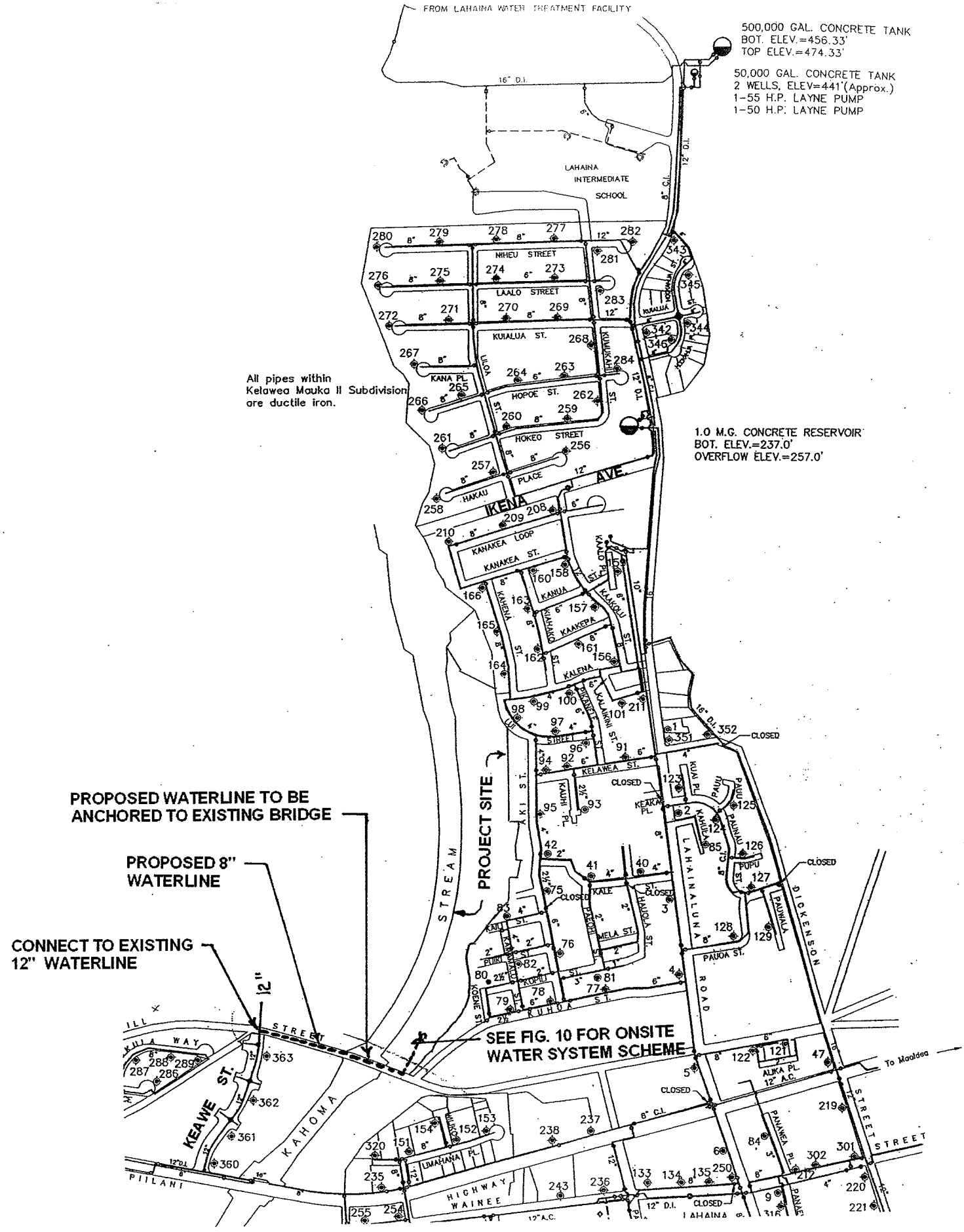
FIGURE 5



SCHEMATIC LAYOUT
OFFSITE GRAVITY WASTEWATER SYSTEM

Not to Scale

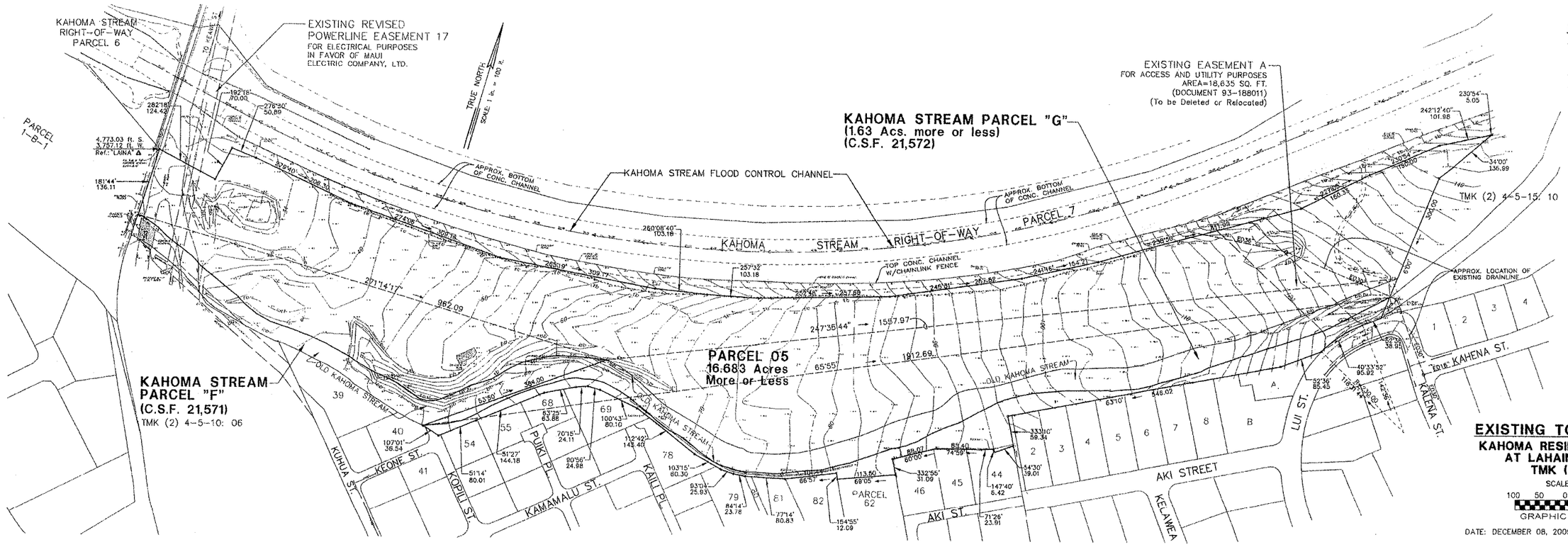
FIGURE 5A



EXISTING COUNTY WATER SYSTEM

Scale: 1" = 800'

FIGURE 6



LEGEND & ABBREVIATION:

150	EXIST. CONTOUR
+111.0	EXIST. SPOT ELEVATION
tb	TOP BANK
bb	BOTTOM BANK
eoc	EDGE A.C. PAVEMENT
PP/TP	POWER/TELEPHONE POLE
HB	HOSE BIBB

EXISTING TOPOGRAPHIC MAP

KAHOMA RESIDENTIAL SUBDIVISION
AT LAHAINA, MAUI, HAWAII
TMK (2) 4-5-10: 05

SCALE: 1 in. = 100 ft.

