Miki Basin Industrial Park
Environmental Assessment

Exhibit I

Water Master Plan

PŪLAMA LĀNAʻI MIKI BASIN

200 ACRE INDUSTRIAL PARK

Lanaʻi, Hawaiʻi

WATER MASTER PLAN

Prepared By: Akinaka & Associates, Ltd.
1100 Alakea Street, Suite 1800
Honolulu, Hawaii 96813

Date: March 2019

TABLE OF CONTENTS

X. REFERENCES (Not attached)

1. County of Water Supply, Department of Water Supply, Water System Standards, dated 2002.
2. County of Water Supply, Department of Water Supply, Lanaʻi Island Water Use and Development Plan, dated 2011.

I. INTRODUCTION

The Water Master Plan for Pūlama Lānaʻi Miki Basin 200-Acre Industrial Park provides the basic information for the design of the water distribution system for the Miki Basin 200-Acre Industrial Park (Industrial Park) based on zoning requirements. The purpose of this master plan is to identify and review the condition of the existing water distribution system and analyze the existing system for projected water demands.

The Industrial Park consists of approximately 200 acres of agricultural zoned lands. Pūlama Lānaʻi is in the process of rezoning the area for light and heavy industrial lands. The project area is located directly south of Lanaʻi Airport within the Palawai Irrigation Grid (see **Exhibit 1: Location Map**). The majority of Miki Basin is currently undeveloped with the exception of the Maui Electric Company (MECO) Miki Basin substation and a portion of the 20-acre approved subdivision which is currently used by Pūlama Lānaʻi. Pūlama Lānaʻi is in the process of finalizing condominium documents for the 20-acre industrial condominium subdivision. A timeline for development of the 20-acre subdivision has not been established.

II. EXECUTIVE SUMMARY

Water for Miki Basin is currently provided by the Manele Water System which is owned, operated and maintained by the Lanaʻi Water Company. The system, sourced by Wells No. 2 (State Well No. 5-4953-001) and 4 (State Well No. 5-4952-002), currently services Manele, Hulopoe and the Palawai Irrigation Grid. Water from the wells is either stored in the existing 0.5 MG Hiʻi Tank or 1.0 MG concrete Hiʻi Reservoir or fed directly into the distribution system depending on need. The existing Manele Water System consists of 10-inch, 12-inch and 16-inch transmission mains. The Manele Water System is interconnected with the Lanaʻi City Water System. During emergencies, the Lanaʻi City System can supply water to the Manele Water System by opening a valve.

The existing average daily water usage of the system is currently estimated at 418,000 gallons per day (gpd). The operation of Lanai Farms, which was anticipated to begin in late 2018, will increase average water usage to a total of approximately 469,000 gpd.

In accordance with the Water System Standards, available source capacity is governed by the well with the smallest pumping unit. Well No. 2 can be outfitted with a pump with a capacity of up to 1,200 gallons per minute (gpm) while Well

No. 4 has a pump capacity of 900 gpm. Since Well No. 4 has the smaller pump capacity, available source capacity for the water system is governed by Well No. 4, which has an average day pumping capacity of 576,000 gpd, which is equivalent to a maximum day pumping capacity of 864,000 gpd. Once this capacity is used/committed, construction of a new well will be required.

Since development plans for the Industrial Park are not yet available, proposed water use for buildout of the Industrial Park is based on the proposed land use and an estimated developable area for each parcel. The developable area of each parcel estimates that up to 70 percent of the total parcel area will require water; the remaining 30 percent will consist of areas with no water use such as roads and parking areas.

The proposed average day demand for full buildout of the Industrial Park, including existing use is 1,309,000 gpd. The existing water system does not have adequate source capacity and reservoir storage to support full buildout of the Industrial Park. In addition, the transmission mains do not meet Water System Standards for fire flow protection.

The following improvements will be required to support full buildout of the Industrial Park:

- Drilling a new source or multiple sources to obtain a total minimum pump capacity of 1,546 gpm.
- Construction a new storage tank with a minimum capacity of 500,000 gallons.
- Upsizing of an existing 12-inch water main between Hi'i Tank and the Kalawai Pressure Reducing Valve to a 16-inch main or installation of a parallel 6-inch water main to meet fire flow requirements. Alternatively, the construction of a new storage tank could provide fire flow protection in additional to storage capacity.
- Construction of new 16-inch distribution mains to provide service to currently undeveloped areas.

III. EXISTING WATER SUPPLY AND DISTRIBUTION SYSTEM

Water for Miki Basin is currently serviced by the Manele Water System (Public Water System 237) which is owned, operated and maintained by Lana'i Water Company (see **Exhibit 2: Existing Water System**). Manele Water System services Manele, Hulopoe and the Palawai Irrigation Grid.

1. SOURCE

Water is provided by Wells No. 2 (State Well No. 5-4953-001) and 4 (State Well No. 5-4952-002) and either stored in the existing 0.5 MG Hi'i Tank or 1.0 MG concrete Hi'i Reservoir or fed directly into a 12-inch transmission main depending on need.

a. Well No. 2 has a pump capacity of 500 gallons per minute (gpm) or an average day capacity of 320,000 gallons per day (gpd) based on an operating time of 16 hours. According to the 2011 Lanai Water Use and Development Plan, the well can be outfitted with a pump with a capacity of up to 1,200 gpm or an average day capacity of 768,000 gpd.

b. Well No. 4 has a pump capacity of 900 gpm or an average day capacity of 576,000 gpd.

c. The existing average daily water usage from the Manele Water System is currently estimated at 418,000 gpd. The operation of Sensei Farms, which was anticipated to start in late 2018, will increase water usage to approximately 469,000 gpd at full operation.

d. The Water System Standards requires sources be able to meet maximum day demand with an operating time of 16 hours, assuming that the largest pumping unit is down. Since Well No. 2 has the larger pump capacity of the two wells, available source capacity for the system is governed by Well No. 4. Based on the existing water use, an average day capacity of 107,000 gpd is available to support the development of the Industrial Park.

e. Lana'i has a sustainable yield of 6 million gallons per day (MGD), with 3 MGD allocated to both the Leeward and Windward aquifer sectors. The majority of the pumping wells are located in the Leeward Aquifer. According to the Lana'i Water Company Periodic Water Report, the current moving average pumping is 1.53 MGD.

2. STORAGE

a. 500,000 gallon Hi'i Tank (O.F. Elev = 1823')
Serves as the water distribution storage tank for Manele, Hulopoe and the Palawai Irrigation Grid.

b. 1,000,000 gallon Hi'i Reservoir (O.F. = 1823')
Primarily serves as storage for the two well water sources to supply water into the distribution system

3. TRANSMISSION

a. A 12-16-inch high density polyethylene (HDPE) transmission main transports water from the 500,000 gallon Hi'i Tank into the Manele Water System. The 12-inch main splits at a junction to serve both Manele and Palawai Irrigation Grid.

b. To Manele and Hulopoe – From the junction, the 12-inch line feeds into three pressure breaker storage tanks that service Manele.

c. To Palawai Irrigation Grid – From the junction, the waterline upsizes to a 16-inch main that delivers water to the Palawai Irrigation Grid area. The existing 12-inch Kalawai Pressure Reducing Valve (PRV) downstream of the junction reduces the pressure in the waterline to 95 psi.

4. CONNECTION TO OTHER WATER SYSTEMS

a. The Manele Water System is interconnected with the Lana'i City Water System. During emergencies, the Lana'i City System can supply water to the Manele Water System by opening a valve.

IV. LAND USE

Pūlama Lāna'i is in the process of rezoning approximately 200 acres of land from agriculture to light and heavy industrial as shown in **Exhibit 3: Proposed Land Use**:

Light Industrial	100 ac
Heavy Industrial	100 ac
Total	200 ac

This conceptual plan is intended to provide a basis for the design of the water system and may not reflect the final development densities. Since development plans for the Industrial Park are not yet available, proposed water use for buildout of the Industrial Park is based on the proposed land use and an estimated developable area for each parcel. The developable area of each parcel estimates that up to 70 percent of the total parcel area

will require water; the remaining 30 percent will consist of areas with no water use such as roads and parking areas.

V. SAFE DRINKING WATER SYSTEM DESIGN CRITERIA

As outlined in the County of Maui Water System Standards, the following criteria are used in determining the minimum requirements for the safe drinking water system.

1. CONSUMPTION GUIDELINES

a. The average daily demand for industrial land uses for planning purposes is 6,000 gallons / acre.

