VOLUME II OF II

Draft Environmental Assessment

PROPOSED WEST MAUI SOURCE DEVELOPMENT PROJECT (MAHINAHINA WELL (WELL NO. 6-5638-004) AND KAHANA WELL (WELL NO. 6-5738-002)) LĀHAINĀ, MAUI

(TMK NOS. (2)4-3-001:017(por.), 084(por.); (2)4-4-002:014(por.), 015(por.), 018(por.); (2)4-4-004:009(por.), 011(por.), and 019(por.))

Prepared for:
County of Maui,
Department of Water Supply

March 2019

MUNEKIYO HIRAGA

Planning. Project Management. Sustainable Solutions.

VOLUME II OF II

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Prepared for:
County of Maui,
Department of Water Supply

March 2019

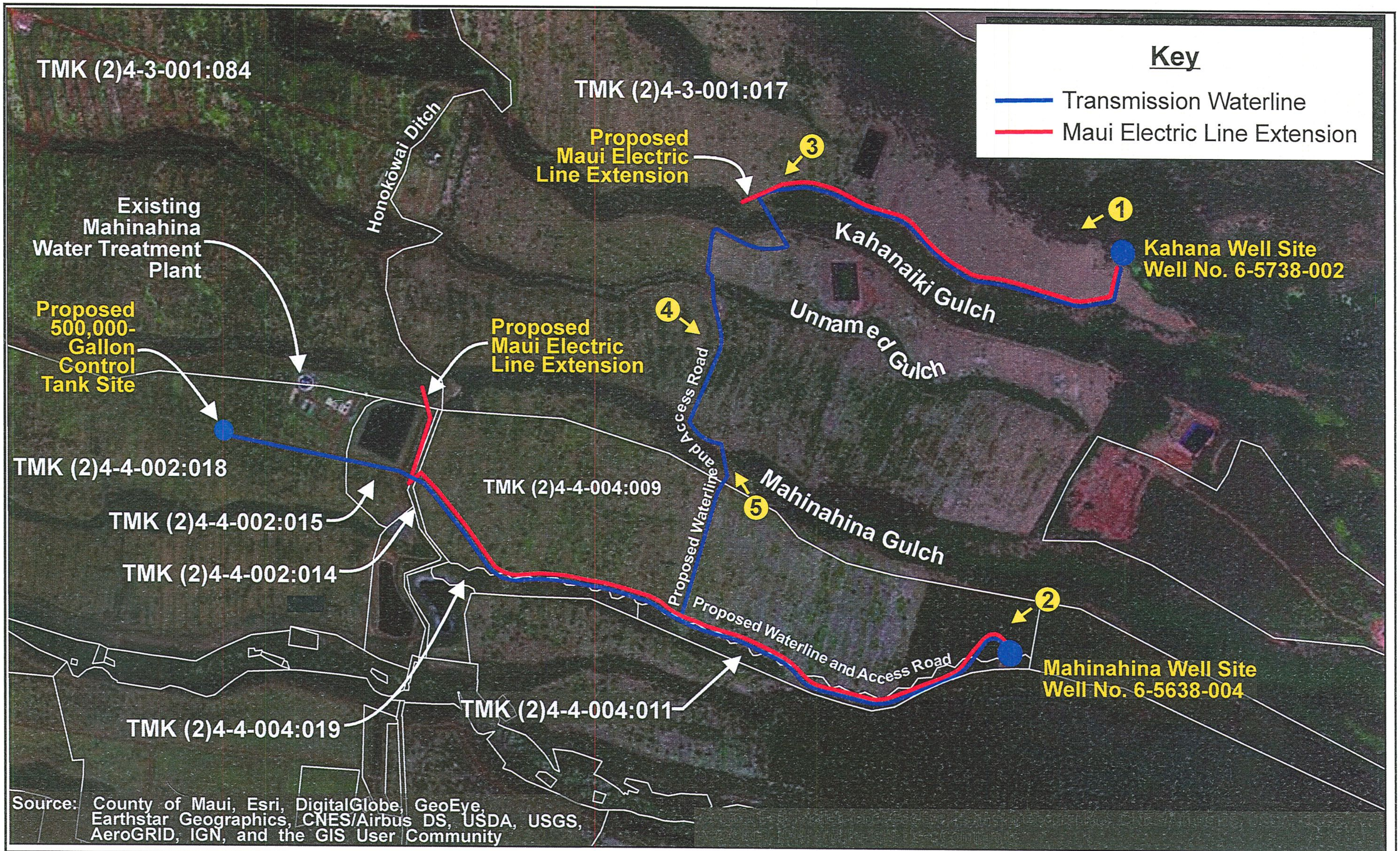
MUNEKIYO HIRAGA

VOLUME II OF II

List of Appendices

PHOTOS OF PROJECT SITE AND SURROUNDING AREAS

APPENDIX A



Proposed West Maui Source Development Project

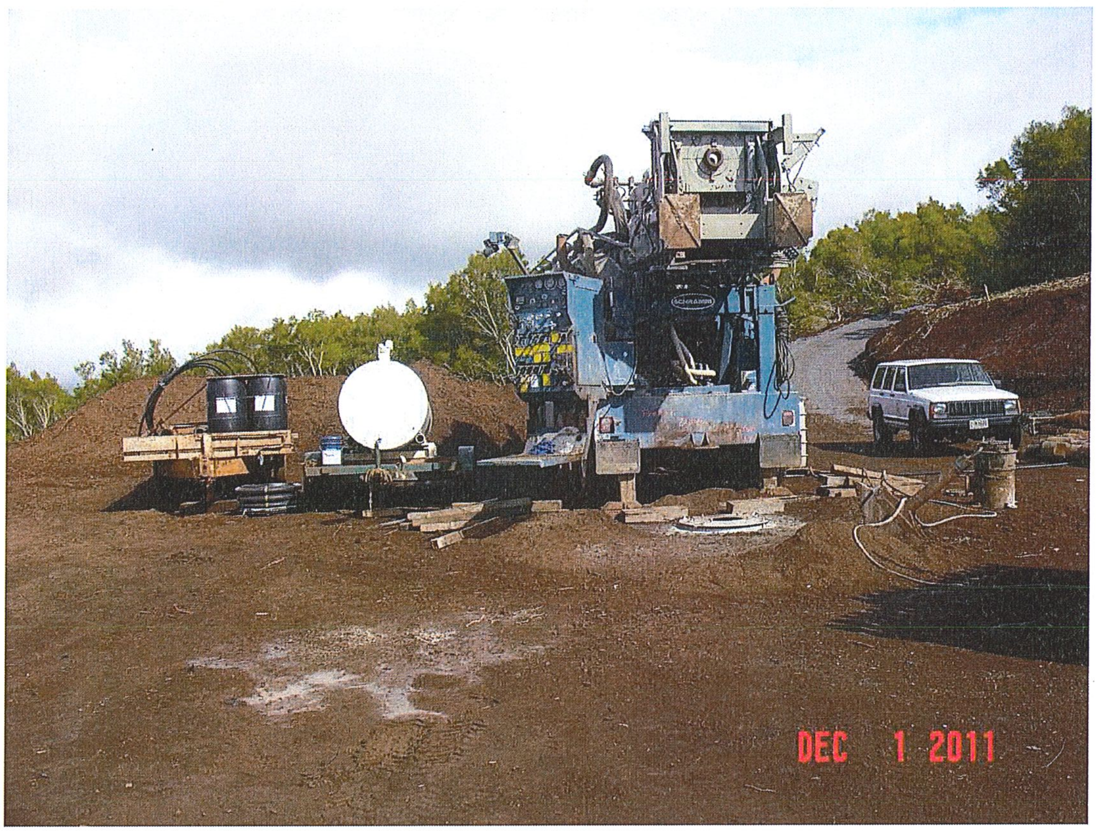
Photographic Reference Map

Prepared for: County of Maui, Department of Water Supply

MUNEKIYO HIRAGA

FE\Kahana Production Well\Applications\Figures\PhotoRef

Photograph No. 1: Kahana Well Site (Kahana Exploratory Well)



Photograph No. 2: Mahinahina Well Site (Mahinahina Exploratory Well)

Photograph No. 3: Kahanaiki Gulch Crossing

Photograph No. 4: Unnamed Gulch Crossing

Photograph No. 5: Mahinahina Gulch Crossing

APPENDIX B

ZONING AND FLOOD CONFIRMATION FORMS

8/4051-SN

COUNTY OF MAUI
DEPARTMENT OF PLANNING
One Main Plaza Building
2200 Main Street, Suite 315
Wailuku, Hawaii 96793

Zoning Administration and Enforcement Division (ZAED)
Telephone: (808) 270-7253
Facsimile: (808) 270-7634
E-mail: planning@mauicounty.gov

ZONING AND FLOOD CONFIRMATION FORM

(This section to be completed by the Applicant)

APPLICANT NAME Munekiyo Hiraga **TELEPHONE** 244-2015

PROJECT NAME West Maui Water Development Project **E-MAIL** planning@munekiyohiraga.com

PROPERTY ADDRESS Lahaina, Maui, Hawaii **TAX MAP KEY** (2)4-3-001:017 (por.) See attached map

2018 JUL 27 P 1:08 DEPT OF PLANNING ZONING DIVISION

☐ **Yes** ■ **No** **Will this Zoning & Flood Confirmation Form be used with a Subdivision Application?**
IF YES, answer questions A and B below and comply with instructions 2 & 3 below:

A) ☐ **Yes** ■ **No** **Will it be processed under a consistency exemption from** Section 18.04.030(B), MCC?
IF YES, which exemption? (No. 1, 2, 3, 4 or 5) ______

B) State the purpose of subdivision and the proposed land uses (*ie 1-lot into 2-lots for all land uses allowed by law*):

INSTRUCTIONS:

1) **Please use a separate Zoning & Flood Confirmation Form for each Tax Map Key (TMK) number.**
2) **If this will be used with a subdivision application AND the subject property contains multiple districts/designations of (1) State Land Use Districts, (2) Maui Island Plan Growth Boundaries, (3) Community Plan Designations, or (4) County Zoning Districts; submit a signed and dated Land Use Designations Map, prepared by a licensed surveyor, showing the metes & bounds of the subject parcel and of each district/designation including any subdistricts.**
3) **If this will be used with a subdivision application AND the subject property contains multiple State Land Use Districts; submit an approved District Boundary Interpretation from the State Land Use Commission.**

(This section to be completed by ZAED)

LAND USE DISTRICTS/DESIGNATIONS (LUD) AND OTHER INFORMATION: [1]

STATE DISTRICT: ☐ Urban ☐ Rural ☒ Agriculture ☐ Conservation

☐ (SMA) Special Management Area

MAUI ISLAND PLAN
Growth Boundary:[2] ☐ Urban ☐ Small Town ☐ Rural ☐ Planned Growth Area ☒ Outside Growth Boundaries
Protected Area:[2] ☐ Preservation ☐ Park ☐ Greenbelt ☐ Greenway ☒ Sensitive Land ☒ Outside Protected Areas

COMMUNITY PLAN:[2] Agriculture

COUNTY ZONING: Agriculture District

OTHER/COMMENTS: zoning based on attached map only

☐ (PD) Planned Development
☐ (PH) Project District
☐ See Additional Comments (Pg.2)
☐ See Attached LUD Map

FEMA FLOOD INFORMATION: A Flood Development Permit is required if any portion of a parcel is designated V, VE, A, AO, AE, AH, D, or Floodway, and the project is on that portion.

FLOOD HAZARD AREA ZONES [3] & BASE FLOOD ELEVATIONS: Zone X

☐ FEMA DESIGNATED FLOODWAY — For Flood Zone AO, FLOOD DEPTH:

SUBDIVISION LAND USE CONSISTENCY: ☐ Not Consistent, (LUDs appear to have NO permitted uses in common).

______ (Signature)
☐ Not Applicable, (Due to processing under consistency exemption No. ☐1, ☐2, ☐3, ☐4, ☐5).
☐ Interim Zoning, (The parcel or portion of the parcel that is zoned interim shall not be subdivided).

☐ [4] Consistent, (LUDs appear to have ALL permitted uses in common).
☐ [4] Consistent, upon obtaining an SMA, PD, or PH subdivision approval from Planning.
☐ [4] Consistent, upon recording a permissible uses unilateral agreement processed by Public Works (See Pg.2).

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1 The conditions and/or representations made in the approval of a State District Boundary Amendment, Community Plan Amendment, County Change In Zoning, SMA Permit, Planned Development, Project District and/or a previous subdivision, may affect building permits, subdivisions, and uses on the land.
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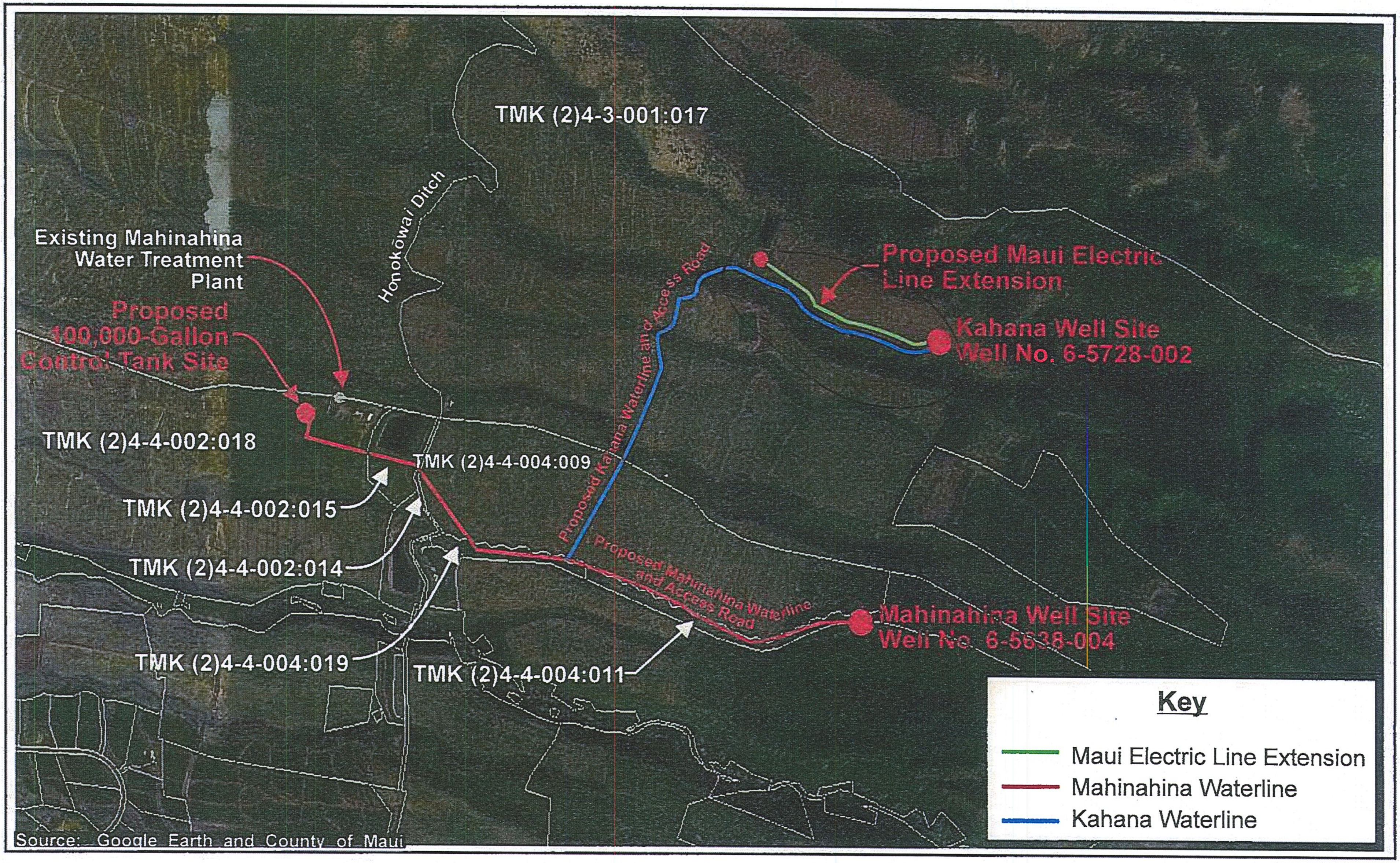
4 Subdivisions will be further reviewed during the subdivision application process to verify consistency, unilateral agreement requirements, and the conditions associated with a unilateral agreement [Section 18.04.030.D, Maui County Code].

REVIEWED & CONFIRMED BY:

[signature] Shikakagawa (Signature) — 8/1/18 (Date)

For: John S Rapacz, Planning Program Administrator, Zoning Administration and Enforcement Division


TMK (2)4-3-001:017
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Proposed 100,000-Gallon Control Tank Site
Proposed Kahana Waterline and Access Road
Proposed Maui Electric Line Extension
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Proposed Mahinahina Waterline and Access Road
Mahinahina Well Site Well No. 6-5638-004
TMK (2)4-4-004:019
TMK (2)4-4-004:011
Key
Maui Electric Line Extension
Mahinahina Waterline
Kahana Waterline
Source: Google Earth and County of Maui

18/4319

COUNTY OF MAUI
DEPARTMENT OF PLANNING
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E-mail: planning@mauicounty.gov

ZONING AND FLOOD CONFIRMATION FORM

RECEIVED 2018 AUG -9 P 3:08

(This section to be completed by the Applicant)

APPLICANT NAME Munekiyo Hiraga **TELEPHONE** 244-2015

PROJECT NAME West Maui Water Development Project **E-MAIL** planning@munekiyohiraga.com

PROPERTY ADDRESS Lahaina, Maui, Hawaii **TAX MAP KEY** (2)4-3-001:084 (por.) (see attached map)

☐ Yes ■ No **Will this Zoning & Flood Confirmation Form be used with a Subdivision Application?**
IF YES, answer questions A and B below and comply with instructions 2 & 3 below:

A) ☐ Yes ■ No **Will it be processed under a consistency exemption from Section 18.04.030(B), MCC?**
IF YES, which exemption? (No. 1, 2, 3, 4 or 5)

B) State the purpose of subdivision and the proposed land uses (*ie 1-lot into 2-lots for all land uses allowed by law*):

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(This section to be completed by ZAED)

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STATE DISTRICT: ☐ Urban ☐ Rural ☒ Agriculture ☐ Conservation

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MAUI ISLAND PLAN
Growth Boundary:[2] ☐ Urban ☐ Small Town ☐ Rural ☐ Planned Growth Area ☒ Outside Growth Boundaries
Protected Area:[2] ☐ Preservation ☐ Park ☐ Greenbelt ☐ Greenway ☒ Sensitive Land ☒ Outside Protected Areas

COMMUNITY PLAN:[2] Agriculture / Open Space

COUNTY ZONING: Agriculture

OTHER/COMMENTS: *noted on portion of parcel on attached map

☐ (PD) Planned Development
☐ (PH) Project District
☐ See Additional Comments (Pg.2)
☐ See Attached LUD Map

FEMA FLOOD INFORMATION: A Flood Development Permit is required if any portion of a parcel is designated V, VE, A, AO, AE, AH, D, or Floodway, and the project is on that portion.

FLOOD HAZARD AREA ZONES [3] & BASE FLOOD ELEVATIONS: Zone X

☐ FEMA DESIGNATED FLOODWAY For Flood Zone AO, FLOOD DEPTH:

SUBDIVISION LAND USE CONSISTENCY: ☐ Not Consistent, (LUDs appear to have NO permitted uses in common).
☐ Not Applicable, (Due to processing under consistency exemption No. ☐1, ☐2, ☐3, ☐4, ☐5).
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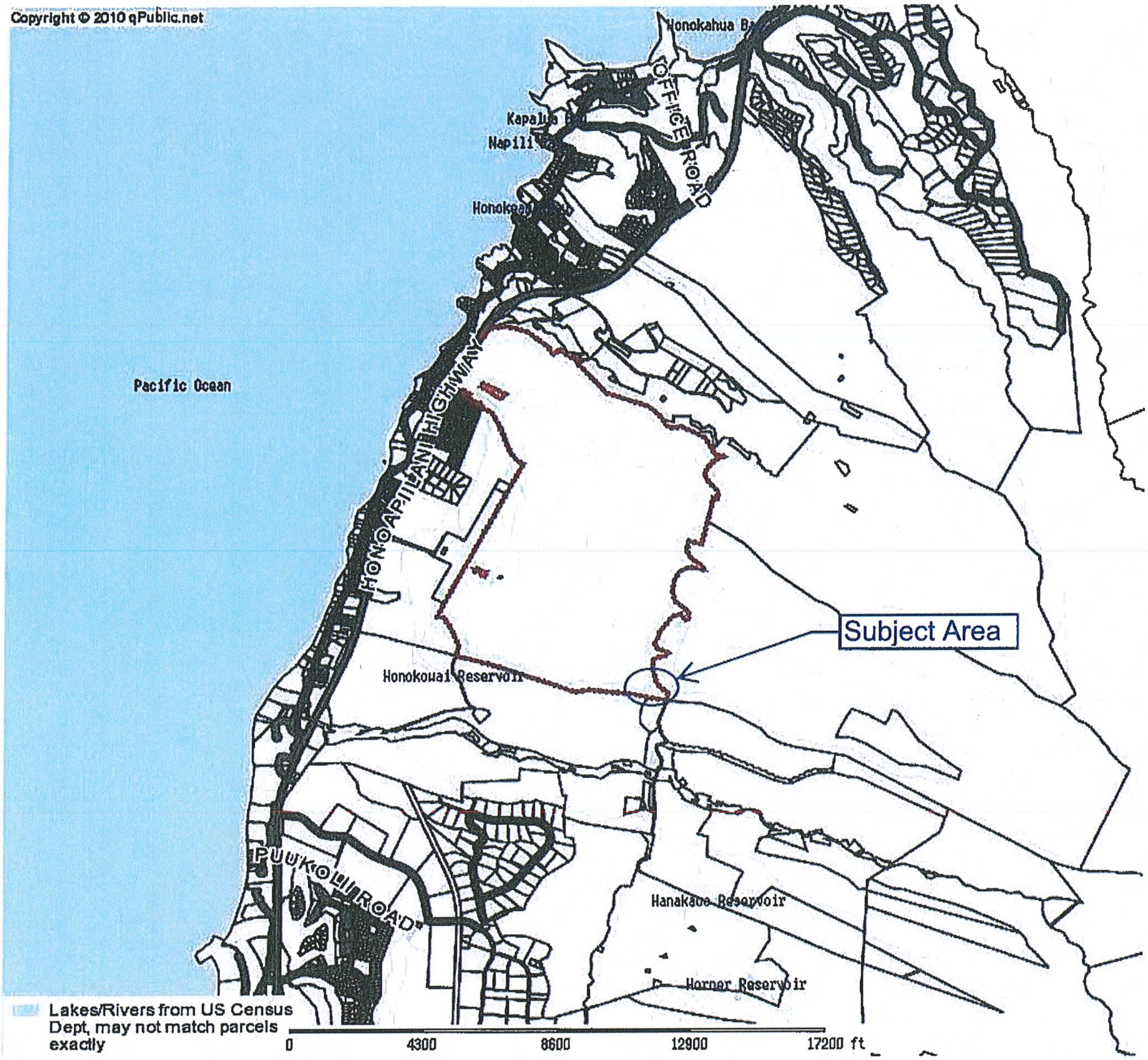
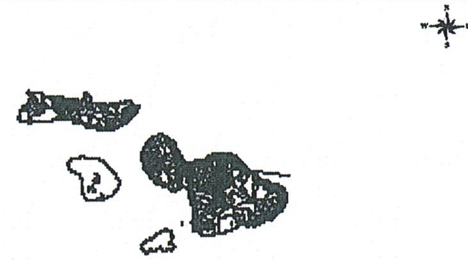
REVIEWED & CONFIRMED BY:

Sheila Nakagawa (Signature) 8/14/18 (Date)

For: John S Rapacz, Planning Program Administrator, Zoning Administration and Enforcement Division



Maui County Assessor			
Parcel: 430010840000 Acres: 1434.8			
Name:	MAUI LAND & PINEAPPLE CO	Land Value	$17,200.00
Site:	HONOAPIILANI HWY	Building Value	$0.00
Sale:		Misc Value	$0.00
Mail:	200 VILLAGE RD	Just Value	$0.00
	LAHAINA HI 96761	Assessed Value	$17,200.00
	,	Exempt Value	$0.00
		Taxable Value	$17,200.00



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18/4319-SN

COUNTY OF MAUI
DEPARTMENT OF PLANNING
One Main Plaza Building
2200 Main Street, Suite 315
Wailuku, Hawaii 96793

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Facsimile: (808) 270-7634
E-mail: planning@mauicounty.gov

ZONING AND FLOOD CONFIRMATION FORM

RECEIVED 2018 AUG -9 P 3:08

(This section to be completed by the Applicant)

APPLICANT NAME Munekiyo Hiraga **TELEPHONE** 2442015

PROJECT NAME West Maui Water Development Project **E-MAIL** planning@munekiyohiraga.com

PROPERTY ADDRESS Lahaina, Maui, Hawaii **TAX MAP KEY** (2)4-4-002:014 (por.) (see attached map)

☐ Yes ■ No **Will this Zoning & Flood Confirmation Form be used with a Subdivision Application?**
IF YES, answer questions A and B below and comply with instructions 2 & 3 below:

A) ☐ Yes ■ No **Will it be processed under a consistency exemption from** Section 18.04.030(B), MCC?
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(This section to be completed by ZAED)

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Protected Area:[2] ☐ Preservation ☐ Park ☐ Greenbelt ☐ Greenway ☐ Sensitive Land ☒ Outside Protected Areas

COMMUNITY PLAN:[2] Agriculture

COUNTY ZONING: Agriculture District

OTHER/COMMENTS: *based on attached map

☐ (PD) Planned Development
☐ (PH) Project District
☐ See Additional Comments (Pg.2)
☐ See Attached LUD Map

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☐ FEMA DESIGNATED FLOODWAY | For Flood Zone AO, FLOOD DEPTH:

SUBDIVISION LAND USE CONSISTENCY: ☐ Not Consistent, (LUDs appear to have NO permitted uses in common).

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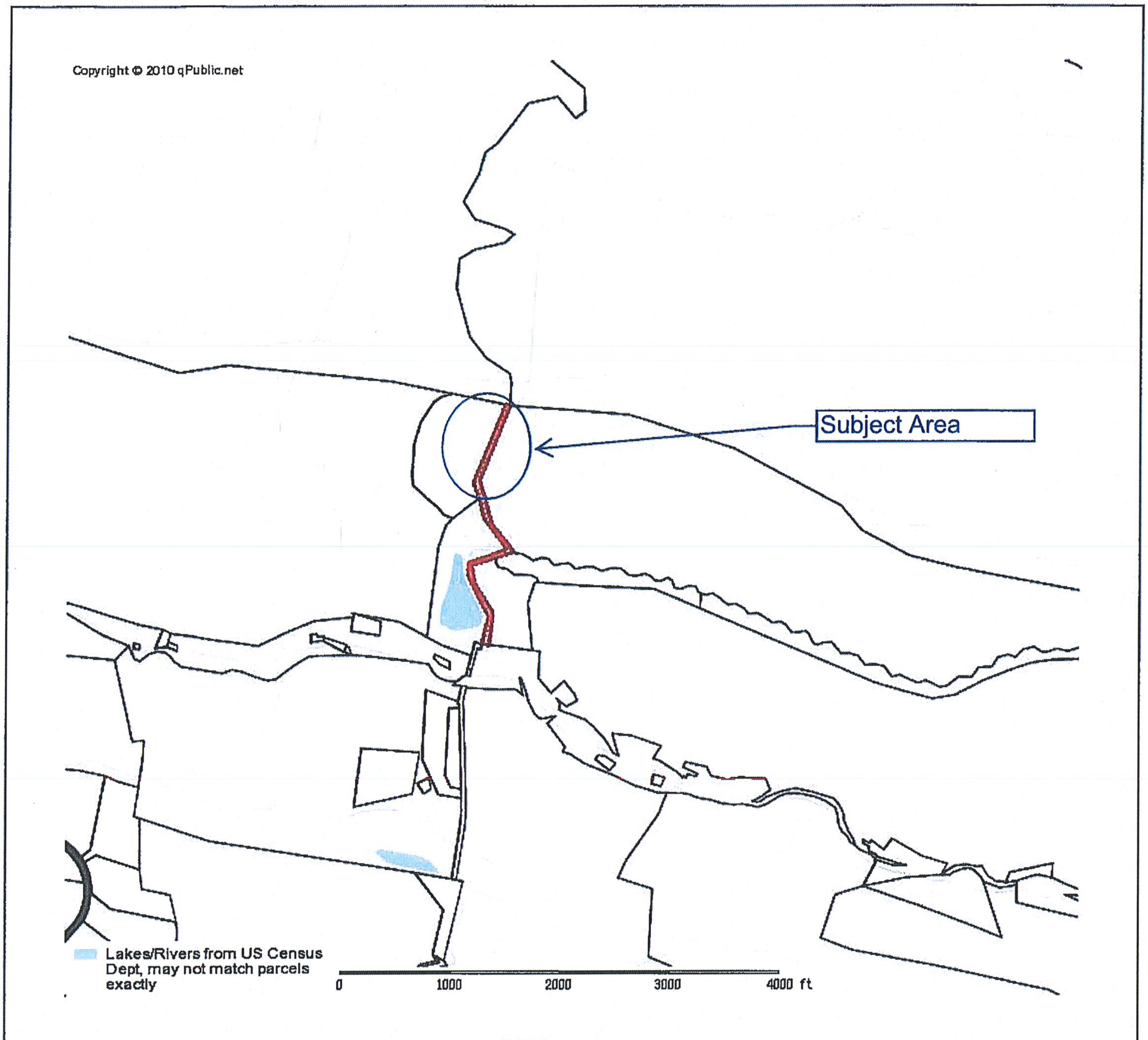
REVIEWED & CONFIRMED BY:

Shibi Nakagawa (Signature) 8/13/18 (Date)

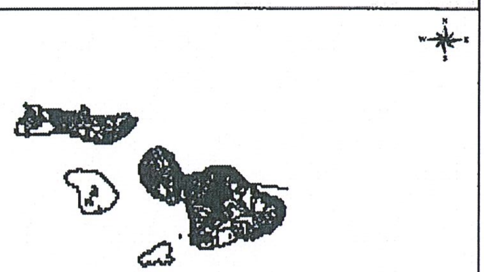
For: John S Rapacz, Planning Program Administrator, Zoning Administration and Enforcement Division



Maui County Assessor

Parcel: 440020140000 Acres: 2.41

Name:	STATE OF HAWAII	Land Value	$200.00
Site:	HONOKOWAI	Building Value	$0.00
Sale:		Misc Value	$0.00
Mail:		Just Value	$0.00
		Assessed Value	$200.00
		Exempt Value	$0.00
		Taxable Value	$200.00



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18/4051 SN

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DEPARTMENT OF PLANNING
One Main Plaza Building
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(This section to be completed by the Applicant)

APPLICANT NAME Munekiyo Hiraga **TELEPHONE** 244-2015

PROJECT NAME West Maui Water Development Project **E-MAIL** planning@munekiyohiraga.com

PROPERTY ADDRESS Lahaina, Maui, Hawaii **TAX MAP KEY** (2)4-4-002:015 (por.) See attached map

2018 JUL 27 P 4:08 RECEIVED DEPT OF PLANNING ZONING DIVISION

☐ Yes ■ No **Will this Zoning & Flood Confirmation Form be used with a Subdivision Application?**
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A) ☐ Yes ■ No **Will it be processed under a consistency exemption from Section 18.04.030(B), MCC?**
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Protected Area:[2] ☐ Preservation ☐ Park ☐ Greenbelt ☐ Greenway ☒ Sensitive Land ☒ Outside Protected Areas

COMMUNITY PLAN:[2] Agriculture

COUNTY ZONING: Agriculture District

OTHER/COMMENTS: Dept. of Hawaiian Homelands / zoning based on attached map only

☐ (PD) Planned Development
☐ (PH) Project District
☐ See Additional Comments (Pg.2)
☐ See Attached LUD Map

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FLOOD HAZARD AREA ZONES [3] & BASE FLOOD ELEVATIONS: Zone X

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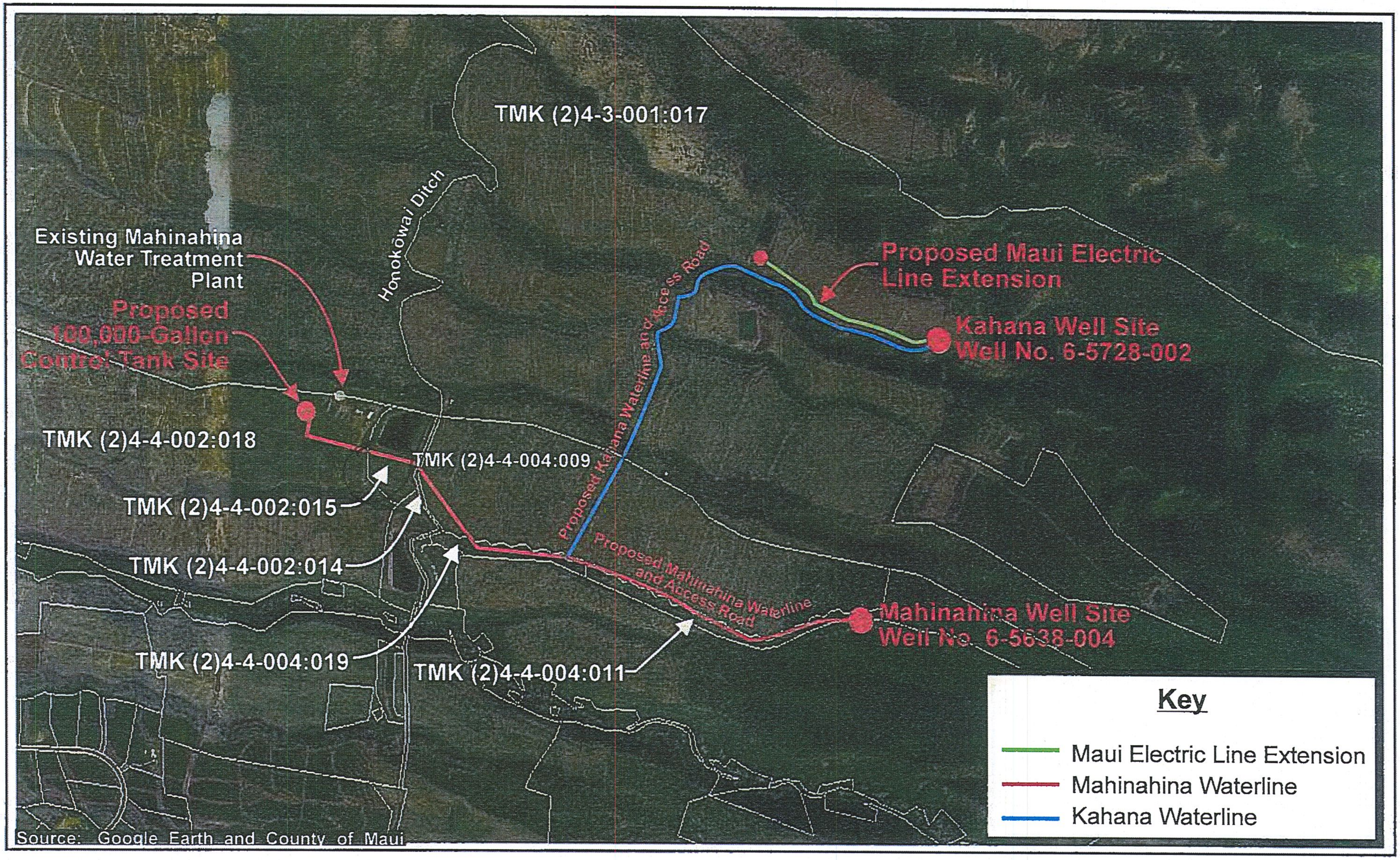
REVIEWED & CONFIRMED BY:

Sheila Nakagawa (Signature) 8/1/18 (Date)

For: John S Rapacz, Planning Program Administrator, Zoning Administration and Enforcement Division



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Source: Google Earth and County of Maui

18/4051-SN

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COUNTY OF MAUI · STATE OF HAWAII

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RECEIVED
2018 JUL 27 P 4:08
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(This section to be completed by the Applicant)

APPLICANT NAME Munekiyo Hiraga **TELEPHONE** 244-2015

PROJECT NAME West Maui Water Development Project **E-MAIL** planning@munekiyohiraga,com

PROPERTY ADDRESS Lahaina, Maui, Hawaii **TAX MAP KEY** (2)4-4-002:018 (por.) See attached map

☐ **Yes** ■ **No** **Will this Zoning & Flood Confirmation Form be used with a Subdivision Application?**
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(This section to be completed by ZAED)

LAND USE DISTRICTS/DESIGNATIONS (LUD) AND OTHER INFORMATION: [1]

STATE DISTRICT: ☐ Urban ☐ Rural ☒ Agriculture ☐ Conservation

☐ (SMA) Special Management Area

MAUI ISLAND PLAN
Growth Boundary:[2] ☐ Urban ☐ Small Town ☐ Rural ☐ Planned Growth Area ☒ Outside Growth Boundaries
Protected Area:[2] ☐ Preservation ☐ Park ☐ Greenbelt ☐ Greenway ☐ Sensitive Land ☒ Outside Protected Areas

COMMUNITY PLAN:[2] Agriculture

COUNTY ZONING: Agriculture

OTHER/COMMENTS: Dept. of Hawaiian Homelands / zoning based on attached map only

☐ (PD) Planned Development
☐ (PH) Project District
☐ See Additional Comments (Pg.2)
☐ See Attached LUD Map

FEMA FLOOD INFORMATION: A Flood Development Permit is required if any portion of a parcel is designated V, VE, A, AO, AE, AH, D, or Floodway, and the project is on that portion.

FLOOD HAZARD AREA ZONES [3] & BASE FLOOD ELEVATIONS: Zone X

☐ FEMA DESIGNATED FLOODWAY | For Flood Zone AO, FLOOD DEPTH:

SUBDIVISION LAND USE CONSISTENCY: ☐ Not Consistent, (LUDs appear to have NO permitted uses in common).

______ (Signature) ☐ Not Applicable, (Due to processing under consistency exemption No. ☐1, ☐2, ☐3, ☐4, ☐5).
☐ Interim Zoning, (The parcel or portion of the parcel that is zoned interim shall not be subdivided).

☐ [4] Consistent, (LUDs appear to have ALL permitted uses in common).
☐ [4] Consistent, upon obtaining an SMA, PD, or PH subdivision approval from Planning.
☐ [4] Consistent, upon recording a permissible uses unilateral agreement processed by Public Works (See Pg.2).

NOTES:

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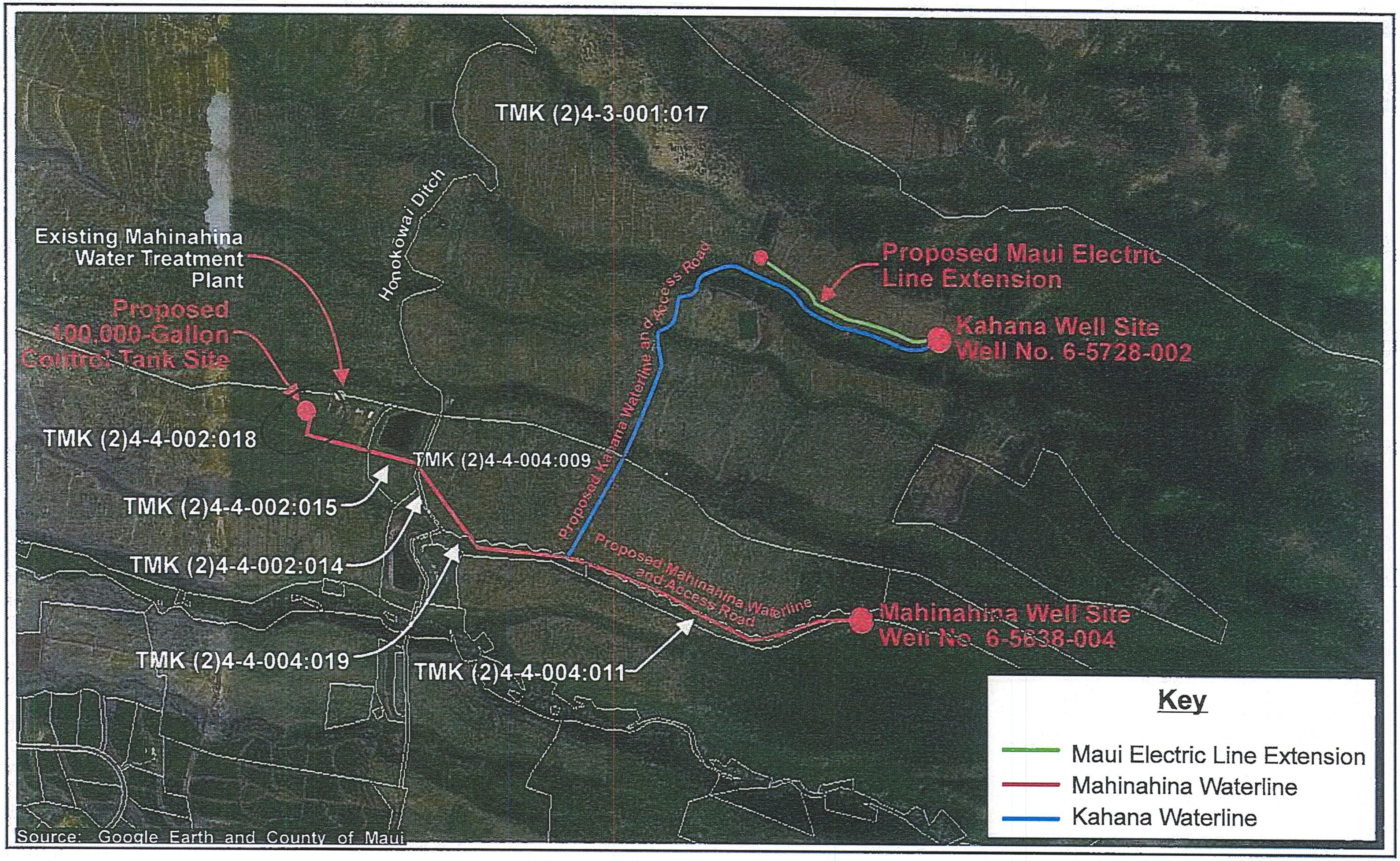
4 Subdivisions will be further reviewed during the subdivision application process to verify consistency, unilateral agreement requirements, and the conditions associated with a unilateral agreement [Section 18.04.030.D, Maui County Code].

REVIEWED & CONFIRMED BY:

Sheila Nakagawa (Signature) 8/1/18 (Date)

For: John S Rapacz, Planning Program Administrator, Zoning Administration and Enforcement Division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TMK (2)4-4-002:015
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Proposed Mahinahina Waterline and Access Road
Mahinahina Well Site Well No. 6-5638-004
TMK (2)4-4-004:019
TMK (2)4-4-004:011
Key
Maui Electric Line Extension
Mahinahina Waterline
Kahana Waterline
Source: Google Earth and County of Maui

18|4318-SK

AUG 13 2018

COUNTY OF MAUI
DEPARTMENT OF PLANNING
One Main Plaza Building
2200 Main Street, Suite 315
Wailuku, Hawaii 96793

Zoning Administration and
Enforcement Division (ZAED)
Telephone: (808) 270-7253
Facsimile: (808) 270-7634
E-mail: planning@mauicounty.gov

ZONING AND FLOOD CONFIRMATION FORM

(This section to be completed by the Applicant)

APPLICANT NAME Munekiyo Hiraga TELEPHONE 244-2015 2018 AUG -9 P 3:08

PROJECT NAME West Maui Water Development Project E-MAIL planning@munekiyohiraga.com

PROPERTY ADDRESS Lahaina, Maui, Hawaii TAX MAP KEY (2)4-4-004:009

☐ Yes ■ No **Will this Zoning & Flood Confirmation Form be used with a Subdivision Application?**
IF YES, answer questions A and B below and comply with instructions 2 & 3 below:

A) ☐ Yes ■ No **Will it be processed under a consistency exemption from Section 18.04.030(B), MCC?**
IF YES, which exemption? (No. 1, 2, 3, 4 or 5)

B) State the purpose of subdivision and the proposed land uses (*ie 1-lot into 2-lots for all land uses allowed by law*):

INSTRUCTIONS:
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(This section to be completed by ZAED)

LAND USE DISTRICTS/DESIGNATIONS (LUD) AND OTHER INFORMATION: [1]

☐ (SMA) Special Management Area

STATE DISTRICT: ☐ Urban ☐ Rural ☒ Agriculture ☐ Conservation

MAUI ISLAND PLAN
Growth Boundary:[2] ☐ Urban ☐ Small Town ☐ Rural ☐ Planned Growth Area ☒ Outside Growth Boundaries
Protected Area:[2] ☐ Preservation ☐ Park ☐ Greenbelt ☐ Greenway ☒ Sensitive Land ☒ Outside Protected Areas

COMMUNITY PLAN:[2] Agriculture

COUNTY ZONING: Agricultural

OTHER/COMMENTS:

☐ (PD) Planned Development
☐ (PH) Project District
☐ See Additional Comments (Pg.2)
☐ See Attached LUD Map

FEMA FLOOD INFORMATION: A Flood Development Permit is required if any portion of a parcel is designated V, VE, A, AO, AE, AH, D, or Floodway, and the project is on that portion.

FLOOD HAZARD AREA ZONES [3] & BASE FLOOD ELEVATIONS: Zone X

☐ FEMA DESIGNATED FLOODWAY For Flood Zone AO, FLOOD DEPTH:

SUBDIVISION LAND USE CONSISTENCY: ☐ Not Consistent, (LUDs appear to have NO permitted uses in common).

(Signature)

☐ Not Applicable, (Due to processing under consistency exemption No. ☐1, ☐2, ☐3, ☐4, ☐5).
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REVIEWED & CONFIRMED BY:

Shelly M. Kan-Hai Shelly M. Kan-Hai 8/13/18
(Signature) (Date)

For: John S Rapacz, Planning Program Administrator, Zoning Administration and Enforcement Division

13/13/18 SK

AUG 13 2018

COUNTY OF MAUI
DEPARTMENT OF PLANNING
One Main Plaza Building
2200 Main Street, Suite 315
Wailuku, Hawaii 96793

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(This section to be completed by the Applicant)

APPLICANT NAME Munekiyo Hiraga TELEPHONE 244-2015

PROJECT NAME West Maui Water Development Project E-MAIL planning@munekiyohiraga.com

PROPERTY ADDRESS Lahaina, Maui, Hawaii TAX MAP KEY (2)4-4-004:011

☐ Yes ■ No **Will this Zoning & Flood Confirmation Form be used with a Subdivision Application?**
IF YES, answer questions A and B below and comply with instructions 2 & 3 below:

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COMMUNITY PLAN:[2] Agriculture

COUNTY ZONING: Agricultural

OTHER/COMMENTS:

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& BASE FLOOD ELEVATIONS: Zone X

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REVIEWED & CONFIRMED BY:

Shelly M. Kan-Hai Shelly M. Kan-Hai 8/10/18
(Signature) (Date)

For: John S Rapacz, Planning Program Administrator, Zoning Administration and Enforcement Division

18/4051-SN

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DEPARTMENT OF PLANNING
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RECEIVED
2018 JUL 27 P 4:08

(This section to be completed by the Applicant)

APPLICANT NAME Munekiyo Hiraga **TELEPHONE** 244-2015

PROJECT NAME West Maui Water Development Project **E-MAIL** planning@munekiyohiraga,com

PROPERTY ADDRESS Lahaina, Maui, Hawaii **TAX MAP KEY** (2)4-4-004:019 (por.) See attached map

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COMMUNITY PLAN:[2] Agriculture

COUNTY ZONING: Agriculture

OTHER/COMMENTS: Zoning based on attached map only

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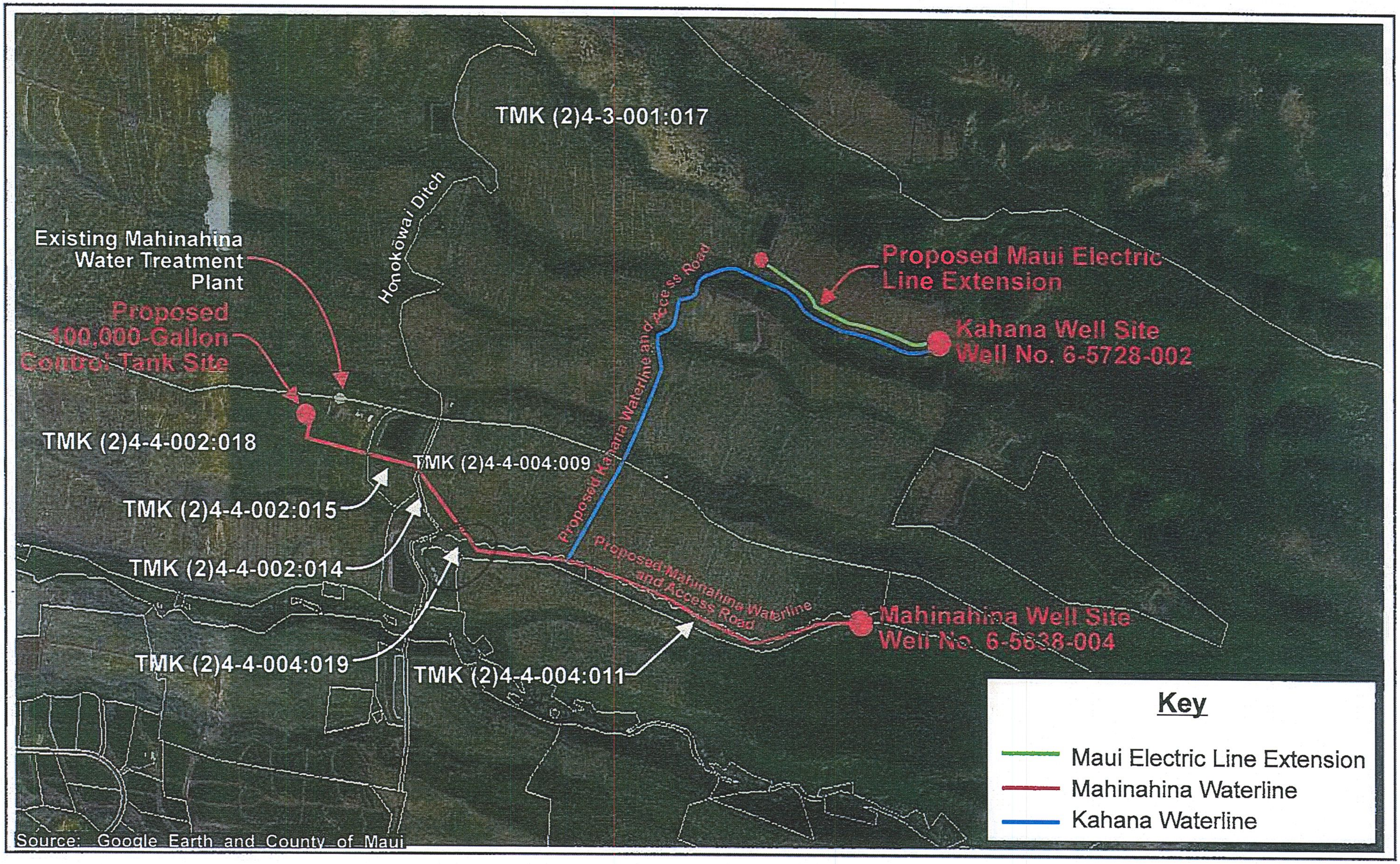
REVIEWED & CONFIRMED BY:

Sheila Nakagawa (Signature) 8/1/18 (Date)

For: John S Rapacz, Planning Program Administrator, Zoning Administration and Enforcement Division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Honokōwai Ditch
Proposed 100,000-Gallon Control Tank Site
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Maui Electric Line Extension
Mahinahina Waterline
Kahana Waterline
Source: Google Earth and County of Maui

PROJECT PLANS FOR MAHINAHINA WELL, TRANSMISSION WATERLINE, AND 500,000-GALLON CONTROL TANK

APPENDIX

C-1

Construction Plans for ...

MAHINAHINA WELL DEVELOPMENT

(WEST MAUI WELL NO. 1)

DWS JOB NO. 11-06

Mahinahina, Lahaina, Maui, Hawaii

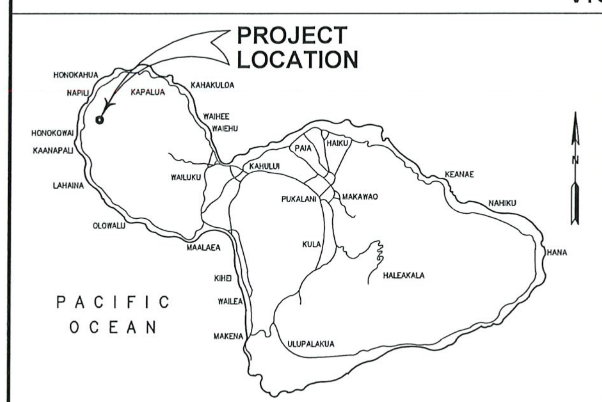
Prepared for . . .

COUNTY OF MAUI
DEPARTMENT OF WATER SUPPLY
Wailuku, Maui, Hawaii

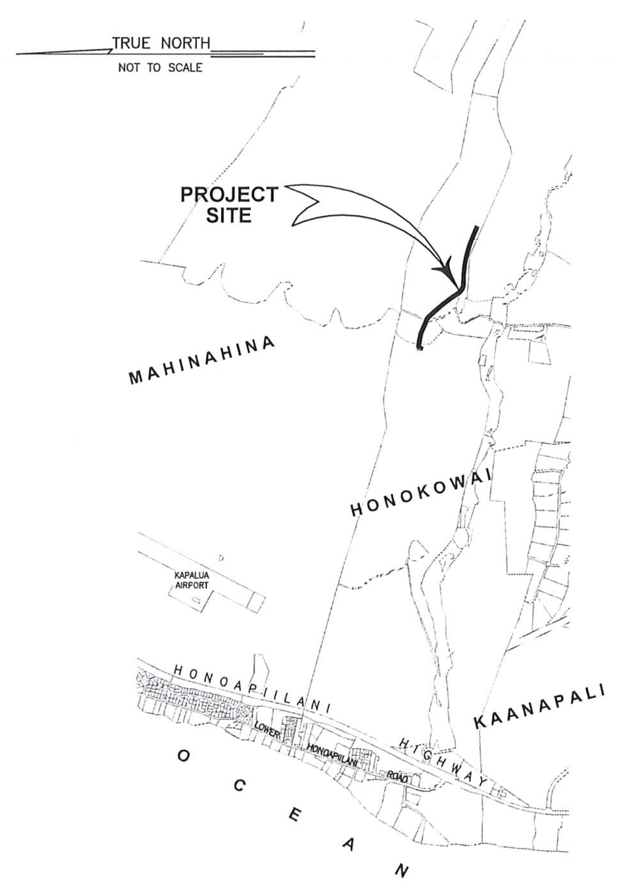
Prepared by . . .

WARREN S. UNEMORI ENGINEERING, INC.
Civil & Structural Engineers - Land Surveyor
Wells Street Professional Center - Suite 403
2145 Wells Street -Wailuku, Maui, Hawaii 96793

VICINITY MAP



ISLAND OF MAUI
NOT TO SCALE



INDEX OF DRAWINGS

SHT. NO.	DWG. NO.	DESCRIPTION
1	C-1.01	TITLE SHEET
2	C-2.01	LOCATION MAP
3	C-2.02	PROJECT OVERVIEW PLAN
4	C-3.01	FLOW SCHEMATICS
5 - 6	C-4.01 - 4.02	TYPICAL ACCESS ROADWAY SECTION
7	C-4.03	TYPICAL CONCRETE FORD
8 - 11	C-5.01 - 5.04	12" TRANSMISSION LINE AND ACCESS ROADWAY - PLAN & PROFILE
12	C-6.01	CONTROL TANK SITE - GRADING PLAN
13	C-6.02	CONTROL TANK SITE - UTILITY PLAN
14	C-6.03	CONTROL TANK SITE - WATERLINE PROFILES
15	C-6.04	CONTROL TANK SITE - DRAINLINE PROFILES
16	C-8.01	TANK DETAILS - GENERAL CONFIGURATION AND FOUNDATION
17	C-8.02	TANK DETAILS - INFLOW, OUTFLOW, OVERFLOW AND WASHOUT LINES
18	C-8.03	TANK DETAILS - LIQUID LEVEL INDICATOR, SAMPLING LINE
19	C-9.01	SECURITY FENCE AND GATE DETAILS
20	C-10.01	WATER SYSTEM DETAILS
21	C-10.02	VALVE VAULT GEOMETRY
22	C-10.03	CONTROL VALVE AND PRV VAULT REINFORCEMENT
23 - 24	C-11.01 - 11.02	DRAINAGE DETAILS
25	C-12.01	BMP PLAN
26	C-12.02	EROSION CONTROL DETAILS AND NOTES
27	C-13.01	GENERAL CONSTRUCTION NOTES
28	E-0	NOTES, DETAILS
29 - 30	E-1 - E-1.1	ELECTRICAL CONTROL TANK SITE PLAN
31	E-1.2	WATER TREATMENT PLANT ELECTRICAL
32	E-2	DETAILS
33	E-3	CONTROL TANK DIAGRAMS & DETAIL
34	E-4	CONTROL TANK ENCLOSURE & DUCTLINE DETAILS
35 - 36	M-1 - M-2	CONTROL PIPING AT CONTROL TANK SITE
37	M-3	CHLORINE ANALYZER & VENTURI METER DETAILS
38	M-4	VALVE MANHOLE PLAN, SECTION & DETAILS

LETTER	DESCRIPTION	DATE

APPROVED

NOT REQUIRED

DIRECTOR, DEPARTMENT OF PUBLIC WORKS
COUNTY OF MAUI — DATE

DIRECTOR, DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI — DATE

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

License Expires: April 30, 2020

SIGNATURE — DATE

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"

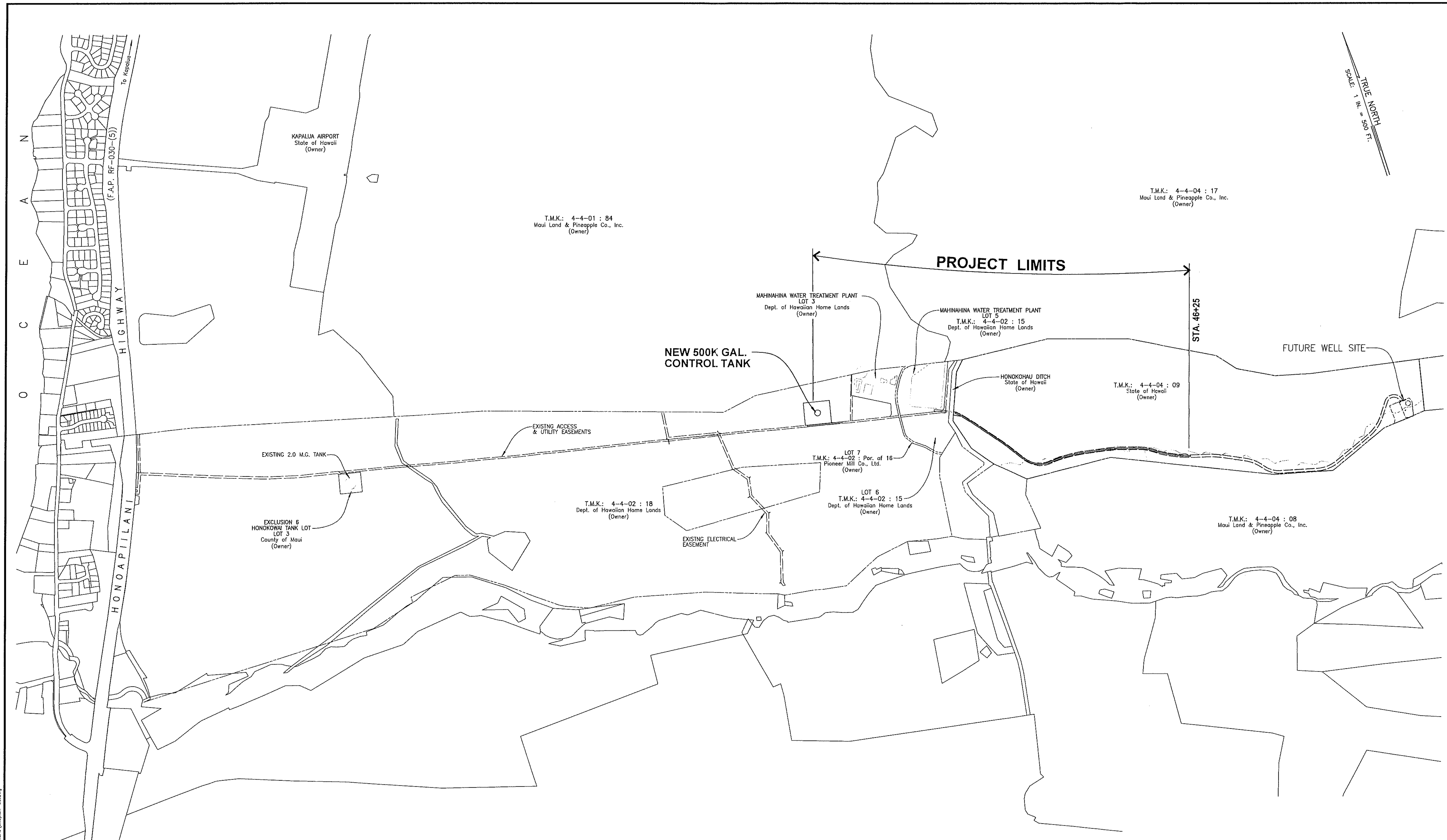
WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE: TITLE SHEET

DESIGNED BY	CHECKED BY	JOB NUMBER	SHEET
ALU	DTU/DTO	11025	C-1.01
DRAWN BY: KAO	APPROVED BY: ALU	DATE: June 29, 2018	OF SHEETS
SCALE: AS NOTED			

V:\Projdata\11proj\11025 - DWS Mahinahina Well\dwg\conplans\11tt000.dwg



ALAN L. UNEMORI
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License Expires: April 30, 2020

SIGNATURE DATE

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

MAHINAHINA WELL DEVELOPMENT (WEST MAUI WELL NO. 1)

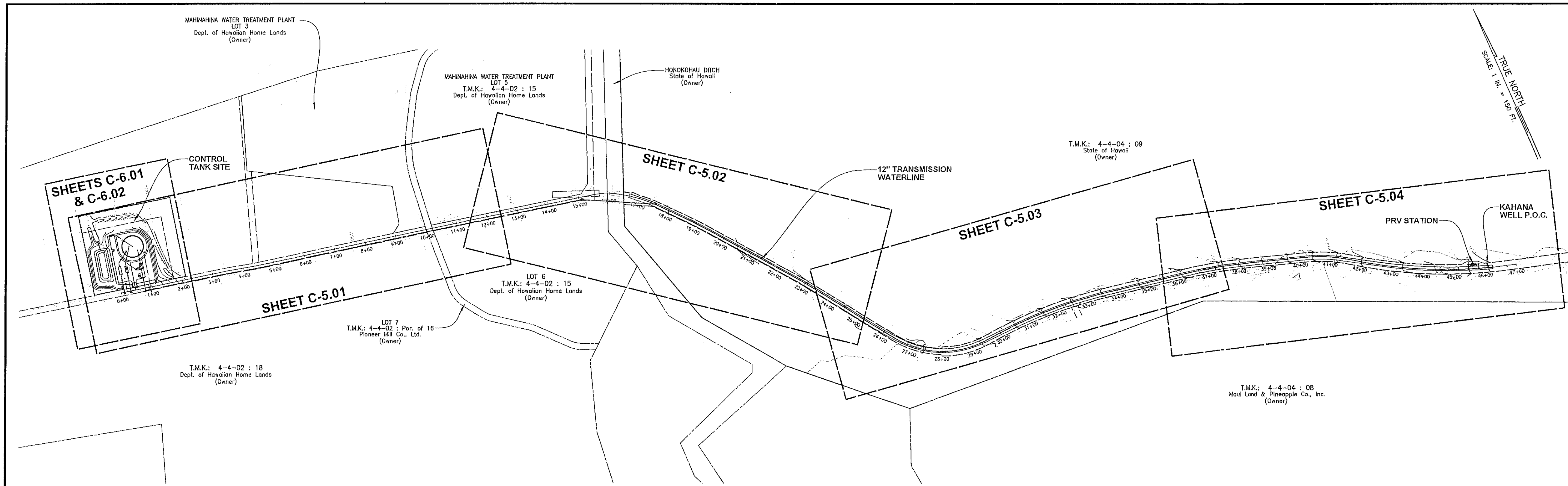
DWS JOB NO. 11-06

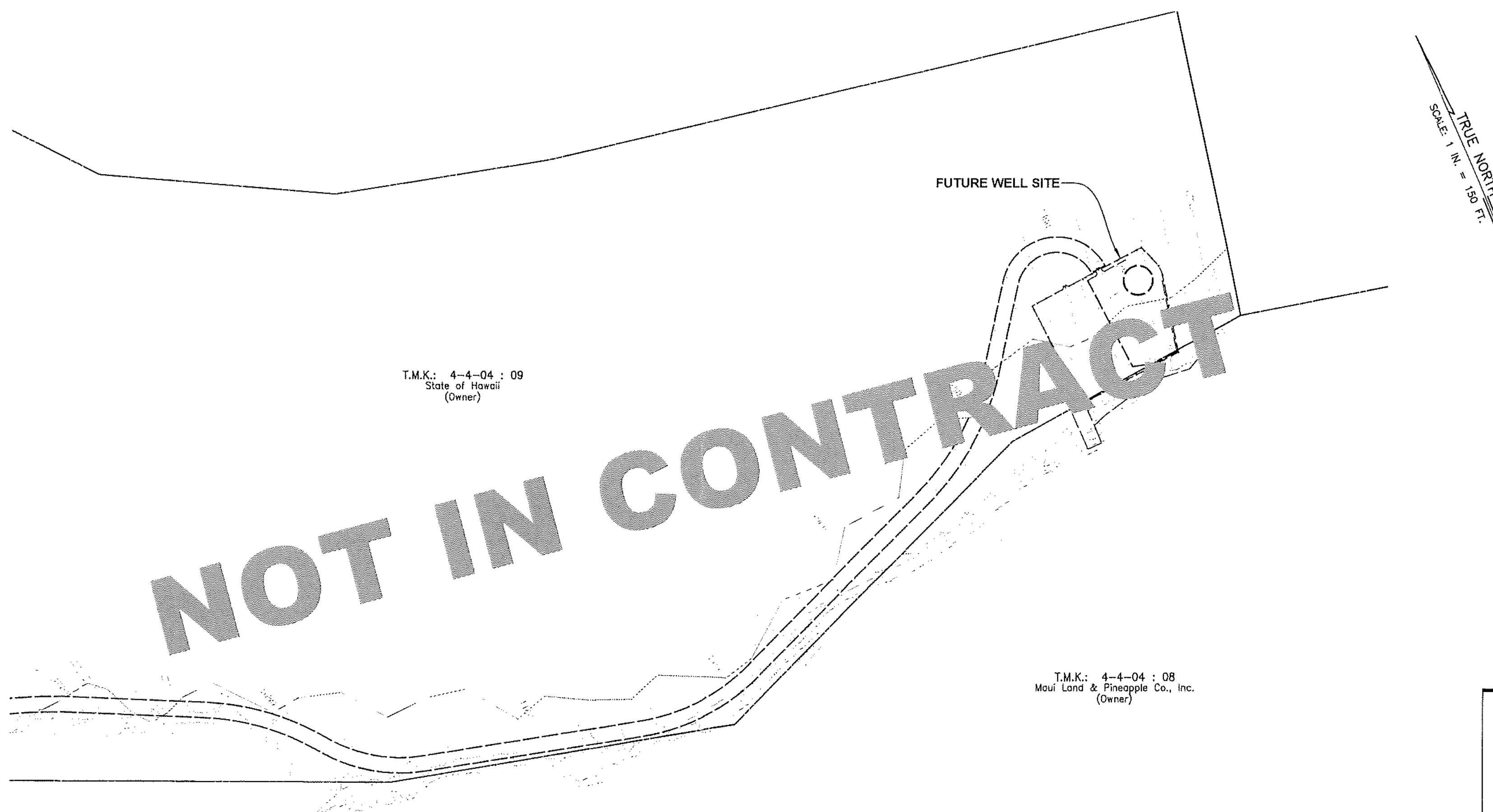
TITLE LOCATION MAP

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-2.01 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE 1 IN. = 500 FT.			

LETTER	DESCRIPTION	DATE

v:\Projects\11proj\11025 - DWS Mahinahina Well\dwg\conplans\siteplan-00.dwg





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LETTER	DESCRIPTION	DATE

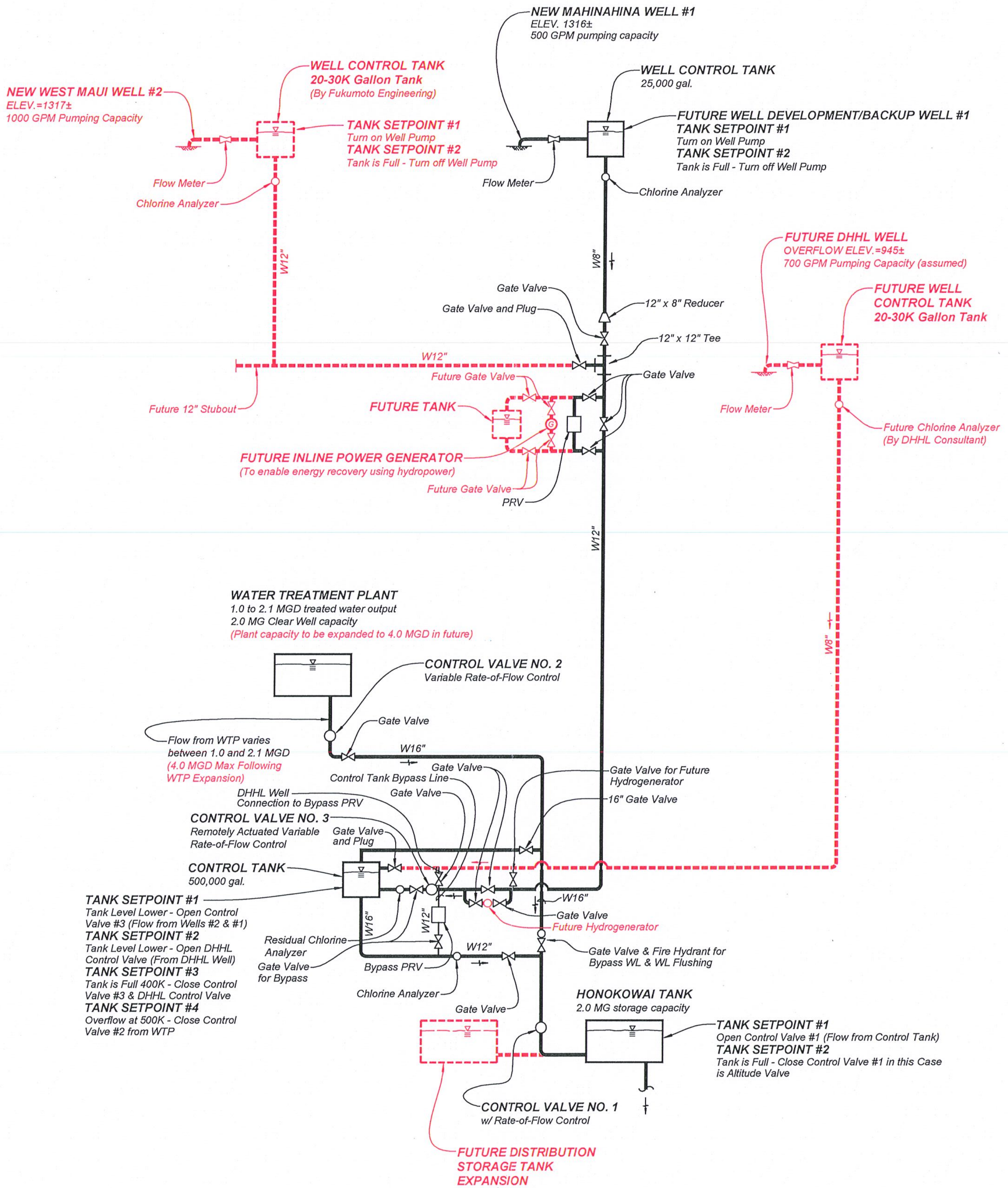
WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE PROJECT OVERVIEW PLAN

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-2.02 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE 1 IN. = 150 FT.			

V:\Projdata\11proj\11025 - DWS Mahinahina Well\dwg\conplans\genplan-00.dwg



FLOW CONTROL

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

License Expires: April 30, 2020

SIGNATURE | DATE

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

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

MAHINAHINA WELL DEVELOPMENT (WEST MAUI WELL NO. 1)

DWS JOB NO. 11-06

TITLE FLOW SCHEMATICS

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-3.01 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	AS NOTED		

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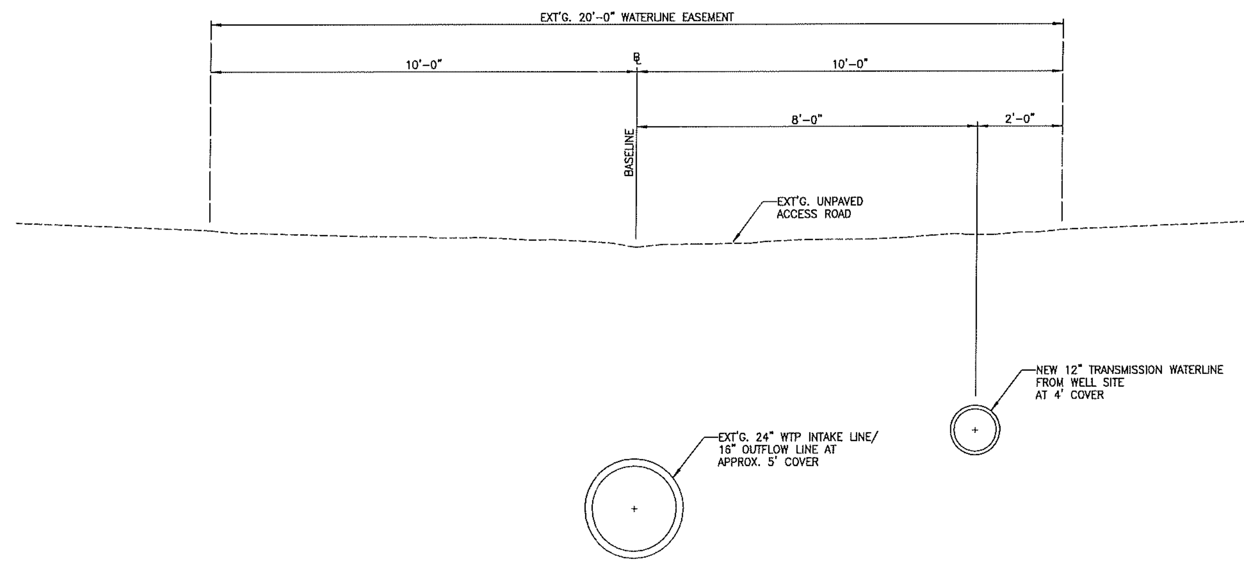

EXISTING UNPAVED ROAD
STA. 0+00 TO 15+50±

TYPICAL ROADWAY SECTION – WELL ACCESS ROAD
SCALE: 1/2" = 1'-0"

LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

SIGNATURE DATE

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2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE TYPICAL ACCESS ROADWAY SECTION

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-4.01 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE AS NOTED			

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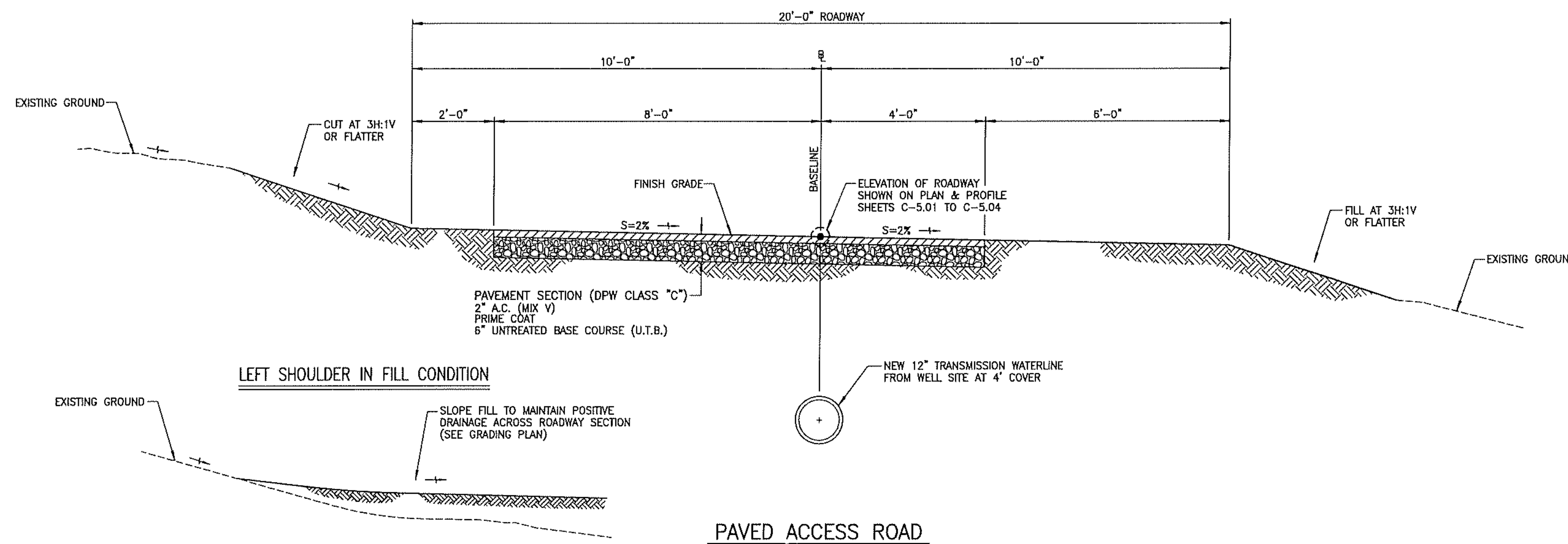
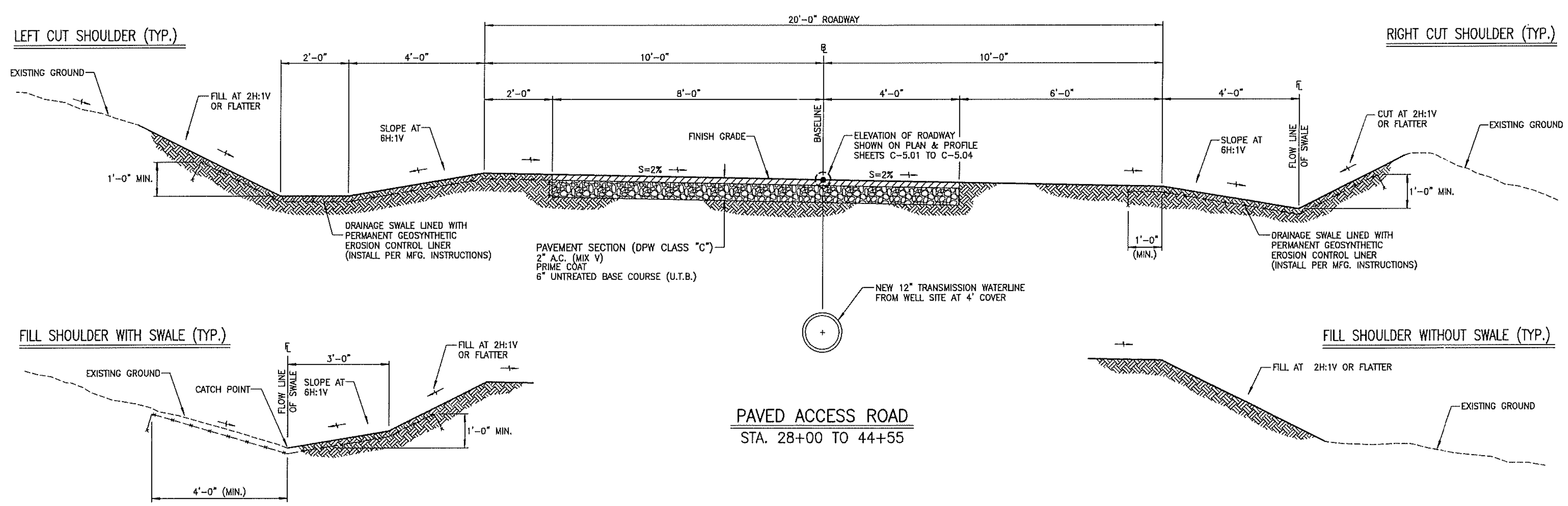


PAVED ACCESS ROAD
STA. 16+65 TO 28+00

NOTES:

1. GRADED SLOPES, SHOULDERS AND ANY AREAS LEFT EXPOSED BY CONSTRUCTION ACTIVITY SHALL BE STABILIZED WITH GRASS AND IRRIGATED TO ACHIEVE AT LEAST 80% COVERAGE PRIOR TO ACCEPTANCE BY THE DEPT. OF WATER SUPPLY.
2. EROSION CONTROL FABRIC SHALL BE NORTH AMERICAN GREEN C350 OR APPROVED EQUAL, INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.



PAVED ACCESS ROAD
STA. 28+00 TO 44+55

TYPICAL ROADWAY SECTIONS – WELL ACCESS ROAD

SCALE: 1/2" = 1'-0"

LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

SIGNATURE DATE

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

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE TYPICAL ACCESS ROADWAY SECTION

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-4.02 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	
SCALE AS NOTED			OF SHEETS

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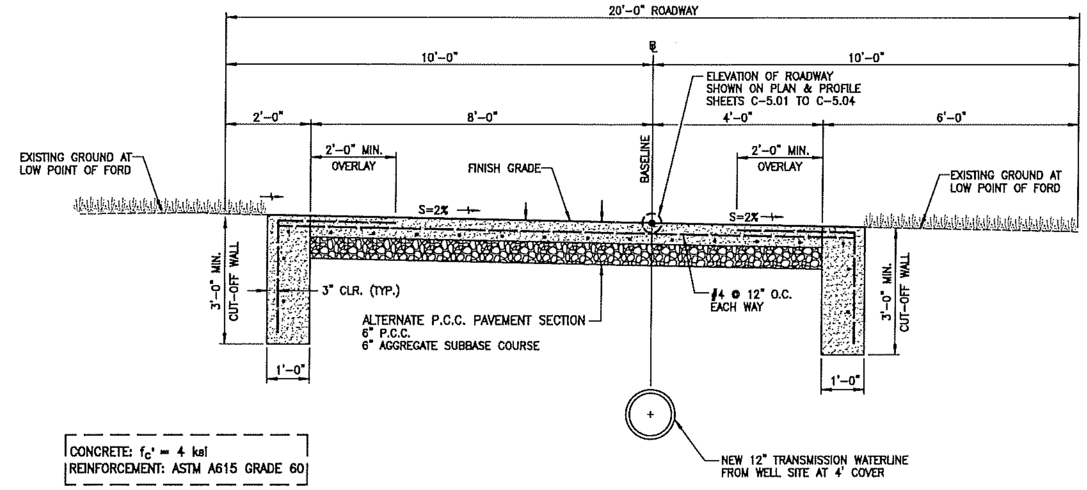
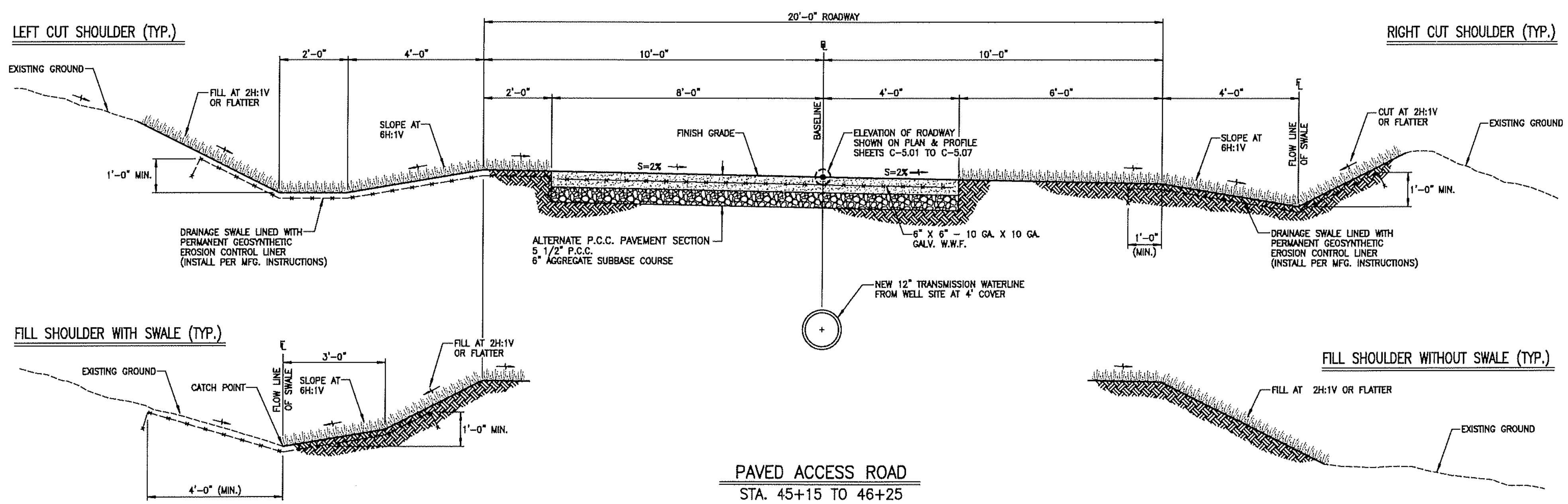


TYPICAL ROADWAY SECTION – CONCRETE FORD AT STA. 27+15, STA. 36+97.50, AND STA. 44+85

SCALE: 1/2" = 1'-0"

NOTES:

1. GRADED SLOPES, SHOULDERS AND ANY AREAS LEFT EXPOSED BY CONSTRUCTION ACTIVITY SHALL BE STABILIZED WITH GRASS AND IRRIGATED TO ACHIEVE AT LEAST 80% COVERAGE PRIOR TO ACCEPTANCE BY THE DEPT. OF WATER SUPPLY.
2. EROSION CONTROL FABRIC SHALL BE NORTH AMERICAN GREEN C350 OR APPROVED EQUAL, INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.



PAVED ACCESS ROAD

STA. 45+15 TO 46+25

TYPICAL ROADWAY SECTION – WELL ACCESS ROAD

SCALE: 1/2" = 1'-0"

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LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

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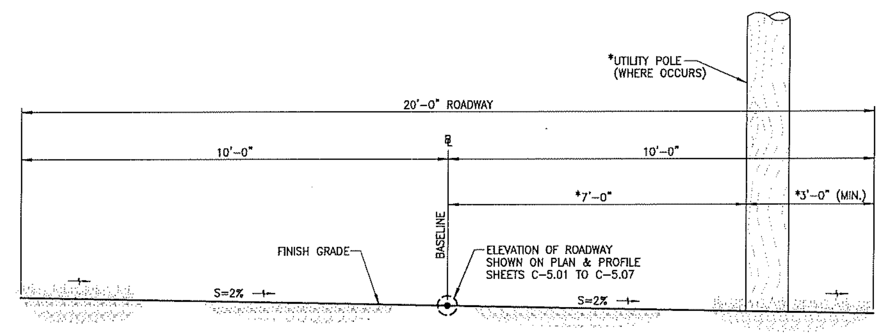
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE TYPICAL CONCRETE FORD

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-4.03 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	AS NOTED		

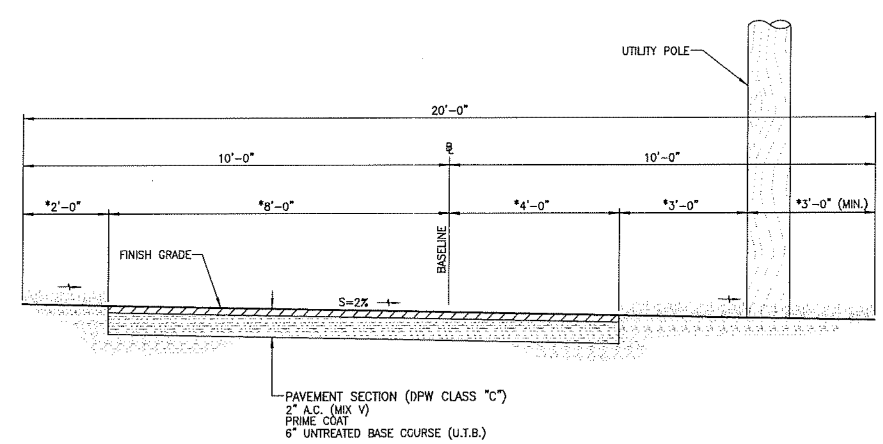


DEDUCTIVE ALTERNATE NO. 1

DELETE A.C. PAVEMENT AND CONSTRUCT UNPAVED ROAD FROM STA. 16+65 TO 58+50

NOTES:

1. UTILITY POLES MAY BE LOCATED ON EITHER SIDE OF ROADWAY.
* DENOTES DISTANCES WHICH ARE RELATIVE TO UTILITY POLE LOCATION.



DEDUCTIVE ALTERNATE NO. 2

SUBSTITUTE A.C. PAVEMENT FOR P.C.C. FROM STA. 58+50 TO 75+40

TYPICAL ROADWAY SECTION – WELL ACCESS ROAD (DEDUCTIVE ALTERNATES)

SCALE: 1/2" = 1'-0"

LETTER	DESCRIPTION	DATE

DARREN T. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 7937-C
HAWAII, U.S.A.

License Expires: April 30, 2014

SIGNATURE DATE

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WARREN S. UNEMORI ENGINEERING, INC.
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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM

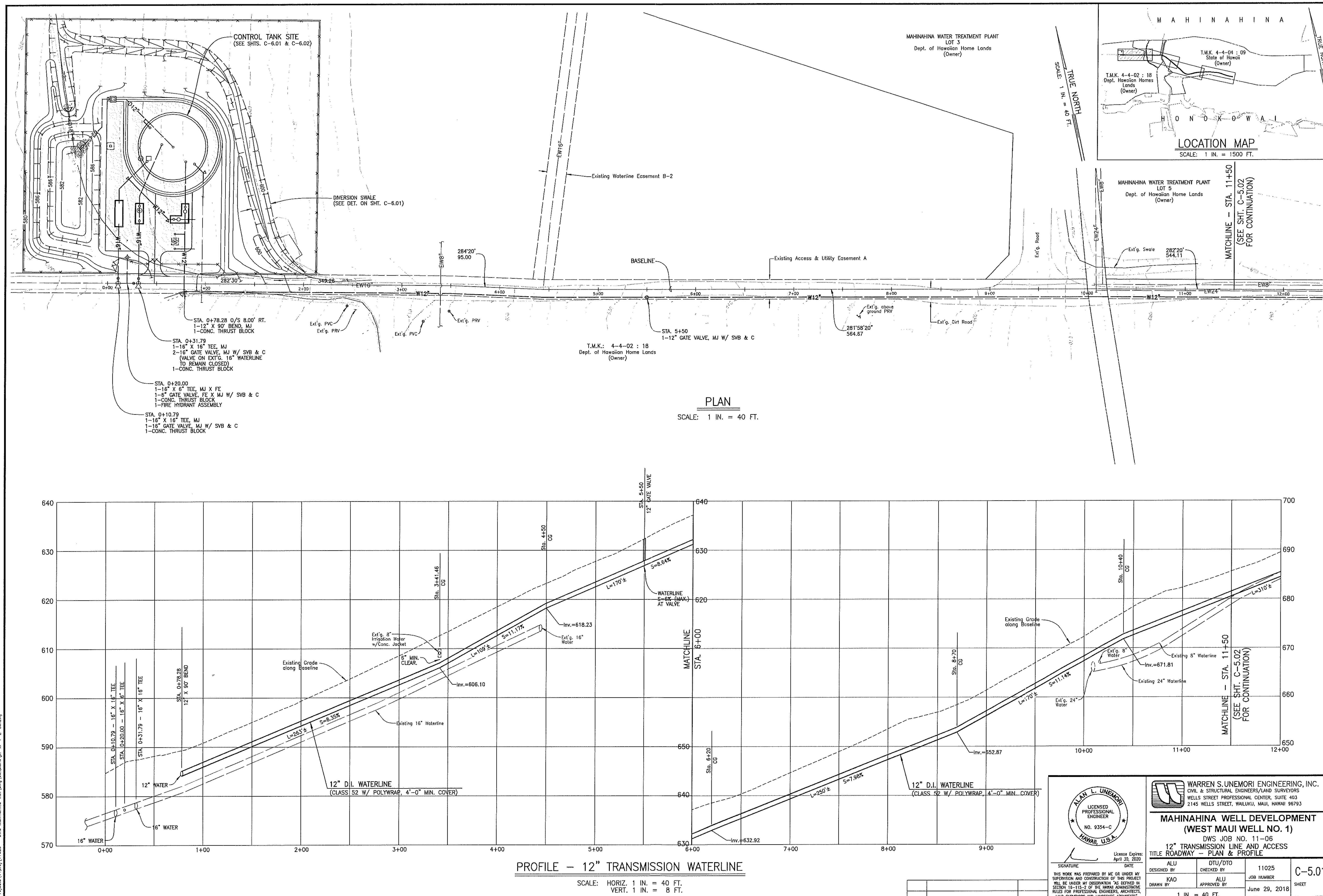
DWS JOB NO. 11-06

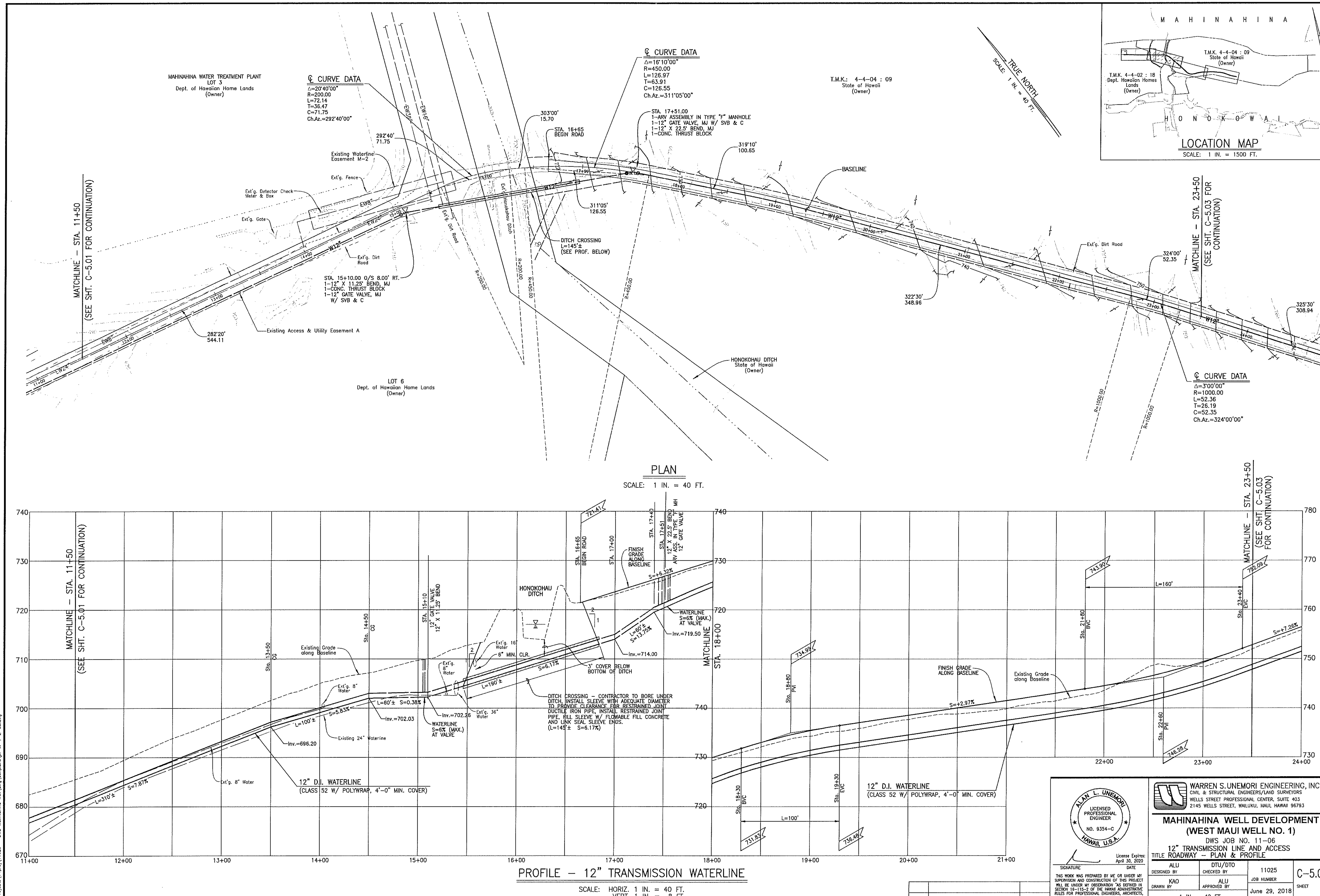
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE TYPICAL ROADWAY SECTIONS – DEDUCTIVE ALTERNATES 1 AND 2

D.T.U. DESIGNED BY	D.T.U. CHECKED BY	11025 JOB NUMBER	C-4.04 SHEET
W.I.S. DRAWN BY	D.T.U. APPROVED BY	June 7, 2012 DATE	OF SHEETS
SCALE AS NOTED			

Y:\Projects\11proj\11025 - DWS Mahinahina Well\dwg\conplans\typ-sec02.dwg


CONTROL TANK SITE
(SEE SHTS. C-6.01 & C-6.02)
DIVERSION SWALE
(SEE DET. ON SHT. C-6.01)
Existing Waterline Easement B-2
MAHINAHINA WATER TREATMENT PLANT
LOT 3
Dept. of Hawaiian Home Lands
(Owner)
BASELINE
Existing Access & Utility Easement A
MAHINAHINA WATER TREATMENT PLANT
LOT 5
Dept. of Hawaiian Home Lands
(Owner)
TRUE NORTH
SCALE: 1 IN. = 40 FT.
MATCHLINE - STA. 11+50
(SEE SHT. C-5.02 FOR CONTINUATION)
STA. 0+78.28 O/S 8.00' RT.
1-12" X 90° BEND, MJ
1-CONC. THRUST BLOCK
STA. 0+31.79
1-16" X 16" TEE, MJ
2-16" GATE VALVE, MJ W/ SVB & C
(VALVE ON EXT'G. 16" WATERLINE TO REMAIN CLOSED)
1-CONC. THRUST BLOCK
STA. 0+20.00
1-16" X 6" TEE, MJ X FE
1-6" GATE VALVE, FE X MJ W/ SVB & C
1-CONC. THRUST BLOCK
1-FIRE HYDRANT ASSEMBLY
STA. 0+10.79
1-16" X 16" TEE, MJ
1-16" GATE VALVE, MJ W/ SVB & C
1-CONC. THRUST BLOCK
STA. 5+50
1-12" GATE VALVE, MJ W/ SVB & C
T.M.K.: 4-4-02 : 18
Dept. of Hawaiian Home Lands
(Owner)
PLAN
SCALE: 1 IN. = 40 FT.
LOCATION MAP
SCALE: 1 IN. = 1500 FT.
M A H I N A H I N A
H O N O K O W A I
T.M.K. 4-4-04 : 09
State of Hawaii
(Owner)
T.M.K. 4-4-02 : 18
Dept. Hawaiian Homes Lands
(Owner)
MATCHLINE STA. 6+00
12" D.I. WATERLINE
(CLASS 52 W/ POLYWRAP, 4'-0" MIN. COVER)
Existing Grade along Baseline
Existing 16" Waterline
Inv.=606.10
Inv.=618.23
Inv.=632.92
Inv.=652.87
Inv.=671.81
WATERLINE S=6% (MAX.) AT VALVE
Existing 8" Waterline
Existing 24" Waterline
PROFILE - 12" TRANSMISSION WATERLINE
SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.
ALAN L. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 9354-C
HAWAII, U.S.A.
License Expires: April 30, 2020
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"
WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793
MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06
TITLE 12" TRANSMISSION LINE AND ACCESS ROADWAY - PLAN & PROFILE
DESIGNED BY ALU
CHECKED BY DTU/DTO
DRAWN BY KAO
APPROVED BY ALU
JOB NUMBER 11025
SCALE 1 IN. = 40 FT.
DATE June 29, 2018
SHEET C-5.01



WARREN S. UNEMORI ENGINEERING, INC.
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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

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NO. 9354-C
HAWAII, U.S.A.
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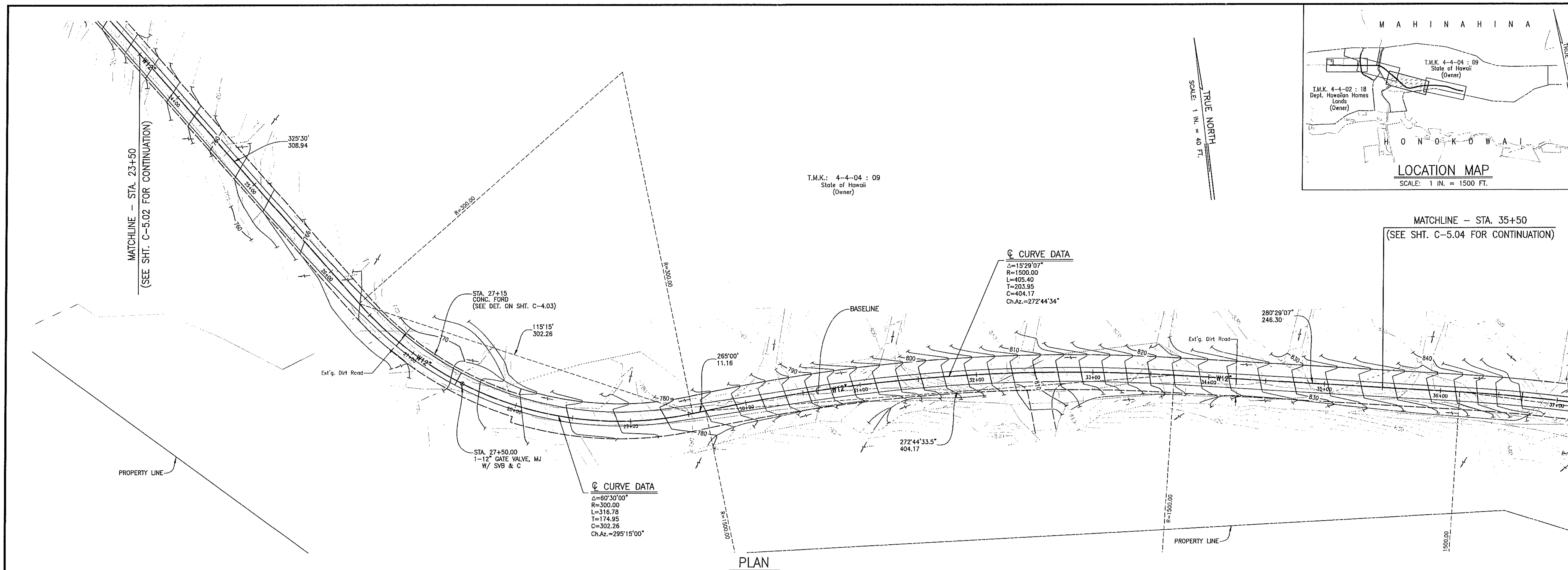
MAHINAHINA WELL DEVELOPMENT (WEST MAUI WELL NO. 1)

DWS JOB NO. 11-06

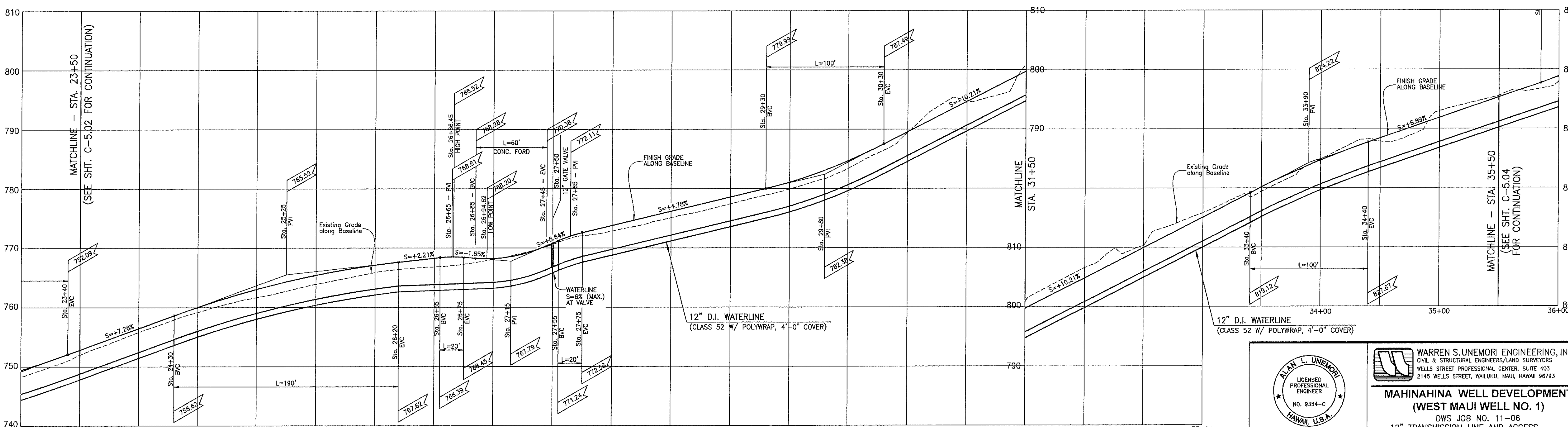
TITLE: 12" TRANSMISSION LINE AND ACCESS ROADWAY – PLAN & PROFILE

DESIGNED BY: ALU	CHECKED BY: DTU/DTO	JOB NUMBER: 11025	SHEET: C-5.02
DRAWN BY: KAO	APPROVED BY: ALU	DATE: June 29, 2018	OF SHEETS
SCALE: 1 IN. = 40 FT.			



PLAN

SCALE: 1 IN. = 40 FT.



PROFILE - 12" TRANSMISSION WATERLINE

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.

LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

SIGNATURE DATE

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MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE 12" TRANSMISSION LINE AND ACCESS ROADWAY - PLAN & PROFILE

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-5.03 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE 1 IN. = 40 FT.			

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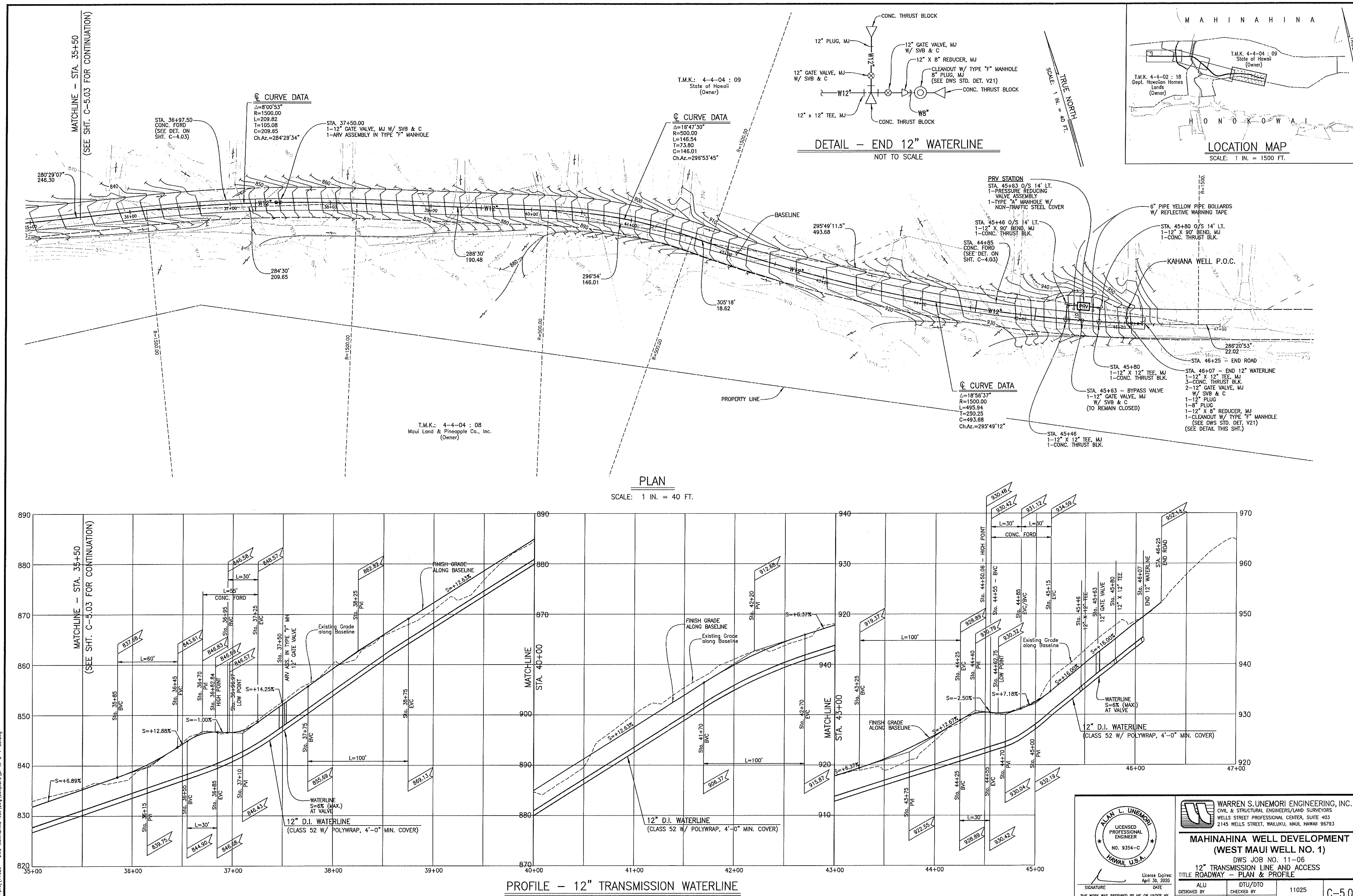

ALAN L. UNEMORI LICENSED PROFESSIONAL ENGINEER NO. 9354-C HAWAII, U.S.A.

License Expires: April 30, 2020

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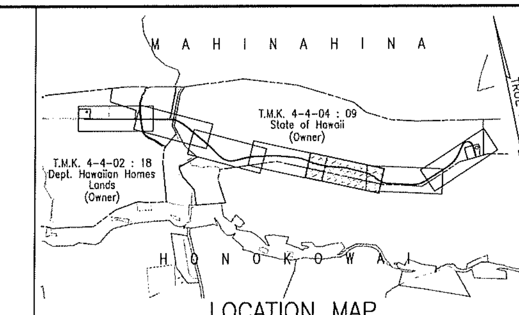
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT (WEST MAUI WELL NO. 1)

DWS JOB NO. 11-06
12" TRANSMISSION LINE AND ACCESS
TITLE ROADWAY - PLAN & PROFILE

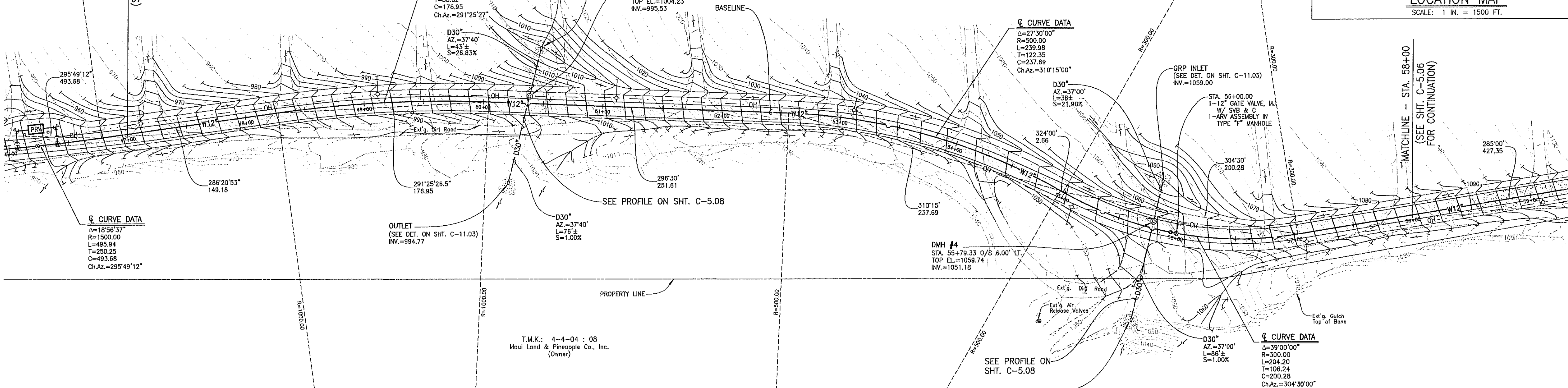
ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-5.04 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	1 IN. = 40 FT.		

LETTER	DESCRIPTION	DATE



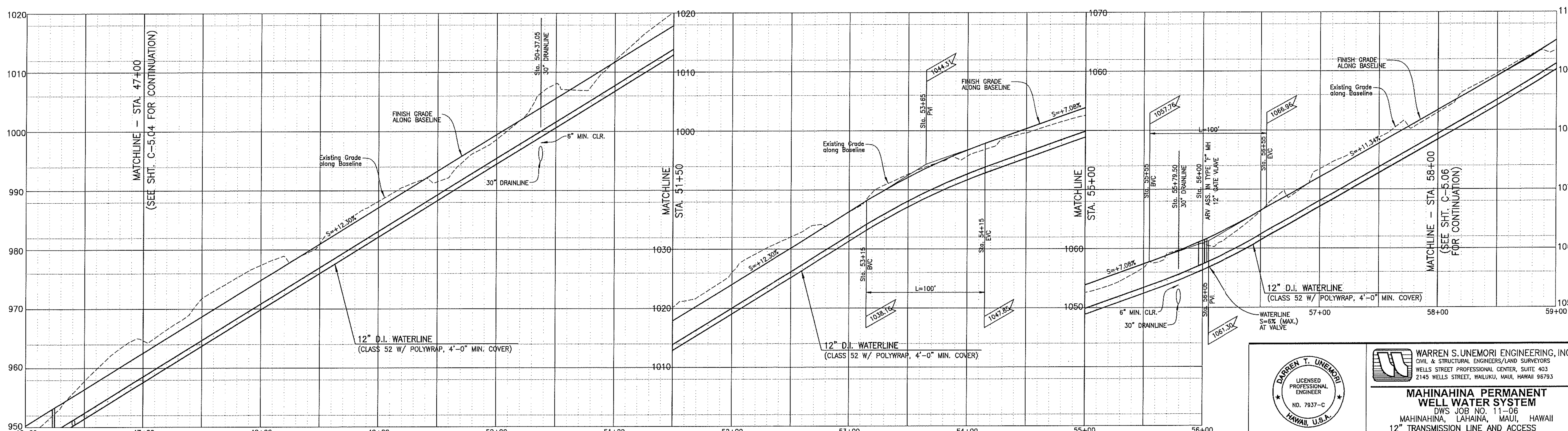
LOCATION MAP

SCALE: 1 IN. = 1500 FT.



PLAN

SCALE: 1 IN. = 40 FT.



PROFILE - 12" TRANSMISSION WATERLINE

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.

DARREN T. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 7937-C
HAWAII, U.S.A.

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2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM

DWS JOB NO. 11-06

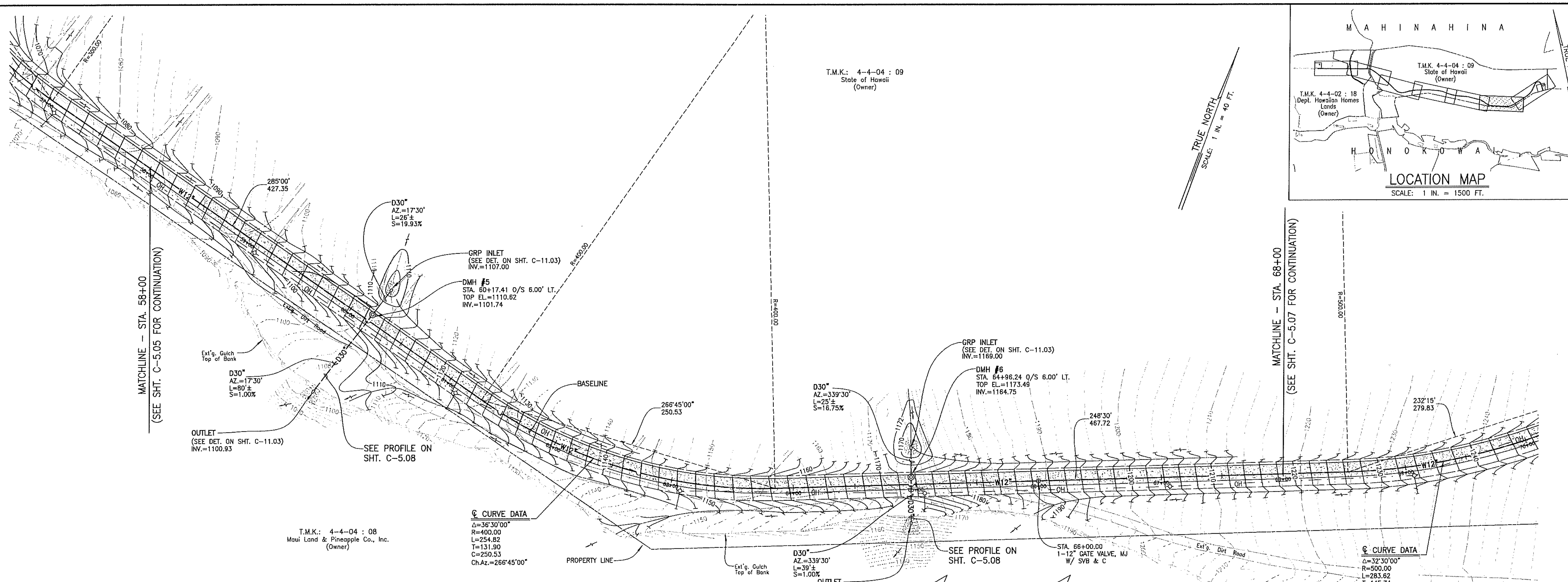
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE 12" TRANSMISSION LINE AND ACCESS ROADWAY - PLAN & PROFILE

D.T.U. DESIGNED BY	D.T.U. CHECKED BY	11025 JOB NUMBER	C-5.05 SHEET
W.I.S. DRAWN BY	D.T.U. APPROVED BY	June 7, 2012 DATE	OF SHEETS
SCALE 1 IN. = 40 FT.			

LETTER	DESCRIPTION	DATE

V:\Projects\11proj\11025 - DWS Mahinahina Well\dwg\conplans\pl-wl-5-6-00.dwg

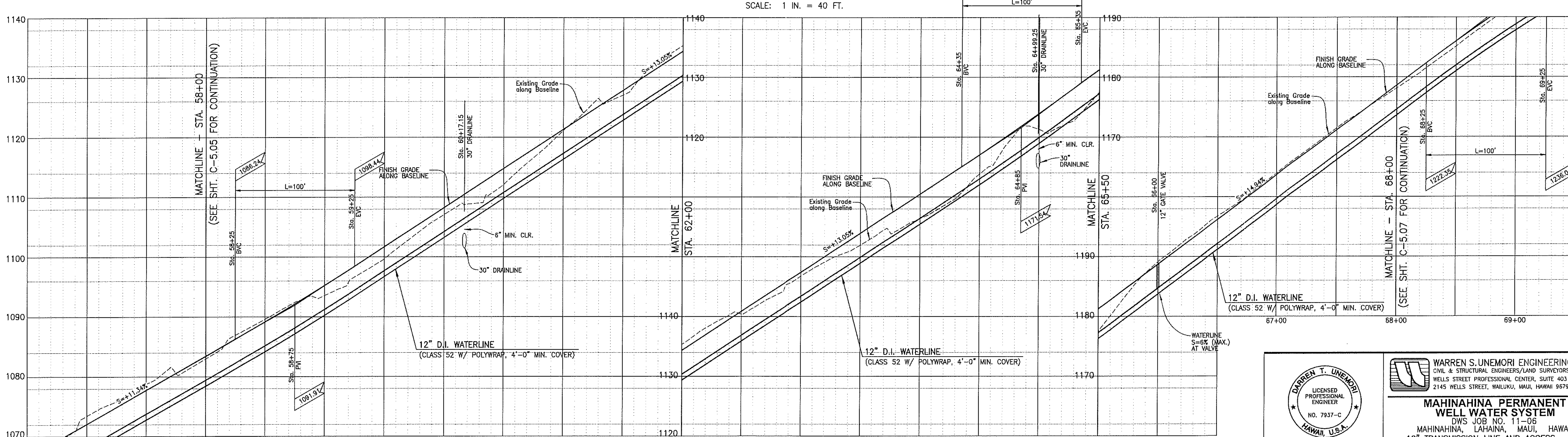


LOCATION MAP

SCALE: 1 IN. = 1500 FT.

PLAN

SCALE: 1 IN. = 40 FT.



PROFILE - 12" TRANSMISSION WATERLINE

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.

DARREN T. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 7937-C
HAWAII, U.S.A.

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LETTER	DESCRIPTION	DATE

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

MAHINAHINA PERMANENT WELL WATER SYSTEM

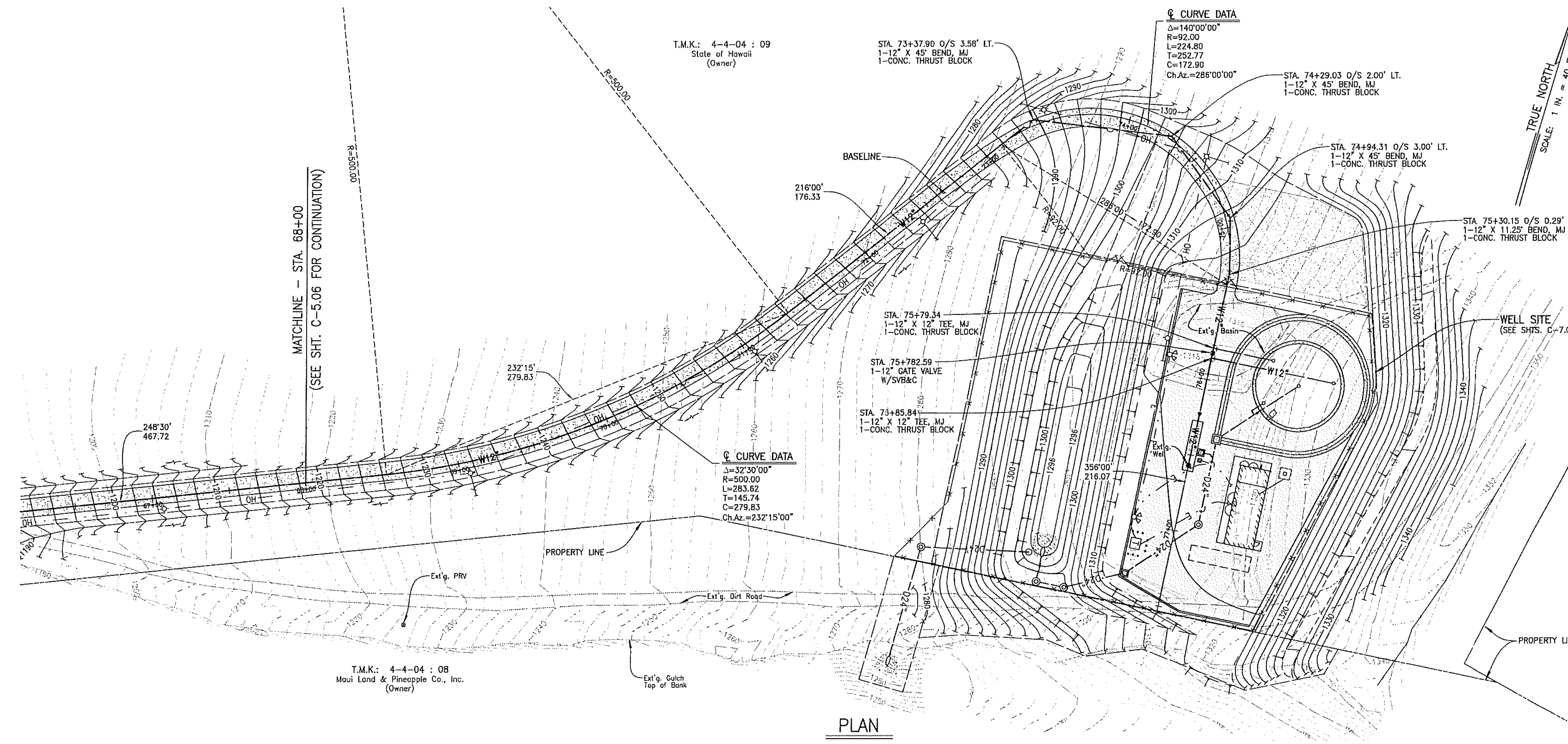
DWS JOB NO. 11-06

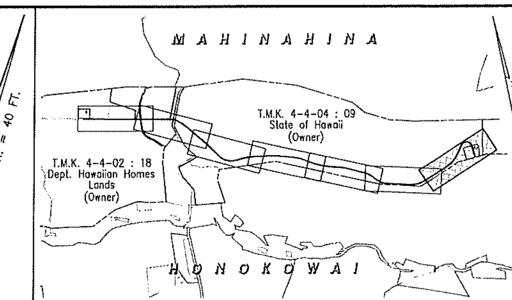
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE 12" TRANSMISSION LINE AND ACCESS ROADWAY - PLAN & PROFILE

DESIGNED BY D.T.U.	CHECKED BY D.T.U.	JOB NUMBER 11025	SHEET C-5.06
DRAWN BY W.I.S.	APPROVED BY D.T.U.	DATE June 7, 2012	OF SHEETS
SCALE 1 IN. = 40 FT.			

V:\Projects\11proj\11025 - DWS Mahinahina Well\dwg\conplans\pl-wl-5-6-00.dwg



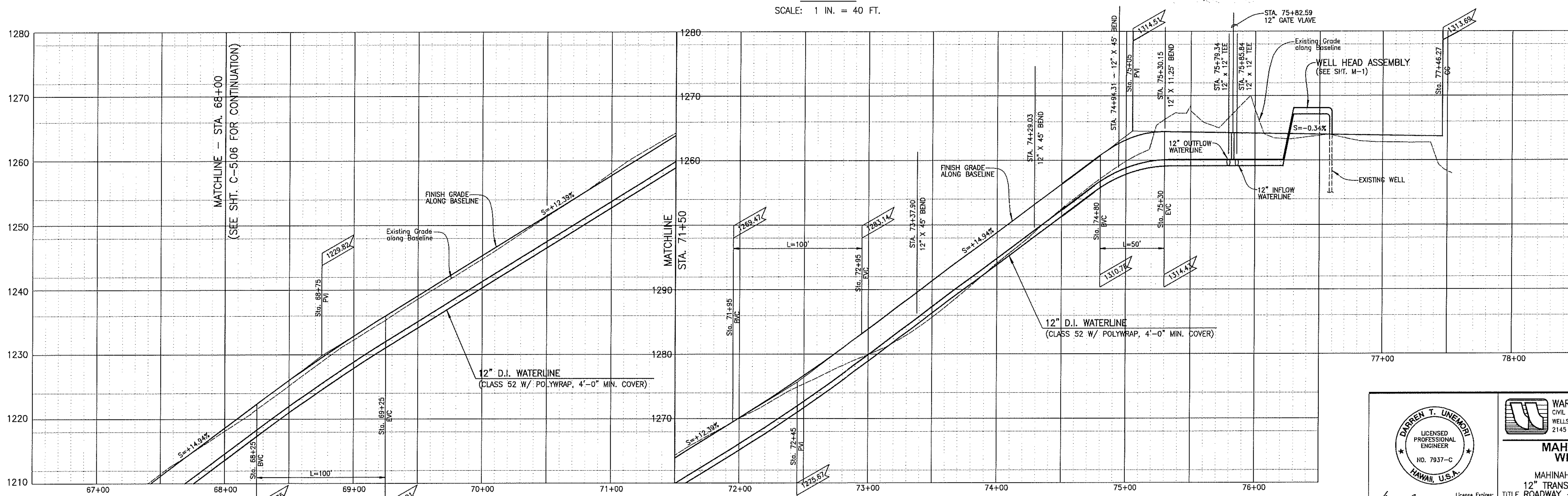


LOCATION MAP

SCALE: 1 IN. = 1500 FT.

PLAN

SCALE: 1 IN. = 40 FT.



PROFILE – WATERLINE

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.

DARREN T. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 7937-C
HAWAII, U.S.A.

License Expires: April 30, 2014

SIGNATURE DATE

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

MAHINAHINA PERMANENT WELL WATER SYSTEM

DWS JOB NO. 11-06

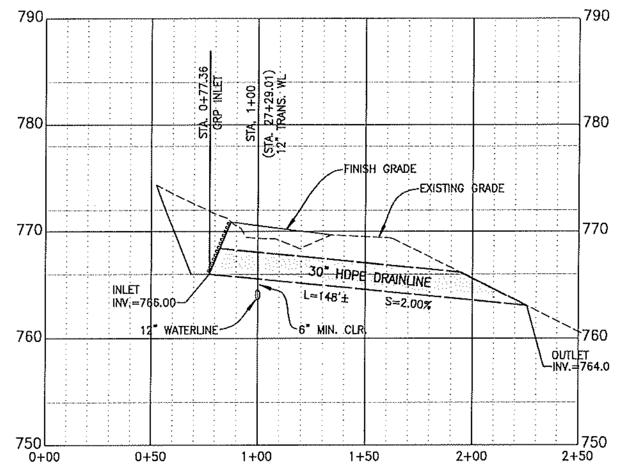
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE 12" TRANSMISSION LINE AND ACCESS ROADWAY – PLAN & PROFILE

DESIGNED BY D.T.U.	CHECKED BY D.T.U.	JOB NUMBER 11025	SHEET C-5.07
DRAWN BY W.I.S.	APPROVED BY D.T.U.	DATE June 7, 2012	OF SHEETS
SCALE 1 IN. = 40 FT.			

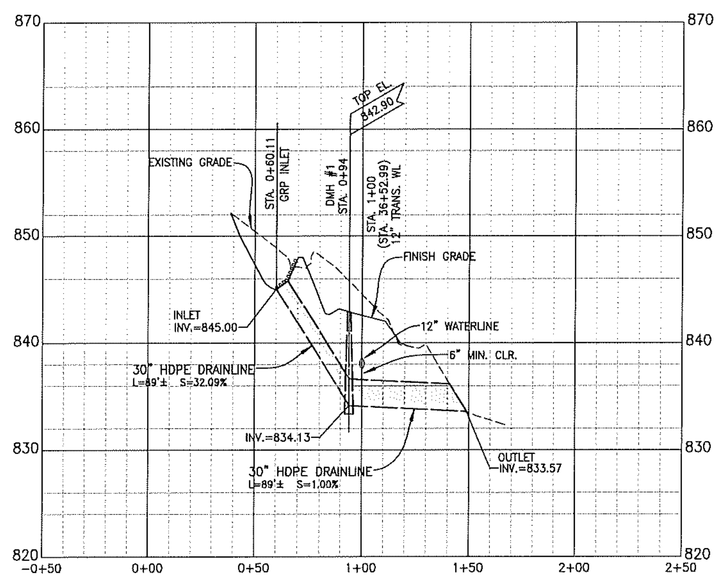
LETTER	DESCRIPTION	DATE

V:\Projdata\11proj\11025 – DWS Mahinahina Well\dwg\conplans\pl-wl-7.07-00.dwg



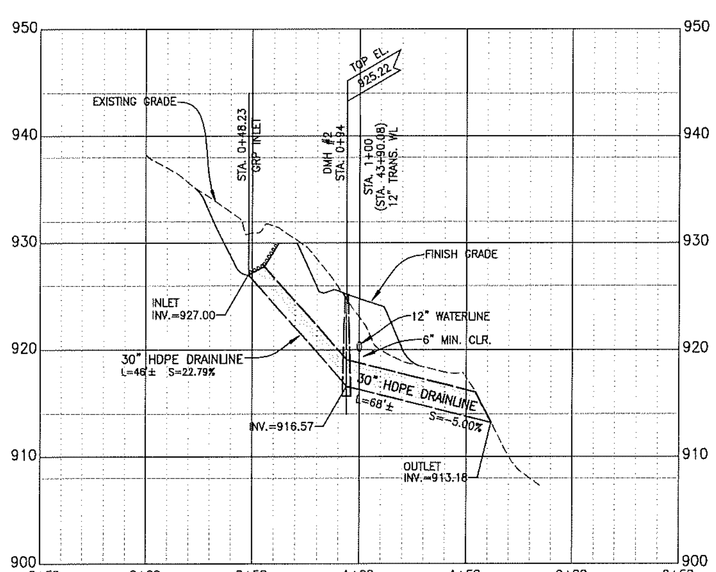
PROFILE – DRAINAGE CULVERT (STA. 27+29.01)

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.



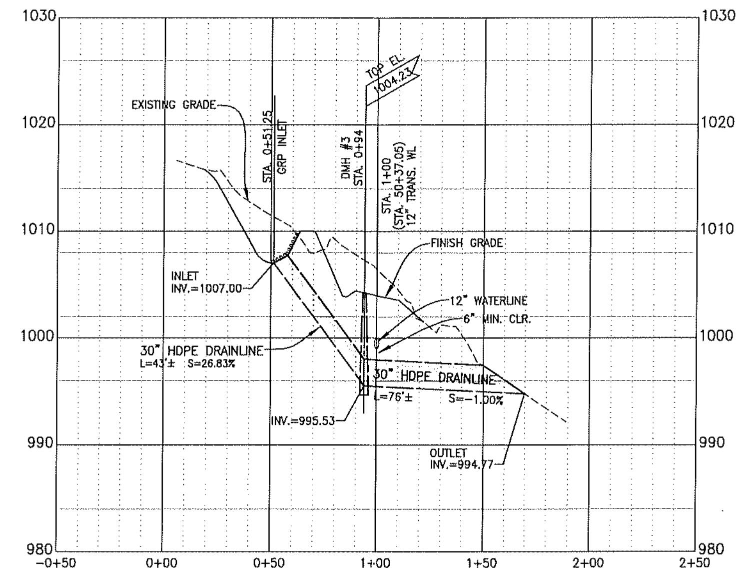
PROFILE – DRAINAGE CULVERT (STA. 36+52.99)

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.



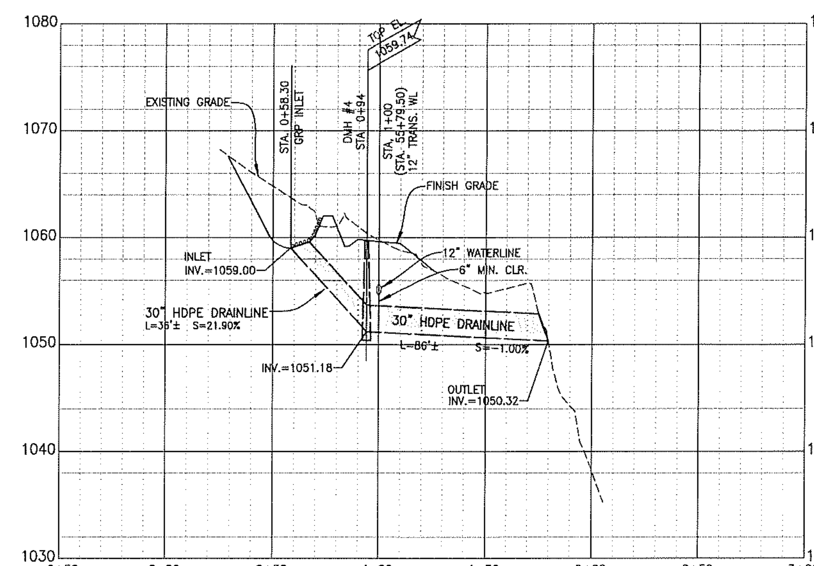
PROFILE – DRAINAGE CULVERT (STA. 43+90.08)

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.



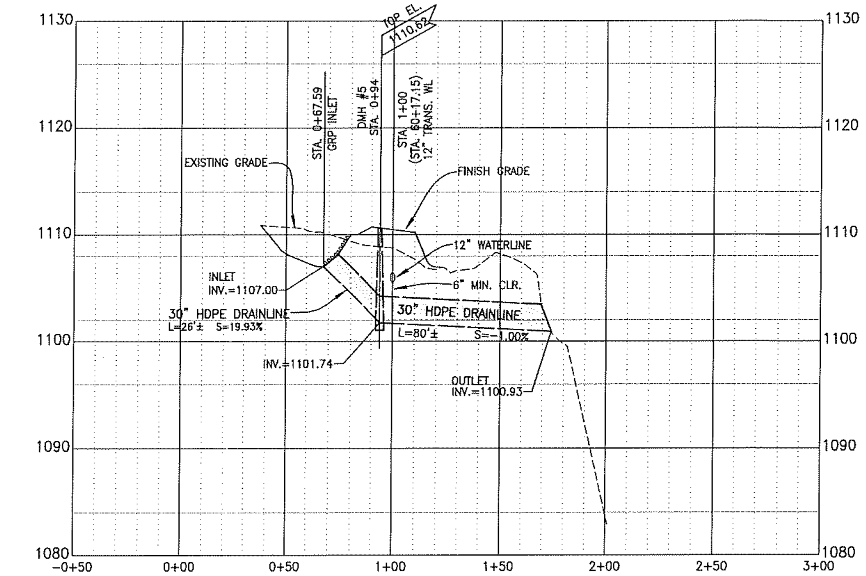
PROFILE – DRAINAGE CULVERT (STA. 50+37.05)

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.



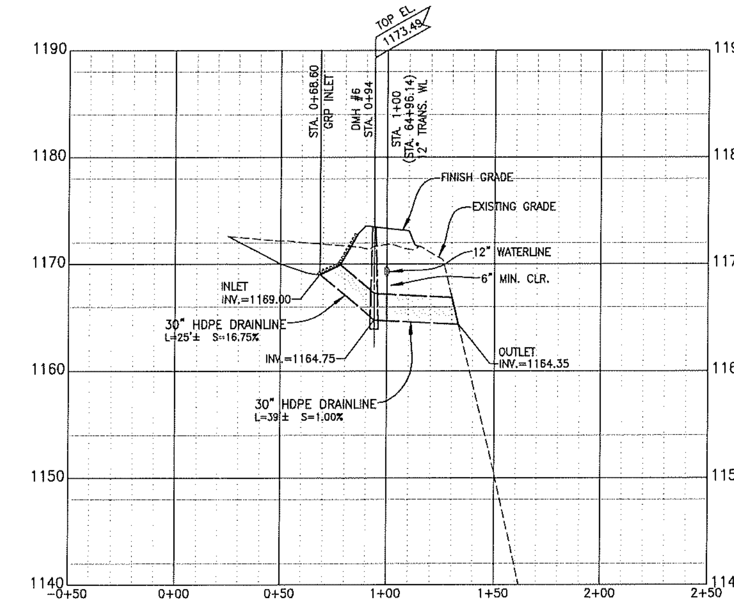
PROFILE – DRAINAGE CULVERT (STA. 55+79.50)

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.



PROFILE – DRAINAGE CULVERT (STA. 60+17.15)

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.



PROFILE – DRAINAGE CULVERT (STA. 64+96.14)

SCALE: HORIZ. 1 IN. = 40 FT.
VERT. 1 IN. = 8 FT.

DARREN T. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 7937-C
HAWAII, U.S.A.

License Expires: April 30, 2014

SIGNATURE DATE

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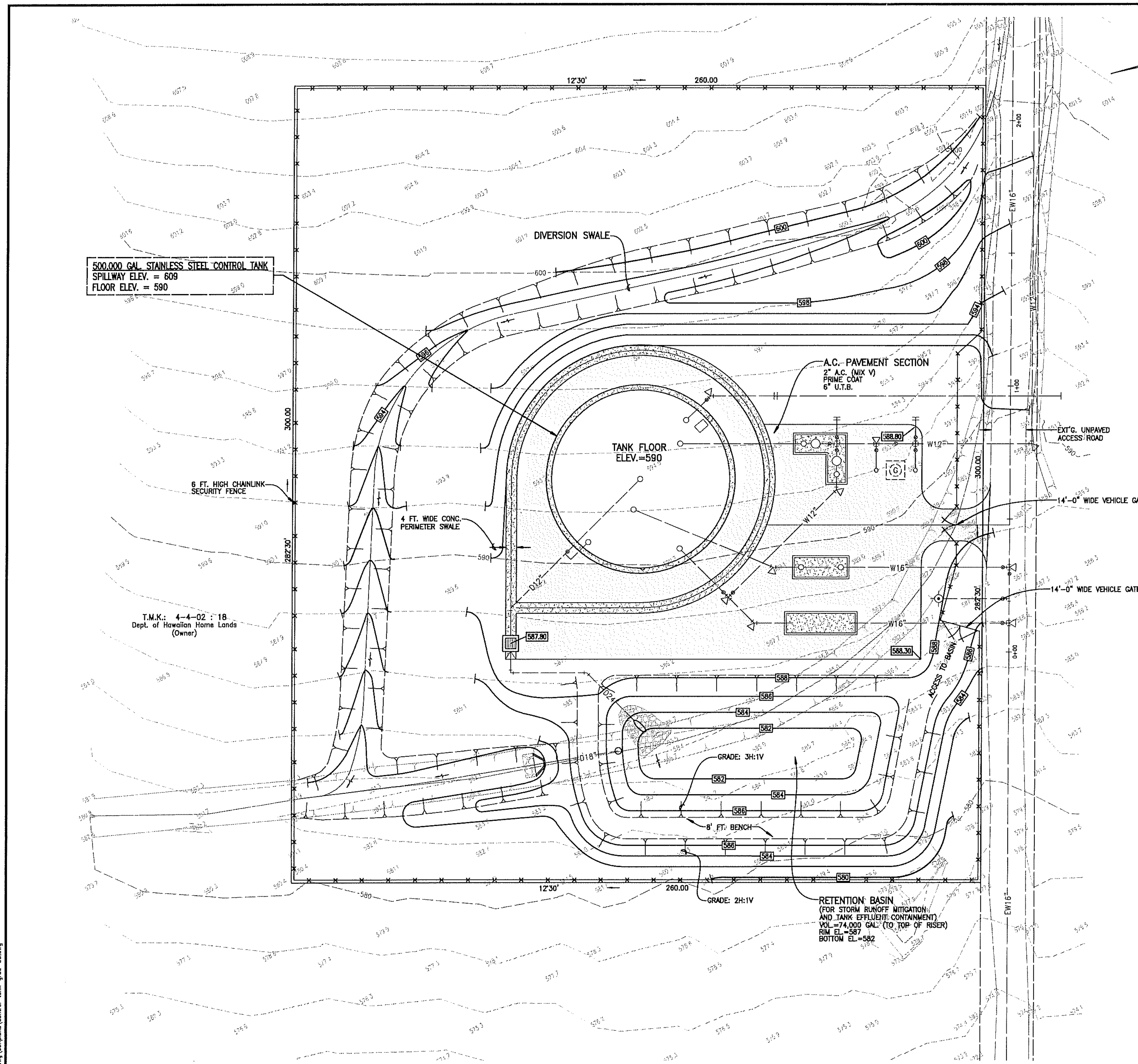
WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM
DWS JOB NO. 11-06
MAHINAHINA, LAHAINA, MAUI, HAWAII
12" TRANSMISSION LINE AND ACCESS ROADWAY
TITLE – DRAINAGE CULVERT PROFILES

D.T.U. DESIGNED BY	D.T.U. CHECKED BY	11025 JOB NUMBER	C–5.08 SHEET
W.I.S. DRAWN BY	D.T.U. APPROVED BY	June 7, 2012 DATE	OF SHEETS
SCALE 1 IN. = 40 FT.			

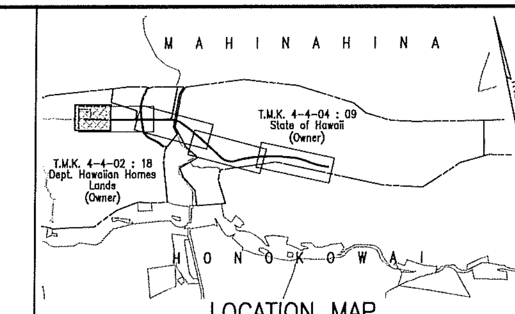
LETTER	DESCRIPTION	DATE

V:\Projdata\11proj\11025 – DWS Mahinahina Well\dwg\conplans\prof-dr-culverts-00.dwg



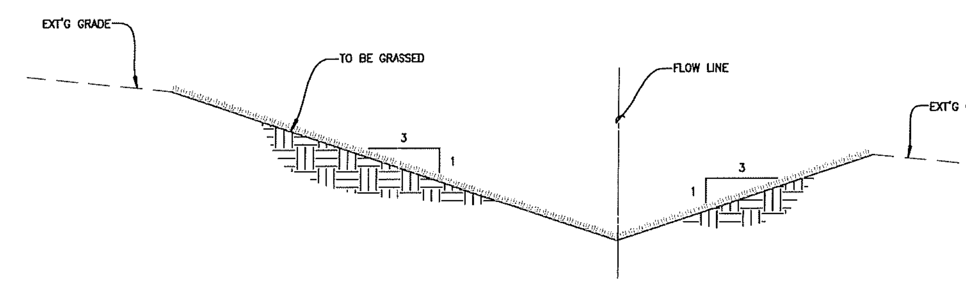
CONTROL TANK SITE

SCALE: 1 IN. = 20 FT.



LOCATION MAP

SCALE: 1 IN. = 1500 FT.



TYPICAL SECTION – DIVERSION SWALE

SCALE: 1/2" IN. = 1'-0"

APPROXIMATE EARTHWORK QUANTITIES

EXCAVATION = 2,715 CU.YD.
EMBANKMENT = 1,205 CU.YD.
NET EXCAVATION = 1,510 CU.YD.

LEGEND:

580	EXISTING GRADE
580	FINISH GRADE
EW16"	EXISTING WATERLINE WITH SIZE
W16"	WATERLINE WITH SIZE
D18"	DRAINLINE WITH SIZE
	GRATED INLET CATCH BASIN
	TOP OF BANK
	TOE OF BANK

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

License Expires: April 30, 2020

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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

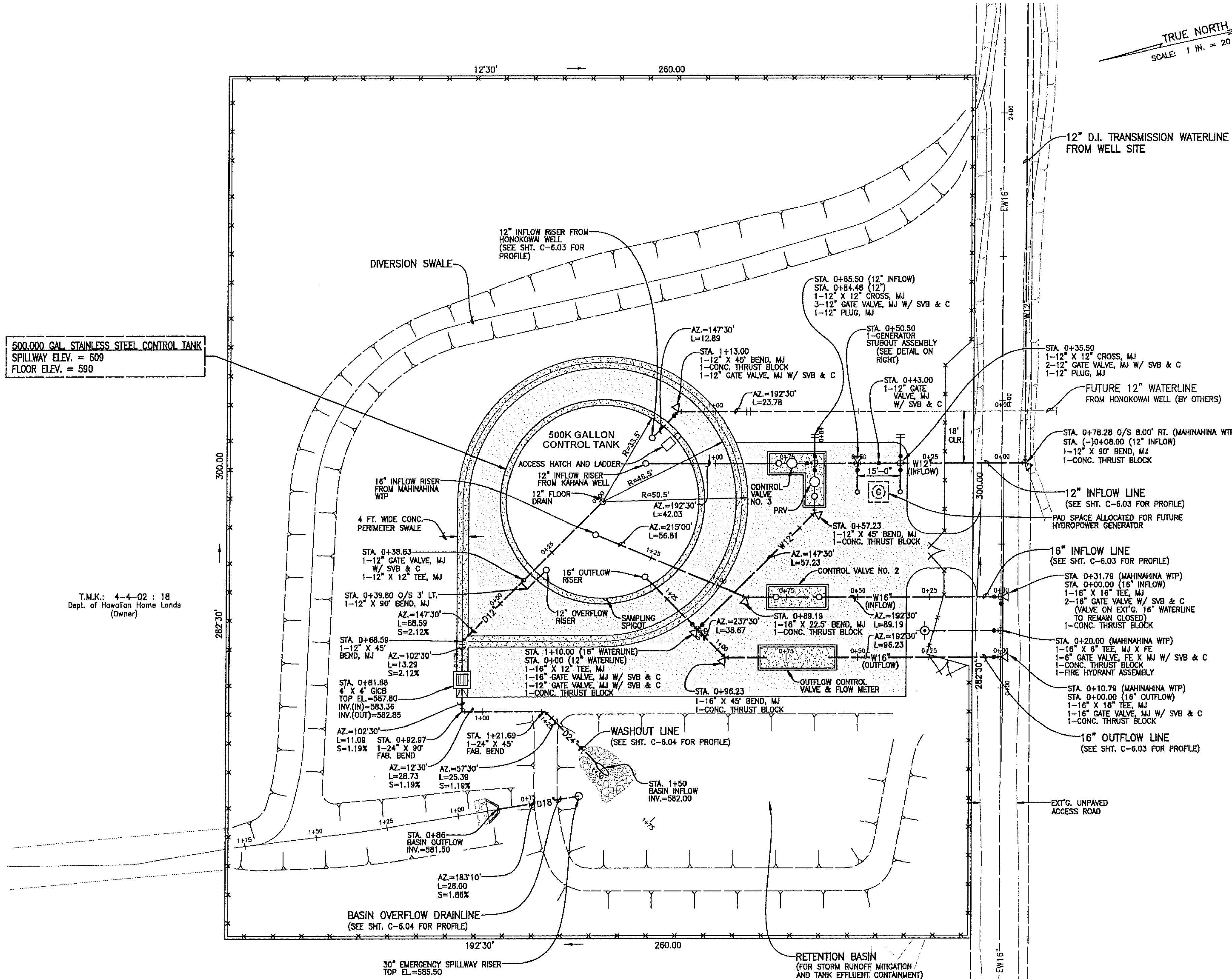
MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE CONTROL TANK SITE – GRADING PLAN

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C–6.01 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	
SCALE 1 IN. = 20 FT.			OF SHEETS

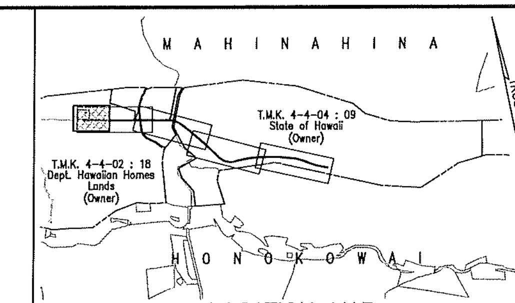
LETTER	DESCRIPTION	DATE

V:\Projects\11proj\11025 – DWS Mahinahina Well\dwg\conplans\control-tank-grad-00.dwg



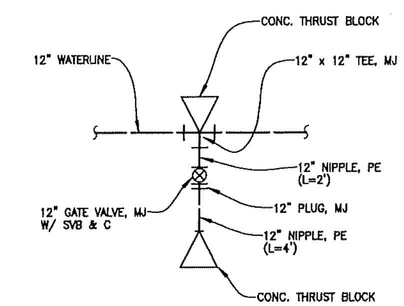
CONTROL TANK SITE

SCALE: 1 IN. = 20 FT.



LOCATION MAP

SCALE: 1 IN. = 1500 FT.



DETAIL – GENERATOR STUBOUT ASSEMBLY

SCALE: 1/8" = 1'-0"

LEGEND:

580	EXISTING GRADE
580	FINISH GRADE
EW16"	EXISTING WATERLINE WITH SIZE
W16"	WATERLINE WITH SIZE
D18"	DRAINLINE WITH SIZE
	GRATED INLET CATCH BASIN
	TOP OF BANK
	TOE OF BANK

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

License Expires: April 30, 2020

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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

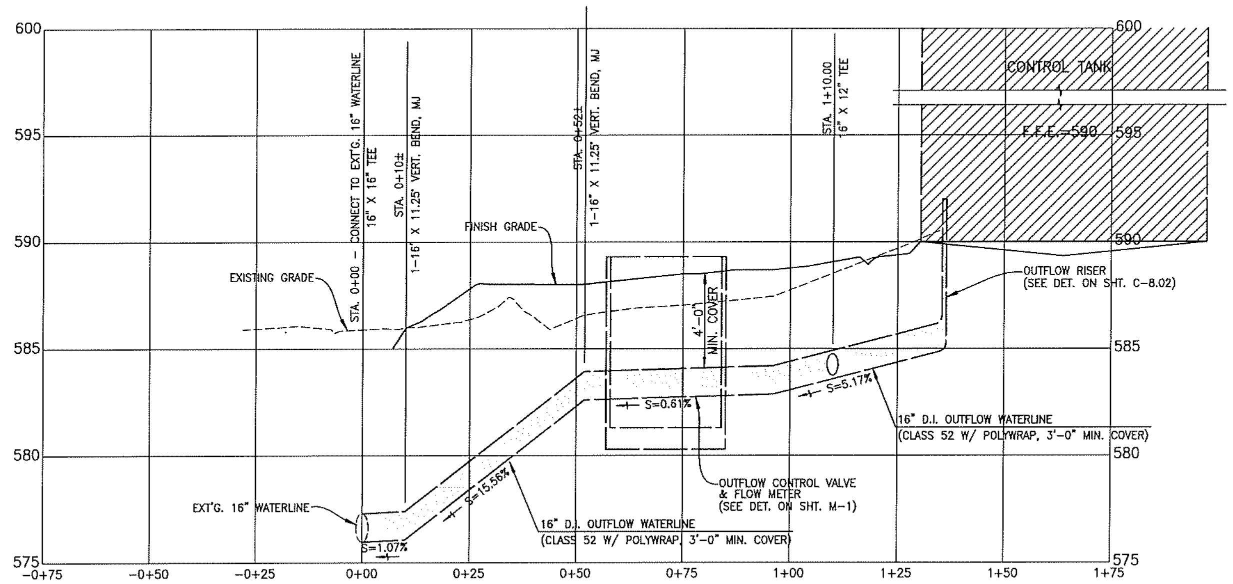
MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE CONTROL TANK SITE – UTILITY PLAN

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C–6.02 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	1 IN. = 20 FT.		

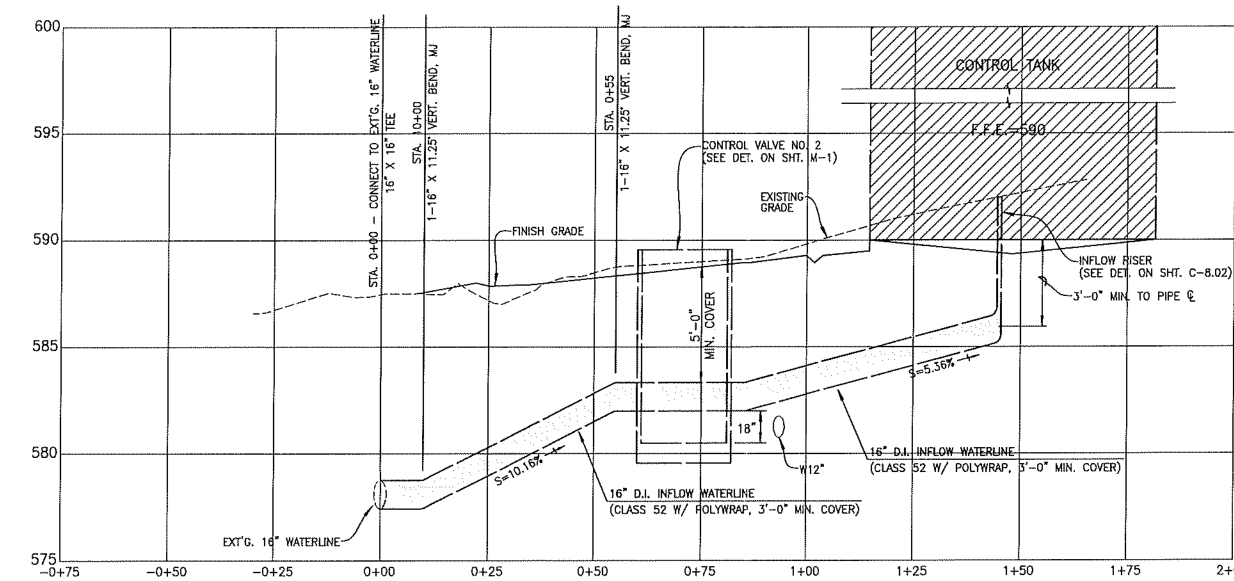
LETTER	DESCRIPTION	DATE

V:\Projects\11proj\11025 – DWS Mahinahina Well\dwg\conplans\control-tank-02.dwg



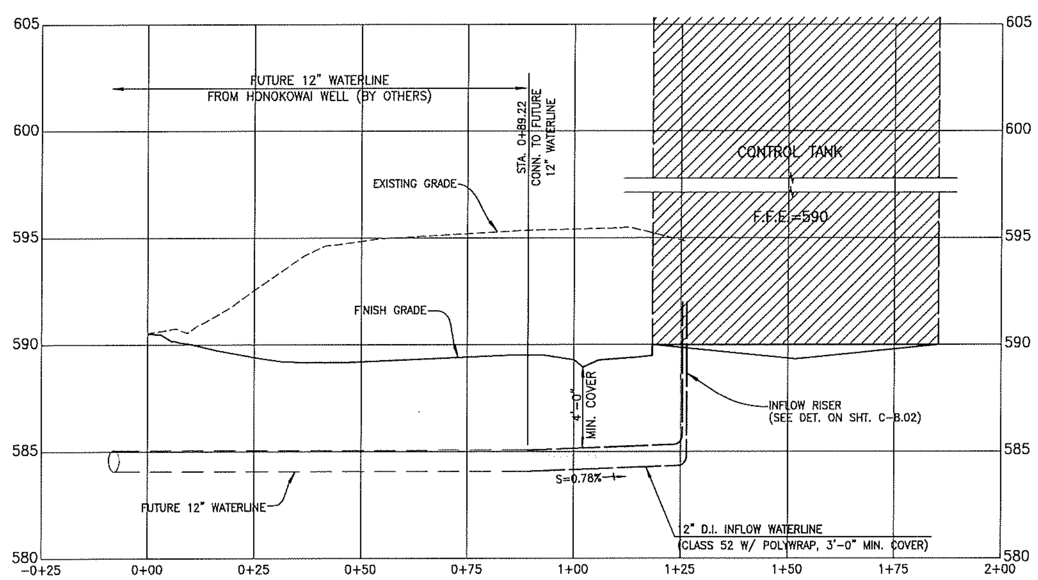
PROFILE – 16" OUTFLOW LINE

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.



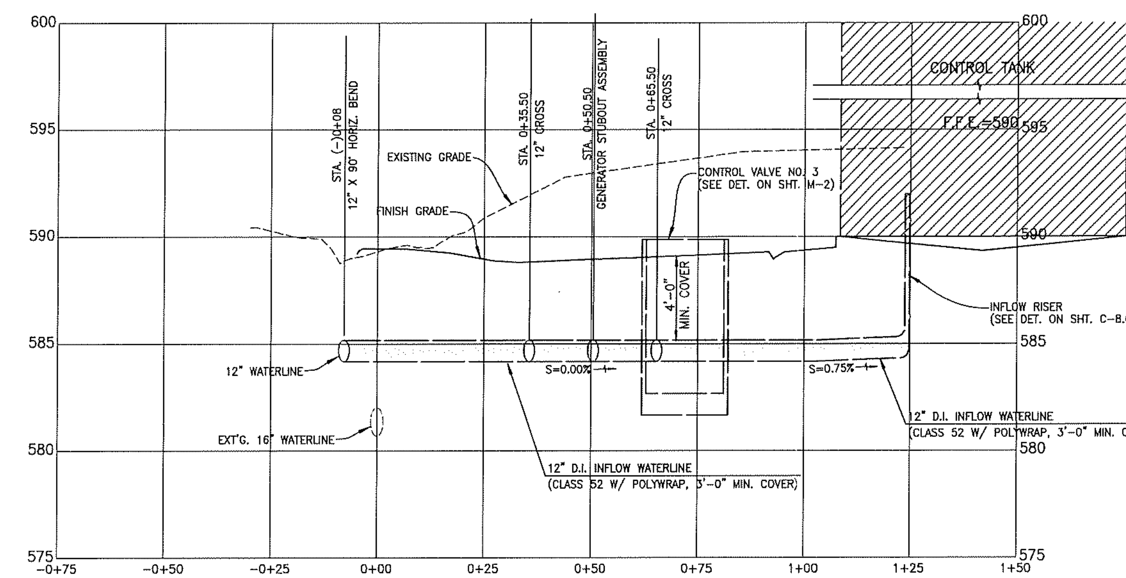
PROFILE – 16" INFLOW LINE (FROM MAHINAHINA WTP)

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.



PROFILE – 12" INFLOW LINE (FROM HONOKOWAI WELL)

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.



PROFILE – 12" INFLOW LINE (FROM KAHANA WELL)

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.

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

License Expires: April 30, 2020

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CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE CONTROL TANK SITE – WATERLINE PROFILES

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-6.03 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE 1 IN. = 20 FT.			

LETTER	DESCRIPTION	DATE

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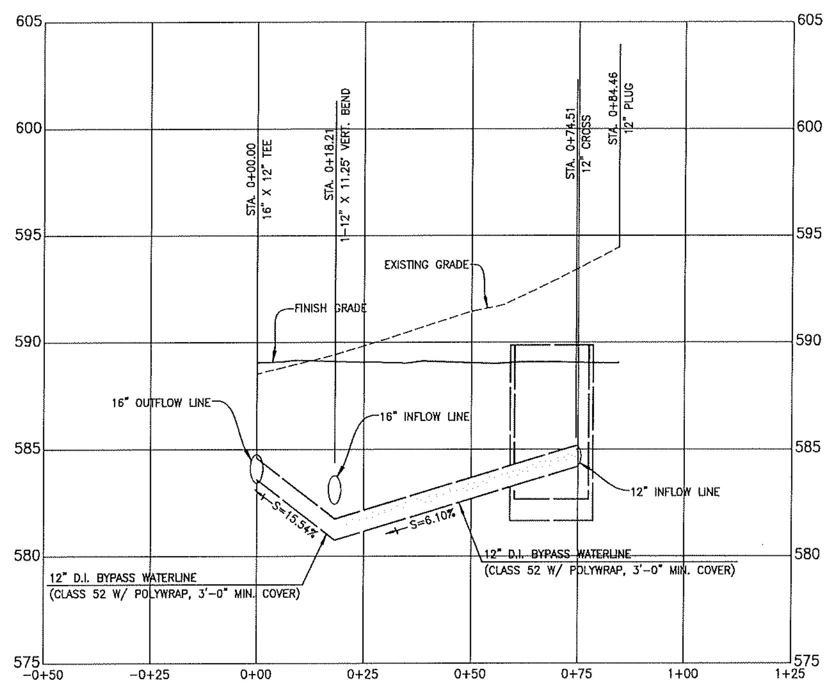
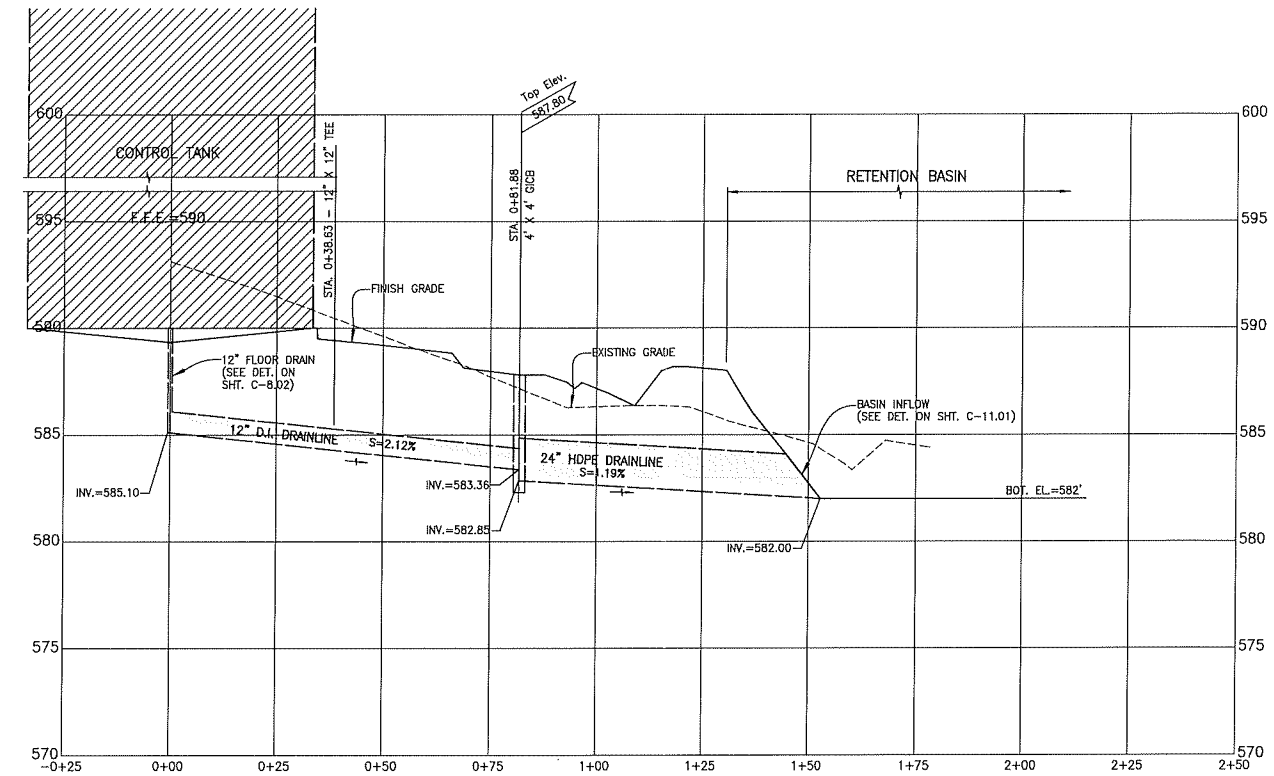


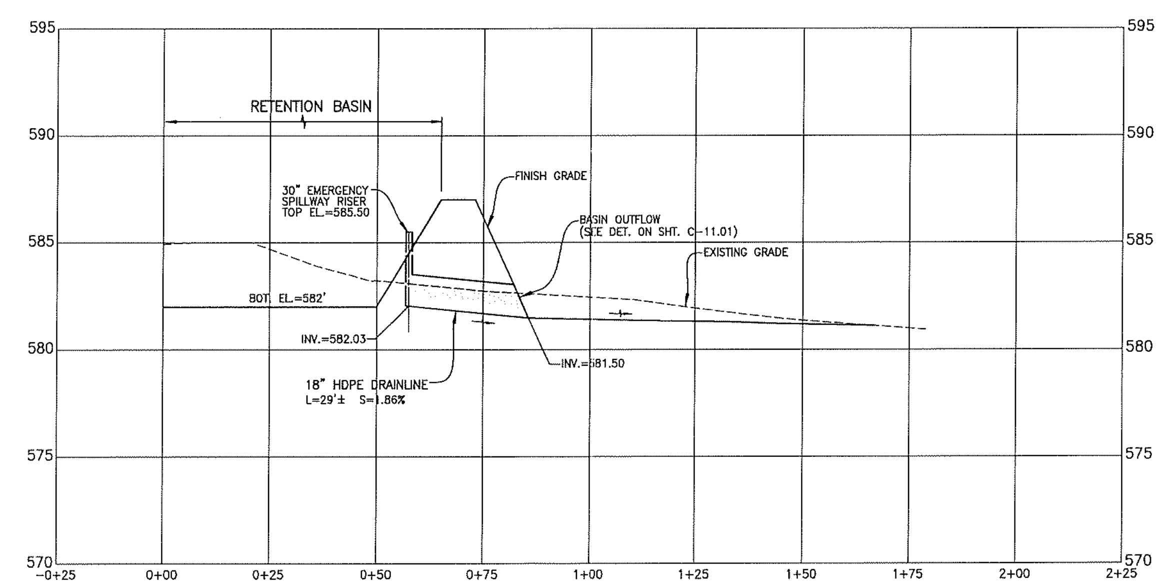
PROFILE – 12" TANK BYPASS LINE

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.



PROFILE – WASHOUT LINE

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.



PROFILE – BASIN OVERFLOW DRAINLINE

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.

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

License Expires: April 30, 2020

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LETTER	DESCRIPTION	DATE

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

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE CONTROL TANK SITE – DRAINLINE PROFILES

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-6.04 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE 1 IN. = 20 FT.			

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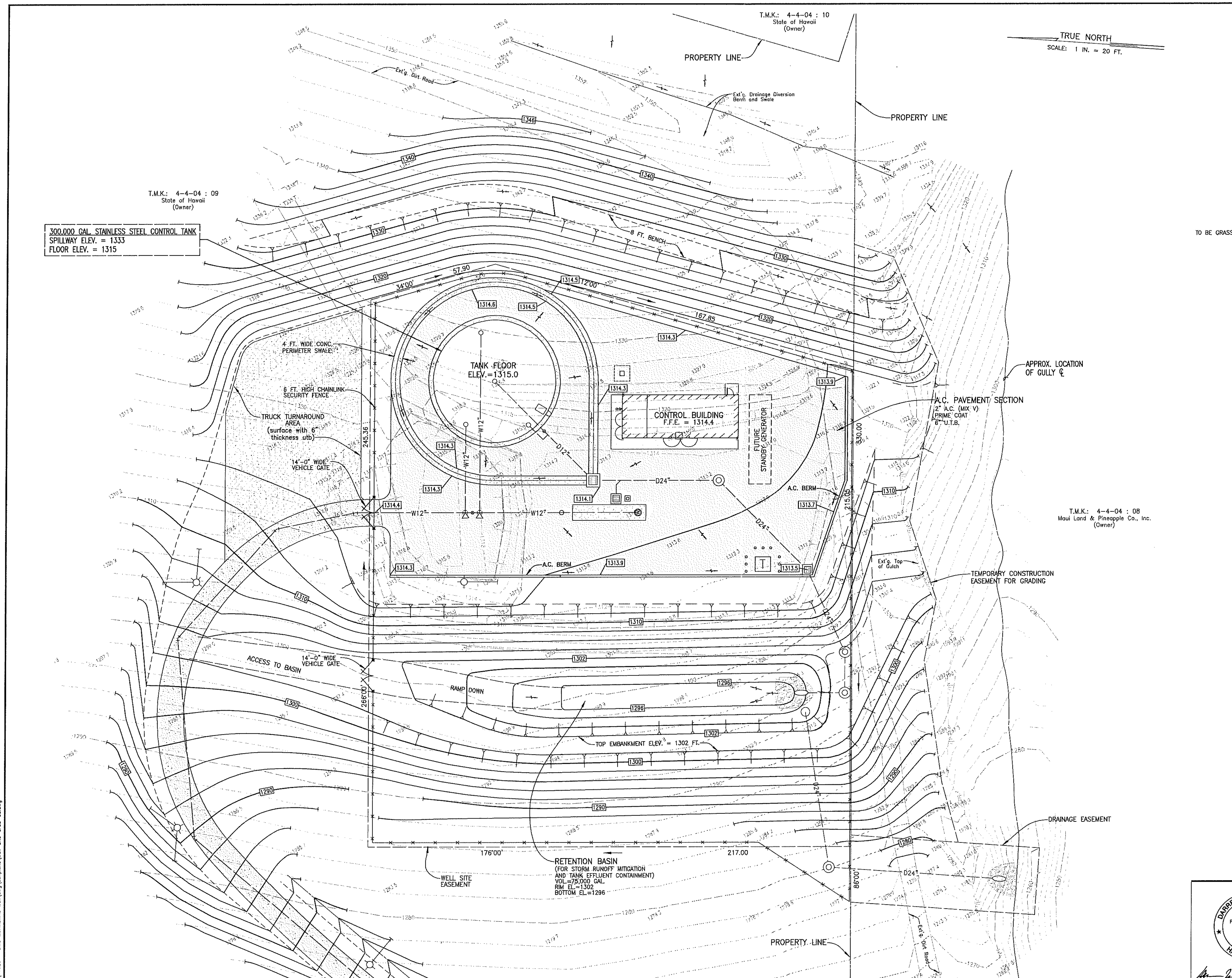
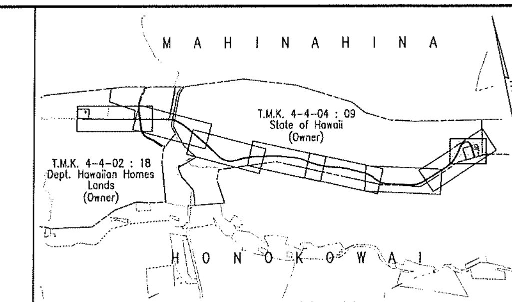
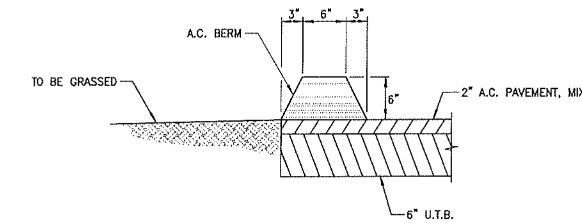


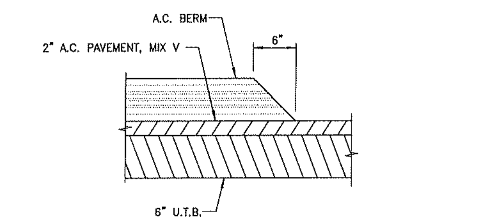
WELL SITE
SCALE: 1 IN. = 20 FT.



LOCATION MAP
SCALE: 1 IN. = 1500 FT.



DETAIL – A.C. BERM
SCALE: 1" = 1'-0"



END DETAIL – A.C. BERM
SCALE: 1" = 1'-0"

LEGEND:

---580---	EXISTING GRADE
[580]	FINISH GRADE
-EW16"-	EXISTING WATERLINE WITH SIZE
-W16"-	WATERLINE WITH SIZE
-D18"-	DRAINLINE WITH SIZE
▣	GRATED INLET CATCH BASIN
┬┬┬	TOP OF BANK
┴┴┴	TOE OF BANK

DARREN T. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 7937-C
HAWAII, U.S.A.

License Expires: April 30, 2014

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WARREN S. UNEMORI ENGINEERING, INC.
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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM
DWS JOB NO. 11-06
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE WELL SITE – GRADING PLAN

D.T.U. DESIGNED BY	D.T.U. CHECKED BY	11025 JOB NUMBER	C-7.01
W.I.S. DRAWN BY	D.T.U. APPROVED BY	June 7, 2012 DATE	SHEET
SCALE 1 IN. = 20 FT.			OF SHEETS

LETTER	DESCRIPTION	DATE

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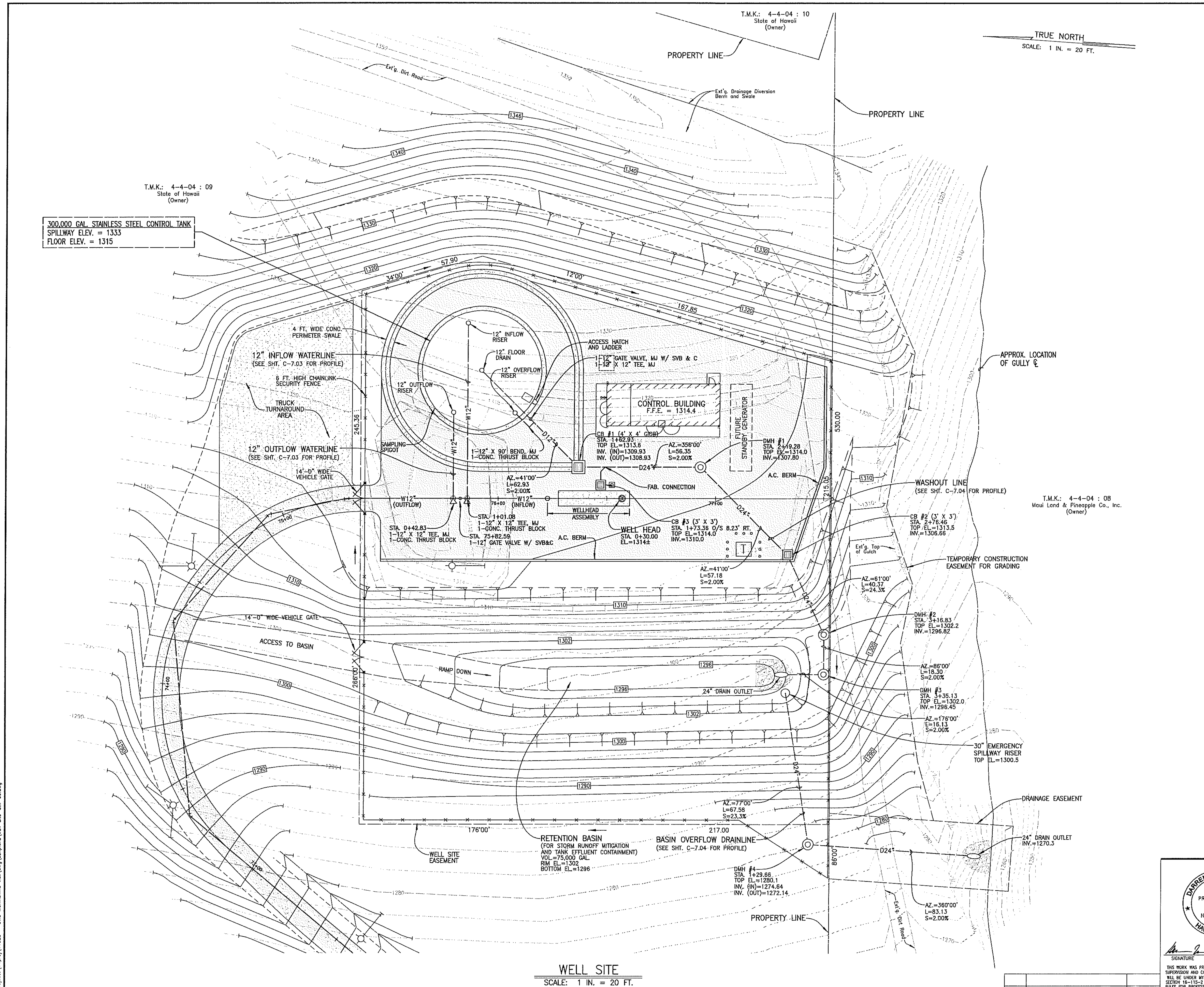

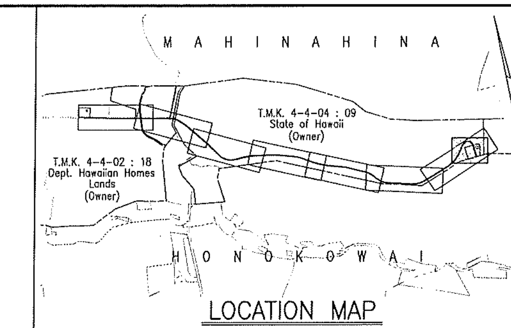

LOCATION MAP

SCALE: 1 IN. = 1500 FT.

WELL SITE

SCALE: 1 IN. = 20 FT.

LEGEND:

---580---	EXISTING GRADE
—580—	FINISH GRADE
—EW16"—	EXISTING WATERLINE WITH SIZE
—W16"—	WATERLINE WITH SIZE
—D18"—	DRAINLINE WITH SIZE
▣	GRATED INLET CATCH BASIN
	TOP OF BANK
	TOE OF BANK

LETTER	DESCRIPTION	DATE

DARREN T. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 7937-C
HAWAII, U.S.A.

SIGNATURE — License Expires: April 30, 2014 — DATE

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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM

DWS JOB NO. 11-06
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE WELL SITE – UTILITY PLAN

D.T.U. DESIGNED BY	D.T.U. CHECKED BY	11025 JOB NUMBER	C–7.02 SHEET
W.I.S. DRAWN BY	D.T.U. APPROVED BY	June 7, 2012 DATE	OF SHEETS
SCALE 1 IN. = 20 FT.			

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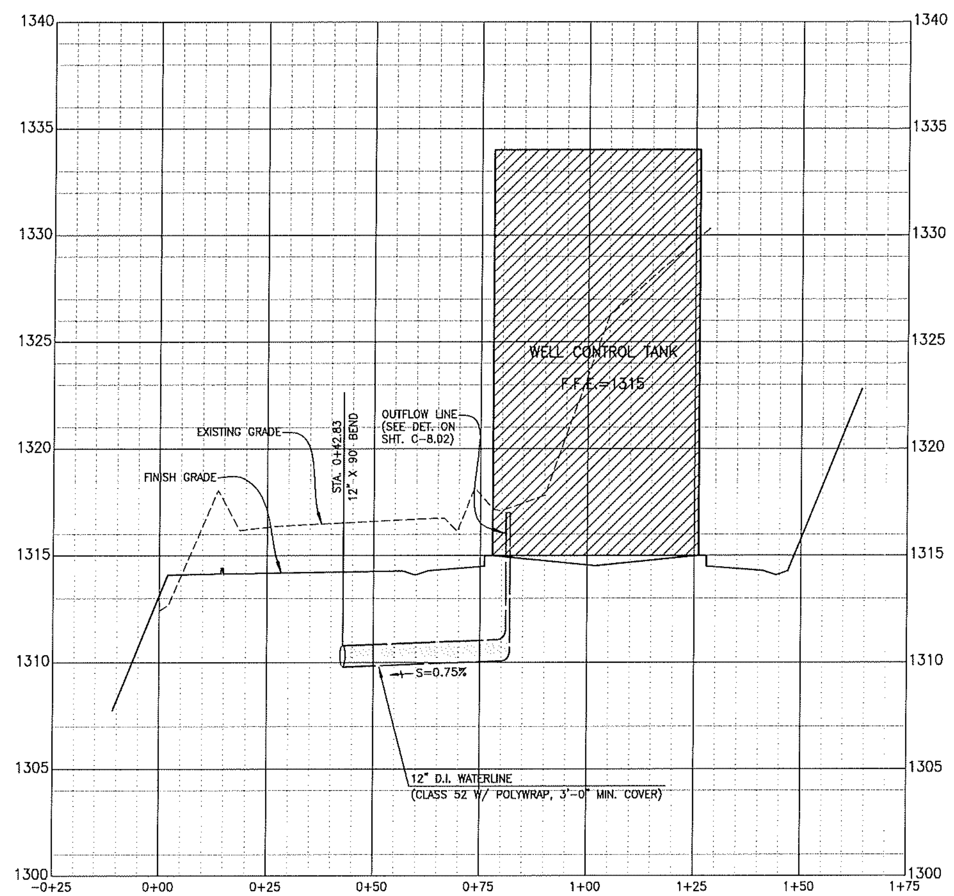
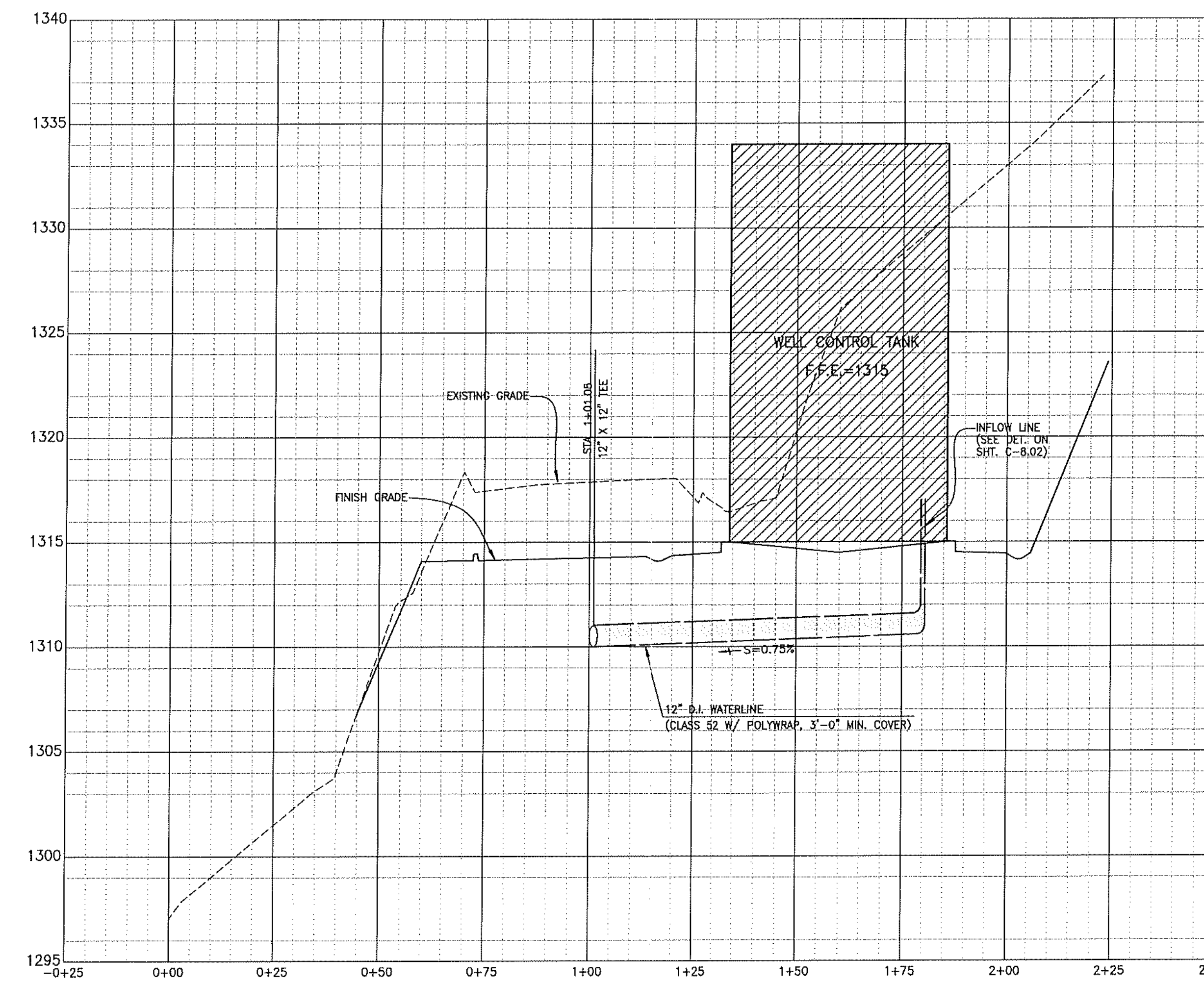


PROFILE – 12" OUTFLOW WATERLINE

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.



PROFILE – 12" INFLOW WATERLINE

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.

DARREN T. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 7937-C
HAWAII, U.S.A.

License Expires: April 30, 2014

SIGNATURE DATE

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

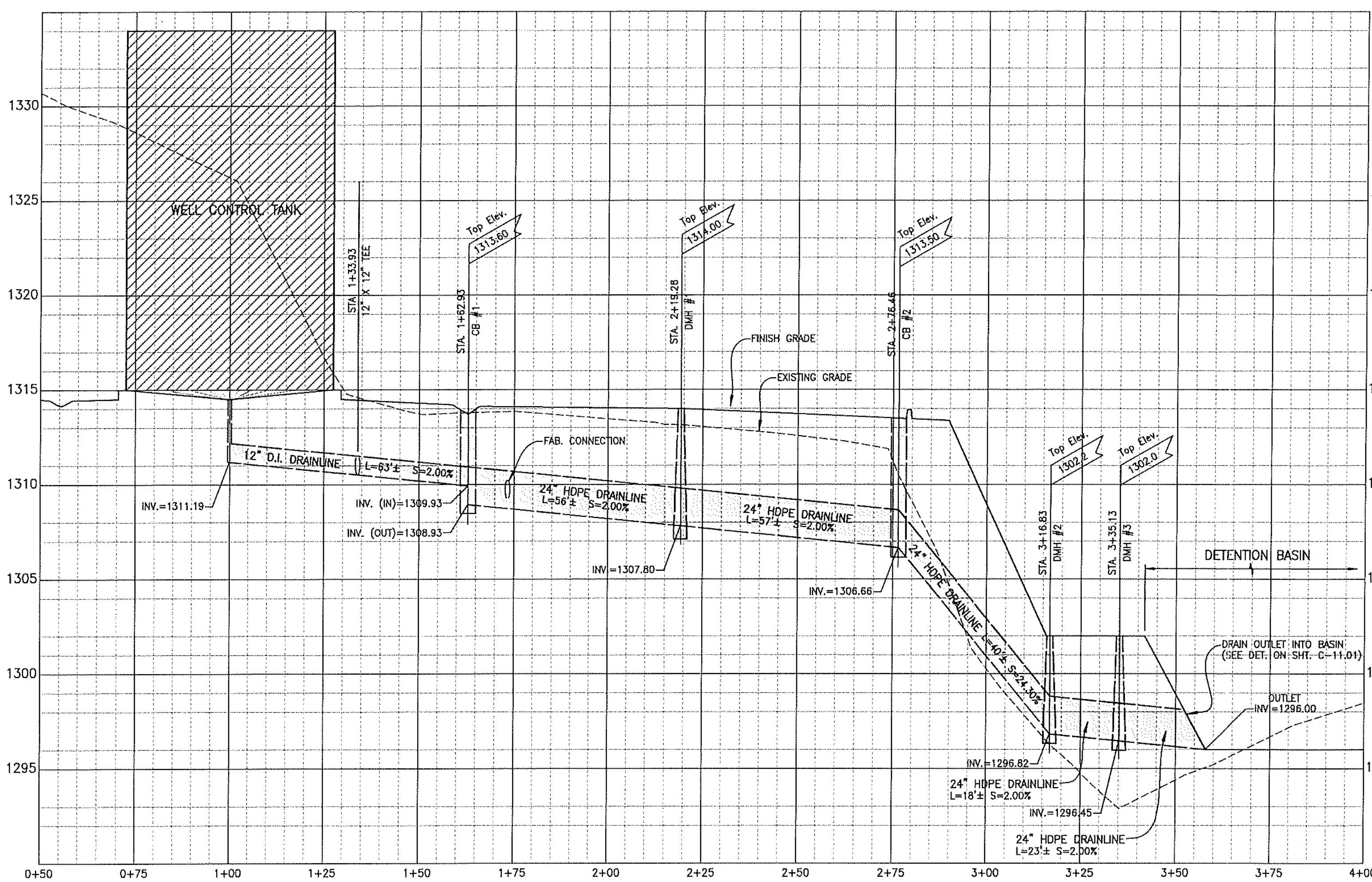
WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM
DWS JOB NO. 11-06
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE WELL SITE – WATERLINE PROFILES

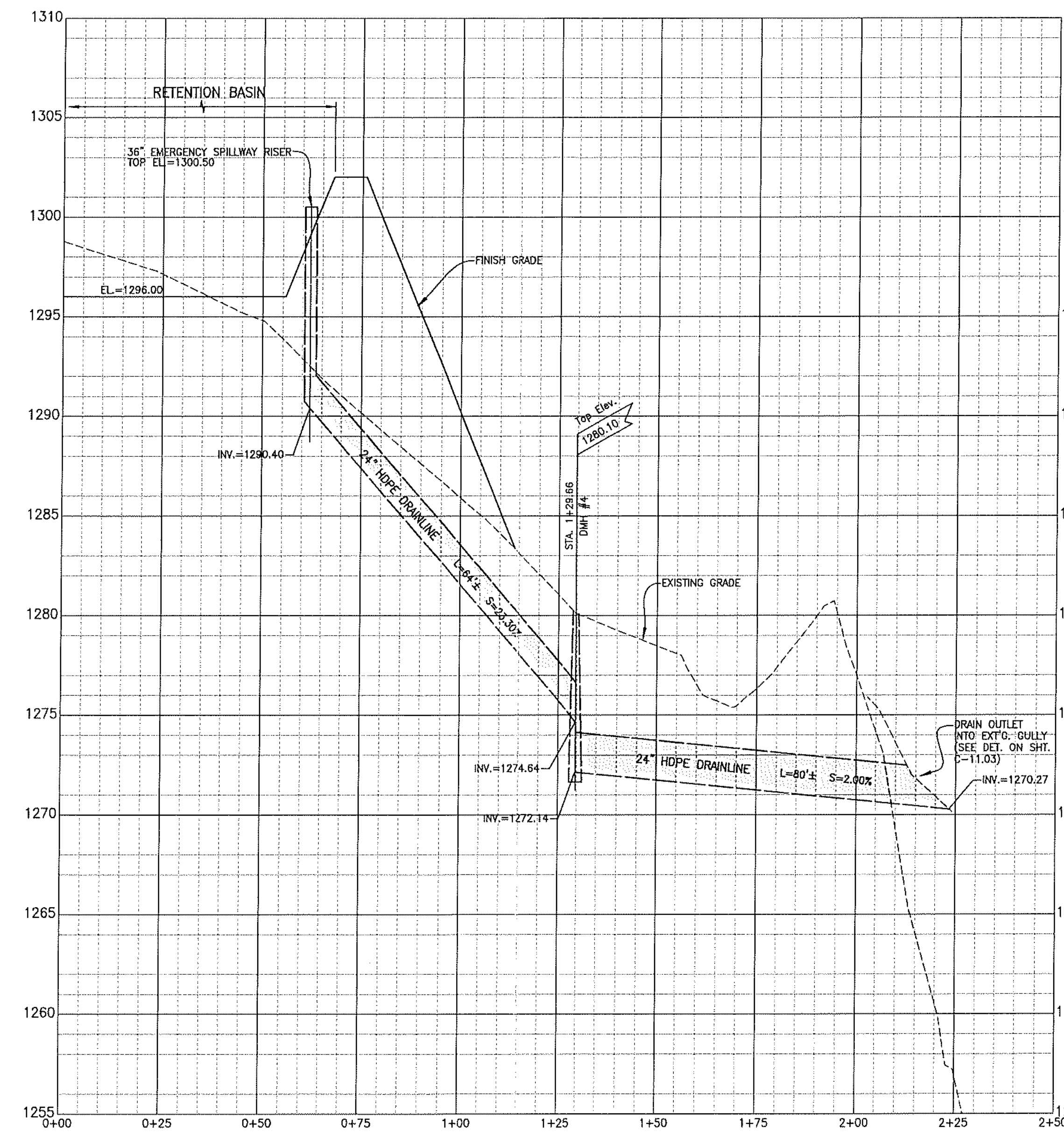
D.T.U. DESIGNED BY	D.T.U. CHECKED BY	11025 JOB NUMBER	C-7.03
W.I.S. DRAWN BY	D.T.U. APPROVED BY	June 7, 2012 DATE	SHEET
SCALE 1 IN. = 20 FT.			OF SHEETS

V:\Projdata\11proj\11025 - DWS Mahinahina Well\dwg\constplans\Prof-well site-00.dwg



PROFILE – WASHOUT LINE

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.



PROFILE – BASIN OVERFLOW DRAINLINE

SCALE: HORIZ. 1 IN. = 20 FT.
VERT. 1 IN. = 4 FT.

V:\Projects\11proj\11025 - DWS Mahinahina Well\dwg\completes\Prof-well site-00.dwg

DARREN T. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 7937-C
HAWAII, U.S.A.

SIGNATURE | License Expires: April 30, 2014 | DATE

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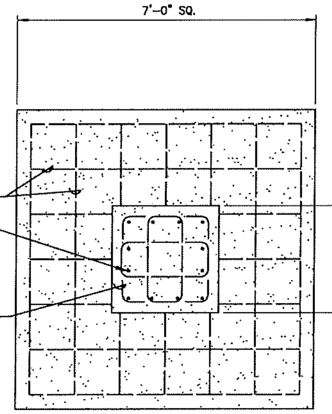
LETTER	DESCRIPTION	DATE

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

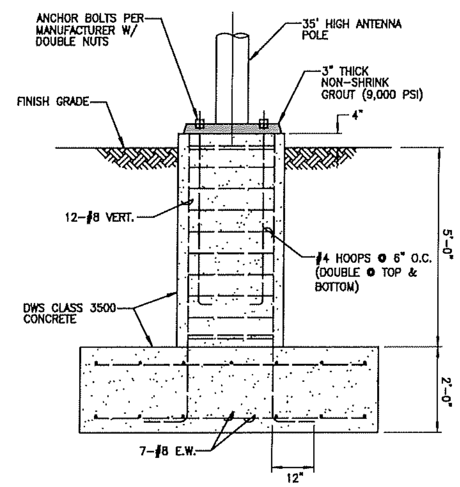
MAHINAHINA PERMANENT WELL WATER SYSTEM
DWS JOB NO. 11-06
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE WELL SITE – DRAINLINE PROFILES

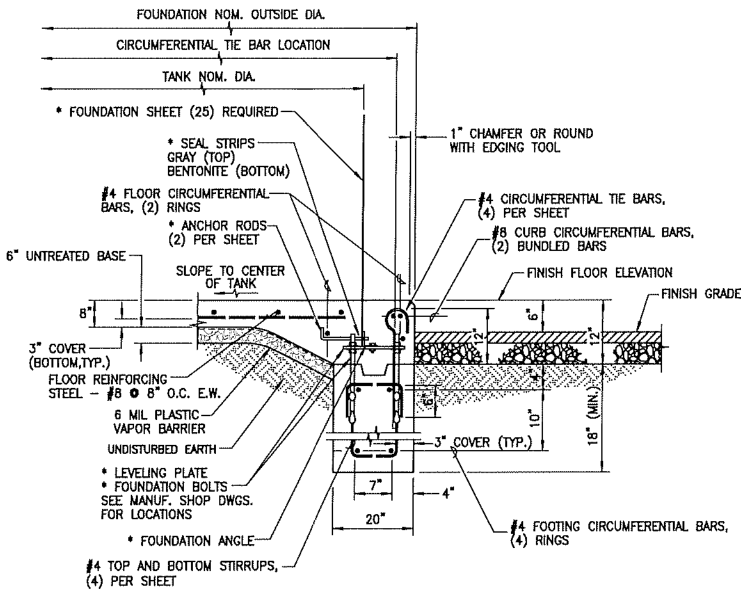
D.T.U. DESIGNED BY	D.T.U. CHECKED BY	11025 JOB NUMBER	C-7.04 SHEET
W.I.S. DRAWN BY	D.T.U. APPROVED BY	June 7, 2012 DATE	OF SHEETS
SCALE 1 IN. = 20 FT.			



PLAN



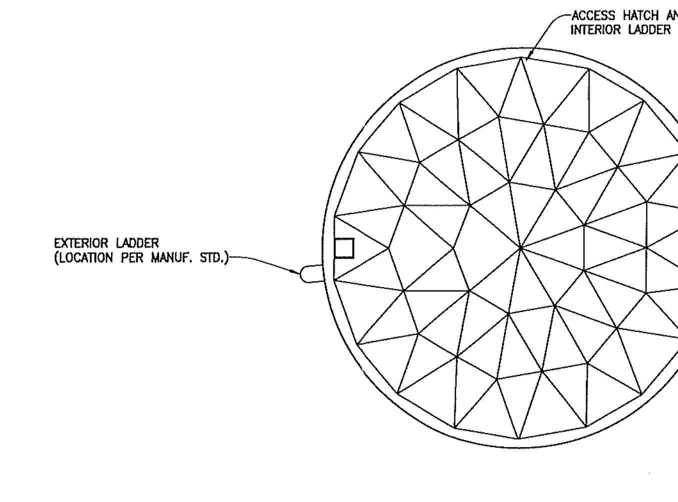
ANTENNA PEDESTAL
NOT TO SCALE



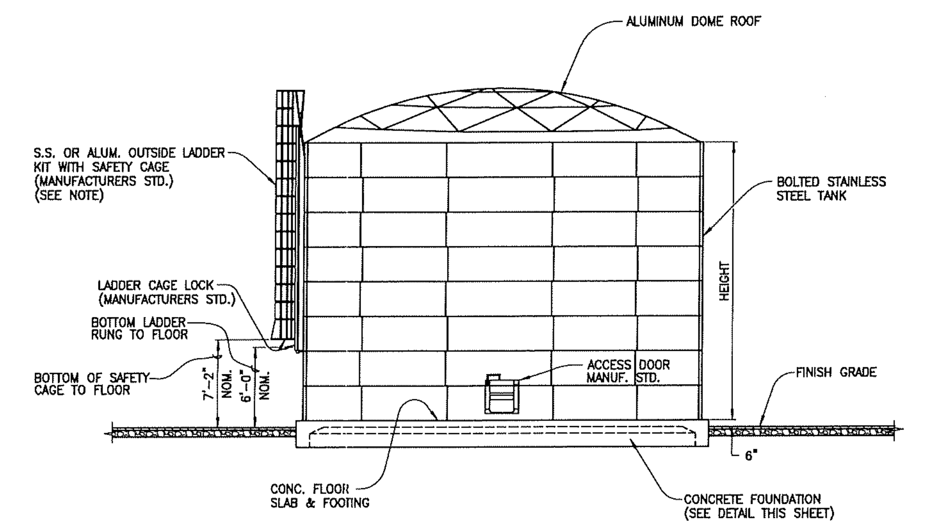
NOTES:

1. THIS DRAWING IS NOT TO SCALE
2. MANUFACTURER'S SHOP DRAWINGS FOR FLOOR FOOTING, INCLUDING ADDITIONAL STEEL REINFORCING AT FLOOR PENETRATION SHALL BE SUBMITTED FOR REVIEW AND APPROVAL, PRIOR TO ORDERING MATERIALS.
3. SIZE AND NUMBER OF ITEMS INDICATED * TO BE DETERMINED AND SUPPLIED BY THE TANK MANUFACTURER.
4. SEE MANUFACTURER'S SHOP DRAWINGS FOR REINFORCEMENT STEEL SCHEDULE.
5. ALL STEEL REINFORCEMENT SHALL BE ASTM A615 GRADE 60.
6. TANK AND ROOF COLORS TO BE DETERMINED BY DWS. CONTRACTOR TO SUBMIT COLOR CHOICES.

SECTION THROUGH FOOTING
NOT TO SCALE



ROOF PLAN
NOT TO SCALE

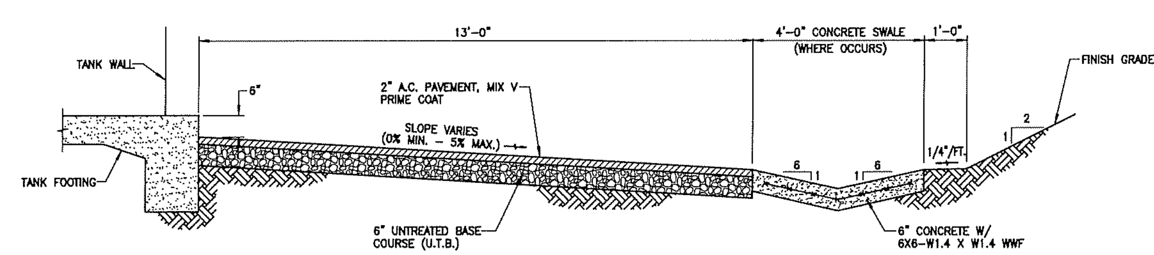


ELEVATION
NOT TO SCALE

NOTE:
ALL HANDRAILS, LADDERS, WALKWAYS DEVICES, ETC. SHALL BE REQUIRED TO COMPLY WITH OSHA FEDERAL AND STATE REGULATIONS. SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO ORDERING MATERIALS.

TANK	NOMINAL DIAMETER (ft.)	HEIGHT (ft.)	CAPACITY (gal.)
A	67	24	500,000

TYPICAL STAINLESS STEEL TANK CONFIGURATION



TYPICAL SECTION – TANK PERIMETER ROAD
SCALE: 1/2" = 1'-0"

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

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SIGNATURE | DATE

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LETTER	DESCRIPTION	DATE

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

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE TANK DETAILS – GENERAL CONFIGURATION AND FOUNDATION

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-8.01 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	AS NOTED		

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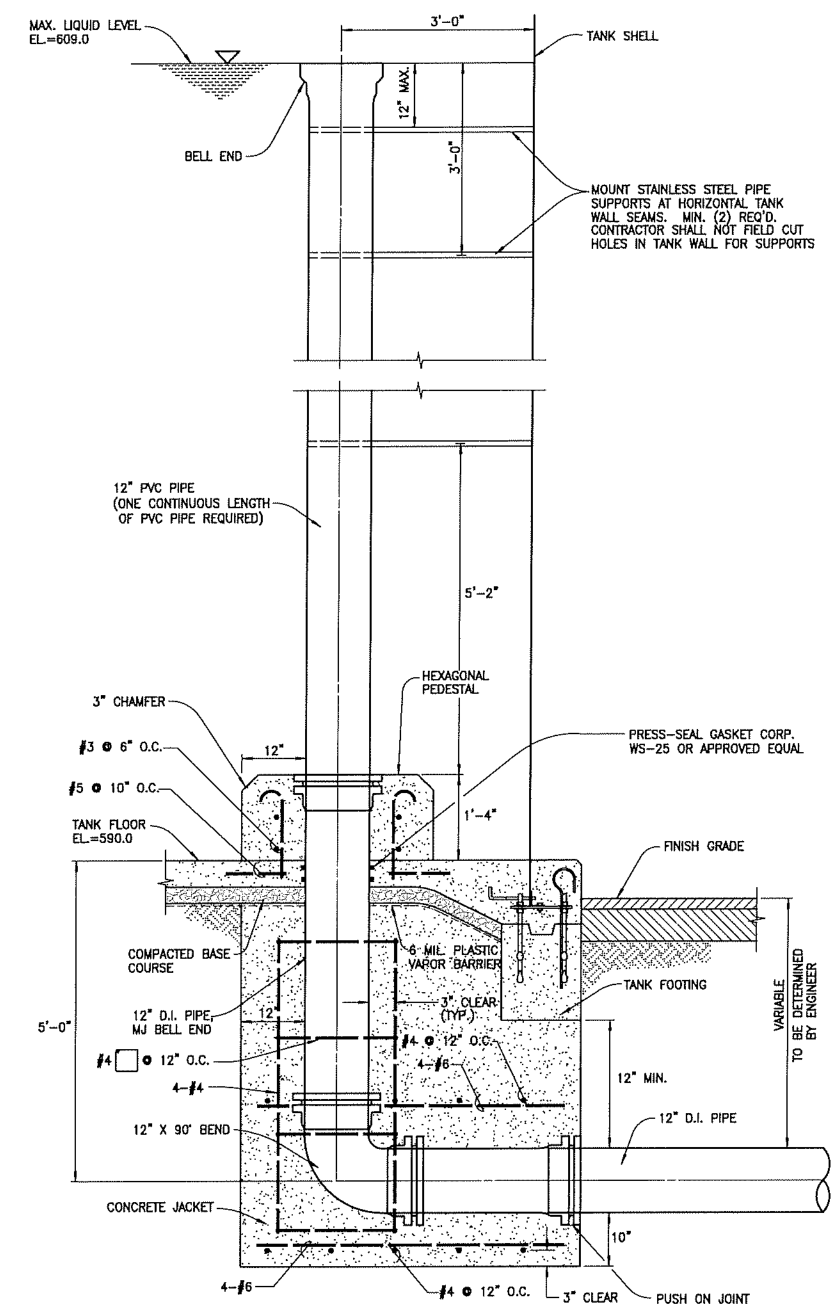
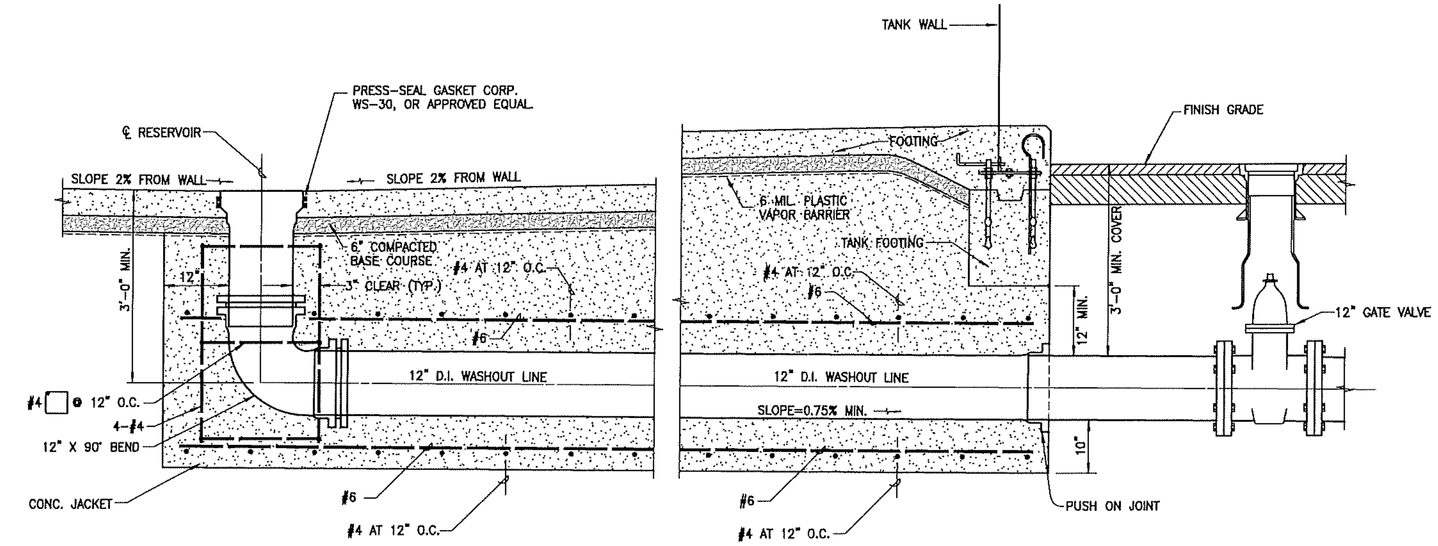


DETAIL – OVERFLOW LINE

NOT TO SCALE

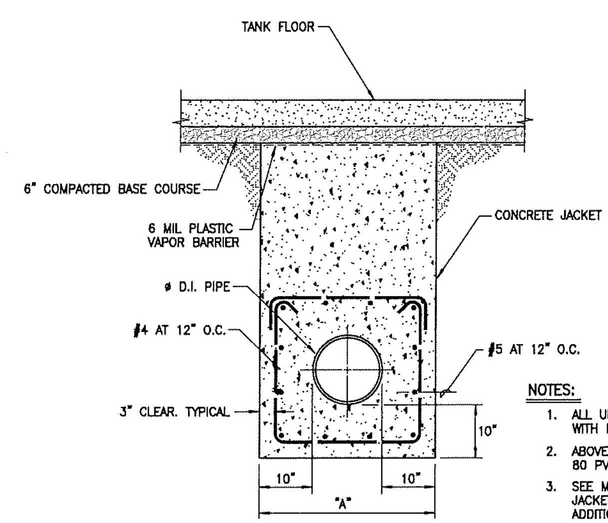


DETAIL – WASHOUT LINE

NOT TO SCALE

NOTES:

CONC. JACKET TO BE POURED TO BOTTOM OF FOOTING AND FLOOR SLAB UNLESS OTHERWISE NOTED.