100 50 0 100 200
GRAPHIC SCALE IN FEET

DATE: DECEMBER 08, 2009

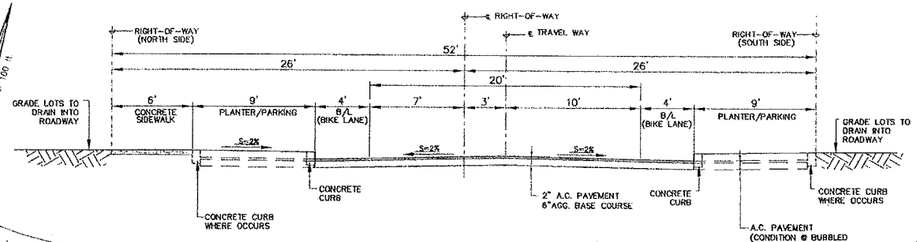
FIGURE 7

(TOPO) Z:\GRAPH\2005\05-105\WMCI_SUBD_EXHIBIT_MAPS_DEC2009.dwg 08-DEC-2009 Revised BY:Nancy

KAHOMA STREAM RIGHT-OF-WAY PARCEL 6

PROPOSED ACCESS TO KEAWE STREET (SEE FIGURE 2) OFFSITE ACCESS WILL BE PROVIDED WITH 20 FT. WIDE PAVEMENT

TRUE NORTH SCALE: 1 in. = 100 ft.



CONCEPTUAL ROADWAY SECTION

NOT TO SCALE

EXISTING EASEMENT A
FOR ACCESS AND UTILITY PURPOSES
AREA=18,635 SQ FT.
(DOCUMENT 93-188011)
(To be Deleted or Relocated)

PARCEL 1-B-1

4,773.03 ft. S
3,757.12 ft. W
Ref.: LAWA Δ

PROVIDE TEMPORARY WOODEN BARRICADE

EXISTING OLD CANE HAUL ROAD

PLANNED KAHUA STREET EXTENSION (BY OTHERS)

KAHOMA STREAM PARCEL "F"
TMK: (2) 4-05-10: 05

TMK: (2) 4-05-10: 05
(AREA= 16.683 Acs.)

KAHOMA STREAM RIGHT-OF-WAY PARCEL 7
TMK: (2) 4-05-10: 08

TMK: (2) 4-05-15.10

OLD KAHOMA STREAM

6' WIDE SIDEWALK
9' WIDE PLANTER
4' WIDE BIKELANE

9' WIDE PLANTER
4' WIDE BIKELANE

KUHUA ST.
KEONE ST.
KOPILI ST.
PUIKI PL.
KAMAMALU ST.
KAILI PL.
AKI ST.
AKI STREET
KELAWEA
LUI ST.
KAHENA ST.
KALENA ST.

69 20,007 SF
1 6,735 SF
2 7,128 SF
3 7,792 SF
4 8,446 SF
5 8,076 SF
6 8,523 SF
7 7,748 SF
8 7,500 SF
9 7,535 SF
10 7,560 SF
68 6,764 SF
67 5,054 SF
66 5,409 SF
65 6,694 SF
64 5,334 SF
63 5,437 SF
62 5,637 SF
61 5,693 SF
60 5,687 SF
59 6,251 SF
58 5,740 SF
57 5,814 SF
56 6,064 SF
55 6,316 SF
70 42,929 SF
11 11,033 SF
12 10,607 SF
13 9,574 SF
14 8,358 SF
15 7,619 SF
16 7,166 SF
17 6,424 SF
18 6,323 SF
19 6,214 SF
20 6,262 SF
21 6,357 SF
22 6,424 SF
23 6,549 SF
24 6,674 SF
25 6,624 SF
26 6,760 SF
27 8,135 SF
28 8,212 SF
29 12,973 SF
30 8,107 SF
31 7,815 SF
32 8,029 SF
33 7,852 SF
34 7,714 SF
35 7,537 SF
36 7,341 SF
37 7,341 SF
38 7,318 SF
39 7,327 SF
40 7,326 SF
41 7,299 SF
42 9,726 SF
43 8,559 SF
44 7,908 SF
45 7,904 SF
46 8,359 SF
47 8,459 SF
48 8,233 SF
49 7,679 SF
50 7,585 SF
51 7,240 SF
52 7,001 SF
53 6,587 SF
54 6,047 SF
72 (For Access and Utility Purposes) 1,719 SF
73 (For Access and Utility Purposes) 10,272 SF
71 (For Access and Utility Purposes) 874 SF
PARCEL 62 135,710 SF