2. DEMAND FACTORS

a. Maximum Daily Demand = 1.5 x Average Day

b. Peak Hour Demand = 3.0 x Average Day

3. FIRE FLOW REQUIREMENTS

a. Light Industrial = 2,000 gpm for 2 hour duration

b. Heavy Industrial = 2,500 gpm for 2 hour duration

4. PIPELINE SIZING

a. Maximum daily flow plus fire flow with a residual pressure of 20 psi at critical fire hydrant.

b. Peak hour flow with a minimum residual pressure of 40 psi.

c. In determining the carrying capacity of the mains, the "C" values to be applied are:

Size	"C"
4" & 6"	100
8" & 12"	110
16" & 20"	120

d. The maximum velocity in transmission mains (without fire flow) is 20 feet per second. The maximum velocity in distribution mains with fire flow shall be 10 feet per second.

e. Maximum static or pumping pressure, whichever is greater, shall not exceed 125 psi.

f. Ductile iron pipe is required by County of Maui Department of Water Supply Standards and is recommended for this project. The design pressures for ductile iron pipe are as follows:

i. Maximum design working pressure = 250 psi

ii. Maximum desirable working pressure = 125 psi

iii. Maximum expected working pressure = 150 psi

g. The working pressure for distribution mains servicing residences:

i. Maximum = 125 psi

ii. Minimum = 40 psi

h. In-line pressure reducing valves for distribution mains are required where pressure exceeds 125 psi.

i. Cleanouts are required at the end of all transmission and distribution waterlines.

j. Sampling spigots: For collection of water samples to determine water quality at dead ends of pipeline.

5. RESERVOIR CAPACITY

a. Meet maximum day consumption. Reservoir fills at the beginning of the 24-hour period with no source input to the reservoir.

b. Meet maximum day consumption plus fire flow for duration of fire. Reservoir ¾-full, with credit for incoming flow from pumps.

c. Minimum reservoir size shall be 100,000 gallons. Reservoir size shall be as specified in Section 105.10 – RESERVOIR, Subsection A – Size.

d. Where there are two or more reservoir serving the same system, the design shall be made on the basis of combined protection by all facilities available.

6. PUMP CAPACITY

a. Meet maximum day demand with an operating time of 16 hours simultaneously with maximum fire flow required independent of the reservoir. The standby unit may be used to determine the total flow required.

b. Meet maximum day demand during the duration of the fire plus fire demand less ¾ of reservoir storage.

c. Meet maximum day demand with an operating time of 16 hours with the largest pumping unit considered out of service.

VI. INDUSTRIAL PARK WATER DEMAND

1. Based on the proposed zoning and an estimated developable area of 70 percent of the total area, the proposed average day demand for full buildout, including existing use is 1,309,000 gpd (see **Exhibit 4: Water Flow Summation** and **Exhibit 5: Water Demand Map**).

2. Based on the source capacity of Well No. 4, the system will require an additional average day capacity of 733,000 gpd to support full buildout of the Industrial Park.

3. The existing system does not meet the Water System Standards criteria for pipe sizing based on a maximum of 2,500 gpm for Fire Flow plus Maximum Daily flow with a maximum velocity of 10 feet per second. The system also does not meet the criteria for the Peak Hour flow with a minimum residual pressure of 40 psi.

4. **Exhibit 6: Water System Nodal Map** shows the overall water system facilities and nodal map.

VII. PROPOSED SAFE DRINKING WATER SYSTEM (BASED ON LAND USE/ZONING)

1. WATER SOURCE

a. Construction of another water source will be required when the average daily demand exceeds 576,000 gpd, which is equivalent to a maximum daily demand of 864,000 gpd**.** The new well will support the outstanding development of the Industrial Park. The current average daily water usage is 418,000 gpd. The operation of Lanai Farms, which was anticipated to start in late 2018, will increase water usage to approximately 469,000 gpd. Accordingly, an average daily use of 107,000 gpd is available for future development within the Industrial Park without having to construct a new well.

b. Well Pump Sizing

i. Existing average day capacity = 576,000 gpd
Existing maximum day capacity = 864,000 gpd

ii. Full buildout average day demand = 1,309,000 gpd
Full buildout maximum day demand = 1,963,500 gpd

iii. Additional average day capacity required = 733,000 gpd
Additional maximum day capacity required = 1,099,500 gpd

1,099,500 gallons / 16 hours / 60 min	=	1,146 gpm
Total required pump capacity	=	1,146 gpm

Full buildout of the Industrial Park will require the development of a new well or multiple wells with a total minimum total capacity of 1,146 gpm.

c. Source Options

The Lana'i Water Use and Development Plan (WUDP) discusses the following options for development of a new well to meet future water demand requirements:

i. Drill a Leeward high level well between Hi'i Tank and Well 3

ii. Well 7 is currently out of service. Recommissioning the well would provide reliability for both the Lana'i City system and the Irrigation Grid.

iii. Install a permanent interconnection with the Lana'i City System.

2. RESERVOIR CAPACITY

a. Case A: Meet maximum day demand in 24-hours
Capacity required = 1,963,500 gallons
Case B: Meet maximum day + fire flow, reservoir ¾ full
Max day rate = 1,963,500 gpd = 1364 gpm
Fire flow = 2,500 gpm

Max day rate + fire flow for 120 minutes
= 3,864 gpm x 120 min
= 463,680 gallons

Size required = 463,680 * ¾ = 347,760 gallons

Case A governs:

Minimum Reservoir Capacity = 2,000,000 gallons

Existing Reservoir Capacity = 1,500,000 gallons

Additional Storage Required = 500,000 gallons

Construction a new storage tank for the Industrial Park could also satisfy fire protection requirements for the Industrial Park. In order to provide service to the Industrial Park, the tank would need to be located at a minimum elevation of 1,414 feet.

3. TRANSMISSION/DISTRIBUTION MAINS

a. Offsite Improvements

i. The following options are proposed to meet fire flow requirements:

1. Option 1. Upsize the existing 12-inch waterline between Hi'i Tank and the Palawai PRV to a 16-inch main. The main is located alongside the

mountainside and may be difficult to access, presenting challenges during construction.

2. Option 2. Provide a parallel 6-inch waterline between Hi'i Tank and the Palawai PRV.

3. Option 3. Construct a new storage tank for Miki Basin to provide fire protection for the Industrial Park. The new storage tank could also provide the additional required storage.

4. Option 4. Consider other fire protection systems that do not use water. Distribution mains would be limited to supplying only potable safe drinking water.

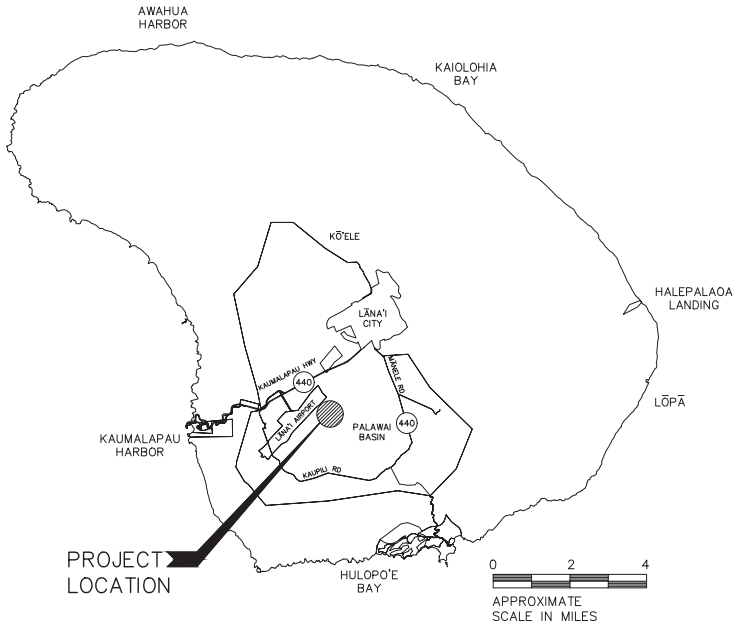
ii. While Lanai Water Company has replaced and has abandoned sections of the Palawai Irrigation Grid, there remains sections that are in need of repair, replacement or possible abandonment. Since the condition and use of these pipes are unknown, those pipes were excluded from this evaluation. A conditional assessment and analysis for those pipes should be conducted separately.

b. Onsite Improvements
Full buildout of Industrial Park will require the installation of 16-inch waterlines within the development (see **Exhibit 5: Water Demand Map**). The new waterline will connect to the existing water system at Miki Road.

VII. COST CONSIDERATIONS

Budgetary cost for the water improvements are provided in Appendix B.