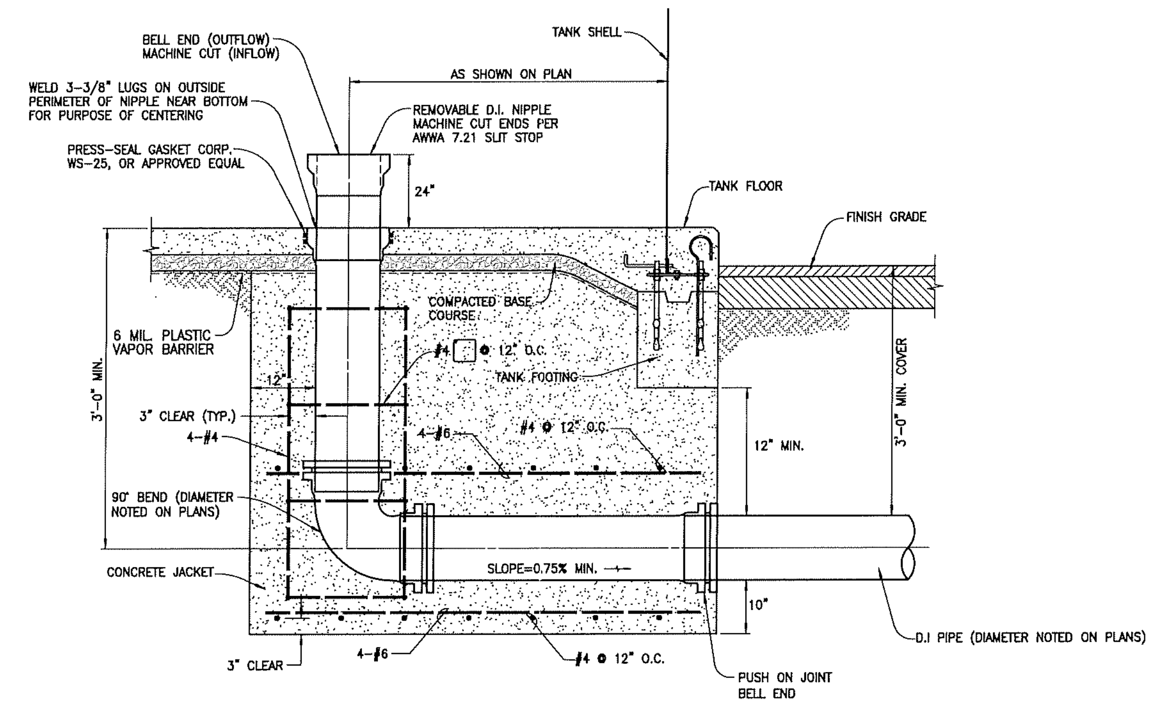
"A"	
PIPE SIZE	TRENCH WIDTH
12"	2'-9"±
16"	3'-1"±

NOTES:

1. ALL UNDERFLOOR PIPING IS DUCTILE IRON WITH MECHANICAL JOINTS.
2. ABOVE FLOOR OVERFLOW PIPE IS SCHEDULE 80 PVC
3. SEE MANUFACTURER'S SHOP DRAWING, CONCRETE JACKETED PIPING DETAILS FOR PIPE SIZES AND ADDITIONAL INFORMATION.

SECTION – CONCRETE JACKETED PIPE

NOT TO SCALE



DETAIL –INFLOW/OUTFLOW LINE

NOT TO SCALE

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

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2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06
TANK DETAILS – INFLOW, OUTFLOW, OVERFLOW AND WASHOUT LINES

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-8.02 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	AS NOTED		

LETTER	DESCRIPTION	DATE

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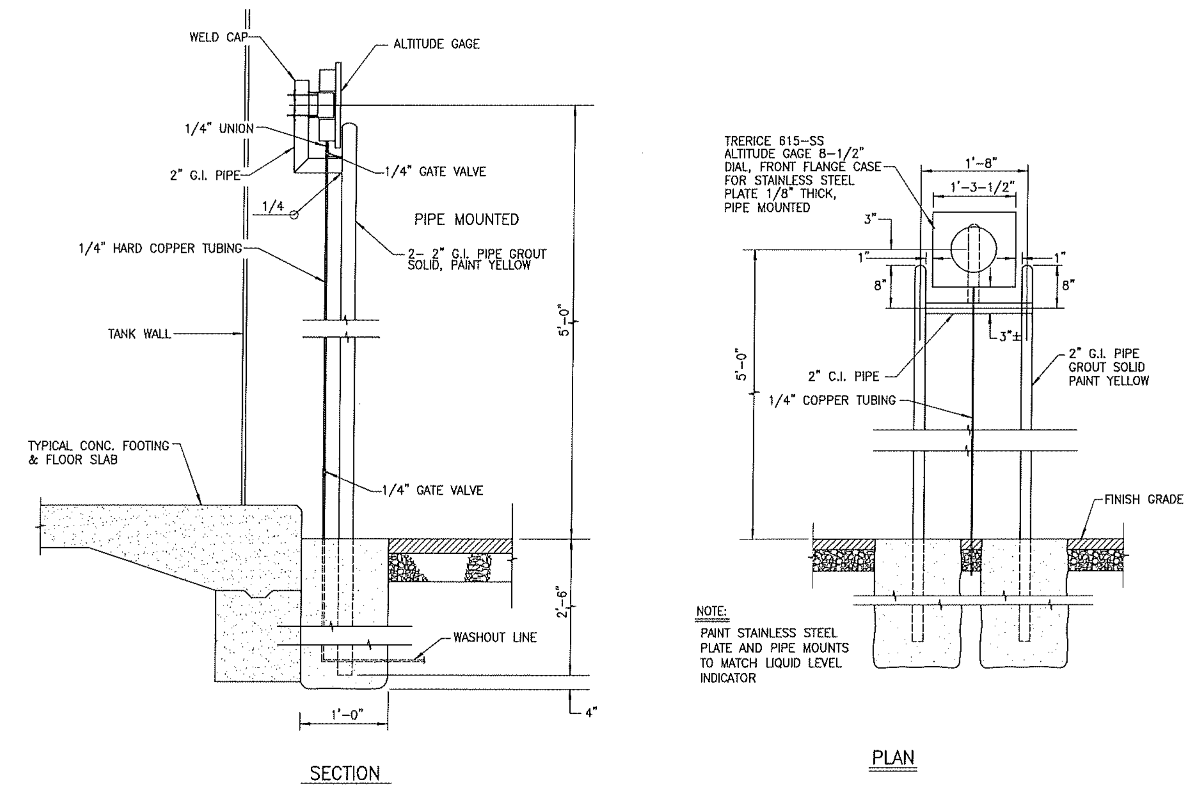
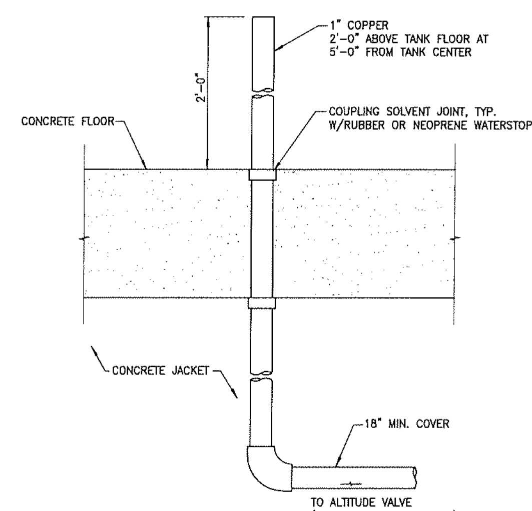


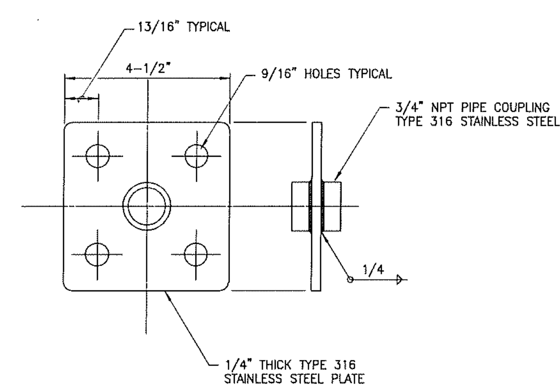
DETAIL – LIQUID LEVEL INDICATOR

SCALE: 3/4" = 1'-0"



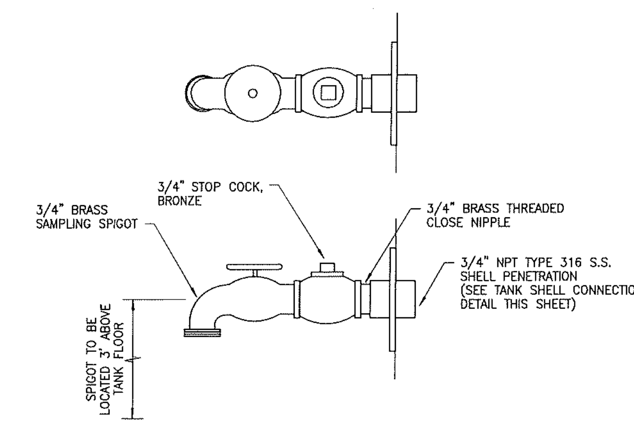
SENSING LINE DETAIL

NOT TO SCALE



TANK SHELL CONNECTION DETAIL

NOT TO SCALE



SAMPLING SPIGOT DETAIL

NOT TO SCALE

NOTES:

FIELD CUT SHELL PENETRATION AND MOUNT WITH 316 STAINLESS STEEL BOLTING HARDWARE

ALAN L. UNEMORI
LICENSED PROFESSIONAL ENGINEER
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2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE TANK DETAILS – LIQUID LEVEL INDICATOR, SAMPLING LINE

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-8.03 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	AS NOTED		

LETTER	DESCRIPTION	DATE

1. FABRIC

NO. 9 GAUGE (W.M.) COPPER BEARING STEEL WIRE WOVEN INTO A 2 INCH MESH, HOT-DIP GALVANIZED AFTER FABRICATION AND PVC COATED. STANDARD FINISH, TWISTED AND BARBED SELVAGE TOP AND BOTTOM. FABRIC HEIGHT 6 FEET.

2. POSTS

ALL POSTS SHALL BE FULL WEIGHT GALVANIZED STEEL
LINE POSTS: 2 INCH PIPE, 3.65 LBS. PER LINEAL FOOT.
GATE POSTS: WALK GATE, 2 1/2 INCH PIPE, 5.79 LBS. PER LINEAL FOOT.
DRIVE GATE, 3 1/2 INCH PIPE, 9.1 LBS. PER LINEAL FOOT.
CORNER POSTS: 2 1/2 INCH PIPE, 5.79 LBS. PER LINEAL FOOT
LINE POSTS SPACED NOT OVER 10 FEET APART, UNLESS OTHERWISE SPECIFIED.
FASTEN FABRIC TO POSTS WITH GALVANIZED STEEL WIRE, SPACED 12 INCHES APART.
CAP ALL POSTS AND PROVIDE WITH STEEL ARM INCLINED OUTWARD AT 45° ANGLE.
INCLINED ARMS SHALL HAVE TORQUES AS REQUIRED TO RECEIVE BARBED WIRE.
SET POSTS TRUE TO LINE AND GRADE AND EMBED IN CONCRETE FOOTINGS AS SHOWN ON THIS DRAWING. TOP OF ALL FOOTINGS SHALL BE TROWELLED SMOOTH AND SLOPED TO SHED WATER. FORM TOP 6 INCHES OF FOOTINGS:
CONCRETE SHALL BE CLASS "B", D.W.S. 2500 CONCRETE.
FENCE POST FOOTING DEPTH SHALL BE MEASURED FROM EXISTING GRADE.
MAINTAIN 18" MINIMUM CLEARANCE BETWEEN FENCE POST FOOTING AND ALL UTILITIES.

3. TOP RAILS

TOP RAILS: 1.66" O.D. PIPE, 2.27 LBS. PER LINEAL FOOT. FASTEN FABRIC TO RAIL WITH GALVANIZED STEEL WIRE NO. 9 GAUGE SPACED 24 INCHES APART, EXCEPT AS SHOWN ON THIS DRAWING.

4. BRACING

BRACES: 1.66" O.D. PIPE, 2.27 LBS. PER LINEAL FOOT. INSTALL HORIZONTAL BRACES AT ALL GATES AND CORNER POSTS, EACH BRACE TO BE DIAGONALLY TRUSSED USING A 3/8 INCH ROUND ROD WITH SUITABLE TRUSS TIGHTNER AND NECESSARY FITTING FASTEN FABRIC TO BRACES WITH GALVANIZED STEEL WIRE SPACED 24 INCHES APART.

5. GATES

PROVIDE GATES AS SHOWN ON DRAWING WITH SUITABLE BACKSTOPS FOR HOLDING THE GATE IN OPEN POSITION.
FRAMES: 1.90" O.D. PIPE, 2.72 LBS. PER LINEAL FOOT, JOINED BY HEAVY MALLEABLE OR PRESSED STEEL FITTINGS, RIGIDLY TRUSSED AND BRACED TO PREVENT SAG.
FRAMES MAY BE WELDED. WHERE WELDING IS DONE, TOUCH UP JOINT AREA WITH "GALIVICON" OR EQUAL APPLIED IN ACCORDANCE WITH MANUFACTURER'S DIRECTIONS.
PROVIDE BARBED WIRE SUPPORT ARMS ON TOP OF FRAME
GATE HINGES TO PERMIT GATE TO SWING OUT FROM ENCLOSURE 180° AND SHALL BE OF CYCLONE HEAVY DUTY DOUBLE CLAMPING OFFSET TYPE OR EQUAL. PROVIDE GATE WITH KEEPER WHICH WILL AUTOMATICALLY ENGAGE A GATE SHOE SET IN CONCRETE TO HOLD GATE IN CLOSED POSITION.
GATE TO BE FURNISHED WITH LOCK KEEPER AND GUIDE FOR PADLOCKS. PADLOCKS SHALL BE NEW BWS H SERIES LOCKS OBTAINED FROM KIHEI SAFE & LOCKSMITH.

6. BARBED WIRE

PROVIDE THREE STRANDS OF DOUBLE TWISTED 4-POINT THICK-SET BARB WIRE, WITH BARBS SPACED 4 INCHES APART, STRUNG ALONG TOP OF FENCE AND GATE SECURELY ATTACHED TO STEEL ARMS.
BARBED WIRE: 12 1/2 GAUGE GALVANIZED STEEL WIRE

7. SELVAGE WIRE

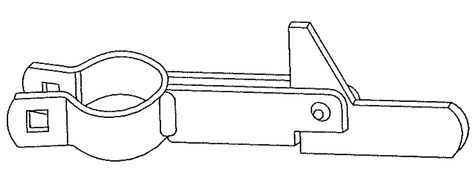
PROVIDE NO. 8 GAUGE (W.M.) WIRE WOVEN ALONG BOTTOM OF FENCE.

8. GALVANIZING

ALL PARTS OF FENCE AND GATE ABOVE AND BELOW GROUND: HEAVILY GALVANIZED BY HOT-DIP PROCESS.

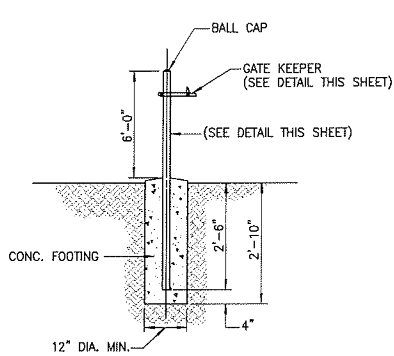
9. LOCKS

CONTRACTOR SHALL FURNISH LOCKS, OBTAINED FROM KIHEI LOCK AND SAFE, APPROVED BY D.W.S. AND KEYED, TO D.W.S.



DETAIL – GATE KEEPER

NOT TO SCALE

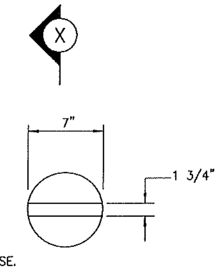


GATE KEEPER POST DETAIL

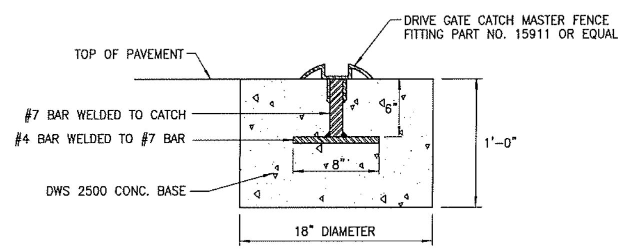
SCALE: 1/2"=1'- 0"

NOTES:

1. PROVIDE 2 GATE STOPS, SIMILAR IN CONSTRUCTION AS GATE CATCH FOR DRIVE GATES WHEN FULLY OPEN.
2. ALL MATERALS SHALL BE HOT-DIPPED GALVANIZED UNLESS SPCIFIED, OTHERWISE.



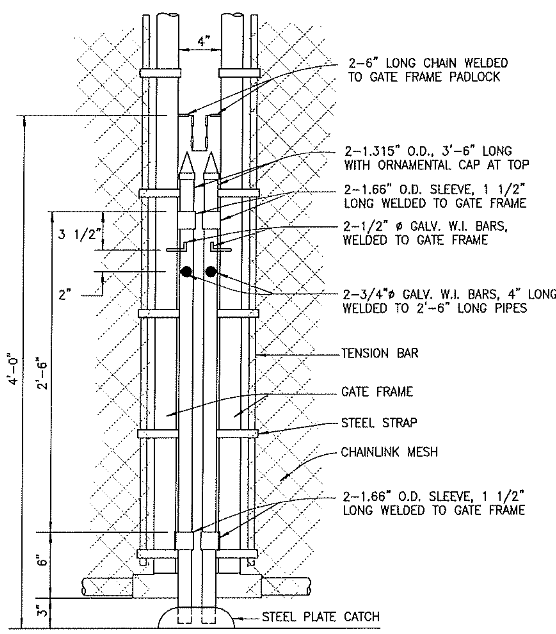
PLAN



SECTION X

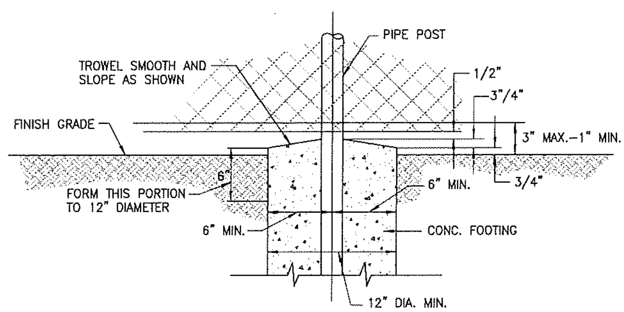
GATE CATCH DETAIL

SCALE: 1 1/2" = 1' – 0"



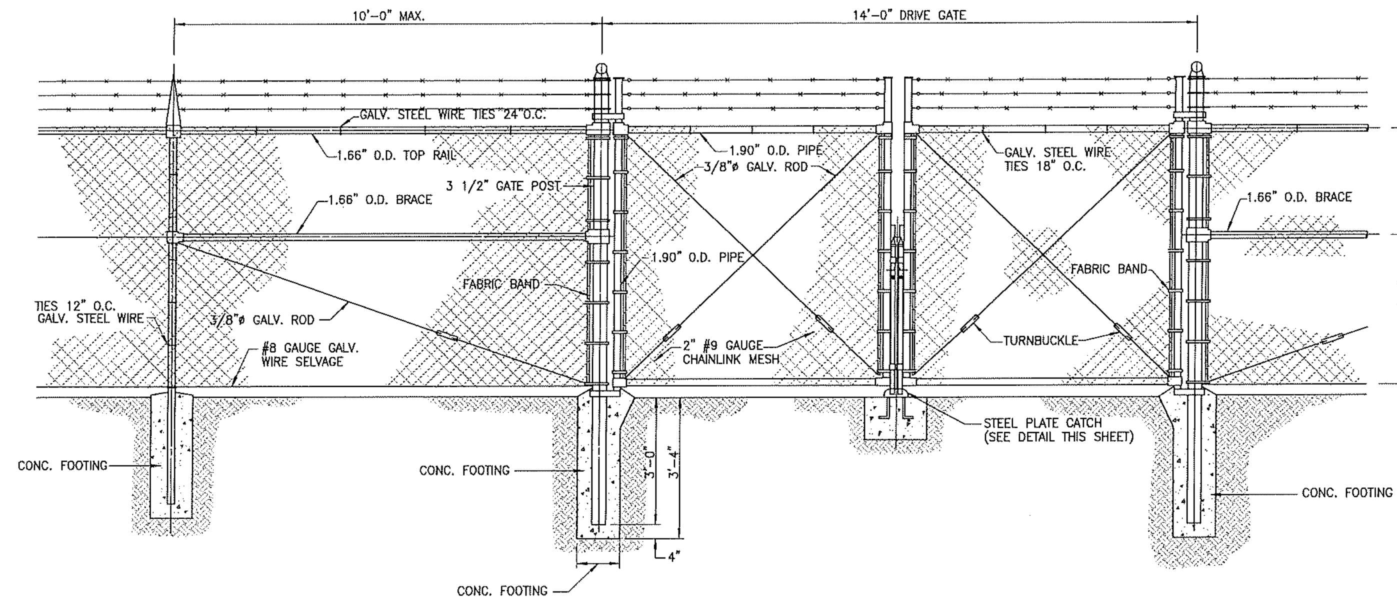
DETAIL AT GATE CATCH

SCALE: 1 1/2" = 1' – 0"



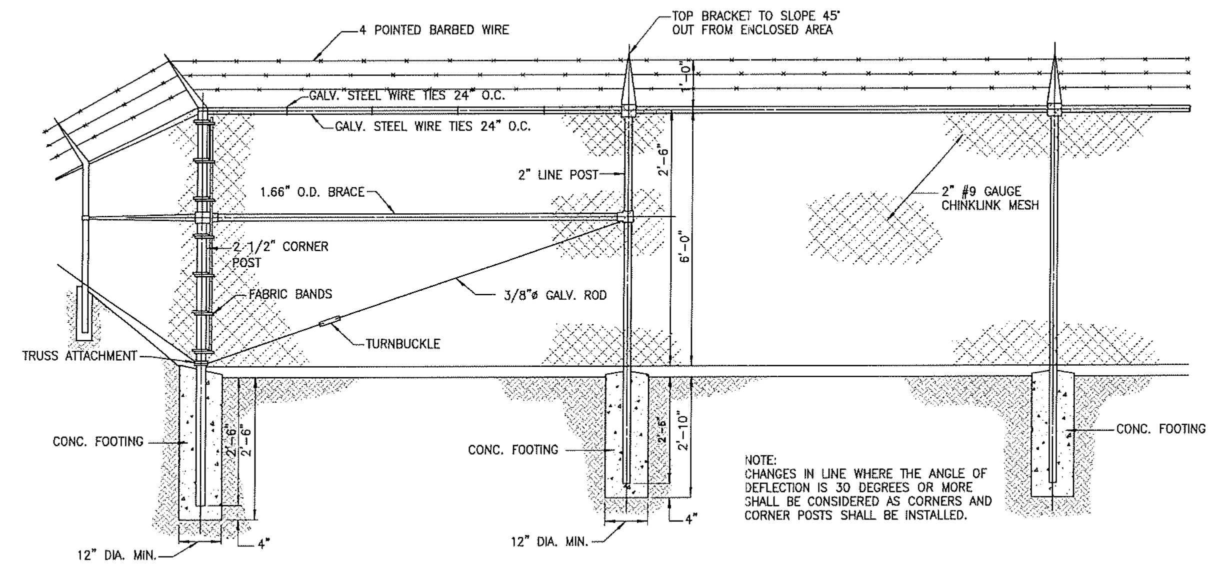
TOP OF FOOTING DETAIL

SCALE: 1 1/2" = 1' – 0"



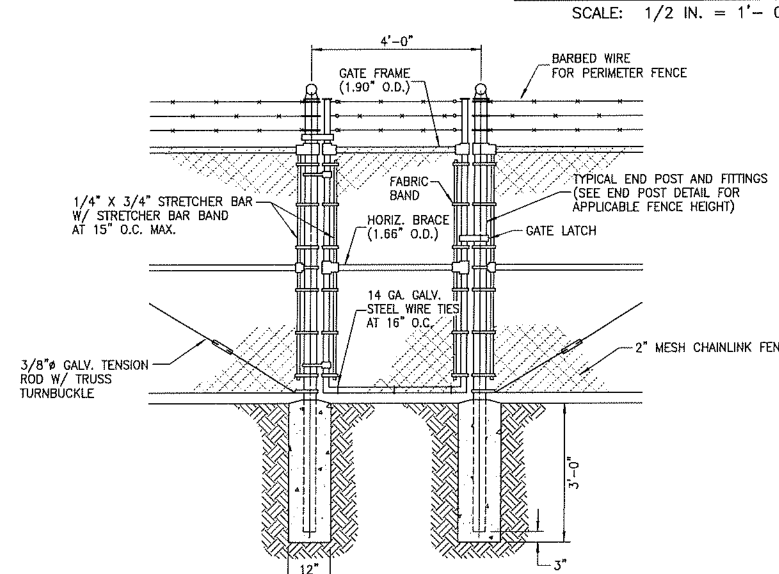
DRIVE GATE DETAIL

SCALE: 1/2"=1'- 0"



BRACE & CORNER POST DETAIL

SCALE: 1/2 IN. = 1'- 0"



TYPICAL PERSONNEL GATE

SCALE: 1/2" = 1' – 0"

LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

SIGNATURE DATE

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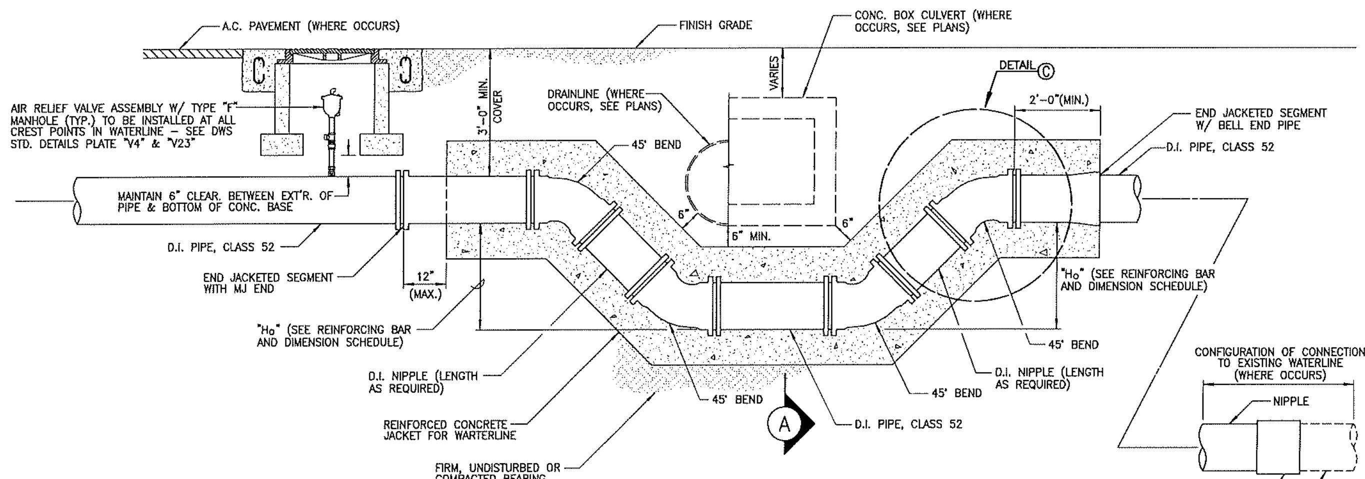
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE SECURITY FENCE AND GATE DETAILS

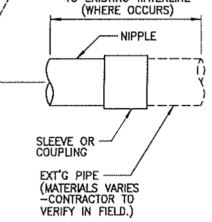
ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-9.01 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	AS NOTED		

V:\Projdata\11proj\11025 - DWS Mahinahina Well\dwg\conplans\det-fence-00.dwg



ELEVATION

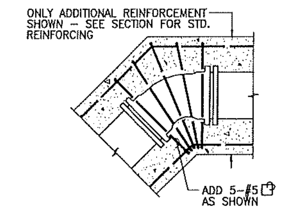
SCALE: 1/2" = 1'-0"



NOTES:

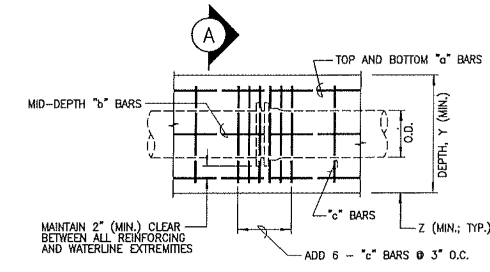
1. CONTRACTOR SHALL CONFIRM LOCATION, DEPTH & TYPE OF ANY EXISTING UTILITIES CROSSINGS PRIOR TO COMMENCEMENT OF OFFSET WORK. IN THE EVENT ANY DISCREPANCIES OCCUR, THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY, OTHERWISE ANY CORRECTIVE WORK REQUIRED SHALL BE PERFORMED SOLELY AT THE CONTRACTORS EXPENSE.
2. FOR CONNECTIONS TO EXISTING A.C. (ASBESTOS-CEMENT) PIPE THE DEPARTMENT OF WATER SUPPLY PROHIBITS CUTTING OF THE A.C. PIPE. CONTRACTOR SHALL REMOVE ONE (1) COMPLETE SECTION OF A.C. PIPE AT EACH CONNECTION TO THE EXISTING A.C. WATERLINE AND REPLACE SAME WITH EQUIVALENT DIAMETER DUCTILE IRON PIPE (CLASS 52).
3. WHEREVER CONSTRUCTION JOINTS ARE REQUIRED 6" RUBBER OR NEOPRENE WATERSTOPS SHALL BE INSTALLED. WATERSTOP SHALL BE OF THE TYPE SPECIFIED AND MANUFACTURED BY THE KIRKHILL COMPANY, OR APPROVED EQUAL.
4. SEE REINFORCING BAR & DIMENSION SCHEDULE FOR REINFORCING AND DIMENSIONS.
5. ALL INTERIOR JOINTS AND FITTINGS SHALL BE "MJ".

CONCRETE: f_c' = 4,000 psi
REINFORCEMENT: ASTM A615 GRADE 60



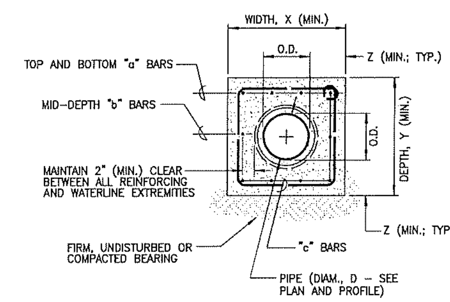
DETAIL - ADDITIONAL REINFORCEMENT AT BENDS (C)

SCALE: 1/2" = 1'-0"



DETAIL - CONCRETE JACKET AT INTERIOR JOINTS (B)

SCALE: 1/2" = 1'-0"



SECTION (A)

SCALE: 1/2" = 1'-0"

DETAIL - REINF. CONC. WATERLINE JACKET FOR VERTICAL OFFSETS

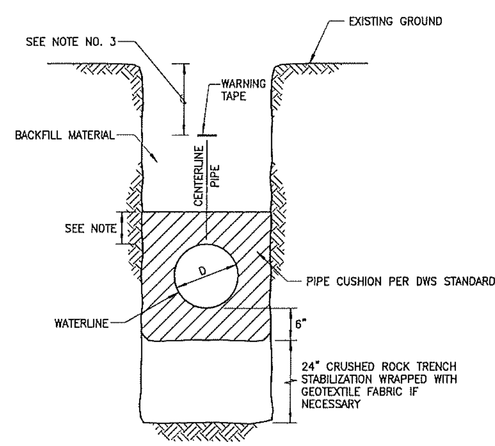
SCALE: 1/2" = 1'-0"

NOTES:

1. CONCRETE: f'_c = 4,000 P.S.I. (MIN.)
2. STEEL REINFORCEMENT: f_y = 60 K.S.I. (ASTM A615 GRADE 60)
3. HYDRAULIC DESIGN PRESSURE: 250 P.S.I.
4. CONTRACTOR SHALL SUBMIT CERTIFICATION OF COMPLIANCE WITH ABOVE CRITERIA FOR CONCRETE AND STEEL REINFORCEMENT WITHIN TWO (2) WORKING DAYS AFTER FABRICATION OF STRUCTURE.
5. FOR PRE-CAST APPLICATIONS, CONTRACTOR SHALL SUBMIT STRUCTURALLY- STAMPED SHOP DRAWINGS DETAILING LIFTING CONFIGURATION AND INTEGRAL LIFTING HARDWARE AT LEAST TEN (10) WORKING DAYS PRIOR TO FABRICATION OF STRUCTURE.
6. FOR CAST-IN-PLACE APPLICATIONS, WHERE HYDRAULIC PRESSURE IS EXPECTED PRIOR TO AT LEAST FOURTEEN (14) DAYS AFTER PLACEMENT OF CONCRETE, CONTRACTOR SHALL PROVIDE TEMPORARY THRUST RESTRAINTS OR RESTRAINED JOINTS (MEGALUG OR APPROVED EQUAL), AS REQUIRED, AND SHALL SUBMIT STRUCTURALLY-STAMPED SHOP DRAWINGS DETAILING SAME AT LEAST TEN (10) WORKING DAYS PRIOR TO FABRICATION OF STRUCTURE.
7. CONCRETE JACKETING OF A.C. OR P.V.C. PIPE SHALL NOT BE ALLOWED.
8. ALL INTERIOR JOINTS AND FITTINGS SHALL BE "MJ".

REINFORCING BAR & DIMENSION SCHEDULE

DIAMETER	H_o (MAX.)	X	Y	Z	TOP & BOTTOM "a" BARS	"b" BARS	"c" BARS
12"	4'-0"	2'-9"	2'-9"	10"	4-#6 T&B	2-#6	#5 @ 12" O.C.
12"	5'-0"	2'-9"	2'-9"	10"	2-#6 T&B AND 2-#7 T&B	2-#7	#5 @ 12" O.C.
12"	6'-0"	3'-0"	3'-0"	1'-0"	2-#6 T&B AND 2-#7 T&B	2-#7	#5 @ 12" O.C.
12"	7'-0"	3'-0"	3'-0"	1'-0"	4-#7 T&B	2-#7	#5 @ 12" O.C.
12"	8'-0"	3'-0"	3'-0"	1'-0"	5-#7 T&B	2-#7	#5 @ 12" O.C.



NOTES:

1. 12" OF CUSHION MATERIAL FOR PIPES 16" OR LARGER. 6" CUSHION MATERIAL FOR PIPES 12" OR SMALLER AT LOCATIONS WHERE INVERT IS ABOVE 4-FOOT ELEVATION.
2. 12" OF CUSHION MATERIAL FOR ALL PIPE SIZES AT LOCATIONS WHERE THE INVERT IS AT OR BELOW THE 4-FOOT ELEVATION.
3. WARNING TAPE SHALL BE INSTALLED OVER THE CENTERLINE OF PIPES, BENDS, AND FITTINGS AT DEPTH OF 12" BELOW THE FINISHED GRADE OR DIRECTLY BELOW THE PAVEMENT STRUCTURE.
4. WHEN TRENCHING ACROSS EXISTING SIDEWAK, CONTRACTOR SHALL SAW CUT AT EXISTING SCORELINES AND REMOVE ALL SIDEWALK PANELS AFFECTED BY TRENCH.
5. EXCAVATED MATERIAL SHALL BE PLACED ON THE UPSTREAM SIDE OF TRENCH.

TYPICAL WATERLINE TRENCH SECTION

NOT TO SCALE

LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

SIGNATURE DATE

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"

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

MAHINAHINA WELL DEVELOPMENT (WEST MAUI WELL NO. 1)

DWS JOB NO. 11-06

TITLE WATER SYSTEM DETAILS

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-10.01 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	AS NOTED		

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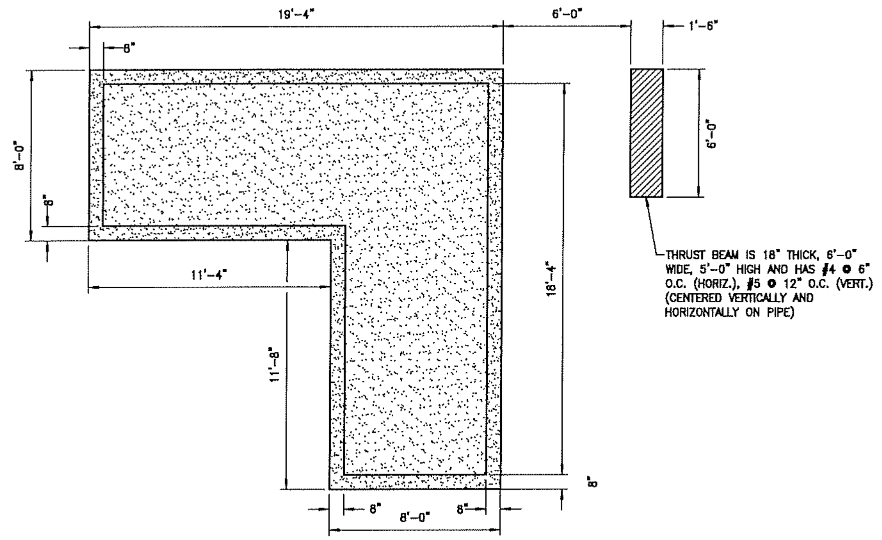
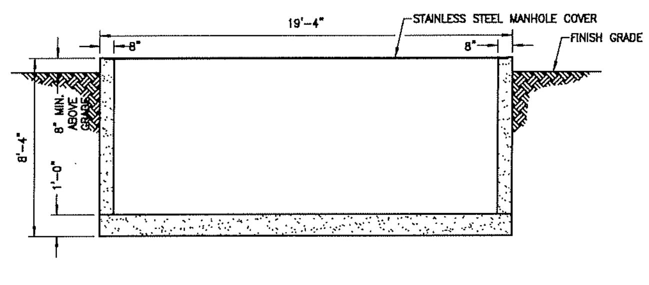
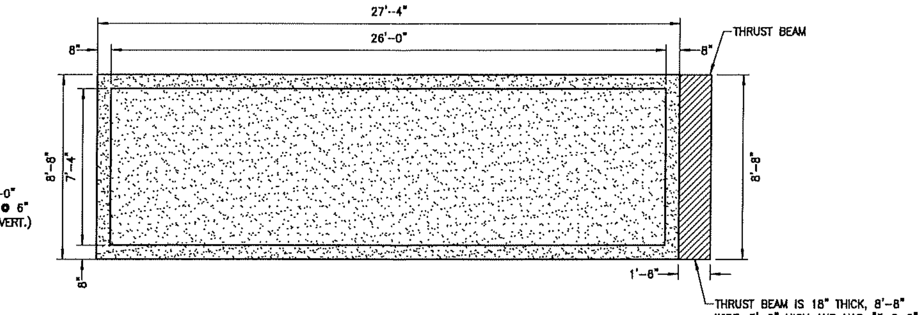


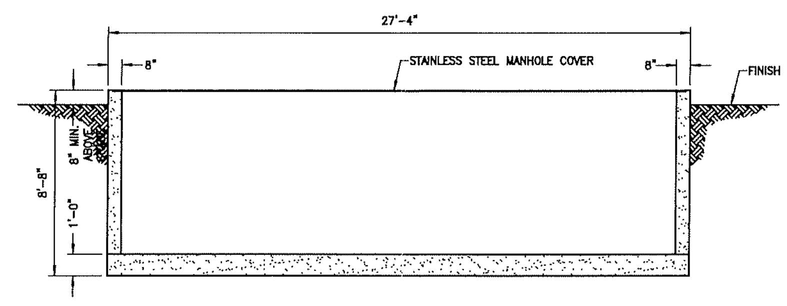
12" CONTROL VALVE NO. 3 VAULT PLAN
SCALE: 1/4" = 1'-0"



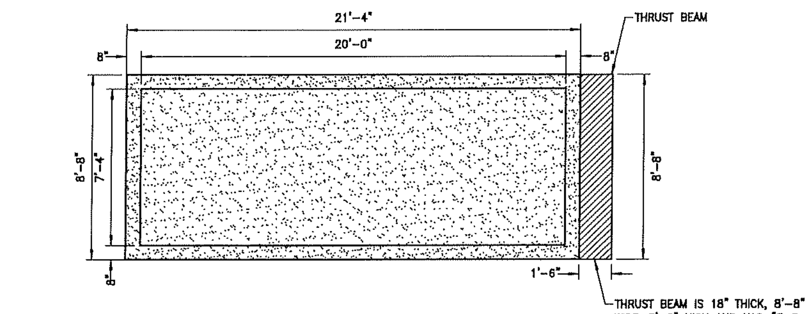
12" CONTROL VALVE NO. 3 VAULT ELEVATION
SCALE: 1/4" = 1'-0"



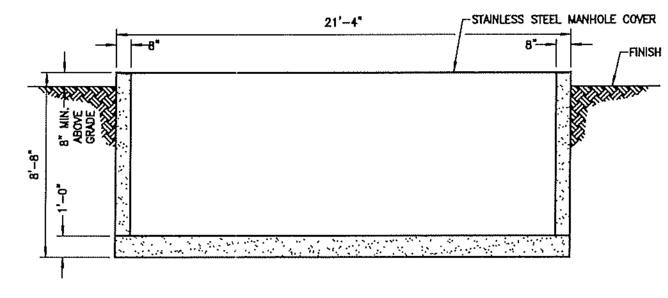
16" OUTLET CONTROL VALVE VAULT PLAN
SCALE: 1/4" = 1'-0"



16" OUTLET CONTROL VALVE VAULT ELEVATION
SCALE: 1/4" = 1'-0"



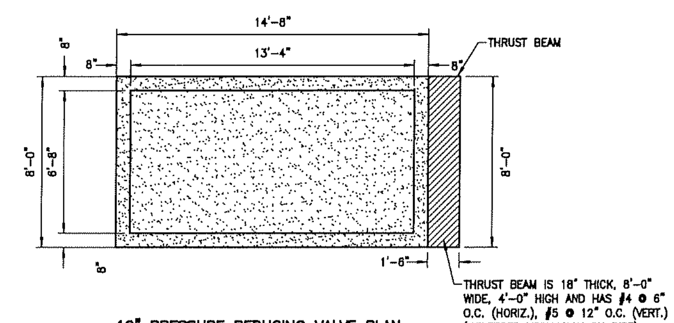
16" CONTROL VALVE NO. 2 VAULT PLAN
SCALE: 1/4" = 1'-0"



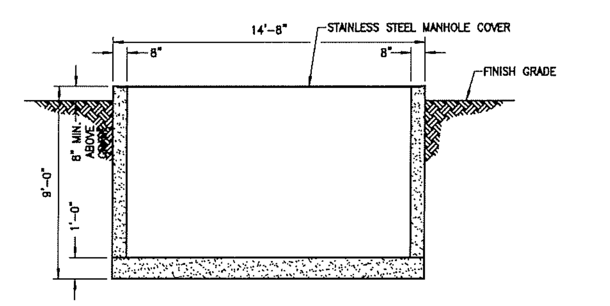
16" CONTROL VALVE NO. 2 VAULT ELEVATION
SCALE: 1/4" = 1'-0"

NOTES:

1. STAINLESS STEEL COVER SHALL CONFORM TO DWS STD. DETAIL M11.
2. THRUST BEAM SHALL CONFORM TO DWS STD. DETAIL B16 & B17.
3. REACTION BLOCKS SHALL CONFORM TO DWS STD. DETAILS B2, B3, & B4.
4. ALL VALVE MANHOLE AND CONCRETE SLABS SHALL BE COMPLETELY CURED AND BACKFILLED BEFORE BEING SUBJECT TO TEST OF SYSTEM PRESSURES.
5. ALL EXPOSED METAL PIPES, FITTINGS, AND SUPPORTS SHALL BE THOROUGHLY CLEANED, PRIMED, AND PAINTED (2 COATS) OF POLYURETHANE PAINT (COLORS TO BE SELECTED BY DWS)
6. PROVIDE DIELECTRIC UNIONS OR COUPLINGS WHEREVER DISSIMILAR METALS ARE IN CONTACT WITH EACH OTHER.
7. PROVIDE ALL STAINLESS STEEL PIPE, FITTINGS, SUPPORTS, AND ATTACHMENTS WHEN NOT OTHERWISED INDICATED.



12" PRESSURE REDUCING VALVE PLAN
SCALE: 1/4" = 1'-0"



12" PRESSURE REDUCING VALVE ELEVATION
SCALE: 1/4" = 1'-0"

NOTES:

1. SEE CIVIL SITE PLAN FOR LOCATION AND ORIENTATION OF ALL CONTROL VALVES.
2. ALL PIPES, VALVES, FITTINGS AND APPURTENANCES SHALL BE RATED FOR A WORKING PRESSURE OF 350 PSI. PROVIDE SPECIAL GASKETS AND ALL NECESSARY STAINLESS STEEL NUTS AND BOLTS.
3. ALL EXPOSE PIPES, FITTINGS AND METAL SURFACES SHALL BE CLEANED, PRIMED AND PAINTED WITH CORROSION RESISTANT POLY EURETANE PAOINT. COLORS SELECTED BY DWS.
4. SEE CIVIL PLANTS FOR STRUCTURAL REQUIREMENTS FOR ALL VALVES MANHOLES.

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

License Expires April 30, 2020

SIGNATURE DATE

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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE VALVE VAULT GEOMETRY

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-10.02
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	SHEET
SCALE	AS NOTED		OF SHEETS

LETTER	DESCRIPTION	DATE

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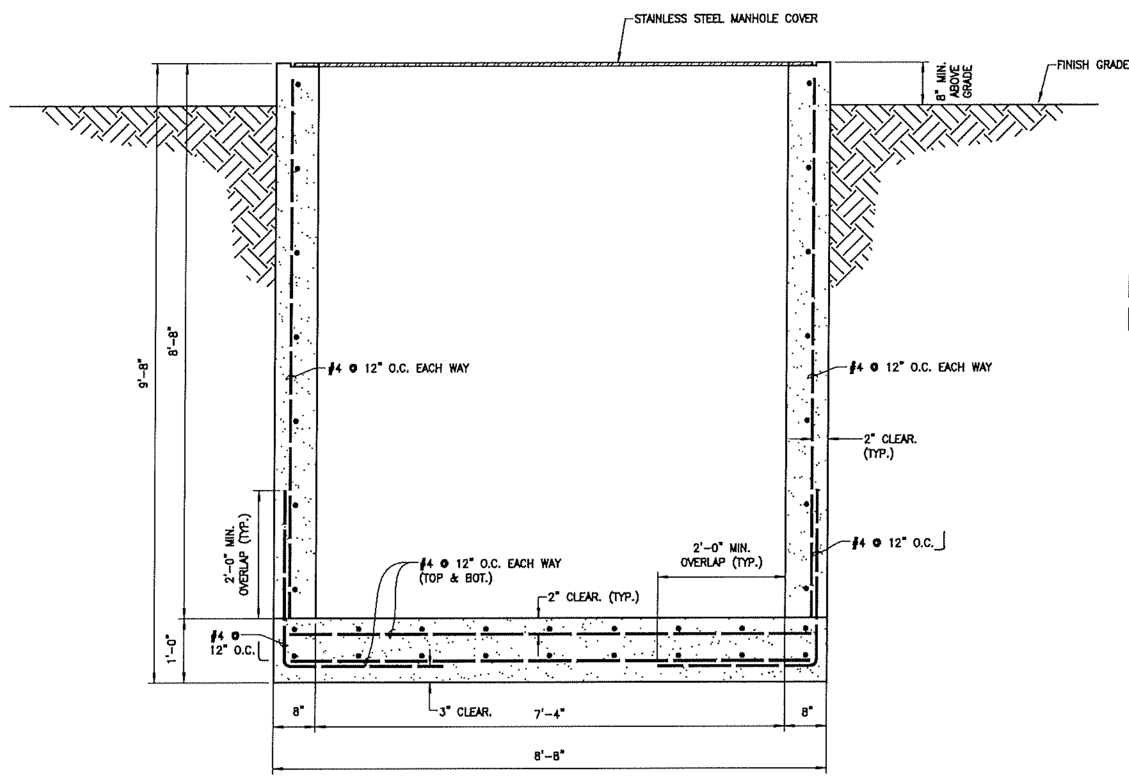
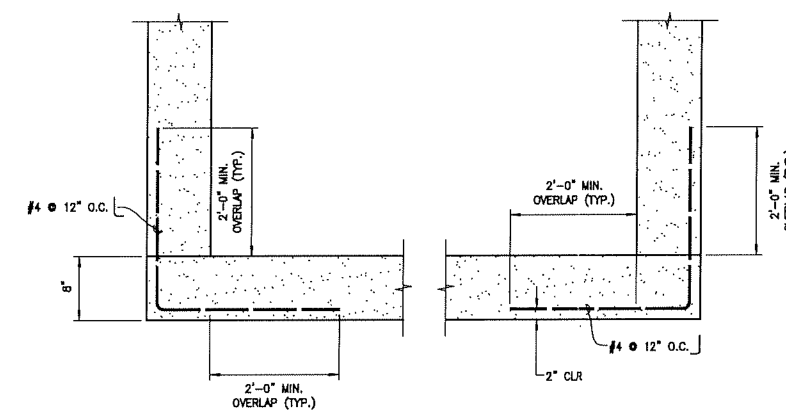


16" CONTROL VALVE NO. 2 VAULT REINF.
SCALE: 3/4" = 1'-0"

CONCRETE: f'c = 4 ksi
REINFORCEMENT: ASTM A615 GRADE 60

NOTE:

REINF. IDENTICAL FOR ALL VAULTS
(1) 16" OUTLET CONTROL VALVE VAULT
(2) 16" CONTROL VALVE NO. 2 VAULT
(3) 12" CONTROL VALVE NO. 3 VAULT
(4) 12" PRESSURE REDUCING VALVE VAULT



NOTE:

HORIZONTAL AND VERTICAL WALL REINF. NOT SHOWN FOR CLARITY

TYPICAL HORIZONTAL REINF. AT CORNERS
NOT TO SCALE

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LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

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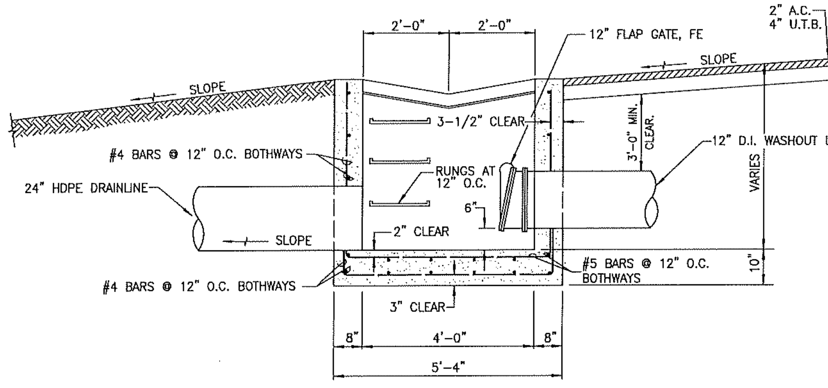
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

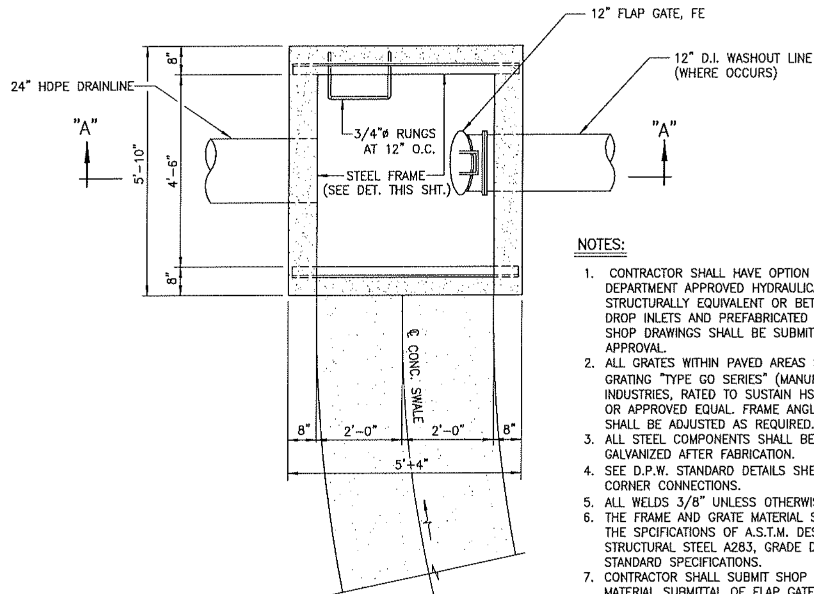
TITLE CONTROL VALVE AND PRV VAULT REINFORCEMENT

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-10.03 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	AS NOTED		



SECTION "A"-"A"

SCALE: 1/2" = 1'-0"



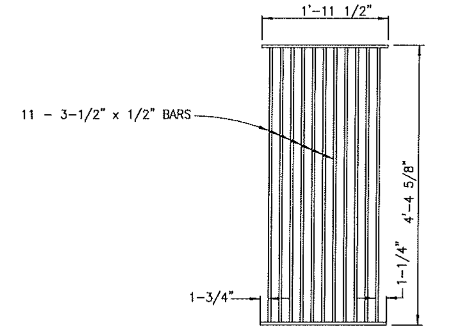
PLAN

NOTES:

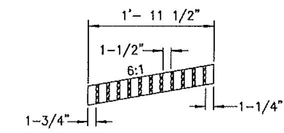
1. CONTRACTOR SHALL HAVE OPTION TO SUBSTITUTE DEPARTMENT APPROVED HYDRAULICALLY AND STRUCTURALLY EQUIVALENT OR BETTER CATCH BASIN DROP INLETS AND PREFABRICATED GRATE ASSEMBLIES. SHOP DRAWINGS SHALL BE SUBMITTED FOR APPROVAL.
2. ALL GRATES WITHIN PAVED AREAS SHALL BE GARY GRATING "TYPE GO SERIES" (MANUFACTURED BY IKG INDUSTRIES, RATED TO SUSTAIN HS20-44 LOADING, OR APPROVED EQUAL. FRAME ANGLE LEG DIMENSIONS SHALL BE ADJUSTED AS REQUIRED.
3. ALL STEEL COMPONENTS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
4. SEE D.P.W. STANDARD DETAILS SHEET "D-44" FOR CORNER CONNECTIONS.
5. ALL WELDS 3/8" UNLESS OTHERWISE NOTED.
6. THE FRAME AND GRATE MATERIAL SHALL CONFORM TO THE SPCIFICATIONS OF A.S.T.M. DESIGNATION STRUCTURAL STEEL A283, GRADE D AND THE STANDARD SPECIFICATIONS.
7. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND MATERIAL SUBMITTAL OF FLAP GATE INSTALLATION TO DEPARTMENT FOR APPROVAL PRIOR TO ORDERING MATERIALS.

DETAILS – GRATED INLET CATCH BASIN AT CONTROL TANK SITE

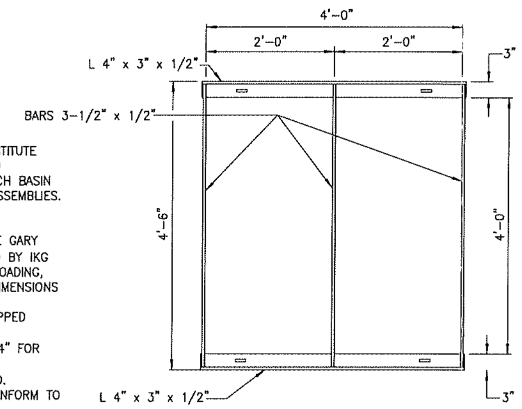
SCALE: 1/2" = 1'-0"



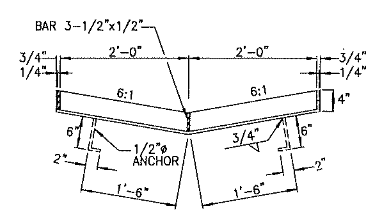
PLAN



SECTION



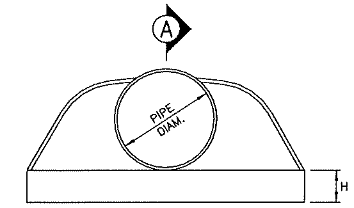
PLAN



SECTION

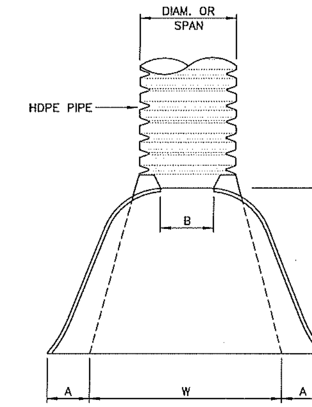
DETAILS – TYPE "L" GRATE & FRAME

SCALE: 3/4" = 1'-0"

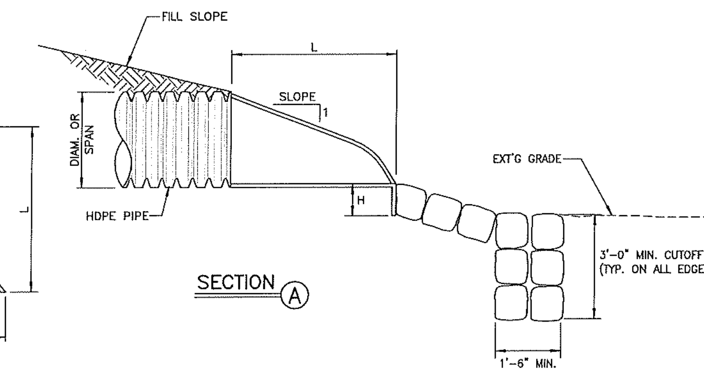


PIPE – ELEVATION

PIPE DIA. (INCHES)	A TOL. ± 1"	B MAX.	H TOL. ± 1"	L TOL. ± 1 1/2"	W TOL. ± 2"
24	9	13	6	41	72



PLAN – PIPE



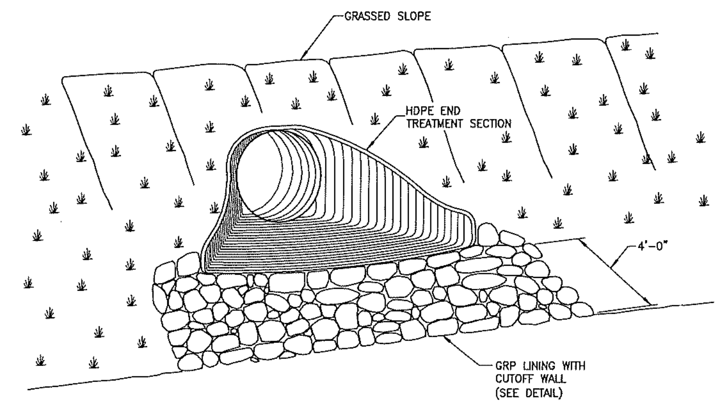
SECTION (A)

NOTE:

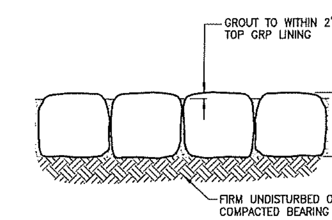
PE THREADED ROD WITH WING NUTS PROVIDED FOR END SECTIONS 12'-24". 30" AND 36" END SECTIONS REQUIRE TWO (20) THREADED RODS FOR ASSEMBLE.

HDPE END SECTION

SCALE: 3/4" = 1'-0"

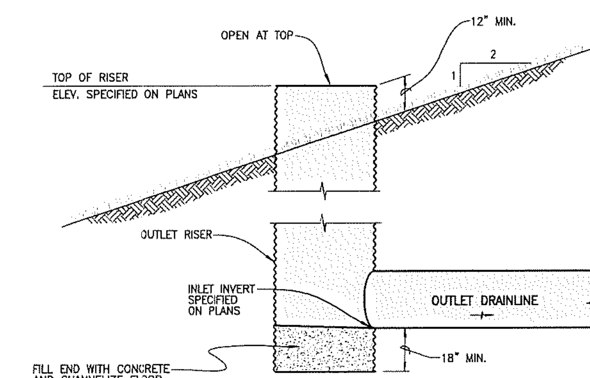


DETAIL – HDPE END SECTIONS



DETAIL – GRP LINING

NOT TO SCALE



BASIN OVERFLOW RISER DETAIL

NOT TO SCALE

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NO. 9354-C
HAWAII, U.S.A.

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SIGNATURE | DATE

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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE DRAINAGE DETAILS

DESIGNED BY	CHECKED BY	JOB NUMBER	SHEET
ALU	DTU/DTO	11025	C-11.01
DRAWN BY KAO	APPROVED BY ALU	DATE June 29, 2018	OF SHEETS
SCALE	AS NOTED		

LETTER	DESCRIPTION	DATE

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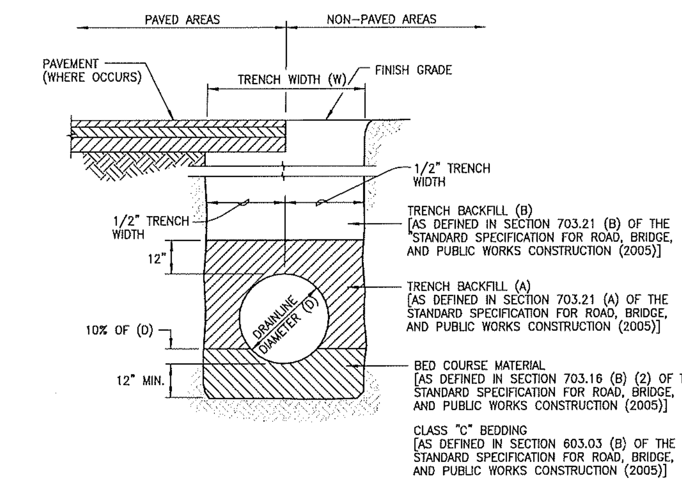

TYPICAL TRENCH SECTION FOR DRAINLINE

NOT TO SCALE

NOTES:

1. TRENCH BACKFILL AND BED COURSE MATERIAL SHALL CONFORM TO SECTION 703 "AGGREGATES" OF THE "STANDARD SPECIFICATION FOR ROAD, BRIDGE, AND PUBLIC WORKS CONSTRUCTION (2005)".
2. INSTALLATION OF CULVERTS SHALL CONFORM TO SECTION 603, "CULVERTS AND STORM DRAINS" OF THE "STANDARD SPECIFICATION FOR ROAD, BRIDGE, AND PUBLIC WORKS CONSTRUCTION (2005)".
3. TRENCH WIDTHS SHALL CONFORM TO TABLE 625.03-1 OF THE "STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND PUBLIC WORKS CONSTRUCTION (2005)".
4. LOADS IMPOSED BY CONSTRUCTION VEHICLES WITH AXLE LOADS IN EXCESS OF THE AASHTO HS-20-44 VEHICLE (32,000 LBS./AXLE) SHOULD BE MINIMIZED BY DESIGNATED CONSTRUCTION VEHICLE CROSSINGS. ADDITIONAL FILL SHOULD BE PLACED OVER THE DRAIN LINES AT THE DESIGNATED CONSTRUCTION VEHICLE CROSSINGS IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, OR STRUTTING TO SUPPORT THE PIPE SHOULD BE PLACED IN ACCORDANCE WITH THE CURRENT "STANDARD SPECIFICATION FOR ROAD, BRIDGE, AND PUBLIC WORKS CONSTRUCTION (2005)". ALL DRAIN LINES DAMAGED BY CONSTRUCTION VEHICLE LOADING SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.
5. WHEN TRENCHING ACROSS EXISTIG SIDEWALK, CONTRACTOR SHALL SAW CUT AT EXISTING SCORELINES AND REMOVE ALL SIDEWALK PANELS AFFECTED BY TRENCH.

LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

SIGNATURE DATE

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MAHINAHINA WELL DEVELOPMENT (WEST MAUI WELL NO. 1)

DWS JOB NO. 11-06

TITLE DRAINAGE DETAILS

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-11.02 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE AS NOTED			

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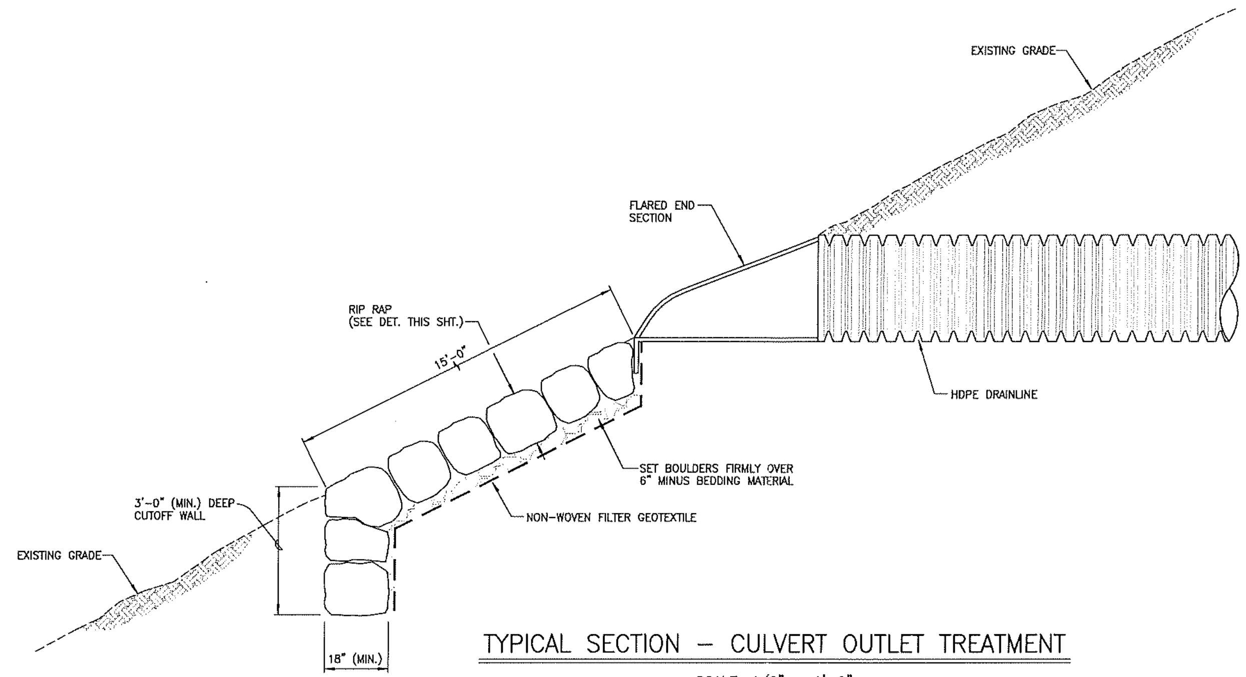
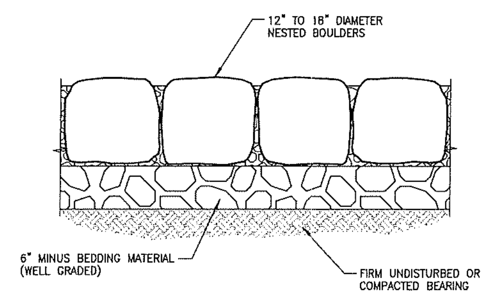


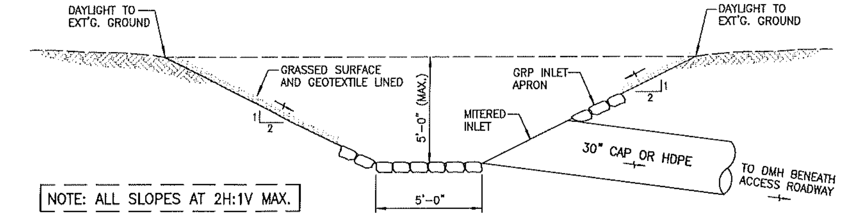
TYPICAL SECTION – CULVERT OUTLET TREATMENT

SCALE: 1/2" = 1'-0"



DETAIL – RIP RAP

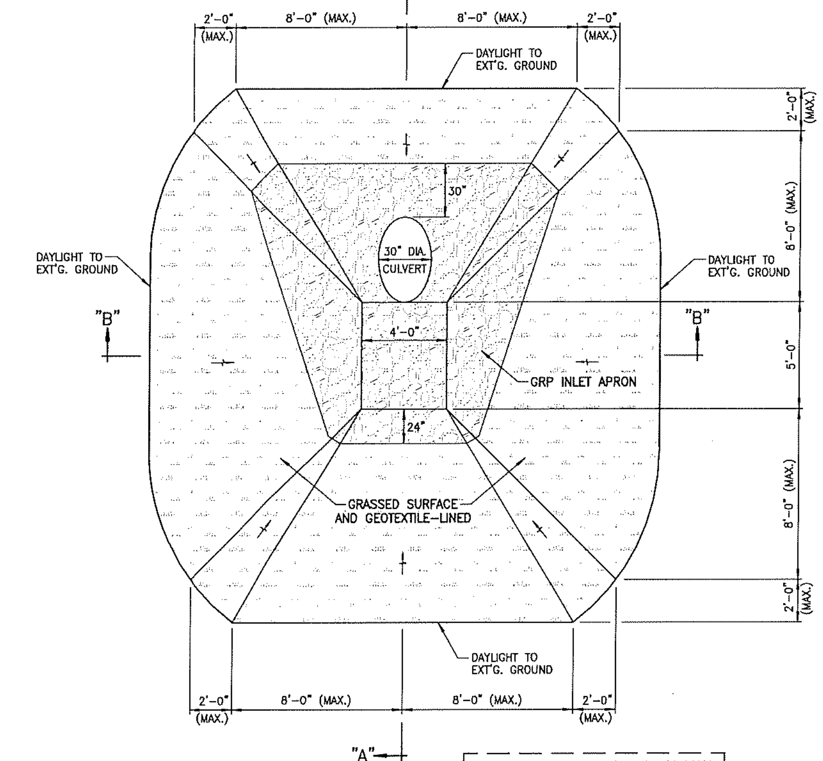
NOT TO SCALE



SECTION "A"–"A"

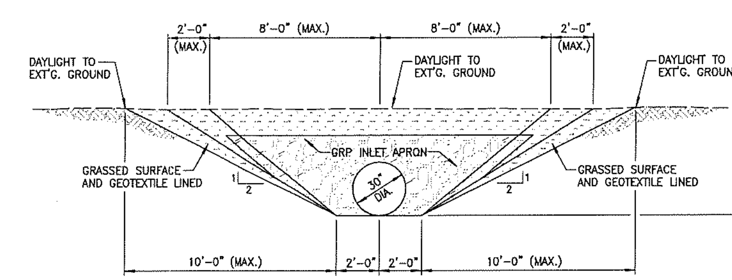
CULVERT INLET PROFILE

SCALE: 1/4" = 1'-0"



PLAN VIEW OF CULVERT INLET

SCALE: 1/4" = 1'-0"



SECTION "B"–"B"

NOTE: ALL SLOPES AT 2H:1V MAX.

CULVERT INLET PROFILE

SCALE: 1/4" = 1'-0"

DARREN T. UNEMORI
LICENSED PROFESSIONAL ENGINEER
NO. 7937-C
HAWAII, U.S.A.

License Expires: April 30, 2014

SIGNATURE DATE

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

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

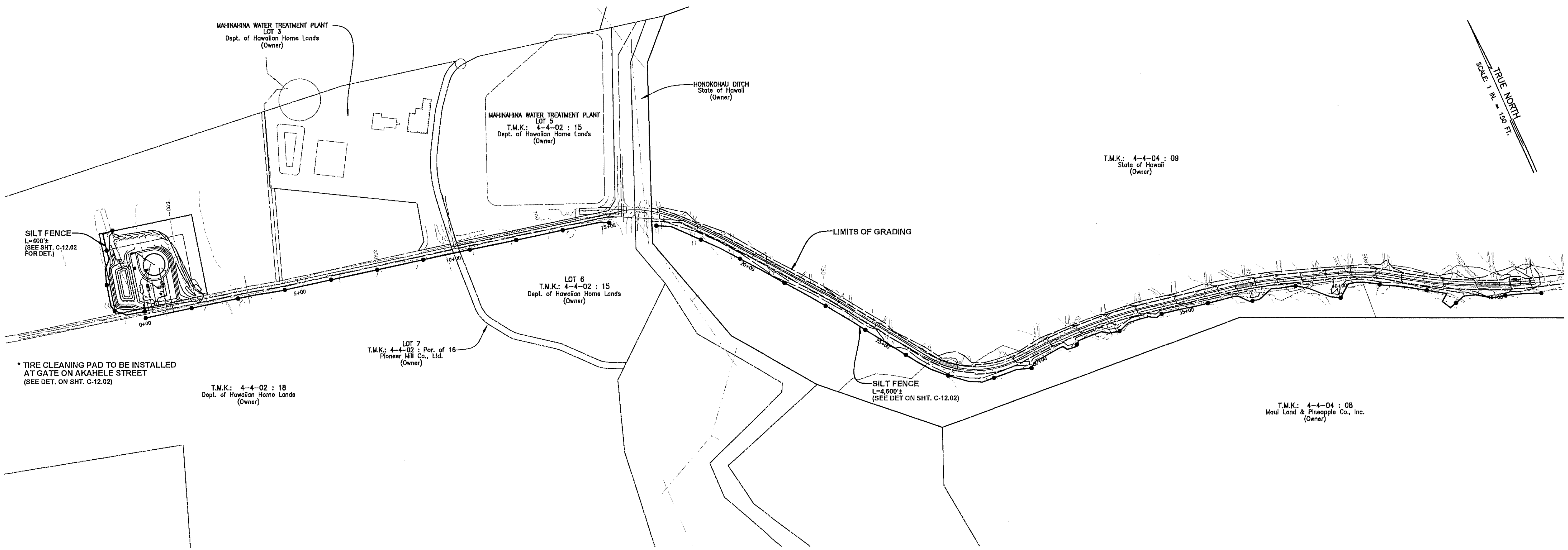
MAHINAHINA PERMANENT WELL WATER SYSTEM
DWS JOB NO. 11-06
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE DRAINAGE DETAILS

D.T.U. DESIGNED BY	D.T.U. CHECKED BY	11025 JOB NUMBER	C-11.03
W.I.S. DRAWN BY	D.T.U. APPROVED BY	June 7, 2012 DATE	SHEET
SCALE	AS NOTED		OF SHEETS

LETTER	DESCRIPTION	DATE

V:\Projects\11proj\11025 - DWS Mahinahina Well\dwg\conplans\det-drain00.dwg



LEGEND:

—●—●—●— SILT FENCE

APPROXIMATE EARTHWORK QUANTITIES

	CUT VOL.	FILL VOL.
CONTROL TANK SITE	2,700 C.Y.	1,200 C.Y. (IN PLACE)
ACCESS ROAD	19,800 C.Y.	2,000 C.Y. (IN PLACE)
	22,500 C.Y.	3,200 C.Y. (IN PLACE)

GRADED AREA = 5 AC.

NOTE: INCLUDED QUANTITIES ARE APPROXIMATE AND SHALL NOT BE USED FOR BIDDING OR PRICING PURPOSES.

LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

SIGNATURE DATE

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MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE BMP PLAN

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-12.01 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE 1 IN. = 150 FT.			

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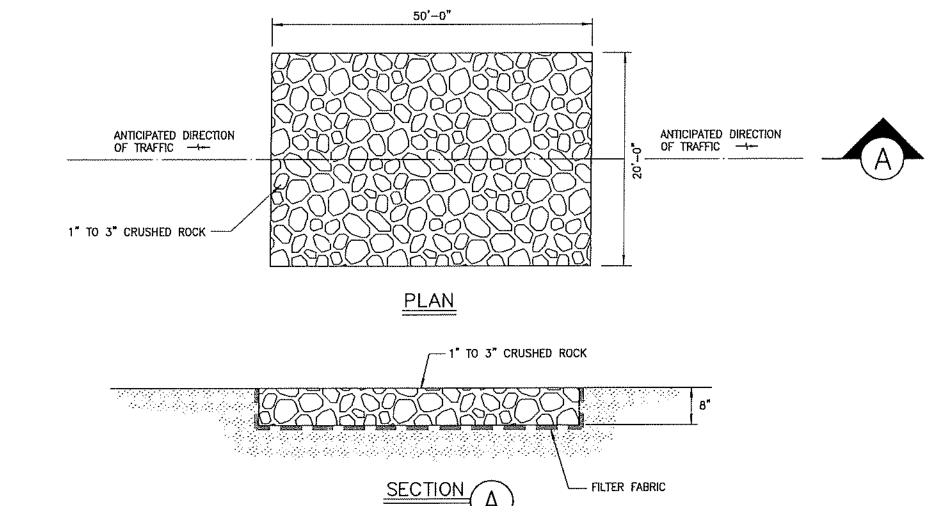
BEST MANAGEMENT PRACTICES

1. EROSION AND SEDIMENT CONTROL PRACTICES
   - A. CONSTRUCTION MANAGEMENT
     - 1) GRADING OPERATIONS SHALL BE PLANNED SO AS TO MINIMIZE TIME OF CONSTRUCTION.
     - 2) GRADING OPERATIONS SHALL BE PLANNED SO AS TO MINIMIZE SIZE OF THE DISTURBED AREA. THE AREA GRUBBED SHALL NOT EXTEND BEYOND WHAT WILL ACTUALLY REQUIRED FOR GRADING.
     - 3) THE PROJECT GRADING LIMITS SHALL BE STAKED PRIOR TO THE START OF CONSTRUCTION.
     - 4) UPON COMPLETION OF GRADING ALL EXPOSED AREAS WILL BE GRASSED AS REQUIRED.
   - B. STABILIZATION TECHNIQUES
     - 1) EXISTING GROUND COVER SHALL NOT BE DESTROYED, REMOVED OR DISTURBED MORE THAN 30 CALENDAR DAYS PRIOR TO THE START OF GRADING OPERATIONS.
     - 2) AREAS THAT REMAIN UNFINISHED FOR MORE THAN 21 CALENDAR DAYS WILL BE HYDROMULCHED WITH SEED TO PROVIDE TEMPORARY SOIL STABILIZATION BY NO LATER THAN THE 14TH DAY AFTER LAST DISTURBANCE.
     - 3) AFTER ACHIEVING FINISHED GRADES, ALL SLOPES AND EXPOSED AREAS SHALL BE PERMANENTLY STABILIZED BY HYDROMULCHING WITH GRASS SEED AS SOON AS PRACTICABLE.
   - C. STRUCTURAL CONTROLS
     - 1) 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. FILTER BAGS SHALL BE PLACED AT ALL EXISTING CURB–INLET CATCH BASIN OPENINGS TO REMOVE SILT FROM THE ONSITE RUNOFF.
   - D. INSPECTION AND MAINTENANCE PROCEDURES
     - 1) ALL CONTROL MEASURES SHALL BE INSPECTED AND REPAIRED AS NECESSARY. 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.
   - E. SCHEDULE FOR IMPLEMENTING CONTROLS
     - 1) EROSION AND SEDIMENT CONTROL MEASURES WILL BE IN PLACE AND FUNCTIONAL BEFORE EARTH MOVING OPERATIONS BEGIN, AND WILL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
     - 2) THE FOLLOWING GENERAL ORDER SHOULD BE USED:
       - A. INSTALLATION OF TIRE CLEANING PAD.
       - B. INSTALLATION OF SILT FENCE AND FILTER BERMS.
       - C. GRADING MAY PROCEED.
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 IF NECESSARY 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 WHEREVER NEEDED ON THE CONSTRUCTION SITE (WEEKENDS AND HOLIDAYS INCLUDED).
   - D. GRADED AREAS SHALL BE THOROUGHLY WATERED DURING CONSTRUCTION, AFTER CONSTRUCTION ACTIVITIES HAVE CEASED FOR THE DAY AND ON WEEKENDS AND HOLIDAYS.
3. OTHER POLLUTION CONTROL PRACTICES
   - A. CONTRACTOR SHALL INSTALL DANDY BEAVER DAM 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 SHALL 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 DOWNSTREAM PROPERTIES.

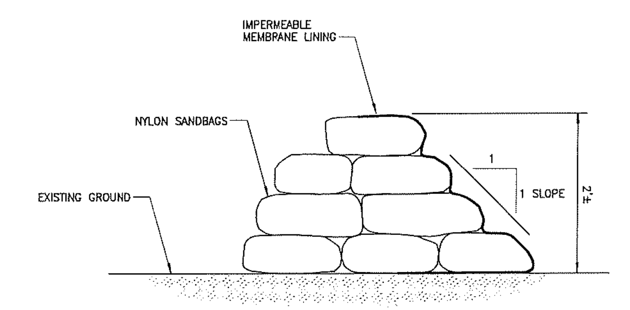
OPERATION AND MAINTENANCE PLAN FOR BMPS

1. A SPECIFIC INDIVIDUAL SHALL BE DESIGNATED TO BE RESPONSIBLE FOR EROSION AND SEDIMENT CONTROLS ON THE PROJECT SITE.
2. DURING EACH INSPECTION, THE FOLLOWING AREAS WILL BE INSPECTED:
   - A. CLEARED, GRADED, OR EXCAVATED AREAS
   - B. STORMWATER CONTROLS (PERIMETER CONTROL, BASINS, INLETS, EXIT POINTS)
   - C. POLLUTION PREVENTION PRACTICES
   - D. MATERIAL, WASTE, OR BORROW AREAS
   - E. EQUIPMENT STORAGE AND MAINTENANCE AREAS
   - F. STABILIZED AREAS
3. WHEN SIGNIFICANT RAINFALL OCCURS, BMPS SHALL BE CONTINUALLY MONITORED AND MAINTAINED. CONSTRUCTION EQUIPMENT SHALL BE MOBILIZED AS NECESSARY TO INSTALL EMERGENCY CONTROL MEASURES. AFTER STORM EVENTS, BMPS SHALL BE EVALUATED AND NEW BMPS SHALL BE DEPLOYED IN AREAS OF INEFFECTIVE BMPS.
4. IRRIGATION AND MAINTENANCE OF THE PERENNIAL VEGETATION SHALL BE PROVIDED.



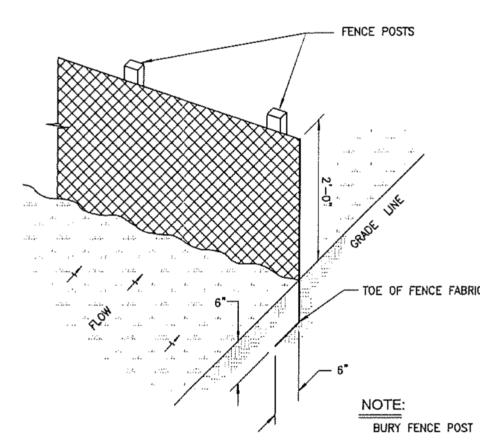
DETAIL – TIRE CLEANING PAD

NOT TO SCALE



DETAIL – SPILL CONTAINMENT BERM

NOT TO SCALE



NOTE:
BURY FENCE POST 1 FOOT MIN.

DETAIL – SILT FENCE

NOT TO SCALE

LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

SIGNATURE DATE

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"

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

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11–06

TITLE EROSION CONTROL DETAILS AND NOTES

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C–12.02 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE	AS NOTED		

CONSTRUCTION NOTES:

GENERAL SITEWORK:

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. "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. COMPACTION REQUIREMENTS: TESTING OF MATERIALS SHALL BE CONDUCTED BY AN APPROVED INDEPENDENT TESTING AGENCY IN ACCORDANCE WITH ASTM STANDARD METHODS OR AS SPECIFIED BY THE DEPARTMENT OF PUBLIC WORKS, ENGINEERING DIVISION, AS FOLLOWS:
   A. EMBANKMENT/SELECT BORROW AND SUBGRADE MATERIALS: ONE (1) COMPACTION TEST PER 600 SQUARE YARDS PER LIFT.
   B. AGGREGATE SUBBASE COURSE: ONE (1) COMPACTION TEST PER 400 SQUARE YARDS; ONE (1) GRADATION AND SAND EQUIVALENT TEST PER PROJECT.
   C. AGGREGATE BASE COURSE: ONE (1) COMPACTION TEST PER 300 SQUARE YARDS; ONE (1) GRADATION AND SAND EQUIVALENT TEST PER PROJECT.
   D. ASPHALT CONCRETE PAVEMENT OR ASPHALT TREATED BASE COURSE: THREE (3) A.C. CORES FOR THICKNESS AND DENSITY TESTS PER PROJECT.
   E. TRENCH BACKFILL MATERIAL: ONE (1) TEST FOR EACH 300 LINEAL FEET OF TRENCH PER LIFT OF MATERIAL.

   CONTRACTOR SHALL SUBMIT ALL TESTING REPORTS INCLUDING RESULTS TO THE COUNTY'S INSPECTION AGENCY FOR REVIEW AND APPROVAL PRIOR TO COUNTY'S ACCEPTANCE OF WORK. THE CONTRACTOR SHALL BE REQUIRED TO NOTIFY THE COUNTY OF ANY TESTING FAILURES AND CORRECT EACH FAILURE PRIOR TO PROCEEDING TO THE NEXT PHASE OF CONSTRUCTION. NONCOMPLIANCE WILL REQUIRE REMOVAL OF ALL SUBSEQUENT WORK TO CORRECT THE AREA OF FAILURE. ALL COSTS OF TESTING, REMOVAL, AND RECONSTRUCTION, SHALL BE BORNE BY THE CONTRACTOR.
4. THE LATEST REVISIONS OF THE STANDARD DETAIL DRAWINGS AND STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND PUBLIC WORKS CONSTRUCTION SHALL BE INCLUDED AS PART OF THE CONSTRUCTION PLANS.
5. THE DIRECTOR OF PUBLIC WORKS OR THE DIRECTOR OF WATER SUPPLY MAY STOP CONSTRUCTION SHOULD ANY WORK BE FOUND CONTRARY TO THE APPROVED CONSTRUCTION PLANS OR BE DETRIMENTAL TO THE PUBLIC INTEREST.
6. THE CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH THE DEVELOPMENT SERVICES ADMINISTRATION FIVE (5) DAYS PRIOR TO COMMENCEMENT OF CONSTRUCTION.
7. RECORD DRAWINGS (ONE (1) TIFF COPY AND SEVEN (7) SETS OF PLANS) ARE TO BE SUBMITTED TO THE DEVELOPMENT SERVICES ADMINISTRATION PRIOR TO FINAL APPROVAL OF THE IMPROVEMENTS AS SHOWN ON THE APPROVED CONSTRUCTION PLANS.
8. BENCH MARKS SHALL BE ESTABLISHED AND CERTIFIED BY A REGISTERED SURVEYOR, AND SUBMITTED TO THE DEVELOPMENT SERVICES ADMINISTRATION.
9. PURSUANT OF MAUI COUNTY CODE SECTION 3.44.015(C), THE COUNTY OF MAUI IS NOT RESPONSIBLE FOR ANY PARK, ROADWAY, EASEMENT (INCLUDING BUT NOT LIMITED TO DRAINAGE, SEWER, ACCESS, RECLAIMED WATER, OR AVIGATION EASEMENT), OR ANY OTHER INTEREST IN REAL PROPERTY SHOWN ON THIS MAP OR SHOWN ON THESE PLANS, UNLESS THE MAUI COUNTY COUNCIL HAS ACCEPTED ITS DEDICATION BY A RESOLUTION APPROVED BY A MAJORITY OF COUNCIL'S MEMBERS AT A REGULAR OR SPECIAL MEETING OF THE MAUI COUNTY COUNCIL.

EXISTING UTILITIES:

1. THE LOCATION, DEPTH AND TYPE OF THE VARIOUS EXISTING UTILITY LINES SHOWN ON THE CONSTRUCTION PLANS WERE DETERMINED ON THE BASIS OF THE BEST INFORMATION AVAILABLE. THE CONTRACTOR SHALL VERIFY EXACT LOCATION, DEPTH AND TYPE PRIOR TO COMMENCEMENT OF WORK.
2. CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES BETWEEN THE EXISTING UTILITIES AS SHOWN ON THE CONSTRUCTION PLANS AND IN GROUND, AND NOT PROCEED WITH ANY FURTHER WORK UNTIL WRITTEN NOTIFICATION IS RECEIVED FROM THE ENGINEER.
3. ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON PLANS, IF DAMAGED DURING CONSTRUCTION BY THE CONTRACTOR, SHALL BE REPAIRED SOLELY AT HIS EXPENSE.

EXISTING GRADES:

1. EXISTING GRADES SHALL BE VERIFIED BY THE CONTRACTOR BEFORE PROCEEDING WITH GRADING WORK. SHOULD ANY DISCREPANCIES BE DISCOVERED IN THE EXISTING GRADES OR DIMENSIONS GIVEN ON THE PLANS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER BEFORE PROCEEDING FURTHER WITH ANY WORK, OTHERWISE HE WILL BE HELD RESPONSIBLE FOR ANY COST INVOLVED IN CORRECTION OF CONSTRUCTION PLACED DUE TO SUCH DISCREPANCIES.

CLEARING AND GRUBBING:

1. NO CLEARING AND GRUBBING MATERIALS SHALL BE DEPOSITED IN COUNTY SANITARY LANDFILLS. CONTRACTOR SHALL MAKE THEIR OWN ARRANGEMENTS FOR SATISFACTORY DEPOSIT OF SAME.

ENVIRONMENTAL PROTECTION:

1. THE CONTRACTOR SHALL REMOVE ALL SILT AND DEBRIS RESULTING FROM HIS WORK AND DEPOSITED IN DRAINAGE FACILITIES, ROADWAYS AND OTHER AREAS. THE COSTS INCURRED FOR ANY NECESSARY REMEDIAL ACTION BY THE CHIEF ENVIRONMENTALIST SHALL BE BORNE BY THE CONTRACTOR.
2. THE CONTRACTOR SHALL KEEP THE PROJECT AREA AND SURROUNDING AREAS FREE FROM DUST NUISANCE, ALL IN ACCORDANCE WITH THE AIR POLLUTION CONTROL STANDARDS AND REGULATIONS OF THE STATE DEPARTMENT OF HEALTH. ALL COSTS SHALL BE BORNE BY THE CONTRACTOR.
3. ALL GRADING OPERATIONS SHALL BE PERFORMED IN CONFORMANCE WITH THE APPLICABLE PROVISIONS OF THE WATER POLLUTION CONTROL AND WATER QUALITY STANDARDS OF THE PUBLIC HEALTH REGULATIONS OF THE STATE DEPARTMENT OF HEALTH AND THE COUNTY'S GRADING ORDINANCE.
4. ALL CUT AND FILL SLOPES SHALL BE SODDED OR PLANTED IMMEDIATELY AFTER GRADING WORK HAS BEEN COMPLETED OR WITHIN 14 DAYS OF LAST DISTURBANCE.
5. CONSTRUCTION DEBRIS AND WASTES SHALL BE DEPOSITED AT APPROPRIATE SITES. THE CONTRACTOR SHALL INFORM THE OWNER OF THE LOCATION OF DISPOSAL SITES. THE DISPOSAL SITE SHALL ALSO FULFILL THE REQUIREMENTS OF THE GRADING ORDINANCE.
6. THE CONTRACTOR SHALL NOT DEMOLISH OR CLEAR ANY STRUCTURE, SITE, OR VACANT LOT WITHOUT FIRST ASCERTAINING THE PRESENCE OR ABSENCE OF RODENTS WHICH MAY ENDANGER THE PUBLIC HEALTH BY DISPERSAL FROM SUCH PREMISES. SHOULD SUCH INSPECTION REVEAL THE PRESENCE OF SUCH RODENTS, THE CONTRACTOR SHALL ERADICATE SUCH RODENTS BEFORE DEMOLISHING OR CLEARING SAID STRUCTURE, SITE OR VACANT LOT.

EARTHWORK:

DISTANCE FROM TOP OF CUT OR BOTTOM OF FILL TO PROPERTY LINE:

HEIGHT OF CUT OR FILL	DISTANCE FROM PROPERTY LINE
0' TO 2':	1'
MORE THAN 2' TO 4':	2'
MORE THAN 4' TO 6':	3'
MORE THAN 6' TO 10':	4'
MORE THAN 10' TO 15':	5'
MORE THAN 15':	8'

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 (243-5169), WHICH WILL ASSESS THE SIGNIFICANCE OF THE FIND AND RECOMMEND AN APPROPRIATE MITIGATION MEASURE, IF NECESSARY.

WATER SYSTEM:

1. THE CONTRACTOR SHALL NOTIFY THE DEPARTMENT OF WATER SUPPLY (DWS), IN WRITING, ONE (1) WEEK PRIOR TO COMMENCEMENT OF WORK.
2. IF CONSTRUCTION OF WATER SYSTEM IMPROVEMENTS WILL AFFECT DWS CONSUMERS, CONTRACTOR SHALL NOTIFY CONSUMERS BY RADIO/NEWSPAPER TWO (2) DAYS BEFORE AND ON DAY OF CONNECTION. CONTRACTOR SHALL ALSO NOTIFY CONSUMERS HOUSE-TO-HOUSE ONE (1) DAY BEFORE CONNECTION WORK.
3. ALL MATERIALS USED AND METHODS OF CONSTRUCTION OF WATER SYSTEM FACILITIES SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF DWS WATER SYSTEM STANDARDS. CONTRACTOR SHALL OBTAIN THE LATEST REVISIONS OF THE DWS STANDARDS BEFORE COMMENCING CONSTRUCTION.
4. ALL WATER SYSTEM WORK SHALL BE PERFORMED BY CONTRACTORS POSSESSING VALID STATE OF HAWAII CONTRACTOR'S LICENSES, REGARDLESS OF THE VALUE OF THE WORK.
5. CONTRACTOR SHALL FOLLOW ALL LOCAL, STATE, FEDERAL LAWS, RULES AND REGULATIONS REGARDING THE HANDLING, REMOVAL AND DISPOSAL OF ASBESTOS PIPE.
6. CONTRACTOR SHALL PROTECT EXISTING WATERLINE DURING COURSE OF CONSTRUCTION AND SUPPORT EXPOSED WATERLINE TO PREVENT ANY MOVEMENT.
7. THE EXACT DEPTH AND LOCATION OF EXISTING WATERLINES, SERVICE LATERALS AND OTHER UTILITIES ARE NOT KNOWN. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE SAME PRIOR TO TRENCHING FOR THE NEW WATERLINE. THE COST OF LOWERING, RELOCATING OR ADJUSTING EXISTING WATERLINES, SERVICE LATERALS AND APPURTENANCES, WHETHER SHOWN OR NOT SHOWN ON THE CONSTRUCTION PLANS AT THE CONTRACTOR'S EXPENSE.
8. PAVEMENT RESURFACING/RESTORATION:
   A. CONTRACTOR SHALL VERIFY LOCATION OF EXISTING DWS VALVES AND MANHOLES, WHEN AFFECTED BY THE WORK, PRIOR TO START OF CONSTRUCTION.
   B. ALL WATER VALVE AND WATER MANHOLE CONCRETE COLLARS WITHIN THE PROJECT LIMITS SHALL BE DEMOLISHED AND RECONSTRUCTED PER DWS STANDARD DETAIL V12 AND V23, RESPECTIVELY, AT THE CONTRACTOR'S EXPENSE.
   C. THE VALVE BOX RISER AND COVER OF ALL WATER VALVES WITHIN THE PROJECT LIMITS SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.
   D. CONTRACTOR SHALL ADJUST DWS SLIDING VALVE BOX ASSEMBLY AND MANHOLE FRAME AND COVER TO FINISHED GRADE.
   E. PRIOR TO PAVEMENT RESURFACING/RESTORATION WORK, THE CONTRACTOR SHALL SCHEDULE INSPECTION WITH DWS.
9. ANY SLIDING VALVE BOX ASSEMBLY, MANHOLE COVER, OR CONCRETE COLLAR, WHETHER DISCOVERED DAMAGED OR NOT SPECIFIED ON THE PLANS TO BE ADJUSTED OR REPLACED, SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.
10. CONTRACTOR SHALL ADJUST TO FINISHED GRADES, ALL UTILITIES (I.E., WATER, SEWER, DRAIN, ETC.) AFFECTED BY THE WORK WHETHER SHOWN OR NOT SHOWN ON THE CONSTRUCTION PLANS AT THE CONTRACTOR'S EXPENSE.
11. CONTRACTOR SHALL RESTORE ALL ROAD IMPROVEMENTS DISTURBED OR DAMAGED DURING CONSTRUCTION IN ACCORDANCE WITH THE 2005 "HAWAII STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION" AS AMENDED, TO THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS AT THE CONTRACTOR'S EXPENSE. ROAD IMPROVEMENTS INCLUDE, BUT ARE NOT LIMITED TO, PAVEMENT, PAVEMENT MARKERS, SHOULDER DRESSING, STRIPING, AND SPEED HUMPS.
12. CONCRETE FOR REACTION BLOCKS AND ANCHOR BLOCKS SHALL BE DWS CLASS 2500.
13. THE MAXIMUM DISTANCE BETWEEN VALVE NUT AND TOP OF MANHOLE COVER SHALL BE THREE (3) FEET.
14. CONTRACTOR SHALL SUBMIT A MATERIALS LIST TO DWS FOR APPROVAL PRIOR TO CONSTRUCTION.
15. CONNECTION TO DWS SYSTEM:
   A. CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING ALL NECESSARY FITTINGS AND OTHER MATERIALS AND EQUIPMENT REQUIRED FOR THE HOOK-UP. CONTRACTOR SHALL VERIFY THE EXACT LOCATION, DEPTH, TYPE, AND CONDITION OF THE EXISTING LINE BEFORE ORDERING MATERIALS FOR THE HOOK-UP. CONTRACTOR SHALL, HOWEVER, CHECK WITH DWS BEFORE EXCAVATING FOR VERIFICATION PURPOSES.
   B. WHENEVER FEASIBLE, MECHANICAL JOINT FITTINGS SHALL BE USED FOR BURIED APPLICATIONS AND FLANGED JOINT FITTINGS SHALL BE USED FOR EXPOSED APPLICATIONS.
   C. DWS PERSONNEL MAY BE REQUIRED TO BE PRESENT OR ASSIST WITH CONNECTIONS TO THE EXISTING WATER SYSTEM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS INCURRED BY DWS FOR SAID WORK.
   D. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING ALL MATERIAL, EQUIPMENT AND LABOR FOR TRENCH EXCAVATION, BACKFILLING, CLEANING AND CHLORINATION, PAVING, AND OTHER WORK NECESSARY TO COMPLETE THE HOOK-UP, AS DIRECTED BY AND TO THE SATISFACTION OF DWS.
16. MINIMUM COVER OVER WATER MAIN, 6" DIAMETER OR LARGER, SHALL BE 3'-0". MINIMUM COVER FOR 4" DIAMETER SHALL BE 2'-6". MINIMUM COVER FOR DIAMETERS LESS THAN 4" SHALL BE 1'-6".
17. CONTRACTOR SHALL ENSURE INSTALLATION OF WATERLINES, SERVICE LATERALS AND APPURTENANCES HAVE PROPER CLEARANCES FROM EXISTING TREES, WALLS, FENCES, ETC. IN ACCORDANCE WITH CURRENT DWS WATER SYSTEM STANDARDS.
18. CONTRACTOR SHALL VERIFY AND MAINTAIN 18" MINIMUM CLEARANCE WITH WATERLINE OR SERVICE LATERAL CROSSING OVER EXISTING SEWERLINE OR SERVICE LATERAL. INSTALL REINFORCED CONCRETE JACKET AROUND SEWERLINE WHERE SEWER IS ABOVE WATERLINE OR LESS THAN 18" BELOW WATERLINE. THE LENGTH OF JACKET REQUIRED SHALL BE AS SPECIFIED IN TABLE 100-5 OF THE DWS STANDARDS. PROVIDE 6" MINIMUM CLEARANCE FROM OUTSIDE JACKET TO WATERLINE OR SERVICE LATERAL. STANDARD CONCRETE JACKET DETAILS FOR SEWERLINE AS SPECIFIED BY THE DEPARTMENT OF PUBLIC WORKS STANDARDS SHALL BE FOLLOWED.
19. CONTRACTOR SHALL HAVE LICENSED SURVEYOR STAKE OUT WATERLINE BASELINE STATIONING, RIGHT-OF-WAY LIMITS, PROPERTY LINES, AND EASEMENT LINES TO ENSURE PROPER LOCATION OF WATER SYSTEM IMPROVEMENTS.
20. BOLTS FOR EXPOSED FLANGED DUCTILE IRON PIPE JOINTS SHALL BE EITHER SILICON BRONZE BOLTS AND NUTS OR 316 STAINLESS STEEL BOLTS WITH THE HEAVY DUTY STAINLESS STEEL NUTS (ONLY) FURNISHED WITH TRIPAC 2000 BLUE COATING SYSTEM. ANTI-SEIZE SHALL NOT BE USED. T-BOLTS FOR DUCTILE IRON MECHANICAL JOINT (MJ) PIPE AND FITTING CONNECTIONS IN UNDERGROUND SITUATIONS SHALL BE ONE OF THE FOLLOWING SYSTEMS:
   A. 316 STAINLESS STEEL T-BOLTS WITH THE HEAVY DUTY STAINLESS STEEL NUTS (ONLY) FURNISHED WITH TRIPAC 2000 BLUE COATING SYSTEM. ANTI-SEIZE SHALL NOT BE USED.
   B. COR-TEN T-BOLTS AND NUTS WITH HIGH GRADE ZINC SACRIFICIAL ANODES, EQUIVALENT TO
   C. "DURATRON" SACRIFICIAL "SAC-NUT" MODULES, INSTALLED ON THE NUTS FOR ALL STANDARD COR-TEN T-BOLTS.
   D. COR-TEN T-BOLTS AND NUTS BOTH FACTORY COATED WITH TRIPAC 2000 BLUE COATING SYSTEM BY "TRIPAC FASTENERS".
   E. ALL HOT FORGED STAINLESS STEEL BOLTS ARE REQUIRED TO BE PASSIVATED PER ASTM A380. MANUFACTURER CERTIFICATES ARE REQUIRED FOR PROOF WITH EACH SHIPMENT.
21. CONTRACTOR SHALL FURNISH AND INSTALL DUCTILE IRON NIPPLES FOR COMPLETE INSTALLATION OF THE WATERLINE, WHETHER SHOWN OR NOT SHOWN ON THE CONSTRUCTION PLANS, AT THE CONTRACTOR'S EXPENSE.
22. CONTRACTOR SHALL FURNISH TEMPORARY CLEANOUTS WHEN NECESSARY TO TEST, FLUSH, AND CHLORINATE THE WATERLINE AT THE CONTRACTOR'S EXPENSE.
23. CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL PORTIONS OF ABANDONED WATERLINES THAT ARE EXPOSED OR WITHIN 12-INCHES BELOW THE GROUND SURFACE AT THE CONTRACTOR'S EXPENSE.
24. ALL BURIED METALS, INCLUDING COPPER PIPES, SHALL BE WRAPPED WITH POLY-WRAP. FOR ALL BURIED INSTALLATIONS OF DUCTILE IRON PIPE AND FITTINGS, POLY-WRAP IS REQUIRED EXCEPT WITHIN CONCRETE JACKETS.
25. LUBRICATE HYDRANT NOZZLE THREADS WITH NON-TOXIC GREASE.
26. CONTRACTOR SHALL PAINT AND NUMBER FIRE HYDRANT(S). NUMBERING TO BE FURNISHED BY DWS.
27. WATER MAINS AND APPURTENANCES SHALL BE SUBJECT TO HYDROSTATIC TESTING IN ACCORDANCE WITH THE LATEST REVISION OF AWWA C600, UNDER THE "HYDROSTATIC TESTING" SECTION, TO A PRESSURE OF AT LEAST 1.5 TIMES THE WORKING PRESSURE. UNLESS OTHERWISE STATED IN THE CONSTRUCTION DOCUMENTS OR LIMITED BY THE PRESSURE RATING OF EQUIPMENT, THE PRESSURE TEST AND LEAKAGE TEST SHALL BE PERFORMED AT 225 POUNDS PER SQUARE INCH PRESSURE.
28. DEVELOPER SHALL SUBMIT A COST LIST ALONG WITH AN AFFIDAVIT FOR THE WATER SYSTEM PRIOR TO ACCEPTANCE.
29. CONTRACTOR SHALL SUBMIT ONE (1) SET OF RECORD DRAWINGS VIA A CONSULTANT PRIOR TO ACCEPTANCE OF THE WATER SYSTEM. AN ELECTRONIC IMAGE FILE IN PDF FORMAT AT FULL PAGE SIZE (24" X 36") SHALL BE PROVIDED TO THE DWS FOR ALL PROJECTS.

CHLORINATION OF WATER SYSTEM PIPELINES:

1. WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA STANDARD FOR DISINFECTING WATER MAINS, ANSI/AWWA C651-14, SECTION 4.4, CONTINUOUS FEED METHOD.
2. THE STORAGE TANK SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA STANDARD FOR DISINFECTING WATER STORAGE FACILITIES, ANSI/AWWA C652-11, SECTION 4.3, CHLORINATION METHOD 1 OR 2.
3. LIQUID CHLORINE OR CALCIUM HYPOCHLORITE THAT HAS BEEN TESTED AND CERTIFIED AS MEETING THE SPECIFICATIONS OF ANSI/NSF STANDARD 60, DRINKING WATER TREATMENT CHEMICALS-HEALTH EFFECTS, SHALL BE USED FOR THE CHLORINATION OF THE WATER MAINS AND STORAGE TANK.
4. PRIOR TO CHLORINATION, THE WATER MAINS SHALL BE THOROUGHLY FLUSHED.
5. THE INTERIOR SURFACES OF THE WATER MAINS AND STORAGE TANK SHALL BE EXPOSED TO THE CHLORINATING SOLUTION, BY COMPLETELY FILLING THE MAIN TO REMOVED ALL AIR POCKETS, FOR A MINIMUM OF 24 HOURS AND THE FREE CHLORINE RESIDUAL SHALL NOT BE LESS THAN 10 PPM AFTER SUCH TIME.
6. SHOULD CALCIUM HYPOCHLORITE BE USED, NO SOLID AND/OR UNDISSOLVED PORTION OF THE COMPOUND SHALL BE INTRODUCED INTO ANY SECTION OF THE WATER MAINS AND STORAGE TANK TO BE CHLORINATED.
7. AT THE END OF THE 24-HOUR DISINFECTION PERIOD, REPRESENTATIVE SAMPLES SHALL BE TAKEN AND ANALYZED TO ASSURE A FREE CHLORINE RESIDUAL OF AT LEAST 10 PPM.
8. SHOULD THE FREE CHLORINE RESULTS INDICATE ADEQUATE CHLORINATION, THE WATER MAINS AND STORAGE TANK SHALL BE THOROUGHLY FLUSHED AND FILLED WITH WATER FROM THE EXISTING SYSTEM AND AGAIN TESTED FOR FREE CHLORINE RESIDUAL. THE FLUSHING SHALL BE CONSIDERED ADEQUATE IF THE FREE CHLORINE RESIDUAL TEST RESULTS INDICATE THAT THE WATER IN THE WATER MAINS AND STORAGE TANK HAS A COMPARABLE CHLORINE RESIDUAL AS THE WATER IN THE EXISTING SYSTEM.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER DISPOSAL OF CHOLORINATED WATER TO SAFEGUARD PUBLIC HEALTH AND THE ENVIRONMENT IN ACCORDANCE WITH APPLICABLE STATE DEPARTMENT OF HEALTH REQUIREMENTS. A NEUTRALIZING CHEMICAL SHALL BE APPLIED TO THE WATER TO BE WASTED TO THOROUGHLY NEUTRALIZE THE CHLORINE RESIDUAL REMAINING IN THE WATER IN ACCORDANCE WITH ASNI/AWWA C651-14, SECTION 4.9.2.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH, PRIOR TO THE START OF CONSTRUCTION FOR THE DISPOSAL OF WATER USED FOR HYDROTESTING AND CHLORINATION.
11. FOLLOWING THE ACCEPTABLE FLUSHING OF THE WATER MAINS AND STORAGE TANK, TWO CONSECUTIVE SETS OF ACCEPTABLE SAMPLES, TAKEN AT LEAST 24 HOURS APART FROM REPRESENTATIVE POINTS, SHALL BE SUBJECTED TO MICROBIOLOGICAL TESTS (TOTAL AND FECAL COLIFORM). FOR WATERLINES, AT LEAST ONE SET OF SAMPLES SHALL BE COLLECTED FROM EVERY 1,200 FEET OF THE NEW WATER MAIN, PLUS ONE FROM THE END OF THE LINE AND AT LEAST ONE SET FROM EACH BRANCH GREATER THAN ONE PIPE LENGTH. FOR THE STORAGE TANK, THE SAMPLE SHALL BE COLLECTED FROM THE TANK'S EFFLUENT LINE SAMPLE TAP. POSITIVE OR INVALID TEST RESULTS WILL NOT BE ACCEPTABLE AND THE PROCESS WILL BE REPEATED.
12. ALL MEASUREMENTS FOR CHLORINE RESIDUAL SHALL BE ANALYZED USING E.P.A. APPROVED METHODS FOR DRINKING WATER.
13. ALL MICROBIOLOGICAL TESTS SHALL BE PERFORMED BY A LABORATORY APPROVED BY THE DEPARTMENT OF HEALTH, STATE OF HAWAII.
14. THE DEVELOPER/CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH ALL OF THE FOREGOING.
15. SEE ANSI/AWWA C651-14, SECTION 4.8.6 FOR SWABBING CHLORINATION PROCEDURES.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEMS (NPDES) AND OTHER AUTHORIZATIONS

THE GENERAL CONTRACTOR/DEVELOPER/OWNER OF THE PROJECT SHALL OBTAIN NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT COVERAGE(S) FOR THE FOLLOWING:

1. STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES THAT DISTURB ONE (1) ACRE OR MORE, AND
2. DISCHARGES OF HYDROTESTING EFFLUENT, DEWATERING EFFLUENT, AND WELL DRILLING EFFLUENT TO STATE WATERS.

IN ACCORDANCE WITH STATE LAW, ALL DISCHARGES RELATED TO PROJECT CONSTRUCTION OR OPERATION ARE REQUIRED TO COMPLY WITH STATE WATER QUALITY STANDARDS (HAWAII ADMINISTRATIVE RULES, CHAPTER 11-54). BEST MANAGEMENT PRACTICES SHALL BE USED TO MINIMIZE OR PREVENT THE DISCHARGE OF SEDIMENT, DEBRIS, AND OTHER POLLUTANTS TO STATE WATERS. PERMIT COVERAGE IS AVAILABLE FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH AT: http://health.hawaii.gov/cwb/

THE GENERAL CONTRACTOR/DEVELOPER/OWNER IS RESPONSIBLE FOR OBTAINING OTHER FEDERAL, STATE, OR LOCAL AUTHORIZATIONS AS REQUIRED BY LAW.

OTHER

1. ALL MATERIALS (PIPE, PIPE LUBRICANTS, PAINTS, SEALANTS, FORM OIL, CONCRETE ADMIXTURES, ETC.) IN DIRECT CONTACT WITH THE DRINKING WATER SHALL HAVE NATIONAL SANITATION FOUNDATIONS (NSF) APPROVALS. THE CONTRACTOR SHALL SUBMIT THESE APPROVALS TO THE OWNER/ENGINEER FOR REVIEW AND APPROVAL PRIOR TO ITS APPLICATION.

LETTER	DESCRIPTION	DATE

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

License Expires: April 30, 2020

SIGNATURE DATE

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"

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

MAHINAHINA WELL DEVELOPMENT
(WEST MAUI WELL NO. 1)
DWS JOB NO. 11-06

TITLE GENERAL CONSTRUCTION NOTES

ALU DESIGNED BY	DTU/DTO CHECKED BY	11025 JOB NUMBER	C-13.01 SHEET
KAO DRAWN BY	ALU APPROVED BY	June 29, 2018 DATE	OF SHEETS
SCALE			

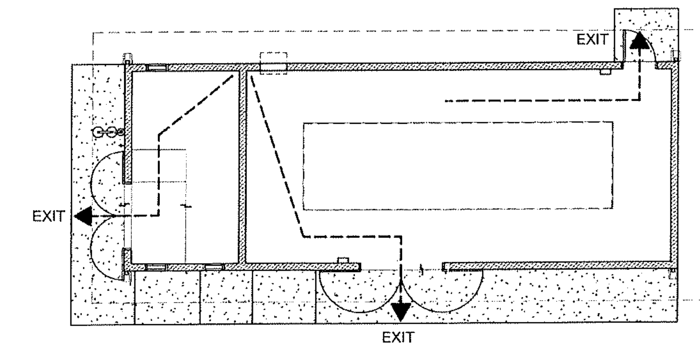
PROJECT INFORMATION

BUILDING ADDRESS:	MAHINAHINA PERMANENT WELL MCC & CHLORINATION BUILDING MAHINAHINA, LAHAINA, MAUI, HAWAII
TAX MAP KEY:	(2) 4-4-004:009
BUILDING FLOOR AREA:	1,005 S.F.

OCCUPANCY LOAD SUMMARY

ROOM OCCUPANCY	AREA (SF)	SF PER PERSON	NO. OF PERSONS	NO. OF REQ. EXITS	WIDTH (in.)
MOTOR CONTROL CABINET	720	300	3	1	0.6
CHLORINATION ROOM	180	300	1	1	0.2
		TOTAL OCCUPANT LOAD:	4		

EGRESS DIAGRAM



EGRESS DIAGRAM (SCALE: 1/8" = 1'-0")

CODE SUMMARY

Applicable Codes:

1. International Building Code, 2006 Edition
   a. Chapter 3 - 180 Hawaii Administrative Rules
2. Uniform Plumbing Code, 1991 Edition
   a. Modified by Ordinance #2330, 1994
3. National Electrical Code, 1999 Edition
   a. Modified by Ordinance #2871, 2000
4. Uniform Fire Code, 1997 Edition
   a. Modified by Ordinance #3354, 2006
5. Hawaii Model Energy Code
   a. Modified by Ordinance #3240, 2005

Project Description:

New CMU building with concrete roof to house Motor Control Cabinet and Chlorination room for new well at site.

OCCUPANCY GROUP:	U (Utility & Miscellaneous)
TYPE OF CONSTRUCTION:	V-B
ALLOWABLE AREA:	5,500 S.F.
BUILDING AREA:	1,005 S.F.
MAXIMUM HEIGHT:	40 ft./ 1 stories
ACTUAL HEIGHT:	11'-3"
FIRE SPRINKLER SYSTEM:	No
FIRE EXTINGUISHERS:	Yes, see plan for locations
OCCUPANCY LOAD REQUIREMENT:	4
MINIMUM EXITS (1 REQUIRED):	Yes

Fire Resistive Requirements for Type II-B Construction: (2006 IBC, Table 601)

1.	Structural Frame:	0 hr.
2.	Bearing walls, Exterior:	0 hr.
3.	Bearing walls, Interior:	0 hr.
4.	Nonbearing walls and partitions, Exterior:	0 hr.
5.	Nonbearing walls and partitions, Interior:	0 hr.
6.	Floor Construction:	0 hr.
7.	Roof Construction:	0 hr.

Exit Width:

Exit width = total occupant load x 0.2 (2006 IBC, Table 1005.1)
0.8 inches = 4 x 0.2

Distance to Exits:

The maximum length of exit access travel shall not exceed the distances given in 2006 IBC Table 1016.1. (300 ft.)
The maximum travel distance in this building is 27 feet.

Exit Doors:

Where this section requires a minimum clear width of 32 inches and a door opening includes 2 door leaves without a mullion, one leaf shall provide a clear opening width of 32 inches. The maximum width of a swinging door leaf shall be 48 inches. (2006 IBC Section 1008.1.1)
The size of the exit door is 3 feet.

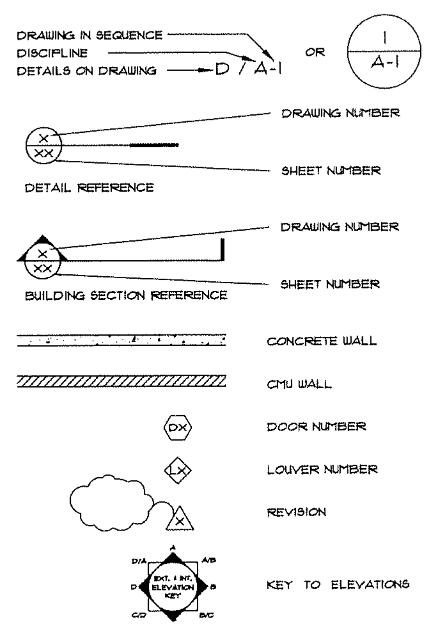
Egress doors shall be side-hinged swinging. Doors shall swing in the direction of egress travel where serving an occupant load of 50 or more persons or a Group H occupancy. (2006 IBC Section 1008.1.2)

Fire safety during construction, alteration, or demolition shall be in accordance with 1997 Uniform Fire Code, Article 87.

ABBREVIATIONS

@	AT	GALV.	GALVANIZED
&	AND	GWB.	GYPSUM WALL BOARD
A.B.	ANCHOR BOLT	GYPBD.	GYPSUM BOARD
A/C	AIR CONDITIONING	H.	HIGH
ACOUS.	ACOUSTICAL	H.B.	HOSE BIB
A.D.A.	AMERICAN WITH DISABILITIES ACT	HDWR.	HARDWARE
ADAAG	ADA ACCESSIBILITY GUIDELINES	H.M.	HOLLOW METAL
ADJ.	ADJUSTABLE	HORIZ.	HORIZONTAL
A.F.F.	ABOVE FINISHED FLOOR	HR.	HOUR
A.H.U.	AIR HANDLING UNIT	I.D.	INSIDE DIAMETER
AL.	ALUMINUM	INT.	INTERIOR
ALT.	ALTERNATE	JT.	JOINT
APPROX.	APPROXIMATE	LAM.	LAMINATE
ARCH.	ARCHITECTURAL	LAV.	LAVATORY
BLDG.	BUILDING	MAX.	MAXIMUM
BLKG.	BLOCKING	MECH.	MECHANICAL
BM.	BEAM	MET.	METAL
BOT.	BOTTOM	MEZZ.	MEZZANINE
CEM.	CEMENT	MIN.	MINIMUM
CER.	CERAMIC	MISC.	MISCELLANEOUS
CLG.	CEILING	M.O.	MASONRY OPENING
CLR.	CLEAR	N.I.C.	NOT IN CONTRACT
C.M.U.	CONCRETE MASONRY UNIT	NO. -OR- #	NUMBER
C.O.	CLEAN OUT	O.F.C.I.	OWNER-FURNISHED CONTRACTOR INSTALLED
COL.	COLUMN	O.F.O.I.	OWNER-FURNISHED OWNER-INSTALLED
CONC.	CONCRETE	O.C.	ON CENTER
CONT.	CONTINUOUS	P.T.D./R.	PAPER TOWEL DISPENSER/RECEPTACLE
DEPT.	DEPARTMENT	PLYWD.	PLYWOOD
DET.	DETAIL	R.D.	ROOF DRAIN
D.F.	DRINKING FOUNTAIN	REF.	REFERENCE
DIA.	DIAMETER	REFRIG.	REFRIGERATOR
DIM.	DIMENSION	REQ'D	REQUIRED
DN.	DOWN	R.O.	ROUGH OPENING
D.S.	DOWN SPOUT	S.C.	SOLID CORE
DWG.	DRAWING	S.C.D.	SEAT COVER DISPENSER
EA.	EACH	SCHED.	SCHEDULE
E..S.	EXTERIOR FINISH SYSTEM	S.D.	SOAP DISPENSER
E.J.	EXPANSION JOINT	S.F.	SQUARE FOOT
EL.	ELEVATION	SECT.	SECTION
ELEC.	ELECTRICAL	S.G.	SAFETY GLASS
ELEV.	ELEVATOR	SIM.	SIMILAR
EMERG.	EMERGENCY	SL	SLOPE
EQ.	EQUAL	SQ.	SQUARE
E.W.C.	ELECTRIC WATER COOLER	STRUC.	STRUCTURAL
F.E.C.	FIRE EXTINGUISHER CABINET	STD.	STANDARD
F.D.	FLOOR DRAIN	THK	THICK
F.D.C.	FIRE DEPT. CONNECTION	T.P.H.	TOILET PAPER HOLDER
F.S.	FLOOR SINK	TYP.	TYPICAL
F.F.	FINISH FLOOR	U.O.N.	UNLESS OTHERWISE NOTED
F.R.P.	FIBERGLASS REINFORCED PANEL	VCT	VINYL COMPOSITION TILE
FT.	FOOT -OR- FEET	VEND.	VENDING
FTG.	FOOTING	W/	WITH
FURR.	FURRING	W.C.	WATER CLOSET
GA.	GAUGE	W.R.	WATER RESISTANT

SYMBOL LEGEND



GENERAL NOTES

1. Contractor shall verify all dimensions, elevations, and existing conditions prior to construction. In the event of a discrepancy within the Drawings, or between Drawings and Specifications, or within the Specifications, immediately bring the discrepancy to the attention of the Architect or Engineer for a decision before preceding with the particular work involved. Work carried out disregarding these instructions is subject to removal and replacement at the expense of the Contractor.
2. The existence and location of utilities and structures as shown on these Drawings are from the latest available records but are not guaranteed as to the accuracy or the existence of other obstacles which may be encountered during the course of the Work. The Contractor shall be responsible and shall pay for all camages to existing utilities as a result of his work. The Contractor must exercise proper care during demolition to prevent damage to utilities.
3. The Contractor shall observe and comply with all Federal, State and local laws required for the protection of public health, safety and environmental quality. All work shall comply with applicable State and local ordinances and regulations. The 2006 International Building Code (IBC) as amended shall apply.
4. The General Contractor shall ensure the integrity of the construction site during and off construction hours. A construction schedule shall be agreed upon with the Owner as to working hours and any special construction needs during the project.
5. The Contractor, at his own expense, shall keep the Project and its surrounding areas free from dust nuisance. The work shall be in conformance with the air pollution standards and regulations of the State Department of Health.
6. The Contractor shall provide, install and maintain all necessary signs, lights, flares, barricades, markers, cones and other protective facilities and shall take all necessary precautions for the protection, convenience and safety of the public. Contractor shall be solely responsible for all means and methods.
7. The Contractor shall be responsible for any damage occurring as a result of the contract work. Repairs shall be made to the satisfaction of the owner.
8. All rubbish created from and by the construction project shall be the responsibility of the Contractor to dispose of off site. The site shall be kept orderly and free of dangerous materials.
9. This Project shall be designed and constructed to conform with the accessibility requirements of the Americans with Disabilities Act.
10. Fire safety during construction, alteration, or demolition shall be in accordance with 1997 Uniform Fire Code, Article 87.

LETTER	DESCRIPTION	DATE

RIECKE SUNNLAND KONO ARCHITECTS, LTD.

EARL H. KONO
LICENSED PROFESSIONAL ARCHITECT
No. 4455
HAWAII, U.S.A.

License Expires April 30, 2014

SIGNATURE DATE

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"

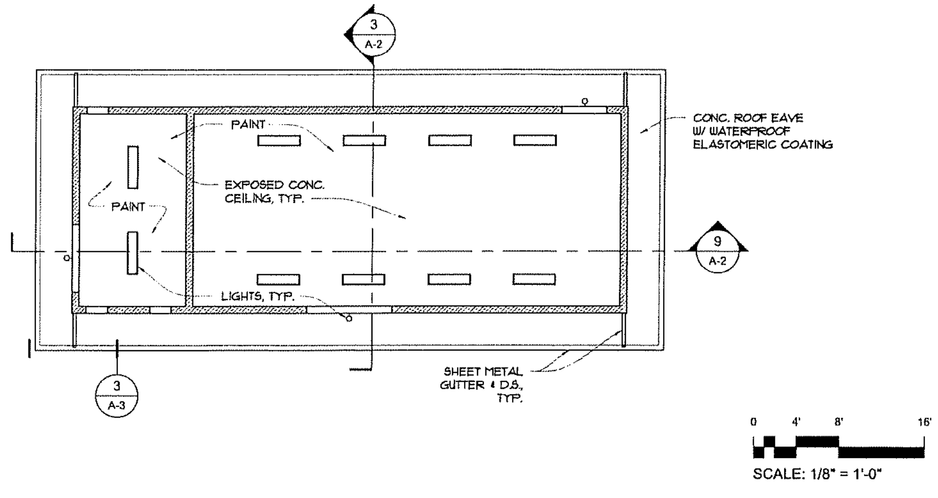
WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM

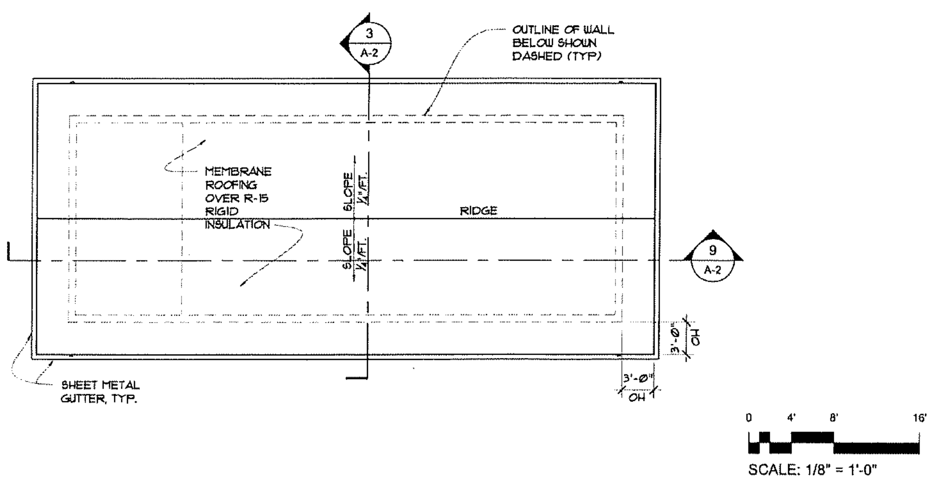
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE CODE SUMMARY, GENERAL NOTES

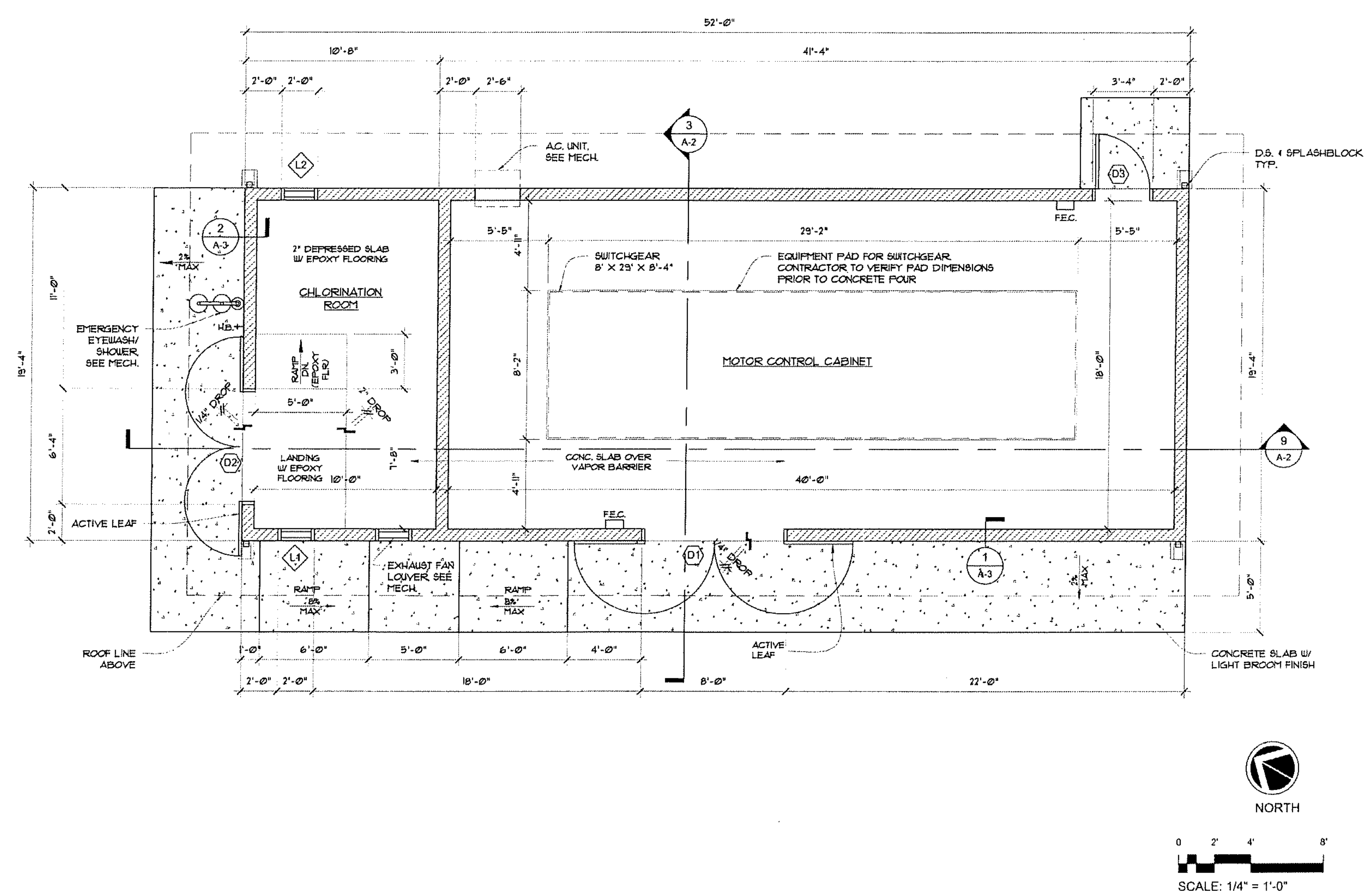
E.H.K. DESIGNED BY	E.H.K. CHECKED BY	11025 JOB NUMBER	A-0 SHEET
W.A.F. DRAWN BY	E.H.K. APPROVED BY	12 SEPT 2012 DATE	OF SHEETS
SCALE NO SCALE			



10	REFLECTED CEILING PLAN
1/8" = 1'-0"	



11	ROOF PLAN
1/8" = 1'-0"	



8	FLOOR PLAN
1/4" = 1'-0"	

RIECKE SUNNLAND KONO ARCHITECTS, LTD.

EARL H. KONO LICENSED PROFESSIONAL ARCHITECT No. 4455 HAWAII, U.S.A.

SIGNATURE DATE

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.

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2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

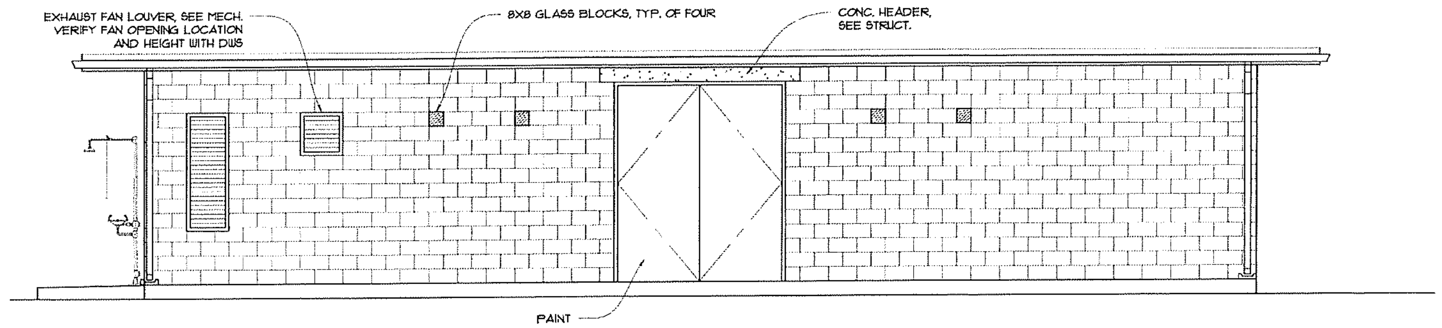
MAHINAHINA PERMANENT WELL WATER SYSTEM

MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE FLOOR PLAN, ROOF PLAN, REFECETED CEILING PLAN

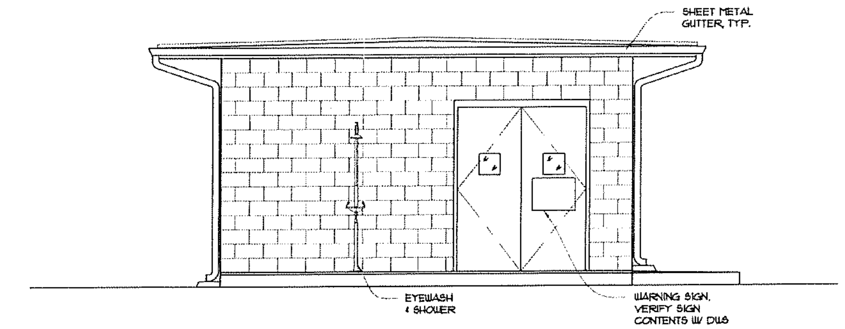
E.H.K. DESIGNED BY	E.H.K. CHECKED BY	11025 JOB NUMBER	A-1 SHEET
W.A.F. DRAWN BY	E.H.K. APPROVED BY	12 SEPT 2012 DATE	
SCALE 1/4" = 1'-0"			

LETTER	DESCRIPTION	DATE



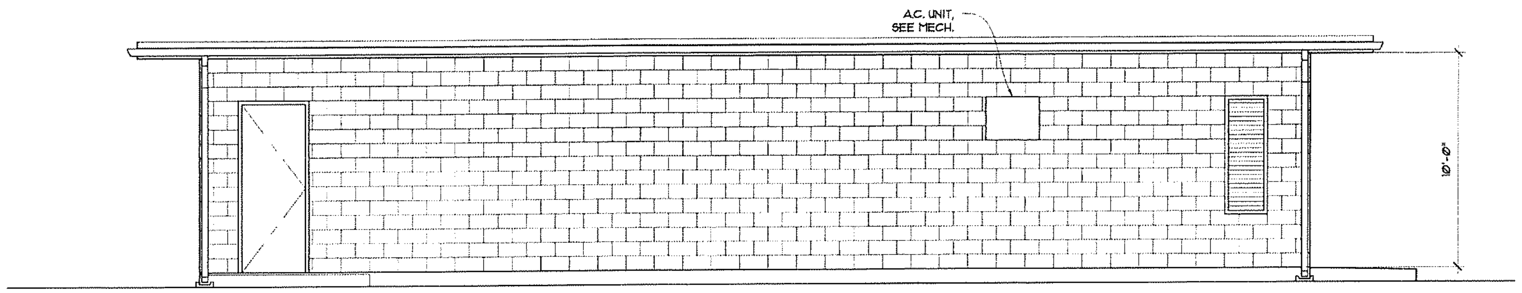
7 FRONT ELEVATION

1/4" = 1'-0"



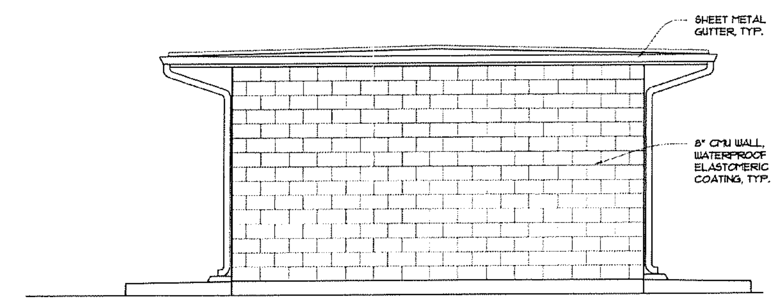
1 LEFT ELEVATION

1/4" = 1'-0"



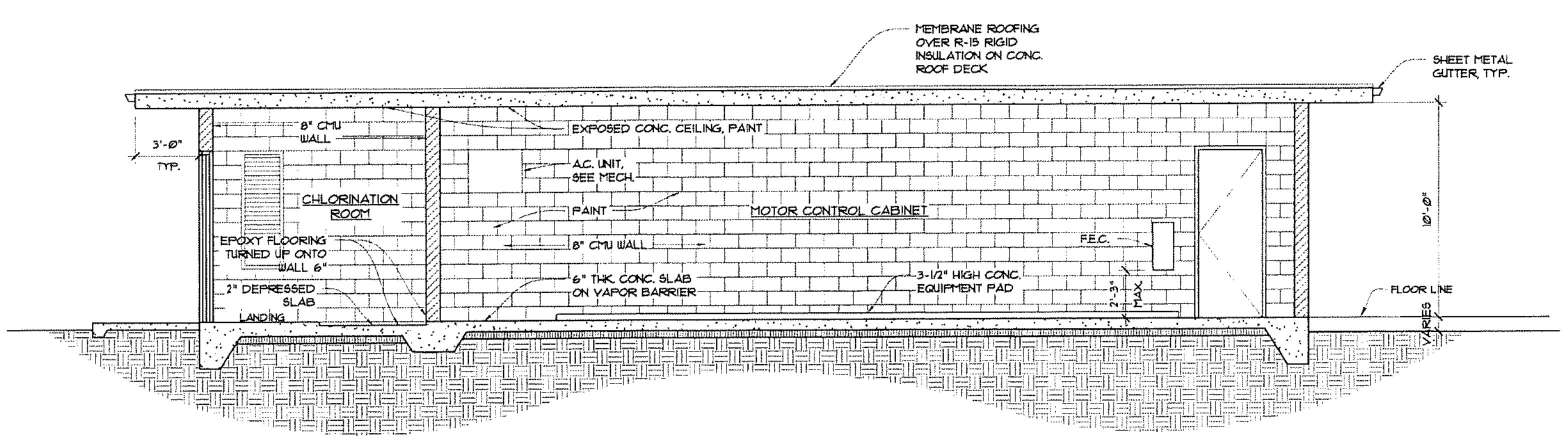
8 REAR ELEVATION

1/4" = 1'-0"



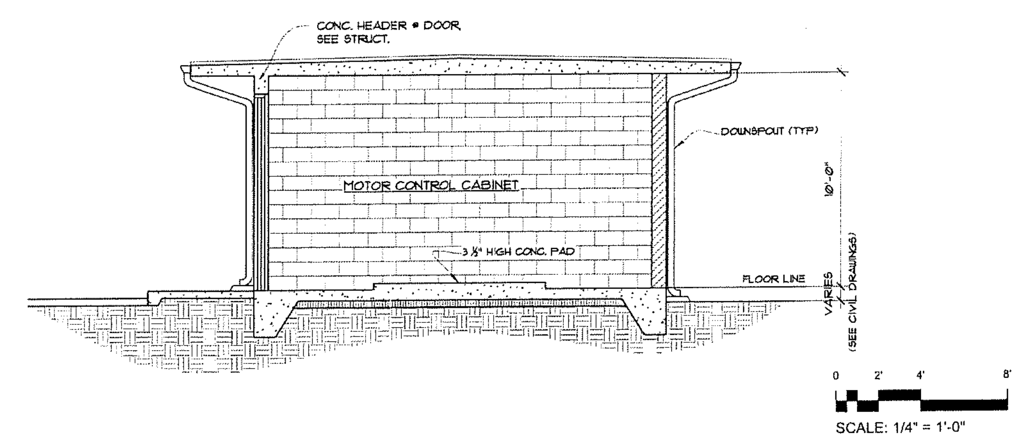
2 RIGHT ELEVATION

1/4" = 1'-0"



9 LONGITUDINAL SECTION

1/4" = 1'-0"



3 CROSS SECTION

1/4" = 1'-0"

LETTER	DESCRIPTION	DATE

RIECKE SUNNLAND KONO ARCHITECTS, LTD.

EARL H. KONO LICENSED PROFESSIONAL ARCHITECT No. 4455 HAWAII, U.S.A.

SIGNATURE — Expires: April 30, 2014 — DATE

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"

WARREN S. UNEMORI ENGINEERING, INC.
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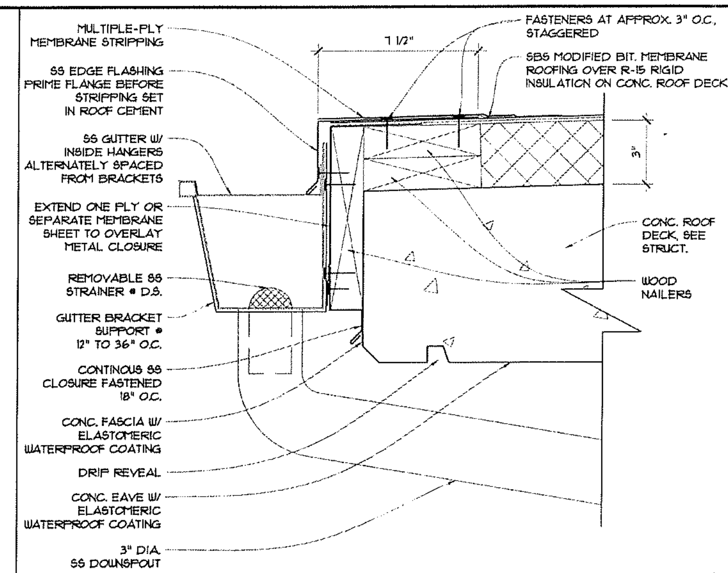
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM

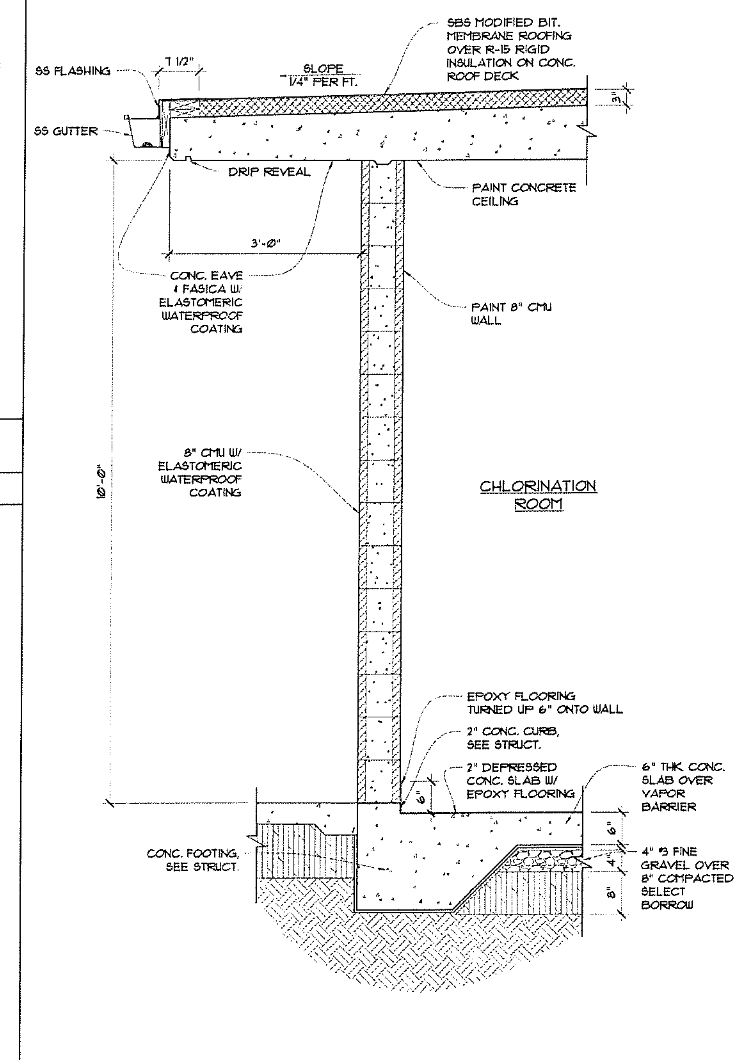
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE ELEVATIONS, SECTIONS

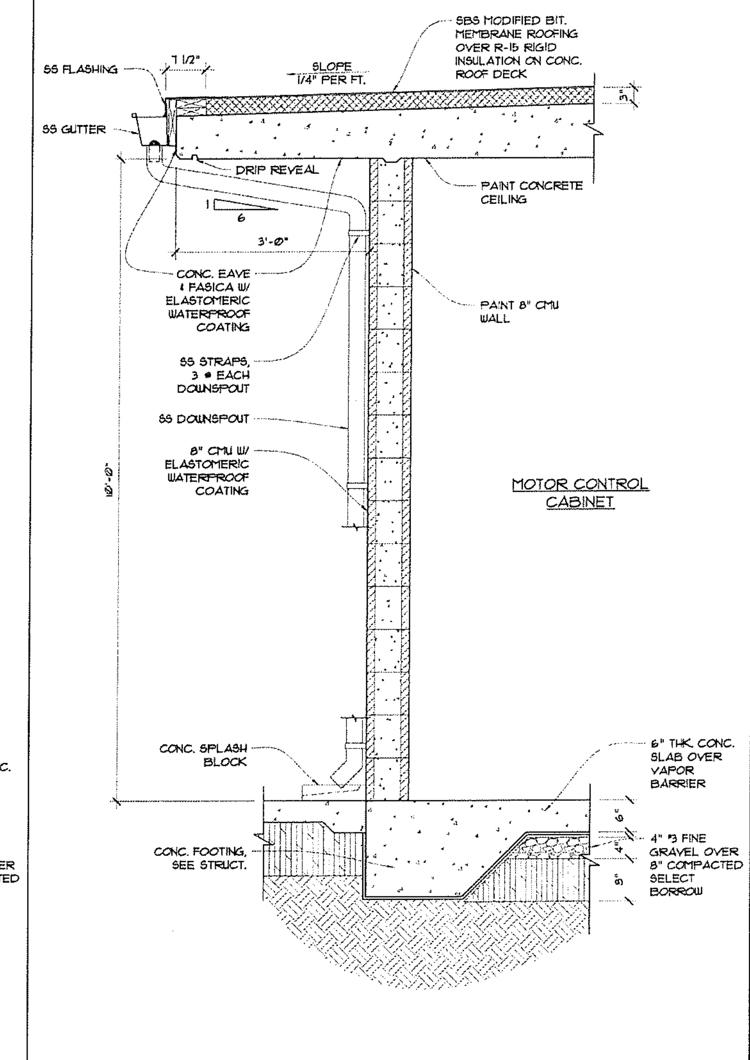
E.H.K. DESIGNED BY	E.H.K. CHECKED BY	11025 JOB NUMBER	A–2 SHEET
W.A.F. DRAWN BY	E.H.K. APPROVED BY	12 SEPT 2012 DATE	OF SHEETS
SCALE 1/4" = 1'-0"			



3	ROOF EDGE DETAIL
3" = 1'-0"	



2	WALL SECTION
3/4" = 1'-0"	



1	WALL SECTION
3/4" = 1'-0"	

RIECKE SUNNLAND KONO ARCHITECTS, LTD.

EARL H. KONO LICENSED PROFESSIONAL ARCHITECT No. 4455 HAWAII, U.S.A.

SIGNATURE — DATE APR 30, 2014

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"

WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 402
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

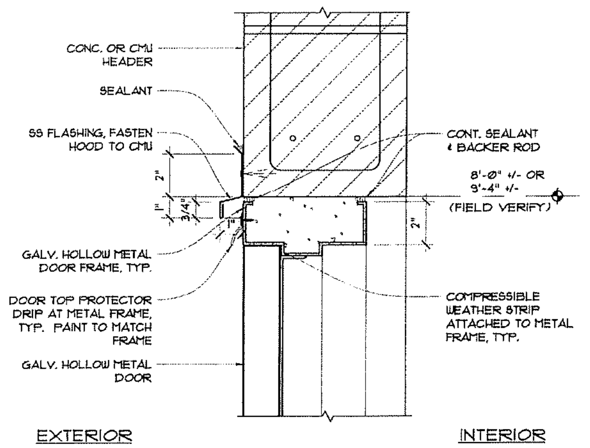
MAHINAHINA PERMANENT WELL WATER SYSTEM

MAHINAHINA, LAHAINA, MAUI, HAWAII

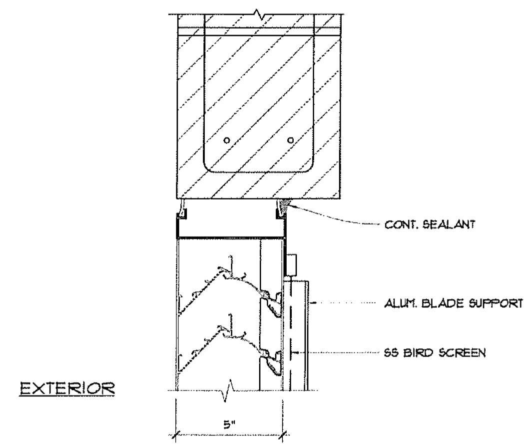
TITLE WALL SECTIONS, DETAILS

DESIGNED BY	CHECKED BY	JOB NUMBER	SHEET
E.H.K.	E.H.K.	11025	A-3
DRAWN BY	**APPROVED BY**	**DATE**	
W.A.F.	E.H.K.	12 SEPT 2012	
SCALE 3/4" = 1'-0"			OF SHEETS

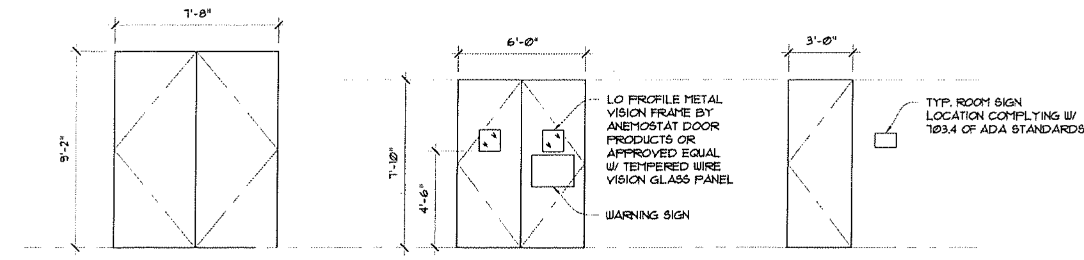
LETTER	DESCRIPTION	DATE



10	DOOR HEAD
3" = 1'-0"	



7	WINDOW HEAD
3" = 1'-0"	



DA
PAIR 1-3/4" THK.
HOLLOW METAL DR.

DB
PAIR 1-3/4" THK.
HOLLOW METAL DR.

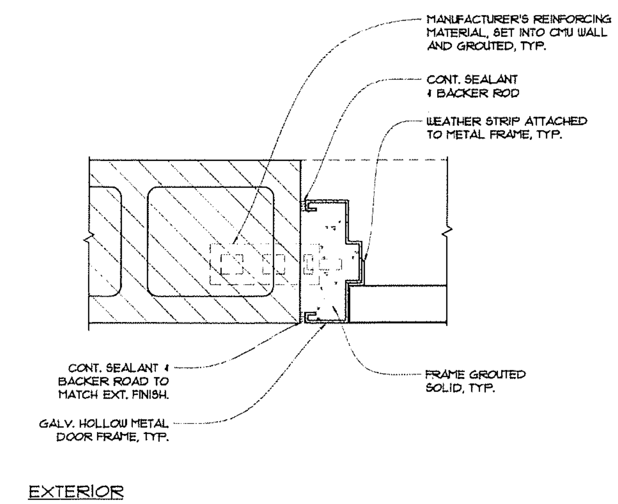
DC
1-3/4" THK.
HOLLOW METAL DR.

DOOR TYPES

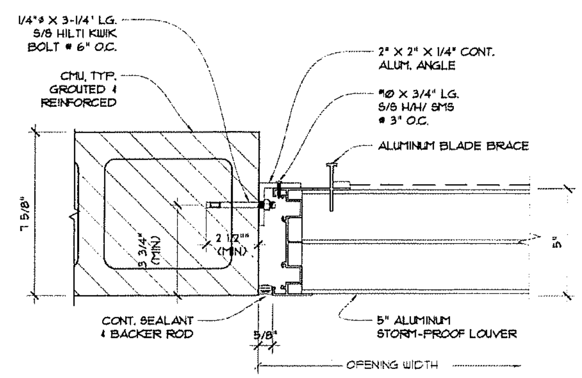
SCALE: 1/4" = 1'-0"

DOOR SCHEDULE

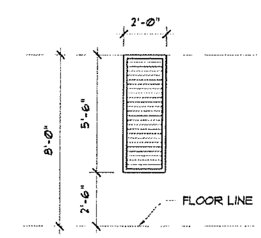
DOOR NUMBER	DOOR TYPE	DOOR SIZE WIDTH X HEIGHT (NOMINAL)	DOOR THICKNESS	DOOR MATERIAL	FRAME THICKNESS	FRAME MATERIAL	DETAIL HEAD	DETAIL JAMB	DETAIL THRESHOLD	DETAIL MISC.	CLOSER	ROOM SIGN	REMARKS
D1	DA	7'-8" X 9'-2"	1 3/4"	HM	2"	HM	10	11	12			"MOTOR CONTROL ROOM"	
D2	DB	6'-0" X 7'-10"	1 3/4"	HM	2"	HM	10	11	12			"CHLORINATION ROOM"	12"X12" TEMPERED GLASS LITES
D3	DC	3'-0" X 7'-10"	1 3/4"	HM	2"	HM	10	11	12			"EXIT"	



11	DOOR JAMB
3" = 1'-0"	



8	WINDOW JAMB
3" = 1'-0"	



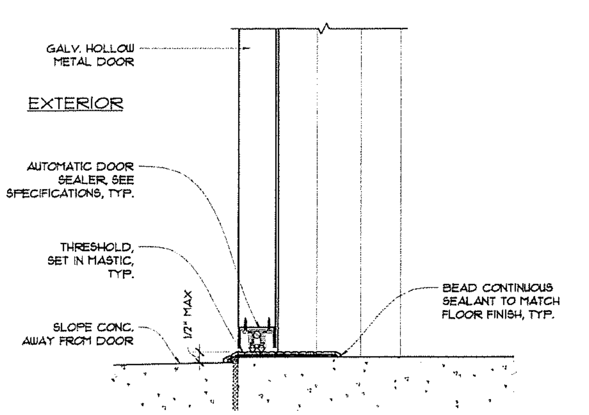
A
FIXED
LOUVER
HURRICANE-RATED

WINDOW TYPES

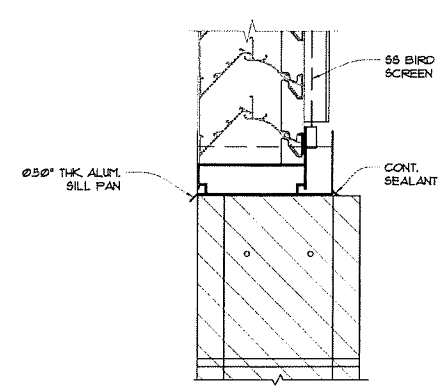
SCALE: 1/4" = 1'-0"

WINDOW SCHEDULE

WINDOW NUMBER	WINDOW TYPE	WINDOW SIZE WIDTH X HEIGHT (MASONRY OPENING DIM)	THICKENSS	MATERIAL	DETAIL HEAD	DETAIL JAMB	DETAIL THRESHOLD	DETAIL MISC.	FINISH	REMARKS
L1	A	2'-0" X 5'-6"	5"	AL.	7	8	9		KYNAR	1/4" X 1/4" STAINLESS STEEL SCREEN
L2	A	2'-0" X 5'-6"	5"	AL.	7	8	9		KYNAR	1/4" X 1/4" STAINLESS STEEL SCREEN



12	DOOR THRESHOLD
3" = 1'-0"	



9	WINDOW SILL
3" = 1'-0"	

LETTER	DESCRIPTION	DATE

RIECKE SUNNLAND KONO ARCHITECTS, LTD.

EARL H. KONO
LICENSED PROFESSIONAL ARCHITECT
No. 4455
HAWAII, U.S.A.

Dec. [illegible] April 30, 2014

SIGNATURE DATE

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"

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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE DOOR & WINDOW SCHEDULES, DETAILS

E.H.K. DESIGNED BY	E.H.K. CHECKED BY	11025 JOB NUMBER	A-4 SHEET
W.A.F. DRAWN BY	E.H.K. APPROVED BY	12 SEPT 2012 DATE	OF SHEETS
SCALE 3" = 1'-0"			

STRUCTURAL NOTES:

GENERAL

1. ALL DETAILS, SECTIONS, AND NOTES SHOWN ON DRAWINGS ARE TYPICAL AND SHALL APPLY TO SIMILAR SITUATIONS ELSEWHERE UNLESS OTHERWISE NOTED.
2. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS AT SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION.
3. ALL OMISSIONS OR CONFLICTS BETWEEN THE VARIOUS ELEMENTS OF THE WORKING DRAWINGS AND/OR THE SPECIFICATIONS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT/ENGINEER BEFORE PROCEEDING WITH ANY WORK INVOLVED.
4. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE INTERNATIONAL BUILDING CODE 2006 EDITION WITH THE LOCAL AMENDMENTS.
5. OBSERVATION VISITS TO THE SITE BY ENGINEER'S FIELD REPRESENTATIVES SHALL NOT BE CONSTRUED AS INSPECTION NOR APPROVAL OF CONSTRUCTION.
6. THE CONTRACTOR SHALL NOTIFY ENGINEER NOT LESS THAN TWO (2) WORKING DAYS PRIOR TO THE NEED FOR FIELD OBSERVATION VISITS SUCH AS BEFORE CONCRETE POURS, ETC.
7. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER OF ANY CONDITION WHICH MIGHT ENDANGER THE STABILITY OF THE STRUCTURE OR CAUSE VISIBLE DISTRESS IN THE STRUCTURE.
8. ALL WORK SHALL CONFORM TO THE BEST PRACTICE PREVAILING IN THE VARIOUS TRADES COMPRISING THE WORK.
9. THE CONTRACTOR SHALL PROVIDE ADEQUATE BRACING AND SHORING FOR ALL STRUCTURAL MEMBERS DURING ALL PHASES OF CONSTRUCTION.
10. THE CONTRACTOR SHALL ENSURE PROPER PLACEMENT OF ALL OPENINGS, SLEEVES, CURBS, CONDUITS, BOLTS, INSERTS, ETC., PRIOR TO PLACEMENT OF CONCRETE AND ANY NOT SPECIFICALLY SHOWN ON THE DRAWINGS SHALL BE LOCATED AND SUBJECT TO APPROVAL BY THE ENGINEER PRIOR TO PLACEMENT OF CONCRETE.
11. REFER TO THE ARCHITECTURAL DRAWINGS FOR THE LOCATIONS OF ALL MOLDS, ORNAMENTS, GROOVES, REGLETS, ETC. IN CONCRETE WORK.
12. ALL CONDITIONS OF POTENTIAL INSTABILITY OF EMBARKMENTS, CUT OR FILL SLOPES SHOULD BE BROUGHT TO THE ATTENTION OF THE SOILS ENGINEER. THE CONTRACTOR TO WORK CLOSELY WITH THE SOILS ENGINEER FOR ALL SOILS RELATED MATTERS.

DESIGN

1. LIVE LOADS:
   ROOF..........20 PSF
2. WIND..........100MPH WIND VELOCITY Topo Factor 1.0
3. EARTHQUAKE ZONE.......... Site class D, Occupancy III
4. OCCUPANCY CATEGORY .... Occupancy III Water Treatment for Potable Water

FOUNDATION

1. ALL FOUNDATION EXCAVATIONS SHALL BE KEPT CLEAR OF WATER AT ALL TIMES. THE BOTTOM OF THE FOOTING EXCAVATION SHALL BE NEAT AND FREE OF LOOSE SOILS AND DEBRIS. ALL FOOTINGS MUST REST ON 95% COMPACTED EARTH. ALL COMPACTIONS MUST BE OBSERVED BY A LICENSED SOILS ENGINEER. THE CONTRACTOR TO PROVIDE A CERTIFICATION THAT ALL FOUNDATIONS ARE RESTING ON 95% COMPACTED EARTH.
2. THE FINISH GRADE OUTSIDE THE SLAB SHALL BE SHAPED TO SHED WATER AWAY FROM THE FOUNDATIONS AND TO AVOID PONDING CONDITIONS NEAR THE SLAB AREA. THE OWNER SHALL BE MADE AWARE THAT ROOF WATER SHALL BE DIVERTED AWAY FROM THE PERIMETER FOOTINGS.
3. IF A FOOTING IS LOCATED NEXT TO A UTILITY LINE, IT SHALL EXTEND TO THE BOTTOM OF THE UTILITY TRENCH TO REDUCE FOOTING SETTLEMENT DUE TO SETTLEMENT OF THE TRENCH BACKFILL.
4. FILLS AND BACKFILLS SHALL BE CLEAN GRANULAR FILL PLACED IN MAXIMUM 8-INCH LIFTS AND COMPACTED TO A MINIMUM OF 95% OF ITS MAXIMUM DRY DENSITY ESTABLISHED BY ASTM D-1557. THE ON-SITE CLAY SOIL OR DEBRIS SHALL NOT BE USED FOR FILL MATERIAL BELOW STRUCTURES.
5. THE FILL AREA SHALL BE CLEARED OF VEGETATION AND DEBRIS PRIOR TO FILLING. ALL COMPACTIONS MUST BE OBSERVED BY A LICENSED SOILS ENGINEER. LIFTS FOR ALL FILL AREAS SHALL BE IN STRICT ACCORDANCE WITH THE RECOMMENDATIONS FROM A SOILS ENGINEER. THE COST OF A SOILS ENGINEER SHALL BE BOURNE BY THE CONTRACTOR.

SPECIAL INSPECTION REQUIREMENTS

THE PROJECT REQUIRES SPECIAL INSPECTIONS. CONTRACTOR TO INFORM OUR OFFICE (MINIMUM 2 DAYS) FOR THE FOLLOWING REQUIRED INSPECTIONS:

A. REINFORCING IN FOOTINGS PRIOR TO POURING OF CONCRETE.
B. REINFORCING IN THE SLAB PRIOR TO POURING OF CONCRETE.
C. REINFORCING IN THE MASONRY WALL PRIOR TO EVERY GROUT LIFT.
D. REINFORCING IN ROOF SLAB PRIOR TO POURING OF CONCRETE

CONCRETE AND REINFORCING

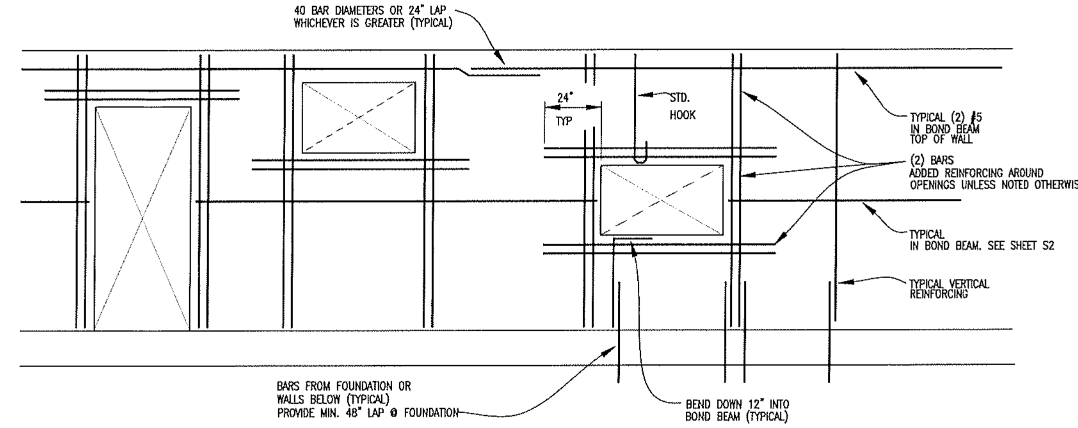
1. USE TYPE I OR II CEMENT CONFORMING WITH ASTM C-150. CONCRETE SHALL HAVE COMPRESSIVE STRENGTHS AT 28 DAYS AS FOLLOWS:

   SLAB ON GRADE..........3000PSI – MIN. 5.0 SACKS OF CEMENT / PER CU.YD
   ROOF SLAB..........4000PSI – MIN. 6.0 SACKS OF CEMENT / PER CU.YD
   CONCRETE FOOTING..........3000PSI – MIN. 5.0 SACKS OF CEMENT

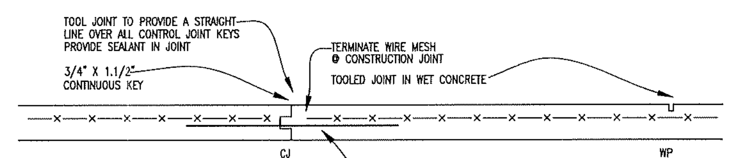
   MISC. CONCRETE NOT MENTIONED ABOVE....3000PSI – MIN. 4.6 SACKS OF CEMENT HARDROCK AGGREGATES SHALL CONFORM TO ASTM C-33 AND SHALL BE ONE INCH (1") MAXIMUM SIZE.
2. CONCRETE PROTECTION FOR REINFORCEMENT SHALL BE AS FOLLOWS:
   FOOTINGS AND SLAB ON GRADE..........3"
   CONCRETE EXPOSED TO WEATHER OR GROUND (FORMED)..........2"
3. MAXIMUM SLUMP FOR ALL CONCRETE SHALL BE 4.1/2 INCHES.
4. DRYPACK CONCRETE SHALL BE ONE PART PORTLAND CEMENT AND ONE PART SAND WITH SUFFICIENT WATER TO ALLOW A SMALL AMOUNT OF PASTE TO COME TO THE SURFACE.
5. ALL REINFORCING STEEL SHALL BE NEW STOCK DEFORMED BARS CONFORMING TO ASTM A-615 GRADE 60 UNLESS OTHERWISE NOTED. PLACEMENT OF REINFORCING STEEL SHALL BE IN ACCORDANCE WITH ACI 315 AND ACI 318. ALL REINFORCING STEEL SHALL BE CLEAN OF RUST, GREASE OR OTHER MATERIALS LIKELY TO IMPAIR BOND. ALL BENDS SHALL BE MADE COLD. ALL #3 BARS TO CONFORM TO GRADE 40. SEE NOTES ON SHEET S2 FOR EPOXY COATED REBARS AND SEE NOTE 9 BELOW FOR ROOF REINFORCING.
6. ALL REINFORCING STEEL SHALL BE ACCURATELY AND SECURELY PLACED.
7. ALL REINFORCING STEEL SHALL BE LAPPED 40 BAR DIAMETERS OR TWENTY-FOUR INCHES (24"), WHICHEVER IS GREATER, AT SPLICES. ALL SPLICES SHALL BE MADE AWAY FROM POINT OF MAXIMUM STRESS.
8. STATEMENT OF MIX DESIGN SHALL BE MADE FOR ALL CONCRETE. THE AVERAGE TRIAL BATCH STRENGTH SHALL EXCEED THE SPECIFIED STRENGTH, F'c, BY 15%. MIX DESIGN SHALL BE APPROVED BY THE STRUCTURAL ENGINEER PRIOR TO COMMENCEMENT OF THE WORK.
9. ALL ROOF REINFORCING SHALL BE 60 ksi EPOXY COATED REBARS. THIS INCLUDES ALL DOWELS FROM WALL INTO THE ROOF SLAB AS WELL AS ALL TIE WIRES. DO NOT USE REGULAR WIRE TO TIE EPOXY COATED REBARS. ANY DAMAGE COATING MUST BE PATCHED PRIOR TO INSTALLATION. ALL EPOXY COATING SHALL CONFORM TO ASTM A775. PROVIDE "SCOTCHKOTE-413" COATINGS FOR REBARS AS MANUFACTURED BY 3M COMPANY OR APPROVED EQUAL. ANY EQUALS TO THIS PRODUCT WILL BE APPROVED ONLY DURING THE BIDDING PROCESS.

CONCRETE MASONRY UNIT

1. MASONRY UNITS SHALL BE GRADE N-2 STANDARD WEIGHT UNITS CONFORMING TO ASTM C-90 WITH F'm = 1800 PSI. MASONRY UNITS SHALL BE CLEAN AND FREE OF ALL SUBSTANCES THAT MAY IMPAIR BOND. ALL MASONRY WALLS SHALL BE LAID WITH RUNNING BOND.
2. MORTAR MIX SHALL BE ONE (1) PART PORTLAND CEMENT, THREE (3) PARTS SAND, ONE FOURTH (1/4) PART LIME PUTTY BY VOLUME OF CEMENT AND SHALL CONFORM TO ASTM C-270. WATER CONTENT SHALL BE THE MINIMUM REQUIRED FOR WORKING CONSISTENCY. TWENTY-EIGHT (28) DAY ULTIMATE STRENGTH SHALL BE 2,500 PSI
3. GROUT ALL CELLS SOLID THROUGHOUT. HEIGHT OF GROUT LIFT SHALL BE 5'4". GROUT MIX SHALL BE ONE (1) PART PORTLAND CEMENT, THREE PARTS SAND, AND (OPTIONALLY) ONE TENTH (1/10) PART LIME PUTTY. GROUT FOR SPACES WIDER THAN TWO INCHES (2") SHALL CONTAIN, IN ADDITION 1.1/2 PARTS PEA GRAVEL, MAKING A 1:3:1.1/2 MIX. SUFFICIENT WATER MAY BE ADDED TO PROVIDE POURING CONSISTENCY WITHOUT SEGREGATION. THE TWENTY EIGHT (28) DAY ULTIMATE STRENGTH OF THE GROUT SHALL BE 3000 PSI (PROVIDE MINIMUM 5.5 SACKS OF CEMENT). CONTRACTOR TO PROVIDE GROUT MIX DESIGN FOR APPROVAL PRIOR TO PLACEMENT.
4. MASONRY UNITS SHALL BE LAID TO PROVIDE UNOBSTRUCTED VERTICAL CONTINUITY OF GROUT SPACE. WHEN GROUTING IS STOPPED FOR LONGER THAN ONE (1) HOUR, CONSTRUCTION JOINTS SHALL BE FORMED AT THE TOP OF THE GROUT LIFT BY STOPPING POUR THREE FOURTH INCHES (3/4") MINIMUM BELOW TOP OF UPPERMOST LIFT.
5. LAP ALL MASONRY REINFORCING 40 BAR DIAMETERS OR 24 INCHES, WHICH EVER IS GREATER. ALL VERTICAL REINFORCING SHALL BE DOWELED (SAME SIZE AND SPACING AS VERTICAL BARS) TO FOUNDATION WALL OR FOOTING BELOW. HORIZONTAL REINFORCING SHALL BE CONTINUOUS AT ALL INTERSECTING WALLS AND AT ALL CORNERS. LAP AT FOOTING SHALL BE 48" O.C.

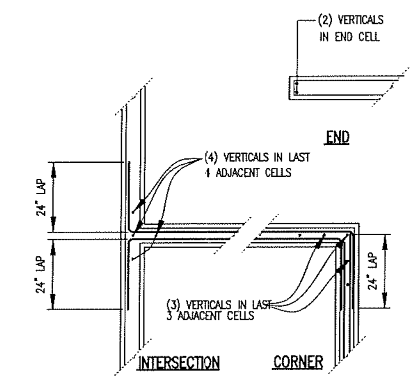


1/S-1 TYPICAL CMU WALL CONSTRUCTION
NOT TO SCALE



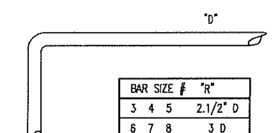
NOTE:
USE PRE-MOLDED METAL KEY FOR CONSTRUCTION JOINT, KEEP TOP OF KEY 1/4" BELOW TOP OF SLAB. ALL SUCH KEYS SHALL BE LEFT IN THE SLAB. SEE PLAN FOR CONSTRUCTION JOINT (CJ) AND WEAKENED PLANE (WP) LOCATIONS.

2/S-1 CONTROL JOINT DETAIL
NOT TO SCALE



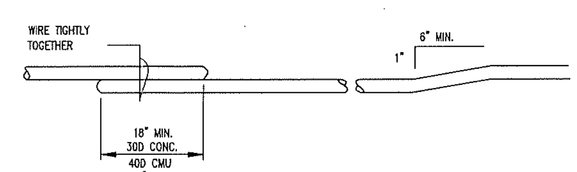
NOTE:
ALL VERTICAL STEEL SHOWN IN THIS DETAIL IS ADDED STEEL OVER AND BEYOND NORMAL STEEL SEE PLAN FOR ADDITIONAL REINFORCING @ BEAM BEARING OR OTHER SPECIAL CONDITIONS

3/S-1 C.M.U. WALL DETAILS



BAR SIZE #	"R"
3 4 5	2.1/2" D
6 7 8	3 D
9 10 11	4 D
14 18	6 D

BAR BENDS



LAP SPLICE

OFFSET

4/S-1 STEEL REINFORCING DETAILS
NOT TO SCALE

LETTER	DESCRIPTION	DATE

SATISH K. GHOLKAR
LICENSED PROFESSIONAL ENGINEER
No. 5623-S
HAWAII, U.S.A.
License Expires: April 30, 2014

Satish K. Gholkar
Sept 18, 2012

SIGNATURE DATE

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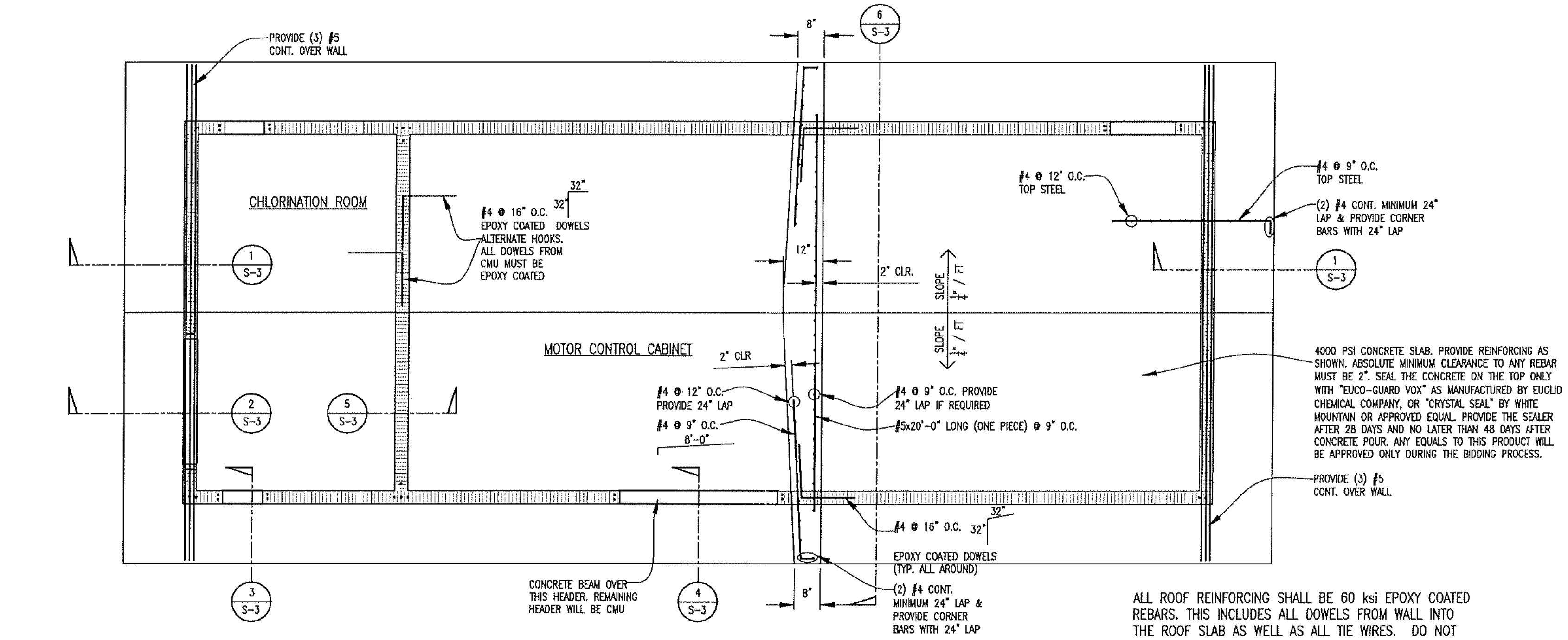
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE TYPICAL NOTES & DETAILS

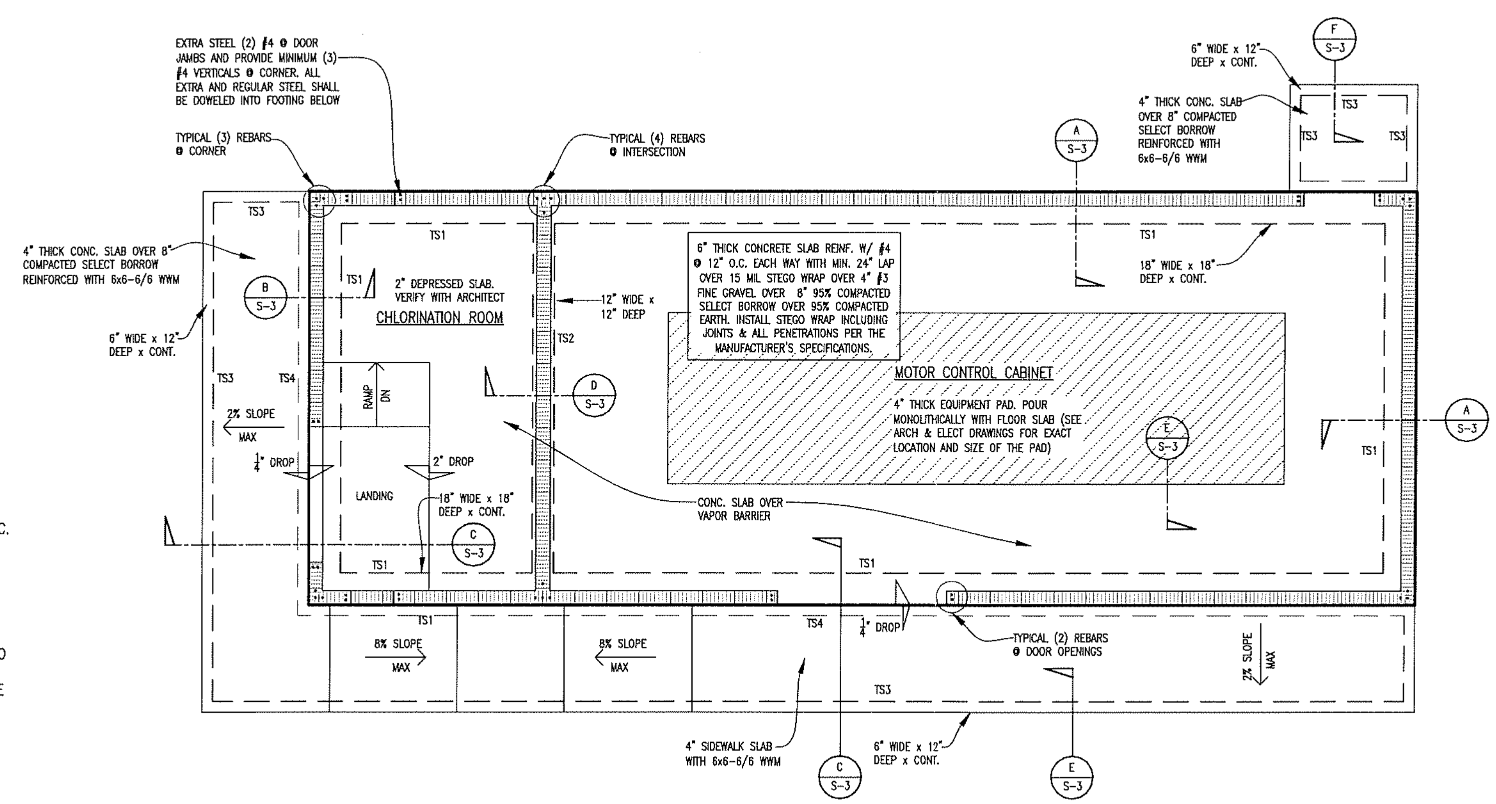
S.K.G. DESIGNED BY	S.K.G CHECKED BY	11025 JOB NUMBER	S-1 SHEET
R.G.P DRAWN BY	S.K.G APPROVED BY	18 SEPT 2012 DATE	OF SHEETS
SCALE			



ROOF FRAMING PLAN

SCALE: 1/4" = 1'-0"

ALL ROOF REINFORCING SHALL BE 60 ksi EPOXY COATED REBARS. THIS INCLUDES ALL DOWELS FROM WALL INTO THE ROOF SLAB AS WELL AS ALL TIE WIRES. DO NOT USE REGULAR WIRE TO TIE EPOXY COATED REBARS. ANY DAMAGE COATING MUST BE PATCHED PRIOR TO INSTALLATION. ALL EPOXY COATING SHALL CONFORM TO ASTM A775. PROVIDE "SCOTCHKOTE-413" COATINGS FOR REBARS AS MANUFACTURED BY 3M COMPANY OR APPROVED EQUAL. ANY EQUALS TO THIS PRODUCT WILL BE APPROVED ONLY DURING THE BIDDING PROCESS.



FOUNDATION PLAN

SCALE: 1/4" = 1'-0"

NOTE :

ALL 8" CMU MASONRY WALL SHALL BE REINFORCED WITH #5 @ 32" O.C. VERTICALLY (48" MIN. DOWELS @ FOOTING AND 32" O.C. BEYOND) AND (2) #4 @ 32" O.C. HORIZONTALLY (32" MIN. LAP AND @ ALL CORNERS) UNLESS NOTED OTHERWISE.

PROVIDE SAW-CUT OR CONTROL JOINTS W/ METAL KEYS @ ABOUT 15'-0" GRID. IF SAW CUT JOINTS ARE USED, CUT THE SLAB WITHIN 12 HOURS AFTER CONCRETE POUR. CONTRACTOR TO PROVIDE SHOP DRAWING OUTLINING ALL SAW CUT OR CONTROL JOINT LOCATIONS FOR APPROVAL PRIOR TO CONSTRUCTION. CURE SLAB PER JOB SPECIFICATIONS.

TYPICAL NOTE:

PROVIDE 6" SLAB REINFORCED WITH #4 @ 12" O.C. EACH WAY WITH MINIMUM 24" LAPS. SLAB IS TO BE PLACED OVER 15 MIL STEGO WRAP. INSTALL STEGO WRAP INCLUDING JOINTS AND ALL PENETRATION IN STRICT SPECIFICATIONS OF THE MANUFACTURER OVER 4" #3 FINE GRAVEL OVER 8" SELECT BORROW COMPACTED TO 95% OVER 95% COMPACTED BACKFILL OR NATURAL EARTH. ALL PLUMBING PIPES & ELECTRICAL CONDUITS SHALL BE PLACED IN COMPACTED EARTH. DO NOT PLACE ANY PLUMBING PIPE IN FOUNDATION TRENCHES. ALL BACKFILL SHALL BE MAXIMUM 8" LIFTS. COMPACT EACH LIFT TO 95% COMPACTION.

USE TYPE I OR II CEMENT CONFORMING WITH ASTM C-150. CONCRETE SHALL HAVE COMPRESSIVE STRENGTHS AT 28 DAYS AS FOLLOWS:

SLAB ON GRADE.......3000PSI -- MIN. 5.0 SACKS OF CEMENT / PER CU.YD

ROOF SLAB...............4000PSI -- MIN. 6.0 SACKS OF CEMENT / PER CU.YD

ALL REINF. STEEL SHALL BE fy = 60 ksi

ALL ROOF REINFORCING SHALL BE 60 ksi EPOXY COATED REBARS. THIS INCLUDES ALL DOWELS FROM WALL INTO THE ROOF SLAB AS WELL AS ALL TIE WIRES. DO NOT USE REGULAR WIRE TO TIE EPOXY COATED REBARS. ANY DAMAGE COATING MUST BE PATCHED PRIOR TO INSTALLATION. ALL EPOXY COATING SHALL CONFORM TO ASTM A775. PROVIDE "SCOTCHKOTE-413" COATINGS FOR REBARS AS MANUFACTURED BY 3M COMPANY OR APPROVED EQUAL. ANY EQUALS TO THIS PRODUCT WILL BE APPROVED ONLY DURING THE BIDDING PROCESS.

MISC. CONCRETE NOT MENTIONED ABOVE....3000PSI -- MIN. 5.0 SACKS OF CEMENT HARDROCK AGGREGATES SHALL CONFORM TO ASTM C-33 AND SHALL BE ONE INCH (1") MAXIMUM SIZE.

LETTER	DESCRIPTION	DATE

SATISH K. GHOLKAR
LICENSED PROFESSIONAL ENGINEER
No. 5623-S
HAWAII, U.S.A.
License Expires April 30, 2014

Satish K. Gholkar
Sept 18, 2012

SIGNATURE DATE

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MAHINAHINA PERMANENT WELL WATER SYSTEM

MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE FOUNDATION PLAN, ROOF FRAMING PLAN

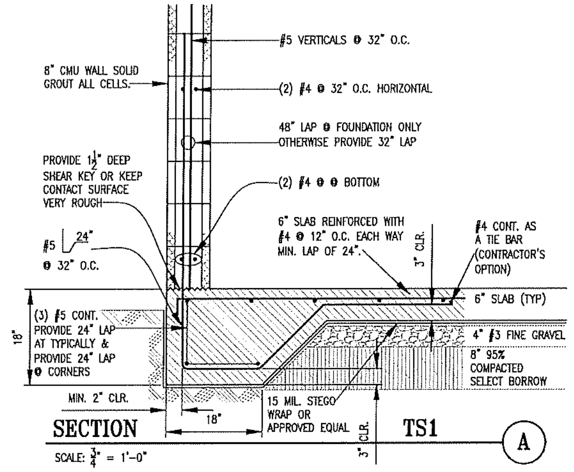
S.K.G. DESIGNED BY	S.K.G CHECKED BY	11025 JOB NUMBER	S-2 SHEET
R.G.P DRAWN BY	S.K.G APPROVED BY	18 SEPT 2012 DATE	OF SHEETS
SCALE 1/4" = 1'-0"			

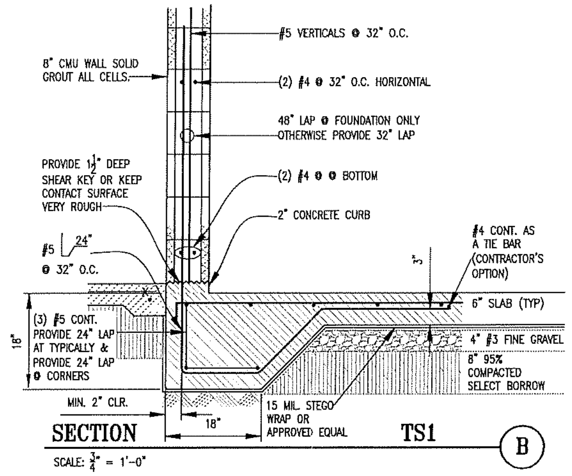
NOTE:

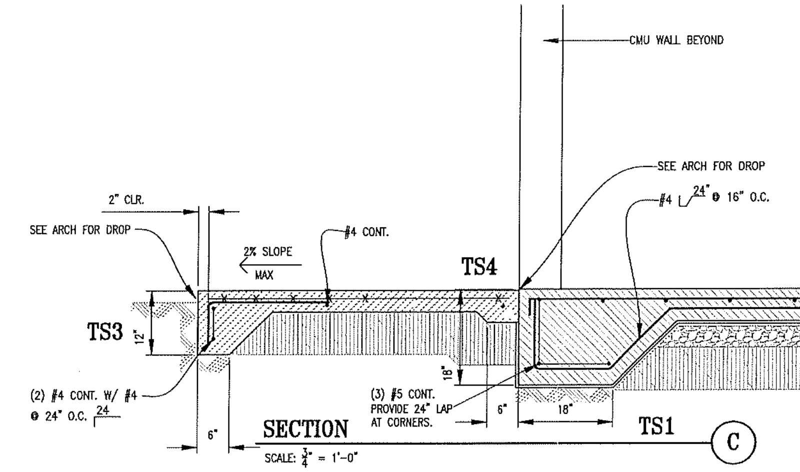
ALL FOUNDATIONS SHALL BE OVER 95% COMPACTED UNDISTURBED EARTH OR 95% COMPACTED EARTH. COMPACT ALL BEARING AREAS TO MINIMUM 95% COMPACTION. REMOVE ANY SOFT AREAS AND FILL WITH COMPACTED CRUSHER WASTE. DO NOT PLACE ANY FOOTINGS OVER NON-COMPACTED EARTH.

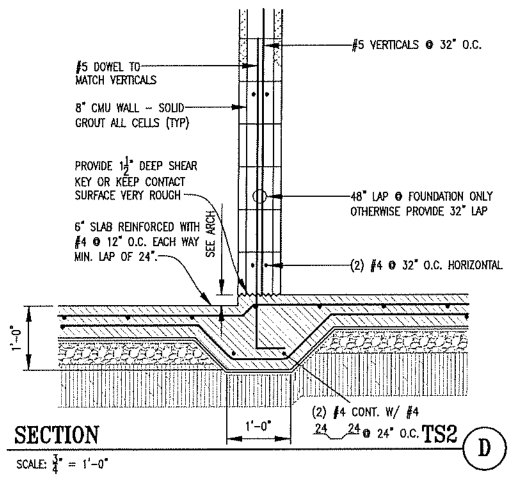
TYPICAL SLAB NOTE:

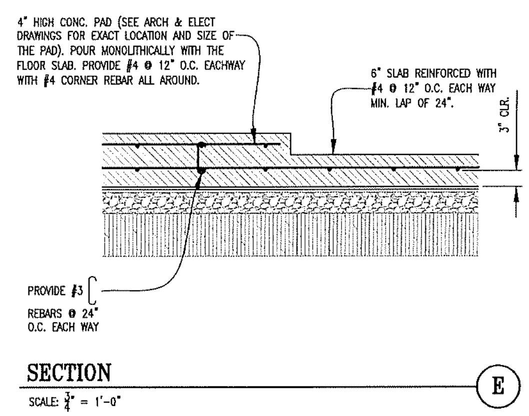
PROVIDE 6" SLAB REINFORCED WITH #4 @ 12" O.C. EACH WAY MIN. LAP OF 24". SLAB IS TO BE PLACED OVER 15 MIL STEGO WRAP OVER 4" #3 FINE GRAVEL OVER OVER 8" SELECT BORROW COMPACTED TO 95% OVER 95% COMPACTED BACKFILL OR NATURAL EARTH. ALL PLUMBING PIPES & ELECTRICAL CONDUITS SHALL BE PLACED IN COMPACTED EARTH. DO NOT PLACE ANY PLUMBING PIPE IN FOUNDATION TRENCHES. ALL BACKFILL SHALL BE MAXIMUM 8" LIFTS. COMPACT EACH LIFT TO 95% COMPACTION. ALL COMPACTIONS SHALL BE DETERMINED AS DRY DENSITY PER ASTM D-1557. ALL TESTINGS SHALL BE PERFORMED BY LICENSED SOIL ENGINEER (STATE OF HAWAII). THE COST OF TESTING SHALL BE BOURNE BY THE CONTRACTOR.

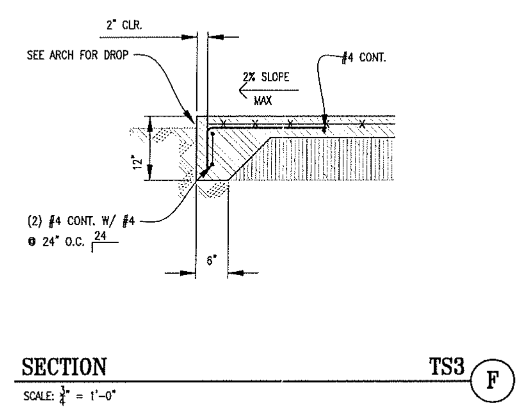


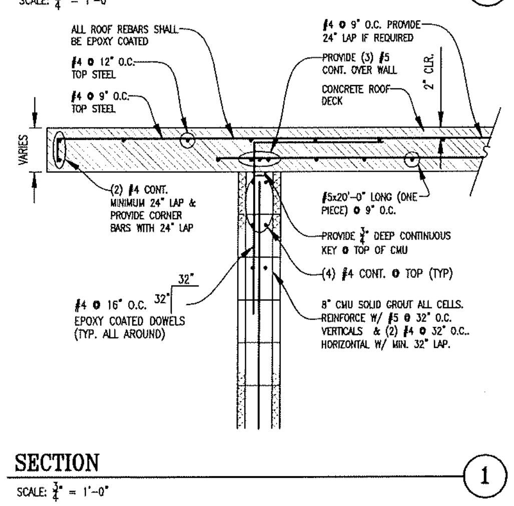


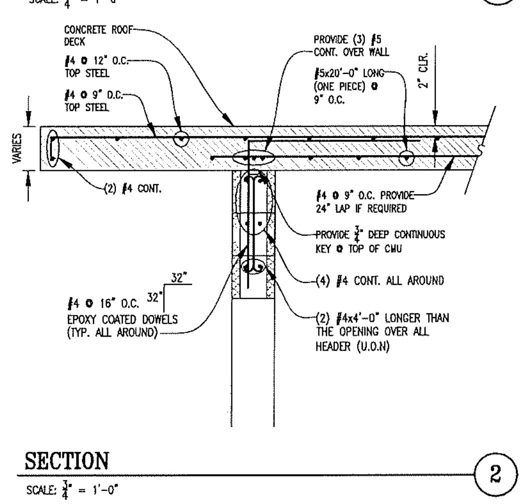


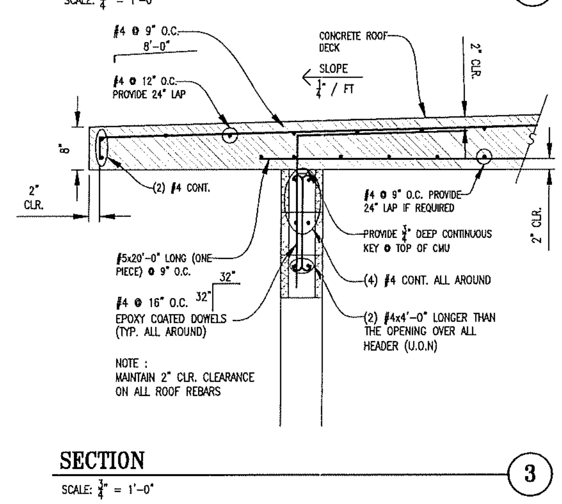


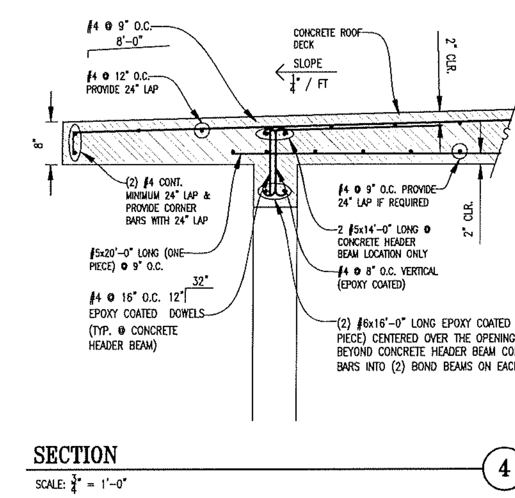


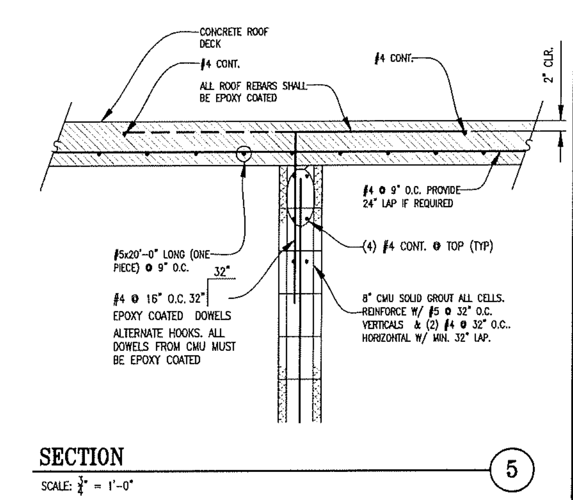


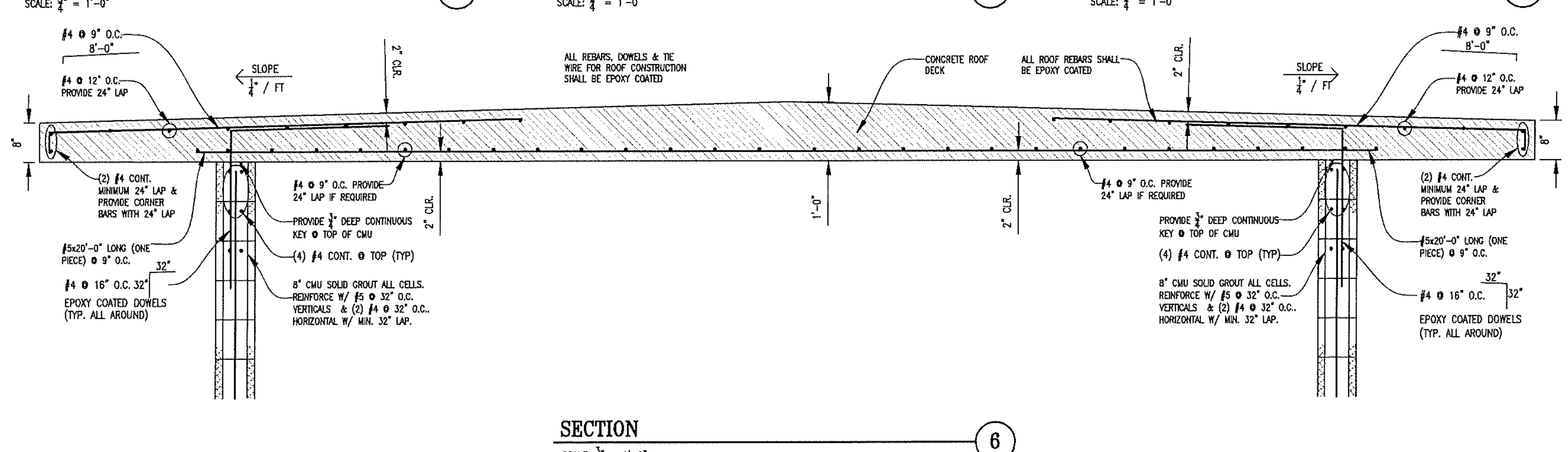












LETTER	DESCRIPTION	DATE

SATISH K. GHOLKAR
LICENSED PROFESSIONAL ENGINEER
No. 5623-S
HAWAII, U.S.A.
License Expires: April 30, 2014

Satish K. Gholkar
Sept 18, 2012

SIGNATURE DATE

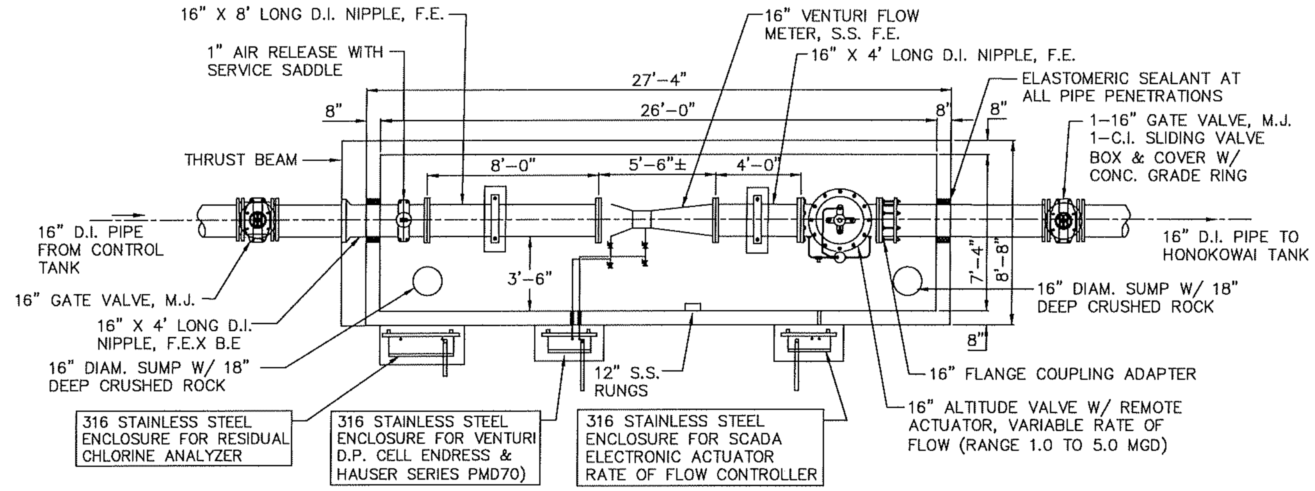
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION "AS DEFINED IN SECTION 16-115-2 OF THE HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, LAND SURVEYORS AND LANDSCAPE ARCHITECTS"

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

MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

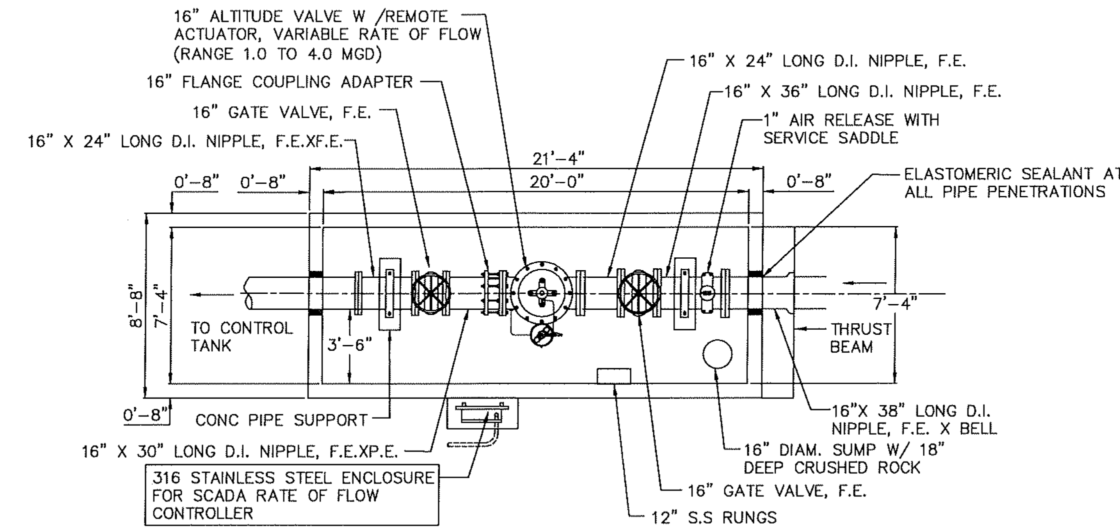
TITLE FOUNDATION DETAILS , ROOF FRAMING DETAILS

S.K.G. DESIGNED BY	S.K.G CHECKED BY	11025 JOB NUMBER	S-3 SHEET
R.G.P DRAWN BY	S.K.G APPROVED BY	18 SEPT 2012 DATE	
SCALE 3/4" = 1'-0"			OF SHEETS



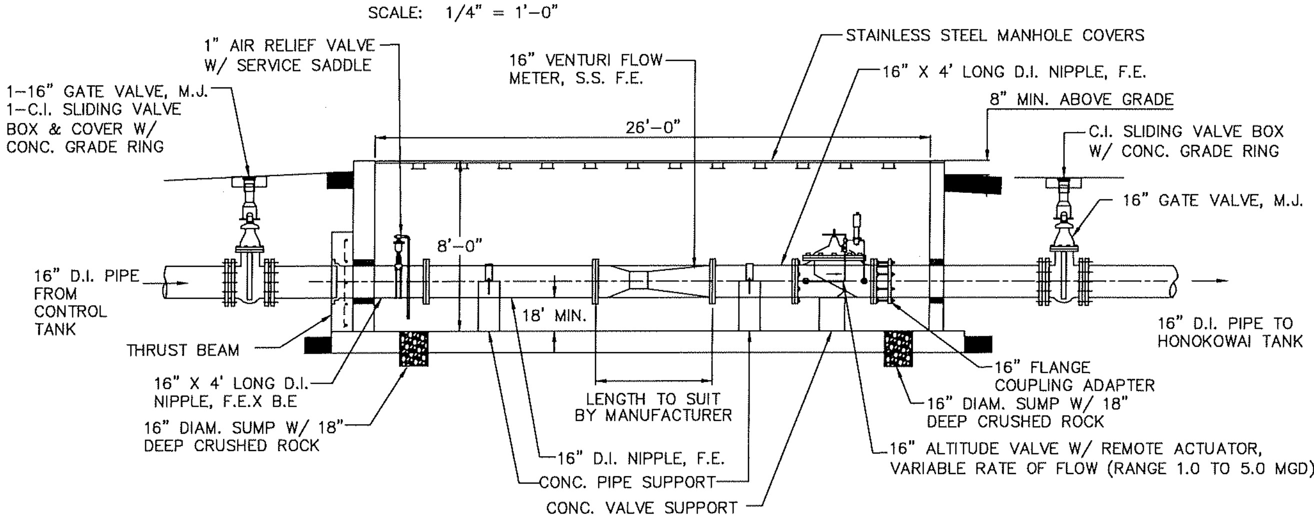
16" OUTLET CONTROL VALVE - PIPING PLAN

SCALE: 1/4" = 1'-0"



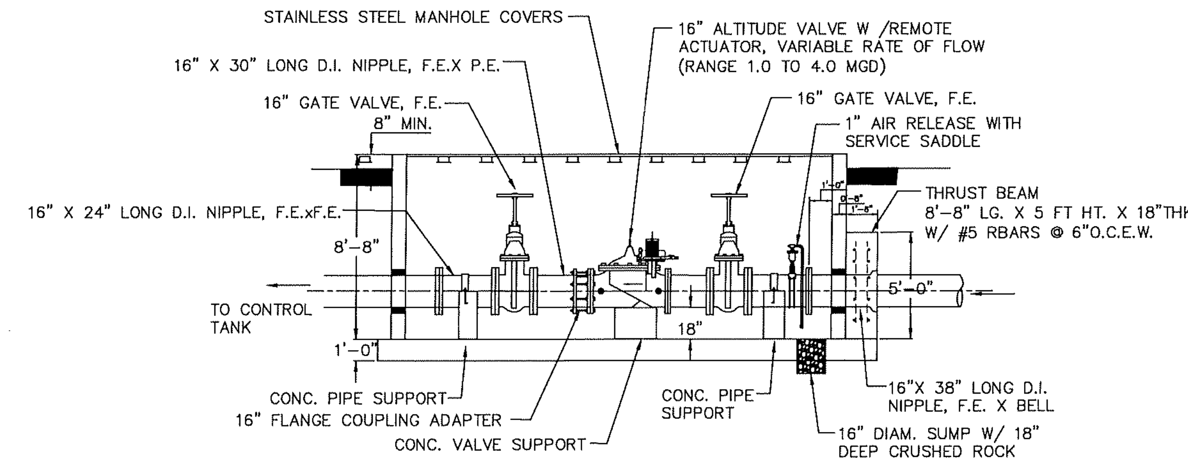
16" CONTROL VALVE NO. 2 - PIPING PLAN

SCALE: 1/4" = 1'-0"



16" OUTLET CONTROL VALVE - PIPING SECTION

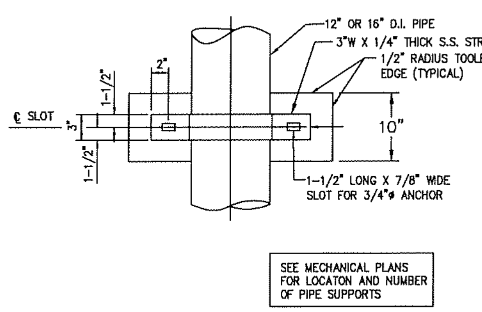
SCALE: 1/4" = 1'-0"



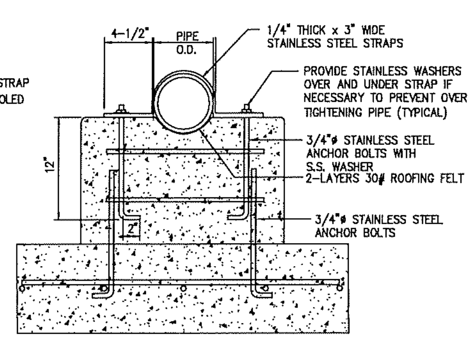
16" CONTROL VALVE NO. 2 - PIPING SECTION

SCALE: 1/4" = 1'-0"

(16" ALTITUDE VALVE WITH REMOTE ADJUSTED VARIABLE RATE OF FLOW CONTROL)



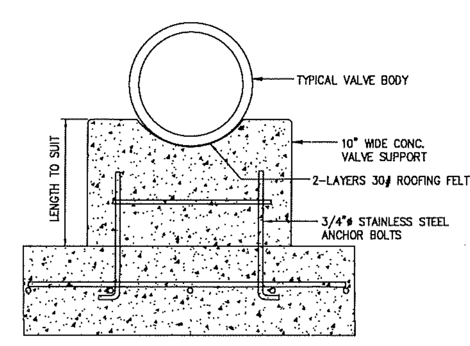
PLAN



SECTION

PIPE SUPPORT DETAIL

NOT TO SCALE



CONCRETE VALVE SUPPORT

NOT TO SCALE

GENERAL NOTE:

1. STAINLESS STEEL COVER SHALL CONFORM TO DWS STD. DETAIL M11.
2. THRUST BEAM SHALL CONFORM TO DWS STD. DETAILS B16 & B17.
3. REACTION BLOCKS SHALL CONFORM TO DWS STD. DETAILS B2, B3, & B4.
4. ALL VALVE MANHOLE AND CONCRETE SLABS SHALL BE COMPLETELY CURED AND BACKFILLED BEFORE BEING SUBJECT TO TEST OF SYSTEM PRESSURES.
5. ALL EXPOSED METAL PIPES, FITTINGS, AND SUPPORTS SHALL BE THOROUGHLY CLEANED, PRIMED, AND PAINTED (2 COATS) OF POLYURETHANE PAINT (COLORS TO BE SELECTED BY DWS)
6. PROVIDE DIELECTRIC UNIONS OR COUPLINGS WHEN EVER DISSIMILAR METALS ARE IN CONTACT WITH EACH OTHER.
7. PROVIDE ALL STAINLESS STEEL PIPE, FITTINGS, SUPPORTS, AND ATTACHMENTS WHEN NOT OTHERWISE INDICATED.