KAHOMA RESIDENTIAL SUBDIVISION

CONCEPTUAL LAYOUT

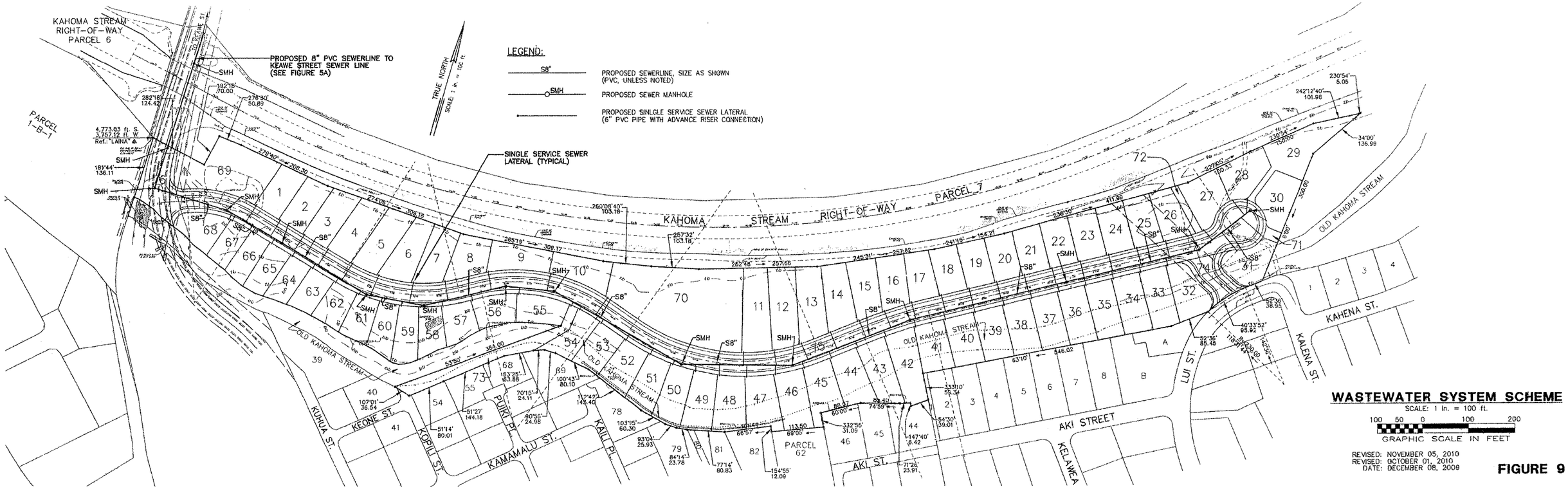
SCALE: 1 in. = 100 ft.

100 50 0 100 200

GRAPHIC SCALE IN FEET

REVISED: MARCH 08, 2011
REVISED: NOVEMBER 05, 2010
REVISED: SEPTEMBER 21, 2010
REVISED: SEPTEMBER 07, 2010
REVISED: SEPTEMBER 03, 2010
DATE: DECEMBER 08, 2009

FIGURE 8



WASTEWATER SYSTEM SCHEME

SCALE: 1 in. = 100 ft.

100 50 0 100 200

GRAPHIC SCALE IN FEET

REVISED: NOVEMBER 05, 2010
REVISED: OCTOBER 01, 2010
DATE: DECEMBER 08, 2009

FIGURE 9

(Sheet FIG 9)
Z:\DRAWINGS\05-105\EXHIBIT MAPS\11-2010_WWLCI_SUBD_EXHIBIT_MAPS.dwg 05-NOV-2010 : Revised

KAHOMA STREAM RIGHT-OF-WAY PARCEL 6

PARCEL 1-B-1

PROPOSED 8" OFFISTE WATERLINE TO KEAWE STREET WATERLINE (SEE FIGURE 8)

DOUBLE SERVICE WATER LATERAL (TYPICAL)

NEW 8" D.I. PIPE CL. 52 WITH POLYWRAP

4,773.03 ft. S
3,757.12 ft. W.
Ref.: "LAINA" ⚓

TRUE NORTH
SCALE: 1 in. = 100 ft.