EXHIBITS



ISLAND OF LĀNA'I

EXHIBIT 1

NORTH

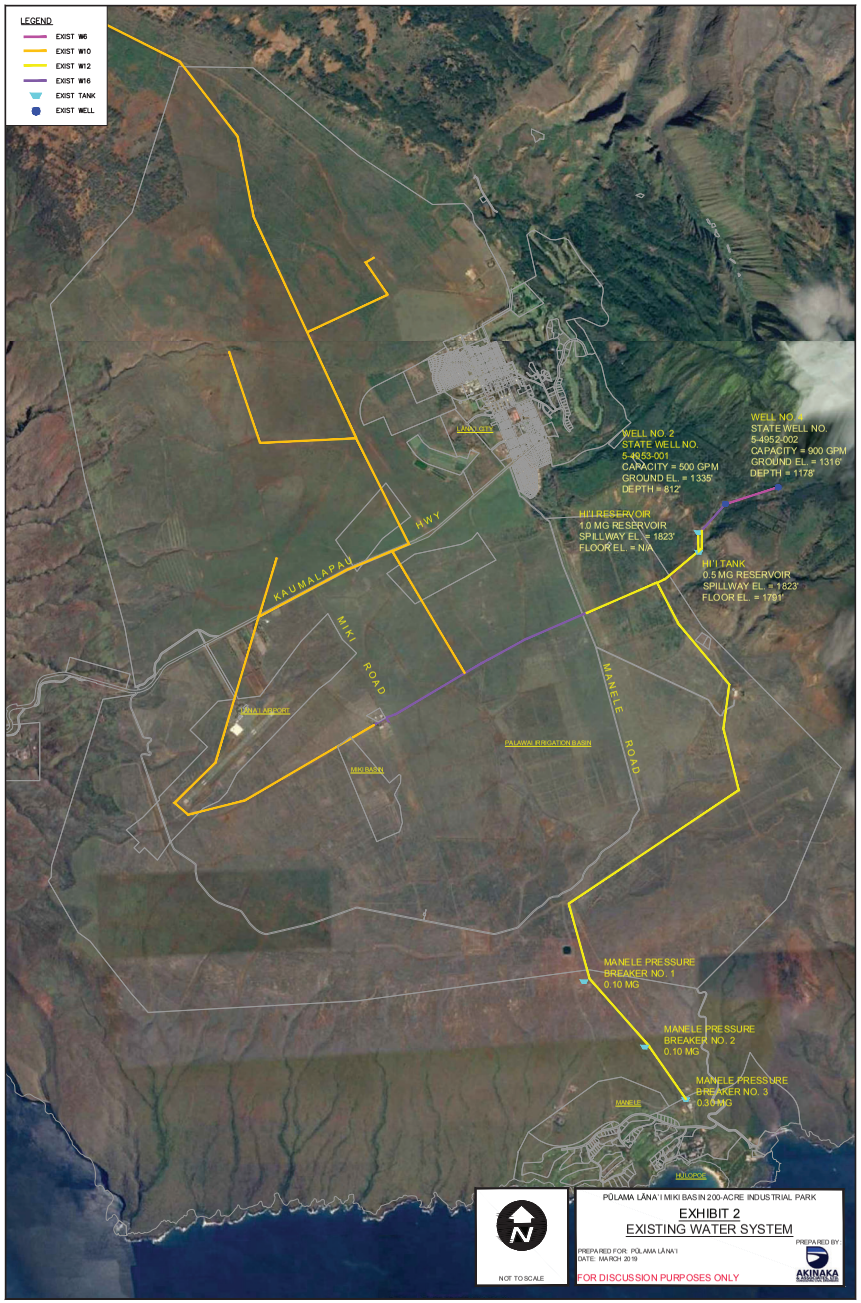
PŪLAMA LĀNA'I MIKI BASIN
200 ACRE INDUSTRIAL PARK

LOCATION MAP

AKINAKA & ASSOCIATES, LTD.

SCALE: AS SHOWN

G:\SSPN 1801 PULAMA LANAI WATER& WASTEWATER MASTER PLAN\200 PLANNING\270 EXHIBITS\02 200 ACRES\EXHIBIT-LOCATION MAP.DWG



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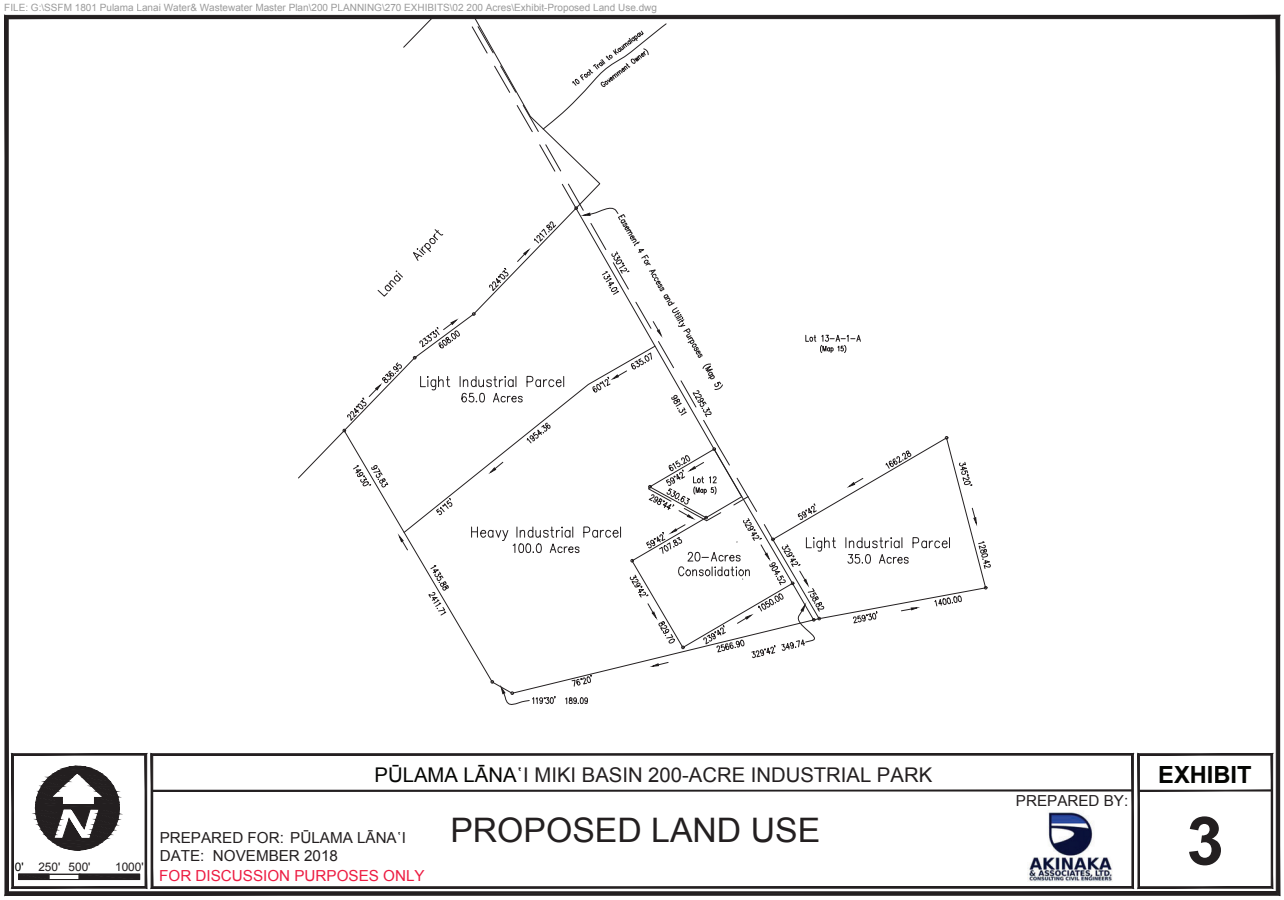