ADVANCE PRINT 11/19/2018
SUBJECT TO CHANGE

DOUGLAS L. GOMES
LICENSED PROFESSIONAL ENGINEER
No. 3646-C
HAWAII, U.S.A.
04/30/2020

SIGNATURE DATE

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

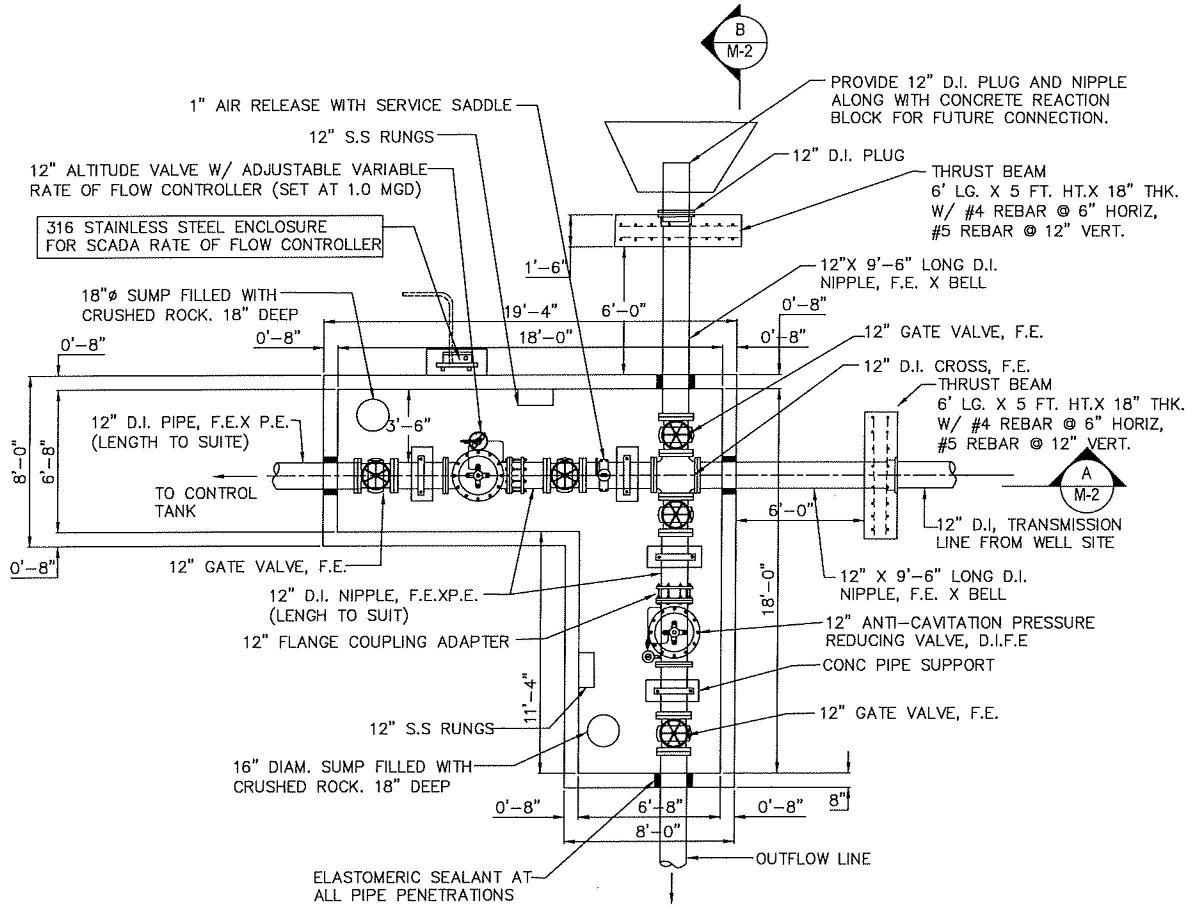
MAHINAHINA PERMANENT WELL #1
WATER SYSTEM - PHASE 1
DWS JOB NO. 1106
MAHINAHINA, LAHAINA MAUI, HAWAII

TITLE CONTROL PIPING AT CONTROL TANK

DLG DESIGNED BY	CHECKED BY	1106 JOB NUMBER	M-1 SHEET
DRAWN BY	DLG APPROVED BY	11/19/2018 DATE	OF SHEETS
SCALE	AS SHOWN		

LETTER	DESCRIPTION	DATE

J:\(ACTIVE JOBS)\1617-NEW MAHINAHINA WELL- UNEMORI\REVISED -REDUCED SCOPE PLANS\MECH DWGS ADVANCE PDF\M-1,2,3 CONTROL TANK REV-3 11-19-2018.dwg

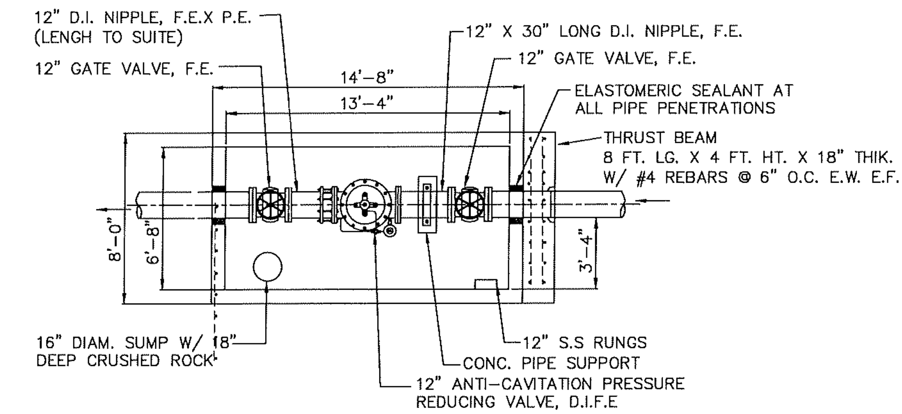


12" CONTROL VALVE NO. 3 - PIPING PLAN

SCALE: 1/4" = 1'-0" (12" ALTITUDE VALVE WITH VARIABLE RATE OF FLOW CONTROL SET AT 1.0 MGD)

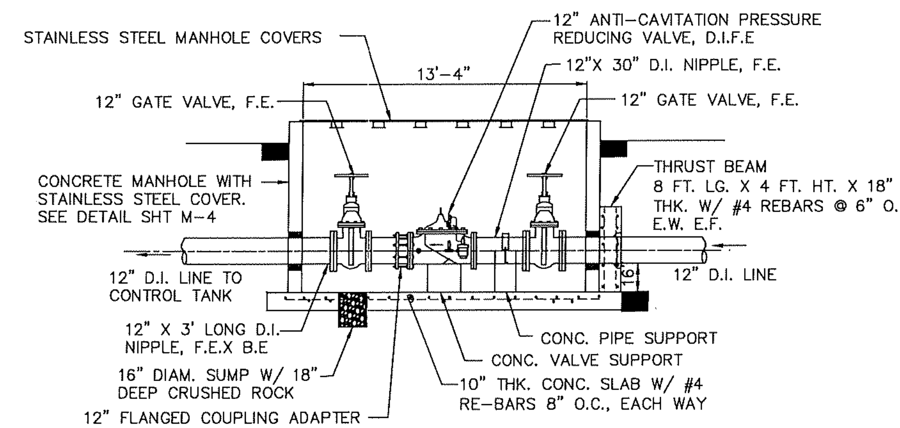
SPECIAL NOTES:

1. SEE CIVIL SITE PLAN FOR LOCATION AND ORIENTATION OF ALL CONTROL VALVES.
2. ALL PIPES, VALVES, FITTINGS AND APPURTENANCES SHALL BE RATED FOR A WORKING PRESSURE OF 250 PSI. PROVIDE SPECIAL GASKETS AND ALL NECESSARY STAINLESS STEEL NUTS AND BOLTS.
3. ALL EXPOSED PIPES, FITTINGS AND METAL SURFACES SHALL BE CLEANED, PRIMED AND PAINTED WITH CORROSION RESISTANT POLYURETHANE PAINT. COLOR SELECTED BY DWS.
4. SEE CIVIL PLANS FOR STRUCTURAL REQUIREMENTS FOR ALL VALVES MANHOLES.



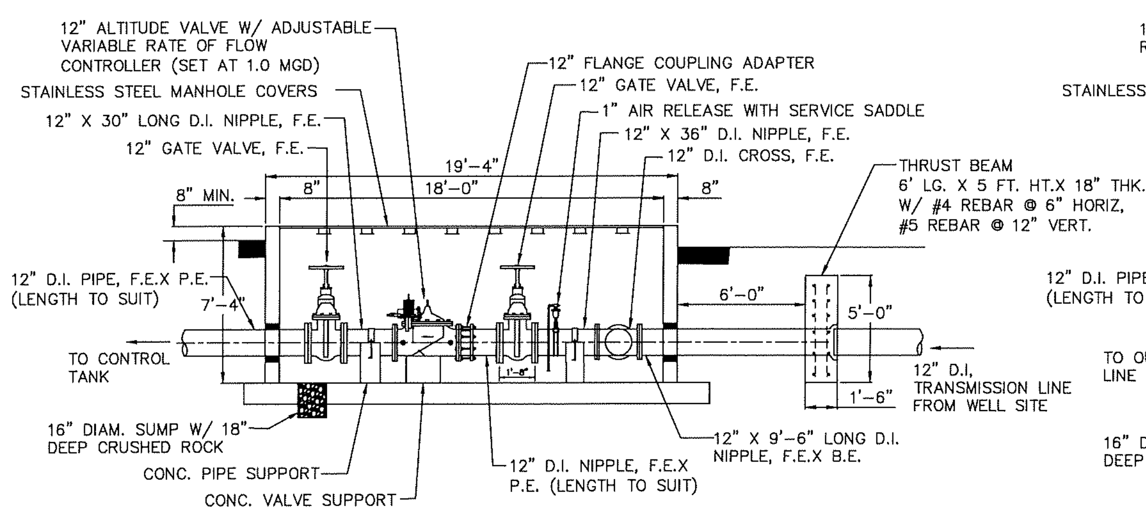
12" PRESSURE REDUCING VALVE PLAN

SCALE: 1/4" = 1'-0"



12" PRESSURE REDUCING VALVE SECTION

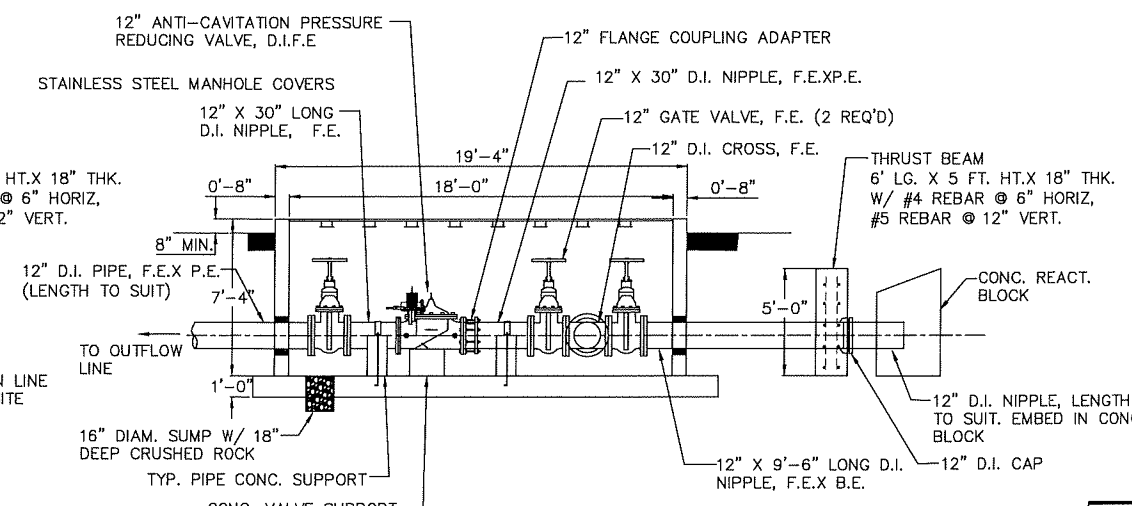
SCALE: 1/4" = 1'-0"



12" CONTROL VALVE NO. 3 - PIPING SECTION - A

SCALE: 1/4" = 1'-0"

(12" ALTITUDE VALVE WITH VARIABLE RATE OF FLOW CONTROL SET AT 1.0 MGD)



12" CONTROL VALVE NO. 3 - PIPING SECTION - B

SCALE: 1/4" = 1'-0"

ADVANCE PRINT 11/19/2018
SUBJECT TO CHANGE

DOUGLAS L. GOMES
LICENSED PROFESSIONAL ENGINEER
No. 3646-C
HAWAII, U.S.A.
04/30/2020

SIGNATURE DATE

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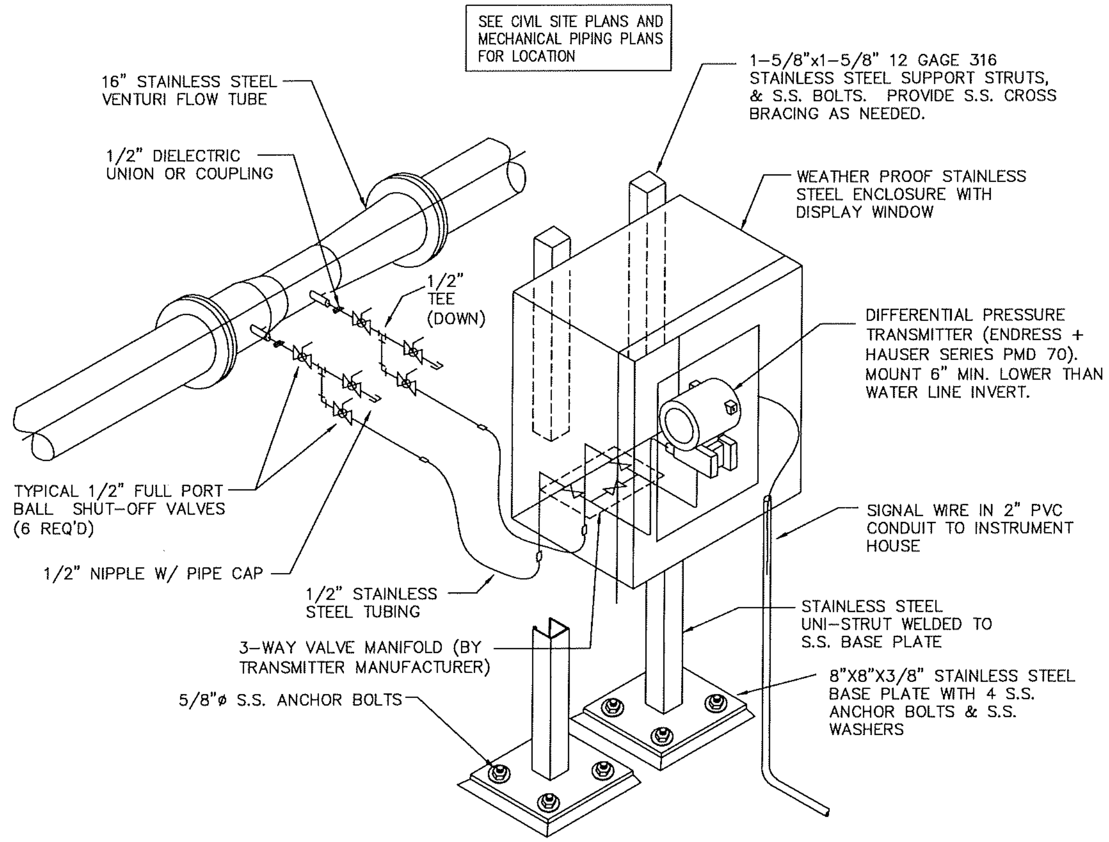
LETTER	DESCRIPTION	DATE
△	REVISED DETAIL	10/21/2012

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

MAHINAHINA PERMANENT WELL #1
WATER SYSTEM - PHASE 1
DWS JOB NO. 1106
MAHINAHINA, LAHAINA MAUI, HAWAII

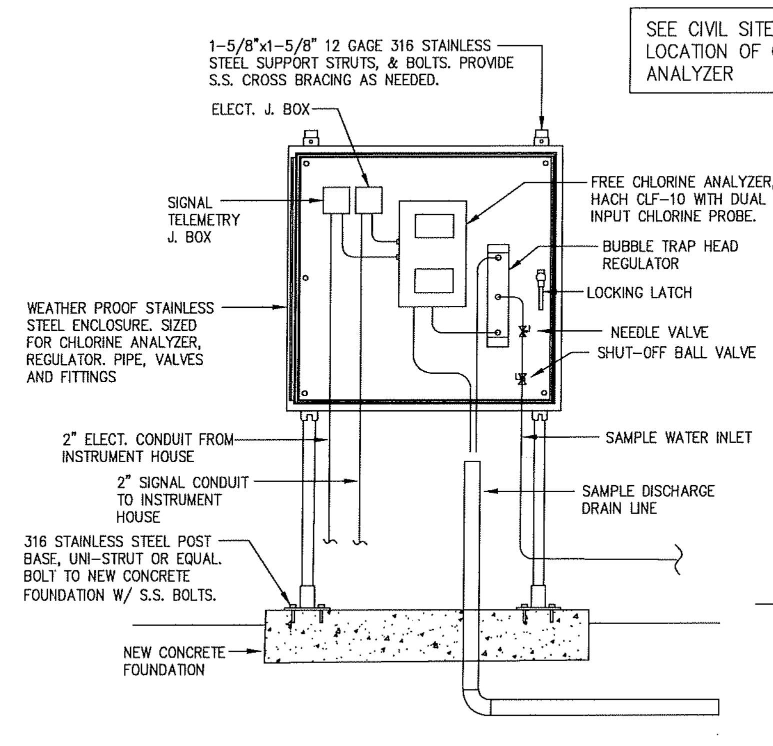
TITLE CONTROL PIPING AT CONTROL TANK

DLG		1106		
DESIGNED BY	CHECKED BY	JOB NUMBER	M-2	
	DLG	11/19/018		
DRAWN BY	APPROVED BY	DATE	SHEET	
AS SHOWN			OF	SHEETS
SCALE				

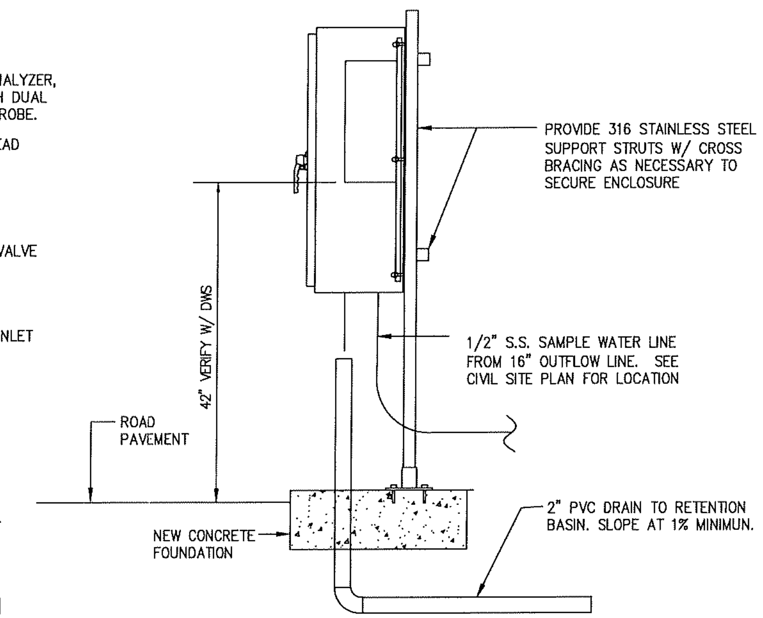


VENTURI METER - DIFFERENTIAL PRESSURE TRANSMITTER SCHEMATIC

NOT TO SCALE



FRONT ELEVATION



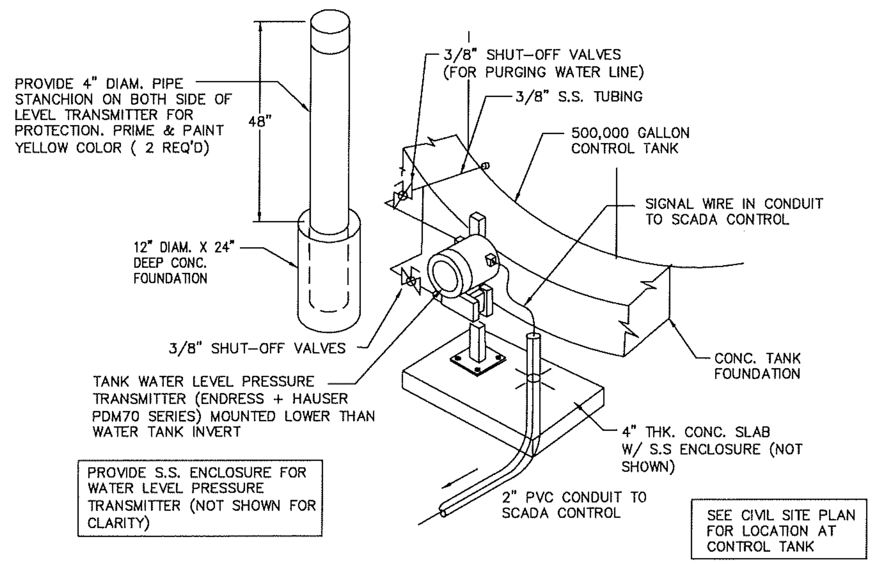
SIDE ELEVATION

RESIDUAL CHLORINE ANALYZER ENCLOSURE DETAIL AT CONTROL TANK

NOT TO SCALE

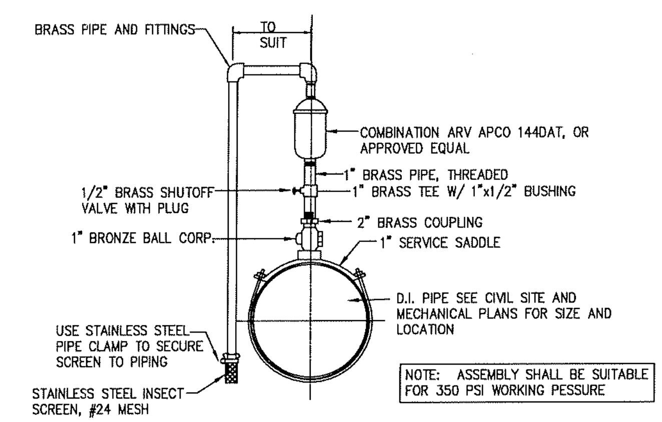
LEGEND AND ABBREVIATIONS

A.F.F.	ABOVE FINISH FLOOR
&	AND
APPROX.	APPROXIMATE
B.E.	BELL END
BTUH	BRITISH THERMAL UNITS PER HOUR
CL	CLASS
CONC.	CONCRETE
DIAM.	DIAMETER
Ø	DIAMETER
D.I.	DUCTILE IRON
D.P.	DIFFERENTIAL PRESSURE
DWS	DEPARTMENT OF WATER SUPPLY
EA.	EACH
EXIST.	EXISTING
F.E.	FLANGED END
H	HEIGHT
H.C.B.	HOLLOW CORE BLOCK
J. BOX	JUNCTION BOX
MAX.	MAXIMUM
MMC	MOTOR CONTROL CENTER
M.J.	MECHANICAL JOINT
M.S.L.	MEAN SEA LEVEL
#	NUMBER
O.C.	ON CENTER
OS&Y	OUTSIDE STEM AND YOKE
O.D.	OUTSIDE DIAMETER
P.E.	PLAN END
PE.	POLYETHYLENE
PH.	PHASE
PSIG	POUND PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
SCHD	SCHEDULE
S.S.	STAINLESS STEEL
THK.	THICKNESS
TYP.	TYPICAL
VERT.	VERTICAL
V	VOLTS
W	WIDTH
W/	WITH



TANK LEVEL PRESSURE TRANSMITTER SCHEMATIC

NOT TO SCALE



COMBINATION AIR RELEASE VALVE ASSEMBLY DETAIL

NOT TO SCALE

ADVANCE PRINT 11/19/2018
SUBJECT TO CHANGE

DOUGLAS L. GOMES
LICENSED PROFESSIONAL ENGINEER
No. 3646-C
HAWAII, U.S.A.
04/30/2020

SIGNATURE DATE

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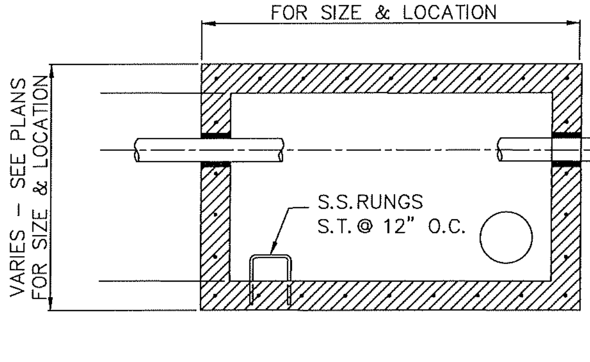
WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL #1
WATER SYSTEM - PHASE 1
DWS JOB NO. 1106
MAHINAHINA, LAHAINA MAUI, HAWAII

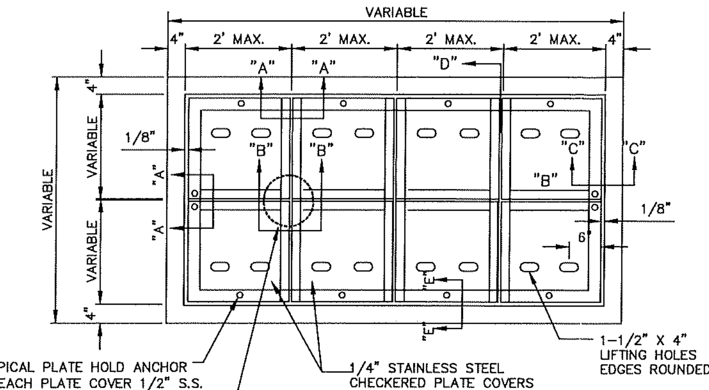
TITLE CHLORINE ANALYZER & VENTURI METER DETAILS

DLG DESIGNED BY	CHECKED BY	1106 JOB NUMBER	M-3 SHEET
DRAWN BY	DLG APPROVED BY	11/19/2018 DATE	
SCALE AS SHOWN			OF SHEETS

LETTER	DESCRIPTION	DATE

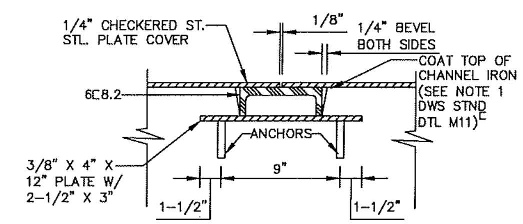


VALVE MANHOLE PLAN
NOT TO SCALE

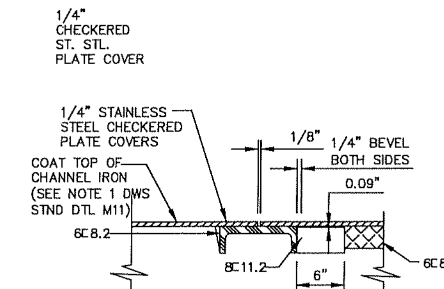


SEE CIVIL SITE PLAN AND MECHANICAL PLANS FOR LOCATION AND ACTLAL SIZE OF VALVE MANHOLES

PLAN
NOT TO SCALE



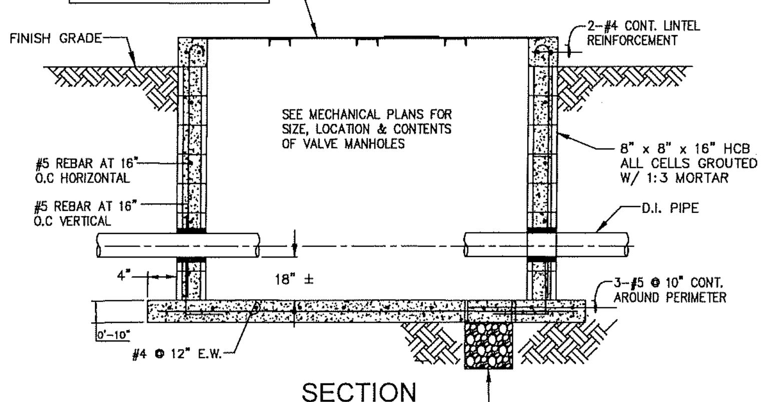
SECTION "A-A"
NOT TO SCALE



SECTION "B-B"
NOT TO SCALE

PROVIDE STAINLESS STEEL COVER. REFER TO DWS STD. DETAINL 48R REVISION 1999

SEE CIVIL SITE PLAN AND MECHANICAL PLANS FOR LOCATION AND SIZE OF VALVE MANHOLES

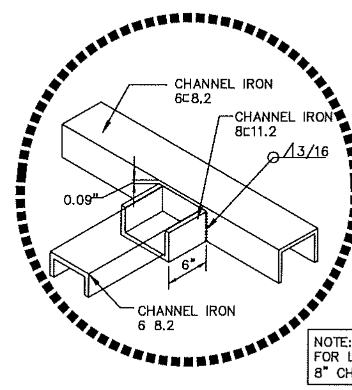


SECTION
NOT TO SCALE

NOTES:

1. FOR MANHOLE COVER DETAILS, SEE PLATE 48R (1997 REVISION).
2. FOR DETECTOR CHECK METER DETAILS, SEE PLATE 63M (1997 REVISION).

VALVE MANHOLE SECTION
REFERENCE D.W.S. STANDARD DETAIL 67M (1997 REVISION)
NOT TO SCALE

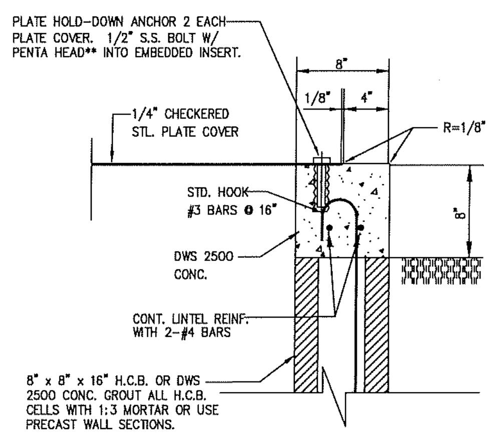


ALL STEEL CHANNELS AND PLATES SHALL BE GALVANIZED STEEL.

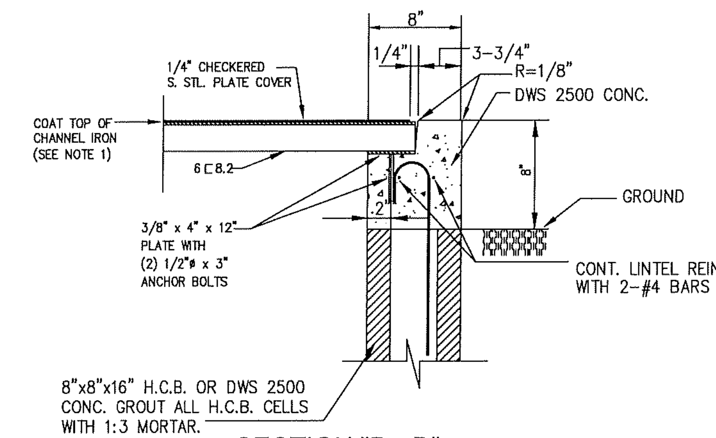
NOTE: OFFSET TOP OF 8" CHANNEL TO ALLOW BOTH 6" CHANNELS TO BE AT SAME LEVEL

NOTE: SEE PLAN FOR LOCATION OF 8" CHANNEL

ENLARGED DETAIL

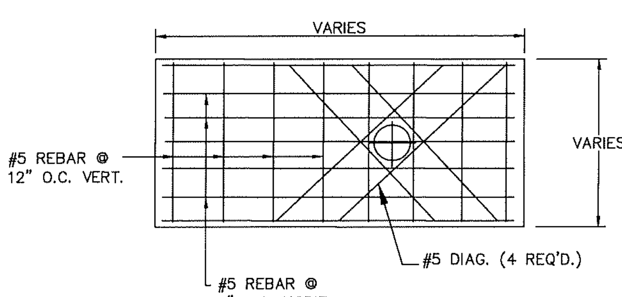


SECTION "C - C"
NOT TO SCALE



SECTION "D - D"
NOT TO SCALE

SPLIT-COVER MANHOLE COVER DETAIL
NOT TO SCALE



SEE CIVIL SITE PLAN AND MECHANICAL PLANS FOR LOCATION AND SIZE OF VALVE MANHOLES AND THRUST BEAMS

THRUST BEAM
NOT TO SCALE

ADVANCE PRINT 11/19/2018
SUBJECT TO CHANGE

DOUGLAS L. GOMES
LICENSED PROFESSIONAL ENGINEER
No. 3646-C
HAWAII, U.S.A.
04/30/2020

SIGNATURE DATE

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

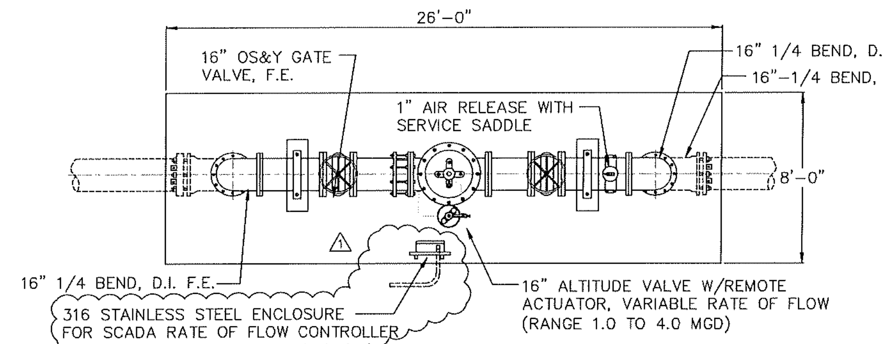
MAHINAHINA PERMANENT WELL #1
WATER SYSTEM - PHASE 1
DWS JOB NO. 1106
MAHINAHINA, LAHAINA MAUI, HAWAII

TITLE VALVE MANHOLE PLAN, SECTION & DETAILS

DESIGNED BY DLG	CHECKED BY	JOB NUMBER 1106	SHEET M-4
DRAWN BY	APPROVED BY DLG	DATE 11/19/2018	OF SHEETS
SCALE AS SHOWN			

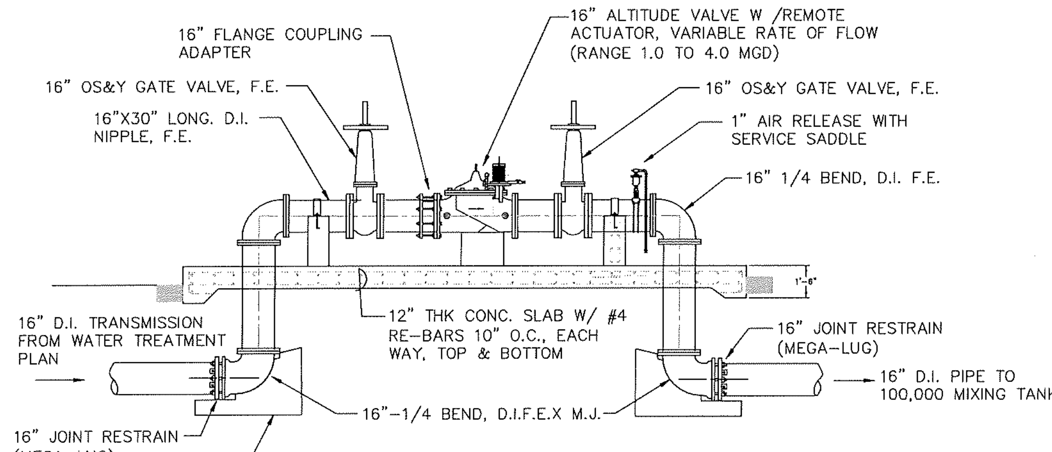
LETTER	DESCRIPTION	DATE

J:\(ACTIVE JOBS\11617-NEW MAHINAHINA WELL- UNEMORI(REVISED -REDUCED SCOPE PLANS\MECH DWGS ADVANCE PDF\M-1,2,3 CONTROL TANK REV-3 11-19-2018.dwg



16" CONTROL VALVE NO. 2 - PIPING PLAN

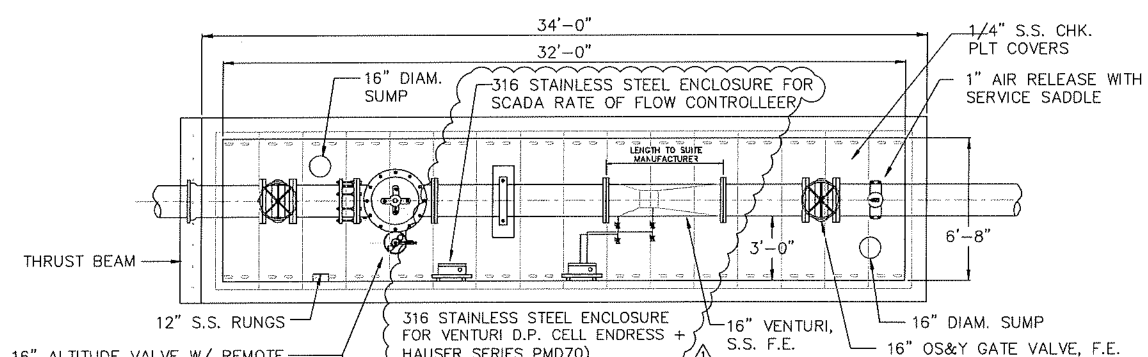
SCALE: 1/4" = 1'-0"



16" CONTROL VALVE NO. 2 - PIPING SECTION

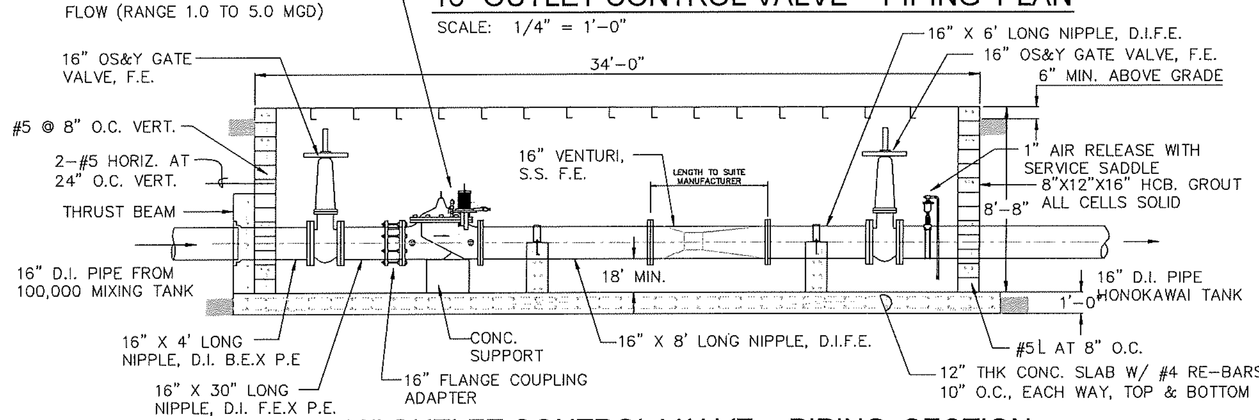
SCALE: 1/4" = 1'-0"

(16" ALTITUDE VALVE WITH REMOTE ADJUSTED VARIABLE RATE OF FLOW CONTROL)



16" OUTLET CONTROL VALVE - PIPING PLAN

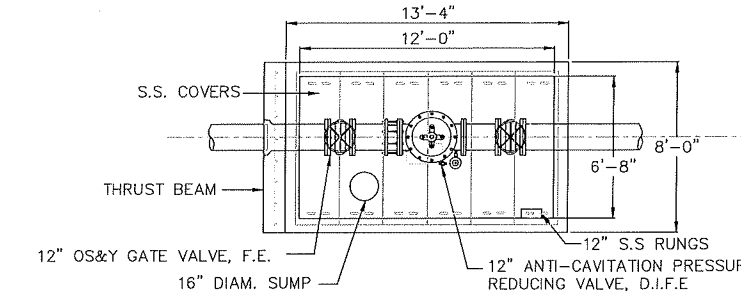
SCALE: 1/4" = 1'-0"



16" OUTLET CONTROL VALVE - PIPING SECTION

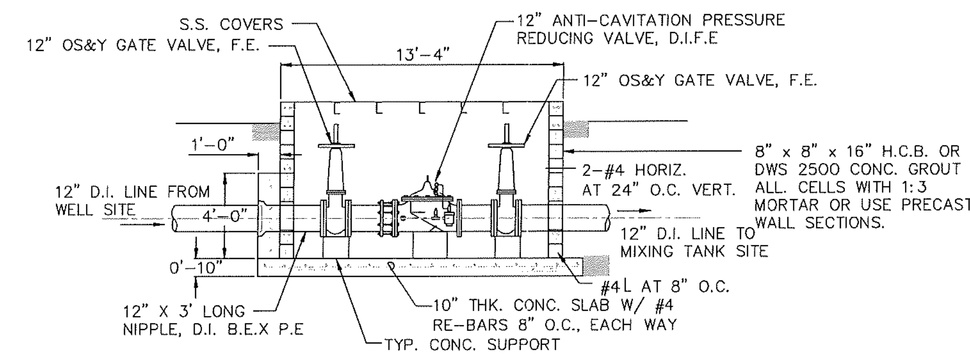
SCALE: 1/4" = 1'-0"

16" ALTITUDE VALVE W/ REMOTE ACTUATOR, VARIABLE RATE OF FLOW (RANGE 1.0 TO 5.0 MGD)



12" PRESSURE REDUCING VALVE PLAN

SCALE: 1/4" = 1'-0"



12" PRESSURE REDUCING VALVE SECTION

SCALE: 1/4" = 1'-0"

GENERAL NOTE:

1. STAINLESS STEEL COVER SHALL CONFORM TO DWS STD. DETAIL M11.
2. THRUST BEAM SHALL CONFORM TO DWS STD. DETAIL B16 & B17.
3. REACTION BLOCKS SHALL CONFORM TO DWS STD. DETAILS B2, B3, & B4.
4. ALL VALVE MANHOLE AND CONCRETE SLABS SHALL BE COMPLETELY CURED AND BACKFILLED BEFORE BEING SUBJECT TO TEST OF SYSTEM PRESSURES.
5. ALL EXPOSED METAL PIPES, FITTINGS, AND SUPPORTS SHALL BE THOROUGHLY CLEANED, PRIMED, AND PAINTED (2 COATS) OF POLYURETHANE PAINT (COLORS TO BE SELECTED BY DWS)
6. PROVIDE DIELECTRIC UNIONS OR COUPLINGS WHEN EVER DISSIMILAR METALS ARE IN CONTACT WITH EACH OTHER.
7. PROVIDE ALL STAINLESS STEEL PIPE, FITTINGS, SUPPORTS, AND ATTACHMENTS WHEN NOT OTHEWISED INDICATED.

LEGEND AND ABBREVIATIONS

A.F.F.	ABOVE FINISH FLOOR
&	AND
APPROX.	APPROXIMATE
B.E.	BELL END
BTUH	BRITISH THERMAL UNITS PER HOUR
CL	CLASS
CONC.	CONCRETE
DIAM.	DIAMETER
Ø	DIAMETER
D.I.	DUCTILE IRON
D.P.	DIFFERENTIAL PRESSURE
DWS	DEPARTMENT OF WATER SUPPLY
EA.	EACH
EXIST.	EXISTING
F.E.	FLANGED END
H	HEIGHT
H.C.B.	HOLLOW CORE BLOCK
J. BOX	JUNCTION BOX
MAX.	MAXIMUM
MMC	MOTOR CONTROL CENTER
M.J.	MECHANICAL JOINT
M.S.L.	MEAN SEA LEVEL
#	NUMBER
O.C.	ON CENTER
OS&Y	OUTSIDE STEM AND YOKE
O.D.	OUTSIDE DIAMETER
P.E.	PLAN END
PE.	POLYETHYLENE
PH.	PHASE
PSIG	POUND PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
SCHD	SCHEDULE
S.S.	STAINLESS STEEL
THK.	THICKNESS
TYP.	TYPICAL
VERT.	VERTICAL
V	VOLTS
W	WIDTH
W/	WITH

LETTER	DESCRIPTION	DATE
1	REVISED DETAIL ADDED TRANSMITTER	10/29/2012

DOUGLAS L. GOMES · LICENSED PROFESSIONAL ENGINEER · No. 3646-C · HAWAII, U.S.A. · 04/30/2014

SIGNATURE 09/20/2012 DATE

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"

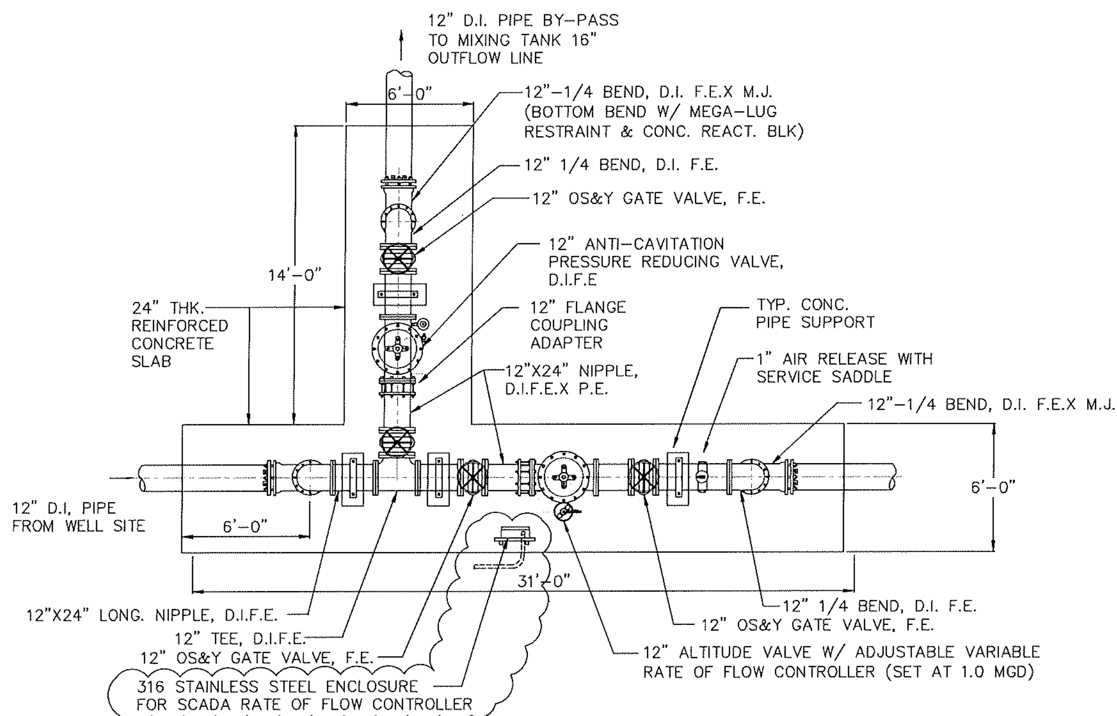
WARREN S. UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL

TMK: (2) 4-4-09: PARCEL 9
MAHINAHINA, LAHAINA MAUI, HAWAII

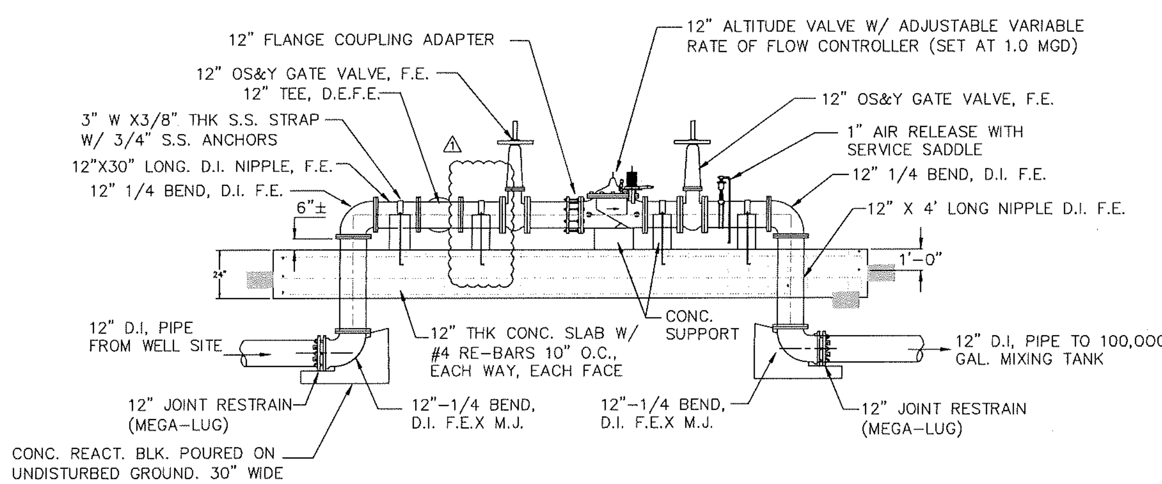
TITLE CONTROL PIPING AT MIXING TANK

DLG DESIGNED BY	RAD CHECKED BY	10059 JOB NUMBER	M-5 SHEET
PB DRAWN BY	DLG APPROVED BY	5-12-11 DATE	
SCALE AS SHOWN			OF SHEETS



12" CONTROL VALVE NO. 3 - PIPING PLAN

SCALE: 1/4" = 1'-0"



12" CONTROL VALVE NO. 3 - PIPING SECTION

SCALE: 1/4" = 1'-0"

(12" ALTITUDE VALVE WITH VARIABLE RATE OF FLOW CONTROL SET AT 1.0 MGD)

DWS 4,000 PSI CONCRETE & GRADE 60 REINFORCING STEEL.

LETTER	DESCRIPTION	DATE
⚠1	REVISED DETAIL	10/29/2012

DOUGLAS L. GOMES
LICENSED PROFESSIONAL ENGINEER
No. 3646-C
HAWAII, U.S.A.
04/30/2014

SIGNATURE 09/20/2012 DATE

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WARREN S. UNEMORI ENGINEERING, INC.
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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA WELL

TMK: (2) 4-4-09: PARCEL 9
MAHINAHINA, LAHAINA MAUI, HAWAII

TITLE CONTROL PIPING AT MIXING TANK

DESIGNED BY	CHECKED BY	JOB NUMBER	SHEET
DLG	RAD	10059	M-6
DRAWN BY	**APPROVED BY**	**DATE**	**OF SHEETS**
PB	DLG	5-12-11	
SCALE AS SHOWN			

GENERAL NOTES:

1. PROVIDE A COMPLETE AND OPERATING ELECTRICAL SYSTEM. PROVIDE SHALL MEAN "FURNISH AND INSTALL". WORK INCLUDES INSTALLATION OF ALL ELECTRICAL EQUIPMENT AND SYSTEMS, INCLUDING ANY FURNISHED BY OWNER, COMPLETE AND OPERATIONAL TO DOCUMENTS.
2. THE CONTRACTOR SHALL COMPLY WITH THE CONSTRUCTION PRACTICES AND REQUIREMENTS OF THE LATEST EDITION OF THE NATIONAL ELECTRIC CODE (NFPA 70), NATIONAL ELECTRICAL SAFETY CODE, AMERICAN ELECTRICIANS HANDBOOK BY CROFT EDISON ELECTRIC INSTITUTE, APPLICABLE INSTRUCTIONS OF MANUFACTURERS OF EQUIPMENT AND MATERIALS SUPPLIED FOR THE PROJECT, AND ALL ORDINANCES, RULES AND POLICIES OF THE STATE AND COUNTY IN WHICH THE WORK IS TO BE PERFORMED.
3. THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL FEES, PERMITS, LICENSES AND INSPECTIONS REQUIRED FOR THIS WORK.
4. ALL CONDUIT SHALL BE MINIMUM SIZE 3/4 INCH. EMT SHALL BE USED INDOORS. STAINLESS STEEL SHALL BE USED IN EXPOSED OUTDOOR LOCATIONS. CONDUIT BELOW GRADE SHALL BE SCHEDULE 40 PVC. TRANSFORM ALL PVC CONDUIT TO RIGID STAINLESS STEEL BEFORE PENETRATING SLAB.
5. FITTINGS FOR EMT CONDUIT SHALL BE COMPRESSION TYPE. SET SCREW FITTINGS SHALL NOT BE ALLOWED.
6. CONDUITS SIZES CALLED OUT ON THE DRAWINGS ARE NOT NECESSARILY BASED ON THE MINIMUM SIZE ALLOWED BY THE NATIONAL ELECTRICAL CODE AND MAY BE PURPOSELY OVERSIZED FOR FUTURE CONDUCTORS OR TO AVOID EXCESS CONDUIT HEATING. CONDUIT SIZES NOT CALLED OUT ON THE DRAWINGS SHALL BE SIZED BY THE CONTRACTOR BASED ON THE ACTUAL NUMBER OF CONDUCTORS TO BE INSTALLED, USING THE NATIONAL ELECTRICAL CODE AS A GUIDE. IN NO CASE SHALL CONDUIT SIZES BE SMALLER THAN IS REQUIRED BY THE NATIONAL ELECTRICAL CODE.
7. ALL CIRCUITS SHALL INCLUDE AN INSULATED GREEN GROUNDING CONDUCTOR, SIZED PER TABLE 250-122 OF THE NATIONAL ELECTRICAL CODE. THIS CONDUCTOR SHALL BE CARRIED IN ALL RACEWAYS INCLUDING THOSE INSTALLED FOR SWITCH LEGS AND SHALL BE ATTACHED TO THE DEVICE OR EQUIPMENT HOUSING USING A SUITABLE GROUNDING LUG.
8. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL JUNCTION AND PULL BOXES REQUIRED FOR THE INSTALLATION OF ELECTRICAL DEVICES AND EQUIPMENT, WHETHER OR NOT SPECIFICALLY INDICATED ON THE PLANS. SIZING OF THESE BOXES SHALL BE PER THE NATIONAL ELECTRICAL CODE.
9. THE CONTRACTOR SHALL FURNISH ALL EQUIPMENT FOR TEMPORARY CONSTRUCTION POWER AS REQUIRED.
10. SHOULD PROJECT CONDITIONS REQUIRE REARRANGEMENT OF WORK, THE CONTRACTOR SHALL MARK SUCH CHANGES ON THE FIELD POSTED DRAWINGS. IF THESE CHANGES REQUIRE ALTERNATE METHODS TO THOSE SPECIFIED IN THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL SUBMIT DRAWINGS SHOWING THE PROPOSED ALTERNATE METHODS TO THE CONTRACTING OFFICER. THE CONTRACTOR SHALL NOT PROCEED UNTIL APPROVAL IS OBTAINED. REARRANGEMENT OF WORK FOR THE PURPOSE OF COORDINATION SHALL NOT BE CONSIDERED AN ITEM FOR EXTRA COST.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING AND DETAILED SCHEDULING OF THE SITE INSPECTION WORK BY UTILITY COMPANIES AND ALL OTHER CONCERNED PARTIES AND AGENCIES.
12. PROVIDE PROTECTION FOR MATERIAL AND EQUIPMENT FROM LOSS, DAMAGE, CORROSION AND EFFECTS OF MOISTURE. REPAIR OR REPLACE DAMAGED ITEMS AT NO ADDITIONAL COST TO THE OWNER.
13. VISIT PROJECT SITE PRIOR TO BID SUBMITTAL TO ASCERTAIN CONDITIONS AND COST ALLOWANCES THAT AFFECT THE PROPOSED WORK.
14. INSTALL MATERIALS AND EQUIPMENT IN WORKMANLIKE MANNER AND IN STRICT ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, UNLESS OTHERWISE SPECIFIED OR DIRECTED BY THE ENGINEER.
15. MATERIALS AND WORKMANSHIP SUBJECT TO INSPECTION AT ANY TIME BY THE OWNER OR HIS REPRESENTATIVE; CORRECT ANY WORK OR MATERIALS NOT IN ACCORDANCE WITH DRAWINGS OR FOUND TO BE DEFICIENT OR DEFECTIVE IN A MANNER SATISFACTORY TO THE OWNER AT NO ADDITIONAL COST.
16. PROVIDE ALL FIRST QUALITY, NEW MATERIALS, FREE FROM DEFECTS SUITABLE FOR SPACE PROVIDED AND APPROVED BY UL WHERE STANDARDS HAVE BEEN PROVIDED BY THAT AGENCY.
17. PROVIDE STANDARD MATERIALS AND EQUIPMENT OF MANUFACTURER'S REGULARLY ENGAGED IN THE PRODUCTION OF THESE PRODUCTS. PROVIDE PRODUCTS OF A SINGLE MANUFACTURER WHERE TWO OR MORE UNITS OF THE SAME CALL ARE REQUIRED.
18. ALL WIRING TO BE STRANDED TYPE THWN COPPER UNLESS NOTED OTHERWISE, #12 AWG MINIMUM, ALL WIRING SHALL BE IN CONDUIT, 3/4" MINIMUM. THHN IS ALLOWABLE FOR #10 AND SMALLER.

COUNTY OF MAUI
MAUI COUNTY CODE, CHAPTER 16.16A ENERGY CODE

TO THE BEST OF MY KNOWLEDGE, THIS PROJECT'S DESIGN SUBSTANTIALLY CONFORMS TO THE ENERGY CODE FOR:

____ BUILDING COMPONENT SYSTEMS
__X__ ELECTRICAL COMPONENT SYSTEMS
____ MECHANICAL COMPONENT SYSTEMS

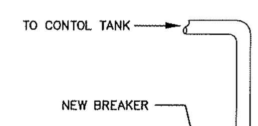
SIGNATURE: ________ DATE: 9-20-12
NAME: MARK J UNEMORI
TITLE: PROJECT ENGINEER
LICENSE NO.: 13993-E

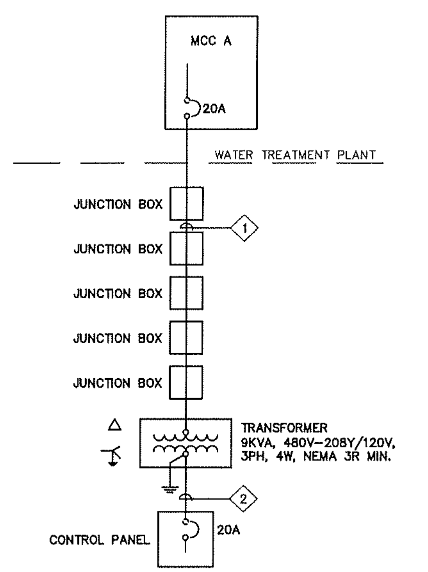
DUCTLINE NOTES

1. REFER TO ELECTRICAL PLAN FOR DUCT SIZES AND QUANTITIES.
2. DIRECT BURIED AND CONCRETE ENCASED ELECTRICAL CONDUITS SHALL BE PVC SCHEDULE 40 CONDUITS.
3. DIRECT BURIED CONDUITS OF LIKE USE SHALL BE SEPARATED BY A MINIMUM OF 3". A MINIMUM SEPARATION OF 12" MUST BE MAINTAINED BETWEEN ELECTRICAL CONDUITS AND TELEMETRY CONDUITS.

   CONCRETE ENCASED CONDUITS OF LIKE USE MAY BE SEPARATED BY 1-1/2". CONDUITS OF UNLIKE USES MUST BE SEPARATED BY 3".
4. CONTRACTOR SHALL COORDINATE DUCTLINE AND TRENCHING DETAILS WITH UTILITY COMPANIES.
5. UPON COMPLETION OF ALL DUCTLINES, THE CONTRACTOR SHALL PASS A BULLET SHAPED, WOODEN TEST MANDREL 1/2" SMALLER IN DIAMETER THAN THE CONDUITS, THROUGH THE ENTIRE LENGTH OF EACH DUCT SECTION TO TEST FOR FREEDOM OF BURRS AND OBSTRUCTIONS. THE CONTRACTOR SHALL REMOVE ALL BURRS, OBSTRUCTION AND FOREIGN MATTER TO THE SATISFACTION OF THE UTILITY COMPANIES' INSPECTORS.

   UPON COMPLETION OF THE TELEMETRY DUCTLINE, THE CONTRACTOR SHALL PASS A BLOCKED SHAPED, WOODEN TEST MANDREL, 12" LONG AND 1/4" SMALLER IN DIAMETER THAN THE CONDUIT THROUGH THE ENTIRE LENGTH OF EACH DUCT SECTION. THE DUCTS SHALL BE SWABBED AND CLEARED OF ALL BURRS, OBSTRUCTIONS AND FOREIGN MATERIAL.
6. THE UTILITY COMPANIES' INSPECTORS SHALL INSPECT THE UNDERGROUND DUCTLINES AND STRUCTURES PRIOR TO AND DURING ALL CONCRETE POUR AND BACKFILL OPERATIONS.
7. ALL HORIZONTAL AND VERTICAL BENDS SHALL HAVE A MINIMUM RADIUS OF 20'-0".
8. CONCRETE COMPRESS STRENGTH SHALL BE 3,000 PSI IN 28 DAYS.
9. THE CONTRACTOR SHALL INSTALL A WARNING TAPE OVER DUCTLINE AS SHOWN THE TAPE SHALL BE 4" WIDE AND 8 MILS THICK, YELLOW IN COLOR WITH BLACK IMPRINTED WARNING MESSAGE.



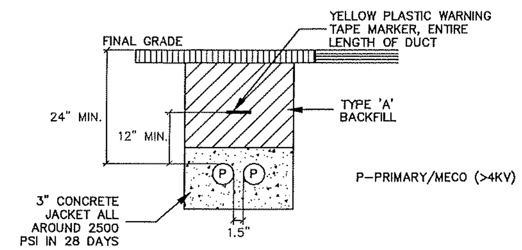


NEW SINGLE-LINE DIAGRAM

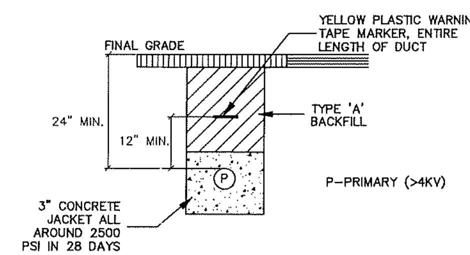
NOT TO SCALE

SINGLE-LINE DIAGRAM NOTES:

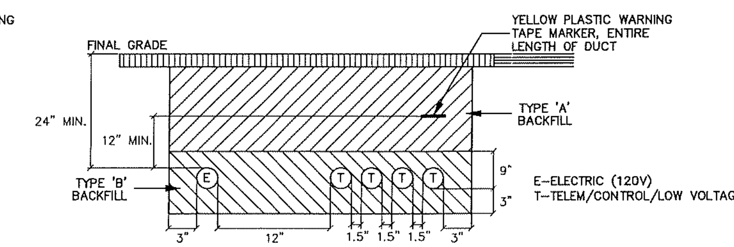
1. 1-¾"C, 3-#8, 1-#12 GND
2. 1-¾"C, 4-#10, 1-#12 GND



A DUCT SECTION
E-0 NOT TO SCALE



B DUCT SECTION
E-0 NOT TO SCALE



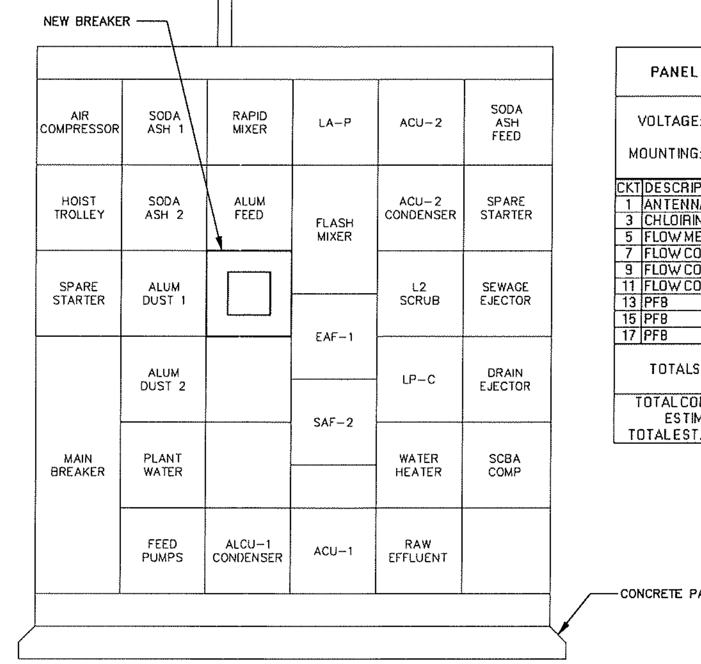
C DUCT SECTION
E-0 NOT TO SCALE

DUCTLINE NOTES:

1. REFER TO ELECTRICAL PLAN FOR DUCT SIZES AND QUANTITIES.
2. CONCRETE ENCASED CONDUITS SHALL BE PVC TYPE 'EB' OR SCH. 40 PVC. ABS TYPE 'DB' PIPES ARE ALSO ACCEPTABLE.
3. DIRECT BURIED CONDUITS SHALL BE PVC SCH. 40 PIPES.
4. CONCRETE ENCASED CONDUITS OF LIKE USE MAYBE SEPARATED BY 1-1/2". CONDUITS OF UNLIKE USES MAYBE SEPARATED BY 3". A MINIMUM 3" SEPARATION MUST BE MAINTAINED BETWEEN ELECTRICAL DUCTS AND TV/TEL. DUCTS.
5. DIRECT BURIED CONDUITS OF LIKE USE SHALL BE SEPARATED BY A MINIMUM OF 3". A MINIMUM SEPARATION OF 12" MUST BE MAINTAINED BETWEEN DIRECT BURIED ELECTRICAL CONDUITS AND TELEMETRY CONDUITS.
6. CONCRETE COMPREHENSIVE STRENGTH SHALL BE 2,500 PSI IN 28 DAYS.
7. DUCTLINE TRENCHES MAY BE BACKFILLED 24 HOURS AFTER CONCRETE IS POURED.
8. CONTRACTOR SHALL COORDINATE DUCTLINE AND TRENCHING DETAILS WITH UTILITY COMPANIES PROJECT PLAN.
9. REFERENCE SPECIFICATION: MECO SPEC. CS7001 WITH LATEST REVISION.

TYPE "A" - BEACH SAND, EARTH, OR EARTH AND GRAVEL. IF EARTH AND GRAVEL, THE MAXIMUM ROCK SHALL BE 1" AND THE MIXTURE SHALL CONTAIN NOT MORE THAN 50% BY VOLUME OF ROCK PARTICLES.

TYPE "B" - BEACH SAND, EARTH, OR EARTH AND GRAVEL. IF EARTH AND GRAVEL, THE MIXTURE MUST PASS A 1/2" MESH SCREEN AND CONTAIN NOT MORE THAN 20% BY VOLUME OF ROCK PARTICLES. CORAL OR CORAL WASTE WILL NOT BE ACCEPTABLE.



MCC A ELEVATION

NOT TO SCALE

PANEL CONTROL — A.I.C. RATING: 10K

VOLTAGE: 120/208V PHASE: 3 WIRE: 4WSN CIRCUITS: 18
MOUNTING: SURFACE MAIN BRKR: 40A BREAKER: BOLT ON MAIN BUS: 50A

CKT	DESCRIPTION	PHASE A	PHASE B	PHASE C	BRKR	WIRE	CKT	DESCRIPTION	PHASE A	PHASE B	PHASE C	BRKR	WIRE
1	ANTENNA	1.5			1P20A	#12	2	LEVEL TRANSMITTER	0.5			1P15A	#12
3	CHLOIRINE ANALYZER		1.0		1P20A	#12	4	PFB					
5	FLOW METER			0.5	1P15A	#12	6	PFB					
7	FLOW CONTROL 1	0.5			1P15A	#12	8	PFB					
9	FLOW CONTROL 2		0.5		1P15A	#12	10	PFB					
11	FLOW CONTROL 3			0.5	1P15A	#12	12	PFB					
13	PFB						14	PFB					
15	PFB						16	PFB					
17	PFB						18	PFB					
	TOTALS	2.0	1.5	1.0				TOTALS	0.5	0.0	0.0		

TOTAL CONNECTED LOAD: 5.0 KVA
ESTIMATED DEMAND: 1.0
TOTAL EST. DEMAND LOAD: 5.0 KVA 14A @V = 208V

*SHUNT TRIP BREAKER REQUIRED R: DENOTES RECEPTACLE LOAD
L: DENOTES LIGHTING LOAD
E: DENOTES A/C EQUIPMENT

LETTER	DESCRIPTION	DATE

ECM INC. Electrical Engineering Consultants
MAUI OFFICE
130 North Market Street
Wailuku, Maui, Hi. 96793
Phone: (808)242-8070
Fax: (808)244-9539
E-mail: ecm@ecm-maui.com

MARK J. UNEMORI LICENSED PROFESSIONAL ENGINEER No. 13993-E HAWAII, U.S.A.
License Expires: April 30, 2020
SIGNATURE DATE

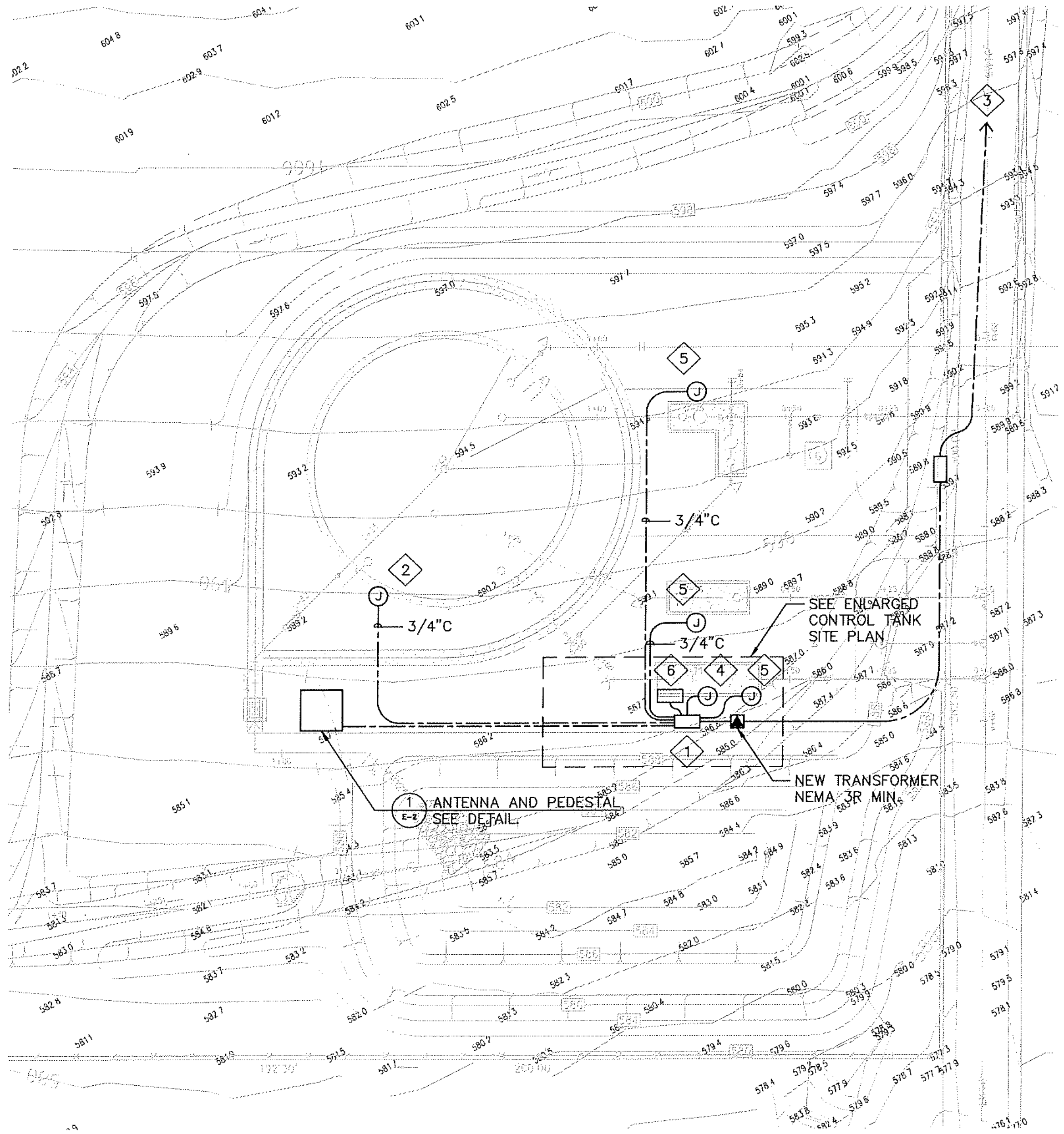
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION "AS DEFINED IN SECTION 16-115-2 OF THE HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, LAND SURVEYORS AND LANDSCAPE ARCHITECTS"

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

MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

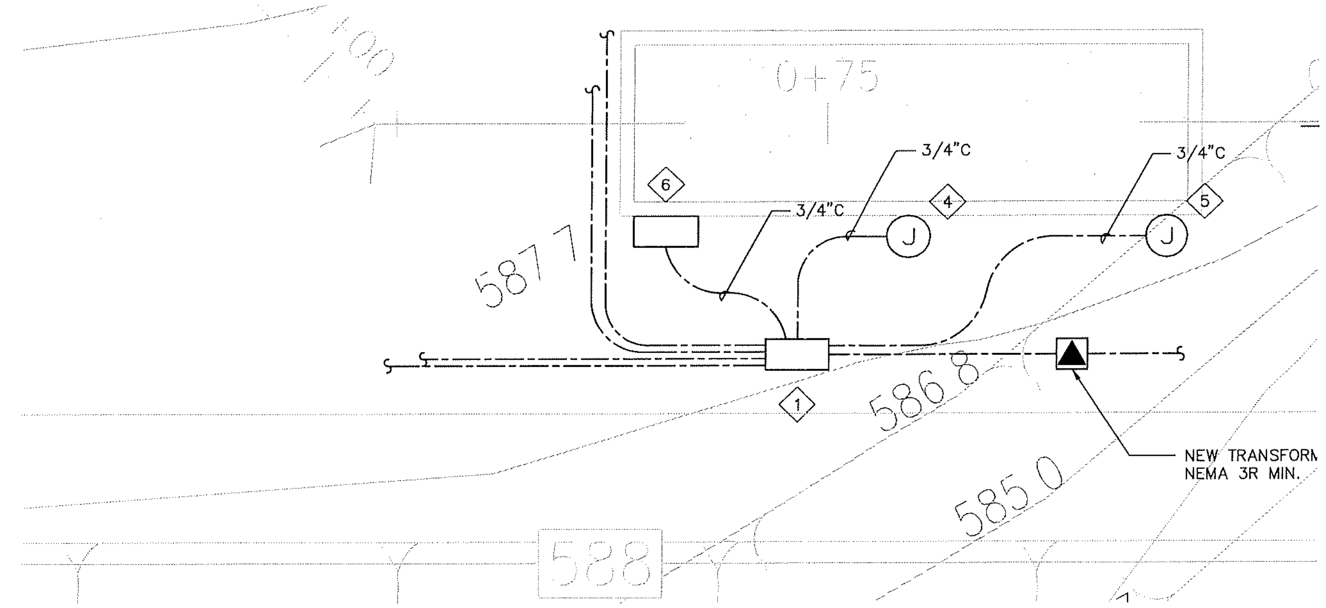
TITLE NOTES, DETAILS

DESIGNED BY: MJU/AM	CHECKED BY: MJU	JOB NUMBER: 2018-48	SHEET: E-0
DRAWN BY: RMB	APPROVED BY: MJU		
SCALE: AS NOTED		DATE:	OF SHEETS



CONTROL TANK SITE PLAN

SCALE: 1" = 20'-0"



ENLARGED CONTROL TANK SITE PLAN

SCALE: 1/4" = 1'-0"

CONTORL TANK SITE PLAN NOTES:

1. INSTRUMENT ENCLOSURE, SEE DETAILS ON E-8.
2. LEVEL TRANSMITTER/RECORDER, NEMA 4X JUNCTION BOX VERIFY EXACT LOCATION AND CONNECTION REQUIREMENTS, ADD NEMA 4X JUNCTION BOX AS REQUIRED.
3. PROVIDE POWER HOMERUN FROM MAHINAHINA WATER TREATMENT PLANT.
4. FLOW METER AND VALVE CONNECTIONS, COORDINATE EXACT LOCATION WITH CIVIL AND VERIFY CONNECTION REQUIREMENTS, ADD NEMA 4X JUNCTION BOX AS REQUIRED.
5. RATE OF FLOW CONTROLLER, COORDINATE EXACT LOCATION WITH CIVIL AND VERIFY CONNECTION REQUIREMENTS; PROVIDE NEMA 4X JUNCTION BOX AS REQUIRED.
6. CHLORINE ANALYZER; PROVIDE EXACT LOCATION WITH CIVIL AND VERIFY CONNECTION REQUIREMENTS.

ECM Inc.
Electrical Engineering Consultants
MAUI OFFICE 130 North Market Street Wailuku, Maui, HI 96793

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

MARK J. UNEMORI LICENSED PROFESSIONAL ENGINEER No. 13993-E HAWAII, U.S.A.

License Expires: April 30, 2020

SIGNATURE DATE

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MAHINAHINA PERMANENT WELL WATER SYSTEM

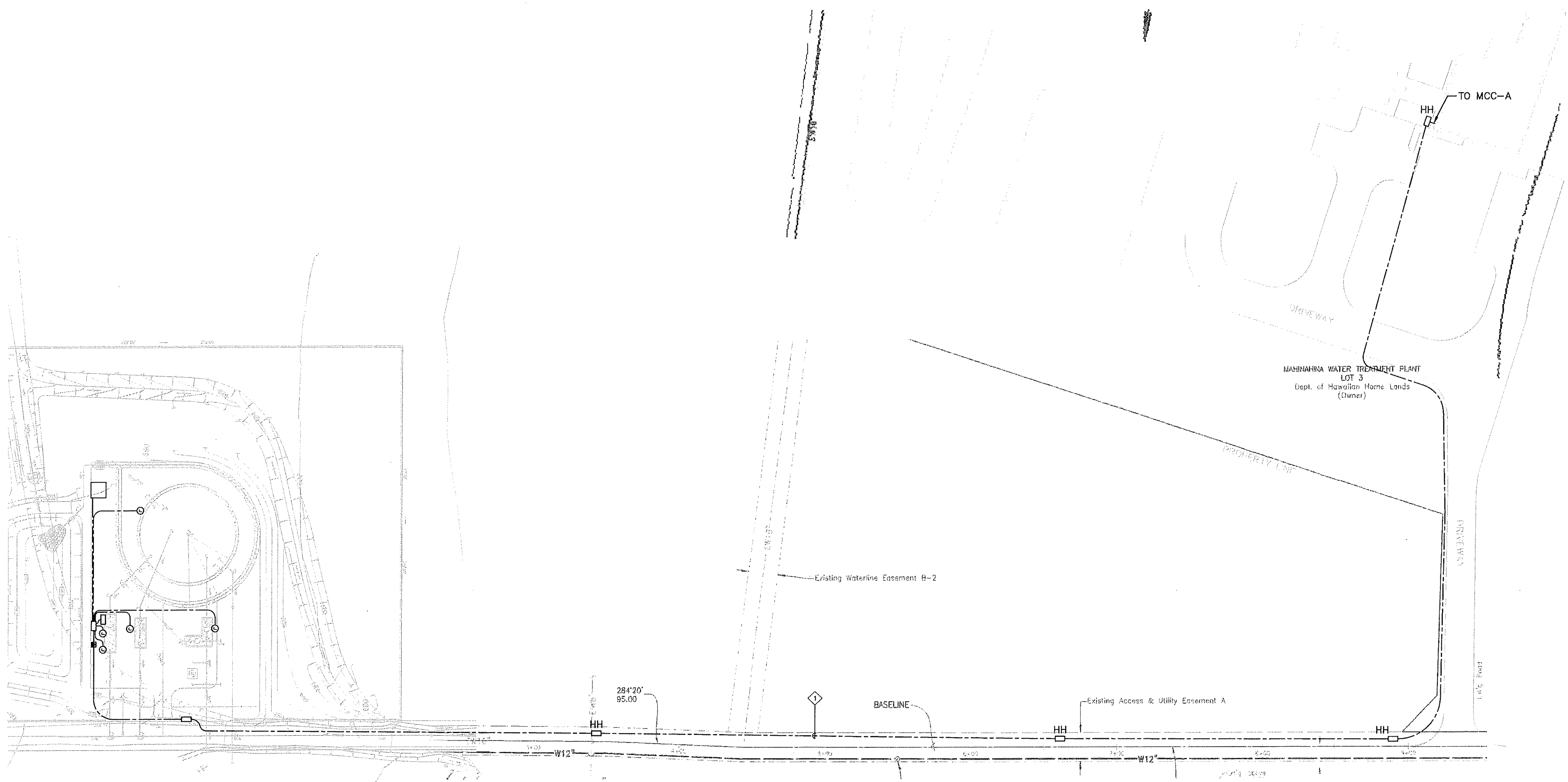
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE ELECTRICAL CONTROL TANK SITE PLAN

DESIGNED BY	CHECKED BY	JOB NUMBER	SHEET
MJU/AM	MJU	2018-48	E-1
DRAWN BY RMB	APPROVED BY MJU		
SCALE AS NOTED		DATE	OF SHEETS

LETTER	DESCRIPTION	DATE

H:\acad\2018-48 Mahinahina Permanent Well #1 Ph1\Drawings\E-1.dwg



SITE PLAN

SCALE: 1" = 35'-0"

SITE PLAN NOTES:

1. PROVIDE ELECTRICAL FEEDER NORTH OF EXISTING WATER LINE, AND WITHIN 20 FEET OF UTILITY AND ACCESS EASEMENT.

ECM Inc.
Electrical Engineering Consultants
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150 North Market Street
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Phone: (808)242-5070
Fax: (808)244-9539
E-mail: ecm@ecm-maui.com

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

MARK J. UNEMORI
LICENSED PROFESSIONAL ENGINEER
No. 13993-E
HAWAII, U.S.A.

License Expires: April 30, 2020

SIGNATURE DATE

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"

MAHINAHINA PERMANENT WELL WATER SYSTEM

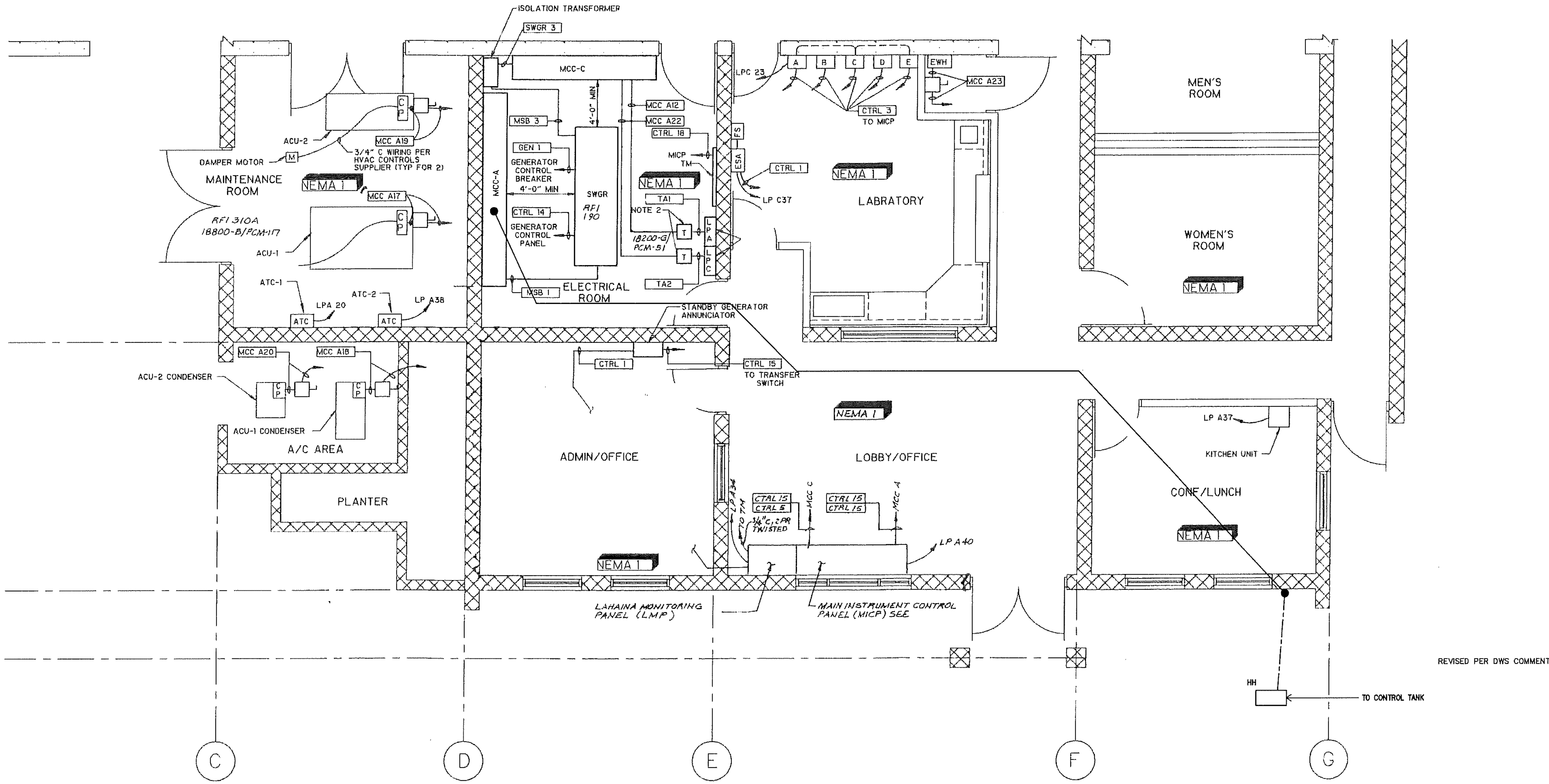
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE ELECTRICAL CONTROL TANK SITE PLAN

MJU/AM DESIGNED BY	MJU CHECKED BY	2018-48 JOB NUMBER	E-1.1 SHEET
RMB DRAWN BY	MJU APPROVED BY		
SCALE AS NOTED		DATE	OF SHEETS

LETTER	DESCRIPTION	DATE

H:\acad2\2018-48 Mahinahina Permanent Well #1 Ph1\Drawings\E-1.1.dwg



WATER TREATMENT PLANT ELECTRICAL PLAN

SCALE: 1/4" = 1'-0"

ECM Inc. Electrical Engineering Consultants
WARREN S. UNEMORI ENGINEERING, INC.
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License Expires: April 30, 2020

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MAHINAHINA PERMANENT WELL WATER SYSTEM

MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE WATER TREATMENT PLANT ELECTRICAL

MJU/AM DESIGNED BY	MJU CHECKED BY	2018-48 JOB NUMBER	E-1.2 SHEET
RMB DRAWN BY	MJU APPROVED BY		
SCALE AS NOTED		DATE	OF SHEETS

LETTER	DESCRIPTION	DATE

SYMBOL LEGEND

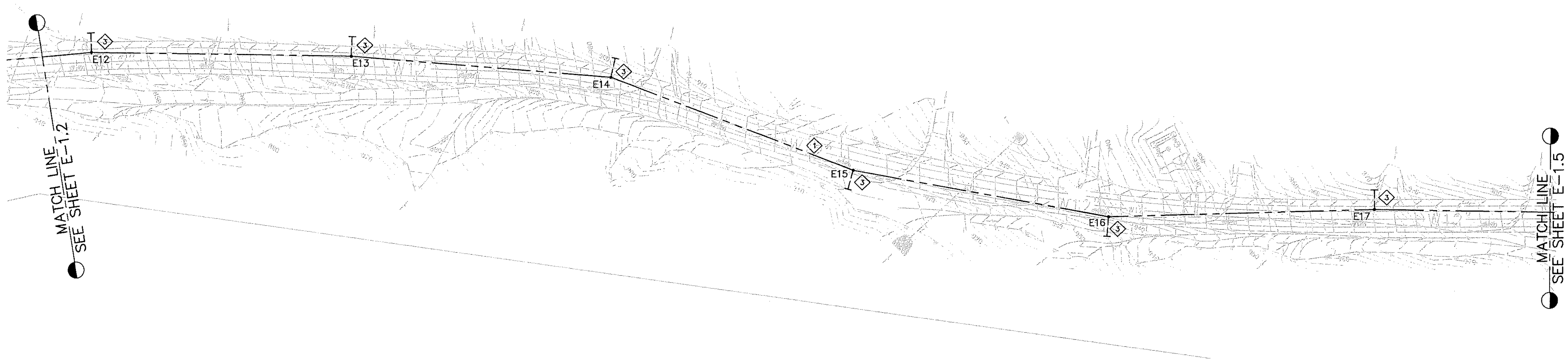
- EXISTING POLE
- EXISTING ANCHOR
- EXISTING OVERHEAD LINES
- NEW TRANSFORMER PAD
- NEW POLE
- NEW ANCHOR
- NEW OVERHEAD PRIMARY LINES (BASED ON VERTICAL CONSTRUCTION BY MECO)
- NEW UNDERGROUND PRIMARY LINES
- NEW UNDERGROUND SECONDARY LINES
- NEW ELECTRICAL EQUIPMENT

GENERAL NOTES:

1. PLANS SUBJECT TO REVIEW AND APPROVAL OF UTILITY COMPANIES.
2. ALL UTILITY CONDUITS CROSSING WATERLINES TO BE CONCRETE ENCASED HAVING A MINIMUM OF 6" VERTICAL CLEARANCE BETWEEN THE OUTSIDE JACKET AND THE WATERLINE, THE JACKET SHOULD EXTEND 5' ON EITHER SIDE OF THE DIAMETER OF THE WATERLINE.
3. NO TELEPHONE OR CABLE TV CONTACT ON NEW POLES.

PLAN NOTES:

1. EASEMENT REQUIRED FOR ACCESS ROADWAY.
2. EASEMENT REQUIRED FOR NEW OVERHEAD LINES [TOTAL 10'-0" WIDE (5'-0" ON EACH SIDE FROM CENTER OF LINE OR AS APPLICABLE)].
3. EASEMENT REQUIRED FOR ANCHOR & GUY WIRE (5'-0" WIDE x 20'-0" DEEP TYPICAL OR AS APPLICABLE).
4. EASEMENT REQUIRED FOR NEW UNDERGROUND LINES [TOTAL 5'-0" WIDE OR AS APPLICABLE].
5. EASEMENT COVERING PADMOUNT TRANSFORMER.
6. EASEMENT REQUIRED FOR NEW OVERHEAD LINES EXTENDING OUTSIDE THE R.O.W LINE [TOTAL 5'-0" WIDE OR AS APPLICABLE].



PARTIAL ELECTRICAL SITE PLAN

SCALE: 1" = 40'-0"

LETTER	DESCRIPTION	DATE

ECM inc
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130 North Market Street
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License Expires: April 30, 2014

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2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM

MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE PARTIAL ELECTRICAL SITE PLAN

MJU/AM DESIGNED BY	MJU CHECKED BY	2011-022 JOB NUMBER	E-1.3 SHEET
RMB DRAWN BY	MJU APPROVED BY	24 AUG 2012 DATE	OF SHEETS
SCALE AS NOTED			

SYMBOL LEGEND

- EXISTING POLE
- EXISTING ANCHOR
- EXISTING OVERHEAD LINES
- NEW TRANSFORMER PAD
- NEW POLE
- NEW ANCHOR
- NEW OVERHEAD PRIMARY LINES (BASED ON VERTICAL CONSTRUCTION BY MECO)
- NEW UNDERGROUND PRIMARY LINES
- NEW UNDERGROUND SECONDARY LINES
- NEW ELECTRICAL EQUIPMENT

GENERAL NOTES:

1. PLANS SUBJECT TO REVIEW AND APPROVAL OF UTILITY COMPANIES.
2. ALL UTILITY CONDUITS CROSSING WATERLINES TO BE CONCRETE ENCASED HAVING A MINIMUM OF 6" VERTICAL CLEARANCE BETWEEN THE OUTSIDE JACKET AND THE WATERLINE, THE JACKET SHOULD EXTEND 5' ON EITHER SIDE OF THE DIAMETER OF THE WATERLINE.
3. NO TELEPHONE OR CABLE TV CONTACT ON NEW POLES.

PLAN NOTES:

1. EASEMENT REQUIRED FOR ACCESS ROADWAY.
2. EASEMENT REQUIRED FOR NEW OVERHEAD LINES [TOTAL 10'-0" WIDE (5'-0" ON EACH SIDE FROM CENTER OF LINE OR AS APPLICABLE)].
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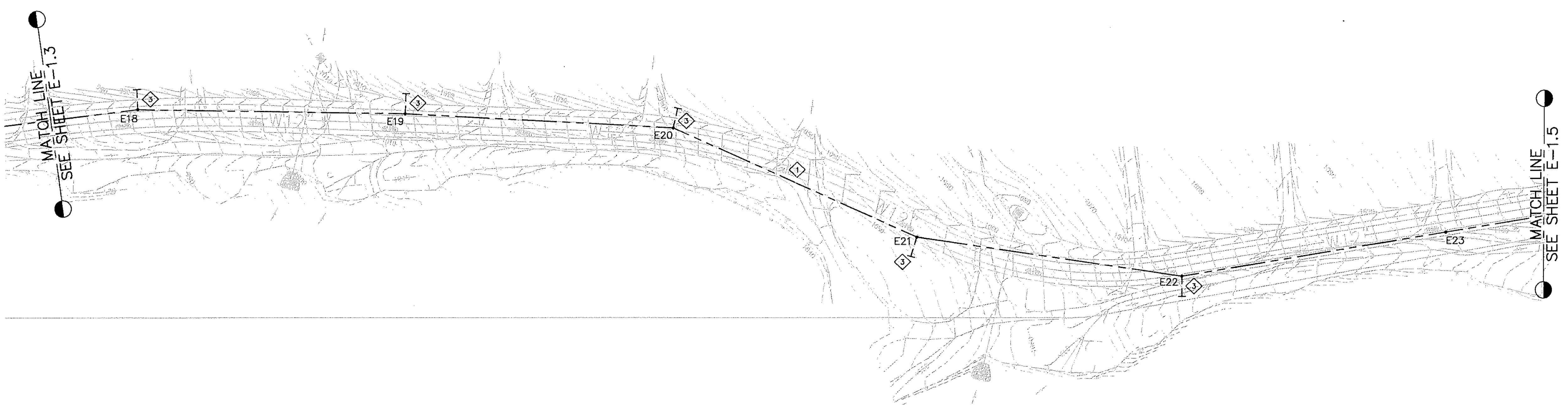
6. EASEMENT REQUIRED FOR NEW OVERHEAD LINES EXTENDING OUTSIDE THE R.O.W LINE [TOTAL 5'-0" WIDE OR AS APPLICABLE].



PARTIAL ELECTRICAL SITE PLAN
SCALE: 1" = 40'-0"

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LETTER DESCRIPTION DATE

MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE PARTIAL ELECTRICAL SITE PLAN

MJU/AM DESIGNED BY	MJU CHECKED BY	2011-022 JOB NUMBER	E-1.4 SHEET
RMB DRAWN BY	MJU APPROVED BY	24 AUG 2012 DATE	OF SHEETS
SCALE AS NOTED			

SYMBOL LEGEND

○	EXISTING POLE
⊢	EXISTING ANCHOR
——— - - ———	EXISTING OVERHEAD LINES
[T]	NEW TRANSFORMER PAD
●	NEW POLE
⊢–	NEW ANCHOR
——— - - ———	NEW OVERHEAD PRIMARY LINES (BASED ON VERTICAL CONSTRUCTION BY MECO)
————————	NEW UNDERGROUND PRIMARY LINES
– – – – – – – –	NEW UNDERGROUND SECONDARY LINES
▨	NEW ELECTRICAL EQUIPMENT

GENERAL NOTES:

1. PLANS SUBJECT TO REVIEW AND APPROVAL OF UTILITY COMPANIES.
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3. NO TELEPHONE OR CABLE TV CONTACT ON NEW POLES.

PLAN NOTES:

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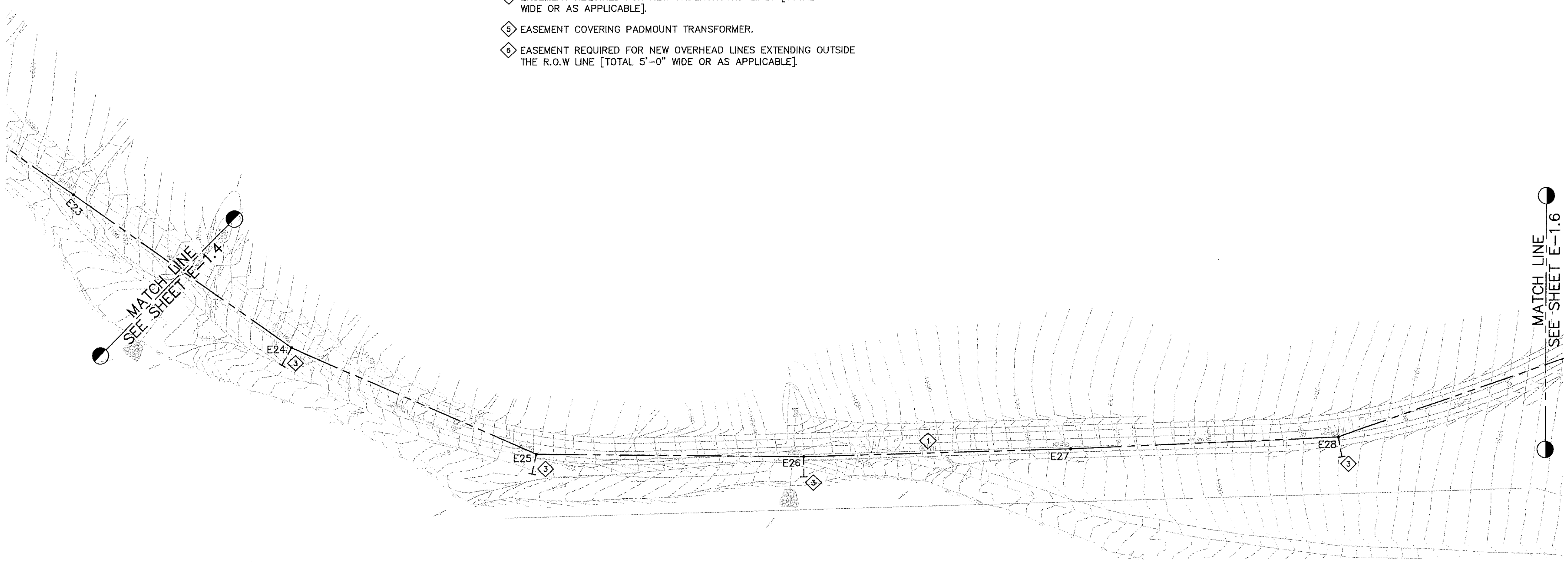
◇2 EASEMENT REQUIRED FOR NEW OVERHEAD LINES [TOTAL 10'-0" WIDE (5'-0" ON EACH SIDE FROM CENTER OF LINE OR AS APPLICABLE)].

◇3 EASEMENT REQUIRED FOR ANCHOR & GUY WIRE (5'-0" WIDE x 20'-0" DEEP TYPICAL OR AS APPLICABLE).

◇4 EASEMENT REQUIRED FOR NEW UNDERGROUND LINES [TOTAL 5'-0" WIDE OR AS APPLICABLE].

◇5 EASEMENT COVERING PADMOUNT TRANSFORMER.

◇6 EASEMENT REQUIRED FOR NEW OVERHEAD LINES EXTENDING OUTSIDE THE R.O.W LINE [TOTAL 5'-0" WIDE OR AS APPLICABLE].



PARTIAL ELECTRICAL SITE PLAN

SCALE: 1" = 40'-0"

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MAHINAHINA PERMANENT WELL WATER SYSTEM

MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE PARTIAL ELECTRICAL SITE PLAN

MJU/AM DESIGNED BY	MJU CHECKED BY	2011-022 JOB NUMBER	E-1.5 SHEET
RMB DRAWN BY	MJU APPROVED BY	24 AUG 2012 DATE	OF SHEETS
SCALE AS NOTED			

LETTER	DESCRIPTION	DATE

SYMBOL LEGEND

- ○ EXISTING POLE
- EXISTING ANCHOR
- EXISTING OVERHEAD LINES
- NEW TRANSFORMER PAD
- ● NEW POLE
- NEW ANCHOR
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- NEW UNDERGROUND SECONDARY LINES
- NEW ELECTRICAL EQUIPMENT

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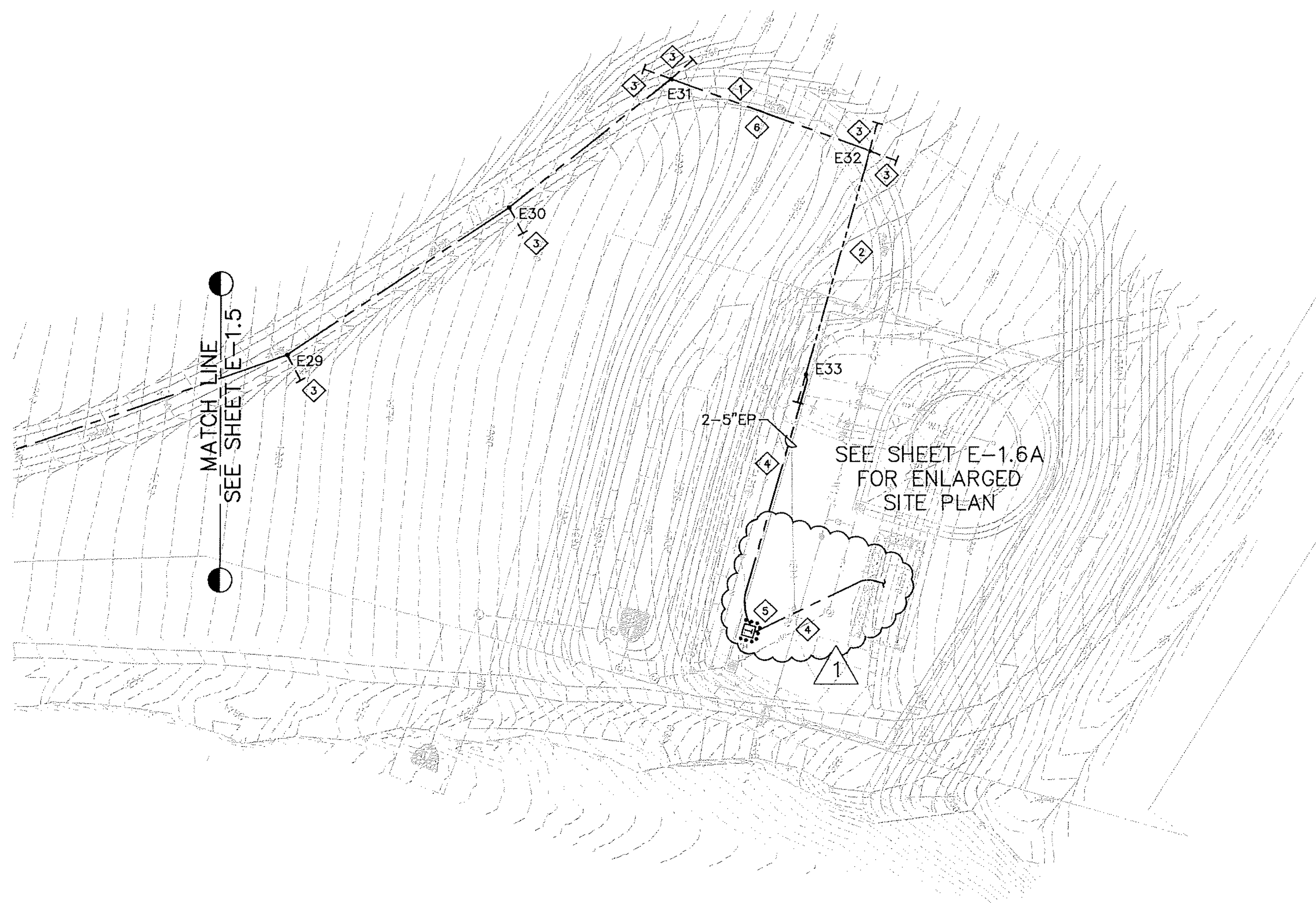
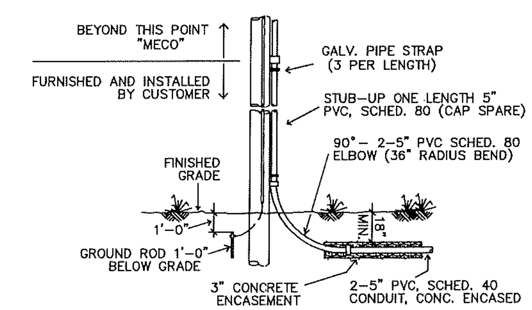
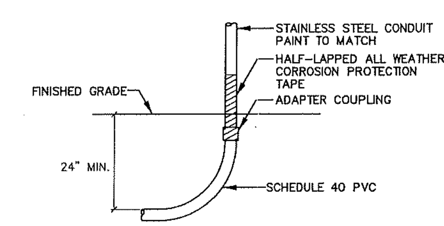


PARTIAL ELECTRICAL SITE PLAN
SCALE: 1" = 40'-0"



1 (E-1.6) CONDUIT INSTALLATION @ RISER
NOT TO SCALE



2 (E-1.6) CONDUIT TRANSITION DETAIL
NOT TO SCALE (CUSTOMER SIDE)

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No. 13993-E
HAWAII, U.S.A.

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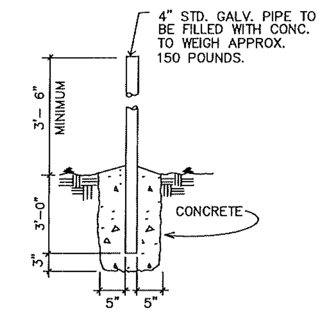
LETTER	DESCRIPTION	DATE
1	REVISED PER DWS COMMENTS	9/12/12

MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE PARTIAL ELECTRICAL SITE PLAN

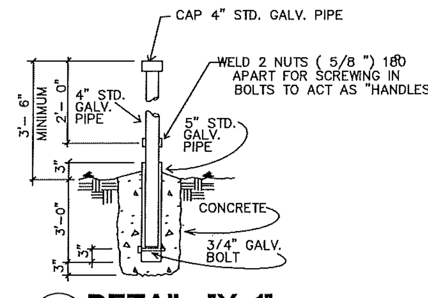
DESIGNED BY: MJU/AM	CHECKED BY: MJU	JOB NUMBER: 2011-022	SHEET: E-1.6
DRAWN BY: RMB	APPROVED BY: MJU	DATE: 24 AUG 2012	OF SHEETS
SCALE: AS NOTED			



1 DETAIL "X"
E-1.6A NOT TO SCALE

NOTE:
BARRIER POSTS ARE TO BE PAINTED YELLOW ACCORDING TO ANSI SPEC Z53.1 TO COMPLY WITH OSHA STANDARDS FOR COLORING CODE.

UG-30-5000

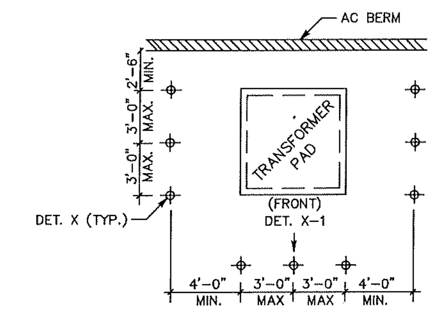


2 DETAIL "X-1"
E-1.6A NOT TO SCALE

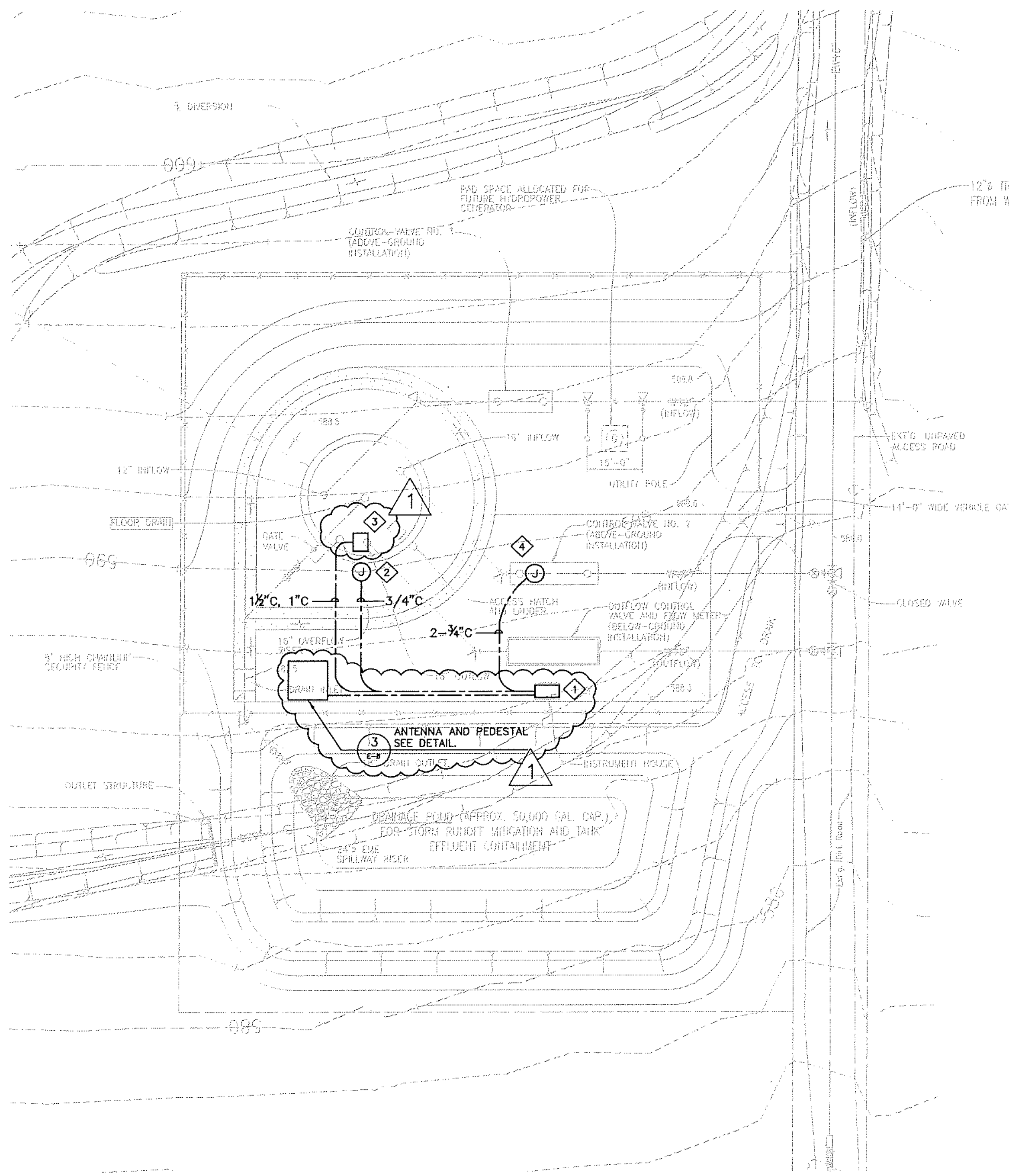
NOTE:
BARRIER POSTS ARE TO BE PAINTED YELLOW ACCORDING TO ANSI SPEC Z53.1 TO COMPLY WITH OSHA STANDARDS FOR COLORING CODE.

THE PIPE THAT IS TO BE PLACED DIRECTLY IN FRONT OF THE DOORS SHALL NOT BE FILLED WITH CONCRETE. THE PIPE SHALL BE CAPPED AND THE WELDED NUTS USED TO SCREW IN BOLTS TO ACT AS HANDLES FOR LIFTING. THE BOLTS ARE TO BE REMOVED AFTER INSTALLATION.

UG-30-5000



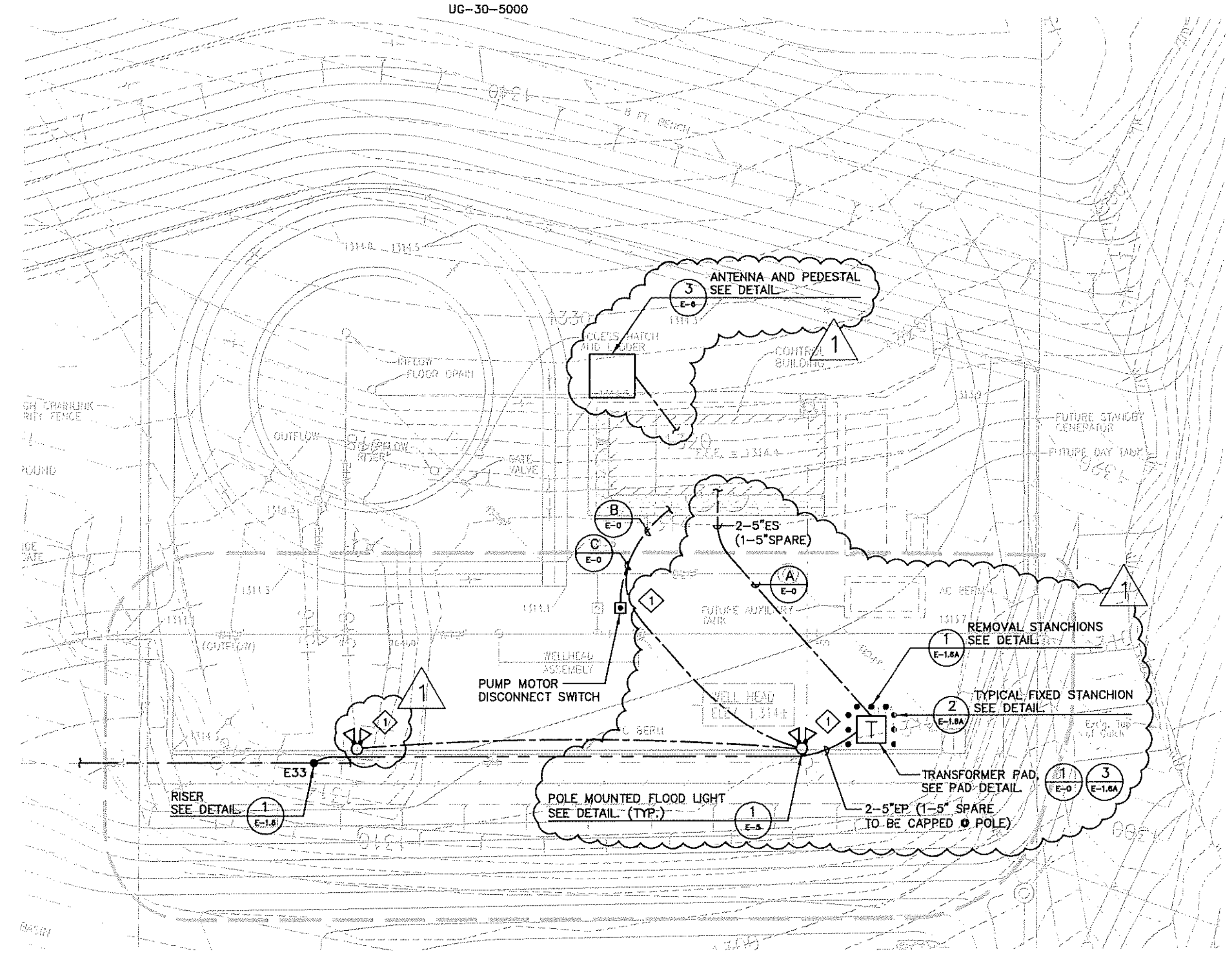
3 POST TYPE BARRIER (STANCHION)
E-1.6A NOT TO SCALE



ENLARGED ELECTRICAL MIXING TANK SITE PLAN
SCALE: 1" = 20'-0"

ENLARGED ELECTRICAL MIXING TANK SITE PLAN NOTES:

1. INSTRUMENT ENCLOSURE, SEE DETAILS ON E-8.
2. LEVEL TRANSMITTER/RECORDER, NEMA 4X JUNCTION BOX VERIFY EXACT LOCATION AND CONNECTION REQUIREMENTS, ADD NEMA 4X JUNCTION BOX AS REQUIRED.
3. PHOTO-VOLTAIC PANEL AND AND ANTENNA ON TANK, VERIFY EXACT LOCATION, SEE DETAIL ON E-7.
4. FLOW METER AND VALVE CONNECTIONS, COORDINATE EXACT LOCATION WITH CIVIL AND VERIFY CONNECTION REQUIREMENTS, ADD NEMA 4X JUNCTION BOX AS REQUIRED.



ENLARGED ELECTRICAL WELL SITE PLAN
SCALE: 1" = 20'-0"

ENLARGED ELECTRICAL WELL SITE PLAN NOTES:

1. COORDINATE FINAL LOCATION WITH DWS.

LETTER	DESCRIPTION	DATE
1	REVISED PER DWS COMMENTS	9/12/12

MARK J. UNEMORI — LICENSED PROFESSIONAL ENGINEER — No. 13993-E — HAWAII, U.S.A.

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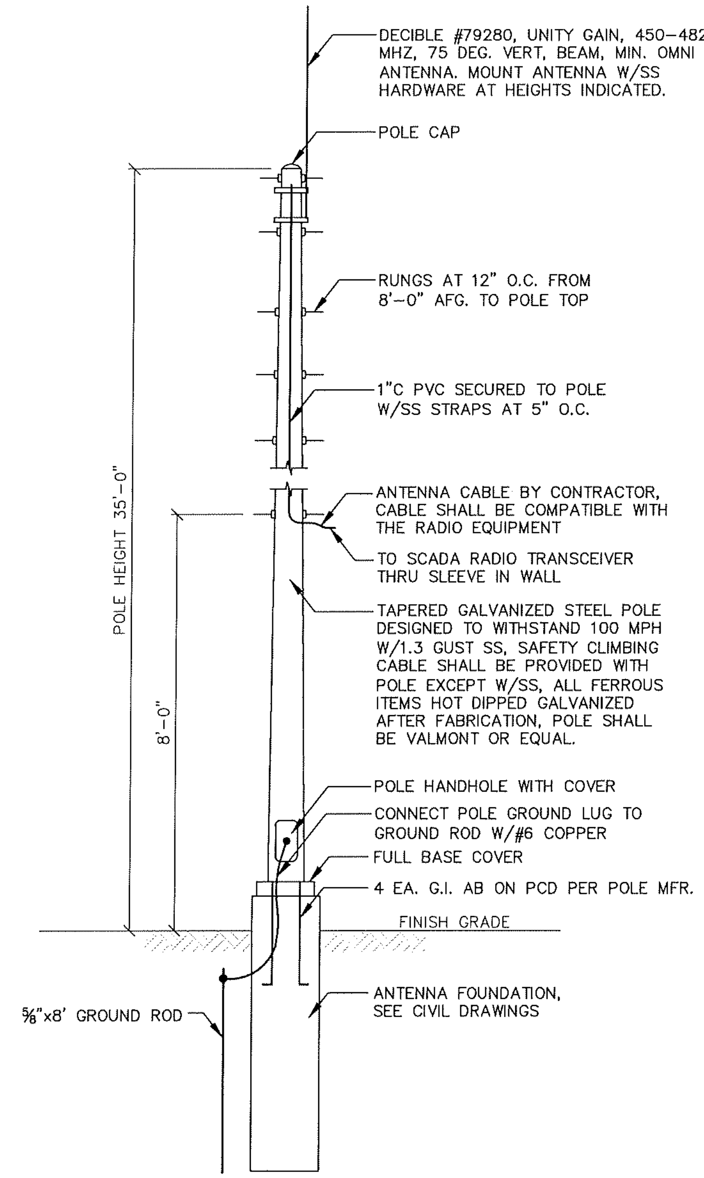
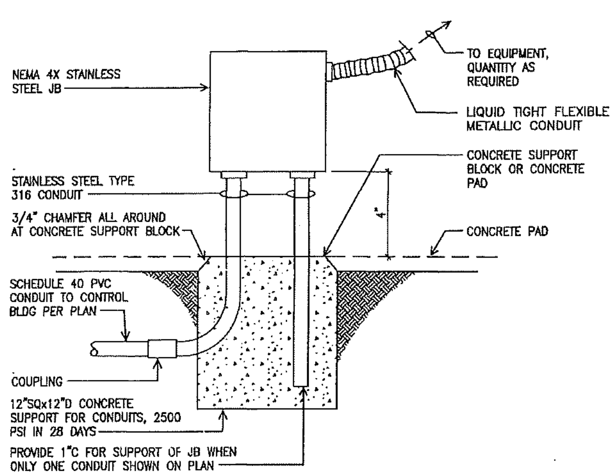
MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE ELECTRICAL MIXING & WELL SITE PLAN

MJU/AM DESIGNED BY	MJU CHECKED BY	2011-022 JOB NUMBER	E-1.6A SHEET
RMB DRAWN BY	MJU APPROVED BY	24 AUG 2012 DATE	OF SHEETS
SCALE	AS NOTED		



1 E–2 **ANTENNA MOUNTING DETAIL**
NOT TO SCALE



CONDUIT MOUNTED JUNCTION BOX DETAIL
NOT TO SCALE

LETTER	DESCRIPTION	DATE

MARK J. UNEMORI LICENSED PROFESSIONAL ENGINEER No. 13993–E HAWAII, U.S.A.

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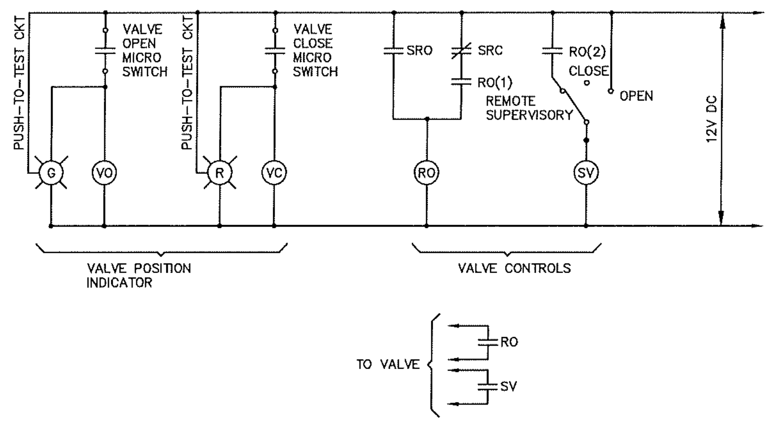
MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

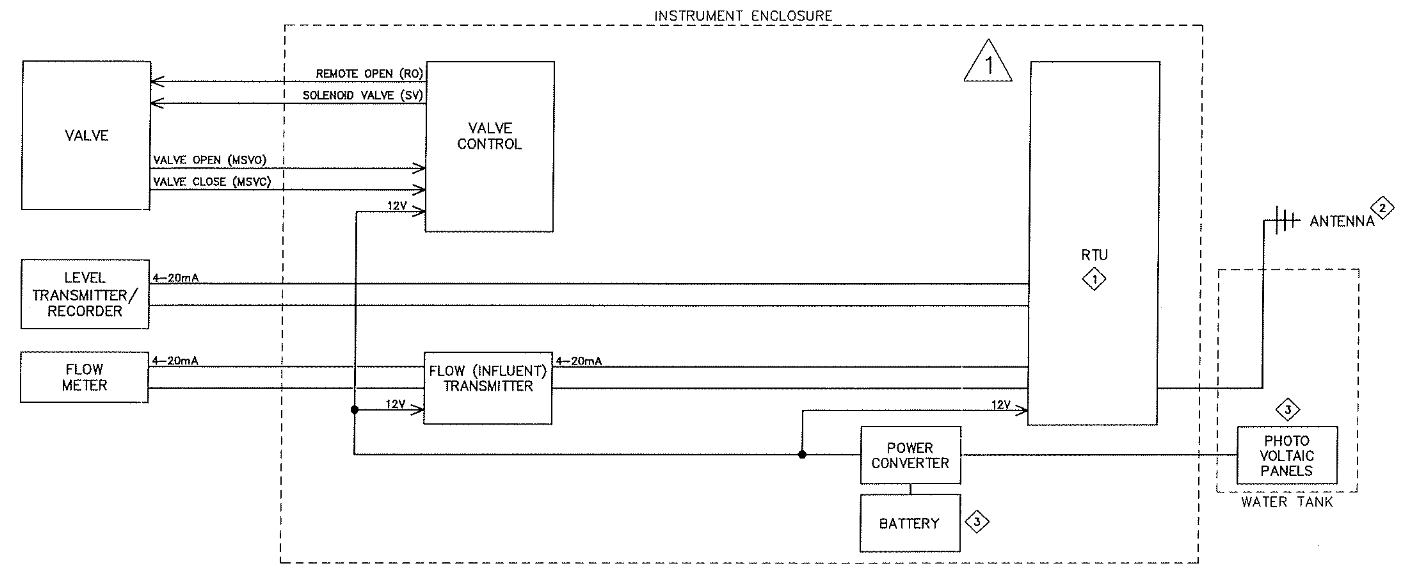
TITLE DETAILS

MJU/AM DESIGNED BY	MJU CHECKED BY	2018–48 JOB NUMBER	E–2 SHEET
RMB DRAWN BY	MJU APPROVED BY	DATE	OF SHEETS
SCALE AS NOTED			

H:\acad2\2018–48 Mahinahina Permanent Well #1 Ph1\Drawings\E–2.dwg



CONTROL TANK VALVE CONTROL SCHEMATIC DIAGRAM



CONTROL TANK CONTROL SCHEMATIC DIAGRAM

LEGEND AND SYMBOLS:

VALVE
MSVO – MICRO SWITCH VALVE OPEN
MSVC – MICRO SWITCH VALVE CLOSE

VALVE CONTROL
VO – VALVE OPEN (VALVE POSITION INDICATOR)
VC – VALVE CLOSE (VALVE POSITION INDICATOR)
RO – REMOTE OPEN (VALVE CONTROL)
SV – SOLENOID VALVE (VALVE CONTROL)

PLC/RTU
IVO – SUPERVISORY INTERPOSING RELAY–VALVE OPEN
IVC – SUPERVISORY INTERPOSING RELAY–VALVE CLOSE
SRA – SUPERVISORY INTERPOSING RELAY–AUTOMATIC CONTROL
SRO – SUPERVISORY INTERPOSING RELAY–VALVE OPEN
SRC – SUPERVISORY INTERPOSING RELAY–VALVE CLOSE
CF – COMMUNICATION/CONTROL RELAY DELAY ON
CFA – COMMUNICATION/CONTROL FAILURE AUX RELAY
SO – SUPERVISORY OPEN (RTU)
SC – SUPERVISORY CLOSE (RTU)
SA – SUPERVISORY AUTO (RTU)
CFR – COMMUNICATION FAIL RESET (RTU)
RL – RESERVOIR LEVEL RELAY

(G) GREEN INDICATOR LIGHT
(R) RED INDICATOR LIGHT
(W) WHITE INDICATOR LIGHT

NOTES:

1. RTU/SCADA SYSTEM TO BE ATSI CP-11 WITH THREE I/O-3 MODULES OR APPROVED EQUAL. VERIFY FREQUENCY OF RADIO TO MATCH WATER DEPARTMENT FREQUENCY. SUPPLIER FOR KING FISHER EQUIPMENT IS ATS I(1-800-468-4230). MODULE CONFIGURATION TO BE CONSISTENT WITH DWS.
2. ANTENNA AND HARDWARE TO COMPLY WITH FCC. SEE DETAIL ON E-6.
3. CONTRACTOR TO DESIGN PHOTO-VOLTAIC BATTERY SYSTEM FOR 5-DAY OPERATION, PROVIDE ALL REQUIRED COMPONENTS AND ACCESSORIES FOR A COMPLETE 12V SYSTEM, PANELS MOUNTED AND SUPPORTED AS REQUIRED TO MEET WIND LOADING.
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WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MARK J. UNEMORI
LICENSED PROFESSIONAL ENGINEER
No. 13993-E
HAWAII, U.S.A.

License Expires: April 30, 2020

SIGNATURE DATE

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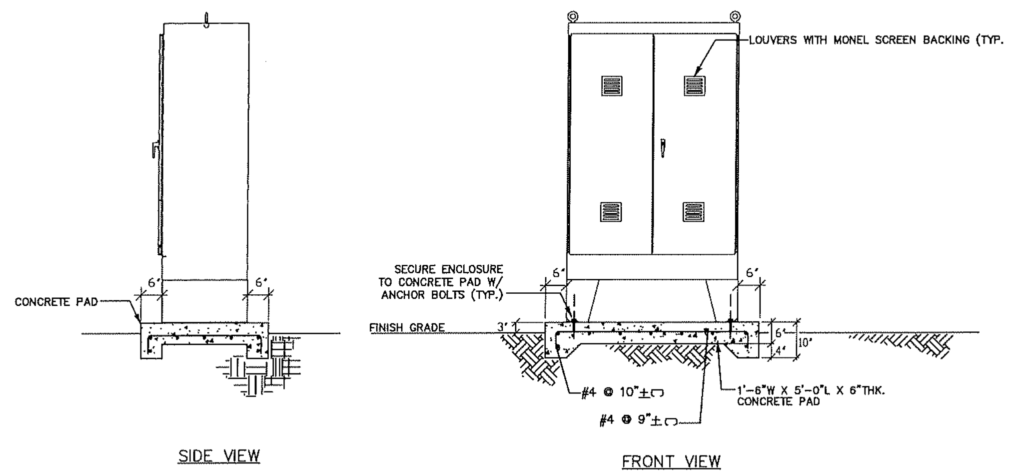
MAHINAHINA PERMANENT WELL WATER SYSTEM

MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE CONTROL TANK DIAGRAMS & DETAIL

MJU/AM DESIGNED BY	MJU CHECKED BY	2018-48 JOB NUMBER	E-3 SHEET
RMB DRAWN BY	MJU APPROVED BY	DATE	OF SHEETS
SCALE AS NOTED			

LETTER	DESCRIPTION	DATE



CONTROL TANK INSTRUMENT ENCLOSURE/PAD DETAIL

NOT TO SCALE

TYPE "A" – BEACH SAND, EARTH, OR EARTH AND GRAVEL. IF EARTH AND GRAVEL, THE MAXIMUM ROCK SHALL BE 1" AND THE MIXTURE SHALL CONTAIN NOT MORE THAN 50% BY VOLUME OF ROCK PARTICLES.

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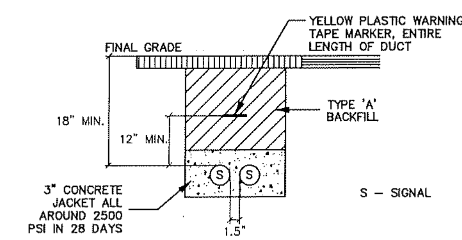
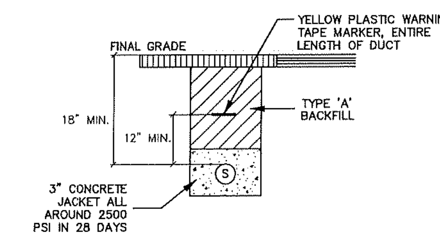


TYPICAL DUCT SECTION THRU DRIVEWAY



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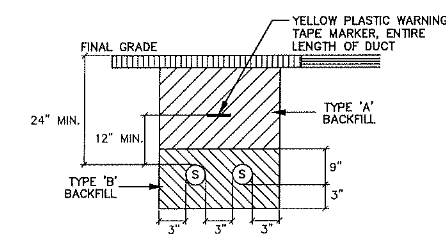
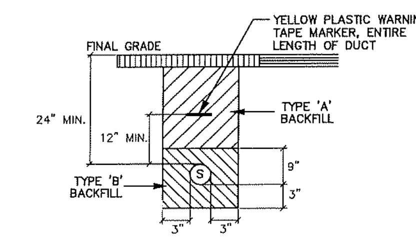
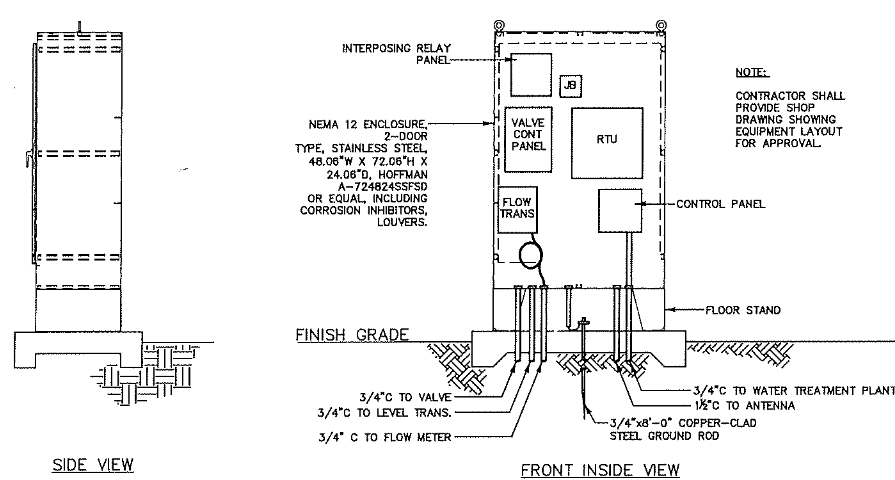
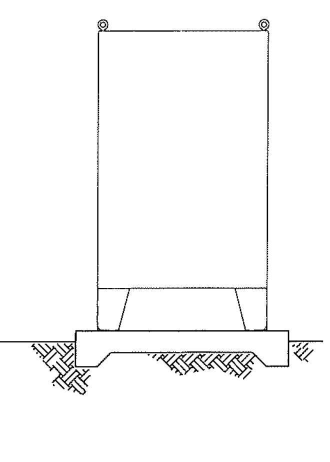


TYPICAL DUCT SECTION THRU NON-TRAFFIC AREAS



TYPICAL DUCT SECTION THRU NON-TRAFFIC AREAS





CONTROL TANK INSTRUMENT ENCLOSURE ELEVATION DETAIL

NOT TO SCALE

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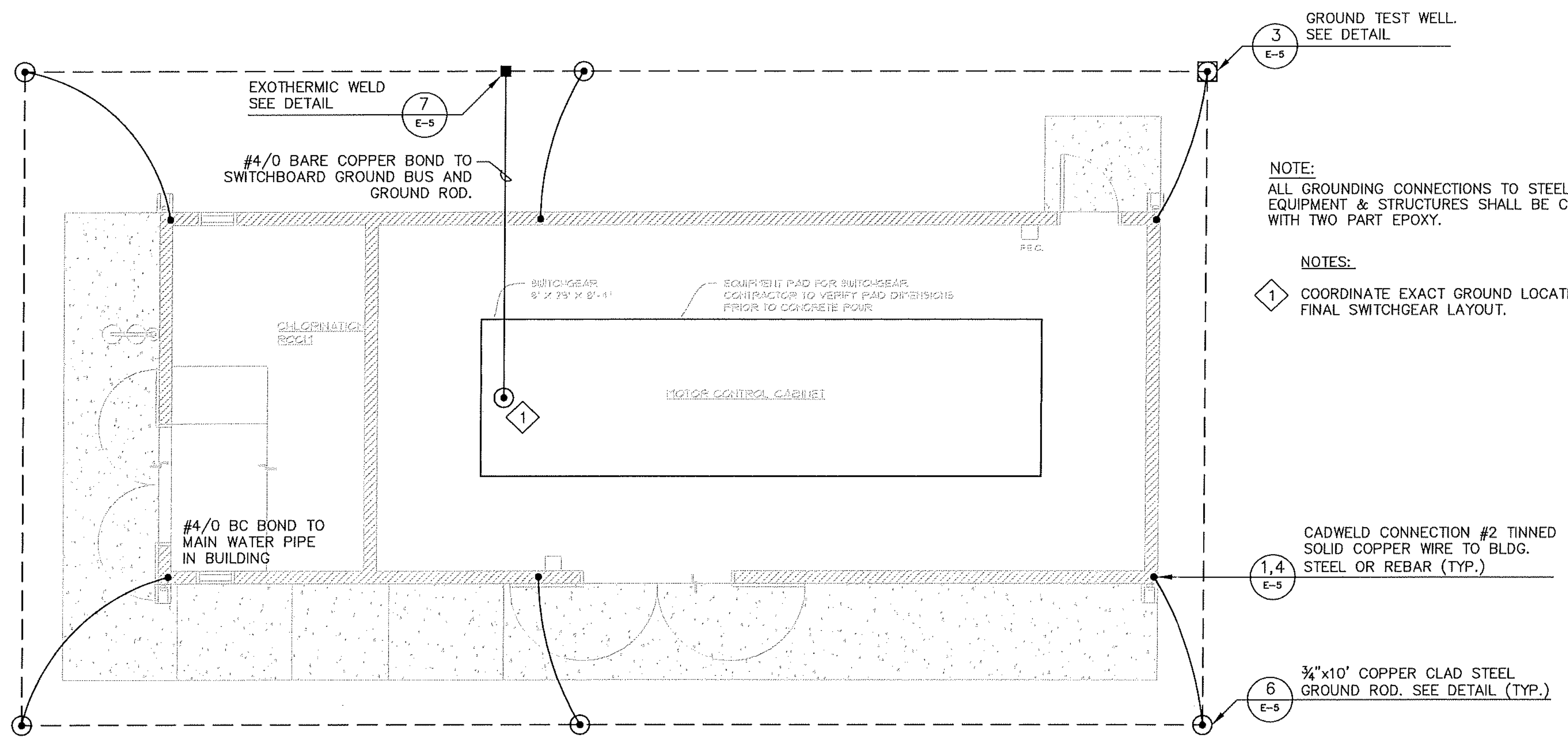
MAHINAHINA PERMANENT WELL WATER SYSTEM

MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE CONTROL TANK ENCLOSURE & DUCTLINE DETAILS

MJU/AM DESIGNED BY	MJU CHECKED BY	2018-48 JOB NUMBER	E-4 SHEET
RMB DRAWN BY	MJU APPROVED BY	DATE	OF SHEETS
SCALE AS NOTED			

H:\pcad2\2018-48 Mahinahina Permanent Well #1 Ph1\Drawings\E-4.dwg



ELECTRICAL BUILDING GROUNDING PLAN

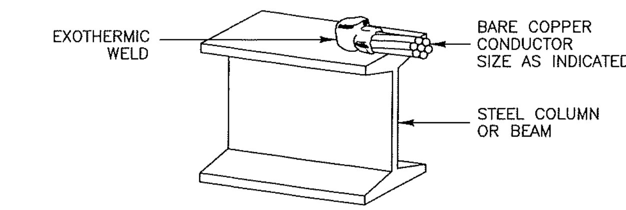
SCALE: 1/4" = 1'-0"

NOTE:
ALL GROUNDING CONNECTIONS TO STEEL EQUIPMENT & STRUCTURES SHALL BE COATED WITH TWO PART EPOXY.

NOTES:
1. COORDINATE EXACT GROUND LOCATION WITH FINAL SWITCHGEAR LAYOUT.

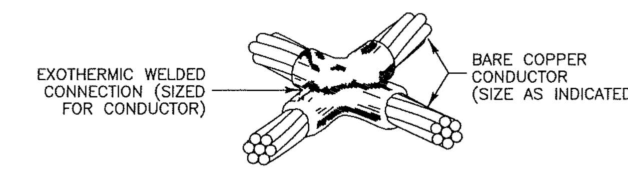
LEGEND

- GROUNDING TEST WELL
- GROUND ROD WITH EXOTHERMIC WELD
- EXOTHERMIC WELD
- GROUND CONDUCTORS. #4/0 SDBC UNLESS OTHERWISE INDICATED. 2'-6" BELOW FINISHED FLOOR OR GRADE



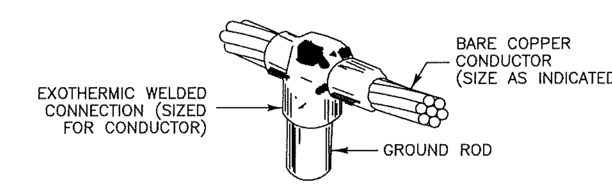
4 E-5 GROUNDING DETAIL CONDUCTOR-TO-STEEL CONNECTION

NOT TO SCALE



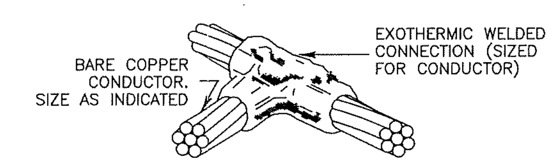
5 E-5 GROUNDING DETAIL CONDUCTOR-TO-CONDUCTOR CONNECTION

NOT TO SCALE



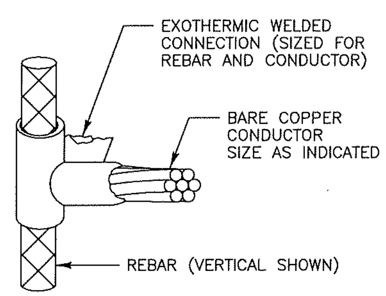
6 E-5 GROUNDING DETAIL CONDUCTOR-CONDUCTOR-TO-GROUND ROD

NOT TO SCALE



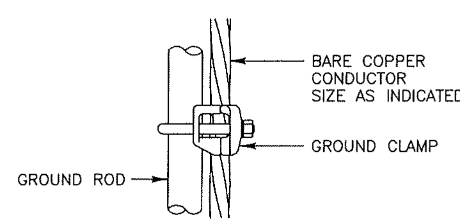
7 E-5 CONDUCTOR-TO-CONDUCTOR CONNECTION DETAIL

NOT TO SCALE



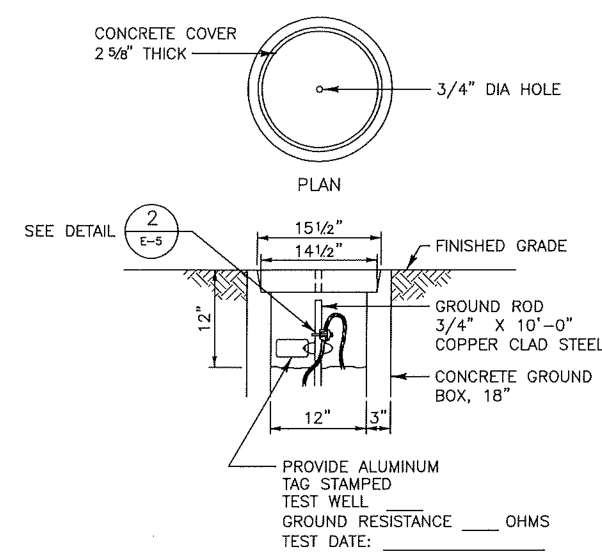
1 E-5 CONDUCTOR TO REBAR

NOT TO SCALE



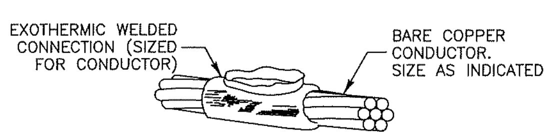
2 E-5 GROUNDING DETAIL MECHANICAL GROUND CONNECTOR

NOT TO SCALE



3 E-5 TYPICAL GROUND TEST WELL BOX DETAIL

NOT TO SCALE



NOTE:
USE ALSO AS WATERSTOP FOR WALL PENETRATION.

8 E-5 CONDUCTOR-TO-CONDUCTOR CONNECTION DETAIL

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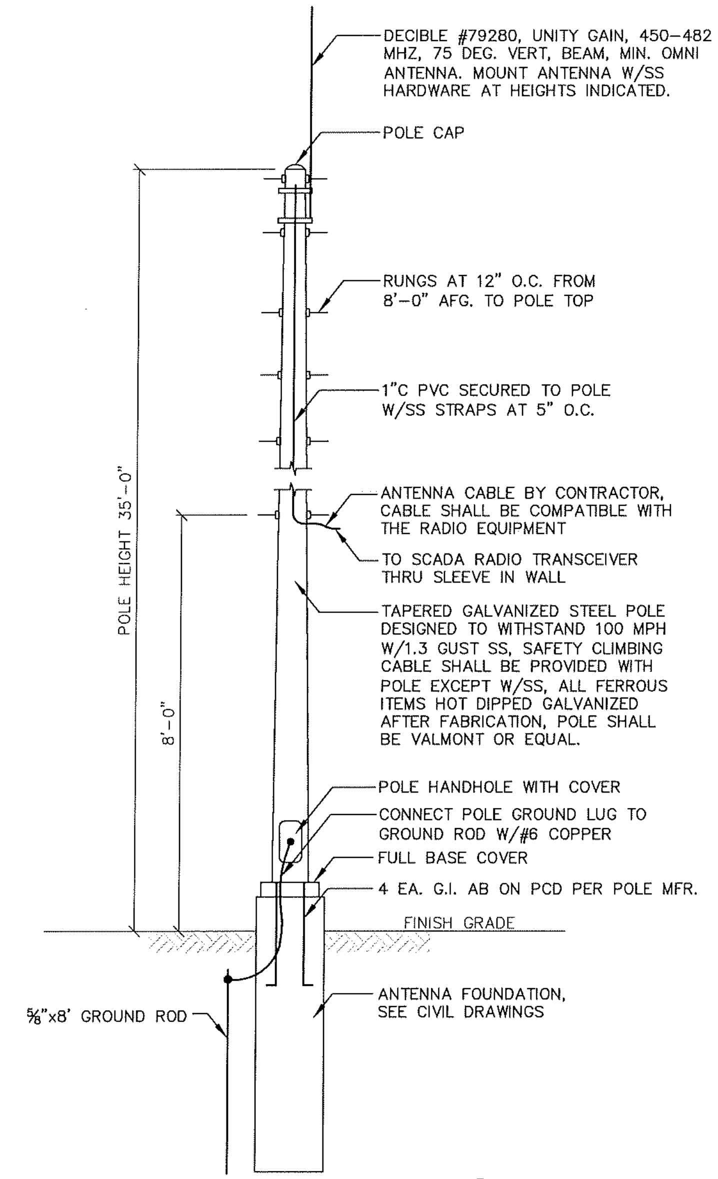
MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

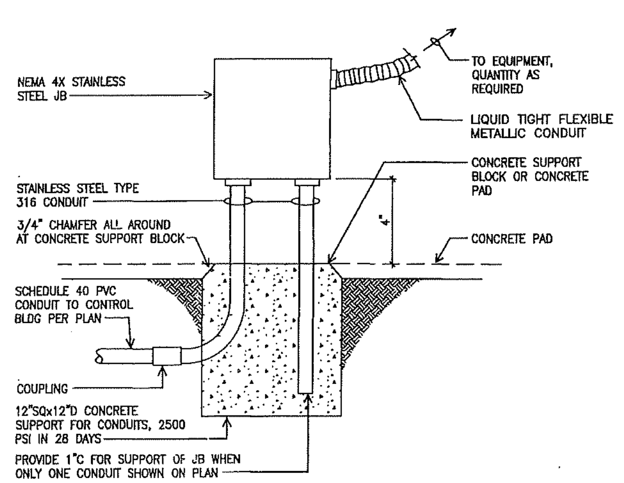
TITLE ELECTRICAL BUILDING GROUND PLAN, DETAILS

MJU/AM DESIGNED BY	MJU CHECKED BY	2011-022 JOB NUMBER	E-5 SHEET
RMB DRAWN BY	MJU APPROVED BY	24 AUG 2012 DATE	OF SHEETS
SCALE	AS NOTED		

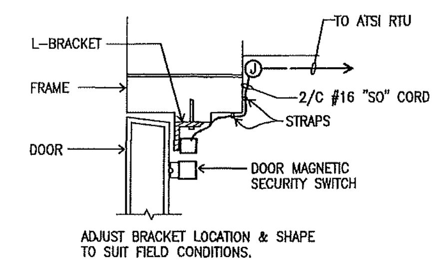


3 (E-6) ANTENNA MOUNTING DETAIL
NOT TO SCALE

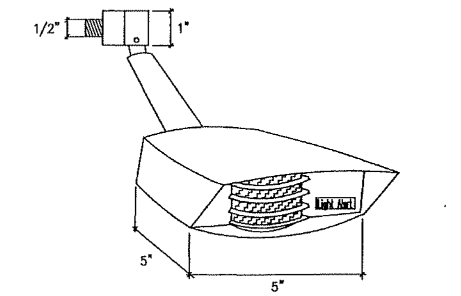
1



CONDUIT MOUNTED JUNCTION BOX DETAIL
NOT TO SCALE



1 (E-6) DOOR MAGNETIC SECURITY SWITCH DETAIL
NOT TO SCALE

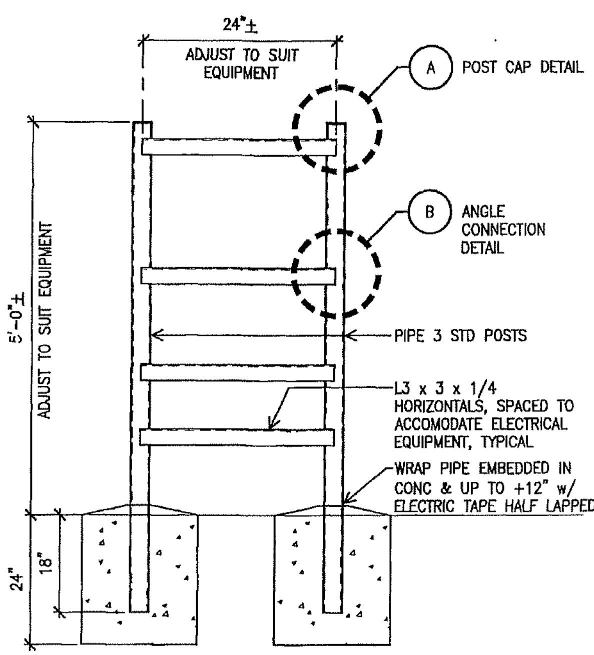


SPECIFICATIONS:

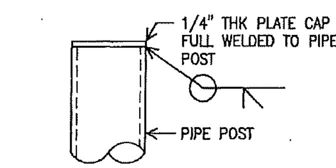
MANUFACTURER:	LIGHT ALERT OR PRE-APPROVED EQUIVALENT
SWITCHING CAPACITY:	1000 WATTS
VOLTS:	120 OR 240
PROTECTION PATTERN:	50' x 100 DEGREE LENS STANDARD
ACCESSORY LENS KIT:	CAT. #LA1000LK WITH 2 ADDITIONAL LENSES
TIME ADJUSTMENT:	5 SEC – 20 MIN
LIMITED WARRANTY:	ONE YEAR
WEIGHT:	1 LB
MATERIAL:	LEXAN

2 (E-6) MOTION SENSOR DETAIL
NOT TO SCALE

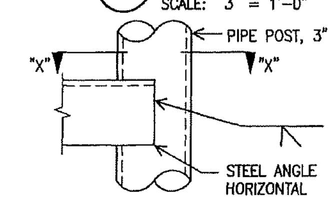
NOTE: HOT-DIP GALVINIZE RACK ASSEMBLY AFTER FABRICATION. USE STAINLESS STEEL FASTENERS AND ACCESSORIES.



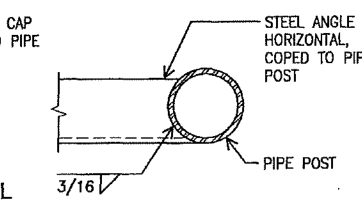
MOUNTING RACK ELEVATION
SCALE: 3/4" = 1'-0"



A POST CAP DETAIL
SCALE: 3" = 1'-0"



B ANGLE CONN DETAIL
SCALE: 3" = 1'-0"



SECTION "X"-"X"
SCALE: 3" = 1'-0"

ELECTRICAL EQUIPMENT MOUNTING RACK DETAIL
SCALE: AS NOTED

LETTER	DESCRIPTION	DATE
1	REVISED PER DWS COMMENTS	9/12/12

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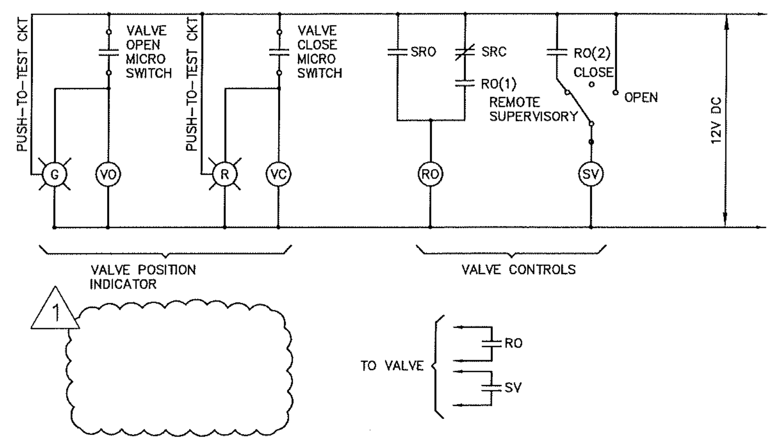
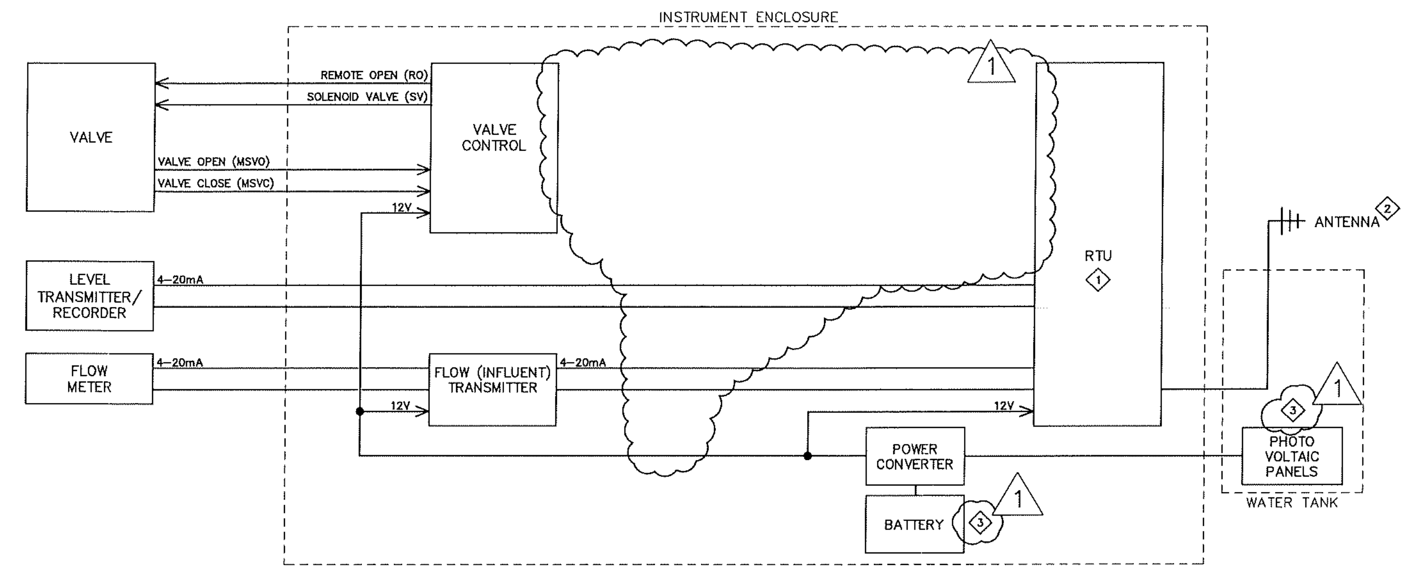
MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE DETAILS

MJU/AM — DESIGNED BY	MJU — CHECKED BY	2011-022 — JOB NUMBER	E-6 — SHEET	
RMB — DRAWN BY	MJU — APPROVED BY	24 AUG 2012 — DATE	OF SHEETS	
AS NOTED — SCALE				



MIXING TANK VALVE CONTROL SCHEMATIC DIAGRAM



MIXING TANK CONTROL SCHEMATIC DIAGRAM

LEGEND AND SYMBOLS:

VALVE
MSVO – MICRO SWITCH VALVE OPEN
MSVC – MICRO SWITCH VALVE CLOSE

VALVE CONTROL
VO – VALVE OPEN (VALVE POSITION INDICATOR)
VC – VALVE CLOSE (VALVE POSITION INDICATOR)
RO – REMOTE OPEN (VALVE CONTROL)
SV – SOLENOID VALVE (VALVE CONTROL)

PLC/RTU
IVO – SUPERVISORY INTERPOSING RELAY–VALVE OPEN
IVC – SUPERVISORY INTERPOSING RELAY–VALVE CLOSE
SRA – SUPERVISORY INTERPOSING RELAY–AUTOMATIC CONTROL
SRO – SUPERVISORY INTERPOSING RELAY–VALVE OPEN
SRC – SUPERVISORY INTERPOSING RELAY–VALVE CLOSE
CF – COMMUNICATION/CONTROL RELAY DELAY ON
CFA – COMMUNICATION/CONTROL FAILURE AUX RELAY
SO – SUPERVISORY OPEN (RTU)
SC – SUPERVISORY CLOSE (RTU)
SA – SUPERVISORY AUTO (RTU)
CFR – COMMUNICATION FAIL RESET (RTU)
RL – RESERVOIR LEVEL RELAY

(G) GREEN INDICATOR LIGHT
(R) RED INDICATOR LIGHT
(W) WHITE INDICATOR LIGHT

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MAHINAHINA, LAHAINA, MAUI, HAWAII

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RMB DRAWN BY	MJU APPROVED BY	24 AUG 2012 DATE	OF SHEETS
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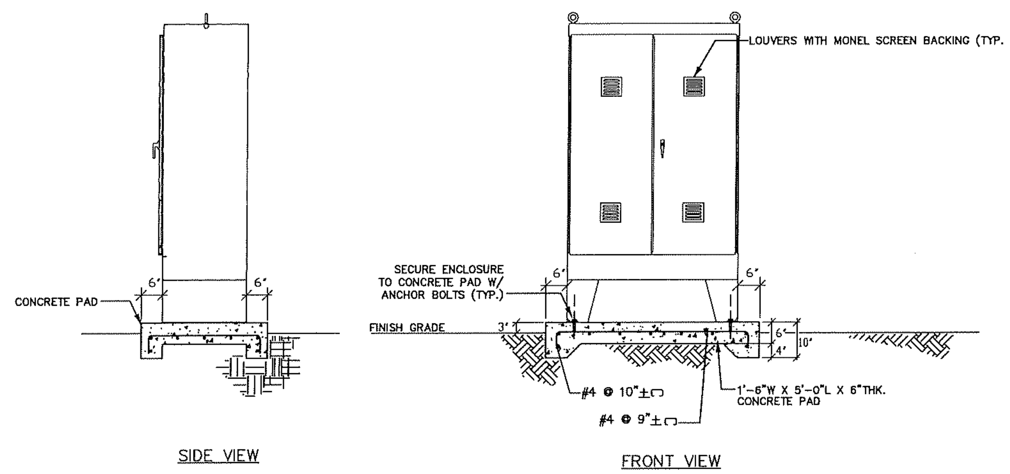

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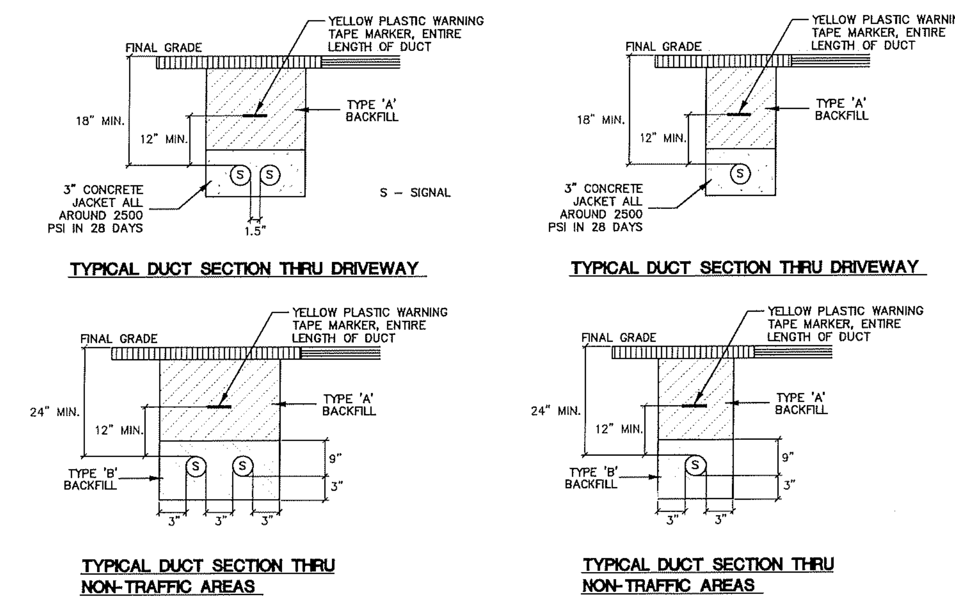

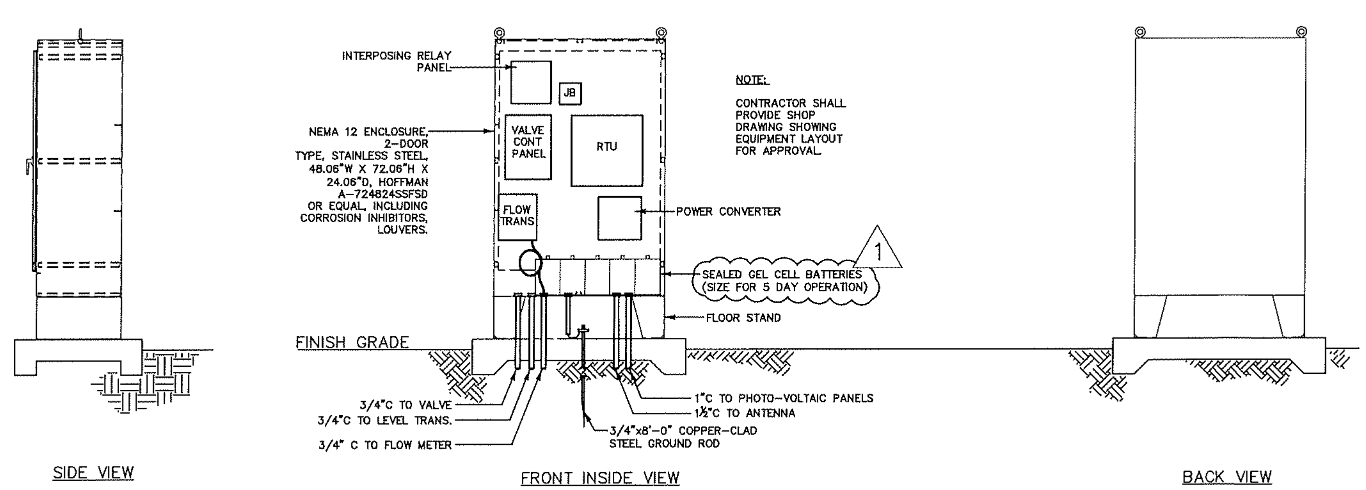

MIXING TANK INSTRUMENT ENCLOSURE ELEVATION DETAIL

NOT TO SCALE

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MAHINAHINA PERMANENT WELL WATER SYSTEM

MAHINAHINA, LAHAINA, MAUI, HAWAII

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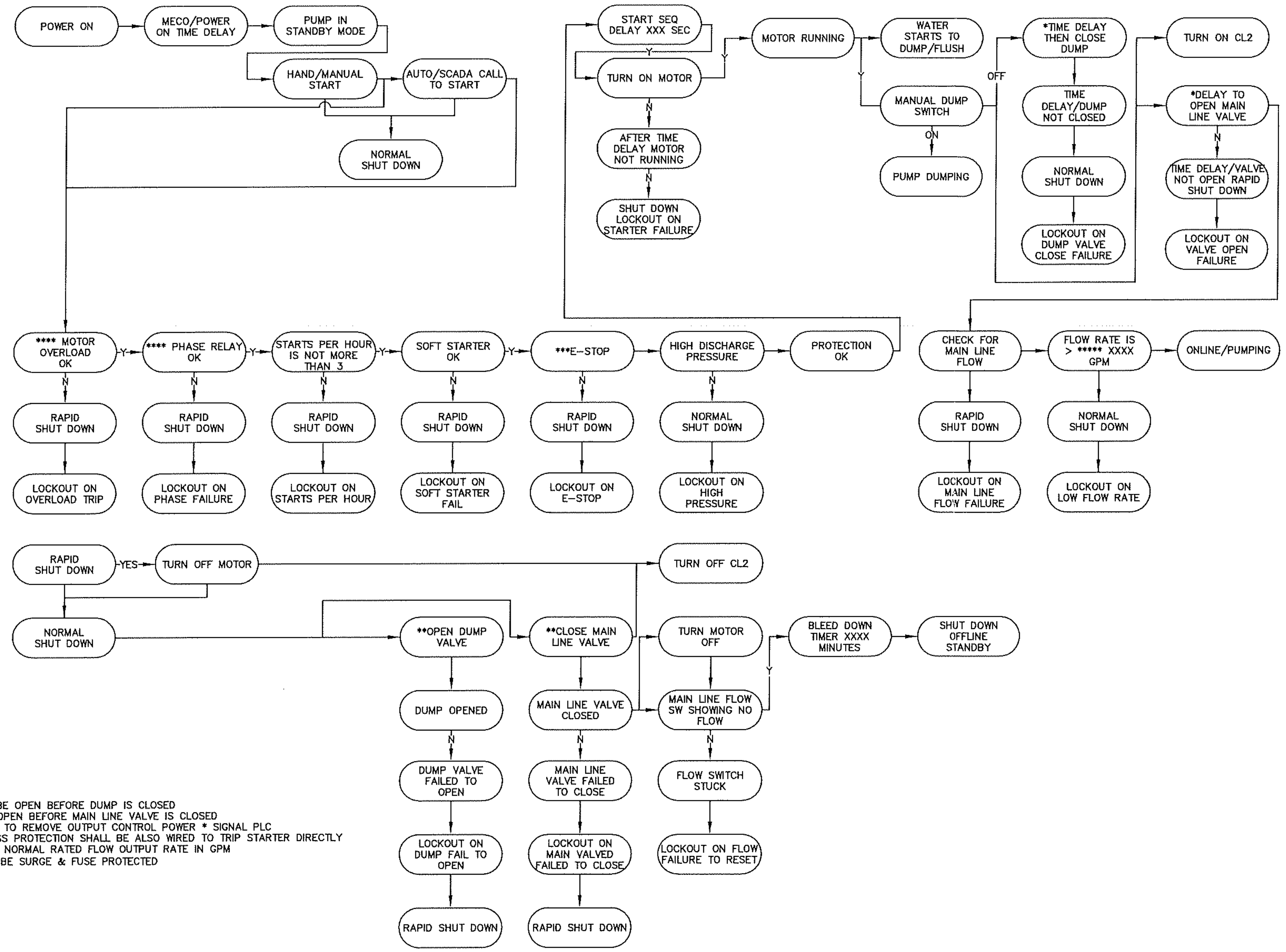
RMB DRAWN BY	MJU APPROVED BY	24 AUG 2012 DATE	
SCALE	AS NOTED		OF SHEETS



* MAIN LINE VALVE SHOULD BE OPEN BEFORE DUMP IS CLOSED
** DUMP VALVE SHOULD BE OPEN BEFORE MAIN LINE VALVE IS CLOSED
*** E-STOP SHALL BE WIRED TO REMOVE OUTPUT CONTROL POWER * SIGNAL PLC
**** OVERLOAD & PHASE LOSS PROTECTION SHALL BE ALSO WIRED TO TRIP STARTER DIRECTLY
***** 10-20 PERCENT BELOW NORMAL RATED FLOW OUTPUT RATE IN GPM
PLC INPUTS/OUTPUTS SHALL BE SURGE & FUSE PROTECTED

DEEP WELL SUMBERSIBLE PUMP CONTROL LOGIC

LETTER	DESCRIPTION	DATE

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License Expires: April 30, 2014
DATE

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"

ECM INC
Electrical Engineering Consultants
MAUI OFFICE
130 North Market Street
Wailuku, Maui, HI. 96793
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WARREN S.UNEMORI ENGINEERING, INC.
CIVIL & STRUCTURAL ENGINEERS/LAND SURVEYORS
WELLS STREET PROFESSIONAL CENTER, SUITE 403
2145 WELLS STREET, WAILUKU, MAUI, HAWAII 96793

MAHINAHINA PERMANENT WELL WATER SYSTEM
MAHINAHINA, LAHAINA, MAUI, HAWAII

TITLE DEEP WELL SUMBERSIBLE PUMP CONTROL LOGIC

MJU/AM DESIGNED BY	MJU CHECKED BY	2011-022 JOB NUMBER	E-9 SHEET
RMB DRAWN BY	MJU APPROVED BY	24 AUG 2012 DATE	OF SHEETS
SCALE AS NOTED			

PROJECT PLANS FOR KAHANA WELL AND TRANSMISSION WATERLINE

APPENDIX C-2

WORK-IN-PROGRESS SET 12/14/18

KAHANA PRODUCTION WELL

TAX MAP KEYS (2) 4-3-001:017, 4-4-004:009 & 011

DWS JOB NO. 15-04

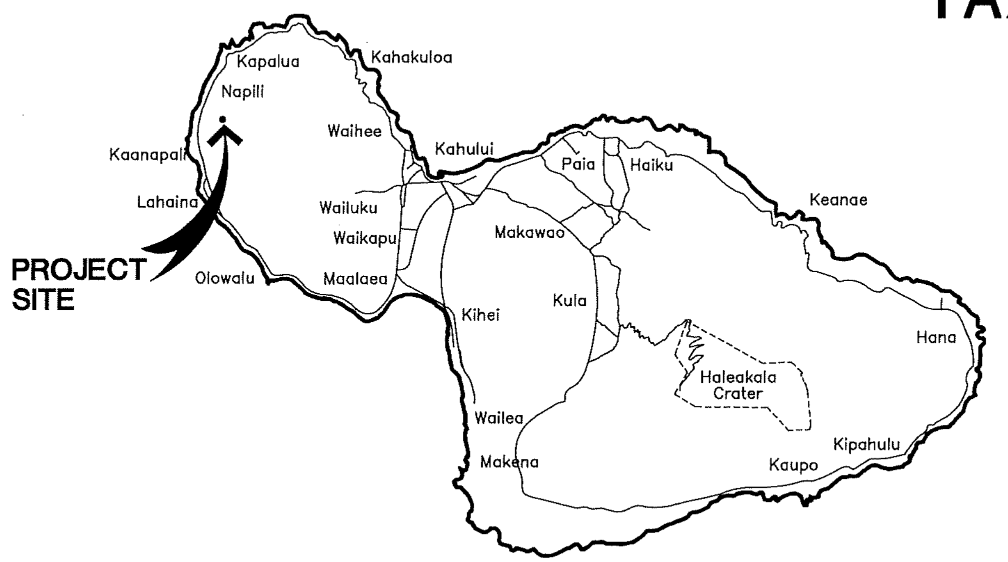
LAHAINA, MAUI, HAWAII

PREPARED FOR:

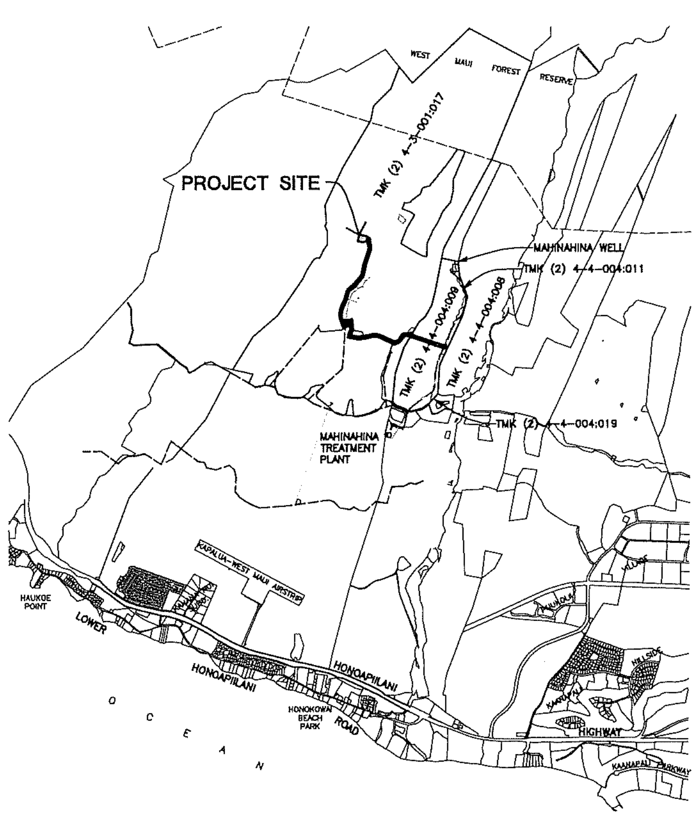
DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 SOUTH HIGH STREET
WAILUKU, HAWAII 96793

PREPARED BY:

FUKUMOTO ENGINEERING, INC.
Civil Engineering & Land Surveying Consultants
1721 Wili Pa Loop, Suite 203 • Wailuku, Hawaii 96793



MAP OF MAUI
SCALE IN MILES
NORTH 5 0 5 10 15



VICINITY MAP
SCALE IN FEET
NORTH 3000 0 3000 6000 9000

APPROVALS:

DIRECTOR, DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
(APPROVAL LIMITED TO WATER IMPROVEMENTS WHICH WILL BE DEDICATED TO THE DEPARTMENT OF WATER SUPPLY)

DATE

INDEX OF DRAWINGS:

KAHANA PRODUCTION WELL
DWS JOB NO. 15-04

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Prepared for:
Department of Water Supply
County of Maui
200 South High Street
Wailuku, Maui, Hawaii 96793
Contact: Curtis Eaton, P.E.

KAHANA PRODUCTION WELL
TAX MAP KEYS (2) 4-3-001:017, 4-4-004:009 & 011
DWS JOB NO. 15-04
LAHAINA, MAUI, HAWAII

TITLE SHEET

RONALD M. FUKUMOTO
LICENSED PROFESSIONAL ENGINEER
No. 4935-C
HAWAII U.S.A.

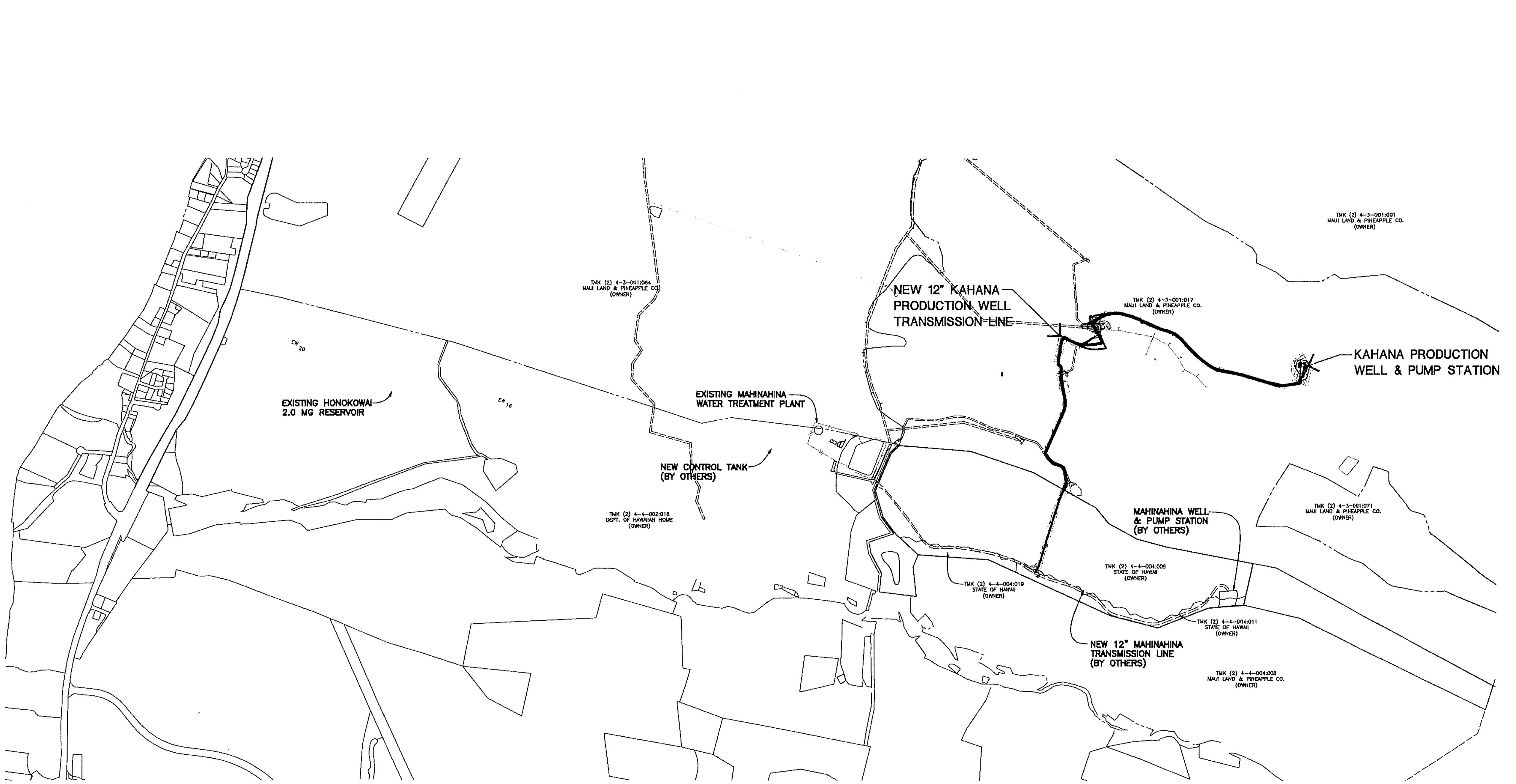
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION, AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION AS DEFINED IN HAR 16-115-2.

LICENSE EXPIRES: 04/30/2020

DESIGNED BY:	R.F.
DRAWN BY:	S.O., N.M.
CHECKED BY:	R.F.
DATE:	DECEMBER 14, 2018
FILE NO:	COM43B

SHEET T-1

1 OF 44



GENERAL PLAN
SCALE: 1" = 800'

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Contact: Curtis Eaton, P.E.

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LICENSE EXPIRES: 04/30/2020

DESIGNED BY:	R.F.
DRAWN BY:	S.O., N.M.
CHECKED BY:	R.F.
DATE:	DECEMBER 14, 2018
FILE NO:	C0M43B

SHEET
C-1
2 OF 44

CONSTRUCTION NOTES

WATER SYSTEM

1. THE CONTRACTOR SHALL NOTIFY THE DEPARTMENT OF WATER SUPPLY (DWS), IN WRITING, ONE (1) WEEK PRIOR TO COMMENCEMENT OF WORK.
2. ALL MATERIALS USED AND METHOD OF CONSTRUCTION OF WATER SYSTEM FACILITIES SHALL BE IN ACCORDANCE WITH THE LATEST REVISIONS OF DWS WATER SYSTEM STANDARDS. CONTRACTOR SHALL OBTAIN THE LATEST REVISIONS OF THE DWS STANDARDS BEFORE COMMENCING CONSTRUCTION.
3. ALL WATER SYSTEM WORK SHALL BE PERFORMED BY CONTRACTORS POSSESSING VALID STATE OF HAWAII CONTRACTOR'S LICENSES, REGARDLESS OF THE VALUE OF THE WORK.
4. CONTRACTOR SHALL FOLLOW ALL LOCAL, STATE, FEDERAL LAWS, RULES AND REGULATIONS REGARDING THE HANDLING, REMOVAL AND DISPOSAL OF ASBESTOS PIPE.
5. CONTRACTOR SHALL PROTECT EXISTING WATERLINE DURING COURSE OF CONSTRUCTION AND SUPPORT EXPOSED WATERLINE TO PREVENT ANY MOVEMENT.
6. THE EXACT DEPTH AND LOCATION OF EXISTING WATERLINES, SERVICE LATERALS AND OTHER UTILITIES ARE NOT KNOWN. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE SAME PRIOR TO TRENCHING FOR THE NEW WATERLINE. THE COST OF LOWERING, RELOCATING OR ADJUSTING EXISTING WATERLINES, SERVICE LATERALS AND APPURTENANCES, WHETHER SHOWN OR NOT SHOWN ON THE CONSTRUCTION PLANS AT THE CONTRACTOR'S EXPENSE.
7. PAVING RESURFACING/RESTORATION:
   a. CONTRACTOR SHALL VERIFY LOCATION OF EXISTING DWS VALVES AND MANHOLES, WHEN AFFECTED BY THE WORK, PRIOR TO START OF CONSTRUCTION.
   b. ALL WATER VALVE AND WATER MANHOLE CONCRETE COLLARS WITHIN THE PROJECT LIMITS SHALL BE DEMOLISHED AND RECONSTRUCTED PER DWS STANDARD DETAIL V12 AND V23, RESPECTIVELY, AT THE CONTRACTOR'S EXPENSE.
   c. THE VALVE BOX RISER AND COVER OF ALL WATER VALVES WITHIN THE PROJECT LIMITS SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.
   d. CONTRACTOR SHALL ADJUST DWS SLIDING VALVE BOX ASSEMBLY AND MANHOLE FRAME AND COVER TO FINISHED GRADE.
   e. PRIOR TO PAVEMENT RESURFACING/RESTORATION WORK, THE CONTRACTOR SHALL SCHEDULE INSPECTION WITH DWS.
8. ANY SLIDING VALVE BOX ASSEMBLY, MANHOLE COVER, OR CONCRETE COLLAR, WHETHER DISCOVERED DAMAGED OR NOT SPECIFIED ON THE PLANS TO BE ADJUSTED OR REPLACED, SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.
9. CONTRACTOR SHALL ADJUST TO FINISHED GRADES, ALL UTILITIES (I.E., WATER, SEWER, DRAIN, ETC.) AFFECTED BY THE WORK WHETHER SHOWN OR NOT SHOWN ON THE CONSTRUCTION PLANS AT THE CONTRACTOR'S EXPENSE.
10. CONTRACTOR SHALL RESTORE ALL ROAD IMPROVEMENTS DISTURBED OR DAMAGED DURING CONSTRUCTION IN ACCORDANCE WITH THE 2005 "HAWAII STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION" AS AMENDED, TO THE SATISFACTION OF THE DEPARTMENT OF PUBLIC WORKS AT THE CONTRACTOR'S EXPENSE. ROAD IMPROVEMENTS INCLUDE, BUT ARE NOT LIMITED TO, PAVEMENT, PAVEMENT MARKERS, SHOULDER DRESSING, STRIPING, AND SPEED HUMPS.
11. CONCRETE FOR REACTION BLOCKS AND ANCHOR BLOCKS SHALL BE DWS CLASS 2500.
12. THE MAXIMUM DISTANCE BETWEEN VALVE NUT AND TOP OF MANHOLE COVER SHALL BE THREE (3) FEET.
13. CONTRACTOR SHALL SUBMIT A MATERIALS LIST TO DWS FOR APPROVAL PRIOR TO CONSTRUCTION.
14. CONNECTION TO DWS SYSTEM:
   a. CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING ALL NECESSARY FITTINGS AND OTHER MATERIALS AND EQUIPMENT REQUIRED FOR THE HOOK-UP. CONTRACTOR SHALL VERIFY THE EXACT LOCATION, DEPTH, TYPE, AND CONDITION OF THE EXISTING LINE BEFORE ORDERING MATERIALS FOR THE HOOK-UP. CONTRACTOR SHALL, HOWEVER, CHECK WITH DWS BEFORE EXCAVATING FOR VERIFICATION PURPOSES.
   b. WHENEVER FEASIBLE, MECHANIC JOINT FITTINGS SHALL BE USED FOR BURIED APPLICATIONS AND FLANGED JOINT FITTINGS SHALL BE USED FOR EXPOSED APPLICATIONS.
   c. DWS PERSONNEL MAY BE REQUIRED TO BE PRESENT OR ASSIST WITH CONNECTIONS TO THE EXISTING WATER SYSTEM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COST INCURRED BY DWS FOR SAID WORK.
   d. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING ALL MATERIAL, EQUIPMENT AND LABOR FOR TRENCH EXCAVATION, BACKFILLING, CLEANING AND CHLORINATION, PAVING, AND OTHER WORK NECESSARY TO COMPLETE THE HOOK-UP, AS DIRECTED BY AND TO THE SATISFACTION OF DWS.
15. MINIMUM COVER OVER WATER MAIN, 6" DIAMETER OR LARGER, SHALL BE 3'-0". MINIMUM COVER FOR 4" DIAMETER SHALL BE 2'-6". MINIMUM COVER FOR DIAMETERS LESS THAN 4" SHALL BE 1'-6".
16. CONTRACTOR SHALL ENSURE INSTALLATION OF WATERLINES, SERVICE LATERALS AND APPURTENANCES HAVE PROPER CLEARANCES FROM EXISTING TREES, WALLS, FENCES, ETC. IN ACCORDANCE WITH CURRENT DWS WATER SYSTEM STANDARDS.
17. CONTRACTOR SHALL VERIFY AND MAINTAIN 18" MINIMUM CLEARANCE WITH WATERLINE OR SERVICE LATERAL CROSSING OVER EXISTING SEWERLINE OR SERVICE LATERAL. INSTALL REINFORCED CONCRETE JACKET AROUND SEWERLINE WHERE SEWER IS ABOVE WATERLINE OR LESS THAN 18" BELOW WATERLINE. THE LENGTH OF JACKET REQUIRED SHALL BE AS SPECIFIED IN TABLE 100-5 OF THE DWS STANDARDS. PROVIDE 6" MINIMUM CLEARANCE FROM OUTSIDE JACKET TO WATERLINE OR SERVICE LATERAL. STANDARD CONCRETE JACKET DETAILS FOR SEWERLINE AS SPECIFIED BY THE DEPARTMENT OF PUBLIC WORKS STANDARDS SHALL BE FOLLOWED.
18. CONTRACTOR SHALL HAVE LICENSED SURVEYOR STAKE OUT WATERLINE BASELINE STATIONING, RIGHT-OF-WAY LIMITS, PROPERTY LINES, AND EASEMENT LINES TO ENSURE PROPER LOCATION OF WATER SYSTEM IMPROVEMENTS.
19. BOLTS FOR EXPOSED FLANGED DUCTILE IRON PIPE JOINTS SHALL BE EITHER SILICON BRONZE BOLTS AND NUTS OR 316 STAINLESS STEEL BOLTS WITH THE HEAVY DUTY STAINLESS STEEL NUTS (ONLY) FURNISHED WITH TRIPAC 2000 BLUE COATING SYSTEM. ANTI-SEIZE SHALL NOT BE USED. T-BOLTS FOR DUCTILE IRON MECHANICAL JOINT (MJ) PIPE AND FITTING CONNECTIONS IN UNDERGROUND SITUATIONS SHALL BE ONE OF THE FOLLOWING SYSTEMS:
   a. 316 STAINLESS STEEL T-BOLTS WITH THE HEAVY DUTY STAINLESS STEEL NUTS (ONLY) FURNISHED WITH TRIPAC 2000 BLUE COATING SYSTEM. ANTI-SEIZE SHALL NOT BE USED.
   b. COR-TEN T-BOLTS AND NUTS WITH HIGH GRADE ZINC SACRIFICIAL ANODES, EQUIVALENT TO "DURATRON" SACRIFICIAL "SAC-NUT" MODULES, INSTALLED ON THE NUTS FOR ALL STANDARD COR-TEN T-BOLTS.
   c. COR-TEN T-BOLTS AND NUTS BOTH FACTORY COATED WITH TRIPAC 2000 BLUE COATING SYSTEM BY "TRIPAC FASTENERS".

   ALL HOT FORGED STAINLESS STEEL BOLTS ARE REQUIRED TO BE PASSIVATED PER ASTM A380. MANUFACTURER CERTIFICATES ARE REQUIRED FOR PROOF WITH EACH SHIPMENT.
20. CONTRACTOR SHALL FURNISH AND INSTALL DUCTILE IRON NIPPLES FOR COMPLETE INSTALLATION OF THE WATERLINE, WHETHER SHOWN OR NOT SHOWN ON THE CONSTRUCTION PLANS, AT THE CONTRACTOR'S EXPENSE.
21. CONTRACTOR SHALL FURNISH TEMPORARY CLEANOUTS WHEN NECESSARY TO TEST, FLUSH, AND CHLORINATE THE WATERLINE AT THE CONTRACTOR'S EXPENSE.
22. CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL PORTIONS OF ABANDONED WATERLINES THAT ARE EXPOSED OR WITHIN 12-INCHES BELOW THE GROUND SURFACE AT THE CONTRACTOR'S EXPENSE.
23. ALL BURIED METALS, INCLUDING COPPER PIPES, SHALL BE WRAPPED WITH POLY-WRAP. FOR ALL BURIED INSTALLATIONS OF DUCTILE IRON PIPE AND FITTINGS, POLY-WRAP IS REQUIRED EXCEPT WITHIN CONCRETE JACKETS.
24. LUBRICATE HYDRANT NOZZLE THREADS WITH NON-TOXIC GREASE.
25. CONTRACTOR SHALL PAINT AND NUMBER FIRE HYDRANT(S). NUMBERING TO BE FURNISHED BY DWS.
26. WATER MAINS AND APPURTENANCES SHALL BE SUBJECT TO HYDROSTATIC TESTING IN ACCORDANCE WITH THE LATEST REVISION OF AWWA C600, UNDER THE "HYDROSTATIC TESTING" SECTION, TO A PRESSURE OF AT LEAST 1.5 TIMES THE WORKING PRESSURE. UNLESS OTHERWISE STATED IN THE CONSTRUCTION DOCUMENTS OR LIMITED BY THE PRESSURE RATING OF EQUIPMENT, THE PRESSURE TEST AND LEAKAGE TEST SHALL BE PERFORMED AT 225 POUNDS PER SQUARE INCH PRESSURE.
27. DEVELOPER SHALL SUBMIT A COST LIST ALONG WITH AN AFFIDAVIT FOR THE WATER SYSTEM PRIOR TO ACCEPTANCE.
28. CONTRACTOR SHALL SUBMIT ONE (1) SET OF RECORD DRAWINGS VIA A CONSULTANT PRIOR TO ACCEPTANCE OF THE WATER SYSTEM. AN ELECTRONIC IMAGE FILE IN PDF FORMAT AT FULL PAGE SIZE (24"x36") SHALL BE PROVIDED TO THE DWS FOR ALL PROJECTS.

REVISION 1/11/2018

CHLORINATION OF WATER SYSTEMS

1. WATER MAINS AND APPURTENANCES SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA C651. ALL PROCEDURES AND MATERIALS (LIQUID CHLORINE OR CALCIUM HYPOCHLORITE) USED FOR THE CHLORINATION OF THE PROJECT SHALL CONFORM TO AWWA REQUIREMENTS.
2. PRIOR TO CHLORINATION, THE PROJECT PIPELINES SHALL BE THOROUGHLY CLEANED. CLEANING OF LINES 8" AND LARGER SHALL BE BY PIGGING USING FOAM PIGS. SMALLER LINES CAN BE FLUSHED IN ACCORDANCE WITH AWWA REQUIREMENTS IF ADEQUATE WATER SUPPLY IS PROVIDED, OTHERWISE BY PIGGING. THE CONTRACTOR SHALL SUBMIT HIS PLAN FOR PIPELINE CLEANING, INCLUDING FITTING REQUIREMENTS FOR PIGGING, FOR APPROVAL PRIOR TO PROCEEDING.
3. THE INTERIOR SURFACES OF THE PROJECT SHALL BE EXPOSED TO THE CHLORINATING SOLUTION FOR A MINIMUM OF 24 HOURS AND THE CHLORINE RESIDUAL SHALL NOT BE LESS THAN 10 PPM AFTER SUCH TIME.
4. SHOULD CALCIUM HYPOCHLORITE BE USED, NO SOLID AND/OR UNDISSOLVED PORTION OF THE COMPOUND SHALL BE INTRODUCED INTO ANY SECTION OF THE PROJECT TO BE CHLORINATED.
5. AT THE END OF THE 24-HOUR DISINFECTION PERIOD, REPRESENTATIVE SAMPLES SHALL BE TAKEN AND ANALYZED TO ASSURE A CHLORINE RESIDUAL OF AT LEAST 10 PPM. MEASUREMENTS FOR CHLORINE RESIDUAL TESTS SHALL BE BY A TRAINED, QUALIFIED TESTER APPROVED BY THE DIRECTOR.
6. SHOULD THE RESULTS INDICATE ADEQUATE CHLORINATION, THE PROJECT SHALL BE THOROUGHLY FLUSHED AND FILLED WITH POTABLE WATER FROM THE EXISTING POTABLE WATER SYSTEM AND AGAIN TESTED FOR CHLORINE RESIDUAL. THE FLUSHING SHALL BE CONSIDERED ADEQUATE IF THE TEST RESULTS INDICATE THAT THE WATER IN THE PROJECT HAS A COMPARABLE CHLORINE RESIDUAL AS THE WATER IN THE EXISTING SYSTEM.
7. FOLLOWING THE ACCEPTABLE FLUSHING OF THE HIGH CONCENTRATION CHLORINE SOLUTION, TWO CONSECUTIVE SETS OF ACCEPTABLE SAMPLES SHALL BE TAKEN AT LEAST 24 HOURS APART FROM REPRESENTATIVE POINTS IN THE PROJECT AND SUBJECTED TO MICROBIOLOGICAL TESTS PERFORMED BY A CERTIFIED LABORATORY APPROVED BY THE DEPARTMENT OF HEALTH. AT LEAST ONE SET OF SAMPLES SHALL BE COLLECTED AND TESTED FROM EVERY 1,200 FEET OF THE NEW WATER MAIN, PLUS ONE SET FROM THE END OF THE LINE AND AT LEAST ONE SET FROM EACH BRANCH. POSITIVE RESULTS WILL NOT BE ACCEPTABLE AND THE ENTIRE CHLORINATION PROCESS WILL BE REPEATED.
8. ANALYSIS FOR RESIDUAL CHLORINE SHALL BE MADE IN ACCORDANCE WITH "STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER", AMERICAN PUBLIC HEALTH ASSOCIATION, CURRENT EDITION.
9. MICROBIOLOGICAL TESTS SHALL BE MADE IN ACCORDANCE WITH "STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER", AMERICAN PUBLIC HEALTH ASSOCIATION, CURRENT EDITION.
10. THE DEVELOPER/CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH ALL OF THE FOREGOING.

REVISED: 12/1/07

GENERAL NOTES

1. LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE BASED ON AVAILABLE "AS-BUILT" OF RECORD CONSTRUCTION PLANS, ARE APPROXIMATE ONLY, AND THEIR ACCURACY IS NOT GUARANTEED.
2. VERIFY EXISTING GRADES BEFORE PROCEEDING WITH GRADING WORK. SHOULD ANY DISCREPANCIES BE DISCOVERED IN THE EXISTING GRADES OR DIMENSIONS GIVEN ON THE PLANS, NOTIFY THE ENGINEER BEFORE PROCEEDING ANY FURTHER WITH THE WORK. THE CONTRACTOR WILL BE HELD RESPONSIBLE FOR ANY COST INVOLVED IN THE CORRECTION OF CONSTRUCTION PLACED DUE TO SUCH DISCREPANCIES.
3. DETERMINE THE EXACT LOCATION OF EXISTING UTILITIES WITHIN PROJECT LIMITS BEFORE COMMENCING WORK, AND AGREE TO BE FULLY RESPONSIBLE FOR DAMAGES DUE TO FAILURE TO EXACTLY LOCATE AND PRESERVE ALL UNDERGROUND UTILITIES.
4. REPORT ANY INCONSISTENCIES WITH THE PROPOSED PLAN TO THE OWNER'S REPRESENTATIVE AND DEMOLISH, REMOVE, OR RELOCATE ALL EXISTING UTILITIES, IMPROVEMENTS, ETC. INCONSISTENT WITH THE PROPOSED PLAN AS DIRECTED BY THE OWNER'S REPRESENTATIVE AND AT THE CONTRACTOR'S EXPENSE.
5. THE LATEST REVISIONS OF THE "STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION," SEPTEMBER 1984 AND THE "HAWAII STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION," 2005 IS INCLUDED AS PART OF THESE CONSTRUCTION PLANS. OBTAIN THE LATEST REVISIONS BEFORE COMMENCING CONSTRUCTION.
6. SHOULD HISTORIC SITES SUCH AS WALLS, PLATFORMS, PAVEMENTS AND MOUNDS, OR REMAINS SUCH AS ARTIFACTS, BURIALS, CONCENTRATION OF CHARCOAL OR SHELLS BE ENCOUNTERED DURING CONSTRUCTION WORK, CEASE WORK IN THE IMMEDIATE VICINITY OF THE FIND, AND PROTECT THE FIND FROM FURTHER DAMAGE. THE CONTRACTOR MUST IMMEDIATELY CONTACT THE STATE HISTORIC PRESERVATION DIVISION (PH: 243-1285 OR 243-4640), WHICH WILL ASSESS THE SIGNIFICANCE OF THE FIND AND RECOMMEND MITIGATION MEASURES, IF NECESSARY.
7. PURSUANT TO CHAPTER 6E OF THE HAWAII REVISED STATUTES, IN THE EVENT THAT ANY HUMAN SKELETAL REMAINS ARE INADVERTENTLY DISCOVERED DURING CONSTRUCTION, DO NOT MOVE THE REMAINS, CEASE ANY ACTIVITY IN THE IMMEDIATE AREA THAT COULD DAMAGE THE REMAINS OR THE POTENTIAL HISTORIC SITE, AND CONTACT THE DEPARTMENT OF LAND AND NATURAL RESOURCES' HISTORIC PRESERVATION DIVISION (PH: 243-1285 OR 243-4640), THE APPROPRIATE MEDICAL EXAMINER OR CORONER, AND THE POLICE DEPARTMENT (TELEPHONE: 244-6400).

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEMS (NPDES) AND OTHER AUTHORIZATIONS

1. THE GENERAL CONTRACTOR/DEVELOPER/OWNER OF THE PROJECT SHALL OBTAIN NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT COVERAGE(S) FOR THE FOLLOWING:
   A. STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES THAT DISTURB ONE (1) ACRE OR MORE, AND
   B. DISCHARGES OF HYDROTESTING EFFLUENT, DEWATERING EFFLUENT, AND WELL DRILLING EFFLUENT TO STATE WATERS.
2. IN ACCORDANCE WITH STATE LAW, ALL DISCHARGES RELATED TO PROJECT CONSTRUCTION OR OPERATION ARE REQUIRED TO COMPLY WITH STATE WATER QUALITY STANDARD (HAWAII ADMINISTRATIVE RULES, CHAPTER 11-54). BEST MANAGEMENT PRACTICES SHALL BE USED TO MINIMIZE OR PREVENT THE DISCHARGE OF SEDIMENT, DEBRIS, AND OTHER POLLUTANTS TO STATE WATERS. PERMIT COVERAGE IS AVAILABLE FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH AT: http://health.hawaii.gov/cwb/
3. THE GENERAL CONTRACTOR/DEVELOPER/OWNER IS RESPONSIBLE FOR OBTAINING OTHER FEDERAL, STATE, OR LOCAL AUTHORIZATIONS AS REQUIRED BY LAW.

REVISED 4/1/2014

GRADING NOTES

1. FINISH SPOT ELEVATIONS AND FINISH CONTOURS, AS SHOWN ON PLAN REPRESENTS FINISH GRADING. THE SITE WORK CONTRACTOR SHALL COORDINATE WITH THE LANDSCAPE CONTRACTOR THE LOCATION AND DEPTH OF TOPSOIL THE FINISH SUBGRADE SHALL REFLECT THE FINISH GRADE LESS SPECIFIED TOPSOIL DEPTH.
2. THE CONTRACTOR SHALL IMPLEMENT AND MAINTAIN THE MEASURES OF THE BEST MANAGEMENT PRACTICE (BMP) PLAN. ALL GRADING OPERATIONS SHALL BE PERFORMED IN CONFORMANCE WITH THE APPLICABLE PROVISIONS OF THE WATER POLLUTION CONTROL AND WATER QUALITY STANDARDS CONTAINED IN THE PUBLIC HEALTH REGULATIONS, STATE DEPARTMENT OF HEALTH, ON WATER POLLUTION CONTROL AND WATER QUALITY STANDARDS.
3. THE CONTRACTOR SHALL REMOVE ALL SILT AND DEBRIS RESULTING FROM HIS WORK AND DEPOSITED IN DRAINAGE FACILITIES, ROADWAYS, AND OTHER AREAS. THE COSTS INCURRED FOR ANY NECESSARY REMEDIAL ACTION BY THE STATE DEPARTMENT OF HEALTH SHALL BE PAYABLE BY THE CONTRACTOR.
4. THE CONTRACTOR, AT HIS EXPENSE, SHALL KEEP THE PROJECT AREA AND SURROUNDING AREA FREE OF DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION CONTROL STANDARDS AND REGULATIONS OF THE STATE DEPARTMENT OF HEALTH.
5. CONSTRUCTION DEBRIS AND WASTES SHALL BE DEPOSITED AT AN APPROPRIATE SITE. THE CONTRACTOR SHALL INFORM THE ENGINEER OF THE LOCATION OF DISPOSAL SITES. THE DISPOSAL SITE MUST ALSO FULFILL REQUIREMENTS OF THE GRADING ORDINANCES.
6. THE CONTRACTOR SHALL NOT DEMOLISH OR CLEAR ANY STRUCTURE, SITE OR VACANT LOT WITHOUT FIRST ASCERTAINING THE PRESENCE OR ABSENCE OF RODENTS WHICH MAY ENDANGER THE PUBLIC HEALTH BY DISPERSAL FROM SUCH PREMISES. SHOULD SUCH INSPECTION REVEAL THE PRESENCE OF SUCH RODENTS, THE CONTRACTOR SHALL ERADICATE SUCH RODENTS BEFORE DEMOLISHING OR CLEARING SAID STRUCTURE, SITE OR VACANT LOT.
7. THE FOLLOWING MEASURES SHALL BE TAKEN TO CONTROL DUST AND EROSION DURING THE SITE DEVELOPMENT PERIOD:
   A. MINIMIZE TIME OF CONSTRUCTION.
   B. RETAIN EXISTING GROUND COVER UNTIL THE LATEST DATE TO COMPLETE CONSTRUCTION.
   C. CONSTRUCT REMAINING PERMANENT EROSION AND DRAINAGE CONTROL FEATURES AS EARLY AS POSSIBLE.
   D. USE TEMPORARY AREA SPRINKLERS IN NON-ACTIVE CONSTRUCTION AREAS WHEN GROUND COVER IS REMOVED.
   E. STATION WATER TRUCK ON-SITE DURING CONSTRUCTION PERIOD TO PROVIDE FOR IMMEDIATE SPRINKLING, AS NEEDED, IN ACTIVE CONSTRUCTION AREAS (WEEKENDS AND HOLIDAYS INCLUDED).
   F. USE TEMPORARY BERMS AND CUT-OFF DITCHES, WHERE NEEDED, FOR CONTROL OF EROSION. IMPLEMENT AND MAINTAIN THE MEASURES OF THE BMP PLAN.
   G. GRADED AREAS SHALL BE THOROUGHLY WATERED AFTER CONSTRUCTION ACTIVITY HAS CEASED FOR THE DAY AND ON WEEKENDS.
   H. ALL CUT AND FILL SLOPES SHALL BE SODDED OR PLANTED IMMEDIATELY AFTER GRADING WORK HAS BEEN COMPLETED.

COMPACTION REQUIREMENTS

1. TESTING OF MATERIALS SHALL BE CONDUCTED BY AN APPROVED INDEPENDENT TESTING AGENCY IN ACCORDANCE WITH ASTM STANDARD METHODS OR AS SPECIFIED BY THE DEPARTMENT OF PUBLIC WORKS, ENGINEERING DIVISION, AS FOLLOWS:
   A. EMBANKMENT/SELECT BORROW AND SUBGRADE MATERIALS: ONE (1) COMPACTION TEST PER 600 SQUARE YARDS PER LIFT;
   B. AGGREGATE SUBBASE COURSE: ONE (1) COMPACTION TEST PER 400 SQUARE YARDS; ONE (1) GRADATION AND SAND EQUIVALENT TEST PER LIFT PER PROJECT;
   C. AGGREGATE BASE COURSE: ONE (1) COMPACTION TEST PER 300 SQUARE YARDS PER LIFT OF MATERIAL; ONE (1) GRADATION AND SAND EQUIVALENT TEST PER PROJECT;
   D. ASPHALT CONCRETE PAVEMENT OR ASPHALT TREATED BASE COURSE; THREE (3) A.C. CORES FOR THICKNESS AND DENSITY TESTS PER PROJECT;
   E. TRENCH BACKFILL MATERIAL: ONE (1) TEST FOR EACH 300 LINEAL FEET OF TRENCH PER LIFT OF MATERIAL.
2. CONTRACTOR SHALL SUBMIT ALL TESTING REPORTS INCLUDING RESULTS TO THE COUNTY'S INSPECTION AGENCY FOR REVIEW AND APPROVAL PRIOR TO COUNTY'S ACCEPTANCE OF WORK.
3. THE CONTRACTOR SHALL BE REQUIRED TO NOTIFY THE COUNTY OF ANY TESTING FAILURES AND CORRECT EACH FAILURE PRIOR TO PROCEEDING TO THE NEXT PHASE OF CONSTRUCTION.