LEGEND:

- EXISTING WATERLINE, SIZE AS SHOWN
- PROPOSED WATERLINE, SIZE: 8" UNLESS SHOWN (D.I. PIPE, CL. 52 WITH POLYWRAP)
- PROPOSED AIR RELIEF VALVE
- PROPOSED TYPE "A-1" DOUBLE SERVICE WATER LATERAL (5/8" METER, UNLESS NOTED)
- PROPOSED TYPE "A" SINLGLE SERVICE WATER LATERAL (5/8" METER, UNLESS NOTED)
- PROPOSED FIRE HYDRANT ASSEMBLY

KAHOMA STREAM RIGHT-OF-WAY PARCEL 7

NEW 8" D.I. PIPE CL. 52 WITH POLYWRAP

OLD KAHOMA STREAM

KEONE ST.

KOPILI ST.

PUIKI PL.

KAMAMALU ST.

KAILI PL.

KUHUA ST.

APPROX. LOCATION OF EXISTING WATERLINES

PARCEL 62

AKI STREET

AKI ST.

KELAWEA ST.

DOUBLE SERVICE WATER LATERAL (TYPICAL)

LUI ST.

KAHENA ST.

KALENA ST.

CONNECT TO EXISTING 4" WATERLINES

SINGLE SERVICE WATER LATERAL

REPLACE EXISTING 4" WATERLINE WITH NEW 8" D.I. PIPE, CL. 52 WITH POLYWRAP

CONNECT TO EXISTING WATERLINES

APPROX. LOCATION OF EXISTING WATERLINES

WATER SYSTEM SCHEME

SCALE: 1 in. = 100 ft.