PŪLAMA LĀNA'I MIKI BASIN 200-ACRE INDUSTRIAL PARK

EXHIBIT

PROPOSED LAND USE

3

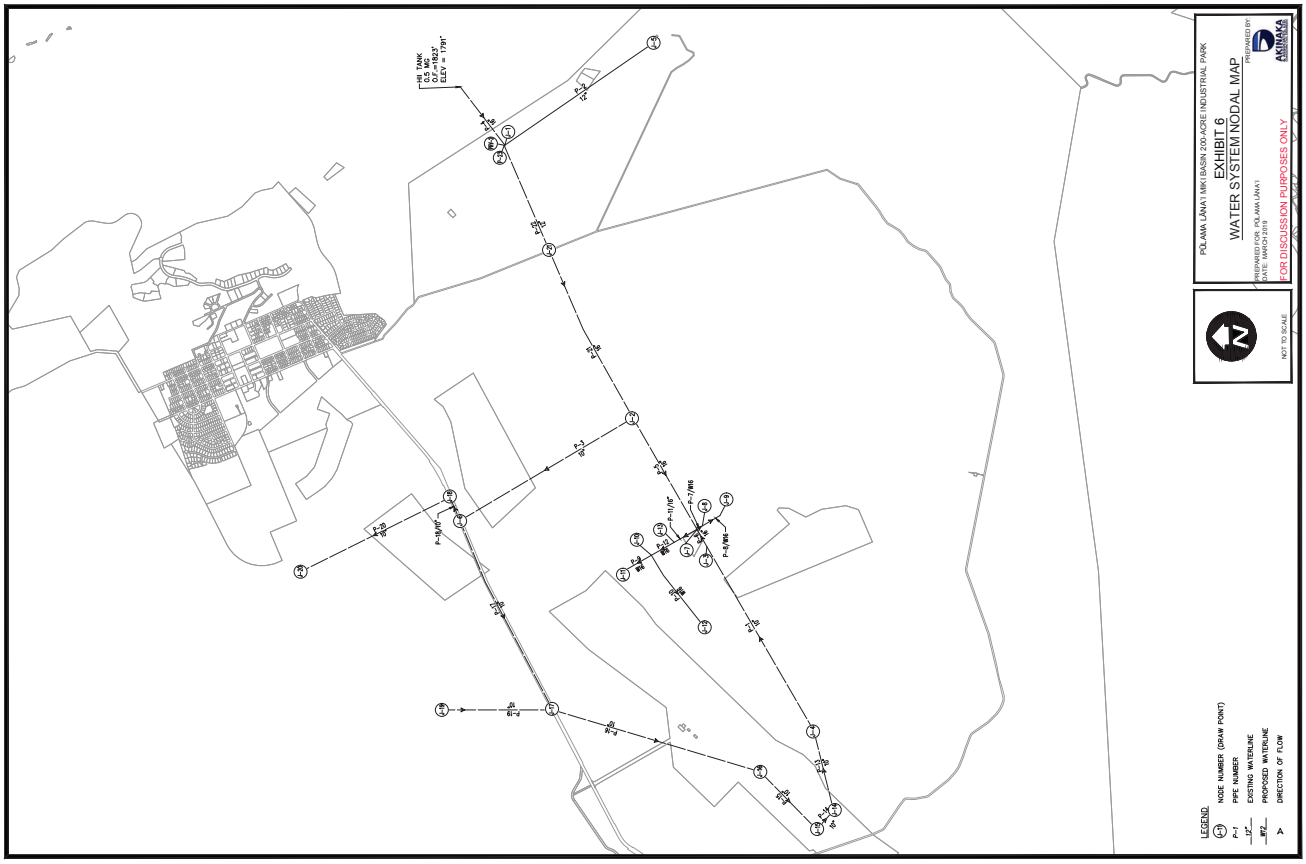
PREPARED FOR: PŪLAMA LĀNA'I
DATE: NOVEMBER 2018
FOR DISCUSSION PURPOSES ONLY

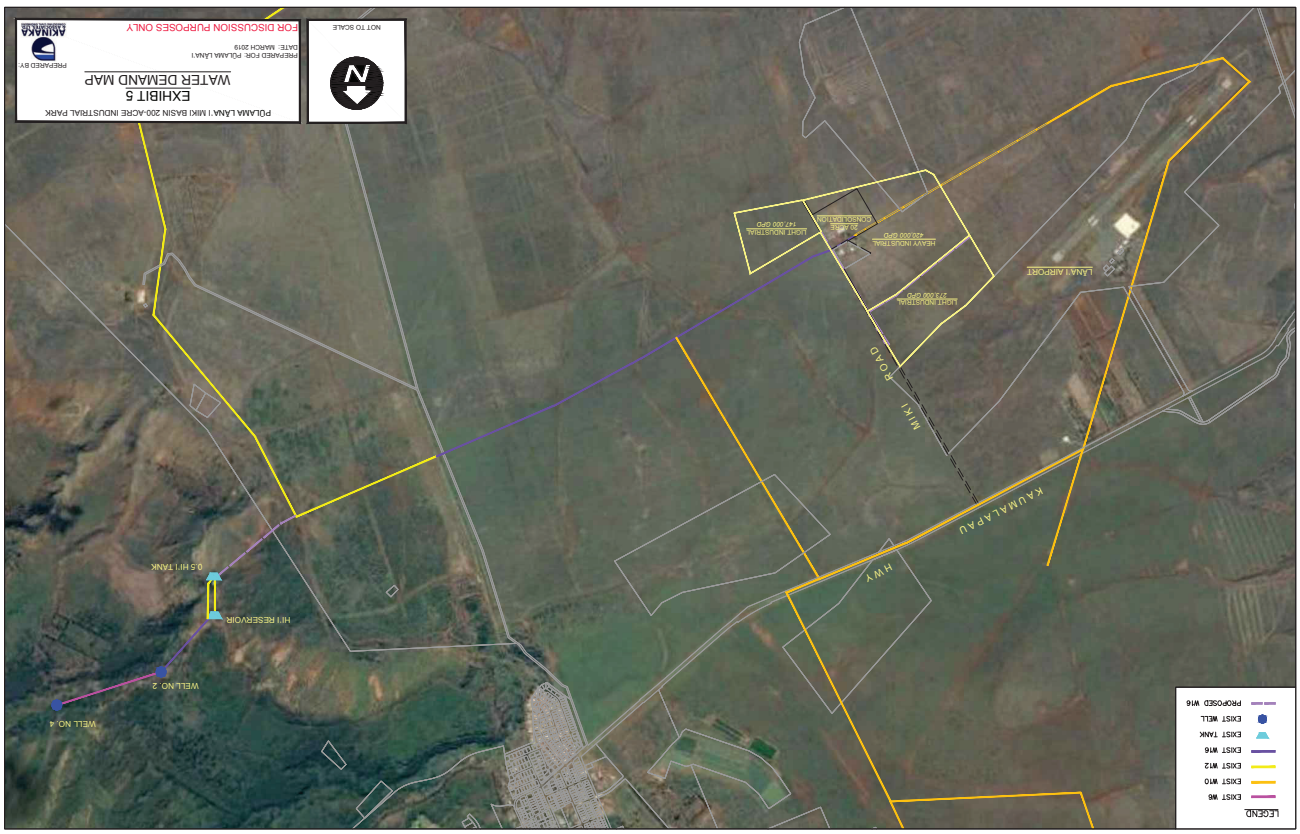
PREPARED BY:
AKINAKA & ASSOCIATES, LTD.
CONSULTING CIVIL ENGINEERS

EXHIBIT 4: WATER FLOW SUMMATION
PŪLAMA LĀNA'I MIKI BASIN 200 ACRE INDUSTRIAL PARK

Point No	Description	Land Use	Area (ac)	Building Area[1] (ac)	Avg Daily Demand (gal/ac)	Avg Day Rate (GPD)	Max Day Rate (GPD)	Peak Hour Rate (GPD)	Avg Day Rate (GPM)	Max Day Rate (GPM)	Peak Hour Rate (GPM)
J-2	*Exist Demand*					*418,000*	*627,000*	*1,254,000*	290.28	435.42	870.83
J-2	*Lanai Farms*	*Agriculture*				*51,000*	*76,500*	*153,000*	35.42	53.13	106.25
J-14/J-13	Light Industrial	Light Industrial	65	45.5	6,000	273,000	409,500	819,000	189.58	284.38	568.75
J-11/J-15	Heavy Industrial	Heavy Industrial	100	70	6,000	420,000	630,000	1,260,000	291.67	437.50	875.00
J-11	Light Industrial	Light Industrial	35	24.5	6,000	147,000	220,500	441,000	102.08	153.13	306.25
					Total	1,309,000	1,963,500	3,927,000	909	1,364	2,727

[1] Based on estimated developable area of 70% of total area


POLAMA LĀNA'I MIKI BASIN 200-ACRE INDUSTRIAL PARK
EXHIBIT 6
WATER SYSTEM NODAL MAP
PREPARED BY:
AMFAC
PREPARED FOR: POLAMA LĀNA'I
DATE: MARCH 2019
FOR DISCUSSION PURPOSES ONLY
NOT TO SCALE
LEGEND:
NODE NUMBER (DRAW POINT)
PIPE NUMBER
EXISTING WATERLINE
PROPOSED WATERLINE
DIRECTION OF FLOW
HI TANK
0.5 MG
ELEV = 1791'
ELEV = 1823'


POLAMA LĀNA'I MIKI BASIN 200-ACRE INDUSTRIAL PARK
EXHIBIT 5
WATER DEMAND MAP
PREPARED FOR: POLAMA LĀNA'I
DATE: MARCH 2019
PREPARED BY:
AMFAC
FOR DISCUSSION PURPOSES ONLY
NOT TO SCALE
LEGEND
EXIST W6
EXIST W10
EXIST W12
EXIST W16
EXIST TANK
EXIST WELL
PROPOSED W16
LĀNA'I AIRPORT
MIKI ROAD
KAUMALAPAU
HWY
HI'I RESERVOIR
0.5 HI'I TANK
WELL NO. 2
WELL NO. 4