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County of Maui
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Contact: Curtis Eaton, P.E.

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LAHAINA, MAUI, HAWAII

CONSTRUCTION NOTES

RONALD M. FUKUMOTO
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No. 4935-C
HAWAII U.S.A.

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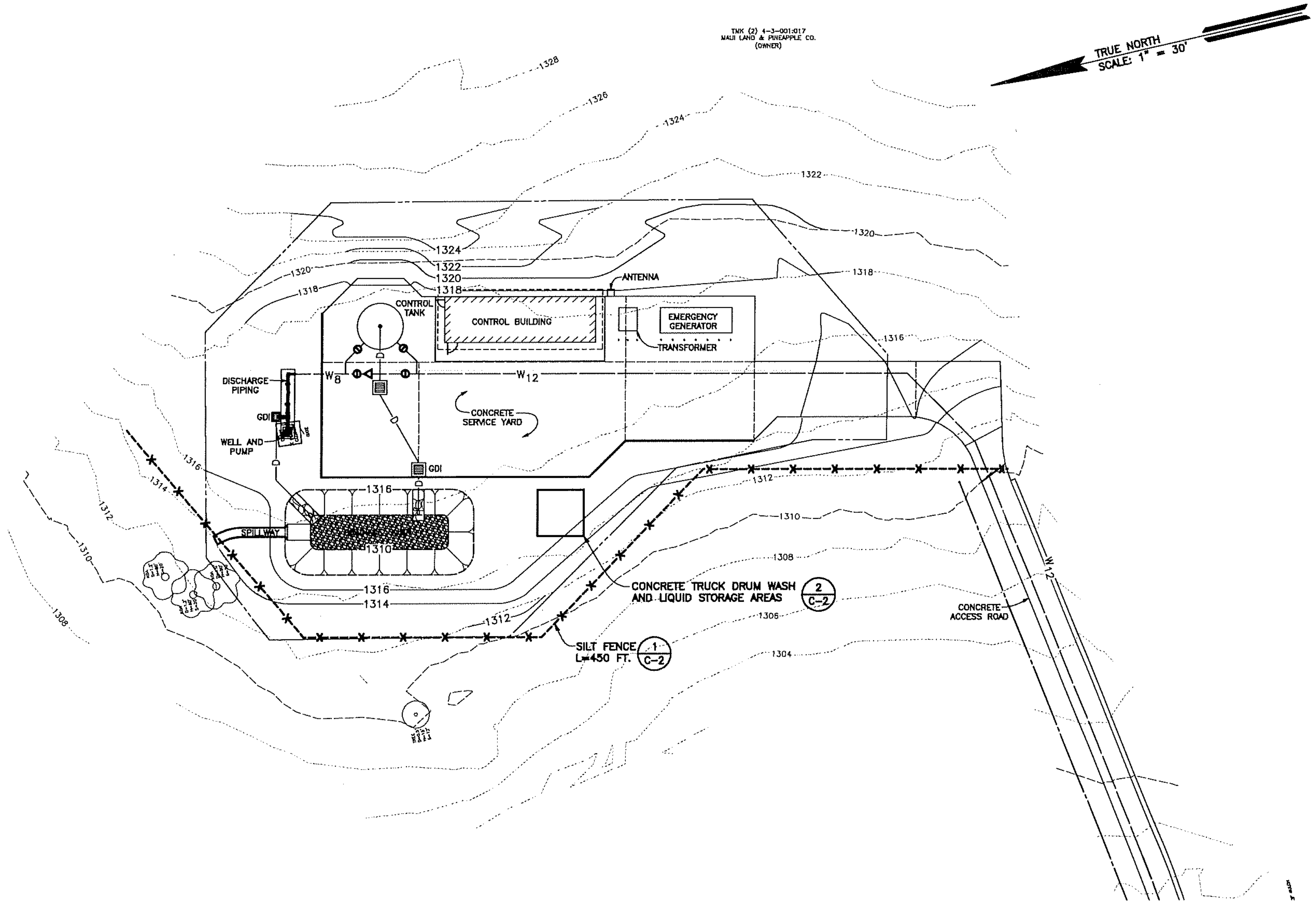
LICENSE EXPIRES: 04/30/2020

DESIGNED BY:	R.F.
DRAWN BY:	S.O., N.M.
CHECKED BY:	R.F.
DATE:	DECEMBER 14, 2018
FILE NO:	COM43B

SHEET C-2

3 OF 44



BEST MANAGEMENT PRACTICES PLAN

SCALE: 1" = 30'

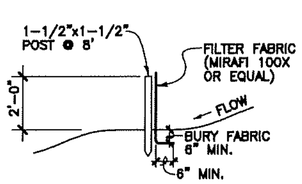
EROSION CONTROL NOTES

THE FOLLOWING IS AN OUTLINE OF THE EROSION CONTROL MEASURES THAT WILL BE IMPLEMENTED FOR THIS PROJECT.

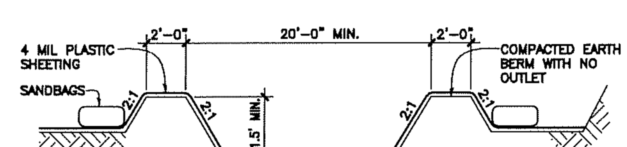
1. GENERAL EROSION CONTROL MEASURES
   A. MINIMIZE TIME OF CONSTRUCTION.
   B. RETAIN EXISTING GROUND COVER UNTIL THE LATEST DATE TO COMPLETE CONSTRUCTION.
   C. USE TEMPORARY BERMS AND CUT-OFF DITCHES, WHERE NEEDED, FOR CONTROL OF EROSION.
   D. MAINTAIN EROSION CONTROL MEASURES UNTIL ESTABLISHMENT OF GRASS AND LANDSCAPE PLANTING.
2. SITE-SPECIFIC EROSION CONTROL MEASURES
   A. INSTALL SILT FENCES AS NOTED ON PLAN. INSPECT FENCES WEEKLY AND AFTER STORMS. REMOVE AND STABILIZE SEDIMENT WHENIT REACHES A HEIGHT OF 8 INCHES AT THE FENCE.
   B. INSTALL GRAVEL SNAKE BAG AS MANUFACTURED BY PROTECH GENERAL CONTRACTING SERVICES, INC., OR APPROVED EQUAL, PRIOR TO EXCAVATION WITHIN PAVEMENT. PROVIDE TRAFFIC CONTROL AS NECESSARY TO PROTECT EROSION CONTROL DEVICES. THE USE OF WATER TO CLEAN THE PAVEMENT IS PROHIBITED.
3. ADDITIONAL EROSION CONTROL NOTES
   A. ALL CONTROL MEASURES SHALL BE CHECKED AND REPAIRED AS NECESSARY WEEKLY IN DRY PERIODS AND WITHIN 24 HOURS AFTER ANY RAINFALL OF 1/2 INCH OR GREATER WITHIN A 24-HOUR PERIOD. DURING PROLONGED PERIODS OF RAINFALL, DAILY CHECKING IS NECESSARY. THE PERMITTEE SHALL MAINTAIN RECORDS OF THE DURATION AND ESTIMATED VOLUME OF STORM WATER DISCHARGE(S), CHECKS, AND REPAIRS.
   B. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IN PLACE AND FUNCTIONAL BEFORE EARTH MOVING OPERATIONS BEGIN. THESE MEASURES SHALL BE PROPERLY CONSTRUCTED AND MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
   C. A SPECIFIC INDIVIDUAL SHALL BE DESIGNATED TO BE RESPONSIBLE FOR EROSION AND SEDIMENT CONTROLS ON EACH PROJECT.
   D. PERMANENT SOIL STABILIZATION WITH PERENNIAL VEGETATION OR PAVEMENT SHALL BE APPLIED AS SOON AS PRACTICAL AFTER FINAL GRADING. IRRIGATION AND MAINTENANCE OF THE PERENNIAL VEGETATION SHALL BE PROVIDED FOR 30 DAYS OR UNTIL THE VEGETATION TAKES ROOT, WHICHEVER IS LONGER.

MINIMUM BEST MANAGEMENT PRACTICES NOTES

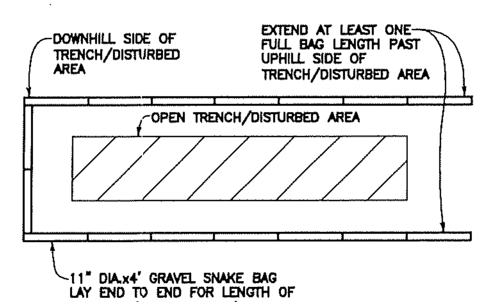
1. DRAINAGE: HANDLE DRAINAGE TO CONTROL EROSION, PREVENT DAMAGE TO DOWNSTREAM PROPERTIES, AND RETURN WATER TO THE NATURAL DRAINAGE COURSE IN A MANNER WHICH MINIMIZES SEDIMENTATION OR OTHER POLLUTION TO THE MAXIMUM EXTENT PRACTICABLE.
2. DUST CONTROL: CONTROL DUST EMISSIONS TO THE MAXIMUM EXTENT PRACTICABLE THROUGH BMPS SUCH AS WATER SPRINKLING, DUST FENCES, LIMITING AREA OF DISTURBANCE, AND TIMELY GRASSING OF FINISHED AREAS.
3. VEGETATION: RETAIN NATURAL VEGETATION, ESPECIALLY GRASSES, WHEREVER FEASIBLE. AVOID STORAGE OF GRUBBED MATERIALS NEAR WATERCOURSES.
4. EROSION CONTROLS: STABILIZE ALL DISTURBED AREAS WITH EROSION CONTROL MEASURES SUCH AS VEGETATION, RUNOFF DIVERSION, CHECK DAMS, MULCHING, BLANKETS, BONDED FIBER MATRICES, AND VEHICLE WHEEL WASH FACILITIES.
5. SEDIMENT CONTROL: CAPTURE SEDIMENT TRANSPORTED IN RUNOFF TO MINIMIZE THE SEDIMENT FROM LEAVING THE SITE WITH METHODS SUCH AS SEDIMENT BASINS, SEDIMENT TRAPS, SILT FENCES, SAND BAGS, AND VEGETATED FILTER STRIPS.
6. MATERIAL AND WASTE MANAGEMENT: PROPERLY STORE TOXIC MATERIAL AND PREVENT THE DISCHARGE OF POLLUTANTS ASSOCIATED WITH CONSTRUCTION MATERIALS.
7. TIMING OF CONTROL MEASURE IMPLEMENTATION: TIMING OF CONTROL MEASURES SHALL BE IN ACCORDANCE WITH THE APPROVED EROSION CONTROL PLAN. DISTURBED AREAS OF CONSTRUCTION SITES THAT WILL NOT BE RE-DISTURBED FOR TWENTY-ONE DAYS OR MORE WILL BE STABILIZED (GRASSES OR GRAVELED) BY NO LATER THAN THE FOURTEENTH DAY AFTER THE LAST DISTURBANCE.
8. EQUIPMENT: ENSURE ALL MATERIALS AND EQUIPMENT ARE FREE OF INVASIVE PLANT AND ANIMAL SPECIES.



1 C-2 **SILT FENCE SECTION**
NOT TO SCALE



2 C-2 **CONCRETE TRUCK DRUM WASH AND LIQUID STORAGE AREAS**
NOT TO SCALE



3 C-2 **PERIMETER CONTROL FILTRATION BAG**
NOT TO SCALE

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Contact: Curtis Eaton, P.E.

KAHANA PRODUCTION WELL

TAX MAP KEYS (2) 4-3-001:017, 4-4-004:009 & 011
DWS JOB NO. 15-04
LAHAINA, MAUI, HAWAII

CONSTRUCTION EROSION CONTROL BEST MANAGEMENT PRACTICES PLAN

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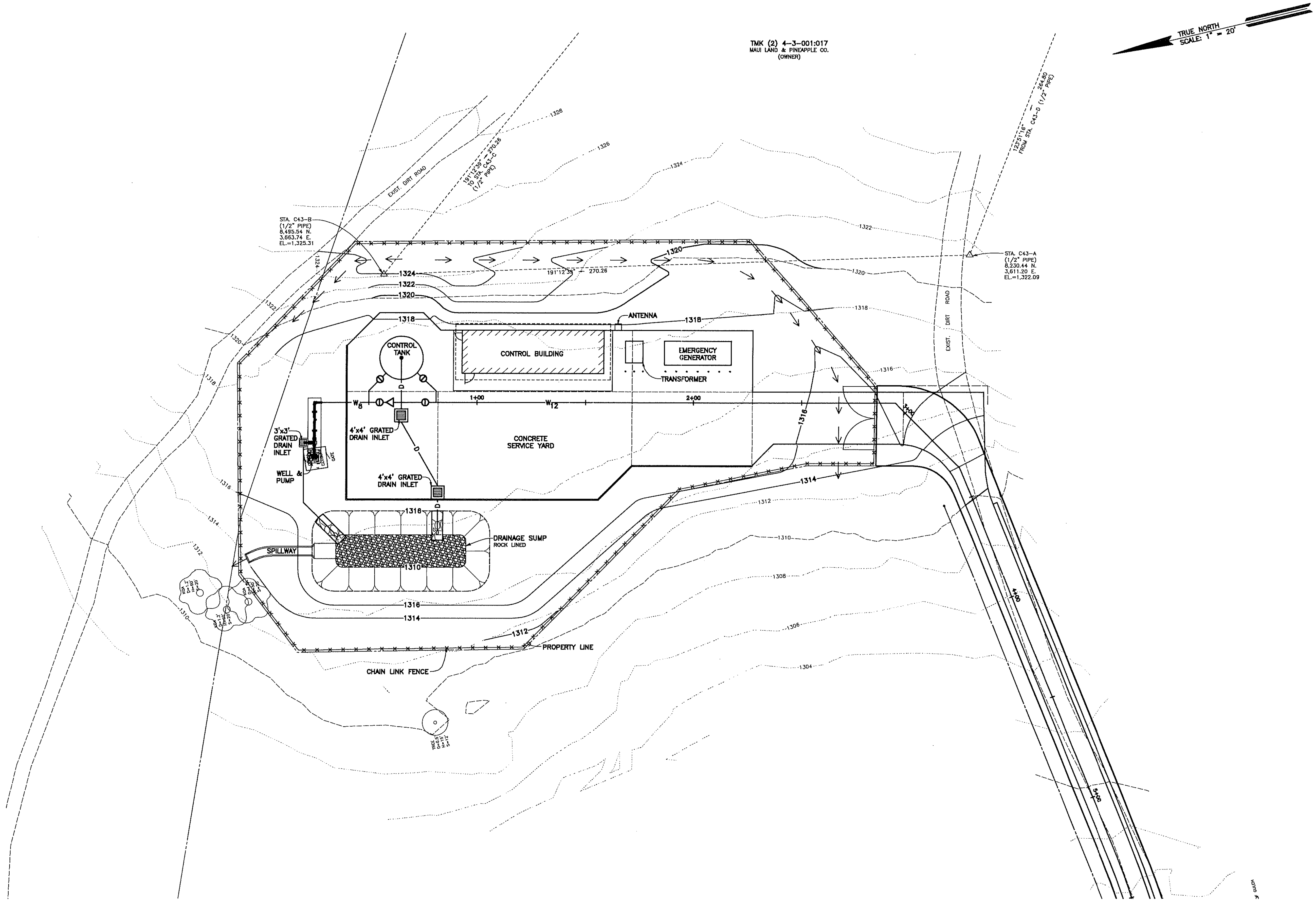
SHEET C-3



GRADING PLAN

SCALE: 1" = 20'

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KAHANA PRODUCTION WELL

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DWS JOB NO. 15-04

LAHAINA, MAUI, HAWAII

GRADING PLAN

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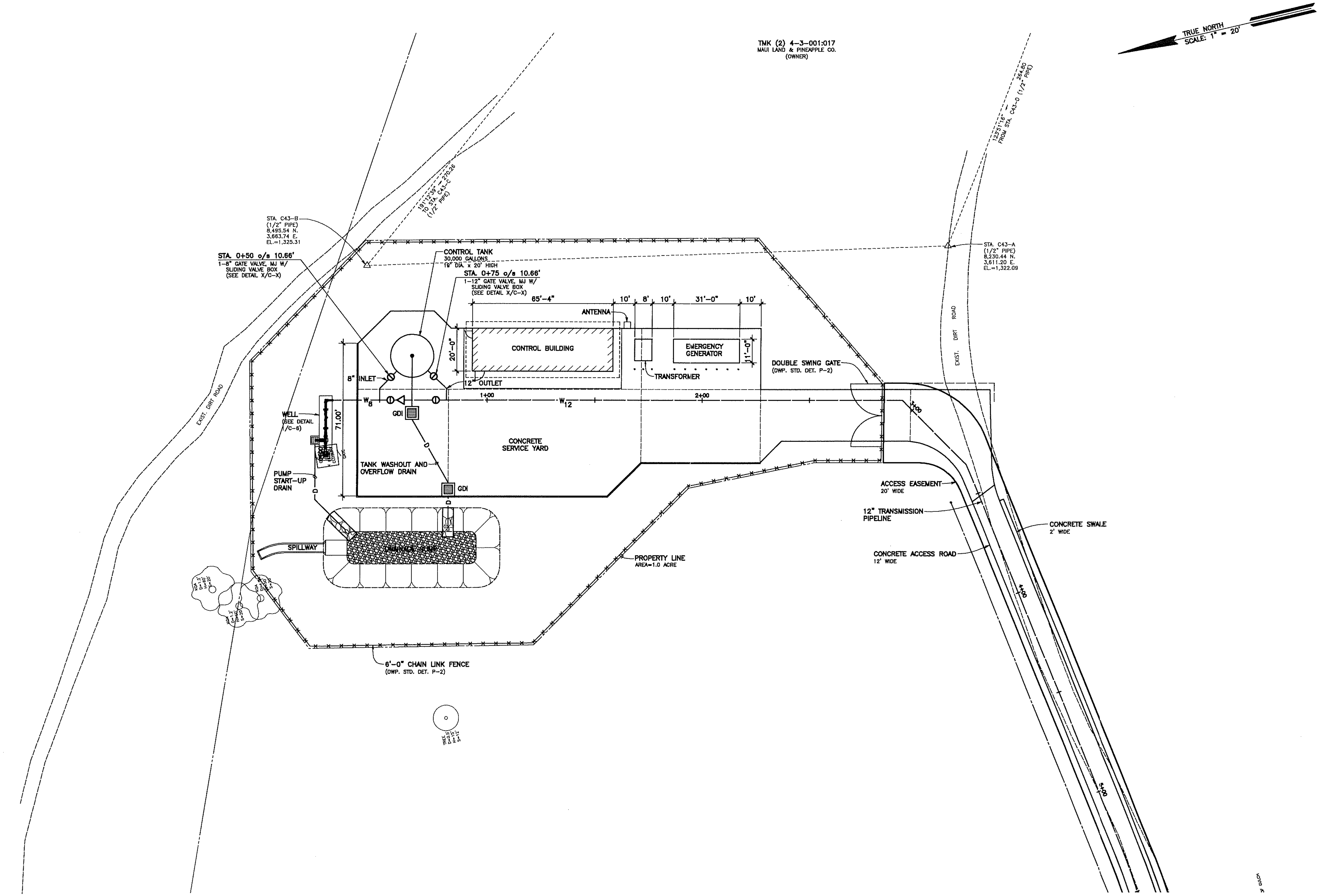
SHEET C-4

5 OF 44



SITE PLAN
SCALE: 1" = 20'

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SITE PLAN

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SHEET C-5

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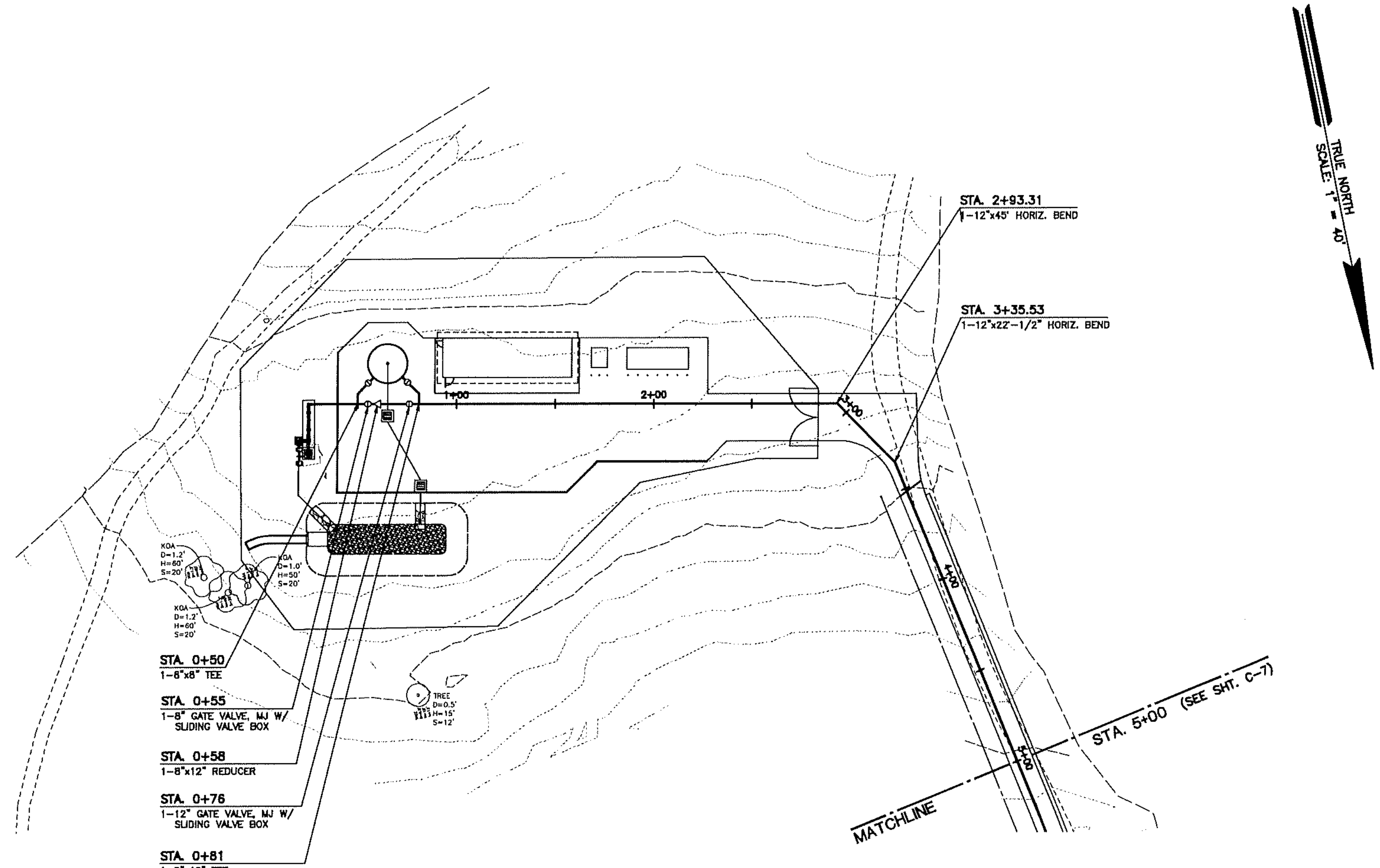

PLAN - STA. 0+00 TO STA. 5+00
SCALE: 1" = 40'
SCALE IN FEET
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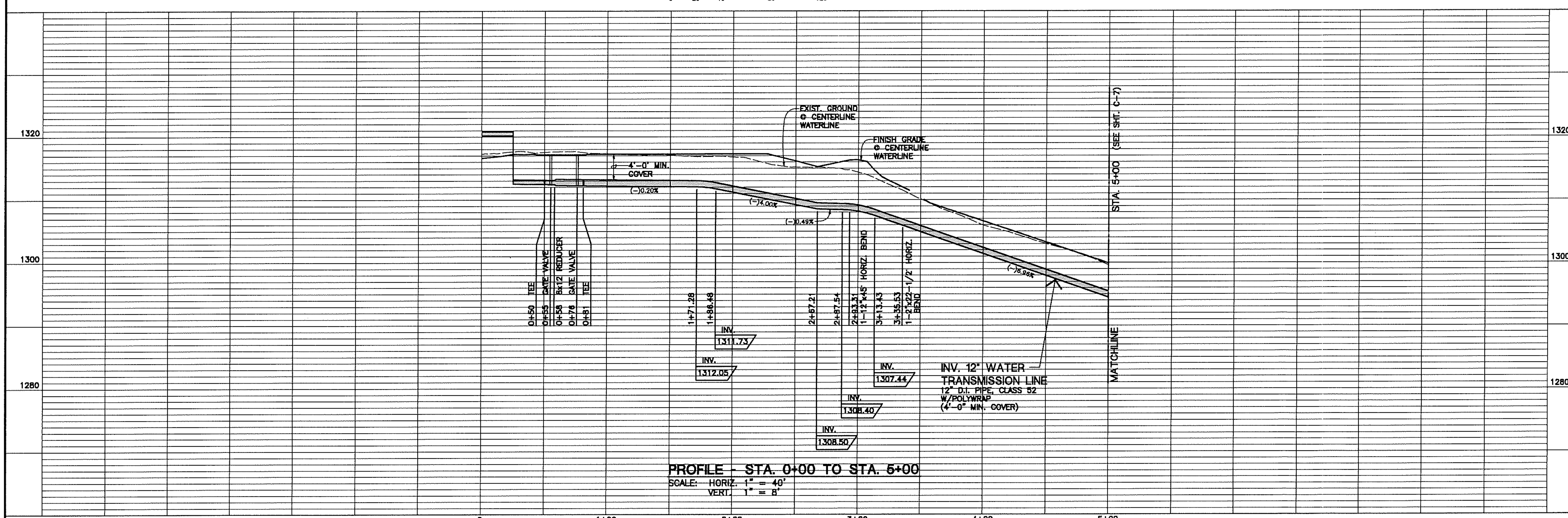

PROFILE - STA. 0+00 TO STA. 5+00
SCALE: HORIZ. 1" = 40'
VERT. 1" = 8'

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PLAN AND PROFILE - STA. 0+00 TO STA. 5+00

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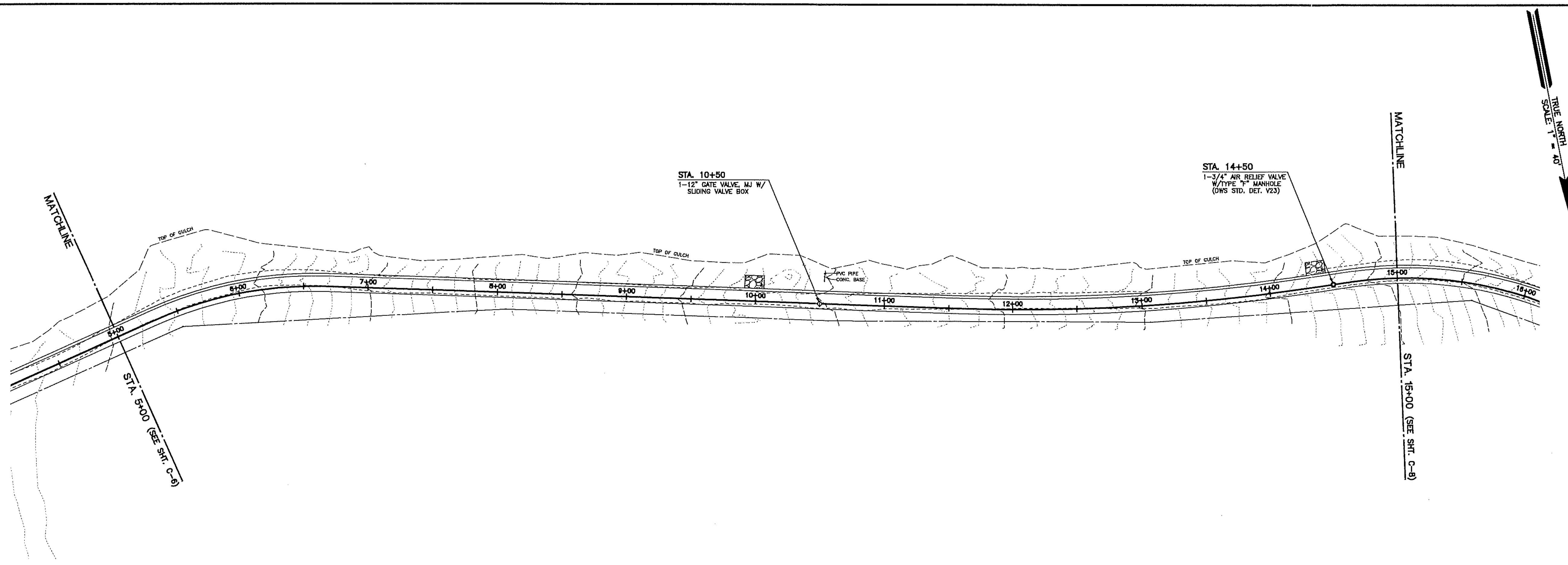
SHEET C-6
7 OF 44



PLAN - STA. 5+00 TO STA. 15+00

SCALE: 1" = 40'

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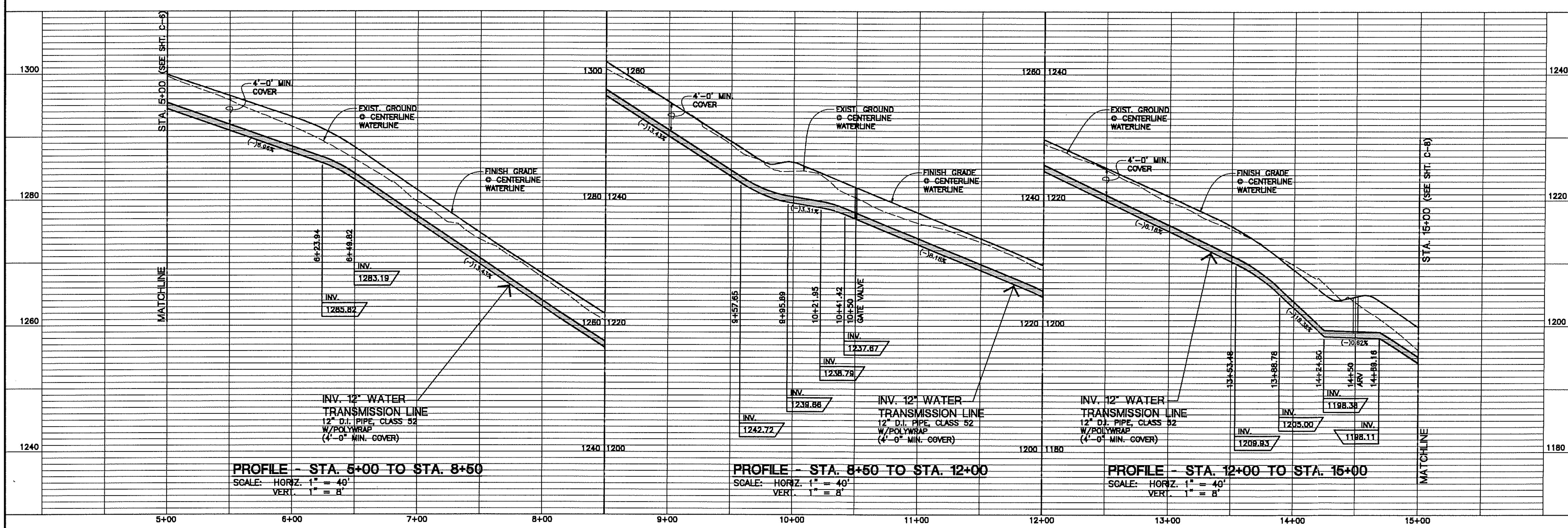

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PLAN AND PROFILE - STA. 5+00 TO STA. 15+00

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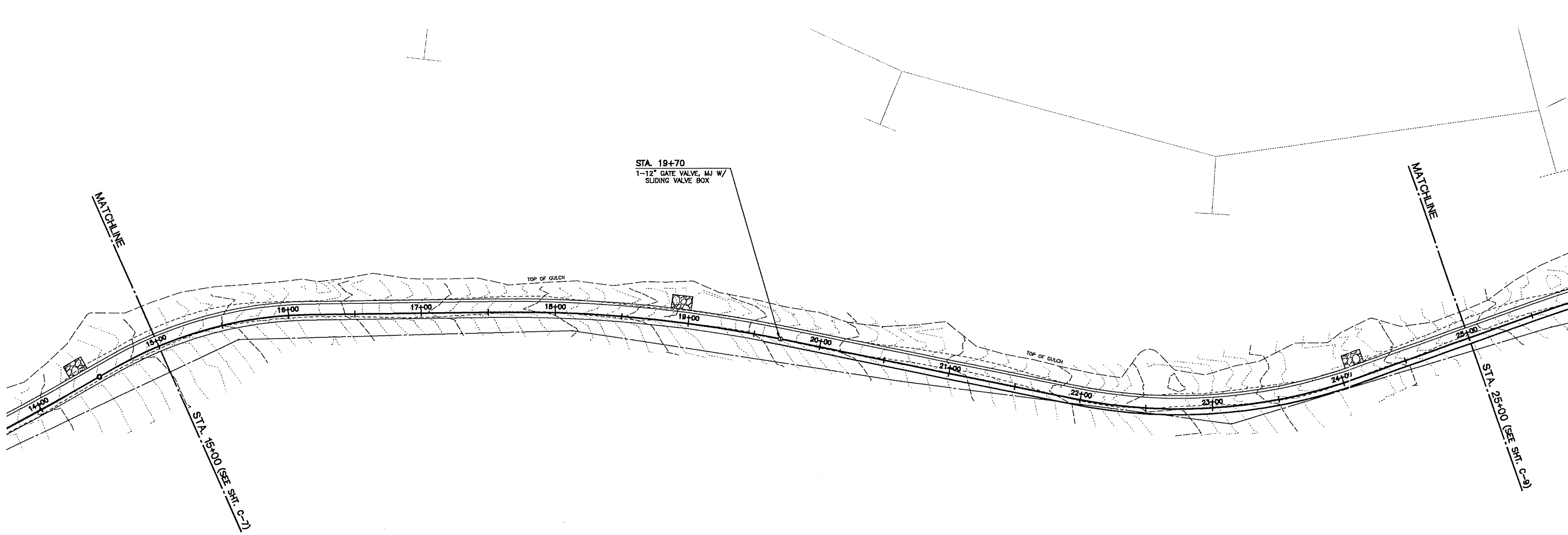
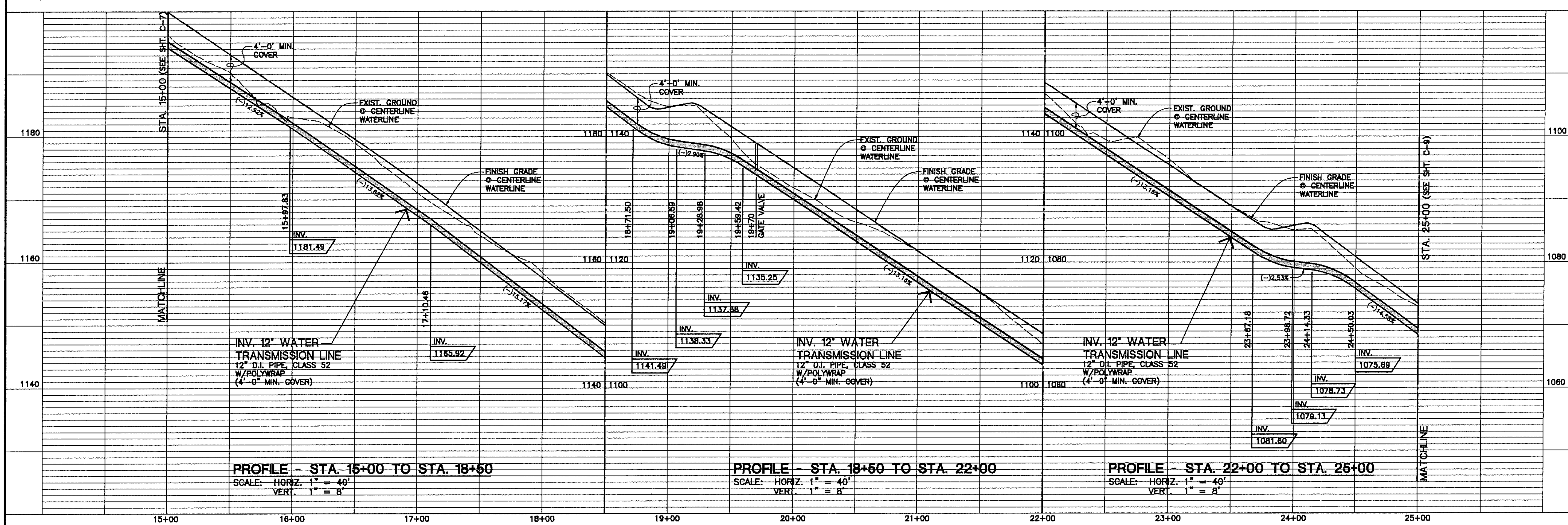
SHEET
C-7
8 OF 44



PLAN - STA. 15+00 TO STA. 25+00
SCALE: 1" = 40'



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PLAN AND PROFILE - STA. 15+00 TO STA. 25+00

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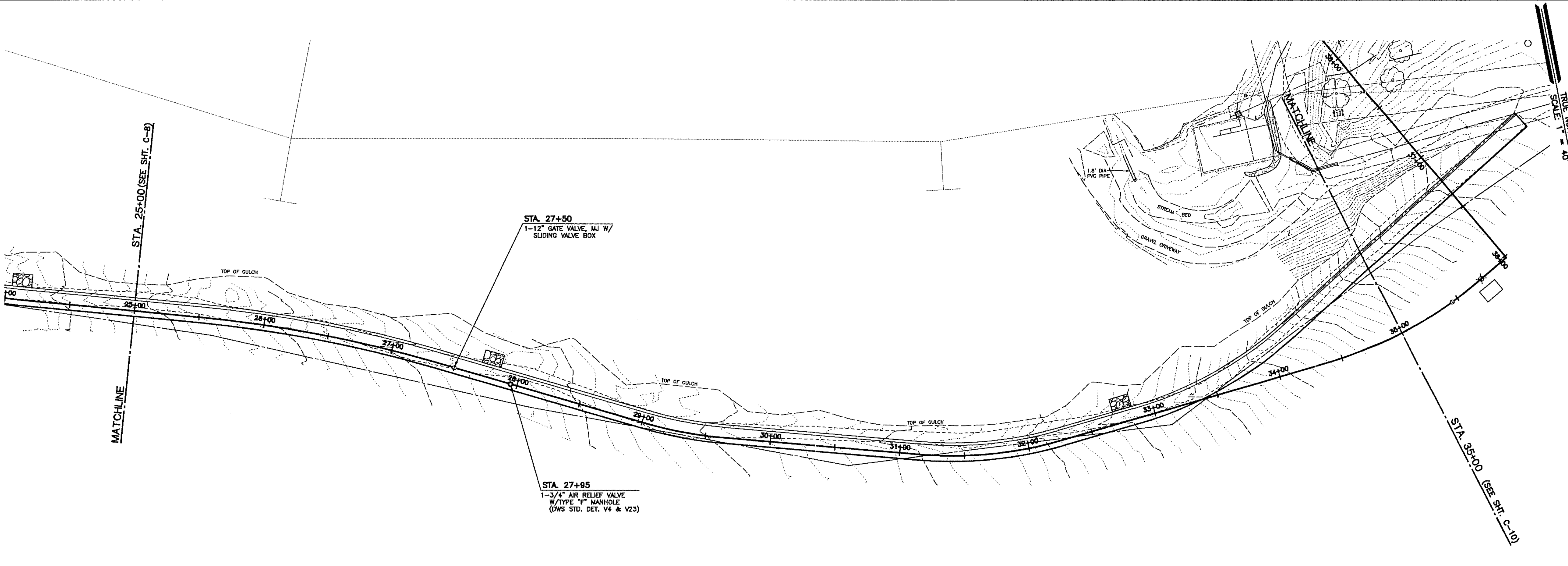
C-8
9 OF 44



PLAN - STA. 25+00 TO STA. 34+50

SCALE: 1" = 40'

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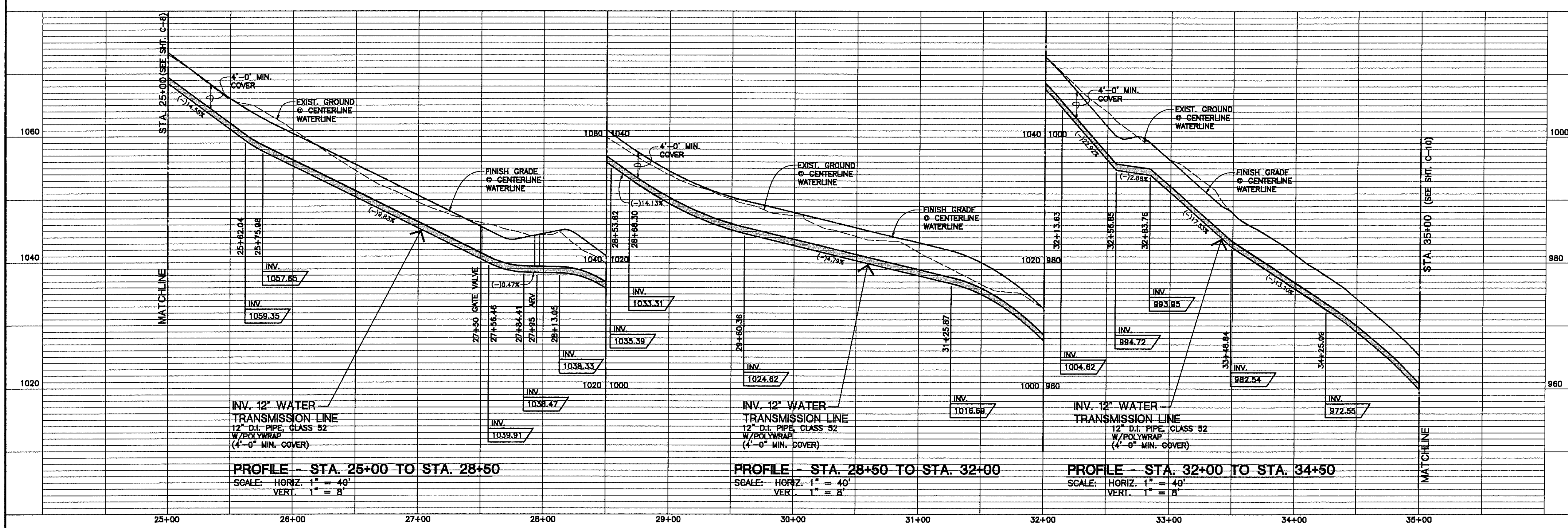

PROFILE - STA. 25+00 TO STA. 28+50

SCALE: HORIZ. 1" = 40' VERT. 1" = 8'

PROFILE - STA. 28+50 TO STA. 32+00

SCALE: HORIZ. 1" = 40' VERT. 1" = 8'

PROFILE - STA. 32+00 TO STA. 34+50

SCALE: HORIZ. 1" = 40' VERT. 1" = 8'

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DWS JOB NO. 15-04

LAHAINA, MAUI, HAWAII

PLAN AND PROFILE - STA. 25+00 TO STA. 34+50

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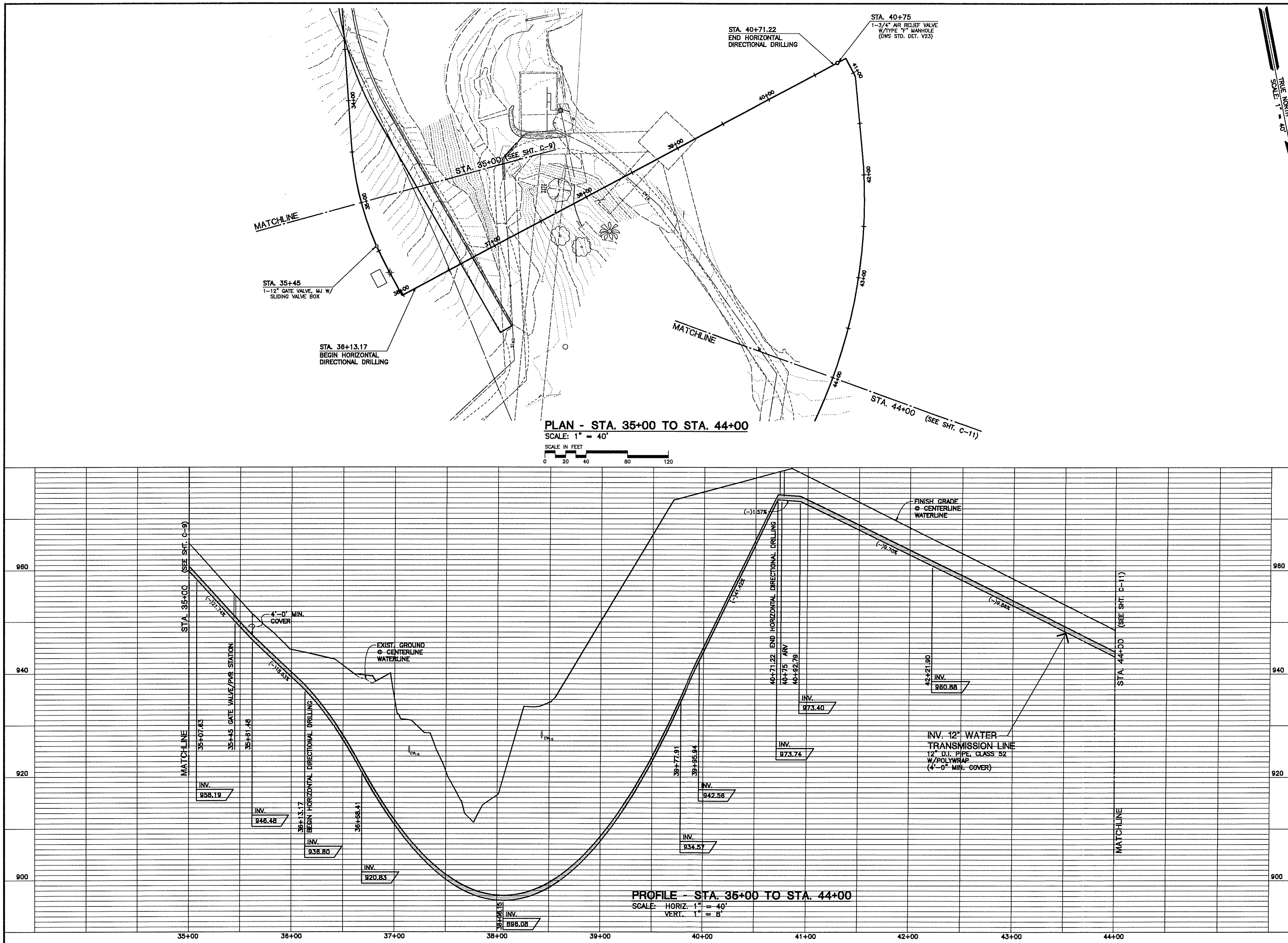
SHEET C-9



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PLAN AND PROFILE - STA. 35+00 TO STA. 44+00

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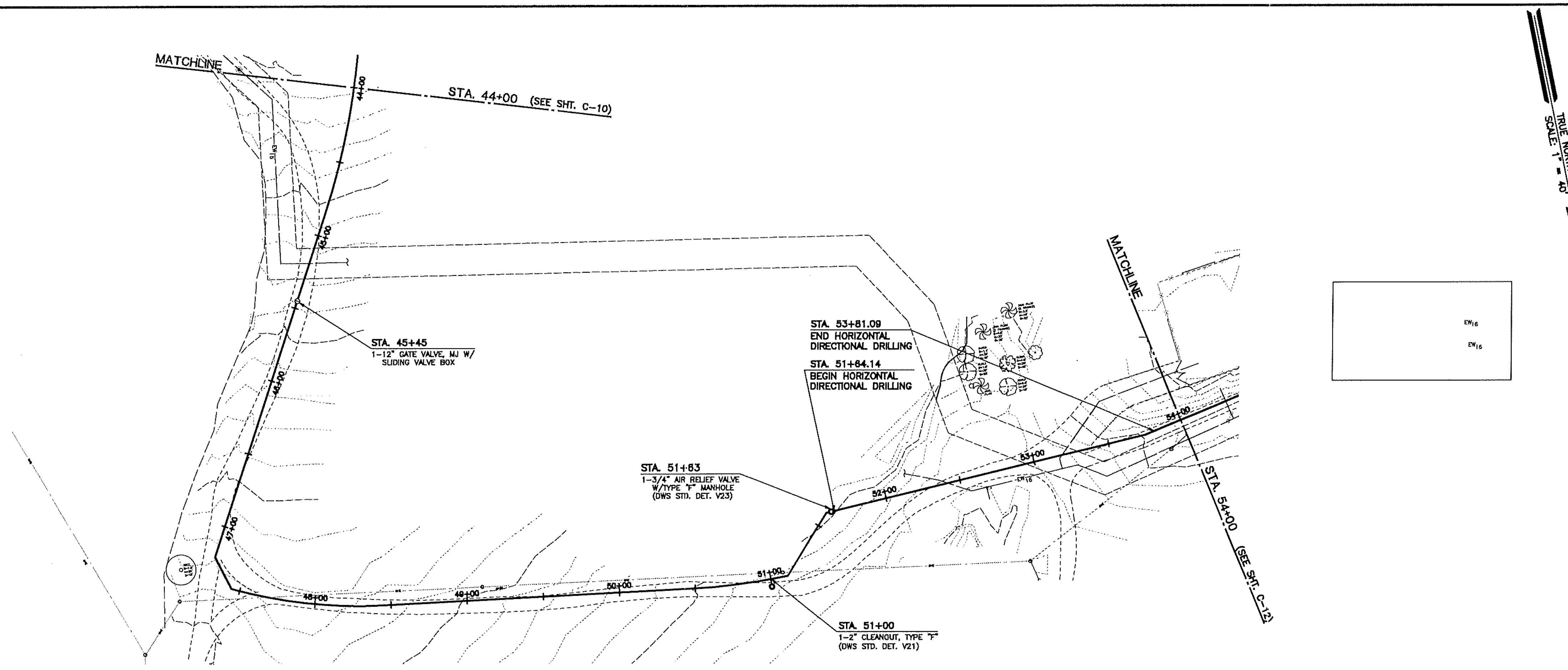
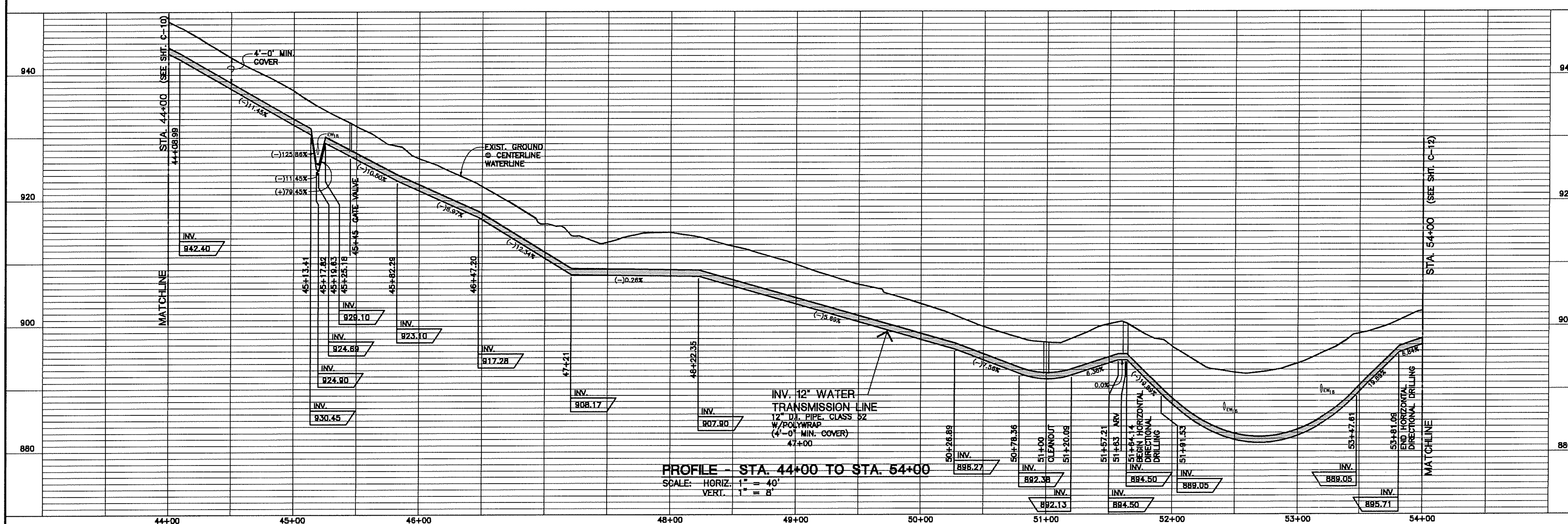
SHEET C-10
11 OF 44



PLAN - STA. 44+00 TO STA. 54+00

SCALE: 1" = 40'

SCALE IN FEET 0 20 40 80 120



PROFILE - STA. 44+00 TO STA. 54+00

SCALE: HORIZ. 1" = 40'
VERT. 1" = 8'

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LAHAINA, MAUI, HAWAII

PLAN AND PROFILE - STA. 45+00 TO STA. 55+00

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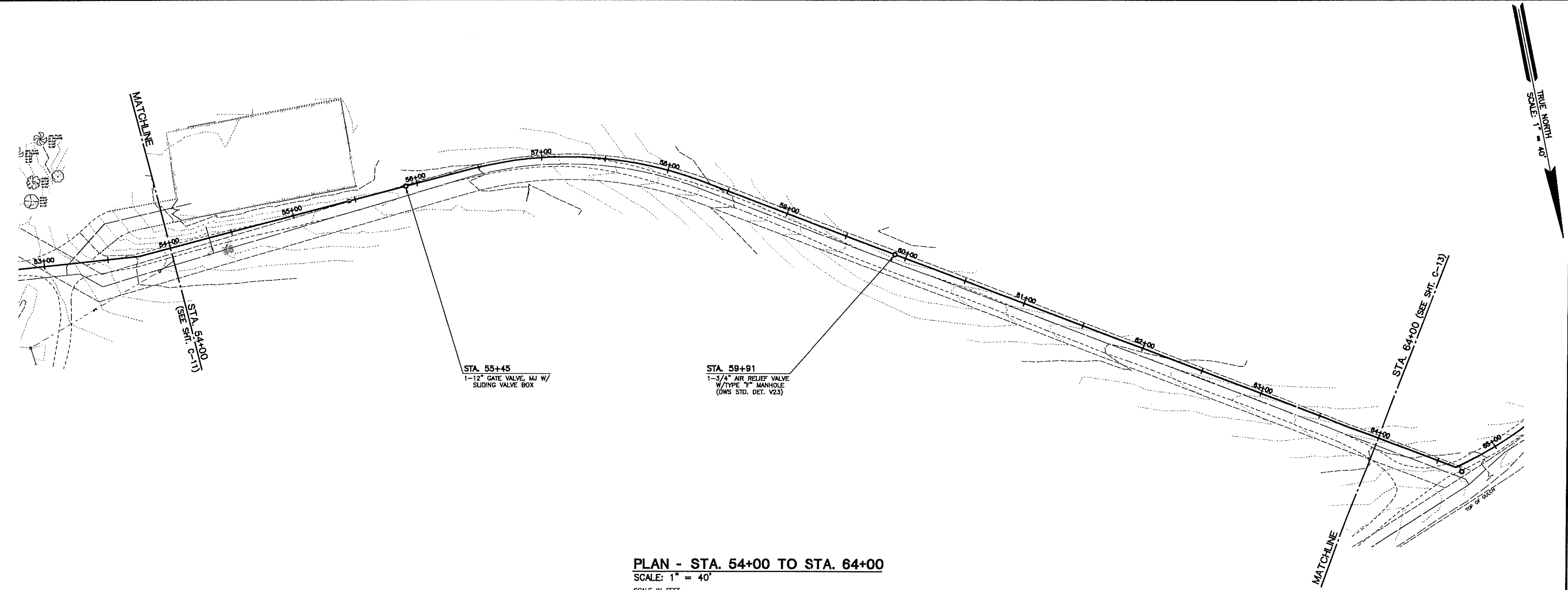
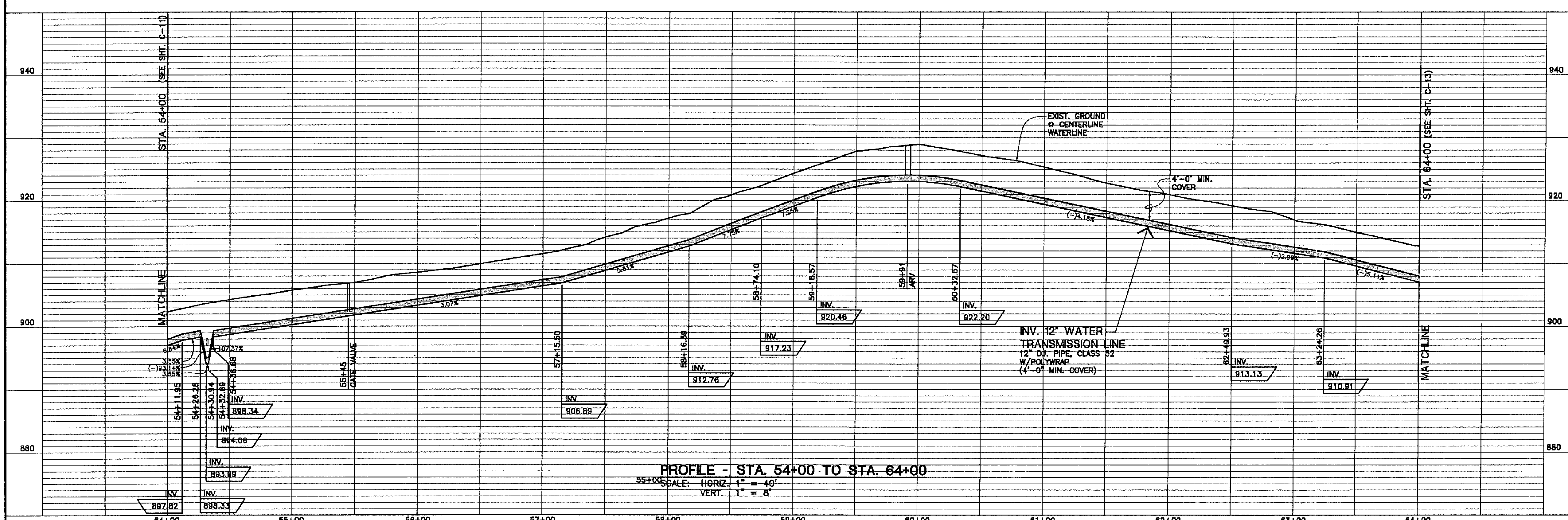
SHEET C-11

12 of 44



PLAN - STA. 54+00 TO STA. 64+00
SCALE: 1" = 40'



PROFILE - STA. 54+00 TO STA. 64+00
SCALE: HORIZ. 1" = 40'
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PLAN AND PROFILE - STA. 54+00 TO STA. 64+00

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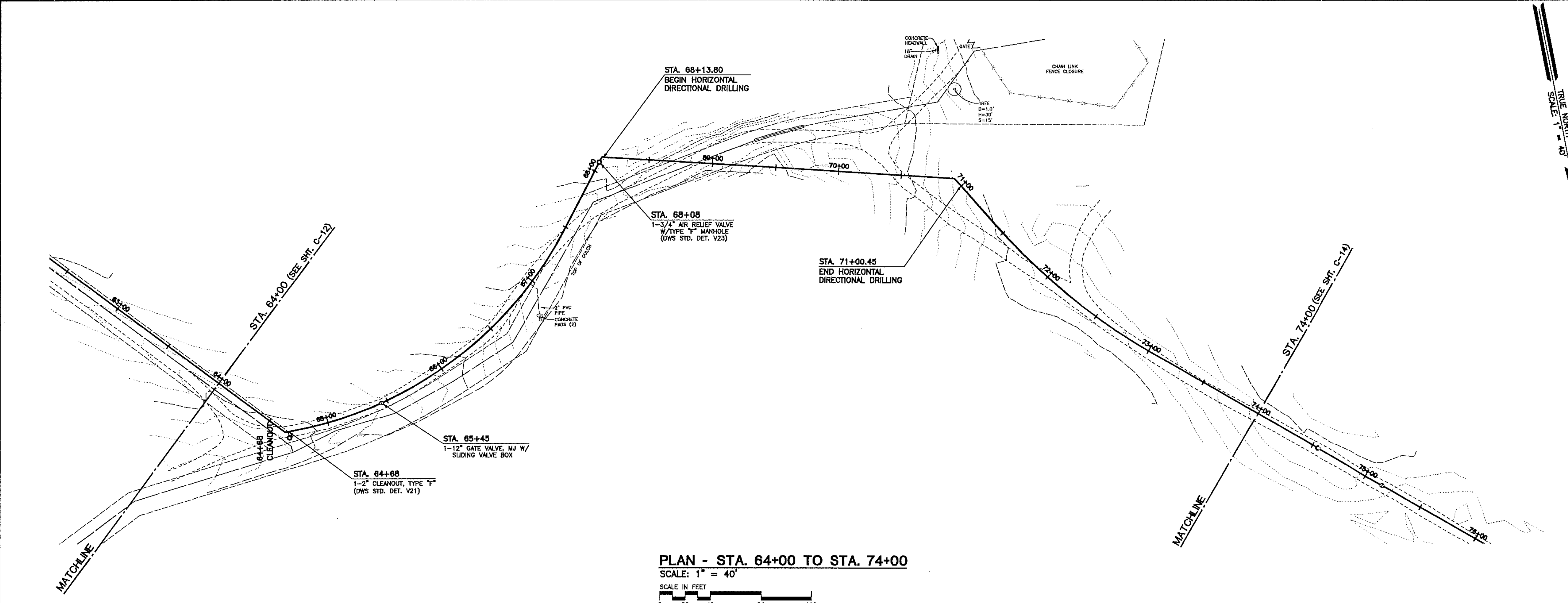

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SCALE: 1" = 40'

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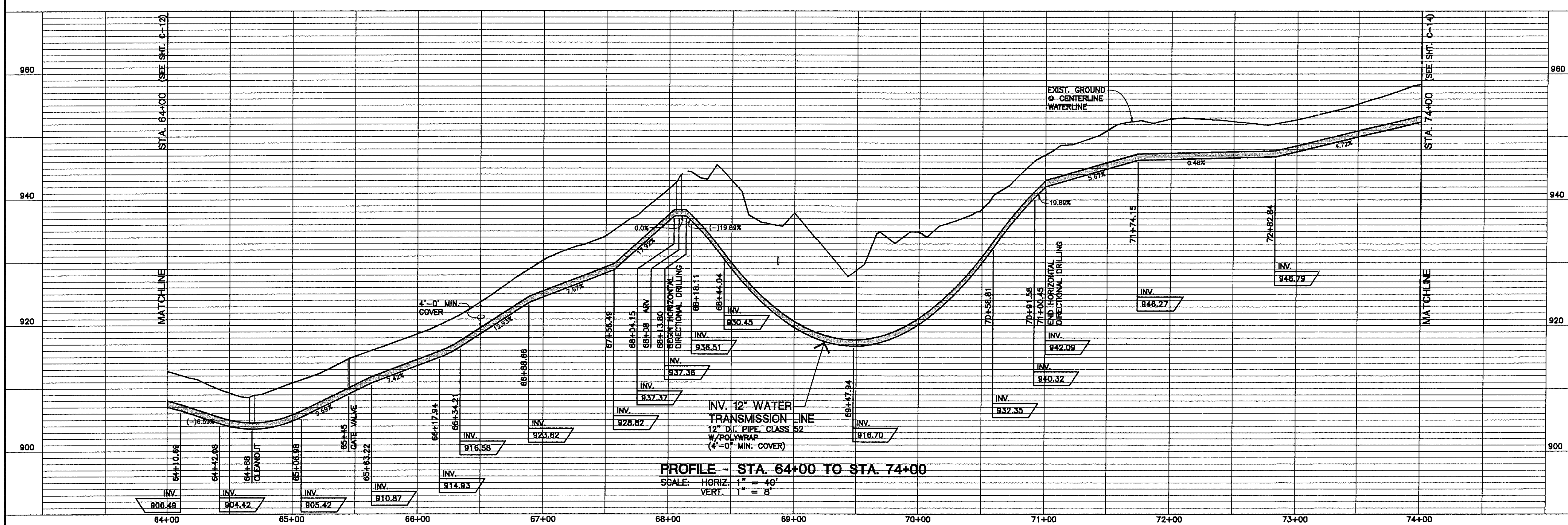

PROFILE - STA. 64+00 TO STA. 74+00

SCALE: HORIZ. 1" = 40'
VERT. 1" = 8'

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Contact: Curtis Eaton, P.E.

KAHANA PRODUCTION WELL

TAX MAP KEYS (2) 4-3-001:017, 4-4-004:009 & 011
DWS JOB NO. 15-04
LAHANA, MAUI, HAWAII

PLAN AND PROFILE - STA. 64+00 TO STA. 74+00

RONALD M. FUKUMOTO
LICENSED PROFESSIONAL ENGINEER
No. 4935-C
HAWAII U.S.A.

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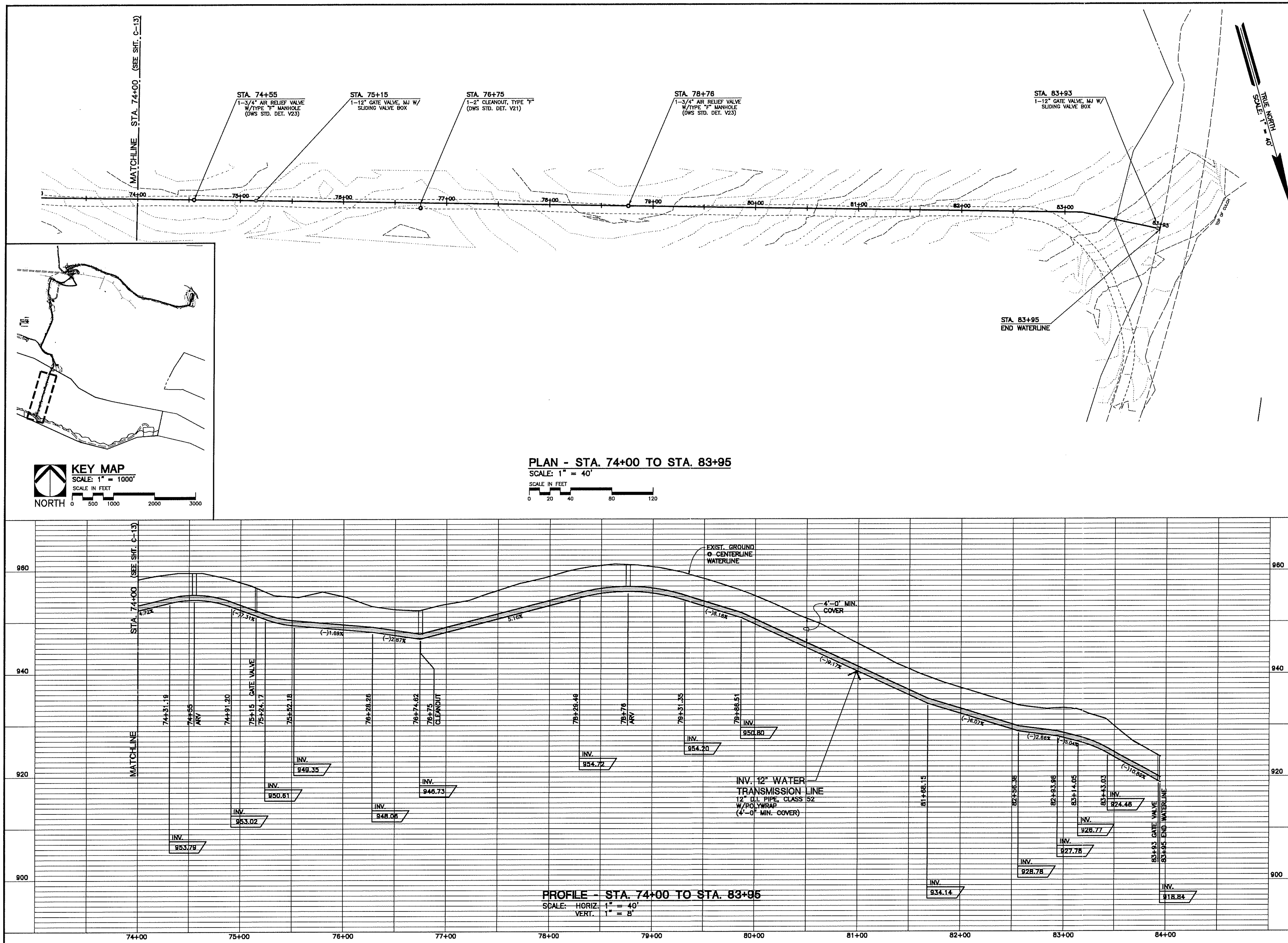
LICENSE EXPIRES: 04/30/2020

DESIGNED BY:	R.F.
DRAWN BY:	S.O., N.M.
CHECKED BY:	R.F.
DATE:	DECEMBER 14, 2018
FILE NO:	COM438

SHEET C-13



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LAHAINA, MAUI, HAWAII

PLAN AND PROFILE - STA. 74+00 TO STA. 83+95

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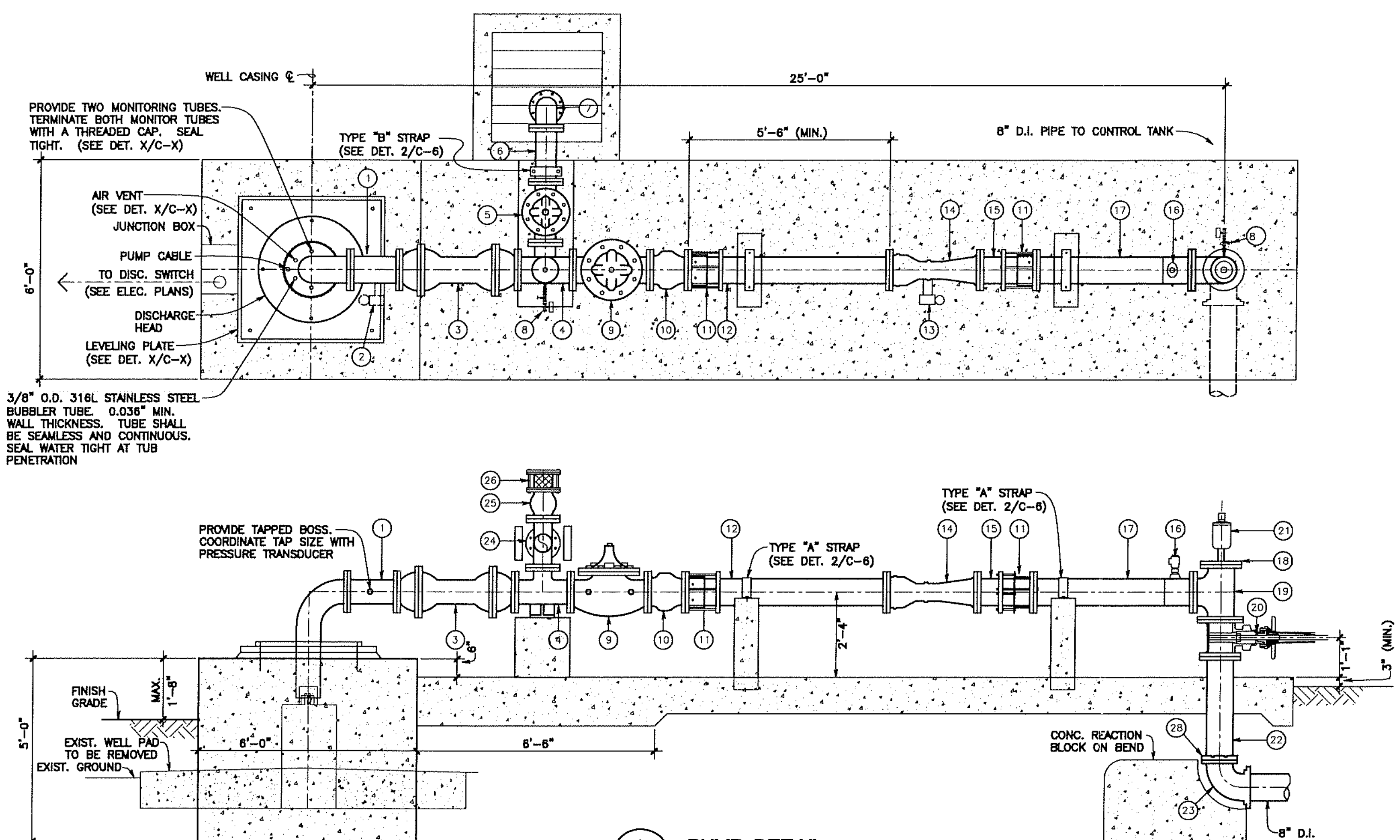
SHEET C-14

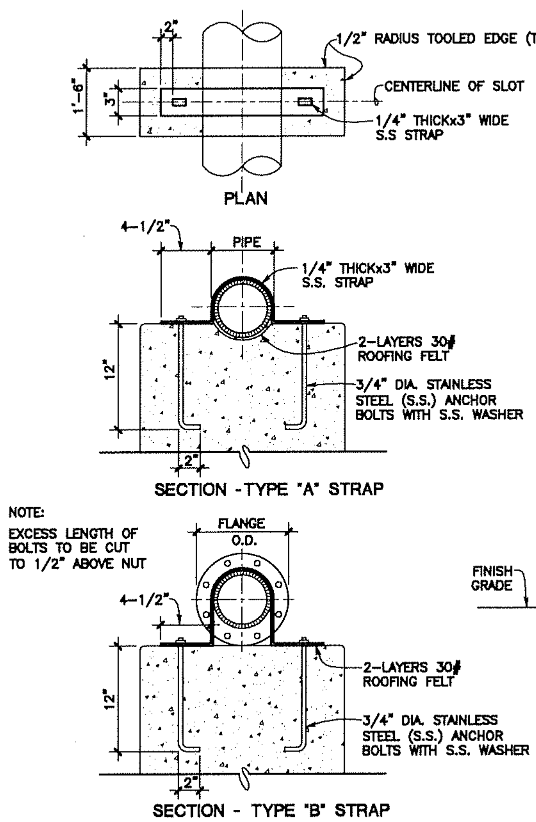
	QUANTITY	PUMP DISCHARGE PIPING SCHEDULE DESCRIPTION
1	1	10"x8" ECCENTRIC REDUCER, FE, TAPPED AT BOSS "M" AT FACTORY
2	1	DISCHARGE PRESSURE TRANSMITTER, SEE DET. 6/C-9
3	1	8" D.I. FLEXIBLE EXPANSION JOINT
4	1	8"x6" BASE TEE, FE, TAPPED AT BOSS "M" AT FACTORY. BOLT TO CONCRETE.
5	1	6" DEEP WELL PUMP CONTROL VALVE, W/SOLENOID CONTROL, CLA-VAL 61-29 BYCS KCX, FE
6	1	6" SPOOL, FExFE, LENGTH AS REQUIRED
7	1	6"x90° BEND, FE
8	2	S.S. GAUGE AND SAMPLING TAP ASSEMBLY, SEE DET. 7/C-9
9	1	8" SOLENOID CONTROL VALVE, CLA-VAL 136-41 BYCS KCX X101, FE
10	1	8" CENTER GUIDE, SILENT GLOBE CHECK VALVE, CLA-VAL MODEL 581
11	2	8" DISMANTLING JOINT, ROMAC DJ405
12	1	8" PIPE, FExPE, LENGTH AS REQUIRED
13	1	DIFFERENTIAL PRESSURE CELL FOR FLOW MEASUREMENT, SEE DET. 5/C-9
14	1	8" VENTURI METER, SEE DET. 5/C-9
15	1	8" SPOOL, FExPE, LENGTH AS REQUIRED
16	1	FLOW SWITCH WITH 2" SADDLE W/1-1/2" REDUCING BUSHING (BORE HOLE TO BE 2-1/8")
17	1	8" D.I. PIPE, FE, LENGTH AS REQUIRED
18	1	8" BLIND FLANGE TAPPED FOR 2" PIPE
19	1	8" TEE, FE, TAPPED AT BOSS "M" AT FACTORY
20	1	8" GATE VALVE, OS&Y WITH HANDWHEEL, FE
21	1	2" COMBINATION AIR RELEASE VALVE ASSEMBLY, SEE DET. 9/C-9
22	1	8" D.I. PIPE, FExPE, LENGTH AS REQUIRED
23	1	8"x90° BEND, MJ WITH CONCRETE REACTION BLOCK
24	1	6' TEE, FE
25	1	6" CENTER GUIDED CHECK VALVE
26	1	SCREENED INLET ASSEMBLY, SEE DET. 10/C-9
27	1	6" CHECK VALVE, RED VALVE SERIES 35, FE
28	1	8" D.I. RETAINING GLAND, EBAA IRON MEGALUG 1100 SERIES, OR APPROVED EQUAL



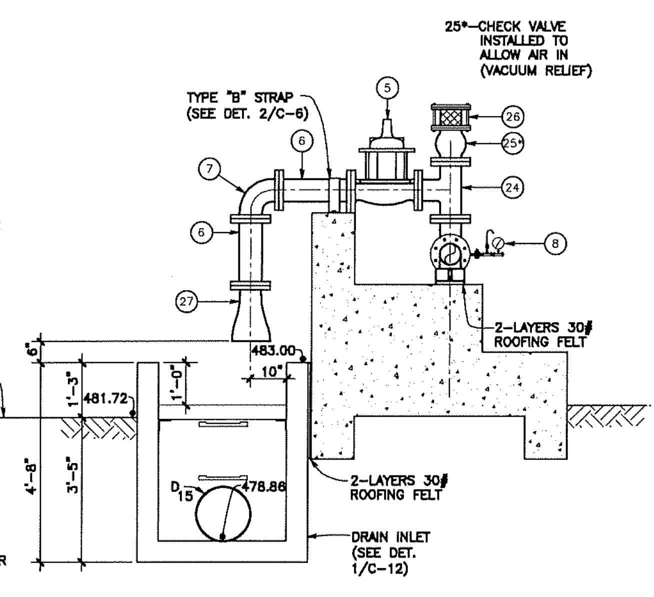
1 C-6 **PUMP DETAIL**
SCALE: 1/2" = 1'-0"

NOTE:

1. PROTECTIVE COAT ALL FERROUS, COPPER AND BRONZE SURFACES. DO NOT COAT STAINLESS STEEL.
2. CONTRACTOR TO EXPOSE CONNECTION POINT AND LAYOUT PIPING IN ORDER TO DETERMINE SUITABLE ALIGNMENT AND BEND ORIENTATION.



2 C-6 **STRAP DETAIL**
NOT TO SCALE



3 C-6 **SECTION BLOW OFF LINE**
SCALE: 1/2" = 1'-0"

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KAHANA PRODUCTION WELL
TAX MAP KEYS (2) 4-3-001:017, 4-4-004:009 & 011
DWS JOB NO. 15-04
LAHAINA, MAUI, HAWAII

WELL PUMP SUCTION AND PUMP DISCHARGE PIPING PLAN & SECTION

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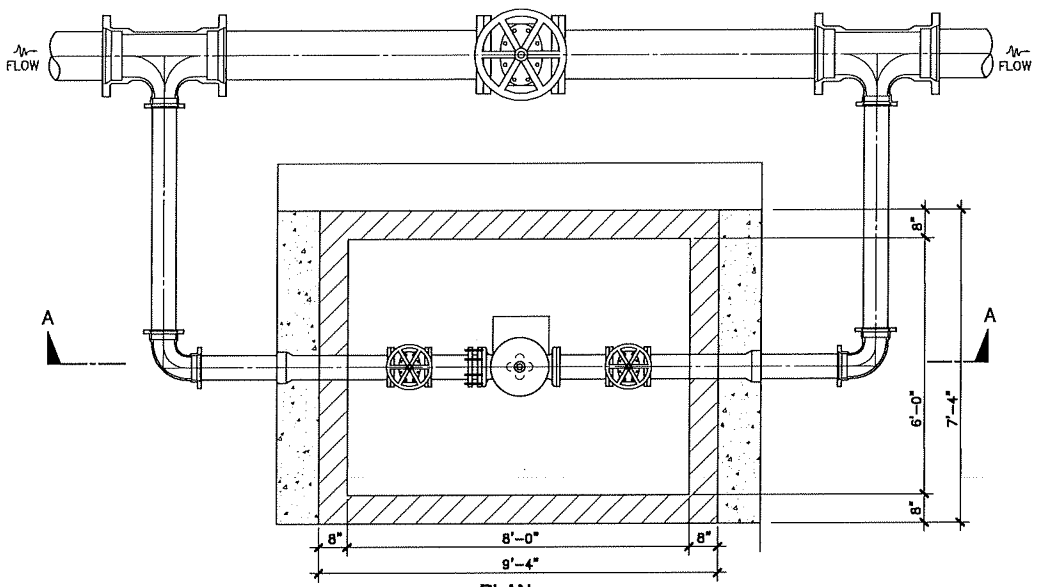
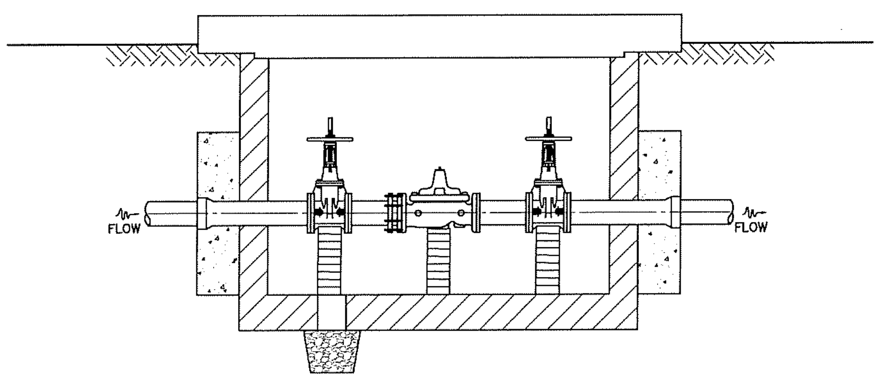
SHEET C-15

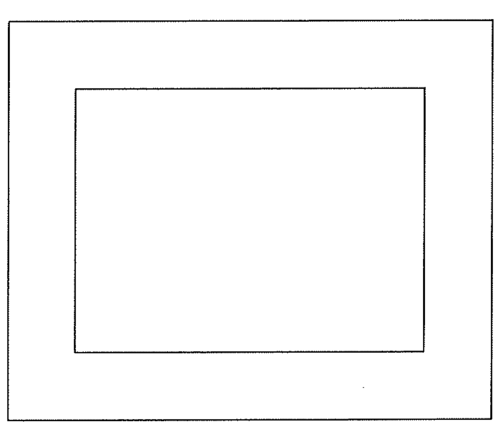


PLAN
SCALE: 1/2" = 1'-0"



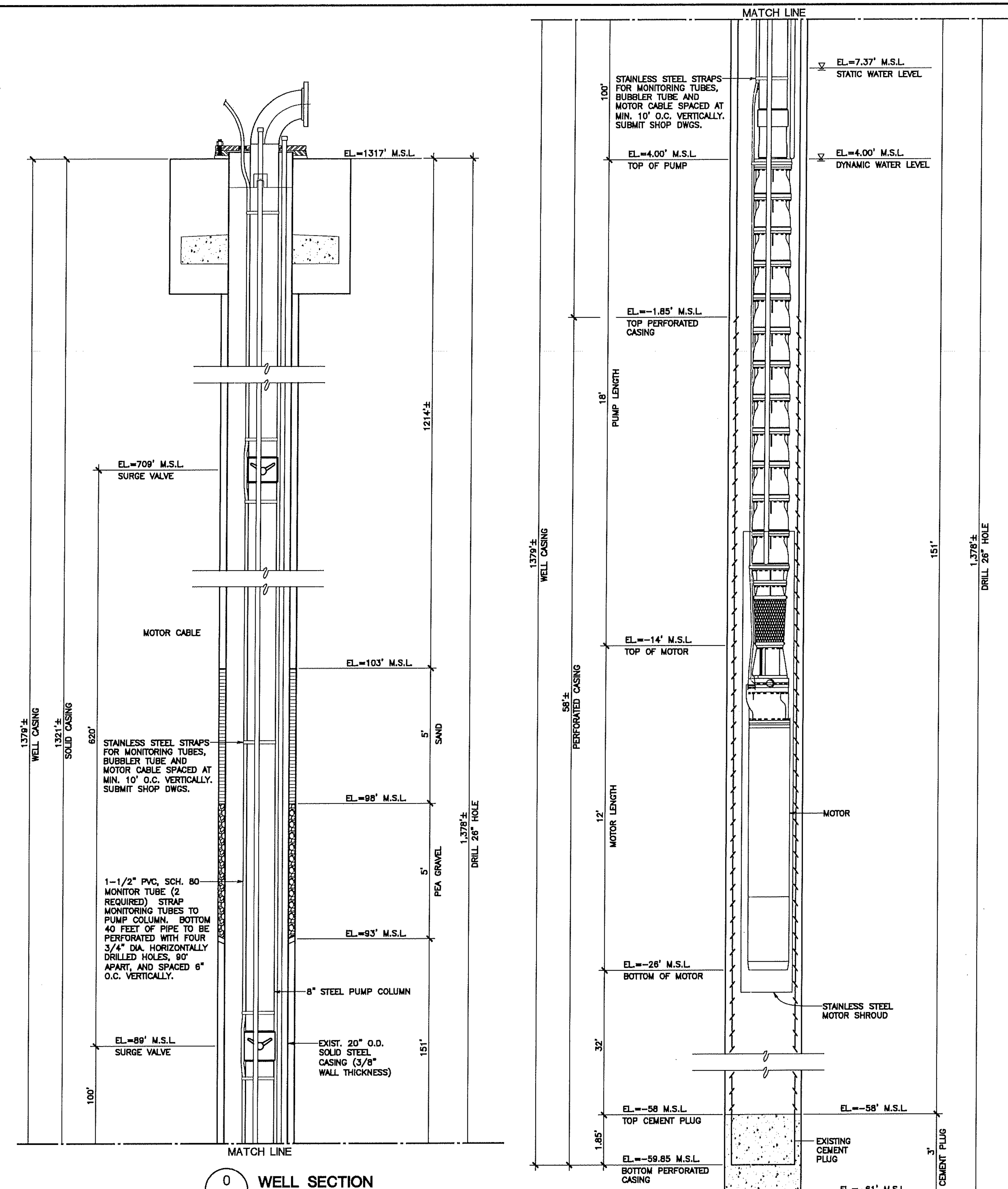
SECTION A-A
SCALE: 1/2" = 1'-0"

4 / C-8 **6" PRESSURE REDUCING VALVE MANHOLE (NON-TRAFFIC)**
SCALE AS NOTED



PLAN
SCALE: 1/2" = 1'-0"

4 / C-8 **6" PRESSURE REDUCING VALVE MANHOLE COVER (NON-TRAFFIC)**
SCALE AS NOTED



0 / C-00 **WELL SECTION**
NOT TO SCALE

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KAHANA PRODUCTION WELL
TAX MAP KEYS (2) 4-3-001:017, 4-4-004:009 & 011
DWS JOB NO. 15-04
LAHAINA, MAUI, HAWAII

PUMP DISCHARGE PIPING DETAILS 1

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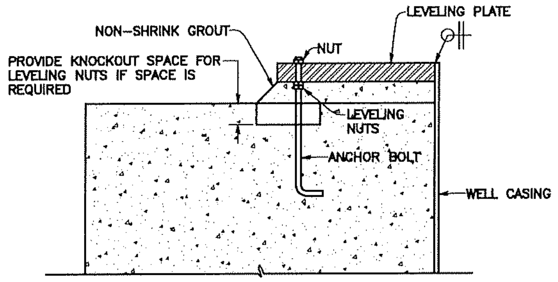
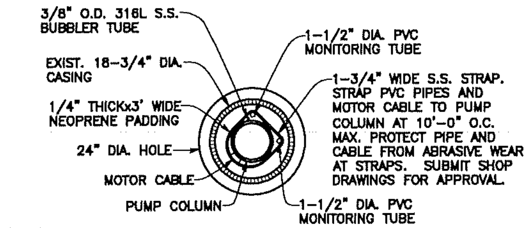
SHEET C-16

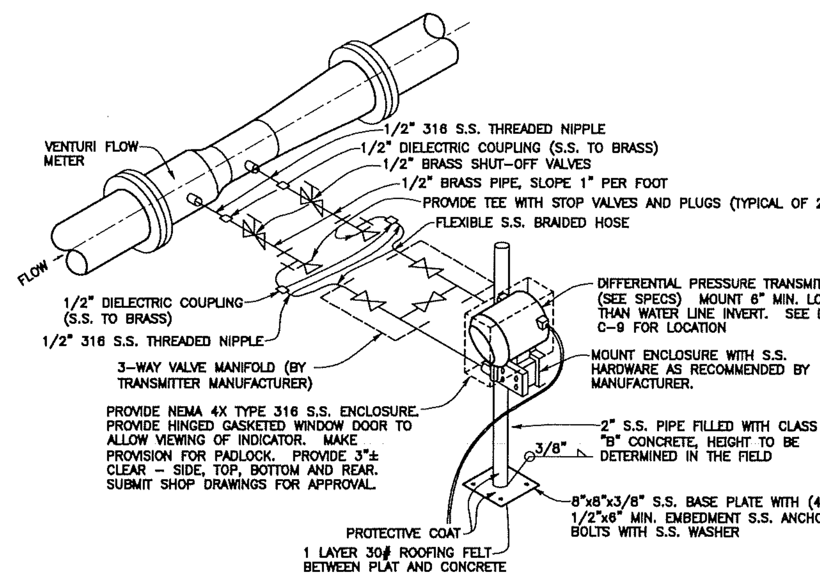


1 LEVELING PLATE DETAIL
C-17 NOT TO SCALE

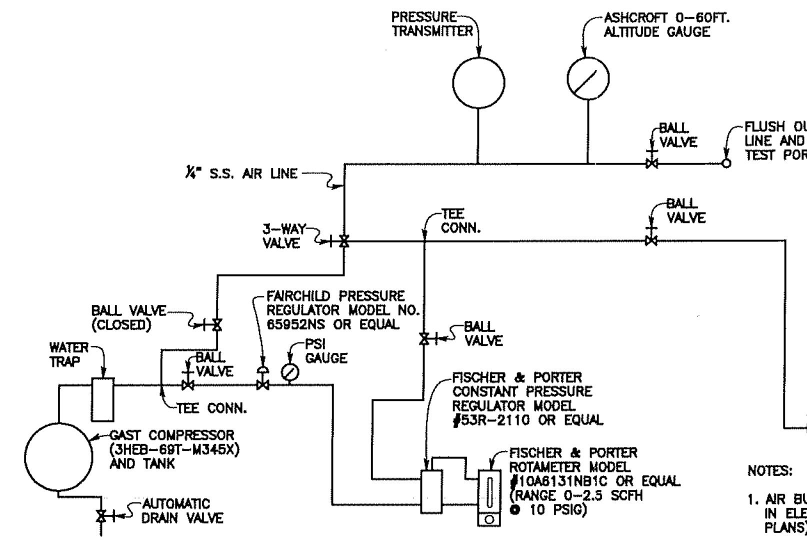


NOTE:
CONTRACTOR MAY USE THREE SETS OF SEPARATE STRAPS; TWO SETS FOR THE MONITORING TUBES AND ONE SET FOR THE BUBBLER TUBE

2 STAINLESS STEEL STRAP FOR MONITORING TUBES
C-17 NOT TO SCALE

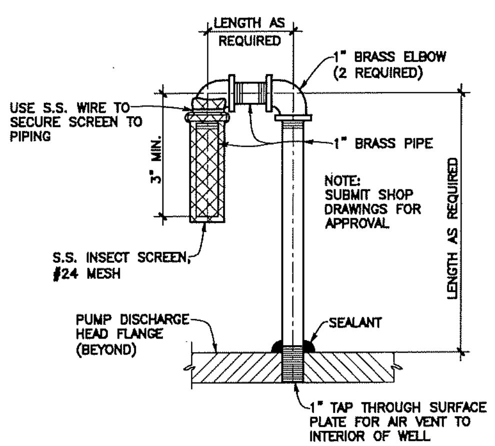


5 VENTURI METER DIFFERENTIAL PRESSURE TRANSMITTER HOOK-UP AND MOUNTING SCHEMATIC
C-17 NOT TO SCALE

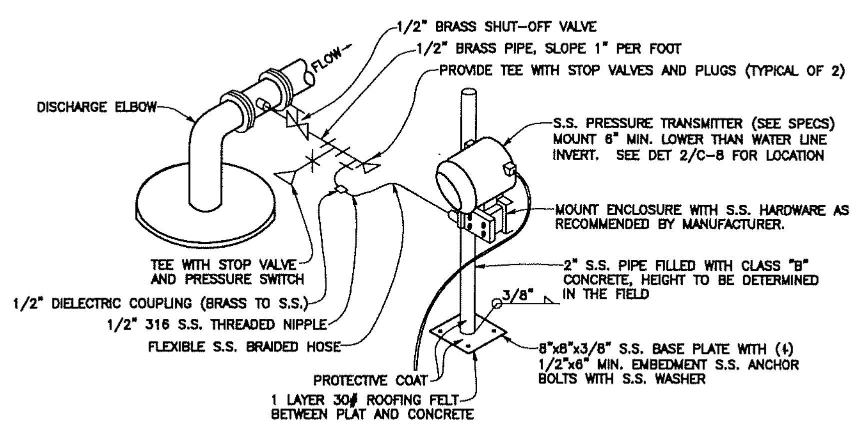


NOTES:
1. AIR BUBBLER SYSTEM TO BE INSTALLED IN ELECTRIC ROOM. (SEE ELECTRICAL PLANS)
2. ALL VALVES TO BE BALL TYPE VALVES.
3. MOUNT EQUIPMENT ON WALL 5'-0" ABOVE GROUND LEVEL.
4. SUBMIT SHOP DRAWINGS OF EQUIPMENT AND LAYOUT FOR APPROVAL.

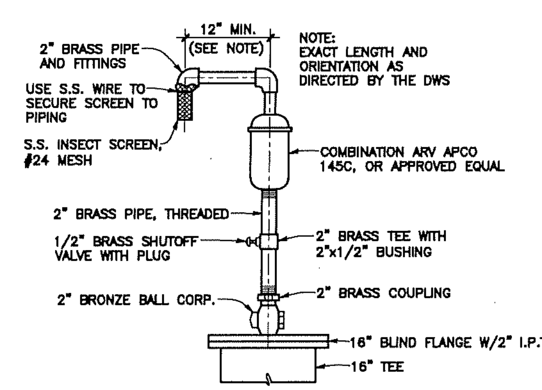
8 WELL WATER LEVEL RECORDER (AIR BUBBLER) SCHEMATIC
C-17 SCALE: NONE



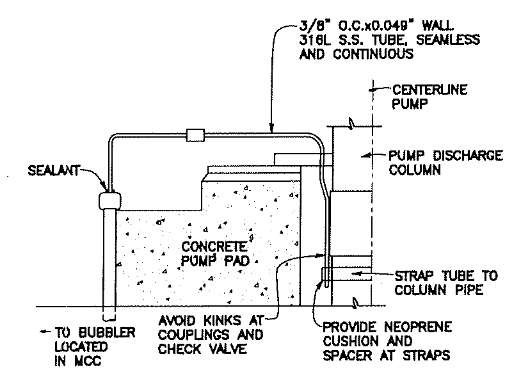
3 AIR VENT DETAIL
C-17 NOT TO SCALE



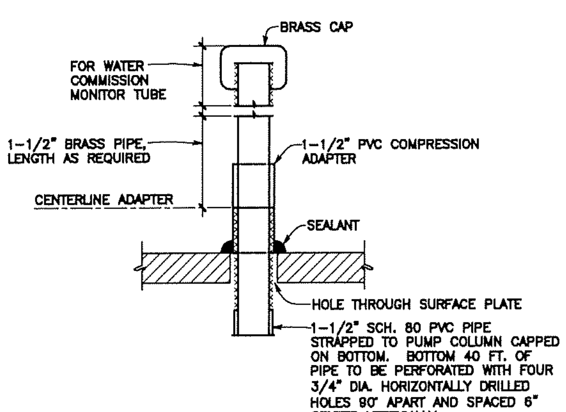
6 SCHEMATIC DISCHARGE PRESSURE TRANSMITTER
C-17 NOT TO SCALE



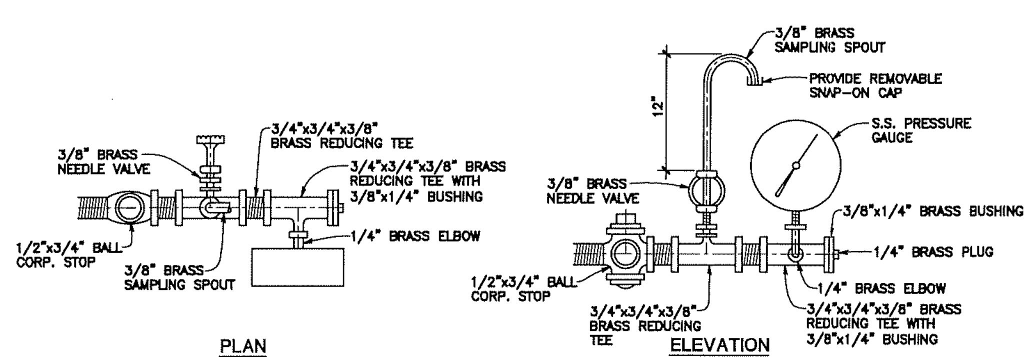
9 COMBINATION AIR RELEASE VALVE ASSEMBLY DETAIL
C-17 NOT TO SCALE



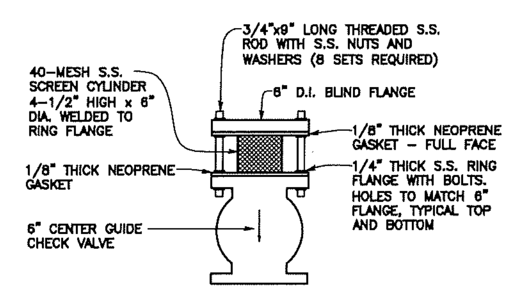
11 BUBBLER PIPING PLAN
C-17 NOT TO SCALE



4 PVC MONITOR TUBE DETAIL
C-17 NOT TO SCALE



7 GAUGE AND SAMPLING TAP ASSEMBLY
C-17 NOT TO SCALE



10 SCREENED INLET
C-17 NOT TO SCALE

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KAHANA PRODUCTION WELL
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PUMP DISCHARGE PIPING DETAILS 2

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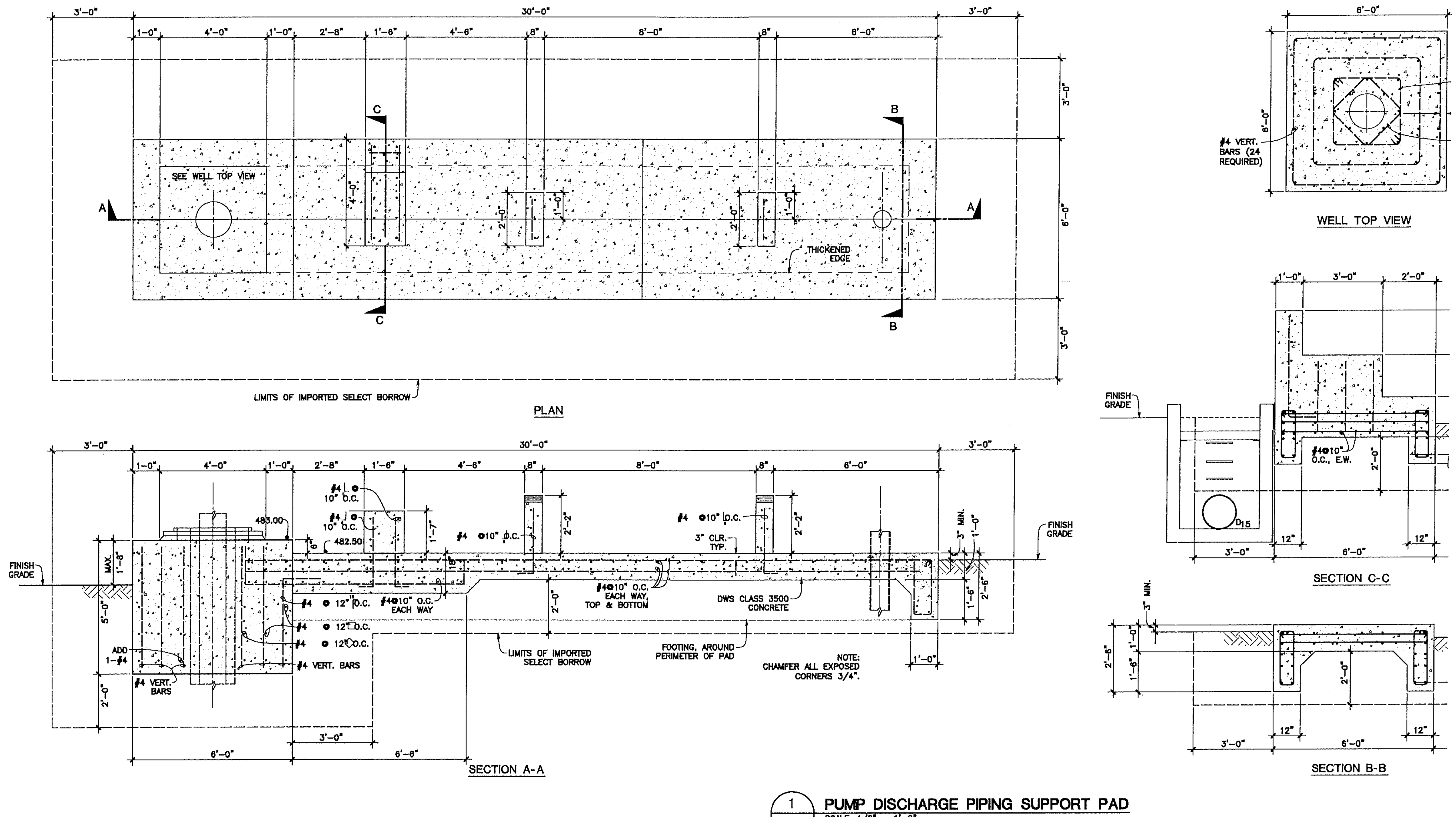
SHEET C-17



1 C-18 PUMP DISCHARGE PIPING SUPPORT PAD
SCALE: 1/2" = 1'-0"

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PUMP DISCHARGE PIPING SUPPORT PAD DETAIL

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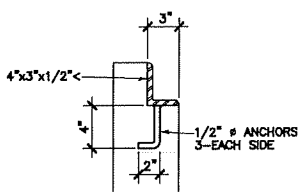
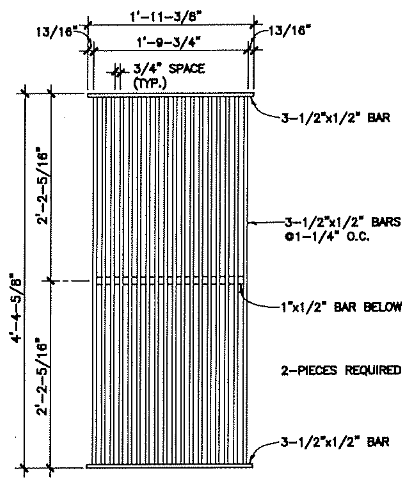
SHEET C-18

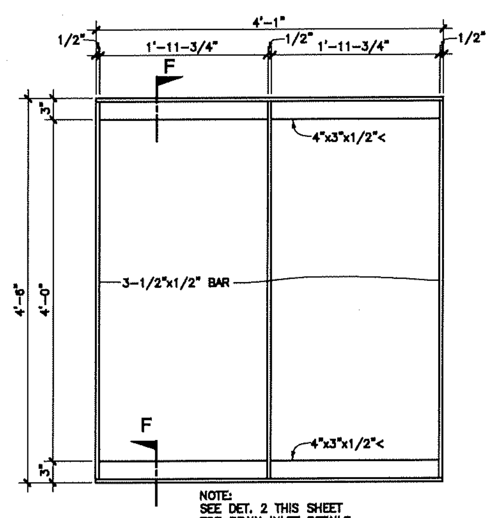
19 OF 44



SECTION F
SCALE: 1-1/2" = 1'-0"



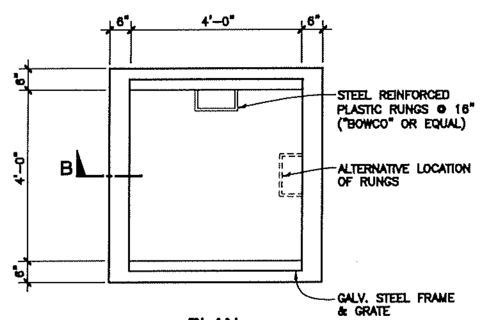
PLAN - GRATE
SCALE: 1" = 1'-0"



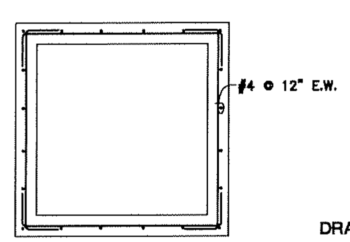
NOTE:
SEE DET. 2 THIS SHEET
FOR DRAIN INLET DETAILS

PLAN - FRAME
SCALE: 1" = 1'-0"

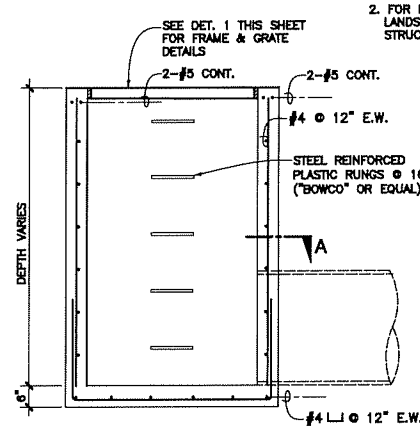
1 / C-19 FRAME & GRATE FOR 4'x4' DRAIN INLET
SCALE AS NOTED



PLAN



SECTION A

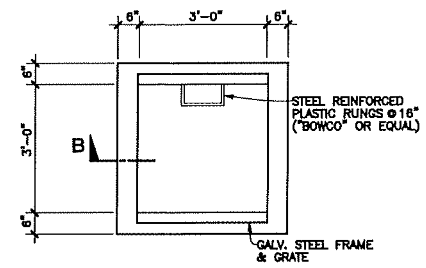


SECTION B

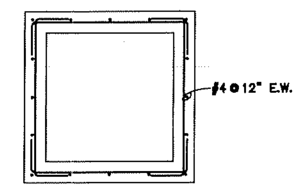
2 / C-19 4'x4' DRAIN INLET
SCALE: 1/2" = 1'-0"

DRAIN INLET & MANHOLE NOTES

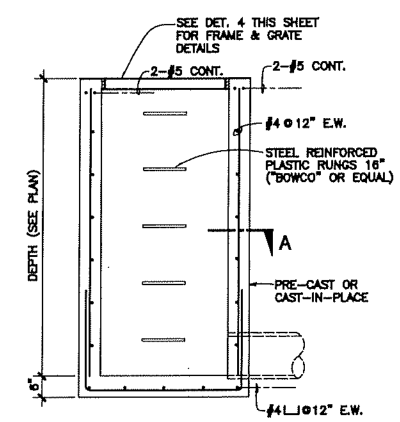
1. FOR DRAIN INLETS AND MANHOLES WITHIN PAVED AREAS, CONSTRUCT TOP OF STRUCTURE TO MATCH. SLOPE OF PAVEMENT.
2. FOR DRAIN INLETS AND MANHOLES WITHIN LANDSCAPED AREAS, CONSTRUCT TOP OF STRUCTURE LEVEL.



PLAN

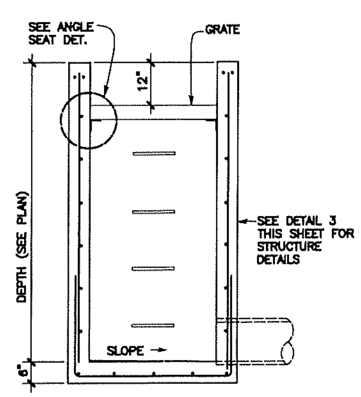


SECTION A

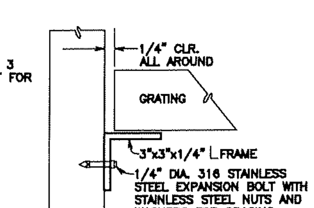


SECTION B

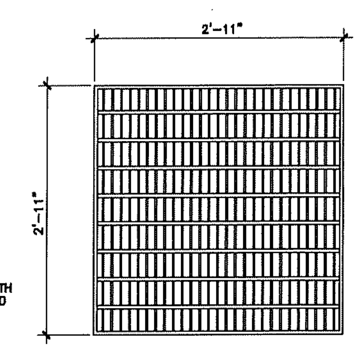
3 / C-19 3'x3' DRAIN INLET
SCALE: 1/2" = 1'-0"



SECTION
SCALE: 1/2" = 1'-0"



ANGLE SEAT DETAIL
NOT TO SCALE



PLAN-GRATE
SCALE: 1" = 1'-0"

4 / C-19 GRATE FOR 3'x3' DISCHARGE GDI
SCALE AS NOTED

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DRAINAGE DETAILS 1

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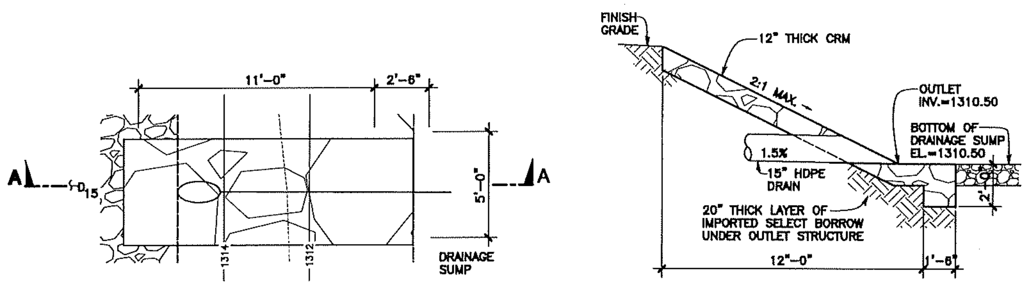
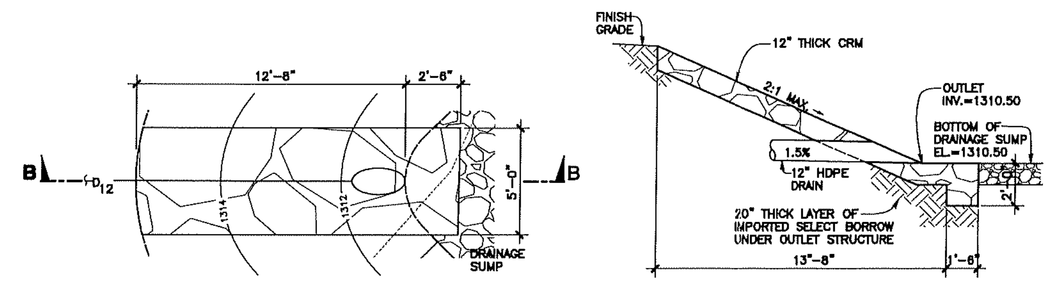
SHEET C-19



PLAN

SECTION A-A

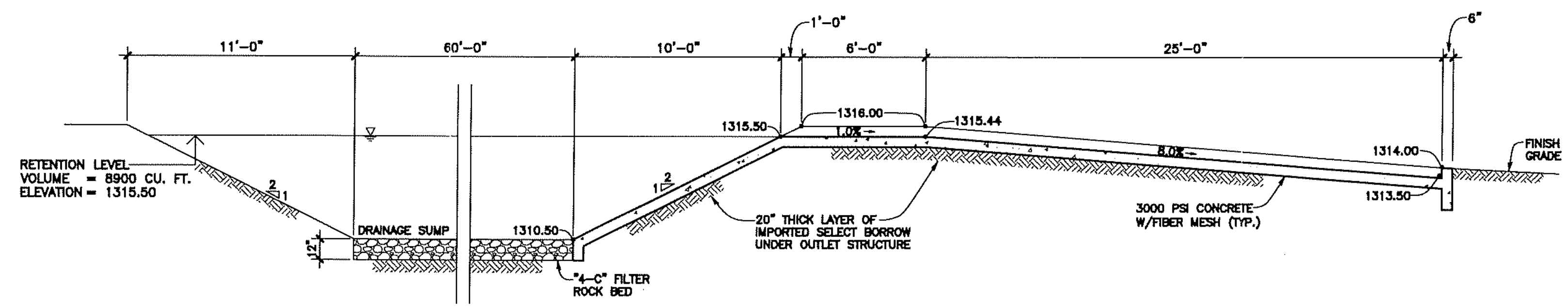
1 C-20 OUTLET #1
SCALE: 1/4" = 1'-0"



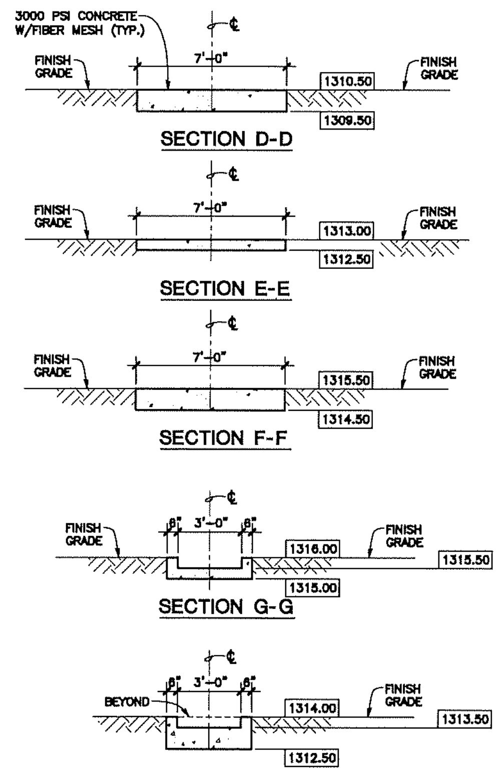
PLAN

SECTION B-B

2 C-20 OUTLET #2
SCALE: 1/4" = 1'-0"



SECTION C-C



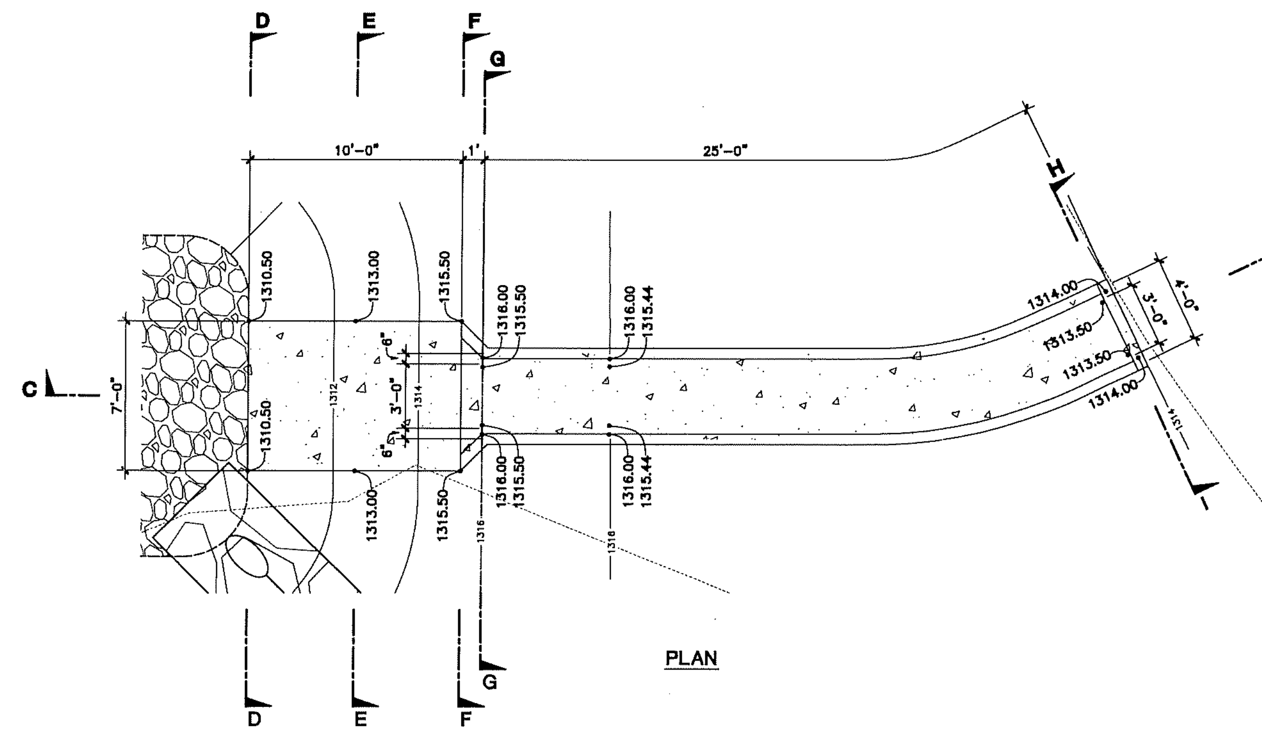
SECTION D-D

SECTION E-E

SECTION F-F

SECTION G-G

SECTION H-H



PLAN

3 C-20 SPILLWAY DETAILS
SCALE: 1/4" = 1'-0"

FUKUMOTO ENGINEERING, INC.
Civil Engineering & Land Surveying Consultants
1721 Wili Pa Loop, Suite 203
Wailuku, Hawaii 96793
Phone: (808) 242-8611
Email: office@femaui.com
Website: www.femaui.com

Prepared for:
Department of Water Supply
County of Maui
200 South High Street
Wailuku, Maui, Hawaii 96793
Contact: Curtis Eaton, P.E.

KAHANA PRODUCTION WELL
TAX MAP KEYS (2) 4-3-001:017, 4-4-004:009 & 011
DWS JOB NO. 15-04
LAHAINA, MAUI, HAWAII

DRAINAGE DETAILS 2

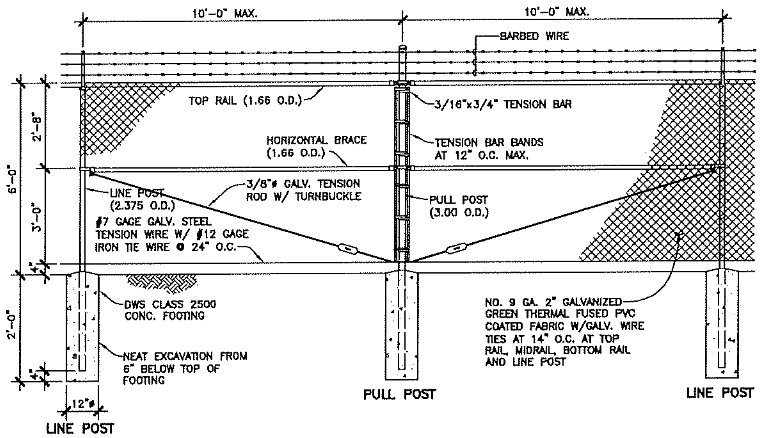
RONALD M. FUKUMOTO
LICENSED PROFESSIONAL ENGINEER
No. 4935-C
HAWAII U.S.A.

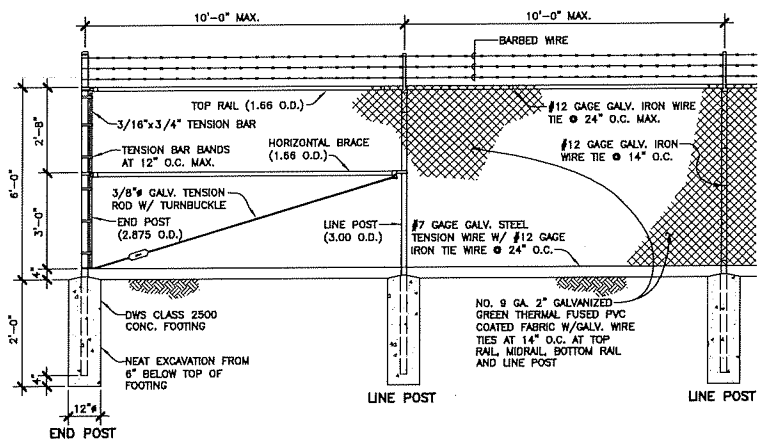
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION, AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION AS DEFINED IN HAR 16-115-2.

LICENSE EXPIRES: 04/30/2020

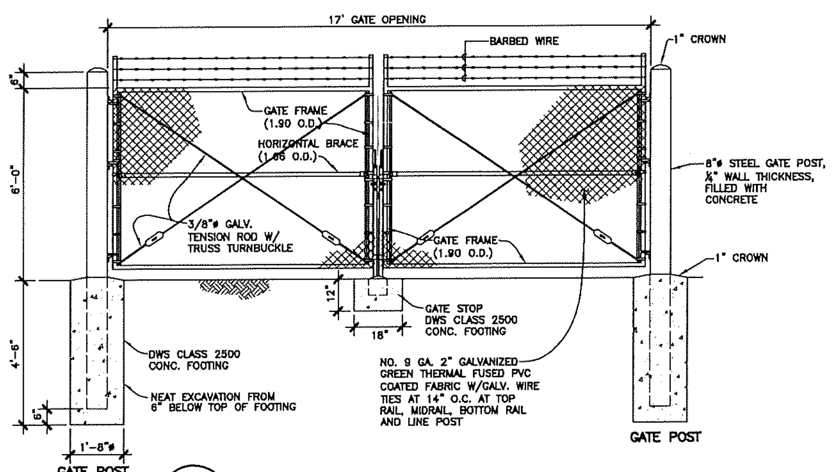
DESIGNED BY:	R.F.
DRAWN BY:	S.O., N.M.
CHECKED BY:	R.F.
DATE:	DECEMBER 14, 2018
FILE NO:	C0M43B

SHEET C-20
21 OF 44





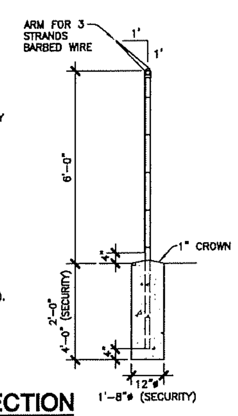
1 C-21 **CHAIN LINK FENCE DETAILS**
SCALE: 3/8" = 1'-0"



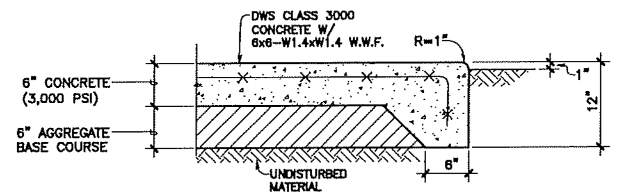
2 C-21 **DOUBLE SWING GATE DETAIL**
SCALE: 3/8" = 1'-0"

NOTES:

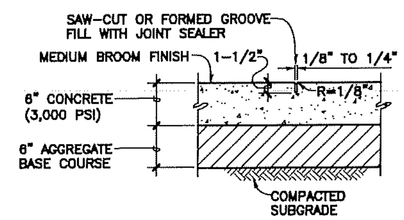
1. ALL TIE WIRES SHALL BE #9 GAUGE UNLESS NOTED.
2. ALL PIPE AND POST SIZES ARE NOMINAL DIAMETER (N.D.).
3. PIPES, FITTINGS, AND POSTS SHALL BE HOT-DIP GALVANIZED.
4. FABRIC SHALL BE CONTINUOUS AND FASTENED TO END POSTS BY STRETCHER TENSION BARS AND TENSION BANDS SPACED APPROXIMATELY 12" APART.
5. WIRE FASTENINGS SHALL BE NO. 12 GAUGE GALVANIZED TIE WIRE.
6. LINE POSTS WIRE FASTENINGS SHALL BE SPACED 14" APART.
7. HORIZONTAL RAILS WIRE FASTENINGS SHALL BE SPACED 14" APART.
8. NO SPLICING SHALL BE ALLOWED ON ALL STRAIGHT-RUN PIPES.
9. TOP AND BOTTOM SALVAGES SHALL BE KNUCKLED FINISH.
10. GATE FRAME SHALL BE OF WELDED PIPE CONSTRUCTION.
11. ALL WELDED CONNECTIONS SHALL BE PAINTED WITH TWO COATS OF Z.R.C. COLD GALVANIZING COMPOUND.
12. GATE HINGES SHALL BE TACK WELDED TO POST.
13. PAD LOCK SHALL BE FURNISHED BY CONTRACTOR (SEE SPECIFICATIONS).
14. FOR ALL WELDED CONNECTIONS: CORNERS SHALL BE MITERED AND ALL PIPE BRACES PROPERLY COPED.
15. ALL WELDING SHALL BE DONE BY A CERTIFIED WELDER. SUBMIT CERTIFICATE TO ENGINEER PRIOR TO COMMENCEMENT OF WORK.



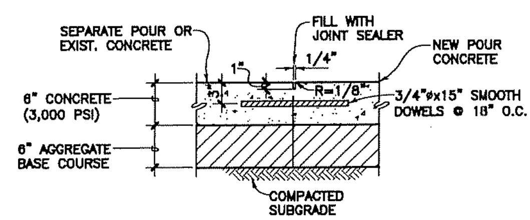
3 C-21 **TYPICAL FENCE SECTION**
SCALE: 3/8" = 1'-0"



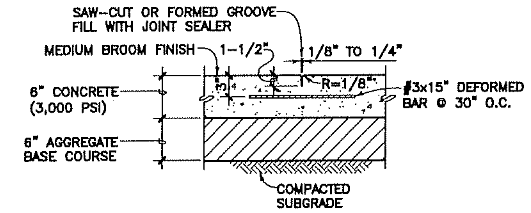
4 C-21 **6" CONCRETE PAVEMENT DETAIL**
SCALE: 1" = 1'-0"



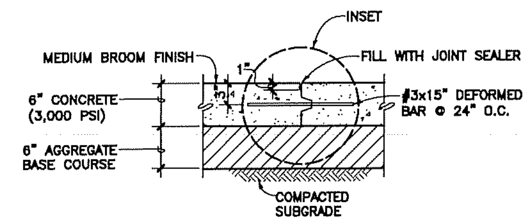
5 C-21 **TRANSVERSE CONTRACTION JOINT**
SCALE: 1" = 1'-0"

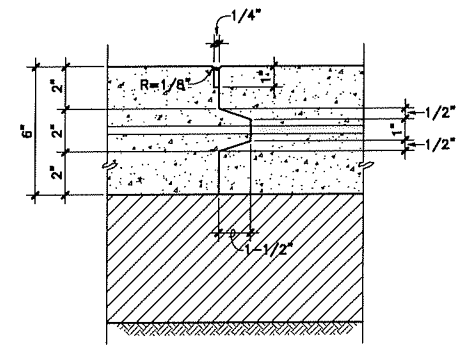


6 C-21 **TRANSVERSE CONSTRUCTION JOINT**
SCALE: 1" = 1'-0"



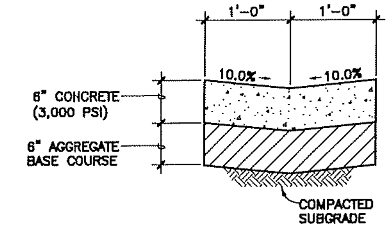
7 C-21 **CONTRACTION JOINT WITH TIE BAR**
SCALE: 1" = 1'-0"



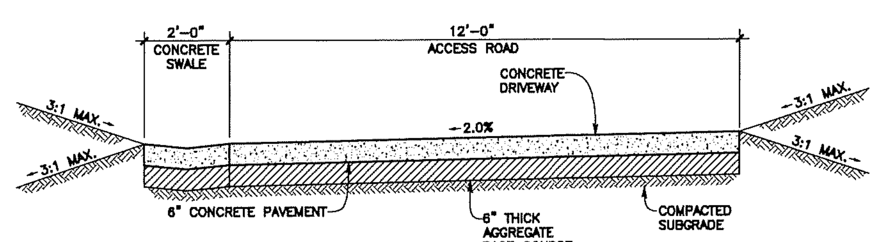


INSET
SCALE: 3" = 1'-0"

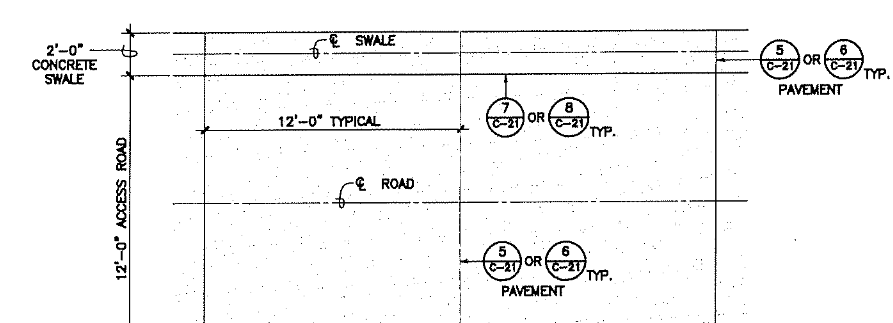
8 C-21 **KEYED CONSTRUCTION JOINT WITH TIE BAR**
SCALE: 1" = 1'-0"



9 C-21 **CONCRETE SWALE**
SCALE: 1" = 1'-0"



TYPICAL ACCESS ROAD SECTION
SCALE: 1/2" = 1'-0"



TYPICAL CONCRETE JOINTS
SCALE: 1/4" = 1'-0"

SCALE IN FEET
0 2 4 8 12

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KAHANA PRODUCTION WELL
TAX MAP KEYS (2) 4-3-001:017, 4-4-004:009 & 011
DWS JOB NO. 15-04
LAHAINA, MAUI, HAWAII

MISCELLANEOUS DETAILS

RONALD M. FUKUMOTO
LICENSED PROFESSIONAL ENGINEER
No. 4935-C
HAWAII, U.S.A.

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LICENSE EXPIRES: 04/30/2020

DESIGNED BY:	R.F.
DRAWN BY:	S.O., N.M.
CHECKED BY:	R.F.
DATE:	DECEMBER 14, 2018
FILE NO:	COM438

SHEET C-21

GENERAL NOTES

A. DESIGN LOADS:

1. LIVE LOADS:

   ROOF . . . . 20 PSF

2. 3 SECOND GUST
   WIND SPEED . . . . . 105 MPH, EXPOSURE C PER IBC 2006

3. SEISMIC . . . . IBC 2006
   S_S = 1.0
   S_1 = 0.265
   SITE CLASS D

B. FOUNDATION:

1. THE SUBGRADE SOIL SHALL BE MOISTURE CONDITIONED TO WITHIN 0 & 3 PERCENT OF THE WET SIDE OF OPTIMUM MOISTURE CONTENT AND COMPACTED TO A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY (AS DETERMINED BY THE ASTM D 1557 TEST PROCEDURE) IF THE MATERIAL IS GRANULAR OR TO A MINIMUM OF 90% OF THE MAXIMUM DRY DENSITY (AS DETERMINED BY THE ASTM D 1557 TEST PROCEDURE) IF THE MATERIAL IS FINE-GRAINED.
2. THE SELECT BORROW GRAVEL SHALL BE COMPACTED TO A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY THE ASTM D 1557 TEST PROCEDURE. EACH LIFT SHALL NOT EXCEED 6" IN COMPACTED THICKNESS.
3. THE #3 FINE GRAVEL SHALL BE COMPACTED BY MEANS OF A VIBRATORY PLATE COMPACTOR MAKING A MINIMUM OF 4 PASSES.
4. THE BUILDING SLAB AND FOOTING SHALL BE SUPPORTED BY A MINIMUM OF 12 INCHES OF COMPACTED #3F GRAVEL.
5. ALLOWABLE SOIL BEARING PRESSURE = 2,975 PSF (FOR DEAD AND LIVE LOADS)
6. SOIL VALUES AND RECOMMENDATIONS IS FROM SOIL REPORT BY HAWAII GEOTECHNICAL CONSULTING, INC., DATED JULY 22, 2018, ENTITLED "GEOTECHNICAL INVESTIGATION REPORT, KAHANA PRODUCTION WELL CONTROL TANK, LAHAINA, MAUI, HAWAII".
7. SITE GRADING SHALL BE FULLY COMPLETED PRIOR TO FOUNDATION WORK.
8. SOILS ENGINEER SHALL APPROVE ALL FILL AND BACKFILL MATERIALS.

C. REINFORCED CONCRETE:

1. ALL CONCRETE WORK SHALL CONFORM TO ACI 318-05.
2. THE MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF CONCRETE AT 28 DAYS SHALL BE:

   FOUNDATION . . . . 3,000 PSI
   SLAB-ON-GRADE . . . . 4,000 PSI
   CONCRETE TOPPING/STRUCT. SLABS/BOND BEAMS . . . . . 4,000 PSI
   PRECAST CONCRETE PLANKS . . . . 6,000 PSI
   (4,000 PSI AT RELEASE)

3. MATERIAL FOR CURING CONCRETE SHALL BE:

   IMPERVIOUS SHEATHING - WATERPROOF PAPER, POLYETHYLENE SHEATHING, OF POLYETHYLENE COATED BURLAP CONFORMING TO ASTM C-171

4. LIQUID MEMBRANE-FORMING COMPOUND - ASTM C-309, WHITE PIGMENTED, TYPE 2, FREE OF PARAFFIN OR PETROLEUM.
5. JOINT SEALING MATERIALS: ASTM D-1190 OR ASTM D-1850 INSIDE BUILDINGS: ASTM D-1190 OUTSIDE BUILDINGS.
6. PERFORMED JOINT FILLER: ASTM D-1751 OR ASTM 1752.
7. VAPOR BARRIER MATERIAL: POLYETHYLENE SHEATHING OF NOT LESS THAN 6-MIL NOMINAL THICKNESS.
8. WELDED WIRE FABRIC: ASTM A-185, 6 x 6 - W1.4 x W1.4, GALVANIZED, UNLESS OTHERWISE INDICATED.

D. REINFORCED STEEL:

1. ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60, EXCEPT #3 OR #4 STIRRUPS AND TIES SHALL BE GRADE 40.
2. ALL BARS MARKED CONTINUOUS (CONT.) ON THE PLANS SHALL BE LAPPED 48 BAR DIAMETERS AT ALL LAPS, SPLICES, INTERSECTIONS, AND CORNERS.
3. IT SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO INSPECT AND ENSURE THAT ALL OF THE REINFORCING STEEL HAS BEEN INSTALLED IN ACCORDANCE TO THE CONTRACT DOCUMENTS. THE GENERAL CONTRACTOR SHALL COMPLETE HIS INSPECTION AND MAKE THE NECESSARY CORRECTIONS BEFORE NOTIFYING THE ENGINEER TO OBTAIN APPROVAL TO POUR CONCRETE. THE ENGINEER SHALL BE GIVEN SUFFICIENT (48 HOURS) TIME TO ALSO INSPECT THE PLACEMENT OF THE REINFORCING STEEL PRIOR TO POURING CONCRETE.
4. ALL REINFORCING STEEL SHALL BE TIED IN PLACE BEFORE POURING CONCRETE.
5. ALL CONCRETE REINFORCEMENT DETAILING AND PLACEMENT SHALL CONFORM TO ACI 315 AND ACI 318-05 UNLESS OTHERWISE INDICATED.
6. THE FOLLOWING MINIMUM COVER SHALL BE PROVIDED FOR REINFORCEMENT:

   MINIMUM COVER, INCH

   CONCRETE CAST AGAINST AND PERMANENTLY
   EXPOSED TO EARTH 3

   CONCRETE EXPOSED TO EARTH OR WEATHER:
   #6 BARS AND LARGER 2
   #5 BARS AND SMALLER 1-1/2

E. PRESTRESSED CONCRETE:

1. TENDONS FOR PRESTRESSING STEEL SHALL BE STANDARD SEVEN-WIRE UNCOATED, STRESS RELIEVED STRANDS.
2. TENSIONING FOR PRESTRESSING STEEL:

   ULTIMATE STRENGTH . . . . 270 ksi
   TENSIONING LOAD . . . . 189 ksi
   DESIGN LOAD . . . . 154 ksi

3. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF STRAND LAYOUT CALCULATIONS AND OTHER PRESTRESSING DETAILS TO THE ENGINEER FOR APPROVAL PRIOR TO FABRICATION.
4. ALL REINFORCING AND PRE-TENSIONED STEEL SHALL BE FIRMLY SECURED IN FORMS TO OBTAIN THE DIMENSIONS AND LOCATIONS SHOWN ON THE PLANS.
5. PLANKS SHALL BE CAST ON FORMS AND STRANDS SHALL BE RELEASED AFTER THE CONCRETE HAS ATTAINED A STRENGTH OF 4,000 PSI (SEE CONCRETE SPECIFICATIONS).
6. DO NOT USE POWDER DRIVEN FASTENER IN PRESTRESSED CONCRETE EXCEPT AS NOTED IN THE SPECIFICATION OR AS APPROVED BY THE ENGINEER.
7. ALL INSERTS AND ANCHORS FOR SUSPENDED MECHANICAL AND ARCHITECTURAL WORK SHALL BE CAST-IN-PLACE WHEREVER POSSIBLE.
8. SLIGHT DEVIATIONS IN SPACING OF SLAB TENDONS ARE PERMITTED WHERE REQUIRED TO AVOID OPENINGS OR INSERTS WHICH ARE SPECIFICALLY LOCATED.
9. TENDONS SHALL CLEAR OPENINGS BY 2 1/2" MINIMUM.
10. FOR STRANDS, SHORING AND CAMBER REQUIREMENTS, SEE DETAIL 5/S-11.
11. NO FIELD DRILLING OR CUT-OUTS SHALL BE ALLOWED AND ABSOLUTELY NO STRANDS SHALL BE CUT.

F. MASONRY:

1. CONCRETE MASONRY UNITS (CMU) SHALL BE THE TWO CORE LOAD BEARING TYPE CONFORMING TO ASTM C90, GRADE N-11. UNITS SHALL BE CURED BEFORE INSTALLATION. PROVIDE JAMBS, SILLS, LINTELS, CORNERS, AND OTHER REQUIRED MASONRY UNITS OF STANDARD SHAPES.
2. MASONRY ULTIMATE COMPRESSIVE STRENGTH SHALL BE f'm = 1,350 PSI.
3. MORTAR: 2,500 PSI (TYPE M) MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS.
4. GROUT: 2,500 PSI MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS.
5. REINFORCING:
   a. ALL CMU WALLS SHALL BE REINFORCED WITH 1-#5 VERTICAL REINFORCING BARS AT 16" O.C. MINIMUM SPACING. AND 2-#4 HORIZONTAL REINFORCING BARS AT 48" O.C. UNLESS OTHERWISE NOTED.
   b. USE 1-#5 VERTICAL AT ALL CORNERS, JAMBS, INTERSECTIONS, MULLIONS, AND DISCONTINUOUS ENDS.
   c. INSTALL NO. 9 GAUGE HORIZONTAL JOINT REINFORCING CONFORMING TO ASTM A82-76 AT 16" O.C. UNLESS OTHERWISE SHOWN ON THE PLANS. LAP 12" MINIMUM AT ALL SPLICES, CORNERS, AND INTERSECTIONS.

G. CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS BEFORE STARTING ANY CONSTRUCTION OR FABRICATION AND SHALL COORDINATE WORK WITH ALL OTHER TRADES. CHECK ARCHITECTURAL, ELECTRICAL, MECHANICAL, AND CIVIL DRAWINGS FOR ANCHORS, INSERTS, PENETRATIONS, GROOVES, CHAMFERS, ETC.
2. NO PENETRATIONS WILL BE ALLOWED THROUGH ANY STRUCTURAL MEMBERS WITHOUT THE APPROVAL OF THE STRUCTURAL ENGINEER.
3. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODE, 2003 EDITION.
4. THE CONTRACTOR SHALL DETAIL, FURNISH, AND INSTALL ALL MEMBERS, CONNECTIONS, AND ACCESSORIES NOT SHOWN BUT WHICH ARE REQUIRED TO COMPLETE THE WORK AND SHALL SUBMIT THEM TO THE ENGINEER FOR APPROVAL. COST OF THESE MEMBERS, CONNECTIONS, AND ACCESSORIES SHALL BE INCLUDED IN THE CONTRACTOR'S BID PRICE. THE CONTRACTOR SHALL PERFORM HIS WORK IN A WORKMANLIKE MANNER.
5. SUBMIT SIX (6) COPIES OF SHOP DRAWINGS FOR CONCRETE AND MASONRY REINFORCING STEEL, PRESTRESSED CONCRETE, AND OF ALL STRUCTURAL WORK TO THE ENGINEER FOR APPROVAL PRIOR TO FABRICATION.
6. INSTALL A POLYETHYLENE MOISTURE BARRIER (MINIMUM 0.01 INCH THICKNESS) UNDER ALL CONCRETE SLABS.

REV. NO.	DESCRIPTION	DATE

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SIGNATURE

LICENSE EXPIRES: 04/30/20

ARNOLD TETSUJI OKUBO
LICENSED PROFESSIONAL ENGINEER
No. 4173-S
HAWAII, U.S.A.

Arnold T. Okubo & Associates, Inc.
CONSULTING ENGINEERS
OAHU, HAWAII

KAHANA PRODUCTION WELL
TMK:(2) 4-3-001:017, (2) 4-4-004:009, (2) 4-4-004:019
LAHAINA, MAUI, HAWAII

DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

GENERAL NOTES

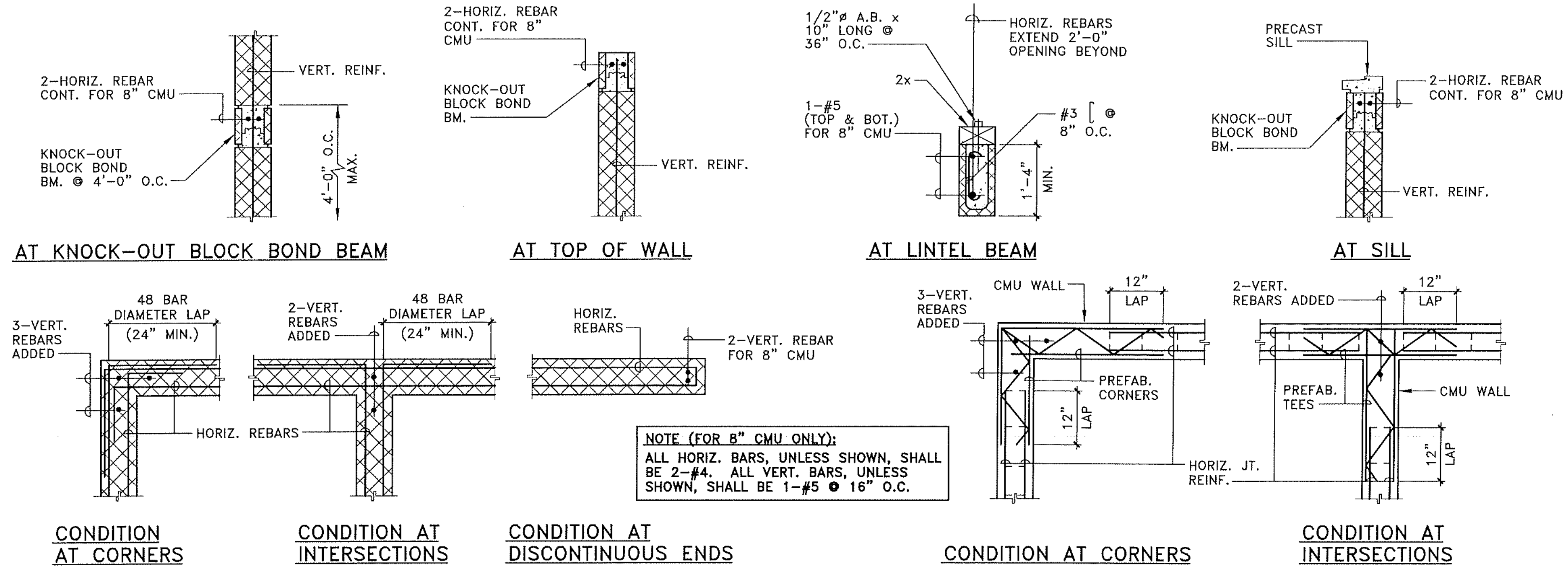
JOB NO.	
DESIGNED BY:	ATO
DRAWN BY:	RMA/LC
CHECKED BY:	ATO
DATE:	APRIL 25, 2018

SHEET NUMBER

S - 1

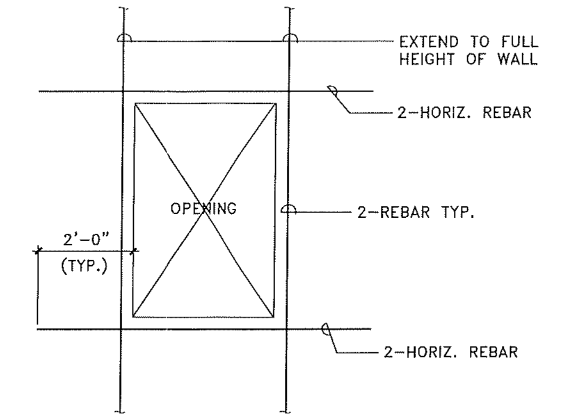
OF XX SHEETS

09/13/18



1 / S-2 TYPICAL 8" CONCRETE MASONRY UNIT (CMU) DETAILS

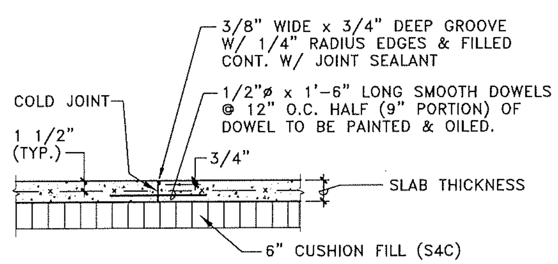
NOT TO SCALE



ELEVATION

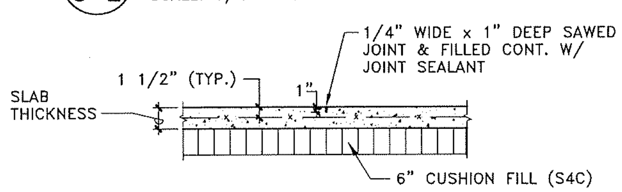
2 / S-2 TYPICAL MIN. REINFORCING AT 8" CMU WALL OPENINGS

NOT TO SCALE



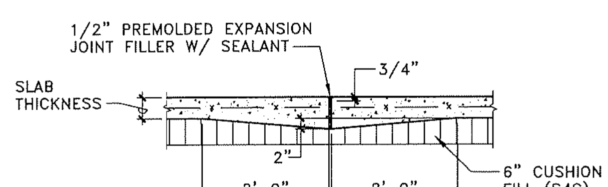
3 / S-2 TYPICAL CONSTRUCTION JOINT DETAIL (C.J.)

SCALE: 3/4" = 1'-0"



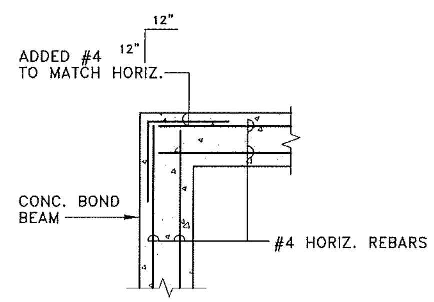
4 / S-2 TYPICAL SAWED JOINT DETAIL (S.J.)

SCALE: 3/4" = 1'-0"



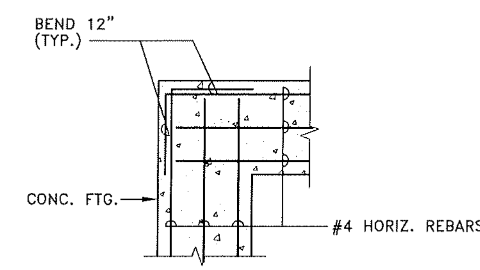
5 / S-2 TYPICAL EXPANSION JOINT DETAIL (E.J.)

SCALE: 3/4" = 1'-0"



6 / S-2 TYYPICAL CORNER DETAIL AT CONCRETE BOND BEAM

NOT TO SCALE



7 / S-2 TYYPICAL FOUNDATION DETAIL AT CORNERS

NOT TO SCALE

GRAPHIC SCALE:

1' 6" 0 1' 2' 3'

SCALE: 3/4" = 1'-0"

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SIGNATURE

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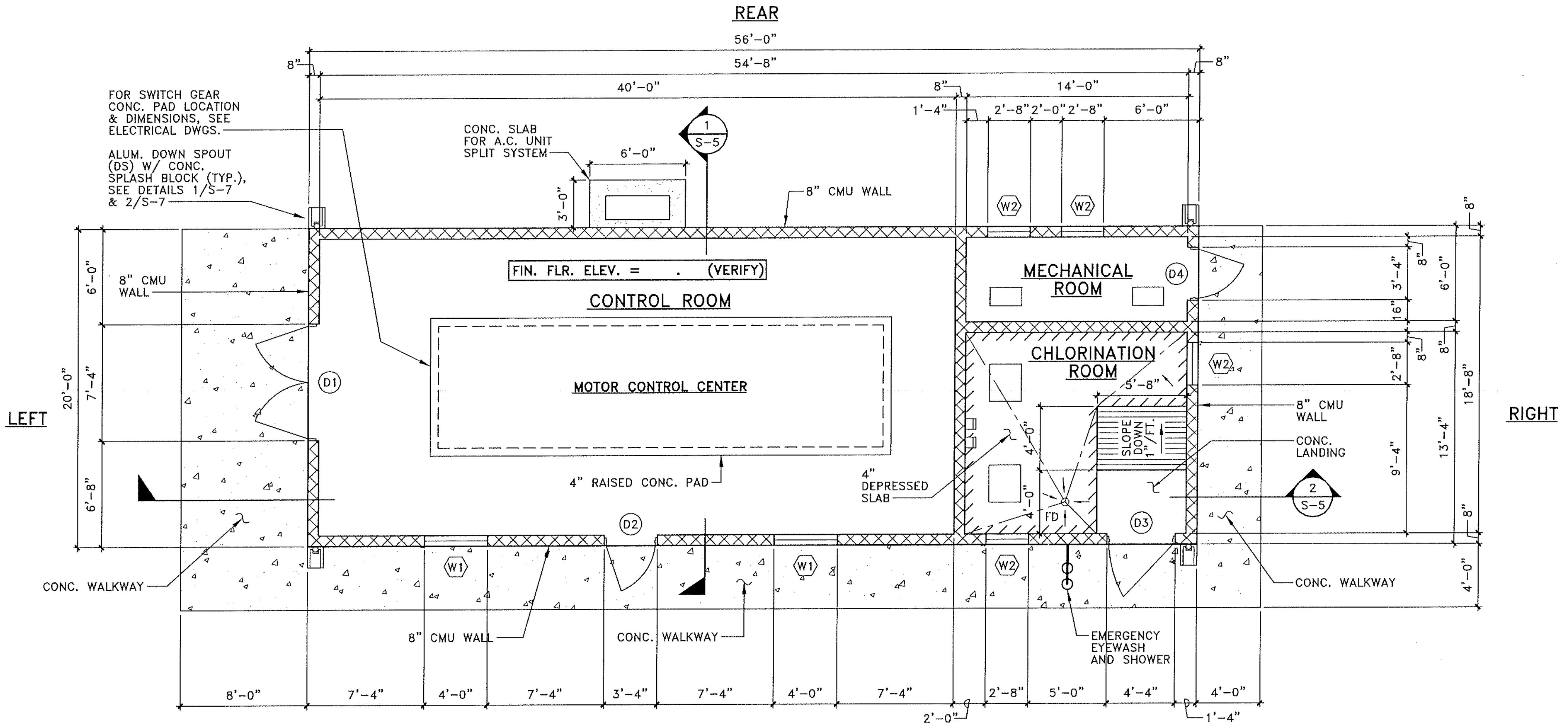
ARNOLD TETSUJI OKUBO LICENSED PROFESSIONAL ENGINEER No. 4173-S HAWAII, U.S.A.

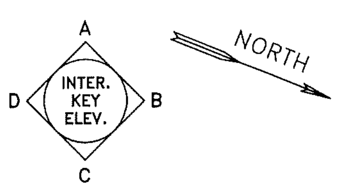
Arnold T. Okubo & Associates, Inc.
CONSULTING ENGINEERS
OAHU, HAWAII

KAHANA PRODUCTION WELL
TMK:(2) 4-3-001:017, (2) 4-4-004:009, (2) 4-4-004:019
LAHAINA, MAUI, HAWAII
DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04
TYPICAL DETAILS

JOB NO.	
DESIGNED BY:	ATO
DRAWN BY:	RMA/LC
CHECKED BY:	ATO
DATE:	APRIL 25, 2018
SHEET NUMBER	S - 2
	OF XX SHEETS

09/13/18

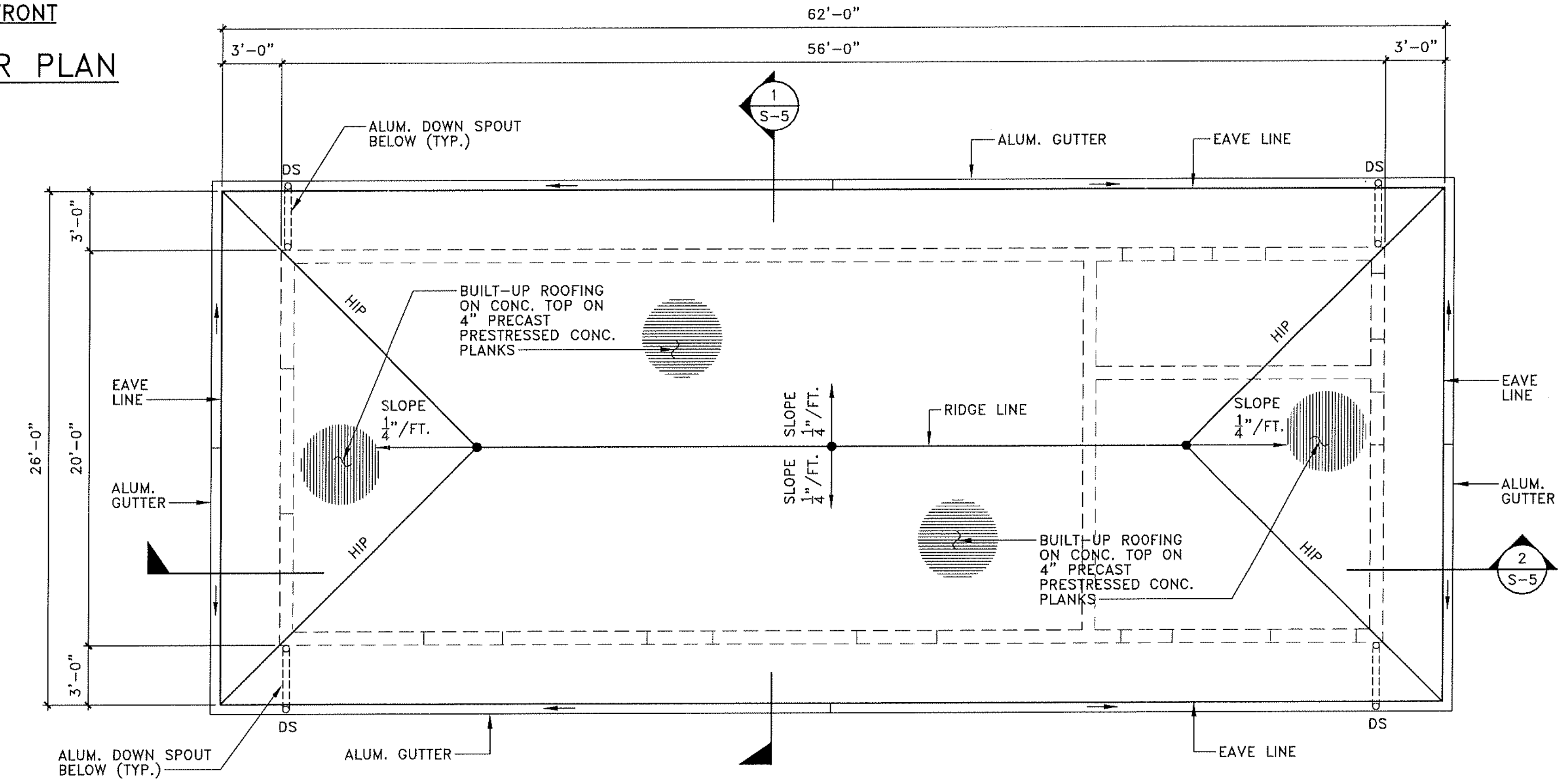




A
S-3

BUILDING FLOOR PLAN

SCALE: 1/4" = 1'-0"



GRAPHIC SCALE: 2' 0 2' 4' 6' 8' 10'

SCALE: 1/4" = 1'-0"

B
S-3

BUILDING ROOF PLAN

SCALE: 1/4" = 1'-0"

REV. NO.	DESCRIPTION	DATE

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SIGNATURE

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OAHU, HAWAII

KAHANA PRODUCTION WELL
TMK:(2) 4-3-001:017, (2) 4-4-004:009, (2) 4-4-004:019
LAHAINA, MAUI, HAWAII

DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

BUILDING FLOOR & ROOF PLANS

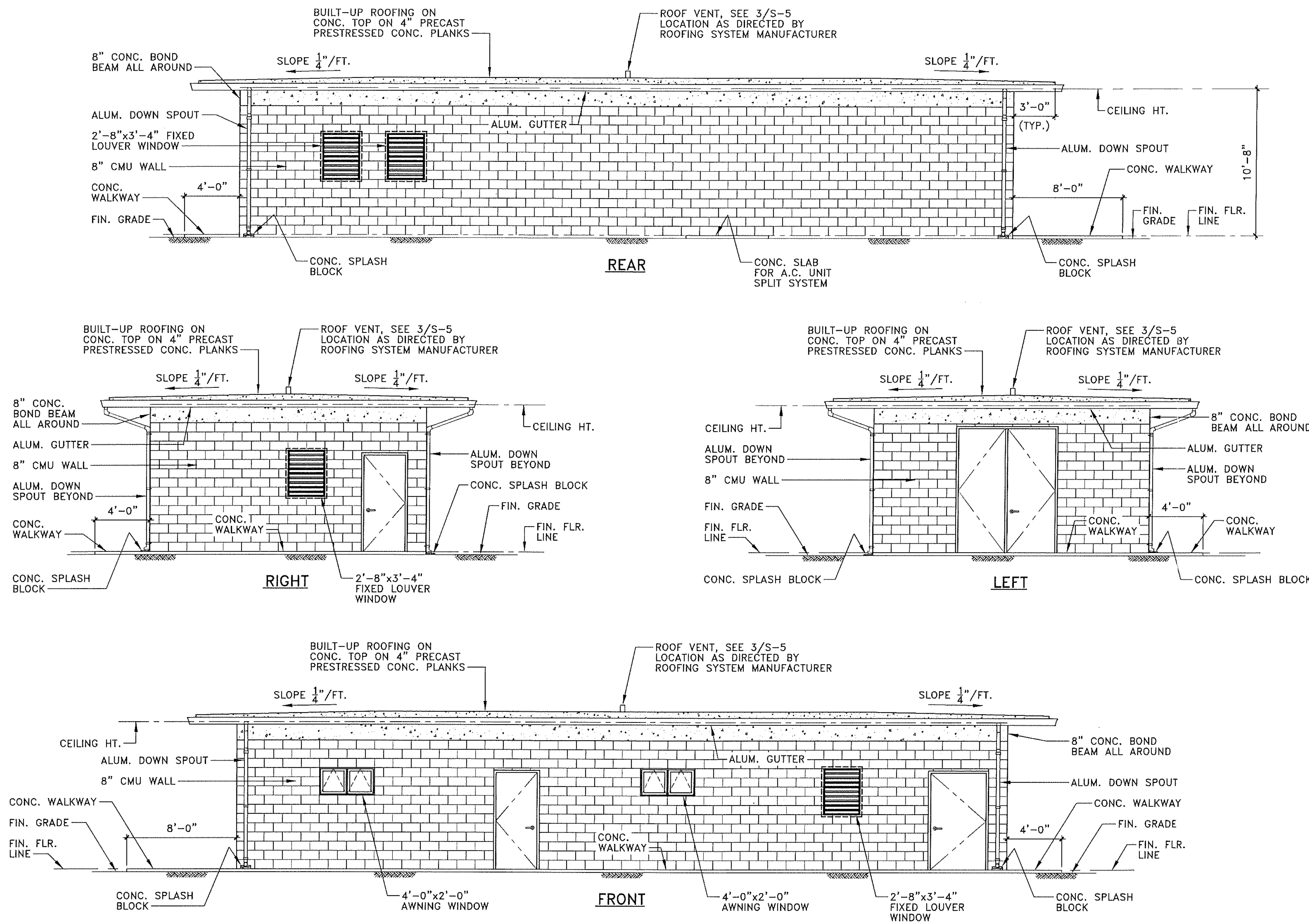
JOB NO.	
DESIGNED BY:	ATO
DRAWN BY:	RMA/LC
CHECKED BY:	ATO
DATE:	APRIL 25, 2018

SHEET NUMBER

S-3

X OF XX SHEETS

08/14/2018



A S-4 EXTERIOR ELEVATIONS
SCALE: 1/4" = 1'-0"

GRAPHIC SCALE: 2' 0 2' 4' 6' 8' 10'
SCALE: 1/4" = 1'-0"

REV. NO.	DESCRIPTION	DATE

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY PERIODIC OBSERVATION.
SIGNATURE
LICENSE EXPIRES: 04/30/20

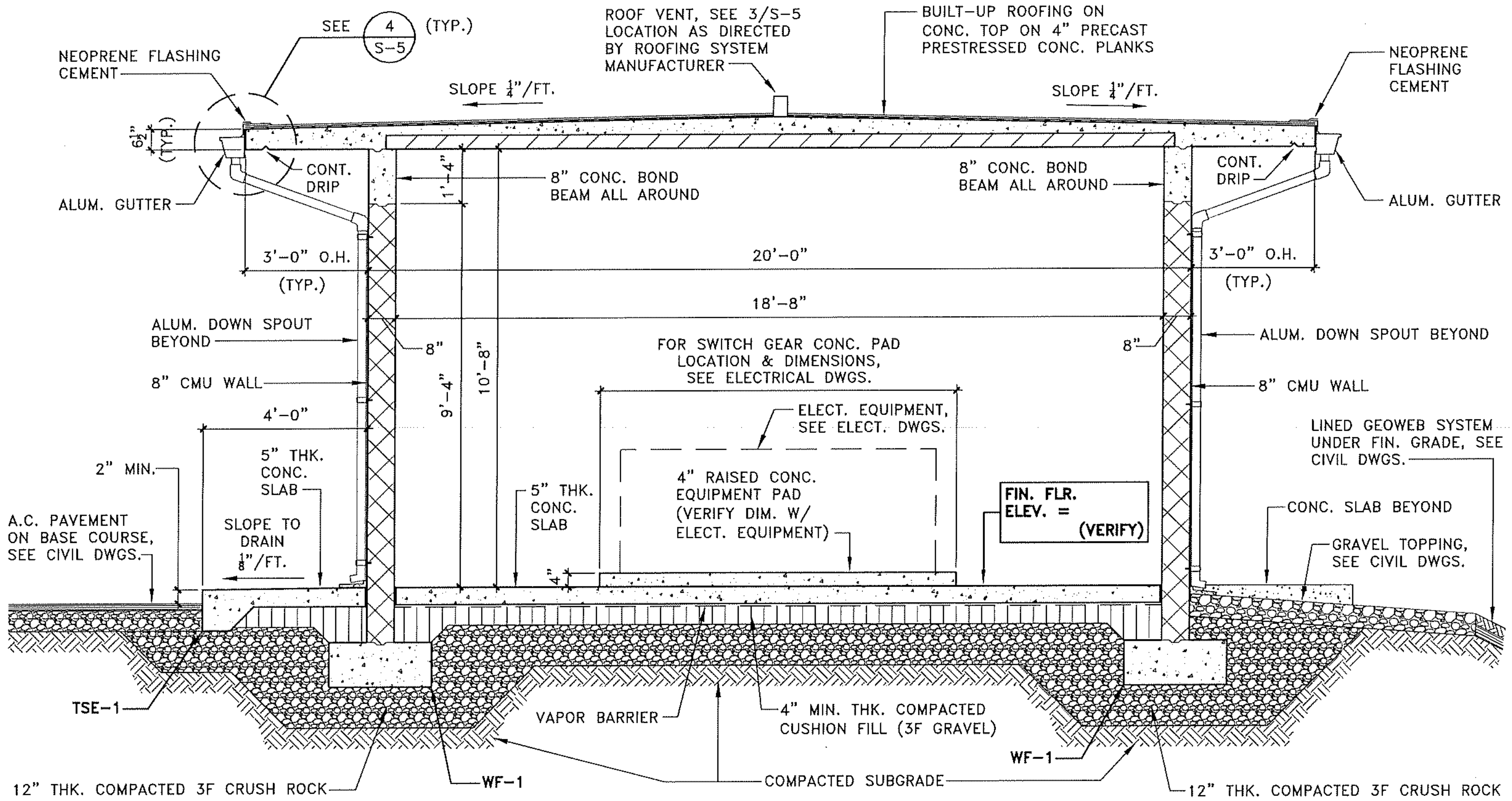
ARNOLD TETSUJI OKUBO, LICENSED PROFESSIONAL ENGINEER No. 4173-S, HAWAII, U.S.A.

Arnold T. Okubo & Associates, Inc.
CONSULTING ENGINEERS
OAHU, HAWAII

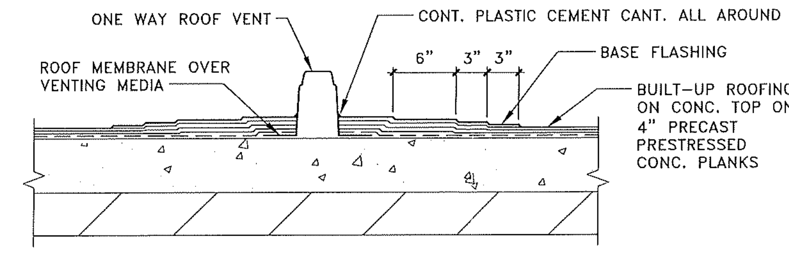
KAHANA PRODUCTION WELL
TMK:(2) 4-3-001:017, (2) 4-4-004:009, (2) 4-4-004:019
LAHAINA, MAUI, HAWAII
DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04
EXTERIOR ELEVATIONS

JOB NO.
DESIGNED BY: ATO
DRAWN BY: RMA/LC
CHECKED BY: ATO
DATE: APRIL 25, 2018
SHEET NUMBER
S - 4
X OF XX SHEETS

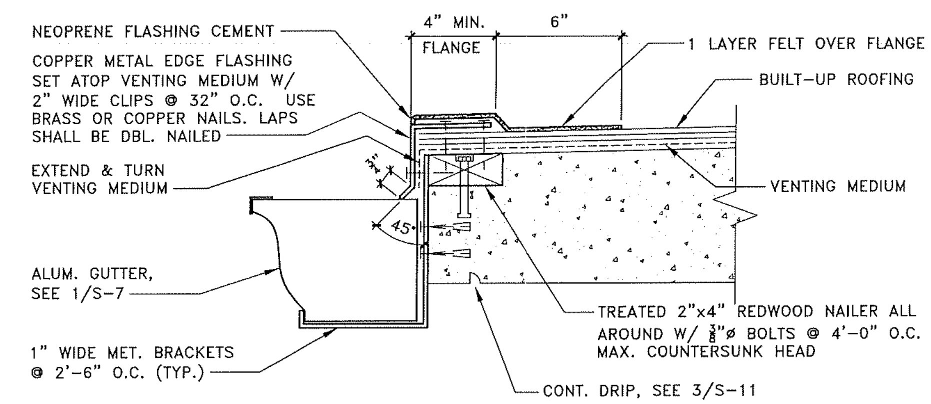
09/14/2018



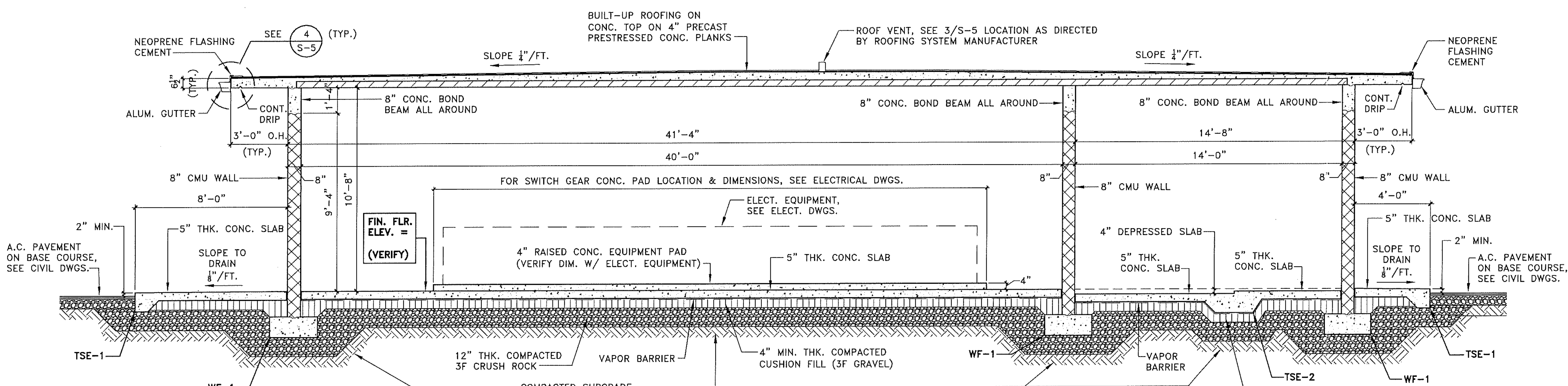
1/S-5 BUILDING SECTION
SCALE: 1/2" = 1'-0"



3/S-5 TYPICAL ROOF VENT DETAIL
NOT TO SCALE



4/S-5 ROOF EDGE DETAIL
SCALE: 3" = 1'-0"



2/S-5 BUILDING SECTION
SCALE: 3/8" = 1'-0"

GRAPHIC SCALE:

1' 0 1' 2' 3' 4' 5'
SCALE: 1/2" = 1'-0"

1' 0 1' 2' 3' 4' 5' 6' 7'
SCALE: 3/8" = 1'-0"

6" 3" 0 6"
SCALE: 3" = 1'-0"

REV. NO.	DESCRIPTION	DATE

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OAHU, HAWAII

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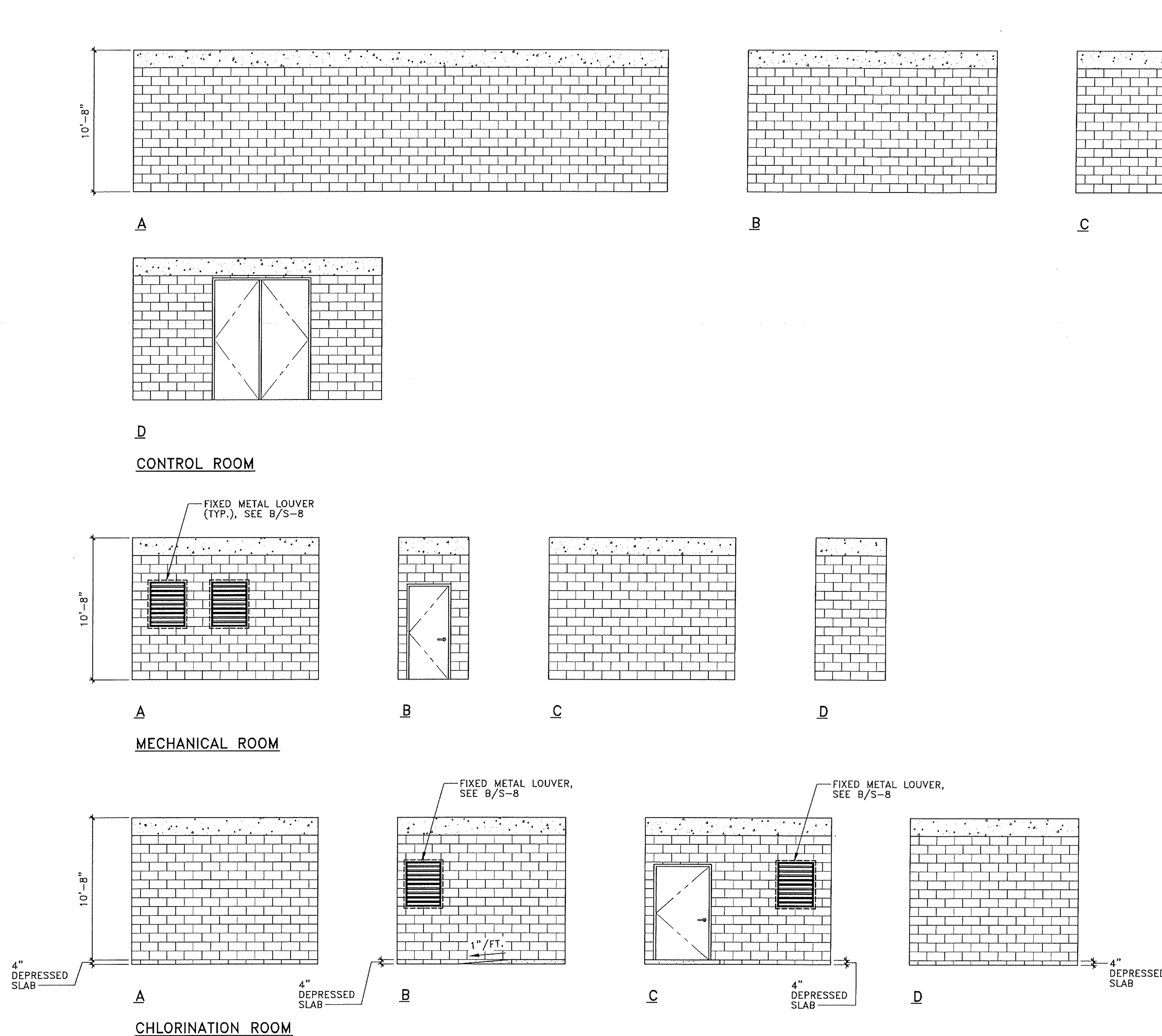
LAHAINA, MAUI, HAWAII

DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

BUILDING SECTIONS & DETAILS

JOB NO.
DESIGNED BY: ATO
DRAWN BY: RMA/LC
CHECKED BY: ATO
DATE: APRIL 25, 2018
SHEET NUMBER
S - 5
OF XX SHEETS

09/13/18



A/S-6 INTERIOR ELEVATIONS

SCALE: 1/4" = 1'-0"

GRAPHIC SCALE: 2' 0 2' 4' 6' 8' 10'

SCALE: 1/4" = 1'-0"

REV. NO.	DESCRIPTION	DATE

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SIGNATURE

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DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

INTERIOR ELEVATIONS

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DESIGNED BY: ATO
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CHECKED BY: ATO
DATE: APRIL 25, 2018

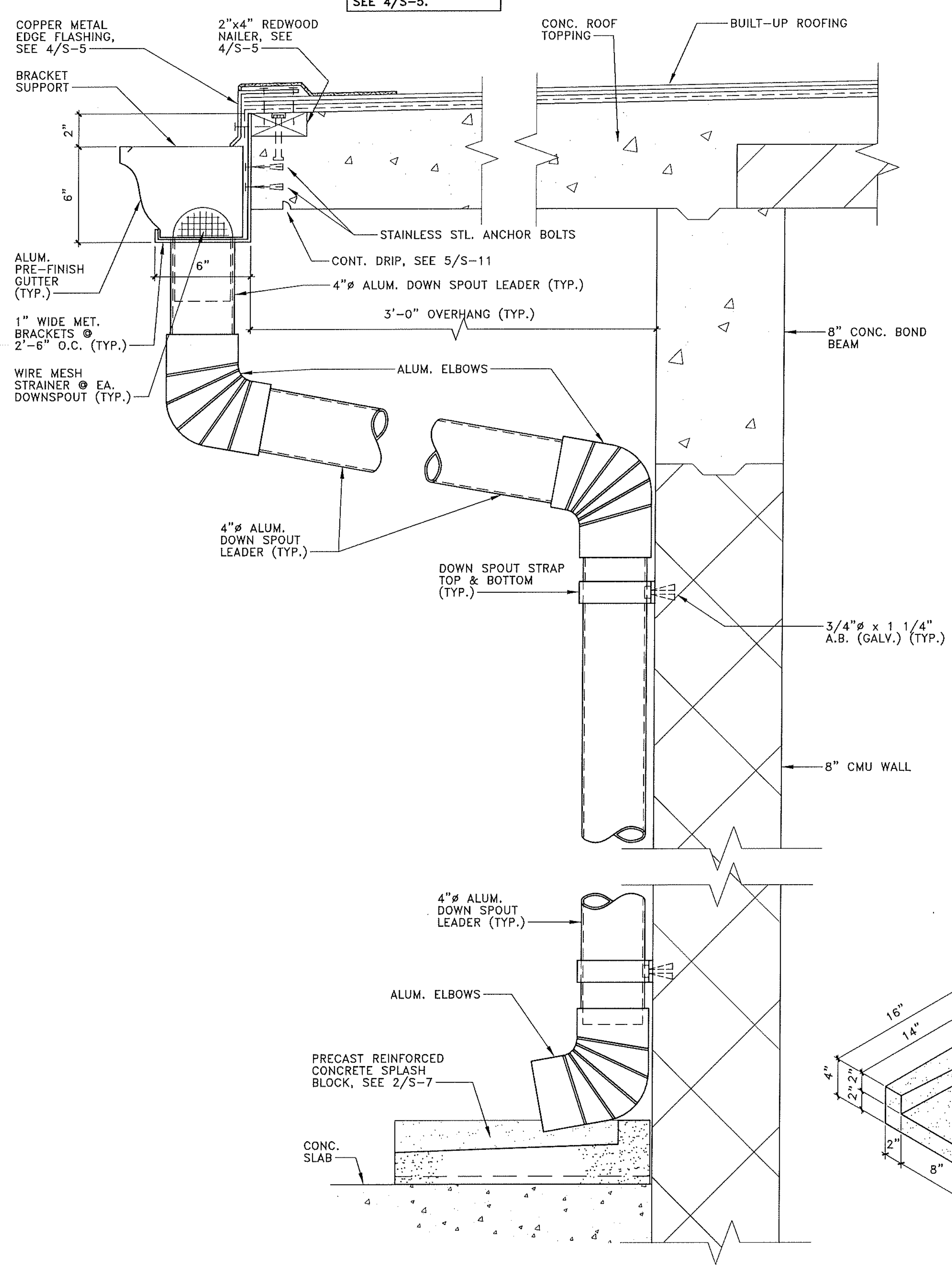
SHEET NUMBER

S - 6

X OF XX SHEETS

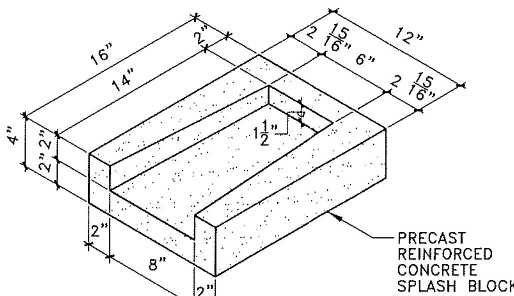
09/14/2018

FOR REMAINING NOTES, SEE 4/S-5.



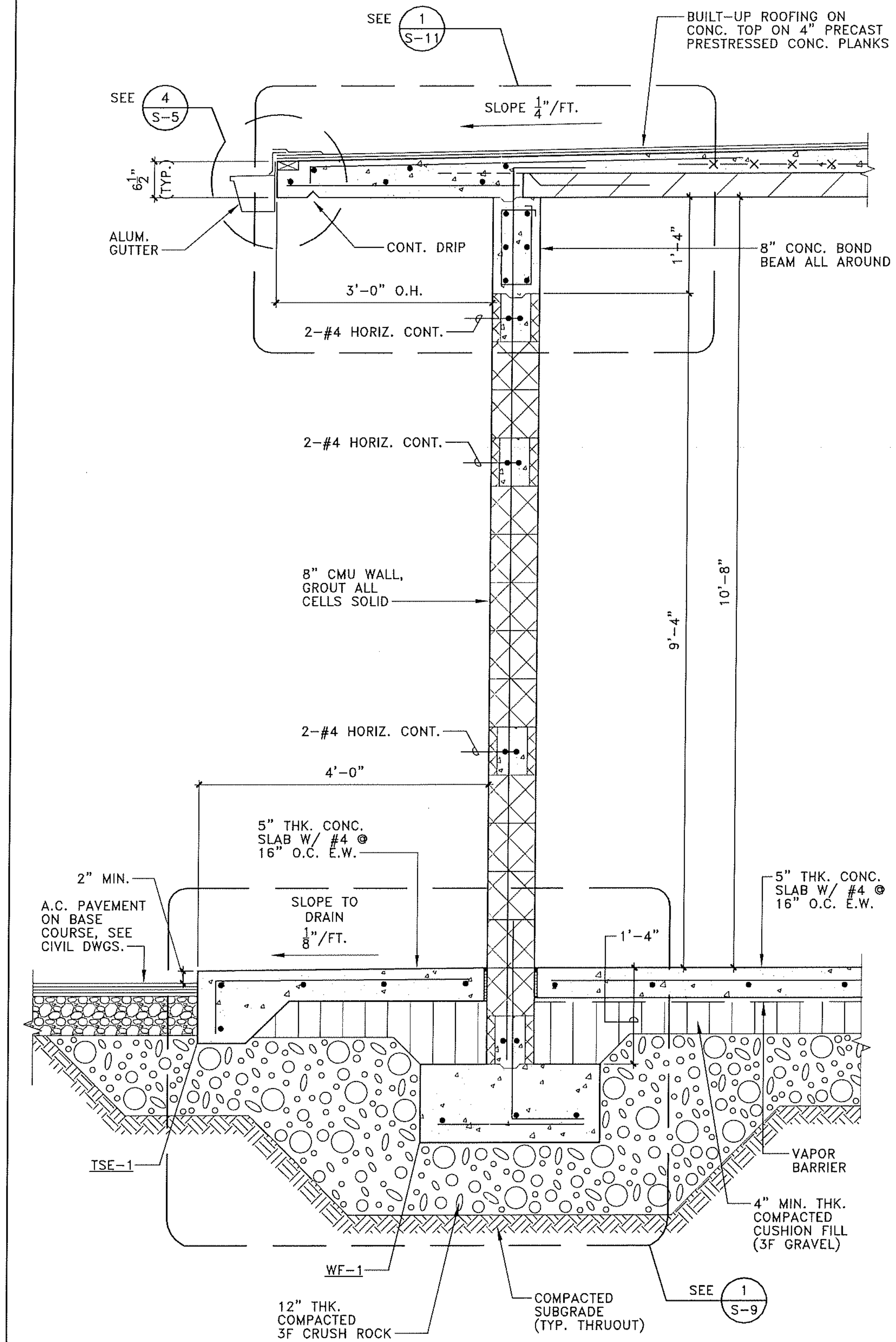
1 / S-7 GUTTER DETAIL

SCALE: 3" = 1'-0"



2 / S-7 SPLASH BLOCK – ISOMETRIC VIEW

NOT TO SCALE



3 / S-7 TYPICAL WALL SECTION

SCALE: 1" = 1'-0"

GRAPHIC SCALE:

1' 6" 0 1' 2'

SCALE: 1" = 1'-0"

0 6" 1'

SCALE: 3" = 1'-0"

REV. NO.	DESCRIPTION	DATE

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SIGNATURE

LICENSE EXPIRES: 04/30/20

ARNOLD TETSUJI OKUBO LICENSED PROFESSIONAL ENGINEER No. 4173-S HAWAII, U.S.A.

Arnold T. Okubo & Associates, Inc.
CONSULTING ENGINEERS
OAHU, HAWAII

KAHANA PRODUCTION WELL
TMK:(2) 4-3-001:017, (2) 4-4-004:009, (2) 4-4-004:019
LAHAINA, MAUI, HAWAII

DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

GUTTER & SPLASH BLOCK DETAILS & TYPICAL WALL SECTION

JOB NO.
DESIGNED BY: ATO
DRAWN BY: RMA/LC
CHECKED BY: ATO
DATE: APRIL 25, 2018

SHEET NUMBER

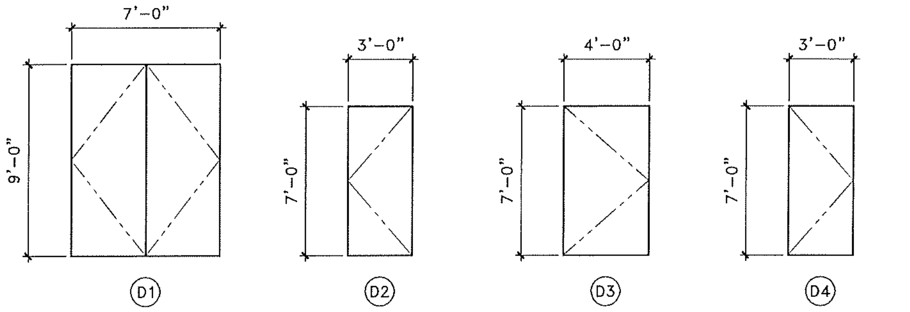
S-7

X OF XX SHEETS

09/14/2018

(A / S-8) DOOR SCHEDULE

SCALE: 1/4" = 1'-0"



D1: 7'-0" x 9'-0" DOOR — PAIR 1 3/4" THK. HOLLOW METAL DOORS

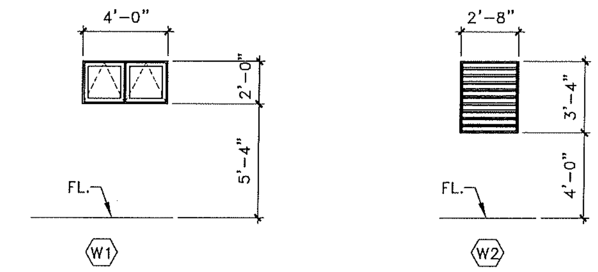
D2: 3'-0" x 7'-0" DOOR — 1 3/4" THK. HOLLOW METAL DOOR

D3: 4'-0" x 7'-0" DOOR — 1 3/4" THK. HOLLOW METAL DOOR

D4: 3'-0" x 7'-0" DOOR — 1 3/4" THK. HOLLOW METAL DOOR

(B / S-8) WINDOW SCHEDULE

SCALE: 1/4" = 1'-0"

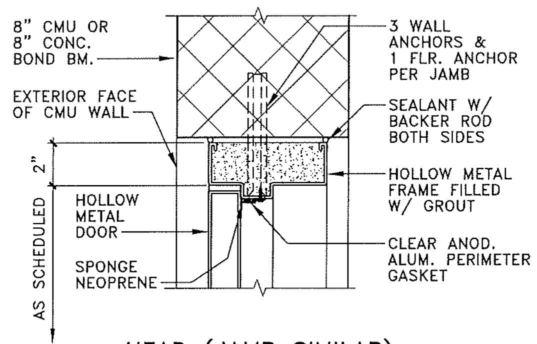


W1: 4'-0" x 2'-0" WINDOW — ALUMINUM AWNING W/ ALUMINUM INSECT SCREEN

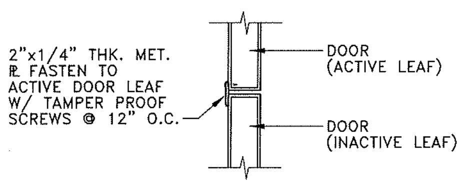
W2: 2'-8" x 3'-4" FIXED LOUVER WINDOW — METAL LOUVERS W/ S.S. INSECT SCREEN

(1 / S-8) DOOR DETAILS

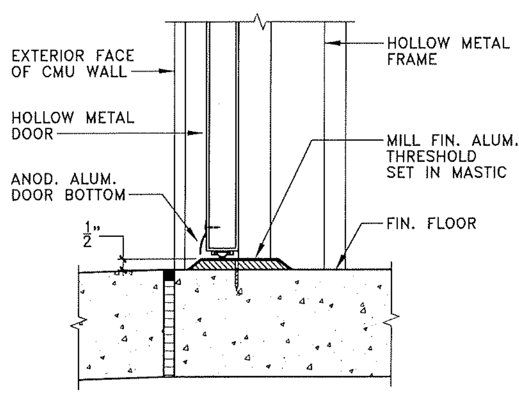
SCALE: 3" = 1'-0"



HEAD (JAMB SIMILAR)



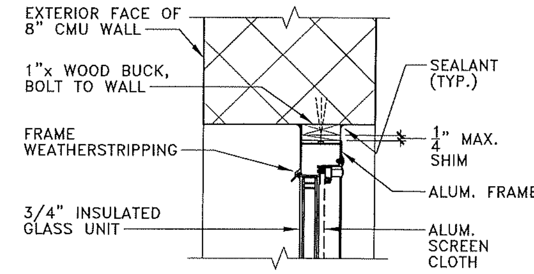
MEETING STILE



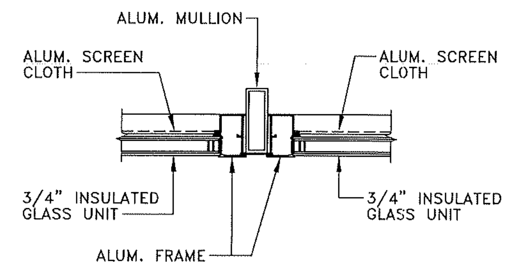
THRESHOLD

(2 / S-8) AWNING WINDOW DETAILS

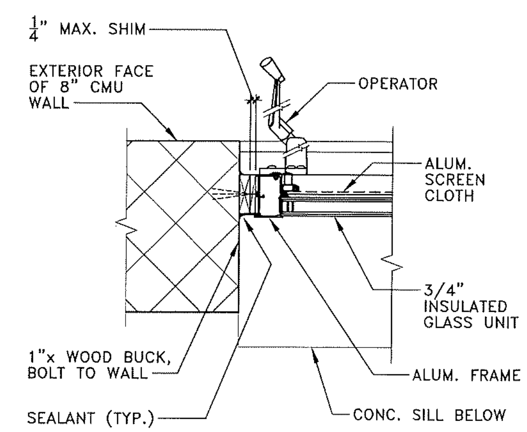
SCALE: 3" = 1'-0"



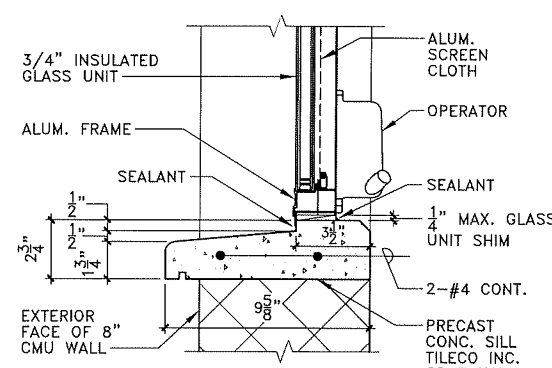
HEAD



MULLION



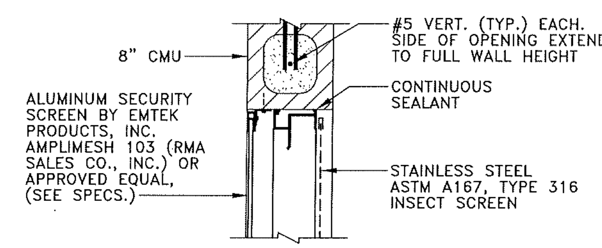
JAMB



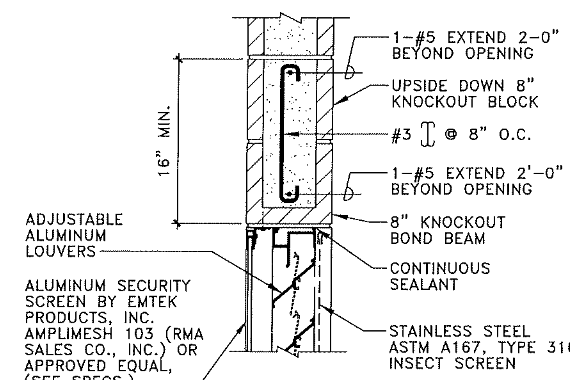
SILL

(3 / S-8) LOUVER DETAIL

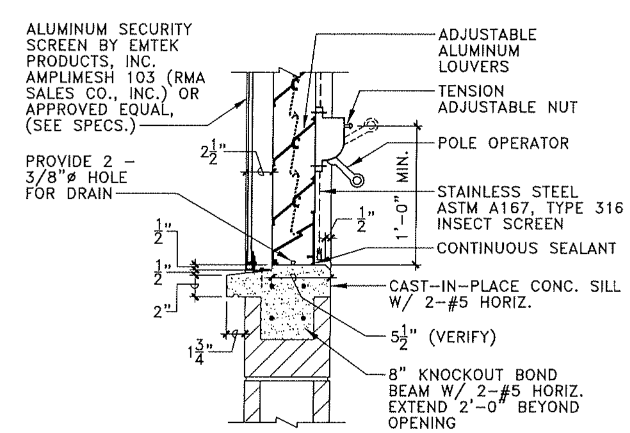
SCALE: 1 1/2" = 1'-0"



JAMB

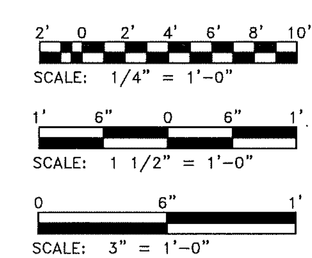


HEAD



SILL

GRAPHIC SCALE:



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SIGNATURE

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LAHAINA, MAUI, HAWAII

DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

DOOR & WINDOW SCHEDULES & DETAILS

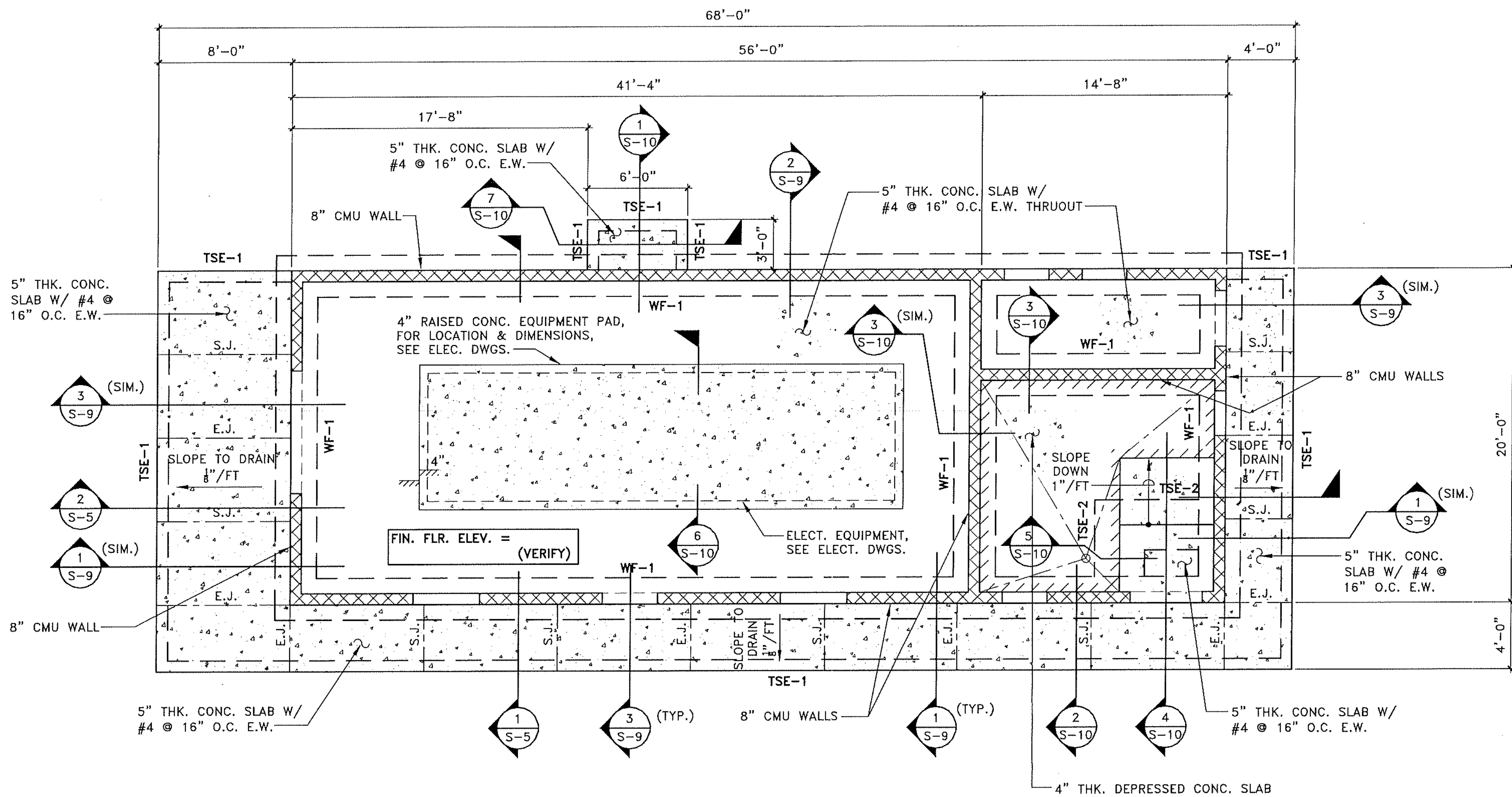
JOB NO.	
DESIGNED BY:	ATO
DRAWN BY:	RMA/LC
CHECKED BY:	ATO
DATE:	APRIL 25, 2018

SHEET NUMBER

S-8

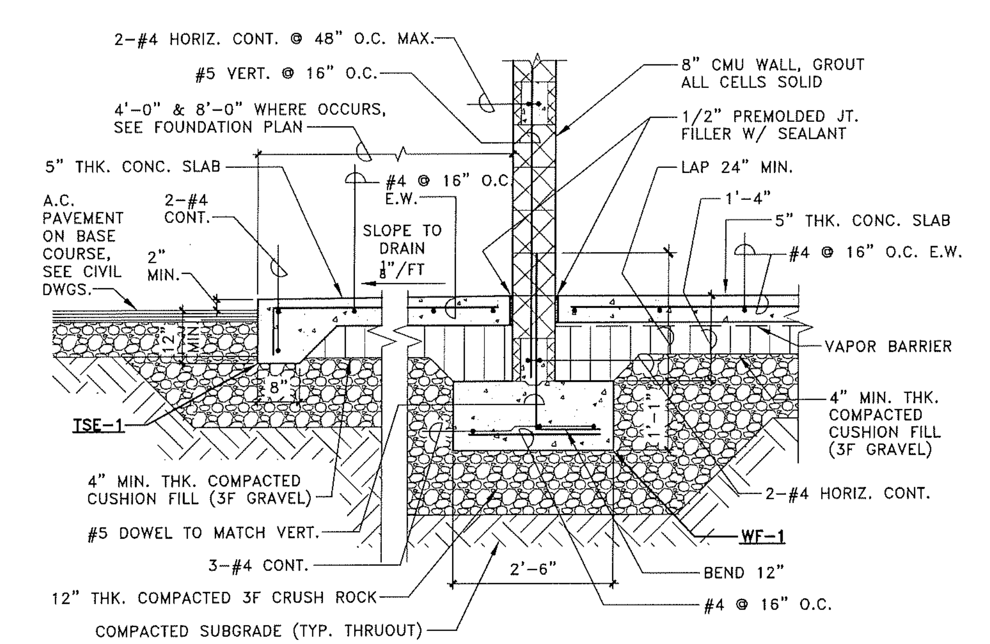
X OF XX SHEETS

09/14/2018



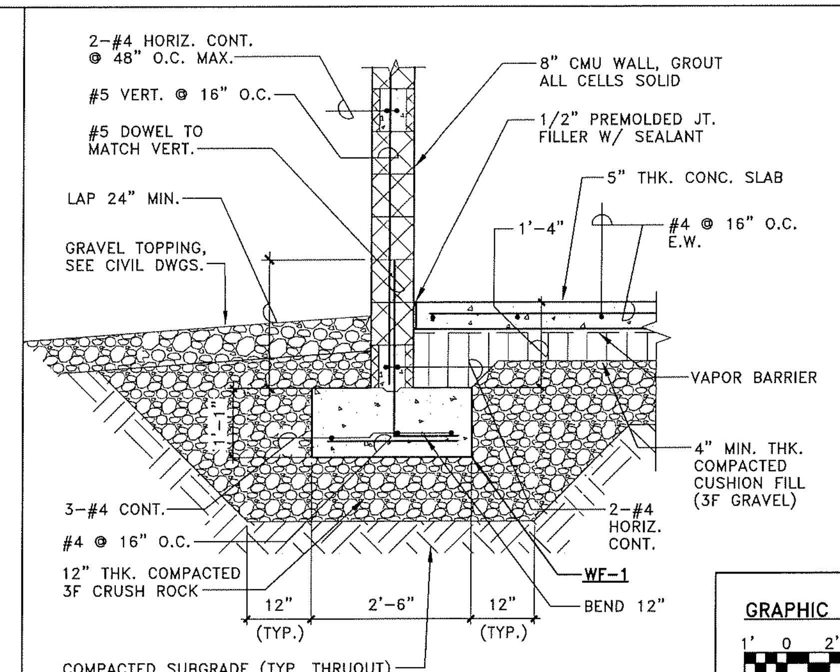
A S-9 BUILDING FOUNDATION PLAN

SCALE: 1/4" = 1'-0"



1 S-9 SECTION

SCALE: 3/4" = 1'-0"



2 S-9 SECTION

SCALE: 3/4" = 1'-0"

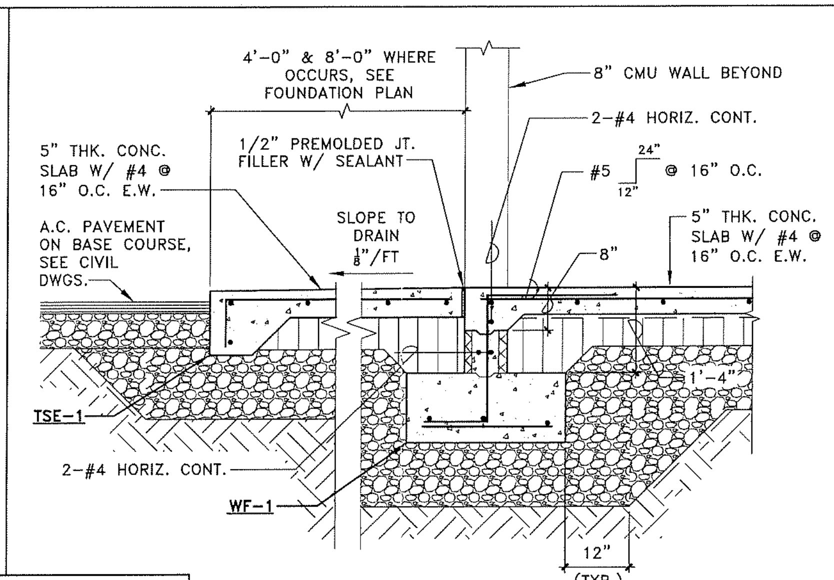
GRAPHIC SCALE:

1' 0 2' 4' 6' 8' 10'

SCALE: 1/4" = 1'-0"

1' 6" 0 1' 2' 3'

SCALE: 3/4" = 1'-0"



3 S-9 SECTION

SCALE: 3/4" = 1'-0"

NOTE:
FOR REMAINING NOTES, SEE 1/S-9.

REV. NO.	DESCRIPTION	DATE

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LAHAINA, MAUI, HAWAII

DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

BUILDING FOUNDATION PLAN & SECTIONS

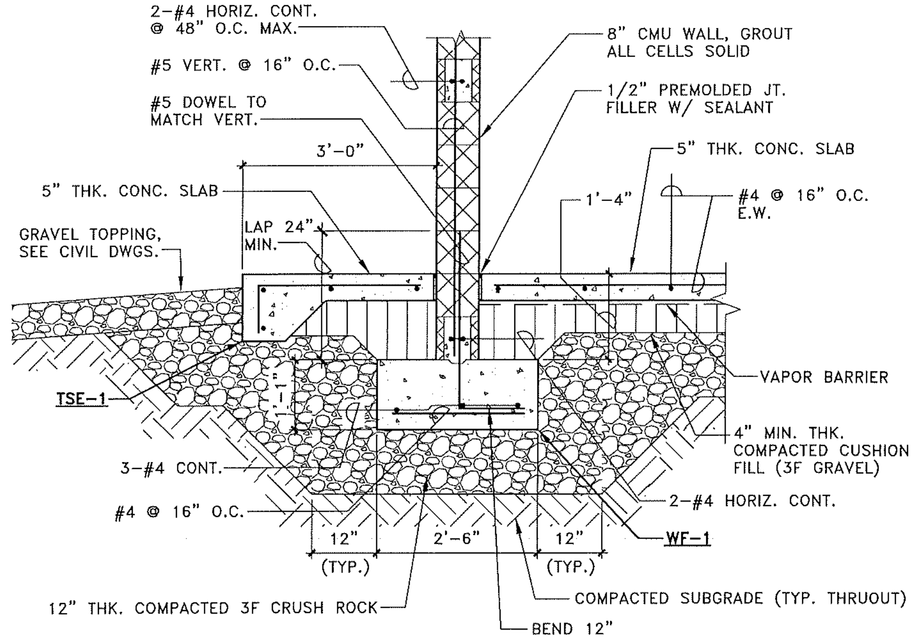
JOB NO.	
DESIGNED BY:	ATO
DRAWN BY:	RMA/LC
CHECKED BY:	ATO
DATE:	APRIL 25, 2018

SHEET NUMBER

S - 9

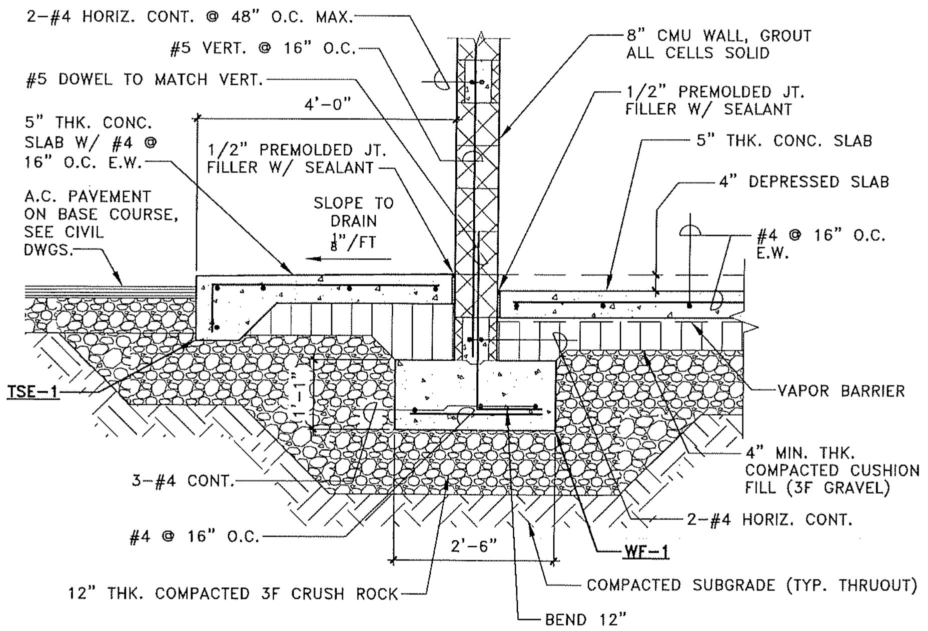
OF XX SHEETS

09/13/18



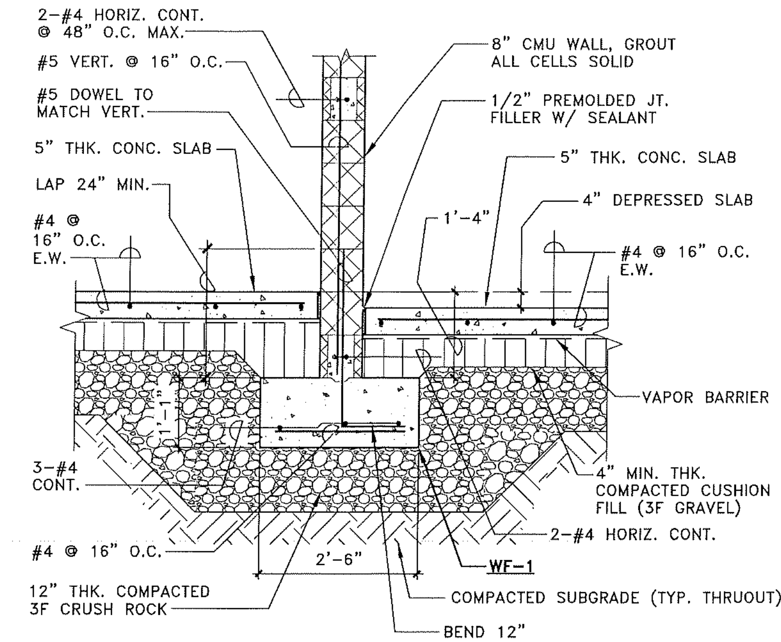
NOTE:
FOR REMAINING NOTES, SEE 1/S-9.