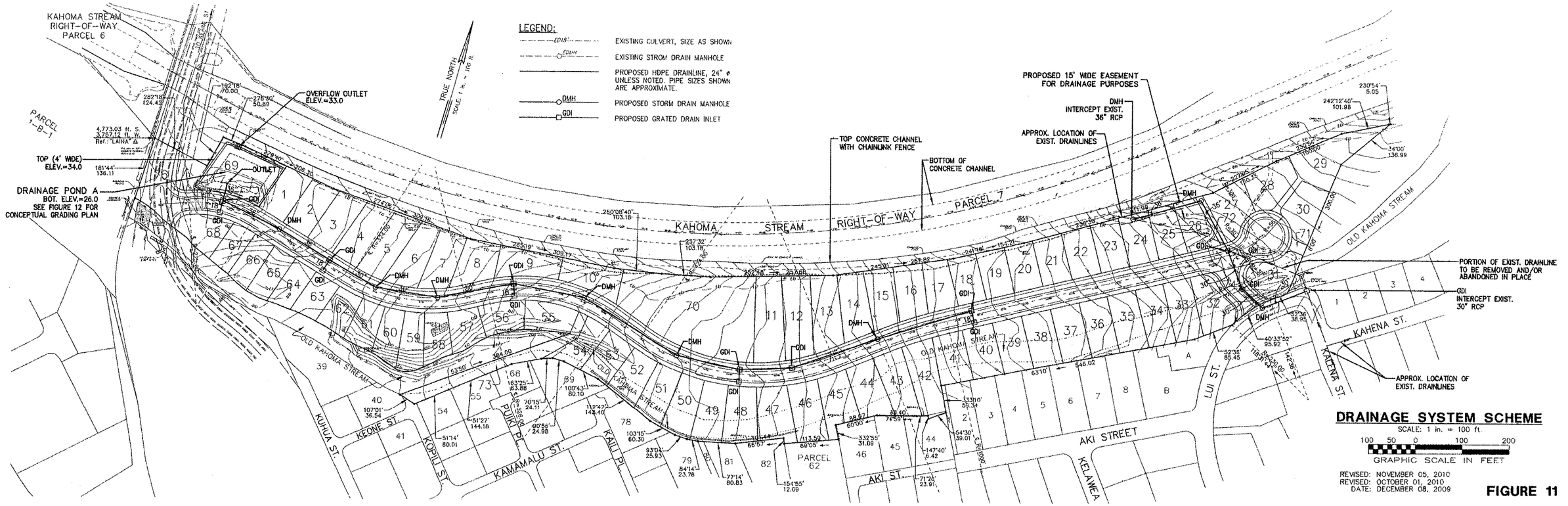
100 50 0 100 200

GRAPHIC SCALE IN FEET

REVISED: NOVEMBER 05, 2010
REVISED: SEPTEMBER 21, 2010
DATE: DECEMBER 08, 2009

FIGURE 10

(Water PIC 10)
Z:\DRAWI\2005\05-105\EXHIBIT MAPS\11-2010_RMICL_SUBD_EXHIBIT_MAPS.dwg 05-NOV-2010 : Revised BY:Nancy



DRAINAGE SYSTEM SCHEME

SCALE: 1 in. = 100 ft.