APPENDIX A

Water Calculations

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
MAX DAY FLOW

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Length (User Defined) (ft)
P-1	6,065	J-3	J-4	10	HDPE	140	-66	0.27	0.21	0
P-2	5,145	J-1	J-5	12	Ductile Iron	110	0	0	0	21,582
P-3	5,729	J-2	J-6	10	HDPE	140	120	0.49	0.6	0
P-4	2,088	J-1	T-1	12	HDPE	140	-1,386	3.93	24.43	6,040
P-5	3,615	J-2	J-7	16	Ductile Iron	120	831	1.33	1.86	0
P-6	571	J-7	J-3	16	Ductile Iron	120	-66	0.11	0	0
P-7	170	J-7	J-8	16	Ductile Iron	120	343	0.55	0.02	0
P-8	590	J-8	J-9	16	Ductile Iron	120	343	0.55	0.06	0
P-9	807	J-10	J-11	16	Ductile Iron	120	65	0.1	0	0
P-10	2,582	J-10	J-12	16	Ductile Iron	120	219	0.35	0.11	0
P-11	749	J-7	J-13	16	Ductile Iron	110	555	0.88	0.21	0
P-12	747	J-13	J-10	16	Ductile Iron	110	283	0.45	0.06	0
P-13	2,338	J-4	J-14	10	Steel	140	-66	0.27	0.08	0
P-14	723	J-14	J-15	10	Steel	140	-66	0.27	0.03	0
P-15	2,294	J-15	J-16	10	Steel	140	-66	0.27	0.08	0
P-16	6,167	J-16	J-17	10	Steel	140	-66	0.27	0.22	0
P-17	6,012	J-17	J-6	10	Steel	140	-120	0.49	0.63	0
P-18	718	J-6	J-18	10	Steel	140	0	0	0	0
P-19	2,246	J-17	J-19	10	Steel	140	53	0.22	0.05	0
P-20	4,767	J-18	J-20	10	Steel	140	0	0	0	0
P-21	2,714	J-2	J-21	16	Ductile Iron	120	-951	1.52	1.79	8,000
P-22	5,931	J-21	PRV-2	12	Ductile Iron	110	-951	2.7	18.66	0
P-23	11	PRV-2	J-1	12	Ductile Iron	110	-951	2.7	0.04	0

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,347.17	435	1,793.57	193
J-2	1,134.61	0	1,546.38	178
J-3	1,212.30	0	1,544.52	144
J-4	1,281.00	0	1,544.74	114
J-5	1,128.00	0	1,793.57	288
J-6	1,350.00	0	1,545.78	85
J-7	1,221.15	0	1,544.52	140
J-8	1,221.91	0	1,544.50	140
J-9	1,259.00	343	1,544.44	123
J-10	1,279.00	0	1,544.24	115
J-11	1,314.00	65	1,544.24	100
J-12	1,255.00	219	1,544.13	125
J-13	1,250.10	271	1,544.31	127
J-14	1,223.00	0	1,544.82	139
J-15	1,207.00	0	1,544.85	146
J-16	1,249.00	0	1,544.93	128
J-17	1,339.00	0	1,545.14	89
J-18	1,424.00	0	1,545.78	53
J-19	1,349.00	53	1,545.09	85
J-20	1,472.00	0	1,545.78	32
J-21	1,345.73	0	1,548.17	88

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
PEAK HOUR FLOW

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	(User Defined) (ft)
P-1	6,065	J-3	J-4	10	HDPE	140	-133	0.54	0.77	0
P-2	5,145	J-1	J-5	12	Ductile Iron	110	0	0	0	21,582
P-3	5,729	J-2	J-6	10	HDPE	140	239	0.98	2.17	0
P-4	2,088	J-1	T-1	12	HDPE	140	-2,772	7.86	88.21	6,040
P-5	3,615	J-2	J-7	16	Ductile Iron	120	1,663	2.65	6.71	0
P-6	571	J-7	J-3	16	Ductile Iron	120	-133	0.21	0.01	0
P-7	170	J-7	J-8	16	Ductile Iron	120	686	1.1	0.06	0
P-8	590	J-8	J-9	16	Ductile Iron	120	686	1.1	0.21	0
P-9	807	J-10	J-11	16	Ductile Iron	120	129	0.21	0.01	0
P-10	2,582	J-10	J-12	16	Ductile Iron	120	438	0.7	0.4	0
P-11	749	J-7	J-13	16	Ductile Iron	110	1,109	1.77	0.77	0
P-12	747	J-13	J-10	16	Ductile Iron	110	567	0.9	0.22	0
P-13	2,338	J-4	J-14	10	Steel	140	-133	0.54	0.3	0
P-14	723	J-14	J-15	10	Steel	140	-133	0.54	0.09	0
P-15	2,294	J-15	J-16	10	Steel	140	-133	0.54	0.29	0
P-16	6,167	J-16	J-17	10	Steel	140	-133	0.54	0.79	0
P-17	6,012	J-17	J-6	10	Steel	140	-239	0.98	2.28	0
P-18	718	J-6	J-18	10	Steel	140	0	0	0	0
P-19	2,246	J-17	J-19	10	Steel	140	106	0.43	0.19	0
P-20	4,767	J-18	J-20	10	Steel	140	0	0	0	0
P-21	2,714	J-2	J-21	16	Ductile Iron	120	-1,902	3.03	6.46	8,000
P-22	5,931	J-21	PRV-2	12	Ductile Iron	110	-1,902	5.39	67.35	0
P-23	11	PRV-2	J-1	12	Ductile Iron	110	-1,902	5.39	0.13	0

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,347.17	871	1,729.79	166
J-2	1,134.61	0	1,493.01	155
J-3	1,212.30	0	1,486.32	119
J-4	1,281.00	0	1,487.09	89
J-5	1,128.00	0	1,729.79	260
J-6	1,350.00	0	1,490.84	61
J-7	1,221.15	0	1,486.31	115
J-8	1,221.91	0	1,486.24	114
J-9	1,259.00	686	1,486.03	98
J-10	1,279.00	0	1,485.31	89
J-11	1,314.00	129	1,485.30	74
J-12	1,255.00	438	1,484.91	99
J-13	1,250.10	543	1,485.53	102
J-14	1,223.00	0	1,487.39	114
J-15	1,207.00	0	1,487.48	121
J-16	1,249.00	0	1,487.77	103
J-17	1,339.00	0	1,488.56	65
J-18	1,424.00	0	1,490.84	29
J-19	1,349.00	106	1,488.37	60
J-20	1,472.00	0	1,490.84	8
J-21	1,345.73	0	1,499.47	67

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
MAX DAY + FIRE FLOW @ J11

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Length (User Defined) (ft)
P-1	6,065	J-3	J-4	10	HDPE	140	-315	1.29	3.83	0
P-2	5,145	J-1	J-5	12	Ductile Iron	110	0	0	0	21,582
P-3	5,729	J-2	J-6	10	HDPE	140	368	1.5	4.83	0
P-4	2,088	J-1	T-1	12	HDPE	140	-3,886	11.02	164.87	6,040
P-5	3,615	J-2	J-7	16	Ductile Iron	120	3,083	4.92	21.05	0
P-6	571	J-7	J-3	16	Ductile Iron	120	-315	0.5	0.05	0
P-7	170	J-7	J-8	16	Ductile Iron	120	2,843	4.54	0.85	0
P-8	590	J-8	J-9	16	Ductile Iron	120	2,843	4.54	2.96	0
P-9	807	J-10	J-11	16	Ductile Iron	120	65	0.1	0	0
P-10	2,582	J-10	J-12	16	Ductile Iron	120	219	0.35	0.11	0
P-11	749	J-7	J-13	16	Ductile Iron	110	555	0.88	0.21	0
P-12	747	J-13	J-10	16	Ductile Iron	110	283	0.45	0.06	0
P-13	2,338	J-4	J-14	10	Steel	140	-315	1.29	1.48	0
P-14	723	J-14	J-15	10	Steel	140	-315	1.29	0.46	0
P-15	2,294	J-15	J-16	10	Steel	140	-315	1.29	1.45	0
P-16	6,167	J-16	J-17	10	Steel	140	-315	1.29	3.89	0
P-17	6,012	J-17	J-6	10	Steel	140	-368	1.5	5.07	0
P-18	718	J-6	J-18	10	Steel	140	0	0	0	0
P-19	2,246	J-17	J-19	10	Steel	140	53	0.22	0.05	0
P-20	4,767	J-18	J-20	10	Steel	140	0	0	0	0
P-21	2,714	J-2	J-21	16	Ductile Iron	120	-3,451	5.51	19.48	8,000
P-22	5,931	J-21	PRV-2	12	Ductile Iron	110	-3,451	9.79	203.07	0
P-23	11	PRV-2	J-1	12	Ductile Iron	110	-3,451	9.79	0.39	0