1 SECTION
S-10 SCALE: 3/4" = 1'-0"



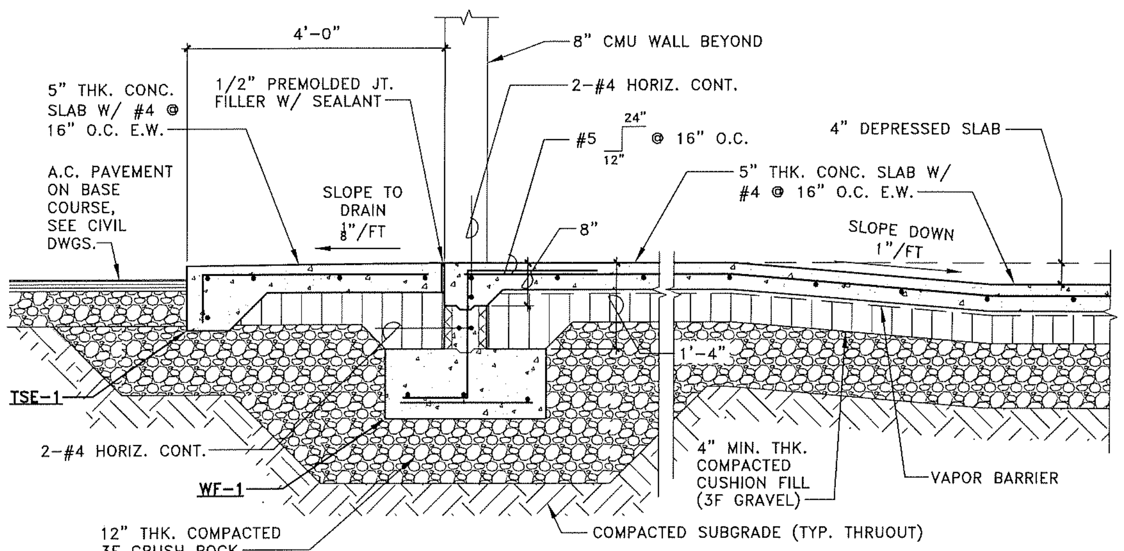
NOTE:
FOR REMAINING NOTES, SEE 1/S-9.

2 SECTION
S-10 SCALE: 3/4" = 1'-0"



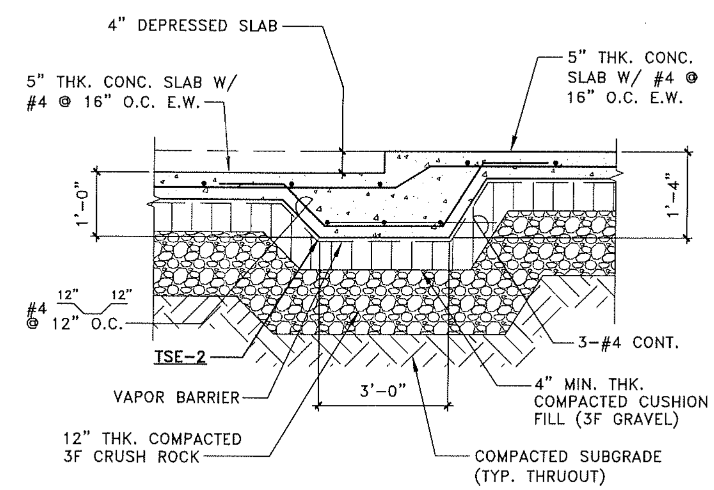
3 SECTION
S-10 SCALE: 3/4" = 1'-0"

NOTE:
FOR REMAINING NOTES, SEE 1/S-9.

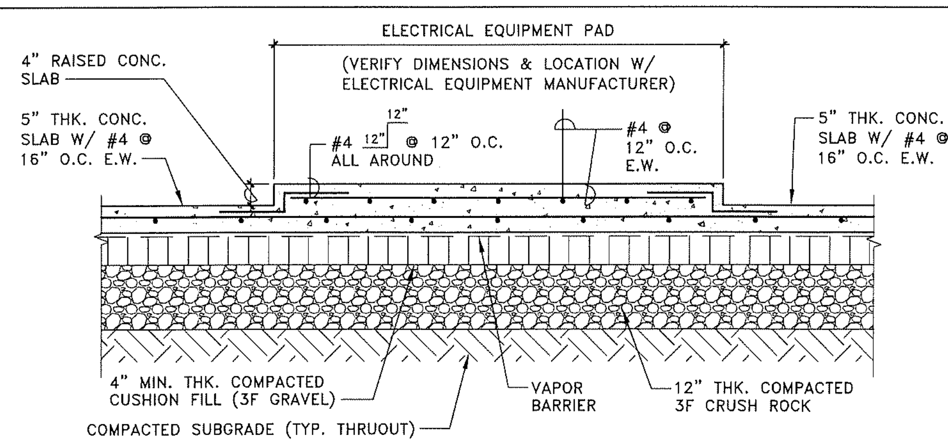


4 SECTION
S-10 SCALE: 3/4" = 1'-0"

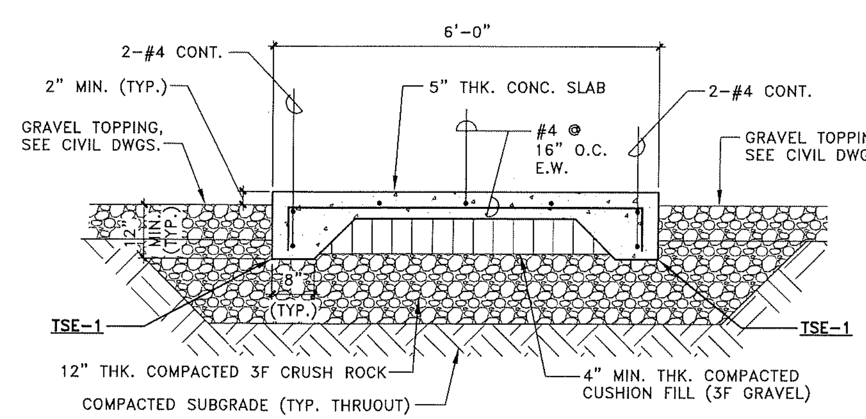
NOTE:
FOR REMAINING NOTES, SEE 1/S-9.



5 SECTION
S-10 SCALE: 3/4" = 1'-0"



6 TYPICAL RAISED CONCRETE SLAB DETAIL
S-10 SCALE: 3/4" = 1'-0"



7 SECTION
S-10 SCALE: 3/4" = 1'-0"

GRAPHIC SCALE:
1' 6" 0 1' 2' 3'
SCALE: 3/4" = 1'-0"

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LICENSED PROFESSIONAL ENGINEER
No. 4173-S
HAWAII, U.S.A.

Arnold T. Okubo & Associates, Inc.
CONSULTING ENGINEERS
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KAHANA PRODUCTION WELL
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LAHAINA, MAUI, HAWAII
DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

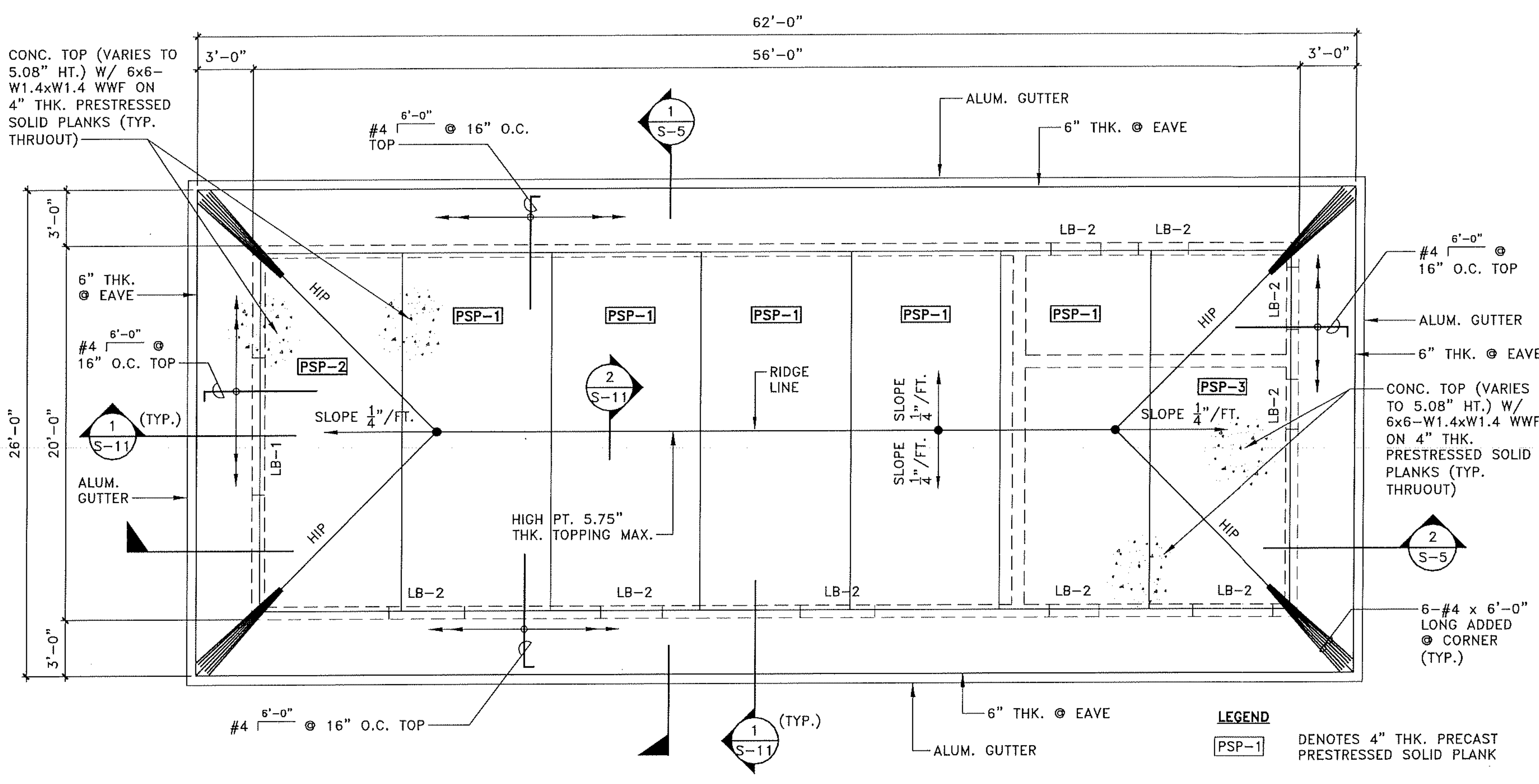
BUILDING FOUNDATION SECTIONS

JOB NO.	
DESIGNED BY:	ATO
DRAWN BY:	RMA/LC
CHECKED BY:	ATO
DATE:	APRIL 25, 2018

SHEET NUMBER
S -10
OF XX SHEETS

REV. NO.	DESCRIPTION	DATE

09/13/18

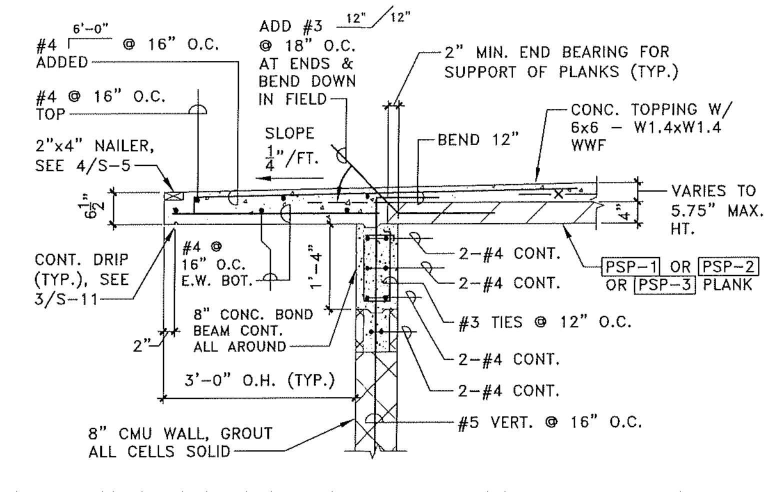


LEGEND

PSP-1 DENOTES 4" THK. PRECAST PRESTRESSED SOLID PLANK

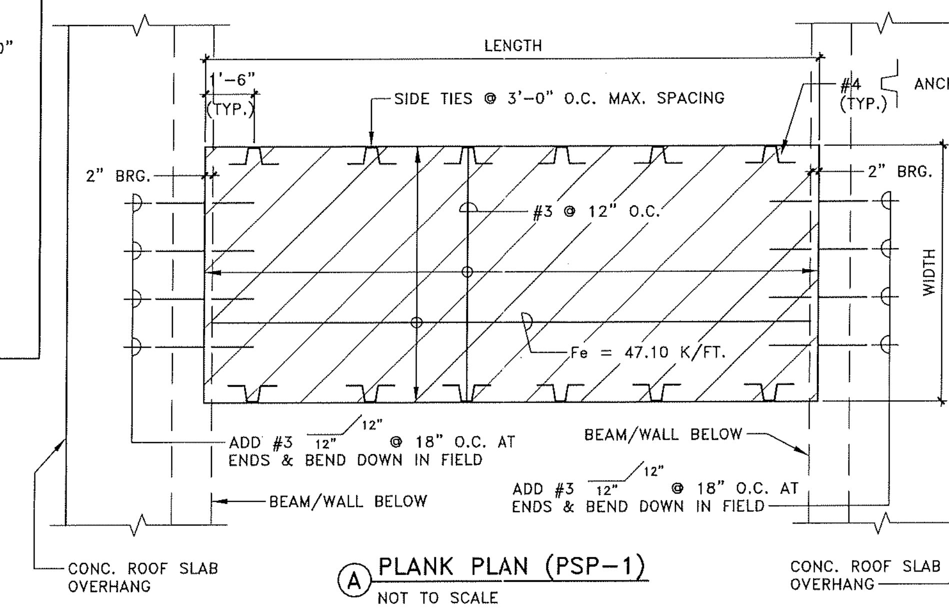
A S-11 BUILDING ROOF FRAMING PLAN (CONCRETE TOPPING OVER PRESTRESSED SOLID PLANK)

SCALE: 1/4" = 1'-0"



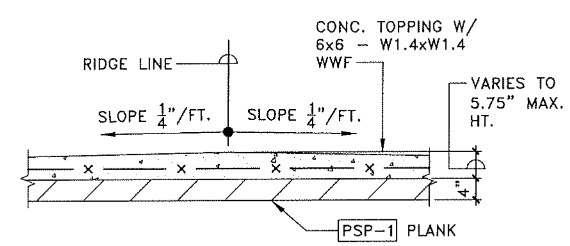
1 S-11 SECTION

SCALE: 3/4" = 1'-0"



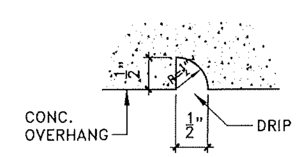
A PLANK PLAN (PSP-1)

NOT TO SCALE



2 S-11 SECTION

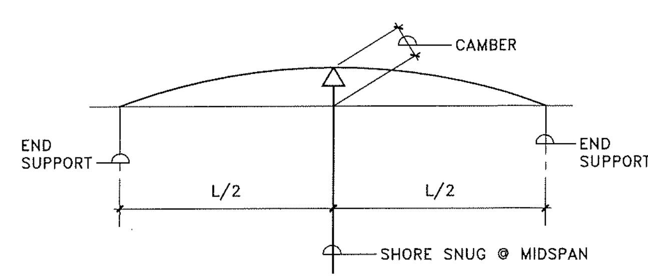
SCALE: 3/4" = 1'-0"



3 S-11 DRIP DETAIL

NOT TO SCALE

NOTE:
OMIT SIDE TIE CONNECTORS FOR PLANKS AT OUTER EDGES.

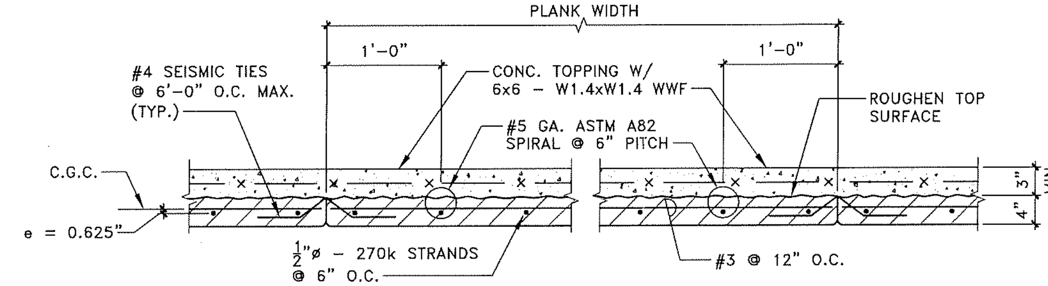


C PLANK SHORING DETAIL

NOT TO SCALE

SHORING PROCEDURES

1. PLACE PLANK/SLAB ON 2 END SUPPORTS.
2. SHORE SNUG AT MIDSPAN.
3. CAST CONCRETE TOPPING.



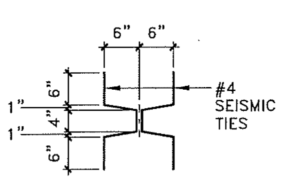
B PLANK SECTION

NOT TO SCALE

Fe DENOTES EFFECTIVE PRESTRESSING FORCE (KIPS/FT.)

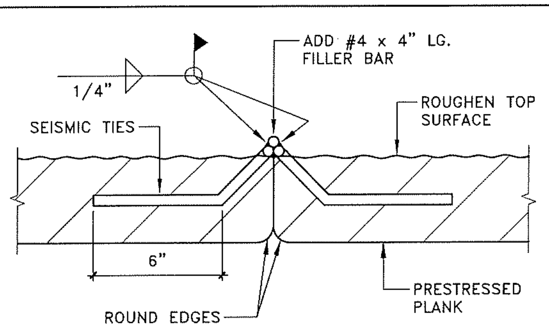
5 S-11 PRESTRESSED SOLID PLANK DETAILS (PSP-1, PSP-2, & PSP-3)

NOT TO SCALE



A SEISMIC TIES

SCALE: 3/4" = 1'-0"



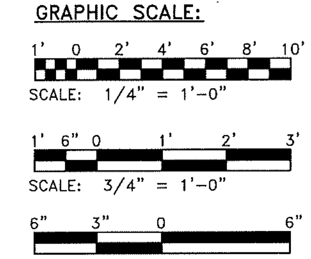
B SECTION

SCALE: 3" = 1'-0"

4 S-11 TYPICAL SEISMIC TIES DETAILS

SCALE AS SHOWN

GRAPHIC SCALE:



REV. NO.	DESCRIPTION	DATE

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY PERIODIC OBSERVATION.

ARNOLD TETSUJI OKUBO LICENSED PROFESSIONAL ENGINEER No. 4173-S HAWAII, U.S.A.

SIGNATURE

LICENSE EXPIRES: 04/30/20

Arnold T. Okubo & Associates, Inc.
CONSULTING ENGINEERS
OAHU, HAWAII

KAHANA PRODUCTION WELL
TMK:(2) 4-3-001:017, (2) 4-4-004:009, (2) 4-4-004:019
LAHAINA, MAUI, HAWAII

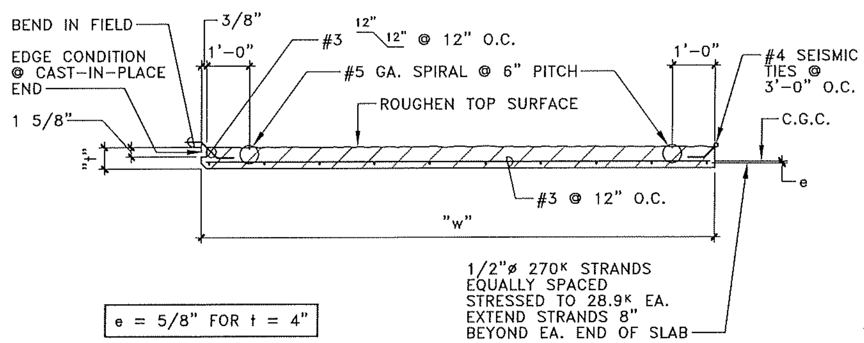
DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

BUILDING ROOF FRAMING PLAN & SECTIONS, PRESTRESSED SOLID PLANK DETAILS

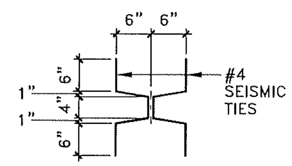
JOB NO.
DESIGNED BY: ATO
DRAWN BY: RMA/LC
CHECKED BY: ATO
DATE: APRIL 25, 2018

SHEET NUMBER
S-11
X OF XX SHEETS

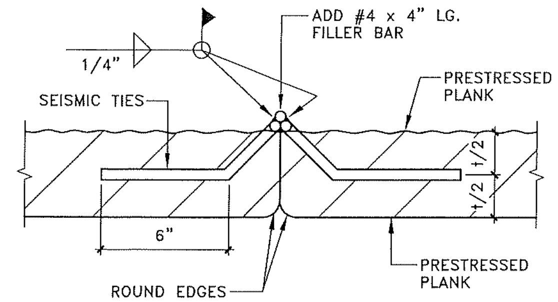
09/14/2018



1 S-12 PRECAST PRESTRESSED PLANK SECTION
NOT TO SCALE

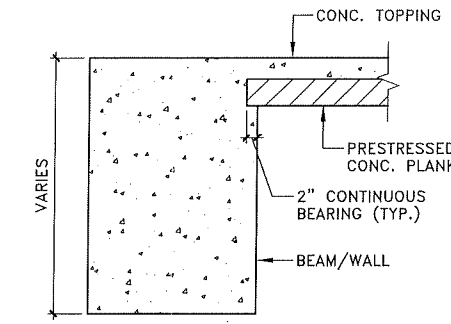


A SEISMIC TIES
SCALE: 3/4" = 1'-0"

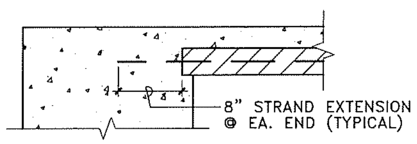


B SECTION
SCALE: 3" = 1'-0"

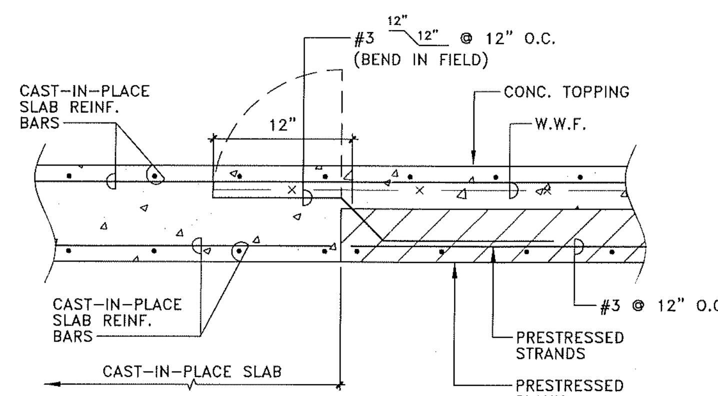
2 S-12 TYPICAL SEISMIC TIES DETAIL
SCALE: AS SHOWN



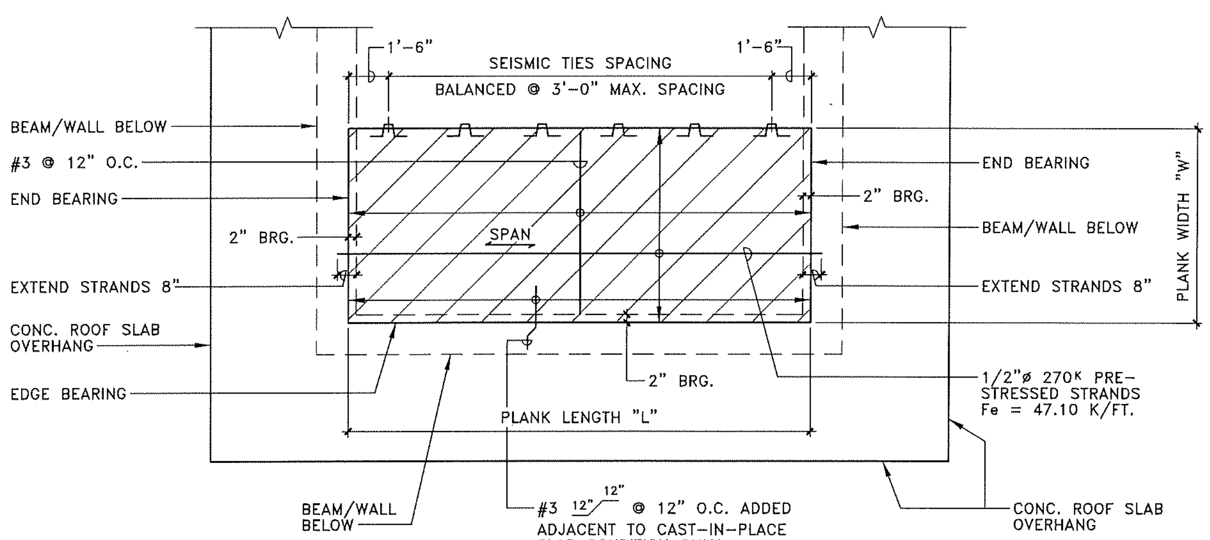
3 S-12 TYPICAL PRESTRESSED CONCRETE PLANK END & EDGE BEARING
NOT TO SCALE



4 S-12 TYPICAL PRESTRESSED CONCRETE PLANK STRAND EXTENSION
NOT TO SCALE



5 S-12 TYPICAL SECTION @ C.I.P. SLAB & PRESTRESSED PLANK
NOT TO SCALE



6 S-12 PLAN – CONCRETE PLANK DETAIL (PS-2 & PS-3)
SCALE: AS SHOWN

GRAPHIC SCALE:

1' 6" 0 6" 1' 2' 3'
SCALE: 3/4" = 1'-0"

0 6" 1'
SCALE: 3" = 1'-0"

REV. NO.	DESCRIPTION	DATE

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SIGNATURE
LICENSE EXPIRES: 04/30/20

ARNOLD TETSUJI OKUBO
LICENSED PROFESSIONAL ENGINEER
No. 4173-S
HAWAII, U.S.A.

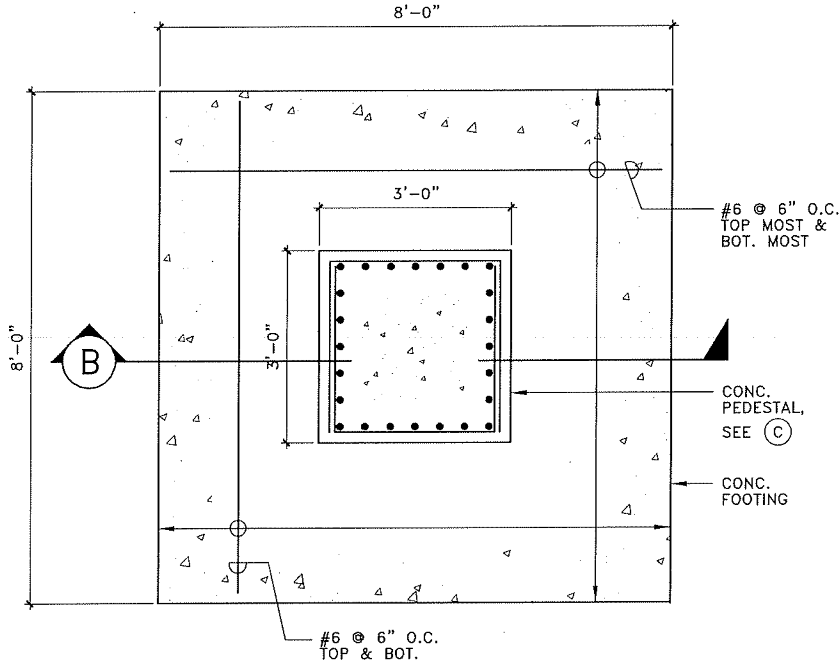
Arnold T. Okubo & Associates, Inc.
CONSULTING ENGINEERS
OAHU, HAWAII

KAHANA PRODUCTION WELL
TMK:(2) 4-3-001:017, (2) 4-4-004:009, (2) 4-4-004:019
LAHAINA, MAUI, HAWAII
DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

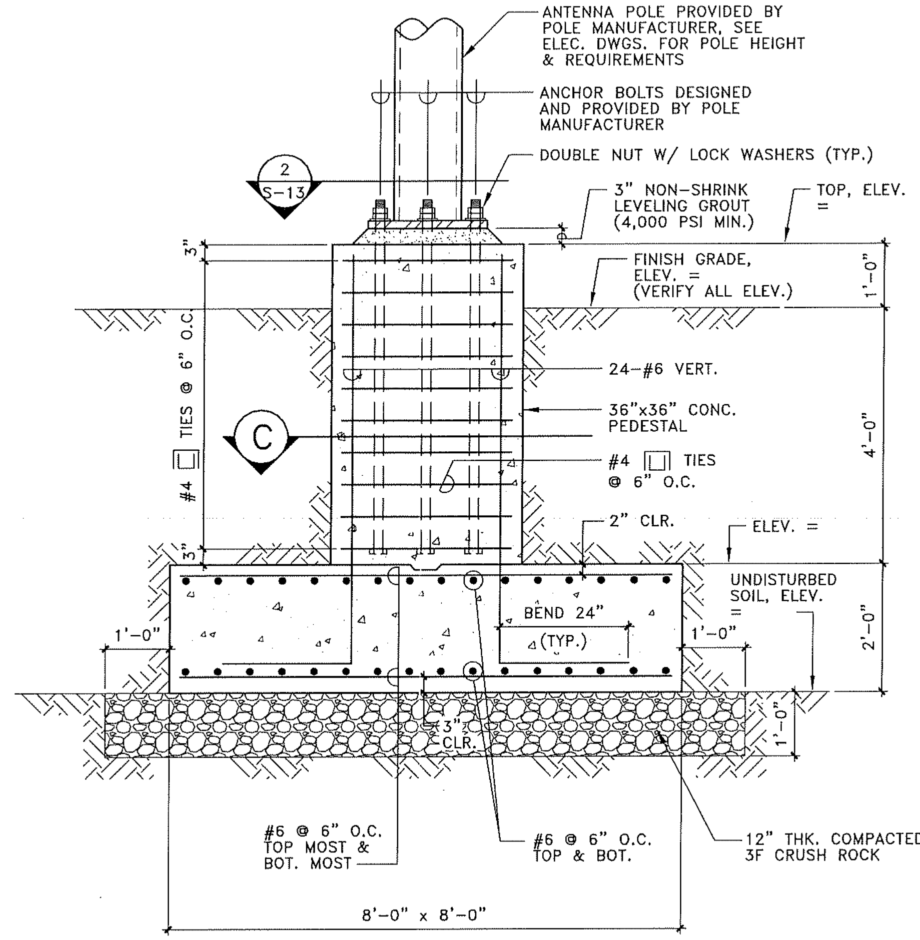
TYPICAL PRESTRESSED CONCRETE PLANK DETAILS

JOB NO.
DESIGNED BY: ATO
DRAWN BY: RMA/LC
CHECKED BY: ATO
DATE: APRIL 25, 2018
SHEET NUMBER
S -12
OF XX SHEETS

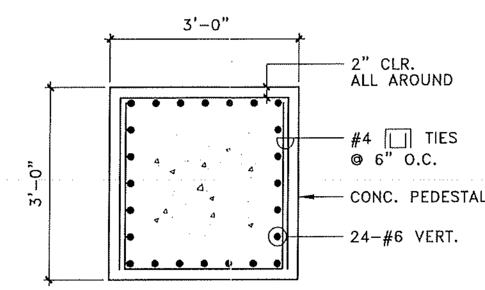
09/14/2018



A FOUNDATION PLAN



B SECTION

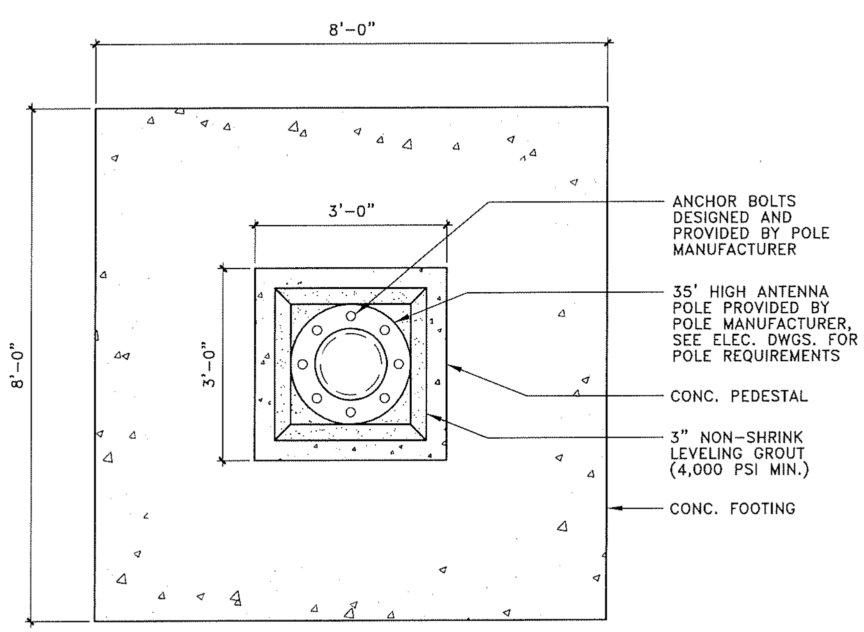


C SECTION AT CONCRETE PEDESTAL

1 S-13 ANTENNA POLE FOUNDATION DETAILS
SCALE: 3/4" = 1'-0"

NOTES:

1. CONTRACTOR SHALL VERIFY ALL ELEVATIONS SHOWN PRIOR TO CONSTRUCTION. ADJUST ELEVATIONS SHOWN IF DIFFER. NOTIFY ENGINEER PRIOR TO ADJUSTMENT OF ELEVATION.
2. ANTENNA FOUNDATION SHALL BEAR ON UNDISTURBED SOIL.



2 S-13 ANTENNA POLE FOUNDATION PLAN
SCALE: 3/4" = 1'-0"

GRAPHIC SCALE:
1' 6" 0 1' 2' 3'
SCALE: 3/4" = 1'-0"

REV. NO.	DESCRIPTION	DATE

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SIGNATURE

LICENSE EXPIRES: 04/30/20

ARNOLD TETSUJI OKUBO, LICENSED PROFESSIONAL ENGINEER No. 4173-S, HAWAII, U.S.A.

Arnold T. Okubo & Associates, Inc.
CONSULTING ENGINEERS
OAHU, HAWAII

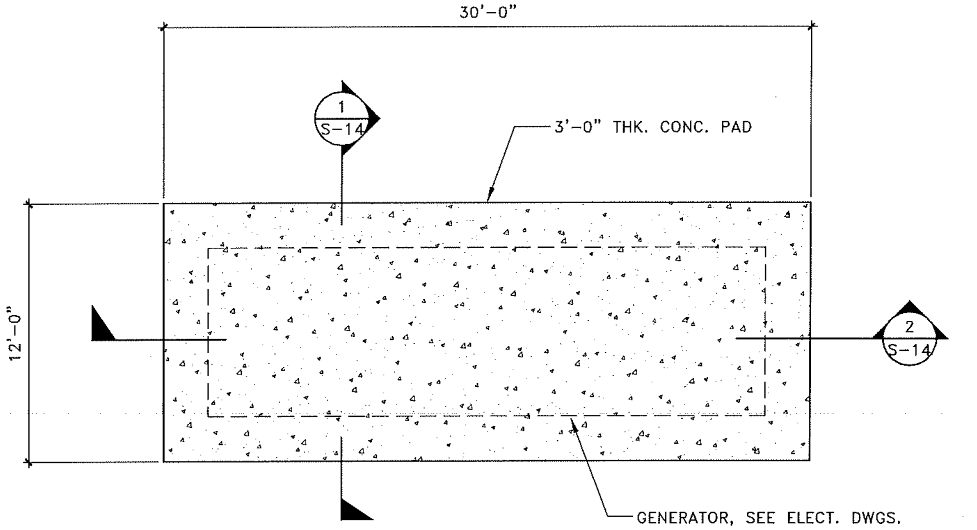
KAHANA PRODUCTION WELL
TMK:(2) 4-3-001:017, (2) 4-4-004:009, (2) 4-4-004:019
LAHAINA, MAUI, HAWAII

DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

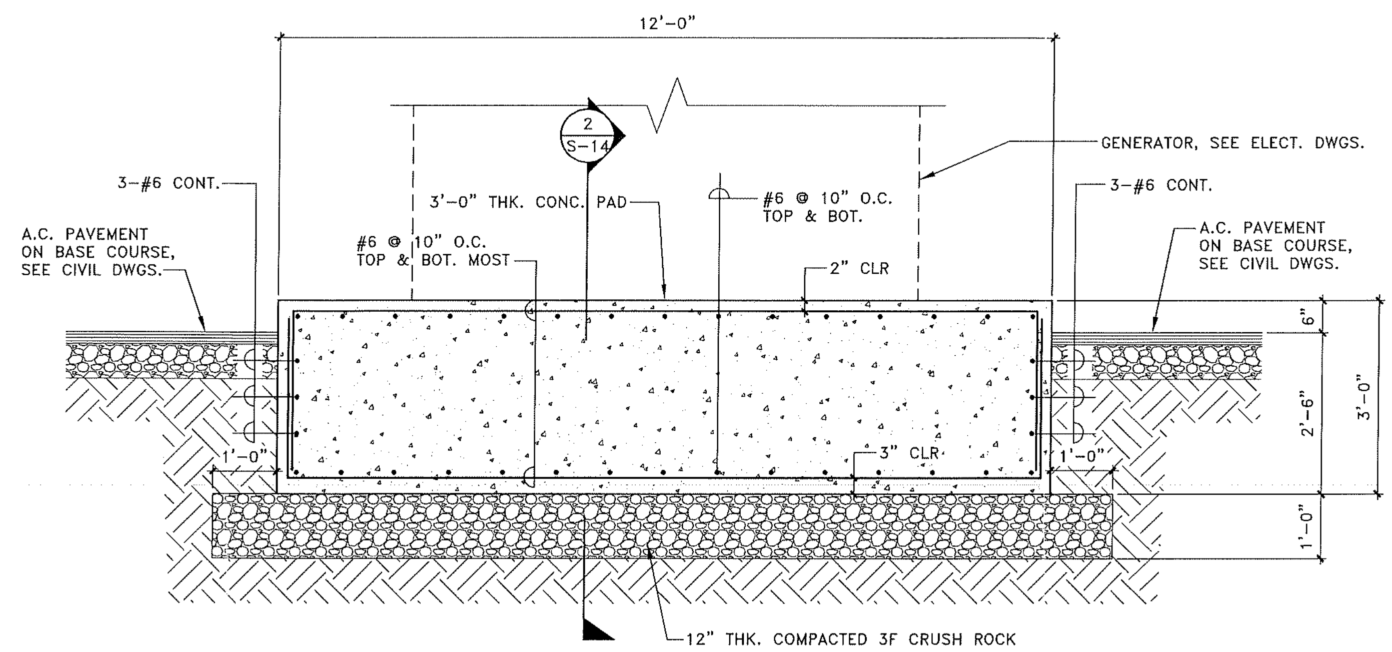
ANTENNA POLE FOUNDATION DETAILS & PLAN

JOB NO.
DESIGNED BY: ATO
DRAWN BY: RMA/LC
CHECKED BY: ATO
DATE: APRIL 25, 2018
SHEET NUMBER
S -13
OF XX SHEETS

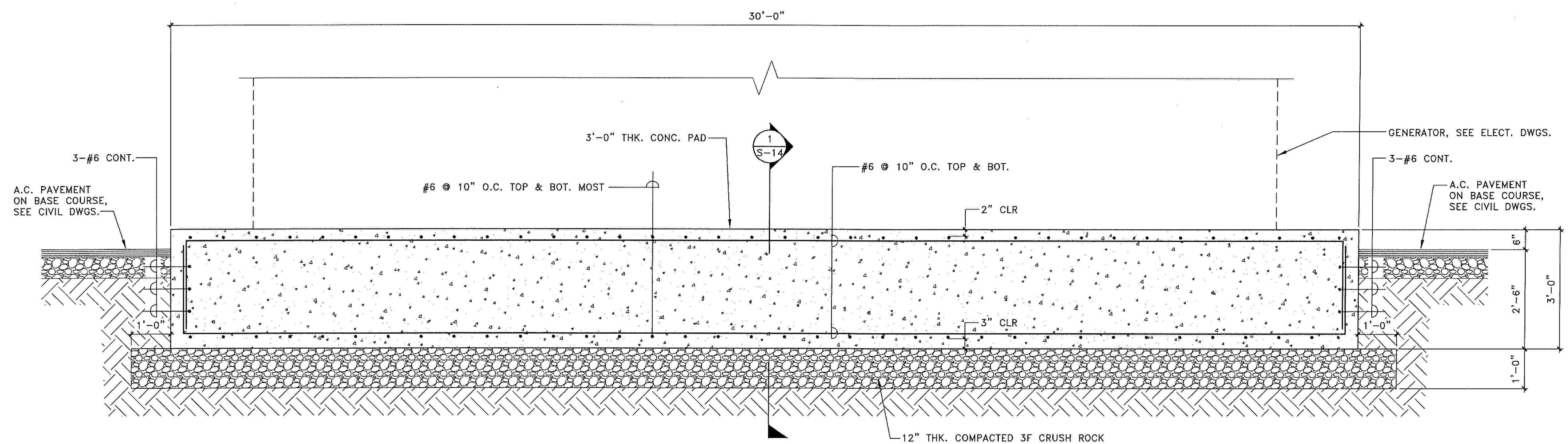
09/13/18



A
S-14
GENERATOR CONCRETE FOUNDATION PAD PLAN
SCALE: 1/4" = 1'-0"



1
S-14
SECTION
SCALE: 3/4" = 1'-0"



2
S-14
SECTION
SCALE: 3/4" = 1'-0"

GRAPHIC SCALE:

1' 0 2' 4' 6' 8' 10'
SCALE: 1/4" = 1'-0"

1' 6" 0 1' 2' 3'
SCALE: 3/4" = 1'-0"

REV. NO.	DESCRIPTION	DATE

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SIGNATURE

LICENSE EXPIRES: 04/30/20

ARNOLD TETSUJI OKUBO * LICENSED PROFESSIONAL ENGINEER No. 4173-S * HAWAII, U.S.A.

Arnold T. Okubo & Associates, Inc.
CONSULTING ENGINEERS
OAHU, HAWAII

KAHANA PRODUCTION WELL
TMK:(2) 4-3-001:017, (2) 4-4-004:009,
(2) 4-4-004:019
LAHAINA, MAUI, HAWAII

DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
DWS JOB NO. 15-04

GENERATOR CONCRETE FOUNDATION PAD DETAILS

JOB NO.	
DESIGNED BY:	ATO
DRAWN BY:	RMA/LC
CHECKED BY:	ATO
DATE:	APRIL 25, 2018

SHEET NUMBER
S -14
OF XX SHEETS

09/13/18

GENERAL NOTES:

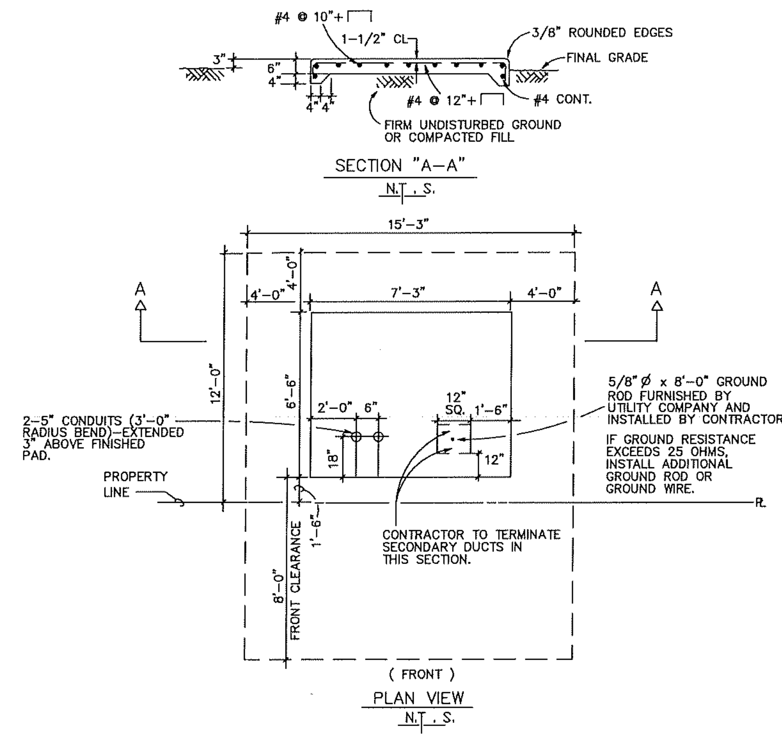
1. PROVIDE A COMPLETE AND OPERATING ELECTRICAL SYSTEM. PROVIDE SHALL MEAN "FURNISH AND INSTALL". WORK INCLUDES INSTALLATION OF ALL ELECTRICAL EQUIPMENT AND SYSTEMS, INCLUDING ANY FURNISHED BY OWNER, COMPLETE AND OPERATIONAL TO DOCUMENTS.
2. THE CONTRACTOR SHALL COMPLY WITH THE CONSTRUCTION PRACTICES AND REQUIREMENTS OF THE LATEST EDITION OF THE NATIONAL ELECTRIC CODE (NFPA 70), NATIONAL ELECTRICAL SAFETY CODE, AMERICAN ELECTRICIANS HANDBOOK BY CROFT EDISON ELECTRIC INSTITUTE, APPLICABLE INSTRUCTIONS OF MANUFACTURERS OF EQUIPMENT AND MATERIALS SUPPLIED FOR THE PROJECT, AND ALL ORDINANCES, RULES AND POLICIES OF THE STATE AND COUNTY IN WHICH THE WORK IS TO BE PERFORMED.
3. THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL FEES, PERMITS, LICENSES AND INSPECTIONS REQUIRED FOR THIS WORK.
4. ALL CONDUIT SHALL BE MINIMUM SIZE 3/4 INCH. EMT SHALL BE USED INDOORS. STAINLESS STEEL SHALL BE USED IN EXPOSED OUTDOOR LOCATIONS. CONDUIT BELOW GRADE SHALL BE SCHEDULE 40 PVC. TRANSFORM ALL PVC CONDUIT TO RIGID STAINLESS STEEL BEFORE PENETRATING SLAB.
5. FITTINGS FOR EMT CONDUIT SHALL BE COMPRESSION TYPE. SET SCREW FITTINGS SHALL NOT BE ALLOWED.
6. CONDUITS SIZES CALLED OUT ON THE DRAWINGS ARE NOT NECESSARILY BASED ON THE MINIMUM SIZE ALLOWED BY THE NATIONAL ELECTRICAL CODE AND MAY BE PURPOSELY OVERSIZED FOR FUTURE CONDUCTORS OR TO AVOID EXCESS CONDUIT HEATING. CONDUIT SIZES NOT CALLED OUT ON THE DRAWINGS SHALL BE SIZED BY THE CONTRACTOR BASED ON THE ACTUAL NUMBER OF CONDUCTORS TO BE INSTALLED, USING THE NATIONAL ELECTRICAL CODE AS A GUIDE. IN NO CASE SHALL CONDUIT SIZES BE SMALLER THAN IS REQUIRED BY THE NATIONAL ELECTRICAL CODE.
7. ALL CIRCUITS SHALL INCLUDE AN INSULATED GREEN GROUNDING CONDUCTOR, SIZED PER TABLE 250-122 OF THE NATIONAL ELECTRICAL CODE. THIS CONDUCTOR SHALL BE CARRIED IN ALL RACEWAYS INCLUDING THOSE INSTALLED FOR SWITCH LEGS AND SHALL BE ATTACHED TO THE DEVICE OR EQUIPMENT HOUSING USING A SUITABLE GROUNDING LUG.
8. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL JUNCTION AND PULL BOXES REQUIRED FOR THE INSTALLATION OF ELECTRICAL DEVICES AND EQUIPMENT, WHETHER OR NOT SPECIFICALLY INDICATED ON THE PLANS. SIZING OF THESE BOXES SHALL BE PER THE NATIONAL ELECTRICAL CODE.
9. THE CONTRACTOR SHALL FURNISH ALL EQUIPMENT FOR TEMPORARY CONSTRUCTION POWER AS REQUIRED.
10. SHOULD PROJECT CONDITIONS REQUIRE REARRANGEMENT OF WORK, THE CONTRACTOR SHALL MARK SUCH CHANGES ON THE FIELD POSTED DRAWINGS. IF THESE CHANGES REQUIRE ALTERNATE METHODS TO THOSE SPECIFIED IN THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL SUBMIT DRAWINGS SHOWING THE PROPOSED ALTERNATE METHODS TO THE CONTRACTING OFFICER. THE CONTRACTOR SHALL NOT PROCEED UNTIL APPROVAL IS OBTAINED. REARRANGEMENT OF WORK FOR THE PURPOSE OF COORDINATION SHALL NOT BE CONSIDERED AN ITEM FOR EXTRA COST.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING AND DETAILED SCHEDULING OF THE SITE INSPECTION WORK BY UTILITY COMPANIES AND ALL OTHER CONCERNED PARTIES AND AGENCIES.
12. PROVIDE PROTECTION FOR MATERIAL AND EQUIPMENT FROM LOSS, DAMAGE, CORROSION AND EFFECTS OF MOISTURE. REPAIR OR REPLACE DAMAGED ITEMS AT NO ADDITIONAL COST TO THE OWNER.
13. VISIT PROJECT SITE PRIOR TO BID SUBMITTAL TO ASCERTAIN CONDITIONS AND COST ALLOWANCES THAT AFFECT THE PROPOSED WORK.
14. INSTALL MATERIALS AND EQUIPMENT IN WORKMANLIKE MANNER AND IN STRICT ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, UNLESS OTHERWISE SPECIFIED OR DIRECTED BY THE ENGINEER.
15. MATERIALS AND WORKMANSHIP SUBJECT TO INSPECTION AT ANY TIME BY THE OWNER OR HIS REPRESENTATIVE; CORRECT ANY WORK OR MATERIALS NOT IN ACCORDANCE WITH DRAWINGS OR FOUND TO BE DEFICIENT OR DEFECTIVE IN A MANNER SATISFACTORY TO THE OWNER AT NO ADDITIONAL COST.
16. PROVIDE ALL FIRST QUALITY, NEW MATERIALS, FREE FROM DEFECTS SUITABLE FOR SPACE PROVIDED AND APPROVED BY UL WHERE STANDARDS HAVE BEEN PROVIDED BY THAT AGENCY.
17. PROVIDE STANDARD MATERIALS AND EQUIPMENT OF MANUFACTURER'S REGULARLY ENGAGED IN THE PRODUCTION OF THESE PRODUCTS. PROVIDE PRODUCTS OF A SINGLE MANUFACTURER WHERE TWO OR MORE UNITS OF THE SAME CALL ARE REQUIRED.
18. ALL WIRING TO BE STRANDED TYPE THWN COPPER UNLESS NOTED OTHERWISE, #12 AWG MINIMUM, ALL WIRING SHALL BE IN CONDUIT, 3/4" MINIMUM. THHN IS ALLOWABLE FOR #10 AND SMALLER.

DUCTLINE NOTES

1. REFER TO ELECTRICAL PLAN FOR DUCT SIZES AND QUANTITIES.
2. DIRECT BURIED AND CONCRETE ENCASED ELECTRICAL CONDUITS SHALL BE PVC SCHEDULE 40 CONDUITS.
3. DIRECT BURIED CONDUITS OF LIKE USE SHALL BE SEPARATED BY A MINIMUM OF 3". A MINIMUM SEPARATION OF 12" MUST BE MAINTAINED BETWEEN ELECTRICAL CONDUITS AND TELEMETRY CONDUITS.

   CONCRETE ENCASED CONDUITS OF LIKE USE MAY BE SEPARATED BY 1-1/2". CONDUITS OF UNLIKE USES MUST BE SEPARATED BY 3".
4. CONTRACTOR SHALL COORDINATE DUCTLINE AND TRENCHING DETAILS WITH UTILITY COMPANIES.
5. UPON COMPLETION OF ALL DUCTLINES, THE CONTRACTOR SHALL PASS A BULLET SHAPED, WOODEN TEST MANDREL 1/2" SMALLER IN DIAMETER THAN THE CONDUITS, THROUGH THE ENTIRE LENGTH OF EACH DUCT SECTION TO TEST FOR FREEDOM OF BURRS AND OBSTRUCTIONS. THE CONTRACTOR SHALL REMOVE ALL BURRS, OBSTRUCTION AND FOREIGN MATTER TO THE SATISFACTION OF THE UTILITY COMPANIES' INSPECTORS.

   UPON COMPLETION OF THE TELEMETRY DUCTLINE, THE CONTRACTOR SHALL PASS A BLOCKED SHAPED, WOODEN TEST MANDREL, 12" LONG AND 1/4" SMALLER IN DIAMETER THAN THE CONDUIT THROUGH THE ENTIRE LENGTH OF EACH DUCT SECTION. THE DUCTS SHALL BE SWABBED AND CLEARED OF ALL BURRS, OBSTRUCTIONS AND FOREIGN MATERIAL.
6. THE UTILITY COMPANIES' INSPECTORS SHALL INSPECT THE UNDERGROUND DUCTLINES AND STRUCTURES PRIOR TO AND DURING ALL CONCRETE POUR AND BACKFILL OPERATIONS.
7. ALL HORIZONTAL AND VERTICAL BENDS SHALL HAVE A MINIMUM RADIUS OF 20'-0".
8. CONCRETE COMPRESS STRENGTH SHALL BE 3,000 PSI IN 28 DAYS.
9. THE CONTRACTOR SHALL INSTALL A WARNING TAPE OVER DUCTLINE AS SHOWN THE TAPE SHALL BE 4" WIDE AND 8 MILS THICK, YELLOW IN COLOR WITH BLACK IMPRINTED WARNING MESSAGE.



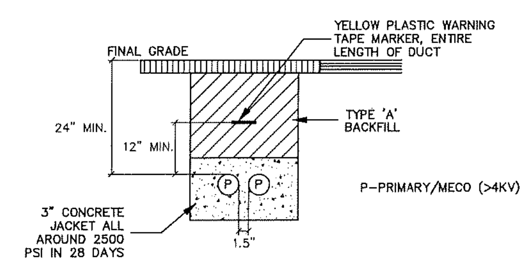
1 E-0 THREE PHASE TRANSFORMER PAD
NOT TO SCALE

CONTRACTOR NOTES:

1. THE CONTRACTOR IS TO FURNISH MATERIALS AND CONSTRUCT THE FACILITIES FOR THE PADMOUNT TRANSFORMER INCLUDING THE CONCRETE PAD, PRIMARY AND SECONDARY DUCTS AND ANCHOR BOLTS. CONCRETE CURB AND ROCK FILL AROUND THE PAD, WHEN REQUIRED, SHALL ALSO BE FURNISHED AND INSTALLED BY THE CONTRACTOR.
2. MECO SHALL HAVE 24-HOUR ACCESS TO THE TRANSFORMER WITHOUT GOING THROUGH LOCKED AREAS.
3. MECO SHALL HAVE A MINIMUM OF 10 FEET WIDE VEHICULAR ACCESS TO THE TRANSFORMER INSTALLATION.
4. BENDS DUE TO CHANGES OF GRADE ARE TO HAVE MINIMUM RADIUS OF 20 FEET. THE DUCT IS TO BE PVC SCHEDULE 40 PIPE. THE CONTRACTOR IS TO INSTALL DUCT FROM THE PAD TO THE RISER POLE OR HANDHOLE AS DESIGNATED ON THE PLAN.
5. ONE COPPER WELD GROUND ROD 5/8 INCH DIAM. X 8 FEET LONG IS TO BE PROVIDED AND INSTALLED BY THE CONTRACTOR. THE ROD IS TO EXTEND 6 INCHES ABOVE THE FINISHED PAD. TIE THE ROD TO A WATER PIPE WITH #1/0 COPPER WIRE. THIS TIE MAY BE ELIMINATED WHERE THE WATER PIPE IS MORE THAN 25 FEET AWAY.
6. NO PERMANENT OR TEMPORARY STRUCTURE OR OBJECT SHALL BE ERECTED OR PLACED WITHIN FOUR FEET OF THE EDGE OF THE CONCRETE TRANSFORMER PAD AND 8 FEET IN FRONT, UNLESS APPROVED BY MECO.
7. WHEN THE CONCRETE PAD IS LOCATED IN THE VICINITY OF EXISTING OR FUTURE COMBUSTIBLE MATERIAL, COMBUSTIBLE BUILDINGS, THE CONTRACTOR SHALL PROVIDE SAFEGUARDS A OUTLINED IN THE NEC LATEST REVISION SUBJECT TO THE APPROVAL OF THE CITY & COUNTY BUILDING INSPECTORS.
8. THE FRONT SIDE OF THE CONCRETE PAD SHALL ALWAYS BE LOCATED TO FACE THE VEHICULAR ACCESS AND SHALL BE FREE OF ANY OBSTRUCTIONS AT ALL TIMES.
9. WHEN PARTS OF BUILDING STRUCTURES ARE LOCATED DIRECTLY OVER THE CONCRETE PAD, A MINIMUM CLEARANCE OF 9 FEET FROM THE PAD GRADE IS REQUIRED. THE CUSTOMER SHALL PROVIDE ADEQUATE SAFEGUARDS AS OUTLINED IN THE NEC, LATEST REVISION, AND IS SUBJECT TO APPROVAL OF THE CITY & COUNTY BUILDING INSPECTORS.
10. ALL DUCTLINES SHALL CONTAIN A "MULE TAPE" PULL LINE (WESCO CAT. #072592000 OR EQUIVALENT).
11. AFTER THE CONDUITS ARE INSTALLED, THE CONTRACTOR SHALL PASS A SMOOTH BULLET-SHAPED WOODEN TEST MANDREL THROUGH THE ENTIRE LENGTH OF EACH CONDUIT TO TEST FRO FREEDOM OF BURRS AND OBSTRUCTIONS.
12. INSPECTION: THREE WORKING DAYS ADVANCE NOTICE REQUIRED BY THE UTILITY COMPANY FOR ANY INSPECTION SERVICE.

    A UTILITY STAND-BY MAN IS REQUIRED TO BE AT THE SITE AT THE TIME ANY NON-UTILITY CO. PERSONNEL WILL BE BREAKING INTO OR ENTERING ANY FACILITIES THAT CONTAIN ENERGIZED UTILITY EQUIPMENT OR CABLES.

    CALL MECO - PHONE 871-7777



A E-0 DUCT SECTION
NOT TO SCALE

DUCTLINE NOTES:

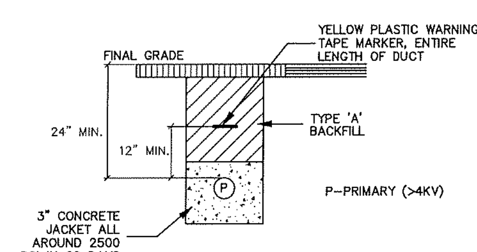
1. REFER TO ELECTRICAL PLAN FOR DUCT SIZES AND QUANTITIES.
2. CONCRETE ENCASED CONDUITS SHALL BE PVC TYPE 'EB' OR SCH. 40 PVC. ABS TYPE 'DB' PIPES ARE ALSO ACCEPTABLE.
3. DIRECT BURIED CONDUITS SHALL BE PVC SCH. 40 PIPES.
4. CONCRETE ENCASED CONDUITS OF LIKE USE MAYBE SEPARATED BY 1-1/2". CONDUITS OF UNLIKE USES MAYBE SEPARATED BY 3". A MINIMUM 3" SEPARATION MUST BE MAINTAINED BETWEEN ELECTRICAL DUCTS AND TV/TEL. DUCTS.
5. DIRECT BURIED CONDUITS OF LIKE USE SHALL BE SEPARATED BY A MINIMUM OF 3". A MINIMUM SEPARATION OF 12" MUST BE MAINTAINED BETWEEN DIRECT BURIED ELECTRICAL CONDUITS AND TELEMETRY CONDUITS.
6. CONCRETE COMPREHENSIVE STRENGTH SHALL BE 2,500 PSI IN 28 DAYS.
7. DUCTLINE TRENCHES MAY BE BACKFILLED 24 HOURS AFTER CONCRETE IS POURED.
8. CONTRACTOR SHALL COORDINATE DUCTLINE AND TRENCHING DETAILS WITH UTILITY COMPANIES PROJECT PLAN.
9. REFERENCE SPECIFICATION: MECO SPEC. CS7001 WITH LATEST REVISION.

TYPE "A" - BEACH SAND, EARTH, OR EARTH AND GRAVEL. IF EARTH AND GRAVEL, THE MAXIMUM ROCK SHALL BE 1" AND THE MIXTURE SHALL CONTAIN NOT MORE THAN 50% BY VOLUME OF ROCK PARTICLES.

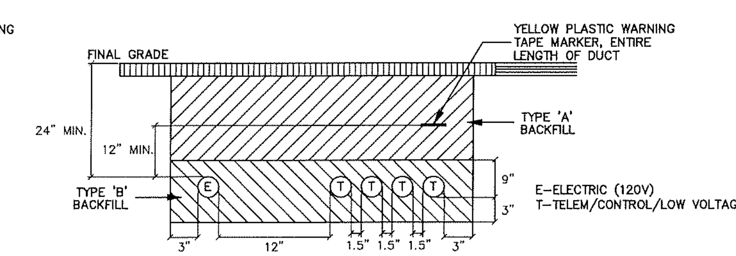
TYPE "B" - BEACH SAND, EARTH, OR EARTH AND GRAVEL. IF EARTH AND GRAVEL, THE MIXTURE MUST PASS A 1/2" MESH SCREEN AND CONTAIN NOT MORE THAN 20% BY VOLUME OF ROCK PARTICLES. CORAL OR CORAL WASTE WILL NOT BE ACCEPTABLE.

COUNTY OF MAUI MAUI COUNTY CODE, CHAPTER 16.16A ENERGY CODE
TO THE BEST OF MY KNOWLEDGE, THIS PROJECT'S DESIGN SUBSTANTIALLY CONFORMS TO THE ENERGY CODE FOR:
______ BUILDING COMPONENT SYSTEMS __X__ ELECTRICAL COMPONENT SYSTEMS ______ MECHANICAL COMPONENT SYSTEMS
SIGNATURE: ____________ DATE: ________
NAME: MARK J UNEMORI
TITLE: PROJECT ENGINEER
LICENSE NO.: 13993-E

MAUI COUNTY CODE CHAPTER 20.35 OUTDOOR LIGHTING	
THE ELECTRICAL OUTDOOR LIGHTING SYSTEM AND EQUIPMENT HAVE BEEN REVIEWED BY ME AN TO THE BEST OF MY KNOWLEDGE, THIS DESIGN SUBSTANTIALLY CONFORMS TO THE REQUIREMENTS SPECIFIED IN MAUI COUNTY CODE CHAPTER 20.35 OUTDOOR LIGHTING.	
	PROJECT ENGINEER
SIGNATURE	TITLE
MARK J UNEMORI	13993-E
NAME (PRINT)	STATE OF HAWAII P.E. LICENSE NUMBER



B E-0 DUCT SECTION
NOT TO SCALE



C E-0 DUCT SECTION
NOT TO SCALE

2018-25-E0

ECM Inc.
Electrical Engineering Consultants
MAUI OFFICE
130 North Market Street
Wailuku, Maui, HI 96793
Phone: (808)242-8070
Fax: (808)244-9629
E-mail: ecm@ecm-maui.com

MARK J. UNEMORI
LICENSED PROFESSIONAL ENGINEER
No. 13993-E
HAWAII, U.S.A.

APRIL 30, 2020
EXPIRATION DATE

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION. (SUPERVISION OF CONSTRUCTION AS DEFINED UNDER SECTION 16-82-2 OF CHAPTER 82, RULES OF THE BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS AND LAND SURVEYORS, STATE OF HAWAII)

Note: Contractor shall check and verify all dimensions at job before proceeding with work.

NO	DATE	DESCRIPTION	INI
		REVISIONS	

JOB NO. 2018-25
DATE: 4/18
DRAWN BY: RMB
DESIGNED BY: MJU
CHECKED BY: MJU

ELECTRICAL PLANS FOR:
KAHANA PRODUCTION WELL
LAHAINA, MAUI, HAWAII TMK: (2) 4-3-001:017, 4-4-004:009 & 019

SHEET NO.
E-0
1 OF - SHEETS

SYMBOL LEGEND

o	EXISTING POLE
⊢	EXISTING ANCHOR
——— - - ———	EXISTING OVERHEAD LINES
T	NEW TRANSFORMER PAD
●	NEW POLE
⊢-	NEW ANCHOR
——— - - ———	NEW OVERHEAD PRIMARY LINES (BASED ON VERTICAL CONSTRUCTION BY MECO)
———————	NEW UNDERGROUND PRIMARY LINES
- - - - - - - - -	NEW UNDERGROUND SECONDARY LINES
▨	NEW ELECTRICAL EQUIPMENT

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 (692-8015), WHICH WILL ASSESS THE SIGNIFICANCE OF THE FIND AND RECOMMEND AN APPROPRIATE MITIGATION MEASURE, IF NECESSARY.

A UTILITY CO. STANDBY MAN IS REQUIRED TO BE AT THE SITE AT THE TIME ANY NON-UTILITY CO. PERSONNEL WILL BE BREAKING INTO OR ENTERING ANY FACILITIES THAT CONTAIN ENERGIZED UTILITY CO. EQUIPMENT OR CABLES.

THREE WORKING DAYS ADVANCE NOTICE IS REQUIRED BY THE UTILITY CO. FOR ANY INSPECTION SERVICE OR STANDBY MAN.

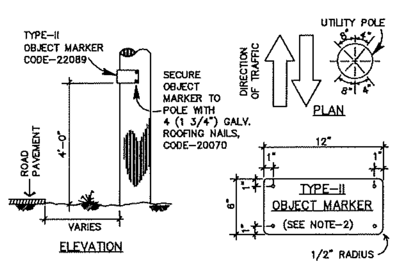
CALL MECO — PH: 871-7777

GENERAL NOTES:

1. PLANS SUBJECT TO REVIEW AND APPROVAL OF UTILITY COMPANIES.
2. ALL UTILITY CONDUITS CROSSING WATERLINES TO BE CONCRETE ENCASED HAVING A MINIMUM OF 6" VERTICAL CLEARANCE BETWEEN THE OUTSIDE JACKET AND THE WATERLINE, THE JACKET SHOULD EXTEND 5' ON EITHER SIDE OF THE DIAMETER OF THE WATERLINE.
3. NO TELEPHONE OR CABLE TV CONTACT ON NEW POLES.

PLAN NOTES:

1. EASEMENT REQUIRED FOR ACCESS ROADWAY.
2. EASEMENT REQUIRED FOR NEW OVERHEAD LINES [TOTAL 10'-0" WIDE (5'-0" ON EACH SIDE FROM CENTER OF LINE OR AS APPLICABLE)].
3. EASEMENT REQUIRED FOR ANCHOR & GUY WIRE (5'-0" WIDE x 20'-0" DEEP TYPICAL OR AS APPLICABLE).
4. EASEMENT REQUIRED FOR NEW UNDERGROUND LINES [TOTAL 5'-0" WIDE OR AS APPLICABLE].
5. EASEMENT COVERING PADMOUNT TRANSFORMER.
6. EASEMENT REQUIRED FOR NEW OVERHEAD LINES EXTENDING OUTSIDE THE R.O.W LINE [TOTAL 5'-0" WIDE OR AS APPLICABLE].



NOTES:

1. THE TYPE-II OBJECT MARKER SHALL BE MADE OF HIGH INTENSITY AMBER REFLECTIVE SHEETING MATERIAL OVERLAYED ON 0.02" ALUMINUM SHEETING.
2. INSTALL TWO (2) OBJECT MARKERS: ONE ON EACH SIDE OF POLE FACING ONCOMING TRAFFIC AS SHOWN ON THIS PLAN VIEW.

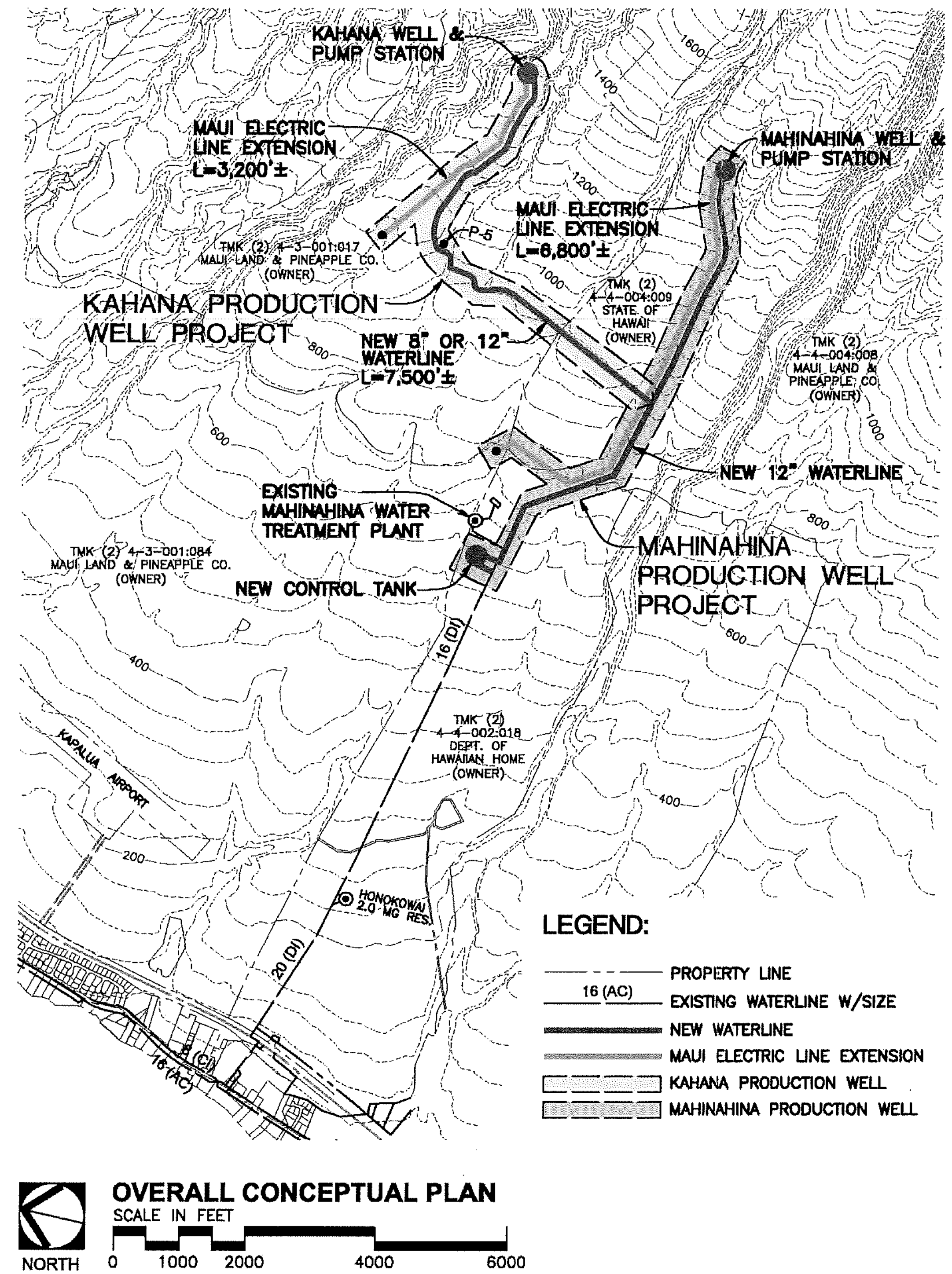
COUNTY REQUIRED TYPE - II MARKER

NOT TO SCALE

APPROVALS:	
MAUI ELECTRIC COMPANY	DATE
HAWAIIAN TELCOM	DATE
SPECTRUM	DATE

NOTE: PLAN NOT FOR CONSTRUCTION UNLESS APPROVED

2018-25-E1



OVERALL CONCEPTUAL PLAN

ECM INC.
Electrical Engineering Consultants

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MARK J. UNEMORI
LICENSED PROFESSIONAL ENGINEER
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HAWAII, U.S.A.

APRIL 30, 2020
EXPIRATION DATE

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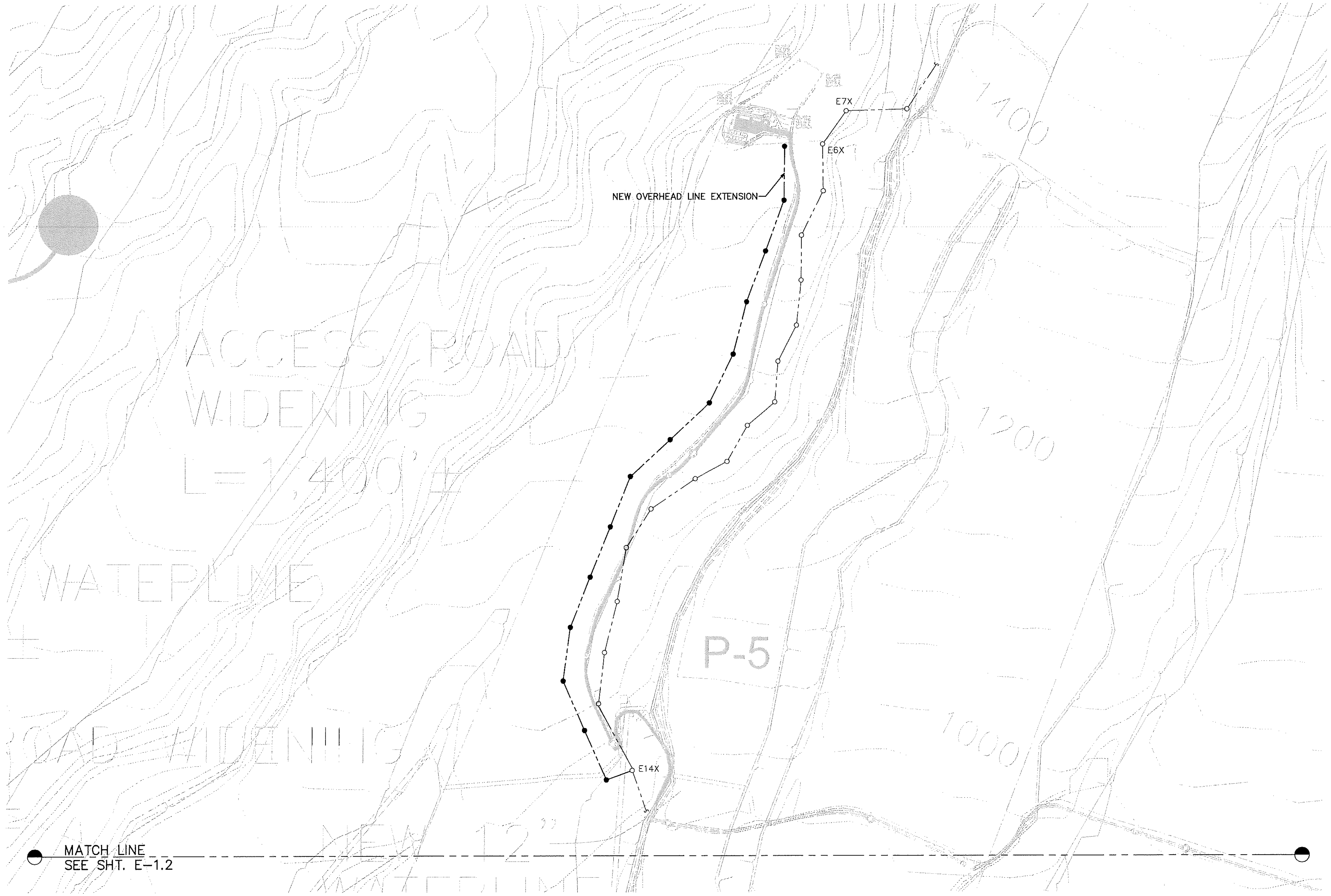

PARTIAL ELECTRICAL SITE PLAN

SCALE: 1" = 50'-0"

2018-25-E1.1

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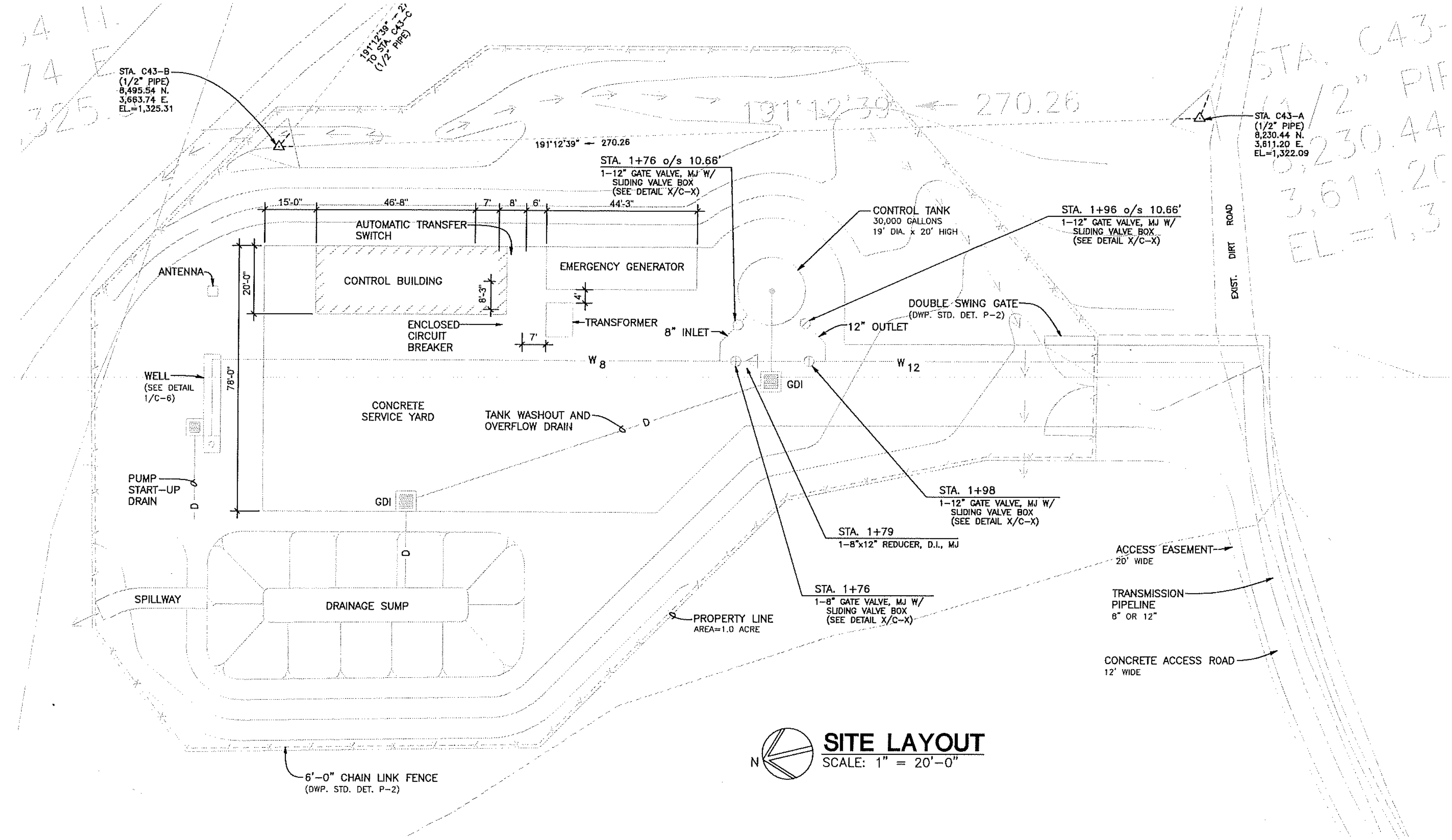
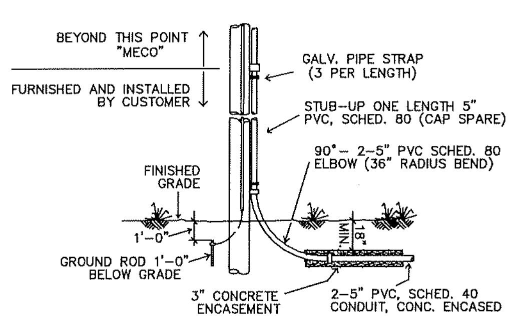


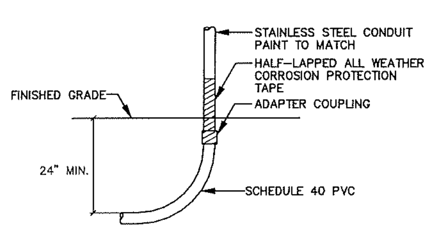
SITE LAYOUT

SCALE: 1" = 20'–0"



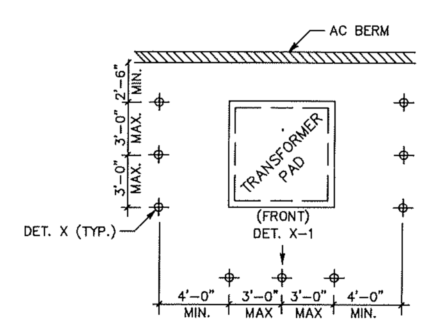
1 E-2 **CONDUIT INSTALLATION @ RISER**

NOT TO SCALE



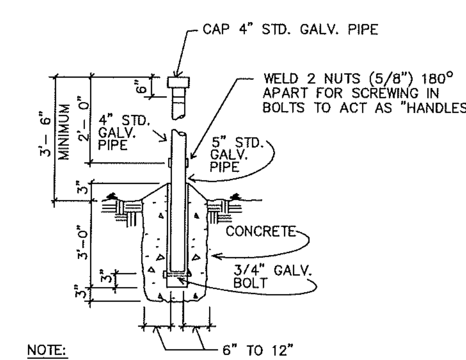
2 E-2 **CONDUIT TRANSITION DETAIL**

NOT TO SCALE (CUSTOMER SIDE)



3 E-1.6A **POST TYPE BARRIER (STANCHION)**

NOT TO SCALE



NOTE:

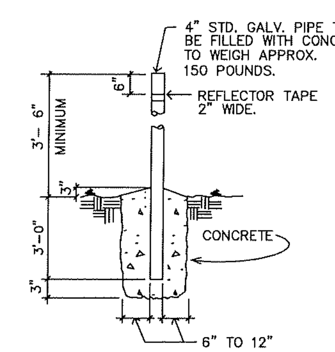
BARRIER POSTS ARE TO BE PAINTED YELLOW ACCORDING TO ANSI SPEC Z535.1 TO COMPLY WITH OSHA STANDARD 1910.144 FOR COLORING CODE. A 2" WIDE STRIPE OF REFLECTIVE TAPE MUST BE PLACED 6" BELOW THE TOP OF THE POST.

THE PIPE THAT IS TO BE PLACED DIRECTLY IN FRONT OF THE DOORS SHALL NOT BE FILLED WITH CONCRETE. THE PIPE SHALL BE CAPPED AND THE WELDED NUTS USED TO SCREW IN BOLTS TO ACT AS HANDLES FOR LIFTING. THE BOLTS ARE TO BE REMOVED AFTER INSTALLATION.

UG–30–5000

DETAIL "X-1"

NOT TO SCALE



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UG–30–5000

DETAIL "X"

NOT TO SCALE

2018–25–E2

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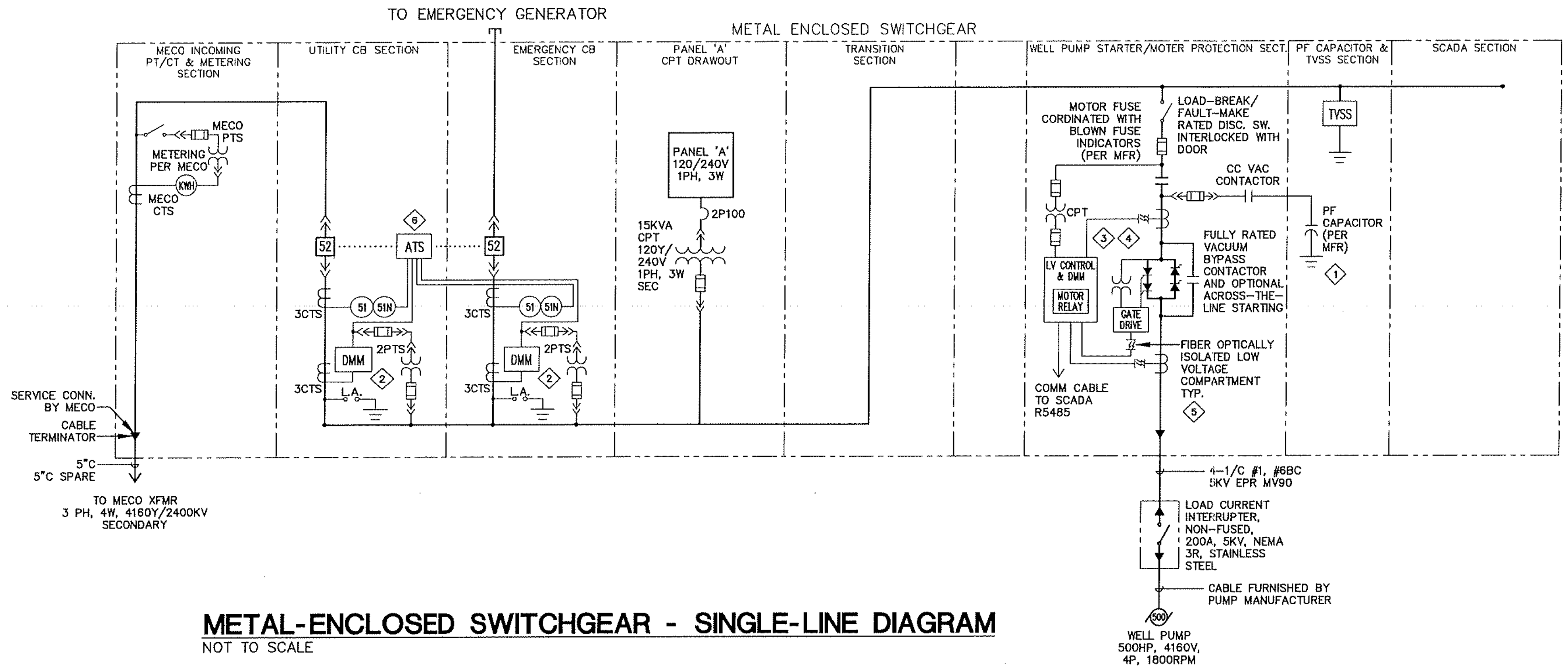
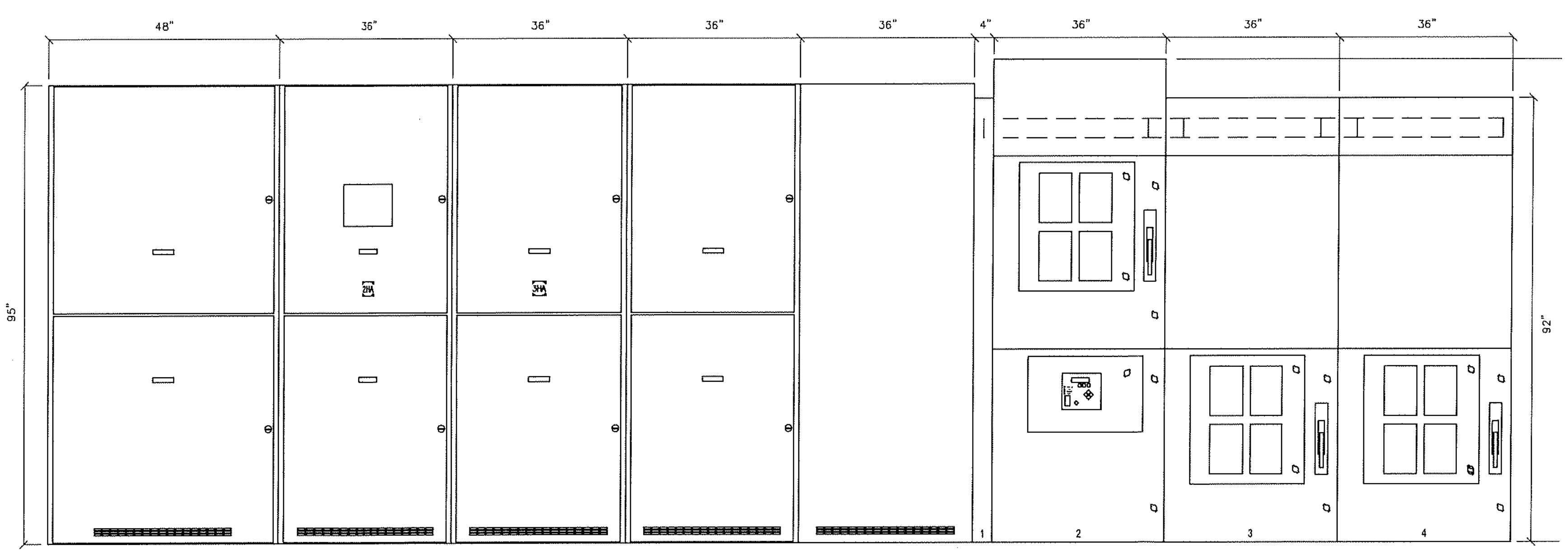


METAL-ENCLOSED SWITCHGEAR - SINGLE-LINE DIAGRAM

NOT TO SCALE



NOTES:

1. OBTAIN MECO APPROVAL OF SHOP DRAWINGS FOR SWITCHBOARD PRIOR TO FABRICATION.

SWITCHBOARD ELEVATION

SCALE: 3/4" = 1'-0"

2018-25-E3

FLAGGED NOTES:

1. POWER FACTOR CORRECTION CAPACITORS AND ISOLATION CONTACTORS (CC) SHALL BE SIZED PER MOTOR MANUFACTURER'S RECOMMENDATION TO CORRECT POWER FACTOR TO A MINIMUM OF 95%. CONTRACTOR SHALL DISCONNECT CAPACITORS FROM SYSTEM DURING PUMP MOTOR START UP.

2. DIGITAL MULTIMETERING DEVICE
UNIT SHALL BE CAPABLE OF METERING AS MINIMUM:

   A. AC AMPERES: PHASE A,B,C
   B. AC VOLTAGE: PHASE A-B, PHASE B-C, PHASE C-A
   C. WATTS
   D. POWER FACTOR
   E. FREQUENCY
   F. WATT-HOURS

   DIGITAL MULTIMETER SHALL USE ETHERNET COMMUNICATION PROTOCOL TO TRANSMIT DATA THROUGH SCADA SYSTEM.

3. FULLY PROGRAMMABLE ELECTRONIC RELAY (MOTORTRONICS RX SERIES) WITH THE FOLLOWING FEATURES (NEMA DESIG.):

A.	19	REDUCED VOLTAGE SOFT STARTER
B.	27	UNDERVOLTAGE
C.	37	UNDERCURRENT
D.	46	CURRENT IMBALANCE
E.	47	PHASE ROTATION
F.	48	LOCKED ROTOR / INCOMPLETE SEQUENCE
G.	49	I^2T ELECTRONIC MOTOR OVERCURRENT TRIP
H.	50	INSTANTANEOUS ELECTRONIC OVERCURRENT TRIP
I.	51	OVERCURRENT
J.	55	POWER FACTOR TRIP
K.	59	OVERVOLTAGE PROTECTION
L.	66	STARTS PER HOUR AND TIME BETWEEN STARTS
M.	81	FREQUENCY VARIANCE
N.	86	LOCKOUT / START INHIBIT
O.	50N/51G/N	GROUND FAULT DETECTION, INSTANTANEOUS AND CURRENT
P.	49/38	STATOR AND BEARING RTD PROTECTION
Q.	14	SPEED SWITCH AND TACHOMETER TRIP

   THE RELAY SHALL ALSO INCLUDE THE FOLLOWING REAL-TIME CLOCK FEATURES:

   A. COAST DOWN/BACK SPIN LOCKOUT (PROGRAMMABLE UP TO 60 MINUTES) PREVENTS A START ATTEMPT WHEN THE MOTOR / LOAD IS BACKSPINNING WHEN THE MOTOR IS TURNED OFF.

   B. ELAPSED TIME METERING INDICATES RUN TIME FOR SCHEDULED MAINTENANCE OR TROUBLE SHOOTING HELP.

   C. TIME BETWEEN STARTS LOCKOUT ELIMINATES MOTOR AND EQUIPMENT DAMAGE CAUSED BY REPEATED START COMMANDS.

   D. TIME AND DATE STAMPING OF FAULTS FOR PRECISE RECORDING OF WHAT HAPPENED WHEN.

   E. STARTS-PER-HOUR LOCKOUT/SHORT CYCLE TIMER ALLOWS YOU TO PROGRAM THE MAXIMUM NUMBER OF STARTS PER HOUR AND PROVIDES A PROGRAMMED "WAIT TIME" (0-60 MINUTES) BETWEEN START ATTEMPTS.

4. DIGITAL MULTIMETERING DEVICE
FOR STARTER MONITOR SHALL DISPLAY AS A MINIMUM:

   F. PHASE A, B, C AND GROUND FAULT
   G. AVERAGE CURRENT OF THE % OF IMBALANCE AND THE MOTOR'S RPM
   H. MOTOR LOAD AS A PERCENTAGE OF MOTOR FLA
   I. LINE FREQUENCY AND PRESENT PHASE SEQUENCE
   J. PERCENTAGE OF REMAINING THERMAL REGISTER
   K. THERMAL CAPACITY REQUIRED TO START THE MOTOR
   L. AVERAGE TIME REQUIRED TO START
   M. AVERAGE CURRENT DURING START
   N. MEASURED I^2T REQUIRED TO START THE MOTOR
   O. AMOUNT OF TIME REQUIRED TO START THE MOTOR DURING THE LAST SUCCESSFUL START
   P. PHASE A, B, C CURRENTS AND POWER FACTOR
   Q. PHASE A, B, C CURRENTS AND GROUND FAULT
   R. KW AND KVA
   S. KVAR AND POWER FACTOR
   T. PEAK ON AND KW DEMAND
   U. PEAK ON AND KVA DEMAND
   V. PEAK ON AND KVAR DEMAND
   W. PEAK ON AND AMPS DEMAND

   DIGITAL MULTIMETER SHALL USE ETHERNET COMMUNICATION PROTOCOL TO TRANSMIT DATA THROUGH SCADA SYSTEM.

5. PROVIDE CUTLER-HAMMER MV4S SOLID STATE MOTOR STARTER RATED AT 600 HP. OVERLOAD PROTECTION, OVER CURRENT PROTECTION, AND OTHER MOTOR PROTECTION FEATURES SHALL BE SET TO MATCH NAMEPLATE RATING OF PUMP. PROVIDE ONE TOTAL SPARE 600 HP SOLID STATE MOTOR STARTER AND TRUCK. DELIVER TO DWS BASEYARD, INCLUDE A LINE REACTOR FOR PUMP DEPTH IN EXCESS OF 1000 FT. PROVIDE SPARE BYPASS CONTACTOR.

6. PROVIDE AUTOMATIC TRANSFER SWITCH FOR OPEN TRANSITION TO BACKUP GENERATOR POWER.

7. PROVIDE SCREENS FOR ALL VENTED SLOTS AND HOLES IN SWITCHGEAR TO PREVENT BUGS FROM ENTERING SWITCHGEAR.

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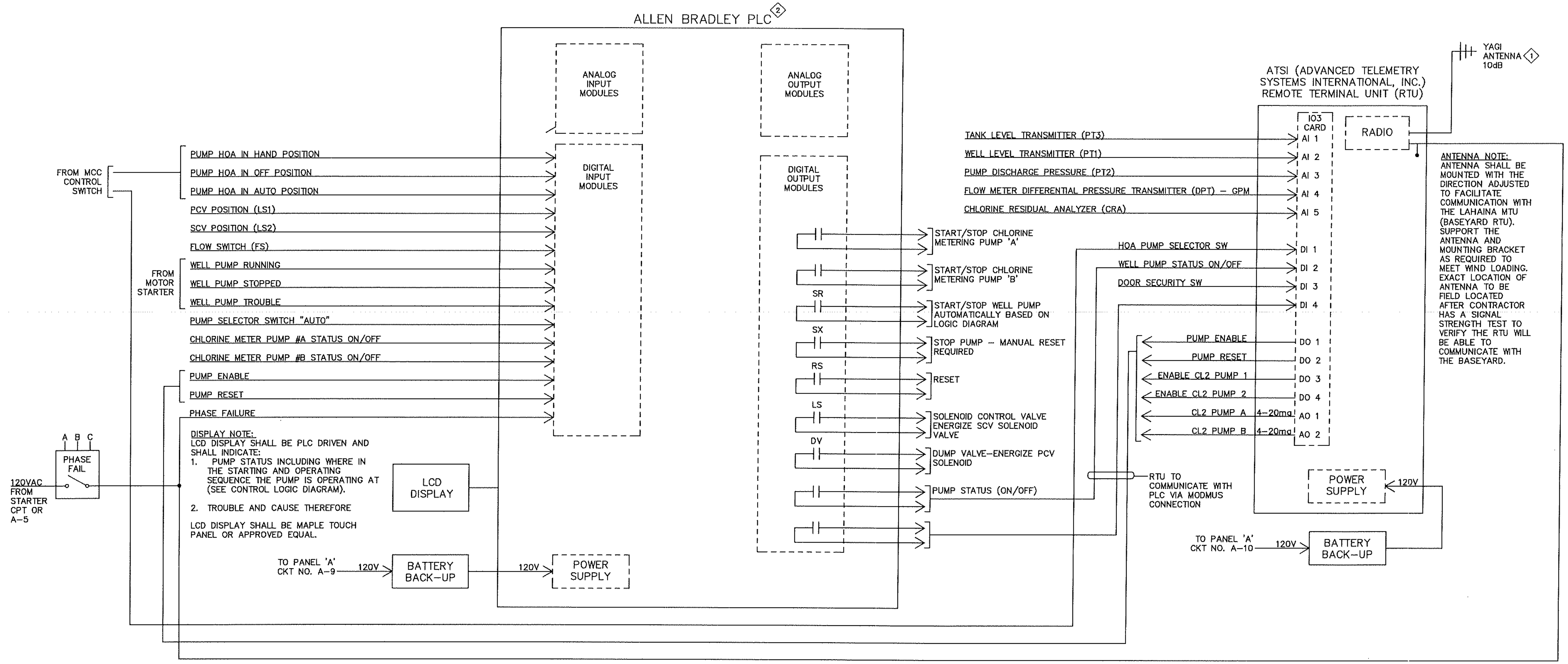
SHEET NO.
E-3



SYMBOL LEGEND

- UNDERGROUND CONDUIT, PVC SCHED 40
- LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT
- J — JUNCTION BOX, NEMA 4X, STAINLESS STEEL
- M — WELL MOTOR PUMP
- DPT — DIFFERENTIAL PRESSURE TRANSMITTER (4–20ma)
- FS — FLOW SWITCH
- LS1 — PCV VALVE LIMIT SWITCH
- LS2 — SCV CONTROL VALVE LIMIT SWITCH
- PCV — DUMP VALVE SOLENOID CONNECTION
- PT1 — WELL LEVEL TRANSMITTER (4–20ma)
- PT2 — PUMP DISCHARGE PRESSURE TRANSMITTER (4–20ma)
- SCV — CONTROL VALVE SOLENOID CONNECTION

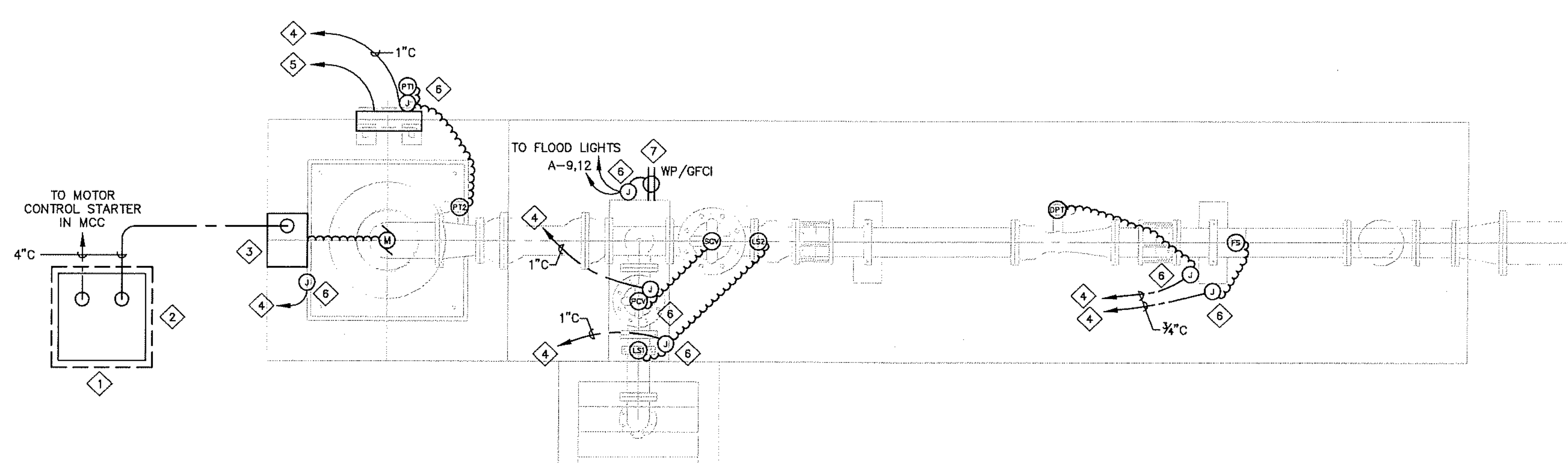
PLC/SCADA DIAGRAM

PLC/SCADA PLAN NOTES:

1. PROVIDE 35' ANTENNA POLE. SEE DETAIL ON E-6.
2. PROVIDE COMPACT LOGIX 1769-L32E ETHERNET PLC WITH 1769-IA16 DIGITAL INPUT, 1769-OB16 24VDC DIGITAL INPUT.

ELECTRICAL PIPING PLAN NOTES:

1. 30"x30" MIN. CONCRETE PAD, 8" THICK WITH REBAR AT 8" O.C. EACH WAY, TOP AND BOTTOM CHAMFER ¾" ALL EXPOSED EDGES.
2. DISC. SW, 5KV, 200A, NON-FUSED, NEMA 3R, STAINLESS STEEL. DISCONNECT SWITCH SHALL BE CONDENSATION HEATER THERMOSTAT CONTROLLED. PLACEMENT OF SWITCH TO BE COORDINATED WITH DEPARTMENT OF WATER SUPPLY.
3. JUNCTION BOX, 16"x30"x12"D MIN, NEMA 3R, STAINLESS STEEL, MOUNTED TO EQUIPMENT RACK, SEE DETAIL ON E-6.
4. 1"C SCADA SECTION IN MCC, ROUTED AS REQUIRED.
5. 1"C TO BUBBLER POWER SUPPLY, ROUTED AS REQUIRED. PLACEMENT TO BE COORDINATED WITH DEPARTMENT OF WATER SUPPLY.
6. NEMA 4X, STAINLESS STEEL JUNCTION BOX, SEE MOUNTING DETAILS ON E-6.
7. RECEPTACLE, STAINLESS STEEL WP COVERPLATE/BOX, ¾"C, 2–#10, #10 GND, TO PANEL 'A' IN MCC.



ELECTRICAL PIPING PLAN

SCALE: 1/2" = 1'-0"

2018-25-E4

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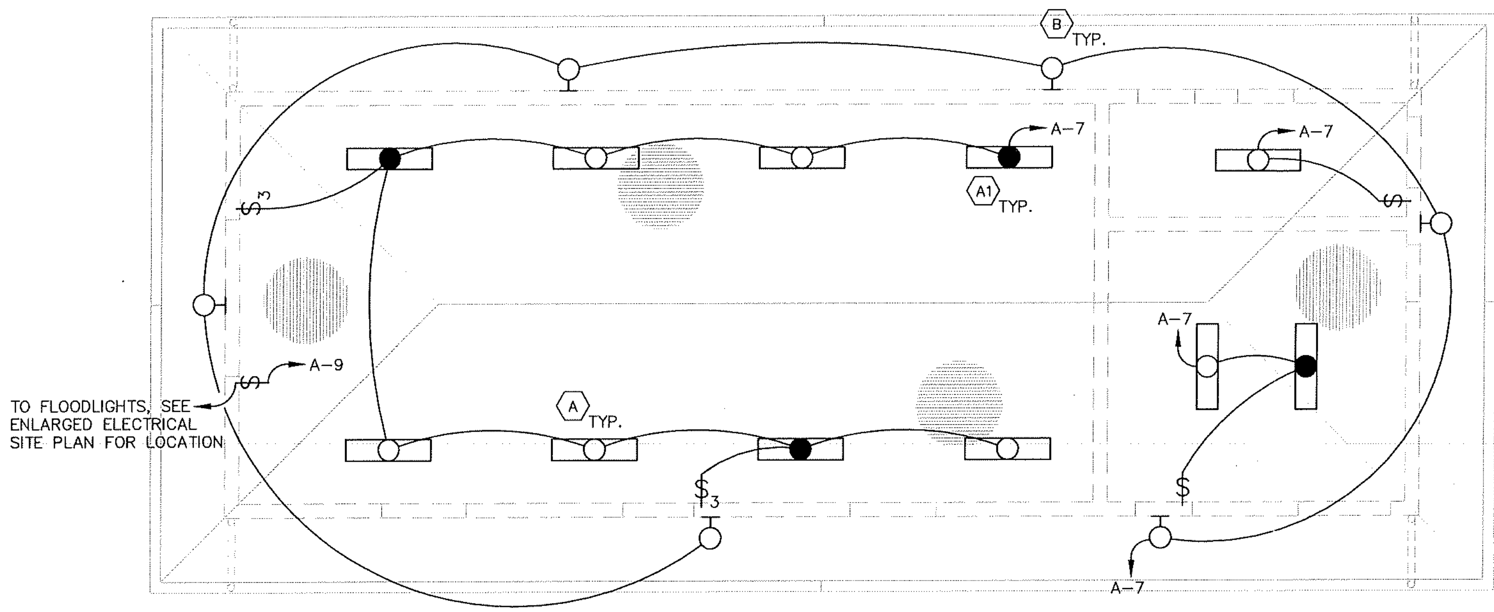


LIGHTING BUILDING PLAN

SCALE: 1/4" = 1'-0"

LIGHTING BUILDING PLAN NOTES:

1. LIGHTING IS NORMALLY OFF DURING NORMAL BUSINES HOURS AND ONLY USED DURING EMERGENCIES AND THEREFORE EXEMPT FROM IECC TOTAL CONNECTED INTERIOR LIGHTING POWER REQUIREMENT.

EXTERIOR LIGHTING POWER ALLOWANCE

APPLICATION	ALLOWED	ACTUAL
BASE ALLOWANCE, ZONE 2	600W	209W

LIGHT FIXTURE SCHEDULE

TYPE	SYMBOL	DESCRIPTION	MANUFACTURER	LAMP
A		FLUORESCENT WRAPAROUND FIXTURE, MOLDED FIBERGLASS, IMPACT RESISTAND HOUSING, FULLY GASKETED, WET LOCATION LISTED, ELECTRONIC BALLAST, 120V.	COLUMBIA LUN4-232-EU OR APPROVED EQUAL	2-F32T8
A1		SAME AS TYPE 'A' EXCEPT WITH EMERGENCY BATTERY PACK.	COLUMBIA LUN4-232-EU-EL OR APPROVED EQUAL	2-F32T8
B		LED WALL PACK, VANDAL RESISTANT, DIE CAST ALUMINUM HOUSING, FULL CUT-OFF, PHOTOCELL, DARK BRONZE ACRYLIC DIFFUSER, 120V.	HUBBELL LNC-9LU-5K-3-1-PC1 OR APPROVED EQUAL	9-LED 20.6W
C		LED FLOOD, DIE CAST ALUMINUM, WET LOCATION LISTED, CORROSION RESISTANT, 12W 4x5 LED, GLARE SHIELD, GRAY, 120V.	HUBBELL CAT. NO. LFS-12LP-1-GR-LFS-GS OR APPROVED EQUAL	CFL 42W

PANEL A (IN MCC) A.I.C. RATING: 10K

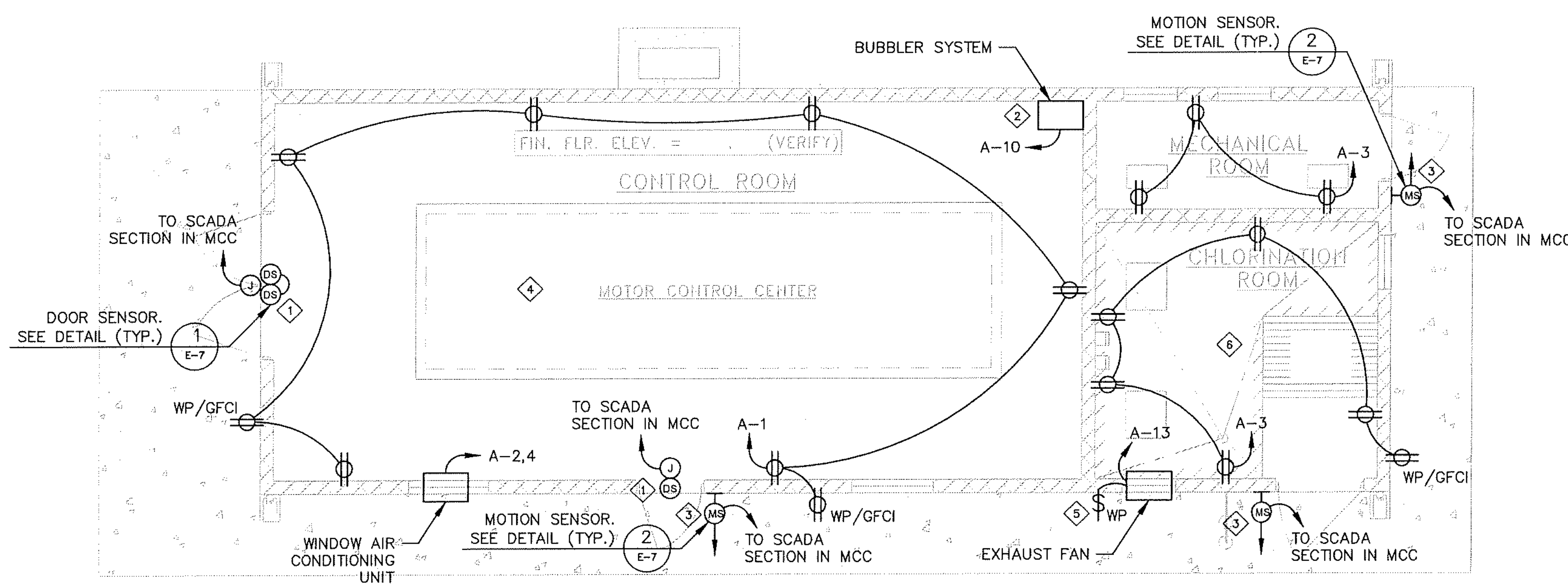
VOLTAGE: 120/240V PHASE: 1 WIRE: 3WSN CIRCUITS: 24

MOUNTING: SWITCHGEAR MAIN BRKR: 2P100 BREAKER: BOLT ON MAIN BUS: 100A

CKT	DESCRIPTION	PHASE A	PHASE B	BRKR	WIRE	CKT	DESCRIPTION	PHASE A	PHASE B	BRKR	WIRE
1	R: CONTROL ROOM	0.9		1P20	#12	2	A/C	1.0		2P20	#12
3	R: CHLORINATION ROOM		0.7	1P20	#12	4			1.0		
5	SWITCHBOARD CONTROLS	1.0		1P20	#12	6	R: SCADA	0.5		1P20	#12
7	L: LIGHTS		0.4	1P20	#12	8	SCADA CONTROLS		1.0	1P20	#12
9	L: EXT. WORK LIGHTS	0.2		1P20	#10	10	BUBBLER SYSTEM	1.0		1P20	#12
11	SPACE HEATERS		1.0	1P20	#12	12	R: PUMP RCPT		1.0	1P20	#10
13	EXHAUST FAN	1.0		1P20	#12	14	PFB				
15	SPARE		1.0	1P20		16	PFB				
17	PFB					18	PFB				
19	PFB					20	PFB				
21	PFB					22	PFB				
23	PFB					24	PFB				
	TOTALS	3.1	3.1				TOTALS	2.5	3.0		

TOTAL CONNECTED LOAD: 11.7 KVA
ESTIMATED DEMAND: 1.0
TOTAL EST. DEMAND LOAD: 11.7 KVA 49 A @ V =240V

R: DENOTES RECEPTACLE LOAD
L: DENOTES LIGHTING LOAD



ELECTRICAL BUILDING PLAN

SCALE: 1/4" = 1'-0"

ELECTRICAL BUILDING PLAN NOTES:

1. DOOR SWITCH, CONNECT TO RTU, COORDINATE EXACT LOCATION.
2. BUBBLER POWER SUPPLY.
3. MOTION SENSOR, CONNECT TO RTU, COORDINATE EXACT LOCATION.
4. PROVIDE CEILING MOUNTED ROOM TEMPERATURE SENSOR IN THE CENTER OF THE ROOM, SENSOR SHALL BE MOORE INDUSTRIES, T2X/PT10, 4-20ma, 8-24 VDC, USB COMMUNICATIONS CABLE 208-836-00 OR APPROVED EQUAL.
5. PROVIDE SIGN THAT READS "SWITCH FOR EXHAUST FAN IN THE CHLORINATION ROOM".
6. ALL SWITCHES AND OUTLETS IN CHLORINE ROOM TO HAVE MARINE GRADE WEATHERPROOF COVERS. PROVIDE PLUG IN PLACE COVERS FOR WATSON MARLOW PUMPS.

SYMBOL LEGEND

- BRANCH CIRCUITS CONCEALED IN CEILING OR WALL, 2 NO. 12 WIRES UNLESS OTHERWISE NOTED. HASH MARKS INDICATE NUMBER OF WIRES WHEN MORE THAN TWO.
- BRANCH CIRCUITS AS ABOVE EXPOSED, RGSC UNLESS OTHERWISE INDICATED
- J — JUNCTION BOX
- DUPLEX CONVENIENCE OUTLET, 2P, 3W GROUNDING TYPE. +24"
- $_3$ — WALL SWITCH, THREE-WAY, +48"
- DISTRIBUTION PANEL
- MS — MOTION SENSOR, APPROXIMATE AIMING, AS SHOWN
- DS — BALANCED MAGNETIC DOOR SWITCH
- GFCI — DENOTES A GROUND FAULT CIRCUIT INTERRUPTER DEVICE
- WP — DENOTES WEATHERPROOF DEVICE

NOTE ON SYMBOLS:
MOUNTING ELEVATIONS ARE AS NOTED ABOVE. ELEVATIONS PROVIDED ON PLANS TAKE PRECEDENCE.

2018-25-E5

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LICENSED PROFESSIONAL ENGINEER
No. 13993-E
HAWAII, U.S.A.

APRIL 30, 2020
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DATE: 4/18
DRAWN BY: RMB
DESIGNED BY: MJU
CHECKED BY: MJU

ELECTRICAL PLANS FOR:
KAHANA PRODUCTION WELL
LAHAINA, MAUI, HAWAII TMK: (2) 4-3-001:017, 4-4-004:009 & 019

SHEET NO.
E-5
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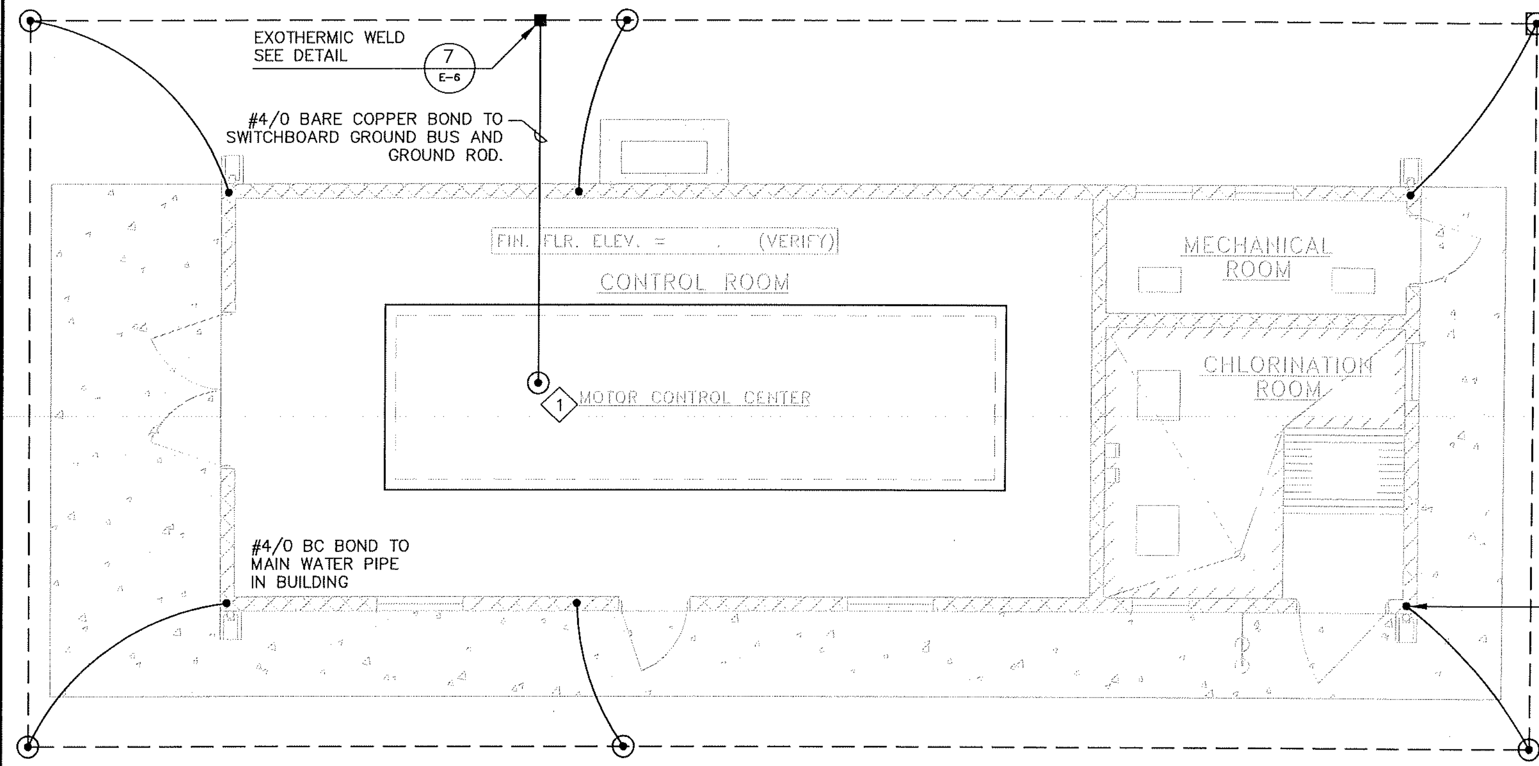


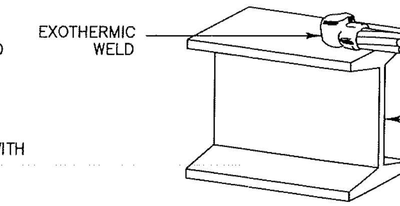
NOTE:
ALL GROUNDING CONNECTIONS TO STEEL EQUIPMENT & STRUCTURES SHALL BE COATED WITH TWO PART EPOXY.

NOTES:
1. COORDINATE EXACT GROUND LOCATION WITH FINAL SWITCHGEAR LAYOUT.

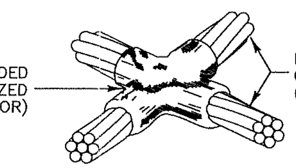
ELECTRICAL BUILDING GROUNDING PLAN
SCALE: 1/4" = 1'-0"

LEGEND

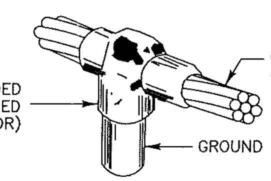
⊡	GROUNDING TEST WELL
⊙	GROUND ROD WITH EXOTHERMIC WELD
•	EXOTHERMIC WELD
— — —	GROUND CONDUCTORS. #4/0 SDBC UNLESS OTHERWISE INDICATED. 2'-6" BELOW FINISHED FLOOR OR GRADE



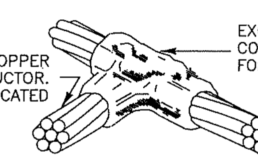
4 (E-6) GROUNDING DETAIL CONDUCTOR-TO-STEEL CONNECTION
NOT TO SCALE



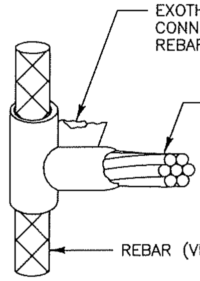
5 (E-6) GROUNDING DETAIL CONDUCTOR-TO-CONDUCTOR CONNECTION
NOT TO SCALE



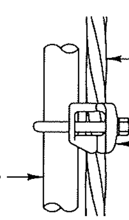
6 (E-6) GROUNDING DETAIL CONDUCTOR-CONDUCTOR-TO-GROUND ROD
NOT TO SCALE



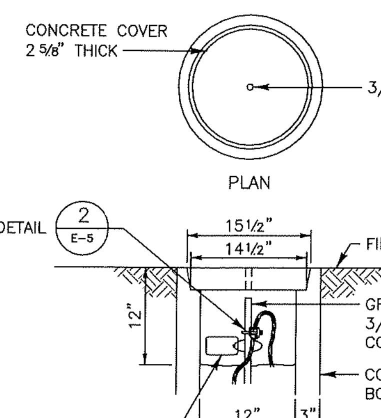
7 (E-6) CONDUCTOR-TO-CONDUCTOR CONNECTION DETAIL
NOT TO SCALE



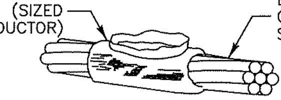
1 (E-6) CONDUCTOR TO REBAR
NOT TO SCALE



2 (E-6) GROUNDING DETAIL MECHANICAL GROUND CONNECTOR
NOT TO SCALE



3 (E-6) TYPICAL GROUND TEST WELL BOX DETAIL
NOT TO SCALE



NOTE:
USE ALSO AS WATERSTOP FOR WALL PENETRATION.

8 (E-6) CONDUCTOR-TO-CONDUCTOR CONNECTION DETAIL
NOT TO SCALE

2018-25-E6

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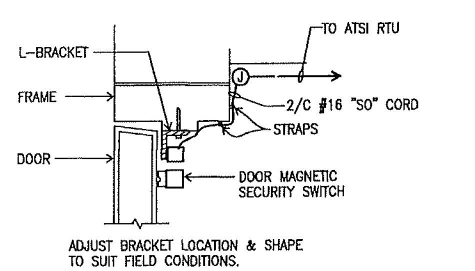
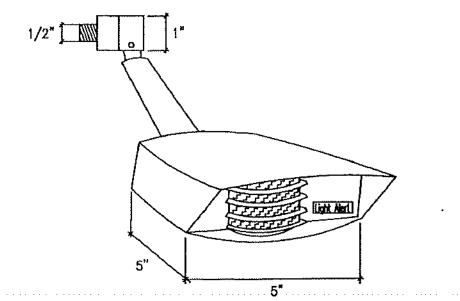
DATE: 4/18
DRAWN BY: RMB
DESIGNED BY: MJU
CHECKED BY: MJU

ELECTRICAL PLANS FOR:
KAHANA PRODUCTION WELL
LAHAINA, MAUI, HAWAII TMK: (2) 4-3-001:017, 4-4-004:009 & 019

SHEET NO.
E-6
7 OF – SHEETS



1 / E-7 DOOR MAGNETIC SECURITY SWITCH DETAIL
NOT TO SCALE

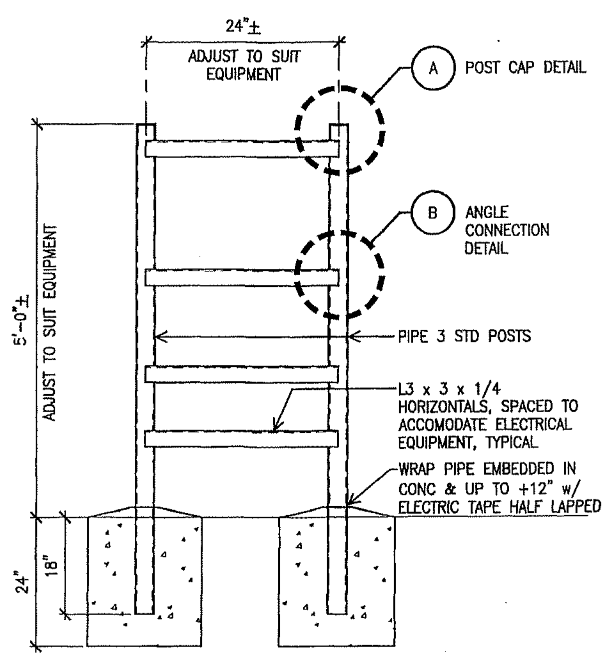


SPECIFICATIONS:

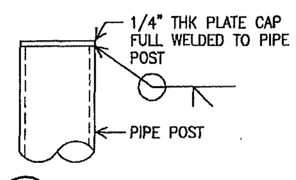
MANUFACTURER:	LIGHT ALERT OR PRE-APPROVED EQUIVALENT
SWITCHING CAPACITY:	1000 WATTS
VOLTS:	120 OR 240
PROTECTION PATTERN:	50' x 100 DEGREE LENS STANDARD
ACCESSORY LENS KIT:	CAT. #LA1000LK WITH 2 ADDITIONAL LENSES
TIME ADJUSTMENT:	5 SEC – 20 MIN
LIMITED WARRANTY:	ONE YEAR
WEIGHT:	1 LB
MATERIAL:	LEXAN

2 / E-7 MOTION SENSOR DETAIL
NOT TO SCALE

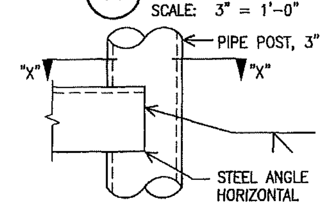
NOTE: HOT-DIP GALVINIZE RACK ASSEMBLY AFTER FABRICATION. USE STAINLESS STEEL FASTENERS AND ACCESSORIES.



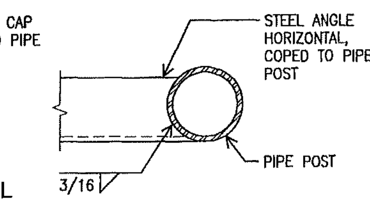
MOUNTING RACK ELEVATION
SCALE: 3/4" = 1'-0"



A POST CAP DETAIL
SCALE: 3" = 1'-0"

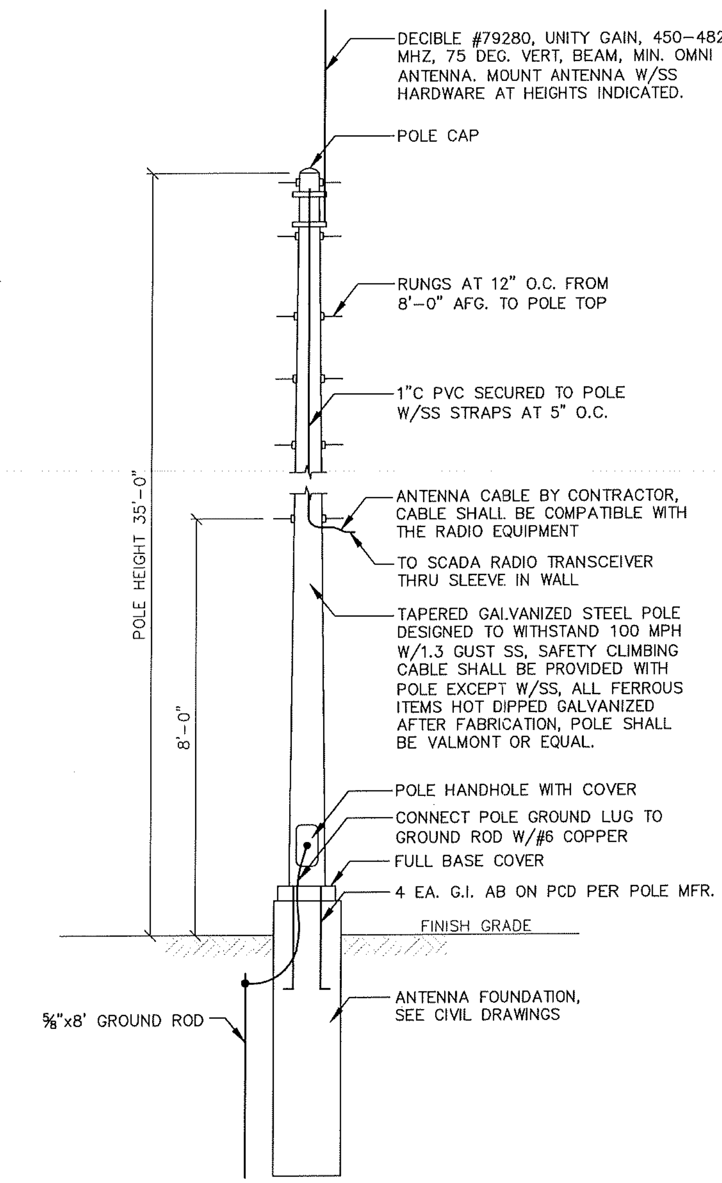


B ANGLE CONN DETAIL
SCALE: 3" = 1'-0"

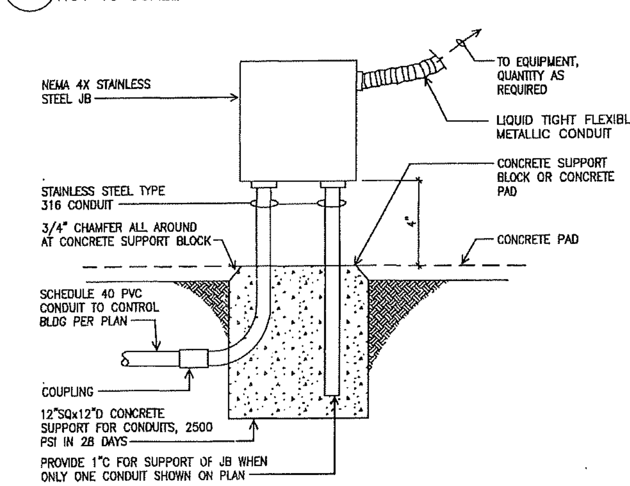


SECTION "X"-"X"
SCALE: 3" = 1'-0"

ELECTRICAL EQUIPMENT MOUNTING RACK DETAIL
SCALE: AS NOTED



3 / E-7 ANTENNA MOUNTING DETAIL
NOT TO SCALE



CONDUIT MOUNTED JUNCTION BOX DETAIL
NOT TO SCALE

2018-25-E7

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LAHAINA, MAUI, HAWAII TMK: (2) 4-3-001:017, 4-4-004:009 & 019

SHEET NO.
E-7
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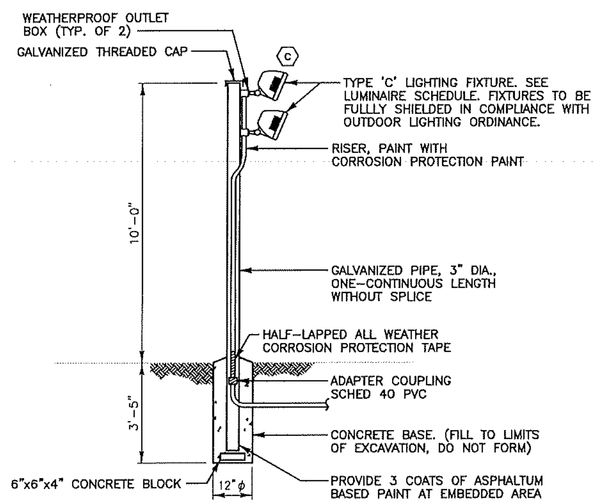
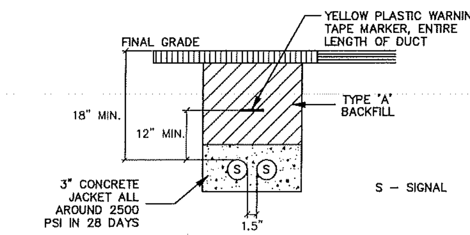
TYPE "A" – BEACH SAND, EARTH, OR EARTH AND GRAVEL. IF EARTH AND GRAVEL, THE MAXIMUM ROCK SHALL BE 1" AND THE MIXTURE SHALL CONTAIN NOT MORE THAN 50% BY VOLUME OF ROCK PARTICLES.

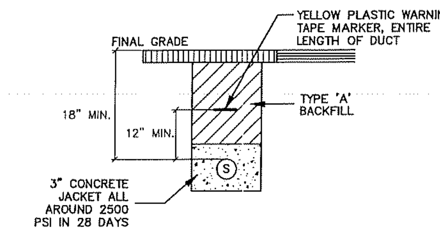
TYPE "B" – BEACH SAND, EARTH, OR EARTH AND GRAVEL. IF EARTH AND GRAVEL, THE MIXTURE MUST PASS A 1/2" MESH SCREEN AND CONTAIN NOT MORE THAN 20% BY VOLUME OF ROCK PARTICLES. CORAL OR CORAL WASTE WILL NOT BE ACCEPTABLE.



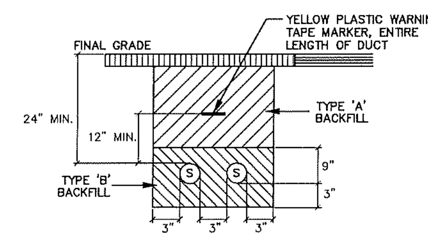
1 E-8 **FLOODLIGHT DETAIL**
NOT TO SCALE



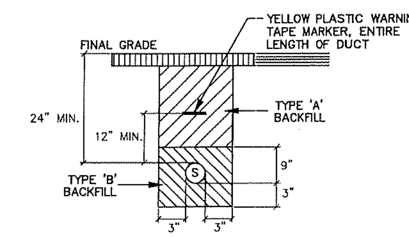
TYPICAL DUCT SECTION THRU DRIVEWAY



TYPICAL DUCT SECTION THRU DRIVEWAY



TYPICAL DUCT SECTION THRU NON-TRAFFIC AREAS



TYPICAL DUCT SECTION THRU NON-TRAFFIC AREAS

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SHEET NO.
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0 1 2
24x36
2018-25

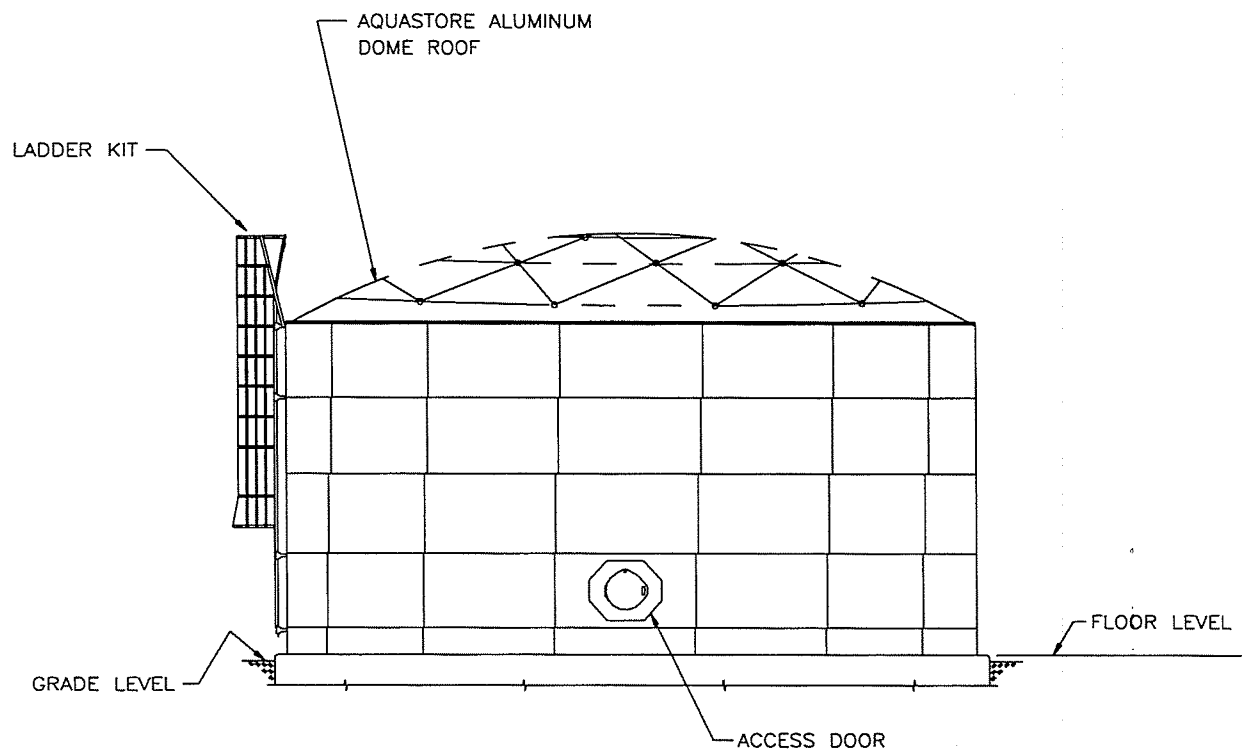
2018-25-E7

SAMPLE PHOTOS AND ELEVATION DIAGRAM OF 500,000 GALLON CONTROL TANK

APPENDIX D


05/19/2008 01:50 pm


01/06/2009 08:22 am



AQUASTORE ALUMINUM
DOME ROOF
LADDER KIT
GRADE LEVEL
FLOOR LEVEL
ACCESS DOOR

DETERMINATION LETTER FROM U.S. ARMY CORPS OF ENGINEERING (DATED DECEMBER 31, 2018)

APPENDIX E

DEPARTMENT OF THE ARMY
ALASKA DISTRICT, U.S. ARMY CORPS OF ENGINEERS
REGULATORY DIVISION
P.O. BOX 6898
JBER, AK 99506-0898

December 31, 2018

SUBJECT: Nationwide Permit Verification for the West Maui Water Source Development Project, Island of Maui, Department of Army File No. POH-2018-00106

Gladys Baisa
County of Maui, Department of Water Supply
200 South High Street, 5th Floor
Wailuku, Hawaii 96793

Dear Ms. Baisa:

This letter responds to your December 20, 2018, request for a Department of the Army (DA) jurisdictional determination for your proposed construction of a potable water line. The project site is located within Tax Map Keys (TMK) (2)4-3-001:017, 084; (2)4-4-002:014, 015, 018; (2)4-4-004:009, 011, and 019; east of Honokowai, Island of Maui, Hawaii.

Based on our review of the information you provided, we have determined that although the subject property may contain waters of the United States (U.S.), including wetlands, your proposed project would not involve an activity we regulate. Originally, the proposed method of installing the pipeline involved trenching and backfilling across three potentially jurisdictional drainages, which would require a DA permit. The proposed new method of installing the pipeline, horizontal directional drilling under the drainages, is not an activity we regulate. This includes the additional water feature, Honokohau Ditch, which your letter indicated the pipeline would also cross. Therefore, a DA permit is not required. However, a permit may be required if you alter the method, scope, or location of your proposed work. You should contact us if you make changes to your project.

Section 404 of the Clean Water Act requires that a DA permit be obtained for the placement or discharge of dredged and/or fill material into waters of the U.S., including jurisdictional wetlands (33 U.S.C. 1344). The Corps of Engineers (Corps) defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Section 10 of the Rivers and Harbors Act of 1899 requires that a DA permit be obtained for structures or work in or affecting navigable waters of the U.S. (33 U.S.C. 403). Section 10 waters are those waters subject to the ebb and flow of the tide shoreward to the mean high water mark, and/or other waters identified by the Alaska District.

Nothing in this letter excuses you from compliance with other Federal, State, or local statutes, ordinances, or regulations.

Thank you for your cooperation with the Honolulu District Regulatory Program. Should you have any questions related to this authorization, please contact me. You are encouraged to provide comments on your experience with the Honolulu District Regulatory Office by accessing our web-based customer survey form at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

Sincerely,

Jason Brewer

Jason Brewer
Regulatory Specialist

CC:

Darryl Lum, State of Hawaii Department of Health, Clean Water Branch (DOH-CWB)
John Nakagawa, State of Hawaii Office of Planning, Coastal Zone Management
Curt Eaton, County of Maui, Department of Water Supply

LETTER FROM COMMISSION ON WATER RESOURCE MANAGEMENT (DATED AUGUST 3, 2018)

APPENDIX F

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

RFD.4905.6

August 3, 2018

Ronald M. Fukumoto, PE, LS
Fukumoto Engineering, Inc.
1721 Wili Pa Loop, Suite 203
Wailuku, Hawaii 96793

Request for Determination
Stream Channel Alteration Permit Application
Pipeline Crossing
Kahanaiki, Un-named, and Mahinahina Gulches, Honolua, Maui, TMK (2) 4-3-001:017; 4-4-004:009

Dear Mr. Fukumoto:

We are responding to your August 2, 2018, request for determination which proposes to cross a gulch with a new waterline. Based on the information that you provided, the Commission on Water Resource Management (Commission) does not require a Stream Channel Alteration Permit Application to be submitted because this gulch is a non-perennial stream that does not support instream uses.

The Commission's Stream Protection and Management Branch has the responsibility to protect stream channels from alteration whenever practicable to provide for fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses in the State under the authorization of the State Water Code, HRS Chapter 174C, and HAR Chapter 13-169, Protection of Instream Uses of Water. The Commission requires that a permit be approved prior to undertaking a stream channel alteration, however, routine streambed and drainageway maintenance activities are exempt from obtaining a permit.

Please be advised that the project may require other agency approvals regarding wetlands, water quality, grading, stockpiling, and floodways. This letter should not be used for other regulatory jurisdictions or used to imply compliance with other federal, state, or county rules. Work performed without appropriate permits or authorizations may be subject to fines and/or remedial actions. If you have any questions, contact Rebecca Alakai at 587-0266, or rebecca.r.alakai@hawaii.gov.

Sincerely,

Rebecca Alakai

Rebecca Alakai, Planner, Regulatory Section
Commission on Water Resource Management

GEOLOGIST REPORT FOR MAHINAHINA WELL

APPENDIX G-1

GEOLOGIST'S REPORT

MAHINAHINA EXPLORATORY WELL 5638-04

Mahinahina, West Maui, Hawaii

Prepared for:

FUKUNAGA AND ASSOCIATES
1357 Kapiolani Boulevard, Suite 1530
Honolulu, HI 96814

and

COUNTY OF MAUI
DEPARTMENT OF WATER SUPPLY
Wailuku, Maui 96793

by:

Daniel Lum
WATER RESOURCE ASSOCIATES
1296 Kapiolani Boulevard, #1704
Honolulu, Hawaii 96814

GEOLOGIST'S REPORT

MAHINAHINA EXPLORATORY WELL 5638-04

Mahinahina, West Maui, Hawaii

Prepared for:

FUKUNAGA AND ASSOCIATES
1357 Kapiolani Boulevard, Suite 1530
Honolulu, HI 96814

and

COUNTY OF MAUI
DEPARMENT OF WATER SUPPLY
200 South High Street
Wailuku, Maui 96793

by:

Daniel Lum
WATER RESOURCE ASSOCIATES
1296 Kapiolani Boulevard, #1704
Honolulu, Hawaii 96814

September 2014 (Revised February 2015)

CONTENTS

FIGURES

GEOLOGIST'S REPORT
MAHINAHINA EXPLORATORY WELL 5638-04
Mahinahina, West Maui, Hawaii

EXECUTIVE SUMMARY

Based on a high head of 44 ft., msl, a pristine chloride content of 10 mg/L, a water temperature of 66.0 degrees F., and area geology, the Mahinahina Well taps a newly discovered high-level, dike-confined groundwater aquifer. The well is located at an elevation of 1,316.8 ft. and has an 18-inch diameter casing. Based on Wailani Drilling's video log of the deepened well, 60 ft. of perforated casing extends from 1,334 ft. to 1,394 ft. (-17 ft. to -77 ft., msl); 24-inch open hole extends to 1,408 ft. (-91 ft., msl); and below that a 12-inch open hole extends to 1,558 ft. (-241 ft., msl). Initial drilling of the well was completed in January 2012 and deepening of the well was completed in February 2014.

The first test of the well was conducted for 6 days at a pumping rate of 1,117 gpm in April 17-23, 2013. The results were unsuccessful in achieving a stable drawdown and quick recovery (**Figure 3**). However, results of water quality tests indicated that the groundwater source has a pristine chloride content of 10 mg/L and is pesticide free. Non-fecal Coliforms were present in water samples taken during the pumping test.

Based on the unsatisfactory results of the April 17-23, 2013 pumping test, it was decided to deepen the well approximately 200 ft. in a "wildcat" attempt to increase well yield. In February 2014, the well was deepened 150 ft. from 1,408 ft. to 1,558 ft. (1,558 ft. depth confirmed by well logging equipment, December 2014). Three months later, the second test of the well was conducted for 10 days at a pumping rate of 726 gpm on May 2-12, 2014. As expected the results were better than the test at 1,117 gpm, but again unsuccessful in achieving a stable drawdown and quick recovery. At 726 gpm, the rate of drawdown in the well appears to be linear during the last four days of the test (**Figures 7 and 8**) and a linear extrapolation of the data (**Figure 9**) indicates that drawdown in the well would reach 80 ft. (-36 ft., msl, or 19 ft. above casing bottom) after 270 days of continuously pumping 24/7 at 726 gpm. The linear extrapolation of drawdown in **Figure 9** is considered to be a reasonable, but uncertain interpretation.

Theoretical equations for unconfined aquifers are not applicable to dike-confined aquifers and estimates of sustainable pumping capacity by graphical analysis cannot be considered reliable. Nevertheless, the sustainable pumping capacity of the Mahinahina Well has been empirically estimated to be approximately 500 to 550 gpm, based on the two Mahinahina pumping tests and experience with similar wells elsewhere. Assuming an estimated sustainable pumping capacity of 500 gpm and an operational schedule of 16- hour pumping per 24-hour period, the Mahinahina Well can be outfitted with a 700 gpm permanent pump. Therefore, the well should be completed and capped as specified.

PART I – DRILLING WELL TO DEPTH OF 1,408 FT. (-91 ft., msl)

WELL LOCATION

The Mahinahina Exploratory Well is located on the western slopes of West Maui at an elevation of 1,316 ft. near the mauka edge of former pineapple fields that were abandoned in 2009 (**see Figure 1**). The well lies approximately 3.3 miles inland from the coast and 1.1 miles inland of the Department of Water Supply's Mahinahina Surface Water Treatment Facility. The well is accessible from the coastal highway (State Hwy 80) via unimproved former agricultural dirt roads.

HYDROGEOLOGIC SETTING

The Mahinahina Exploratory Well is the first deep well to encounter high-level, dike-confined groundwater on the western slopes of West Maui. Heretofore, all wells in the area have encountered unconfined basal groundwater. The Mahinahina well penetrated flank flow lavas typical of Hawaii volcanoes. However, based on the Mahinahina Well tests and mapped dike exposures in the floor of nearby Honokowai Gulch (Stearns and Macdonald, 1942), these lavas presumably have been intruded by dikes. The nearest dike exposure is located only 4,000 ft. away. Several of the mapped dikes have a northwest-southeast trend in the direction of the Mahinahina Well. Rainfall at the well site averages 50 inches a year—not enough to significantly recharge the groundwater aquifer below. Therefore, most recharge is believed to originate several miles away from higher rainfall on the upper slopes of West Maui.

AS-BUILT WELL DATA (Well Depths from Video Log of Deepened Well; Initial Depth verified from Video Log of Cased Hole by Wailani Drilling)

Month/Year Drilling and Testing Completed:	April 2013
Month/Year Deepening and Testing Completed:	May 2014
Ground Elevation:	1,316.8 ft.
Depth to Static Water Level:	1,268 ft. (49 ft., msl)
Solid Casing (18") Depth:	1,334 ft. (-17 ft., msl)
Perforated Casing (18") Depth:	1,394 ft. (-77 ft., msl)
Grouted Annular Space Depth:	1,200 ft. (+117ft., msl)
Initial Depth of Well (From Video Log of Pilot Hole):	1,408 ft. (-91 ft., msl)
Extended Depth of Well (12" Open Hole):	150 ft.
Final Depth of Well:	1,558 ft., (-241 ft., msl)

INITIAL PLANNING AND DESIGN

The Mahinahina Well was initially planned and designed to develop a unconfined basal aquifer, based on basal water conditions observed in nearby Honokowai Well B with a head of 17 ft. reported in the State Water Commission's Well Index and Summary (later reported as 4.3 ft. after outfitted for development) and in other existing wells in the area with heads of about 4 to 5 ft.

Almost from the moment that the pilot hole encountered groundwater standing at an elevation of approximately 44 ft. above mean sea level, it became apparent that high-level groundwater had been encountered by the Mahinahina well. The question of well yield limited by chloride sensitivity became a question of well yield limited by high-level water conditions.

RESULTS OF 2/18/13 STEP-DRAWDOWN TEST

A step-drawdown test was performed on February18, 2013 at pumping rates ranging from approximately 650 to 1,250 gpm with corresponding drawdowns ranging from 1.1 ft. to 2.4 ft. The resulting Yield vs Drawdown Curve (**see Figure 2**) is useful in showing initial drawdowns that can be expected for different rates of pumping. The specific capacity of the well is 500 gpm per foot of drawdown, based on a pumping rate of 1,250 gpm. The 2/18/13 Step-Drawdown Test data is shown in the Appendix.

RESULTS OF 4/17-23/13 CONSTANT-RATE TEST @ 1,117 GPM

After several attempts, a 6-day constant-rate test was successfully performed on April 17-23, 2013 at an average pumping rate of 1,117 gpm (1.6 mgd). The resulting drawdown and recovery curve is shown in **Figure 3**. After an initial drawdown of 3 ft., drawdown in the well increased somewhat linearly with time, at a rate of roughly 0.7 ft. per day, reaching a total of 8.2 feet after six days of continuous pumping. After pumping was stopped, well recovery was slow, as expected for a confined, high-level aquifer. The well took 5 days to recover 80 percent toward its initial drawdown of 3 ft. (from 8.2 to 4.04 ft. drawdown) and 10.5 days to recover 90 percent (from 8.2 ft. to 3.52 ft. drawdown). As shown in **Figure 3**, the rate of recovery averaged 0.15 ft./day during the latter part of the observed recovery.

Drawdown measurements were made with an electrical sounder consisting of a flat tape with calibrated footage markings to the nearest one-hundredth of a foot. Measurements using an airline assembly were discontinued after pressure gage readings proved to be both unreliable and imprecise (pressure gage readings equivalent to 0.5 feet of drawdown). Throughout the April 17-23, 2013 test, the chloride content of the pumped water remained unchanged at 110 microSiemens per centimeter (10 mg/L, based on silver nitrate titration in the laboratory). Temperature of the pumped water remained steady at 66.0 degrees Fahrenheit. The 4/17-23/2013 Constant-Rate Test data is shown in the Appendix

RESULTS OF PLUMBNESS AND ALIGNMENT TESTS (Open-Hole and Cased Well)

A Plumbness and Alignment (P&A) Test of the 25-inch open hole was performed on August 29, 2012. The open-hole test served as a preliminary assessment of the open-hole alignment prior to installing the well casing. A graph of the calculated drift of the open-hole at 20-foot intervals of depth is shown in **Figure 4** and was deemed satisfactory prior to installation of the well casing. The data is shown in the Appendix.

A Plumbness and Alignment Test of the 18-inch cased well was performed on June 24, 2014. A graph of the calculated drift is shown in **Figure 5** and indicates that the plumbness and alignment of the cased well are within specifications of a maximum drift of ½ the casing diameter per any 100 foot interval of casing. A tabulation of the data is shown in the Appendix.

LABORATORY REPORT ON WATER QUALITY

Water samples were collected on April 3, 2013 after three days of pumping. The samples were shipped to and analyzed by Eurofins Eaton Analytical of Monrovia, California for water quality parameters required by the Hawaii Department of Health for new drinking water sources. All organic parameters tested were non-detectable and all other parameters were less than maximum contaminant levels (see Appendix).

Water samples for bacteriological analyses were collected by others and analyzed by Food Quality Lab of Honolulu, Hawaii. The results reportedly were positive for non-fecal Coliforms.

CONCLUSIONS

Based on pumping test results, an average high head of 44.1 ft., a pristine chloride content of 10 mg/L, a water temperature of 66.0 degrees, F., and dike occurrence in nearby Honokowai Gulch). Groundwater recharge is believed to be primarily from rainfall on the interior slopes of West Maui. The dike-confined, high-level aquifer tapped by the Mahinahina Well is isolated from and unaffected by basal-water conditions; namely, salt-water intrusion experienced in existing wells located seaward of the Mahinahina Well. A linear extrapolation microSiemens per centimeter (10 mg/L, based on silver nitrate titration in the laboratory). Temperature of the pumped water remained steady at 66.0 degrees Fahrenheit. The 4/17-23/2013 Constant-Rate Test data is shown in the Appendix

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After completion of the 4/17-23, 2013 Constant-Rate Test, the Mahinahina Well at the interim depth of 1,408 ft. (-91ft., msl) clearly could not be sustained at a constant pumping rate of 1,117 gpm (1.6 mgd), based on the observed drawdown and recovery data in **Figure 3**. In view of expectations for a 1.0 mgd (700 gpm) primary, rather than standby well source, recommendations were made to deepen Mahinahina Well 200 ft. in a "wildcat" attempt to increase well yield by encountering additional water-bearing formations, based on similar successful wildcat drilling in North Kona's high level aquifers.

PART II – DEEPENING THE WELL 150 FEET TO DEPTH OF 1,558 FEET (-241 ft., msl)

The Mahinahina Well was deepened an additional 150 ft. by drilling a 12-inch diameter open hole from a depth of 1,408 ft.to a depth of 1,558 ft. (-241 ft., msl), based on video logs of the pilot hole and the deepened well. Before drilling, the risk of encountering brackish groundwater by drilling deeper was considered to be little to none.

MAHINAHINA HYDROLOGY, WATER USE, AND SUSTAINABLE YIELD

As shown in **Figure 6**, the boundary between high-level and basal groundwater occurrence has been delineated by the Mahinahina Well with its high head of 44.1 ft. and pristine 10 mg/L chlorides, and Honokowai Well B with its basal head of 4.3 ft. and high 218 mg/L chlorides (potable water limit is 250 mg/L).

The geologic nature of the hydrologic boundary between the high-level and basal groundwater occurrences in the Mahinahina area is likely due to subsurface dikes as evidenced dike exposures mapped in nearby Honokowai Gulch by Stearns and Macdonald, 1942. Most of the dikes have a general northwest-southeast trend and the closest exposure is located only 4,000 ft. from the Mahinahina Well. Because the physical characteristics of the dike compartment(s) encountered by the Mahinahina Well are indeterminate, the confined aquifer's hydrologic characteristics are impossible to predict on the basis of typical pumping tests.

On the other hand, the basal aquifers in the Mahinahina area is generally characterized as thin and affected by increases in chlorides (due to salt-water upconing) under pumping conditions, based on data from existing Wells P-1 to P-6 and Honokowai Well B located along a two-mile stretch of the coast (see **Figure 6**). For the month of April 2014, the monthly water use from these six wells totaled 2.66 mgd, with chlorides ranging from a low of 50 mg/L to a high of 326 mg/L (see individual well data in **Figure 6**). Interestingly, Honokowai Well B, the most inland well located 3.1 miles inland from the coast and approximately 2,000 ft. south-southeast of the Mahinahina Well, had a chloride content of 218 mg/L with a monthly pumpage of 1.01 mgd. With approximately 2.7 mgd of water use already being produced by these existing wells, together with an additional 1.0 mgd of groundwater use potentially available for development by the recently drilled and presently unused Department of Hawaiian Homes Well (see **Figure 1** for location), there remains approximately 2.3 mgd of groundwater available for development in the Mahinahina-Honokowai area, based on the State Water Commission's estimated sustainable yield of 6 mgd for the Honokowai Hydrologic Sector. This 2.3 mgd balance of groundwater available in the Honokowai Hydrologic Sector may well come from future wells located to tap the newly discovered dike-confined groundwater, as reliable potable water sources free from salt water intrusion and upconing.

RESULTS OF 3/31/14 STEP-DRAWDOWN TEST

With the Mahinahina Well drilled 150 ft. deeper, a second step-drawdown test was performed on March 31, 2014 at pumping rates ranging from 700 to 1,015 gpm, with corresponding drawdowns ranging from 1.2 ft. to 2.0 ft. The resulting Yield vs Drawdown Curve, shown in **Figure 2**, represents the as-built yield vs drawdown data for the Mahinahina Well. However, the two yield-drawdown curves shown in **Figure 2** are roughly the same, suggesting that the "wildcat" deepening of the Mahinahina Well did not improve its yield as hoped.

RESULTS OF 5/2-12/14 CONSTANT-RATE TEST @ 726 GPM

During May 2-12, 2014, the Mahinahina Well, with its new depth of 1,558 ft. (-241 ft., msl) was tested at a constant rate of 726 gpm (1.04 mgd) for 10 days. As expected for a confined aquifer, the chloride content and temperature of the pumped water remained steady at a pristine 10 mg/L chlorides (based on electrical conductivity measurements of 110 microSiemens/cm) and 68.0 degrees Fahrenheit.

On the other hand, drawdown in the well did not stabilize (see **Figure 7**) even though the pumping rate was lowered from 1,117 gpm to 726 gpm. **Figure 7** shows the observed drawdown curve during 10 days of pumping and the recovery curve during 17 days of recovery. The rate of drawdown appears to decrease with time and the rate of recovery varies with time, presumably in response to geohydrologic differences in water-bearing formations and irregularities in dike occurrences.

The scale of the drawdown curve in **Figure 7** was expanded in **Figure 8** to more precisely determine an apparent linear rate of drawdown (0.28 ft./day) during the last four days of the test. Then, based on 0.28 ft./day and the assumption that the well's drawdown rate remains linear, the observed drawdown curve was extrapolated, indicating that drawdown in the well would reach 80 ft. (-36 ft., msl, or 19 ft. above casing bottom) after approximately 270 days of continuously pumping 24/7 @ 726 gpm (see **Figure 9**). In other words, a permanent pump installed near the bottom of the well casing would reach its maximum drawdown limit after approximately 270 days of constant pumping at an average rate of 726 gpm. Note: The bottom of the perforated casing in the Mahinahina Well is at -77 ft., msl.

CONCLUSIONS

The linear extrapolation of drawdown in **Figure 9** is considered to be a reasonable, but uncertain interpretation. The slope of the drawdown curve appears to decrease with time and to become linear (0.28 ft./day) during the last four days of the test. However, it is conceivable that the slope of the drawdown curve beyond the ten days of pumping could either decrease further (become asymptotic) or increase due to hydrologic boundaries. What is certain is that the sustainable pumping capacity of the Mahinahina Well cannot be definitively determined from the 10-day test data. Theoretical equations for unconfined aquifers are not applicable to dike-confined aquifers and estimates of sustainable pumping capacity by graphical extrapolations of both the drawdown and recovery data cannot be considered reliable. Only by conducting long-term continuous pumping with a permanent pump would it be possible or practical to determine the well's sustainable pumping capacity.

However, the sustainable pumping capacity of the Mahinahina Well has been empirically estimated to be approximately 500 to 550 gpm, based on the two Mahinahina pumping tests and experience with similar wells elsewhere. Assuming an estimated 500 gpm sustainable pumping capacity and an operational schedule of 16 hours pumping per 24 hour period, the Mahinahina Well can be outfitted with a 700 gpm permanent pump.

Finally, the Mahinahina Well has located high-level groundwater, a source free from salt-water intrusion, at elevation 1300 ft. which is reasonable for water development when compared to an elevation of 1600 ft. in North Kona. Based on hydrogeologic conditions indicated by the Mahinahina and by other existing wells in the area, additional exploratory well drilling in the Mahinahina area to locate high-level or basal groundwater is warranted.

PART III – RE-TEST OF PLUMBNESS AND ALIGNMENT AND FINAL DEPTH OF WELL (1,558 FEET, or -241 ft., msl)

On December 4, 2014 a re-test of the plumbness and alignment of the cased well was conducted by Beylik Drilling with data recorded by Tom Nance. The results were within contract specifications. Beylik Drilling also checked the depth of the well with logging equipment and a small weight. The depth of the well measured 1,558 ft., 37 ft. less than the 1,595 ft. depth reported in the Wailani Driller's logs.

On December 15, 2014 a dummy test was conducted by Beylik Drilling. The dummy was constructed with five equally spaced rings welded onto a 40 ft. length of 8-inch diameter pump column pipe. The dummy was run in and out of the cased well at a roughly estimated rate of less than 40 ft. per minute. On the down-hole run the dummy ran freely, but between the approximate depths of 1,000 to 1,040 ft., three or four distinct metallic scraping sounds were heard at the top of the casing. On the up-hole run the sounds were recorded with a small Canon S-95 camera. Four separate metallic scraping sounds were audible on the recording. One was loud and one was faint. The one loud and two moderate scraping sounds suggest that the dummy did not move freely through the 1,000 to 1,040 ft. interval of the casing.

On December 29, 2014 Beylik Drilling attempted to bail the well because it was suspected by the contractor that caved-in material had filled the open hole (Walani driller's logs showed drilled depth of 1,595 ft., whereas current measured well depth is 1,558 ft.). An approximately 10 ft. long, 6-inch diameter suction bailer was used and after seven bails (observed by Jeff Pearson and Dan Lum), less than 2 gallons of material were brought to the surface. Several of the seven bails came up empty. Based on experience, retrieval of at least 5 to 10 gallons (3 to 6 ft. of bailer length) of caved-in fill material per bail was expected. The material brought to the surface consisted of crushed red and black cinders with a few coarse pieces up to one inch in size. The fact that a total of 15 bails (an additional 8 bails were reported by Beylik but not observed by Pearson and Lum) retrieved comparatively little material suggests that the 1,558 ft. depth of the well represents undrilled bedrock and not caved-in fill material.

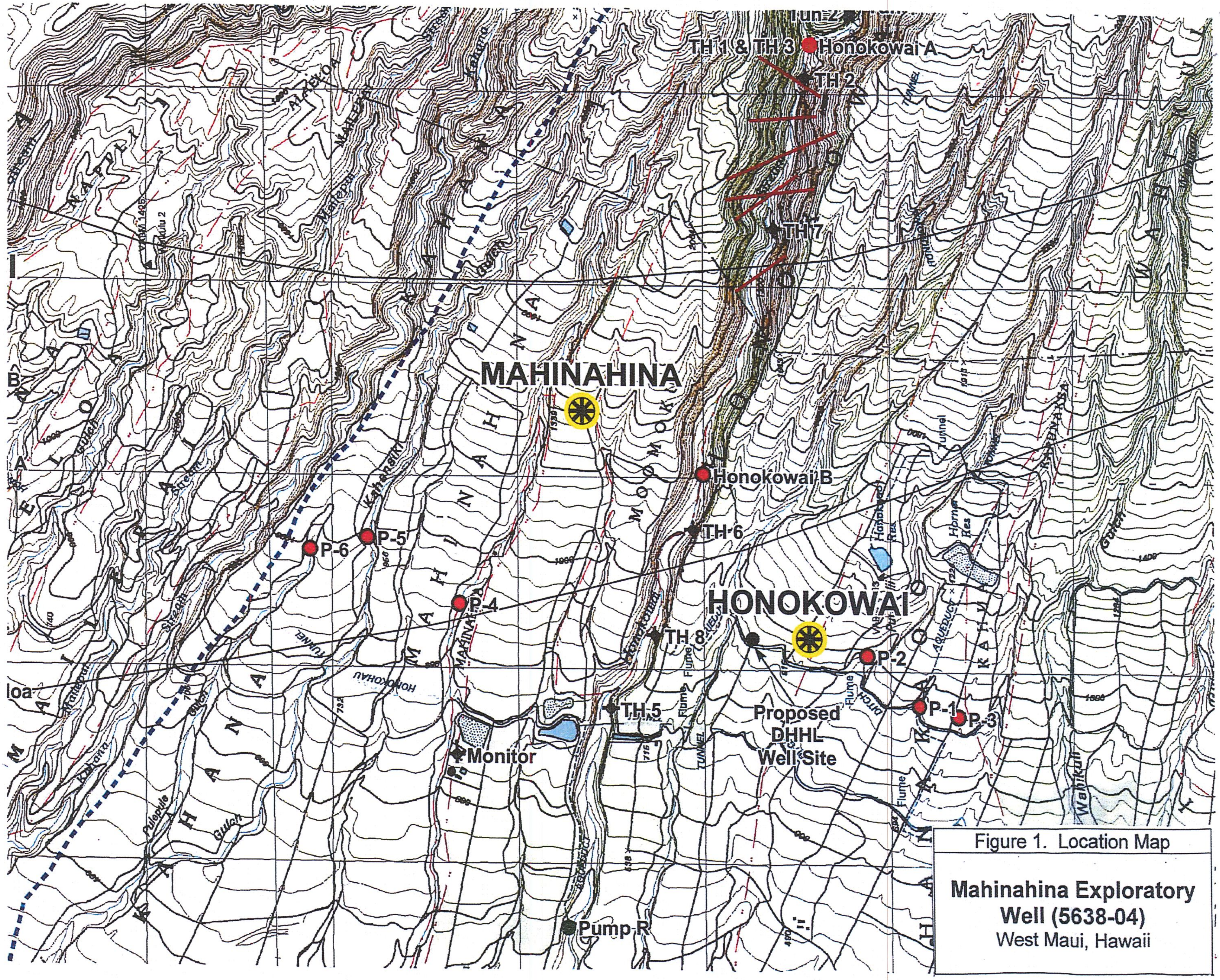


Figure 1. Location Map

Mahinahina Exploratory Well (5638-04)

West Maui, Hawaii

Figure 2. Yield vs Drawdown Curves

Mahinahina Well 5638-04

Step-Drawdown Tests, 2/18/13 (TD = -91 ft., msl) and 3/31/14 (-241 ft., msl)

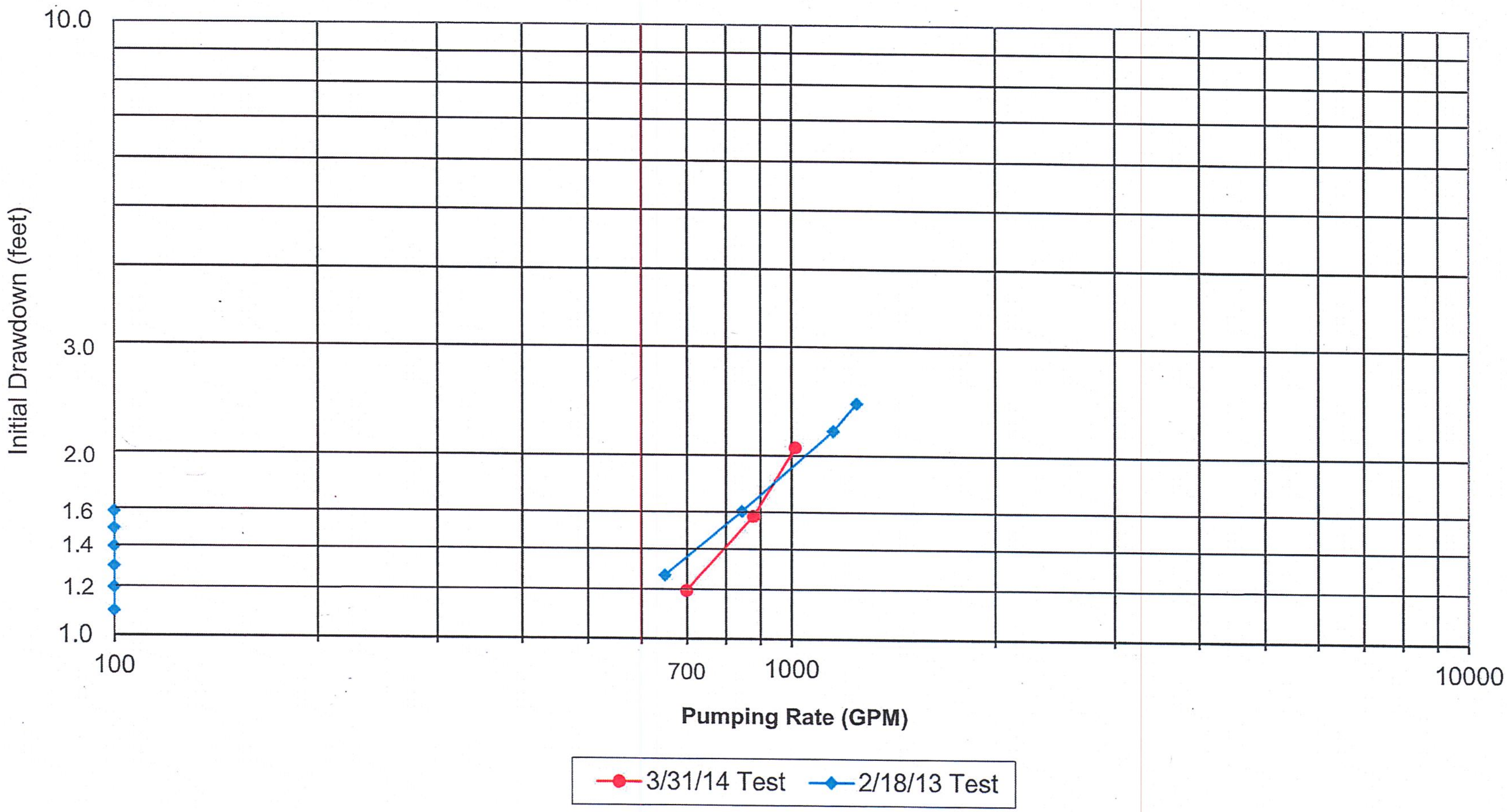
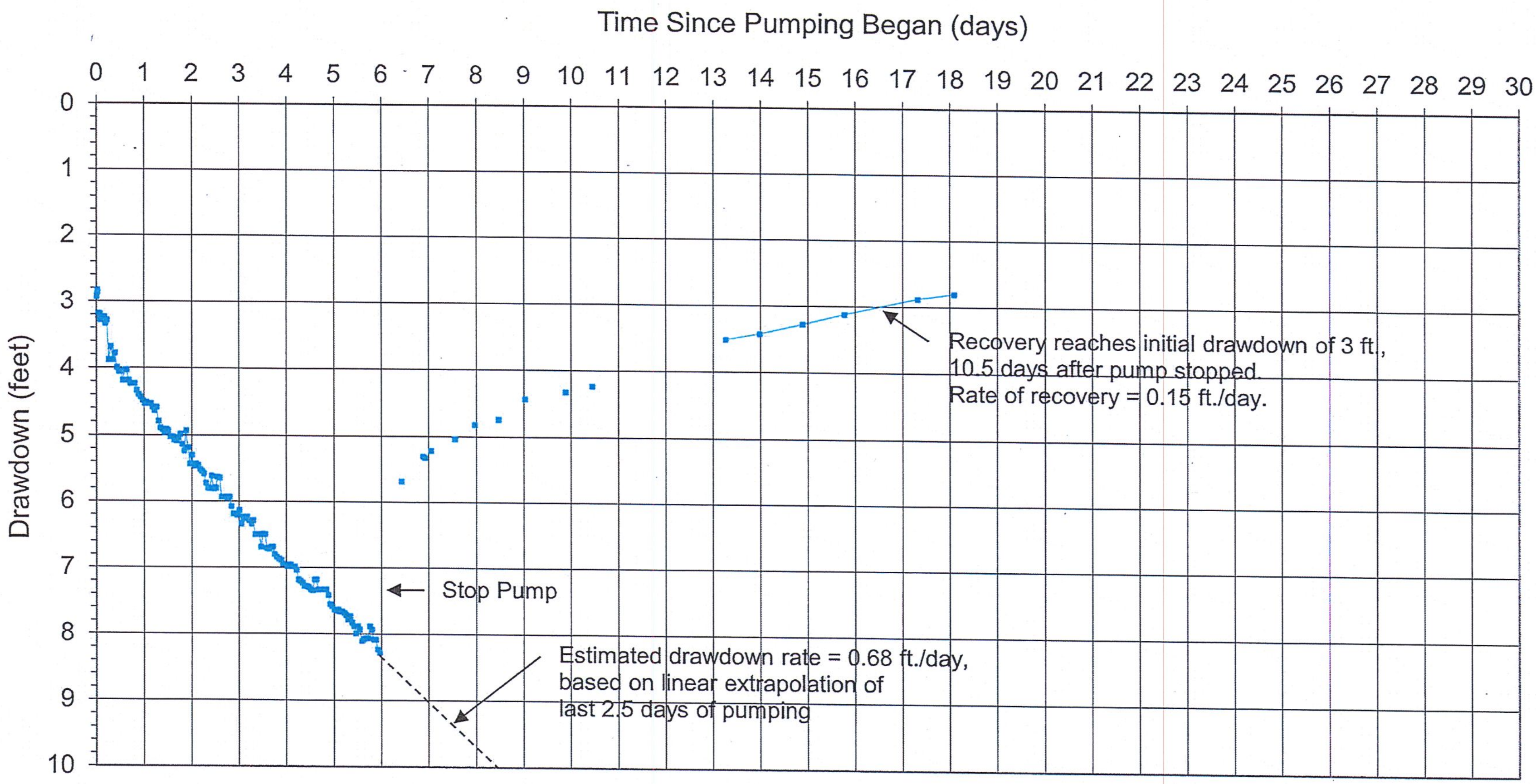


Figure 3. Drawdown and Recovery Curve
Mahinahina Well 5638-04
C.R. Test at 1,117 GPM, 4/17-23/13. T.D. = -91 ft., msl



Note: Slack in cable detected at 1390+/- ft. depth. Therefore, deflection readings at 1400' and 1420' not valid, but taken to corroborate slack.

Figure 4. CALCULATED DRIFT OF 25" OPEN HOLE
MAHINAHINA WELL 5638-04
P & A Test, 8/29/12

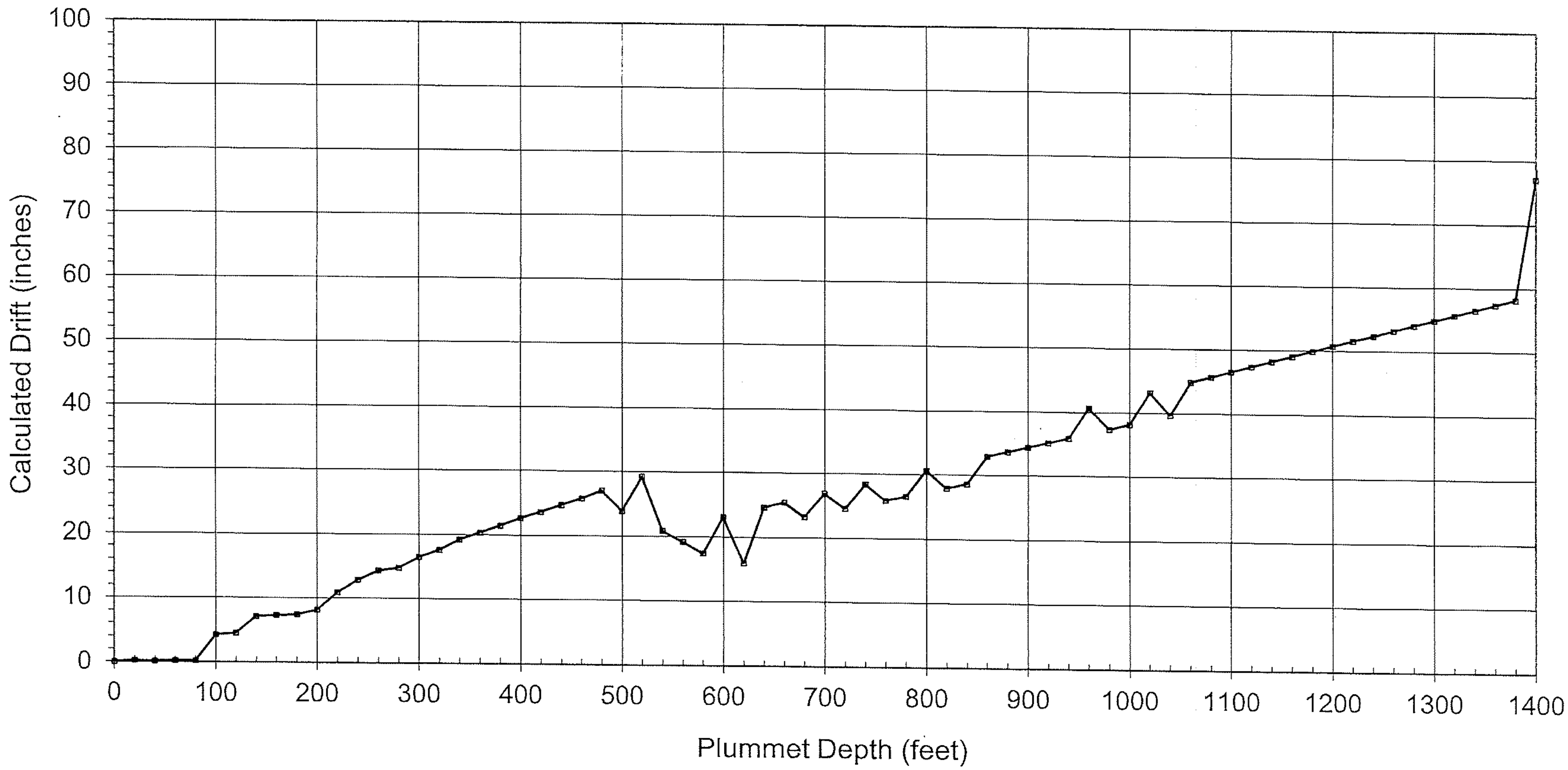
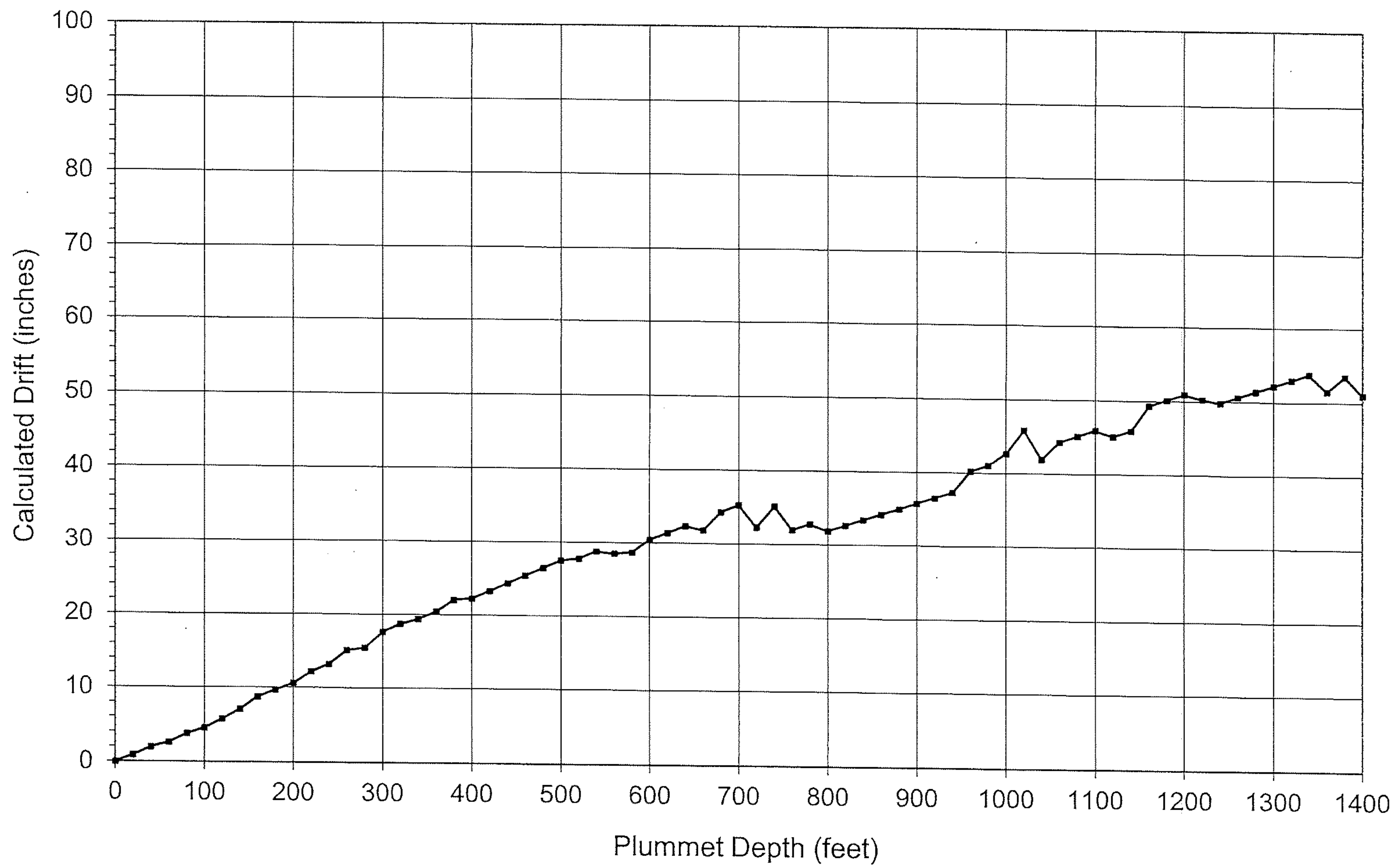


Figure 5. CALCULATED DRIFT OF 18" CASING
MAHINAHINA WELL 5638-04
P & A Test, 6/24/14



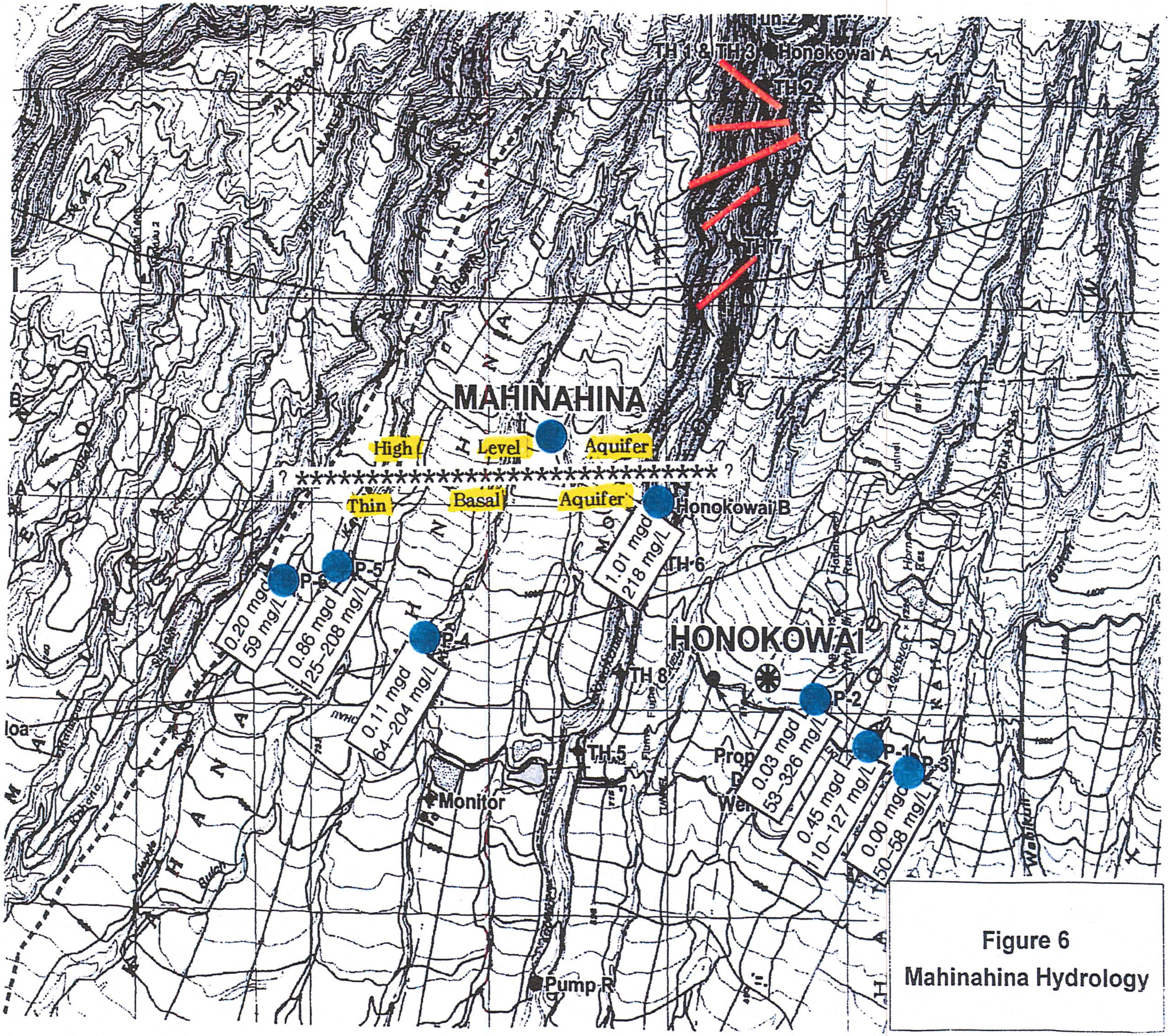


Figure 6
Mahinahina Hydrology

Figure 7. Drawdown & Recovery Curve, Mahinahina Well 5638-04

C.R. Test at 726 gpm, May 2-12, 2014. T.D. = -241 feet, msl

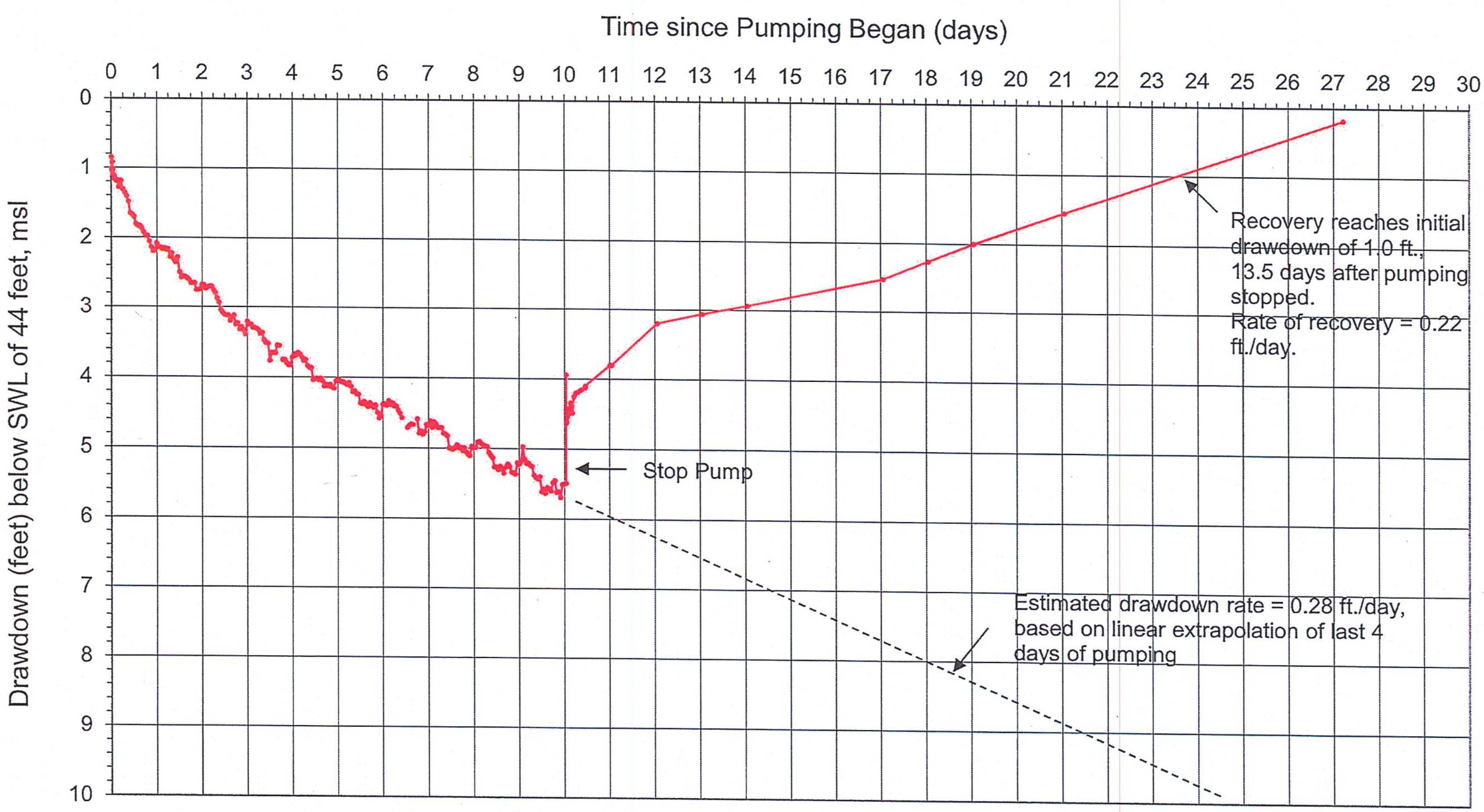


Figure 8. Observed Drawdown Curve, Mahinahina 5638-04
C.R. Test at 726 gpm, May 2-12, 2014. T.D. = -241 ft., msl

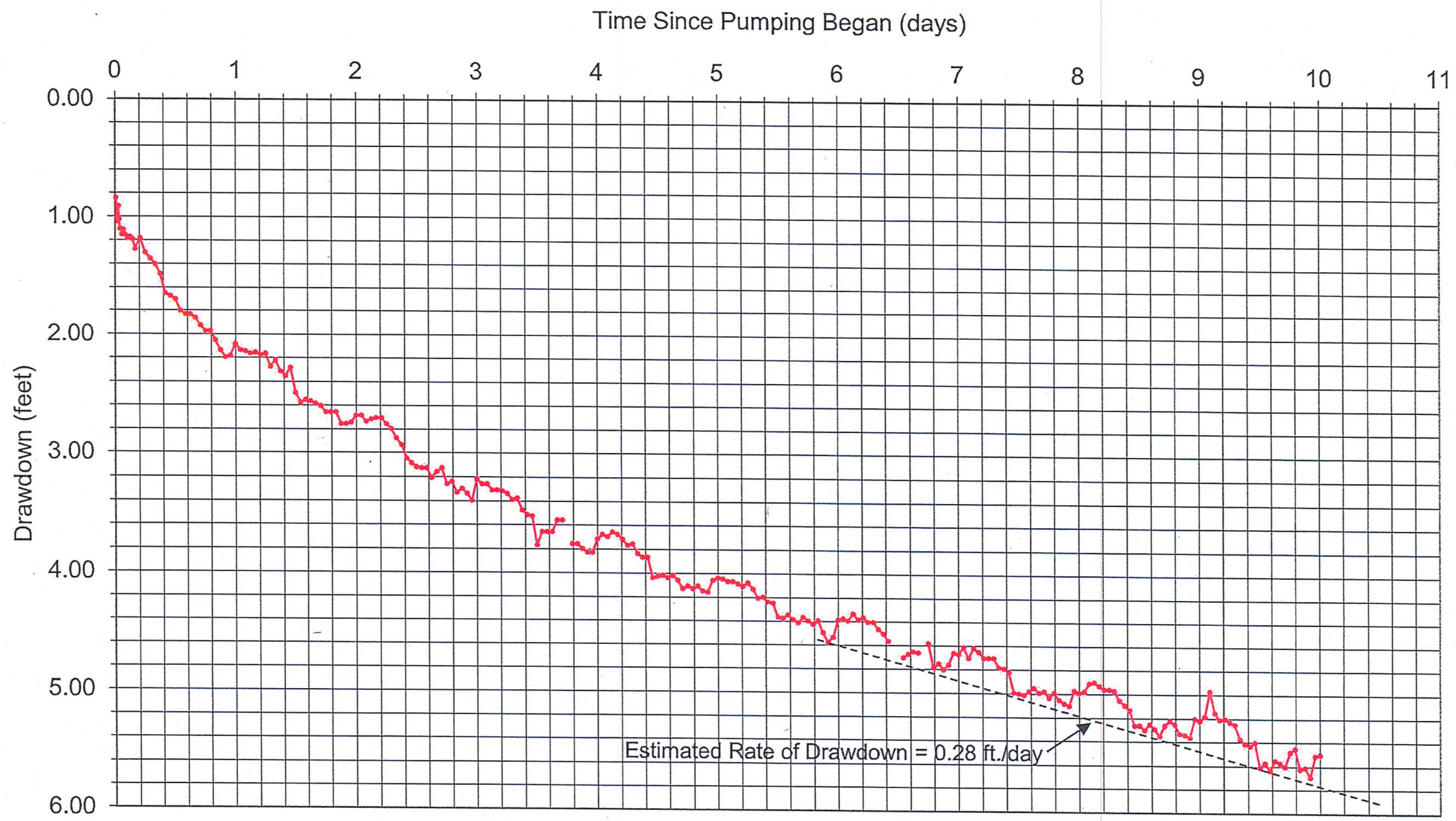
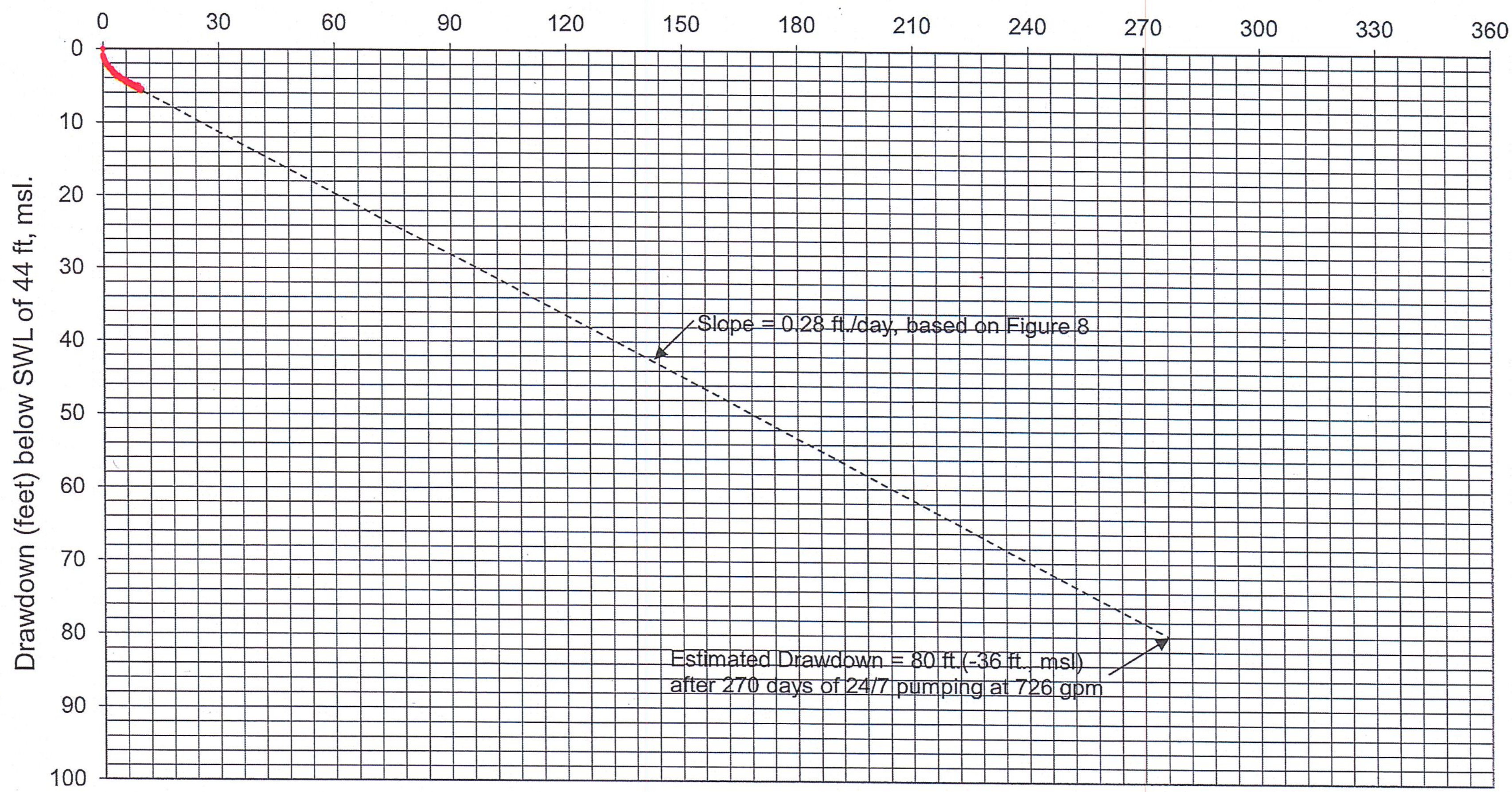


Figure 9. Observed & Extrapolated Drawdown
Mahinahina Well 5638-04
C.R. Test at 726 gpm, May 2-12, 2014. T.D. = -241 feet, msl



APPENDICES

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GEOLOGIST'S REPORT

MAHINAHINA EXPLORATORY WELL 5638-04

Mahinahina, West Maui, Hawaii

Prepared for:

FUKUNAGA AND ASSOCIATES
1357 Kapiolani Boulevard, Suite 1530
Honolulu, HI 96814

and

COUNTY OF MAUI
DEPARMENT OF WATER SUPPLY
200 South High Street
Wailuku, Maui 96793

by:

Daniel Lum
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Honolulu, Hawaii 96814

September 2014 (Revised February 2015)

CONTENTS

ERRATA: In the Step Drawdown and Constant Rate Test Records, the Initial and Final Depths of the Well were reported as 1,420 ft. and 1595 ft., respectively, based on Wailani Driller's Logs. However, these two figures, 1,420 ft. and 1,595 ft., have been corrected in the text as 1,408 ft. and 1,558 ft., respectively. These two corrections and their corresponding mean sea level values are based on footage from video logs taken subsequent to the Driller's Logs.

2/18/13 STEP-DRAWDOWN TEST RECORD

Date: 2/18/2013

Well Name: MAHINAHINA
State Well No.: 5638-04
Project WEST MAUI
Island MAUI

DEPTH (Below Ground Surface):
Solid Csg: 1312' Perforated Csg: 1372'
Total Depth: 1420'
Depth to Water __________*
*Remarks: __________

ELEVATIONS (Mean Sea Level):
Ground Surface: 1316.8 ft.
Top of Casing: ______ ft. Rotary Table: ______ ft.
Bot. of Solid Csg: ______ Bot. of Perf. Csg: ______
Bot. of Well: ______ Static Water Level: 44.17

TEST PUMP:
Type: LINE SHAFT Intake Elev: ______

DRAWDOWN MEASUREMENT:
☒ Pressure Gage ☐ Elect. Probe ☐ Transducer

DISCHARGE MEASUREMENT: ☐ Flow meter ☐ Other ______
Begin Meter: 75,197,100 gals.
End Meter: 75,318,550 gals.

PRESENT AT TEST: D. LUM, C. EATON, J. MENDONCA, K. AHUNA

Suggested Elapsed Time (min)	Actual Elapsed Time (min)	Time Of Day	Airline Reading (psi)	Electric Sounder Reading (psi)	Drawdown (feet)	Pumping Rate (gpm)	Sample No.	Chloride s (mg/L)	Temp. (°F)	E.C. (µS/cm @ 25 °C)
-45	-45	9:15	18.50		0					
-30	-30	9:30	18.50		0					
-15	-15	9:45	18.50		0					
0	0	10:00	18.50		0					
			START PUMP – ADJUST RATE TO 600 ± GPM							
5	7	10:07	18.20		0.69	643				111
10	10	10:10	18.15		0.81	632				
15	15	10:15	18.10		0.92	660			68.0	
20	20	10:20	18.00		1.15	652				
25	25	10:25	18.00		1.15	645				
30	30	10:30	17.95		1.27	660				
35										
40										
45										
50										
55										
60										
			ADJUST RATE TO 800 ± GPM							
65	35	10:35	17.95		1.27	845				
70	40	10:40	17.85		1.50	845				

WEATHER: INTERMITTENT LIGHT RAIN, MUDDY SITE

Step-Drawdown Test Record (Cont'd)

Well Name: MAHINAHINA State Well No.: 5638-04

Suggested Elapsed Time (min)	Actual Elapsed Time (min)	Time of Day	Airline Reading (psi)	Electric Sounder Reading (psi)	Drawdown (feet)	Pumping Rate (gpm)	Sample No.	Chlorides (mg/L)	Temp (°F)	E.C. (µS/cm @ 25 °C)
75	45	10:45	17.80		1.62	845				
80	50	10:50	17.80		1.62	845				
85	60	11:00	17.85		1.50	845				
90										
95										
100										
105										
110										
115										
120										
				ADJUST RATE TO 1100 ± gpm						
125	65	11:05	17.70		1.85	1154				
130	70	11:10	17.60		2.08	1154				
135	75	11:15	17.65		1.96	1154				
140	80	11:20	17.60		2.08	1154				
145	85	11:25	17.55		2.19	1154				
150	90	11:30	17.55		2.19	11:54				
155										
160										
165										
170										
175										
180										
				ADJUST RATE TO Max gpm						
185	95	11:35	17.50		2.31	1250				
190	100	11:40	17.50		2.31	1250			68.0	110
195	105	11:45	17.50		2.31	1250				
200	110	11:50	17.50		2.31	1250				
205	115	11:55	17.45		2.43	1250				
210	120	11:20	17.40		2.54	1250				

Step-Drawdown Test Record (Cont'd)

Well Name: MAHINAHINA State Well No.: 5638-04

Suggested Elapsed Time (min)	Actual Elapsed Time (min)	Time of Day	Airline Reading (psi)	Electric Sounder Reading (psi)	Drawdown (feet)	Pumping Rate (gpm)	Sample No.	Chlorides (mg/L)	Temp. (°F)	E.C. (µS/cm @ 25 °C)
215										
220										
225										
230										
235										
240	125	12:05	17.45		2.43	1250				
	0			STOP PUMP – RECOVERY						
1	3	12:08	18.50		0	0				
2	5	12:10	18.54		0.05					
3										
4										
5										
6										
7										
8										
10										
15										
20										
25										
30										
40										
50										
60										
70										
80										
100										
120										
150										
180										
210										

250

3/31/14 STEP-DRAWDOWN TEST RECORD

Date: 3/ 31 / 2014

Well Name: Mahinahina Exploratory Well **State Well No.:** 5638-04

Project: West Maui Island Maui

DEPTH (Below Ground Surface):

Solid Csg: 1312 ft. Perforated Csg: 1372 ft.

Total Depth: 1595 ft.

Depth to Water .

*Remarks: ______________________________

ELEVATIONS (Mean Sea Level):

Ground Surface: 1316.8 ft.

Top of Casing: ________ ft. Rotary Table: __________ ft.

Bot. of Solid Csg: Bot. of Perf. Csg:

Bot. of Well: Static Water Level: 44.17 ft.

TEST PUMP:

Type: _______________ Intake Elev: ___________

DRAWDOWN MEASUREMENT:

■ Pressure Gage ☐ Elect. Probe ☐ Transducer

DISCHARGE MEASUREMENT: ■ Flow meter ☐ Other________ Begin Meter: 917149 x 100 gals.

PRESENT AT TEST: ____ End Meter: ____________________ gals.

Suggested Elapsed Time (min)	Actual Elapsed Time (min)	Time Of Day	Solinst Reading (ft.)		Drawdown (feet)	Pumping Rate (gpm)	Sample No.	Chlorides (mg/L)	Temp. (°F)	E.C. (µS/cm @ 25 °C)
-45										
-30			1294.02			0				
-15			1294.01			0				
0	0	12:00N	1294.02			0				
5	5		1295.08		1.07	675			66.5	
10	10		1295.09		1.08	675				
15	15		1295.19		1.18	675		10		
20	20		1295.22		1.21	700			67.1	119
25	25		1295.21		1.20	700			66.9	110
30	30		1295.21		1.20	700			68.7	110
35	35		1295.56		1.55	860			68.0	108.9
40	40		1295.50		1.49	860				
45	45		1295.54		1.53	880			67.4	109
50	50		1295.54		1.53	880			65.9	109
55	55		1295.61		1.59	880			68.0	109
60	60		1295.57			880			67.2	109
65	65		1295.59			1,015			68.0	107
75	75		1296.08		2.06	1,015			67.8	109
85	85		1295.94			1,015			68.7	109
95	95		1295.97			1,020			68.3	109
100	100		1295.96			1,015			68.1	109

Step-Drawdown Test Record (Cont'd)

Well Name: Mahinahina Exploratory Well **State Well No.:** 5638-04

Suggested Elapsed Time (min)	Actual Elapsed Time (min)	Time of Day	Solinst Reading (ft.)		Drawdown (feet)	Pumping Rate (gpm)	Sample No.	Chlorides (mg/L)	Temp (°F)	E.C. (µS/cm @ 25 °C)
105	105		1296.01			1,015			67.4	109
				STOP PUMP - RECOVERY						
1			1292.22							
2			1292.70							
3			1292.90							
4			1293.85							
5			1294.06							
6			1294.14							
7			1294.14							
8			1294.14							
10			1294.00							
15			1294.12							
20			1294.19							
25			1294.18							

APRIL 17-23, 2013 CONSTANT RATE TEST RECORD
MAHINAHINA WELL 5638-04

Date: 4/17-23/13

Depth (Below Ground Surface):
Solid Csg: 1312 ft. Perf. Csg: 1372 ft.
Total Depth: 1420 ft.
Depth to Water: 1272.63 ft.
Test Pump: Line Shaft
Drawdown Measurement: Pressure Gage, Elect. Probe
Discharge Measurement: Flow meter
Present at Test: D. Lum, C. Eaton, K. Ahuna

Elevations (Mean Sea Level):
Ground Elevation: 1316.8 ft.
Bot. of Solid Csg: +5 ft.
Bot. of Perf. Csg: -55 ft.
Bot. of Well: -103 ft.
Static Water Level: 44.17 ft.
Begin Meter: 81,361,400 gals.
End Meter: 91,013,200 gals.