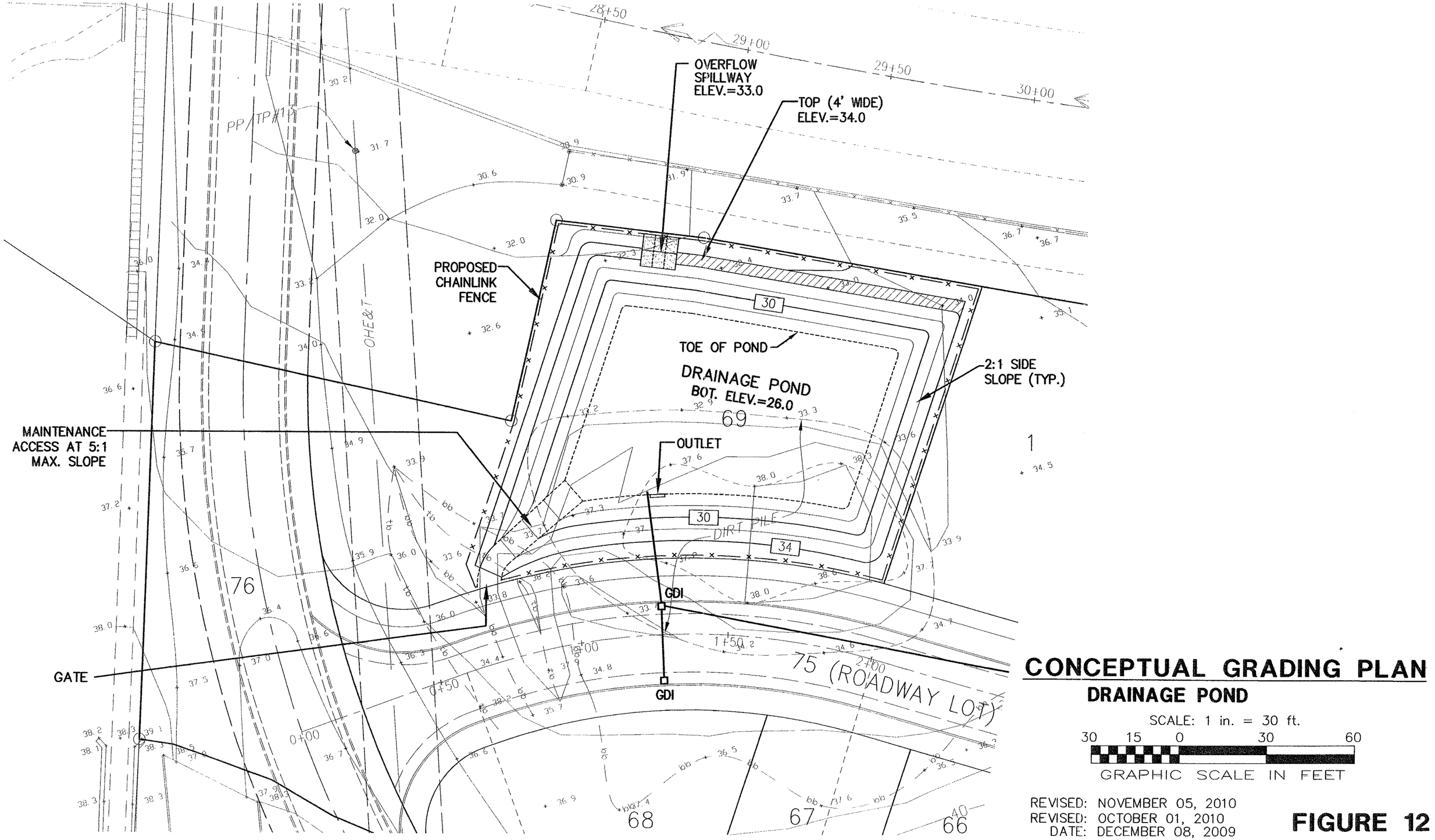
100 50 0 100 200

GRAPHIC SCALE IN FEET

REVISED: NOVEMBER 05, 2010
REVISED: OCTOBER 01, 2010
DATE: DECEMBER 08, 2009

FIGURE 11

(Drainage FIG.11)
Z:\DRAW\12005\05--105\EXHIBIT MAPS\11-2010_WMLCI_SUBD_EXHIBIT_MAPS.dwg 05--NOV--2010 - Revised BY Nancy



CONCEPTUAL GRADING PLAN

DRAINAGE POND

SCALE: 1 in. = 30 ft.

30 15 0 30 60

GRAPHIC SCALE IN FEET

REVISED: NOVEMBER 05, 2010
REVISED: OCTOBER 01, 2010
DATE: DECEMBER 08, 2009

FIGURE 12

KAHOMA STREAM RIGHT-OF-WAY PARCEL 6

EXISTING REVISED POWERLINE EASEMENT 17
FOR ELECTRICAL PURPOSES
IN FAVOR OF MAUI ELECTRIC COMPANY, LTD.

TRUE NORTH
SCALE: 1 in. = 100 ft.

EXISTING EASEMENT A
FOR ACCESS AND UTILITY PURPOSES
AREA=18,635 SQ. FT.
(DOCUMENT 93-188011)
(To be Deleted or Relocated)

KAHOMA STREAM FLOOD CONTROL CHANNEL

TOP CONCRETE CHANNEL WITH CHAINLINK FENCE

APPROX. BOTTOM OF CONCRETE CHANNEL

PARCEL 1-B-1

DRAINAGE POND

PARCEL 7

RIGHT-OF-WAY

KAHOMA STREAM

OLD KAHOMA STREAM

APPROX. LOCATION OF EXISTING DRAINLINE

KAHOMA STREAM PARCEL "F"
TMK: (2) 4-05-10: 06

16.88 ACRES

PARCEL 62

KUHUA ST.

KEONE ST.

KOPILI ST.

PUIKI PL.

KAMAMALU ST.

KAILI PL.

AKI ST.

AKI STREET

LUI ST.

KELAWEA

KALENA ST.

KAHENA ST.

ONSITE DRAINAGE AREA

SCALE: 1 In. = 100 ft.

100 50 0 100 200

GRAPHIC SCALE IN FEET

REVISED: NOVEMBER 05, 2010
REVISED: OCTOBER 01, 2010
DATE: DECEMBER 08, 2009

FIGURE 13

(ONSITE DRAINAGE FIG.13)
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