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,347.17	435	1,653.13	132
J-2	1,134.61	0	1,344.27	91
J-3	1,212.30	0	1,323.27	48
J-4	1,281.00	0	1,327.10	20
J-5	1,128.00	0	1,653.13	227
J-6	1,350.00	0	1,339.44	-5
J-7	1,221.15	0	1,323.22	44
J-8	1,221.91	0	1,322.37	43
J-9	1,259.00	2,843	1,319.41	26
J-10	1,279.00	0	1,322.94	19
J-11	1,314.00	65	1,322.94	4
J-12	1,255.00	219	1,322.83	29
J-13	1,250.10	271	1,323.01	32
J-14	1,223.00	0	1,328.57	46
J-15	1,207.00	0	1,329.03	53
J-16	1,249.00	0	1,330.48	35
J-17	1,339.00	0	1,334.37	-2
J-18	1,424.00	0	1,339.44	-37
J-19	1,349.00	53	1,334.32	-6
J-20	1,472.00	0	1,339.44	-57
J-21	1,345.73	0	1,363.75	8

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
MAX DAY + FIRE FLOW @ J13

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Length (User Defined) (ft)
P-1	6,065	J-3	J-4	10	HDPE	140	-265	1.08	2.79	0
P-2	5,145	J-1	J-5	12	Ductile Iron	110	0	0	0	21,582
P-3	5,729	J-2	J-6	10	HDPE	140	319	1.3	3.7	0
P-4	2,088	J-1	T-1	12	HDPE	140	-3,386	9.61	127.75	6,040
P-5	3,615	J-2	J-7	16	Ductile Iron	120	2,632	4.2	15.71	0
P-6	571	J-7	J-3	16	Ductile Iron	120	-265	0.42	0.04	0
P-7	170	J-7	J-8	16	Ductile Iron	120	343	0.55	0.02	0
P-8	590	J-8	J-9	16	Ductile Iron	120	343	0.55	0.06	0
P-9	807	J-10	J-11	16	Ductile Iron	120	2,065	3.29	2.24	0
P-10	2,582	J-10	J-12	16	Ductile Iron	120	219	0.35	0.11	0
P-11	749	J-7	J-13	16	Ductile Iron	110	2,555	4.08	3.62	0
P-12	747	J-13	J-10	16	Ductile Iron	110	2,283	3.64	2.93	0
P-13	2,338	J-4	J-14	10	Steel	140	-265	1.08	1.08	0
P-14	723	J-14	J-15	10	Steel	140	-265	1.08	0.33	0
P-15	2,294	J-15	J-16	10	Steel	140	-265	1.08	1.06	0
P-16	6,167	J-16	J-17	10	Steel	140	-265	1.08	2.84	0
P-17	6,012	J-17	J-6	10	Steel	140	-319	1.3	3.88	0
P-18	718	J-6	J-18	10	Steel	140	0	0	0	0
P-19	2,246	J-17	J-19	10	Steel	140	53	0.22	0.05	0
P-20	4,767	J-18	J-20	10	Steel	140	0	0	0	0
P-21	2,714	J-2	J-21	16	Ductile Iron	120	-2,951	4.71	14.58	8,000
P-22	5,931	J-21	PRV-2	12	Ductile Iron	110	-2,951	8.37	151.97	0
P-23	11	PRV-2	J-1	12	Ductile Iron	110	-2,951	8.37	0.29	0

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,347.17	435	1,690.25	148
J-2	1,134.61	0	1,400.28	115
J-3	1,212.30	0	1,384.60	75
J-4	1,281.00	0	1,387.40	46
J-5	1,128.00	0	1,690.25	243
J-6	1,350.00	0	1,396.58	20
J-7	1,221.15	0	1,384.57	71
J-8	1,221.91	0	1,384.55	70
J-9	1,259.00	343	1,384.49	54
J-10	1,279.00	0	1,378.02	43
J-11	1,314.00	2,065	1,375.78	27
J-12	1,255.00	219	1,377.91	53
J-13	1,250.10	271	1,380.95	57
J-14	1,223.00	0	1,388.47	72
J-15	1,207.00	0	1,388.80	79
J-16	1,249.00	0	1,389.86	61
J-17	1,339.00	0	1,392.70	23
J-18	1,424.00	0	1,396.58	-12
J-19	1,349.00	53	1,392.65	19
J-20	1,472.00	0	1,396.58	-33
J-21	1,345.73	0	1,414.86	30

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
MAX DAY + FIRE FLOW @ J14

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Length (User Defined) (ft)
P-1	6,065	J-3	J-4	10	HDPE	140	-265	1.08	2.79	0
P-2	5,145	J-1	J-5	12	Ductile Iron	110	0	0	0	21,582
P-3	5,729	J-2	J-6	10	HDPE	140	319	1.3	3.7	0
P-4	2,088	J-1	T-1	12	HDPE	140	-3,386	9.61	127.75	6,040
P-5	3,615	J-2	J-7	16	Ductile Iron	120	2,632	4.2	15.71	0
P-6	571	J-7	J-3	16	Ductile Iron	120	-265	0.42	0.04	0
P-7	170	J-7	J-8	16	Ductile Iron	120	343	0.55	0.02	0
P-8	590	J-8	J-9	16	Ductile Iron	120	343	0.55	0.06	0
P-9	807	J-10	J-11	16	Ductile Iron	120	65	0.1	0	0
P-10	2,582	J-10	J-12	16	Ductile Iron	120	2,219	3.54	8.18	0
P-11	749	J-7	J-13	16	Ductile Iron	110	2,555	4.08	3.62	0
P-12	747	J-13	J-10	16	Ductile Iron	110	2,283	3.64	2.93	0
P-13	2,338	J-4	J-14	10	Steel	140	-265	1.08	1.08	0
P-14	723	J-14	J-15	10	Steel	140	-265	1.08	0.33	0
P-15	2,294	J-15	J-16	10	Steel	140	-265	1.08	1.06	0
P-16	6,167	J-16	J-17	10	Steel	140	-265	1.08	2.84	0
P-17	6,012	J-17	J-6	10	Steel	140	-319	1.3	3.88	0
P-18	718	J-6	J-18	10	Steel	140	0	0	0	0
P-19	2,246	J-17	J-19	10	Steel	140	53	0.22	0.05	0
P-20	4,767	J-18	J-20	10	Steel	140	0	0	0	0
P-21	2,714	J-2	J-21	16	Ductile Iron	120	-2,951	4.71	14.58	8,000
P-22	5,931	J-21	PRV-2	12	Ductile Iron	110	-2,951	8.37	151.97	0
P-23	11	PRV-2	J-1	12	Ductile Iron	110	-2,951	8.37	0.29	0

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,347.17	435	1,690.25	148
J-2	1,134.61	0	1,400.28	115
J-3	1,212.30	0	1,384.60	75
J-4	1,281.00	0	1,387.40	46
J-5	1,128.00	0	1,690.25	243
J-6	1,350.00	0	1,396.58	20
J-7	1,221.15	0	1,384.57	71
J-8	1,221.91	0	1,384.55	70
J-9	1,259.00	343	1,384.49	54
J-10	1,279.00	0	1,378.02	43
J-11	1,314.00	65	1,378.01	28
J-12	1,255.00	2,219	1,369.84	50
J-13	1,250.10	271	1,380.95	57
J-14	1,223.00	0	1,388.47	72
J-15	1,207.00	0	1,388.80	79
J-16	1,249.00	0	1,389.86	61
J-17	1,339.00	0	1,392.70	23
J-18	1,424.00	0	1,396.58	-12
J-19	1,349.00	53	1,392.65	19
J-20	1,472.00	0	1,396.58	-33
J-21	1,345.73	0	1,414.86	30

APPENDIX A2

Water Calculations – Upsized Pipes

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
UPSIZE PIPE - MAX DAY

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Length (User Defined) (ft)
P-1	6,065	J-3	J-4	10	HDPE	140	-66	0.27	0.21	0
P-2	5,145	J-1	J-5	12	Ductile Iron	110	0	0	0	21,592
P-3	5,72I	J-2	J-6	10	HDPE	140	120	0.4I	0.6	0
P-4	2,099	J-1	T-1	16	Ductile Iron	120	-1,396	2.21	9.01	6,040
P-5	3,615	J-2	J-7	16	Ductile Iron	120	931	1.33	1.96	0
P-6	571	J-7	J-3	16	Ductile Iron	120	-66	0.11	0	0
P-7	170	J-7	J-9	16	Ductile Iron	120	343	0.55	0.02	0
P-9	5I 0	J-9	J-I	16	Ductile Iron	120	343	0.55	0.06	0
P-I	907	J-10	J-11	16	Ductile Iron	120	65	0.1	0	0
P-10	2,592	J-10	J-12	16	Ductile Iron	120	21I	0.35	0.11	0
P-11	74I	J-7	J-13	16	Ductile Iron	110	555	0.99	0.21	0
P-12	747	J-13	J-10	16	Ductile Iron	110	293	0.45	0.06	0
P-13	2,339	J-4	J-14	10	Steel	140	-66	0.27	0.09	0
P-14	723	J-14	J-15	10	Steel	140	-66	0.27	0.03	0
P-15	2,2I 4	J-15	J-16	10	Steel	140	-66	0.27	0.09	0
P-16	6,167	J-16	J-17	10	Steel	140	-66	0.27	0.22	0
P-17	6,012	J-17	J-6	10	Steel	140	-120	0.4I	0.63	0
P-19	719	J-6	J-19	10	Steel	140	0	0	0	0
P-1I	2,246	J-17	J-1I	10	Steel	140	53	0.22	0.05	0
P-20	4,767	J-19	J-20	10	Steel	140	0	0	0	0
P-21	2,714	J-2	J-21	16	Ductile Iron	120	-I 51	1.52	1.7I	9,000
P-22	5,I 31	J-21	PRV-2	12	Ductile Iron	110	-I 51	2.7	19.66	0
P-23	11	PRV-2	J-1	12	Ductile Iron	110	-I 51	2.7	0.04	0