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)
		-45						
		-30						
		-15						
4/17/13	10:45	0	0.00	1279.52				
	10:55	10	2.93	1282.45	1134			
	11:05	20	2.88	1282.40	1128			
	11:15	30	2.83	1282.35	1130			
	11:25	40	2.86	1282.38	1126			
	11:45	60	3.18	1282.70	1188		111	66.0
	12:05	80	3.23	1282.75	1172			
	12:25	100	3.19	1282.71	1163			
	12:45	120	3.28	1282.80	1165		111	66.0
	1:15	150	3.23	1282.75	1160			
	1:45	180	3.23	1282.75	1148			
	2:15	210	3.23	1282.75	1111			
	2:45	240	3.23	1282.75	1111		111	66.0
	3:15	270	3.33	1282.85	1111			
	4:00	315	3.28	1282.80	1073			
	5:00	375	3.88	1283.40	1174			
	6:00	435	3.68	1283.20	1123		111	60.0
	7:00	495	3.88	1283.40	1170			
	8:00	555	3.78	1283.30	1147			
	9:00	615	3.99	1283.51	1134			
	10:00	675	4.05	1283.57	1162			
	11:00	735	4.05	1283.57	1121			
	12:00	795	4.18	1283.70	1121		110	66.0
4/18/13	1:00	855	4.03	1283.55	1134			

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)
	2:00	915	4.03	1283.55	1129			
	3:00	975	4.18	1283.70	1123			
	4:00	1035	4.23	1283.75	1113			
	5:00	1095	4.23	1283.75	1127			
	6:00	1155	4.23	1283.75	1125		110	66.0
	7:00	1215	4.33	1283.85	1113			
	8:00	1275	4.39	1283.91	1111			
	9:00	1335	4.43	1283.95	1130			
	10:00	1395	4.48	1284.00	1137			
	11:00	1455	4.53	1284.05	1117			
	12:00	1515	4.51	1284.03	1115		110	66.0
	1:00	1575	4.53	1284.05	1130			
	2:00	1635	4.53	1284.05	1132			
	3:00	1695	4.58	1284.10	1126			
	4:00	1755	4.63	1284.15	1132			
	5:00	1815	4.58	1284.10	1117			
	6:00	1875	4.79	1284.31	1102		110	66.0
	7:00	1935	4.89	1284.41	1102			
	8:00	1995	4.91	1284.43	1121			
	9:00	2055	4.96	1284.48	1104			
	10:00	2115	4.91	1284.43	1102			
	11:00	2175	4.93	1284.45	1104			
	12:00	2235	5.02	1284.54	1134		110	66.0
4/19/13	1:00	2295	5.02	1284.54	1104			
	2:00	2355	5.07	1284.59	1104			
	3:00	2415	5.08	1284.60	1094			
	4:00	2475	5.03	1284.55	1090			
	5:00	2535	4.98	1284.50	1094			
	6:00	2595	5.13	1284.65	1090		110	66.0
	7:00	2655	5.23	1284.75	1090			
	8:00	2715	4.93	1284.45	1090			
	9:00	2775	5.18	1284.70	1090			
	10:00	2835	5.43	1284.95	1138	Meter:	84,554,200	gals.
	11:00	2895	5.30	1284.82	1134			
	12:00	2955	5.46	1284.98	1126		110	66.0
	1:00	3015	5.43	1284.95	1128			
	2:00	3075	5.45	1284.97	1126			
	3:00	3135	5.51	1285.03	1111			
	4:00	3195	5.54	1285.06	1117			
	5:00	3255	5.58	1285.10	1107			
	6:00	3315	5.72	1285.24	1111			
	7:00	3375	5.79	1285.31	1111			

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)
	8:00	3435	5.80	1285.32	1113			
	9:00	3495	5.61	1285.13	1117			
	10:00	3555	5.81	1285.33	1117			
	11:00	3615	5.79	1285.31	1109			
	12:00	3675	5.63	1285.15	1134		110	66.0
4/20/13	1:00	3735	5.64	1285.16	1121			
	2:00	3795	5.93	1285.45	1109			
	3:00	3855	5.93	1285.45	1109			
	4:00	3915	5.93	1285.45	1107			
	5:00	3975	5.94	1285.46	1104			
	6:00	4035	5.93	1285.45	1104			
	7:00	4095	6.07	1285.59	1104			
	8:00	4155	6.18	1285.70	1124	(adjust)		
	9:00	4215	6.18	1285.70	1124			
	10:00	4275	6.20	1285.72	1130	Meter:	86,145,500	gals.
	11:00	4335	6.13	1285.65	1132			
	12:00	4395	6.33	1285.85	1128		110	66.0
	1:00	4455	6.23	1285.75	1111			
	2:00	4515	6.25	1285.77	1100			
	3:00	4575	6.23	1285.75	1099			
	4:00	4635	6.28	1285.80	1113			
	5:00	4695	6.33	1285.85	1109			
	6:00	4755	6.28	1285.80	1104			
	7:00	4815	6.49	1286.01	1102			
	8:00	4875	6.49	1286.01	1100			
	9:00	4935	6.49	1286.01	1115			
	10:00	4995	6.68	1286.20	1113			
	11:00	5055	6.48	1286.00	1107			
	12:00	5115	6.49	1286.01	1129		110	66.0
4/21/13	1:00	5175	6.70	1286.22	1121			
	2:00	5235	6.71	1286.23	1138			
	3:00	5295	6.68	1286.20	1132			
	4:00	5355	6.68	1286.20	1123			
	5:00	5415	6.79	1286.31	1123			
	6:00	5475	6.83	1286.35	1121		110	66.0
	7:00	5535	6.86	1286.38	1121			
	8:00	5595	6.88	1286.40	1121			
	9:00	5655	6.94	1286.46	1129			
	10:00	5715	6.95	1286.47	1130	Meter:	87,744,000	gals.
	11:00	5775	6.98	1286.50	1128			
	12:00	5835	6.98	1286.50	1126			
	1:00	5895	6.95	1286.47	1111			

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)
	2:00	5955	6.98	1286.50	1105			
	3:00	6015	6.98	1286.50	1100			
	4:00	6075	7.03	1286.55	1109			
	5:00	6135	7.18	1286.70	1115			
	6:00	6195	7.20	1286.72	1107			
	7:00	6255	7.23	1286.75	1117			
	8:00	6315	7.27	1286.79	1119			
	9:00	6375	7.28	1286.80	1116			
	10:00	6435	7.29	1286.81	1090			
	11:00	6495	7.33	1286.85	1102			
	12:00	6555	7.34	1286.86	1107		110	66.0
4/22/13	1:00	6615	7.18	1286.70	1109			
	2:00	6675	7.18	1286.70	1113			
	3:00	6735	7.33	1286.85	1107			
	4:00	6795	7.33	1286.85	1105			
	5:00	6855	7.33	1286.85	1103			
	6:00	6915	7.33	1286.85	1100		110	66.0
	7:00	6975	7.33	1286.85	1100			
	8:00	7035	7.41	1286.93	1100			
	9:00	7095	7.55	1287.07	1100			
	10:00	7155	7.58	1287.10	1109			
	11:00	7215	7.63	1287.15	1111	Meter:	89,401,800	gals.
	12:00	7275	7.65	1287.17	1115		110	66.0
	1:00	7335	7.63	1287.15	1115			
	2:00	7395	7.66	1287.18	1110			
	3:00	7455	7.66	1287.18	1100			
	4:00	7515	7.68	1287.20	1100			
	5:00	7575	7.71	1287.23	1100			
	6:00	7635	7.78	1287.30	1127		110	66.0
	7:00	7695	7.73	1287.25	1121			
	8:00	7755	7.82	1287.34	1119			
	9:00	7815	7.88	1287.40	1104			
	10:00	7875	7.99	1287.51	1104			
	11:00	7935	7.88	1287.40	1134			
	12:00	7995	7.93	1287.45	1140		110	66.0
4/23/13	1:00	8055	8.10	1287.62	1158			
	2:00	8115	8.07	1287.59	1134			
	3:00	8175	8.06	1287.58	1127			
	4:00	8235	8.06	1287.58	1117			
	5:00	8295	7.88	1287.40	1127			
	6:00	8355	7.93	1287.45	1121		110	66.0
	7:00	8415	8.08	1287.60	1115			

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)
	8:00	8475	8.08	1287.60	1109			
	9:00	8535	8.23	1287.75	1121			
	10:00	8595	8.28	1287.80	1126		109	66.0
	11:00	8655			Stop Pump - Recovery			
	11:01			1284.83				
	11:02			1285.04				
	11:03			1285.22				
	11:04			1285.67				
	11:05			1285.79				
	11:06			1285.74				
	11:07			1285.81				
	11:10			1285.89				
	11:15			1285.80				
	11:20			1285.84				
	11:25			1285.75				
	11:30			1285.72				
	11:40			1285.69				
	11:50			1285.68				
	12:00N			1285.68				
	12:10			1285.61				
	12:20			1285.64				
	12:30			1285.66				
	12:40			1285.55				
	1:30			1285.52				
	2:20			1285.42				
	9:00			1285.20				
4/24/13	7:50am			1284.82				
	8:50			1284.84				
	12:00N			1284.73				
	12:00M			1284.55				
4/25/13	10:00am			1284.34				
	10:00pm			1284.26				
4/26/13	11:30am			1283.95				
4/27/13	8:00am			1283.84				
	9:30pm			1283.75				
4/28/13	8:30am			1283.60				
4/30/13	5:10pm			1283.03				

5/2-12/14 CONSTANT RATE TEST
MAHINAHINA WELL 5638-04

Ground Elevation: 1316.8 ft.
Total Depth: 1,595 ft.
Solid Casing Depth; 1,312 ft.
Perorated Casing Depth: 1,372 ft.
Casing Diameter: 18" I.D.
Open hole Diameter: 25" I.D.
Solinst Measuring Point Elevation:1316.04 ft.
Head: 43.56 ft., msl
Present: D. Lum, C. Eaton, N. Robertson

Begin Meter Rdg: 99,042,500
End Meter Rdg: 109,493,000
Average Pumping Rate: 726 gpm

Test Pump:Dual Diesel-powered Line Shaft

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)	
		-45							
		-30							
		-15							
5/2/14	10:00	0	0.00	1295.35	0				
	10:10	10	0.84	1296.19	0			990425	
	10:20	20	1.00	1296.35					
	10:30	30	1.04	1296.39					
	10:40	40	0.91	1296.26					
	10:50	50	1.02	1296.37					
	11:00	60	1.10	1296.45					
	11:10	70	1.10	1296.45					
	11:20	80	1.15	1296.50					
	11:40	100	1.11	1296.46					
	12:00	120	1.15	1296.50					
	12:30	150	1.18	1296.53					
	13:00	180	1.17	1296.52					
	13:30	210	1.19	1296.54					
	14:00	240	1.27	1296.62					
	15:00	300	1.18	1296.53					
	16:00	360	1.30	1296.65					
	17:00	420	1.35	1296.70					
	18:00	480	1.40	1296.75					
	19:00	540	1.48	1296.83					
	20:00	600	1.65	1297.00					
	21:00	660	1.67	1297.02					
	22:00	720	1.70	1297.05					
	13:00	780	1.80	1297.15					
5/3/14	0:00	840	1.83	1297.18					
	1:00	900	1.83	1297.18					

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)	
	2:00	960	1.86	1297.21					
	3:00	1020	1.92	1297.27					
	4:00	1080	1.97	1297.32					
	5:00	1140	1.97	1297.32					
	6:00	1200	2.05	1297.40					
	7:00	1260	2.13	1297.48					
	8:00	1320	2.19	1297.54					
	9:00	1380	2.18	1297.53					
	10:00	1440	2.08	1297.43					
	11:00	1500	2.13	1297.48					
	12:00	1560	2.14	1297.49					
	13:00	1620	2.16	1297.51					
	14:00	1680	2.15	1297.50					
	15:00	1740	2.17	1297.52					
	16:00	1800	2.16	1297.51					
	17:00	1860	2.27	1297.62					
	18:00	1920	2.22	1297.57					
	19:00	1980	2.31	1297.66					
	20:00	2040	2.35	1297.70					
	21:00	2100	2.28	1297.63					
	22:00	2160	2.49	1297.84					
	23:00	2220	2.57	1297.92					
5/4/14	0:00	2280	2.55	1297.90					
	1:00	2340	2.56	1297.91					
	2:00	2400	2.58	1297.93					
	3:00	2460	2.60	1297.95					
	4:00	2520	2.65	1298.00					
	5:00	2580	2.65	1298.00					
	6:00	2640	2.65	1298.00					
	7:00	2700	2.75	1298.10					
	8:00	2760	2.75	1298.10					
	9:00	2820	2.74	1298.09					
	10:00	2880	2.68	1298.03					
	11:00	2940	2.68	1298.03					
	12:00	3000	2.73	1298.08					
	13:00	3060	2.71	1298.06					
	14:00	3120	2.70	1298.05					
	15:00	3180	2.70	1298.05					
	16:00	3240	2.75	1298.10					
	17:00	3300	2.79	1298.14					
	18:00	3360	2.87	1298.22					
	19:00	3420	2.93	1298.28					

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)	
	20:00	3480	3.04	1298.39					
	21:00	3540	3.08	1298.43					
	22:00	3600	3.11	1298.46					
	23:00	3660	3.12	1298.47					
5/5/14	0:00	3720	3.12	1298.47					
	1:00	3780	3.20	1298.55					
	2:00	3840	3.15	1298.50					
	3:00	3900	3.12	1298.47					
	4:00	3960	3.25	1298.60					
	5:00	4020	3.23	1298.58					
	6:00	4080	3.32	1298.67					
	7:00	4140	3.29	1298.64					
	8:00	4200	3.33	1298.68					
	9:00	4260	3.39	1298.74					
	10:00	4320	3.21	1298.56					
	11:00	4380	3.25	1298.60					
	12:00	4440	3.25	1298.60					
	13:00	4500	3.30	1298.65					
	14:00	4560	3.30	1298.65					
	15:00	4620	3.31	1298.66					
	16:00	4680	3.33	1298.68					
	17:00	4740	3.38	1298.73					
	18:00	4800	3.37	1298.72					
	19:00	4860	3.47	1298.82					
	20:00	4920	3.51	1298.86					
	21:00	4980	3.52	1298.87					
	22:00	5040	3.76	1299.11					
	23:00	5100	3.65	1299.00					
5/6/14	0:00	5160	3.65	1299.00					
	1:00	5220	3.65	1299.00					
	2:00	5280	3.55	1298.90					
	3:00	5340	3.55	1298.90					
	4:00	5400	4.17	1299.52					
	5:00	5460	3.75	1299.10					
	6:00	5520	3.75	1299.10					
	7:00	5580	3.79	1299.14					
	8:00	5640	3.82	1299.17					
	9:00	5700	3.82	1299.17					
	10:00	5760	3.71	1299.06					
	11:00	5820	3.67	1299.02					
	12:00	5880	3.69	1299.04					
	13:00	5940	3.65	1299.00					

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)	
	14:00	6000	3.67	1299.02					
	15:00	6060	3.71	1299.06					
	16:00	6120	3.76	1299.11					
	17:00	6180	3.75	1299.10					
	18:00	6240	3.83	1299.18					
	19:00	6300	3.86	1299.21					
	20:00	6360	3.86	1299.21					
	21:00	6420	4.03	1299.38					
	22:00	6480	4.02	1299.37					
	23:00	6540	4.01	1299.36					
5/7/14	0:00	6600	4.03	1299.38					
	1:00	6660	4.01	1299.36					
	2:00	6720	4.05	1299.40					
	3:00	6780	4.12	1299.47					
	4:00	6840	4.10	1299.45					
	5:00	6900	4.12	1299.47					
	6:00	6960	4.10	1299.45					
	7:00	7020	4.14	1299.49					
	8:00	7080	4.15	1299.50					
	9:00	7140	4.05	1299.40					
	10:00	7200	4.03	1299.38					
	11:00	7260	4.04	1299.39					
	12:00	7320	4.06	1299.41					
	13:00	7380	4.06	1299.41					
	14:00	7440	4.08	1299.43					
	15:00	7500	4.10	1299.45					
	16:00	7560	4.07	1299.42					
	17:00	7620	4.12	1299.47					
	18:00	7680	4.20	1299.55					
	19:00	7740	4.19	1299.54					
	20:00	7800	4.23	1299.58					
	21:00	7860	4.24	1299.59					
	22:00	7920	4.36	1299.71					
	23:00	7980	4.37	1299.72					
5/8/14	0:00	8040	4.34	1299.69					
	1:00	8100	4.38	1299.73					
	2:00	8160	4.41	1299.76					
	3:00	8220	4.36	1299.71					
	4:00	8280	4.39	1299.74					
	5:00	8340	4.42	1299.77					
	6:00	8400	4.39	1299.74					
	7:00	8460	4.49	1299.84					

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)	
	8:00	8520	4.57	1299.92					
	9:00	8580	4.53	1299.88					
	10:00	8640	4.38	1299.73					
	11:00	8700	4.37	1299.72					
	12:00	8760	4.39	1299.74					
	13:00	8820	4.33	1299.68					
	14:00	8880	4.38	1299.73					
	15:00	8940	4.36	1299.71					
	16:00	9000	4.40	1299.75					
	17:00	9060	4.40	1299.75					
	18:00	9120	4.46	1299.81					
	19:00	9180	4.50	1299.85					
	20:00	9240	4.56	1299.91					
	21:00	9300		1301.30					
	22:00	9360		1300.50					
	23:00	9420	4.70	1300.05					
5/9/14	0:00	9480	4.67	1300.02					
	1:00	9540	4.65	1300.00					
	2:00	9600	4.66	1300.01					
	3:00	9660		1300.50					
	4:00	9720	4.58	1299.93					
	5:00	9780	4.78	1300.13					
	6:00	9840	4.75	1300.10					
	7:00	9900	4.80	1300.15					
	8:00	9960	4.76	1300.11					
	9:00	10020	4.66	1300.01					
	10:00	10080	4.67	1300.02					
	11:00	10140	4.61	1299.96					
	12:00	10200	4.70	1300.05					
	13:00	10260	4.62	1299.97					
	14:00	10320	4.65	1300.00					
	15:00	10380	4.70	1300.05					
	16:00	10440	4.70	1300.05					
	17:00	10500	4.70	1300.05					
	18:00	10560	4.78	1300.13					
	19:00	10620	4.79	1300.14					
	20:00	10680	4.82	1300.17					
	21:00	10740	4.99	1300.34					
	22:00	10800	5.00	1300.35					
	23:00	10860	5.01	1300.36					
5/10/14	0:00	10920	4.98	1300.33					

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)	
	1:00	10980	4.95	1300.30					
	2:00	11040	4.99	1300.34					
	3:00	11100	4.98	1300.33					
	4:00	11160	5.03	1300.38					
	5:00	11220	4.99	1300.34					
	6:00	11280	5.05	1300.40					
	7:00	11340	5.08	1300.43					
	8:00	11400	5.10	1300.45					
	9:00	11460	4.97	1300.32					
	10:00	11520	4.99	1300.34					
	11:00	11580	4.98	1300.33					
	12:00	11640	4.91	1300.26					
	13:00	11700	4.90	1300.25					
	14:00	11760	4.93	1300.28					
	15:00	11820	4.96	1300.31					
	16:00	11880	4.96	1300.31					
	17:00	11940	4.97	1300.32					
	18:00	12000	5.05	1300.40					
	19:00	12060	5.09	1300.44					
	20:00	12120	5.13	1300.48					
	21:00	12180	5.26	1300.61					
	22:00	12240	5.26	1300.61					
	23:00	12300	5.30	1300.65					
5/11/14	0:00	12360	5.25	1300.60					
	1:00	12420	5.29	1300.64					
	2:00	12480	5.35	1300.70					
	3:00	12540	5.26	1300.61					
	4:00	12600	5.22	1300.57					
	5:00	12660	5.25	1300.60					
	6:00	12720	5.33	1300.68					
	7:00	12780	5.34	1300.69					
	8:00	12840	5.36	1300.71					
	9:00	12900	5.20	1300.55					
	10:00	12960	5.22	1300.57					
	11:00	13020	5.18	1300.53					
	12:00	13080	4.97	1300.32					
	13:00	13140	5.15	1300.50					
	14:00	13200	5.21	1300.56					
	15:00	13260	5.20	1300.55					
	16:00	13320	5.23	1300.58					

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)	
	17:00	13380	5.25	1300.60					
	18:00	13440	5.37	1300.72					
	19:00	13500	5.41	1300.76					
	20:00	13560	5.43	1300.78					
	21:00	13620	5.40	1300.75					
	22:00	13680	5.61	1300.96					
	23:00	13740	5.57	1300.92					
5/12/14	0:00	13800	5.63	1300.99					
	1:00	13860	5.55	1300.90					
	2:00	13920	5.57	1300.92					
	3:00	13980	5.60	1300.95					
	4:00	14040	5.48	1300.83					
	5:00	14100	5.45	1300.80					
	6:00	14160	5.62	1300.97					
	7:00	14220	5.61	1300.96					
	8:00	14280	5.69	1301.04					
	9:00	14340	5.51	1300.86					
	10:00	14400	5.50	1300.85					
	11:00	14460	5.49	1300.84		Stop Pump			
	11:01	14461	3.94	1299.29					
	11:02	14462	4.45	1299.80					
	11:05	14465	4.61	1299.96					
	11:10	14470	4.62	1299.97					
	11:20	14480	4.61	1299.96					
	11:40	14500	4.54	1299.89					
	12:00	14520	4.50	1299.85					
	12:20	14540	4.46	1299.81					
	12:40	14560	4.42	1299.77					
	13:30	14610	4.34	1299.69					
	14:20	14660	4.48	1299.83					
	15:10	14710	4.25	1299.60					
	16:10	14770	4.20	1299.55					
	17:10	14830	4.19	1299.54					
	18:10	14890	4.17	1299.52					
	19:10	14950	4.15	1299.50					
	20:10	15070	4.12	1299.47					
	21:10	15070	4.10	1299.45					
5/13/14	10:20	15860	3.80	1299.15					
	11:20	15920	3.80	1299.15					
5/14/14	11:20	17360	3.20	1298.55					
5/15/14	11:20	18800	3.06	1298.41					
5/16/14	11:20	20240	2.93	1298.28					
5/19/14	11:20	24560	2.52	1297.87					
5/20/14	11:20	26000	2.26	1297.61					
5/21/14	11:20	27440	2.00	1297.35					
5/23/14	11:20	30320	1.55	1296.90					

Date	Time	Elapsed Time (min)	Draw-down (ft.)	Solinst Rdg. (ft.)	Pumping Rate (gpm)	Chlorides (mg/L)	E.C at 25 (uS/cm)	Water Temp. (°F)	
5/28/14	15:15	39195	0.18	1295.53					

PLUMBNESS AND ALIGNMENT TEST
CALCULATED DRIFT OF OPEN HOLE
Mahinahina Well 5638-04, August 29, 2012

I.D. of hole in inches:	25.00
O.D. of Plummet in inches:	24.00
Height of Apex above top of well in ft.:	15.00
I.D. of casing	

Depth of Plummet Below Ground of Well (feet)	Observed & Resultant Horizontal Deflection of Plumb Line (inches)				Calc Drift	I.D. 25.00" "2/3" Allow Drift	I.D. 25.00" "1/2" Allow Drift
	South		West	Result			
0	0		0	0.000	0.000	0.000	0.000
20	0.063		0.063	0.089	0.207	3.333	2.500
40	0.000		0.031	0.031	0.114	6.667	5.000
60	0.032		0.031	0.045	0.223	10.000	7.500
80	0.000		0.031	0.031	0.196	13.333	10.000
100	0.531		0.156	0.553	4.243	16.667	12.500
120	0.500		0.031	0.501	4.509	20.000	15.000
140	0.688		0.000	0.688	7.109	23.333	17.500
160	0.625		0.031	0.626	7.301	26.667	20.000
180	0.563		0.094	0.571	7.420	30.000	22.500
200	0.563		0.094	0.571	8.181	33.333	25.000
220	0.688		0.094	0.694	10.879	36.667	27.500
240	0.750		0.094	0.756	12.850	40.000	30.000
260	0.781		0.000	0.781	14.318	43.333	32.500
280	0.750		0.031	0.751	14.763	46.667	35.000
300	0.781		0.031	0.782	16.414	50.000	37.500
320	0.781		0.094	0.787	17.568	53.333	40.000
340	0.813		0.031.	0.814	19.255	56.667	42.500
360	0.813		0.031	0.814	20.340	60.000	45.000
380	0.813		0.031	0.814	21.425	63.333	47.500
400	0.813		0.094	0.818	22.643	66.667	50.000
420	0.813		0.031	0.814	23.594	70.000	52.500
440	0.813		0.031	0.814	24.679	73.333	55.000
460	0.813		0.031	0.814	25.764	76.667	57.500
480	0.813		0.094	0.818	27.008	80.000	60.000
500	0.688		0.094	0.694	23.841	83.333	62.500
520	0.813		0.094	0.818	29.190	86.667	65.000
540	0.563		0.031	0.564	20.863	90.000	67.500
560	0.500		0.031	0.501	19.203	93.333	70.000
580	0.438		0.031	0.439	17.417	96.667	72.500
600	0.563		0.031	0.564	23.118	100.000	75.000
620	0.375		0.031	0.376	15.929	103.333	77.500
640	0.563		0.031	0.564	24.622	106.667	80.000
660	0.563		0.031	0.564	25.373	110.000	82.500
680	0.500		0.031	0.501	23.211	113.333	85.000
700	0.563		0.031	0.564	26.877	116.667	87.500

Depth of Plummet Below Ground of Well (feet)	Observed & Resultant Horizontal Deflection of Plumb Line (inches)				Calc Drift	I.D. 25.00" "2/3" Allow Drift	I.D. 25.00" "1/2" Allow Drift
	South		West	Result			
720	0.500		0.031	0.501	24.547	120.000	90.000
740	0.563		0.031	0.564	28.381	123.333	92.500
760	0.500		0.031	0.501	25.883	126.667	95.000
780	0.500		0.031	0.501	26.551	130.000	97.500
800	0.563		0.031	0.564	30.636	133.333	100.000
820	0.500		0.031	0.501	27.887	136.667	102.500
840	0.500		0.031	0.501	28.555	140.000	105.000
860	0.563		0.031	0.564	32.891	143.333	107.500
880	0.563		0.031	0.564	33.643	146.667	110.000
900	0.563		0.031	0.564	34.395	150.000	112.500
920	0.563		0.031	0.564	35.147	153.333	115.000
940	0.563		0.031	0.564	35.899	156.667	117.500
960	0.625		0.031	0.626	40.675	160.000	120.000
980	0.563		0.031	0.564	37.402	163.333	122.500
1000	0.563		0.031	0.564	38.154	166.667	125.000
1020	0.625		0.031	0.626	43.178	170.000	127.500
1040	0.563		0.031	0.564	39.658	173.333	130.000
1060	0.625		0.031	0.626	44.847	176.667	132.500
1080	0.625		0.031	0.626	45.681	180.000	135.000
1100	0.625		0.031	0.626	46.515	183.333	137.500
1120	0.625		0.031	0.626	47.350	186.667	140.000
1140	0.625		0.031	0.626	48.184	190.000	142.500
1160	0.625		0.031	0.626	49.019	193.333	145.000
1180	0.625		0.031	0.626	49.853	196.667	147.500
1200	0.625		0.031	0.626	50.687	200.000	150.000
1220	0.625		0.031	0.626	51.522	203.333	152.500
1240	0.625		0.031	0.626	52.356	206.667	155.000
1260	0.625		0.031	0.626	53.190	210.000	157.500
1280	0.625		0.031	0.626	54.025	213.333	160.000
1300	0.625		0.031	0.626	54.859	216.667	162.500
1320	0.625		0.031	0.626	55.693	220.000	165.000
1340	0.625		0.031	0.626	56.528	223.333	167.500
1360	0.625		0.031	0.626	57.362	226.667	170.000
1380	0.625		0.031	0.626	58.196	230.000	172.500
1400	0.813		0.094	0.818	77.204	233.333	175.000
1420	0.938		0.031	0.939	89.784	236.667	177.500

NOTE: Slack in cable detected at 1390+/- ft., therefore deflection rdgs at 1400 ft. and 1420 ft. are not valid, but taken to corroborate slack in cable.

Present at Test:
Dan Lum, Water Resource Associates
Curtis Eation, MDWS
Mike Robertson, Wailani Drilling

179\P&A\Calc Drft Open

PLUMBNESS AND ALIGNMENT TEST
CALCULATED DRIFT OF WELL CASING
Mahinahina Well 5638-04, June 24, 2014

I.D. of Well Casing	18.00
O.D. of Plummet in inches:	17.50
Height of Apex above top of well in ft.:	24.00

Depth of Plummet Below Ground of Well (feet)	Observed & Resultant Horizontal Deflection of Plumb Line (inches)				Calc Drift	I.D. 18" "2/3" Allow Drift	I.D. 18" "1/2" Allow Drift
	South		West	Resultant			
0	0		0	0.000	0.000	0.000	0.000
20	0.490		0.000	0.490	0.898	2.400	1.800
40	0.740		0.000	0.740	1.973	4.800	3.600
60	0.740		0.000	0.740	2.590	7.200	5.400
80	0.865		0.063	0.867	3.758	9.600	7.200
100	0.865		0.125	0.874	4.516	12.000	9.000
120	0.928		0.250	0.961	5.767	14.400	10.800
140	0.990		0.313	1.038	7.095	16.800	12.600
160	1.053		0.438	1.140	8.744	19.200	14.400
180	1.053		0.438	1.140	9.694	21.600	16.200
200	1.053		0.438	1.140	10.644	24.000	18.000
220	1.115		0.438	1.198	12.179	26.400	19.800
240	1.115		0.438	1.198	13.177	28.800	21.600
260	1.178		0.500	1.280	15.143	31.200	23.400
280	1.115		0.500	1.222	15.478	33.600	25.200
300	1.178		0.563	1.306	17.626	36.000	27.000
320	1.178		0.563	1.306	18.714	38.400	28.800
340	1.115		0.625	1.278	19.386	40.800	30.600
360	1.115		0.625	1.278	20.452	43.200	32.400
380	1.115		0.688	1.310	22.055	45.600	34.200
400	1.053		0.688	1.258	22.222	48.000	36.000
420	1.053		0.688	1.258	23.270	50.400	37.800
440	1.053		0.688	1.258	24.318	52.800	39.600
460	1.053		0.688	1.258	25.366	55.200	41.400
480	1.053		0.688	1.258	26.415	57.600	43.200
500	1.053		0.688	1.258	27.463	60.000	45.000
520	1.053		0.625	1.225	27.756	62.400	46.800
540	1.053		0.625	1.225	28.776	64.800	48.600
560	0.990		0.625	1.171	28.489	67.200	50.400
580	0.990		0.563	1.139	28.662	69.600	52.200
600	0.990		0.625	1.171	30.440	72.000	54.000
620	0.990		0.625	1.171	31.416	74.400	55.800
640	0.990		0.625	1.171	32.392	76.800	57.600
660	0.928		0.625	1.119	31.887	79.200	59.400
680	0.990		0.625	1.171	34.343	81.600	61.200

Depth of Plummet Below Ground of Well (feet)	Observed & Resultant Horizontal Deflection of Plumb Line (inches)				Calc Drift	I.D. 18" "2/3" Allow Drift	I.D. 18" "1/2" Allow Drift
	South		West	Resultant			
700	0.990		0.625	1.171	35.319	84.000	63.000
720	0.865		0.583	1.043	32.337	86.400	64.800
740	0.865		0.688	1.105	35.184	88.800	66.600
760	0.803		0.563	0.981	32.036	91.200	68.400
780	0.803		0.563	0.981	32.854	93.600	70.200
800	0.740		0.563	0.930	31.924	96.000	72.000
820	0.740		0.563	0.930	32.699	98.400	73.800
840	0.740		0.563	0.930	33.474	100.800	75.600
860	0.740		0.563	0.930	34.248	103.200	77.400
880	0.740		0.563	0.930	35.023	105.600	79.200
900	0.740		0.563	0.930	35.798	108.000	81.000
920	0.740		0.563	0.930	36.573	110.400	82.800
940	0.740		0.563	0.930	37.348	112.800	84.600
960	0.803		0.563	0.981	40.209	115.200	86.400
980	0.803		0.563	0.981	41.026	117.600	88.200
1000	0.865		0.500	0.999	42.629	120.000	90.000
1020	0.928		0.500	1.054	45.855	122.400	91.800
1040	0.803		0.500	0.946	41.937	124.800	93.600
1060	0.803		0.563	0.981	44.295	127.200	95.400
1080	0.803		0.563	0.981	45.112	129.600	97.200
1100	0.803		0.563	0.981	45.930	132.000	99.000
1120	0.803		0.500	0.946	45.090	134.400	100.800
1140	0.803		0.500	0.946	45.878	136.800	102.600
1160	0.865		0.500	0.999	49.290	139.200	104.400
1180	0.865		0.500	0.999	50.122	141.600	106.200
1200	0.865		0.500	0.999	50.955	144.000	108.000
1220	0.865		0.438	0.970	50.256	146.400	109.800
1240	0.803		0.500	0.946	49.820	148.800	111.600
1260	0.803		0.500	0.946	50.608	151.200	113.400
1280	0.803		0.500	0.946	51.396	153.600	115.200
1300	0.803		0.500	0.946	52.185	156.000	117.000
1320	0.803		0.500	0.946	52.973	158.400	118.800
1340	0.803		0.500	0.946	53.761	160.800	120.600
1360	0.740		0.500	0.893	51.501	163.200	122.400
1380	0.803		0.438	0.915	53.509	165.600	124.200
1400	0.740		0.438	0.860	51.021	168.000	126.000

Present at Test:
Dan Lum, Water Resource Associates
Curtis Eation, MDWS
Mike Robertson, Wailani Drilling

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750 Royal Oaks Drive, Suite 100
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Laboratory Report

for

Water Resource Associates
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814
Attention: Dan Lum

Date of Issue
05/29/2013
EUROFINS EATON
ANALYTICAL

DEB: Debbie.L.Frank

Project Manager

NELAP ACCREDITED TNI LABORATORY
01114CA

Report: 430285
Project: NEW-SOURCE
Group: DEEP Well - New Source

Laboratory certifies that the test results meet all TNI NELAP requirements unless noted in the Comments section or the Case Narrative. Following the cover page are Hits Reports, Comments, QC Summary, QC Report and Regulatory Forms. This report shall not be reproduced except in full, without the written approval of the laboratory.

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STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	Mississippi	Certified
Alaska	CA00006	Montana	Cert 0035
Arizona	AZ0778	Nevada	CA00006-2012-1
Arkansas	Certified	New Hampshire	2959-11
California – NELAP	01114CA	New Jersey	CA 008
California – ELAP	1422	New Mexico	Certified
Colorado	Certified	New York	11320
Connecticut	PH-0107	North Carolina	06701
Delaware	CA 006	North Dakota	R-009
Florida	E871024	Oregon	CA 200003-011
Georgia	947	Pennsylvania	68-565
Guam	12-006r	Rhode Island	LAO00326
Hawaii	Certified	South Carolina	87016001
Idaho	Certified	South Dakota	Certified
Illinois	200033	Tennessee	TN02839
Indiana	C-CA-01	Texas	T104704230-12-4
Kansas	E-10268	Utah	Mont-1
Kentucky	90107	Vermont	VT0114
Louisiana	LA130008	Virginia	00210
Maine	CA0006	Washington	C383
Maryland	224	West Virginia	9943 C
Commonwealth of Northern Marianas Is.	MP0004	Wisconsin	998316660
Massachusetts	M-CA006	Wyoming	8TMS-L
Michigan	9906	EPA Region 5	Certified

750 Royal Oaks Dr., Ste 100, Monrovia, CA 91016 Tel (626) 386-1100 Fax (626) 386-1101 http://EatonAnalytical.com

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Acknowledgement of Samples Received

Addr: Water Resource Associates
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Client ID: WRA-HI
Folder #: 430285
Project: NEW-SOURCE
Sample Group: DEEP Well - New Source

Attn: Dan Lum
Phone: 808-593-8032 (o)

Project Manager: Debbie.L.Frank
Phone: (626) 386-1149

The following samples were received from you on **April 04, 2013**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

Sample #	Sample ID		Sample Date
201304040581	MAHINAHINA		04/03/2013 0800
	@ICPMS	Mercury	@ICPMS
	Uranium by ICPMS as pCi/L	@2378-TCDD_Dioxin	@504MOD
	@525REG	@DIQUAT	@ML505
	@ML515.4	@ML531.2	@RA226 GA
	@RA228 GA	@RAD	@VOASDWA
	Alkalinity in CaCO3 units	Asbestos by TEM - >10 microns	Calcium Total ICAP
	Cyanide	Endothall	Fluoride
	Glyphosate	Nitrate as Nitrogen by IC	Nitrite Nitrogen by IC
	PH (H3=past HT not compliant)	Source Temperature Degrees F	Specific Conductance
	Turbidity		
201304040582	Travel Blank - HOLD		04/03/2013 0800
	@504MOD TB	@VOASDWA TB	

Test Description

@ICPMS -- ICPMS Metals

@ICPMS -- ICPMS Metals

@2378-TCDD_Dioxin -- 2,3,7,8-TCDD_Dioxin

@504MOD -- EPA Method 504.1

@504MOD TB -- EPA Method 504.1

@525REG -- Semivolatiles by GCMS

@DIQUAT -- Diquat and Paraquat

@ML505 -- Organochlorine Pesticides/PCBs

@ML515.4 -- Chlorophenoxy Herbicides

@ML531.2 -- Aldicarbs

@RA226 GA -- Radium 226

@RA228 GA -- Radium 228

@RAD -- Gross Alpha/Beta Radiation

@VOASDWA -- Volatile Organics by GCMS

@VOASDWA TB -- Volatile Organics by GCMS

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CHAIN OF CUSTODY RECORD

430285

750 Royal Oaks Drive, Suite 100
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Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

EUROFINS EATON ANALYTICAL USE ONLY:

LOGIN COMMENTS: W/ TV'S

SAMPLES CHECKED AGAINST COC BY: W
SAMPLES LOGGED IN BY: V
SAMPLES REC'D DAY OF COLLECTION? ☐ (check for yes)

SAMPLE TEMP RECEIVED AT:
☐ Colton / No. California / Arizona ____ °C (Compliance: 4 ± 2 °C)
☑ Monrovia 5.0 ✓ °C (Compliance: 4 ± 2 °C)

CONDITION OF BLUE ICE: Frozen ____ Partially Frozen ____ Thawed ____ Wet Ice ____ No Ice ____

METHOD OF SHIPMENT: Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: ____

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME: WATER RESOURCE ASSOCIATES	PROJECT CODE: NEW SOURCE	COMPLIANCE SAMPLES ☐ (check for yes) - Requires state forms ☐	NON-COMPLIANCE SAMPLES ☑ (check for yes) REGULATION INVOLVED:
EEA CLIENT CODE: WRA-HI / COC ID:	SAMPLE GROUP: DEEP WELL	Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)	

TAT requested: rush by adv notice only STD ✓ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

SEE ATTACHED BOTTLE ORDER FOR ANALYSES ☑ (check for yes); OR
list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX*	FIELD DATA	FIELD DATA	SAMPLER COMMENTS
4-3-13		MAHINAHINA		RGW			
		Hwe 04/04/13 1218					

* MATRIX TYPES: RSW = Raw Surface Water, RGW = Raw Ground Water, CFW = Chlor(am)inated Finished Water, FW = Other Finished Water, SEAW = Sea Water, WW = Waste Water, BW = Bottled Water, SW = Storm Water, SO = Soil, SL = Sludge, O = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:	[signature]	DAN LUM	WATER RESOURCE ASSOC.	4/3/13	9:00a
RELINQUISHED BY:	[signature]	" "	" " "	4/3/13	10:40a
RECEIVED BY:	[signature]	CHRIS OABREA	EEA	4-4-13	1138
RELINQUISHED BY:					
RECEIVED BY:					

PAGE ____ OF ____

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750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
(626) 386-1100 FAX (626) 386-1101

Kit Order for Water Resource Associates

Debbie.L.Frank is your Eurofins Eaton Analytical Project Manager

Note: Sampler Please return this paper with your samples

Kit #: 58806
Created By: ADT
Order Date: 11/01/2012
Ship By: 10/22/2012
STG: Bottle Orders

Client ID: WRA-HI
Project Code: NEW-SOURCE Bottle Orders
Group Name: DEEP WELL
PO#/JOB#:

Ship Sample Kits to	Send Report to	Billing Address
Water Resource Associates 1296 Kapiolani Blvd. #1704 Honolulu, HI 96814 Attn: Dan Lum Phone: 808-593-8032	Water Resource Associates 1296 Kapiolani Blvd. #1704 Honolulu, HI 96814 Attn: Dan Lum Phone: 808-593-8032	Water Resource Associates 1296 Kapiolani Blvd. #1704 Honolulu, HI 96814 Attn: Dan Lum Phone: 808-593-8032

# of Samples	Tests	Bottles - Qty for each sample, type & preservative if a	UN DOT #
2	@2378-TCDD_Dioxin	2 1L amber glass D1613_NO_PRESERVATIVE	
2	@504MOD	3 40ml amber glass vial no preservative	
2	@504MOD TB	2 40ml amber glass vial no preservative + H20	
2	@525REG	2 1L amber glass 2ml of 6N HCl	UN1789
2	@DIQUAT	1 1L amber poly no preservative	
2	@ICPMS, Mercury, @ICPMS, Uranium by ICPMS as pCi/L, Calcium Total ICAP	1 500ml acid poly 2ml HNO3 (18%)	UN2031
2	@ML505	4 40ml amber glass vial 1drop thio (8%)	
2	@ML515.4	2 125ml amber glass 7mg SULFITE xls	
2	@ML531.2	2 40ml amber glass vial 0.38g KH2Citrate+1drop 8% thio	
2	@RA226 GA, @RA228 GA	3 1L poly 4ml HNO3 (18%)	UN2031
2	@RAD	1 500ml poly 2ml 18%HNO3+125ml poly/no pres	UN2031
2	@VOASDWA	3 40ml amber glass vial 4drops 6N HCL (36%)	UN1789
2	@VOASDWA TB	2 40ml amber glass vial 4drops of 1:1 HCL + H2O	UN1789
2	Alkalinity in CaCO3 units	1 250ml poly no preservative	
2	Asbestos by TEM - >10 microns	1 1L poly sonicated no preservative	
2	Cyanide	1 250 ml poly 2 ml NaOH (30%)+6 scoops AA	
2	Endothall	1 250ml amber glass no preservative	
2	Fluoride, Nitrate as Nitrogen by IC, Nitrite Nitrogen by IC, PH (H3=past H: not compliant), Specific Conductance, Turbidity	1 125ml poly no preservative	
2	Glyphosate	1 125ml amber glass no preservative	

Comments

Code	Status	Date Shipped	Via	Tracking #	# of Coolers	Prepared By

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Laboratory Hits
Report: 430285

Water Resource Associates
Dan Lum
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Samples Received on:
04/04/2013

Analyzed	Analyte	Sample ID	Result	Federal MCL	Units	MRL
	201304040581	MAHINAHINA				
04/05/2013 22:23	Alkalinity in CaCO3 units		37		mg/L	2
04/17/2013 14:28	Alpha, Gross		3.6	15	pCi/L	3
04/09/2013 2:11	Calcium Total ICAP		6.9		mg/L	1
04/05/2013 18:08	Copper Total ICAP/MS		2.9	1300	ug/L	2
04/17/2013 14:28	Gross Alpha + adjusted error		5.8	15	pCi/L	3
04/04/2013 13:32	Nitrate as Nitrogen by IC		0.24	10	mg/L	0.1
04/05/2013 22:23	PH (H3=past HT not compliant)		8.0		Units	0.1
04/03/2013 08:00	Source Temperature Degrees F		65.8		deg F	
04/05/2013 22:23	Specific Conductance, 25 C		120		umho/cm	2
04/04/2013 18:06	Turbidity		0.30	5	NTU	0.05

SUMMARY OF POSITIVE DATA ONLY

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Laboratory Data
Report: 430285

Water Resource Associates
Dan Lum
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Samples Received on:
04/04/2013

Prepared	Analyzed	QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
MAHINAHINA (201304040581)						Sampled on 04/03/2013 0800		
		FIELD/SM2550B - Source Temperature Degrees F						
	04/03/2013 08:00	702197	(FIELD/SM2550B)	Source Temperature Degrees F	65.8	deg F		1
		EPA 200.8 - ICPMS Metals						
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Antimony Total ICAP/MS	ND	ug/L	1	1
4/5/2013	04/08/2013 17:30	701677	(EPA 200.8)	Arsenic Total ICAP/MS	ND	ug/L	1	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Barium Total ICAP/MS	ND	ug/L	2	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Beryllium Total ICAP/MS	ND	ug/L	1	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Cadmium Total ICAP/MS	ND	ug/L	0.5	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Chromium Total ICAP/MS	ND	ug/L	1	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Copper Total ICAP/MS	2.9	ug/L	2	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Lead Total ICAP/MS	ND	ug/L	0.5	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Nickel Total ICAP/MS	ND	ug/L	5	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Selenium Total ICAP/MS	ND	ug/L	5	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Thallium Total ICAP/MS	ND	ug/L	1	1
4/5/2013	04/09/2013 19:03	701883	(EPA 200.8)	Uranium ICAP/MS	ND	ug/L	1	1
		EPA 200.7 - ICP Metals						
4/5/2013	04/09/2013 2:11	701595	(EPA 200.7)	Calcium Total ICAP	6.9	mg/L	1	1
		EPA 245.1 - Mercury Total						
4/11/2013	04/12/2013 16:13	702448	(EPA 245.1)	Mercury	ND	ug/L	0.2	1
		EPA 100.2 - Asbestos by TEM - >10 microns						
4/4/2013	04/17/2013 00:00	703042	(EPA 100.2)	Asbestos by TEM - >10 microns	ND	MFL	0.2	1
		EPA 200.8 - Uranium by ICPMS as pCi/L						
	04/08/2013 09:56		(EPA 200.8)	Uranium by ICPMS as pCi/L	ND	pCi/L	0.7	1
		EPA 505 - Organochlorine Pesticides/PCBs						
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Alachlor (Alanex)	ND	ug/L	0.1	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Aldrin	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Chlordane	ND	ug/L	0.1	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Dieldrin	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Endrin	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Heptachlor	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Heptachlor Epoxide	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Lindane (gamma-BHC)	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Methoxychlor	ND	ug/L	0.05	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	PCB 1016 Aroclor	ND	ug/L	0.08	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	PCB 1221 Aroclor	ND	ug/L	0.1	1

Rounding on totals after summation.
(c) - indicates calculated results

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Laboratory Data
Report: 430285

Water Resource Associates
Dan Lum
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Samples Received on:
04/04/2013

Prepared	Analyzed		QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
4/8/2013	04/09/2013	03:31	701779	(EPA 505)	PCB 1232 Aroclor	ND	ug/L	0.1	1
4/8/2013	04/09/2013	03:31	701779	(EPA 505)	PCB 1242 Aroclor	ND	ug/L	0.1	1
4/8/2013	04/09/2013	03:31	701779	(EPA 505)	PCB 1248 Aroclor	ND	ug/L	0.1	1
4/8/2013	04/09/2013	03:31	701779	(EPA 505)	PCB 1254 Aroclor	ND	ug/L	0.1	1
4/8/2013	04/09/2013	03:31	701779	(EPA 505)	PCB 1260 Aroclor	ND	ug/L	0.1	1
4/8/2013	04/09/2013	03:31	701779	(EPA 505)	Total PCBs	ND	ug/L	0.1	1
4/8/2013	04/09/2013	03:31	701779	(EPA 505)	Toxaphene	ND	ug/L	0.5	1
4/8/2013	04/09/2013	03:31	701779	(EPA 505)	Tetrachlorometaxylene	101	%		1
		EPA 515.4 - Chlorophenoxy Herbicides							
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	2,4,5-T	ND	ug/L	0.2	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	2,4,5-TP (Silvex)	ND	ug/L	0.2	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	2,4-D	ND	ug/L	0.1	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	2,4-DB	ND	ug/L	2	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	3,5-Dichlorobenzoic acid	ND	ug/L	0.5	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	Acifluorfen	ND	ug/L	0.2	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	Bentazon	ND	ug/L	0.5	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	Dalapon	ND	ug/L	1	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	Dicamba	ND	ug/L	0.1	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	Dichlorprop	ND	ug/L	0.5	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	Dinoseb	ND	ug/L	0.2	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	Pentachlorophenol	ND	ug/L	0.04	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	Picloram	ND	ug/L	0.1	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	Tot DCPA Mono&Diacid Degradate	ND	ug/L	0.1	1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	2,4-Dichlorophenyl acetic acid	108	%		1
4/12/2013	04/13/2013	16:38	702256	(EPA 515.4)	4,4-Dibromooctafluorobiphenyl	98	%		1
		EPA 504.1 - EPA Method 504.1							
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	1,2,3-Trichloropropane (TCP)	ND	ug/L	0.04	1
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	Dibromochloropropane (DBCP)	ND	ug/L	0.01	1
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	Ethylene Dibromide (EDB)	ND	ug/L	0.01	1
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	1,2-Dibromopropane	111	%		1
		EPA 525.2 - Semivolatiles by GCMS							
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Atrazine	ND	ug/L	0.05	1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Benzo(a)pyrene	ND	ug/L	0.02	1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Di-(2-Ethylhexyl)adipate	ND	ug/L	0.6	1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Di(2-Ethylhexyl)phthalate	ND	ug/L	0.6	1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Hexachlorobenzene	ND	ug/L	0.05	1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Hexachlorocyclopentadiene	ND	ug/L	0.05	1

Rounding on totals after summation.
(c) - indicates calculated results

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1 800 566 LABS (1 800 566 5227)

Laboratory Data
Report: 430285

Water Resource Associates
Dan Lum
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Samples Received on:
04/04/2013

Prepared	Analyzed		QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Molinate	ND	ug/L	0.1	1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Simazine	ND	ug/L	0.05	1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Thiobencarb (ELAP)	ND	ug/L	0.2	1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	1,3-Dimethyl-2-nitrobenzene	94	%		1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Acenaphthene-d10	62	%		1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Chrysene-d12	70	%		1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Perylene-d12	88	%		1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Phenanthrene-d10	67	%		1
4/16/2013	04/25/2013	14:47	704575	(EPA 525.2)	Triphenylphosphate	107	%		1
		EPA 548.1 - Endothall							
4/9/2013	04/11/2013	13:42	702334	(EPA 548.1)	Endothall	ND	ug/L	5	1
		EPA 1613B - 2,3,7,8-TCDD_Dioxin							
4/8/2013	04/11/2013	1:34	702102	(EPA 1613B)	2,3,7,8-TCDD	ND	pg/L	5	1
4/8/2013	04/11/2013	1:34	702102	(EPA 1613B)	C12-2,3,7,8-TCDD	90	%		1
		EPA 547 - Glyphosate							
	04/09/2013	12:49	701685	(EPA 547)	Glyphosate	ND	ug/L	6	1
		EPA 531.2 - Aldicarbs							
	04/12/2013	02:34	701935	(EPA 531.2)	3-Hydroxycarbofuran	ND	ug/L	0.5	1
	04/12/2013	02:34	701935	(EPA 531.2)	Aldicarb (Temik)	ND	ug/L	0.5	1
	04/12/2013	02:34	701935	(EPA 531.2)	Aldicarb sulfone	ND	ug/L	0.5	1
	04/12/2013	02:34	701935	(EPA 531.2)	Aldicarb sulfoxide	ND	ug/L	0.5	1
	04/12/2013	02:34	701935	(EPA 531.2)	Baygon	ND	ug/L	0.5	1
	04/12/2013	02:34	701935	(EPA 531.2)	Carbaryl	ND	ug/L	0.5	1
	04/12/2013	02:34	701935	(EPA 531.2)	Carbofuran (Furadan)	ND	ug/L	0.5	1
	04/12/2013	02:34	701935	(EPA 531.2)	Methiocarb	ND	ug/L	0.5	1
	04/12/2013	02:34	701935	(EPA 531.2)	Methomyl	ND	ug/L	0.5	1
	04/12/2013	02:34	701935	(EPA 531.2)	Oxamyl (Vydate)	ND	ug/L	0.5	1
	04/12/2013	02:34	701935	(EPA 531.2)	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	82	%		1
		EPA 549.2 - Diquat and Paraquat							
4/5/2013	04/06/2013	04:11	701492	(EPA 549.2)	Diquat	ND	ug/L	0.4	1
4/5/2013	04/06/2013	04:11	701492	(EPA 549.2)	Paraquat	ND	ug/L	2	1
		EPA 300.0 - Nitrate, Nitrite by EPA 300.0							
	04/04/2013	13:32	701199	(EPA 300.0)	Nitrate as Nitrogen by IC	0.24	mg/L	0.1	1
	04/04/2013	13:32	701199	(EPA 300.0)	Nitrite Nitrogen by IC	ND	mg/L	0.05	1
		EPA 900.0 - Gross Alpha/Beta Radiation							
4/10/2013	04/17/2013	14:28	703938	(EPA 900.0)	Alpha, Gross	3.6	pCi/L	3	1
4/10/2013	04/17/2013	14:28	703938	(EPA 900.0)	Alpha, Min Detectable Activity	3.0	pCi/L		1

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Prepared	Analyzed		QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
4/10/2013	04/17/2013	14:28	703938	(EPA 900.0)	Alpha, Two Sigma Error	2.6	pCi/L		1
4/10/2013	04/17/2013	14:28	703938	(EPA 900.0)	Beta, Gross	ND	pCi/L	3	1
4/10/2013	04/17/2013	14:28	703938	(EPA 900.0)	Beta, Min Detectable Activity	3.0	pCi/L		1
4/10/2013	04/17/2013	14:28	703938	(EPA 900.0)	Beta, Two Sigma Error	1.5	pCi/L		1
4/10/2013	04/17/2013	14:28	703938	(EPA 900.0)	Gross Alpha + adjusted error	5.8	pCi/L	3	1
		Ra-226 GA - Radium 226							
4/25/2013	05/17/2013	22:20	705241	(Ra-226 GA)	Radium 226	ND	pCi/L	1	1
4/25/2013	05/17/2013	22:20	705241	(Ra-226 GA)	Radium 226 Min Detect Activity	0.32	pCi/L		1
4/25/2013	05/17/2013	22:20	705241	(Ra-226 GA)	Radium 226 Two Sigma Error	0.17	pCi/L		1
		RA-228 GA - Radium 228							
4/25/2013	05/17/2013	22:20	705245	(RA-228 GA)	Radium 228	ND	pCi/L	1	1
4/25/2013	05/17/2013	22:20	705245	(RA-228 GA)	Radium 228 Min Detect Activity	0.76	pCi/L		1
4/25/2013	05/17/2013	22:20	705245	(RA-228 GA)	Radium 228 Two Sigma Error	0	pCi/L		1
		EPA 524.2 - Volatile Organics by GCMS							
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,1,1,2-Tetrachloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,1,1-Trichloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,1,2,2-Tetrachloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,1,2-Trichloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,1-Dichloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,1-Dichloroethylene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,1-Dichloropropene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,2,3-Trichlorobenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,2,3-Trichloropropane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,2,4-Trichlorobenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,2,4-Trimethylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,2-Dichloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,2-Dichloropropane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,3,5-Trimethylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,3-Dichloropropane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	2,2-Dichloropropane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	2-Butanone (MEK)	ND	ug/L	5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	4-Methyl-2-Pentanone (MIBK)	ND	ug/L	5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Benzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Bromobenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Bromochloromethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Bromodichloromethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Bromoethane	ND	ug/L	0.5	1

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4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Bromoform	ND (LK,VC)	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Bromomethane (Methyl Bromide)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Carbon disulfide	ND (LK)	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Carbon Tetrachloride	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Chlorobenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Chlorodibromomethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Chloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Chloroform (Trichloromethane)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Chloromethane(Methyl Chloride)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	cis-1,2-Dichloroethylene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	cis-1,3-Dichloropropene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Dibromomethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Dichlorodifluoromethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Dichloromethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Di-isopropyl ether	ND	ug/L	3	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Ethyl benzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Hexachlorobutadiene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Isopropylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	m,p-Xylenes	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	m-Dichlorobenzene (1,3-DCB)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Methyl Tert-butyl ether (MTBE)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Naphthalene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	n-Butylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	n-Propylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	o-Chlorotoluene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	o-Dichlorobenzene (1,2-DCB)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	o-Xylene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	p-Chlorotoluene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	p-Dichlorobenzene (1,4-DCB)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	p-Isopropyltoluene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	sec-Butylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Styrene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	tert-amyl Methyl Ether	ND	ug/L	3	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	tert-Butyl Ethyl Ether	ND	ug/L	3	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	tert-Butylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Tetrachloroethylene (PCE)	ND	ug/L	0.5	1

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Prepared	Analyzed		QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Toluene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Total 1,3-Dichloropropene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Total THM	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Total xylenes	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	trans-1,2-Dichloroethylene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	trans-1,3-Dichloropropene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Trichloroethylene (TCE)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Trichlorofluoromethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Trichlorotrifluoroethane(Freon 113)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Vinyl chloride (VC)	ND	ug/L	0.3	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,2-Dichloroethane-d4	101	%		1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	4-Bromofluorobenzene	106	%		1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Toluene-d8	86	%		1
		SM4500CN-F - Cyanide							
	04/06/2013	03:54	701580	(SM4500CN-F)	Cyanide	ND	mg/L	0.025	1
		SM 4500F-C - Fluoride							
	04/19/2013	00:25	703527	(SM 4500F-C)	Fluoride	ND	mg/L	0.05	1
		SM 2320B - Alkalinity in CaCO3 units							
	04/05/2013	22:23	701401	(SM 2320B)	Alkalinity in CaCO3 units	37	mg/L	2	1
		SM4500-HB - PH (H3=past HT not compliant)							
	04/05/2013	22:23	701404	(SM4500-HB)	PH (H3=past HT not compliant)	8.0	Units	0.1	1
		EPA 180.1 - Turbidity							
	04/04/2013	18:06	701195	(EPA 180.1)	Turbidity	0.30	NTU	0.05	1
		SM2510B - Specific Conductance							
	04/05/2013	22:23	701407	(SM2510B)	Specific Conductance, 25 C	120	umho/cm	2	1

Travel Blank - HOLD (201304040582) Sampled on 04/03/2013 0800

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		EPA 504.1 - EPA Method 504.1							
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	1,2,3-Trichloropropane (TCP)	NA	ug/L	0.04	1
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	Dibromochloropropane (DBCP)	NA	ug/L	0.01	1
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	Ethylene Dibromide (EDB)	NA	ug/L	0.01	1
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	1,2-Dibromopropane	NA	%		1
		EPA 524.2 - Volatile Organics by GCMS							
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1,1,2-Tetrachloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1,1-Trichloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1,2,2-Tetrachloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1,2-Trichloroethane	NA	ug/L	0.5	1

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4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1-Dichloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1-Dichloroethylene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1-Dichloropropene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,2,3-Trichlorobenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,2,3-Trichloropropane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,2,4-Trichlorobenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,2,4-Trimethylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,2-Dichloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,2-Dichloropropane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,3,5-Trimethylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,3-Dichloropropane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	2,2-Dichloropropane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	2-Butanone (MEK)	NA	ug/L	5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	4-Methyl-2-Pentanone (MIBK)	NA	ug/L	5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Benzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Bromobenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Bromochloromethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Bromodichloromethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Bromoethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Bromoform	NA (LK,VC)	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Bromomethane (Methyl Bromide)	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Carbon disulfide	NA (LK)	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Carbon Tetrachloride	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Chlorobenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Chlorodibromomethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Chloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Chloroform (Trichloromethane)	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Chloromethane(Methyl Chloride)	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	cis-1,2-Dichloroethylene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	cis-1,3-Dichloropropene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Dibromomethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Dichlorodifluoromethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Dichloromethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Di-isopropyl ether	NA	ug/L	3	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Ethyl benzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Hexachlorobutadiene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Isopropylbenzene	NA	ug/L	0.5	1

Rounding on totals after summation.
(c) - indicates calculated results

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Laboratory Data
Report: 430285

Water Resource Associates
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1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Samples Received on:
04/04/2013

Prepared	Analyzed		QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	m,p-Xylenes	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	m-Dichlorobenzene (1,3-DCB)	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Methyl Tert-butyl ether (MTBE)	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Naphthalene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	n-Butylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	n-Propylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	o-Chlorotoluene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	o-Dichlorobenzene (1,2-DCB)	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	o-Xylene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	p-Chlorotoluene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	p-Dichlorobenzene (1,4-DCB)	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	p-Isopropyltoluene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	sec-Butylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Styrene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	tert-amyl Methyl Ether	NA	ug/L	3	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	tert-Butyl Ethyl Ether	NA	ug/L	3	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	tert-Butylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Tetrachloroethylene (PCE)	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Toluene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Total 1,3-Dichloropropene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Total THM	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Total xylenes	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	trans-1,2-Dichloroethylene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	trans-1,3-Dichloropropene	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Trichloroethylene (TCE)	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Trichlorofluoromethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Trichlorotrifluoroethane(Freon 113)	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Vinyl chloride (VC)	NA	ug/L	0.3	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,2-Dichloroethane-d4	NA	%		1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	4-Bromofluorobenzene	NA	%		1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	Toluene-d8	NA	%		1

Rounding on totals after summation.
(c) - indicates calculated results

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Laboratory Comments
Report: 430285

Water Resource Associates
Dan Lum
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Flags Legend:

LK - The associated blank spike recovery was above method acceptance limits. This target analyte was not detected in the sample.
VC - CCV is high biased, ND data are reportable as per NELAC 5.5.5.10

The Comments Report may be blank if there are no comments for this report.

Drilling Log Sheet

Job: DWS Mahinahina
Elevation: 1316.85
Rig: Schramn T 130 XD
Depth Hit Water:
Driller: Michael Robertson
Depth to Water Level:
Crew Nathan R. & John T.
Page #: 1

Date	Time	Rod	Depth	Footage	Notes/Comments
12/1/11	1000	BHA =	Hammer w. 12 1/4	Bit	6'8"
	600 quit		1) Roller reamer	12 1/4	5'3"
			1) Full	Blade Stab 12"	20"
			1) Full	Blade Stab 12"	20"
			1) Roller	reamer Stab 12	1/4 = 77"
			1) Top	Sub with cutters	3' → 62
12/2	900	complete	Set up	5:30	
12/5	800	BHA"	0-14	Red Clay	
	830		14-30	Soft Brown Rock	
	900		30-52	Med Basalt	Grey
	930		52-60	Softer Grey	
		1	60-85	Med Basalt	Grey
			85-92	Soft Weathered	Basalt Grey
	1000	2	92-122	Med-Hard B.R.	"
	1030	3	122-152	Med-Hard B.R.	"
	1100	4	152-182	" " "	"
	1145	5	182-200	" " "	"
			200-212	Tan Rock	
	1200	6	212-235	Hard B.R.	Grey
			235-242	Med-Soft Basalt	Grey
	1235	7	242-262	H.B.R.	Grey/Blue
			262-272	Soft Tan-Pink	Rock
	100	8	272-302	Med Basalt	Grey
	130	9	302-321	Hard Basalt	Blue/Grey
	315		321-332	Tan Rock soft	engine shut down
	345	10	332-337	Tan Rock	
			337-347	Med Basalt	grey
			347-357	Blue Rock	"
			357-362	Tan Rock Soft	
	420	11	360-380	" " "	Blew coolant hose
			380-387	" " "	
			387-392	Small Tube temp	loss return
	625	12	392-422	Med Basalt	Grey
	655	13	422-452	" "	
	720	14	452-482	Med Hard Basalt	Grey
	745	15	482-500	Med Hard Basalt	quit at 800
12/6	430	15	500-512	" " "	"

Drilling Log Sheet

Job: DWS Mahinahina
Elevation: 1316.85
Rig: Schramn T 130 XD
Depth Hit Water:
Driller: Michael Robertson
Depth to Water Level:
Crew Nathan R. & John T.
Page # 2

Date	Time	Rod	Depth	Footage	Notes/Comments
12/6/xx	500	16	512-535	Med Hard Basalt	
	510		535-542	Soft weathered Basalt	quit 600
12/7	730			3 DP out	Fuel Full 40 61.4 HRS
	900	17	542-467	Black Cinder	
			567-572	Med Hard cinder	Black
	1000	18	572-582	" " "	"
			582-602	Hard Bluerock	
	1042	19	602-610	" " "	
			610-621	Black Cinder + Weathered Basalt	
			621-632	Med BR	
	1123	20	632-640	" "	
			640-650	Cinder Red + Black	
			650-662	Hard Basalt Br	
	1155	21	662 692	MBR	
	1222	22	692-722	MBR	
	120	23	722-752	Soft-Med Weathered Basalt Gry	
	245	24	752 782	Hard Basalt BR	
	340	25	782-812	HBR " " "	
	428	26	812-842	" " "	
	515	27	842-872	Hard Dense Bluerock	
	607	28	872-880	" " "	"
12/7	10:00	quit	880-902	Heaving Cinders	Loss of Circulation
				Stuck for 5	weeks

45 Drill pipe on site

Drilling Log Sheet

Job: DWS Mahinahina
Elevation: 1316.85
Depth Hit Water: 1325
Depth to Water Level: 1272.7
Rig: Schramm T 130 XD
Driller: Michael Robertson
Crew: Nathan R. & John T.
Page #: 3

Date	Time	Rod	Depth	Footage	Notes/Comments
1/26/10				BHA = 65'	
	900	28	872-902	Clean to ~~bottom~~	
	1200	29	902-932	Med - Hard Basalt	added 3' stinger on Tophead - adjust depth
	200	30	932-965	" " "	
	235	31	965-995	" " "	
	315	32	995-1025	Grey Clinkers + Rock	
	420	33	1025-1055	Med - Soft Sticky Gray	
	530	34	1055-1085	Tan + Pink Soft Rock	
	610	35	1085-1115	Pahoehoe Pink	quit at 6:50
1/27	930	35		Clean out	filled in 20'
	1015	36	1115-1145	Med Basalt	
	1125	37	1145-1160	Tan Rock	
			1160-1175	Med Basalt	
	12:05	38	1175-1205	" "	
	1:00	39	1205-1235	" "	
	1:50	40	1235-1265	" "	
	230	41	1265-1295	Med - Harder Basalt	
	302	42	1295-1300	" " "	
		"	1300-1325	Softer Grey - Wet	
	402	43	1325-1355	Porous Grey with	Black + Red Cinder
	502	44	1355-1370	Soft - Red + Black	Cinders (Water)
			1370-1375	Hard Basalt	
			1375-1385	Soft Cinders	(Water)
	6:30	45	1385-1408	Red + Black Cinders	(Water)
				Purged Well with 2 1/2 Barrels	
				of Stiff Foam till Clean	
				for 3 hours Pulled tools	
	10:30	quit.			

Drilling Log Sheet

Job: Mahinahina CO1
Elevation: 1316.8
Rig: T130-XD
Depth Hit Water:
Driller: Michael Robertson
Depth to Water Level: At Start 1272.5
Crew Kurtis, Nathan
Page #(1) 44.3 MSL

Date	Time	Rod	Depth	Footage	Notes/Comments
1/24/14	11:00	B.H.A	= 30'	45 D.P. in hole	= 1350 + 30' = 1380'
	1:37	46		1380' - 1410	No TD Yet
	1:56	47		1410 - 1420 TD	
		47		1420 - 1435	Cinders + Gravel
		47		1435 - 1440	Hard Basalt BR
		48		1440 - 1445	Med Grey
		48		1445 - 1470	Soft Black Cinder
					quit at 500
1/31	8:00	49		1470 - 1479	Med Soft
	10:15			1479 - 1500	Hard Basalt
	1:08	50		1500 - 1530	Loose Red Cinder
				quit @ 600 PM	" "
2/3				Measure Water Level	1268.5 = 4' rise
"				Pull Tools	
				Change Bit	
2/6	9:00	51		1530 - 1535	Hard Basalt
				1535 - 1558	Soft Grey
				1558 - 1560	Hard Basalt
	10:10	52		1560 - 1580	Soft R+Bl Cinders
				1580 - 1590	Hard Basalt
	12:30	53		1590 - 1595	Hard Basalt BR
				quit at 630	after Pulling Tools
	All Tools + Pipe on			Trailer	
2/10		De Mob - CH		ECK Water Level	= 1268.45
					= 48.35 MSL
				orig Level	44.3
			Net	Water Level Gain =	4.05'
				Chloride	10 mg/L
				EC	140 MS/cm

ENGINEERING REPORT FOR NEW DRINKING WATER SOURCE FOR KAHANA WELL AND APPROVAL LETTER

APPENDIX G-2

ENGINEERING REPORT
For New Drinking Water Source for Kahana Well

Lahaina, Maui, Hawaii
Tax Map Key (2) 4-3-001: Portion of 017
State Well No. 6-5738-002

CONTENTS:

Owner:

Department of Water Supply
County of Maui
200 South High Street
Wailuku, Hawaii 96793
Phone: (808) 270-7835
Fax: (808) 270-7833

Consultant:

Fukumoto Engineering, Inc.
1721 Wili Pa Loop, Suite 203
Wailuku, Hawaii 96793
Phone: (808) 242-8611
Fax: (808) 244-7510
Email: office@femaui.com

Date: August 17, 2018

1. **PURPOSE**

The purpose of this engineering report is to comply with the provisions of Hawaii Administrative Rules, Title 11, Department of Health, Chapter 20, Rules Relating to Public Water Systems. The rules require that drinking water sources for a public water system be approved by the Department of Health.

2. **GENERAL INFORMATION**

2.1 Brief description of the project and location, including phasing schedule.

Description

The Kahana Production Well, a project of the County of Maui, Department of Water Supply (DWS), involves construction of a new water source within the Honolua Aquifer System of the Lahaina Sector. The purpose of the new water source is to provide additional source capacity for the DWS Lahaina Water System. (See Figure 1 – CWRM Hydrologic Units Map, page 26.)

Existing improvements at the site include the capped-off Kahana Well, a temporary concrete slab around the well, and temporary fencing around the well.

The project involves connecting the Kahana Well, a basal well that was drilled, cased, and tested, to the water system near the Mahinahina Water Treatment Facility (MWTF). The Kahana Well is also known as West Maui Well #2. Project components include a 1-acre pump station site, a submersible vertical turbine deep well pump, pump discharge piping, 12-inch transmission pipeline, a control building, electrical controls, supervisory control and data acquisition (SCADA) system, chlorination system, and an emergency generator.

The Kahana Production Well project will tie in to another DWS project, the first phase of the Mahinahina Permanent Well project. The first phase involves construction of a 12-inch transmission pipeline, a 500,000-gallon control tank below the MWTF, and control valves for regulating flows into and out of the control tank. The DWS will seek bids for the first phase of the Mahinahina Permanent Well and the Kahana Production Well project, and will construct both projects.

The Kahana Production Well site will be graded to accommodate a service yard, a control building, a concrete pad for the pump discharge piping, and a drainage sump. The service yard will be used for various operation and maintenance activities. Short-term activities include pump station monitoring, delivery of chlorination supplies, delivery of emergency generator fuel, and landscape maintenance. Long-term activities include replacement of the well pump and motor, maintenance of structures, and replacement of other major equipment. Site improvements also include security fencing and site lighting.

A pump with the following characteristics will be installed.

PUMP DATA	
Type	Submersible vertical turbine deep well pump
Rating	1,000 gallons per minute @ 1,380 feet total dynamic head
Motor	Submersible, 500 horsepower, 1,800 revolutions per minute
Power Supply	4,160 volt, 3 phase, 60 hertz
Piping	8-inch ductile iron pipe from pump column discharge elbow to control tank
Appurtenances	Solenoid control valve, deep well pump solenoid control valve, check valve, venturi meter, and air and vacuum valve
Pump Control	SCADA system controlled start and stop sequence
Well Level Control	Air bubbler system with compressor, stainless steel airline, and pressure transmitter

Various piping systems will be installed. Such systems include an 8-inch pump discharge line consisting of deep well pump control valves with solenoid controls, check valve, venturi meter, air and vacuum valve, and a connection to a control tank. Piping systems also consist of a 12-inch transmission pipeline from the control tank to another 12-inch transmission pipeline for the Mahinahina Permanent Well project. Piping systems also include small-diameter air lines for measuring the water level in the well, pressure sensing lines, a sampling tap, and a chlorination injection line.

The control tank is a bolted stainless steel tank with a concrete foundation and an aluminum dome roof. The tank has a diameter of about 18.5 feet, a height of about 20 feet, and an operating capacity of about 34,000 gallons. Piping connections to the tank consist of inlet and outlet lines, an overflow pipe, and washout line. Tank accessories include an exterior ladder, roof access hatch, roof ventilator, and shell manway.

The 34,000-gallon control tank at the well site handles fluctuations in water levels due to draining and filling the tank. Water is initially withdrawn from the tank when a control valve at the lower-level 500,000-gallon tank opens and fills the 500,000-gallon tank. A drop in the water level of the 34,000-gallon control tank triggers the start of the deep well pump. During pump startup, the pumped water is purged for a few minutes through a pump control valve. After a few minutes, the pump control valve redirects the pumped water into the control tank. Under normal operating conditions, the deep well pump fills the tank at a rate of 1,000 gallons per minute and the control valve at the 500,000-gallon tank regulates the outflow to match the filling rate. When the 500,000-gallon tank is filled, its control valve closes and causes the water level in the 34,000-gallon tank to rise. When the 34,000-gallon tank is filled, the deep well pump stops. Tank level pressure transducers sense the

water levels in the tank to start the deep well pump when the water level drops and to stop the deep well pump upon filling of the tank.

The control building is a 1,120-square foot slab-on-grade, concrete masonry unit structure with a concrete roof. The building will house electrical and mechanical equipment.

Electrical improvements consist of extending the distribution system to the site, providing power to the building, installing light poles and an antenna pole, and installing motor controls, instrumentation, and SCADA systems for the new well. Electrical improvements also include an emergency generator, fuel tank, automatic transfer switch, and if necessary, a step-up transformer.

Mechanical equipment consists of a well level sensor, chlorination system, and water booster pump. The well level sensor includes an air compressor; pressure regulators, transmitter, and gauges; and air lines. The chlorination system consists of sodium hypochlorite tanks, pumps, and lines for injecting the disinfecting solution into the pumped water, and a chlorine residual analyzer for monitoring disinfectant levels. The water booster pump supplies pressurized water for operating the emergency eyewash and shower, and the well control valves.

Location

The well is located at the upper limits of an abandoned pineapple field between Kahana Stream and Kahanaiki Gulch about 2.4 miles to the East of the Kapalua Airport in Lahaina, Maui. The elevation of the site is about 1,320 feet above mean sea level. Access to the site from Honoapiilani Highway begins at the Akahele Street intersection, continues South for about 3,600 feet along a field road, heads East about 9,500 feet to the Mahinahina Water Treatment Facility, and continues for about 8,500 feet along various field roads to the site. The tax maps identify the well site as Tax Map Key (2) 4-3-001: 017. (See Figure 2 – Location Map (USGS Map), page 27 and Figure 3 – Vicinity Map (Tax Map), page 28.)

Phasing

The well drilling contractor completed the drilling, casing, and water quality testing of the exploratory well in June 2017. The water quality test results were received in July 2017. Upon confirmation of the acceptability of the water quality tests, the contractor removed the test pump and performed the plumbness test in July 2017 and the alignment test in August 2017. The plumbness and alignment tests were acceptable.

The design and permitting for the Kahana Production Well is currently in progress. The project schedule calls for completion of design and permitting in the first quarter of 2019. The schedule also targets the start of construction in the second quarter of 2019 and the end of construction in the last quarter of 2020.

2.2 Persons/communities served by new water source and/or service connections.

The Lahaina System serves the communities of Puamana, Wainee, Kelawea, Lahaina, Wahikuli, Honokowai, Mahinahina, Kahana, Alaeloa, and Napili.

2.3 Public water system (PWS) name and number (as designated by SDWB).

Department of Water Supply Lahaina System, Public Water System No. 214.

2.4 Conformance with local land use planning and zoning regulations.

The site lies within the Agricultural State Land Use District. The County community plan and zoning maps identify the site as being within the Agricultural District. The zoning regulations in the Maui County Code allow minor utility facilities such as water wells, tanks and distribution equipment, electrical lines, or other similar uses within the Agricultural District.

2.5 Name of well owner, land owner, and any authorized representative(s).

The County of Maui Department of Water Supply is the owner of the well. DWS obtained a right-of-entry to construct the well on the property from the land owner, Maui Land & Pineapple Company, Inc. DWS will process a subdivision application for acquisition of the well site and related easements.

3. PHYSICAL CHARACTERISTICS OF AREA

3.1 Site plan and topographic map of well or project site drawn to scale.

Attached are reduced preliminary plans that show the proposed improvements. The General Plan shows the pump station site, transmission pipeline, and the connections to the Mahinahina Permanent Well transmission pipeline. The Grading Plan shows existing and proposed grades of the pump station site. It also shows drainage improvements including a cut-off channel at the upstream side of the site, a grated drain inlet to collect runoff from the service yard, a drainage sump to store storm runoff and pump start-up discharge, and a drainage spillway. The Site Plan shows the control building, pump discharge pad, piping, service yard, and fencing. (See General Plan – Figure 4, page 29; Preliminary Grading Plan – Figure 5, page 30; and Preliminary Site Plan – Figure 6, page 31.)

Also attached is a reduced grading plan of the exploratory well that shows the topography of the pump station site and surrounding area. The background topography was based on surveys performed in April and May of 2013 and reflects conditions during drilling and casing of the exploratory well. (See Topographic Map –

Figure 7, page 32.)

3.2 Earthquake considerations and design parameters.

Structures will be designed to resist earthquake loads in accordance with the International Building Code, 2006 Edition (IBC), and modifications of the IBC as shown in Chapter 16.26B, Building Code, of the Maui County Code.

3.3 Flood problems including tsunami inundation zones and preventive measures that may be used.

The site is not subject to flood and tsunami inundation. The Flood Insurance Rate Map of the area, prepared by the Federal Emergency Management Agency, designates the site as Zone X, an area of minimal flooding.

The site will be graded to prevent localized flooding. Drainage swales at the upper perimeter of the site will direct off-site storm runoff around the site. Additionally, drainage swales within the site will direct on-site storm runoff away from the wellhead, control building, control tank, and other structures.

4. WELL INFORMATION

4.1 Coordinates (latitude, longitude) in GPS NAD 83, State Well Number, and Tax Map Key Number.

GENERAL DATA	
Latitude	20° 57' 08.3" North
Longitude	156° 38' 19.3" West
State Well No.	6-5738-002
Tax Map Key	(2) 4-3-001:017

4.2 Well cross-sectional diagram, as approved by the Department of Land and Natural Resources' Commission on Water Resource Management (CWRM), showing as-built well depth and depth to groundwater; CWRM-approved pumping rate (gpm) and/or proposed withdrawal (gpd).

Attached is the well cross-sectional diagram adapted from the information in the approved Well Completion Report Part 1 for Well No. 6-5738-002. (See Well Cross-Sectional Diagram – Figure 8, page 33 and Well Completion Report in Appendix F.) The following table lists the elevations of key points:

ELEVATION DATA	
Description of Point	**Elevation (in feet above mean sea level)**
Top of Exploratory Well Casing	1319.15
Ground Surface Elevation	1317.00
Bottom of Grout and Top of Open Hole	93.00
Static Water Level	7.37
Bottom of Solid Casing and Top of Screen Casing	-1.85
Top of Cement Grout Plug	-58.00
Bottom of Well	-61.00

Construction documents for the project, including the submersible vertical turbine deep well pump, are currently being developed. DWS has therefore not filed the Application for a Well Construction / Pump Installation Permit with CWRM for the pump. However, based on the pump test results and the hydrogeologist's recommendations, DWS has selected a pump with a pumping rate of 1,000 gallons per minute. (See the following report in Appendix A: *West Maui Well No. 2, aka Kahana Exploratory Well, State Well No. 6-5738-002, Summary of Drilling and Well Testing June 19, June 23-June 27, 2017,* dated July 2017, prepared by Glenn Bauer, Geologist.) DWS will operate the well in a similar manner as other production wells that run for 16 hours per day, resulting in a withdrawal amount of 960,000 gallons per day.

4.3 Water quality data on any existing wells in the area.

Existing wells in the area include Mahinahina Well (Exploratory), Kaanapali Well P-4, Kaanapali Well P-5, Kaanapali Well P-5A, and Kaanapali Well P-6. The Mahinahina Well is located about 3,500 feet to the South of the Kahana Well at a ground surface elevation of about 1,314 feet above mean sea level. The Kaanapali wells are located about 2,900 feet to 4,100 feet to the West and downslope of the Kahana Well. Approximate ground surface elevations above mean sea level of P-4, P-5, P-5A, and P-6, are respectively, 870 feet, 940 feet, 910 feet, and 950 feet.

The water quality data from DWS records for the Mahinahina Exploratory Well is included in Appendix E. Data on contaminants found in the existing Kaanapali wells was obtained from the Safe Drinking Water Branch Groundwater Contamination Viewer (Maps) portal. The Safe Drinking Water Branch also provided supplementary data for the Kaanapali wells.

The following table shows the detected contaminants and water quality parameters of the Kahana Well and the other existing wells in the area. These abbreviations are used in the table below.

Abbreviation	Definition
ND	not detected
NT	not tested
mg/l	milligrams per liter
µmho/cm	micromhos per centimeter
degrees F	degrees Fahrenheit

Abbreviation	Definition
NTU	nephelometric turbidity units
pCi/l	picocuries per liter

DETECTED CONTAMINANTS & WATER QUALITY PARAMETERS OF WELLS IN THE AREA

Contaminant or Water Quality Parameter	Maximum Contaminant Level (MCL)	Unit	Kahana (tested 6/27/17)	Mahinahina (tested 4/4/13)	Kaanapali P-4 (tested as noted)	Kaanapali P-5 (tested as noted)	Kaanapali P-5A (tested as noted)	Kaanapali P-6 (tested as noted)
Barium	2	mg/l	0.0032	ND	NT	NT	NT	NT
Chromium	0.1	mg/l	ND	ND	NT	NT	0.0039 (OK) 12/13/11	NT
Nitrate (as Nitrogen)	10	mg/l	0.54	0.24	2.0 (OK) 9/25/07	1.6 (OK) 3/21/07	1.0 (OK) 12/13/11	2.3 (OK) 3/21/07
Fluoride	4	mg/l	0.065	ND	NT	NT	NT	NT
Copper	1.3 (action level)	mg/l	ND	0.0029	NT	NT	NT	NT
Lead	0.015 (action level)	mg/l	ND	ND	NT	NT	0.00096 (OK) 12/13/11	NT
Gross Alpha	15	pCi/l	2.19±1.58	5.8	NT	NT	NT	NT
Gross Beta	50 (screening level)	pCi/l	2.73±1.11	ND	NT	NT	2.3 (OK) 4/30/12	NT
Alkalinity	Not Applicable (N/A)	mg/l	49	37	NT	NT	NT	NT
Calcium	N/A	mg/l	15	6.9	NT	NT	NT	NT
Conductivity	N/A	µmho/cm	350	120	NT	NT	NT	NT
pH	6.5 – 8.5	-	7.74	8.0	NT	NT	NT	NT
Temperature	N/A	degrees F	71.4	65.8	NT	NT	NT	NT
Turbidity	5	NTU	0.14	0.30	NT	NT	NT	NT
DBCP (Dibromochloropropane)	0.00004	mg/l	ND	ND	0.00004 (OK) 10/11/00	0.00006 (>MCL) 5/19/08	0.000011 (OK) 4/30/12	0.00015 (>MCL) 6/28/16
TCP (1,2,3-Trichloropropane)	0.00060	mg/l	ND	ND	0.00028 (OK) 6/28/16	0.00044 (OK) 6/28/16	0.00029 (OK) 6/28/16	0.00066 (>MCL) 6/28/16

As shown in the table above, the water quality of the Mahinahina Well is similar to Kahana Well. The wells have small amounts of the same contaminants and similar water quality parameters. The test results of the detected contaminants are substantially less than the maximum contaminant levels (MCLs).

The table above also shows the detection of contaminants in the Kaanapali P-4, P-5, P-5A, and P-6 wells, including Chromium, Nitrate (as Nitrogen), Lead, and Gross Beta Radionuclide. The table includes the most recent test results. The test results of these contaminants are substantially less that the MCLs.

In addition, the table above shows the detection of DBCP (Dibromochloropropane) and TCP (1,2,3-Trichloropropane) in the Kaanapali wells. The table includes the most recent test results. DBCP is a soil fumigant that was previously used in pineapple cultivation to treat nematodes and TCP is an impurity in the manufacturing process of the soil fumigant. The levels of DBCP in Kaanapali P-5 of 0.00006 milligrams per liter and Kaanapali P-6 of 0.00015 milligrams per liter are above the MCL of 0.00004 milligrams per liter. Although DBCP was detected in Kaanapali P-4 and Kaanapali P-5A, the levels were below the MCL. The level of TCP in Kaanapali P-6 of 0.00066 milligrams per liter is above the MCL of 0.00060 milligrams per liter. Although TCP was detected in Kaanapali P-4, P-5, and P-5A, the levels were below the MCL.

The following table is a comprehensive summary of Nitrate, DBCP, and TCP contaminants for the Kaanapali P-4, P-5, P-5A, and P-6 wells from 1993 through 2016.

NITRATE, DBCP, AND TCP IN KAANAPALI WELLS FROM 1993 - 2016

Contaminant or Water Quality Parameter	Maximum Contaminant Level (MCL)	Unit	Date Tested	Remarks	Kaanapali P-4	Kaanapali P-5	Kaanapali P-5A	Kaanapali P-6
Nitrate (as Nitrogen)	10	mg/l	11/3/97-9/25/07	OK	1.7-2.4			
			11/3/97-3/21/07	OK		1.4-2.9		
			12/13/11	OK			0.71-1.0	
			11/3/97-3/21/07	OK				1.4-3.4
DBCP (Dibromochloropropane)	0.00004	mg/l	3/16/94-5/18/98	>MCL	0.000042-0.000250			
			8/31/98-10/11/00	OK	0.000030-0.000040			
			3/16/94-11/2/99	>MCL		0.000108-0.000290		
			2/14/00	OK		0.000021		
			6/19/00-5/19/08	>MCL		0.000060-0.000280		
			4/30/12	OK			0.000011	
			3/16/94-6/28/16	>MCL				0.000080-0.000360
TCP (1,2,3-Trichloropropane)	0.00060	mg/l	6/15/93-5/10/95	OK	0.00040			
			8/7/96-1/28/98	>MCL	0.00080-0.00140			
			5/18/98-8/31/98	OK	0.00060			
			11/10/98	>MCL	0.00070			
			12/10/98	OK	0.00050			
			3/8/98	>MCL	0.00070			

NITRATE, DBCP, AND TCP IN KAANAPALI WELLS FROM 1993 - 2016

Contaminant or Water Quality Parameter	Maximum Contaminant Level (MCL)	Unit	Date Tested	Remarks	Kaanapali P-4	Kaanapali P-5	Kaanapali P-5A	Kaanapali P-6
TCP (1,2,3-Trichloropropane)	0.00060	mg/l	4/21/99-6/19/00	OK	0.00050-0.00060			
			3/6/01-4/16/01	>MCL	0.00062-0.00065			
			7/18/01-5/22/03	OK	0.00042-0.00057			
			11/20/03	>MCL	0.00098			
			4/21/04-10/11/04	OK	0.00042-0.00056			
			4/18/05	>MCL	0.00062			
			8/8/05-10/25/06	OK	0.00043-0.00056			
			8/15/07	>MCL	0.00072			
			10/9/07-6/28/16	OK	0.00028-0.00059			
			6/15/93-11/1/93	OK		0.00040		
			6/13/94-8/3/94	>MCL		0.00070-0.00080		
			10/10/94-8/22/96	OK		0.00040-0.00050		
			10/29/96-5/19/08	>MCL		0.00066-0.00180		
			11/26/12-6/28/16	OK		0.00043-0.00051		
			12/13/11-6/28/16	OK			0.00013-0.00029	
			6/15/93-3/12/97	OK				0.00040-0.00060
			5/19/97	>MCL				0.00080
			8/6/97-5/18/98	OK				0.00040-0.00060
			8/31/98-2/27/02	>MCL				0.00062-0.00110
			5/20/02-7/27/04	OK				0.00044-0.00057
			10/11/04	>MCL				0.00067
			2/9/05	OK				0.00055
			4/18/05-5/19/08	>MCL				0.00066-0.00097
			5/29/14	OK				0.00060
			6/23/15-6/28/16	>MCL				0.00066-0.00067

The table above shows that Nitrate is below the MCL for all of the Kaanapali wells. The table also shows that DBCP and TCP have been detected in all of the Kaanapali wells. The levels of DBCP have been above and below the MCL for P-4 and P-5, below the MCL for P-5A, and above the MCL for P-6. The levels of TCP have been above and below the MCL for P-4, P-5, and P-6, and below the MCL for P-5A.

4.4 Nature of soil and stratum within and overlaying the water source, with special emphasis on identification of fissures and faults as it relates to the natural purification or treatment of percolating fluids from existing or future activities.

As stated in the report, *West Maui Well No. 2, aka Kahana Exploratory Well, State Well No. 6-5738-002, Summary of Drilling and Well Testing June 19, June 23-June 27, 2017,* dated July 2017, prepared by Glenn Bauer, Geologist, the well is located on Wailuku Basalt. The geologic log only describes the upper 220 feet and the bottom 50 feet of the well, due to the loss of circulation of drilling fluid between the depths of 200 feet and 1,290 feet. The report states that the upper portion of the well, about 220 feet deep, penetrates weathered rock belonging mainly to the post-caldera stage Honolua Volcanics. In the upper 220 feet, 6 out of 22 samples contained "white clay minerals". At some depth, the well penetrates the shield-building lavas of the Wailuku Basalt. These lavas are thin-bedded and highly permeable, and are the source of water to the well.

The publication, *Geology and Ground-Water Resources of the Island of Maui, Hawaii*, dated October 1942, prepared by Harold T. Stearns and Gordon A. MacDonald, provides additional information about the Honolua volcanic series in the Lahaina region. The publication states that the Honolua lavas are andesites and soda trachytes, and are differentiated from the Wailuku basalts due to their white and gray surfaces when weathered. The publication also states that the less permeable Honolua lavas overlay the highly permeable Wailuku basalts in the region. The "white clay minerals" noted in the geologic log are indicators of the Honolua lavas.

According to the *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*, the on-site soil consists of Olelo silty clay, 3 to 15 percent slopes (OFC). The Olelo series consists of well-drained soils on uplands on the islands of Molokai and Maui derived from basic igneous rock. The survey characterizes the soil as having a dark reddish-brown surface layer about 10 inches thick, a dark reddish-brown and dark-red subsoil layer about 27 inches thick, moderately rapid permeability, slow runoff, and slight erosion hazard. (See Soil Map – Figure 9, page 34.)

There are no known fissures and faults in the vicinity of the well. The less permeable surface layer of soil derived from the Honolua lavas provide opportunities for natural treatment of percolating fluids. Assuming that the Honolua lavas are within the upper 200 feet of soil, there would be about 1,100 feet of soil derived from the

Wailuku basalts above the basal groundwater level. Although permeable, the substantial thickness of the soil above the groundwater level provides additional natural treatment of percolating fluids.

4.5 Slope of water table, with a map showing approximate groundwater contours (if possible), preferably as determined from observation wells, or studies of wells in the area.

The report, *Groundwater Availability in the Lahaina District, West Maui, Hawaii*, dated 2012, prepared by the U. S. Geological Survey, provides information on the slope of the water table. The report included modeling of groundwater contours based on water-level measurements of various wells in the Lahaina area. The groundwater contours for water-level measurements taken on September 10, 2008 are shown on Figure 18 of the report. The attached map shows the location of the Kahana Well and the groundwater contours taken from Figure 18 of the report. (See Groundwater Contour Map, Figure 10, page 35.) The slope of the water table at Kahana Well is 0.00148 foot per foot or 7.8 feet per mile.

The modeled groundwater elevation of the Kahana Well shown on the attached map is 8.0 feet. This elevation is based on simulated conditions in year 2008. This level compares to a measured groundwater elevation of 7.4 feet of the Kahana Well in year 2017. There is a good correlation between the modeled groundwater elevation and the measured groundwater elevation.

4.6 Data relating to quality and quantity of the source waters under normal conditions and during stress conditions such as drought or heavy precipitation, as determined by field and laboratory analyses and investigations of available records. If records are not available or are inadequate to determine source quality under stress conditions, an estimate of expected quality and quantity during stress conditions should be established and related to the hydrologic budget to the aquifer or isopiestic area.

The report, *Groundwater Availability in the Lahaina District, West Maui, Hawaii*, dated 2012, prepared by the U. S. Geological Survey, provides information regarding the quality and quantity of the source waters under normal and during stress conditions. According to the report, groundwater withdrawals from this area are projected to increase from 5.8 million gallons per day (MGD) in 2007 to 11.2 MGD by 2030. The objectives of the report were to estimate the effects of several hypothetical withdrawal scenarios on water levels, the transition zone between freshwater and saltwater, and surface/groundwater interactions. To evaluate simulated salinity, the report used the following classification: (1) "acceptable" for salinity less that 1.0 percent seawater; (2) "cautionary" for salinity between 1.0 and 2.5 percent seawater; and (3) "threatened" for salinity greater than 2.5 percent seawater. Wells with salinity in the cautionary class may produce water that is unacceptable for drinking. Wells with salinity in the threatened class are likely to produce water that is unacceptable for drinking.

The report considered the following scenarios.

SIMULATION SCENARIOS		
Scenario	Recharge Condition	Pumping Condition
1	89 MGD base flow; 2000-2004 land use without agriculture; 1926-2004 rainfall	6.3 MGD 2008-2009 withdrawal rate; 2.0 MGD wastewater injection
2	89 MGD base flow; 2000-2004 land use without agriculture; 1926-2004 rainfall	11.2 MGD 30-year projected withdrawal rate; 7.0 MGD wastewater injection
3	89 MGD base flow; 2000-2004 land use without agriculture; 1926-2004 rainfall	11.2 MGD 30-year projected withdrawal rate; no wastewater injection
4	89 MGD base flow; 2000-2004 land use without agriculture; 1926-2004 rainfall	17.1 MGD 30-year projected withdrawal rate with full Hawaii Water Service Company projection; 7.0 MGD wastewater injection
5	89 MGD base flow; 2000-2004 land use without agriculture; 1926-2004 rainfall	20.7 MGD 30-year projected withdrawal rate with redistributed withdrawal; 7.0 MGD wastewater injection
6	105 MGD base flow including 16 MGD streambed recharge; 2000-2004 land use without agriculture; 1926-2004 rainfall	11.2 MGD 30-year projected withdrawal rate; 7.0 MGD wastewater injection
7	89 MGD base flow; 2000-2004 land use without agriculture; 1926-2004 rainfall with worse historic drought (65 MGD) during 2025-2029	11.2 MGD 30-year projected withdrawal rate; 7.0 MGD wastewater injection

The following table, adapted of Table 7 from the report, classifies the withdrawals into the cautionary and threatened classes. The amounts of cautionary and threatened withdrawals are indicators of stress on the aquifers resulting from lowering of water levels and increasing salinity.

CLASSIFICATION OF WITHDRAWAL FOR SIMULATED SCENARIOS				
Aquifer system	CWRM sustainable yield in million gallons per day (MGD)	Total simulated withdrawal after 30 years in MGD	After 30 years	
			Cautionary withdrawal in MGD	Threatened withdrawal in MGD
Scenario 1 – 2008-2009 withdrawal				
Honokohau	9	0.00	0.00	0.00
Honolua	8	2.27	0.65	0.00
Honokowai	6	3.19	0.60	0.93
Launiupoko	7	0.78	0.42	0.05
Olowalu	2	0.05	0.00	0.00
Ukumehame	2	0.00	0.00	0.00

CLASSIFICATION OF WITHDRAWAL FOR SIMULATED SCENARIOS				
Aquifer system	CWRM sustainable yield in million gallons per day (MGD)	Total simulated withdrawal after 30 years in MGD	After 30 years	
			Cautionary withdrawal in MGD	Threatened withdrawal in MGD
Scenario 2 – projected withdrawal				
Honokohau	9	0.00	0.00	0.00
Honolua	8	2.38	0.53	0.53
Honokowai	6	6.41	3.37	0.61
Launiupoko	7	1.88	0.00	0.08
Olowalu	2	0.53	0.00	0.00
Ukumehame	2	0.00	0.00	0.00
Scenario 3 – projected withdrawal, no injection				
Honokohau	9	0.00	0.00	0.00
Honolua	8	2.38	0.53	0.53
Honokowai	6	6.41	2.21	2.23
Launiupoko	7	1.88	0.00	0.08
Olowalu	2	0.53	0.00	0.00
Ukumehame	2	0.00	0.00	0.00
Scenario 4 – full-build projected withdrawal				
Honokohau	9	0.00	0.00	0.00
Honolua	8	2.38	0.53	0.53
Honokowai	6	12.34	2.90	8.85
Launiupoko	7	1.88	0.00	0.08
Olowalu	2	0.53	0.00	0.00
Ukumehame	2	0.00	0.00	0.00
Scenario 5 – redistributed withdrawal				
Honokohau	9	0.00	0.00	0.00
Honolua	8	3.16	0.00	0.00
Honokowai	6	5.07	0.00	0.00
Launiupoko	7	10.85	0.00	0.00
Olowalu	2	1.60	0.00	0.00
Ukumehame	2	0.00	0.00	0.00
Scenario 6 – restored streamflow				
Honokohau	9	0.00	0.00	0.00
Honolua	8	2.38	0.53	0.53
Honokowai	6	6.41	0.81	0.00
Launiupoko	7	1.88	0.00	0.08
Olowalu	2	0.53	0.00	0.00
Ukumehame	2	0.00	0.00	0.00
Scenario 7 – 5-year drought				
Honokohau	9	0.00	0.00	0.00
Honolua	8	2.38	0.53	0.53
Honokowai	6	6.41	3.37	0.61
Launiupoko	7	1.88	0.00	0.08
Olowalu	2	0.53	0.00	0.00
Ukumehame	2	0.00	0.00	0.00

In most cases, the simulated data indicates that large withdrawals from the Honolua and Honokowai Aquifer Systems results in large cautionary and threatened withdrawals from those aquifer systems. However, when withdrawals are reduced from those aquifer systems and redistributed under Scenario 5, there are no cautionary and threatened withdrawals.

The report states that injection of treated wastewater effluent acts as a hydrologic barrier and reduces the amount of saltwater that encroaches into the aquifer at wells upland of the injection site. The injection site is within the Honokowai Aquifer System. Thus, under Scenario 3 with no injection, there are significant increases in threatened withdrawals from the Honokowai Aquifer System.

The simulated data shows the impact of excess withdrawals from an aquifer. The Honokowai Aquifer System has a sustainable yield of 6 MGD according to the Commission on Water Resource Management. Withdrawals of 12.34 MGD from the Honokowai Aquifer System shown in Scenario 4 results in very large amounts of cautionary and threatened withdrawals.

The report considers the effects of full streamflow restoration in the region under Scenario 6. There are significant reductions of cautionary and threatened withdrawals in Honokowai Aquifer System due to streambed recharge.

Finally, the report considers the effects of a 5-year drought in the region under Scenario 7. The results of Scenario 7 are the same as Scenario 2.

The report, *West Maui Well No. 2, aka Kahana Exploratory Well, State Well No. 6-5738-002, Summary of Drilling and Well Testing, June 19, June 23-June 27, 2017*, dated July 2017, prepared by Glenn Bauer, Geologist, provides an indication of source water quality and quantity under stress conditions. The Kahana Well exhibited minimal drawdown during the step-drawdown test, indicating resiliency of the aquifer. During the test, the well was pumped at 508 gallons per minute (gpm), 780 gpm, 963 gpm, and 1,132 gpm, with respective drawdowns of 1.10 feet, 1.95 feet, 2.77 feet, and 3.36 feet. During the test, chloride readings taken by the contractor ranged between 40 milligrams per liter (mg/L) and 45 mg/L. Chloride tests performed at the Maui DWS laboratory averaged 49.6 mg/L. The water level recovered quickly after the test. Thirty minutes after the test, the water level was within 94 percent of the water level before the test. The results of the constant rate test with an average pumping rate of 1,182 gpm for 96 hours also confirms the resiliency of the aquifer. For this test, the drawdown ranged from 2.86 feet at the beginning of the test to 3.92 feet at the end of the test with chloride levels that ranged from 50 mg/L at the beginning of the test to 60 mg/L at the end of the test. Chloride tests performed by the Maui DWS laboratory ranged from about 50 mg/L at the beginning of the test to about 70 mg/L at the end of the test. The report concludes that the 1,183 gpm pumping rate was not sustainable due to the increase in drawdown and the increase in chloride levels, and that the installed capacity of the pump would be 1,000 gpm and operated for 16 hours per day.

4.7 **Analyses for all of the contaminants listed in the table, "Contaminants to be Tested in All New Sources of Drinking Water", including Total Coliform and Fecal Coliform, shall be performed by a laboratory approved by the Department of Health, State Laboratories Division, for all sources being addressed in the report. For example, when approval of a "well field" is being sought, all of the wells must be tested for all of the required contaminants.**

Before performing pump and water quality tests, the well drilling contractor chlorinated the well, purged it, and tested for Total Coliform, *E. coli,* and free chlorine residual. Pural Water Specialty Co., Inc. collected water samples on June 14, 2017 and sent them to Aecos, Inc. The results indicated the absence of Total Coliform, the absence of *E. coli*, and non-detection of free chlorine residual. The complete test results are included in this report in Appendix B.

Pural Water Specialty Co., Inc. collected water samples during testing of the well on June 27, 2017. Tests were performed by the following certified laboratories: Eurofins Eaton Analytical and Pace Analytical Services, Inc. Eurofins Eaton Analytical performed the majority of the tests. Pace Analytical Services performed tests for 2,3,7,8-TCDD and radionuclides. The complete results are included in this report as Appendix C.

The following test results show that water from Kahana Well meets drinking water standards. These abbreviations are used in the Summary of Laboratory Test Results below.

Abbreviation	Definition
ND	not detected
NT	not tested
N/A	not applicable
Mg/l	milligrams per liter
µg/l	micrograms per liter
pCi/l	picocuries per liter
µmho/cm	micromhos per centimeter
degrees F	degrees Fahrenheit
NTU	nephelometric turbidity units

WATER QUALITY TEST RESULTS TABLE

No.	Category	Contaminant	Max. Contam. Level (MCL)	Unit	Sample Date	Re-sults	Unit	Re-marks
1	Microbiological	Total Coliform Bacteria	For 40 or more samples per month: No more than 5.0% of the samples positive For less than 40 samples per month: no more than 1 sample per month positive	(none)	6/14/17	Negative	(none)	OK
2	Microbiological	Fecal Coliform or E. coli Bacteria	Acute violation when: total coliform positive routine is flowed by a fecal coliform of E. coli positive repeat or a fecal coliform or E. Coli positive routine is followed by a total coliform positive repeat	(none)	6/14/17	Negative	(none)	OK
3	Inorganic Chemicals	Arsenic	0.01	mg/l	6/27/17	Not Detected (ND)	mg/l	OK
4	Inorganic Chemicals	Asbestos	7	million fibers per liter longer than 10 Mm	6/27/17	ND	million fibers per liter longer than 10 mm	OK
5	Inorganic Chemicals	Barium	2	mg/l	6/27/17	0.0032	mg/l	OK
6	Inorganic Chemicals	Cadmium	0.005	mg/l	6/27/17	ND	mg/l	OK
7	Inorganic Chemicals	Chromium	0.1	mg/l	6/27/17	ND	mg/l	OK
8	Inorganic Chemicals	Copper (Action Level)	1.3	mg/l	6/27/17	ND	mg/l	OK
9	Inorganic Chemicals	Lead (Action Level)	0.015	mg/l	6/27/17	ND	mg/l	OK
10	Inorganic Chemicals	Mercury	0.002	mg/l	6/27/17	ND	mg/l	OK
11	Inorganic Chemicals	Nickel	(None)	mg/l	6/27/17	ND	mg/l	OK
12	Inorganic Chemicals	Nitrate (as Nitrogen)	10	mg/l	6/27/17	0.54	mg/l	OK
13	Inorganic Chemicals	Nitrite (as Nitrogen)	1	mg/l	6/27/17	ND	mg/l	OK
14	Inorganic Chemicals	Total Nitrate & Nitrite (as Nitrogen)	10	mg/l	6/27/17	0.54	mg/l	OK

WATER QUALITY TEST RESULTS TABLE

No.	Category	Contaminant	Max. Contam. Level (MCL)	Unit	Sample Date	Re-sults	Unit	Re-marks
15	Inorganic Chemicals	Selenium	0.05	mg/l	6/27/17	ND	mg/l	OK
16	Inorganic Chemicals	Fluoride	4.0	mg/l	6/27/17	0.065	mg/l	OK
17	Inorganic Chemicals	Antimony	0.006	mg/l	6/27/17	ND	mg/l	OK
18	Inorganic Chemicals	Beryllium	0.004	mg/l	6/27/17	ND	mg/l	OK
19	Inorganic Chemicals	Cyanide (as free Cyanide)	0.2	mg/l	6/27/17	ND	mg/l	OK
20	Inorganic Chemicals	Thallium	0.002	mg/l	6/27/17	ND	mg/l	OK
21	Disinfection Byproducts (only Subpart H & P systems with population > 10,000 until 1/1/04)	Total trihalomethanes (sum of chloroform, bromoform, bromodichloro-methane, dibro-mochlorome-thane)	0.080	mg/l	NT		mg/l	
22	Disinfection Byproducts (only Subpart H & P systems with population > 10,000 until 1/1/04)	Total Haloacetic Acids (sum of mono-, di-, tri-chloroacetic acids and mono- and dibromoacetic acids	0.060	mg/l	NT		mg/l	
23	Disinfection Byproducts (only Subpart H & P systems with population > 10,000 until 1/1/04)	Chlorite (usually formed under ClO_2 use)	1.0	mg/l	NT		mg/l	
24	Disinfection Byproducts (only Subpart H & P systems with population > 10,000 until 1/1/04)	Bromate (brominated waters using ozone)	0.010	mg/l	NT		mg/l	
25	Radionuclides	Combined Radium 226 and Radium 228	5	pCi/l	6/27/17	0.479± 0.477	pCi/l	OK
26	Radionuclides	Gross alpha	15	pCi/l	6/27/17	2.19± 1.58	pCi/l	OK
27	Radionuclides	Gross beta	50 (screening level)	pCi/l	6/27/17	2.73± 1.11	pCi/l	OK
28	Radionuclides	Uranium	30	µg/l	6/27/17	0.140± 0.007	µg/l	OK
29	Organic Chemicals Volatile Organic Chemicals	Benzene	0.005	mg/l	6/27/17	ND	mg/l	OK

WATER QUALITY TEST RESULTS TABLE

No.	Category	Contaminant	Max. Contam. Level (MCL)	Unit	Sample Date	Re-sults	Unit	Re-marks
30	Organic Chemicals Volatile Organic Chemicals	Carbon Tetrachloride	0.005	mg/l	6/27/17	ND	mg/l	OK
31	Organic Chemicals Volatile Organic Chemicals	Chlorobenzene	(None)	mg/l	6/27/17	ND	mg/l	OK
32	Organic Chemicals Volatile Organic Chemicals	o-Dichloroben-zene	0.6	mg/l	6/27/17	ND	mg/l	OK
33	Organic Chemicals Volatile Organic Chemicals	para-Dichloro-benzene	0.075	mg/l	6/27/17	ND	mg/l	OK
34	Organic Chemicals Volatile Organic Chemicals	1,2-Dichloro-ethane	0.005	mg/l	6/27/17	ND	mg/l	OK
35	Organic Chemicals Volatile Organic Chemicals	1,1-Dichloroeth-ylene	0.007	mg/l	6/27/17	ND	mg/l	OK
36	Organic Chemicals Volatile Organic Chemicals	cis-1,2-Dichloro-ethylene	0.07	mg/l	6/27/17	ND	mg/l	OK
37	Organic Chemicals Volatile Organic Chemicals	trans-1,2-Dichlo-roethylene	0.1	mg/l	6/27/17	ND	mg/l	OK
38	Organic Chemicals Volatile Organic Chemicals	DCP (1,2-Dichlo-ropropane)	0.005	mg/l	6/27/17	ND	mg/l	OK
39	Organic Chemicals Volatile Organic Chemicals	Ethylbenzene	0.7	mg/l	6/27/17	ND	mg/l	OK
40	Organic Chemicals Volatile Organic Chemicals	Styrene	0.1	mg/l	6/27/17	ND	mg/l	OK
41	Organic Chemicals Volatile Organic Chemicals	Tetrachloroethy-lene	0.005	mg/l	6/27/17	ND	mg/l	OK
42	Organic Chemicals Volatile Organic Chemicals	Toluene	1	mg/l	6/27/17	ND	mg/l	OK
43	Organic Chemicals Volatile Organic Chemicals	1,1,1-Trichloro-ethane	0.2	mg/l	6/27/17	ND	mg/l	OK
44	Organic Chemicals Volatile Organic Chemicals	Trichloroethylene	0.005	mg/l	6/27/17	ND	mg/l	OK
45	Organic Chemicals Volatile Organic Chemicals	TCP (1,2,3-Tri-chloropropane)	0.0006	mg/l	6/27/17	ND	mg/l	OK
46	Organic Chemicals Volatile Organic Chemicals	Vinyl Chloride	0.002	mg/l	6/27/17	ND	mg/l	OK
47	Organic Chemicals Volatile Organic Chemicals	Xylenes (total)	10	mg/l	6/27/17	ND	mg/l	OK

WATER QUALITY TEST RESULTS TABLE

No.	Category	Contaminant	Max. Contam. Level (MCL)	Unit	Sample Date	Re-sults	Unit	Re-marks
48	Organic Chemicals Volatile Organic Chemicals	Dichloromethane	0.005	mg/l	6/27/17	ND	mg/l	OK
49	Organic Chemicals Volatile Organic Chemicals	1,2,4-Trichloro-bezene	0.07	mg/l	6/27/17	ND	mg/l	OK
50	Organic Chemicals Volatile Organic Chemicals	1,1,2-Trichloro-ethane	0.005	mg/l	6/27/17	ND	mg/l	OK
51	Organic Chemicals Synthetic Organic Chemicals	Alachlor	0.002	mg/l	6/27/17	ND	mg/l	OK
52	Organic Chemicals Synthetic Organic Chemicals	Aldicarb	0.003	mg/l	6/27/17	ND	mg/l	OK
53	Organic Chemicals Synthetic Organic Chemicals	Aldicarb Sulfone	0.002	mg/l	6/27/17	ND	mg/l	OK
54	Organic Chemicals Synthetic Organic Chemicals	Aldicarb Sulfox-ide	0.004	mg/l	6/27/17	ND	mg/l	OK
55	Organic Chemicals Synthetic Organic Chemicals	Atrazine	0.003	mg/l	6/27/17	ND	mg/l	OK
56	Organic Chemicals Synthetic Organic Chemicals	Carbofuran	0.04	mg/l	6/27/17	ND	mg/l	OK
57	Organic Chemicals Synthetic Organic Chemicals	Chlordane	0.002	mg/l	6/27/17	ND	mg/l	OK
58	Organic Chemicals Synthetic Organic Chemicals	DBCP (Dibro-mochloropro-pane)	0.00004	mg/l	6/27/17	ND	mg/l	OK
59	Organic Chemicals Synthetic Organic Chemicals	2,4-D	0.07	mg/l	6/27/17	ND	mg/l	OK
60	Organic Chemicals Synthetic Organic Chemicals	EDB (Ethylene Dibromide)	0.00004	mg/l	6/27/17	ND	mg/l	OK
61	Organic Chemicals Synthetic Organic Chemicals	Heptachlor	0.0004	mg/l	6/27/17	ND	mg/l	OK
62	Organic Chemicals Synthetic Organic Chemicals	Heptachlor Epoxide	0.0002	mg/l	6/27/17	ND	mg/l	OK
63	Organic Chemicals Synthetic Organic Chemicals	Lindane	0.0002	mg/l	6/27/17	ND	mg/l	OK
64	Organic Chemicals Synthetic Organic Chemicals	Methoxychlor	0.04	mg/l	6/27/17	ND	mg/l	OK
65	Organic Chemicals Synthetic Organic Chemicals	Polychlorinated Biphenyls (PCBs)	0.005	mg/l	6/27/17	ND	mg/l	OK

WATER QUALITY TEST RESULTS TABLE

No.	Category	Contaminant	Max. Contam. Level (MCL)	Unit	Sample Date	Re-sults	Unit	Re-marks
66	Organic Chemicals Synthetic Organic Chemicals	Pentachlorophe-nol	0.001	mg/l	6/27/17	ND	mg/l	OK
67	Organic Chemicals Synthetic Organic Chemicals	Toxaphene	0.003	mg/l	6/27/17	ND	mg/l	OK
68	Organic Chemicals Synthetic Organic Chemicals	2,4,5-TP (Silvex)	0.05	mg/l	6/27/17	ND	mg/l	OK
69	Organic Chemicals Synthetic Organic Chemicals	Benzo(a)pyrene	0.0002	mg/l	6/27/17	ND	mg/l	OK
70	Organic Chemicals Synthetic Organic Chemicals	Dalapon	0.2	mg/l	6/27/17	ND	mg/l	OK
71	Organic Chemicals Synthetic Organic Chemicals	Di(2-ethylhexyl) adipate	0.4	mg/l	6/27/17	ND	mg/l	OK
72	Organic Chemicals Synthetic Organic Chemicals	Di(2-ethylhexyl) phthalate	0.006	mg/l	6/27/17	ND	mg/l	OK
73	Organic Chemicals Synthetic Organic Chemicals	Dinoseb	0.007	mg/l	6/27/17	ND	mg/l	OK
74	Organic Chemicals Synthetic Organic Chemicals	Diquat	0.02	mg/l	6/27/17	ND	mg/l	OK
75	Organic Chemicals Synthetic Organic Chemicals	Endothall	0.1	mg/l	6/27/17	ND	mg/l	OK
76	Organic Chemicals Synthetic Organic Chemicals	Endrin	0.002	mg/l	6/27/17	ND	mg/l	OK
77	Organic Chemicals Synthetic Organic Chemicals	Glyphosate	0.7	mg/l	6/27/17	ND	mg/l	OK
78	Organic Chemicals Synthetic Organic Chemicals	Hexachloro-benzene	0.001	mg/l	6/27/17	ND	mg/l	OK
79	Organic Chemicals Synthetic Organic Chemicals	Hexachlorocyc-lopentadiene	0.05	mg/l	6/27/17	ND	mg/l	OK
80	Organic Chemicals Synthetic Organic Chemicals	Oxamyl (Vydate)	0.2	mg/l	6/27/17	ND	mg/l	OK
81	Organic Chemicals Synthetic Organic Chemicals	Picloram	0.5	mg/l	6/27/17	ND	mg/l	OK
82	Organic Chemicals Synthetic Organic Chemicals	Simazine	0.004	mg/l	6/27/17	ND	mg/l	OK
83	Organic Chemicals Synthetic Organic Chemicals	2,3,7,8-TCDD (Dioxin)	3 X 10 -8	mg/l	6/27/17	ND	mg/l	OK

WATER QUALITY TEST RESULTS TABLE

No.	Category	Contaminant	Max. Contam. Level (MCL)	Unit	Sample Date	Re-sults	Unit	Re-marks
84	Water Quality Pa-rameters	Alkalinity	Not Applicable (N/A)	mg/l	6/27/17	49	mg/l	
85	Water Quality Pa-rameters	Calcium	N/A	mg/l	6/27/17	15	mg/l	
86	Water Quality Pa-rameters	Chlorine Resi-dual	N/A		6/27/17	ND		
87	Water Quality Pa-rameters	Conductivity	N/A		6/27/17	350	µmho /cm	
88	Water Quality Pa-rameters	pH (field meas-urement)	6.5-8.5		6/27/17	7.74		
89	Water Quality Pa-rameters	Temperature (field measure-ment)	N/A	degrees F	6/27/17	71.4	degrees F	
90	Water Quality Pa-rameters	Turbidity	5	NTU	6/27/17	0.14	NTU	OK

4.8 **Laboratories performing the analyses must be currently certified by the Hawaii Department of Health, State Laboratories Division. While the lab data has often been conveniently summarized in a table, some reports have failed to note when analyses have been subcontracted to another lab. The lab reports from all of the laboratories involved must be included in the engineering report to allow the Department to verify that an approved lab performed the analyses. Failure to do so will delay the review process.**

Included in Appendix C are the test results from the following certified laboratories: Eurofins Eaton Analytical and Pace Analytical Services, Inc.

5. EXISTING OR POTENTIAL SOURCES OF CONTAMINATION IN SOURCE WATER ASSESSMENT AND PROTECTION PROGRAM (SWAP) ZONES

5.1 Extent of SWAP zones likely to contribute water to source.

SWAP zones likely to contribute water to the Kahana Well (West Maui Well 2) are shown on the attached *Hawaii Source Water Assessment Program Groundwater Sources Datasheets and Potential Contaminating Activities (PCA) Report.* (See Appendix D.) Zone A encompasses an area 50 feet around the well. Zone B extends to the southeast of Zone A for about 0.1 mile across agricultural land and about 1.1 miles of conservation land. Zone C extends to the southeast of Zone B for about 0.9 miles across conservation lands.

5.2 Type of contaminants.

The *PCA Report* identifies pineapple cultivation as a potential contaminating activity within Zone A and Zone B.

Pineapple is no longer cultivated in all zones. The cultivation of crops ended about nine years ago in 2009. Although pineapple cultivation is a potential contaminating activity, the water quality tests indicate no adverse effects due to it and that the water meets drinking water standards. Contaminants that may leach into groundwater due to pineapple cultivation include soil fumigants, 1,2-dibromo-3-chloropropane (DCBP) and ethylene dibromide (EDB), and solvent, 1,2,3-trichloropropane (TCP). The test results show that none of the above contaminants were detected.

5.3 **Distance to proposed well.**

Pineapple cultivation occurred at the well site and about 0.1 mile upslope of the well.

5.4 **Method of disposal, i.e., surface, subsurface – above groundwater table, subsurface – in groundwater table.**

Soil fumigants for pineapple cultivation were applied on the ground surface. The elevation of the ground surface at the well and the elevation of the basal water surface are about 1,317 feet above mean sea level and 7 feet above mean sea level, respectively. This results in a vertical distance of about 1,310 feet between the ground surface and the basal water surface.

5.5 **"Sources of contamination" include but are not limited to urban development, agricultural areas, pasture lands, feedlots, sanitary landfills, dumps, subsurface disposal units and abandoned wells.**

The well site is at the upper limits of an abandoned pineapple field in a remote location. Future sources of contamination at the well site or upland of the well site such as urban development, feedlots, sanitary landfills, dumps, and subsurface disposal units are unlikely. Although the land around the well site is suitable for agricultural and pasture use, such uses are unlikely due to the remote location of the site.

5.6 **A copy of the 1:24,000 scale USGS map: this is the 7-1/2 minute quadrangle map. (Provide a portion large enough to identify the surrounding areas and surrounding pertinent features.) Plot on the map any injection wells, cesspools, septic systems or any other "sources of contamination" as listed above, located within, or a little more than, a ¼-mile radius of the facility.**

There are no injection wells, cesspools, septic systems located within a ¼-mile of the facility. (See Location Map (USGS Map) – Figure 2, page 27.)

5.7 **The probability and effect of surface drainage or contaminated underground water entering the source.**

The probability of surface drainage or contaminated underground water entering the water source is low. The surface layer consists of less permeable Honolua series soil that is probably about 200 feet deep. Permeable Wailuku Basalt lies below the surface layer.

Additionally, the type of well construction, with a concrete cap and cement grout 1,214 feet below the ground surface at an elevation of 103 feet above mean sea level will seal potential surface and underground water from entering the well through the annular space. (See Well Cross-Sectional Diagram – Figure 8, page 33.)

5.8 **Identification of all significant factors having potential for contaminating or reducing the quality of the water source or which could cause the quality of water to be in violation of any state primary drinking water regulation.**

Significant factors that could potentially cause contamination or quality reduction of the water source are potential agricultural use of the area and the development of the production well site. Potential agricultural uses may include livestock grazing and diversified crop production. The production well site will include above ground fuel storage tanks and storm drainage facilities.

5.9 **For each present and projected potential source of contamination, identify and evaluate the alternative control measures that could be implemented to reduce or eliminate the potential for contamination of the water source.**

The *PCA Report* lists pineapple cultivation as the current potentially contaminating activity. Projected potentially contaminating activities include agricultural use of the surrounding land and development of the production well site.

The following measures can be implemented to reduce or eliminate the potential for contamination of the water source. Pineapple cultivation and the use of soil fumigants ended about nine years ago in 2009. Before performing any construction work, the site should be inspected for old containers or equipment that may have been used to store or apply such soil agricultural chemicals. If such old containers or equipment are found, they should be disposed in a proper manner. If future agricultural activities are conducted on the surrounding land, proper management of livestock operations and crop production should be implemented. Such management methods for livestock operations may involve containing waste and preventing it from entering the adjoining gulches. Crop production management methods may involve proper application of fertilizers, pesticides, and herbicides. Measures to prevent fuel spills include implementing proper fuel delivery procedures and using double-walled fuel tanks or having a spill containment basin. Measures to mitigate contamination of the water source due to storm drainage include preventing off-site runoff from entering the production well site, and collecting on-site runoff and conveying it to a drainage basin for disposal. During construction activities, storm runoff from the site should be contained and prevented from entering the adjoining gulches.

6. PROPOSED TREATMENT WORKS

None required.

7. PROFESSIONAL ENGINEER CERTIFICATION

The undersigned, being a registered professional engineer, certifies that:

1. I have prepared the attached report and the information contained therein is true to the best of my information and belief; and

2. The water produced by Kahana Well (State Well No. 6-5738-002), the drinking water system identified in the attached report, will comply with the State primary drinking water regulations contained in Hawaii Administrative Rules, Title 11, Chapter 20, Rules Relating to Public Water Systems, and will comply with the Rules and Regulations of the Department of Water Supply, County of Maui, when said drinking water system is operated and maintained in accordance with the instruction and information contained in this report.

RONALD M. FUKUMOTO
LICENSED PROFESSIONAL ENGINEER
No. 4935-C
HAWAII, U.S.A.

This work was prepared by me or under my supervision

Ronald M. Fukumoto

Ronald M. Fukumoto
President
Fukumoto Engineering, Inc.
License Expires 4/30/2020

8. REFERENCES

8.1 Gingerich, Stephen B., and Engott, John A., *Groundwater Availability in the Lahaina District, West Maui, Hawai'i: U.S. Geological Survey Scientific Investigations Report 2012–5010*, 90 p., 2012.

8.2 Bauer, Glenn, Geologist, *West Maui Well No. 2, aka Kahana Exploratory Well, State Well No. 6-5738-002, Summary of Drilling and Well Testing, June 19, June 23-June 27, 2017*, July 2017.

8.3 Stearns, Harold T., and MacDonald, Gordon A., *Geology and Ground-Water Resources of the Island of Maui, Hawaii (Including Haleakala Section, Hawaii National Park)*, U. S. Geological Survey, United States Department of the Interior, October 1942.

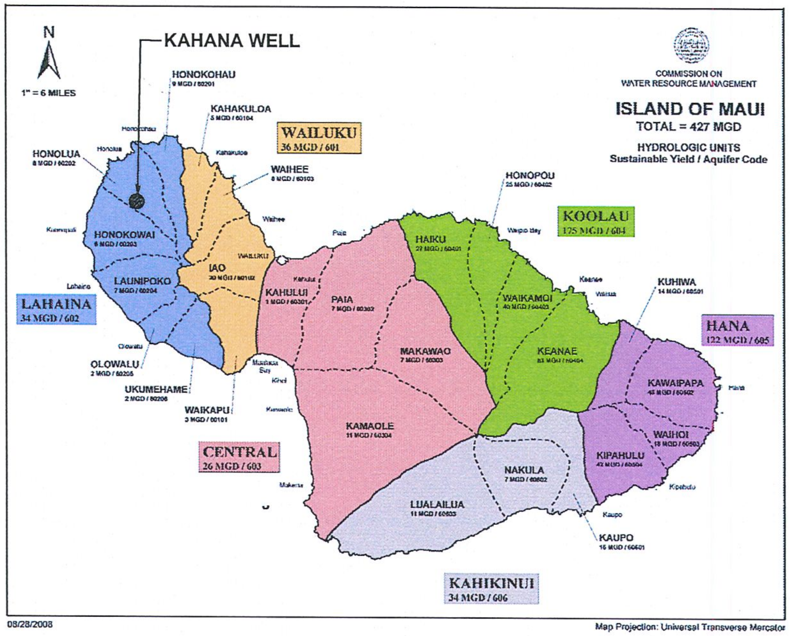
8.4 Department of Water Supply, County of Maui, *Water System Standards, 2002.*

8.5 Hawaii Department of Health, Safe Drinking Water Branch and University of Hawaii Department of Geology and Geophysics, *Hawaii Source Water Assessment Program, New Groundwater Sources Datasheets and Potential Contaminating Activities (PCA) Report, Maui, Maui Department of Water Supply, New Drinking Water Source Report for West Maui Well 2*, September 6, 2017.

8.6 Ronald M. Fukumoto Engineering, Inc., *Preliminary Design Report for West Maui Well No. 2, Lahaina, Maui, Hawaii*, prepared for Department of Water Supply, County of Maui, April 23, 2013.

8.7 United States Department of Agriculture, Soil Conservation Service in cooperation with the University of Hawaii Agricultural Experiment Station, *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*, August 1972.

8.8 Commission on Water Resource Management, *Water Resource Protection Plan, Volume I & II*, June 1990.



CWRM HYDROLOGIC UNITS MAP

Figure 1

SCALE IN MILES 0 4 8 16 24

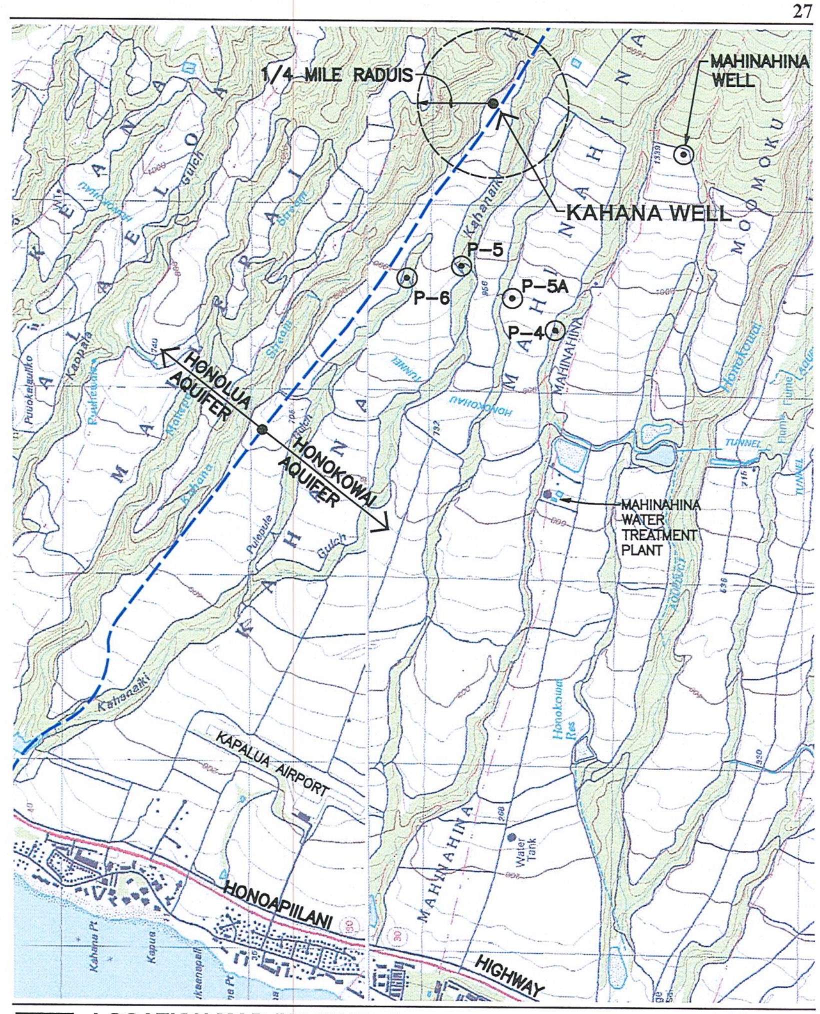
NORTH

SOURCE: COMMISSION ON WATER RESOURCE MANAGEMENT

PREPARED FOR: DEPT. OF WATER SUPPLY, COUNTY OF MAUI

PREPARED BY: FUKUMOTO ENGINEERING, INC.

ENGINEERING REPORT FOR NEW DRINKING WATER SOURCE FOR KAHANA WELL



LOCATION MAP (USGS Map)

Figure 2

SCALE IN FEET 0 1000 2000 4000 6000

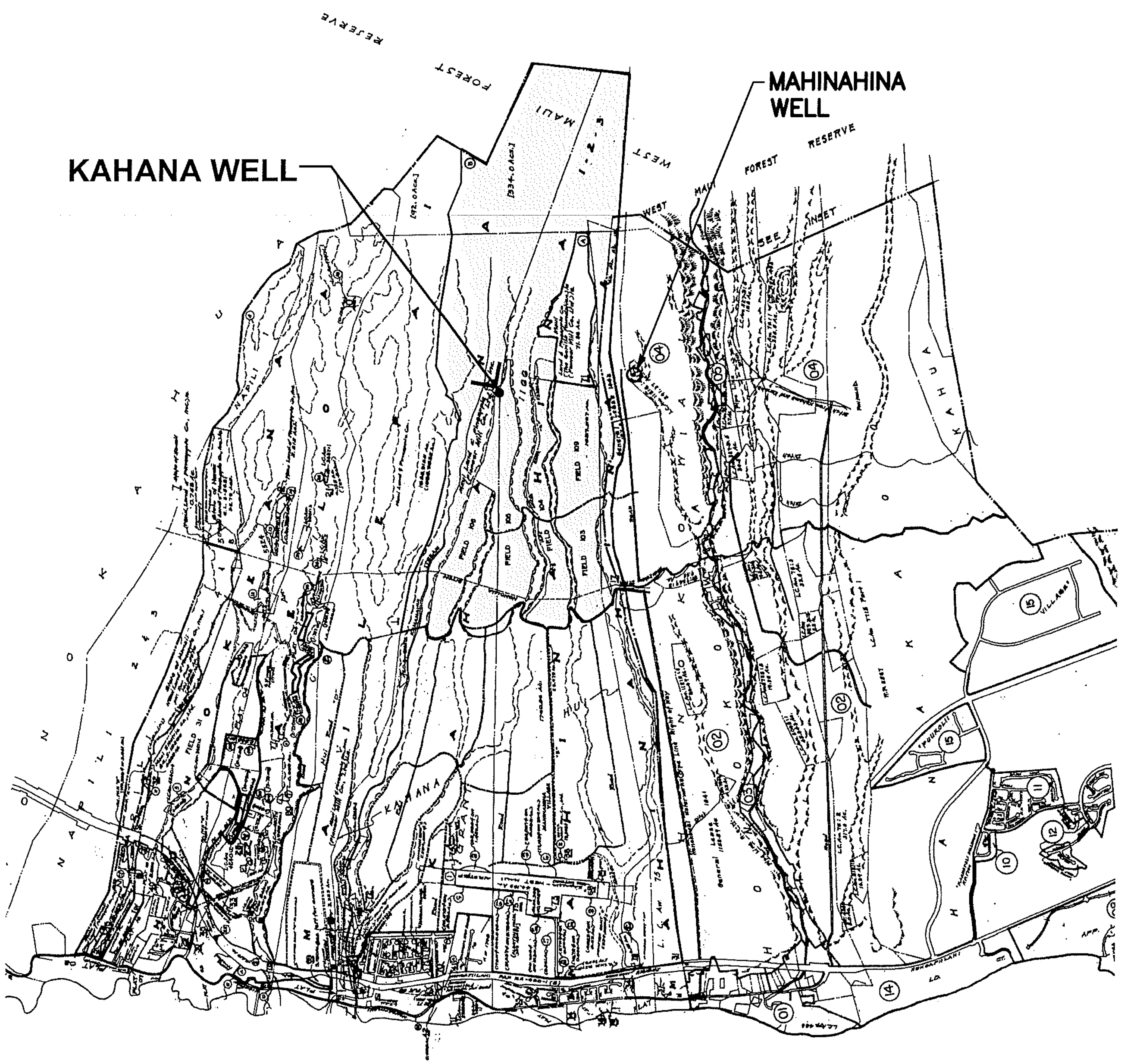
NORTH

SOURCE: USGS LAHAINA & NAPILI QUADRANGLE MAP

PREPARED FOR: DEPT. OF WATER SUPPLY, COUNTY OF MAUI

PREPARED BY: FUKUMOTO ENGINEERING, INC.

ENGINEERING REPORT FOR NEW DRINKING WATER SOURCE FOR KAHANA WELL



VICINITY MAP (Tax Map)

Figure 3

SCALE IN FEET

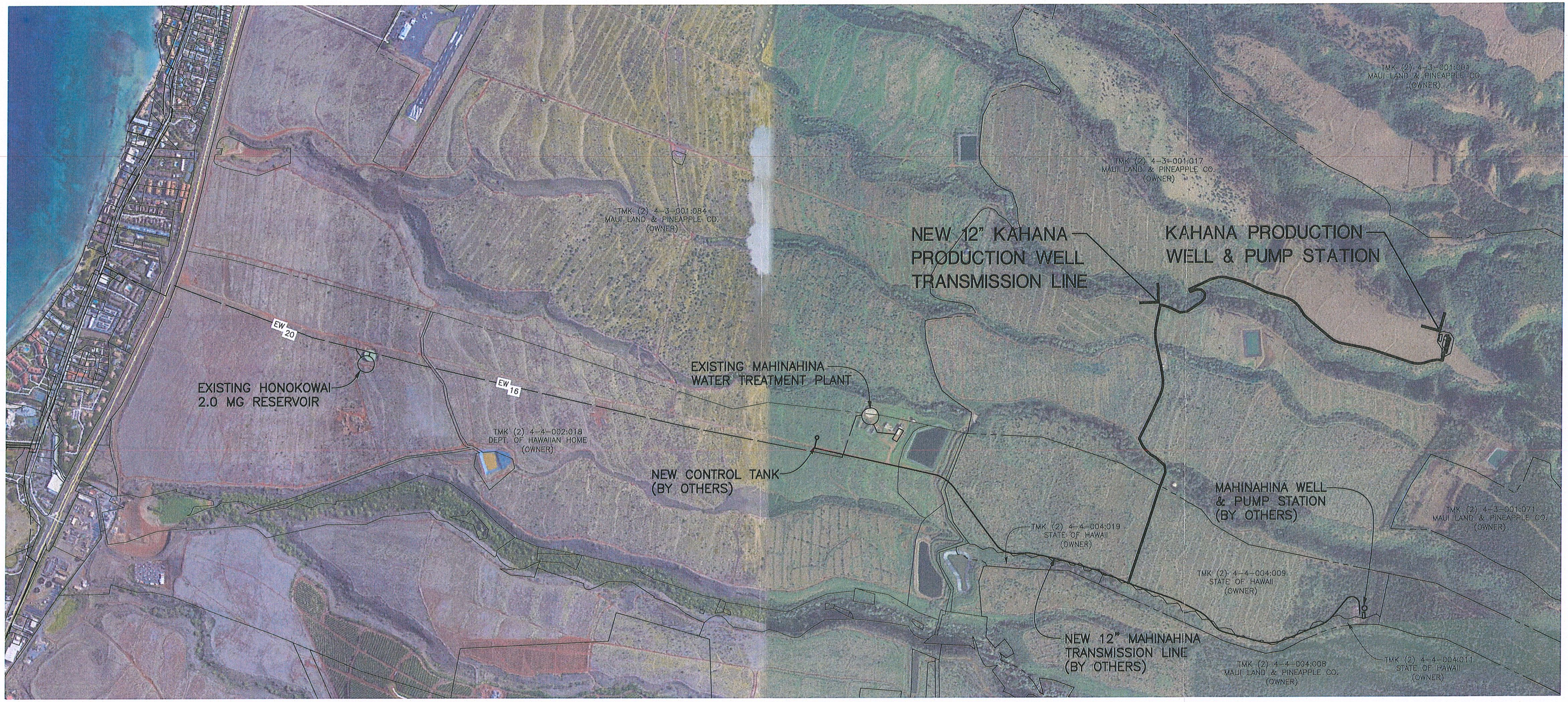
0 2000 4000 8000 12000

NORTH

SOURCE: TAX MAP KEY (2) 4-3-001 & 4-4-000

PREPARED FOR: DEPT. OF WATER SUPPLY, COUNTY OF MAUI

PREPARED BY: FUKUMOTO ENGINEERING, INC.



NORTH

GENERAL PLAN

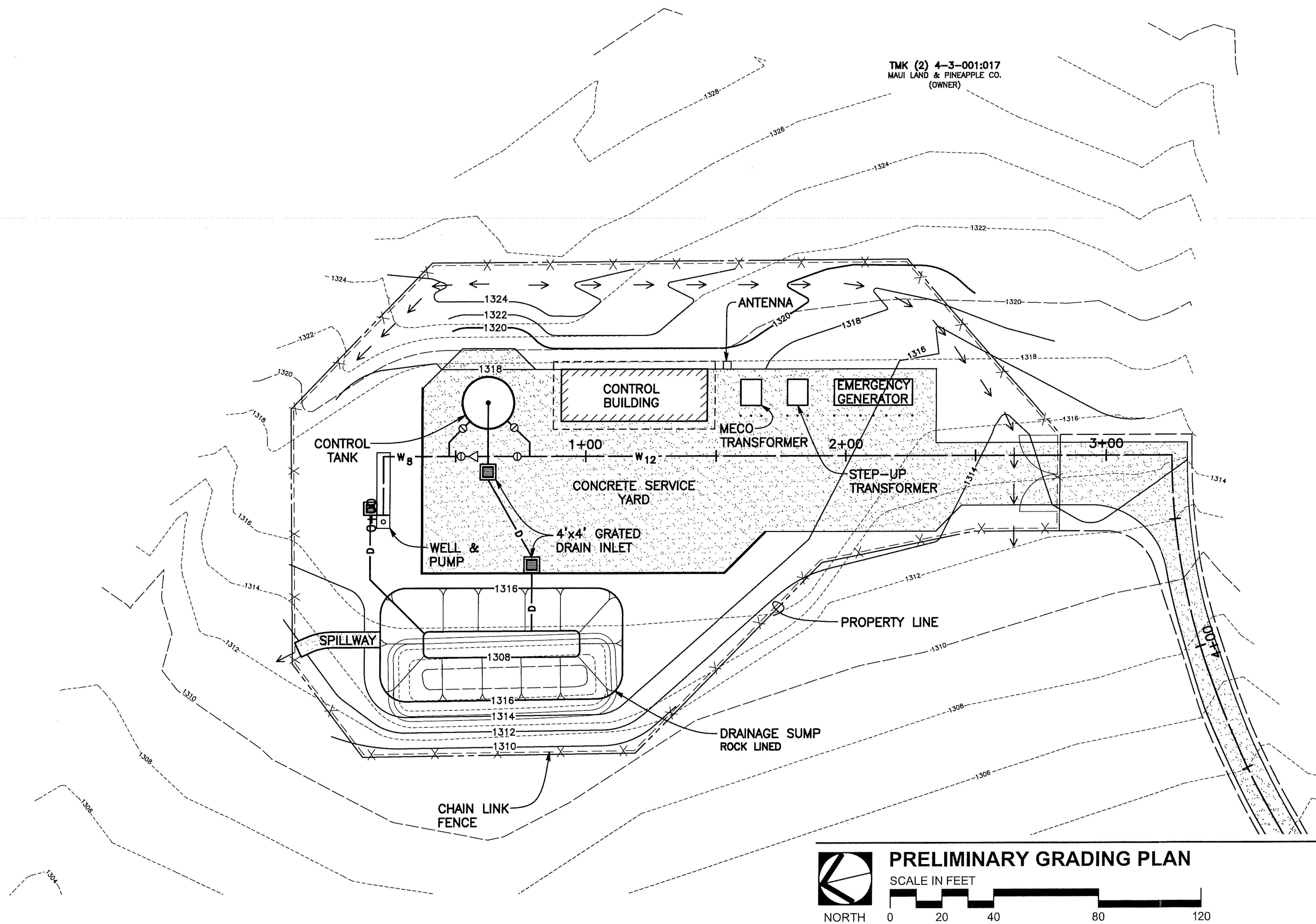
SCALE IN FEET

0 600 1200 2400 3600

Figure 4

PREPARED FOR: DEPT. OF WATER SUPPLY, COUNTY OF MAUI

PREPARED BY: FUKUMOTO ENGINEERING, INC.

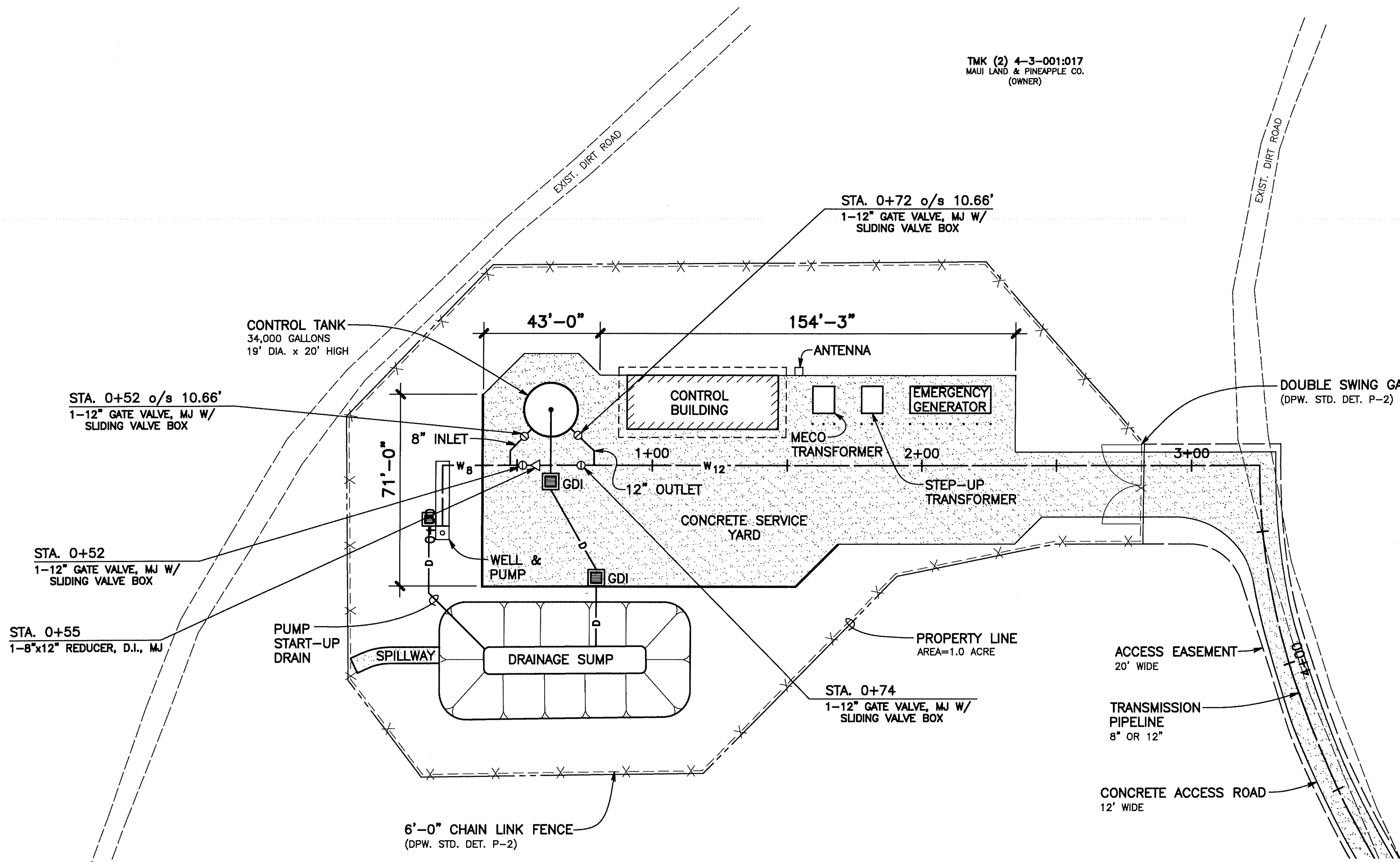


PRELIMINARY GRADING PLAN

Figure 5

PREPARED FOR: DEPT. OF WATER SUPPLY, COUNTY OF MAUI

PREPARED BY: FUKUMOTO ENGINEERING, INC.



PRELIMINARY SITE PLAN

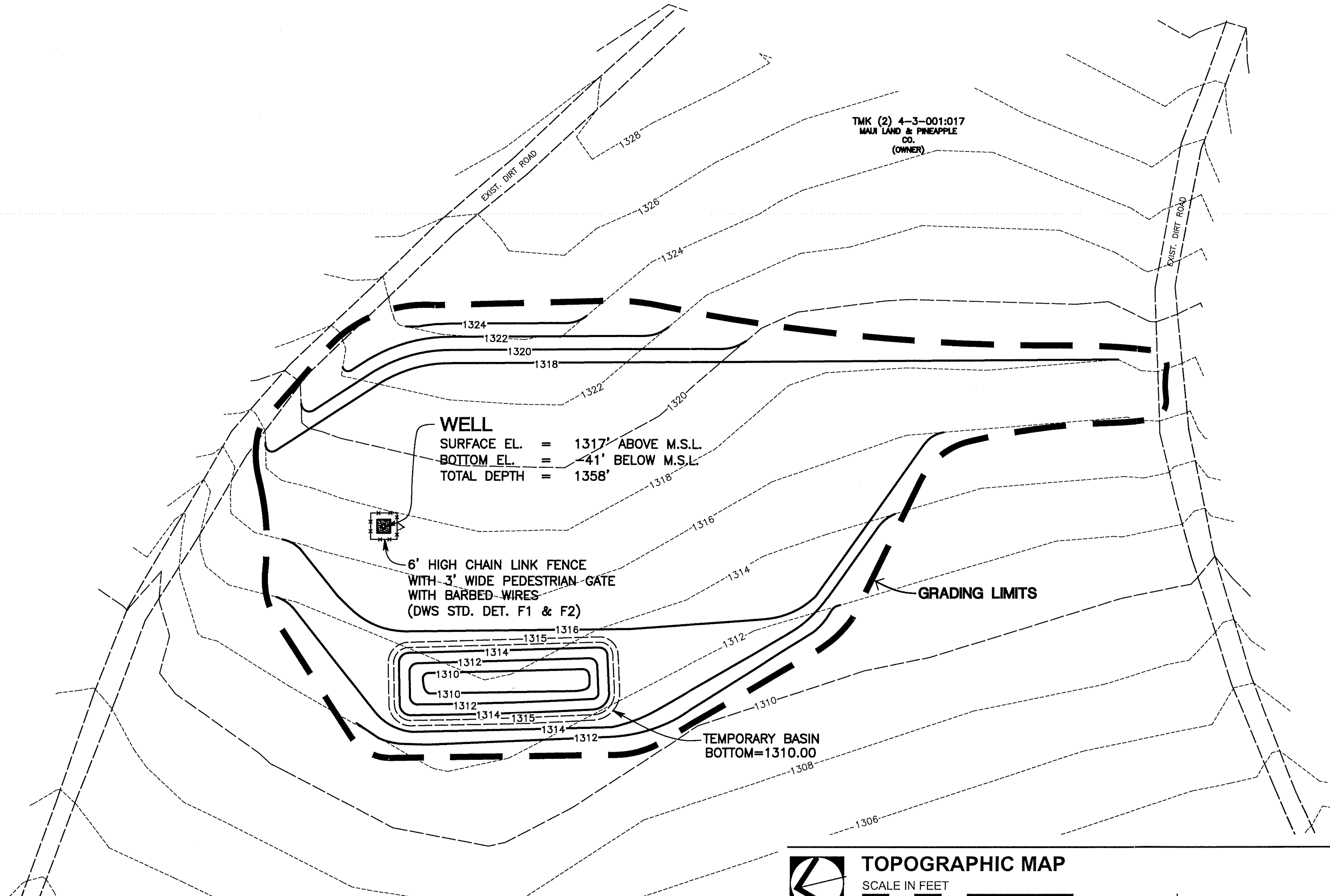
SCALE IN FEET

NORTH 0 20 40 80 120

Figure 6

PREPARED FOR: DEPT. OF WATER SUPPLY, COUNTY OF MAUI

PREPARED BY: FUKUMOTO ENGINEERING, INC.



TOPOGRAPHIC MAP

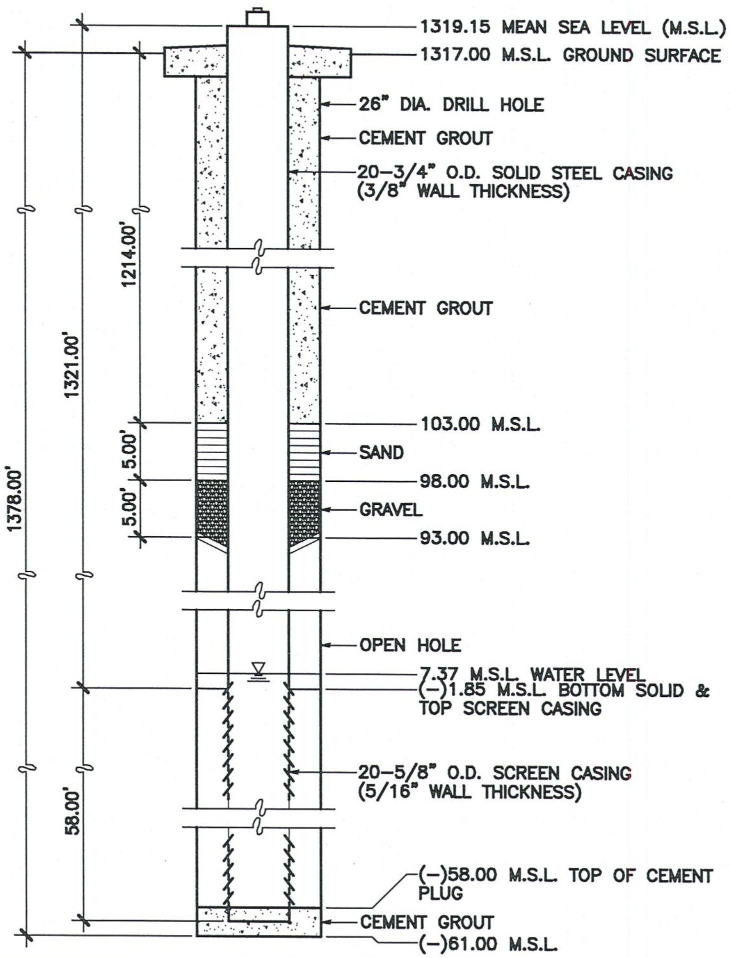
SCALE IN FEET

NORTH 0 20 40 80 120

Figure 7

PREPARED FOR: DEPT. OF WATER SUPPLY, COUNTY OF MAUI

PREPARED BY: FUKUMOTO ENGINEERING, INC.



WELL CROSS-SECTIONAL DIAGRAM
NOT TO SCALE

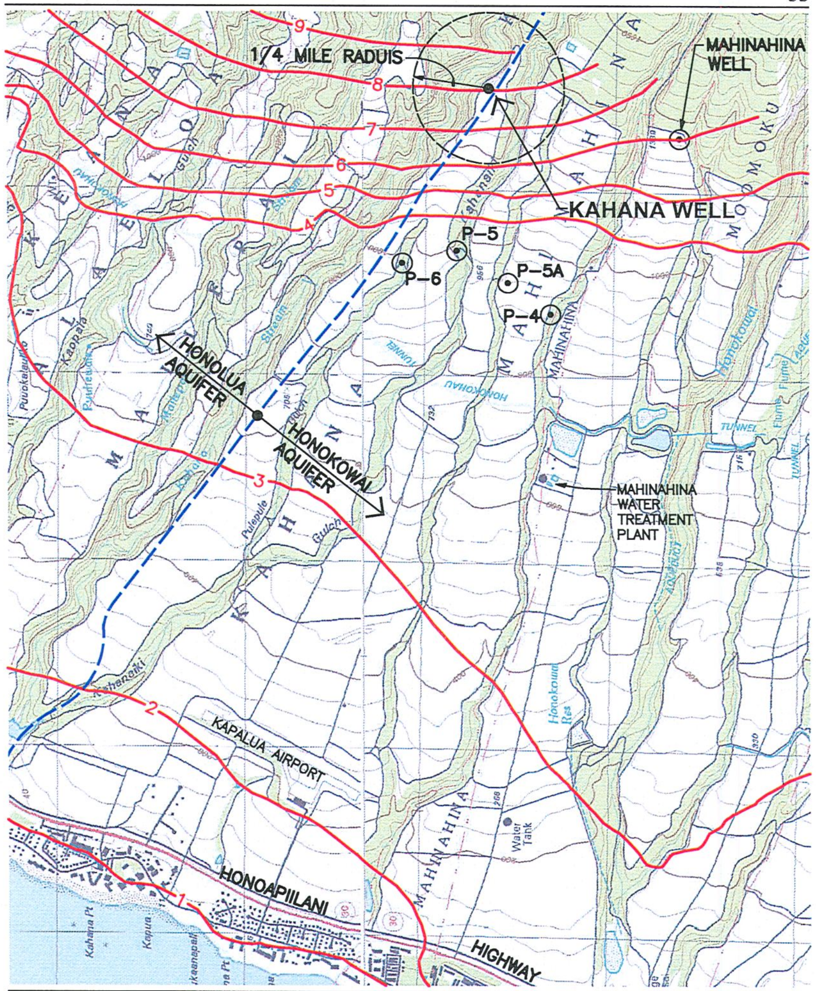
Figure 8

PREPARED FOR: DEPT. OF WATER SUPPLY, COUNTY OF MAUI PREPARED BY: FUKUMOTO ENGINEERING, INC.
ENGINEERING REPORT FOR NEW DRINKING WATER SOURCE FOR KAHANA WELL

SOIL MAP
SCALE IN FEET
0 1000 2000 4000 6000
NORTH

Figure 9
SOURCE: SOIL SURVEY

PREPARED FOR: DEPT. OF WATER SUPPLY, COUNTY OF MAUI PREPARED BY: FUKUMOTO ENGINEERING, INC.
ENGINEERING REPORT FOR NEW DRINKING WATER SOURCE FOR KAHANA WELL



GROUNDWATER CONTOUR MAP

SCALE IN FEET

NORTH 0 1000 2000 4000 6000

Figure 10

SOURCE: USGS LAHAINA & NAPILI QUADRANGLE MAP
USGS SCIENTIFIC INVESTIGATIONS
REPORT 2012-5010

PREPARED FOR: DEPT. OF WATER SUPPLY, COUNTY OF MAUI

PREPARED BY: FUKUMOTO ENGINEERING, INC.

APPENDIX A

WEST MAUI WELL NO. 2, AKA KAHANA EXPLORATORY WELL
STATE WELL NO. 6-5738-002, SUMMARY OF DRILLING AND WELL TESTING

West Maui Well No. 2, aka
Kahana Exploratory Well
State Well No. 6-5738-002
Summary of Drilling and Well Testing
June 19, June 23-June 27, 2017

Prepared For:

Fukumoto Engineering, Inc.
1721 Wili Pa Loop, Suite 203
Wailuku, Hawaii 96793

Prepared By:

Glenn Bauer, Geologist
182 Kuuala Street
Kailua, Hawaii 96734

July 2017

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APPENDICES

Introduction

The Maui Department of Water Supply's new Kahana Exploratory Well (aka West Maui Well No. 2, and State Well No. 6-5738-002) is located at ground elevation of 1,317± feet above sea level (ft., msl). The surveyed benchmark elevation on top of the northwest corner of the well pad is 1,317.32 ft., msl. The NAD83 coordinates were determined for the well using a Garmin 62st GPS unit are latitude 20° 57′ 8.3″N and longitude 156° 38′ 19.3″W with an error factor of ±9 ft. Alpha, Inc. under the direction of Jason Stenger, completed the well on May 1, 2017. Grading the site for drilling began in April 2014. Figure 1 is a Google Earth map showing the location of the well.

With the installation of a variable speed submersible pump, the well was readied for the step-drawdown and constant rate test. The step-drawdown test was performed on June 19, 2017. The targeted test rates for the test were 500, 700, 1,000, 1,200 gallons per minute (gpm), with each step lasting 60 minutes. The highest rate was never attained. The well recovered to within 94 percent of the initial static water level in 30 minutes. Because the 1,200 gpm goal was not attained during the step-drawdown test, it was decided that Alpha, Inc. would work on the pump controls and test the flow meter. The 96-hour constant rate test began on June 23 and ended on June 27, 2017. The well recovered to over 80 percent of the static conditions in 100 minutes (Curtis Eaton, personal communication).

A geologic log was compiled from the drill cuttings. The geologic log is attached as Appendix 1. The log only describes the upper 220 feet and the bottom 50 feet of the well. During drilling, circulation of drilling fluid was lost between the depths of 220 feet and 1,290 feet. There was no recovery of cuttings during this interval. The log shows that upper 220 feet is weathered rock belonging mainly to the post-caldera stage Honolua Volcanics. At some depth the well penetrates the shield-building lavas of the Wailuku Basalt (Stearns and Macdonald, 1942; Clague and Langenheim 1987). These thin-bedded and highly permeable lavas are the source of water to the well.

A summary of the construction details of the well and tabulation of pump test results will be submitted by the driller to the Commission on Water Resource Management (CWRM) in the required well completion report. However, below is a summary of the pertinent well data provided by Alpha, Inc.

- Driller: Alpha, Inc. (Jason Stenger)
- Ground elevation: 1,317± ft., msl
- Benchmark elevation: 1,317.32 ft., msl
- Measuring point elevation: 1,319.15 ft., msl (top of casing)
- Depth of well from top of casing: 1,379± ft.
- Bottom elevation: -60 ft., msl (measured from top of casing)
- Hole diameter: 26 inches
- Casing diameter: 20 inches nominal diameter
- Solid casing length: 1,321 ft.
- Perforated casing length: 58 ft.
- Depth to water from measuring point: 1,311.78 ft.
- Static water level elevation: 7.37 ft., msl (June 19, 2017)

Summary of Step-Drawdown Test Results

The step-drawdown test was conducted on June 19, 2017 using Alpha, Inc.'s variable speed submersible pump. Three pumping rates (Qave) of 508 gpm, 780 gpm, and 963 gpm were run. An attempt to run a fourth rate at 1,200 gpm only yielded an average of 1,132 gpm after a lot of adjustments to the pump controls. Each rate lasted one hour while drawdown, water temperature, and water samples were collected. Drawdown stabilized within 45 minutes from the beginning of each rate. After the completion of the step-drawdown test, the well was allowed to recover 60 minutes. After 30 minutes the recovery was within 0.45 feet of static conditions. Figures 2, 3, 4, and 5 show the set-up of the pump, generator, and meter.

Prior to the step-drawdown test, the static measured water level was 7.37 ft., msl. The drawdowns measured in the well during the test are in relation to this water level. Table 1 below summarizes the measured parameters during the step-drawdown test. The complete record of measurements taken during the step-drawdown test and constant rate tests by Alpha, Inc. are shown in Appendix 2.

Table 1

Ave. Pumping	Stable Drawdown	Field Chloride[1]	DWS Lab Chloride[2] (mg/L)	Sp. Conductance[3] (µS/cm)	Temperature[4] (°F)
508	1.10	45	51.1	295	68.7
780	1.95	45	49.0	283	68.5
963	2.77	40		281	68.5
1,132	3.36*	40	48.7	282	69.4

*Pump rate unsteady
[1]Hach kit analysis using a Hach strip
[2]Samples collected by Curtis Eaton of Maui DWS
[3]Average specific conductance using Myron UltraPen
[4]Average temperature

In addition to the field chloride sampling, Maui DWS collected a chloride sample at the beginning of the step-drawdown test and another sample at the end of each rate. These samples were analyzed at their laboratory using EPA's SM4500CL-D method (see Appendix 2). The three analyzed samples had chloride concentrations decreasing from 51.1 mg/L to 48.7 mg/L. These analyses are slightly higher than the Hach test strip chlorides.

. As stated above, the well penetrates highly permeable basaltic lava flows of the Wailuku Basalt. These highly permeable lavas are reflected in the well's efficiency and low drawdowns. Figure 6 is a plot of the step-drawdown results of drawdown versus pumping rate. The equation for the straight line is shown. If the equation of the line is cast in the form of combining drawdown (s) as laminar flow, BQ, with turbulent flow, CQ^2, then the equation is:

$$s = BQ + C\,Q^2$$

To solve for B and C using simultaneous equations by using the first rate (508 gpm or 97,790 ft^3/d) and the last rate (963 gpm or 185,378 ft^3/d) yields are:

$$1.10 = B(97{,}790) + C(97{,}790)^2$$

$$2.77 = B(185{,}378) + C(185{,}378)^2$$

So that the drawdown equation becomes:

$$s = 7.124E\text{-}06\ Q + 4.217E\text{-}11\ Q^2$$

Therefore, if the pumping rate is 1,000 gpm or 192,500 ft^3/d, the calculated drawdowns due to laminar and turbulent flow are 1.37 ft. and 1.56 ft., respectively. Total drawdown is 2.93 ft. From the laminar (aquifer loss) and turbulent (well loss) flow contributions, 32.5 percent of the drawdown is due to aquifer loss from the permeable aquifer, and only 67.5 percent is well loss due to turbulent flow at the well bore. The cause for the turbulent flow at the well bore could be due to perforated casing and the crushed basalt packing. Nevertheless, the aquifer is very permeable with minimal drawdown.

The step-drawdown data can be used to calculate the hydraulic conductivity (K) of the aquifer in the vicinity of the well. K, in feet per day (ft/d), is a measure of an aquifer's permeability. High yield basal basaltic aquifers typically have K values greater than 1,000 ft/d. An equation presented in Underwood and others (equation 1, 1995) can be used in a partially penetrating well using the adjusted drawdown data from the step-drawdown test:

$$K = \frac{Q\ln(1.6L/rw)}{2\pi L sw}$$

Where: Q is the pumping rate in ft^3/d (192,500 ft^3/d);
ln is the natural logarithm (base e = 2.7180);
L is the length of the open interval (59 ft);
π is pi, equal to 3.1415;
rw is the radius of the well in ft. (0.83 ft.);
sw is drawdown in pumped well adjusted for well loss (1.37 ft).

Substituting the above values into the equation, a K of 1,794 ft/d is calculated. The equation assumes a well that partially penetrates a much thicker aquifer. A factor of

1.6 times the bottom elevation of the well defines the influence of the well on the aquifer affected, but the actual freshwater thickness of the aquifer is much greater.

The total amount of water pumped during the step-drawdown test was 202,500 gallons. At the end of the step-drawdown test recovery to within 94 percent of static conditions occurred within 30 minutes.

Summary of the 96-Hour Constant Rate Test

As state above, the 96-hour constant rate, scheduled to begin on June 19, was postponed until June 23. Postponing the test allowed Alpha, Inc. time determine how to reach constant rate of 1,200 gpm. In addition, there was an issue with the flow meter possibly under measuring discharge from the well. Alpha, Inc. installed a second flow meter about 25 feet downstream from the first. This flow meter became the official test meter, as its totalizer dial performed more smoothly through a cycle of 1,000 gallons. See Figure 7.

The constant rate test began at 12:00 noon on and shut off at 12:23 pm because the target rate could not be achieved. After some discussion regarding the maximum rate, the test was restarted at 12:30 pm. Maui DWS agreed that any rate over 1,100 gpm would be satisfactory. The test was shut off on June 27, 2017 at 12:30 pm. The static water level prior to restarting the test was 7.36 ft., msl. Again, all subsequent drawdown measurements are compared to this water level. Over the 96 hours, a total of 6,813,300 gallons was pumped. The average pumping rate was 1,182 gpm, or 99 percent of the target rate of 1,200 gpm.

Drawdown data were collected every 30 seconds for the first five minutes, every minute for the first 10 minutes. From 10 minutes to 20 minutes measurements were taken every two minutes. A measurement was taken at 25 minutes, and then

every 10 minutes until 100 minutes of elapsed time was reached. After 100 minutes a measurement was taken following the Commission on Water Resource Management's pump (CWRM) test protocol until the end of the test (see Appendix 2). Field Hach test kit chlorides, specific conductance, and temperature measurements were taken using the same elapsed time protocol after 150 minutes. Maui DWS chloride samples were random when the DWS inspector was able to go to the job site. Since the test occurred over the weekend (June 24 and 25), no Maui DWS samples were collected. Pural Water Specialty Co., Inc. collected the State DOH mandated EPA samples on June 27, 2017.

Table 2 summarizes the measured parameters collected in the field during the 96-hour test. The data were collected by Alpha, Inc. personnel. The field measurements provided by Alpha, Inc. as the CWRM protocol are in Appendix 2.

Table 2

Date	Average Drawdown (ft.)	Average sp. conductance (µS/cm)	Average Field Chloride (mg/L)	Average Temperature (°F)
6/23/17	2.86	280	50	70.4
6/24/17	3.31	298	51	70.5
6/25/17	3.43	300	52	72.9 (?)
6/26/17	3.82	316	60	69.6
6/27/17	3.92	333	60	73.0 (?)

As shown in Table 2, drawdown increased slightly over time. Figure 7 shows how drawdown changed during the duration of the test. Minor variations are due primarily to atmospheric pressure changes and possibly to ocean tides.

The specific conductance varied with increasing chlorides over the duration of the test. Figure 9 shows changes in the Maui DWS analyzed chloride concentration over time (data from Appendix 3). Total increase in chloride concentration during the test was 17.5 mg/L. This increase is the result of a pumping rate of almost 1,200 gpm is not sustainable for a basal aquifer with a static water level of 7.5± ft., msl.

In a basal lens, where freshwater floats on denser saltwater, the sustainable capacity of a well is determined by the bottom elevation of the well (-60 ft., msl). As pointed out in Appendix D of the "Kahukuloa Water Study" (Wilson Okamoto & Assoc., 1977), the bottom elevation is constrained to be no more than one third of the theoretical thickness of the lens. Since the theoretical thickness (41 times 7.4) is 303 feet, the bottom elevation is within this parameter. Table D-3 in that report shows a matrix of Lahaina-Napili wells, their pumping rates, and their chlorides. Later, John Mink (personal communication, 1990), who was the primary author of the study, devised an empirical equation for maximum pump capacity (in gpm) to be $Q = 20 \times h^2$. For this well with a head of 7.4 ft., msl, the maximum pump capacity would be, 1,095 gpm.

The temperature collected during the 96-hour constant rate test seems high when compared to the temperature data collected during the step-drawdown test (Table 1). The temperature anomalies are probably associated with either the collection method (time from collecting and handling) or instrument error.

The aquifer is an unconfined basal aquifer. As stated previously, the calculated hydraulic conductivity, K, is 1,794 ft./day, which means the aquifer is very permeable. This value is typical of flank lava flows of basaltic composition.

Conclusions

The results from the step-drawdown and constant rate tests show that the Kahana Exploratory Well is an excellent well, and will be a dependable source of potable water for Maui DWS. Though the well can produce almost 1,200 gpm with a drawdown of almost four feet, the chloride results indicate that this rate is too high. Maui DWS indicated that the installed capacity of the pump will be 1,000 gpm, operated on a 16-hour day basis, which is less than 1 mgd, and should be sustainable.

References

Commission on Water Resource Management, State of Hawaii, well files.

Langenheim, V. A. M. and Clague, D. A., 1987, The Hawaiian-Emperor Volcanic chain Part II. Stratigraphic framework of volcanic rocks of the Hawaiian Islands: USGS Prof. Paper 1350, pp. 55-84.

Stearns, H. T. and Macdonald, G. A., 1942, Geology and ground-water resources of the island of Maui, Hawaii: Hawaii Div. Hydrography Bull. 7, 344 p.

Underwood, M. R., Meyer, W., and W. R. Sousa, 1995, Ground-water availability from the Hawi aquifer in the Kohala area, Hawaii: U. S. Geological Survey WRI Report 95-4113, 57 p.

Wilson Okamoto & Assoc., 1977, Kahukuloa Water Study, prepared for the Dept. of Land and Natural Resources, Division of Water and Land Development, Report No. R54, 84 p., 7 Appendices.

Figure 1: Google Earth location map showing Kahana Exploratory Well 5738-002.

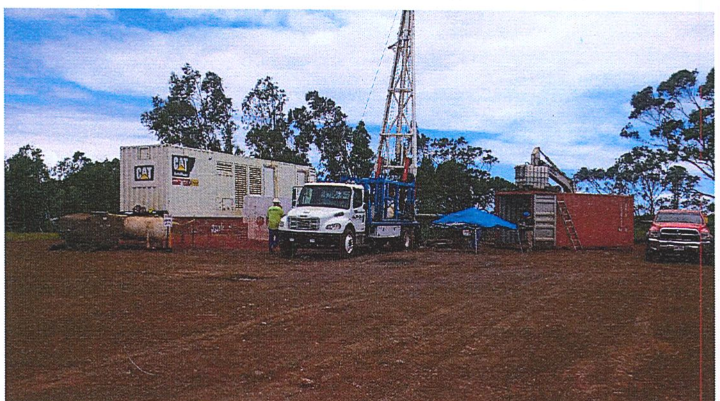

Figure 2: Overall set-up of the generator and pump behind the rig.
View is to the northwest.

Figure 3: View is to the west of well and discharge line from
The submersible pump. Red arrow points to the location of the benchmark.

Figure 4: McMcrometer flow meter used during the step-drawdown test.

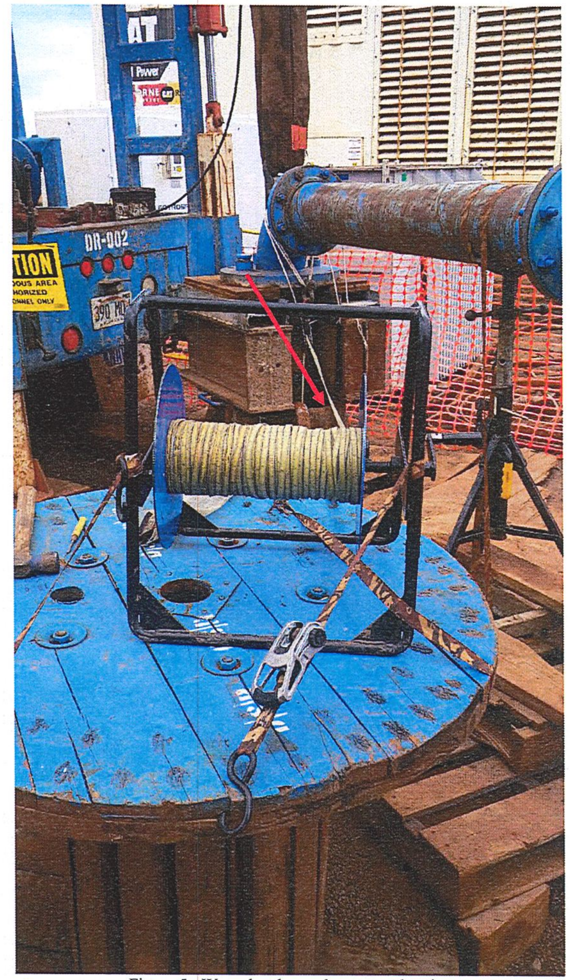

Figure 5: Water level sounder set-up showing the measuring point (red arrow).

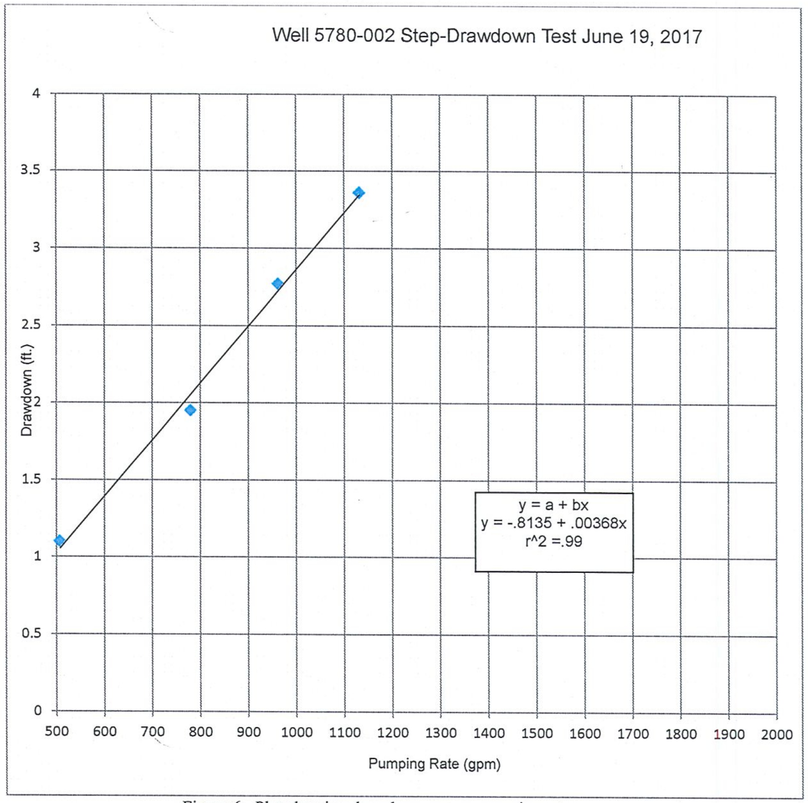

Figure 6: Plot showing drawdown versus pumping rate.

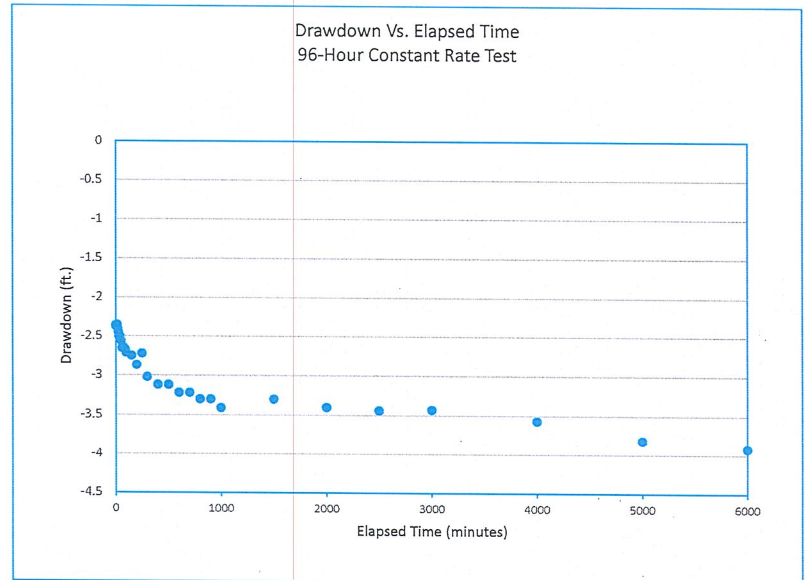

Figure 7: Drawdown during the constant rate test. The test began at 12:30 pm on June 23 and ended at 12:30 pm on June 27, 2017.

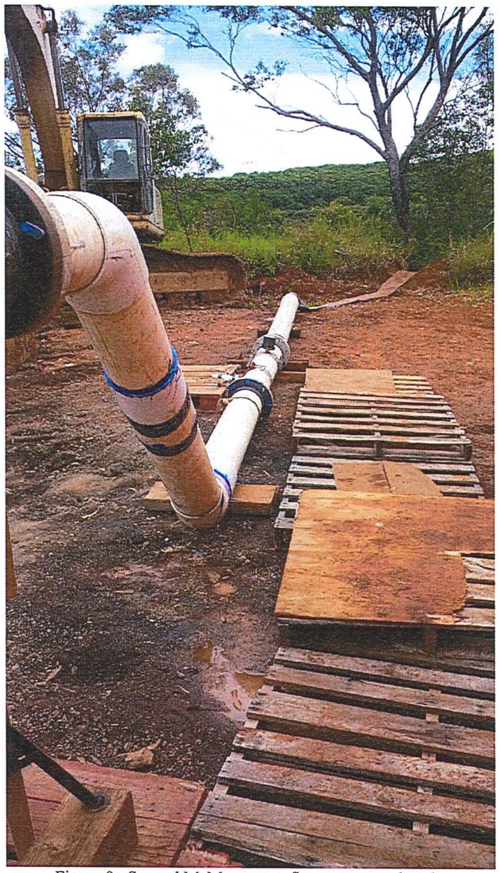

Figure 8: Second McMcrometer flow meter used as the official meter during the 96-hour constant rate test. Its totalizer ran smoothly during a 1,000 gallon cycle.

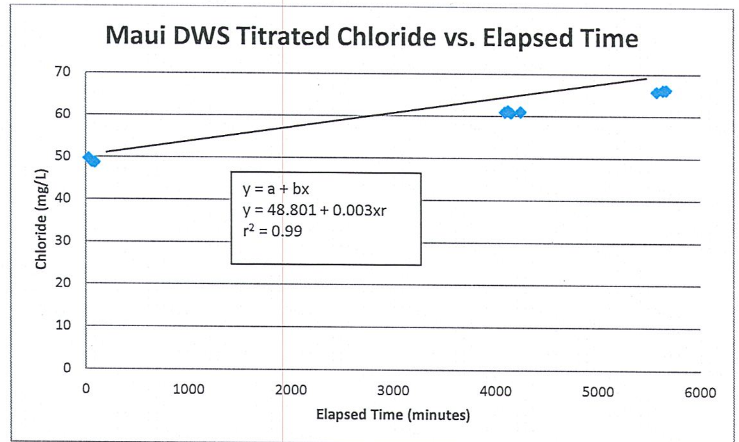

Figure 9: Maui DWS titrated chloride samples plotted against elapsed time of the 96-hour constant rate test, June 23 – 27, 2017.

Appendix 1

Maui DWS Kahana Exploratory Well 6-5738-002
Geologic Log
By Glenn Bauer, Geologist

Ground Elevation
is: 1317 ± ft., msl
NAD83 Lat/Long: 20°57'08.3" 156°38'19.3" (coordinates deteremined by R. Fukumoto Engineering)

Depth Sample Taken (ft.)	Elevation (ft., msl)	Description
10	1307	Brown clayey soil
20	1297	Brown clay with weathered rock fragments
30	1287	Brown clay
40	1277	Brown clay with weathered rock fragments and white clay minerals
50	1267	Brown clay with weathered rock fragments and white clay minerals
60	1257	Brown clay with weathered rock fragments and white clay minerals
70	1247	Brown clay with weathered rock fragments
80	1237	Brown clay with weathered rock fragments
90	1227	Brown clay with weathered rock fragments
100	1217	Brown clay with weathered rock fragments
110	1207	Red/brown clay with weathered rock fragments and white clay minerals
120	1197	Dark brown clay with weathered rock fragments and white clay minerals
130	1187	Gray/brown clay with weathered rock fragments
140	1177	Red/brown clay with very weathered rock fragments
150	1167	Red/brown clay with rock fragments
160	1157	Red/brown clay with rock fragments
170	1147	Red clay with small fragments of weathered rock
180	1137	Red clay with small fragments of weathered rock
190	1127	Brown clay with rock fragments
200	1117	Brown clay with rock fragments
210	1107	Light brown clay with rock fragments
220	1097	Brown clay with weathered rock fragments and white clay minerals
220-1290	1097-27	Lost circulation no samples collected due to lava tube
1300	17	Gray aphyric pahoehoe
1310	7	Slightly weathered gray aphyric cinder
1320	-3	Gray scoriacious cinder mostly aphyric, with minor plagioclase feldspar phenocryts
1330	-13	Mixture of red and gray aphyric cinder
1340	-23	Mixture of red pahoehoe and gray scoriacious cinder
1350	-33	Mixture of red pahoehoe and gray scoriacious cinder

Appendix 2

STEP-DRAWDOWN PUMP TEST DATA

(not required for wells producing < 100,000 gpd or 70 gpm)

Pumped Well No. 6-5738-002 — Observation Well No. N/A

Pumped Well Name Kahana — Distance between Obs. & Pumped Well N/A ft.

Target Q 1000 gpm — Reference pt. for depth to water 1319.15 Top of ~~Casing~~ ft. msl

Static Water Level @ start of test 7.37 ft. msl

Water level measurements by: ☑ electrical sounder ☐ pressure transducer ☐ airline

START TEST Date: June 19, 2017 Time of day: 8:25 a.m.

Flow Meter Reading Start: 13442500 gallons

Suggested Elapsed time t (min)	Actual Elapsed Time t (min)	Depth to water (nearest 0.1 ft)	Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (at least 3 steps) (gpm)	EC (µS/cm)	Cl⁻ (mg/l)	Temp. X °F or — °C	Data in this table is for: ☑ Pumped Well ☐ Observation Well Remarks
-45	.35	1311.78		0			.	Start test/ Step 1
-30	.30	1311.78		0			.	
-15	.15	1311.78		0			.	
9am 0	0	1311.78		492 1			.	Start pump
1	1	1312.8		492			.	
1.5	1.5	1312.8		↓			.	
2	2	1312.85					.	
2.5	2.5	1312.85					.	
3	3	1312.85					.	
4	4	1312.85					.	
5	5	1312.85					.	
6	6	1312.85					.	
7	7	1312.85					.	
8	8	1312.80					.	
10	10	1312.79					.	
15	15	1312.85					.	
20	20	1312.85					.	
25	25	1312.90					.	
930am 30 2	31	1312.83			278	70 3	70.7 .	Conductivity reading Chloride sample taken
45	44	1312.92					.	Step 2 next page
955am 55	55	1313.00						

3/24/2015

SDPTD Form 3/24/2015

Suggested Elapsed time t (min)	Actual Elapsed Time t (min)	Depth to water (nearest 0.1 ft)	Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (at least 3 steps) (gpm)	EC (µS/cm)	Cl^- (mg/l)	Temp. X °F or ___ °C	Data in this table is for: ☒ Pumped Well ☐ Observation Well Remarks
0								Start Step 2
10am 1	1	1312.7		778				
1.5	1.5	1312.7						
2	2	1312.7						
2.5	2.5	1312.7						
3	3	1312.7						
4	4	1312.7						
5	5	1313.68						
6	6	1313.67						
7	7	1313.72						
8	8	1313.7						
10	10	1313.71						
15	15	1313.71			259		70.1	
20	20	1313.77						
25	25	1313.74						
30[2]	30	1313.75			257	65[3]	70.0	Conductivity reading Chloride sample taken
45	45	1313.08						
60	58	1313.9						
11am 1	1	1314.43		968				
1.5	1.5	1314.44						
2	2	1314.50						
2.5	2.5	1314.52						
3	3	1314.45						
4	4	1314.43						
5	5	1314.46						
6	6	1314.55						
7	7	1314.55						
8	8	1314.55						
10	10	1314.55						
15	15	1314.57						
20	20	1314.60				40		Test Strip
25	25	1314.62						
30	30	1314.65			263	65	70.3	Sample
45	45	1314.68						
60	59	1314.68						

SDPTD Form 3/24/2015

Suggested Elapsed time t (min)	Actual Elapsed Time t (min)	Depth to water (nearest 0.1 ft)	Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (at least 3 steps) (gpm)	EC (µS/cm)	Cl^- (mg/l)	Temp. X °F or ___ °C	Data in this table is for: ☒ Pumped Well ☐ Observation Well Remarks
0				[1]				Start Step 3
1200 1		1315.22		1110				
1.5		1315.20						
2		1315.05						
2.5		1315.03						
3		1315.10						
4		1315.11						
5		1315.15						
6		1315.12						
7		1315.14						
8		1315.17						
10		1315.20						
15		1315.18						
20		1315.05						
25		1315.05						
30[2]		1315.06			273	40[3]	71.4	Conductivity reading Chloride sample taken
45		1314.75						
60		1314.72						
								Max possible duration, water level or quality did not stabilize for any 24 period
			[4]	0				Begin recovery data next page Flow meter reading at end of pumped period: 13649900 gals

[1] starting pumping rate Q
[2] minimum length of step period of constant pumping rate
[3] minimum mandatory Chloride (Cl^-) measurement/sampling at end of every step
[4] Use same ending drawdown figure as start for recovery

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Suggested elapsed time t (min)	Actual elapsed time t (min)	Depth To Water (nearest 0.1 ft)	Recovery Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (gpm)	EC (µS/cm)	Cl^- mg/l)	Temp. X °F or °C	Data in this table is for: ☑ Pumped Well ☐ Observation Well Remarks
0	0			0				Pump off, start recovery
1	1	1312.10		0				
1.5	1.5	1312.00		0				
2	2	1311.98		0				
2.5	2.5	1311.95		0				
3	3	1311.86		0				
4	4	1311.90		0				
5	5	1311.92		0				
6	6	1311.96		0				
7	7	1312.11		0				
8	9	1312.32		0				
10	10	1312.40		0				
15	15	1312.35		0				
20	16	1312.33		0				
25	20	1312.33		0				
30	25	1312.28		0				
40	30	1312.23		0				
50				0				
60				0				
70				0				
80				0				
90				0				
100				0				
150				0				
200				0				
250				0				☒ 80% recovery achieved ☐ 80% recovery not achieved

END TEST Date: June 19, 2017 Time of day: 1:40 p.m.

ADDITIONAL REMARKS:

Person in charge of pump test (print): Jason Stenger

Signature:

The signature above indicates that the data reported on this form is accurate and true to the best of the person's knowledge who operated this pump test.

CRPTD Form 3/24/2015

CONSTANT-RATE PUMP TEST DATA

(not required for wells producing < 50 gpm)

Pumped Well No. 6-5738-002 Observation Well No. N/A

Pumped Well Name Kahana Well Distance between Obs. & Pumped Well N/A ft.

Target Q 1200 gpm Reference pt. for depth to water 1319.15 ft. msl

Static Water Level @ start of test 1311.78 ft. msl

Water level measurements by: ☒ electrical sounder ☐ pressure transducer ☐ airline

START TEST Date: June 23, 2017 Time of day: 12:30 p.m.

Flow Meter Reading Start: 11455800 gallons

Suggested elapsed time t (min)	Actual elapsed time t (min)	Depth to water (nearest 0.1 ft)	Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (gpm)	EC (µS/cm)	Cl^- (mg/l)	Temp. X °F or °C	Data in this table is for: ☐ Pumped Well ☐ Observation Well Remarks
-45		1311.78		1200				Start test
-30		1311.78						
-15		1311.78						
0	0		0.00			1		Start pump/Cl^- taken*
1	12:31	1314.14	2.37		268	47	71.3	
1.5	12:31.5	1314.14	2.37					
2	12:32	1314.15	2.37					
2.5	12:32.5	1314.15	2.37					
3	12:33	1314.14	2.36					
4	12:34	1314.15	2.37					
5	12:35	1314.15	2.37					
6	12:36	1314.14	2.36					
7	12:37	1314.14	2.36					
8	12:38	1314.14	2.36					
10	12:40	1314.14	2.36					
15	12:46	1314.15	2.35					
20	12:50	1314.18	2.4					
25	12:55	1314.22	2.44					
30	13:00	1314.28	2.5					
40	13:10	1314.28	2.5					
50	13:20	1314.34	2.56					
60	13:30	1314.43	2.65					

CRPTD Form 3/24/2015

Suggested elapsed time t (min)	Actual elapsed time t (min)	Depth to water (nearest 0.1 ft)	Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (gpm)	EC (µS/cm)	Cl⁻ (mg/l)	Temp. X °F or ___ °C	Data in this table is for: ☐ Pumped Well ☐ Observation Well Remarks
70	13:40	1314.43	2.65	1200			.	
80	13:50	1314.43	2.65				.	
90	14:00	1314.45	2.67				.	
100	14:10	1314.49	2.71				.	
150	15:10	1314.53	2.75		281	50	69.8 .	
200	15:50	1314.65	2.87				.	
250	16:40	1314.7	2.72				.	
300	17:30	1314.8	3.02				.	
400	19:10	1314.9	3.12		280	50 [1]	70.5 .	Conductivity reading
500	20:50	1314.9	3.12				.	
600	22:30	1315.02	3.22				.	
700	00:10	1315.02	3.22				.	
800	2:00	1315.1	3.3		287	50 [1]	70.8 .	Conductivity reading
900	3:40	1315.1	3.3				.	
1000	5:10	1315.19	3.41		306	52 [1]	67.6 .	Conductivity reading
1500	13:30	1315.1	3.3		291	52 [1]	73.2 .	Conductivity reading
2000	21:30	1315.18	3.4		309	52 [1]	68.2 .	Conductivity reading
2500	11:30	1315.24	3.44		302	52 [1]	71.8 .	Conductivity reading
3000	19:30	1315.23	3.43		299	52 [1]	74.1 .	Conductivity reading
4000	11:30	1315.35	3.57		312	53 [1]	72.1 .	Conductivity reading
5000	3:30	1315.6	3.82		316	60 [1]	69.6 .	Conductivity reading
6000	11:40	1315.7	3.92		333	60 [1]	73.0 .	Conductivity reading
7000						[1]	.	Conductivity reading
8000						[1]	.	Conductivity reading
9000						[1]	.	Cl⁻ sample taken*
10000								Max possible duration, water level or quality did not stabilize for any 24 period
			[2]	0				Begin recovery data next page Flow meter reading at end of pumped period: 18269100 gals

[1] Conductivity reading (*Chloride sampling required at the beginning and end of test)
[2] Use same ending drawdown figure as start for recovery

CRPTD Form 3/24/2015

Suggested elapsed time t (min)	Actual elapsed time t (min)	Depth to water (nearest 0.1 ft)	Recovery Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (gpm)	EC (µS/cm)	Cl⁻ (mg/l)	Temp. ___ °F or ___ °C	Data in this table is for: ☐ Pumped Well ☐ Observation Well Remarks
0	12:20 0	1315.69	3.91	0			.	Start recovery
1	12:31	1312.9	1.12	0			.	
1.5	12:32	1312.81	1.03	0			.	
2	12:32	1312.8	1.02	0			.	
2.5	12:32.5	1312.8	1.02	0			.	
3	12:33	1312.8	1.02	0			.	
4	12:34	1312.78	1	0			.	
5	12:35.5	1312.82	1.04	0			.	
6	12:36	1312.85	1.07	0			.	
7	12:37	1312.9	1.12	0			.	
8	12:38	1312.95	1.17	0			.	
10	12:39	1313.05	1.27	0			.	
15	12:45	1313.21	1.43	0			.	
20	12:50	1313.17	1.37	0			.	
25	12:55	1313.1	1.32	0			.	
30	13:00	1313.07	1.29	0			.	
40	13:10	1312.98	1.2	0			.	
50	13:20	1312.95	1.17	0			.	
60	13:30	1312.88	1.1	0			.	
70	13:40	1312.85	1.07	0			.	
80	13:50	1312.8	1.02	0			.	
90	14:00	1312.77	0.99	0			.	
100	14:10	1312.76	0.98	0			.	
150	15:00	1312.61	0.83	0			.	
200	15:54	1312.54	0.76	0			.	
250				0			.	☒ 80% recovery achieved ☐ 80% recovery not achieved

END TEST Date: June 27, 2017 Time of day: 12:30 p.m.

ADDITIONAL REMARKS: 1312.56 = 80% Recovery

Person in charge of pump test (print): **James A. Stenger, Jr., President, Alpha, Inc.**

Signature: ____________

The signature above indicates that the data reported on this form is accurate and true to the best of the person's knowledge who operated this pump test.

Appendix 3

Department of Water Supply
"By Water All Things Find Life"
614 Palapala Drive
Kahului, Hawaii 96732
Phone: (808) 270 – 7550

Laboratory Report

for

County of Maui
Department of Water Supply
Engineering Division

200 S High Street
Wailuku, HI 96793

Attention: Curtis Eaton
(808) 270-7835

DATE OF ISSUE
06-30-2017
MONTH DAY YEAR

LABORATORY ACCREDITATION BUREAU a division of A-S-B
ACCREDITED ISO/IEC 17025
Certificate # L2399 – Field Sampling & Measurement

FSMO AP

NELAP ACCREDITED TNI LABORATORY
ORELAP ID: 4009

C Sumabat
CARI SUMABAT
TECHNICAL DIRECTOR
(808)270-7550
MDWS REPORT #201743
PROJECT: NEWSOURCE

Laboratory certifies that the test results meet all **TNI** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are Chain of Custody, Hits Report, Data Report, QC Summary, QC Report totaling 14 page[s].

Results found in this report relates only to samples identified within.

This report shall not be reproduced except in full, without the written approval of the Department of Water Supply, Maui County.

The laboratory assures validity of the results in this report by using the following sampling procedures (when applicable): NM01 .

CHAIN OF CUSTODY RECORD

Department of Water Supply
"By Water All Things Find Life"

614 Palapala Drive
Kahului, Hawaii 96732
Phone : (808)270-7550
Fax: (808)270-6133

TO BE COMPLETED BY SAMPLER:

See reverse side to verify bottle, preservative and volume requirement for each analysis

COMPANY:	Compliance Samples: ☑	SAMPLE DATE: 6-19-17
PROJECT DESCRIPTION: New Well Chemistry Analysis	Non Compliance Samples: ☐	PROJECT CODE: NEWSOURCE
SAMPLER PRINTED NAME AND SIGNATURE: Curt Eaton	Regulation: SDWA (SDWA, PHASE V, NPDES, FDA,...)	Laboratory Report #: 201743

SAMPLE TIME	SITE NAME OR LOCATION	DWS SAMPLE ID#	MATRIX*	GRAB	COMP	CHLORIDE						Number of Sample Bottles Collected	SAMPLER COMMENTS	WEATHER CONDITIONS (circle all that apply)
	Kahana 06-20-17													
9:28	Kanaha Well Exploratory Pump	2017061915	RGW	✓		✓						1		sunny overcast calm windy rainy
1030A	Kanaha Well Exploratory Pump	2017061916	RGW	✓		✓						1		sunny overcast calm windy rainy
1 P	Kanaha Well Exploratory Pump	2017061917	RGW	✓		✓						1		sunny overcast calm windy rainy
	Kanaha Well Exploratory Pump		RGW	✓		✓								sunny overcast calm windy rainy
	Kanaha Well Exploratory Pump		RGW	✓		✓								sunny overcast calm windy rainy
	Kanaha Well Exploratory Pump	06-20-17	RGW	✓		✓								sunny overcast calm windy rainy
	Kanaha Well Exploratory Pump		RGW	✓		✓								sunny overcast calm windy rainy
	EMail Curt with													
	final report Results													

***MATRIX TYPES**

CFW=Chlor(am)inated Finished Wate RGW=Raw Ground Water RSW=Raw Surface Water FW=Other Finished Water

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
RELINQUISHED BY:	Curt E	Curt Eaton	DWS	6-20-17	7:25 A
RECEIVED BY:	Ann Yanagi	Ann Yanagi	MDWS / WMI	6-20-17	0920
RELINQUISHED BY:					
RECEIVED BY:					

Form 0014.B (11-29-16) MDWS chemistry coc
Page 1 of 2

Refer to field log sheets for sample Cl_2, and pH data

CHAIN OF CUSTODY RECORD

Department of Water Supply
"By Water All Things Find Life"

614 Palapala Drive
Kahului, Hawaii 96732
Phone : (808)270-7550
Fax: (808)270-6133

REQUIREMENTS FOR CONTAINERS, PRESERVATIVES, SAMPLE VOLUME, AND HOLD TIMES FOR CHEMICAL ANALYSIS

ANALYTE	METHOD	CONTAINER TYPE	STORAGE & PRESERVATIVE	SAMPLE VOLUME	HOLD TIME
METALS:					
Lead and Copper	SM 3113 B/ EPA 200.9	Plastic	HNO3 to pH < 2 (preservative to be added in-house)	500 mL (Grab)/1 Liter (Consumer samples for Pb/Cu Rule)	6 months
INORGANICS:					
Anions I (Nitrate (N), Nitrite (N), Phosphate)	EPA 300.0	Plastic	None, 4° C	100 mL	48 hours
Anions II (Chloride, Fluoride, Sulfate)	EPA 300.0	Plastic	None	100 mL	28 days
Chloride	SM 4500 Cl- D	Plastic	None	100 mL	28 days
Conductivity	SM 2510 B	Plastic	None, 4° C	100 mL	28 days
Dissolved Organic Carbon (DOC)	SM 5310 B	Borosilicate Glass	Filter within 48 hours then add 50% HCl to pH <2	125 mL	28 days
pH	SM 4500 H+ B	Plastic	None	25 mL	15 minutes
Residual Chlorine, Free/Total	SM 4500 Cl G	Plastic	None	500 mL	15 minutes
Total Organic Carbon (TOC)	SM 5310 B	Borosilicate Glass	50% HCl to pH <2	125 mL	28 days
Turbidity	SM 2130 B/ EPA 180.1	Plastic	4° C, dark	100 mL	48 hours

MDWS LABORATORY USE ONLY:

Samples logged in by (Print/Signature): Ann Yanagi Date: 6-20-17 Time: 0920

Samples received on date of collection? ☐YES ☑NO

Method of shipment? Hand Carried ✓ Courier___ Airbill#___ Custody seal intact? ☐YES ☐NO ☑NA TSA/Carrier Inspected (circle one)

Sample Temperature Receipt in Lab (Compliance >0 ° and ≤6 °C for Chemistry; >0 °C and ≤10 °C for Microbiology)

Thermometer ID: ERTC03930 Correction Factor: +0.2°C TOC PRESERVATIVE ID: TOC

Initial Temperature Control: 4.0 °C Corrected Initial Temperature: 4.2 °C Final Temperature Control: 1.5 °C Corrected Final Temperature: 1.7 °C

Circle one: Blue Ice Crushed Ice ☐Frozen ☑Partially Frozen ☐Thawed

Did all bottles arrive unbroken and in good condition? ☑YES ☐NO

Were all bottles sealed in separate bags? ☐YES ☑NO

Were correct containers used for the analytes? ☑YES ☐NO

Were all bottle labels complete? (ID, date, time, sign?) ☑YES ☐NO

Was sufficient amount of sample collected for tests? ☑YES ☐NO

Were correct preservatives used when required? ☑YES ☐NO

Were bubbles absent in TOC vials? ☐YES ☐NO ☑NA

Were custody papers filled out properly? (ink, etc) ☑YES ☐NO

Did all bottle labels agree with custody papers? ☑YES ☐NO

Was Laboratory Director or Supervisor informed of problems? ☐YES ☐NO ☑NA

Please record description of any sample abnormalities, including departures from normal or specified conditions:

Samples placed in refrigerator by: Ann Yanagi Date: 6-20-17 Time: 0922

Analyte: ~~pH~~ CHLORIDE	Analyte:	Analyte:
Date Samples Analyzed: 6-21-17	Date Samples Analyzed: 06-30-17	Date Samples Analyzed:
Analyzed By: AY	Analyzed By:	Analyzed By:

Form 0014.B (11-29-16) MDWS chemistry coc
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Laboratory Report #: 201743

CHAIN OF CUSTODY RECORD

Department of Water Supply
"By Water All Things Find Life"

614 Pala[illegible] Drive
Kahului, Haw[illegible] 96732
Phone : (808)270-7550
Fax: (808)270-6133

TO BE COMPLETED BY SAMPLER:

See reverse side to verify bottle, preservative and volume requirement for each analysis

COMPANY: Maui County Department of Water Supply	**Compliance Samples:** ☑	**SAMPLE DATE:** 6/23/17
PROJECT DESCRIPTION: New Well Chemistry Analysis	**Non Compliance Samples:** ☐	**PROJECT CODE:** NEWSOURCE
SAMPLER PRINTED NAME AND SIGNATURE: Kekoa Babcock	**Regulation:** SDWA (SDWA, PHASE V, NPDES, FDA,...)	**Laboratory Report #:** 201743

SAMPLE TIME	SITE NAME OR LOCATION	DWS SAMPLE ID#	MATRIX*	GRAB	COMP	CHLORIDE						Number of Sample Bottles Collected	SAMPLER COMMENTS Test start 12:30 p	WEATHER CONDITIONS (circle all that apply)
1:00 P	West Maui Well #2 (Kahana Exploratory Pump)	2017 06 23 02	RGW	✓		✓						1	Start of Constant rate Test 1 Pm	sunny overcast calm windy rainy
1:30P	West Maui Well #2 (Kahana Exploratory Pump)	2017062303	RGW	✓		✓						1		sunny overcast calm windy rainy
2:00P	West Maui Well #2 (Kahana Exploratory Pump)	2017062304	RGW	✓		✓						1		sunny overcast calm windy rainy
	~~West Maui Well #2 (Kahana Exploratory Pump)~~		~~RGW~~	✓		✓								sunny overcast calm windy rainy
	West Maui Well #2 (Kahana Exploratory Pump)		RGW	✓		✓								sunny overcast calm windy rainy
	West Maui Well #2 (Kahana Exploratory Pump)	06-23-17	RGW	✓		✓								sunny overcast calm windy rainy
	~~West Maui Well #2 (Kahana Exploratory Pump)~~		RGW	✓		✓								sunny overcast calm windy rainy

***MATRIX TYPES**
CFW=Chlor(am)inated Finished Water RGW=Raw Ground Water RSW=Raw Surface Water FW=Other Finished Water

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
RELINQUISHED BY:	[signature]	Kekoa Babcock	DWS	6/23/17	2:10 P
RECEIVED BY:	[signature]	Rowena L.S. Kellough	DWS / Lab Tech I	06-23-17	1514
RELINQUISHED BY:					
RECEIVED BY:					

Form 0014.B (11-29-16) MDWS chemistry coc
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Refer to field log sheets for sample Cl_2, and pH data

CHAIN OF CUSTODY RECORD

Department of Water Supply
"By Water All Things Find Life"

614 Palapala Drive
Kahului, Hawaii 96732
Phone : (808)270-7550
Fax: (808)270-6133

REQUIREMENTS FOR CONTAINERS, PRESERVATIVES, SAMPLE VOLUME, AND HOLD TIMES FOR CHEMICAL ANALYSIS

ANALYTE	METHOD	CONTAINER TYPE	STORAGE & PRESERVATIVE	SAMPLE VOLUME	HOLD TIME
METALS:					
Lead and Copper	SM 3113 B/ EPA 200.9	Plastic	HNO3 to pH < 2 (preservative to be added in-house)	500 mL (Grab)/1 Liter (Consumer samples for Pb/Cu Rule)	6 months
INORGANICS:					
Anions I (Nitrate (N), Nitrite (N), Phosphate)	EPA 300.0	Plastic	None, 4º C	100 mL	48 hours
Anions II (Chloride, Fluoride, Sulfate)	EPA 300.0	Plastic	None	100 mL	28 days
Chloride	SM 4500 Cl- D	Plastic	None	100 mL	28 days
Conductivity	SM 2510 B	Plastic	None, 4º C	100 mL	28 days
Dissolved Organic Carbon (DOC)	SM 5310 B	Borosilicate Glass	Filter within 48 hours then add 50% HCl to pH <2	125 mL	28 days
pH	SM 4500 H+ B	Plastic	None	25 mL	15 minutes
Residual Chlorine, Free/Total	SM 4500 Cl G	Plastic	None	500 mL	15 minutes
Total Organic Carbon (TOC)	SM 5310 B	Borosilicate Glass	50% HCl to pH <2	125 mL	28 days
Turbidity	SM 2130 B/ EPA 180.1	Plastic	4º C, dark	100 mL	48 hours

MDWS LABORATORY USE ONLY:
Samples logged in by (Print/Signature): Rowena L.S. Kellough / [signature] Date: 06-23-17 Time: 1517
Samples received on date of collection? ☑YES ☐NO
Method of shipment? Hand Carried ✓ Courier____ Airbill#____ Custody seal intact? ☐YES ☐NO ☐NA TSA/Carrier Inspected (circle one)
Sample Temperature Receipt in Lab (Compliance >0 º and ≤6 ºC for Chemistry; >0 ºC and ≤10 ºC for Microbiology)
Thermometer ID: ~~7.2~~ EXTCO 3930 Correction Factor: +0.2ºC **TOC PRESERVATIVE ID:** TOC
Initial Temperature Control: 7.2 ºC Corrected Initial Temperature: 7.4 ºC Final Temperature Control: N/A ºC Corrected Final Temperature: N/A ºC
Circle one: Blue Ice Crushed Ice ☐Frozen ☐Partially Frozen ☐Thawed

				Did all bottles arrive unbroken and in good condition?	☑YES	☐NO	
Were all bottles sealed in separate bags?	☐YES	☑NO		Were correct containers used for the analytes?	☑YES	☐NO	
Were all bottle labels complete?(ID, date, time, sign?)	☑YES	☐NO		Was sufficient amount of sample collected for tests?	☑YES	☐NO	
Were correct preservatives used when required?	☑YES	☐NO		Were bubbles absent in TOC vials?	☐YES	☐NO	☑NA
Were custody papers filled out properly? (ink, etc)	☑YES	☐NO		Did all bottle labels agree with custody papers?	☑YES	☐NO	
Was Laboratory Director or Supervisor informed of problems?	☐YES	☐NO	☑NA				

Please record description of any sample abnormalities, including departures from normal or specified conditions:

Samples placed in refrigerator by: R. Kellough Date: 06-23-17 Time: 1520

Analyte: **CHLORIDE**	Analyte:	Analyte:
Date Samples Analyzed: 6-27-17	Date Samples Analyzed:	Date Samples Analyzed:
Analyzed By: [signature]	Analyzed By:	Analyzed By:
		Laboratory Report #: 201743

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CHAIN OF CU DY RECORD

Department of Water Supply
"By Water All Things Find Life"

614 Pala Drive
Kahului, Hawaii 96732
Phone : (808)270-7550
Fax: (808)270-6133

TO BE COMPLETED BY SAMPLER:

See reverse side to verify bottle, preservative and volume requirement for each analysis

COMPANY: Maui County Department of Water Supply

PROJECT DESCRIPTION: New Well Chemistry Analysis

SAMPLER PRINTED NAME AND SIGNATURE: Kekoa Babcock

Compliance Samples: ☑

Non Compliance Samples: ☐

Regulation: SDWA (SDWA, PHASE V, NPDES, FDA,...)