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,347.17	435	1,90I .I I	200
J-2	1,134.61	0	1,546.39	179
J-3	1,212.30	0	1,544.52	144
J-4	1,291.00	0	1,544.74	114
J-5	1,129.00	0	1,90I .I I	2I 5
J-6	1,350.00	0	1,545.79	95
J-7	1,221.15	0	1,544.52	140
J-9	1,221.I 1	0	1,544.50	140
J-I	1,25I .00	343	1,544.44	123
J-10	1,27I .00	0	1,544.24	115
J-11	1,314.00	65	1,544.24	100
J-12	1,255.00	21I	1,544.13	125
J-13	1,250.10	271	1,544.31	127
J-14	1,223.00	0	1,544.92	13I
J-15	1,207.00	0	1,544.95	146
J-16	1,24I .00	0	1,544.I 3	129
J-17	1,33I .00	0	1,545.14	9I
J-19	1,424.00	0	1,545.79	53
J-1I	1,34I .00	53	1,545.0I	95
J-20	1,472.00	0	1,545.79	32
J-21	1,345.73	0	1,549.17	99

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
UPSIZE PIPE - PEAK HOUR

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Length (User Defined) (ft)
P-1	6,065	J-3	J-4	10	HDPE	140	-133	0.54	0.77	0
P-2	5,145	J-1	J-5	12	Ductile Iron	110	0	0	0	21,592
P-3	5,72I	J-2	J-6	10	HDPE	140	23I	0.I 9	2.17	0
P-4	2,099	J-1	T-1	16	Ductile Iron	120	-2,772	4.42	29.I	6,040
P-5	3,615	J-2	J-7	16	Ductile Iron	120	1,663	2.65	6.71	0
P-6	571	J-7	J-3	16	Ductile Iron	120	-133	0.21	0.01	0
P-7	170	J-7	J-9	16	Ductile Iron	120	696	1.1	0.06	0
P-9	5I 0	J-9	J-I	16	Ductile Iron	120	696	1.1	0.21	0
P-I	907	J-10	J-11	16	Ductile Iron	120	12I	0.21	0.01	0
P-10	2,592	J-10	J-12	16	Ductile Iron	120	439	0.7	0.4	0
P-11	74I	J-7	J-13	16	Ductile Iron	110	1,10I	1.77	0.77	0
P-12	747	J-13	J-10	16	Ductile Iron	110	567	0.I	0.22	0
P-13	2,339	J-4	J-14	10	Steel	140	-133	0.54	0.3	0
P-14	723	J-14	J-15	10	Steel	140	-133	0.54	0.0I	0
P-15	2,2I 4	J-15	J-16	10	Steel	140	-133	0.54	0.2I	0
P-16	6,167	J-16	J-17	10	Steel	140	-133	0.54	0.7I	0
P-17	6,012	J-17	J-6	10	Steel	140	-23I	0.I 9	2.29	0
P-19	719	J-6	J-19	10	Steel	140	0	0	0	0
P-1I	2,246	J-17	J-1I	10	Steel	140	106	0.43	0.1I	0
P-20	4,767	J-19	J-20	10	Steel	140	0	0	0	0
P-21	2,714	J-2	J-21	16	Ductile Iron	120	-1,I 02	3.03	6.46	9,000
P-22	5,I 31	J-21	PRV-2	12	Ductile Iron	110	-1,I 02	5.3I	67.35	0
P-23	11	PRV-2	J-1	12	Ductile Iron	110	-1,I 02	5.3I	0.13	0

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,347.17	971	1,79I .10	1I 1
J-2	1,134.61	0	1,4I 3.01	155
J-3	1,212.30	0	1,496.32	11I
J-4	1,291.00	0	1,497.0I	9I
J-5	1,129.00	0	1,79I .10	296
J-6	1,350.00	0	1,4I 0.94	61
J-7	1,221.15	0	1,496.31	115
J-9	1,221.I 1	0	1,496.24	114
J-I	1,25I .00	696	1,496.03	I 9
J-10	1,27I .00	0	1,495.31	9I
J-11	1,314.00	12I	1,495.30	74
J-12	1,255.00	439	1,494.I 1	I I
J-13	1,250.10	543	1,495.53	102
J-14	1,223.00	0	1,497.3I	114
J-15	1,207.00	0	1,497.49	121
J-16	1,24I .00	0	1,497.77	103
J-17	1,33I .00	0	1,499.56	65
J-19	1,424.00	0	1,4I 0.94	2I
J-1I	1,34I .00	106	1,499.37	60
J-20	1,472.00	0	1,4I 0.94	9
J-21	1,345.73	0	1,4I I .47	67

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
UPSIZE PIPE - MAX DAY + FIRE FLOW@J11

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Length (User Defined) (ft)
P-1	6,065	J-3	J-4	10	HDPE	140	-315	1.2I	3.93	0
P-2	5,145	J-1	J-5	12	Ductile Iron	110	0	0	0	21,592
P-3	5,72I	J-2	J-6	10	HDPE	140	369	1.5	4.93	0
P-4	2,099	J-1	T-1	16	Ductile Iron	120	-3,996	6.2	54.02	6,040
P-5	3,615	J-2	J-7	16	Ductile Iron	120	3,093	4.I 2	21.05	0
P-6	571	J-7	J-3	16	Ductile Iron	120	-315	0.5	0.05	0
P-7	170	J-7	J-9	16	Ductile Iron	120	2,943	4.54	0.95	0
P-9	5I 0	J-9	J-I	16	Ductile Iron	120	2,943	4.54	2.I 6	0
P-I	907	J-10	J-11	16	Ductile Iron	120	65	0.1	0	0
P-10	2,592	J-10	J-12	16	Ductile Iron	120	21I	0.35	0.11	0
P-11	74I	J-7	J-13	16	Ductile Iron	110	555	0.99	0.21	0
P-12	747	J-13	J-10	16	Ductile Iron	110	293	0.45	0.06	0
P-13	2,339	J-4	J-14	10	Steel	140	-315	1.2I	1.49	0
P-14	723	J-14	J-15	10	Steel	140	-315	1.2I	0.46	0
P-15	2,2I 4	J-15	J-16	10	Steel	140	-315	1.2I	1.45	0
P-16	6,167	J-16	J-17	10	Steel	140	-315	1.2I	3.9I	0
P-17	6,012	J-17	J-6	10	Steel	140	-369	1.5	5.07	0
P-19	719	J-6	J-19	10	Steel	140	0	0	0	0
P-1I	2,246	J-17	J-1I	10	Steel	140	53	0.22	0.05	0
P-20	4,767	J-19	J-20	10	Steel	140	0	0	0	0
P-21	2,714	J-2	J-21	16	Ductile Iron	120	-3,451	5.51	1I .49	9,000
P-22	5,I 31	J-21	PRV-2	12	Ductile Iron	110	-3,451	I .7I	203.07	0
P-23	11	PRV-2	J-1	12	Ductile Iron	110	-3,451	I .7I	0.3I	0

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,347.17	435	1,763.I 9	190
J-2	1,134.61	0	1,344.27	I 1
J-3	1,212.30	0	1,323.27	49
J-4	1,291.00	0	1,327.10	20
J-5	1,129.00	0	1,763.I 9	275
J-6	1,350.00	0	1,33I .44	-5
J-7	1,221.15	0	1,323.22	44
J-9	1,221.I 1	0	1,322.37	43
J-I	1,25I .00	2,943	1,31I .41	26
J-10	1,27I .00	0	1,322.I 4	1I
J-11	1,314.00	65	1,322.I 4	4
J-12	1,255.00	21I	1,322.93	2I
J-13	1,250.10	271	1,323.01	32
J-14	1,223.00	0	1,329.57	46
J-15	1,207.00	0	1,32I .03	53
J-16	1,24I .00	0	1,330.49	35
J-17	1,33I .00	0	1,334.37	-2
J-19	1,424.00	0	1,33I .44	-37
J-1I	1,34I .00	53	1,334.32	-6
J-20	1,472.00	0	1,33I .44	-57
J-21	1,345.73	0	1,363.75	9

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
UPSIZE PIPE - MAX DAY + FIRE FLOW@J13

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Length (User Defined) (ft)
P-1	6,065	J-3	J-4	10	HDPE	140	-265	1.09	2.7I	0
P-2	5,145	J-1	J-5	12	Ductile Iron	110	0	0	0	21,592
P-3	5,72I	J-2	J-6	10	HDPE	140	31I	1.3	3.7	0
P-4	2,099	J-1	T-1	16	Ductile Iron	120	-3,396	5.4	41.96	6,040
P-5	3,615	J-2	J-7	16	Ductile Iron	120	2,632	4.2	15.71	0
P-6	571	J-7	J-3	16	Ductile Iron	120	-265	0.42	0.04	0
P-7	170	J-7	J-9	16	Ductile Iron	120	343	0.55	0.02	0
P-9	5I 0	J-9	J-I	16	Ductile Iron	120	343	0.55	0.06	0
P-I	907	J-10	J-11	16	Ductile Iron	120	2,065	3.2I	2.24	0
P-10	2,592	J-10	J-12	16	Ductile Iron	120	21I	0.35	0.11	0
P-11	74I	J-7	J-13	16	Ductile Iron	110	2,555	4.09	3.62	0
P-12	747	J-13	J-10	16	Ductile Iron	110	2,293	3.64	2.I 3	0
P-13	2,339	J-4	J-14	10	Steel	140	-265	1.09	1.09	0
P-14	723	J-14	J-15	10	Steel	140	-265	1.09	0.33	0
P-15	2,2I 4	J-15	J-16	10	Steel	140	-265	1.09	1.06	0
P-16	6,167	J-16	J-17	10	Steel	140	-265	1.09	2.94	0
P-17	6,012	J-17	J-6	10	Steel	140	-31I	1.3	3.99	0
P-19	719	J-6	J-19	10	Steel	140	0	0	0	0
P-1I	2,246	J-17	J-1I	10	Steel	140	53	0.22	0.05	0
P-20	4,767	J-19	J-20	10	Steel	140	0	0	0	0
P-21	2,714	J-2	J-21	16	Ductile Iron	120	-2,I 51	4.71	14.59	9,000
P-22	5,I 31	J-21	PRV-2	12	Ductile Iron	110	-2,I 51	9.37	151.I 7	0
P-23	11	PRV-2	J-1	12	Ductile Iron	110	-2,I 51	9.37	0.2I	0

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,347.17	435	1,776.14	196
J-2	1,134.61	0	1,400.29	115
J-3	1,212.30	0	1,394.60	75
J-4	1,291.00	0	1,397.40	46
J-5	1,129.00	0	1,776.14	290
J-6	1,350.00	0	1,3I 6.59	20
J-7	1,221.15	0	1,394.57	71
J-9	1,221.I 1	0	1,394.55	70
J-I	1,25I .00	343	1,394.4I	54
J-10	1,27I .00	0	1,379.02	43
J-11	1,314.00	2,065	1,375.79	27
J-12	1,255.00	21I	1,377.I 1	53
J-13	1,250.10	271	1,390.I 5	57
J-14	1,223.00	0	1,399.47	72
J-15	1,207.00	0	1,399.90	7I
J-16	1,24I .00	0	1,39I .96	61
J-17	1,33I .00	0	1,3I 2.70	23
J-19	1,424.00	0	1,3I 6.59	-12
J-1I	1,34I .00	53	1,3I 2.65	1I
J-20	1,472.00	0	1,3I 6.59	-33
J-21	1,345.73	0	1,414.96	30

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
UPSIZE PIPE - MAX DAY + FIRE FLOW@J14

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Length (User Defined) (ft)
P-1	6,065	J-3	J-4	10	HDPE	140	-265	1.09	2.7I	0
P-2	5,145	J-1	J-5	12	Ductile Iron	110	0	0	0	21,592
P-3	5,72I	J-2	J-6	10	HDPE	140	31I	1.3	3.7	0
P-4	2,099	J-1	T-1	16	Ductile Iron	120	-3,396	5.4	41.96	6,040
P-5	3,615	J-2	J-7	16	Ductile Iron	120	2,632	4.2	15.71	0
P-6	571	J-7	J-3	16	Ductile Iron	120	-265	0.42	0.04	0
P-7	170	J-7	J-9	16	Ductile Iron	120	343	0.55	0.02	0
P-9	5I 0	J-9	J-I	16	Ductile Iron	120	343	0.55	0.06	0
P-I	907	J-10	J-11	16	Ductile Iron	120	65	0.1	0	0
P-10	2,592	J-10	J-12	16	Ductile Iron	120	2,21I	3.54	9.19	0
P-11	74I	J-7	J-13	16	Ductile Iron	110	2,555	4.09	3.62	0
P-12	747	J-13	J-10	16	Ductile Iron	110	2,293	3.64	2.I 3	0
P-13	2,339	J-4	J-14	10	Steel	140	-265	1.09	1.09	0
P-14	723	J-14	J-15	10	Steel	140	-265	1.09	0.33	0
P-15	2,2I 4	J-15	J-16	10	Steel	140	-265	1.09	1.06	0
P-16	6,167	J-16	J-17	10	Steel	140	-265	1.09	2.94	0
P-17	6,012	J-17	J-6	10	Steel	140	-31I	1.3	3.99	0
P-19	719	J-6	J-19	10	Steel	140	0	0	0	0
P-1I	2,246	J-17	J-1I	10	Steel	140	53	0.22	0.05	0
P-20	4,767	J-19	J-20	10	Steel	140	0	0	0	0
P-21	2,714	J-2	J-21	16	Ductile Iron	120	-2,I 51	4.71	14.59	9,000
P-22	5,I 31	J-21	PRV-2	12	Ductile Iron	110	-2,I 51	9.37	151.I 7	0
P-23	11	PRV-2	J-1	12	Ductile Iron	110	-2,I 51	9.37	0.2I	0

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,347.17	435	1,776.14	196
J-2	1,134.61	0	1,400.29	115
J-3	1,212.30	0	1,394.60	75
J-4	1,291.00	0	1,397.40	46
J-5	1,129.00	0	1,776.14	290
J-6	1,350.00	0	1,3I 6.59	20
J-7	1,221.15	0	1,394.57	71
J-9	1,221.I 1	0	1,394.55	70
J-I	1,25I .00	343	1,394.4I	54
J-10	1,27I .00	0	1,379.02	43
J-11	1,314.00	65	1,379.01	29
J-12	1,255.00	2,21I	1,36I .94	50
J-13	1,250.10	271	1,390.I 5	57
J-14	1,223.00	0	1,399.47	72
J-15	1,207.00	0	1,399.90	7I
J-16	1,24I .00	0	1,39I .96	61
J-17	1,33I .00	0	1,3I 2.70	23
J-19	1,424.00	0	1,3I 6.59	-12
J-1I	1,34I .00	53	1,3I 2.65	1I
J-20	1,472.00	0	1,3I 6.59	-33
J-21	1,345.73	0	1,414.96	30

APPENDIX B

0% Construction Costs

PULAMA LANAI MIKI BASIN
200 ACRE INDUSTRIAL PARK
0% CONSTRUCTION COSTS FOR PROPOSED WATER IMPROVEMENTS

ITEM	QTY	UNIT	UNIT PRICE	AMOUNT
OFFSITE IMPROVEMENTS				
Well Studies, including environmental and hydrologic studies for siting exploratory well		Lump Sum	Lump Sum	$ 250,000.00
Exploratory Well, including siting, drilling and testing	1	Each	Each	$ 1,000,000.00
Well Construction, including reaming of exploratory well, drilling, installation of casing and pump installation	1	Each	Each	$ 2,300,000.00
500,000 gallon Concrete Reservoir, including grading, backfill, subbase, base course, structural fill, liners, piping & fittings to exterior face of footing, ladders, railing hatched, vents, finishes and all appurtenances and incidentals	1	Each	Each	$ 3,000,000.00
Upsize existing 12-inch waterline to 16-inch waterline between Hii Tank and Palawai PRV	7,840	LF	$ 600.00	$ 4,704,000.00
6-inch parallel waterline between Hii Tank and Palawai PRV	7,840	LF	$ 550.00	$ 4,312,000.00
ONSITE IMPROVEMENTS				
16-inch water line along Miki Road within the parcel, including trench excavation, cushion and backfill, fittings and connections to existing water lines	2,875	LF	$ 200.00	$ 575,000.00
16-inch water line along Road A, including trench excavation, cushion and backfill, fittings and connections to existing water lines	2,620	LF	$ 200.00	$ 524,000.00
Contingency (20%)		Lump Sum	Lump Sum	$ 219,800.00
TOTAL ONSITE IMPROVEMENTS				**$ 1,318,800.00**