SAMPLE DATE: 6/26/17

PROJECT CODE: NEWSOURCE

Laboratory Report #: 201743

SAMPLE TIME	SITE NAME OR LOCATION	DWS SAMPLE ID#	MATRIX*	GRAB	COMP	CHLORIDE	Number of Sample Bottles Collected	SAMPLER COMMENTS	WEATHER CONDITIONS (circle all that apply)
8:58	West Maui Well #2 (Kahana Exploratory Pump)	2017062602	RGW	✓		✓	1		sunny overcast calm windy rainy
9:15	West Maui Well #2 (Kahana Exploratory Pump)	2017062603	RGW	✓		✓	1		sunny overcast calm windy rainy
9:46	West Maui Well #2 (Kahana Exploratory Pump)	2017062604	RGW	✓		✓	1		sunny overcast calm windy rainy
11:18	West Maui Well #2 (Kahana Exploratory Pump)	2017062605	RGW	✓		✓	1	Sample by Contractor	sunny overcast calm windy rainy
	~~West Maui Well #2 (Kahana Exploratory Pump)~~		~~RGW~~	✓		✓			sunny overcast calm windy rainy
	West Maui Well #2 (Kahana Exploratory Pump)		RGW	✓		✓			sunny overcast calm windy rainy
	~~West Maui Well #2 (Kahana Exploratory Pump)~~		~~RGW~~	✓		✓			sunny overcast calm windy rainy

***MATRIX TYPES**

CFW=Chlor(am)inated Finished Water RGW=Raw Ground Water RSW=Raw Surface Water FW=Other Finished Water

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
RELINQUISHED BY:		Kekoa Babcock	DWS	6/26/17	3:30 P
RECEIVED BY:		Rowena L.S. Kellough	MDWS / LAB TECH	06-26-17	1453
RELINQUISHED BY:					
RECEIVED BY:					

Form 0014.B (11-29-16) MDWS chemistry coc
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Refer to field log sheets for sample Cl_2, and pH data

CHAIN OF CUSTODY RECORD

Department of Water Supply
"By Water All Things Find Life"

614 Palapala Drive
Kahului, Hawaii 96732
Phone : (808)270-7550
Fax: (808)270-6133

REQUIREMENTS FOR CONTAINERS, PRESERVATIVES, SAMPLE VOLUME, AND HOLD TIMES FOR CHEMICAL ANALYSIS

ANALYTE	METHOD	CONTAINER TYPE	STORAGE & PRESERVATIVE	SAMPLE VOLUME	HOLD TIME
METALS:					
Lead and Copper	SM 3113 B/ EPA 200.9	Plastic	HNO3 to pH < 2 (preservative to be added in-house)	500 mL (Grab)/1 Liter (Consumer samples for Pb/Cu Rule)	6 months
INORGANICS:					
Anions I (Nitrate (N), Nitrite (N), Phosphate)	EPA 300.0	Plastic	None, 4° C	100 mL	48 hours
Anions II (Chloride, Fluoride, Sulfate)	EPA 300.0	Plastic	None	100 mL	28 days
Chloride	SM 4500 Cl- D	Plastic	None	100 mL	28 days
Conductivity	SM 2510 B	Plastic	None, 4° C	100 mL	28 days
Dissolved Organic Carbon (DOC)	SM 5310 B	Borosilicate Glass	Filter within 48 hours then add 50% HCl to pH <2	125 mL	28 days
pH	SM 4500 H+ B	Plastic	None	25 mL	15 minutes
Residual Chlorine, Free/Total	SM 4500 Cl G	Plastic	None	500 mL	15 minutes
Total Organic Carbon (TOC)	SM 5310 B	Borosilicate Glass	50% HCl to pH <2	125 mL	28 days
Turbidity	SM 2130 B/ EPA 180.1	Plastic	4° C, dark	100 mL	48 hours

MDWS LABORATORY USE ONLY:

Samples logged in by (Print/Signature): Rowena L.S. Kellough / Date: 06-26-17 Time: 1455

Samples received on date of collection? ☑YES ☐NO

Method of shipment? Hand Carried ✓ Courier___ Airbill#___ Custody seal intact? ☐YES ☐NO ☑NA TSA/Carrier Inspected (circle one)

Sample Temperature Receipt in Lab (Compliance >0 ° and ≤6 °C for Chemistry; >0 °C and ≤10 °C for Microbiology)

Thermometer ID: ERTCO 3930 Correction Factor: +0.2°C TOC PRESERVATIVE ID: TOC N/A

Initial Temperature Control: 4.4 °C Corrected Initial Temperature: 4.6 °C Final Temperature Control: 8.1 °C Corrected Final Temperature: 8.3 °C

Circle one: Blue Ice Crushed Ice ☐Frozen ☐Partially Frozen ☐Thawed

Were all bottles sealed in separate bags?	☐YES ☑NO	Did all bottles arrive unbroken and in good condition?	☑YES ☐NO
Were all bottle labels complete?(ID, date, time, sign?)	☑YES ☐NO	Were correct containers used for the analytes?	☑YES ☐NO
Were correct preservatives used when required?	☑YES ☐NO	Was sufficient amount of sample collected for tests?	☑YES ☐NO
Were custody papers filled out properly? (ink, etc)	☑YES ☐NO	Were bubbles absent in TOC vials?	☐YES ☐NO ☑NA
Was Laboratory Director or Supervisor informed of problems?	☐YES ☐NO ☑NA	Did all bottle labels agree with custody papers?	☐YES ☑NO

Please record description of any sample abnormalities, including departures from normal or specified conditions:

Samples placed in refrigerator by: R. Kellough Date: 06-26-17 Time: 1458

Analyte: **CHLORIDE**	Analyte:	Analyte:
Date Samples Analyzed: 6-27-17	Date Samples Analyzed:	Date Samples Analyzed:
Analyzed By:	Analyzed By:	Analyzed By:

Laboratory Report #: 201743

Form 0014.B (11-29-16) MDWS chemistry coc
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CHAIN OF CUSTODY RECORD

Department of Water Supply
"By Water All Things Find Life"

614 Palapala Drive
Kahului, Hawaii 96732
Phone : (808)270-7550
Fax: (808)270-6133

TO BE COMPLETED BY SAMPLER:

See reverse side to verify bottle, preservative and volume requirement for each analysis

COMPANY: Maui County Department of Water Supply	**Compliance Samples:** ☑	**SAMPLE DATE:** 6/27/17
PROJECT DESCRIPTION: New Well Chemistry Analysis	**Non Compliance Samples:** ☐	**PROJECT CODE: NEWSOURCE**
SAMPLER PRINTED NAME AND SIGNATURE: Keloa Babcock [signature]	**Regulation: SDWA** (SDWA, PHASE V, NPDES, FDA,...)	**Laboratory Report #:** 201743

SAMPLE TIME	SITE NAME OR LOCATION	DWS SAMPLE ID#	MATRIX*	GRAB	COMP	CHLORIDE						Number of Sample Bottles Collected	SAMPLER COMMENTS	WEATHER CONDITIONS (circle all that apply)
9:30A	West Maui Well #2 (Kahana Exploratory Pump)	2017062706	RGW	✓		✓						1		sunny overcast calm windy rainy
10:30A	West Maui Well #2 (Kahana Exploratory Pump)	2017062707	RGW	✓		✓						1		sunny overcast calm windy rainy
11:00A	West Maui Well #2 (Kahana Exploratory Pump)	2017062708	RGW	✓		✓						1	Rural took test sampling	sunny overcast calm windy rainy
	~~West Maui Well #2 (Kahana Exploratory Pump)~~		RGW	✓		✓							second Temp control	sunny overcast calm windy rainy
	West Maui Well #2 (Kahana Exploratory Pump)		RGW	✓		✓							was not taken	sunny overcast calm windy rainy
	West Maui Well #2 (Kahana Exploratory Pump)		~~RGW~~	~~✓~~		✓							Because well was	sunny overcast calm windy rainy
	~~West Maui Well #2 (Kahana Exploratory Pump)~~		~~RGW~~	~~✓~~		~~✓~~							going to be runed	sunny overcast calm windy rainy
													one more time but	
													but it was not	
													run	

***MATRIX TYPES**
CFW=Chlor(am)inated Finished Water RGW=Raw Ground Water RSW=Raw Surface Water FW=Other Finished Water

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
RELINQUISHED BY:	[signature]	Keloa Babcock	DWS	6/27/17	3:00P
RECEIVED BY:	[signature]	Rowena L.S. Kellough	MDWS / LAB TECH I	06-27-17	1501
RELINQUISHED BY:					
RECEIVED BY:					

Form 0014.B (11-29-16) MDWS chemistry coc
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Refer to field log sheets for sample Cl_2, and pH data

CHAIN OF CUSTODY RECORD

Department of Water Supply
"By Water All Things Find Life"

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Phone : (808)270-7550
Fax: (808)270-6133

REQUIREMENTS FOR CONTAINERS, PRESERVATIVES, SAMPLE VOLUME, AND HOLD TIMES FOR CHEMICAL ANALYSIS

ANALYTE	METHOD	CONTAINER TYPE	STORAGE & PRESERVATIVE	SAMPLE VOLUME	HOLD TIME
METALS:					
Lead and Copper	SM 3113 B/ EPA 200.9	Plastic	HNO3 to pH < 2 (preservative to be added in-house)	500 mL (Grab)/1 Liter (Consumer samples for Pb/Cu Rule)	6 months
INORGANICS:					
Anions I (Nitrate (N), Nitrite (N), Phosphate)	EPA 300.0	Plastic	None, 4º C	100 mL	48 hours
Anions II (Chloride, Fluoride, Sulfate)	EPA 300.0	Plastic	None	100 mL	28 days
Chloride	SM 4500 Cl- D	Plastic	None	100 mL	28 days
Conductivity	SM 2510 B	Plastic	None, 4º C	100 mL	28 days
Dissolved Organic Carbon (DOC)	SM 5310 B	Borosilicate Glass	Filter within 48 hours then add 50% HCl to pH <2	125 mL	28 days
pH	SM 4500 H+ B	Plastic	None	25 mL	15 minutes
Residual Chlorine, Free/Total	SM 4500 Cl G	Plastic	None	500 mL	15 minutes
Total Organic Carbon (TOC)	SM 5310 B	Borosilicate Glass	50% HCl to pH <2	125 mL	28 days
Turbidity	SM 2130 B/ EPA 180.1	Plastic	4º C, dark	100 mL	48 hours

MDWS LABORATORY USE ONLY:

Samples logged in by (Print/Signature): Rowena L.S. Kellough Date: 06-27-17 Time:

Samples received on date of collection? ☑YES ☐NO

Method of shipment? Hand Carried ✓ Courier____ Airbill#____ Custody seal intact? ☐YES ☐NO ☐NA TSA/Carrier Inspected (circle one)

Sample Temperature Receipt in Lab (Compliance >0 º and ≤6 ºC for Chemistry; >0 ºC and ≤10 ºC for Microbiology)

Thermometer ID: ERTCO 3930 Correction Factor: +0.2ºC TOC PRESERVATIVE ID: TOC N/A

Initial Temperature Control: 8.0 ºC Corrected Initial Temperature: 8.2 ºC Final Temperature Control: N/A ºC Corrected Final Temperature: N/A ºC

Circle one: Blue Ice Crushed Ice ☐Frozen ☑Partially Frozen ☐Thawed

Did all bottles arrive unbroken and in good condition?	☑YES	☐NO
Were all bottles sealed in separate bags?	☐YES	☑NO
Were correct containers used for the analytes?	☑YES	☐NO
Were all bottle labels complete? (ID, date, time, sign?)	☑YES	☐NO
Was sufficient amount of sample collected for tests?	☑YES	☐NO
Were correct preservatives used when required?	☑YES	☐NO
Were bubbles absent in TOC vials?	☐YES	☐NO ☑NA
Were custody papers filled out properly? (ink, etc)	☑YES	☐NO
Did all bottle labels agree with custody papers?	☑YES	☐NO
Was Laboratory Director or Supervisor informed of problems?	☐YES	☐NO ☑NA

Please record description of any sample abnormalities, including departures from normal or specified conditions:

Samples placed in refrigerator by: R. Kellough Date: ~~06-22-17~~ 06-27-17 Time: 1505

Analyte: **CHLORIDE**	Analyte:	Analyte:
Date Samples Analyzed: 6-28-17	Date Samples Analyzed:	Date Samples Analyzed:
Analyzed By: [signature]	Analyzed By:	Analyzed By:

Form 0014.B (11-29-16) MDWS chemistry coc
Page 2 of 2

Laboratory Report #: 201743

Department of Water Supply
"By Water All Things Find Life"
614 Palapala Drive
Kahului, Hawaii 96732
Phone: (808) 270 - 7550

Laboratory Data Report
MDWS REPORT #201743

County of Maui Department of Water Supply-Engineering Division
Attention: Curtis Eaton
200 S High Street
Wailuku HI 96793

Sample #	Sample ID	Sampled on	Analyzed	QC Ref#	Method	Analyte	Result	Units	MRL	Dilution
Samples received 06-20-17 0920										
2017061915	Kahana Well Exploratory Pump	06-19-17 0928	06-21-17	062117Cl-	SM4500Cl- D	Chloride	51.1	mg/L	7.00	1
2017061916	Kahana Well Exploratory Pump	06-19-17 1030	06-21-17	062117Cl-	SM4500Cl- D	Chloride	49.0	mg/L	7.00	1
2017061917	Kahana Well Exploratory Pump	06-19-17 1300	06-21-17	062117Cl-	SM4500Cl- D	Chloride	48.7	mg/L	7.00	1
Samples received 06-23-17 1514										
2017062302	West Maui Well #2	06-23-17 1300	06-27-17	062717Cl-	SM4500Cl- D	Chloride	49.7	mg/L	7.00	1
2017062303	West Maui Well #2	06-23-17 1330	06-27-17	062717Cl-	SM4500Cl- D	Chloride	48.9	mg/L	7.00	1
2017062304	West Maui Well #2	06-23-17 1400	06-27-17	062717Cl-	SM4500Cl- D	Chloride	48.7	mg/L	7.00	1
Samples received 06-26-17 1453										
2017062602	West Maui Well #2	06-26-17 0845	06-27-17	062717Cl-	SM4500Cl- D	Chloride	60.9	mg/L	7.00	1
2017062603	West Maui Well #2	06-26-17 0915	06-27-17	062717Cl-	SM4500Cl- D	Chloride	61.2	mg/L	7.00	1
2017062604	West Maui Well #2	06-26-17 0945	06-27-17	062717Cl-	SM4500Cl- D	Chloride	60.7	mg/L	7.00	1
2017062605	West Maui Well #2	06-26-17 1118	06-27-17	062717Cl-	SM4500Cl- D	Chloride	61.0	mg/L	7.00	1
Samples received 06-27-17 1501										
2017062706	West Maui Well #2	06-27-17 0930	06-28-17	062817Cl-	SM4500Cl- D	Chloride	65.8	mg/L	7.00	1
2017062707	West Maui Well #2	06-27-17 1030	06-28-17	062817Cl-	SM4500Cl- D	Chloride	66.1	mg/L	7.00	1
2017062708	West Maui Well #2	06-27-17 1100	06-28-17	062817Cl-	SM4500Cl- D	Chloride	66.2	mg/L	7.00	1

Data Report

Department of Water Supply
"By Water All Things Find Life"
614 Palapala Drive
Kahului, Hawaii 96732
Phone: (808) 270 - 7550

Laboratory Hits Report
MDWS REPORT #201743

County of Maui Department of Water Supply-Engineering Division
Attention: Curtis Eaton
200 S High Street
Wailuku HI 96793

Sample #	Sample ID	Sampled on	Analyzed	Method	Analyte	Results	Units
Samples received 06-20-17 0920							
2017061915	Kahana Well Exploratory Pump	06-19-17 0928	06-21-17	SM4500Cl- D	Chloride	51.1	mg/L
2017061916	Kahana Well Exploratory Pump	06-19-17 1030	06-21-17	SM4500Cl- D	Chloride	49.0	mg/L
2017061917	Kahana Well Exploratory Pump	06-19-17 1300	06-21-17	SM4500Cl- D	Chloride	48.7	mg/L
Samples received 06-23-17 1514							
2017062302	West Maui Well #2	06-23-17 1300	06-27-17	SM4500Cl- D	Chloride	49.7	mg/L
2017062303	West Maui Well #2	06-23-17 1330	06-27-17	SM4500Cl- D	Chloride	48.9	mg/L
2017062304	West Maui Well #2	06-23-17 1400	06-27-17	SM4500Cl- D	Chloride	48.7	mg/L
Samples received 06-26-17 1453							
2017062602	West Maui Well #2	06-26-17 0845	06-27-17	SM4500Cl- D	Chloride	60.9	mg/L
2017062603	West Maui Well #2	06-26-17 0915	06-27-17	SM4500Cl- D	Chloride	61.2	mg/L
2017062604	West Maui Well #2	06-26-17 0945	06-27-17	SM4500Cl- D	Chloride	60.7	mg/L
2017062605	West Maui Well #2	06-26-17 1118	06-27-17	SM4500Cl- D	Chloride	61.0	mg/L
Samples received 06-27-17 1501							
2017062706	West Maui Well #2	06-27-17 0930	06-28-17	SM4500Cl- D	Chloride	65.8	mg/L
2017062707	West Maui Well #2	06-27-17 1030	06-28-17	SM4500Cl- D	Chloride	66.1	mg/L
2017062708	West Maui Well #2	06-27-17 1100	06-28-17	SM4500Cl- D	Chloride	66.2	mg/L

SUMMARY OF POSITIVE DATA ONLY.

Department of Water Supply
"By Water All Things Find Life"
614 Palapala Drive
Kahului, Hawaii 96732
Phone: (808) 270 - 7550

Laboratory
QC Summary
MDWS REPORT #201743

County of Maui Department of Water Supply-Engineering Division
Attention: Curtis Eaton
200 S High Street
Wailuku HI 96793

QC Ref # 062117Cl-	Chloride SM4500Cl- D	Analysis Date: 06-21-17
Sample ID #	**Sample Location**	**Analyzed by:**
2017061915	Kahana Well Exploratory Pump	A Yanagi
2017061916	Kahana Well Exploratory Pump	A Yanagi
2017061917	Kahana Well Exploratory Pump	A Yanagi
QC Ref 062717Cl-	**Chloride SM4500Cl- D**	**Analysis Date: 06-27-17**
Sample ID #	**Sample Location**	**Analyzed by:**
2017062302	West Maui Well #2	A Yanagi
2017062303	West Maui Well #2	A Yanagi
2017062304	West Maui Well #2	A Yanagi
2017062602	West Maui Well #2	A Yanagi
2017062603	West Maui Well #2	A Yanagi
2017062604	West Maui Well #2	A Yanagi
2017062605	West Maui Well #2	A Yanagi
QC Ref 062817Cl-	**Chloride SM4500Cl- D**	**Analysis Date: 06-28-17**
Sample ID #	**Sample Location**	**Analyzed by:**
2017062706	West Maui Well #2	A Yanagi
2017062707	West Maui Well #2	A Yanagi
2017062708	West Maui Well #2	A Yanagi

Department of Water Supply
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Laboratory
QC Report
MDWS REPORT #201743

County of Maui Department of Water Supply-Engineering Division
Attention: Curtis Eaton
200 S High Street
Wailuku HI 96793

Analysis Date: 06-21-17
QC Ref# 062117Cl- **Chloride SM4500Cl- D**

QC	Analyte	Lab #	Spiked	Recovered	Units	Yield (%)	Limits(%)	RPDLimit (%)	RPD
LFB/ICVS	Chloride	INR17628	100.	101	mg/L	101	(85-115)		
Cal Blank	Chloride		ND	ND	mg/L				
CCV #1	Chloride	INR17629	50.0	50.1	mg/L	100.	(90-110)		
RDL	Chloride	INR17630	7.00	7.63	mg/L	109	(50-150)		
LRB	Chloride		ND	ND	mg/L				
LFM-2017060801	Chloride	INR17631	100.	100.	mg/L	100.	(85-115)		
LFMD-2017060801	Chloride	INR17632	100.	99.8	mg/L	99.8	(85-115)	<20%	0.17
CCV End	Chloride	INR17633	150	160	mg/L	107	(90-110)		
Cal Blank	Chloride		ND	ND	mg/L				

Analysis Date: 06-27-17
QC Ref# 062717Cl- **Chloride SM4500Cl- D**

QC	Analyte	Lab #	Spiked	Recovered	Units	Yield (%)	Limits(%)	RPDLimit (%)	RPD
LFB/ICVS	Chloride	INR17652	100.	101	mg/L	101	(85-115)		
Cal Blank	Chloride		ND	ND	mg/L				
CCV #1	Chloride	INR17653	50.0	49.8	mg/L	99.6	(90-110)		
RDL	Chloride	INR17654	7.00	8.04	mg/L	115	(50-150)		
LRB	Chloride		ND	ND	mg/L				
LFM-2017062302	Chloride	INR17655	100.	97.7	mg/L	97.7	(85-115)		
LFMD-2017062302	Chloride	INR17656	100.	95.1	mg/L	95.1	(85-115)	<20%	1.78
CCV End	Chloride	INR17657	150	153	mg/L	102	(90-110)		
Cal Blank	Chloride		ND	ND	mg/L				

Department of Water Supply
"By Water All Things Find Life"
614 Palapala Drive
Kahului, Hawaii 96732
Phone: (808) 270 - 7550

Laboratory
QC Report
MDWS REPORT #201743

County of Maui Department of Water Supply-Engineering Division
Attention: Curtis Eaton
200 S High Street
Wailuku HI 96793

Analysis Date: 06-28-17
QC Ref# 062817Cl- **Chloride SM4500Cl- D**

QC	Analyte	Lab #	Spiked	Recovered	Units	Yield (%)	Limits(%)	RPDLimit (%)	RPD
LFB/ICVS	Chloride	INR17666	100.	100.	mg/L	100.	(85-115)		
Cal Blank	Chloride		ND	ND	mg/L				
CCV #1	Chloride	INR17667	50.0	49.5	mg/L	99.0	(90-110)		
RDL	Chloride	INR17668	7.00	7.27	mg/L	104	(50-150)		
LRB	Chloride		ND	ND	mg/L				
LFM-2017062706	Chloride	INR17669	100.	94.9	mg/L	94.9	(85-115)		
LFMD-2017062706	Chloride	INR17670	100.	94.6	mg/L	94.6	(85-115)	<20%	0.19
CCV End	Chloride	INR17671	150	150	mg/L	100.	(90-110)		
Cal Blank	Chloride		ND	ND	mg/L				

APPENDIX B

WATER BACTERIAL TEST CERTIFICATE

AECOS, Inc.
45-939 Kamehameha Highway Suite 104
Kaneohe, Oahu, HI 96744
Tel: (808) 234-7770 Fax: 234-7775

CHAIN OF CUSTODY FORM

PROJECT FILE No.:
LOG NUMBER [034385]

CLIENT: Pural Water Specialty Co., Inc.
CONTACT: Efren Ugalino
ADDRESS: 1955 Vineyard Street, Wailuku, HI 96793
PHONE No.: (808) 757-0369
Purchase Order No.:

☐ RUSH
☒ SEE REVERSE
SPECIAL INSTRUCTIONS

	☑	SAMPLE ID	DATE (SAMPLED)	TIME (SAMPLED)	SAMPLE TYPE	CONTAINER(S)		REQUESTED ANALYSES	PRESERVATION
1		West Maui Well No. 2	6/14/17	11:30 am	Grab			Total Coliform / E. Coli	
2		West Maui Well No. 2	6/14/17	12:00 pm	Grab			Total Coliform / E. Coli	
3									
4									
5									
6									
7									
8									
9									
10									

CLIENTS PROVIDING SAMPLES TO THE LABORATORY SHOULD COMPLETE AS MUCH OF THE ABOVE FORM AS POSSIBLE. NOTE: NAME AND DATED SIGNATURE OF PERSON COLLECTING THE SAMPLE MUST BE ENTERED BELOW ↓. INFORMATION REQUESTED IN SHADED BOXES ABOVE TO BE FILLED IN BY THE LABORATORY.

SAMPLED BY:	DATE	RECEIVED BY:	DATE	RECEIVED FOR LABORATORY:	DATE
Race Hozaki (PRINT NAME)	6/14 2017	SIGNATURE	20__ TIME	Brooke Miller (SIGNATURE)	6/15 2017 TIME 0950
RELINQUISHED: [signature] (SIGNATURE)	6/14 2017 TIME 2:00 pm	RELINQUISHED: SIGNATURE OR INITIALS	DATE 20__ TIME	RELINQUISHED: SIGNATURE OR INITIALS	DATE 20__ TIME

COMMENTS: 6/13/17 Locked in S. Hypochlorite 60 ppm @ 2:30 pm. Cl2: Nondetected on both samples.
PRECAUTIONS:
DISPOSAL:

RETURN SAMPLE TO CLIENT ☐

USE (BLACK) INK

3.6°C

PURAL WATER SPECIALTY CO. INC.

WATER BACTERIAL TEST CERTIFICATE

Project Name: West Maui Well 2 M-3-17

Project Location: Lahaina, Maui Date of Sample: June 14, 2017

Client: Alpha Inc Project Manager: Jason Stenger

We of Pural Water Specialty Company, Inc. hereby certify that the well of the above project were chlorinated. Chlorine test and Bacterial sample of the above project were taken and analyzed. The methods and practices that were used are in accordance with American Water Works Association Standards or are accepted practices by local County Water Department and the Hawaii State Department of Health.

Free Chlorine residual after flushing and Microbiological result:

Sample Site, 6/14/17, 11:30 am.
Well
Free Chlorine Residual – Non detected
Total Coliform & E.coli - 100mL – Absent

Sample Site, 6/14/17, 12:00 pm.
Well
Free Chlorine Residual – Non detected
Total Coliform & E.coli - 100mL – Absent

Comments: The well was chlorinated at 60 ppm on 6/13/17. The Free Chlorine residual was non-detected and Bacteriological results at the time of sampling for all sample sites were satisfactory.

Reported By (Sign): [signature] Date of Certificate: June 19, 2017
Efren Ugalino

ENT:	INV:	√ PROOF	SENT
6/16 am →			

CLIENT: Pural Water Specialty Co

ATTENTION: Efren Ugalino (808) 757-0369
efren.ugalino@puralwater.com

FILE #846
REPORT DATE:
PAGE: 1 of 1

AECOS REPORT OF MICROBIOLOGICAL RESULTS

SAMPLE TYPE: Potable H_2O
DATE SAMPLED: 6/14/2017
DATE/TIME RECEIVED: 6/15/17 @ 0950
TEMP. CONTROL: TC₁ 3.6 °C TC₂ ____ °C
CHLORINE RESIDUAL: not detected
Analysis Date/Time: 6/15/17 @ ~~0953~~ 0953 (sm)

AECOS LOG #: ~~33~~ (sm) [34385]
SAMPLER: R. Hozaki
MATRIX: water
Analyst: S'mello

SAMPLE ID		Total Coliform	e. coli		
	Units ⇒	P/A	P/A		
	Method Number ⇒	SM 9223B	colilert		
	√ by ⇒	jw	jw		
	Time Sampled				
West Maui Well #2	1130	absent	absent		
West Maui Well #2	1200	absent	absent		

E-MAILED

NOTES:
AECOS Microbiologist phoned ____________ on ___/___/___
at approximately ______ (am/pm), and spoke with ____________.
(describe message given)

APPENDIX C

LABORATORY TEST RESULTS FOR KAHANA WELL

eurofins | Eaton Analytical

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)

AT-1807

Laboratory Report

for

Pural Water Specialty Company
1955 Vineyard
Wailuku, HI 96793
Attention: Eric Okazaki
Fax: 808-244-8878

Date of Issue
07/22/2017
EUROFINS EATON ANALYTICAL, INC.

DST: David S Tripp
Project Manager

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

ORELAP 4034

* Accredited in accordance with TNI 2009 and ISO/IEC 17025:2005.
* Laboratory certifies that the test results meet all **TNI 2009 and ISO/IEC 17025:2005** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.

STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	Michigan	9906
Arizona	AZ0778	Mississippi	Certified
Arkansas	Certified	Montana	Cert 0035
California-Monrovia-ELAP	2813	Nebraska	Certified
California-Colton- ELAP	2812	Nevada	CA00006-2016
California-Folsom- ELAP	2820	New Hampshire *	2959
California-Fresno- ELAP	2966	New Jersey *	CA 008
Colorado	Certified	New Mexico	Certified
Connecticut	PH-0107	New York *	11320
Delaware	CA 006	North Carolina	06701
Florida *	E871024	North Dakota	R-009
Georgia	947	Oregon (Primary AB) *	ORELAP 4034
Guam	17-005R	Pennsylvania *	68-565
Hawaii	Certified	Puerto Rico	Certified
Idaho	Certified	Rhode Island	LAO00326
Illinois *	200033	South Carolina	87016
Indiana	C-CA-01	South Dakota	Certified
Iowa - Asbestos	413	Tennessee	TN02839
Kansas *	E-10268	Texas *	T104704230-16-11
Kentucky	90107	Utah *	CA000062017-11
Louisiana *	LA16003	Vermont	VT0114
Maine	CA0006	Virginia *	460260
Maryland	224	Washington	C838
Commonwealth of Northern Marianas Is.	MP0004	EPA Region 5	Certified
Massachusetts	M-CA006	Los Angeles County Sanitation Districts	10264

* NELAP/TNI Recognized Accreditation Bodies

ISO 17025 Accredited Method List

The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ANAB.
Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com

SPECIFIC TESTS	METHOD OR TECHNIQUE USED	Environmental (Drinking Water)	Environmental (Waste Water)	Water as a Component of Food and Bev/Bev/ Bottled Water
1,4-Dioxane	EPA 522	x		x
2,3,7,8-TCDD	Modified EPA 1613B	x		x
Acrylamide	In House Method (2440)	x		x
Alkalinity	SM 2320B	x	x	x
Ammonia	EPA 350.1		x	x
Ammonia	SM 4500-NH3 H		x	x
Anions and DBPs by IC	EPA 300.0	x	x	x
Anions and DBPs by IC	EPA 300.1	x		x
Asbestos	EPA 100.2	x	x	
Bicarbonate Alkalinity as HCO3	SM 2320B	x	x	x
BOD / CBOD	SM 5210B		x	x
Bromate	In House Method (2447)	x		x
Carbamates	EPA 531.2	x		x
Carbonate as CO3	SM 2330B	x	x	x
Carbonyls	EPA 556	x		x
COD	EPA 410.4 / SM 5220D		x	
Chloramines	SM 4500-CL G	x	x	x
Chlorinated Acids	EPA 515.4	x		x
Chlorinated Acids	EPA 555	x		x
Chlorine Dioxide	SM 4500-CLO2 D	x		x
Chlorine -Total/Free/ Combined Residual	SM 4500-Cl G	x	x	x
Conductivity	EPA 120.1		x	
Conductivity	SM 2510B	x	x	x
Corrosivity (Langelier Index)	SM 2330B	x		x
Cryptosporidium	EPA 1623	x		x
Cyanide, Amenable	SM 4500-CN G	x	x	
Cyanide, Free	SM 4500CN F	x	x	x
Cyanide, Total	EPA 335.4	x	x	x
Cyanogen Chloride (screen)	In House Method (2470)	x		x
Diquat and Paraquat	EPA 549.2	x		x
DBP/HAA	SM 6251B	x		x
Dissolved Oxygen	SM 4500-O G		x	x
DOC	SM 5310C	x		x
E. Coli	(MTF/EC+MUG)	x		x
E. Coli	CFR 141.21(f)(6)(i)	x		x
E. Coli	SM 9223		x	
E. Coli (Enumeration)	SM 9221B.1/ SM 9221F	x		x
E. Coli (Enumeration)	SM 9223B	x		x
EDB/DCBP	EPA 504.1	x		
EDB/DBCP and DBP	EPA 551.1	x		x
EDTA and NTA	In House Method (2454)	x		x
Endothall	EPA 548.1	x		x
Endothall	In-house Method (2445)	x		x
Enterococci	SM 9230B	x	x	
Fecal Coliform	SM 9221 E (MTF/EC)	x		
Fecal Coliform	SM 9221C, E (MTF/EC)		x	
Fecal Coliform (Enumeration)	SM 9221E (MTF/EC)	x		x
Fecal Coliform with Chlorine Present	SM 9221E		x	
Fecal Streptococci	SM 9230B	x	x	
Fluoride	SM 4500-F C	x	x	x
Giardia	EPA 1623	x		x
Glyphosate	EPA 547	x		x
Gross Alpha/Beta	EPA 900.0	x	x	x
Gross Alpha Coprecipitation	SM 7110 C	x	x	x
Hardness	SM 2340B	x	x	x
Heterotrophic Bacteria	In House Method (2439)	x		x
Heterotrophic Bacteria	SM 9215 B	x		x
Hexavalent Chromium	EPA 218.6	x	x	x

SPECIFIC TESTS	METHOD OR TECHNIQUE USED	Environmental (Drinking Water)	Environmental (Waste Water)	Water as a Component of Food and Bev/Bev/ Bottled Water
Hexavalent Chromium	EPA 218.7	x		x
Hexavalent Chromium	SM 3500-Cr B		x	
Hormones	EPA 539	x		x
Hydroxide as OH Calc.	SM 2330B	x		x
Kjeldahl Nitrogen	EPA 351.2		x	
Legionella	CDC Legionella	x		x
Mercury	EPA 245.1	x	x	x
Metals	EPA 200.7 / 200.8	x	x	x
Microcystin LR	ELISA (2360)	x		x
NDMA	EPA 521	x		x
NDMA	TQ In house method based on EPA 521 (2425)	x		x
Nitrate/Nitrite Nitrogen	EPA 353.2	x	x	x
OCL, Pesticides/PCB	EPA 505	x		x
Ortho Phosphate	EPA 365.1	x	x	x
Ortho Phosphate	SM 4500P E			x
Ortho Phosphorous	SM 4500P E	x		
Oxyhalides Disinfection Byproducts	EPA 317.0	x		x
Perchlorate	EPA 331.0	x		x
Perchlorate (low and high)	EPA 314.0	x		x
Perfluorinated Alkyl Acids	EPA 537	x		x
pH	EPA 150.1	x		
pH	SM 4500-H+B	x	x	x
Phenylurea Pesticides/ Herbicides	In House Method, based on EPA 532 (2448)	x		x
Pseudomonas	IDEXX Pseudalert (2461)	x		x
Radium-226	GA Institute of Tech	x		x
Radium-228	GA Institute of Tech	x		x
Radon-222	SM 7500RN	x		x
Residue, Filterable	SM 2540C	x	x	x
Residue, Non-filterable	SM 2540D		x	
Residue, Total	SM 2540B		x	x
Residue, Volatile	EPA 160.4		x	
Semi-VOC	EPA 525.2	x		x
Semi-VOC	EPA 625		x	x
Silica	SM 4500-Si D	x	x	
Silica	SM 4500-SiO2 C	x	x	
Sulfide	SM 4500-S$^=$ D		x	
Sulfite	SM 4500-SO^{3}B	x	x	x
Surfactants	SM 5540C	x	x	x
Taste and Odor Analytes	SM 6040E	x		x
Total Coliform (P/A)	SM 9221 A, B	x		x
Total Coliform (Enumeration)	SM 9221 A, B, C	x		x
Total Coliform / E. coli	Colisure SM 9223	x		x
Total Coliform	SM 9221B		x	
Total Coliform with Chlorine Present	SM 9221B		x	
Total Coliform / E.coli (P/A and Enumeration)	SM 9223	x		x
TOC	SM 5310C	x	x	x
TOX	SM 5320B		x	
Total Phenols	EPA 420.1		x	
Total Phenols	EPA 420.4	x	x	x
Total Phosphorous	SM 4500 P E		x	
Turbidity	EPA 180.1	x	x	x
Turbidity	SM 2130B	x	x	
Uranium by ICP/MS	EPA 200.8	x		x
UV 254	SM 5910B	x		
VOC	EPA 524.2/EPA 524.3	x		x
VOC	EPA 624		x	x
VOC	EPA SW 846 8260	x		x
VOC	In House Method (2411)	x		x
Yeast and Mold	SM 9610	x		x

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Acknowledgement of Samples Received

Addr: **Pural Water Specialty Company**
1955 Vineyard
Wailuku, HI 96793

Attn: Eric Okazaki
Phone: 808-242-7299

Client ID: PURAL-HI
Folder #: 669412
Project: PURAL-MAUI
Sample Group: 2017 New Source

Project Manager: David S Tripp
Phone: (626) 386-1158

The following samples were received from you on **June 29, 2017 at 1121**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical, Inc..

Sample #	Sample ID		Sample Date
201706290318	Kahana Exploratory Well		06/27/2017 1230
	@ICPMS	Mercury	@504MOD
	@505PAC	@525PAC	@DIQUAT
	@ML515.4	@ML531.2	@VOASDWA
	Alkalinity in CaCO3 units	Asbestos by TEM - >10 microns	Cadmium Total ICAP/MS
	Calcium Total ICAP	Cyanide by manual distillation	2,3,7,8-TCDD
	Endothall	Fluoride	Glyphosate
	Nitrate as Nitrogen by IC	Nitrate as NO3 (calc)	Nitrite Nitrogen by IC
	PH (H3=past HT not compliant)	Specific Conductance	Subcontract Test-See Attached
	Turbidity		
201706290319	TRAVEL BLANK		06/27/2017 1230
	@VOASDWA TB		

Test Description

@ICPMS -- ICPMS Metals

@504MOD -- EPA Method 504.1

@505PAC -- Organochlorine Pesticides/PCBs

@525PAC -- Semivolatiles by GCMS

@DIQUAT -- Diquat and Paraquat

@ML515.4 -- Chlorophenoxy Herbicides

@ML531.2 -- Aldicarbs

@VOASDWA -- Volatile Organics by GCMS

@VOASDWA TB -- Volatile Organics by GCMS

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CHAIN OF CUSTODY RECORD

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629
Phone: 626 386 1100
Fax: 626 386 1101
800 566 LABS (800 566 5227)
Website: www.EatonAnalytical.com

EUROFINS EATON ANALYTICAL USE ONLY: G6412

LOGIN COMMENTS: ______

SAMPLES CHECKED AGAINST COC BY: IJ
SAMPLES LOGGED IN BY: IJ

SAMPLE TEMP RECEIVED AT: SAMPLES REC'D DAY OF COLLECTION? [ ] (check for yes)
[ ] ______ (Other) IR Gun ID = ______ (Observation= ______ °C) (Corr.Factor ______ °C) (Final = ______ °C)
[✓] Monrovia IR Gun ID = 589A (Observation= 3.9 °C) (Corr.Factor -.2 °C) (Final = 3.7 °C)
Compliance Acceptance Criteria: (Chemistry: 4 ± 2 °C) (Microbiology: < 10°C)

TYPE OF ICE: Real ____ Synthetic ✓ No Ice ____ CONDITION OF ICE: Frozen ✓ Partially Frozen ____ Thawed ____ N/A ____
METHOD OF SHIPMENT: Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: ______
8112 9654 3317

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME: PURAL WATER SPECIALTY Co., INC.
PROJECT CODE: PURAL - MAUI
EEA CLIENT CODE: PURAL-HI
COC ID:
SAMPLE GROUP: KAHANA EXPLORATORY WELL 2017 NEW SOURCE
TAT requested: rush by adv notice only STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

COMPLIANCE SAMPLES [X] (check for yes) - Requires state forms [ ]
NON-COMPLIANCE SAMPLES [ ] (check for yes) REGULATION INVOLVED: (eg. SDWA, NPDES, etc.)
Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION
SEE ATTACHED KIT ORDER FOR ANALYSES [X] (check for yes), OR
List ALL ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	FIELD DATA	FIELD DATA	SAMPLER COMMENTS
6/27/17	12:30pm	KAHANA EXPLORATORY WELL -		RGW			CL2 - 0.00 mg/L
		WEST MAUI WELL 2					
		FLOWMETER - 19714700					
		CHLORIDE - 63mg/L					
		CONDUCTIVITY - 297.5 uS					
		SALINITY - 0.1 PPT					
		pH - 7.74					
		TEMP - 21.9°C					
		TURBIDITY - 0.44 NTU					

* MATRIX TYPES: RSW = Raw Surface Water, RGW = Raw Ground Water, CFW = Chlor(am)inated Finished Water, FW = Other Finished Water, SEAW = Sea Water, WW = Waste Water, BW = Bottled Water, SW = Storm Water, SO = Soil, SL = Sludge, O = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:	[signature]	DONALD PASCUAL	PURAL WATER	6/27/17	12:30pm
RELINQUISHED BY:	[signature]	DONALD PASCUAL	PURAL WATER	6/28/17	8:00AM
RECEIVED BY:	[signature]	CHRIS GEREEL	EEA	6.29.17	1121
RELINQUISHED BY:					
RECEIVED BY:					

QA FO 0029.2 (Version 2) (08/28/2014) PAGE ____ OF ____

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Kit Order for Pural Water Specialty Company

David S Tripp is your Eurofins Eaton Analytical Service Manager

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
(626) 386-1100 FAX (626) 386-1101

Note: Sampler Please return this paper with your samples

Kit #: 171686

Created By: Ivana Velez - [SZN3]
Deliver By: 06/05/2017
STG: Bottle Orders
Ice Type: W

Client ID: PURAL-HI
Project Code: PURAL-MAUI Bottle Orders
Group Name: 2017 New Source
PO#/JOB#:

Ship Sample Kits to	Send Report to	Billing Address
Pural Water Specialty Company 1955 Vineyard Wailuku, HI 96793 Attn: Efren Ugalino Phone: 808-242-7299 Fax: 808-244-8878	Pural Water Specialty Company 1955 Vineyard Wailuku, HI 96793 Attn: Eric Okazaki Phone: 808-242-7299 Fax: 808-244-8878	Pural Water Specialty Company 1955 Vineyard Wailuku, HI 96793 Attn: Eric Okazaki Phone: 808-242-7299 Fax: 808-244-8878

# of Sample	Tests	Bottle Qty - Type [preservative information]	UN DOT #
1	Glyphosate	✓ 1 - 125ml amber glass [no preservative]	
1	CG • Fluoride, Nitrate as Nitrogen by IC, Nitrate as NO3 (calc), Nitrite Nitrogen by IC, PH (H3=past HT not compliant), Specific Conductance, Turbidity	✓ 1 - 125ml poly [no preservative]	
1	@525PAC	✓ 2 - 1L amber glass [2ml of 6N HCl]	UN1789
1	@2378-TCDD_Dioxin	✓ 2 - 1L amber glass [no preservative]	
1	@DIQUAT	✓ 1 - 1L amber poly [no preservative]	
1	CG • Asbestos by TEM - >10 microns	✓ 1 - 1L poly sonicated [no preservative]	
1	Cyanide	✓ 1 - 250 ml poly [2 ml NaOH (30%)+6 scoops AA]	
1	Endothall	✓ 1 - 250ml amber glass [no preservative]	
1	Alkalinity in CaCO3 units	✓ 1 - 250ml poly [no preservative]	
1	@ML531.2	✓ 2 - 40ml amber glass vial [0.37g KH2Citrate+6mg ThioSO4]	
1	@505PAC	✓ 4 - 40ml amber glass vial [1 drop Thio (8%)]	
1	@VOASDWA	✓ 3 - 40ml amber glass vial [4drops 6N HCL (36%)]	UN1789
1	@VOASDWA TB	✓ 2 - 40ml amber glass vial [4drops of 1:1 HCL + H2O]	UN1789
1	@504MOD	✓ 3 - 40ml amber glass vial [no preservative]	
1	@ICPMS, Mercury, Cadmium Total ICAP/MS, Calcium Total ICAP	✓ 1 - 500ml acid poly [2ml HNO3 (18%)]	UN2031
1	@ML515.4	✓ 4 - 60ml amber glass [3 mg NaSulfite]	

Comments

SHIPPING:
*Please deliver kit by Monday, 06/05/17.
**Please include extra ice packs for Hawaii client.

Thank you!

Code	Status	Date Shipped	Via	Tracking #	# of Coolers	Prepared By

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Laboratory Comments

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

Pural Water Specialty Company
Eric Okazaki
1955 Vineyard
Wailuku, HI 96793

Folder Comments

Analytical results for TCDD Dioxin by 1613B are submitted by Pace Analytical Services, Minneapolis, MN

Flags Legend:

H1 - Sample analysis performed past holding time. Data not acceptable for regulatory compliance.

The Comments Report may be blank if there are no comments for this report.

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Laboratory Hits

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

Pural Water Specialty Company
Eric Okazaki
1955 Vineyard
Wailuku, HI 96793

Samples Received on:
06/29/2017 1121

Analyzed	Analyte	Sample ID	Result	Federal MCL	Units	MRL
	201706290318	**Kahana Exploratory Well**				
07/01/2017 05:08	Alkalinity in CaCO3 units		49		mg/L	2
06/30/2017 12:12	Barium Total ICAP/MS		3.2	2000	ug/L	2
07/03/2017 22:42	Calcium Total ICAP		15		mg/L	1
07/05/2017 19:15	Fluoride		0.065	4	mg/L	0.05
06/29/2017 11:55	Nitrate as Nitrogen by IC		0.54	10	mg/L	0.2
06/29/2017 11:55	Nitrate as NO3 (calc)		2.4	45	mg/L	0.88
07/01/2017 05:08	PH (H3=past HT not compliant)		8.2		Units	0.1
07/01/2017 05:08	Specific Conductance, 25 C		350		umho/cm	10
06/30/2017 17:52	Turbidity		0.14	5	NTU	0.1

SUMMARY OF POSITIVE DATA ONLY

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Laboratory Data

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

Pural Water Specialty Company
Eric Okazaki
1955 Vineyard
Wailuku, HI 96793

Samples Received on:
06/29/2017 1121

Kahana Exploratory Well (201706290318) — Sampled on 06/27/2017 1230

Prepped	Analyzed	Prep Batch	Analytical Batch	Method	Analyte	Result	Units	MRL	Dilution
EPA 200.8 - ICPMS Metals									
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Antimony Total ICAP/MS	ND	ug/L	1	1
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Arsenic Total ICAP/MS	ND	ug/L	1	1
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Barium Total ICAP/MS	3.2	ug/L	2	1
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Beryllium Total ICAP/MS	ND	ug/L	1	1
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Cadmium Total ICAP/MS	ND	ug/L	0.5	1
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Chromium Total ICAP/MS	ND	ug/L	1	1
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Copper Total ICAP/MS	ND	ug/L	2	1
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Lead Total ICAP/MS	ND	ug/L	0.5	1
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Nickel Total ICAP/MS	ND	ug/L	5	1
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Selenium Total ICAP/MS	ND	ug/L	5	1
06/29/17	06/30/17 12:12	1006973	1007193	(EPA 200.8)	Thallium Total ICAP/MS	ND	ug/L	1	1
EPA 200.7 - ICP Metals									
06/29/17	07/03/17 22:42	1006973	1007694	(EPA 200.7)	Calcium Total ICAP	15	mg/L	1	1
EPA 245.1 - Mercury Total									
07/07/17	07/07/17 13:31	1008606	1008807	(EPA 245.1)	Mercury	ND	ug/L	0.2	1
EPA 100.2 - Asbestos by TEM - >10 microns									
06/29/17	07/17/17 00:00	1009560	1011143	(EPA 100.2)	Asbestos by TEM - >10 microns	ND	MFL	0.2	1
EPA 505 - Organochlorine Pesticides/PCBs									
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	Alachlor (Alanex)	ND	ug/L	0.1	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	Aldrin	ND	ug/L	0.01	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	Chlordane	ND	ug/L	0.1	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	Dieldrin	ND	ug/L	0.01	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	Endrin	ND	ug/L	0.01	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	Heptachlor Epoxide	ND	ug/L	0.01	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	Lindane (gamma-BHC)	ND	ug/L	0.01	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	Methoxychlor	ND	ug/L	0.05	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	PCB 1016 Aroclor	ND	ug/L	0.08	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	PCB 1221 Aroclor	ND	ug/L	0.1	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	PCB 1232 Aroclor	ND	ug/L	0.1	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	PCB 1242 Aroclor	ND	ug/L	0.1	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	PCB 1248 Aroclor	ND	ug/L	0.1	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	PCB 1254 Aroclor	ND	ug/L	0.1	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	PCB 1260 Aroclor	ND	ug/L	0.1	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	Total PCBs	ND	ug/L	0.1	1
06/29/17	06/30/17 07:43	1007125	1007433	(EPA 505)	Toxaphene	ND	ug/L	0.5	1

Rounding on totals after summation.
(c) - indicates calculated results

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Laboratory Data

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

Pural Water Specialty Company
Eric Okazaki
1955 Vineyard
Wailuku, HI 96793

Samples Received on:
06/29/2017 1121

Prepped	Analyzed	Prep Batch	Analytical Batch	Method	Analyte	Result	Units	MRL	Dilution
EPA 515.4 - Chlorophenoxy Herbicides									
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	2,4,5-T	ND	ug/L	0.2	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	2,4,5-TP (Silvex)	ND	ug/L	0.2	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	2,4-D	ND	ug/L	0.1	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	2,4-DB	ND	ug/L	2	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	3,5-Dichlorobenzoic acid	ND	ug/L	0.5	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	Acifluorfen	ND	ug/L	0.2	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	Bentazon	ND	ug/L	0.5	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	Dalapon	ND	ug/L	1	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	Dicamba	ND	ug/L	0.1	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	Dichlorprop	ND	ug/L	0.5	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	Dinoseb	ND	ug/L	0.2	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	Pentachlorophenol	ND	ug/L	0.04	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	Picloram	ND	ug/L	0.1	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	Tot DCPA Mono&Diacid Degradate	ND	ug/L	0.1	1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	2,4-Dichlorophenyl acetic acid	112	%		1
07/07/17	07/11/17 11:09	1008570	1009291	(EPA 515.4)	4,4-Dibromooctafluorobiphenyl	91	%		1
EPA 504.1 - EPA Method 504.1									
07/05/17	07/05/17 21:39	1007149	1008226	(EPA 504.1)	1,2,3-Trichloropropane (TCP)	ND	ug/L	0.04	1
07/05/17	07/05/17 21:39	1007149	1008226	(EPA 504.1)	Dibromochloropropane (DBCP)	ND	ug/L	0.01	1
07/05/17	07/05/17 21:39	1007149	1008226	(EPA 504.1)	Ethylene Dibromide (EDB)	ND	ug/L	0.01	1
07/05/17	07/05/17 21:39	1007149	1008226	(EPA 504.1)	1,2-Dibromopropane	94	%		1
EPA 525.2 - Semivolatiles by GCMS									
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Atrazine	ND	ug/L	0.05	1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Benzo(a)pyrene	ND	ug/L	0.02	1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Di-(2-Ethylhexyl)adipate	ND	ug/L	0.6	1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Di(2-Ethylhexyl)phthalate	ND	ug/L	0.6	1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Heptachlor	ND	ug/L	0.04	1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Hexachlorobenzene	ND	ug/L	0.05	1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Hexachlorocyclopentadiene	ND	ug/L	0.05	1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Molinate	ND	ug/L	0.1	1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Simazine	ND	ug/L	0.05	1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Thiobencarb (ELAP)	ND	ug/L	0.2	1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	1,3-Dimethyl-2-nitrobenzene	95	%		1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Acenaphthene-d10	97	%		1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Chrysene-d12	101	%		1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Perylene-d12	83	%		1
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Phenanthrene-d10	100	%		1

Rounding on totals after summation.
(c) - indicates calculated results

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1 800 566 LABS (1 800 566 5227)

Laboratory Data

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

Pural Water Specialty Company
Eric Okazaki
1955 Vineyard
Wailuku, HI 96793

Samples Received on:
06/29/2017 1121

Prepped	Analyzed	Prep Batch	Analytical Batch	Method	Analyte	Result	Units	MRL	Dilution
07/05/17	07/12/17 14:40	1007816	1010488	(EPA 525.2)	Triphenylphosphate	106	%		1
	EPA 548.1 - Endothall								
06/30/17	07/07/17 17:22	1007409	1009223	(EPA 548.1)	Endothall	ND	ug/L	5	1
	EPA 547 - Glyphosate								
	06/30/17 19:55		1007557	(EPA 547)	Glyphosate	ND	ug/L	6	1
	EPA 531.2 - Aldicarbs								
	07/04/17 04:17		1007655	(EPA 531.2)	3-Hydroxycarbofuran	ND	ug/L	0.5	1
	07/04/17 04:17		1007655	(EPA 531.2)	Aldicarb (Temik)	ND	ug/L	0.5	1
	07/04/17 04:17		1007655	(EPA 531.2)	Aldicarb sulfone	ND	ug/L	0.5	1
	07/04/17 04:17		1007655	(EPA 531.2)	Aldicarb sulfoxide	ND	ug/L	0.5	1
	07/04/17 04:17		1007655	(EPA 531.2)	Baygon	ND	ug/L	0.5	1
	07/04/17 04:17		1007655	(EPA 531.2)	Carbaryl	ND	ug/L	0.5	1
	07/04/17 04:17		1007655	(EPA 531.2)	Carbofuran (Furadan)	ND	ug/L	0.5	1
	07/04/17 04:17		1007655	(EPA 531.2)	Methiocarb	ND	ug/L	0.5	1
	07/04/17 04:17		1007655	(EPA 531.2)	Methomyl	ND	ug/L	0.5	1
	07/04/17 04:17		1007655	(EPA 531.2)	Oxamyl (Vydate)	ND	ug/L	0.5	1
	07/04/17 04:17		1007655	(EPA 531.2)	4-Bromo-3,5-dimethylphenyl-N-methylc arbamate	91	%		1
	EPA 549.2 - Diquat and Paraquat								
06/30/17	07/03/17 18:42	1007274	1007653	(EPA 549.2)	Diquat	ND	ug/L	0.4	1
06/30/17	07/03/17 18:42	1007274	1007653	(EPA 549.2)	Paraquat	ND	ug/L	2	1
	EPA 300.0 - Nitrate, Nitrite by EPA 300.0								
	06/29/17 11:55		1007082	(EPA 300.0)	Nitrate as Nitrogen by IC	0.54	mg/L	0.2	2
	06/29/17 11:55		1007082	(EPA 300.0)	Nitrate as NO3 (calc)	2.4	mg/L	0.88	2
	06/29/17 11:55		1007082	(EPA 300.0)	Nitrite Nitrogen by IC	ND	mg/L	0.1	2
	EPA 335.4 - Cyanide by manual distillation								
07/07/17	07/07/17 21:59	1008928	1009012	(EPA 335.4)	Cyanide by manual distillation	ND	mg/L	0.005	1
	EPA 1613B - 2,3,7,8-TCDD								
07/18/17	07/19/17 13:07			(EPA 1613B)	2,3,7,8-TCDD	ND	pg/L	5	1
	EPA 524.2 - Volatile Organics by GCMS								
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,1,1,2-Tetrachloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,1,1-Trichloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,1,2,2-Tetrachloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,1,2-Trichloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,1-Dichloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,1-Dichloroethylene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,1-Dichloropropene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,2,3-Trichlorobenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,2,3-Trichloropropane	ND	ug/L	0.5	1

Rounding on totals after summation.
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Laboratory Data

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Group: 2017 New Source

Pural Water Specialty Company
Eric Okazaki
1955 Vineyard
Wailuku, HI 96793

Samples Received on:
06/29/2017 1121

Prepped	Analyzed	Prep Batch	Analytical Batch	Method	Analyte	Result	Units	MRL	Dilution
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,2,4-Trichlorobenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,2,4-Trimethylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,2-Dichloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,2-Dichloropropane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,3,5-Trimethylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,3-Dichloropropane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	2,2-Dichloropropane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	2-Butanone (MEK)	ND	ug/L	5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	4-Methyl-2-Pentanone (MIBK)	ND	ug/L	5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Benzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Bromobenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Bromochloromethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Bromodichloromethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Bromoethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Bromoform	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Bromomethane (Methyl Bromide)	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Carbon disulfide	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Carbon Tetrachloride	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Chlorobenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Chlorodibromomethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Chloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Chloroform (Trichloromethane)	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Chloromethane(Methyl Chloride)	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	cis-1,2-Dichloroethylene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	cis-1,3-Dichloropropene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Dibromomethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Dichlorodifluoromethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Dichloromethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Di-isopropyl ether	ND	ug/L	3	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Ethyl benzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Hexachlorobutadiene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Isopropylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	m,p-Xylenes	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	m-Dichlorobenzene (1,3-DCB)	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Methyl Tert-butyl ether (MTBE)	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Naphthalene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	n-Butylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	n-Propylbenzene	ND	ug/L	0.5	1

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Prepped	Analyzed	Prep Batch	Analytical Batch	Method	Analyte	Result	Units	MRL	Dilution
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	o-Chlorotoluene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	o-Dichlorobenzene (1,2-DCB)	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	o-Xylene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	p-Chlorotoluene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	p-Dichlorobenzene (1,4-DCB)	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	p-Isopropyltoluene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	sec-Butylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Styrene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	tert-amyl Methyl Ether	ND	ug/L	3	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	tert-Butyl Ethyl Ether	ND	ug/L	3	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	tert-Butylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Tetrachloroethylene (PCE)	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Toluene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Total 1,3-Dichloropropene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Total THM	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Total xylenes	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	trans-1,2-Dichloroethylene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	trans-1,3-Dichloropropene	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Trichloroethylene (TCE)	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Trichlorofluoromethane	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Trichlorotrifluoroethane(Freon 113)	ND	ug/L	0.5	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Vinyl chloride (VC)	ND	ug/L	0.3	1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	1,2-Dichloroethane-d4	104	%		1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	4-Bromofluorobenzene	99	%		1
06/30/17	06/30/17 19:43	1007488	1007492	(EPA 524.2)	Toluene-d8	95	%		1
		SM 4500F-C - Fluoride							
	07/05/17 19:15		1007639	(SM 4500F-C)	Fluoride	0.065	mg/L	0.05	1
		SM 2320B - Alkalinity in CaCO3 units							
	07/01/17 05:08		1007418	(SM 2320B)	Alkalinity in CaCO3 units	49	mg/L	2	1
		SM4500-HB - PH (H3=past HT not compliant)							
	07/01/17 05:08		1007422	(SM4500-HB)	PH (H3=past HT not compliant)	8.2	Units	0.1	1
		EPA 180.1 - Turbidity							
	06/30/17 17:52		1007390	(EPA 180.1)	Turbidity	0.14 (H1)	NTU	0.1	1
		SM2510B - Specific Conductance							
	07/01/17 05:08		1007426	(SM2510B)	Specific Conductance, 25 C	350	umho/cm	10	1
<u>TRAVEL BLANK (201706290319)</u>						**Sampled on 06/27/2017 1230**			
		EPA 524.2 - Volatile Organics by GCMS							
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,1,1,2-Tetrachloroethane	ND	ug/L	0.5	1

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Prepped	Analyzed	Prep Batch	Analytical Batch	Method	Analyte	Result	Units	MRL	Dilution
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,1,1-Trichloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,1,2,2-Tetrachloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,1,2-Trichloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,1-Dichloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,1-Dichloroethylene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,1-Dichloropropene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,2,3-Trichlorobenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,2,3-Trichloropropane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,2,4-Trichlorobenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,2,4-Trimethylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,2-Dichloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,2-Dichloropropane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,3,5-Trimethylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,3-Dichloropropane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	2,2-Dichloropropane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	2-Butanone (MEK)	ND	ug/L	5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	4-Methyl-2-Pentanone (MIBK)	ND	ug/L	5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Benzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Bromobenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Bromochloromethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Bromodichloromethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Bromoethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Bromoform	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Bromomethane (Methyl Bromide)	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Carbon disulfide	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Carbon Tetrachloride	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Chlorobenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Chlorodibromomethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Chloroethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Chloroform (Trichloromethane)	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Chloromethane(Methyl Chloride)	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	cis-1,2-Dichloroethylene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	cis-1,3-Dichloropropene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Dibromomethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Dichlorodifluoromethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Dichloromethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Di-isopropyl ether	ND	ug/L	3	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Ethyl benzene	ND	ug/L	0.5	1

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06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Hexachlorobutadiene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Isopropylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	m,p-Xylenes	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	m-Dichlorobenzene (1,3-DCB)	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Methyl Tert-butyl ether (MTBE)	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Naphthalene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	n-Butylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	n-Propylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	o-Chlorotoluene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	o-Dichlorobenzene (1,2-DCB)	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	o-Xylene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	p-Chlorotoluene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	p-Dichlorobenzene (1,4-DCB)	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	p-Isopropyltoluene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	sec-Butylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Styrene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	tert-amyl Methyl Ether	ND	ug/L	3	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	tert-Butyl Ethyl Ether	ND	ug/L	3	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	tert-Butylbenzene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Tetrachloroethylene (PCE)	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Toluene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Total 1,3-Dichloropropene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Total THM	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Total xylenes	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	trans-1,2-Dichloroethylene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	trans-1,3-Dichloropropene	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Trichloroethylene (TCE)	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Trichlorofluoromethane	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Trichlorotrifluoroethane(Freon 113)	ND	ug/L	0.5	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Vinyl chloride (VC)	ND	ug/L	0.3	1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	1,2-Dichloroethane-d4	108	%		1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	4-Bromofluorobenzene	98	%		1
06/30/17	06/30/17 20:05	1007488	1007492	(EPA 524.2)	Toluene-d8	93	%		1

Rounding on totals after summation.
(c) - indicates calculated results

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Laboratory QC Summary

Report: 669412
Project: PURAL-MAUI
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Pural Water Specialty Company

Nitrate, Nitrite by EPA 300.0
Analytical Batch: 1007082 — **Analysis Date: 06/29/2017**
201706290318 Kahana Exploratory Well — Analyzed by: O2TX

ICPMS Metals
Prep Batch: 1006973 Analytical Batch: 1007193 — **Analysis Date: 06/30/2017**
201706290318 Kahana Exploratory Well — Analyzed by: DTN

Turbidity
Analytical Batch: 1007390 — **Analysis Date: 06/30/2017**
201706290318 Kahana Exploratory Well — Analyzed by: B7YX

Alkalinity in CaCO3 units
Analytical Batch: 1007418 — **Analysis Date: 07/01/2017**
201706290318 Kahana Exploratory Well — Analyzed by: J7RA

PH (H3=past HT not compliant)
Analytical Batch: 1007422 — **Analysis Date: 07/01/2017**
201706290318 Kahana Exploratory Well — Analyzed by: J7RA

Specific Conductance
Analytical Batch: 1007426 — **Analysis Date: 07/01/2017**
201706290318 Kahana Exploratory Well — Analyzed by: J7RA

Organochlorine Pesticides/PCBs
Prep Batch: 1007125 Analytical Batch: 1007433 — **Analysis Date: 06/30/2017**
201706290318 Kahana Exploratory Well — Analyzed by: LRL

Volatile Organics by GCMS
Prep Batch: 1007488 Analytical Batch: 1007492 — **Analysis Date: 06/30/2017**
201706290318 Kahana Exploratory Well — Analyzed by: MCB
201706290319 TRAVEL BLANK — Analyzed by: MCB

Glyphosate
Analytical Batch: 1007557 — **Analysis Date: 06/30/2017**
201706290318 Kahana Exploratory Well — Analyzed by: XWO

Fluoride
Analytical Batch: 1007639 — **Analysis Date: 07/05/2017**
201706290318 Kahana Exploratory Well — Analyzed by: J7RA

Diquat and Paraquat
Prep Batch: 1007274 Analytical Batch: 1007653 — **Analysis Date: 07/03/2017**
201706290318 Kahana Exploratory Well — Analyzed by: XWO

Aldicarbs
Analytical Batch: 1007655 — **Analysis Date: 07/04/2017**
201706290318 Kahana Exploratory Well — Analyzed by: XWO

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ICP Metals

Prep Batch: 1006973 Analytical Batch: 1007694 — **Analysis Date: 07/03/2017**
201706290318 Kahana Exploratory Well — Analyzed by: NINA

EPA Method 504.1

Prep Batch: 1007149 Analytical Batch: 1008226 — **Analysis Date: 07/05/2017**
201706290318 Kahana Exploratory Well — Analyzed by: DYM

Mercury Total

Prep Batch: 1008606 Analytical Batch: 1008807 — **Analysis Date: 07/07/2017**
201706290318 Kahana Exploratory Well — Analyzed by: MYH

Cyanide by manual distillation

Prep Batch: 1008928 Analytical Batch: 1009012 — **Analysis Date: 07/07/2017**
201706290318 Kahana Exploratory Well — Analyzed by: AZS

Endothall

Prep Batch: 1007409 Analytical Batch: 1009223 — **Analysis Date: 07/07/2017**
201706290318 Kahana Exploratory Well — Analyzed by: PAC

Chlorophenoxy Herbicides

Prep Batch: 1008570 Analytical Batch: 1009291 — **Analysis Date: 07/11/2017**
201706290318 Kahana Exploratory Well — Analyzed by: A4H

Semivolatiles by GCMS

Prep Batch: 1007816 Analytical Batch: 1010488 — **Analysis Date: 07/12/2017**
201706290318 Kahana Exploratory Well — Analyzed by: KAM

Asbestos by TEM - >10 microns

Prep Batch: 1009560 Analytical Batch: 1011143 — **Analysis Date: 07/17/2017**
201706290318 Kahana Exploratory Well — Analyzed by: CJB

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Laboratory QC

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
Nitrate, Nitrite by EPA 300.0 by EPA 300.0									
Analytical Batch: 1007082						**Analysis Date: 06/29/2017**			
LCS1	Nitrate as Nitrogen by IC		2.5	2.49	mg/L	100	(90-110)		
LCS2	Nitrate as Nitrogen by IC		2.5	2.49	mg/L	100	(90-110)	20	0.0
MBLK	Nitrate as Nitrogen by IC			<0.05	mg/L				
MRL_CHK	Nitrate as Nitrogen by IC		0.05	0.0479	mg/L	96	(50-150)		
MS_201706290131	Nitrate as Nitrogen by IC	ND	6.5	6.55	mg/L	105	(80-120)		
MSD_201706290131	Nitrate as Nitrogen by IC	ND	6.5	6.58	mg/L	105	(80-120)	20	0.46
LCS1	Nitrite Nitrogen by IC		1	0.970	mg/L	97	(90-110)		
LCS2	Nitrite Nitrogen by IC		1	0.965	mg/L	97	(90-110)	20	0.52
MBLK	Nitrite Nitrogen by IC			<0.025	mg/L				
MRL_CHK	Nitrite Nitrogen by IC		0.05	0.0483	mg/L	97	(50-150)		
MS_201706290131	Nitrite Nitrogen by IC	ND	2.5	2.51	mg/L	100	(80-120)		
MSD_201706290131	Nitrite Nitrogen by IC	ND	2.5	2.51	mg/L	100	(80-120)	20	0.0
ICPMS Metals by EPA 200.8									
Analytical Batch: 1007193						**Analysis Date: 06/30/2017**			
LCS1	Antimony Total ICAP/MS		50	49.5	ug/L	99	(85-115)		
LCS2	Antimony Total ICAP/MS		50	49.2	ug/L	98	(85-115)	20	0.61
MBLK	Antimony Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Antimony Total ICAP/MS		1	0.833	ug/L	83	(50-150)		
MS_201706290318	Antimony Total ICAP/MS	ND	50	49.0	ug/L	98	(70-130)		
MS2_201706280586	Antimony Total ICAP/MS	ND	50	50.1	ug/L	100	(70-130)		
MSD_201706290318	Antimony Total ICAP/MS	ND	50	48.3	ug/L	97	(70-130)	20	1.4
MSD2_201706280586	Antimony Total ICAP/MS	ND	50	49.8	ug/L	100	(70-130)	20	0.40
LCS1	Arsenic Total ICAP/MS		20	20.7	ug/L	103	(85-115)		
LCS2	Arsenic Total ICAP/MS		20	20.0	ug/L	100	(85-115)	20	3.4
MBLK	Arsenic Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Arsenic Total ICAP/MS		1	1.16	ug/L	116	(50-150)		
MS_201706290318	Arsenic Total ICAP/MS	ND	20	21.8	ug/L	109	(70-130)		
MS2_201706280586	Arsenic Total ICAP/MS	ND	20	21.7	ug/L	109	(70-130)		
MSD_201706290318	Arsenic Total ICAP/MS	ND	20	21.1	ug/L	105	(70-130)	20	3.3
MSD2_201706280586	Arsenic Total ICAP/MS	ND	20	21.9	ug/L	110	(70-130)	20	0.92
LCS1	Barium Total ICAP/MS		100	104	ug/L	104	(85-115)		
LCS2	Barium Total ICAP/MS		100	104	ug/L	104	(85-115)	20	0.0
MBLK	Barium Total ICAP/MS			<1	ug/L				
MRL_CHK	Barium Total ICAP/MS		2	2.15	ug/L	108	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Group: 2017 New Source

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201706290318	Barium Total ICAP/MS	3.2	100	110	ug/L	106	(70-130)		
MS2_201706280586	Barium Total ICAP/MS	9.8	100	114	ug/L	104	(70-130)		
MSD_201706290318	Barium Total ICAP/MS	3.2	100	108	ug/L	105	(70-130)	20	1.8
MSD2_201706280586	Barium Total ICAP/MS	9.8	100	114	ug/L	104	(70-130)	20	0.0
LCS1	Beryllium Total ICAP/MS		5	5.04	ug/L	101	(85-115)		
LCS2	Beryllium Total ICAP/MS		5	5.12	ug/L	102	(85-115)	20	1.6
MBLK	Beryllium Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Beryllium Total ICAP/MS		1	1.14	ug/L	114	(50-150)		
MS_201706290318	Beryllium Total ICAP/MS	ND	5	5.82	ug/L	116	(70-130)		
MS2_201706280586	Beryllium Total ICAP/MS	ND	5	5.37	ug/L	107	(70-130)		
MSD_201706290318	Beryllium Total ICAP/MS	ND	5	5.81	ug/L	116	(70-130)	20	0.17
MSD2_201706280586	Beryllium Total ICAP/MS	ND	5	5.11	ug/L	102	(70-130)	20	5.0
LCS1	Cadmium Total ICAP/MS		20	20.5	ug/L	102	(85-115)		
LCS2	Cadmium Total ICAP/MS		20	20.3	ug/L	101	(85-115)	20	0.98
MBLK	Cadmium Total ICAP/MS			<0.25	ug/L				
MRL_CHK	Cadmium Total ICAP/MS		0.5	0.576	ug/L	115	(50-150)		
MS_201706290318	Cadmium Total ICAP/MS	ND	20	20.8	ug/L	104	(70-130)		
MS2_201706280586	Cadmium Total ICAP/MS	ND	20	20.4	ug/L	102	(70-130)		
MSD_201706290318	Cadmium Total ICAP/MS	ND	20	20.7	ug/L	104	(70-130)	20	0.48
MSD2_201706280586	Cadmium Total ICAP/MS	ND	20	20.3	ug/L	102	(70-130)	20	0.49
LCS1	Chromium Total ICAP/MS		100	100	ug/L	100	(85-115)		
LCS2	Chromium Total ICAP/MS		100	100	ug/L	100	(85-115)	20	0.0
MBLK	Chromium Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Chromium Total ICAP/MS		1	0.998	ug/L	100	(50-150)		
MS_201706290318	Chromium Total ICAP/MS	ND	100	102	ug/L	103	(70-130)		
MS2_201706280586	Chromium Total ICAP/MS	ND	100	103	ug/L	103	(70-130)		
MSD_201706290318	Chromium Total ICAP/MS	ND	100	99.8	ug/L	100	(70-130)	20	3.1
MSD2_201706280586	Chromium Total ICAP/MS	ND	100	100	ug/L	100	(70-130)	20	3.0
LCS1	Copper Total ICAP/MS		100	103	ug/L	103	(85-115)		
LCS2	Copper Total ICAP/MS		100	103	ug/L	103	(85-115)	20	0.0
MBLK	Copper Total ICAP/MS			<1	ug/L				
MRL_CHK	Copper Total ICAP/MS		2	2.15	ug/L	107	(50-150)		
MS_201706290318	Copper Total ICAP/MS	ND	100	105	ug/L	105	(70-130)		
MS2_201706280586	Copper Total ICAP/MS	ND	100	103	ug/L	103	(70-130)		
MSD_201706290318	Copper Total ICAP/MS	ND	100	103	ug/L	103	(70-130)	20	1.9
MSD2_201706280586	Copper Total ICAP/MS	ND	100	100	ug/L	100	(70-130)	20	3.0
LCS1	Lead Total ICAP/MS		20	20.3	ug/L	101	(85-115)		
LCS2	Lead Total ICAP/MS		20	20.3	ug/L	101	(85-115)	20	0.0

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Lead Total ICAP/MS			<0.25	ug/L				
MRL_CHK	Lead Total ICAP/MS		0.5	0.476	ug/L	95	(50-150)		
MS_201706290318	Lead Total ICAP/MS	ND	20	20.1	ug/L	101	(70-130)		
MS2_201706280586	Lead Total ICAP/MS	ND	20	20.1	ug/L	101	(70-130)		
MSD_201706290318	Lead Total ICAP/MS	ND	20	19.8	ug/L	99	(70-130)	20	1.5
MSD2_201706280586	Lead Total ICAP/MS	ND	20	19.5	ug/L	98	(70-130)	20	3.0
LCS1	Nickel Total ICAP/MS		50	51.2	ug/L	102	(85-115)		
LCS2	Nickel Total ICAP/MS		50	51.2	ug/L	102	(85-115)	20	0.0
MBLK	Nickel Total ICAP/MS			<2.5	ug/L				
MRL_CHK	Nickel Total ICAP/MS		5	5.39	ug/L	108	(50-150)		
MS_201706290318	Nickel Total ICAP/MS	ND	50	51.2	ug/L	102	(70-130)		
MS2_201706280586	Nickel Total ICAP/MS	ND	50	50.6	ug/L	101	(70-130)		
MSD_201706290318	Nickel Total ICAP/MS	ND	50	51.0	ug/L	102	(70-130)	20	0.39
MSD2_201706280586	Nickel Total ICAP/MS	ND	50	49.3	ug/L	99	(70-130)	20	2.6
LCS1	Selenium Total ICAP/MS		20	21.9	ug/L	110	(85-115)		
LCS2	Selenium Total ICAP/MS		20	21.1	ug/L	106	(85-115)	20	3.7
MBLK	Selenium Total ICAP/MS			<2.5	ug/L				
MRL_CHK	Selenium Total ICAP/MS		5	4.52	ug/L	90	(50-150)		
MS_201706290318	Selenium Total ICAP/MS	ND	20	21.2	ug/L	106	(70-130)		
MS2_201706280586	Selenium Total ICAP/MS	ND	20	24.6	ug/L	123	(70-130)		
MSD_201706290318	Selenium Total ICAP/MS	ND	20	22.3	ug/L	111	(70-130)	20	5.1
MSD2_201706280586	Selenium Total ICAP/MS	ND	20	24.0	ug/L	120	(70-130)	20	2.5
LCS1	Thallium Total ICAP/MS		20	20.2	ug/L	101	(85-115)		
LCS2	Thallium Total ICAP/MS		20	20.4	ug/L	102	(85-115)	20	0.99
MBLK	Thallium Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Thallium Total ICAP/MS		1	0.966	ug/L	97	(50-150)		
MS_201706290318	Thallium Total ICAP/MS	ND	20	20.2	ug/L	101	(70-130)		
MS2_201706280586	Thallium Total ICAP/MS	ND	20	20.3	ug/L	102	(70-130)		
MSD_201706290318	Thallium Total ICAP/MS	ND	20	20.2	ug/L	101	(70-130)	20	0.0
MSD2_201706280586	Thallium Total ICAP/MS	ND	20	20.2	ug/L	101	(70-130)	20	0.49

Turbidity by EPA 180.1

Analytical Batch: 1007390 — **Analysis Date: 06/30/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
DUP1_201706300464	Turbidity	0.20	0.1	0.195	NTU		(0-20)	20	2.5
LCS1	Turbidity		20	20.0	NTU	100	(90-110)		
LCS2	Turbidity		20	20.4	NTU	102	(90-110)	20	2.0
MBLK	Turbidity			<0.10	NTU				
MRLHI	Turbidity		0.1	0.0990	NTU	99	(50-150)		

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Alkalinity in CaCO3 units by SM 2320B
Analytical Batch: 1007418 — **Analysis Date: 07/01/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Alkalinity in CaCO3 units		100	101	mg/L	101	(90-110)		
LCS2	Alkalinity in CaCO3 units		100	101	mg/L	101	(90-110)	20	0.0
MBLK	Alkalinity in CaCO3 units			<1	mg/L				
MRL_CHK	Alkalinity in CaCO3 units		2	2.23	mg/L	112	(50-150)		
MS_201706280720	Alkalinity in CaCO3 units	120	100	124	mg/L	3.7	(80-120)		
MS_201706280778	Alkalinity in CaCO3 units	300	100	331	mg/L	32	(80-120)		
MSD_201706280720	Alkalinity in CaCO3 units	120	100	123	mg/L	3.3	(80-120)	20	0.81
MSD_201706280778	Alkalinity in CaCO3 units	300	100	332	mg/L	32	(80-120)	20	0.30

PH (H3=past HT not compliant) by SM4500-HB
Analytical Batch: 1007422 — **Analysis Date: 07/01/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
DUP_201706280720	PH (H3=past HT not compliant)	7.8	0.01	7.81	Units		(0-20)	20	0.13
DUP_201706280778	PH (H3=past HT not compliant)	7.7	0.01	7.72	Units		(0-20)	20	0.26
LCS1	PH (H3=past HT not compliant)		6	6.05	Units	101	(98-102)		
LCS2	PH (H3=past HT not compliant)		6	6.05	Units	101	(98-102)	20	0.0

Specific Conductance by SM2510B
Analytical Batch: 1007426 — **Analysis Date: 07/01/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
DUP1_201706280720	Specific Conductance	17000	2	16900	umho/cm		(0-20)	20	0.56
DUP1_201706280778	Specific Conductance	1400	2	1400	umho/cm		(0-20)	20	0.20
LCS1	Specific Conductance		1000	994	umho/cm	99	(95-105)		
LCS2	Specific Conductance		1000	990	umho/cm	99	(95-105)	20	0.40
MBLK	Specific Conductance			2.20	umho/cm				
MRLHI	Specific Conductance		11	10.5	umho/cm	96	(50-150)		

Organochlorine Pesticides/PCBs by EPA 505
Prep Batch: 1007125 Analytical Batch: 1007433 — **Analysis Date: 06/29/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCCH	Alachlor (Alanex)		1	1.00	ug/L	100	(70-130)		
CCCH	Alachlor (Alanex)		1	1.07	ug/L	107	(70-130)		
MBLK	Alachlor (Alanex)			<0.1	ug/L				
MRL_CHK	Alachlor (Alanex)		0.1	0.115	ug/L	115	(50-150)		
MS1_201706280603	Alachlor (Alanex)	ND	0.2	0.214	ug/L	107	(65-135)		
MS2_201706270201	Alachlor (Alanex)	ND	1	1.02	ug/L	103	(65-135)		
CCCH	Aldrin		0.1	0.0953	ug/L	95	(70-130)		
CCCH	Aldrin		0.1	0.102	ug/L	102	(70-130)		
MBLK	Aldrin			<0.01	ug/L				

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Laboratory QC

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

Pural Water Specialty Company

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Aldrin		0.01	0.00800	ug/L	80	(50-150)		
MS1_201706280603	Aldrin	ND	0.02	0.0172	ug/L	86	(65-135)		
MS2_201706270201	Aldrin	ND	0.1	0.0970	ug/L	97	(65-135)		
CCCH	Chlordane		0.5	0.478	ug/L	96	(70-130)		
MBLK	Chlordane			<0.1	ug/L				
MRL_CHK	Chlordane		0.1	0.0905	ug/L	91	(50-150)		
MS1_201706280603	Chlordane	ND	0.5	0.448	ug/L	90	(65-135)		
MS2_201706270201	Chlordane	ND	0.5	0.464	ug/L	93	(65-135)		
CCCH	Dieldrin		0.1	0.0951	ug/L	95	(70-130)		
CCCH	Dieldrin		0.1	0.102	ug/L	102	(70-130)		
MBLK	Dieldrin			<0.01	ug/L				
MRL_CHK	Dieldrin		0.01	0.00830	ug/L	83	(50-150)		
MS1_201706280603	Dieldrin	ND	0.02	0.0183	ug/L	92	(65-135)		
MS2_201706270201	Dieldrin	ND	0.1	0.0957	ug/L	96	(65-135)		
CCCH	Endrin		0.1	0.0948	ug/L	95	(70-130)		
CCCH	Endrin		0.1	0.101	ug/L	101	(70-130)		
MBLK	Endrin			<0.01	ug/L				
MRL_CHK	Endrin		0.01	0.00900	ug/L	90	(50-150)		
MS1_201706280603	Endrin	ND	0.02	0.0183	ug/L	92	(65-135)		
MS2_201706270201	Endrin	ND	0.1	0.0966	ug/L	97	(65-135)		
CCCH	Heptachlor Epoxide		0.1	0.0970	ug/L	97	(70-130)		
CCCH	Heptachlor Epoxide		0.1	0.103	ug/L	103	(70-130)		
MBLK	Heptachlor Epoxide			<0.01	ug/L				
MRL_CHK	Heptachlor Epoxide		0.01	0.0107	ug/L	107	(50-150)		
MS1_201706280603	Heptachlor Epoxide	ND	0.02	0.0193	ug/L	97	(65-135)		
MS2_201706270201	Heptachlor Epoxide	ND	0.1	0.0985	ug/L	99	(65-135)		
CCCH	Lindane (gamma-BHC)		0.1	0.0955	ug/L	96	(70-130)		
CCCH	Lindane (gamma-BHC)		0.1	0.102	ug/L	102	(70-130)		
MBLK	Lindane (gamma-BHC)			<0.01	ug/L				
MRL_CHK	Lindane (gamma-BHC)		0.01	0.0108	ug/L	108	(50-150)		
MS1_201706280603	Lindane (gamma-BHC)	ND	0.02	0.0203	ug/L	101	(65-135)		
MS2_201706270201	Lindane (gamma-BHC)	ND	0.1	0.0976	ug/L	98	(65-135)		
CCCH	Methoxychlor		0.5	0.496	ug/L	99	(70-130)		
CCCH	Methoxychlor		0.5	0.527	ug/L	105	(70-130)		
MBLK	Methoxychlor			<0.05	ug/L				
MRL_CHK	Methoxychlor		0.05	0.0469	ug/L	94	(50-150)		
MS1_201706280603	Methoxychlor	ND	0.1	0.0908	ug/L	91	(65-135)		
MS2_201706270201	Methoxychlor	ND	0.5	0.495	ug/L	99	(65-135)		

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Pural Water Specialty Company

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	PCB 1016 Aroclor			<0.08	ug/L				
MBLK	PCB 1221 Aroclor			<0.1	ug/L				
MBLK	PCB 1232 Aroclor			<0.1	ug/L				
MBLK	PCB 1242 Aroclor			<0.1	ug/L				
MBLK	PCB 1248 Aroclor			<0.1	ug/L				
MBLK	PCB 1254 Aroclor			<0.1	ug/L				
MBLK	PCB 1260 Aroclor			<0.1	ug/L				
MBLK	Toxaphene			<0.5	ug/L				

Volatile Organics by GCMS by EPA 524.2
Analytical Batch: 1007492 **Analysis Date: 06/30/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	1,1,1,2-Tetrachloroethane		5	5.14	ug/L	103	(70-130)		
LCS2	1,1,1,2-Tetrachloroethane		5	5.09	ug/L	102	(70-130)	20	0.98
MBLK	1,1,1,2-Tetrachloroethane			<0.5	ug/L				
MRL_CHK	1,1,1,2-Tetrachloroethane		0.5	0.470	ug/L	94	(50-150)		
LCS1	1,1,1-Trichloroethane		5	5.06	ug/L	101	(70-130)		
LCS2	1,1,1-Trichloroethane		5	4.79	ug/L	96	(70-130)	20	5.5
MBLK	1,1,1-Trichloroethane			<0.5	ug/L				
MRL_CHK	1,1,1-Trichloroethane		0.5	0.440	ug/L	88	(50-150)		
LCS1	1,1,2,2-Tetrachloroethane		5	5.35	ug/L	107	(70-130)		
LCS2	1,1,2,2-Tetrachloroethane		5	5.26	ug/L	105	(70-130)	20	1.7
MBLK	1,1,2,2-Tetrachloroethane			<0.5	ug/L				
MRL_CHK	1,1,2,2-Tetrachloroethane		0.5	0.530	ug/L	106	(50-150)		
LCS1	1,1,2-Trichloroethane		5	5.21	ug/L	104	(70-130)		
LCS2	1,1,2-Trichloroethane		5	4.87	ug/L	97	(70-130)	20	6.8
MBLK	1,1,2-Trichloroethane			<0.5	ug/L				
MRL_CHK	1,1,2-Trichloroethane		0.5	0.520	ug/L	104	(50-150)		
LCS1	1,1-Dichloroethane		5	4.92	ug/L	98	(70-130)		
LCS2	1,1-Dichloroethane		5	4.70	ug/L	94	(70-130)	20	4.6
MBLK	1,1-Dichloroethane			<0.5	ug/L				
MRL_CHK	1,1-Dichloroethane		0.5	0.480	ug/L	96	(50-150)		
LCS1	1,1-Dichloroethylene		5	5.14	ug/L	103	(70-130)		
LCS2	1,1-Dichloroethylene		5	5.06	ug/L	101	(70-130)	20	1.6
MBLK	1,1-Dichloroethylene			<0.5	ug/L				
MRL_CHK	1,1-Dichloroethylene		0.5	0.590	ug/L	118	(50-150)		
LCS1	1,1-Dichloropropene		5	5.01	ug/L	100	(70-130)		
LCS2	1,1-Dichloropropene		5	4.78	ug/L	96	(70-130)	20	4.7
MBLK	1,1-Dichloropropene			<0.5	ug/L				

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	1,1-Dichloropropene		0.5	0.480	ug/L	96	(50-150)		
LCS1	1,2,3-Trichlorobenzene		5	5.15	ug/L	103	(70-130)		
LCS2	1,2,3-Trichlorobenzene		5	5.27	ug/L	105	(70-130)	20	2.3
MBLK	1,2,3-Trichlorobenzene			<0.5	ug/L				
MRL_CHK	1,2,3-Trichlorobenzene		0.5	0.600	ug/L	120	(50-150)		
LCS1	1,2,3-Trichloropropane		5	4.89	ug/L	98	(70-130)		
LCS2	1,2,3-Trichloropropane		5	4.82	ug/L	96	(70-130)	20	1.4
MBLK	1,2,3-Trichloropropane			<0.5	ug/L				
MRL_CHK	1,2,3-Trichloropropane		0.5	0.540	ug/L	108	(50-150)		
LCS1	1,2,4-Trichlorobenzene		5	4.94	ug/L	99	(70-130)		
LCS2	1,2,4-Trichlorobenzene		5	5.04	ug/L	101	(70-130)	20	2.0
MBLK	1,2,4-Trichlorobenzene			<0.5	ug/L				
MRL_CHK	1,2,4-Trichlorobenzene		0.5	0.560	ug/L	112	(50-150)		
LCS1	1,2,4-Trimethylbenzene		5	5.20	ug/L	104	(70-130)		
LCS2	1,2,4-Trimethylbenzene		5	5.19	ug/L	104	(70-130)	20	0.19
MBLK	1,2,4-Trimethylbenzene			<0.5	ug/L				
MRL_CHK	1,2,4-Trimethylbenzene		0.5	0.420	ug/L	84	(50-150)		
LCS1	1,2-Dichloroethane		5	4.86	ug/L	97	(70-130)		
LCS2	1,2-Dichloroethane		5	4.84	ug/L	97	(70-130)	20	0.41
MBLK	1,2-Dichloroethane			<0.5	ug/L				
MRL_CHK	1,2-Dichloroethane		0.5	0.530	ug/L	106	(50-150)		
LCS1	1,2-Dichloroethane-d4 (S)		5	101	%	101	(70-130)		
LCS2	1,2-Dichloroethane-d4 (S)		5	95.2	%	95	(70-130)		
MBLK	1,2-Dichloroethane-d4 (S)			109	%	109	(70-130)		
MRL_CHK	1,2-Dichloroethane-d4 (S)		5	102	%	102	(70-130)		
MRLLW	1,2-Dichloroethane-d4 (S)		5	103	%	103	(70-130)		
LCS1	1,2-Dichloropropane		5	4.81	ug/L	96	(70-130)		
LCS2	1,2-Dichloropropane		5	4.54	ug/L	91	(70-130)	20	5.8
MBLK	1,2-Dichloropropane			<0.5	ug/L				
MRL_CHK	1,2-Dichloropropane		0.5	0.500	ug/L	100	(50-150)		
LCS1	1,3,5-Trimethylbenzene		5	5.19	ug/L	104	(70-130)		
LCS2	1,3,5-Trimethylbenzene		5	5.21	ug/L	104	(70-130)	20	0.39
MBLK	1,3,5-Trimethylbenzene			<0.5	ug/L				
MRL_CHK	1,3,5-Trimethylbenzene		0.5	0.450	ug/L	90	(50-150)		
LCS1	1,3-Dichloropropane		5	4.81	ug/L	96	(70-130)		
LCS2	1,3-Dichloropropane		5	4.64	ug/L	93	(70-130)	20	3.6
MBLK	1,3-Dichloropropane			<0.5	ug/L				
MRL_CHK	1,3-Dichloropropane		0.5	0.510	ug/L	102	(50-150)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	2,2-Dichloropropane		5	4.66	ug/L	93	(70-130)		
LCS2	2,2-Dichloropropane		5	4.20	ug/L	84	(70-130)	20	10
MBLK	2,2-Dichloropropane			<0.5	ug/L				
MRL_CHK	2,2-Dichloropropane		0.5	0.510	ug/L	102	(50-150)		
LCS1	2-Butanone (MEK)		50	48.2	ug/L	96	(70-130)		
LCS2	2-Butanone (MEK)		50	47.6	ug/L	95	(70-130)	20	1.0
MBLK	2-Butanone (MEK)			<5.0	ug/L				
MRL_CHK	2-Butanone (MEK)		5	5.42	ug/L	108	(50-150)		
LCS1	4-Bromofluorobenzene (S)		5	102	%	102	(70-130)		
LCS2	4-Bromofluorobenzene (S)		5	100	%	100	(70-130)		
MBLK	4-Bromofluorobenzene (S)			96.2	%	96	(70-130)		
MRL_CHK	4-Bromofluorobenzene (S)		5	96.8	%	97	(70-130)		
MRLLW	4-Bromofluorobenzene (S)		5	100	%	100	(70-130)		
LCS1	4-Methyl-2-Pentanone (MIBK)		50	53.1	ug/L	106	(70-130)		
LCS2	4-Methyl-2-Pentanone (MIBK)		50	51.6	ug/L	103	(70-130)	20	2.9
MBLK	4-Methyl-2-Pentanone (MIBK)			<5.0	ug/L				
MRL_CHK	4-Methyl-2-Pentanone (MIBK)		5	4.68	ug/L	94	(50-150)		
LCS1	Benzene		5	5.19	ug/L	104	(70-130)		
LCS2	Benzene		5	4.91	ug/L	98	(70-130)	20	5.5
MBLK	Benzene			<0.5	ug/L				
MRL_CHK	Benzene		0.5	0.510	ug/L	102	(50-150)		
LCS1	Bromobenzene		5	5.12	ug/L	102	(70-130)		
LCS2	Bromobenzene		5	5.00	ug/L	100	(70-130)	20	2.4
MBLK	Bromobenzene			<0.5	ug/L				
MRL_CHK	Bromobenzene		0.5	0.510	ug/L	102	(50-150)		
LCS1	Bromochloromethane		5	5.12	ug/L	102	(70-130)		
LCS2	Bromochloromethane		5	4.85	ug/L	97	(70-130)	20	5.4
MBLK	Bromochloromethane			<0.5	ug/L				
MRL_CHK	Bromochloromethane		0.5	0.530	ug/L	106	(50-150)		
LCS1	Bromodichloromethane		5	4.92	ug/L	98	(70-130)		
LCS2	Bromodichloromethane		5	4.84	ug/L	97	(70-130)	20	1.6
MBLK	Bromodichloromethane			<0.5	ug/L				
MRL_CHK	Bromodichloromethane		0.5	0.480	ug/L	96	(50-150)		
LCS1	Bromoethane		5	5.92	ug/L	118	(70-130)		
LCS2	Bromoethane		5	5.63	ug/L	113	(70-130)	20	5.0
MBLK	Bromoethane			<0.5	ug/L				
MRL_CHK	Bromoethane		0.5	0.490	ug/L	98	(50-150)		
LCS1	Bromoform		5	4.68	ug/L	94	(70-130)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Bromoform		5	4.67	ug/L	93	(70-130)	20	0.21
MBLK	Bromoform			<0.5	ug/L				
MRL_CHK	Bromoform		0.5	0.510	ug/L	102	(50-150)		
LCS1	Bromomethane (Methyl Bromide)		5	5.08	ug/L	102	(70-130)		
LCS2	Bromomethane (Methyl Bromide)		5	5.11	ug/L	102	(70-130)	20	0.59
MBLK	Bromomethane (Methyl Bromide)			<0.5	ug/L				
MRL_CHK	Bromomethane (Methyl Bromide)		0.5	0.600	ug/L	120	(50-150)		
LCS1	Carbon disulfide		5	4.81	ug/L	96	(70-130)		
LCS2	Carbon disulfide		5	4.59	ug/L	92	(70-130)	20	4.7
MBLK	Carbon disulfide			<0.5	ug/L				
MRL_CHK	Carbon disulfide		0.5	0.480	ug/L	96	(50-150)		
LCS1	Carbon Tetrachloride		5	4.88	ug/L	98	(70-130)		
LCS2	Carbon Tetrachloride		5	4.75	ug/L	95	(70-130)	20	2.7
MBLK	Carbon Tetrachloride			<0.5	ug/L				
MRL_CHK	Carbon Tetrachloride		0.5	0.390	ug/L	78	(50-150)		
LCS1	Chlorobenzene		5	4.56	ug/L	91	(70-130)		
LCS2	Chlorobenzene		5	4.78	ug/L	96	(70-130)	20	4.7
MBLK	Chlorobenzene			<0.5	ug/L				
MRL_CHK	Chlorobenzene		0.5	0.480	ug/L	96	(50-150)		
LCS1	Chlorodibromomethane		5	4.51	ug/L	90	(70-130)		
LCS2	Chlorodibromomethane		5	4.55	ug/L	91	(70-130)	20	0.88
MBLK	Chlorodibromomethane			<0.5	ug/L				
MRL_CHK	Chlorodibromomethane		0.5	0.520	ug/L	104	(50-150)		
LCS1	Chloroethane		5	5.09	ug/L	102	(70-130)		
LCS2	Chloroethane		5	5.20	ug/L	104	(70-130)	20	2.1
MBLK	Chloroethane			<0.5	ug/L				
MRL_CHK	Chloroethane		0.5	0.610	ug/L	122	(50-150)		
LCS1	Chloroform (Trichloromethane)		5	4.91	ug/L	98	(70-130)		
LCS2	Chloroform (Trichloromethane)		5	4.67	ug/L	93	(70-130)	20	5.0
MBLK	Chloroform (Trichloromethane)			<0.5	ug/L				
MRL_CHK	Chloroform (Trichloromethane)		0.5	0.500	ug/L	100	(50-150)		
LCS1	Chloromethane(Methyl Chloride)		5	5.03	ug/L	101	(70-130)		
LCS2	Chloromethane(Methyl Chloride)		5	4.98	ug/L	100	(70-130)	20	1
MBLK	Chloromethane(Methyl Chloride)			<0.5	ug/L				
MRL_CHK	Chloromethane(Methyl Chloride)		0.5	0.670	ug/L	134	(50-150)		
LCS1	cis-1,2-Dichloroethylene		5	4.90	ug/L	98	(70-130)		
LCS2	cis-1,2-Dichloroethylene		5	4.62	ug/L	92	(70-130)	20	5.9
MBLK	cis-1,2-Dichloroethylene			<0.5	ug/L				

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MRL_CHK	cis-1,2-Dichloroethylene		0.5	0.470	ug/L	94	(50-150)		
LCS1	cis-1,3-Dichloropropene		5	4.57	ug/L	91	(70-130)		
LCS2	cis-1,3-Dichloropropene		5	4.59	ug/L	92	(70-130)	20	0.44
MBLK	cis-1,3-Dichloropropene			<0.5	ug/L				
MRL_CHK	cis-1,3-Dichloropropene		0.5	0.570	ug/L	114	(50-150)		
LCS1	Dibromomethane		5	4.85	ug/L	97	(70-130)		
LCS2	Dibromomethane		5	4.64	ug/L	93	(70-130)	20	4.4
MBLK	Dibromomethane			<0.5	ug/L				
MRL_CHK	Dibromomethane		0.5	0.510	ug/L	102	(50-150)		
LCS1	Dichlorodifluoromethane		5	5.30	ug/L	106	(70-130)		
LCS2	Dichlorodifluoromethane		5	5.05	ug/L	101	(70-130)	20	4.8
MBLK	Dichlorodifluoromethane			<0.5	ug/L				
MRL_CHK	Dichlorodifluoromethane		0.5	0.570	ug/L	114	(50-150)		
LCS1	Dichloromethane		5	5.15	ug/L	103	(70-130)		
LCS2	Dichloromethane		5	4.84	ug/L	97	(70-130)	20	6.2
MBLK	Dichloromethane			<0.5	ug/L				
MRL_CHK	Dichloromethane		0.5	0.430	ug/L	86	(50-150)		
LCS1	Di-isopropyl ether		5	4.89	ug/L	98	(70-130)		
LCS2	Di-isopropyl ether		5	4.67	ug/L	93	(70-130)	20	4.6
MBLK	Di-isopropyl ether			<3.0	ug/L				
MRL_CHK	Di-isopropyl ether		0.5	0.530	ug/L	106	(50-150)		
LCS1	Ethyl benzene		5	4.98	ug/L	100	(70-130)		
LCS2	Ethyl benzene		5	5.01	ug/L	100	(70-130)	20	0.60
MBLK	Ethyl benzene			<0.5	ug/L				
MRL_CHK	Ethyl benzene		0.5	0.440	ug/L	88	(50-150)		
LCS1	Hexachlorobutadiene		5	4.87	ug/L	97	(70-130)		
LCS2	Hexachlorobutadiene		5	5.20	ug/L	104	(70-130)	20	6.5
MBLK	Hexachlorobutadiene			<0.5	ug/L				
MRL_CHK	Hexachlorobutadiene		0.5	0.690	ug/L	138	(50-150)		
LCS1	Isopropylbenzene		5	5.17	ug/L	103	(70-130)		
LCS2	Isopropylbenzene		5	4.90	ug/L	98	(70-130)	20	5.4
MBLK	Isopropylbenzene			<0.5	ug/L				
MRL_CHK	Isopropylbenzene		0.5	0.470	ug/L	94	(50-150)		
LCS1	m,p-Xylenes		10	10.1	ug/L	101	(70-130)		
LCS2	m,p-Xylenes		10	10.1	ug/L	101	(70-130)	20	0.0
MBLK	m,p-Xylenes			<0.5	ug/L				
MRL_CHK	m,p-Xylenes		1	0.830	ug/L	83	(50-150)		
MRLLW	m,p-Xylenes		0.5	0.460	ug/L	92	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	m-Dichlorobenzene (1,3-DCB)		5	5.18	ug/L	104	(70-130)		
LCS2	m-Dichlorobenzene (1,3-DCB)		5	4.97	ug/L	99	(70-130)	20	4.1
MBLK	m-Dichlorobenzene (1,3-DCB)			<0.5	ug/L				
MRL_CHK	m-Dichlorobenzene (1,3-DCB)		0.5	0.520	ug/L	104	(50-150)		
LCS1	Methyl Tert-butyl ether (MTBE)		5	4.83	ug/L	97	(70-130)		
LCS2	Methyl Tert-butyl ether (MTBE)		5	4.65	ug/L	93	(70-130)	20	3.8
MBLK	Methyl Tert-butyl ether (MTBE)			<0.5	ug/L				
MRL_CHK	Methyl Tert-butyl ether (MTBE)		0.5	0.500	ug/L	100	(50-150)		
LCS1	Naphthalene		5	5.05	ug/L	101	(70-130)		
LCS2	Naphthalene		5	5.46	ug/L	109	(70-130)	20	7.8
MBLK	Naphthalene			<0.5	ug/L				
MRL_CHK	Naphthalene		0.5	0.580	ug/L	116	(50-150)		
LCS1	n-Butylbenzene		5	5.15	ug/L	103	(70-130)		
LCS2	n-Butylbenzene		5	5.21	ug/L	104	(70-130)	20	1.2
MBLK	n-Butylbenzene			<0.5	ug/L				
MRL_CHK	n-Butylbenzene		0.5	0.520	ug/L	104	(50-150)		
LCS1	n-Propylbenzene		5	5.24	ug/L	105	(70-130)		
LCS2	n-Propylbenzene		5	4.89	ug/L	98	(70-130)	20	6.9
MBLK	n-Propylbenzene			<0.5	ug/L				
MRL_CHK	n-Propylbenzene		0.5	0.520	ug/L	104	(50-150)		
LCS1	o-Chlorotoluene		5	5.27	ug/L	105	(70-130)		
LCS2	o-Chlorotoluene		5	4.81	ug/L	96	(70-130)	20	9.1
MBLK	o-Chlorotoluene			<0.5	ug/L				
MRL_CHK	o-Chlorotoluene		0.5	0.490	ug/L	98	(50-150)		
LCS1	o-Dichlorobenzene (1,2-DCB)		5	5.08	ug/L	102	(70-130)		
LCS2	o-Dichlorobenzene (1,2-DCB)		5	5.07	ug/L	101	(70-130)	20	0.20
MBLK	o-Dichlorobenzene (1,2-DCB)			<0.5	ug/L				
MRL_CHK	o-Dichlorobenzene (1,2-DCB)		0.5	0.590	ug/L	118	(50-150)		
LCS1	o-Xylene		5	4.72	ug/L	94	(70-130)		
LCS2	o-Xylene		5	4.76	ug/L	95	(70-130)	20	0.84
MBLK	o-Xylene			<0.5	ug/L				
MRL_CHK	o-Xylene		0.5	0.440	ug/L	88	(50-150)		
LCS1	p-Chlorotoluene		5	5.17	ug/L	103	(70-130)		
LCS2	p-Chlorotoluene		5	5.01	ug/L	100	(70-130)	20	3.1
MBLK	p-Chlorotoluene			<0.5	ug/L				
MRL_CHK	p-Chlorotoluene		0.5	0.500	ug/L	100	(50-150)		
LCS1	p-Dichlorobenzene (1,4-DCB)		5	5.19	ug/L	104	(70-130)		
LCS2	p-Dichlorobenzene (1,4-DCB)		5	4.98	ug/L	100	(70-130)	20	4.1

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	p-Dichlorobenzene (1,4-DCB)			<0.5	ug/L				
MRL_CHK	p-Dichlorobenzene (1,4-DCB)		0.5	0.540	ug/L	108	(50-150)		
LCS1	p-Isopropyltoluene		5	5.18	ug/L	104	(70-130)		
LCS2	p-Isopropyltoluene		5	4.90	ug/L	98	(70-130)	20	5.6
MBLK	p-Isopropyltoluene			<0.5	ug/L				
MRL_CHK	p-Isopropyltoluene		0.5	0.430	ug/L	86	(50-150)		
LCS1	sec-Butylbenzene		5	5.27	ug/L	105	(70-130)		
LCS2	sec-Butylbenzene		5	5.20	ug/L	104	(70-130)	20	1.3
MBLK	sec-Butylbenzene			<0.5	ug/L				
MRL_CHK	sec-Butylbenzene		0.5	0.460	ug/L	92	(50-150)		
LCS1	Styrene		5	5.17	ug/L	103	(70-130)		
LCS2	Styrene		5	5.23	ug/L	105	(70-130)	20	1.1
MBLK	Styrene			<0.5	ug/L				
MRL_CHK	Styrene		0.5	0.400	ug/L	80	(50-150)		
LCS1	tert-amyl Methyl Ether		5	4.76	ug/L	95	(70-130)		
LCS2	tert-amyl Methyl Ether		5	4.61	ug/L	92	(70-130)	20	3.2
MBLK	tert-amyl Methyl Ether			<3.0	ug/L				
MRL_CHK	tert-amyl Methyl Ether		0.5	0.490	ug/L	98	(50-150)		
LCS1	tert-Butyl Ethyl Ether		5	4.73	ug/L	95	(70-130)		
LCS2	tert-Butyl Ethyl Ether		5	4.59	ug/L	92	(70-130)	20	3.0
MBLK	tert-Butyl Ethyl Ether			<3.0	ug/L				
MRL_CHK	tert-Butyl Ethyl Ether		0.5	0.500	ug/L	100	(50-150)		
LCS1	tert-Butylbenzene		5	4.95	ug/L	99	(70-130)		
LCS2	tert-Butylbenzene		5	4.74	ug/L	95	(70-130)	20	4.3
MBLK	tert-Butylbenzene			<0.5	ug/L				
MRL_CHK	tert-Butylbenzene		0.5	0.450	ug/L	90	(50-150)		
LCS1	Tetrachloroethylene (PCE)		5	4.82	ug/L	96	(70-130)		
LCS2	Tetrachloroethylene (PCE)		5	4.76	ug/L	95	(70-130)	20	1.3
MBLK	Tetrachloroethylene (PCE)			<0.5	ug/L				
MRL_CHK	Tetrachloroethylene (PCE)		0.5	0.480	ug/L	96	(50-150)		
LCS1	Toluene		5	5.07	ug/L	101	(70-130)		
LCS2	Toluene		5	4.81	ug/L	96	(70-130)	20	5.3
MBLK	Toluene			<0.5	ug/L				
MRL_CHK	Toluene		0.5	0.500	ug/L	100	(50-150)		
LCS1	Toluene-d8 (S)		5	99.0	%	99	(70-130)		
LCS2	Toluene-d8 (S)		5	97.8	%	98	(70-130)		
MBLK	Toluene-d8 (S)			96.8	%	97	(70-130)		
MRL_CHK	Toluene-d8 (S)		5	92.6	%	93	(70-130)		

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRLLW	Toluene-d8 (S)		5	99.6	%	100	(70-130)		
LCS1	trans-1,2-Dichloroethylene		5	4.81	ug/L	96	(70-130)		
LCS2	trans-1,2-Dichloroethylene		5	4.75	ug/L	95	(70-130)	20	1.3
MBLK	trans-1,2-Dichloroethylene			<0.5	ug/L				
MRL_CHK	trans-1,2-Dichloroethylene		0.5	0.540	ug/L	108	(50-150)		
LCS1	trans-1,3-Dichloropropene		5	4.69	ug/L	94	(70-130)		
LCS2	trans-1,3-Dichloropropene		5	4.44	ug/L	89	(70-130)	20	5.5
MBLK	trans-1,3-Dichloropropene			<0.5	ug/L				
MRL_CHK	trans-1,3-Dichloropropene		0.5	0.600	ug/L	120	(50-150)		
LCS1	Trichloroethylene (TCE)		5	4.95	ug/L	99	(70-130)		
LCS2	Trichloroethylene (TCE)		5	4.83	ug/L	97	(70-130)	20	2.5
MBLK	Trichloroethylene (TCE)			<0.5	ug/L				
MRL_CHK	Trichloroethylene (TCE)		0.5	0.530	ug/L	106	(50-150)		
LCS1	Trichlorofluoromethane		5	5.12	ug/L	102	(70-130)		
LCS2	Trichlorofluoromethane		5	4.86	ug/L	97	(70-130)	20	5.2
MBLK	Trichlorofluoromethane			<0.5	ug/L				
MRL_CHK	Trichlorofluoromethane		0.5	0.530	ug/L	106	(50-150)		
LCS1	Trichlorotrifluoroethane(Freon		5	5.11	ug/L	102	(70-130)		
LCS2	Trichlorotrifluoroethane(Freon		5	4.80	ug/L	96	(70-130)	20	6.3
MBLK	Trichlorotrifluoroethane(Freon			<0.5	ug/L				
MRL_CHK	Trichlorotrifluoroethane(Freon		0.5	0.530	ug/L	106	(50-150)		
LCS1	Vinyl chloride (VC)		5	4.82	ug/L	96	(70-130)		
LCS2	Vinyl chloride (VC)		5	4.69	ug/L	94	(70-130)	20	2.7
MBLK	Vinyl chloride (VC)			<0.3	ug/L				
MRL_CHK	Vinyl chloride (VC)		0.5	0.540	ug/L	108	(50-150)		
MRLLW	Vinyl chloride (VC)		0.25	0.310	ug/L	124	(50-150)		

Glyphosate by EPA 547

Analytical Batch: 1007557 **Analysis Date: 06/30/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCCH	Glyphosate		25	20.3	ug/L	81	(80-120)		
CCCM	Glyphosate		10	8.52	ug/L	85	(80-120)		
LCS1	Glyphosate		10	9.09	ug/L	91	(70-130)		
MBLK	Glyphosate			<3	ug/L				
MRL_CHK	Glyphosate		6	5.69	ug/L	95	(50-150)		
MS_201704050383	Glyphosate	ND	10	9.26	ug/L	93	(70-130)		
MS2_201706290318	Glyphosate	ND	10	8.94	ug/L	89	(70-130)		
MSD_201704050383	Glyphosate	ND	10	9.00	ug/L	90	(70-130)	20	2.9

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
Fluoride by SM 4500F-C									
Analytical Batch: 1007639						**Analysis Date: 07/05/2017**			
LCS1	Fluoride		1	1.02	mg/L	102	(90-110)		
LCS2	Fluoride		1	1.04	mg/L	104	(90-110)	20	1.9
MBLK	Fluoride			<0.05	mg/L				
MRL_CHK	Fluoride		0.05	0.0521	mg/L	104	(50-150)		
MS_201706290633	Fluoride	0.66	1	1.62	mg/L	96	(80-120)		
MS_201706290635	Fluoride	0.57	1	1.55	mg/L	98	(80-120)		
MSD_201706290633	Fluoride	0.66	1	1.63	mg/L	98	(80-120)	20	0.62
MSD_201706290635	Fluoride	0.57	1	1.56	mg/L	99	(80-120)	20	0.64
Diquat and Paraquat by EPA 549.2									
Analytical Batch: 1007653						**Analysis Date: 07/03/2017**			
CCCH	Diquat		10	10.2	ug/L	102	(80-120)		
CCCL	Diquat		0.4	0.494	ug/L	123	(50-150)		
CCCM	Diquat		4	4.01	ug/L	100	(80-120)		
LCS1	Diquat		5	3.79	ug/L	76	(70-130)		
MBLK	Diquat			<0.4	ug/L				
MRLLW	Diquat		0.4	0.385	ug/L	96	(50-150)		
MS_201706280603	Diquat	ND	5	3.26	ug/L	65	(70-130)		
MS2_201703210330	Diquat	ND	5	3.39	ug/L	68	(70-130)		
MSD_201706280603	Diquat	ND	5	3.23	ug/L	65	(70-130)	20	0.92
CCCH	Paraquat		10	9.74	ug/L	97	(80-120)		
CCCL	Paraquat		2	2.02	ug/L	101	(50-150)		
CCCM	Paraquat		4	3.83	ug/L	96	(80-120)		
LCS1	Paraquat		5	3.66	ug/L	73	(70-130)		
MBLK	Paraquat			<2	ug/L				
MRL_CHK	Paraquat		2	1.44	ug/L	72	(50-150)		
MS_201706280603	Paraquat	ND	5	3.35	ug/L	67	(70-130)		
MS2_201703210330	Paraquat	ND	5	3.41	ug/L	68	(70-130)		
MSD_201706280603	Paraquat	ND	5	3.29	ug/L	66	(70-130)	20	1.8
Aldicarbs by EPA 531.2									
Analytical Batch: 1007655						**Analysis Date: 07/03/2017**			
CCCH	3-Hydroxycarbofuran		25	26.7	ug/L	107	(70-130)		
CCCM	3-Hydroxycarbofuran		10	11.0	ug/L	110	(70-130)		
LCS2	3-Hydroxycarbofuran		5	5.39	ug/L	108	(70-130)		
MBLK	3-Hydroxycarbofuran			<0.167	ug/L				

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	3-Hydroxycarbofuran		0.5	0.548	ug/L	110	(50-150)		
MS1_201706270201	3-Hydroxycarbofuran	ND	5	5.67	ug/L	113	(70-130)		
MSD1_201706270201	3-Hydroxycarbofuran	ND	5	5.50	ug/L	110	(70-130)	20	2.9
CCCH	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		91.4	%	91	(70-130)		
CCCM	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		94.0	%	94	(70-130)		
LCS2	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		95.7	%	96	(70-130)		
MBLK	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		99.2	%	99	(70-130)		
MRL_CHK	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		94.6	%	95	(70-130)		
MS1_201706270201	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		94.5	%	95	(70-130)		
MSD1_201706270201	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		93.6	%	94	(70-130)		
CCCH	Aldicarb (Temik)		25	22.5	ug/L	90	(70-130)		
CCCM	Aldicarb (Temik)		10	9.41	ug/L	94	(70-130)		
LCS2	Aldicarb (Temik)		5	5.15	ug/L	103	(70-130)		
MBLK	Aldicarb (Temik)			<0.167	ug/L				
MRL_CHK	Aldicarb (Temik)		0.5	0.422	ug/L	84	(50-150)		
MS1_201706270201	Aldicarb (Temik)	ND	5	5.36	ug/L	107	(70-130)		
MSD1_201706270201	Aldicarb (Temik)	ND	5	5.46	ug/L	109	(70-130)	20	1.9
CCCH	Aldicarb sulfone		25	26.8	ug/L	107	(70-130)		
CCCM	Aldicarb sulfone		10	11.0	ug/L	110	(70-130)		
LCS2	Aldicarb sulfone		5	5.72	ug/L	114	(70-130)		
MBLK	Aldicarb sulfone			<0.167	ug/L				
MRL_CHK	Aldicarb sulfone		0.5	0.532	ug/L	106	(50-150)		
MS1_201706270201	Aldicarb sulfone	ND	5	5.65	ug/L	113	(70-130)		
MSD1_201706270201	Aldicarb sulfone	ND	5	5.62	ug/L	112	(70-130)	20	0.53
CCCH	Aldicarb sulfoxide		25	25.4	ug/L	102	(70-130)		
CCCM	Aldicarb sulfoxide		10	10.3	ug/L	103	(70-130)		
LCS2	Aldicarb sulfoxide		5	4.66	ug/L	93	(70-130)		
MBLK	Aldicarb sulfoxide			<0.167	ug/L				
MRL_CHK	Aldicarb sulfoxide		0.5	0.470	ug/L	94	(50-150)		
MS1_201706270201	Aldicarb sulfoxide	ND	5	5.64	ug/L	113	(70-130)		
MSD1_201706270201	Aldicarb sulfoxide	ND	5	5.66	ug/L	113	(70-130)	20	0.35
CCCH	Baygon		25	25.4	ug/L	101	(70-130)		
CCCM	Baygon		10	10.6	ug/L	107	(70-130)		
LCS2	Baygon		5	5.24	ug/L	105	(70-130)		
MBLK	Baygon			<0.167	ug/L				
MRL_CHK	Baygon		0.5	0.567	ug/L	113	(50-150)		
MS1_201706270201	Baygon	ND	5	5.27	ug/L	105	(70-130)		
MSD1_201706270201	Baygon	ND	5	5.38	ug/L	108	(70-130)	20	2.3

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCCH	Carbaryl		25	26.5	ug/L	106	(70-130)		
CCCM	Carbaryl		10	10.6	ug/L	106	(70-130)		
LCS2	Carbaryl		5	5.29	ug/L	106	(70-130)		
MBLK	Carbaryl			<0.167	ug/L				
MRL_CHK	Carbaryl		0.5	0.562	ug/L	112	(50-150)		
MS1_201706270201	Carbaryl	ND	5	5.28	ug/L	106	(70-130)		
MSD1_201706270201	Carbaryl	ND	5	5.39	ug/L	108	(70-130)	20	2.1
CCCH	Carbofuran (Furadan)		25	25.6	ug/L	103	(70-130)		
CCCM	Carbofuran (Furadan)		10	10.4	ug/L	104	(70-130)		
LCS2	Carbofuran (Furadan)		5	5.23	ug/L	105	(70-130)		
MBLK	Carbofuran (Furadan)			<0.167	ug/L				
MRL_CHK	Carbofuran (Furadan)		0.5	0.559	ug/L	112	(50-150)		
MS1_201706270201	Carbofuran (Furadan)	ND	5	5.25	ug/L	105	(70-130)		
MSD1_201706270201	Carbofuran (Furadan)	ND	5	5.26	ug/L	105	(70-130)	20	0.19
CCCH	Methiocarb		25	24.7	ug/L	99	(70-130)		
CCCM	Methiocarb		10	10.1	ug/L	101	(70-130)		
LCS2	Methiocarb		5	4.94	ug/L	99	(70-130)		
MBLK	Methiocarb			<0.167	ug/L				
MRL_CHK	Methiocarb		0.5	0.611	ug/L	122	(50-150)		
MS1_201706270201	Methiocarb	ND	5	4.78	ug/L	96	(70-130)		
MSD1_201706270201	Methiocarb	ND	5	4.88	ug/L	98	(70-130)	20	2.1
CCCH	Methomyl		25	25.3	ug/L	101	(70-130)		
CCCM	Methomyl		10	10.2	ug/L	102	(70-130)		
LCS2	Methomyl		5	5.32	ug/L	106	(70-130)		
MBLK	Methomyl			<0.167	ug/L				
MRL_CHK	Methomyl		0.5	0.422	ug/L	84	(50-150)		
MS1_201706270201	Methomyl	ND	5	5.67	ug/L	113	(70-130)		
MSD1_201706270201	Methomyl	ND	5	5.64	ug/L	113	(70-130)	20	0.53
CCCH	Oxamyl (Vydate)		25	26.5	ug/L	106	(70-130)		
CCCM	Oxamyl (Vydate)		10	10.8	ug/L	108	(70-130)		
LCS2	Oxamyl (Vydate)		5	5.44	ug/L	109	(70-130)		
MBLK	Oxamyl (Vydate)			<0.167	ug/L				
MRL_CHK	Oxamyl (Vydate)		0.5	0.533	ug/L	107	(50-150)		
MS1_201706270201	Oxamyl (Vydate)	ND	5	5.58	ug/L	112	(70-130)		
MSD1_201706270201	Oxamyl (Vydate)	ND	5	5.56	ug/L	111	(70-130)	20	0.36

ICP Metals by EPA 200.7

Analytical Batch: 1007694 **Analysis Date: 07/03/2017**

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Calcium Total ICAP		50	50.1	mg/L	100	(85-115)		
LCS2	Calcium Total ICAP		50	50.1	mg/L	100	(85-115)	20	0.0
MBLK	Calcium Total ICAP			<0.5	mg/L				
MRL_CHK	Calcium Total ICAP		1	1.02	mg/L	102	(50-150)		
MS_201706201067	Calcium Total ICAP	55	50	102	mg/L	95	(70-130)		
MS2_201706220314	Calcium Total ICAP	ND	50	48.6	mg/L	97	(70-130)		
MSD_201706201067	Calcium Total ICAP	55	50	102	mg/L	95	(70-130)	20	0.0
MSD2_201706220314	Calcium Total ICAP	ND	50	49.0	mg/L	98	(70-130)	20	0.82

EPA Method 504.1 by EPA 504.1

Analytical Batch: 1008226 **Analysis Date: 07/05/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCCH	1,2,3-Trichloropropane		1.3	1.17	ug/L	94	(70-130)		
CCCM2	1,2,3-Trichloropropane		0.25	0.282	ug/L	113	(70-130)		
DUP_201706290362	1,2,3-Trichloropropane	0.54		0.548	ug/L		(0-20)	20	1.5
LCS2	1,2,3-Trichloropropane		0.2	0.199	ug/L	100	(70-130)		
MBLK	1,2,3-Trichloropropane			<0.04	ug/L				
MRL_CHK	1,2,3-Trichloropropane		0.05	0.0522	ug/L	104	(60-140)		
MRLLW	1,2,3-Trichloropropane		0.04	0.0374	ug/L	94	(60-140)		
MS_201706290356	1,2,3-Trichloropropane	0.16	1.3	1.31	ug/L	92	(65-135)		
CCCH	1,2-Dibromo-3-chloropropane		0.25	0.245	ug/L	98	(70-130)		
CCCM2	1,2-Dibromo-3-chloropropane		0.05	0.0561	ug/L	112	(70-130)		
DUP_201706290362	1,2-Dibromo-3-chloropropane	0.20		0.198	ug/L		(0-20)	20	0.90
LCS2	1,2-Dibromo-3-chloropropane		0.2	0.191	ug/L	96	(70-130)		
MBLK	1,2-Dibromo-3-chloropropane			<0.01	ug/L				
MRL_CHK	1,2-Dibromo-3-chloropropane		0.01	0.0100	ug/L	100	(60-140)		
MRLLW	1,2-Dibromo-3-chloropropane		0.008	0.00770	ug/L	96	(60-140)		
MS_201706290356	1,2-Dibromo-3-chloropropane	0.018	0.25	0.262	ug/L	98	(65-135)		
CCCH	1,2-Dibromoethane		0.25	0.251	ug/L	100	(70-130)		
CCCM2	1,2-Dibromoethane		0.05	0.0607	ug/L	121	(70-130)		
DUP_201706290362	1,2-Dibromoethane	ND		ND	ug/L		(0-20)		
LCS2	1,2-Dibromoethane		0.2	0.198	ug/L	99	(70-130)		
MBLK	1,2-Dibromoethane			<0.01	ug/L				
MRL_CHK	1,2-Dibromoethane		0.01	0.00700	ug/L	70	(60-140)		
MRLLW	1,2-Dibromoethane		0.008	0.00550	ug/L	69	(60-140)		
MS_201706290356	1,2-Dibromoethane	ND	0.25	0.260	ug/L	104	(65-135)		
CCCH	1,2-Dibromopropane (S)			105	%	105	(60-140)		
CCCM2	1,2-Dibromopropane (S)			114	%	114	(60-140)		
DUP_201706290362	1,2-Dibromopropane (S)			104	%	104	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	1,2-Dibromopropane (S)			99.8	%	100	(60-140)		
MBLK	1,2-Dibromopropane (S)			101	%	101	(60-140)		
MRL_CHK	1,2-Dibromopropane (S)			93.8	%	94	(60-140)		
MRLLW	1,2-Dibromopropane (S)			95.1	%	95	(60-140)		
MS_201706290356	1,2-Dibromopropane (S)			99.5	%	100	(60-140)		

Mercury Total by EPA 245.1
Analytical Batch: 1008807 **Analysis Date: 07/07/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Mercury		1.5	1.52	ug/L	102	(90-110)		
LCS2	Mercury		1.5	1.55	ug/L	103	(90-110)	20	2.0
MBLK	Mercury			<0.1	ug/L				
MRL_CHK	Mercury		0.2	0.237	ug/L	118	(50-150)		
MS_201706290131	Mercury	ND	1.5	1.45	ug/L	97	(70-130)		
MS_201706290318	Mercury	ND	1.5	1.73	ug/L	115	(70-130)		
MSD_201706290131	Mercury	ND	1.5	1.43	ug/L	96	(70-130)	20	1.4
MSD_201706290318	Mercury	ND	1.5	1.52	ug/L	102	(70-130)	20	13

Cyanide by manual distillation by EPA 335.4
Analytical Batch: 1009012 **Analysis Date: 07/07/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Cyanide by manual distillation		0.1	0.0989	mg/L	99	(90-110)		
LCS2	Cyanide by manual distillation		0.1	0.100	mg/L	100	(90-110)	20	1.1
MBLK	Cyanide by manual distillation			<0.0025	mg/L				
MRL_CHK	Cyanide by manual distillation		0.005	0.00500	mg/L	100	(50-150)		
MS_201703210330	Cyanide by manual distillation	ND	0.1	0.0918	mg/L	92	(90-110)		
MS_201706280369	Cyanide by manual distillation	0.027	0.1	0.117	mg/L	91	(90-110)		
MSD_201703210330	Cyanide by manual distillation	ND	0.1	0.0947	mg/L	95	(90-110)	20	3.1
MSD_201706280369	Cyanide by manual distillation	0.027	0.1	0.121	mg/L	95	(90-110)	20	3.4

Endothall by EPA 548.1
Prep Batch: 1007409 Analytical Batch: 1009223 **Analysis Date: 07/07/2017**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Endothall		25	25.3	ug/L	101	(66-117)		
MBLK	Endothall			<5	ug/L				
MRL_CHK	Endothall		5	5.70	ug/L	114	(50-150)		
MS_201706290463	Endothall	ND	37.5	24.9	ug/L	100	(66-117)		
MS_2ND_201706160185	Endothall	ND	25	25.0	ug/L	100	(66-117)		
MSD_201706290463	Endothall	ND	37.5	24.8	ug/L	99	(66-117)	30	0.40

Chlorophenoxy Herbicides by EPA 515.4
Prep Batch: 1008570 Analytical Batch: 1009291 **Analysis Date: 07/11/2017**

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCC3	2,4,5-T		4	3.79	ug/L	95	(70-130)		
CCCH	2,4,5-T		4	3.99	ug/L	100	(70-130)		
CCCM	2,4,5-T		1	0.931	ug/L	93	(70-130)		
MBLK	2,4,5-T			<0.066	ug/L				
MRL_CHK	2,4,5-T		0.2	0.226	ug/L	113	(50-150)		
MS1_201706270201	2,4,5-T	ND	3	2.96	ug/L	99	(70-130)		
MSD1_201706270201	2,4,5-T	ND	3	2.89	ug/L	96	(70-130)	30	2.7
CCC3	2,4,5-TP (Silvex)		4	3.79	ug/L	95	(70-130)		
CCCH	2,4,5-TP (Silvex)		4	3.98	ug/L	100	(70-130)		
CCCM	2,4,5-TP (Silvex)		1	0.909	ug/L	91	(70-130)		
MBLK	2,4,5-TP (Silvex)			<0.066	ug/L				
MRL_CHK	2,4,5-TP (Silvex)		0.2	0.210	ug/L	105	(50-150)		
MS1_201706270201	2,4,5-TP (Silvex)	ND	3	2.91	ug/L	97	(70-130)		
MSD1_201706270201	2,4,5-TP (Silvex)	ND	3	2.89	ug/L	96	(70-130)	30	0.69
CCC3	2,4-D		2	1.85	ug/L	93	(70-130)		
CCCH	2,4-D		2	1.82	ug/L	91	(70-130)		
CCCM	2,4-D		0.5	0.415	ug/L	83	(70-130)		
MBLK	2,4-D			<0.033	ug/L				
MRL_CHK	2,4-D		0.1	0.0951	ug/L	95	(50-150)		
MS1_201706270201	2,4-D	ND	1.5	1.43	ug/L	96	(70-130)		
MSD1_201706270201	2,4-D	ND	1.5	1.41	ug/L	94	(70-130)	30	1.4
CCC3	2,4-DB		40	39.2	ug/L	98	(70-130)		
CCCH	2,4-DB		40	40.3	ug/L	101	(70-130)		
CCCM	2,4-DB		10	8.92	ug/L	89	(70-130)		
MBLK	2,4-DB			<0.666	ug/L				
MRL_CHK	2,4-DB		2	1.88	ug/L	94	(50-150)		
MS1_201706270201	2,4-DB	ND	30	30.8	ug/L	103	(70-130)		
MSD1_201706270201	2,4-DB	ND	30	31.1	ug/L	104	(70-130)	30	0.97
CCC3	2,4-Dichlorophenyl acetic acid (S)			101	%	101	(70-130)		
CCCH	2,4-Dichlorophenyl acetic acid (S)			94.7	%	95	(70-130)		
CCCM	2,4-Dichlorophenyl acetic acid (S)			98.6	%	99	(70-130)		
MBLK	2,4-Dichlorophenyl acetic acid (S)			93.3	%	93	(70-130)		
MRL_CHK	2,4-Dichlorophenyl acetic acid (S)			99.2	%	99	(70-130)		
MS1_201706270201	2,4-Dichlorophenyl acetic acid (S)			105	%	105	(70-130)		
MSD1_201706270201	2,4-Dichlorophenyl acetic acid (S)			79.6	%	80	(70-130)		
CCC3	3,5-Dichlorobenzoic acid		10	9.93	ug/L	99	(70-130)		
CCCH	3,5-Dichlorobenzoic acid		10	10.0	ug/L	100	(70-130)		
CCCM	3,5-Dichlorobenzoic acid		2.5	2.39	ug/L	96	(70-130)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	3,5-Dichlorobenzoic acid			<0.166	ug/L				
MRL_CHK	3,5-Dichlorobenzoic acid		0.5	0.505	ug/L	101	(50-150)		
MS1_201706270201	3,5-Dichlorobenzoic acid	ND	7.5	7.66	ug/L	102	(70-130)		
MSD1_201706270201	3,5-Dichlorobenzoic acid	ND	7.5	7.43	ug/L	99	(70-130)	30	3.0
CCC3	4,4-Dibromooctafluorobiphenyl (I)			101	%	101	(70-130)		
CCCH	4,4-Dibromooctafluorobiphenyl (I)			94.8	%	95	(50-150)		
CCCM	4,4-Dibromooctafluorobiphenyl (I)			98.8	%	99	(50-150)		
MBLK	4,4-Dibromooctafluorobiphenyl (I)			98.9	%	99	(50-150)		
MRL_CHK	4,4-Dibromooctafluorobiphenyl (I)			101	%	101	(50-150)		
MS1_201706270201	4,4-Dibromooctafluorobiphenyl (I)			95.4	%	95	(50-150)		
MSD1_201706270201	4,4-Dibromooctafluorobiphenyl (I)			95.0	%	95	(50-150)		
CCC3	Acifluorfen		4	3.94	ug/L	99	(70-130)		
CCCH	Acifluorfen		4	3.98	ug/L	99	(70-130)		
CCCM	Acifluorfen		1	0.919	ug/L	92	(70-130)		
MBLK	Acifluorfen			<0.066	ug/L				
MRL_CHK	Acifluorfen		0.2	0.221	ug/L	111	(50-150)		
MS1_201706270201	Acifluorfen	ND	3	2.90	ug/L	97	(70-130)		
MSD1_201706270201	Acifluorfen	ND	3	2.97	ug/L	99	(70-130)	30	2.4
CCC3	Bentazon		10	9.48	ug/L	95	(70-130)		
CCCH	Bentazon		10	8.97	ug/L	90	(70-130)		
CCCM	Bentazon		2.5	2.22	ug/L	89	(70-130)		
MBLK	Bentazon			<0.166	ug/L				
MRL_CHK	Bentazon		0.5	0.515	ug/L	103	(50-150)		
MS1_201706270201	Bentazon	ND	7.5	7.13	ug/L	95	(70-130)		
MSD1_201706270201	Bentazon	ND	7.5	6.79	ug/L	91	(70-130)	30	4.9
CCC3	Dalapon		20	21.8	ug/L	109	(70-130)		
CCCH	Dalapon		20	21.9	ug/L	109	(70-130)		
CCCM	Dalapon		5	4.78	ug/L	96	(70-130)		
MBLK	Dalapon			<0.333	ug/L				
MRL_CHK	Dalapon		1	1.11	ug/L	111	(50-150)		
MS1_201706270201	Dalapon	ND	15	16.3	ug/L	109	(70-130)		
MSD1_201706270201	Dalapon	ND	15	16.2	ug/L	108	(70-130)	30	0.62
CCC3	Dicamba		2	2.04	ug/L	102	(70-130)		
CCCH	Dicamba		2	1.88	ug/L	94	(70-130)		
CCCM	Dicamba		0.5	0.449	ug/L	90	(70-130)		
MBLK	Dicamba			<0.033	ug/L				
MRL_CHK	Dicamba		0.1	0.0969	ug/L	97	(50-150)		
MS1_201706270201	Dicamba	ND	1.5	1.54	ug/L	103	(70-130)		

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Laboratory QC

Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

Pural Water Specialty Company

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD1_201706270201	Dicamba	ND	1.5	1.52	ug/L	102	(70-130)	30	1.3
CCC3	Dichlorprop		10	10.4	ug/L	104	(70-130)		
CCCH	Dichlorprop		10	10.4	ug/L	104	(70-130)		
CCCM	Dichlorprop		2.5	2.27	ug/L	91	(70-130)		
MBLK	Dichlorprop			<0.166	ug/L				
MRL_CHK	Dichlorprop		0.5	0.589	ug/L	118	(50-150)		
MS1_201706270201	Dichlorprop	ND	7.5	7.75	ug/L	103	(70-130)		
MSD1_201706270201	Dichlorprop	ND	7.5	7.73	ug/L	103	(70-130)	30	0.26
CCC3	Dinoseb		4	3.92	ug/L	98	(70-130)		
CCCH	Dinoseb		4	3.95	ug/L	99	(70-130)		
CCCM	Dinoseb		1	0.944	ug/L	94	(70-130)		
MBLK	Dinoseb			<0.066	ug/L				
MRL_CHK	Dinoseb		0.2	0.210	ug/L	105	(50-150)		
MS1_201706270201	Dinoseb	ND	3	2.78	ug/L	93	(70-130)		
MSD1_201706270201	Dinoseb	ND	3	2.84	ug/L	95	(70-130)	30	2.1
CCC3	Pentachlorophenol		0.8	0.796	ug/L	100	(70-130)		
CCCH	Pentachlorophenol		0.8	0.794	ug/L	99	(70-130)		
CCCM	Pentachlorophenol		0.2	0.189	ug/L	95	(70-130)		
MBLK	Pentachlorophenol			<0.013	ug/L				
MRL_CHK	Pentachlorophenol		0.04	0.0457	ug/L	114	(50-150)		
MS1_201706270201	Pentachlorophenol	ND	0.6	0.276	ug/L	46	(70-130)		
MSD1_201706270201	Pentachlorophenol	ND	0.6	0.313	ug/L	52	(70-130)	30	13
CCC3	Picloram		2	1.78	ug/L	89	(70-130)		
CCCH	Picloram		2	1.85	ug/L	92	(70-130)		
CCCM	Picloram		0.5	0.446	ug/L	89	(70-130)		
MBLK	Picloram			<0.033	ug/L				
MRL_CHK	Picloram		0.1	0.145	ug/L	145	(50-150)		
MS1_201706270201	Picloram	ND	1.5	1.39	ug/L	93	(70-130)		
MSD1_201706270201	Picloram	ND	1.5	1.36	ug/L	91	(70-130)	30	2.2
CCC3	Tot DCPA Mono&Diacid Degradate		2	2.08	ug/L	104	(70-130)		
CCCH	Tot DCPA Mono&Diacid Degradate		2	2.04	ug/L	102	(70-130)		
CCCM	Tot DCPA Mono&Diacid Degradate		0.5	0.477	ug/L	95	(70-130)		
MBLK	Tot DCPA Mono&Diacid Degradate			<0.033	ug/L				
MRL_CHK	Tot DCPA Mono&Diacid Degradate		0.1	0.123	ug/L	123	(50-150)		
MS1_201706270201	Tot DCPA Mono&Diacid Degradate	ND	1.5	1.58	ug/L	106	(70-130)		
MSD1_201706270201	Tot DCPA Mono&Diacid Degradate	ND	1.5	1.61	ug/L	108	(70-130)	30	1.3

Spike recovery is already corrected for native results.
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Pural Water Specialty Company

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
Semivolatiles by GCMS by EPA 525.2									
Prep Batch: 1007816 Analytical Batch: 1010488							**Analysis Date: 07/12/2017**		
LCS1	1,3-Dimethyl-2-nitrobenzene (S)			102	%	102	(70-130)		
LCS2	1,3-Dimethyl-2-nitrobenzene (S)			100	%	101	(70-130)		
MBLK	1,3-Dimethyl-2-nitrobenzene (S)			101	%	101	(70-130)		
MRL_CHK	1,3-Dimethyl-2-nitrobenzene (S)			97.5	%	98	(70-130)		
MS_201706290526	1,3-Dimethyl-2-nitrobenzene (S)			100	%	100	(70-130)		
LCS1	Acenaphthene-d10 (I)			87.9	%	88	(50-150)		
LCS2	Acenaphthene-d10 (I)			118	%	118	(50-150)		
MBLK	Acenaphthene-d10 (I)			111	%	111	(50-150)		
MRL_CHK	Acenaphthene-d10 (I)			74.9	%	75	(50-150)		
MS_201706290526	Acenaphthene-d10 (I)			110	%	110	(50-150)		
LCS1	Atrazine		2	2.37	ug/L	119	(70-130)		
LCS2	Atrazine		2	2.26	ug/L	113	(70-130)	20	4.3
MBLK	Atrazine			<0.025	ug/L				
MRL_CHK	Atrazine		0.05	0.0670	ug/L	134	(50-150)		
MS_201706290526	Atrazine	ND	2	2.29	ug/L	114	(70-130)		
LCS1	Benzo(a)pyrene		2	2.34	ug/L	117	(70-130)		
LCS2	Benzo(a)pyrene		2	2.35	ug/L	118	(70-130)	20	0.43
MBLK	Benzo(a)pyrene			<0.01	ug/L				
MRL_CHK	Benzo(a)pyrene		0.02	0.0200	ug/L	100	(50-150)		
MS_201706290526	Benzo(a)pyrene	ND	2	2.18	ug/L	109	(70-130)		
LCS1	Chrysene-d12 (I)			92.1	%	92	(50-150)		
LCS2	Chrysene-d12 (I)			120	%	120	(50-150)		
MBLK	Chrysene-d12 (I)			107	%	107	(50-150)		
MRL_CHK	Chrysene-d12 (I)			89.8	%	90	(50-150)		
MS_201706290526	Chrysene-d12 (I)			115	%	115	(50-150)		
LCS1	Di-(2-Ethylhexyl)adipate		2	2.36	ug/L	118	(70-130)		
LCS2	Di-(2-Ethylhexyl)adipate		2	2.38	ug/L	119	(70-130)	20	0.84
MBLK	Di-(2-Ethylhexyl)adipate			<0.15	ug/L				
MRL_CHK	Di-(2-Ethylhexyl)adipate		0.3	0.363	ug/L	121	(50-150)		
MS_201706290526	Di-(2-Ethylhexyl)adipate	ND	2	2.28	ug/L	114	(70-130)		
LCS1	Di(2-Ethylhexyl)phthalate		2	2.26	ug/L	113	(70-130)		
LCS2	Di(2-Ethylhexyl)phthalate		2	2.33	ug/L	117	(70-130)	20	3.0
MBLK	Di(2-Ethylhexyl)phthalate			<0.15	ug/L				
MRL_CHK	Di(2-Ethylhexyl)phthalate		0.6	0.643	ug/L	107	(50-150)		
MS_201706290526	Di(2-Ethylhexyl)phthalate	ND	2	2.20	ug/L	110	(70-130)		

Spike recovery is already corrected for native results.
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RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Laboratory QC

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

Pural Water Specialty Company

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Heptachlor		2	1.97	ug/L	99	(70-130)		
LCS2	Heptachlor		2	1.95	ug/L	98	(70-130)	20	1.0
MBLK	Heptachlor			<0.015	ug/L				
MRL_CHK	Heptachlor		0.04	0.0370	ug/L	93	(50-150)		
MS_201706290526	Heptachlor	ND	2	1.97	ug/L	99	(70-130)		
LCS1	Hexachlorobenzene		2	1.90	ug/L	95	(70-130)		
LCS2	Hexachlorobenzene		2	1.93	ug/L	96	(70-130)	20	1.0
MBLK	Hexachlorobenzene			<0.025	ug/L				
MRL_CHK	Hexachlorobenzene		0.05	0.0520	ug/L	104	(50-150)		
MS_201706290526	Hexachlorobenzene	ND	2	1.93	ug/L	97	(70-130)		
LCS1	Hexachlorocyclopentadiene		2	1.89	ug/L	95	(70-130)		
LCS2	Hexachlorocyclopentadiene		2	1.95	ug/L	98	(70-130)	20	3.1
MBLK	Hexachlorocyclopentadiene			<0.025	ug/L				
MRL_CHK	Hexachlorocyclopentadiene		0.05	0.0270	ug/L	54	(50-150)		
MS_201706290526	Hexachlorocyclopentadiene	ND	2	1.89	ug/L	95	(70-130)		
LCS1	Molinate		2	2.17	ug/L	108	(70-130)		
LCS2	Molinate		2	2.13	ug/L	106	(70-130)	20	1.9
MBLK	Molinate			<0.05	ug/L				
MRL_CHK	Molinate		0.1	0.114	ug/L	114	(50-150)		
MS_201706290526	Molinate	ND	2	2.27	ug/L	114	(70-130)		
LCS1	Perylene-d12 (S)			99.4	%	99	(70-130)		
LCS2	Perylene-d12 (S)			98.8	%	99	(70-130)		
MBLK	Perylene-d12 (S)			76.3	%	76	(70-130)		
MRL_CHK	Perylene-d12 (S)			92.2	%	92	(70-130)		
MS_201706290526	Perylene-d12 (S)			95.1	%	95	(70-130)		
LCS1	Phenanthrene-d10 (I)			90.3	%	90	(50-150)		
LCS2	Phenanthrene-d10 (I)			120	%	120	(50-150)		
MBLK	Phenanthrene-d10 (I)			113	%	113	(50-150)		
MRL_CHK	Phenanthrene-d10 (I)			83.5	%	84	(50-150)		
MS_201706290526	Phenanthrene-d10 (I)			112	%	112	(50-150)		
LCS1	Simazine		2	2.36	ug/L	118	(70-130)		
LCS2	Simazine		2	2.27	ug/L	113	(70-130)	20	3.9
MBLK	Simazine			<0.025	ug/L				
MRL_CHK	Simazine		0.05	0.0680	ug/L	136	(50-150)		
MS_201706290526	Simazine	ND	2	2.31	ug/L	116	(70-130)		
LCS1	Thiobencarb		2	2.36	ug/L	118	(70-130)		
LCS2	Thiobencarb		2	2.36	ug/L	118	(70-130)	20	0.0
MBLK	Thiobencarb			<0.1	ug/L				

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Laboratory QC

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

Pural Water Specialty Company

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Thiobencarb		0.1	0.113	ug/L	113	(50-150)		
MS_201706290526	Thiobencarb	ND	2	2.36	ug/L	118	(70-130)		
LCS1	Triphenylphosphate (S)			104	%	104	(70-130)		
LCS2	Triphenylphosphate (S)			100	%	101	(70-130)		
MBLK	Triphenylphosphate (S)			98.7	%	99	(70-130)		
MRL_CHK	Triphenylphosphate (S)			106	%	106	(70-130)		
MS_201706290526	Triphenylphosphate (S)			100	%	100	(70-130)		

Spike recovery is already corrected for native results.
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Laboratory Hits

Report: 669412
Project: PURAL-MAUI
Group: 2017 New Source

Pural Water Specialty Company
Eric Okazaki
1955 Vineyard
Wailuku, HI 96793

Samples Received on:
06/29/2017 1121

Analyzed	Analyte	Sample ID	Result	HI Limit	Units	MRL
	201706290318	**Kahana Exploratory Well**				
07/01/2017 05:08	Alkalinity in CaCO3 units		49		mg/L	2
06/30/2017 12:12	Barium Total ICAP/MS		3.2	2000	ug/L	2
07/03/2017 22:42	Calcium Total ICAP		15		mg/L	1
07/05/2017 19:15	Fluoride		0.065	4	mg/L	0.05
06/29/2017 11:55	Nitrate as Nitrogen by IC		0.54	10	mg/L	0.2
06/29/2017 11:55	Nitrate as NO3 (calc)		2.4	45	mg/L	0.88
07/01/2017 05:08	PH (H3=past HT not compliant)		8.2	8.5	Units	0.1
07/01/2017 05:08	Specific Conductance, 25 C		350	--	umho/cm	10
06/30/2017 17:52	Turbidity		0.14	5	NTU	0.1

SUMMARY OF POSITIVE DATA ONLY

Pace Analytical™

www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444

Report Prepared for:

Jaclyn Contreras
Eurofins Eaton Analytical
750 Royal Oaks Drive
Monrovia CA 91016

REPORT OF LABORATORY ANALYSIS FOR 2,3,7,8-TCDD

Report Summary:

Enclosed are analytical results of one drinking water sample analyzed for 2,3,7,8-TCDD content. This sample was analyzed according to Method 1613B by High Resolution Gas Chromatography/High Resolution Mass Spectrometry.

The results reported for this sample and the associated quality control samples were all within the criteria described in Method 1613B. If you have any questions or concerns regarding these results, please contact Joanne Richardson, your Pace Project Manager.

Report Prepared Date:

July 19, 2017

Report Information:

Pace Project #: 10395703
Sample Receipt Date: 07/14/2017
Client Project #: 669412
Client Sub PO #: 99-49547
State Cert #: MN00064

Invoicing & Reporting Options:

The report provided has been invoiced as a Level 2 Drinking Water Report. If an upgrade of this report package is requested, an additional charge may be applied.

Please review the attached invoice for accuracy and forward any questions to Joanne Richardson, your Pace Project Manager.

This report has been reviewed by:

Joanne Richardson

July 19, 2017
Joanne Richardson,
(612) 607-6453
(612) 607-6444 (fax)

Report of Laboratory Analysis

The results relate only to the samples included in this report.

Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Minnesota Laboratory Certifications

Authority	Certificate #	Authority	Certificate #
A2LA	2926.01	Montana	CERT0092
Alabama	40770	Nebraska	NE-OS-18-06
Alaska	MN00064	Nevada	MN00064
Alaska	UST-078	New Jersey (NE	MN002
Arizona	AZ0014	New York (NEL	11647
Arkansas	88-0680	New hampshire	2081
CNMI Saipan	MP0003	North Carolina	27700
California	MN00064	North Carolina	530
Colorado	MN00064	North Dakota	R-036
Connecticut	PH-0256	Ohio	41244
EPA Region 8	8TMS-L	Ohio VAP	CL101
Florida (NELAP	E87605	Oklahoma	9507
Georgia (EDP)	959	Oregon (ELAP)	MN200001
Guam EPA	959	Oregon (OREL	MN300001
Hawaii	MN00064	Pennsylvania	68-00563
Idaho	MN00064	Puerto Rico	MN00064
Illinois	200011	South Carolina	74003001
Indiana	C-MN-01	Tennessee	TN02818
Iowa	368	Texas	T104704192
Kansas	E-10167	Utah (NELAP)	MN00064
Kentucky	90062	Virginia	460163
Louisiana	03086	Washington	C486
Louisiana	MN00064	West Virginia #	9952C
Maryland	322	West Virginia D	382
Michigan	9909	Wisconsin	999407970
Minnesota	027-053-137	Wyoming	8TMS-L
Mississippi	MN00064		

REPORT OF LABORATORY ANALYSIS

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Submittal Form & Purchase Order 99-49547

Date: 7/13/2017

10395703

*REPORTING REQUIRMENTS: *Do Not Combine Reports with any other samples submitted under different Folder Numbers!*
Report & Invoice must have the Folder# 669412 Sub PO# 99-49547 and Job # 1000014

Report all quality control data according to Method. Include dates analyzed. Date extracted (if extracted) and Method reference on the report.
Results must have Complete data & QC with Approval Signature.

Ship To:
PACE Analytical Services, Inc.
1700 Southeast Elm Street, Suite 200

Minneapolis, MN 55414

Phone: 843-556-8171 Fax: 612-607-6444

Reports: Jackie Contreras Sub-Contracting Administrator
EMAIL TO: us20_subcontract@eurofinsus.com
Eurofins Eaton Analytical, Inc. 750 Royal Oaks Drive, Suite 100, Monrovia, CA 91016
Phone (626) 386-1165 Fax (626) 386-1122
Invoices to: Eurofins Eaton Analytical, Inc.

Provide in each Report the Specified State Certification # & Exp Date for requested tests + matrix.

Samples from: HAWAII

5 day rush

Folder #:	Report Due:	Sub PO #:
669412	07/20/2017	99-49547

JLS	Use Lab Order # for ID	Client Sample ID for reference only	Analysis Requested	Sample Date & Time	Matrix	PWS Systemcode	PWSID
	201706290318	Kahana Exploratory Well		06/27/17 1230	DW		001
EPA 1613B	2,3,7,8-TCDD		2,3,7,8-TCDD				

Relinquished by: Sample Control Date 7-13-17 Time 1413
Received by: [signature] PACE Date 7-14-17 Time 930
Relinquished by: Sample Control Date ____ Time ____
Received by: ____ Date ____ Time ____

T=4.6

NOTIFICATION REQUIRED IF RECEIVED OUTSIDE OF 0-6 CELSIUS
An Acknowledgement of Receipt is requested to attn: Jackie Contreras

Page 4 of 4

750 Royal Oaks Drive, Suite 100, Monrovia, CA 91016 Tel (626) 386-1100 Fax (866) 988-3757 www.EurofinsUS.com/Eaton

Report No. 10395703_1613DW

PaceAnalytical™

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Minneapolis, MN 55414
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Fax: 612-607-6444

Reporting Flags

A = Reporting Limit based on signal to noise
B = Less than 10x higher than method blank level
C = Result obtained from confirmation analysis
D = Result obtained from analysis of diluted sample
E = Exceeds calibration range
I = Interference present
J = Estimated value
Nn = Value obtained from additional analysis
P = PCDE Interference
R = Recovery outside target range
S = Peak saturated
U = Analyte not detected
V = Result verified by confirmation analysis
X = %D Exceeds limits
Y = Calculated using average of daily RFs
* = See Discussion

REPORT OF LABORATORY ANALYSIS

Report No.....10395703_1613DW

Pace Analytical	Document Name: Sample Condition Upon Receipt Form	Document Revised: 19Dec2016 Page 1 of 2
	Document No.: F-MN-L-213-rev.20	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Eurofins

Project #: WO#: 10395703

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

Tracking Number: 7792 4506 0656

Custody Seal on Cooler/Box Present? ☐ Yes ☒ No   Seals Intact? ☐ Yes ☒ No   Optional: Proj. Due Date: Proj. Name:

Packing Material: ☒ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other: Temp Blank? ☐ Yes ☒ No

Thermometer Used: ☒ 151401163 ☐ 151401164   Type of Ice: ☒ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

Cooler Temp Read (°C): 4.6   Cooler Temp Corrected (°C): 4.6   Biological Tissue Frozen? ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C   Correction Factor: TRUE   Date and Initials of Person Examining Contents: ME 7-14-17

USDA Regulated Soil (☒ N/A, water sample)

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☐ No   Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present?	☒ Yes	☐ No		1.
Chain of Custody Filled Out?	☒ Yes	☐ No		2.
Chain of Custody Relinquished?	☒ Yes	☐ No		3.
Sampler Name and/or Signature on COC?	☐ Yes	☒ No	☐ N/A	4.
Samples Arrived within Hold Time?	☒ Yes	☐ No		5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No		6.
Rush Turn Around Time Requested?	☒ Yes	☐ No		7.
Sufficient Volume?	☒ Yes	☐ No		8.
Correct Containers Used?	☒ Yes	☐ No		9.
-Pace Containers Used?	☐ Yes	☒ No		
Containers Intact?	☒ Yes	☐ No		10.
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: WT	☒ Yes	☐ No		12.
All containers needing acid/base preservation have been checked?	☐ Yes	☐ No	☒ N/A	13. ☐ HNO₃ ☐ H_2SO_4 ☐ NaOH Positive for Res. Chlorine? Y N Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☐ Yes	☐ No	☒ N/A	
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin.	☐ Yes	☐ No	☒ N/A	Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes	☐ No	☒ N/A	14.
Trip Blank Present?	☐ Yes	☐ No	☒ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION   Field Data Required? ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

Project Manager Review: [signature]   Date: 7-14-17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Pace Analytical™

Pace Analytical Services, LLC.
1700 Elm Street - Suite 200
Minneapolis, MN, 55414
Tel: 612-607-1700
Fax: 612-607-6444

Drinking Water Analysis Results
2,3,7,8-TCDD -- USEPA Method 1613B

Sample ID..........201706290318
Client.................. Eurofins Eaton Analytical
Lab Sample ID..... 10395703001

Date Collected.....06/27/2017
Date Received......07/14/2017
Date Extracted.....07/18/2017

	Sample 201706290318	Method Blank	Lab Spike	Lab Spike Dup
[2,3,7,8-TCDD]	**ND**	ND	--	--
LOQ	5.0 pg/L	5.0 pg/L	--	--
2,3,7,8-TCDD Recovery	--	--	111%	117%
Spike Recovery Limit	--	--	73-146%	73-146%
RPD			5.4%	
IS Recovery	77%	80%	72%	81%
IS Recovery Limits	31-137%	31-137%	25-141%	25-141%
CS Recovery	**107%**	116%	106%	113%
CS Recovery Limits	42-164%	42-164%	37-158%	37-158%
Filename	F170719A_14	F170719A_05	F170719A_02	F170719A_03
Analysis Date	07/19/2017	07/19/2017	07/19/2017	07/19/2017
Analysis Time	13:07	09:10	07:53	08:18
Analyst	SMT	SMT	SMT	SMT
Volume	1.024L	1.029L	1.032L	1.050L
Dilution	NA	NA	NA	NA
ICAL Date	01/11/2017	01/11/2017	01/11/2017	01/11/2017
CCAL Filename	F170719A_01	F170719A_01	F170719A_01	F170719A_01

! = Outside the Control Limits
ND = Not Detected
LOQ = Limit of Quantitation
Limits = Control Limits from Method 1613 (10/94 Revision), Tables 6A and 7A
RPD = Relative Percent Difference of Lab Spike Recoveries
IS = Internal Standard [2,3,7,8-TCDD-$^{13}C_{12}$]
CS = Cleanup Standard [2,3,7,8-TCDD-$^{37}Cl_4$]

Analyst: [signature]

Project No............10395703

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

July 24, 2017

Mr. Efren Ugalino
Pural Water Specialty Co., Inc.
1955 Vineyard Street
Wailuku, HI 96793

RE: Project: KAHANA EXPLORATORY WELL
Pace Project No.: 30223162

Dear Mr. Ugalino:

Enclosed are the analytical results for sample(s) received by the laboratory on June 30, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jacquelyn Collins
jacquelyn.collins@pacelabs.com
(724)850-5612
Project Manager

Enclosures

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

CERTIFICATIONS

Project: KAHANA EXPLORATORY WELL
Pace Project No.: 30223162

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS
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Greensburg, PA 15601
(724)850-5600

SAMPLE SUMMARY

Project: KAHANA EXPLORATORY WELL
Pace Project No.: 30223162

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30223162001	KAHANA EXPLORATORY WELL WEST M	Drinking Water	06/27/17 12:30	06/30/17 10:10

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Greensburg, PA 15601
(724)850-5600

SAMPLE ANALYTE COUNT

Project: KAHANA EXPLORATORY WELL
Pace Project No.: 30223162

Lab ID	Sample ID	Method	Analysts	Analytes Reported
30223162001	KAHANA EXPLORATORY WELL WEST M	EPA 900.0	NEG	2
		EPA 903.1	WRR	1
		EPA 904.0	VAL	1
		ASTM D5174-97	NEG	1

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: KAHANA EXPLORATORY WELL
Pace Project No.: 30223162

Sample: KAHANA EXPLORATORY WELL WEST M **Lab ID: 30223162001** Collected: 06/27/17 12:30 Received: 06/30/17 10:10 Matrix: Drinking Water

PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Gross Alpha	EPA 900.0	**2.19 ± 1.58 (2.54) C:NA T:NA**	pCi/L	07/11/17 10:01	12587-46-1	
Gross Beta	EPA 900.0	**2.73 ± 1.11 (1.89) C:NA T:NA**	pCi/L	07/11/17 10:01	12587-47-2	
Radium-226	EPA 903.1	**0.249 ± 0.364 (0.611) C:NA T:89%**	pCi/L	07/14/17 12:43	13982-63-3	
Radium-228	EPA 904.0	**0.230 ± 0.309 (0.667) C:73% T:91%**	pCi/L	07/17/17 11:37	15262-20-1	
Total Uranium	ASTM D5174-97	**0.140 ± 0.007 (0.193) C:NA T:NA**	ug/L	07/24/17 12:11	7440-61-1	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: KAHANA EXPLORATORY WELL
Pace Project No.: 30223162

QC Batch: 264507 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 30223162001

METHOD BLANK: 1302872 Matrix: Water
Associated Lab Samples: 30223162001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.558 ± 0.378 (0.718) C:80% T:73%	pCi/L	07/17/17 11:35	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: KAHANA EXPLORATORY WELL
Pace Project No.: 30223162

QC Batch: 264354 | Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 | Analysis Description: 903.1 Radium-226
Associated Lab Samples: 30223162001

METHOD BLANK: 1301984 | Matrix: Water
Associated Lab Samples: 30223162001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.348 ± 0.399 (0.236) C:NA T:88%	pCi/L	07/14/17 11:38	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: KAHANA EXPLORATORY WELL
Pace Project No.: 30223162

QC Batch: 264473 | Analysis Method: ASTM D5174-97
QC Batch Method: ASTM D5174-97 | Analysis Description: D5174.97 Total Uranium KPA
Associated Lab Samples: 30223162001

METHOD BLANK: 1302707 | Matrix: Water
Associated Lab Samples: 30223162001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Total Uranium	0.127 ± 0.005 (0.193) C:NA T:NA	ug/L	07/12/17 13:34	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL - RADIOCHEMISTRY

Project: KAHANA EXPLORATORY WELL
Pace Project No.: 30223162

QC Batch: 264210 | Analysis Method: EPA 900.0
QC Batch Method: EPA 900.0 | Analysis Description: 900.0 Gross Alpha/Beta
Associated Lab Samples: 30223162001

METHOD BLANK: 1301402 | Matrix: Water
Associated Lab Samples: 30223162001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Gross Alpha	0.345 ± 0.502 (1.04) C:NA T:NA	pCi/L	07/11/17 09:59	
Gross Beta	1.03 ± 0.945 (1.95) C:NA T:NA	pCi/L	07/11/17 09:59	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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Greensburg, PA 15601
(724)850-5600

QUALIFIERS

Project: KAHANA EXPLORATORY WELL
Pace Project No.: 30223162

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.
ND - Not Detected at or above adjusted reporting limit.
TNTC - Too Numerous To Count
J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
MDL - Adjusted Method Detection Limit.
PQL - Practical Quantitation Limit.
RL - Reporting Limit.
S - Surrogate
1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.
Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.
LCS(D) - Laboratory Control Sample (Duplicate)
MS(D) - Matrix Spike (Duplicate)
DUP - Sample Duplicate
RPD - Relative Percent Difference
NC - Not Calculable.
SG - Silica Gel - Clean-Up
U - Indicates the compound was analyzed for, but not detected.
N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.
Act - Activity
Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).
Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)
(MDC) - Minimum Detectable Concentration
Trac - Tracer Recovery (%)
Carr - Carrier Recovery (%)
Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.
TNI - The NELAC Institute.

Date: 07/24/2017 01:09 PM

REPORT OF LABORATORY ANALYSIS
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Sample Condition Upon Receipt Pittsburgh

Pace Analytical

30223162

Client Name: Rural water Project #

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other
Tracking #: 8094 5285 2989

Custody Seal on Cooler/Box Present: ☐ yes ☑ no Seals Intact: ☐ yes ☐ no

Thermometer Used N/A Type of Ice: Wet Blue (None)

Cooler Temperature Observed Temp — °C Correction Factor: — °C Final Temp: — °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: ZH 6/30/17

Comments:	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC:	✓			5.
-Includes date/time/ID Matrix: WT				
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used:	✓			
Containers Intact:	✓			11.
Orthophosphate field filtered				12.
Organic Samples checked for dechlorination:			✓	13.
Filtered volume received for Dissolved tests			✓	14.
All containers have been checked for preservation.	✓			15. P<2
All containers needing preservation are found to be in compliance with EPA recommendation.	✓			
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed ZH; Date/time of preservation; Lot # of added preservative
Headspace in VOA Vials (>6mm):			✓	16.
Trip Blank Present:			✓	17.
Trip Blank Custody Seals Present			✓	
Rad Aqueous Samples Screened > 0.5 mrem/hr		✓		Initial when completed: ZH Date: 6/30/17

Client Notification/ Resolution:

Person Contacted: Date/Time: Contacted By:

Comments/ Resolution:

☐ **A check in this box indicates that additional information has been stored in ereports.**

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)
*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

J:\QAQC\Master\Document Management\Sample Mgt\Sample Condition Upon Receipt Pittsburgh (C056-4 15Dec2010)

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:
Company: RURAL WATER SPECIALTY CO., INC.
Address: 1955 VINEYARD ST.
WAILUKU HI 96793
Email To: efren.ugalino@ruralwater.com
Phone: 808-242-7299 Fax: 808-244-8878
Requested Due Date/TAT:

Section B Required Project Information:
Report To:
Copy To:
Purchase Order No.:
Project Name: KAHANA ~~[illegible]~~ EXPLORATORY WELL
Project Number: M-10696

Section C Invoice Information:
Attention:
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager: JACQUELYN COLLINS
Pace Profile #:

Page: of

2131328

REGULATORY AGENCY
NPDES GROUND WATER DRINKING WATER
UST RCRA OTHER

Site Location STATE:

Requested Analysis Filtered (Y/N)

Section D Required Client Information

Matrix Codes MATRIX / CODE: Drinking Water DW, Water WT, Waste Water WW, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Tissue TS, Other OT

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

WO#:30223162

ITEM #	SAMPLE ID	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Composite Start DATE	Composite Start TIME	Composite End/Grab DATE	Composite End/Grab TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	RAD 226/228	GROSS ALPHA	BETA	URANIUM	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	KAHANA EXPLORATORY WELL	WT	G	6/27/17	12:30pm				3			✓							✓	✓	✓	✓	N	001
2	WEST MAUI WELL 2																							
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	[signature]	6/28/17	8:00AM	[signature]	6/30/17	1010	N/A	N	N	Y

ORIGINAL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: DONALD PASCUAL
SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 6/26/17

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007

HAWAII SOURCE WATER ASSESSMENT PROGRAM
GROUNDWATER SOURCES
DATASHEETS AND POTENTIAL CONTAMINATING ACTIVITIES (PCA) REPORT

MAUI

MAUI DEPARTMENT OF WATER SUPPLY

NEW DRINKING WATER SOURCE REPORT FOR

WEST MAUI WELL 2

The Hawaii Source Water Assessment Program is a project collaboration between:

Hawaii Department of Health
Safe Drinking Water Branch

and

University of Hawaii
Department of Geology and Geophysics

APPENDIX D

HAWAII SOURCE WATER ASSESSMENT PROGRAM (SWAP) REPORT

West Maui Well 2

Owner: Maui Dept. of Water Supply | Water System: xxxxxx | **System ID No:** xxx-

		Construction Details						Water Data		Pump Data	
Well Name	Well No.	Year Drilled	Ground Elevation (ft msl)	Well Depth (ft bgs)	Solid Casing (ft bgs)	Screen or Open Length (ft)	Pump Elev. (ft msl)	Initial Water Level (ft msl)	Initial Chlorides (ppm)	Specific Capacity (gpm/ft)	Pump Output (gpm)
West Maui Well 2	6-5738-002	2017	1317	1379	1321	58		7.4	50	475	1000

AQUIFER DATA — **Aquifer Code:** 60203 **Aquifer Sector:** Lahaina **Aquifer System:** Honokowai

	Upper Aquifer		Lower Aquifer
HYDROLOGY:	Basal	Freshwater in contact with seawater	
TYPE:	Unconfined	Where water table is upper surface of saturated aquifer	
GEOLOGY:	Flank	Horizontally extensive lavas	
USE STATUS:	Currently used		
UTILITY:	Drinking		
SALINITY (mg/L)	Fresh	(Cl < 250 mg/L)	
UNIQUENESS:	Irreplaceable		
VULNERABILITY:	High		

WELL SITE GEOLOGY

Formation: Honolua Volcanics **Rock Type:** Lava Flows **Lithology:** Aa **Composition:** Hawaiite and Trachyte

 Printed: 09/06/2017

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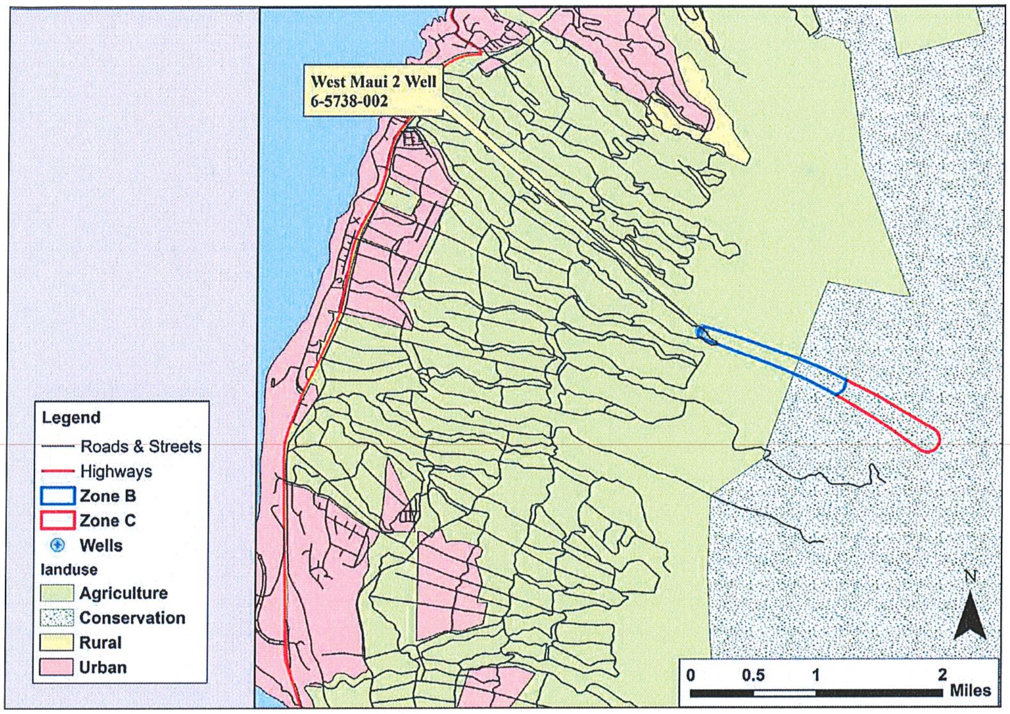

LOCATION MAP: West Maui Well 2; 6-5738-002

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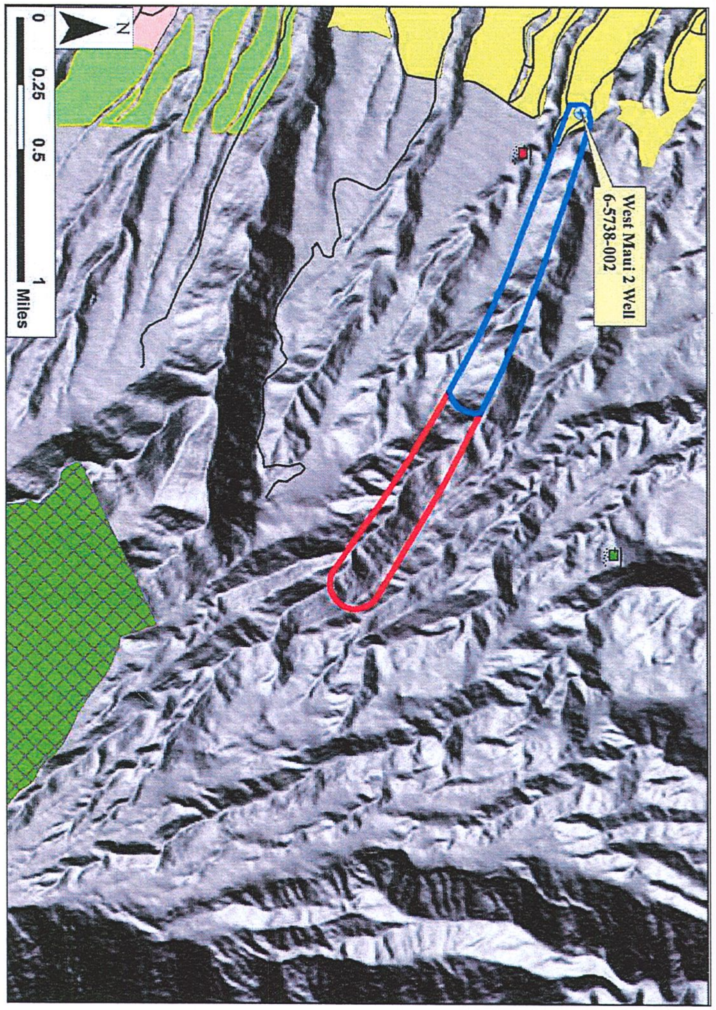

PCA MAP: West Maui Well 2; 6-5738-002

Legend

PCA - Extremly High

- RCRA *National Corrective Action Prioritization System*

PCA - Very High

- Abandoned Well
- Airport
- CERCLA
- Cesspool
- Confined Animal Feedlot
- Dry Cleaner
- Gas Station
- Herbicide Mixing & Loading
- Illegal Dumping
- Injection of Discharge
- Injection Well
- Metal Fabricating
- Petroleum Storage
- Plastic Fabricating
- Power Plant
- RCRA *Large Quantity Hazardous Waste Generators*
- RCRA *Treatment, Storage and Disposal*
- UST (leaking)
- Wastewater Treatment Plant
- Wood Treatment
- Petroleum Pipe
- Feral Animals (Conservation Land)
- Crops Using Soil Fumigants
- Landfill
- Military Installation
- Pineapple Cultivation
- Recorded Spill
- Sugarcane Cultivation

PCA - High

- Boat Repair
- Bus Terminal
- Car Body Shop
- Car Repair
- Construction Machinery
- Furniture Fabricating
- Geothermal Well
- Junkyard
- Liquid Waste
- Machine Shop
- Pesticide Applicator
- Photo Processing
- RCRA *No Info*
- RCRA *Small Quantity Hazardous Waste Generator*
- Research Laboratory
- Septic System
- UST (no info)
- UST (no leak reported)
- Utility Substation
- Sewer Line
- Diversified Agriculture
- Golf Course
- Grazing
- Other Field Crops
- R2 - Water

PCA - Medium

- AST
- Baseyard
- Campground
- Car Wash
- Cement Plant
- Cemetery
- Food Processing
- Hardware Store
- High School & University
- Hospital
- Motor Pool
- Parking Lot
- RCRA *Conditionally Exempt Generator*
- Residential
- Storm Drain Discharge Point
- Waste Transfer Station
- Transportation Corridor
- Artificial Recharge
- Park
- R1 - Water
- Sewage Application

Drinking Water Source

- Well
- Spring/Tunnel
- Surface Water Intake

Capture Zone Delineation

- CZD - Zone A
- CZD - Zone B
- CZD - Zone C

West Maui Well 2

Potentially Contaminating Activity Inventory and Scoring Table

		COUNT (by zone)			SCORE (by zone)		
PCA NAME	RANK	A	B	C	A	B	C
RCRA - National Correction Action Prioritization	Extremely High						
Airports - maint. and fueling Areas	Very High						
CERCLA sites	Very High						
Cesspools	Very High						
Chemical/Petroleum processing & storage	Very High						
Confined animal feedlot	Very High						
Dry cleaners/processing	Very High						
Gas stations	Very High						
Illegal activities/ unauthorized dumping	Very High						
Improperly abandoned wells	Very High						
Injection wells/dry wells/sumps	Very High						
Landfills/dumps/or historic dumps	Very High						
RCRA - Large Quantity Hazardous Waste Generators	Very High						
Leaking underground storage tank	Very High						
Metal plating/finishing/fabricating	Very High						
Military installations	Very High						
Other crops using soil fumigants	Very High						
Pesticide or herbicide mixing and loading sites	Very High						
Pineapple cultivation	Very High	1	2.7		18	12	
Plastics/synthetic fabricators	Very High						
Power plants	Very High						
RCRA Treatment, Storage, and/or Disposal	Very High						
Recorded spills	Very High						
Sugarcane cultivation	Very High						
Underground injection of Industrial discharge	Very High						
Wastewater treatment plants	Very High						
Wood treatment facilities	Very High						
Auto body shops	High						
Automobile repair shops	High						
Boat services/repair/refinishing	High						

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West Maui Well 2

Potentially Contaminating Activity Inventory and Scoring Table

PCA NAME	RANK	COUNT (by zone) A	COUNT (by zone) B	COUNT (by zone) C	SCORE (by zone) A	SCORE (by zone) B	SCORE (by zone) C
Above ground storage tanks	Medium						
Artificial recharge (non potable water)	Medium						
Campgrounds	Medium						
Car washes	Medium						
Cement/concrete plants	Medium						
Cemetery	Medium						
Equipment storage yard	Medium						
Food processing (sugarcane mills)	Medium						
Hardware/lumber/part stores	Medium						
High schools	Medium						
Hospitals	Medium						
Parking lots	Medium						
Parks	Medium						
RCRA - Conditionally Exempt Generator	Medium						
Reclaimed wastewater irrigation – R1 water	Medium						
Residential parcels	Medium						
Storm drain discharge points, detention facilities and dry wells	Medium						
Transportation corridors	Medium						
Waste transfer / recycling stations	Medium						

Susceptibility Score Summary

Zone	CZD Identifier	Score
Capture Zone Delineation A	N/A	18
Capture Zone Delineation B	6XB075	12
Capture Zone Delineation C	6XC075	0
Additional Score if Contamination detected:		**0**
Total Susceptibility Score for this Source:		**30**

West Maui Well 2

Potentially Contaminating Activity Inventory and Scoring Table

PCA NAME	RANK	COUNT (by zone) A	COUNT (by zone) B	COUNT (by zone) C	SCORE (by zone) A	SCORE (by zone) B	SCORE (by zone) C
Construction or farm machinery repair/maintenance	High						
Diversified agriculture	High						
Fleet/trucking/bus terminals	High						
Furniture repair or manufacturing	High						
Golf courses	High						
Junk yards/scrap/salvage yards	High						
Lagoons/liquid wastes	High						
Machine shops	High						
Pesticide distributors/professional applicators	High						
Photo processing/printing	High						
Reclaimed water R2	High						
Research laboratories	High						
Septic systems	High						
Sewer lines	High						
RCRA - Small Quantity Generators	High						
UST - non regulated, not upgraded or registered	High						
USTs - no reported leaks	High						
Utility Stations/maintenance areas	High						
Wells geothermal - production and injection	High						

APPENDIX E

LABORATORY TEST RESULTS FOR MAHINAHINA WELL

Well Contaminant Data

WELL NO.	Well Name	CONTAMINANT	SAMPLE DATE	CONC.	UNITS	> EPA MCL	> HI MCL
6-5738-002	West Maui Well 2	New Well, No Contaminant Records	NA	NA	NA	NA	NA

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Laboratory Report

for

Water Resource Associates
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814
Attention: Dan Lum

NELAP ACCREDITED TNI LABORATORY
01114CA

Report: 430285
Project: NEW-SOURCE
Group: DEEP Well - New Source

Date of Issue
05/29/2013
EUROFINS EATON ANALYTICAL

DEB: Debbie.L.Frank

Project Manager

Laboratory certifies that the test results meet all **TNI NELAP** requirements unless noted in the Comments section or the Case Narrative. Following the cover page are Hits Reports, Comments, QC Summary, QC Report and Regulatory Forms. This report shall not be reproduced except in full, without the written approval of the laboratory.

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STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	Mississippi	Certified
Alaska	CA00006	Montana	Cert 0035
Arizona	AZ0778	Nevada	CA00006-2012-1
Arkansas	Certified	New Hampshire	2959-11
California – NELAP	01114CA	New Jersey	CA 008
California – ELAP	1422	New Mexico	Certified
Colorado	Certified	New York	11320
Connecticut	PH-0107	North Carolina	06701
Delaware	CA 006	North Dakota	R-009
Florida	E871024	Oregon	CA 200003-011
Georgia	947	Pennsylvania	68-565
Guam	12-006r	Rhode Island	LAO00326
Hawaii	Certified	South Carolina	87016001
Idaho	Certified	South Dakota	Certified
Illinois	200033	Tennessee	TN02839
Indiana	C-CA-01	Texas	T104704230-12-4
Kansas	E-10268	Utah	Mont-1
Kentucky	90107	Vermont	VT0114
Louisiana	LA130008	Virginia	00210
Maine	CA0006	Washington	C383
Maryland	224	West Virginia	9943 C
Commonwealth of Northern Marianas Is.	MP0004	Wisconsin	998316660
Massachusetts	M-CA006	Wyoming	8TMS-L
Michigan	9906	EPA Region 5	Certified

750 Royal Oaks Dr., Ste 100, Monrovia, CA 91016 Tel (626) 386-1100 Fax (626) 386-1101 http://EatonAnalytical.com

430285

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CHAIN OF CUSTODY RECORD

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Monrovia, CA 91016-3629

Phone: 626 386 1100
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800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

EUROFINS EATON ANALYTICAL USE ONLY:

LOGIN COMMENTS: W/ TB's

SAMPLES CHECKED AGAINST COC BY:
SAMPLES LOGGED IN BY:
SAMPLES REC'D DAY OF COLLECTION? ☐ (check for yes)

SAMPLE TEMP RECEIVED AT:
☐ Colton / No. California / Arizona ____ °C (Compliance: 4 ± 2 °C)
☑ Monrovia 5.0 °C (Compliance: 4 ± 2 °C)

CONDITION OF BLUE ICE: Frozen ____ Partially Frozen ____ Thawed ____ Wet Ice ____ No Ice ____

METHOD OF SHIPMENT: Pick-Up / Walk-in / FedEx / UPS / DHL / Area Fast / Top Line / Other: ____

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME:	PROJECT CODE:
WATER RESOURCE ASSOCIATES	NEW SOURCE
EEA CLIENT CODE: WRA-HI / COC ID:	SAMPLE GROUP: DEEP WELL
TAT requested: rush by adv notice only	STD ✓ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

COMPLIANCE SAMPLES ☐ - Requires state forms ☐ (check for yes)
NON-COMPLIANCE SAMPLES ☑ (check for yes)
REGULATION INVOLVED:
Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA,...)

SEE ATTACHED BOTTLE ORDER FOR ANALYSES ☑ (check for yes), OR
list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	FIELD DATA	FIELD DATA	SAMPLER COMMENTS
4-3-13		MAHINAHINA		RGW			
		Hold 04/04/13 1218					

* MATRIX TYPES: RSW = Raw Surface Water, RGW = Raw Ground Water, CFW = Chlor(am)inated Finished Water, FW = Other Finished Water, SEAW = Sea Water, WW = Waste Water, BW = Bottled Water, SW = Storm Water, SO = Soil, SL = Sludge, O = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:	Dan Lum	DAN LUM	WATER RESOURCE ASSOC.	4/3/13	9:00a
RELINQUISHED BY:	Dan Lum	" "	" " "	4/3/13	10:40a
RECEIVED BY:	CM	CHRIS CARDENAS	EEA	4-4-13	1138
RELINQUISHED BY:					
RECEIVED BY:					

PAGE ____ OF ____

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Addr: Water Resource Associates
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Attn: Dan Lum
Phone: 808-593-8032 (o)

Acknowledgement of Samples Received

Client ID: WRA-HI
Folder #: 430285
Project: NEW-SOURCE
Sample Group: DEEP Well - New Source

Project Manager: Debbie.L.Frank
Phone: (626) 386-1149

The following samples were received from you on **April 04, 2013**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical.

Sample #	Sample ID	Sample Date
201304040581	MAHINAHINA	04/03/2013 0800
	@ICPMS; Mercury; @ICPMS; Uranium by ICPMS as pCi/L; @2378-TCDD_Dioxin; @504MOD; @525REG; @DIQUAT; @ML505; @ML515.4; @ML531.2; @RA226 GA; @RA228 GA; @RAD; @VOASDWA; Alkalinity in CaCO3 units; Asbestos by TEM - >10 microns; Calcium Total ICAP; Cyanide; Endothall; Fluoride; Glyphosate; Nitrate as Nitrogen by IC; Nitrite Nitrogen by IC; PH (H3=past HT not compliant); Source Temperature Degrees F; Specific Conductance; Turbidity	
201304040582	Travel Blank - HOLD	04/03/2013 0800
	@504MOD TB; @VOASDWA TB	

Test Description

@ICPMS -- ICPMS Metals
@ICPMS -- ICPMS Metals
@2378-TCDD_Dioxin -- 2,3,7,8-TCDD_Dioxin
@504MOD -- EPA Method 504.1
@504MOD TB -- EPA Method 504.1
@525REG -- Semivolatiles by GCMS
@DIQUAT -- Diquat and Paraquat
@ML505 -- Organochlorine Pesticides/PCBs
@ML515.4 -- Chlorophenoxy Herbicides
@ML531.2 -- Aldicarbs
@RA226 GA -- Radium 226
@RA228 GA -- Radium 228
@RAD -- Gross Alpha/Beta Radiation
@VOASDWA -- Volatile Organics by GCMS
@VOASDWA TB -- Volatile Organics by GCMS

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Laboratory Hits
Report: 430285

Water Resource Associates
Dan Lum
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Samples Received on:
04/04/2013

Analyzed		Analyte	Sample ID	Result	Federal MCL	Units	MRL
		201304040581	**MAHINAHINA**				
04/05/2013	22:23	Alkalinity in CaCO3 units		37		mg/L	2
04/17/2013	14:28	Alpha, Gross		3.6	15	pCi/L	3
04/09/2013	2:11	Calcium Total ICAP		6.9		mg/L	1
04/05/2013	18:08	Copper Total ICAP/MS		2.9	1300	ug/L	2
04/17/2013	14:28	Gross Alpha + adjusted error		5.8	15	pCi/L	3
04/04/2013	13:32	Nitrate as Nitrogen by IC		0.24	10	mg/L	0.1
04/05/2013	22:23	PH (H3=past HT not compliant)		8.0		Units	0.1
04/03/2013	08:00	Source Temperature Degrees F		65.8		deg F	
04/05/2013	22:23	Specific Conductance, 25 C		120		umho/cm	2
04/04/2013	18:06	Turbidity		0.30	5	NTU	0.05

SUMMARY OF POSITIVE DATA ONLY

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Eaton Analytical

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(626) 386-1100 FAX (626) 386-1101

Kit Order for Water Resource Associates

Debbie.L.Frank is your Eurofins Eaton Analytical Project Manager

Note: Sampler Please return this paper with your samples

Kit #: 58806
Created By: ADT
Order Date: 11/01/2012
Ship By: 10/22/2012
STG: Bottle Orders

Client ID: WRA-HI
Project Code: NEW-SOURCE Bottle Orders
Group Name: DEEP WELL
PO#/JOB#:

Ship Sample Kits to
Water Resource Associates
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814
Attn: Dan Lum
Phone: 808-593-8032

Send Report to
Water Resource Associates
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814
Attn: Dan Lum
Phone: 808-593-8032

Billing Address
Water Resource Associates
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814
Attn: Dan Lum
Phone: 808-593-8032

# of Samples	Tests	Bottles - Qty for each sample, type & preservative if ai	UN DOT #
2	@2378-TCDD_Dioxin	2 1L amber glass D1613_NO_PRESERVATIVE	
2	@504MOD	3 40ml amber glass vial no preservative	
2	@504MOD TB	2 40ml amber glass vial no preservative + H20	
2	@525REG	2 1L amber glass 2ml of 6N HCl	UN1789
2	@DIQUAT	1 1L amber poly no preservative	
2	@ICPMS, Mercury, @ICPMS, Uranium by ICPMS as pCi/L, Calcium Tota ICAP	1 500ml acid poly 2ml HNO3 (18%)	UN2031
2	@ML505	4 40ml amber glass vial 1drop thio (8%)	
2	@ML515.4	2 125ml amber glass 7mg SULFITE xls	
2	@ML531.2	2 40ml amber glass vial 0.38g KH2Citrate+1drop 8% thio	
2	@RA226 GA, @RA228 GA	3 1L poly 4ml HNO3 (18%)	UN2031
2	@RAD	1 500ml poly 2ml 18%HNO3+125ml poly/no pres	UN2031
2	@VOASDWA	3 40ml amber glass vial 4drops 6N HCL (36%)	UN1789
2	@VOASDWA TB	2 40ml amber glass vial 4drops of 1:1 HCL + H2O	UN1789
2	Alkalinity in CaCO3 units	1 250ml poly no preservative	
2	Asbestos by TEM - >10 microns	1 1L poly sonicated no preservative	
2	Cyanide	1 250 ml poly 2 ml NaOH (30%)+6 scoops AA	
2	Endothall	1 250ml amber glass no preservative	
2	Fluoride, Nitrate as Nitrogen by IC, Nitrite Nitrogen by IC, PH (H3=past H not compliant), Specific Conductance, Turbidity	1 125ml poly no preservative	
2	Glyphosate	1 125ml amber glass no preservative	

Comments

Code	Status	Date Shipped	Via	Tracking #	# of Coolers	Prepared By

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Laboratory Data
Report: 430285

Water Resource Associates
Dan Lum
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Samples Received on:
04/04/2013

MAHINAHINA (201304040581) — **Sampled on 04/03/2013 0800**

Prepared	Analyzed	QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
FIELD/SM2550B - Source Temperature Degrees F								
	04/03/2013 08:00	702197	(FIELD/SM2550B)	Source Temperature Degrees F	65.8	deg F		1
EPA 200.8 - ICPMS Metals								
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Antimony Total ICAP/MS	ND	ug/L	1	1
4/5/2013	04/08/2013 17:30	701677	(EPA 200.8)	Arsenic Total ICAP/MS	ND	ug/L	1	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Barium Total ICAP/MS	ND	ug/L	2	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Beryllium Total ICAP/MS	ND	ug/L	1	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Cadmium Total ICAP/MS	ND	ug/L	0.5	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Chromium Total ICAP/MS	ND	ug/L	1	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Copper Total ICAP/MS	2.9	ug/L	2	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Lead Total ICAP/MS	ND	ug/L	0.5	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Nickel Total ICAP/MS	ND	ug/L	5	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Selenium Total ICAP/MS	ND	ug/L	5	1
4/5/2013	04/05/2013 18:08	701503	(EPA 200.8)	Thallium Total ICAP/MS	ND	ug/L	1	1
4/5/2013	04/09/2013 19:03	701883	(EPA 200.8)	Uranium ICAP/MS	ND	ug/L	1	1
EPA 200.7 - ICP Metals								
4/5/2013	04/09/2013 2:11	701595	(EPA 200.7)	Calcium Total ICAP	6.9	mg/L	1	1
EPA 245.1 - Mercury Total								
4/11/2013	04/12/2013 16:13	702448	(EPA 245.1)	Mercury	ND	ug/L	0.2	1
EPA 100.2 - Asbestos by TEM - >10 microns								
4/4/2013	04/17/2013 00:00	703042	(EPA 100.2)	Asbestos by TEM - >10 microns	ND	MFL	0.2	1
EPA 200.8 - Uranium by ICPMS as pCi/L								
	04/08/2013 09:56		(EPA 200.8)	Uranium by ICPMS as pCi/L	ND	pCi/L	0.7	1
EPA 505 - Organochlorine Pesticides/PCBs								
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Alachlor (Alanex)	ND	ug/L	0.1	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Aldrin	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Chlordane	ND	ug/L	0.1	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Dieldrin	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Endrin	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Heptachlor	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Heptachlor Epoxide	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Lindane (gamma-BHC)	ND	ug/L	0.01	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Methoxychlor	ND	ug/L	0.05	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	PCB 1016 Aroclor	ND	ug/L	0.08	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	PCB 1221 Aroclor	ND	ug/L	0.1	1

Rounding on totals after summation.
(c) - indicates calculated results

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Laboratory Data
Report: 430285

Water Resource Associates
Dan Lum
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Samples Received on:
04/04/2013

Prepared	Analyzed	QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	PCB 1232 Aroclor	ND	ug/L	0.1	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	PCB 1242 Aroclor	ND	ug/L	0.1	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	PCB 1248 Aroclor	ND	ug/L	0.1	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	PCB 1254 Aroclor	ND	ug/L	0.1	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	PCB 1260 Aroclor	ND	ug/L	0.1	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Total PCBs	ND	ug/L	0.1	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Toxaphene	ND	ug/L	0.5	1
4/8/2013	04/09/2013 03:31	701779	(EPA 505)	Tetrachlorometaxylene	101	%		1
EPA 515.4 - Chlorophenoxy Herbicides								
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	2,4,5-T	ND	ug/L	0.2	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	2,4,5-TP (Silvex)	ND	ug/L	0.2	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	2,4-D	ND	ug/L	0.1	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	2,4-DB	ND	ug/L	2	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	3,5-Dichlorobenzoic acid	ND	ug/L	0.5	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	Acifluorfen	ND	ug/L	0.2	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	Bentazon	ND	ug/L	0.5	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	Dalapon	ND	ug/L	1	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	Dicamba	ND	ug/L	0.1	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	Dichlorprop	ND	ug/L	0.5	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	Dinoseb	ND	ug/L	0.2	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	Pentachlorophenol	ND	ug/L	0.04	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	Picloram	ND	ug/L	0.1	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	Tot DCPA Mono&Diacid Degradate	ND	ug/L	0.1	1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	2,4-Dichlorophenyl acetic acid	108	%		1
4/12/2013	04/13/2013 16:38	702256	(EPA 515.4)	4,4-Dibromooctafluorobiphenyl	98	%		1
EPA 504.1 - EPA Method 504.1								
4/9/2013	04/10/2013 02:10	701826	(EPA 504.1)	1,2,3-Trichloropropane (TCP)	ND	ug/L	0.04	1
4/9/2013	04/10/2013 02:10	701826	(EPA 504.1)	Dibromochloropropane (DBCP)	ND	ug/L	0.01	1
4/9/2013	04/10/2013 02:10	701826	(EPA 504.1)	Ethylene Dibromide (EDB)	ND	ug/L	0.01	1
4/9/2013	04/10/2013 02:10	701826	(EPA 504.1)	1,2-Dibromopropane	111	%		1
EPA 525.2 - Semivolatiles by GCMS								
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Atrazine	ND	ug/L	0.05	1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Benzo(a)pyrene	ND	ug/L	0.02	1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Di-(2-Ethylhexyl)adipate	ND	ug/L	0.6	1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Di(2-Ethylhexyl)phthalate	ND	ug/L	0.6	1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Hexachlorobenzene	ND	ug/L	0.05	1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Hexachlorocyclopentadiene	ND	ug/L	0.05	1

Rounding on totals after summation.
(c) - indicates calculated results

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1 800 566 LABS (1 800 566 5227)

Laboratory Data
Report: 430285

Water Resource Associates
Dan Lum
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Samples Received on:
04/04/2013

Prepared	Analyzed	QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Molinate	ND	ug/L	0.1	1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Simazine	ND	ug/L	0.05	1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Thiobencarb (ELAP)	ND	ug/L	0.2	1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	1,3-Dimethyl-2-nitrobenzene	94	%		1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Acenaphthene-d10	62	%		1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Chrysene-d12	70	%		1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Perylene-d12	88	%		1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Phenanthrene-d10	67	%		1
4/16/2013	04/25/2013 14:47	704575	(EPA 525.2)	Triphenylphosphate	107	%		1
	EPA 548.1 - Endothall							
4/9/2013	04/11/2013 13:42	702334	(EPA 548.1)	Endothall	ND	ug/L	5	1
	EPA 1613B - 2,3,7,8-TCDD_Dioxin							
4/8/2013	04/11/2013 1:34	702102	(EPA 1613B)	2,3,7,8-TCDD	ND	pg/L	5	1
4/8/2013	04/11/2013 1:34	702102	(EPA 1613B)	C12-2,3,7,8-TCDD	90	%		1
	EPA 547 - Glyphosate							
	04/09/2013 12:49	701685	(EPA 547)	Glyphosate	ND	ug/L	6	1
	EPA 531.2 - Aldicarbs							
	04/12/2013 02:34	701935	(EPA 531.2)	3-Hydroxycarbofuran	ND	ug/L	0.5	1
	04/12/2013 02:34	701935	(EPA 531.2)	Aldicarb (Temik)	ND	ug/L	0.5	1
	04/12/2013 02:34	701935	(EPA 531.2)	Aldicarb sulfone	ND	ug/L	0.5	1
	04/12/2013 02:34	701935	(EPA 531.2)	Aldicarb sulfoxide	ND	ug/L	0.5	1
	04/12/2013 02:34	701935	(EPA 531.2)	Baygon	ND	ug/L	0.5	1
	04/12/2013 02:34	701935	(EPA 531.2)	Carbaryl	ND	ug/L	0.5	1
	04/12/2013 02:34	701935	(EPA 531.2)	Carbofuran (Furadan)	ND	ug/L	0.5	1
	04/12/2013 02:34	701935	(EPA 531.2)	Methiocarb	ND	ug/L	0.5	1
	04/12/2013 02:34	701935	(EPA 531.2)	Methomyl	ND	ug/L	0.5	1
	04/12/2013 02:34	701935	(EPA 531.2)	Oxamyl (Vydate)	ND	ug/L	0.5	1
	04/12/2013 02:34	701935	(EPA 531.2)	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	82	%		1
	EPA 549.2 - Diquat and Paraquat							
4/5/2013	04/06/2013 04:11	701492	(EPA 549.2)	Diquat	ND	ug/L	0.4	1
4/5/2013	04/06/2013 04:11	701492	(EPA 549.2)	Paraquat	ND	ug/L	2	1
	EPA 300.0 - Nitrate, Nitrite by EPA 300.0							
	04/04/2013 13:32	701199	(EPA 300.0)	Nitrate as Nitrogen by IC	0.24	mg/L	0.1	1
	04/04/2013 13:32	701199	(EPA 300.0)	Nitrite Nitrogen by IC	ND	mg/L	0.05	1
	EPA 900.0 - Gross Alpha/Beta Radiation							
4/10/2013	04/17/2013 14:28	703938	(EPA 900.0)	Alpha, Gross	3.6	pCi/L	3	1
4/10/2013	04/17/2013 14:28	703938	(EPA 900.0)	Alpha, Min Detectable Activity	3.0	pCi/L		1

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Prepared	Analyzed	QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
4/10/2013	04/17/2013 14:28	703938	(EPA 900.0)	Alpha, Two Sigma Error	2.6	pCi/L		1
4/10/2013	04/17/2013 14:28	703938	(EPA 900.0)	Beta, Gross	ND	pCi/L	3	1
4/10/2013	04/17/2013 14:28	703938	(EPA 900.0)	Beta, Min Detectable Activity	3.0	pCi/L		1
4/10/2013	04/17/2013 14:28	703938	(EPA 900.0)	Beta, Two Sigma Error	1.5	pCi/L		1
4/10/2013	04/17/2013 14:28	703938	(EPA 900.0)	Gross Alpha + adjusted error	5.8	pCi/L	3	1
	Ra-226 GA - Radium 226							
4/25/2013	05/17/2013 22:20	705241	(Ra-226 GA)	Radium 226	ND	pCi/L	1	1
4/25/2013	05/17/2013 22:20	705241	(Ra-226 GA)	Radium 226 Min Detect Activity	0.32	pCi/L		1
4/25/2013	05/17/2013 22:20	705241	(Ra-226 GA)	Radium 226 Two Sigma Error	0.17	pCi/L		1
	RA-228 GA - Radium 228							
4/25/2013	05/17/2013 22:20	705245	(RA-228 GA)	Radium 228	ND	pCi/L	1	1
4/25/2013	05/17/2013 22:20	705245	(RA-228 GA)	Radium 228 Min Detect Activity	0.76	pCi/L		1
4/25/2013	05/17/2013 22:20	705245	(RA-228 GA)	Radium 228 Two Sigma Error	0	pCi/L		1
	EPA 524.2 - Volatile Organics by GCMS							
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,1,1,2-Tetrachloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,1,1-Trichloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,1,2,2-Tetrachloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,1,2-Trichloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,1-Dichloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,1-Dichloroethylene	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,1-Dichloropropene	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,2,3-Trichlorobenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,2,3-Trichloropropane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,2,4-Trichlorobenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,2,4-Trimethylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,2-Dichloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,2-Dichloropropane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,3,5-Trimethylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	1,3-Dichloropropane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	2,2-Dichloropropane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	2-Butanone (MEK)	ND	ug/L	5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	4-Methyl-2-Pentanone (MIBK)	ND	ug/L	5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	Benzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	Bromobenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	Bromochloromethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	Bromodichloromethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013 10:24	702124	(EPA 524.2)	Bromoethane	ND	ug/L	0.5	1

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4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Bromoform	ND (LK,VC)	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Bromomethane (Methyl Bromide)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Carbon disulfide	ND (LK)	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Carbon Tetrachloride	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Chlorobenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Chlorodibromomethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Chloroethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Chloroform (Trichloromethane)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Chloromethane(Methyl Chloride)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	cis-1,2-Dichloroethylene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	cis-1,3-Dichloropropene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Dibromomethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Dichlorodifluoromethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Dichloromethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Di-isopropyl ether	ND	ug/L	3	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Ethyl benzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Hexachlorobutadiene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Isopropylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	m,p-Xylenes	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	m-Dichlorobenzene (1,3-DCB)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Methyl Tert-butyl ether (MTBE)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Naphthalene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	n-Butylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	n-Propylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	o-Chlorotoluene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	o-Dichlorobenzene (1,2-DCB)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	o-Xylene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	p-Chlorotoluene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	p-Dichlorobenzene (1,4-DCB)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	p-Isopropyltoluene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	sec-Butylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Styrene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	tert-amyl Methyl Ether	ND	ug/L	3	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	tert-Butyl Ethyl Ether	ND	ug/L	3	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	tert-Butylbenzene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Tetrachloroethylene (PCE)	ND	ug/L	0.5	1

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Prepared	Analyzed		QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Toluene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Total 1,3-Dichloropropene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Total THM	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Total xylenes	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	trans-1,2-Dichloroethylene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	trans-1,3-Dichloropropene	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Trichloroethylene (TCE)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Trichlorofluoromethane	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Trichlorotrifluoroethane(Freon 113)	ND	ug/L	0.5	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Vinyl chloride (VC)	ND	ug/L	0.3	1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	1,2-Dichloroethane-d4	101	%		1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	4-Bromofluorobenzene	106	%		1
4/10/2013	04/11/2013	10:24	702124	(EPA 524.2)	Toluene-d8	86	%		1
	SM4500CN-F - Cyanide								
	04/06/2013	03:54	701580	(SM4500CN-F)	Cyanide	ND	mg/L	0.025	1
	SM 4500F-C - Fluoride								
	04/19/2013	00:25	703527	(SM 4500F-C)	Fluoride	ND	mg/L	0.05	1
	SM 2320B - Alkalinity in CaCO3 units								
	04/05/2013	22:23	701401	(SM 2320B)	Alkalinity in CaCO3 units	37	mg/L	2	1
	SM4500-HB - PH (H3=past HT not compliant)								
	04/05/2013	22:23	701404	(SM4500-HB)	PH (H3=past HT not compliant)	8.0	Units	0.1	1
	EPA 180.1 - Turbidity								
	04/04/2013	18:06	701195	(EPA 180.1)	Turbidity	0.30	NTU	0.05	1
	SM2510B - Specific Conductance								
	04/05/2013	22:23	701407	(SM2510B)	Specific Conductance, 25 C	120	umho/cm	2	1

Travel Blank - HOLD (201304040582) — **Sampled on 04/03/2013 0800**

Prepared	Analyzed		QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
	EPA 504.1 - EPA Method 504.1								
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	1,2,3-Trichloropropane (TCP)	NA	ug/L	0.04	1
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	Dibromochloropropane (DBCP)	NA	ug/L	0.01	1
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	Ethylene Dibromide (EDB)	NA	ug/L	0.01	1
4/9/2013	04/10/2013	02:10	701826	(EPA 504.1)	1,2-Dibromopropane	NA	%		1
	EPA 524.2 - Volatile Organics by GCMS								
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1,1,2-Tetrachloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1,1-Trichloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1,2,2-Tetrachloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013	12:42	702124	(EPA 524.2)	1,1,2-Trichloroethane	NA	ug/L	0.5	1

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4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,1-Dichloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,1-Dichloroethylene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,1-Dichloropropene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,2,3-Trichlorobenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,2,3-Trichloropropane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,2,4-Trichlorobenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,2,4-Trimethylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,2-Dichloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,2-Dichloropropane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,3,5-Trimethylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,3-Dichloropropane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	2,2-Dichloropropane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	2-Butanone (MEK)	NA	ug/L	5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	4-Methyl-2-Pentanone (MIBK)	NA	ug/L	5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Benzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Bromobenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Bromochloromethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Bromodichloromethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Bromoethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Bromoform	NA (LK,VC)	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Bromomethane (Methyl Bromide)	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Carbon disulfide	NA (LK)	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Carbon Tetrachloride	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Chlorobenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Chlorodibromomethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Chloroethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Chloroform (Trichloromethane)	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Chloromethane(Methyl Chloride)	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	cis-1,2-Dichloroethylene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	cis-1,3-Dichloropropene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Dibromomethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Dichlorodifluoromethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Dichloromethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Di-isopropyl ether	NA	ug/L	3	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Ethyl benzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Hexachlorobutadiene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Isopropylbenzene	NA	ug/L	0.5	1

Rounding on totals after summation.
(c) - indicates calculated results

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Laboratory Data
Report: 430285

Water Resource Associates
Dan Lum
1296 Kapiolani Blvd. #1704
Honolulu, HI 96814

Samples Received on:
04/04/2013

Prepared	Analyzed	QC Ref #	Method	Analyte	Result	Units	MRL	Dilution
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	m,p-Xylenes	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	m-Dichlorobenzene (1,3-DCB)	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Methyl Tert-butyl ether (MTBE)	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Naphthalene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	n-Butylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	n-Propylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	o-Chlorotoluene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	o-Dichlorobenzene (1,2-DCB)	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	o-Xylene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	p-Chlorotoluene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	p-Dichlorobenzene (1,4-DCB)	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	p-Isopropyltoluene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	sec-Butylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Styrene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	tert-amyl Methyl Ether	NA	ug/L	3	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	tert-Butyl Ethyl Ether	NA	ug/L	3	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	tert-Butylbenzene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Tetrachloroethylene (PCE)	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Toluene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Total 1,3-Dichloropropene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Total THM	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Total xylenes	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	trans-1,2-Dichloroethylene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	trans-1,3-Dichloropropene	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Trichloroethylene (TCE)	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Trichlorofluoromethane	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Trichlorotrifluoroethane(Freon 113)	NA	ug/L	0.5	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Vinyl chloride (VC)	NA	ug/L	0.3	1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	1,2-Dichloroethane-d4	NA	%		1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	4-Bromofluorobenzene	NA	%		1
4/10/2013	04/11/2013 12:42	702124	(EPA 524.2)	Toluene-d8	NA	%		1

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Laboratory Comments
Report: 430285

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Flags Legend:

LK - The associated blank spike recovery was above method acceptance limits. This target analyte was not detected in the sample.

VC - CCV is high biased, ND data are reportable as per NELAC 5.5.5.10

The Comments Report may be blank if there are no comments for this report.

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Laboratory
QC Summary: 430285

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QC Ref # 701195 - Turbidity		**Analysis Date: 04/04/2013**
201304040581	MAHINAHINA	Analyzed by: ADV
QC Ref # 701199 - Nitrate, Nitrite by EPA 300.0		**Analysis Date: 04/04/2013**
201304040581	MAHINAHINA	Analyzed by: CYP
QC Ref # 701401 - Alkalinity in CaCO3 units		**Analysis Date: 04/05/2013**
201304040581	MAHINAHINA	Analyzed by: JMO
QC Ref # 701404 - PH (H3=past HT not compliant)		**Analysis Date: 04/05/2013**
201304040581	MAHINAHINA	Analyzed by: JMO
QC Ref # 701407 - Specific Conductance		**Analysis Date: 04/05/2013**
201304040581	MAHINAHINA	Analyzed by: JMO
QC Ref # 701492 - Diquat and Paraquat		**Analysis Date: 04/06/2013**
201304040581	MAHINAHINA	Analyzed by: XWO
QC Ref # 701503 - ICPMS Metals		**Analysis Date: 04/05/2013**
201304040581	MAHINAHINA	Analyzed by: SXK
QC Ref # 701580 - Cyanide		**Analysis Date: 04/06/2013**
201304040581	MAHINAHINA	Analyzed by: MXT
QC Ref # 701595 - ICP Metals		**Analysis Date: 04/09/2013**
201304040581	MAHINAHINA	Analyzed by: NINA
QC Ref # 701677 - ICPMS Metals		**Analysis Date: 04/08/2013**
201304040581	MAHINAHINA	Analyzed by: SXK
QC Ref # 701685 - Glyphosate		**Analysis Date: 04/09/2013**
201304040581	MAHINAHINA	Analyzed by: FWH
QC Ref # 701779 - Organochlorine Pesticides/PCBs		**Analysis Date: 04/09/2013**
201304040581	MAHINAHINA	Analyzed by: LRL
QC Ref # 701826 - EPA Method 504.1		**Analysis Date: 04/10/2013**
201304040581	MAHINAHINA	Analyzed by: MCP
201304040582	Travel Blank - HOLD	Analyzed by: MCP
QC Ref # 701883 - ICPMS Metals		**Analysis Date: 04/09/2013**
201304040581	MAHINAHINA	Analyzed by: SXK
QC Ref # 701935 - Aldicarbs		**Analysis Date: 04/12/2013**
201304040581	MAHINAHINA	Analyzed by: XWO
QC Ref # 702102 - 2,3,7,8-TCDD_Dioxin		**Analysis Date: 04/11/2013**
201304040581	MAHINAHINA	Analyzed by: PAC
QC Ref # 702124 - Volatile Organics by GCMS		**Analysis Date: 04/11/2013**
201304040581	MAHINAHINA	Analyzed by: SZZ
201304040582	Travel Blank - HOLD	Analyzed by: SZZ

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QC Summary: 430285

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QC Ref # 702197 - Source Temperature Degrees F — **Analysis Date: 04/03/2013**
201304040581 MAHINAHINA — Analyzed by: ADT

QC Ref # 702256 - Chlorophenoxy Herbicides — **Analysis Date: 04/13/2013**
201304040581 MAHINAHINA — Analyzed by: KCL

QC Ref # 702334 - Endothall — **Analysis Date: 04/11/2013**
201304040581 MAHINAHINA — Analyzed by: CRW

QC Ref # 702448 - Mercury Total — **Analysis Date: 04/12/2013**
201304040581 MAHINAHINA — Analyzed by: MXT

QC Ref # 703042 - Asbestos by TEM - >10 microns — **Analysis Date: 04/17/2013**
201304040581 MAHINAHINA — Analyzed by: CJB

QC Ref # 703527 - Fluoride — **Analysis Date: 04/19/2013**
201304040581 MAHINAHINA — Analyzed by: MXT

QC Ref # 703938 - Gross Alpha/Beta Radiation — **Analysis Date: 04/17/2013**
201304040581 MAHINAHINA — Analyzed by: MAL

QC Ref # 704575 - Semivolatiles by GCMS — **Analysis Date: 04/25/2013**
201304040581 MAHINAHINA — Analyzed by: JWC

QC Ref # 705241 - Radium 226 — **Analysis Date: 05/17/2013**
201304040581 MAHINAHINA — Analyzed by: WBH

QC Ref # 705245 - Radium 228 — **Analysis Date: 05/17/2013**
201304040581 MAHINAHINA — Analyzed by: WBH

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Laboratory QC
Report: 430285

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
QC Ref# 701195 - Turbidity by EPA 180.1						**Analysis Date: 04/04/2013**			
DUP1_201304040179	Turbidity	0.068		0.0670	NTU		(0-20)	20	1.5
DUP2_201304040379	Turbidity	0.12		0.129	NTU		(0-20)	20	4.0
LCS1	Turbidity		20	19.9	NTU	100	(90-110)		
LCS2	Turbidity		20	19.7	NTU	99	(90-110)	20	1.0
MBLK	Turbidity			<0.05	NTU				
MRL_CHK	Turbidity		0.05	0.0610	NTU	122	(50-150)		
QC Ref# 701199 - Nitrate, Nitrite by EPA 300.0 by EPA 300.0						**Analysis Date: 04/04/2013**			
LCS1	Nitrate as Nitrogen by IC		2.5	2.48	mg/L	99	(90-110)		
LCS2	Nitrate as Nitrogen by IC		2.5	2.41	mg/L	96	(90-110)	20	2.9
MBLK	Nitrate as Nitrogen by IC			<0.10	mg/L				
MRL_CHK	Nitrate as Nitrogen by IC		0.05	0.0504	mg/L	101	(50-150)		
MS_201304040625	Nitrate as Nitrogen by IC	5.8	1.3	8.23	mg/L	98	(80-120)		
MS_201304040581	Nitrate as Nitrogen by IC	0.24	1.3	1.49	mg/L	100	(80-120)		
MSD_201304040625	Nitrate as Nitrogen by IC	5.8	1.3	8.25	mg/L	98	(80-120)	20	0.24
MSD_201304040581	Nitrate as Nitrogen by IC	0.24	1.3	1.50	mg/L	101	(80-120)	20	0.67
LCS1	Nitrite Nitrogen by IC		1.0	0.975	mg/L	98	(90-110)		
LCS2	Nitrite Nitrogen by IC		1.0	0.979	mg/L	98	(90-110)	20	0.41
MBLK	Nitrite Nitrogen by IC			<0.10	mg/L				
MRL_CHK	Nitrite Nitrogen by IC		0.05	0.0495	mg/L	99	(50-150)		
MS_201304040581	Nitrite Nitrogen by IC	ND	0.5	0.495	mg/L	99	(80-120)		
MS_201304040625	Nitrite Nitrogen by IC	ND	0.5	0.951	mg/L	95	(80-120)		
MSD_201304040625	Nitrite Nitrogen by IC	ND	0.5	0.956	mg/L	96	(80-120)	20	0.52
MSD_201304040581	Nitrite Nitrogen by IC	ND	0.5	0.495	mg/L	99	(80-120)	20	0.0
QC Ref# 701401 - Alkalinity in CaCO3 units by SM 2320B						**Analysis Date: 04/05/2013**			
LCS1	Alkalinity in CaCO3 units		100	99.7	mg/L	100	(90-110)		
LCS2	Alkalinity in CaCO3 units		100	100	mg/L	100	(90-110)	20	0.30
MBLK	Alkalinity in CaCO3 units			<2	mg/L				
MRL_CHK	Alkalinity in CaCO3 units		2.0	2.16	mg/L	108	(50-150)		
MS_201304040591	Alkalinity in CaCO3 units	170	100	220	mg/L	<u>55</u>	(80-120)		
MS_201304050098	Alkalinity in CaCO3 units	59	100	150	mg/L	91	(80-120)		
MSD_201304040591	Alkalinity in CaCO3 units	170	100	223	mg/L	<u>58</u>	(80-120)	20	1.4
MSD_201304050098	Alkalinity in CaCO3 units	59	100	149	mg/L	90	(80-120)	20	0.67
QC Ref# 701404 - PH (H3=past HT not compliant) by SM4500-HB						**Analysis Date: 04/05/2013**			
DUP_201304050193	PH (H3=past HT not compliant)	7.9		7.93	Units		(0-20)	20	0.25
DUP_201304040382	PH (H3=past HT not compliant)	7.9		7.92	Units		(0-20)	20	0.13

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS3	PH (H3=past HT not compliant)		8.0	8.00	Units	100	(99-101)		
LCS4	PH (H3=past HT not compliant)		8.0	8.00	Units	100	(99-101)	20	0.0
QC Ref# 701407 - Specific Conductance by SM2510B						**Analysis Date: 04/05/2013**			
DUP1_201304040382	Specific Conductance	3600		3560	umho/cm		(0-20)	20	0.022
DUP1_201304050193	Specific Conductance	2600		2560	umho/cm		(0-20)	20	0.14
LCS1	Specific Conductance		1000	1000	umho/cm	100	(95-105)		
LCS2	Specific Conductance		1000	999	umho/cm	100	(95-105)	20	0.10
MBLK	Specific Conductance			<2	umho/cm				
MRL_CHK	Specific Conductance		2.0	1.80	umho/cm	90	(50-150)		
QC Ref# 701492 - Diquat and Paraquat by EPA 549.2						**Analysis Date: 04/05/2013**			
CCCH	Diquat		10	10.0	ug/L	100	(80-120)		
CCCL	Diquat		0.4	0.358	ug/L	90	(80-120)		
CCCM	Diquat		4.0	4.08	ug/L	102	(80-120)		
LCS1	Diquat		5.0	4.37	ug/L	87	(70-130)		
LCS2	Diquat		5.0	4.46	ug/L	89	(70-130)	20	2.0
MBLK	Diquat			<0.2	ug/L				
MRL_CHK	Diquat		0.4	0.348	ug/L	87	(50-150)		
MS_201304040624	Diquat	ND	5.0	4.07	ug/L	81	(70-130)		
MS2_201304040625	Diquat	ND	5.0	2.95	ug/L	59	(70-130)		
MSD_201304040624	Diquat	ND	5.0	3.98	ug/L	80	(70-130)	20	2.2
CCCH	Paraquat		10	9.81	ug/L	98	(80-120)		
CCCL	Paraquat		2.0	2.24	ug/L	112	(80-120)		
CCCM	Paraquat		4.0	3.97	ug/L	99	(80-120)		
LCS1	Paraquat		5.0	3.95	ug/L	79	(70-130)		
LCS2	Paraquat		5.0	3.98	ug/L	80	(70-130)	20	0.76
MBLK	Paraquat			<1	ug/L				
MRL_CHK	Paraquat		2.0	1.58	ug/L	79	(50-150)		
MS_201304040624	Paraquat	ND	5.0	3.60	ug/L	72	(70-130)		
MS2_201304040625	Paraquat	ND	5.0	1.92	ug/L	39	(70-130)		
MSD_201304040624	Paraquat	ND	5.0	3.42	ug/L	68	(70-130)	20	5.1
QC Ref# 701503 - ICPMS Metals by EPA 200.8						**Analysis Date: 04/05/2013**			
LCS1	Antimony Total ICAP/MS		50	49.9	ug/L	100	(85-115)		
LCS2	Antimony Total ICAP/MS		50	51.0	ug/L	102	(85-115)	20	2.2
MBLK	Antimony Total ICAP/MS			<1	ug/L				
MRL_CHK	Antimony Total ICAP/MS		1.0	1.06	ug/L	106	(50-150)		
MS_201304040367	Antimony Total ICAP/MS	ND	50	48.4	ug/L	96	(70-130)		
MS2_201304050033	Antimony Total ICAP/MS	ND	50	49.7	ug/L	99	(70-130)		

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201304040367	Antimony Total ICAP/MS	ND	50	51.1	ug/L	101	(70-130)	20	5.4
MSD2_201304050033	Antimony Total ICAP/MS	ND	50	49.4	ug/L	99	(70-130)	20	0.61
LCS1	Arsenic Total ICAP/MS		20	20.7	ug/L	103	(85-115)		
LCS2	Arsenic Total ICAP/MS		20	20.7	ug/L	103	(85-115)	20	0.0
MBLK	Arsenic Total ICAP/MS			<1	ug/L				
MRL_CHK	Arsenic Total ICAP/MS		1.0	1.15	ug/L	115	(50-150)		
MS_201304040367	Arsenic Total ICAP/MS	3.9	20	24.2	ug/L	101	(70-130)		
MS2_201304050033	Arsenic Total ICAP/MS	9.17	20	30.2	ug/L	105	(70-130)		
MSD_201304040367	Arsenic Total ICAP/MS	3.9	20	25.2	ug/L	106	(70-130)	20	4.0
MSD2_201304050033	Arsenic Total ICAP/MS	9.17	20	30.1	ug/L	105	(70-130)	20	0.33
LCS1	Barium Total ICAP/MS		100	96.2	ug/L	96	(85-115)		
LCS2	Barium Total ICAP/MS		100	98.8	ug/L	99	(85-115)	20	2.7
MBLK	Barium Total ICAP/MS			<2	ug/L				
MRL_CHK	Barium Total ICAP/MS		2.0	2.03	ug/L	102	(50-150)		
MS_201304040367	Barium Total ICAP/MS	110	100	200	ug/L	88	(70-130)		
MS2_201304050033	Barium Total ICAP/MS	190	100	287	ug/L	94	(70-130)		
MSD_201304040367	Barium Total ICAP/MS	110	100	207	ug/L	96	(70-130)	20	3.4
MSD2_201304050033	Barium Total ICAP/MS	190	100	284	ug/L	91	(70-130)	20	1.1
LCS1	Beryllium Total ICAP/MS		5.0	4.94	ug/L	99	(85-115)		
LCS2	Beryllium Total ICAP/MS		5.0	4.96	ug/L	99	(85-115)	20	0.40
MBLK	Beryllium Total ICAP/MS			<1	ug/L				
MRL_CHK	Beryllium Total ICAP/MS		1.0	0.976	ug/L	98	(50-150)		
MS_201304040367	Beryllium Total ICAP/MS	ND	5.0	5.29	ug/L	106	(70-130)		
MS2_201304050033	Beryllium Total ICAP/MS	ND	5.0	5.56	ug/L	111	(70-130)		
MSD_201304040367	Beryllium Total ICAP/MS	ND	5.0	5.46	ug/L	109	(70-130)	20	3.2
MSD2_201304050033	Beryllium Total ICAP/MS	ND	5.0	5.47	ug/L	109	(70-130)	20	1.6
LCS1	Cadmium Total ICAP/MS		20	19.9	ug/L	100	(85-115)		
LCS2	Cadmium Total ICAP/MS		20	19.7	ug/L	99	(85-115)	20	1.0
MBLK	Cadmium Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Cadmium Total ICAP/MS		0.5	0.533	ug/L	107	(50-150)		
MS_201304040367	Cadmium Total ICAP/MS	ND	20	18.1	ug/L	90	(70-130)		
MS2_201304050033	Cadmium Total ICAP/MS	ND	20	18.6	ug/L	93	(70-130)		
MSD_201304040367	Cadmium Total ICAP/MS	ND	20	19.2	ug/L	96	(70-130)	20	5.9
MSD2_201304050033	Cadmium Total ICAP/MS	ND	20	18.5	ug/L	92	(70-130)	20	1.1
LCS1	Chromium Total ICAP/MS		100	96.2	ug/L	96	(85-115)		
LCS2	Chromium Total ICAP/MS		100	95.7	ug/L	96	(85-115)	20	0.52
MBLK	Chromium Total ICAP/MS			<1	ug/L				
MRL_CHK	Chromium Total ICAP/MS		1.0	1.12	ug/L	112	(50-150)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Laboratory QC
Report: 430285

Water Resource Associates

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201304040367	Chromium Total ICAP/MS	ND	100	91.6	ug/L	91	(70-130)		
MS2_201304050033	Chromium Total ICAP/MS	3.8	100	91.1	ug/L	87	(70-130)		
MSD_201304040367	Chromium Total ICAP/MS	ND	100	94.4	ug/L	94	(70-130)	20	3.0
MSD2_201304050033	Chromium Total ICAP/MS	3.8	100	90.1	ug/L	86	(70-130)	20	1.1
LCS1	Copper Total ICAP/MS		100	98.7	ug/L	99	(85-115)		
LCS2	Copper Total ICAP/MS		100	99.4	ug/L	99	(85-115)	20	0.71
MBLK	Copper Total ICAP/MS			<2	ug/L				
MRL_CHK	Copper Total ICAP/MS		2.0	2.18	ug/L	109	(50-150)		
MS_201304040367	Copper Total ICAP/MS	3.2	100	94.2	ug/L	91	(70-130)		
MS2_201304050033	Copper Total ICAP/MS	ND	100	89.0	ug/L	88	(70-130)		
MSD_201304040367	Copper Total ICAP/MS	3.2	100	96.8	ug/L	94	(70-130)	20	2.8
MSD2_201304050033	Copper Total ICAP/MS	ND	100	88.3	ug/L	87	(70-130)	20	0.79
LCS1	Lead Total ICAP/MS		20	19.5	ug/L	97	(85-115)		
LCS2	Lead Total ICAP/MS		20	19.7	ug/L	98	(85-115)	20	1.0
MBLK	Lead Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Lead Total ICAP/MS		0.5	0.525	ug/L	105	(50-150)		
MS_201304040367	Lead Total ICAP/MS	ND	20	18.6	ug/L	93	(70-130)		
MS2_201304050033	Lead Total ICAP/MS	ND	20	18.8	ug/L	94	(70-130)		
MSD_201304040367	Lead Total ICAP/MS	ND	20	19.5	ug/L	98	(70-130)	20	4.7
MSD2_201304050033	Lead Total ICAP/MS	ND	20	18.6	ug/L	93	(70-130)	20	1.1
LCS1	Nickel Total ICAP/MS		50	48.4	ug/L	97	(85-115)		
LCS2	Nickel Total ICAP/MS		50	48.3	ug/L	97	(85-115)	20	0.21
MBLK	Nickel Total ICAP/MS			<5	ug/L				
MRL_CHK	Nickel Total ICAP/MS		5.0	3.94	ug/L	79	(50-150)		
MS_201304040367	Nickel Total ICAP/MS	ND	50	46.8	ug/L	91	(70-130)		
MS2_201304050033	Nickel Total ICAP/MS	ND	50	45.8	ug/L	89	(70-130)		
MSD_201304040367	Nickel Total ICAP/MS	ND	50	48.7	ug/L	95	(70-130)	20	4.0
MSD2_201304050033	Nickel Total ICAP/MS	ND	50	44.9	ug/L	87	(70-130)	20	2.2
LCS1	Selenium Total ICAP/MS		20	20.9	ug/L	104	(85-115)		
LCS2	Selenium Total ICAP/MS		20	20.9	ug/L	105	(85-115)	20	0.0
MBLK	Selenium Total ICAP/MS			<5	ug/L				
MRL_CHK	Selenium Total ICAP/MS		5.0	5.56	ug/L	111	(50-150)		
MS_201304040367	Selenium Total ICAP/MS	ND	20	21.6	ug/L	103	(70-130)		
MS2_201304050033	Selenium Total ICAP/MS	7.4	20	28.4	ug/L	105	(70-130)		
MSD_201304040367	Selenium Total ICAP/MS	ND	20	22.4	ug/L	107	(70-130)	20	3.6
MSD2_201304050033	Selenium Total ICAP/MS	7.4	20	28.7	ug/L	107	(70-130)	20	1.1
LCS1	Thallium Total ICAP/MS		20	19.4	ug/L	97	(85-115)		
LCS2	Thallium Total ICAP/MS		20	19.4	ug/L	97	(85-115)	20	0.0

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Thallium Total ICAP/MS			<1	ug/L				
MRL_CHK	Thallium Total ICAP/MS		1.0	1.04	ug/L	104	(50-150)		
MS_201304040367	Thallium Total ICAP/MS	ND	20	18.7	ug/L	93	(70-130)		
MS2_201304050033	Thallium Total ICAP/MS	ND	20	18.8	ug/L	94	(70-130)		
MSD_201304040367	Thallium Total ICAP/MS	ND	20	19.6	ug/L	98	(70-130)	20	4.7
MSD2_201304050033	Thallium Total ICAP/MS	ND	20	18.9	ug/L	94	(70-130)	20	0.53
LCS1	Uranium ICAP/MS		20	18.8	ug/L	94	(85-115)		
LCS2	Uranium ICAP/MS		20	19.4	ug/L	97	(85-115)	20	3.1
MBLK	Uranium ICAP/MS			<1	ug/L				
MRL_CHK	Uranium ICAP/MS		1.0	0.982	ug/L	98	(50-150)		
MS_201304040367	Uranium ICAP/MS	2.0	20	21.7	ug/L	99	(70-130)		
MS2_201304050033	Uranium ICAP/MS	4.365	20	23.8	ug/L	97	(70-130)		
MSD_201304040367	Uranium ICAP/MS	2.0	20	22.7	ug/L	104	(70-130)	20	4.5
MSD2_201304050033	Uranium ICAP/MS	4.365	20	24.8	ug/L	102	(70-130)	20	4.1
QC Ref# 701580 - Cyanide by SM4500CN-F						**Analysis Date: 04/06/2013**			
LCS1	Cyanide		0.1	0.105	mg/L	105	(90-110)		
LCS2	Cyanide		0.1	0.102	mg/L	101	(90-110)	20	2.9
MBLK	Cyanide			<0.025	mg/L				
MRL_CHK	Cyanide		0.025	0.0279	mg/L	112	(50-150)		
MS_201304040431	Cyanide	ND	0.1	0.0175	mg/L	8.3	(80-120)		
MS_201304040574	Cyanide	ND	0.1	0.101	mg/L	94	(80-120)		
MSD_201304040431	Cyanide	ND	0.1	0.0218	mg/L	13	(80-120)	20	22
MSD_201304040574	Cyanide	ND	0.1	0.103	mg/L	96	(80-120)	20	2.0
QC Ref# 701595 - ICP Metals by EPA 200.7						**Analysis Date: 04/09/2013**			
LCS1	Calcium Total ICAP		50	46.6	mg/L	93	(85-115)		
LCS2	Calcium Total ICAP		50	47.2	mg/L	94	(85-115)	20	1.3
MBLK	Calcium Total ICAP			<0.5	mg/L				
MRL_CHK	Calcium Total ICAP		1.0	0.959	mg/L	96	(50-150)		
MS_201304050096	Calcium Total ICAP	27	50	72.5	mg/L	92	(70-130)		
MS2_201304040431	Calcium Total ICAP	27	50	71.4	mg/L	89	(70-130)		
MSD_201304050096	Calcium Total ICAP	27	50	73.4	mg/L	93	(70-130)	20	1.2
MSD2_201304040431	Calcium Total ICAP	27	50	72.0	mg/L	90	(70-130)	20	0.84
QC Ref# 701677 - ICPMS Metals by EPA 200.8						**Analysis Date: 04/08/2013**			
LCS1	Antimony Total ICAP/MS		50	49.4	ug/L	99	(85-115)		
LCS2	Antimony Total ICAP/MS		50	50.4	ug/L	101	(85-115)	20	2.0
MBLK	Antimony Total ICAP/MS			<1	ug/L				
MRL_CHK	Antimony Total ICAP/MS		1.0	1.05	ug/L	105	(50-150)		

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RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201304060075	Antimony Total ICAP/MS	ND	50	50.3	ug/L	100	(70-130)		
MS2_201304060076	Antimony Total ICAP/MS	ND	50	49.9	ug/L	100	(70-130)		
MSD_201304060075	Antimony Total ICAP/MS	ND	50	42.6	ug/L	85	(70-130)	20	17
MSD2_201304060076	Antimony Total ICAP/MS	ND	50	51.0	ug/L	102	(70-130)	20	2.2
LCS1	Arsenic Total ICAP/MS		20	20.4	ug/L	102	(85-115)		
LCS2	Arsenic Total ICAP/MS		20	20.2	ug/L	101	(85-115)	20	0.99
MBLK	Arsenic Total ICAP/MS			<1	ug/L				
MRL_CHK	Arsenic Total ICAP/MS		1.0	1.17	ug/L	117	(50-150)		
MS_201304060075	Arsenic Total ICAP/MS	ND	20	20.2	ug/L	100	(70-130)		
MS2_201304060076	Arsenic Total ICAP/MS	ND	20	21.0	ug/L	101	(70-130)		
MSD_201304060075	Arsenic Total ICAP/MS	ND	20	17.5	ug/L	86	(70-130)	20	14
MSD2_201304060076	Arsenic Total ICAP/MS	ND	20	21.0	ug/L	101	(70-130)	20	0.48
LCS1	Barium Total ICAP/MS		100	97.6	ug/L	98	(85-115)		
LCS2	Barium Total ICAP/MS		100	99.8	ug/L	100	(85-115)	20	2.2
MBLK	Barium Total ICAP/MS			<2	ug/L				
MRL_CHK	Barium Total ICAP/MS		2.0	2.00	ug/L	100	(50-150)		
MS_201304060075	Barium Total ICAP/MS	ND	100	103	ug/L	101	(70-130)		
MS2_201304060076	Barium Total ICAP/MS	8.2	100	107	ug/L	99	(70-130)		
MSD_201304060075	Barium Total ICAP/MS	ND	100	88.6	ug/L	87	(70-130)	20	15
MSD2_201304060076	Barium Total ICAP/MS	8.2	100	110	ug/L	101	(70-130)	20	2.8
LCS1	Beryllium Total ICAP/MS		5.0	5.10	ug/L	102	(85-115)		
LCS2	Beryllium Total ICAP/MS		5.0	5.03	ug/L	101	(85-115)	20	1.4
MBLK	Beryllium Total ICAP/MS			<1	ug/L				
MRL_CHK	Beryllium Total ICAP/MS		1.0	1.01	ug/L	101	(50-150)		
MS_201304060075	Beryllium Total ICAP/MS	ND	5.0	5.51	ug/L	110	(70-130)		
MS2_201304060076	Beryllium Total ICAP/MS	ND	5.0	5.45	ug/L	109	(70-130)		
MSD_201304060075	Beryllium Total ICAP/MS	ND	5.0	4.74	ug/L	95	(70-130)	20	15
MSD2_201304060076	Beryllium Total ICAP/MS	ND	5.0	5.43	ug/L	108	(70-130)	20	0.37
LCS1	Cadmium Total ICAP/MS		20	19.7	ug/L	98	(85-115)		
LCS2	Cadmium Total ICAP/MS		20	19.9	ug/L	100	(85-115)	20	1.0
MBLK	Cadmium Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Cadmium Total ICAP/MS		0.5	0.467	ug/L	93	(50-150)		
MS_201304060075	Cadmium Total ICAP/MS	ND	20	20.0	ug/L	100	(70-130)		
MS2_201304060076	Cadmium Total ICAP/MS	ND	20	19.6	ug/L	98	(70-130)		
MSD_201304060075	Cadmium Total ICAP/MS	ND	20	17.5	ug/L	87	(70-130)	20	13
MSD2_201304060076	Cadmium Total ICAP/MS	ND	20	20.4	ug/L	102	(70-130)	20	4.0
LCS1	Chromium Total ICAP/MS		100	99.3	ug/L	99	(85-115)		
LCS2	Chromium Total ICAP/MS		100	99.1	ug/L	99	(85-115)	20	0.20

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Chromium Total ICAP/MS			<1	ug/L				
MRL_CHK	Chromium Total ICAP/MS		1.0	1.08	ug/L	108	(50-150)		
MS_201304060075	Chromium Total ICAP/MS	ND	100	95.4	ug/L	95	(70-130)		
MS2_201304060076	Chromium Total ICAP/MS	ND	100	95.1	ug/L	95	(70-130)		
MSD_201304060075	Chromium Total ICAP/MS	ND	100	82.6	ug/L	83	(70-130)	20	14
MSD2_201304060076	Chromium Total ICAP/MS	ND	100	95.4	ug/L	95	(70-130)	20	0.32
LCS1	Copper Total ICAP/MS		100	99.5	ug/L	100	(85-115)		
LCS2	Copper Total ICAP/MS		100	101	ug/L	101	(85-115)	20	1.5
MBLK	Copper Total ICAP/MS			<2	ug/L				
MRL_CHK	Copper Total ICAP/MS		2.0	2.19	ug/L	110	(50-150)		
MS_201304060075	Copper Total ICAP/MS	ND	100	77.1	ug/L	77	(70-130)		
MS2_201304060076	Copper Total ICAP/MS	ND	100	96.4	ug/L	96	(70-130)		
MSD_201304060075	Copper Total ICAP/MS	ND	100	67.3	ug/L	67	(70-130)	20	14
MSD2_201304060076	Copper Total ICAP/MS	ND	100	96.9	ug/L	97	(70-130)	20	0.52
LCS1	Lead Total ICAP/MS		20	19.6	ug/L	98	(85-115)		
LCS2	Lead Total ICAP/MS		20	19.6	ug/L	98	(85-115)	20	0.0
MBLK	Lead Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Lead Total ICAP/MS		0.5	0.535	ug/L	107	(50-150)		
MS_201304060075	Lead Total ICAP/MS	ND	20	20.4	ug/L	102	(70-130)		
MS2_201304060076	Lead Total ICAP/MS	ND	20	19.7	ug/L	98	(70-130)		
MSD_201304060075	Lead Total ICAP/MS	ND	20	17.2	ug/L	86	(70-130)	20	16
MSD2_201304060076	Lead Total ICAP/MS	ND	20	19.5	ug/L	97	(70-130)	20	1.0
LCS1	Nickel Total ICAP/MS		50	49.2	ug/L	98	(85-115)		
LCS2	Nickel Total ICAP/MS		50	49.5	ug/L	99	(85-115)	20	0.61
MBLK	Nickel Total ICAP/MS			<5	ug/L				
MRL_CHK	Nickel Total ICAP/MS		5.0	4.72	ug/L	94	(50-150)		
MS_201304060075	Nickel Total ICAP/MS	ND	50	46.8	ug/L	94	(70-130)		
MS2_201304060076	Nickel Total ICAP/MS	ND	50	47.3	ug/L	95	(70-130)		
MSD_201304060075	Nickel Total ICAP/MS	ND	50	41.1	ug/L	82	(70-130)	20	13
MSD2_201304060076	Nickel Total ICAP/MS	ND	50	47.1	ug/L	94	(70-130)	20	0.42
LCS1	Selenium Total ICAP/MS		20	21.2	ug/L	106	(85-115)		
LCS2	Selenium Total ICAP/MS		20	20.3	ug/L	101	(85-115)	20	4.3
MBLK	Selenium Total ICAP/MS			<5	ug/L				
MRL_CHK	Selenium Total ICAP/MS		5.0	5.24	ug/L	105	(50-150)		
MS_201304060075	Selenium Total ICAP/MS	ND	20	14.5	ug/L	68	(70-130)		
MS2_201304060076	Selenium Total ICAP/MS	ND	20	21.2	ug/L	106	(70-130)		
MSD_201304060075	Selenium Total ICAP/MS	ND	20	11.5	ug/L	54	(70-130)	20	23
MSD2_201304060076	Selenium Total ICAP/MS	ND	20	20.6	ug/L	103	(70-130)	20	2.9

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Thallium Total ICAP/MS		20	19.3	ug/L	96	(85-115)		
LCS2	Thallium Total ICAP/MS		20	19.6	ug/L	98	(85-115)	20	1.5
MBLK	Thallium Total ICAP/MS			<1	ug/L				
MRL_CHK	Thallium Total ICAP/MS		1.0	1.03	ug/L	103	(50-150)		
MS_201304060075	Thallium Total ICAP/MS	ND	20	20.1	ug/L	100	(70-130)		
MS2_201304060076	Thallium Total ICAP/MS	ND	20	19.2	ug/L	96	(70-130)		
MSD_201304060075	Thallium Total ICAP/MS	ND	20	17.4	ug/L	86	(70-130)	20	14
MSD2_201304060076	Thallium Total ICAP/MS	ND	20	19.7	ug/L	98	(70-130)	20	2.0
LCS1	Uranium ICAP/MS		20	19.2	ug/L	96	(85-115)		
LCS2	Uranium ICAP/MS		20	19.7	ug/L	98	(85-115)	20	2.6
MBLK	Uranium ICAP/MS			<1	ug/L				
MRL_CHK	Uranium ICAP/MS		1.0	1.05	ug/L	105	(50-150)		
MS2_201304060076	Uranium ICAP/MS	ND	20	17.1	ug/L	85	(70-130)		
MSD2_201304060076	Uranium ICAP/MS	ND	20	19.1	ug/L	95	(70-130)	20	11

QC Ref# 701685 - Glyphosate by EPA 547 — **Analysis Date: 04/09/2013**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCCH	Glyphosate		25	27.6	ug/L	110	(80-120)		
CCCM	Glyphosate		10	10.6	ug/L	107	(80-120)		
LCS1	Glyphosate		10	10.3	ug/L	103	(70-130)		
MBLK	Glyphosate			<6	ug/L				
MRL_CHK	Glyphosate		6.0	4.92	ug/L	82	(50-150)		
MS_201304050247	Glyphosate	ND	10	11.1	ug/L	111	(70-130)		
MS2_201304060130	Glyphosate	ND	10	12.0	ug/L	120	(70-130)		
MSD_201304050247	Glyphosate	ND	10	11.1	ug/L	111	(70-130)	20	0.0

QC Ref# 701779 - Organochlorine Pesticides/PCBs by EPA 505 — **Analysis Date: 04/08/2013**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCCH	Alachlor (Alanex)		1.0	1.08	ug/L	108	(70-130)		
CCCH	Alachlor (Alanex)		1.0	1.03	ug/L	103	(70-130)		
CCCH	Alachlor (Alanex)		1.0	1.07	ug/L	107	(70-130)		
CCCH	Alachlor (Alanex)		1.0	1.11	ug/L	111	(70-130)		
LCS1	Alachlor (Alanex)		1.0	0.914	ug/L	91	(70-130)		
MBLK	Alachlor (Alanex)			<0.1	ug/L				
MRL_CHK	Alachlor (Alanex)		0.1	0.101	ug/L	101	(50-150)		
MS1_201304040236	Alachlor (Alanex)	ND	0.2	0.193	ug/L	96	(65-135)		
MS2_201304040584	Alachlor (Alanex)	ND	1.0	1.04	ug/L	104	(65-135)		
CCCH	Aldrin		0.1	0.106	ug/L	106	(70-130)		
CCCH	Aldrin		0.1	0.0988	ug/L	99	(70-130)		
CCCH	Aldrin		0.1	0.0998	ug/L	100	(70-130)		
CCCH	Aldrin		0.1	0.105	ug/L	105	(70-130)		

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RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Aldrin		0.1	0.0875	ug/L	88	(70-130)		
MBLK	Aldrin			<0.01	ug/L				
MRL_CHK	Aldrin		0.01	0.0113	ug/L	113	(50-150)		
MS1_201304040236	Aldrin	ND	0.02	0.0213	ug/L	107	(65-135)		
MS2_201304040584	Aldrin	ND	0.1	0.0953	ug/L	95	(65-135)		
MBLK	Chlordane			<0.1	ug/L				
CCCH	Dieldrin		0.1	0.108	ug/L	108	(70-130)		
CCCH	Dieldrin		0.1	0.108	ug/L	108	(70-130)		
CCCH	Dieldrin		0.1	0.111	ug/L	111	(70-130)		
CCCH	Dieldrin		0.1	0.110	ug/L	111	(70-130)		
LCS1	Dieldrin		0.1	0.0878	ug/L	88	(70-130)		
MBLK	Dieldrin			<0.01	ug/L				
MRL_CHK	Dieldrin		0.01	0.0103	ug/L	103	(50-150)		
MS1_201304040236	Dieldrin	ND	0.02	0.0218	ug/L	109	(65-135)		
MS2_201304040584	Dieldrin	ND	0.1	0.104	ug/L	105	(65-135)		
CCCH	Endrin		0.1	0.110	ug/L	110	(70-130)		
CCCH	Endrin		0.1	0.108	ug/L	108	(70-130)		
CCCH	Endrin		0.1	0.110	ug/L	110	(70-130)		
CCCH	Endrin		0.1	0.111	ug/L	111	(70-130)		
LCS1	Endrin		0.1	0.0896	ug/L	90	(70-130)		
MBLK	Endrin			<0.01	ug/L				
MRL_CHK	Endrin		0.01	0.0110	ug/L	110	(50-150)		
MS1_201304040236	Endrin	ND	0.02	0.0225	ug/L	113	(65-135)		
MS2_201304040584	Endrin	ND	0.1	0.105	ug/L	105	(65-135)		
CCCH	Heptachlor		0.1	0.100	ug/L	100	(70-130)		
CCCH	Heptachlor		0.1	0.104	ug/L	104	(70-130)		
CCCH	Heptachlor		0.1	0.105	ug/L	105	(70-130)		
CCCH	Heptachlor		0.1	0.0975	ug/L	98	(70-130)		
LCS1	Heptachlor		0.1	0.0865	ug/L	87	(70-130)		
MBLK	Heptachlor			<0.01	ug/L				
MRL_CHK	Heptachlor		0.01	0.0105	ug/L	105	(50-150)		
MS1_201304040236	Heptachlor	ND	0.02	0.0210	ug/L	105	(65-135)		
MS2_201304040584	Heptachlor	ND	0.1	0.0966	ug/L	97	(65-135)		
CCCH	Heptachlor Epoxide		0.1	0.106	ug/L	106	(70-130)		
CCCH	Heptachlor Epoxide		0.1	0.109	ug/L	109	(70-130)		
CCCH	Heptachlor Epoxide		0.1	0.107	ug/L	107	(70-130)		
CCCH	Heptachlor Epoxide		0.1	0.110	ug/L	110	(70-130)		
LCS1	Heptachlor Epoxide		0.1	0.0893	ug/L	89	(70-130)		

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Laboratory QC
Report: 430285

Water Resource Associates

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Heptachlor Epoxide			<0.01	ug/L				
MRL_CHK	Heptachlor Epoxide		0.01	0.00970	ug/L	97	(50-150)		
MS1_201304040236	Heptachlor Epoxide	ND	0.02	0.0215	ug/L	108	(65-135)		
MS2_201304040584	Heptachlor Epoxide	ND	0.1	0.103	ug/L	103	(65-135)		
CCCH	Lindane (gamma-BHC)		0.1	0.108	ug/L	108	(70-130)		
CCCH	Lindane (gamma-BHC)		0.1	0.106	ug/L	106	(70-130)		
CCCH	Lindane (gamma-BHC)		0.1	0.104	ug/L	104	(70-130)		
CCCH	Lindane (gamma-BHC)		0.1	0.109	ug/L	109	(70-130)		
LCS1	Lindane (gamma-BHC)		0.1	0.0877	ug/L	88	(70-130)		
MBLK	Lindane (gamma-BHC)			<0.01	ug/L				
MRL_CHK	Lindane (gamma-BHC)		0.01	0.00930	ug/L	93	(50-150)		
MS1_201304040236	Lindane (gamma-BHC)	ND	0.02	0.0214	ug/L	107	(65-135)		
MS2_201304040584	Lindane (gamma-BHC)	ND	0.1	0.102	ug/L	102	(65-135)		
CCCH	Methoxychlor		0.5	0.542	ug/L	108	(70-130)		
CCCH	Methoxychlor		0.5	0.523	ug/L	105	(70-130)		
CCCH	Methoxychlor		0.5	0.553	ug/L	111	(70-130)		
CCCH	Methoxychlor		0.5	0.539	ug/L	108	(70-130)		
LCS1	Methoxychlor		0.5	0.470	ug/L	94	(70-130)		
MBLK	Methoxychlor			<0.05	ug/L				
MRL_CHK	Methoxychlor		0.05	0.0615	ug/L	123	(50-150)		
MS1_201304040236	Methoxychlor	ND	0.1	0.107	ug/L	107	(65-135)		
MS2_201304040584	Methoxychlor	ND	0.5	0.519	ug/L	104	(65-135)		
MBLK	PCB 1016 Aroclor			<0.08	ug/L				
MBLK	PCB 1221 Aroclor			<0.1	ug/L				
MBLK	PCB 1232 Aroclor			<0.1	ug/L				
MBLK	PCB 1242 Aroclor			<0.1	ug/L				
MBLK	PCB 1248 Aroclor			<0.1	ug/L				
MBLK	PCB 1254 Aroclor			<0.1	ug/L				
MBLK	PCB 1260 Aroclor			<0.1	ug/L				
CCCH	Tetrachlorometaxylene (S)			102	%	102	(70-130)		
CCCH	Tetrachlorometaxylene (S)			106	%	107	(70-130)		
CCCH	Tetrachlorometaxylene (S)			103	%	103	(70-130)		
CCCH	Tetrachlorometaxylene (S)			109	%	109	(70-130)		
LCS1	Tetrachlorometaxylene (S)			93.8	%	94	(70-130)		
MBLK	Tetrachlorometaxylene (S)			105	%	105	(70-130)		
MRL_CHK	Tetrachlorometaxylene (S)			102	%	102	(70-130)		
MS1_201304040236	Tetrachlorometaxylene (S)			104	%	105	(70-130)		
MS2_201304040584	Tetrachlorometaxylene (S)			102	%	102	(70-130)		

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Laboratory QC
Report: 430285

Water Resource Associates

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Total PCBs			<0.08	ug/L				
CCCH	Toxaphene		2.5	2.88	ug/L	115	(70-130)		
CCCH	Toxaphene		2.5	2.82	ug/L	113	(70-130)		
LCS1	Toxaphene		2.5	2.34	ug/L	94	(70-130)		
MBLK	Toxaphene			<0.5	ug/L				
MRL_CHK	Toxaphene		0.5	0.559	ug/L	112	(50-150)		
MS1_201304040236	Toxaphene	ND	2.5	2.43	ug/L	97	(65-135)		
MS2_201304040584	Toxaphene		2.5	2.68	ug/L	107	(65-135)		
QC Ref# 701826 - EPA Method 504.1 by EPA 504.1						**Analysis Date: 04/09/2013**			
CCCM	1,2,3-Trichloropropane		1.3	1.26	ug/L	101	(70-130)		
DUP_201304040359	1,2,3-Trichloropropane	ND		ND	ug/L		(0-20)		
MBLK	1,2,3-Trichloropropane			<0.04	ug/L				
MRL_CHK	1,2,3-Trichloropropane		0.05	0.0547	ug/L	109	(60-140)		
MRLLW	1,2,3-Trichloropropane		0.04	0.0406	ug/L	101	(60-140)		
MS_201304030600	1,2,3-Trichloropropane	ND	1.3	1.14	ug/L	94	(65-135)		
CCCM	1,2-Dibromo-3-chloropropane		0.25	0.251	ug/L	100	(70-130)		
DUP_201304040359	1,2-Dibromo-3-chloropropane	ND		ND	ug/L		(0-20)		
MBLK	1,2-Dibromo-3-chloropropane			<0.01	ug/L				
MRL_CHK	1,2-Dibromo-3-chloropropane		0.01	0.0134	ug/L	134	(60-140)		
MS_201304030600	1,2-Dibromo-3-chloropropane	ND	0.25	0.223	ug/L	92	(65-135)		
CCCM	1,2-Dibromoethane		0.25	0.246	ug/L	98	(70-130)		
DUP_201304040359	1,2-Dibromoethane	ND		ND	ug/L		(0-20)		
MBLK	1,2-Dibromoethane			<0.01	ug/L				
MRL_CHK	1,2-Dibromoethane		0.01	0.0115	ug/L	115	(60-140)		
MS_201304030600	1,2-Dibromoethane	ND	0.25	0.228	ug/L	94	(65-135)		
CCCM	1,2-Dibromopropane (S)			110	%	110	(60-140)		
DUP_201304040359	1,2-Dibromopropane (S)			99.0	%	99	(60-140)		
MBLK	1,2-Dibromopropane (S)			97.5	%	98	(60-140)		
MRL_CHK	1,2-Dibromopropane (S)			110	%	110	(60-140)		
MRLLW	1,2-Dibromopropane (S)			106	%	107	(60-140)		
MS_201304030600	1,2-Dibromopropane (S)			88.3	%	88	(60-140)		
QC Ref# 701883 - ICPMS Metals by EPA 200.8						**Analysis Date: 04/09/2013**			
LCS1	Antimony Total ICAP/MS		50	51.5	ug/L	103	(85-115)		
LCS2	Antimony Total ICAP/MS		50	51.5	ug/L	103	(85-115)	20	0.0
MBLK	Antimony Total ICAP/MS			<1	ug/L				
MRL_CHK	Antimony Total ICAP/MS		1.0	1.08	ug/L	108	(50-150)		
MS_201304050292	Antimony Total ICAP/MS	ND	50	52.1	ug/L	104	(70-130)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201304050292	Antimony Total ICAP/MS	ND	50	50.9	ug/L	101	(70-130)	20	2.3
LCS1	Arsenic Total ICAP/MS		20	20.5	ug/L	102	(85-115)		
LCS2	Arsenic Total ICAP/MS		20	20.6	ug/L	103	(85-115)	20	0.49
MBLK	Arsenic Total ICAP/MS			<1	ug/L				
MRL_CHK	Arsenic Total ICAP/MS		1.0	1.12	ug/L	112	(50-150)		
MS_201304050292	Arsenic Total ICAP/MS	1.895	20	22.0	ug/L	101	(70-130)		
MSD_201304050292	Arsenic Total ICAP/MS	1.895	20	21.5	ug/L	98	(70-130)	20	2.3
LCS1	Barium Total ICAP/MS		100	104	ug/L	104	(85-115)		
LCS2	Barium Total ICAP/MS		100	105	ug/L	105	(85-115)	20	0.96
MBLK	Barium Total ICAP/MS			<2	ug/L				
MRL_CHK	Barium Total ICAP/MS		2.0	2.25	ug/L	113	(50-150)		
MS_201304050292	Barium Total ICAP/MS	110.8	100	214	ug/L	103	(70-130)		
MSD_201304050292	Barium Total ICAP/MS	110.8	100	211	ug/L	100	(70-130)	20	1.4
LCS1	Beryllium Total ICAP/MS		5.0	5.05	ug/L	101	(85-115)		
LCS2	Beryllium Total ICAP/MS		5.0	5.09	ug/L	102	(85-115)	20	0.79
MBLK	Beryllium Total ICAP/MS			<1	ug/L				
MRL_CHK	Beryllium Total ICAP/MS		1.0	1.02	ug/L	102	(50-150)		
MS_201304050292	Beryllium Total ICAP/MS	ND	5.0	5.58	ug/L	112	(70-130)		
MSD_201304050292	Beryllium Total ICAP/MS	ND	5.0	5.55	ug/L	111	(70-130)	20	0.54
LCS1	Cadmium Total ICAP/MS		20	20.7	ug/L	104	(85-115)		
LCS2	Cadmium Total ICAP/MS		20	20.6	ug/L	103	(85-115)	20	0.48
MBLK	Cadmium Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Cadmium Total ICAP/MS		0.5	0.537	ug/L	107	(50-150)		
MS_201304050292	Cadmium Total ICAP/MS	ND	20	19.6	ug/L	98	(70-130)		
MSD_201304050292	Cadmium Total ICAP/MS	ND	20	19.1	ug/L	95	(70-130)	20	2.6
LCS1	Chromium Total ICAP/MS		100	104	ug/L	104	(85-115)		
LCS2	Chromium Total ICAP/MS		100	104	ug/L	104	(85-115)	20	0.0
MBLK	Chromium Total ICAP/MS			<1	ug/L				
MRL_CHK	Chromium Total ICAP/MS		1.0	0.946	ug/L	95	(50-150)		
MS_201304050292	Chromium Total ICAP/MS	ND	100	98.2	ug/L	98	(70-130)		
MSD_201304050292	Chromium Total ICAP/MS	ND	100	95.4	ug/L	95	(70-130)	20	2.9
LCS1	Copper Total ICAP/MS		100	105	ug/L	105	(85-115)		
LCS2	Copper Total ICAP/MS		100	104	ug/L	105	(85-115)	20	0.0
MBLK	Copper Total ICAP/MS			<2	ug/L				
MRL_CHK	Copper Total ICAP/MS		2.0	2.22	ug/L	111	(50-150)		
MS_201304050292	Copper Total ICAP/MS	ND	100	96.9	ug/L	95	(70-130)		
MSD_201304050292	Copper Total ICAP/MS	ND	100	94.6	ug/L	93	(70-130)	20	2.4
LCS1	Lead Total ICAP/MS		20	20.9	ug/L	105	(85-115)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Lead Total ICAP/MS		20	20.9	ug/L	105	(85-115)	20	0.0
MBLK	Lead Total ICAP/MS			<0.5	ug/L				
MRL_CHK	Lead Total ICAP/MS		0.5	0.529	ug/L	106	(50-150)		
MS_201304050292	Lead Total ICAP/MS	ND	20	19.2	ug/L	96	(70-130)		
MSD_201304050292	Lead Total ICAP/MS	ND	20	19.1	ug/L	96	(70-130)	20	0.52
LCS1	Nickel Total ICAP/MS		50	51.4	ug/L	103	(85-115)		
LCS2	Nickel Total ICAP/MS		50	51.2	ug/L	102	(85-115)	20	0.39
MBLK	Nickel Total ICAP/MS			<5	ug/L				
MRL_CHK	Nickel Total ICAP/MS		5.0	5.21	ug/L	104	(50-150)		
MS_201304050292	Nickel Total ICAP/MS	ND	50	47.4	ug/L	93	(70-130)		
MSD_201304050292	Nickel Total ICAP/MS	ND	50	47.2	ug/L	93	(70-130)	20	0.42
LCS1	Selenium Total ICAP/MS		20	20.8	ug/L	104	(85-115)		
LCS2	Selenium Total ICAP/MS		20	20.9	ug/L	105	(85-115)	20	0.48
MBLK	Selenium Total ICAP/MS			<5	ug/L				
MRL_CHK	Selenium Total ICAP/MS		5.0	5.58	ug/L	112	(50-150)		
MS_201304050292	Selenium Total ICAP/MS	ND	20	21.8	ug/L	102	(70-130)		
MSD_201304050292	Selenium Total ICAP/MS	ND	20	20.5	ug/L	96	(70-130)	20	6.2
LCS1	Thallium Total ICAP/MS		20	20.9	ug/L	105	(85-115)		
LCS2	Thallium Total ICAP/MS		20	20.9	ug/L	104	(85-115)	20	0.0
MBLK	Thallium Total ICAP/MS			<1	ug/L				
MRL_CHK	Thallium Total ICAP/MS		1.0	1.10	ug/L	110	(50-150)		
MS_201304050292	Thallium Total ICAP/MS	ND	20	19.4	ug/L	97	(70-130)		
MSD_201304050292	Thallium Total ICAP/MS	ND	20	19.0	ug/L	95	(70-130)	20	2.1
LCS1	Uranium ICAP/MS		20	20.8	ug/L	104	(85-115)		
LCS2	Uranium ICAP/MS		20	21.0	ug/L	105	(85-115)	20	0.96
MBLK	Uranium ICAP/MS			<1	ug/L				
MRL_CHK	Uranium ICAP/MS		1.0	1.06	ug/L	106	(50-150)		
MS_201304050292	Uranium ICAP/MS	4.104	20	25.3	ug/L	106	(70-130)		
MSD_201304050292	Uranium ICAP/MS	4.104	20	24.6	ug/L	102	(70-130)	20	2.8
QC Ref# 701935 - Aldicarbs by EPA 531.2						**Analysis Date: 04/11/2013**			
CCCH	3-Hydroxycarbofuran		25	27.9	ug/L	112	(70-130)		
CCCM	3-Hydroxycarbofuran		10	9.59	ug/L	96	(70-130)		
LCS1	3-Hydroxycarbofuran		10	9.98	ug/L	100	(70-130)		
MBLK	3-Hydroxycarbofuran			<0.16	ug/L				
MRL_CHK	3-Hydroxycarbofuran		0.5	0.501	ug/L	100	(50-150)		
MS_201304090365	3-Hydroxycarbofuran	ND	10	9.97	ug/L	100	(70-130)		
MSD_201304090365	3-Hydroxycarbofuran	ND	10	10.1	ug/L	101	(70-130)	20	1.3
CCCH	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate (			127	%	127	(70-130)		

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Laboratory QC
Report: 430285

Water Resource Associates

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCCM	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		109	%	109	(70-130)		
LCS1	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		95.2	%	95	(70-130)		
MBLK	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		89.0	%	89	(70-130)		
MRL_CHK	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		94.4	%	94	(70-130)		
MS_201304090365	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		88.1	%	88	(70-130)		
MSD_201304090365	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	(		94.5	%	94	(70-130)		
CCCH	Aldicarb (Temik)		25	26.5	ug/L	106	(70-130)		
CCCM	Aldicarb (Temik)		10	9.55	ug/L	96	(70-130)		
LCS1	Aldicarb (Temik)		10	9.08	ug/L	91	(70-130)		
MBLK	Aldicarb (Temik)			<0.16	ug/L				
MRL_CHK	Aldicarb (Temik)		0.5	0.459	ug/L	92	(50-150)		
MS_201304090365	Aldicarb (Temik)	ND	10	9.58	ug/L	96	(70-130)		
MSD_201304090365	Aldicarb (Temik)	ND	10	9.98	ug/L	100	(70-130)	20	4.1
CCCH	Aldicarb sulfone		25	27.6	ug/L	111	(70-130)		
CCCM	Aldicarb sulfone		10	9.59	ug/L	96	(70-130)		
LCS1	Aldicarb sulfone		10	9.00	ug/L	90	(70-130)		
MBLK	Aldicarb sulfone			<0.16	ug/L				
MRL_CHK	Aldicarb sulfone		0.5	0.561	ug/L	112	(50-150)		
MS_201304090365	Aldicarb sulfone	ND	10	9.63	ug/L	96	(70-130)		
MSD_201304090365	Aldicarb sulfone	ND	10	9.86	ug/L	99	(70-130)	20	2.4
CCCH	Aldicarb sulfoxide		25	27.0	ug/L	108	(70-130)		
CCCM	Aldicarb sulfoxide		10	9.58	ug/L	96	(70-130)		
LCS1	Aldicarb sulfoxide		10	9.94	ug/L	99	(70-130)		
MBLK	Aldicarb sulfoxide			<0.16	ug/L				
MRL_CHK	Aldicarb sulfoxide		0.5	0.512	ug/L	102	(50-150)		
MS_201304090365	Aldicarb sulfoxide	ND	10	9.36	ug/L	94	(70-130)		
MSD_201304090365	Aldicarb sulfoxide	ND	10	9.73	ug/L	97	(70-130)	20	3.9
CCCH	Baygon		25	27.1	ug/L	108	(70-130)		
CCCM	Baygon		10	9.40	ug/L	94	(70-130)		
LCS1	Baygon		10	9.30	ug/L	93	(70-130)		
MBLK	Baygon			<0.16	ug/L				
MRL_CHK	Baygon		0.5	0.539	ug/L	108	(50-150)		
MS_201304090365	Baygon	ND	10	10.2	ug/L	102	(70-130)		
MSD_201304090365	Baygon	ND	10	9.88	ug/L	99	(70-130)	20	3.1
CCCH	Carbaryl		25	30.2	ug/L	121	(70-130)		
CCCM	Carbaryl		10	9.92	ug/L	99	(70-130)		
LCS1	Carbaryl		10	10.2	ug/L	102	(70-130)		
MBLK	Carbaryl			<0.16	ug/L				

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Laboratory QC
Report: 430285

Water Resource Associates

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Carbaryl		0.5	0.498	ug/L	100	(50-150)		
MS_201304090365	Carbaryl	ND	10	9.84	ug/L	98	(70-130)		
MSD_201304090365	Carbaryl	ND	10	10.2	ug/L	102	(70-130)	20	3.6
CCCH	Carbofuran (Furadan)		25	27.2	ug/L	109	(70-130)		
CCCM	Carbofuran (Furadan)		10	9.56	ug/L	96	(70-130)		
LCS1	Carbofuran (Furadan)		10	9.69	ug/L	97	(70-130)		
MBLK	Carbofuran (Furadan)			<0.16	ug/L				
MRL_CHK	Carbofuran (Furadan)		0.5	0.532	ug/L	106	(50-150)		
MS_201304090365	Carbofuran (Furadan)	ND	10	9.98	ug/L	100	(70-130)		
MSD_201304090365	Carbofuran (Furadan)	ND	10	9.86	ug/L	99	(70-130)	20	1.2
CCCH	Methiocarb		25	27.3	ug/L	109	(70-130)		
CCCM	Methiocarb		10	10.0	ug/L	100	(70-130)		
LCS1	Methiocarb		10	9.90	ug/L	99	(70-130)		
MBLK	Methiocarb			<0.16	ug/L				
MRL_CHK	Methiocarb		0.5	0.424	ug/L	85	(50-150)		
MS_201304090365	Methiocarb	ND	10	9.39	ug/L	94	(70-130)		
MSD_201304090365	Methiocarb	ND	10	10.0	ug/L	100	(70-130)	20	6.3
CCCH	Methomyl		25	27.2	ug/L	109	(70-130)		
CCCM	Methomyl		10	9.57	ug/L	96	(70-130)		
LCS1	Methomyl		10	9.57	ug/L	96	(70-130)		
MBLK	Methomyl			<0.16	ug/L				
MRL_CHK	Methomyl		0.5	0.466	ug/L	93	(50-150)		
MS_201304090365	Methomyl	ND	10	9.95	ug/L	100	(70-130)		
MSD_201304090365	Methomyl	ND	10	9.91	ug/L	99	(70-130)	20	0.40
CCCH	Oxamyl (Vydate)		25	27.2	ug/L	109	(70-130)		
CCCM	Oxamyl (Vydate)		10	9.31	ug/L	93	(70-130)		
LCS1	Oxamyl (Vydate)		10	9.72	ug/L	97	(70-130)		
MBLK	Oxamyl (Vydate)			<0.16	ug/L				
MRL_CHK	Oxamyl (Vydate)		0.5	0.579	ug/L	116	(50-150)		
MS_201304090365	Oxamyl (Vydate)	ND	10	10.1	ug/L	101	(70-130)		
MSD_201304090365	Oxamyl (Vydate)	ND	10	9.75	ug/L	98	(70-130)	20	3.5
QC Ref# 702102 - 2,3,7,8-TCDD_Dioxin by EPA 1613B						**Analysis Date: 04/10/2013**			
LCS1	2,3,7,8-TCDD		200	162	pg/L	81	(73-146)		
MBLK	2,3,7,8-TCDD			<1.67	pg/L				
MRL_CHK	2,3,7,8-TCDD		5.0	4.40	pg/L	88	(50-150)		
MS_201304030199	2,3,7,8-TCDD	ND	200	161	pg/L	81	(73-146)		
MSD_201304030199	2,3,7,8-TCDD	ND	200	162	pg/L	81	(73-146)	20	0.62
LCS1	C12-2,3,7,8-TCDD (S)			89.8	%	90	(25-141)		

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RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	C12-2,3,7,8-TCDD (S)			97.8	%	98	(31-137)		
MRL_CHK	C12-2,3,7,8-TCDD (S)			91.4	%	91	(31-137)		
MS_201304030199	C12-2,3,7,8-TCDD (S)			87.8	%	88	(25-141)		
MSD_201304030199	C12-2,3,7,8-TCDD (S)			88.3	%	88	(25-141)		

QC Ref# 702124 - Volatile Organics by GCMS by EPA 524.2 **Analysis Date: 04/11/2013**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	1,1,1,2-Tetrachloroethane		5.0	4.55	ug/L	91	(70-130)		
LCS2	1,1,1,2-Tetrachloroethane		5.0	4.98	ug/L	100	(70-130)	20	9.0
MBLK	1,1,1,2-Tetrachloroethane			<0.5	ug/L				
LCS1	1,1,1-Trichloroethane		5.0	5.42	ug/L	108	(70-130)		
LCS2	1,1,1-Trichloroethane		5.0	5.75	ug/L	115	(70-130)	20	5.9
MBLK	1,1,1-Trichloroethane			<0.5	ug/L				
LCS1	1,1,2,2-Tetrachloroethane		5.0	5.41	ug/L	108	(70-130)		
LCS2	1,1,2,2-Tetrachloroethane		5.0	5.46	ug/L	109	(70-130)	20	0.92
MBLK	1,1,2,2-Tetrachloroethane			<0.5	ug/L				
LCS1	1,1,2-Trichloroethane		5.0	4.41	ug/L	88	(70-130)		
LCS2	1,1,2-Trichloroethane		5.0	4.96	ug/L	99	(70-130)	20	12
MBLK	1,1,2-Trichloroethane			<0.5	ug/L				
LCS1	1,1-Dichloroethane		5.0	5.15	ug/L	103	(70-130)		
LCS2	1,1-Dichloroethane		5.0	5.28	ug/L	106	(70-130)	20	2.5
MBLK	1,1-Dichloroethane			<0.5	ug/L				
LCS1	1,1-Dichloroethylene		5.0	5.02	ug/L	100	(70-130)		
LCS2	1,1-Dichloroethylene		5.0	5.31	ug/L	106	(70-130)	20	5.6
MBLK	1,1-Dichloroethylene			<0.5	ug/L				
LCS1	1,1-Dichloropropene		5.0	4.80	ug/L	96	(70-130)		
LCS2	1,1-Dichloropropene		5.0	5.15	ug/L	103	(70-130)	20	7.0
MBLK	1,1-Dichloropropene			<0.5	ug/L				
LCS1	1,2,3-Trichlorobenzene		5.0	4.94	ug/L	99	(70-130)		
LCS2	1,2,3-Trichlorobenzene		5.0	5.38	ug/L	108	(70-130)	20	8.5
MBLK	1,2,3-Trichlorobenzene			<0.5	ug/L				
LCS1	1,2,3-Trichloropropane		5.0	5.14	ug/L	103	(70-130)		
LCS2	1,2,3-Trichloropropane		5.0	5.41	ug/L	108	(70-130)	20	5.1
MBLK	1,2,3-Trichloropropane			<0.5	ug/L				
LCS1	1,2,4-Trichlorobenzene		5.0	4.68	ug/L	94	(70-130)		
LCS2	1,2,4-Trichlorobenzene		5.0	5.06	ug/L	101	(70-130)	20	7.8
MBLK	1,2,4-Trichlorobenzene			<0.5	ug/L				
LCS1	1,2,4-Trimethylbenzene		5.0	5.61	ug/L	112	(70-130)		
LCS2	1,2,4-Trimethylbenzene		5.0	5.82	ug/L	116	(70-130)	20	3.7

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RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	1,2,4-Trimethylbenzene			<0.5	ug/L				
LCS1	1,2-Dichloroethane		5.0	5.01	ug/L	100	(70-130)		
LCS2	1,2-Dichloroethane		5.0	5.23	ug/L	105	(70-130)	20	4.3
MBLK	1,2-Dichloroethane			<0.5	ug/L				
LCS1	1,2-Dichloroethane-d4 (S)			94.4	%	94	(70-130)		
LCS2	1,2-Dichloroethane-d4 (S)			95.8	%	96	(70-130)		
MBLK	1,2-Dichloroethane-d4 (S)			94.6	%	95	(70-130)		
LCS1	1,2-Dichloropropane		5.0	4.83	ug/L	97	(70-130)		
LCS2	1,2-Dichloropropane		5.0	5.22	ug/L	104	(70-130)	20	7.8
MBLK	1,2-Dichloropropane			<0.5	ug/L				
LCS1	1,3,5-Trimethylbenzene		5.0	5.52	ug/L	110	(70-130)		
LCS2	1,3,5-Trimethylbenzene		5.0	5.83	ug/L	117	(70-130)	20	5.5
MBLK	1,3,5-Trimethylbenzene			<0.5	ug/L				
LCS1	1,3-Dichloropropane		5.0	4.52	ug/L	90	(70-130)		
LCS2	1,3-Dichloropropane		5.0	4.73	ug/L	95	(70-130)	20	4.5
MBLK	1,3-Dichloropropane			<0.5	ug/L				
LCS1	2,2-Dichloropropane		5.0	4.29	ug/L	86	(70-130)		
LCS2	2,2-Dichloropropane		5.0	4.57	ug/L	91	(70-130)	20	6.3
MBLK	2,2-Dichloropropane			<0.5	ug/L				
LCS1	2-Butanone (MEK)		50	44.5	ug/L	89	(70-130)		
LCS2	2-Butanone (MEK)		50	48.4	ug/L	97	(70-130)	20	8.4
MBLK	2-Butanone (MEK)			<5.0	ug/L				
LCS1	4-Bromofluorobenzene (S)			108	%	108	(70-130)		
LCS2	4-Bromofluorobenzene (S)			103	%	103	(70-130)		
MBLK	4-Bromofluorobenzene (S)			103	%	103	(70-130)		
LCS1	4-Methyl-2-Pentanone (MIBK)		50	40.4	ug/L	81	(70-130)		
LCS2	4-Methyl-2-Pentanone (MIBK)		50	43.1	ug/L	86	(70-130)	20	6.5
MBLK	4-Methyl-2-Pentanone (MIBK)			<5	ug/L				
LCS1	Benzene		5.0	5.07	ug/L	101	(70-130)		
LCS2	Benzene		5.0	5.42	ug/L	108	(70-130)	20	6.7
MBLK	Benzene			<0.5	ug/L				
LCS1	Bromobenzene		5.0	5.53	ug/L	111	(70-130)		
LCS2	Bromobenzene		5.0	5.74	ug/L	115	(70-130)	20	3.7
MBLK	Bromobenzene			<0.5	ug/L				
LCS1	Bromochloromethane		5.0	5.30	ug/L	106	(70-130)		
LCS2	Bromochloromethane		5.0	5.43	ug/L	109	(70-130)	20	2.4
MBLK	Bromochloromethane			<0.5	ug/L				
LCS1	Bromodichloromethane		5.0	4.91	ug/L	98	(70-130)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Bromodichloromethane		5.0	5.18	ug/L	104	(70-130)	20	5.3
MBLK	Bromodichloromethane			<0.5	ug/L				
LCS1	Bromoethane		5.0	4.93	ug/L	99	(70-130)		
LCS2	Bromoethane		5.0	5.13	ug/L	103	(70-130)	20	4.0
MBLK	Bromoethane			<0.5	ug/L				
LCS1	Bromoform		5.0	6.96	ug/L	<u>139</u>	(70-130)		
LCS2	Bromoform		5.0	7.56	ug/L	<u>151</u>	(70-130)	20	8.3
MBLK	Bromoform			<0.5	ug/L				
LCS1	Bromomethane (Methyl Bromide)		5.0	4.15	ug/L	83	(70-130)		
LCS2	Bromomethane (Methyl Bromide)		5.0	4.35	ug/L	87	(70-130)	20	4.7
MBLK	Bromomethane (Methyl Bromide)			<0.5	ug/L				
LCS1	Carbon disulfide		5.0	6.09	ug/L	122	(70-130)		
LCS2	Carbon disulfide		5.0	6.65	ug/L	<u>133</u>	(70-130)	20	8.8
MBLK	Carbon disulfide			<0.5	ug/L				
LCS1	Carbon Tetrachloride		5.0	5.65	ug/L	113	(70-130)		
LCS2	Carbon Tetrachloride		5.0	5.84	ug/L	117	(70-130)	20	3.3
MBLK	Carbon Tetrachloride			<0.5	ug/L				
LCS1	Chlorobenzene		5.0	4.64	ug/L	93	(70-130)		
LCS2	Chlorobenzene		5.0	4.95	ug/L	99	(70-130)	20	6.5
MBLK	Chlorobenzene			<0.5	ug/L				
LCS1	Chlorodibromomethane		5.0	4.76	ug/L	95	(70-130)		
LCS2	Chlorodibromomethane		5.0	5.47	ug/L	109	(70-130)	20	14
MBLK	Chlorodibromomethane			<0.5	ug/L				
LCS1	Chloroethane		5.0	3.97	ug/L	79	(70-130)		
LCS2	Chloroethane		5.0	4.43	ug/L	89	(70-130)	20	11
MBLK	Chloroethane			<0.5	ug/L				
LCS1	Chloroform (Trichloromethane)		5.0	4.76	ug/L	95	(70-130)		
LCS2	Chloroform (Trichloromethane)		5.0	5.06	ug/L	101	(70-130)	20	6.1
MBLK	Chloroform (Trichloromethane)			<0.5	ug/L				
LCS1	Chloromethane(Methyl Chloride)		5.0	3.71	ug/L	74	(70-130)		
LCS2	Chloromethane(Methyl Chloride)		5.0	4.14	ug/L	83	(70-130)	20	11
MBLK	Chloromethane(Methyl Chloride)			<0.5	ug/L				
LCS1	cis-1,2-Dichloroethylene		5.0	4.98	ug/L	100	(70-130)		
LCS2	cis-1,2-Dichloroethylene		5.0	5.12	ug/L	102	(70-130)	20	2.8
MBLK	cis-1,2-Dichloroethylene			<0.5	ug/L				
LCS1	cis-1,3-Dichloropropene		5.0	4.61	ug/L	92	(70-130)		
LCS2	cis-1,3-Dichloropropene		5.0	4.70	ug/L	94	(70-130)	20	1.9
MBLK	cis-1,3-Dichloropropene			<0.5	ug/L				

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Dibromomethane		5.0	4.81	ug/L	96	(70-130)		
LCS2	Dibromomethane		5.0	5.05	ug/L	101	(70-130)	20	4.9
MBLK	Dibromomethane			<0.5	ug/L				
LCS1	Dichlorodifluoromethane		5.0	4.96	ug/L	99	(70-130)		
LCS2	Dichlorodifluoromethane		5.0	5.33	ug/L	107	(70-130)	20	7.2
MBLK	Dichlorodifluoromethane			<0.5	ug/L				
LCS1	Dichloromethane		5.0	4.64	ug/L	93	(70-130)		
LCS2	Dichloromethane		5.0	4.74	ug/L	95	(70-130)	20	2.1
MBLK	Dichloromethane			<0.5	ug/L				
LCS1	Di-isopropyl ether		5.0	4.94	ug/L	99	(70-130)		
LCS2	Di-isopropyl ether		5.0	5.20	ug/L	104	(70-130)	20	5.1
MBLK	Di-isopropyl ether			<3.0	ug/L				
LCS1	Ethyl benzene		5.0	4.76	ug/L	95	(70-130)		
LCS2	Ethyl benzene		5.0	5.10	ug/L	102	(70-130)	20	6.9
MBLK	Ethyl benzene			<0.5	ug/L				
LCS1	Hexachlorobutadiene		5.0	5.06	ug/L	101	(70-130)		
LCS2	Hexachlorobutadiene		5.0	5.23	ug/L	105	(70-130)	20	3.3
MBLK	Hexachlorobutadiene			<0.5	ug/L				
LCS1	Isopropylbenzene		5.0	5.21	ug/L	104	(70-130)		
LCS2	Isopropylbenzene		5.0	5.44	ug/L	109	(70-130)	20	4.3
MBLK	Isopropylbenzene			<0.5	ug/L				
LCS1	m,p-Xylenes		10	9.77	ug/L	98	(70-130)		
LCS2	m,p-Xylenes		10	10.6	ug/L	106	(70-130)	20	8.2
MBLK	m,p-Xylenes			<0.5	ug/L				
LCS1	m-Dichlorobenzene (1,3-DCB)		5.0	5.46	ug/L	109	(70-130)		
LCS2	m-Dichlorobenzene (1,3-DCB)		5.0	5.78	ug/L	116	(70-130)	20	5.7
MBLK	m-Dichlorobenzene (1,3-DCB)			<0.5	ug/L				
LCS1	Methyl Tert-butyl ether (MTBE)		5.0	4.94	ug/L	99	(70-130)		
LCS2	Methyl Tert-butyl ether (MTBE)		5.0	5.08	ug/L	102	(70-130)	20	2.8
MBLK	Methyl Tert-butyl ether (MTBE)			<0.5	ug/L				
LCS1	Naphthalene		5.0	4.89	ug/L	98	(70-130)		
LCS2	Naphthalene		5.0	5.20	ug/L	104	(70-130)	20	6.1
MBLK	Naphthalene			<0.5	ug/L				
LCS1	n-Butylbenzene		5.0	4.93	ug/L	99	(70-130)		
LCS2	n-Butylbenzene		5.0	5.31	ug/L	106	(70-130)	20	7.4
MBLK	n-Butylbenzene			<0.5	ug/L				
LCS1	n-Propylbenzene		5.0	5.44	ug/L	109	(70-130)		
LCS2	n-Propylbenzene		5.0	5.62	ug/L	112	(70-130)	20	3.3

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	n-Propylbenzene			<0.5	ug/L				
LCS1	o-Chlorotoluene		5.0	5.38	ug/L	108	(70-130)		
LCS2	o-Chlorotoluene		5.0	5.53	ug/L	111	(70-130)	20	2.8
MBLK	o-Chlorotoluene			<0.5	ug/L				
LCS1	o-Dichlorobenzene (1,2-DCB)		5.0	4.87	ug/L	97	(70-130)		
LCS2	o-Dichlorobenzene (1,2-DCB)		5.0	5.15	ug/L	103	(70-130)	20	5.6
MBLK	o-Dichlorobenzene (1,2-DCB)			<0.5	ug/L				
LCS1	o-Xylene		5.0	4.62	ug/L	92	(70-130)		
LCS2	o-Xylene		5.0	4.96	ug/L	99	(70-130)	20	7.1
MBLK	o-Xylene			<0.5	ug/L				
LCS1	p-Chlorotoluene		5.0	5.63	ug/L	113	(70-130)		
LCS2	p-Chlorotoluene		5.0	5.78	ug/L	116	(70-130)	20	2.6
MBLK	p-Chlorotoluene			<0.5	ug/L				
LCS1	p-Dichlorobenzene (1,4-DCB)		5.0	5.54	ug/L	111	(70-130)		
LCS2	p-Dichlorobenzene (1,4-DCB)		5.0	5.90	ug/L	118	(70-130)	20	6.3
MBLK	p-Dichlorobenzene (1,4-DCB)			<0.5	ug/L				
LCS1	p-Isopropyltoluene		5.0	5.03	ug/L	101	(70-130)		
LCS2	p-Isopropyltoluene		5.0	5.47	ug/L	109	(70-130)	20	8.4
MBLK	p-Isopropyltoluene			<0.5	ug/L				
LCS1	sec-Butylbenzene		5.0	5.65	ug/L	113	(70-130)		
LCS2	sec-Butylbenzene		5.0	5.94	ug/L	119	(70-130)	20	5.0
MBLK	sec-Butylbenzene			<0.5	ug/L				
LCS1	Styrene		5.0	4.77	ug/L	95	(70-130)		
LCS2	Styrene		5.0	5.05	ug/L	101	(70-130)	20	5.7
MBLK	Styrene			<0.5	ug/L				
LCS1	tert-amyl Methyl Ether		5.0	4.62	ug/L	92	(70-130)		
LCS2	tert-amyl Methyl Ether		5.0	4.90	ug/L	98	(70-130)	20	5.9
MBLK	tert-amyl Methyl Ether			<3	ug/L				
LCS1	tert-Butyl Ethyl Ether		5.0	4.85	ug/L	97	(70-130)		
LCS2	tert-Butyl Ethyl Ether		5.0	5.10	ug/L	102	(70-130)	20	5.0
MBLK	tert-Butyl Ethyl Ether			<3	ug/L				
LCS1	tert-Butylbenzene		5.0	5.17	ug/L	103	(70-130)		
LCS2	tert-Butylbenzene		5.0	5.54	ug/L	111	(70-130)	20	6.9
MBLK	tert-Butylbenzene			<0.5	ug/L				
LCS1	Tetrachloroethylene (PCE)		5.0	5.28	ug/L	106	(70-130)		
LCS2	Tetrachloroethylene (PCE)		5.0	5.52	ug/L	110	(70-130)	20	4.4
MBLK	Tetrachloroethylene (PCE)			<0.5	ug/L				
LCS1	Toluene		5.0	4.78	ug/L	96	(70-130)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Toluene		5.0	5.30	ug/L	106	(70-130)	20	10
MBLK	Toluene			<0.5	ug/L				
LCS1	Toluene-d8 (S)			98.2	%	98	(70-130)		
LCS2	Toluene-d8 (S)			97.4	%	97	(70-130)		
MBLK	Toluene-d8 (S)			95.2	%	95	(70-130)		
LCS1	trans-1,2-Dichloroethylene		5.0	4.98	ug/L	100	(70-130)		
LCS2	trans-1,2-Dichloroethylene		5.0	5.17	ug/L	103	(70-130)	20	3.7
MBLK	trans-1,2-Dichloroethylene			<0.5	ug/L				
LCS1	trans-1,3-Dichloropropene		5.0	4.17	ug/L	83	(70-130)		
LCS2	trans-1,3-Dichloropropene		5.0	4.63	ug/L	93	(70-130)	20	11
MBLK	trans-1,3-Dichloropropene			<0.5	ug/L				
LCS1	Trichloroethylene (TCE)		5.0	5.29	ug/L	106	(70-130)		
LCS2	Trichloroethylene (TCE)		5.0	5.63	ug/L	113	(70-130)	20	6.2
MBLK	Trichloroethylene (TCE)			<0.5	ug/L				
LCS1	Trichlorofluoromethane		5.0	4.56	ug/L	91	(70-130)		
LCS2	Trichlorofluoromethane		5.0	4.70	ug/L	94	(70-130)	20	3.0
MBLK	Trichlorofluoromethane			<0.5	ug/L				
LCS1	Trichlorotrifluoroethane(Freon		5.0	4.10	ug/L	82	(70-130)		
LCS2	Trichlorotrifluoroethane(Freon		5.0	4.59	ug/L	92	(70-130)	20	11
MBLK	Trichlorotrifluoroethane(Freon			<0.5	ug/L				
LCS1	Vinyl chloride (VC)		5.0	4.38	ug/L	88	(70-130)		
LCS2	Vinyl chloride (VC)		5.0	4.52	ug/L	90	(70-130)	20	3.1
MBLK	Vinyl chloride (VC)			<0.3	ug/L				
QC Ref# 702256 - Chlorophenoxy Herbicides by EPA 515.4						**Analysis Date: 04/13/2013**			
CCCH	2,4,5-T		4.0	4.32	ug/L	108	(70-130)		
CCCM	2,4,5-T		1.0	1.05	ug/L	105	(70-130)		
MBLK	2,4,5-T			<0.1	ug/L				
MRL_CHK	2,4,5-T		0.2	0.248	ug/L	124	(50-150)		
MS2_201304090365	2,4,5-T	ND	0.75	0.803	ug/L	107	(70-130)		
MSD2_201304090365	2,4,5-T	ND	0.75	0.821	ug/L	110	(70-130)	30	2.2
CCCH	2,4,5-TP (Silvex)		4.0	4.36	ug/L	109	(70-130)		
CCCM	2,4,5-TP (Silvex)		1.0	1.06	ug/L	106	(70-130)		
MBLK	2,4,5-TP (Silvex)			<0.1	ug/L				
MRL_CHK	2,4,5-TP (Silvex)		0.2	0.231	ug/L	116	(50-150)		
MS2_201304090365	2,4,5-TP (Silvex)	ND	0.75	0.790	ug/L	105	(70-130)		
MSD2_201304090365	2,4,5-TP (Silvex)	ND	0.75	0.806	ug/L	107	(70-130)	30	2.0
CCCH	2,4-D		2.0	2.16	ug/L	108	(70-130)		
CCCM	2,4-D		0.5	0.514	ug/L	103	(70-130)		

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RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	2,4-D			<0.05	ug/L				
MRL_CHK	2,4-D		0.1	0.112	ug/L	112	(50-150)		
MS2_201304090365	2,4-D	ND	0.38	0.344	ug/L	92	(70-130)		
MSD2_201304090365	2,4-D	ND	0.38	0.390	ug/L	104	(70-130)	30	13
CCCH	2,4-DB		40	40.5	ug/L	101	(70-130)		
CCCM	2,4-DB		10	10.1	ug/L	101	(70-130)		
MBLK	2,4-DB			<1	ug/L				
MRL_CHK	2,4-DB		2.0	2.11	ug/L	106	(50-150)		
MS2_201304090365	2,4-DB	ND	7.5	8.02	ug/L	103	(70-130)		
MSD2_201304090365	2,4-DB	ND	7.5	7.82	ug/L	101	(70-130)	30	2.5
CCCH	2,4-Dichlorophenyl acetic acid (S)			107	%	107	(70-130)		
CCCM	2,4-Dichlorophenyl acetic acid (S)			109	%	109	(70-130)		
MBLK	2,4-Dichlorophenyl acetic acid (S)			101	%	101	(70-130)		
MRL_CHK	2,4-Dichlorophenyl acetic acid (S)			102	%	102	(70-130)		
MS2_201304090365	2,4-Dichlorophenyl acetic acid (S)			99.2	%	99	(70-130)		
MSD2_201304090365	2,4-Dichlorophenyl acetic acid (S)			103	%	103	(70-130)		
CCCH	3,5-Dichlorobenzoic acid		10	11.2	ug/L	112	(70-130)		
CCCM	3,5-Dichlorobenzoic acid		2.5	2.77	ug/L	111	(70-130)		
MBLK	3,5-Dichlorobenzoic acid			<0.25	ug/L				
MRL_CHK	3,5-Dichlorobenzoic acid		0.5	0.521	ug/L	104	(50-150)		
MS2_201304090365	3,5-Dichlorobenzoic acid	ND	1.9	1.88	ug/L	100	(70-130)		
MSD2_201304090365	3,5-Dichlorobenzoic acid	ND	1.9	2.13	ug/L	113	(70-130)	30	13
CCCH	4,4-Dibromooctafluorobiphenyl (I)			101	%	101	(50-150)		
CCCM	4,4-Dibromooctafluorobiphenyl (I)			98.7	%	99	(50-150)		
MBLK	4,4-Dibromooctafluorobiphenyl (I)			105	%	105	(50-150)		
MRL_CHK	4,4-Dibromooctafluorobiphenyl (I)			104	%	105	(50-150)		
MS2_201304090365	4,4-Dibromooctafluorobiphenyl (I)			99.7	%	100	(50-150)		
MSD2_201304090365	4,4-Dibromooctafluorobiphenyl (I)			99.1	%	99	(50-150)		
CCCH	Acifluorfen		4.0	4.27	ug/L	107	(70-130)		
CCCM	Acifluorfen		1.0	1.04	ug/L	104	(70-130)		
MBLK	Acifluorfen			<0.1	ug/L				
MRL_CHK	Acifluorfen		0.2	0.224	ug/L	112	(50-150)		
MS2_201304090365	Acifluorfen	ND	0.75	0.783	ug/L	104	(70-130)		
MSD2_201304090365	Acifluorfen	ND	0.75	0.798	ug/L	106	(70-130)	30	2.0
CCCH	Bentazon		10	11.3	ug/L	113	(70-130)		
CCCM	Bentazon		2.5	2.45	ug/L	98	(70-130)		
MBLK	Bentazon			<0.25	ug/L				
MRL_CHK	Bentazon		0.5	0.532	ug/L	106	(50-150)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS2_201304090365	Bentazon	ND	1.9	1.94	ug/L	103	(70-130)		
MSD2_201304090365	Bentazon	ND	1.9	2.20	ug/L	117	(70-130)	30	13
CCCH	Dalapon		20	22.0	ug/L	110	(70-130)		
CCCM	Dalapon		5.0	5.40	ug/L	108	(70-130)		
MBLK	Dalapon			<0.5	ug/L				
MRL_CHK	Dalapon		1.0	1.10	ug/L	110	(50-150)		
MS2_201304090365	Dalapon	ND	3.8	4.10	ug/L	109	(70-130)		
MSD2_201304090365	Dalapon	ND	3.8	4.20	ug/L	112	(70-130)	30	2.2
CCCH	Dicamba		2.0	2.13	ug/L	107	(70-130)		
CCCM	Dicamba		0.5	0.525	ug/L	105	(70-130)		
MBLK	Dicamba			<0.04	ug/L				
MRL_CHK	Dicamba		0.1	0.0990	ug/L	99	(50-150)		
MS2_201304090365	Dicamba	ND	0.38	0.303	ug/L	81	(70-130)		
MSD2_201304090365	Dicamba	ND	0.38	0.356	ug/L	95	(70-130)	30	16
CCCH	Dichlorprop		10	11.1	ug/L	111	(70-130)		
CCCM	Dichlorprop		2.5	2.66	ug/L	107	(70-130)		
MBLK	Dichlorprop			<0.25	ug/L				
MRL_CHK	Dichlorprop		0.5	0.512	ug/L	102	(50-150)		
MS2_201304090365	Dichlorprop	ND	1.9	1.89	ug/L	101	(70-130)		
MSD2_201304090365	Dichlorprop	ND	1.9	1.88	ug/L	100	(70-130)	30	0.53
CCCH	Dinoseb		4.0	4.42	ug/L	111	(70-130)		
CCCM	Dinoseb		1.0	1.06	ug/L	106	(70-130)		
MBLK	Dinoseb			<0.1	ug/L				
MRL_CHK	Dinoseb		0.2	0.208	ug/L	104	(50-150)		
MS2_201304090365	Dinoseb	ND	0.75	0.824	ug/L	110	(70-130)		
MSD2_201304090365	Dinoseb	ND	0.75	0.817	ug/L	109	(70-130)	30	0.97
CCCH	Pentachlorophenol		0.8	0.860	ug/L	108	(70-130)		
CCCM	Pentachlorophenol		0.2	0.207	ug/L	104	(70-130)		
MBLK	Pentachlorophenol			<0.02	ug/L				
MRL_CHK	Pentachlorophenol		0.04	0.0453	ug/L	113	(50-150)		
MS2_201304090365	Pentachlorophenol	ND	0.15	0.159	ug/L	106	(70-130)		
MSD2_201304090365	Pentachlorophenol	ND	0.15	0.172	ug/L	115	(70-130)	30	7.8
CCCH	Picloram		2.0	2.25	ug/L	112	(70-130)		
CCCM	Picloram		0.5	0.547	ug/L	109	(70-130)		
MBLK	Picloram			<0.05	ug/L				
MRL_CHK	Picloram		0.1	0.110	ug/L	110	(50-150)		
MS2_201304090365	Picloram	ND	0.38	0.434	ug/L	116	(70-130)		
MSD2_201304090365	Picloram	ND	0.38	0.411	ug/L	110	(70-130)	30	5.4

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCCH	Tot DCPA Mono&Diacid Degradate		2.0	2.12	ug/L	106	(70-130)		
CCCM	Tot DCPA Mono&Diacid Degradate		0.5	0.522	ug/L	104	(70-130)		
MBLK	Tot DCPA Mono&Diacid Degradate			<0.5	ug/L				
MRL_CHK	Tot DCPA Mono&Diacid Degradate		0.1	0.0725	ug/L	73	(50-150)		
MS2_201304090365	Tot DCPA Mono&Diacid Degradate	ND	0.38	0.412	ug/L	110	(70-130)		
MSD2_201304090365	Tot DCPA Mono&Diacid Degradate	ND	0.38	0.408	ug/L	109	(70-130)	30	0.98

QC Ref# 702334 - Endothall by EPA 548.1 — **Analysis Date: 04/11/2013**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Endothall		25	18.0	ug/L	72	(65-114)		
MBLK	Endothall			<5	ug/L				
MRL_CHK	Endothall		5.0	3.50	ug/L	70	(50-150)		
MS_201304050244	Endothall	ND	25	19.2	ug/L	77	(61-113)		
MS_2ND_201304050246	Endothall	ND	25	21.4	ug/L	86	(61-113)		
MSD_201304050244	Endothall	ND	25	20.0	ug/L	80	(61-113)	30	4.6

QC Ref# 702448 - Mercury Total by EPA 245.1 — **Analysis Date: 04/12/2013**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Mercury		1.5	1.50	ug/L	100	(85-115)		
LCS2	Mercury		1.5	1.47	ug/L	98	(85-115)	20	2.0
MBLK	Mercury			<0.2	ug/L				
MRL_CHK	Mercury		0.2	0.155	ug/L	78	(50-150)		
MS_201304100173	Mercury	ND	1.5	1.61	ug/L	107	(70-130)		
MS_201304100165	Mercury	ND	1.5	1.59	ug/L	106	(70-130)		
MSD_201304100173	Mercury	ND	1.5	1.66	ug/L	111	(70-130)	20	3.1
MSD_201304100165	Mercury	ND	1.5	1.69	ug/L	113	(70-130)	20	6.1

QC Ref# 703527 - Fluoride by SM 4500F-C — **Analysis Date: 04/18/2013**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Fluoride		1.0	1.07	mg/L	107	(81-116)		
LCS2	Fluoride		1.0	1.07	mg/L	107	(81-116)	20	0.0
MBLK	Fluoride			<0.05	mg/L				
MRL_CHK	Fluoride		0.05	0.0441	mg/L	88	(50-150)		
MS_201304120166	Fluoride	ND	1.0	1.10	mg/L	110	(73-124)		
MS_201304180226	Fluoride	ND	1.0	1.14	mg/L	113	(73-124)		
MSD_201304180226	Fluoride	ND	1.0	1.08	mg/L	107	(73-124)	20	5.4
MSD_201304120166	Fluoride	ND	1.0	1.04	mg/L	104	(73-124)	20	5.6

QC Ref# 703938 - Gross Alpha/Beta Radiation by EPA 900.0 — **Analysis Date: 04/17/2013**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
DUP1_201304080083	Alpha, Gross	ND		ND	pCi/L		(0-20)		
DUP2_201304080087	Alpha, Gross	ND		ND	pCi/L		(0-20)		
LCS1	Alpha, Gross		34	35.7	pCi/L	106	(80-120)		
LCS2	Alpha, Gross		34	33.5	pCi/L	100	(80-120)	20	6.4

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Alpha, Gross			<3	pCi/L				
MS_201304090070	Alpha, Gross	ND	34	35.6	pCi/L	106	(70-130)		
DUP1_201304080083	Beta, Gross	ND		ND	pCi/L		(0-20)		
DUP2_201304080087	Beta, Gross	ND		ND	pCi/L		(0-20)		
LCS1	Beta, Gross		32	34.3	pCi/L	106	(80-120)		
LCS2	Beta, Gross		32	34.4	pCi/L	107	(80-120)	20	0.29
MBLK	Beta, Gross			<3	pCi/L				
MS_201304090070	Beta, Gross	ND	32	28.8	pCi/L	88	(70-130)		

QC Ref# 704473 - Semivolatiles by GCMS by EPA 525.2 — **Analysis Date: 04/23/2013**

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	1,3-Dimethyl-2-nitrobenzene (S)			91.0	%	91	(70-130)		
LCS2	1,3-Dimethyl-2-nitrobenzene (S)			93.1	%	93	(70-130)		
MBLK	1,3-Dimethyl-2-nitrobenzene (S)			93.3	%	93	(70-130)		
MRL_CHK	1,3-Dimethyl-2-nitrobenzene (S)			92.4	%	92	(70-130)		
MS_201304150014	1,3-Dimethyl-2-nitrobenzene (S)			91.7	%	92	(70-130)		
MSD_201304150014	1,3-Dimethyl-2-nitrobenzene (S)			93.7	%	94	(70-130)		
LCS1	Acenaphthene-d10 (I)			78.7	%	79	(50-150)		
LCS2	Acenaphthene-d10 (I)			76.2	%	76	(50-150)		
MBLK	Acenaphthene-d10 (I)			75.5	%	76	(50-150)		
MRL_CHK	Acenaphthene-d10 (I)			73.5	%	74	(50-150)		
MS_201304150014	Acenaphthene-d10 (I)			67.9	%	68	(50-150)		
MSD_201304150014	Acenaphthene-d10 (I)			78.1	%	78	(50-150)		
LCS1	Atrazine		2.0	2.16	ug/L	108	(70-130)		
LCS2	Atrazine		2.0	2.19	ug/L	109	(70-130)	20	1.4
MBLK	Atrazine			<0.025	ug/L				
MRL_CHK	Atrazine		0.05	0.0490	ug/L	98	(50-150)		
MS_201304150014	Atrazine	ND	2.0	2.23	ug/L	112	(70-130)		
MSD_201304150014	Atrazine	ND	2.0	2.24	ug/L	112	(70-130)	20	0.45
LCS1	Benzo(a)pyrene		2.0	2.28	ug/L	114	(70-130)		
LCS2	Benzo(a)pyrene		2.0	2.29	ug/L	115	(70-130)	20	0.44
MBLK	Benzo(a)pyrene			<0.01	ug/L				
MRL_CHK	Benzo(a)pyrene		0.02	0.0130	ug/L	65	(50-150)		
MS_201304150014	Benzo(a)pyrene	ND	2.0	2.17	ug/L	109	(70-130)		
MSD_201304150014	Benzo(a)pyrene	ND	2.0	2.22	ug/L	111	(70-130)	20	2.3
LCS1	Chrysene-d12 (I)			89.1	%	89	(50-150)		
LCS2	Chrysene-d12 (I)			87.4	%	87	(50-150)		
MBLK	Chrysene-d12 (I)			90.9	%	91	(50-150)		
MRL_CHK	Chrysene-d12 (I)			80.4	%	80	(50-150)		
MS_201304150014	Chrysene-d12 (I)			79.4	%	79	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201304150014	Chrysene-d12 (I)			88.8	%	89	(50-150)		
LCS1	Di-(2-Ethylhexyl)adipate		2.0	1.80	ug/L	90	(70-130)		
LCS2	Di-(2-Ethylhexyl)adipate		2.0	1.81	ug/L	90	(70-130)	20	0.55
MBLK	Di-(2-Ethylhexyl)adipate			<0.15	ug/L				
MRL_CHK	Di-(2-Ethylhexyl)adipate		0.3	0.290	ug/L	97	(50-150)		
MS_201304150014	Di-(2-Ethylhexyl)adipate	ND	2.0	1.82	ug/L	91	(70-130)		
MSD_201304150014	Di-(2-Ethylhexyl)adipate	ND	2.0	1.90	ug/L	95	(70-130)	20	4.3
LCS1	Di(2-Ethylhexyl)phthalate		2.0	1.95	ug/L	98	(70-130)		
LCS2	Di(2-Ethylhexyl)phthalate		2.0	1.98	ug/L	99	(70-130)	20	1.5
MBLK	Di(2-Ethylhexyl)phthalate			<0.15	ug/L				
MRL_CHK	Di(2-Ethylhexyl)phthalate		0.6	0.603	ug/L	101	(50-150)		
MS_201304150014	Di(2-Ethylhexyl)phthalate	ND	2.0	1.95	ug/L	98	(70-130)		
MSD_201304150014	Di(2-Ethylhexyl)phthalate	ND	2.0	2.08	ug/L	104	(70-130)	20	6.5
LCS1	Hexachlorobenzene		2.0	1.94	ug/L	97	(70-130)		
LCS2	Hexachlorobenzene		2.0	1.96	ug/L	98	(70-130)	20	1.0
MBLK	Hexachlorobenzene			<0.025	ug/L				
MRL_CHK	Hexachlorobenzene		0.05	0.0480	ug/L	96	(50-150)		
MS_201304150014	Hexachlorobenzene	ND	2.0	1.99	ug/L	100	(70-130)		
MSD_201304150014	Hexachlorobenzene	ND	2.0	2.00	ug/L	100	(70-130)	20	0.50
LCS1	Hexachlorocyclopentadiene		2.0	1.90	ug/L	95	(70-130)		
LCS2	Hexachlorocyclopentadiene		2.0	1.96	ug/L	98	(70-130)	20	3.6
MBLK	Hexachlorocyclopentadiene			<0.025	ug/L				
MRL_CHK	Hexachlorocyclopentadiene		0.05	0.0520	ug/L	104	(50-150)		
MS_201304150014	Hexachlorocyclopentadiene	ND	2.0	1.94	ug/L	97	(70-130)		
MSD_201304150014	Hexachlorocyclopentadiene	ND	2.0	1.96	ug/L	98	(70-130)	20	1.0
LCS1	Molinate		2.0	2.00	ug/L	100	(70-130)		
LCS2	Molinate		2.0	2.02	ug/L	101	(70-130)	20	1
MBLK	Molinate			<0.05	ug/L				
MRL_CHK	Molinate		0.1	0.0940	ug/L	94	(50-150)		
MS_201304150014	Molinate	ND	2.0	2.06	ug/L	103	(70-130)		
MSD_201304150014	Molinate	ND	2.0	2.02	ug/L	101	(70-130)	20	2.0
LCS1	Perylene-d12 (S)			106	%	106	(70-130)		
LCS2	Perylene-d12 (S)			105	%	105	(70-130)		
MBLK	Perylene-d12 (S)			81.8	%	82	(70-130)		
MRL_CHK	Perylene-d12 (S)			84.1	%	84	(70-130)		
MS_201304150014	Perylene-d12 (S)			95.6	%	96	(70-130)		
MSD_201304150014	Perylene-d12 (S)			99.3	%	99	(70-130)		
LCS1	Phenanthrene-d10 (I)			85.9	%	86	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Phenanthrene-d10 (I)			85.7	%	86	(50-150)		
MBLK	Phenanthrene-d10 (I)			82.5	%	83	(50-150)		
MRL_CHK	Phenanthrene-d10 (I)			82.1	%	82	(50-150)		
MS_201304150014	Phenanthrene-d10 (I)			77.8	%	78	(50-150)		
MSD_201304150014	Phenanthrene-d10 (I)			86.9	%	87	(50-150)		
LCS1	Simazine		2.0	2.06	ug/L	103	(70-130)		
LCS2	Simazine		2.0	2.13	ug/L	106	(70-130)	20	3.3
MBLK	Simazine			<0.025	ug/L				
MRL_CHK	Simazine		0.05	0.0700	ug/L	140	(50-150)		
MS_201304150014	Simazine	ND	2.0	2.26	ug/L	113	(70-130)		
MSD_201304150014	Simazine	ND	2.0	2.30	ug/L	115	(70-130)	20	1.3
LCS1	Thiobencarb		2.0	2.04	ug/L	102	(70-130)		
LCS2	Thiobencarb		2.0	2.03	ug/L	101	(70-130)	20	0.49
MBLK	Thiobencarb			<0.1	ug/L				
MRL_CHK	Thiobencarb		0.1	0.0860	ug/L	86	(50-150)		
MS_201304150014	Thiobencarb	ND	2.0	2.07	ug/L	103	(70-130)		
MSD_201304150014	Thiobencarb	ND	2.0	2.06	ug/L	103	(70-130)	20	0.48
LCS1	Triphenylphosphate (S)			106	%	106	(70-130)		
LCS2	Triphenylphosphate (S)			102	%	102	(70-130)		
MBLK	Triphenylphosphate (S)			107	%	107	(70-130)		
MRL_CHK	Triphenylphosphate (S)			102	%	102	(70-130)		
MS_201304150014	Triphenylphosphate (S)			105	%	105	(70-130)		
MSD_201304150014	Triphenylphosphate (S)			106	%	106	(70-130)		
QC Ref# 705241 - Radium 226 by Ra-226 GA						**Analysis Date: 05/16/2013**			
LCS1	Radium 226		10	11.5	pCi/L	114	(80-120)		
LCS2	Radium 226		10	11.6	pCi/L	115	(80-120)	20	0.87
MBLK	Radium 226			<1	pCi/L				
MS_201304080087	Radium 226	ND	10	11.3	pCi/L	101	(70-130)		
QC Ref# 705245 - Radium 228 by RA-228 GA						**Analysis Date: 05/16/2013**			
LCS1	Radium 228		9.8	8.92	pCi/L	92	(80-120)		
LCS2	Radium 228		9.8	8.76	pCi/L	90	(80-120)	20	1.8
MBLK	Radium 228			<1	pCi/L				
MS_201304080087	Radium 228	ND	9.8	8.64	pCi/L	89	(70-130)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

APPENDIX F

WELL COMPLETION REPORT PART 1 FOR WELL NO. 6-5738-002

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

October 18, 2017

6-5738-002.wcr1ack.docx

Mr. James Stenger, Jr.
Alpha, Inc.
P.O. Box 330449
Kahului, HI 96733

Dear Mr. Stenger, Jr.

Well Completion Report Part I for Well No. 6-5738-002
Honolua, Island of Maui

We received your Well Completion Report Part I for the Kahana-MDWS Well (Well No. 6-5738-002) on October 12, 2017 and acknowledge that it is complete.

This completes your obligation under the well construction permit. A certificate of well construction completion will be issued to the well operator/landowner and you will receive a copy. This certificate transfers responsibility of specific aspects of well usage and maintenance from you to the well operator/landowner.

If you have any questions, please contact Charley Ice of the Commission staff at 587-0218 or toll-free at 984-2400 (Maui), extension 70218.

Sincerely,

JEFFREY T. PEARSON, P.E.
Deputy Director

CI:ss

c: County of Maui, Department of Water Supply
Maui Land & Pineapple Company, Inc.

ALPHA INC.
CONSTRUCTION DRILLING ENGINEERING

(808) 873-3883 OFFICE (808) 873-3884 FAX
P.O. BOX 330449 KAHULUI, HI 96733 ABC -31555

August 1, 2017

Commission on Water Resource Management
State of Hawaii
Dept. of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

SUBJECT: County of Maui – Kahana Well
State Well No. 6-5738-002

Dear Sir or Madam,

Attached for your information and handling is Well Completion Report – Part 1 for the above subject well.

Should you have any questions please contact me at (808) 873-3883.

Sincerely,

Robyne Nishida Nakao
Business Development Director

Attachment

Copy: C. Eaton, County of Maui, DWS
Ronald M. Fukumoto Engineering, Inc.

State of Hawaii
COMMISSION ON WATER RESOURCE MANAGEMENT
Department of Land and Natural Resources
WELL COMPLETION REPORT - PART I
Well Construction

For Official Use Only:

Instructions: Please print in ink or type and send completed report (with attachments, if applicable) to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96809. The Commission may not accept incomplete reports. This form shall be submitted within 60 days of the completion of work. For assistance, please consult the Hawaii Well Construction and Pump Installation Standards or call the Regulation Branch at **587-0225**. For updates to this form or additional information, please visit our website at http://www.state.hi.us/dlnr/cwrm/

1. State Well No.: 6-5738-002 Well Name: Kahana Island: Maui
2. Well Location Address: Honolua, Maui, Hawaii Tax Map Key: (2) 4-3-001:017
3. Drilling Company: Alpha, Inc.
4. Drilling method used during construction: ☑ Rotary ☐ Percussion ☐ Other (describe)
5. Date Well Construction (drilled,cased,grouted) completed: May 1, 2017 (month/day/year)
6. Was the subject well cored? ☐ Yes ☑ No
7. Step-Drawdown Test completed? ☐ No ☑ Yes **Attach Step-Drawdown Test form (*12/17/97 SDPTD Form*)**
8. Constant Rate Aquifer Test completed? ☐ No ☑ Yes **Attach Constant Rate Aquifer Test form (*12/17/97 CRPTD Form*)**

Water Level Data:	Reference point elevation	-	Depth to water (feet)	=	Water Level ft. above mean sea level (see note below)	Date/time of measurement
9. Initial encountered during drilling (this should also be filled in on the driller's log)	Ground = 1317 ft. msl		1309.63		7.37	Nov. 4, 2015
10. Just prior to casing installation	Ground = 1317 ft. msl		1309.63		7.37	Nov. 14, 2016
11. After casing installation (this information should be before any pump tests are performed with casing installed) Chloride: 65 ppm, Temperature: 70.0 °F	If this reference point is not the benchmark, the difference between the benchmark and this point is: .32 ft.		1309.63		7.37	Dec. 2, 2016

note: for all elevations referenced to mean sea level, take the ground elevation (surveyed or estimated if survey not required at this time) and subtract the depth to the water level.

12. **As-built section filled in completely (refer to attached sheet)** ☑
13. **Driller's Log filled in completely (refer to attached sheet)** ☑
14. **Well location info filled in completely (refer to attached sheet)** ☑
15. **Well elevation certification filled in completely (refer to attached sheet)** ☑
16. **Photograph of well and concrete pad showing benchmark on concrete pad attached** ☑
17. If a pump is not planned to be installed, please describe (below in the remarks section) how well is secured to prevent unauthorized access (example: lockable cover, threaded coupling, etc.)
18. Remarks: **Welded cap to secure well**

Licensed Driller (print) Alpha, Inc. C-57 Lic. No. ABC-31555

Signature James A. Stenger, Jr., President Date 7/28/2017

12. AS-BUILT WELL SECTION *(Please attach as-built if different from diagram provided below)*

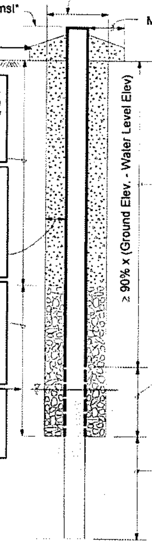
STATE WELL NO. 6-5738-002

Elevation at top of casing 1319.15 ft., msl* (to nearest 0.01 ft.)

Hole Diameter: 28 in.

Minimum of 2' Radius & 4" Thick Concrete Pad

Ground Elevation: 1317 ft., msl ☒ Surveyed ☐ Estimated



Bench mark elevation:
1317.32 ft., msl*
☒ (Surveyed to nearest 0.01 ft.)
☐ (Estimated)

Cement Grout: 1214 ft.
(min. 70% of distance from ground elevation to top of water surface or 500 ft., whichever is less.)

Please refer to the
HAWAII WELL CONSTRUCTION AND PUMP INSTALLATION STANDARDS
to ensure that your as-built is in compliance with applicable standards.

Grouting method:
☒ Positive displacement (if annular space is less than two inches, attach photo of tremie)
☐ Other

and

Annular space grouted in lifts?:
☒ Yes
☐ No

Annular space between hole and casing: 3 in.
Note: minimum for positive displacement shall be 1.5". For other grouting methods, minimum shall be 2" (non-public water systems) or 3" (public water systems):

Solid Casing: (≥ 90% x (Ground Elev.-Water Level Elev))
Length: 1318.85 ft.
Nominal Diameter: 20 3/4 O.D. in.
Wall Thickness: 3/8 in.
Bottom Elevation: -1.85 ft., msl

Rock or Gravel Packing:
10 ft.
Material:
☒ Crushed Basalt
☐ Rounded Gravel

Open Casing: ☒ Perforated ☐ Screen
Length: 58 ft.
Nominal Diameter: 20 5/8 O.D. in.
Wall Thickness: 5/16 in.
Bottom Elevation: -59.85 ft., msl

Water Level Elevation:
7.37 ft. msl*
(Item 11 from page 1)

Total Depth
1378 ft.

Open Hole:
Length: N/A ft.
Diameter: in.
Bottom Elevation: ft., msl

*msl = mean sea level

Solid Casing Material:

Carbon Steel: compliant with (*check one or more*): ☐ ANSI/AWWA C200 ☐ API Spec. 5L ☐ ASTM A53 ☒ ASTM A139
And compliant with (*check one or more*): ☒ ASTM A242 or A606 ☐ Type E ☐ Type S ☐ Grade B ☐ Other
Stainless Steel: (*check one*): ☐ ASTM A409 (production wells) ☐ ASTM A312 (monitor wells)
ABS Plastic conforming to ASTM F480 and ASTM D1527: (*check one*) ☐ Schedule 40 ☐ Schedule 80
PVC Plastic conforming to ASTM F480 and (ASTM D1785 or ASTM D2241): (*check one*): ☐ Schedule 40 ☐ Schedule 80 ☐ Schedule 120
Thermoset Plastic: (*check one*)
☐ Filament Wound Resin Pipe conforming to ASTM D2996
☐ Centrifugally Cast Resin Pipe conforming to ASTM D2997
☐ Reinforced Plastic Mortar Pressure Pipe conforming to ASTM D3517
☐ Glass Fiber Reinforced Resin Pressure Pipe conforming to AWWA C950
☐ PTFE Fluorocarbon Tubing conforming to ASTM D3296
☐ FEP Fluorocarbon Tubing conforming to ASTM D3296

Open Casing Material:

Carbon Steel: compliant with (*check one or more*): ☐ ANSI/AWWA C200 ☐ API Spec. 5L ☐ ASTM A53 ☒ ASTM A139
And compliant with (*check one or more*): ☒ ASTM A242 or A606 ☐ Type E ☐ Type S ☐ Grade B ☐ Other
Stainless Steel: (*check one*): ☐ ASTM A409 (production wells) ☐ ASTM A312 (monitor wells)
ABS Plastic conforming to ASTM F480 and ASTM D1527: (*check one*) ☐ Schedule 40 ☐ Schedule 80
PVC Plastic conforming to ASTM F480 and (ASTM D1785 or ASTM D2241): (*check one*): ☐ Schedule 40 ☐ Schedule 80 ☐ Schedule 120
Thermoset Plastic: (*check one*)
☐ Filament Wound Resin Pipe conforming to ASTM D2996
☐ Centrifugally Cast Resin Pipe conforming to ASTM D2997
☐ Reinforced Plastic Mortar Pressure Pipe conforming to ASTM D3517
☐ Glass Fiber Reinforced Resin Pressure Pipe conforming to AWWA C950
☐ PTFE Fluorocarbon Tubing conforming to ASTM D3296
☐ FEP Fluorocarbon Tubing conforming to ASTM D3296

13. DRILLER'S LOG

STATE WELL NO. West Maui Well #2

In addition to the driller's log, if a geologic log was prepared, please submit with this form

Depths (ft.)	Rock Description	Water Level (ft.)	Cl- (ppm)	Dates	Depths (ft.)	Rock Description	Water Level (ft.)	Cl- (ppm)	Dates
0 to 150	Red Clay Soft.				1293 to 1320	Hard In water			
150 to 210	Red Clay w/Black Soft.				to	Can Blow Hole dry Slow			
210 to 280	Lost Circulation Rough				to	recovery			
280 to 400	" " Soft				1320 to 1340	getting Cir. Still not			
400 to 420	No Circulation Med dense				to	much Water Porous but small			
420 to 584	" " Soft				to	Holes			
584 to 643	Trace of Cir. Gray Med soft				1340 to 1355	getting more water to			
643 to 657	No Cir. Hard slow drlg.				to	surface but still slow			
657 to 750	No Cir. med. w/ soft stringers				to	recovery			
750 to 770	Trace of Cir. Soft Brown Color				to				
770 to 800	No Cir med to hard				1355 to 1360	Broke through Large			
800 to 920	No Cir. Soft fast drlg.				to	water (lrg. Porous Black & Red			
920 to 947	No Cir. med				to	chunks. well recovers fast			
947 to 1090	No Cir Soft				to				
1090 to 1180	No Cir. Real Soft				to				
1180 to 1230	No Cir. med				to				
1280 to 1275	Trace Cir. Gray fine Med.				to				
1275 to 1293	" " Soft Black fines				to	Static WTR Level w/ sounder			

Remarks:

1309.63 From Ground level

Grnd level bench mark 1317.

Water level 7.37 above MSL

STEP-DRAWDOWN PUMP TEST DATA
(not required for wells producing < 100,000 gpd or 70 gpm)

Pumped Well No. 6-5738-002 Observation Well No. N/A

Pumped Well Name Kahana Distance between Obs. & Pumped Well N/A ft.

Target Q 1000 gpm Reference pt. for depth to water 1319.15 Top of ~~Casing~~ ft. msl

Static Water Level @ start of test 7.37 ft. msl

Water level measurements by: ☑ electrical sounder ☐ pressure transducer ☐ airline

START TEST Date: June 19, 2017 Time of day: 8:25 a.m.

Flow Meter Reading Start: 13442500 gallons

Suggested Elapsed time t (min)	Actual Elapsed Time t (min)	Depth to water (nearest 0.1 ft)	Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (at least 3 steps) (gpm)	EC (µS/cm)	Cl⁻ (mg/l)	Temp. X °F or ___ °C	Data in this table is for: ☑ Pumped Well ☐ Observation Well Remarks
-45	.35	1311.78		0			.	Start test/ Step 1
-30	.30	1311.78		0			.	
-15	.15	1311.78		0			.	
9am 0	0	1311.78		492 [1]			.	Start pump
1	1	1312.8		492			.	
1.5	1.5	1312.8		↓			.	
2	2	1312.85					.	
2.5	2.5	1312.85					.	
3	3	1312.85					.	
4	4	1312.85					.	
5	5	1312.85					.	
6	6	1312.85					.	
7	7	1312.85					.	
8	8	1312.80					.	
10	10	1312.79					.	
15	15	1312.85					.	
20	20	1312.85					.	
25	25	1312.90					.	
930am 30^2	31	1312.83			278	70 [3]	70.7 ·	Conductivity reading Chloride sample taken
45	44	1312.92					.	Step 2 next page
955am 55	55	1313.00		↓				

3/24/2015

SDPTD Form 3/24/2015

Suggested Elapsed time t (min)	Actual Elapsed Time t (min)	Depth to water (nearest 0.1 ft)	Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (at least 3 steps) (gpm)	EC (µS/cm)	Cl⁻ (mg/l)	Temp. X °F or ___ °C	Data in this table is for: ☑ Pumped Well ☐ Observation Well Remarks
0								Start Step 2
10am 1	1	1312.7		778			.	
1.5	1.5	1312.7		↓			.	
2	2	1312.7					.	
2.5	2.5	1312.7					.	
3	3	1312.7					.	
4	4	1312.7					.	
5	5	1313.68					.	
6	6	1313.67					.	
7	7	1313.72					.	
8	8	1313.7					.	
10	10	1313.71					.	
15	15	1313.71			259		70.1 .	
20	20	1313.77					.	
25	25	1313.74					.	
30^2	30	1313.75			257	65 [3]	70.0 ·	Conductivity reading Chloride sample taken
45	45	1313.08						
60	58	1313.9		↓				
11am 1	1	1314.43		968				
1.5	1.5	1314.44		↓				
2	2	1314.50						
2.5	2.5	1314.52						
3	3	1314.45						
4	4	1314.43						
5	5	1314.46						
6	6	1314.55						
7	7	1314.55						
8	8	1314.55						
10	10	1314.55						
15	15	1314.57						
20	20	1314.60				40		Test Strip
25	25	1314.62						
30	30	1314.65			263	65	70.3	Sample
45	45	1314.68						
60	59	1314.68		↓				

SDPTD Form 3/24/2015

Suggested Elapsed time t (min)	Actual Elapsed Time t (min)	Depth to water (nearest 0.1 ft)	Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (at least 3 steps) (gpm)	EC (µS/cm)	Cl⁻ (mg/l)	Temp. X °F or ___ °C	Data in this table is for: ☑ Pumped Well ☐ Observation Well Remarks
0				[1]			.	Start Step 3
1200 1		1315.22		1110			.	
1.5		1315.20		↓			.	
2		1315.05					.	
2.5		1315.03					.	
3		1315.10					.	
4		1315.11					.	
5		1315.15					.	
6		1315.12					.	
7		1315.14					.	
8		1315.17					.	
10		1315.20					.	
15		1315.18					.	
20		1315.05					.	
25		1315.05					.	
30[2]		1315.06			273	40 [3]	71.4 .	Conductivity reading Chloride sample taken
45		1314.75						
60		1314.72		↓				
								Max possible duration, water level or quality did not stabilize for any 24 period
			[4]	0				Begin recovery data next page Flow meter reading at end of pumped period: 13649900 gals

[1] starting pumping rate Q
[2] minimum length of step period of constant pumping rate
[3] minimum mandatory Chloride (Cl⁻) measurement/sampling at end of every step
[4] Use same ending drawdown figure as start for recovery

SDPTD Form 3/24/2015

Suggested elapsed time t (min)	Actual elapsed time t (min)	Depth To Water (nearest 0.1 ft)	Recovery Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (gpm)	EC (µS/cm)	Cl⁻ mg/l)	Temp. X °F or ___ °C	Data in this table is for: ☑ Pumped Well ☐ Observation Well Remarks
0	0			0			.	Pump off, start recovery
1	1	1312.10		0			.	
1.5	1.5	1312.00		0			.	
2	2	1311.98		0			.	
2.5	2.5	1311.95		0			.	
3	3	1311.86		0			.	
4	4	1311.90		0			.	
5	5	1311.92		0			.	
6	6	1311.96		0			.	
7	7	1312.11		0			.	
8	9	1312.32		0			.	
10	10	1312.40		0			.	
15	15	1312.35		0			.	
20	16	1312.33		0			.	
25	20	1312.33		0			.	
30	25	1312.28		0			.	
40	30	1312.23		0			.	
50				0			.	
60				0			.	
70				0			.	
80				0			.	
90				0			.	
100				0			.	
150				0			.	
200				0			.	
250				0			.	☒ 80% recovery achieved ☐ 80% recovery not achieved

END TEST Date: June 19, 2017 Time of day: 1:40 p.m.
ADDITIONAL REMARKS:

Person in charge of pump test (print): Jason Stenger

Signature:

The signature above indicates that the data reported on this form is accurate and true to the best of the person's knowledge who operated this pump test.

CRPTD Form 3/24/2015

CONSTANT-RATE PUMP TEST DATA

(not required for wells producing < 50 gpm)

Pumped Well No. 6-5738-002 Observation Well No. N/A

Pumped Well Name Kahana Well Distance between Obs. & Pumped Well N/A ft.

Target Q 1200 gpm Reference pt. for depth to water 1319.15 ft. msl

Static Water Level @ start of test 1311.78 ft. msl

Water level measurements by: ☒ electrical sounder ☐ pressure transducer ☐ airline

START TEST Date: June 23, 2017 Time of day: 12:30 p.m.

Flow Meter Reading Start: 11455800 gallons

Suggested elapsed time t (min)	Actual elapsed time t (min)	Depth to water (nearest 0.1 ft)	Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (gpm)	EC (µS/cm)	Cl⁻ (mg/l)	Temp. X °F or — °C	Data in this table is for: ☐ Pumped Well ☐ Observation Well Remarks
-45		1311.78		1200				Start test
-30		1311.78						
-15		1311.78						
0	0		0.00			[1]		Start pump/Cl⁻ taken*
1	12:31	1314.14	2.37		268	47	71.3	
1.5	12:31.5	1314.14	2.37					
2	12:32	1314.15	2.37					
2.5	12:32.5	1314.15	2.37					
3	12:33	1314.14	2.36					
4	12:34	1314.15	2.37					
5	12:35	1314.15	2.37					
6	12:36	1314.14	2.36					
7	12:37	1314.14	2.36					
8	12:38	1314.14	2.36					
10	12:40	1314.14	2.36					
15	12:46	1314.15	2.35					
20	12:50	1314.18	2.4					
25	12:55	1314.22	2.44					
30	13:00	1314.28	2.5					
40	13:10	1314.28	2.5					
50	13:20	1314.34	2.56					
60	13:30	1314.43	2.65					

CRPTD Form 3/24/2015

Suggested elapsed time t (min)	Actual elapsed time t (min)	Depth to water (nearest 0.1 ft)	Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (gpm)	EC (µS/cm)	Cl⁻ (mg/l)	Temp. X °F or — °C	Data in this table is for: ☐ Pumped Well ☐ Observation Well Remarks
70	13:40	1314.43	2.65	1200				
80	13:50	1314.43	2.65					
90	14:00	1314.45	2.67					
100	14:10	1314.49	2.71					
150	15:10	1314.53	2.75		281	50	69.8	
200	15:50	1314.65	2.87					
250	16:40	1314.7	2.72					
300	17:30	1314.8	3.02					
400	19:10	1314.9	3.12		280	50 [1]	70.5	Conductivity reading
500	20:50	1314.9	3.12					
600	22:30	1315.02	3.22					
700	00:10	1315.02	3.22					
800	2:00	1315.1	3.3		287	50 [1]	70.8	Conductivity reading
900	3:40	1315.1	3.3					
1000	5:10	1315.19	3.41		306	52 [1]	67.6	Conductivity reading
1500	13:30	1315.1	3.3		291	52 [1]	71.8	Conductivity reading
2000	21:30	1315.18	3.4		309	52 [1]	68.2	Conductivity reading
2500	11:30	1315.24	3.44		302	52 [1]	71.8	Conductivity reading
3000	19:30	1315.23	3.43		299	52 [1]	68.7	Conductivity reading
4000	11:30	1315.35	3.57		312	53 [1]	70.1	Conductivity reading
5000	3:30	1315.6	3.82		316	60 [1]	69.6	Conductivity reading
6000	11:40	1315.7	3.92		333	60 [1]	70.0	Conductivity reading
7000						[1]		Conductivity reading
8000						[1]		Conductivity reading
9000						[1]		Cl⁻ sample taken*
10000								**Max possible duration**, water level or quality did not stabilize for any 24 period
			[2]	0				**Begin recovery data next page** Flow meter reading at end of pumped period: 00182691 gals

[1] Conductivity reading (*Chloride sampling required at the beginning and end of test)
[2] Use same ending drawdown figure as start for recovery

CRPTD Form 3/24/2015

Suggested elapsed time t (min)	Actual elapsed time t (min)	Depth to water (nearest 0.1 ft)	Recovery Drawdown S (unadjusted to nearest 0.1 ft)	Pumping rate Q (gpm)	EC (µS/cm)	Cl⁻ (mg/l)	Temp. ___°F or ___°C	Data in this table is for: ☐ Pumped Well ☐ Observation Well Remarks
0	12:20 0	1315.69	3.91	0			.	Start recovery
1	12:31	1312.9	1.12	0			.	
1.5	12:32	1312.81	1.03	0			.	
2	12:32	1312.8	1.02	0			.	
2.5	12:32.5	1312.8	1.02	0			.	
3	12:33	1312.8	1.02	0			.	
4	12:34	1312.78	1	0			.	
5	12:35.5	1312.82	1.04	0			.	
6	12:36	1312.85	1.07	0			.	
7	12:37	1312.9	1.12	0			.	
8	12:38	1312.95	1.17	0			.	
10	12:39	1313.05	1.27	0			.	
15	12:45	1313.21	1.43	0			.	
20	12:50	1313.17	1.37	0			.	
25	12:55	1313.1	1.32	0			.	
30	13:00	1313.07	1.29	0			.	
40	13:10	1312.98	1.2	0			.	
50	13:20	1312.95	1.17	0			.	
60	13:30	1312.88	1.1	0			.	
70	13:40	1312.85	1.07	0			.	
80	13:50	1312.8	1.02	0			.	
90	14:00	1312.77	0.99	0			.	
100	14:10	1312.76	0.98	0			.	
150	15:00	1312.61	0.83	0			.	
200	15:54	1312.54	0.76	0			.	
250				0			.	☒ 80% recovery achieved ☐ 80% recovery not achieved

END TEST Date: June 27, 2017 Time of day: 12:30 p.m.

ADDITIONAL REMARKS: 1312.56 = 80% Recovery

Person in charge of pump test (print): **James A. Stenger, Jr., President, Alpha, Inc.**

Signature: ____________

The signature above indicates that the data reported on this form is accurate and true to the best of the person's knowledge who operated this pump test.

14. WELL LOCATION AND CURRENT OWNERSHIP INFORMATION

STATE WELL NO. 6-5738-002

Well coordinates (decimal degrees to at least 5 decimal places, example Latitude 21.334303, Longitude -157.962447)

Latitude 20.95231 Longitude 156.63869

Was a GPS used? ☒ yes ☐ no (if no, specify how you got these coordinates: ____________)

Current well owner ☐ same as application or ☐ new (fill in below)

Company Name Dept. of Water Supply,County of Maui Contact Curtis Eaton

Address 200 South High Street Wailuku HI 96793

City Wailuku State Hawaii Zip ______

Business Phone (808) 270-7835 Residential Phone ______ Fax (808) 270-7833

E-mail Address (808) 270-7833 Company Website ______

Current land owner ☐ same as application or ☒ new (fill in below)

Company Name Maui Land and Pineapple Company Contact Ryan Churchill

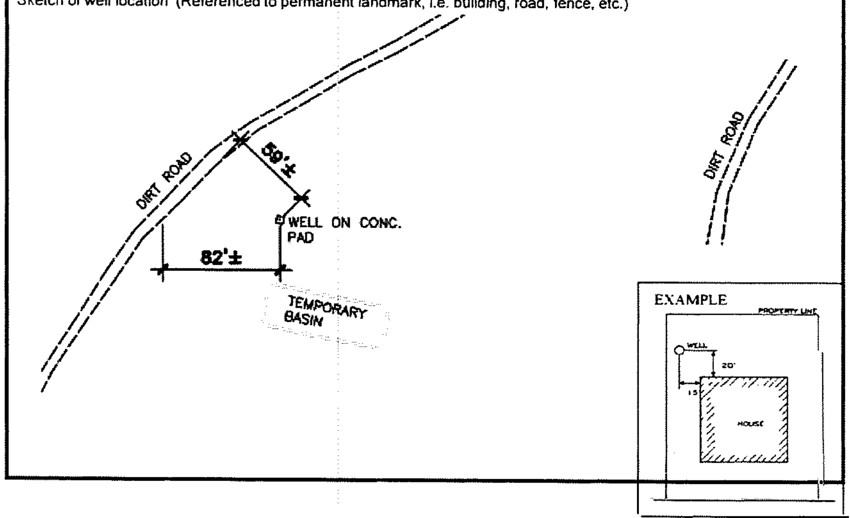
Address 200 Village Road

City Lahaina State Hawaii Zip 96761

Business Phone 808-877-1667 Residential Phone ______ Fax ______

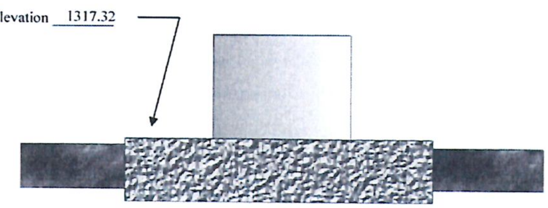
E-mail Address rchurchill@mlpmaui.com Company Website ______

Sketch of well location (Referenced to permanent landmark, i.e. building, road, fence, etc.)



15. WELL ELEVATION

STATE WELL NO. 6-5738-002



I certify that the elevation shown above:

1) Was done in accordance with acceptable surveying practices
2) Is accurate to the nearest 0.01 ft.
3) Is referenced to mean sea level

Surveyor Mandy K. Saito, PE, LS, LEED AP	License No. 16775	Date 7/28/2017

DAVID Y. IGE
GOVERNOR OF HAWAII

BRUCE S. ANDERSON, Ph.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
SAFE DRINKING WATER BRANCH
ULUAKUPU BLDG. 4
2385 WAIMANO HOME ROAD, SUITE 110
PEARL CITY, HI 96782-1400

In reply, please refer to:
File: SDWB
214D1118l.docx

November 7, 2018

Ms. Gladys Baisa
Director
Department of Water Supply
County of Maui
200 South High Street, 5th Floor
Wailuku, Hawaii 96793-2155
[via water.supply@mauicounty.gov only]

Dear Ms. Baisa:

SUBJECT: PUBLIC WATER SYSTEM NO. 214, LAHAINA
KAHANA WELL
STATE WELL NO. 6-5738-002
LAHAINA, MAUI, HAWAII

The Safe Drinking Water Branch (SDWB) acknowledges receipt of the engineering report for Kahana Well, dated August 17, 2018. We have completed our review and have determined that the engineering report is satisfactory.

The Department of Health (DOH) SDWB hereby grants conditional approval for the use of the Kahana Well, hereinafter referred to in this document as the "Source," as a drinking water source for a public water system. In its operation of the Source, the Maui Department of Water Supply, hereinafter referred to in this document as the "PWS," shall be subject to the following conditions:

1. A final and complete engineering report (1 copy) addressing all prior comments shall be provided to the SDWB in ".pdf" format.

2. Prior to commencing operation, the Source shall be equipped with properly installed sampling taps.

   a. The Source shall be equipped with a sampling tap prior to any treatment, to allow for the sampling of the raw, untreated water from the Source.

   b. Another sampling point after all treatment, at the entry point to the distribution system (i.e., prior to any service connection) shall be installed and clearly identified. Prior to installation, construction plans shall be submitted to the SDWB for review and approval in order to ensure the satisfactory placement of the sampling tap which will be utilized as the primary compliance monitoring point for the Source, unless otherwise indicated.

Clearly labeled, digital photos with dates imprinted must be provided to document that the above requirements have been met.

3. The Source shall deliver drinking water of the quality in compliance with Hawaii Administrative Rules (HAR), Chapter 11-20, "Rules Relating to Public Water Systems." The water quality shall be subject to verification by the SDWB.

4. The PWS, in its operation of the Source, shall comply with all other relevant provisions of HAR, Chapter 11-20.

5. The PWS shall notify the SDWB of any condition that may arise or be revealed which may contaminate the source and pose a threat to human health.

6. Initial source water quality data is valid for five (5) years from the sampling date. If any water quality data expires (i.e., exceeds the five-year time period) prior to start-up of the well, the well shall be retested for the expired contaminants.

7. The PWS shall notify the SDWB of the planned source activation date in writing, at least 10 calendar days in advance. This will help the SDWB incorporate the source into its monitoring schedules. A sample New Source Activation Letter is enclosed for your use.

8. Prior to activation of the Source, the PWS shall submit water quality data and well information to demonstrate that the Source is similar in water chemistry to all existing sources in the PWS **or** upon activation of the Source, the PWS shall return to standard lead and copper monitoring every six (6) months in accordance with Title 40 Code of Federal Regulations §141.86(d)(4)(vii). The submitted water quality data and well information shall reference "Public Water System Lahaina (PWS 214) Requesting Review of Lead & Copper Monitoring Requirement."

Water quality data and well information shall include all available pH, alkalinity, calcium, magnesium and total dissolved solids data, a map showing the location of the Source in relation to all existing wells, and the aquifer and well depth for each well. The PWS shall include a comparison of all data and preliminary determination that the new well is similar in water chemistry to all existing sources in the PWS water system. The submittal of data in only a laboratory report format and partial submittals are not acceptable and will not be reviewed.

Upon review of the submitted information, the SDWB will render a decision on the lead and copper monitoring schedule for the PWS. Please contact Mr. Michael Miyahira of the SDWB Engineering Section for more information.

9. Immediately prior to, or upon startup, the Source shall be retested (at the same detection level used in the original analyses) to confirm the presence of Barium, Nitrate as Nitrogen, Fluoride, and Radionuclides.

Please note that pH, Temperature, and Conductivity must be measured at the wellhead using EPA-approved methods, at the same time that the required samples are collected.

All of the laboratory analyses must be performed by a laboratory certified or approved by the State Laboratories Division (DOH-SLD), using EPA-approved methods for drinking water.

These results are to be submitted to the SDWB along with copies of the chain of custodies and laboratory reports for the contaminants specified in the preceding paragraphs no later than sixty (60) calendar days after the startup of the wells. The submittal shall be clearly labeled as "Kahana Well Confirmation Testing Results."

10. In accordance with HAR, Section 11-20-12(h)(20), the PWS shall be responsible for performing the following Initial Quarterly Monitoring (IQM) of the Source as outlined in "Contaminants to be Tested with Initial Quarterly Monitoring (IQM) for New Sources" at the SDWB website at: http://health.hawaii.gov/sdwb/files/2015/02/ContaminantsTestIQM2014.pdf.

All the above analyses shall be performed by a laboratory certified or approved by the DOH- SLD, using Environmental Protection Agency (EPA)-approved methods. The chain of custodies and laboratory reports shall be submitted to the SDWB no later than ten (10) calendar days after the end of each quarterly period (i.e., January – March data due on April 10, April – June data due on July 10, July – September data due on October 10, and October – November data due January 10). The submittal shall be clearly labeled as "Kahana Well Initial Quality Monitoring Testing."

11. Hawaii Revised Statues, Section 340E-24, requires suppliers of water to notify the SDWB, in writing, of any previously undetected chemical contaminant found in a source of drinking water, within seven (7) calendar days of the positive detection.

The SDWB reserves the right to suspend or revoke this conditional approval upon either a finding of violation on any of the above conditions or a determination of a threat to public health from factors which may arise in the future.

If there are any questions, please call Ms. Jennifer Nikaido of the SDWB Engineering Section at (808) 586-4258.

Sincerely,

Ann J. Zane

for JOANNA L. SETO, P.E., CHIEF
Safe Drinking Water Branch

JN:cb

Enclosure: Sample Source Activation Letter

c: Mr. Ronald Fukumoto, Fukumoto Engineering, Inc. (w/encl.)
[via ron@femaui.com only]
Mr. Curtis Eaton, Maui DWS (w/encl.) [via curtis.eaton@co.maui.hi.us only]
Ms. Leonore Amano, Maui DWS (w/encl.) [via leonore.amano@co.maui.hi.us only]

SDWB Monitoring Section (w/encl.) [via email only]
SDWB Compliance Section (w/encl.) [via email only]
SDWB Engineering (Mr. Mike Miyahira) (w/encl.) [via email only]

SAMPLE NEW SOURCE ACTIVATION LETTER

Ms. Joanna L. Seto, P.E. Chief
Department of Health, Safe Drinking Water Branch
Uluakupu Bldg 4
2385 Waimano Home Road, Suite 110
Pearl City, HI 96782-1400

Attention: Ms. Ann Zane, P.E.
Attention: Mr. Michael Miyahira, P.E.

Dear Ms. Seto:

SUBJECT: PUBLIC WATER SYSTEM (PWS) NO. 214, LAHAINA
ACTIVATION OF KAHANA WELL, STATE WELL NO. 6-5738-002

The County of Maui, Department of Water Supply (DWS) would like to inform the Department of Health (DOH), Safe Drinking Water Branch that the Kahana Well, State Well I.D. no. 6-5738-002 will be activated on ___________(date). This written notification is in accordance with the November 7, 2018 letter from the DOH granting conditional approval to use this source.

We would like to request SDWIS facility IDs and sample point IDs for the source and the entry-point-to-distribution-system (EPD) as follows:

	Source	EPD
Facility Name:	Kahana Well	____________ (e.g., Kahana Well chlorinator)
Facility ID no.:	____________(a)	____________ (a)
Sampling Pt. Location:	Wellhead	____________
Sample Pt. ID no.:	____________ (a)	____________ (a)

Note: (a) DOH will assign this number

If you have any questions on this new source activation, please call ____________ (contact person).

Sincerely,

____

COMMISSION ON WATER RESOURCE MANAGEMENT PERMITS FOR MAHINAHINA WELL (APPROVED SEPTEBMER 1, 2011)

APPENDIX H-1

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

September 1, 2011

Ref: 5638-04.wcp

Mr. Michael Robertson
Wailani Drilling, Inc.
110 West Uahi Way
Wailuku, HI 96793

Dear Mr. Robertson:

Well Construction Permit
Mahinahina Well (Well No. 5638-04)

Enclosed are two (2) copies of your approved Well Construction Permit for the captioned well(s) that authorize well construction activities but excludes installation work for a permanent pump. As part of the Chairperson's approval, the following special conditions were added and are part of your permit under Permit Condition 17:

Special Conditions

1. **Attached for your information are copies of the Department of Health's (DOH) review comments. Please note DOH's requirements related to discharge of effluent from well drilling and testing activities. Also, please contact the Noise Radiation and Indoor Air Quality Branch at 586-4700 to check compliance with construction noise permit requirements for this project.**

Please refer to the Permit Processes Worksheet (transmitted with your acknowledgement letter) for further information regarding the process of drilling a well and installing a pump.

No withdrawal of water shall be made other than for testing purposes until a certificate of pump installation completion has been issued by the Commission.

Please sign both permit originals and return **one** copy to the Commission office for our files. For copies of the aquifer pump test worksheet, please call staff or visit www.state.hi.us/dlnr/cwrm/forms.htm.

IMPORTANT - Drilling work shall not commence until a fully signed permit is returned to the Commission. The permit shall be prominently displayed or made available at the construction site during construction. Be advised that you may be subject to fines of up to $5,000 per day for any violations of your permit conditions starting from the permit approval date.

If you have any questions, please call Charley Ice of the Commission staff at 587-0218 or toll-free at 984-2400 (Maui), extension 70218.

Sincerely,

for WILLIAM J. AILA, JR.
Chairperson

Enclosures

c: MDWS (with applicable comments – DOH SDWB)

WELL CONSTRUCTION PERMIT

Mahinahina Well, Well No. 5638-04

Note: This permit shall be prominently displayed at the construction site until the work is completed

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management's Administrative Rules, Section 13-168, entitled "Water Use, Wells, and Stream Diversion Works", this document permits the construction and testing of **Mahinahina Well** (Well No. **5638-04**) at TMK **(2) 4-4-004:009, Maui**, subject to the Hawaii Well Construction & Pump Installation Standards (HWCPIS - February 2004) which include but are not limited to the following conditions:

1. The Chairperson of the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences and staff shall be allowed to inspect installation activities in accordance with §13-168-15, Hawaii Administrative Rules (HAR).
2. This permit shall be prominently displayed, or made available, at the site of construction work until work is completed.
3. The well construction permit shall be for construction and testing of the well only. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the HWCPIS (the latest pump test worksheet can be obtained by contacting Commission staff or at **www.hawaii.gov/dlnr/cwrm/resources_permits.htm**). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson. No withdrawal of water shall be made for purposes other than testing without a Certificate of Pump Installation Completion. The permitted pump capacity described on the pump installation permit **may be reduced** in the event that the pump test does not support the capacity.
4. In basal ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basal ground water unless otherwise authorized by the Chairperson. If it can be shown that the well does not tap basal ground water then this condition may be waived after consultation with and acceptance by Commission staff. However, in no instance can the well be drilled deeper than one-half (1/2) of the theoretical thickness without Commission approval.
5. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.
6. In the event that historically significant remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and immediately contact the Department of Land and Natural Resources' State Historic Preservation Division. Work may recommence only after written concurrence by the State Historic Preservation Division.
7. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.
8. The Well Completion Report Part I shall be submitted to the Chairperson within sixty (60) days after completion of work (please contact staff or visit **www.hawaii.gov/dlnr/cwrm/resources_permits.htm** for current form).
9. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.
10. The well construction permit application and, if relevant, any related staff submittal approved by the Commission are incorporated into this permit by reference.
11. If the HWCPIS are not followed and as a consequence water is wasted or contaminated, a lien on the property may result.
12. Any variances from the HWCPIS shall be approved by the Chairperson prior to invoking the variance.
13. The work proposed in the well construction permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than the date the permit expires.
14. If the well is not to be used it must be properly capped. If the well is to be abandoned during the course of the project then the permittee must apply for a well abandonment permit in accordance with §13-168-12(f), HAR, prior to any well sealing or plugging work.
15. The permittee, its successors, and assigns shall indemnify, defend, and hold the State of Hawaii harmless from and against any loss, liability, claim, or demand for property damage, personal injury, or death arising out of any act or omission of the applicant, assigns, officers, employees, contractors, and agents under this permit or relating to or connected with the granting of this permit.
16. This permit shall apply to the location shown on the application only. If the well is to be relocated, the permittee shall apply for a new well construction/pump installation permit in accordance with §13-168-12(f), HAR.
17. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

Date of Approval: **August 31, 2011**
Expiration Date: **August 31, 2013**

William J. Aila for
WILLIAM J. AILA, JR., Chairperson
Commission on Water Resource Management

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed and understand that I shall not commence work until I have signed, dated, and returned the permit to the Commission. I understand that this permit is not to be transferred to any other entity. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $5,000 per day starting from the permit date of approval.

Driller's Signature: ______________ C-57 License #: **C-20115** Date: ______________

Printed Name: Michael Robertson Firm or Title: Wailani Drilling, Inc.

Please sign both copies of this permit, return one copy to the Commission office, and retain the other for your records.

Attachment

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

September 1, 2011

Ref: 5638-04.pip

Mr. Michael Robertson
Wailani Drilling, Inc.
110 West Uahi Way
Wailuku, HI 96793

Dear Mr. Robertson:

Pump Installation Permit
Mahinahina Well (Well No. 5638-04)

Enclosed are two (2) originals of your approved Pump Installation Permit for the captioned well(s) that authorize permanent pump installation work for your well(s). As part of the Chairperson's approval, the following special conditions were added and are part of your permit under Permit Condition 14:

Special Conditions

1. **If the elevation benchmark needs to be altered, the permittee, well operator, and/or well owner shall ensure that the benchmark is transferred (or the well resurveyed) and documentation of the new benchmark shall be submitted to the Commission within sixty (60) days after the pump is installed.**

The permittee is responsible for all conditions of the permit. This includes ensuring the submission of a completed Well Completion Report Part II form within sixty (60) days after the pump installation work is completed. Be advised that you may be subject to fines of up to $5,000 per day for any violations of your permit conditions starting from the permit approval date.

Please sign both permit originals and return **one** copy to the Commission office for our files.

IMPORTANT - Pump installation shall not commence until a fully signed permit is returned to the Commission.

If you have any questions, please call Charley Ice of the Commission staff at 587-0218 or toll-free at 984-2400 (Maui), extension 70218.

Sincerely,

WILLIAM J. AILA, JR.
Chairperson

Enclosure

c: MDWS

PUMP INSTALLATION PERMIT
Mahinahina Well, Well No. 5638-04

Note: This permit shall be prominently displayed at the site until the work is completed

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management's Administrative Rules, Section 13-168, entitled "Water Use, Wells, and Stream Diversion Works", this document permits the pump installation for **Mahinahina Well** (Well No. **5638-04**) at TMK **(2) 4-4-004:009**, **Maui**, subject to the Hawaii Well Construction & Pump Installation Standards (HWCPIS - February 2004) which include but are not limited to the following conditions:

1. The Chairperson to the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work covered by this permit commences and staff shall be allowed to inspect installation activities in accordance with §13-168-15, Hawaii Administrative Rules (HAR).

2. No withdrawal of water shall be made other than for testing until a Certificate of Pump Installation Completion has been issued by the Commission.

3. This permit shall be prominently displayed, or made available, at the site of construction work until work is completed.

4. The pump installation permit shall be for installation of a **1400** gpm rated capacity, or less, pump in the well. This permanent capacity may be reduced in the event that the pump test data does not support the capacity.

5. A water-level measurement access shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels.

6. The permittee shall install an approved meter or other appropriate means for measuring and reporting withdrawals and appropriate devices or means for measuring chlorides and temperature at the well head.

7. Well Completion Report Part II shall be submitted to the Chairperson within sixty (60) days after completion of work (please contact staff or visit **www.hawaii.gov/dlnr/cwrm/resources _permits.htm** for current form).

8. The permittee, well operator, and/or well owner shall comply with all applicable laws, rules, and ordinances, and non-compliance may be grounds for revocation of this permit.

9. The pump installation permit application and, if relevant, any related staff submittal approved by the Commission are incorporated into this permit by reference.

10. If the HWCPIS are not followed and as a consequence water is wasted or contaminated, a lien on the property may result.

11. Any variances from the HWCPIS shall be approved by the Chairperson prior to invoking the variance.

12. The work proposed in the pump installation permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than the date the permit expires.

13. The permittee, its successors, and assigns shall indemnify, defend, and hold the State of Hawaii harmless from and against any loss, liability, claim, or demand for property damage, personal injury, or death arising out of any act or omission of the applicant, assigns, officers, employees, contractors, and agents under this permit or relating to or connected with the granting of this permit.

14. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

for WILLIAM J. AILA, JR., Chairperson
Commission on Water Resource Management

Date of Approval: **August 31, 2011**
Expiration Date: **August 31, 2013**

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed and understand that I shall not commence work until I and the pump installer have signed, dated, and returned the permit to the Commission. I understand that this permit is not to be transferred to any other entity. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $5,000 per day starting from the permit date of approval.

Installer's Signature: ____________ C-57, C-57a, or A License #: **C-20115** Date: ____________

Printed Name: Michael Robertson Firm or Title: Wailani Drilling, Inc.

Please sign both copies of this permit, return one copy to the Commission office, and retain the other for your records.

Attachments

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

APPLICATION FOR A WELL CONSTRUCTION / PUMP INSTALLATION PERMIT

For Official Use Only:

Instructions: Please print in ink or type and send completed application with attachments to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96809. Application must be accompanied by 10 copies and a non-refundable filing fee of **$25.00** payable to the Dept. of Land and Natural Resources. The Commission may not accept incomplete applications. For assistance, call the Regulation Branch at 587-0225. For further information and updates to this application form, visit http://www.hawaii.gov/dlnr/cwrm.

WELL LOCATION INFORMATION

1. STATE WELL NO. (if already assigned)	2. WELL NAME	3. ISLAND	4. TMK
	Mahinahina	Maui	4 (zone) - 4 (sec) - 004 (plat) : 009 (parcel)

The following must be attached before this application is accepted as complete:
- Portion of 7.5-Minute Series USGS topographic map (scale 1:24,000) with well location labeled and include the name of the quad map
- Property tax map, showing well location referenced to established property boundaries
- Photograph of the proposed well site
- A schematic diagram showing the well site, access road and proposed well infrastructure
- For dug wells, attach a grading plan with cross section profiles showing existing and finish grades

5. WELL OPERATOR'S NAME/COMPANY	Well Operator's Contact	6. LANDOWNER'S NAME/COMPANY	Landowner's Contact
Maui DWS	Alan Murata	State of Hawaii	Daniel Ornellas

Well Operator's Mailing Address: 200 S High St, Wailuku, HI 96793

Landowner's Mailing Address: 1151 Punchbowl Street, Room 220

Well Operator's Phone	Well Operator's Fax	Well Operator's E-mail	Landowner's Phone	Landowner's Fax	Landowner's E-mail
(808)270-7835	808-270-7951	alan.murata@co.maui.hi.us	(808)984-8103	(808)984-8111	daniel.l.ornellas@hawaii.gov

PROPOSED WELL CONSTRUCTION

7. Proposed Work
- ☒ Construct New Well
- ☐ Modify Existing Well
- ☐ Abandon/Seal Well

8. Construction Type
- ☒ Drilled
- ☐ Dug
- ☐ Shaft
- ☐ Tunnel

9. Is this well part of a battery of wells? ☐ Yes ☒ No

PROPOSED PUMP INSTALLATION

10. Proposed Work
- ☐ Install New Pump
- ☐ Replace Pump

11. Proposed Pump Capacity, gpm (gallons per minute)

12. Proposed Amount of Withdrawal, gpd (gallons per day)

13. Method of flow measurement
- ☐ Flowmeter
- ☐ Other (explain)

14. Proposed Surveyor name and license number (a surveyor is required for all Well Construction Permits and may be required for some Pump Installation Permits)

PROPOSED USE

☒ 15. Municipal (water systems serving greater than 25 individuals or 15 service connections)

☐ 16. Domestic Number of units to be served: ________

☐ 17. Industrial (describe)

☐ 18. Irrigation (describe crop and no. of acres)

☐ 19. Military (describe)

☐ 20. Other (describe)

OTHER LEGAL REQUIREMENTS *If required, items 21. and 22. must be obtained before the Commission can legally issue a permit:*

21. Conservation District Use Permit (CDUP)
- ☐ Well is in Conservation District
  - ☐ Required, CDUP # ________ date approved ________
  - ☐ Not Required (attach documentation from OCCL)
  - ☐ I have not checked with OCCL about whether or not a CDUP is required.
- ☒ Well is not in Conservation District
- ☐ I have not checked if well is in or out of Conservation District.

22. Special Management Area Permit (SMAP)
- ☐ Required, SMA # ________ date approved ________
- ☒ Not Required (attach documentation from applicable County agency)
- ☐ I have not checked with the county about whether or not an SMA Permit is required.

23. State Historic Preservation Division (SHPD) of the Department of Land and Natural Resources
- ☒ I have consulted with the SHPD regarding potential impacts of well construction activities on historic sites. I have attached applicable documentation from the HPD.
- ☐ I have not consulted with the SHPD regarding potential impacts of well construction activities on historic sites.

24. Chapter 343
- ☒ An Environmental Assessment was completed, and
  - ☐ An Environmental Impact Statement was required and has been accepted (attach letter of acceptance). Publication date in The Environmental Notice: ________
  - ☒ A Finding of No Significant Impact has been determined (attach letter). Publication date in The Environmental Notice: July 23, 2011

This project proposes:
- ☒ Use of state or county lands, or use of state or county funds
- ☐ Use within a state conservation district
- ☐ Use within a shoreline setback area
- ☐ Use within a national or Hawaii registered historic site
- ☐ Use within the Waikiki Special District
- ☐ The construction, expansion or modification of helicopter facility
- ☐ A wastewater treatment unit
- ☐ Waste-to-energy facility
- ☐ Landfill
- ☐ Oil refinery
- ☐ Power-generating facility
- ☐ None of the above 11 items

25. Water Use Permit No. (if applicable): ________

Additional remarks, explanations, etc. (attach additional sheet if more space is needed)

NOTE: Signing below indicates that the signatories understand and swear that the information provided is accurate and true to the best of their knowledge. Further, the signatories understand that upon permit approval: 1) the proposed work is to be completed within two (2) years of the approval date; 2) the contractor shall submit to the Commission a well completion/abandonment report within 60 days after the completion date of the permitted work; 3) in the event that the application is not completed correctly, any permit may be suspended until the item is brought in to compliance, and any work done while the permit is in suspension may result in fines of up to $5000/day.

26. WELL DRILLER (Must be filled out if application is for Well Construction)

Licensee business name ________ C-57 License No. ________

Signature ________ Print ________ Date ________

Address ________

Phone ________ Fax ________ E-mail ________

27. PUMP INSTALLER (Must be filled out if application is for Pump Installation)

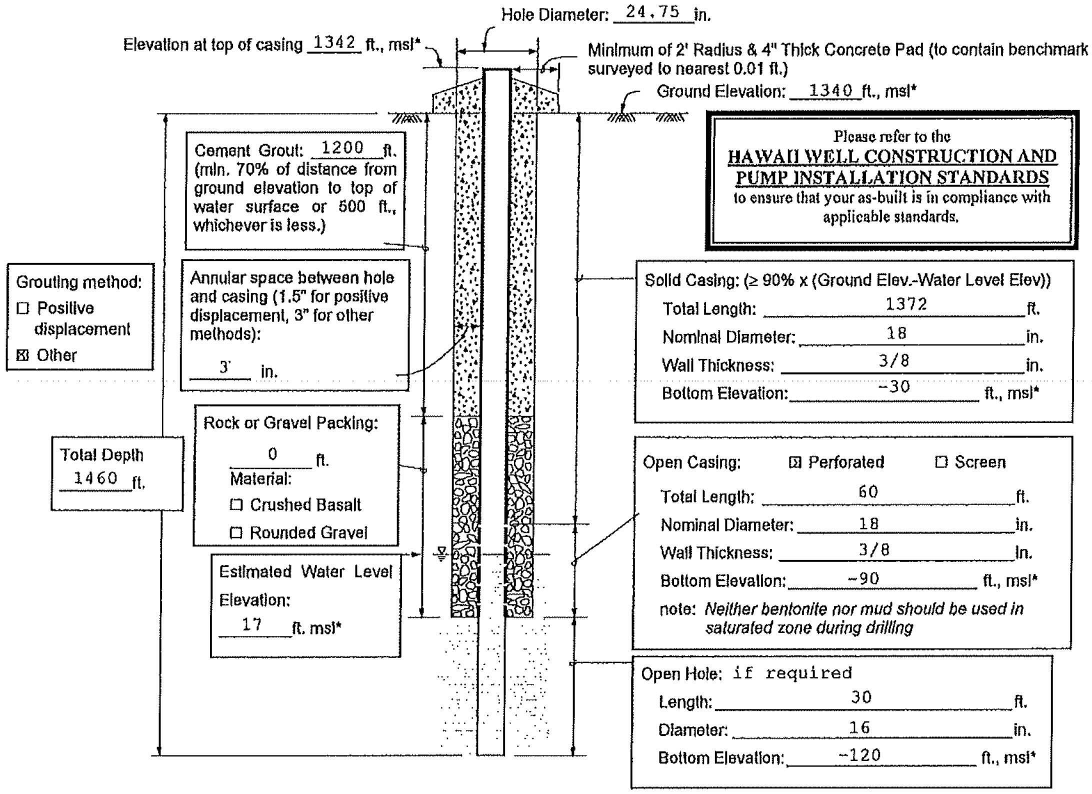
Licensee business name ________ C-57/C-57a/A License No. ________

Signature ________ Print ________ Date ________

Address ________

Phone ________ Fax ________ E-mail ________

PROPOSED WELL SECTION *(Please attach schematic if different from diagram provided below)*



* The approximate elevation must be referenced to mean sea level (msl) at the time of application filing. Final elevations of well components shall be submitted in the Well Completion/Well Abandonment reports and referenced to a benchmark which has been established by a surveyor licensed by the State.

For non-salt water Basal Wells - bottom elevation of well should not be deeper than 1/4 of aquifer thickness or,

Bottom Elevation of Well Limit = $\left(\text{Water Elevation} - \frac{41 \times \text{Water Level Elevation}}{4}\right)$

Example: Estimated + 2 ft. Water Level Elev. ⟶ Bottom Elevation of Well Limit = $\left(2 - \frac{41 \times (2)}{4}\right) = -18.5$ ft.

Solid Casing Material:

Carbon Steel: compliant with (check one or more): ☐ ANSI/AWWA C200 ☐ API Spec. 5L ☐ ASTM A53 ☒ ASTM A139
And compliant with (check one or more): ☒ ASTM A242 (or A606) ☐ Type E ☐ Type S ☐ Grade B ☐ Other
Stainless Steel: (check one): ☐ ASTM A409 (production wells) ☐ ASTM A312 (monitor wells)
ABS Plastic conforming to ASTM F480 and ASTM D1527: (check one) ☐ Schedule 40 ☐ Schedule 80
PVC Plastic conforming to ASTM F480 and (ASTM D1785 or ASTM D2241): (check one): ☐ Schedule 40 ☐ Schedule 80 ☐ Schedule 120
Thermoset Plastic: (check one)
☐ Filament Wound Resin Pipe conforming to ASTM D2996
☐ Centrifugally Cast Resin Pipe conforming to ASTM D2997
☐ Reinforced Plastic Mortar Pressure Pipe conforming to ASTM D3517
☐ Glass Fiber Reinforced Resin Pressure Pipe conforming to AWWA C950
☐ PTFE Fluorocarbon Tubing conforming to ASTM D3296
☐ FEP Fluorocarbon Tubing conforming to ASTM D3296

Open Casing Material:

Carbon Steel: compliant with (check one or more): ☐ ANSI/AWWA C200 ☐ API Spec. 5L ☐ ASTM A53 ☒ ASTM A139
And compliant with (check one or more): ☒ ASTM A242 (or A606) ☐ Type E ☐ Type S ☐ Grade B ☐ Other
Stainless Steel: (check one): ☐ ASTM A409 (production wells) ☐ ASTM A312 (monitor wells)
ABS Plastic conforming to ASTM F480 and ASTM D1527: (check one) ☐ Schedule 40 ☐ Schedule 80
PVC Plastic conforming to ASTM F480 and (ASTM D1785 or ASTM D2241): (check one): ☐ Schedule 40 ☐ Schedule 80 ☐ Schedule 120
Thermoset Plastic: (check one)
☐ Filament Wound Resin Pipe conforming to ASTM D2996
☐ Centrifugally Cast Resin Pipe conforming to ASTM D2997
☐ Reinforced Plastic Mortar Pressure Pipe conforming to ASTM D3517
☐ Glass Fiber Reinforced Resin Pressure Pipe conforming to AWWA C950
☐ PTFE Fluorocarbon Tubing conforming to ASTM D3296
☐ FEP Fluorocarbon Tubing conforming to ASTM D3296

INSTRUCTIONS FOR FILLING OUT WELL CONSTRUCTION/PUMP INSTALLATION PERMIT APPLICATION FORM

CHECKLIST FOR A COMPLETE APPLICATION

- ☐ Fill in the most recent application form.
  (check www.hawaii.gov/dlnr/cwrm or call 587-0225 for updates)
- ☐ Fill every line in (both sides of application).
- ☐ Enclose a check for $25 payable to the Department of Land and Natural Resources.
- ☐ Mark the proposed well location on: the appropriate USGS quad map, the TMK map, the photo and the schematic, and attach to the application.
- ☐ For dug wells, attach a grading plan and cross section profiles showing existing and finish grades.
- ☐ Attach the original and 10 copies of the application form, maps, photo and schematic.
- ☐ Attach letters from OCCL and appropriate county agencies regarding items 21 to 23.
- ☐ Sign the application form.

Send the application and maps, copies, and the filing fee to:
Commission on Water Resource Management
P.O. Box 621
Honolulu, HI 96809

DESCRIPTIONS FOR LINES ON APPLICATION

WELL LOCATION INFORMATION

1. **STATE WELL NO.** If you already have a state well number assigned, please fill it out here. Otherwise, leave it blank and a well number will be assigned by the CWRM.
2. **WELL NAME** Give the well a short concise name that will differentiate it from other wells. It is what you want to call the well.
3. **ISLAND** The island name where the well is located.
4. **TMK** Tax Map Key number
5. **Well operator's information** Fill in the information for the well operator. This should be the entity that will be responsible for reporting the pumpage when the construction is completed.
6. **Landowner's information** Fill in the information for the landowner of the property where the well is located.

PROPOSED WELL CONSTRUCTION

7. **Proposed work** The proposed work can be the construction of a new well, the modification (deepening, etc.) of an existing well, or the abandonment and sealing of an existing well. Check one box only.
8. **Construction type** The construction type can be drilled, dug, shaft, or tunnel.
9. **Battery** Is this well part of a battery of wells? A battery is defined as two or more wells in close proximity that for all intents and purposes functions as a single source.

PROPOSED PUMP INSTALLATION

10. **Proposed work** The proposed work can be either the installation of a new pump or the replacement of an existing pump. Replacement of an existing pump requires a permit only if the pump is of greater capacity than the existing installed pump. Otherwise, a replacement will only require the submission of a Well Completion Report Part II.
11. **Proposed pump capacity** The proposed pump capacity rate of the pump in gallons per minute (gpm).
12. **Proposed amount of withdrawal** The proposed amount of withdrawal in gallons per day (gpd), not to exceed (the proposed pumping capacity in gallons per minute) x 1440 minutes/day.
13. **Method of flow measurement** This is the proposed method the operator will be using to measure pumpage for reporting purposes.

PROPOSED SURVEYOR

14. **Proposed surveyor name and license number** A Hawaii licensed surveyor must establish benchmark elevations for wells where proposed pumps of 70 gpm or more are to be installed, to comply with the well completion report requirements. Proposed pumps less than 70 gpm may have this requirement deferred until the Commission deems it is necessary. If you wish to defer this requirement and your pump is less than 70 gpm, please write "deferred" in this space.

PROPOSED USE

15. **Municipal Use** is domestic, industrial, and commercial use of water through public services available to persons of a county for the promotion and protection of their health, comfort, and safety, for the protection of property from fire, and for the purposes listed under the term "domestic use".
16. **Domestic Use** is any use of water for individual personal needs and for household purposes such as drinking, bathing, heating, cooking, noncommercial gardening, and sanitation.
17. **Industrial Use** is for uses such as cooling or processing water, etc.
18. **Irrigation Use** is for golf courses, agriculture, etc. Describe crop type and acreage.
19. **Military Use** is water used by the military from military operated water supply systems.
20. **Other** Use not described in items 15 through 19. Please add a description.

OTHER LEGAL REQUIREMENTS

21. **Conservation District Use Permit (CDUP)** To find out if your well is located in a Conservation District (CD), you should first check with the Land Use Commission (LUC) (http://www.hawaii.gov/dbedt/gis/maps/slud.jpg or call 587-2833). If the well is not in a CD, then you may check not in a CD box. If the well site is in a CD you will need to then determine if a Conservation District Use Permit (CDUP) is required. To find out if a CDUP is necessary, please contact the Office of Conservation and Coastal Lands (OCCL) of DLNR at 587-0377.
22. **Special Management Area Permit (SMAP)** To determine if an SMAP is necessary, on Oahu call 527-5374; on Hawaii call 961-8288; for Maui County call 270-7235; on Kauai call 241-6677
23. **Historic Preservation review** If the parcel(s) affected by construction (well location/access road/infrastructure for well) has been reviewed by the State Department of Land and Natural Resources Historic Preservation Division (SHPD or through an OEQC Environmental Review, Special Management Area Permit, etc.), check "yes" and attach any relevant documentation from SHDP. If the affected parcel(s) has not undergone SHDP review, attach a photograph of the affected area, a schematic diagram (showing the well location, access road and infrastructure for the well), and a short description of the prior use(s) of the land on which the well resides.

    *Please note: You are **strongly advised** to contact the SHPD to obtain a pre-review of your project. In the event that you do not get an HP pre-review and if during the course of either review or the permit itself it is determined that you need SHPD's concurrence, your application or permit may be held in abeyance or denied until issues with HP are resolved. To contact SHPD, please call 692-8015.
24. **Chapter 343** If an Environmental Assessment was completed, fill in the dates of publication and acceptance. For additional information about the proposed uses checkboxes, refer to http://luc.state.hi.us/docs/hrs_343.pdf
25. **Ground Water Use Permit No. (if applicable)** If a Ground Water Use Permit number has been obtained, identify it here.

SIGNATURES

26. **Well Driller** This section must be filled out completely for the Well Construction Permit application to be accepted as complete.
27. **Pump Installer** This section must be filled out completely for the Pump Installation Permit application to be accepted as complete.

COMMISSION ON WATER RESOURCE MANAGEMENT
WELL CONSTRUCTION/PUMP INSTALLATION
PERMIT PROCESS WORKSHEET

Step	Description	Responsible Party	Legal Deadline
1	Ensure that if items 21 to 23 of the application are required, that they are obtained prior to applying for a permit. Otherwise, post-application comments obtained from these agencies may delay processing of your application.	Applicant	None
2	Application for Well Construction (or modification) and/or Pump Installation (or replacement with larger capacity than existing pump - see note B below).	Licensed Well Driller (for Well Construction) and/or Licensed Pump Contractor (for Pump Installation) (See note C below)	None
3	Issuance of Well Construction Permit to Well Driller (if applied for).	CWRM	Within 90 days of acceptance of completed application & contingent upon other agencies' legal requirements. (See note A below)
4	Issuance of Pump Installation Permit to Pump Installer (if applied for).	CWRM	Within 90 days of acceptance of completed application & contingent upon other agencies' legal requirements. (See note A below)
5	Execute/Sign Permit.	Licensed Well Driller or Licensed Pump Installer	Before work activity begins.
6	Start of Work Notice.	Licensed Well Driller or Licensed Pump Installer	2 weeks prior to beginning of work activity.
7	Post copy of permit at the work site.	Licensed Well Driller or Licensed Pump Installer	During entire period of work activity at the site.
8	Construction of well. Note: a) If the well is to be abandoned during the course of the Well Construction Permit, and no further work is to be done, the applicant shall apply for and obtain a Well Abandonment Permit prior to doing any abandonment work. b) If the well is to be abandoned and relocated during the course of the Well Construction Permit, the applicant shall apply for and obtain a Well Abandonment Permit prior to doing any abandonment work, and a new Well Construction Permit shall be applied for and obtained prior to doing any new work (i.e. go back to step 1 above).	Licensed Well Driller	Within 2 years of issuance of Well Construction Permit.
9	Installation of a temporary test pump that can adequately conduct a step-drawdown test (if proposed pump>70 gpm).	Licensed Well Driller or Licensed Pump Installer	Within 2 years of issuance of Well Construction Permit.
10	Installation of permanent pump.	Licensed Pump Installer	Within 2 years of issuance of Pump Installation Permit.
11	Application for permit extension (if required).		None
12	Well Completion Report Part I (including Elevation Survey and Pump Tests, if applicable) to be returned completed to CWRM.	Licensed Well Driller	Within 60 days of completion of Well Construction (the date that ALL aspects of Well Completion Report Part I can be filled in).
13	Well Completion Report Part II to be returned to CWRM.	Licensed Pump Installer	Within 60 days of completion of Pump Installation (the date that ALL aspects of Well Completion Report Part II can be filled in).
14	Acceptance of Well Completion Report Part I, Elevation Survey.	CWRM	None
15	Issuance of Certificate of Well Construction Completion to Landowner.	CWRM	None
16	Acceptance of Well Completion Report Part II.	CWRM	None
17	Issuance of Certificate of Pump Installation Completion to Landowner.	CWRM	None
18	Pumpage may commence, Water Use Reporting required.	Well Operator	Monthly recording.
19	Abandonment (initiated in Step 2 of process).	Landowner	Until well sealed.

NOTES:

A. For non-compliance of other agencies' legal requirements that preclude the Commission from issuing a permit, your application may:
   a) Have the 90-day deadline for approval waived (at your request); or
   b) Be denied and you can seek recourse at a Commission hearing.

B. If a pump replacement of equal or less than the existing capacity is done, then only step 10 is required (Well Completion Report Part II).

C. If a contractor is not selected, the application will not be accepted as complete, but may be routed for comments. If the application undergoes a satisfactory review, a letter of assurance will then be issued indicating that a permit will be issued upon selection of a contractor without outstanding issues with the Commission.

COMMISSION ON WATER RESOURCE MANAGEMENT PERMIT FOR KAHANA WELL (APPROVED NOVEMBER 10, 2014)

APPENDIX H-2

14 0364

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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NOV 17 2014
By LD

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NOV 14

DEPT. OF WATER
STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

November 10, 2014

6-5738-002.wcp.docx

Mr. James Stenger, Jr.
Alpha, Inc.
P.O. Box 330449
Kahului, HI 96733

Dear Mr. Stenger, Jr.:

Well Construction Permit
MDWS-Kahana Well (Well No. 6-5738-002), Honolua, Island of Maui

Enclosed are two (2) copies of your approved Well Construction Permit for the captioned well(s) that authorize well construction activities but excludes installation work for a permanent pump. As part of the Chairperson's approval, the following special conditions were added and are part of your permit under Permit Condition 17:

Special Conditions

1. **Attached for your information are copies of the Department of Health's (DOH) review comments. Please note DOH's requirements related to discharge of effluent from well drilling and testing activities. Also, please contact the Noise Radiation and Indoor Air Quality Branch at 586-4700 to check compliance with construction noise permit requirements for this project.**

Please refer to the Permit Processes Worksheet (transmitted with your acknowledgement letter) for further information regarding the process of drilling a well and installing a pump.

No withdrawal of water shall be made other than for testing purposes until a certificate of pump installation completion has been issued by the Commission.

Please sign both permit originals and return **one** copy to the Commission office for our files. For copies of the aquifer pump test worksheet, please call staff or visit http://files.hawaii.gov/dlnr/cwrm/forms/APTR.pdf.

IMPORTANT - Drilling work shall not commence until a fully signed permit is returned to the Commission. The permit shall be prominently displayed or made available at the construction site during construction. Be advised that you may be subject to fines of up to $5,000 per day for any violations of your permit conditions starting from the permit approval date.

If you have any questions, please call Charley Ice of the Commission staff at 587-0218 or toll-free at 984-2400 (Maui), extension 70218.

Sincerely,

William J. Aila

WILLIAM J. AILA, JR.
Chairperson

Enclosures

c: County of Maui, Department of Water (with applicable comments – DOH SDWB, WWB)
Maui Land & Pineapple Company, Inc. (with applicable comments – DOH SDWB, WWB)

NOV 14 2014

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

October 10, 2014

TO: Ms. Linda Rosen, M.D., M.P.H., Director
Department of Health
Attention: Sina Pruder, Wastewater Branch
Joanna L. Seto, Chief, Safe Drinking Water Branch
Alec Wong, Chief, Clean Water Branch
Dr. Keith Kawaoka, Office of Hazard Evaluation and Emergency Response

FROM: William J. Aila, Jr., Chairperson
Commission on Water Resource Management

SUBJECT: Well Permit Application
Kahana Well (Well No. 6-5738-002) TMK: (2) 4-3-001:017

Transmitted for your review and comment is a copy of the captioned Well permit application.

We would appreciate your comments on the captioned application for any conflicts or inconsistencies with the programs, plans, and objectives specific to your department. **Please respond by returning this cover memo form by November 10, 2014.** If we do not receive comments or a request for additional review time by this date, we will assume that you have no comments.

Please find the attached maps to locate the proposed well. If you have any questions about this permit application, request additional information, or request additional review time, please contact Charley Ice of the Commission staff at 587-0218.

CI:ss
Attachment(s)

RESPONSE:

[X] This well qualifies as a source which will serve as a source of potable water to a public water system (defined as serving 25 or more people at least 60 days per year or has 15 or more service connections) and must receive Director of Health approval prior to its use to comply with Hawaii Administrative Rules (HAR), Title 11, Chapter 20, Rules Relating to Potable Water Systems, §11-20-29.

[ ] This well does not qualify as a source serving a public water system (serves less than 25 people or more people at least 60 days per year or 15 service connections) and if the well water is used for drinking, the private owner should test for bacteriological and chemical presence before initiating such use and routinely monitor the water quality thereafter. However, if future planned use from this source increases to meet the public water system definition then Director of Health approval is required prior to implementation.

[ ] If the well is used to supply both potable and non-potable purposes in a single system, the user shall eliminate cross-connections and backflow connections by physically separating potable and non-potable systems by an air gap or an approved backflow preventer, and by clearly labeling all non-potable spigots with warning signs to prevent inadvertent consumption of non-potable water. Backflow prevention devices should be routinely inspected and tested.

[ ] It does not appear that this well will be used for consumptive purposes and is not subject to Safe Drinking Water Regulations.

[ ] For the applicant's information, a source of possible wastewater contamination [ ]is [ ] is not located near the proposed well site (information attached).

[ ] An NPDES permit is required.

[ ] Other relevant DOH rules/regulations, information, or recommendations are attached.

[ ] In the event that the location of the well changes but is still within the parcel described on this application, our division considers the comments to still be applicable, and we do not need to review the new location.

[ ] An injection well permit is required for the disposal of the effluent from this well.

[ ] No comments/objections

Contact Person: MICHAEL MIYAHIRA Phone: 586-4258

Signed: [signature] Date: 10/28/14

■ 7. Projects proposing to develop new public water systems or proposing substantial modifications to existing public water systems must receive approval by the Director of Health prior to construction of the proposed system or modification. These projects include treatment, storage and distribution systems of public water systems. The approval authority for projects owned and operated by a County Board or Department of Water or Water Supply has been delegated to them.

☐ 8. All public water systems must be operated by certified distribution system and water treatment plant operators as defined by HAR Chapter 11-25, entitled "Rules Pertaining to Certification of Public Water System Operators."

☐ 9. All projects which propose the use of dual water systems or the use of a non-potable water system in proximity to an existing drinking water system to meet irrigation or other needs must be carefully designed and operated these systems to prevent the cross-connection of these systems and prevent the possibility of backflow of water from the non-potable system to the drinking water system. The two systems must be clearly labeled and physically separated by air gaps or reduced pressure principle backflow prevention devices to avoid contaminating the drinking water supply. In addition backflow devices must be tested periodically to assure their proper operation. Further, all non-potable spigots and irrigated areas should be clearly labeled with warning signs to prevent the inadvertent consumption on non-potable water. Compliance with HAR Chapter 11-21, entitled "Cross-Connection and Backflow Control" is also required.

☐ 10. All projects which propose the establishment of a potentially contaminating activity (as identified in the Hawai`i Source Water Assessment Plan) within the source water protection area of an existing source of water for a public water supply should address this potential and activities that will be implemented to prevent or reduce the potential for contamination of the drinking water source.

For further information concerning the application of capacity, new source approval, operator certification, source water assessment, backflow/cross-connection prevention or other regulated public water system programs, please contact the Safe Drinking Water Branch Engineering Section at (808) 586-4258.

<u>Underground Injection Control (UIC)</u>

☐ 1. The application's information is not fully complete.
☐ However, based on the information provided, we offer the following comments.
☐ Comments would not be appropriate at this time.
☐ We recommend that a satisfactorily complete application be first obtained.

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

October 10, 2014

TO: Ms. Linda Rosen, M.D., M.P.H., Director
Department of Health
Attention: Sina Pruder, Wastewater Branch
Joanna L. Seto, Chief, Safe Drinking Water Branch
Alec Wong, Chief, Clean Water Branch
Dr. Keith Kawaoka, Office of Hazard Evaluation and Emergency Response

FROM: William J. Aila, Jr., Chairperson
Commission on Water Resource Management

SUBJECT: Well Permit Application
Kahana Well (Well No. 6-5738-002) TMK: (2) 4-3-001:017

Maui Land & Pineapple Co.
Mahinahina Village
Kapalua
96761

Transmitted for your review and comment is a copy of the captioned Well permit application.

We would appreciate your comments on the captioned application for any conflicts or inconsistencies with the programs, plans, and objectives specific to your department. **Please respond by returning this cover memo form by November 10, 2014**. If we do not receive comments or a request for additional review time by this date, we will assume that you have no comments.

Please find the attached maps to locate the proposed well. If you have any questions about this permit application, request additional information, or request additional review time, please contact Charley Ice of the Commission staff at 587-0218.

CI:ss
Attachment(s)

RESPONSE:

[ ] This well qualifies as a source which will serve as a source of potable water to a public water system (defined as serving 25 or more people at least 60 days per year or has 15 or more service connections) and must receive Director of Health approval prior to its use to comply with Hawaii Administrative Rules (HAR), Title 11, Chapter 20, Rules Relating to Potable Water Systems, §11-20-29.

[ ] This well does not qualify as a source serving a public water system (serves less than 25 people or more people at least 60 days per year or 15 service connections) and if the well water is used for drinking, the private owner should test for bacteriological and chemical presence before initiating such use and routinely monitor the water quality thereafter. However, if future planned use from this source increases to meet the public water system definition then Director of Health approval is required prior to implementation.

[ ] If the well is used to supply both potable and non-potable purposes in a single system, the user shall eliminate cross-connections and backflow connections by physically separating potable and non-potable systems by an air gap or an approved backflow preventer, and by clearly labeling all non-potable spigots with warning signs to prevent inadvertent consumption of non-potable water. Backflow prevention devices should be routinely inspected and tested.

[ ] It does not appear that this well will be used for consumptive purposes and is not subject to Safe Drinking Water Regulations.

[X] For the applicant's information, a source of possible wastewater contamination [X] is [ ] is not located near the proposed well site (information attached).

[ ] An NPDES permit is required.

[X] Other relevant DOH rules/regulations, information, or recommendations are attached. One-Stop database screen

[ ] In the event that the location of the well changes but is still within the parcel described on this application, our division considers the comments to still be applicable, and we do not need to review the new location.

[ ] An injection well permit is required for the disposal of the effluent from this well.

[X] No comments/objections

Contact Person: Roland Tejano, Eng. on Maui 984-8232

Signed: Lori Morikami, Planner, Wastewater Branch, Oahu Date: 10/17/2014

RECEIVED

DEC 31 2008

ENVIRONMENTAL HEALTH
MAUI

December 23, 2008

Douglas Gomes
Engineering Dynamics Corp.
66 Wailani St.
Wailuku, HI 96793

Dear Sir/Madam:

Subject: Individual Wastewater System (IWS) for
Owner/Lessee: - Maui Land and Pine
Project Site: Mahinahina, Kapalua, Lahaina, HI
TMK: 243001017
IWS File No.: 38719 (Septic Tank)
Old File No.: N/A

We have received your IWS final inspection report, **Certification of Construction** and As Built Plans for the above IWS. Information submitted to us indicates that the installed IWS meets applicable provisions of Hawaii Administrative Rules, Title 11, Chapter 62, entitled Wastewater Systems.

As the professional engineer responsible for the **Certification of Construction**, please inform your client that the above IWS is approved for use. You are also responsible for seeing that your client receives a copy of this Approval for Use letter together with the IWS as-built plans. We strongly recommend that you discuss the necessary operation and maintenance of the individual wastewater system with your client. Emphasis should be placed on periodic inspections of scum and sludge accumulation as well as informing them not to dispose of materials that could affect the operation of the wastewater system.

If the IWS is an aerobic system, please inform your client that an active service contract must be maintained. Furthermore, the Department of Health may perform an annual inspection of the subject wastewater system for compliance with our Chapter 11-62 rules.

Should you have any questions, please feel free to contact Roland Tejano at 984-8232.

Sincerely,

TOMAS S. SEE, P.E.
Chief, Wastewater Branch

LIST OF CHANGES MADE TO APPROVED IWS PLANS

Leach fields were relocated to accomodate for the existing road way

AS THE ENGINEER PERFORMING THE ABOVE FINAL IWS INSPECTION, THE FOLLOWING STATEMENT IS MADE (check one):

_____ THE IWS HAS BEEN INSTALLED IN STRICT ACCORDANCE WITH THE PLANS THAT WERE SUBMITTED AND APPROVED OF BY THE DEPARTMENT OF HEALTH.

__X__ THE NOTED DEFICIENCIES AND / OR CHANGES TO THE APPROVED PLANS HAVE BEEN ADDRESSED BY THE HOMEOWNER, CONTRACTOR, AND MYSELF AND THE FINAL AS BUILT IWS IS ACCEPTABLE TO ME.

_____ THE FINAL CONSTRUCTION OF THE IWS CANNOT BE COMPLETED FOR THE FOLLOWING REASONS:

_____ THE CONSTRUCTION OF THE IWS IS NOT IN ACCORDNACE WITH THE APPROVED PLANS AND I DO NOT ACCEPT THE CHANGES MADE TO THE PLANS DESIGNED BY ME.

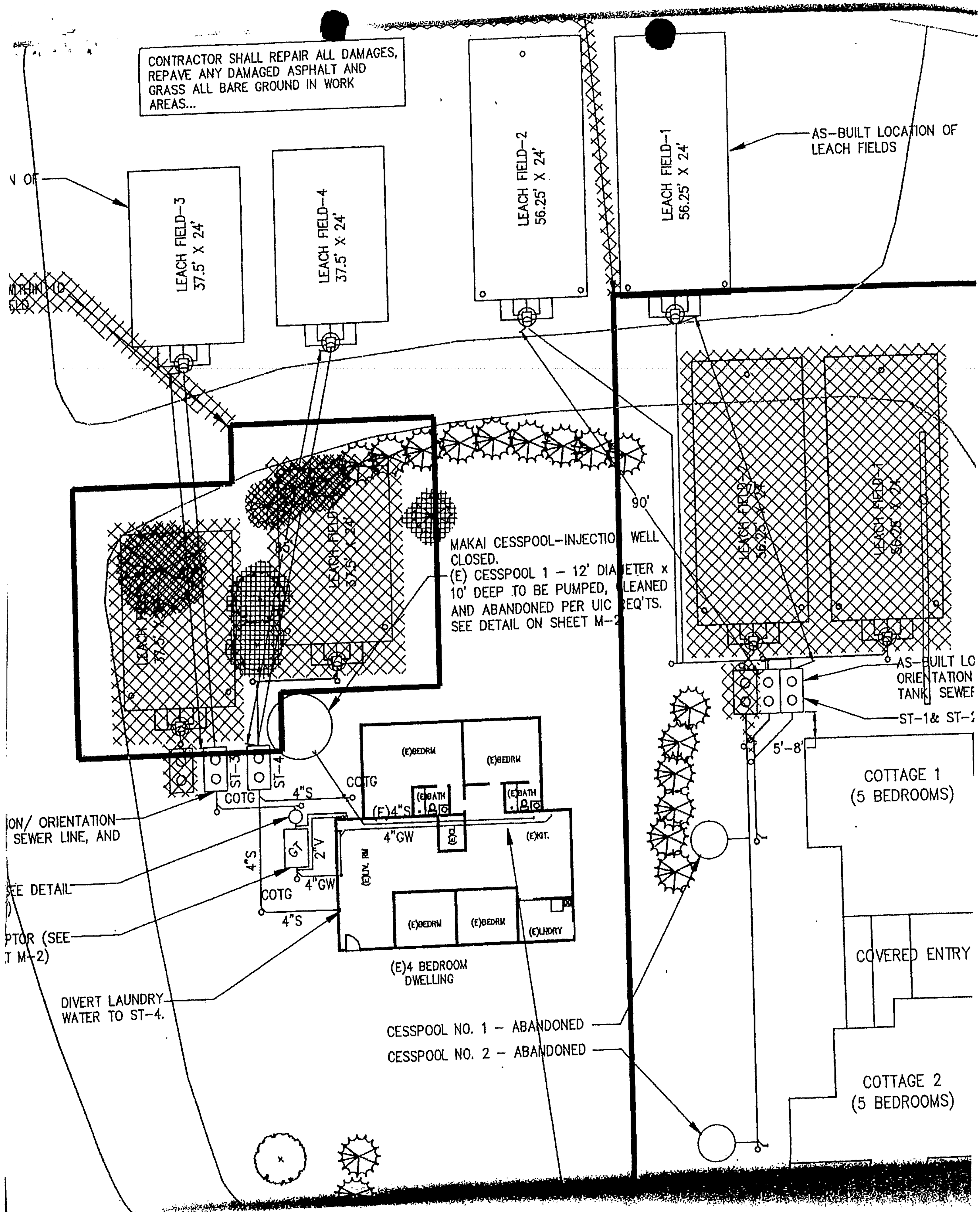
ROLYN A. DOMINGO
07524
LICENSED PROFESSIONAL ENGINEER
NO. 8111-M
11-4-08
HAWAII, U.S.A.

11-4-08

SIGNATURE, STAMP, AND DATE

EXP. 4-30-2010

ENCLOSURES: AS-BUILT PLANS, STAMPED AND SIGNED BY ENGINEER
PHOTOGRAPHS OF TREATMENT UNIT, DISPOSAL SYSTEM, OVERVIEW OF IWS



CONTRACTOR SHALL REPAIR ALL DAMAGES, REPAVE ANY DAMAGED ASPHALT AND GRASS ALL BARE GROUND IN WORK AREAS...
LEACH FIELD-3 37.5' X 24'
LEACH FIELD-4 37.5' X 24'
LEACH FIELD-2 56.25' X 24'
LEACH FIELD-1 56.25' X 24'
AS-BUILT LOCATION OF LEACH FIELDS
90'
MAKAI CESSPOOL-INJECTION WELL CLOSED.
(E) CESSPOOL 1 - 12' DIAMETER x 10' DEEP TO BE PUMPED, CLEANED AND ABANDONED PER UIC REQ'TS. SEE DETAIL ON SHEET M-2
ST-3
ST-4
COTG
4"S
(E)4"S
4"GW
2"V
GT
(E)BEDRM
(E)BATH
(E)KIT.
(E)LIV. RM
(E)LNDRY
(E)4 BEDROOM DWELLING
ON/ ORIENTATION SEWER LINE, AND
EE DETAIL
PTOR (SEE T M-2)
DIVERT LAUNDRY WATER TO ST-4.
CESSPOOL NO. 1 - ABANDONED
CESSPOOL NO. 2 - ABANDONED
AS-BUILT LO ORIENTATION TANK, SEWER
ST-1& ST-2
5'-8"
COTTAGE 1 (5 BEDROOMS)
COVERED ENTRY
COTTAGE 2 (5 BEDROOMS)

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Permit
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- Pending
- Review
- Plan Approved
- Use Approved
- Terminated
- Show All

TMK/Street Search
TMK/Street

General Search
TMK/Street

Building Permits
BPA
Show All

Cesspool Cards
Cesspool Card
Show All

AU Inspection
AU Inspections
AU Inspect Types
- Initial Inspection
- Follow Up Inspection
- 1st INOV
- 2nd INOV
- Show All

CWDA Zones
CWDA Zone
Show All

Site Info | IWS System | Compliance | Documents | BPA | Notes

IWS Application Information

Permit ID:	38719	IWS Type:	Septic Tank	Assigned To:	Tejar[illegible] Roland
Legacy File#:	N/A	Island:	Maui	Source:	WWB
eHawaii ID:	N/A	Status:	Use Approved	Description:	IWS [illegible]
Variance ID:					

Project Information

Engineer:	Douglas L Gomes
TMK:	24[illegible]
	IWS may be within 1,000 ft. of a potable well
Street Address:	Mahinahina
Street Address 2:	
Suite/Apt.:	
City:	Kapalua, Lahaina, HI
Zip Code:	96761

Review Information

Submit Date:	2/12/20[illegible]	
Reviewed:	[illegible]20/20[illegible]	Done
Plan Approved:	[illegible]/20[illegible]	Done
No Final Approval Ltr:		Done
Inspection Date:	[illegible]	
Final Approval:	[illegible]12/20[illegible]	Done
Termination Date:		Done

Payment Information

Payment Type:	Check	Check Number:	[illegible]	Amount:	1[illegible]0.00
Check Date:	[illegible]	Payor:	Engineering Dynamics [illegible]		

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AU Inspection
- AU Inspections

AU Inspect Types
- Initial Inspection
- Follow Up Inspection
- 1st INOV
- 2nd INOV
- Show All

CWDA Zones
- CWDA Zone
- Show All

General | Site Info | Compliance | Documents | BPA | Notes

IWS System Information

Septic Tank Information

Septic Tank Liquid Volume: gal. | Manufacturer: Jensen Pre
6" Inspection Port(s) to grade: | Disposal Type: Infiltrators Chambers
Manhole openings brought to grade

Remarks:
Upgrade 4 bd ... /IWS C designed for both and laundry ... (9 ... d based on occupancy)- Note: ... waste separate system ... ID 38720

Soil Profile Information

Percolation Rate: 2 | Minimum Soil Absorption: 238 sq. ft./bd | 3' Groundwater Setback:
Total Min. Soil Absorp. Required: 952 sq. ft.
Total Soil Absorp. Provided: 888 sq. ft.

Soil Absorption Information

Soil Absorption Bed		Soil Absorption Trenches		Seepage Pit	
Length:	37 ft	Length:	ft	Diameter: ft	Depth: ft
Width:	24 ft	Width:	ft	Lining Type:	
3' Soil Replacement		# of Trenches:		Access Opening:	inches
Total Bed Area: 888 sq. ft.		Soil Replacement		Cover Diameter:	ft
				6" Inspection Port	

Added By: rtejano 2/12/2008 3:05 PM Last Modified: rtejano 12/22/2008 8:24 AM

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- 2nd INOV
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CWDA Zones
- CWDA Zone
- Show All

Site Info | IWS System | Compliance | Documents | BPA | Notes

IWS Application Information

Permit ID: 36048
Legacy Files: N/A
eHawaii ID: N/A
Variance ID:

IWS Type: Septic Tar
Island: Maui
Status: Use Approved

Assigned To: Tee, Tomas
Source: WWB
Description: IWS-F

Project Information

Engineer: Rolyn
TMK: 24
IWS may be within 1,000 ft. of a potable well
Street Address: Mahinahina
Street Address 2:
Suite/Apt.:
City: Lahiana , HI
Zip Code:

Review Information

Submit Date: 4/1 07
Reviewed: 4/1 2007 Done
Plan Approved: 4/23/2 7 Done
No Final Approval Ltr: Done
Inspection Date: 8/ 3/20
Final Approval: 1 /2008 Done
Termination Date: Done

Payment Information

Payment Type: Che
Check Number:
Amount: .00
Check Date:
Payer: E C

Approval to Build | Approve To Use | Exception Report | Inspection Deficiency Report | Save

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- 2nd INOV
- Show All

CWDA Zones

- CWDA Zone
- Show All

General | Site Info | Compliance | Documents | BPA | Notes

IWS System Information

Septic Tank Information

Septic Tank Liquid Volume: 12.. gal. Manufacturer: Jensen Precast

6" Inspection Port(s) to grade: ☐ Disposal Type: Infiltrator Chambers

Manhole opening brought to grade: ☑

Remarks:

Existing Cottage

Soil Profile Information

Percolation Rate: Minimum Soil Absorption 250 sq. ft./bd 3' Groundwater Setback ☐

Total Min. Soil Absorp. Required: 1250 sq. ft.

Total Soil Absorp. Provided: 1344 sq. ft.

Soil Absorption Information

Soil Absorption Bed		Soil Absorption Trenches		Seepage Pit	
Length:	56 ft	Length:	ft	Diameter: ft	Depth: ft
Width:	24 ft	Width:	ft	Lining Type:	
3' Soil Replacement:	☐	# of Trenches:		Access Opening:	inches
Total Bed Area: 1344 sq. ft.		3' Soil Replacement	☐	Cover Diameter:	ft
				6" Inspection Port	☐

Added By: rtejano 4/10/2007 7:25 AM Last Modified: rtejano 12/22/2008 8:25 AM

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SUBSURFACE INVESTIGATION REPORT FOR MAHINAHINA WELL AND CONTROL TANK

APPENDIX I-1

FEWELL GEOTECHNICAL ENGINEERING, LTD. www.fgeltd.com
96-1416 Waihona Place Pearl City, Hawaii 96782-1973 Ph (808) 455-6569 FAX (808) 456-7062 E-mail: fge@fgeltd.com

SUBSURFACE INVESTIGATION REPORT

NEW MAHINAHINA WELL WATER SYSTEM
MAHINAHINA, MAUI, HAWAII

for

WARREN S. UNEMORI ENGINEERING, INC.

by

FEWELL GEOTECHNICAL ENGINEERING, LTD.

TIMOTHY J. CAVANAUGH
LICENSED PROFESSIONAL ENGINEER
No. 6619-C
HAWAII, U.S.A.

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Expiration Date: 4/30/2014

By ______________________
Timothy J. Cavanaugh, P.E.

OCTOBER 16, 2012

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SUBSURFACE INVESTIGATION REPORT

New Mahinahina Well Water System
Mahinahina, Maui, Hawaii

We have completed a subsurface investigation for the New Mahinahina Well Water System in Mahinahina, Maui, Hawaii. This report presents our findings and conclusions. This work has been completed in general accordance with our September 12, 2011 Proposal and your June 26, 2012 authorization to proceed.

PURPOSE AND SCOPE

Information provided by Warren S. Unemori Engineering, Inc. (WSUE) indicates that the County of Maui Department of Water Supply is planning to construct a new water system for the New Mahinahina Well in Mahinahina. Geotechnical assistance has been requested of Fewell Geotechnical Engineering, Ltd. (FGE) by WSUE to aid in the design of the proposed improvements.

Our work included a subsurface investigation of the site for the 300,000 gallon water tank near the well site, a new 100,000 gallon mixing tank, approximately 7,700 lineal feet of a new water transmission main and the related site improvements. The scope of work of our investigation is detailed in the above-reference proposal, but generally included: 1) drilling and sampling 9 test borings at selected locations across the site, 2) performing laboratory testing on the soils obtained from the test borings, 3) evaluating the soil characteristics as they pertain to the new construction, and 4) presenting our findings and conclusions in this report.

The results of the field exploration, including a Boring Location Plan and the Boring Logs, are presented in Appendix A. Appendix B presents the results of the laboratory and field tests. The limitations of this investigation and report are presented in Appendix C.

PROJECT CONSIDERATIONS

The preliminary information provided by Warren S. Unemori Engineering, Inc. (WSUE) indicates that the site of the New Mahinahina Well is about 1¼ miles east of the Mahinahina Surface Water Treatment Plant in Mahinahina. The proposed water system improvements extend from just east of the new well where a 300,000 gallon reservoir is planned, to about 1,000 feet west of the existing Mahinahina Surface Water Treatment Plan where a 100,000 gallon mixing tank is planned. A water transmission line and new access road will extend between the 2 tank sites. The general project area is shown on the Project Location Map, Figure 1 in Appendix A.

The both the new reservoir site and the mixing tank site consist mostly of abandoned pineapple fields and is currently covered with dense grass, bushes and trees. The reservoir site measures about 300 feet by 300 feet in plan dimensions. The original existing ground surface at the reservoir site slopes down toward the west at an average gradient of about 10 percent. The existing ground surface elevations at the reservoir site range from about Elev. 1340 on the eastern side of the site, down to about Elev. 1300 on its western side. Recent grading performed as part of the well site development has leveled off western section of the proposed reservoir pad at about Elev. 1320. The grading has resulted in a large soil stockpile near the northwestern corner of the tank pad, and an uncontrolled fill along the western edge of the pad, near the well site.

The mixing tank measures about 200 feet by 250 feet in plan dimensions. The existing topography at the mixing tank site slopes down toward the west at an average gradient of about 8 percent. Existing ground surface elevations range from about Elev. 600 on the eastern side of the mixing tank site, down to about Elev. 580 on its western side.

Most of the alignment of the new water transmission line is through the abandoned pineapple fields, or along the northern shoulder of an existing dirt road along the southern side of the pineapple fields.

The well site will be developed to support a new 300,000 gallon reservoir, a control building, and the well's necessary pumping and electrical equipment. Additional improvements will include a 75,000 gallon drainage detention basin on the western, downhill side of the reservoir. The reservoir will be a stainless steel tank measuring about 52 feet in diameter by 20 feet high. The finish floor level of the tank is planned at Elev. 1315. It is anticipated that the tank will be supported on shallow foundations structurally integrated with a concrete slab-on-grade floor. The control house is planned immediately south of the reservoir and will measure about 30 feet wide by 80 feet long. The bottom of the detention basin will be about 20 feet wide by about 160 feet long and will have 2 Horizontal to 1 Vertical (2H:1V) sideslopes up to 12 feet in height. The longitudinal axis of both the control house and detention basin are oriented in a general north-south direction.

The mixing tank site will include a 100,000 gallon stainless steel tank and a 50,000 gallon detention basin. The mixing tank will measure about 32 feet in diameter by about 18 feet high with a finish floor level at Elev. 590. The mixing tank is anticipated to be supported on thickened-edge slab-on-grade foundations.

Although detailed loading information is not available for the new tanks, we have assumed that the tank wall loads will not exceed 3 kips per foot and that the loads on interior tank columns, if required, will not exceed 150 kips. We have assumed that the wall loads for the control building will not exceed 2 kips per foot.

The new, approximately 7,700 foot long transmission main connecting the new well site to an existing Department of Water Supply (DWS) line near the mixing tank site will be a 12-inch diameter pipe. The invert of the most of the water line will be 4 feet below the finish access road grades. Most of the access road will paved with an asphalt concrete pavement although concrete pavements will be used where the gradient of the access road exceeds 12 percent.

Grading within the new reservoir site is anticipated to include cuts of up to 20 feet in depth with fills of up to 8 feet in thickness. Grading at the mixing tank site will include cuts and fills of up to 6 feet in depth and thickness, respectively. Grading along the access road alignment will generally follow the existing grades with cuts and fills of up to 4 feet required along various segments of the road. Cut slopes up to 30 feet high, and fill slopes up to 12 feet high, will be used to support the grade differences resulting from the site grading. No retaining walls currently planned.

SUBSURFACE INVESTIGATION

Nine test borings were drilled during the period between July 27 and August 2, 2012 at the approximate locations shown on the Boring Location Plans, Figures 2a through 2f in Appendix A. The borings were extended to depths of between 6 and 50 feet below the existing ground surface using a Simco SK2400 truck-mounted drilling rig advancing 4-inch diameter continuous flight augers.

Samples of the subsurface soils were obtained at selected depths using either a 2.0-inch O.D. Standard Penetration Test (SPT) sampler or a 3.0-inch O.D. split-spoon sampler. Both samplers were driven by a 140-pound hammer falling 30 inches. The number of blows required to drive the samplers the final 12 inches into the soil mass was recorded and is shown on the Boring Logs, Figures 3 through 11. The blow counts shown on the logs are the actual blow counts obtained in the field. Both the actual and the estimated equivalent Standard Penetration Test (SPT) blow counts for the 3-inch sampler are shown on the logs. A Boring Log Legend is included as Figure 12.

In addition to the subsurface samples, two bulk samples of the near-surface materials was obtained for laboratory classification and California Bearing Ratio (CBR) testing. One bulk sample, Bag A, as obtained from the 300,000 gallon reservoir site while the second bulk sample, Bag B, was obtained along the alignment of the new access road and transmission main.

LABORATORY TESTING

Selected samples of the subsurface soils were tested in the laboratory to determine their general engineering characteristics, including in-situ moisture content, density, consolidation, direct shear strength and expansion. Atterberg Limits tests were completed on visually representative samples to aid in the classification of the soils. A CBR test was performed on a bulk sample of the soils to evaluate their pavement support characteristics and their recompacted swell potential.

The results of the laboratory tests are shown on the Boring Logs, where appropriate, with selected results exhibited graphically as Figures 13 through 18 in Appendix B. The results of the laboratory testing are summarized in Table I in Appendix B.

GENERAL SUBSURFACE CONDITIONS

The test borings indicate that the area of the new 300,000 gallon reservoir, the 100,000 gallon mixing tank, and the access road and transmission line alignments are generally underlain by residual (weathered-in-place from parent basalt) soils and saprolites (residual soils which exhibit the original rock structure) which extend to the bottom of Borings 3, 4, 6, 7, and 9, at depths ranging between 6 and 15 feet below the existing ground surface, and to depths of between 4½ and 35 feet below the existing ground surface in the remaining borings. The residual soils and saprolites are underlain by Aa Clinker and highly weathered basalt which extends to the bottom of Borings 1, 2, 5, and 8.

The residual soils and saprolite generally consists of clayey silts which are classified as ML and MH soils under the Unified Soil Classification (USC) system. The residual soils and saprolites generally exhibited very stiff to hard consistencies and moderate to high blow count resistances.

Laboratory direct shear tests performed on samples of the soils indicated moderate to high shear strengths with friction angles of between 31 and 34 degrees, and between 500 and 1,800 pounds per square foot (psf) of cohesion. A laboratory consolidation test performed a sample of the residual soils at the reservoir site indicates that the soil exhibits a preconsolidation pressure of at least 6,000 psf and a strain-based compression Index, Cc', of about 6 percent.

Laboratory swell tests performed on relatively undisturbed samples of the residual soils and saprolites indicated between 0 and 2.5 percent swell, through generally les than 1 percent, when tested at their current in-situ moisture content. Laboratory CBR tests performed on samples of the residual soils indicated CBRs of between 18 and 22 with between 0.9 and 1.1 percent swell when recompacted near the soil's optimum moisture to at least 95 percent relative compaction.

The basalt encountered in Borings 1, 2, 5, and 8, generally consisted of soft, highly weathered basalt which could be penetrated fairly easily with the auger drilling tools. The basalt is interbedded with seams of Aa clinker which consists of silty sand- and gravel-sized basalt fragments. The clinker was generally loose to medium dense but appeared to be partially welded.

Groundwater was not encountered in any of the test borings at the time of the field investigation.

DISCUSSION

The test borings indicate that the site is generally underlain by relatively competent residual soils and saprolites over weathered basalt which should provide adequate support for the planned construction using relatively standard excavating equipment and construction techniques.

The main geotechnical concern associated with the proposed construction is the uncontrolled fill placed along the western side of the reservoir at the new well site. We understand that this fill was placed to allow construction access for the well drilling operations. The quality of this fill is unknown but based on our visual observations in the field, appeared to contain various vegetation. The uncontrolled fill should be removed down to the underlying residual soils and replaced with properly compacted fill conforming to the recommendations of this report. Although the extent of the uncontrolled fill must be determined in the field during construction, it appears that the area measures about 30 feet wide by 100 feet long and is up to 12 feet thick.

After the uncontrolled fill has been removed and replaced with properly compacted material, we believe that the new remainder of the construction can proceed using relatively standard earthmoving construction.

Our analysis of the planned 2H:1V cut slopes on the eastern sides of both the 300,000 gallon reservoir and the 100,000 gallon mixer tank, indicates that the slopes should possess adequate stability against failure with estimated factors of safety of at least 2.0 with respect to slope failure under static loading conditions. Fill slopes up to 12 feet high, constructed using the excavated residual soils and saprolites, should similarly possess a factor of safety of at least 2.0 with respect to slope failure under static loading conditions. Under seismic loading conditions, our analysis indicates that the slopes should possess estimated factors of safety of at least 1.5 against slope failure based on the seismic criteria indicated in the 2006 IBC. For slope stability analysis, minimum factors of safety of 1.5 and 1.1 are generally considered adequate for static and seismic loading conditions, respectively.

RECOMMENDATIONS

Site Preparation

1. Prior to the start of the actual construction, the site should be cleared and grubbed in accordance with Section 201 of the Standard Specifications for Road, Bridge and Public Works Construction (1994) for the County of Maui (Standard Specifications). All organics, vegetation, boulders, rubbish and other deleterious materials should be removed and wasted off-site.

2. All underground utilities which interfere with the planned construction should be removed and re-routed. The trenches resulting from the removal of the existing utilities should be backfilled in accordance with the Site Grading recommendation of this report.

3. The uncontrolled fill present beneath the western portion of the 300,000 gallon reservoir site should be removed down to the underlying residual soils or saprolites. Although the actual extent of the uncontrolled fill must be determined in the field during construction, it appears to underlie an area measuring an estimated 30 feet wide by 100 feet long and is up to about 12 feet thick. The excavated material resulting from the removal of the uncontrolled fill may be re-used to backfill the resulting depression, provided all organics, vegetation and other deleterious materials

are removed and it is placed and compacted in accordance with the Site Grading recommendations of this report.

4. Ares to receive fill which are steeper than 5H:1V, should be benched with a series of relatively level terraces prior to fill placement.

Site Grading

5. Once the site has been properly prepared and the uncontrolled fill has been removed from the site, grading operations may begin to generate the planned finished grades. Any loose or soft spots present at the exposed subgrade level in areas to receive fill or new construction should be removed down to the very stiff to hard residual soils and saprolites.

6. We anticipate that the majority of the site excavations should encounter the existing residual soils and saprolites which can likely be completed using heavy earthmoving equipment. However, the occasional use of rock excavating equipment should be anticipated to facilitate the removal of harder seams of basalt from the deeper site excavations at both the 300,000 gallon reservoir site and the 100,000 gallon mixing tank site. Highly weathered basalt was also encountered at a depth as shallow as 4½ feet below the existing ground surface near the central portion of the water transmission line alignment. The use of rock excavating equipment should also be anticipated for segments of the water line trench excavation.

7. The exposed subgrade at the tank sites and along the access road alignment should be scarified, moisture-conditioned above their optimum moisture content, and uniformly compacted to at least 95 percent of the soil's maximum dry density as determined by Laboratory Compaction Test ASTM D1557, for a minimum depth of 6 inches.

8. The excavated on-site fill and residual soils may be used for fill or backfill provided all organics and rocks or soil clods greater than 3 inches in maximum dimension are removed and they are placed, moisture conditioned and compacted in accordance with the recommendations herein.

9. Should imported fill be required, it should be similar to the on-site soils and should exhibit less than 2 percent swell when tested in accordance with ASTM D1883. The fill should be free of organics, rocks, and soil clods larger than 3 inches in diameter, with a CBR of at least 12.

10. Fill and backfill should be placed in maximum loose lifts of 8 inches in thickness, moisture-conditioned to no drier than their optimum moisture content and uniformly compacted to at least 90 percent of their maximum dry density as determined by Laboratory Compaction Test ASTM D1557.

11. Cut slopes should be excavated at slopes no steeper than 2H:1V for slope heights of up to 30 feet. For slopes exceeding 20 feet in height, an 8-foot wide horizontal bench should be provided at the approximate mid-height of the slope. Fill slopes may be constructed as steep as 2H:1V for heights of up to 12 feet. Cut and fill slopes exceeding these heights are not anticipated on this project and should be individually evaluated should they occur.

12. Fill slopes should be over-constructed during the mass grading and subsequently cut back to their desired lines and grades during the fine grading to provide a tight, compacted slope face.

13. Although the on-site soils generally exhibit low expansion potential, the on-site soils should be kept moist and not be allowed to dry excessively during the intervening period between the completion of the pads and the construction of the slabs, foundations and pavements. Should shrinkage cracks greater than 1/8 inch in width be noted in the compacted soils, the affected areas should be re-scarified, re-moisture-conditioned and re-compacted in accordance with the above recommendations.

Utilities

14. The installation of the new water transmission line and other site utilities should be completed in accordance with Section 206 and the particular section of the Standard Specifications pertaining to each utility. Utility backfills should be placed and compacted utilizing the appropriate mechanical compactors around and above the pipes. Jetting and ponding of the backfill as a method to achieve compaction should not be allowed.

15. Utilities may be founded in the properly compacted fill, the hard residual soils and saprolites, or the basalt. Where soft spots are encountered at the bottom of utility excavations, they should be removed down to properly compacted fill and the resulting depression replaced with fill compacted in accordance with the Grading Recommendations.

16. Should basalt be encountered at the utility invert levels, it should be overexcavated to a depth of at least 6 inches below the bottom of the proposed utilities to allow placement of at least 6 inches of pipe bedding. The pipe bedding should conform to Standard Specifications as well as the specific requirements of the pertinent utility.

17. Assuming that center of reaction blocks for the water transmission line are located at least 3 feet below the finish subgrade levels, and will be embedded within either the residual soils and saprolites, or fills constructed with these soils, the reaction blocks may be designed for an allowable average passive resistance of 900 psf.

18. Adequate shoring and bracing should be provided by the contractor in accordance with HIOSH and other governmental regulations for the utility trenches and other similar site excavations. The design of the shoring, bracing and dewatering systems should be the responsibility of the contractor.

Foundations

19. We believe that the proposed 300,000 gallon reservoir and 100,000 gallon mixing tank can be supported on continuous perimeter ring footings and individual spread footings, while the control building may be supported on continuous strip foundations, provided the Grading Recommendations of this report are followed. Although other foundation systems have been considered, we believe that the recommended shallow foundation system will prove satisfactory and will likely be the most economical.

20. Foundations for the reservoir, mixing tank, and control building should bear on compacted fill or the natural residual soils and saprolites where they may be designed for an allowable bearing capacity of 3,500 pounds per squa0e foot (p.s.f.). This value may be increased by one-third for short-term wind or seismic loads.

21. Individual spread footings should have a minimum base width of at least 2 feet. Continuous foundations should have a minimum base width of at least 18 inches.

22. Foundations should be embedded at least 12 inches below the lowest adjacent compacted subgrade on level ground. Foundations which are on slopes or within 5 feet of the top

of slopes, should be founded such that there is at least 6 feet of lateral setback from the lower outside edge of the foundation to the slope face.

23. The bottom of the foundation excavations should be cleaned of loose materials and compacted to at least 90 percent relative compaction prior to the placement of the steel and concrete. Soft areas found in the fills should be removed down to properly compacted fill or hard/dense natural ground, and the resulting depression backfilled with properly compacted materials.

24. Steel reinforcement of the foundations should be provided in accordance with the recommendations of the Project Structural Engineer.

a. Total and differential settlements exceeding ¾ inch are not anticipated under the currently planned grading, the anticipated weight of 19 feet of water, and the assumed column and wall loads of 150 kips and 3 kips per foot, respectively. The majority of the settlement is anticipated at the center of the tank.

b. Total and differential settlements exceeding ½ inch are not anticipated for the control building.

c. Should the site grading or foundation loads be revised, Fewell Geotechnical Engineering, Ltd. (FGE) should be notified such that the recommendations can be re-evaluated and revised, if necessary.

Concrete Slabs-on-Grade

25. Concrete slabs-on-grade may be used provided the Grading Recommendations have been followed. This will assure that the subgrades for the slabs consist of a well-graded granular fill material compacted to at least 95 percent relative compaction.

26. The concrete slabs-on-grade for the reservoir and mixing tank, and where used as pavements for the access road, should be underlain by at least 6 inches of Aggregate Base Course conforming to the requirements of Section 703.06 of the Standard Specifications. The base course should be compacted to at least 95 percent relative compaction.

27. Unloaded or lightly-loaded slabs-on-grade such as those for the control building should be underlain by 4 inches of ASTM C33 No. 67 aggregate to provide a capillary break between the bottom of the slab and the subgrade materials. If a vapor barrier is desirable, it should be installed in accordance with the recommendations of the Project Structural Engineer.

28. Steel reinforcing of the concrete slabs-on-grade should be provided as recommended by the Project Structural Engineer.

Pavements

29. Laboratory CBR tests performed on samples of the predominant near-surface soils indicated CBRs of between 18 and 22 with no more than 1.1 percent swell when they are moisture conditioned near their optimum moisture content and compacted to at least 95 percent relative compaction as determined by ASTM D1557. For this condition and the anticipated light intermittent traffic, we believe that a pavement section consisting of 2 inches of Asphalt Concrete Paving (ACP) over 6 inches of Aggregate Base Course placed over compacted subgrades should be sufficient. Concrete pavements should be at least 5 ½ inches thick and should be underlain by 6 inches of Aggregate Base Course.

30. The composition, placement and compaction of the Aggregate Base Course should conform to Section 703.06 of the Standard Specifications.

31. The road subgrade should be shaped to drain to preclude the ponding of water adjacent to or beneath the pavements, and compacted to at least 95 percent relative compaction for a minimum of 6 inches prior to the placement of the Aggregate Subbase.

32. The above pavement section is recommended for preliminary design purposes and should be verified by CBR tests on samples of the actual subgrade materials during construction.

Miscellaneous

33. Assuming that the subsurface conditions found in the borings extend to a depth of at least 100 feet, the site may be considered as Site Class D, as defined in Table 1613.5.2 of the 2006 IBC for seismic considerations.

34. Positive drainage provisions should be included in the design of the project to direct surface water away from slopes and to preclude the ponding of water adjacent to or beneath the structures and their foundations.

Quality Control

35. The site grading, including the removal of the uncontrolled fill, should be observed by FGE to verify that the anticipated conditions are encountered. Intermittent field density tests should be taken to determine whether the specified levels of compaction and moisture conditioning are consistently obtained in the fills and backfills.

36. Samples of the proposed fill materials should be submitted to FGE no less than 7 working days prior to its intended job-site delivery to allow adequate time for testing, evaluation, and approval.

37. The foundation excavations should be observed by FGE to determine whether the anticipated bearing materials have been encountered. The recommendations given herein are contingent on adequate observation and testing of the geotechnical phases of the construction by FGE.

Limitations

38. This report was prepared for the exclusive use of **Warren S. Unemori Engineering, Inc.** for the **Proposed New Mahinahina Well Water System** in Mahinahina, Maui, Hawaii. The limitations of this report are presented in Appendix C.

/tjc:ajs:fse

APPENDIX A

Subsurface Investigation Summary

Project Designation: New Mahinahina Well Water System **File:** 3102.01

Location: Mahinahina, Maui, Hawaii

Project Location Map: Figure 1

Boring Location Plans: Figures 2a through 2f

Drilling Equipment: Simco SK2400

Drilling Method:

/ x / 4-inch Auger / / Wash
/ / 5-inch Auger / / NX Core
/ / 6-inch Auger / / PQ Core

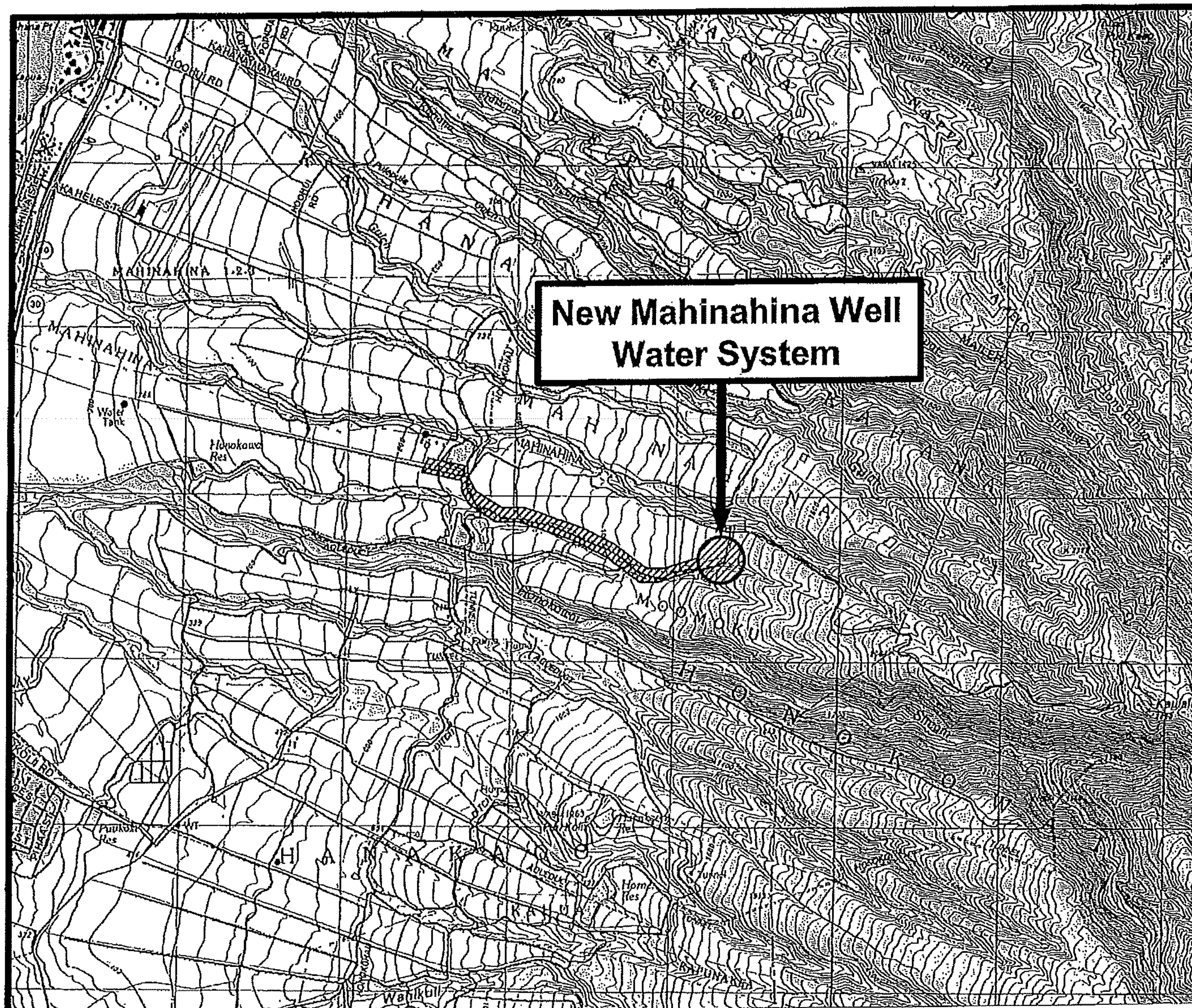
Boring Summary

Boring	Depth	Number of Samples	Depth to Rock	Depth to Water Table	Figure No.
1	50.0'	12	35.0'	N.E.	3
2	35.0'	9	26.0'	N.E.	4
3	15.0'	5	N.E.	N.E.	5
4	7.5'	3	N.E.	N.E.	6
5	6.0'	3	4.5'	N.E.	7
6	7.5'	3	N.E.	N.E.	8
7	14.5'	5	N.E.	N.E.	9
8	23.5'	8	12.0	N.E.	10
9	10.0'	4	N.E.	N.E.	11
Total:	169.0'	52			

N.E. = None Encountered

Date Started: 7-27-12 **Date Completed:** 8-2-12

Boring Log Legend: 12



LEGEND:

PROJECT LOCATION

SCALE: 1:24000

GENERAL AREA:
LAHAINA, MAUI, HAWAII

REFERENCE:
LAHAINA QUADRANGLE
U.S.G.S. TOPOGRAPHIC MAP

F.G.E.

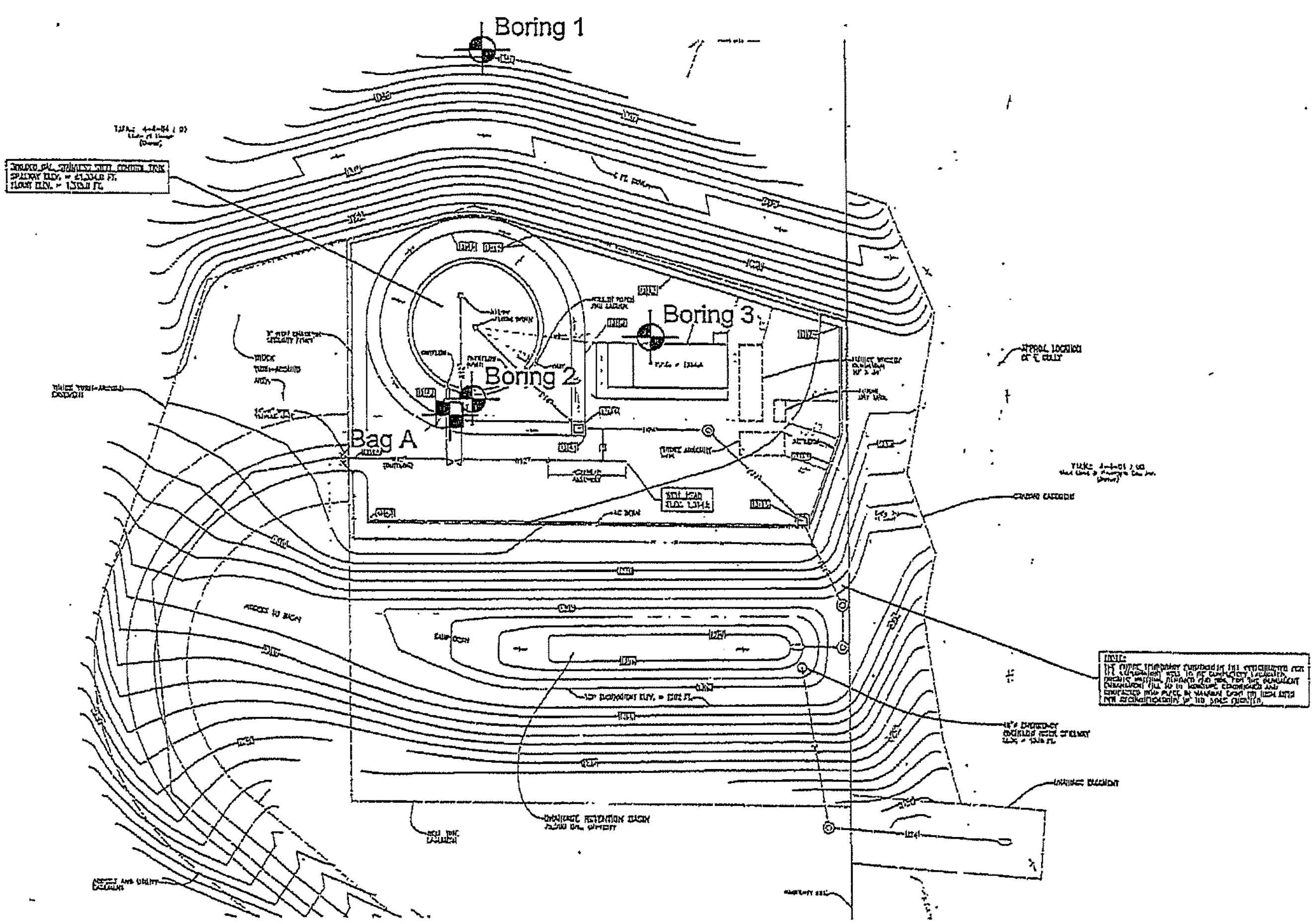
PROJECT LOCATION MAP

New Mahinahina Well Water System
Mahinahina, Maui, Hawaii

File: 3102.01

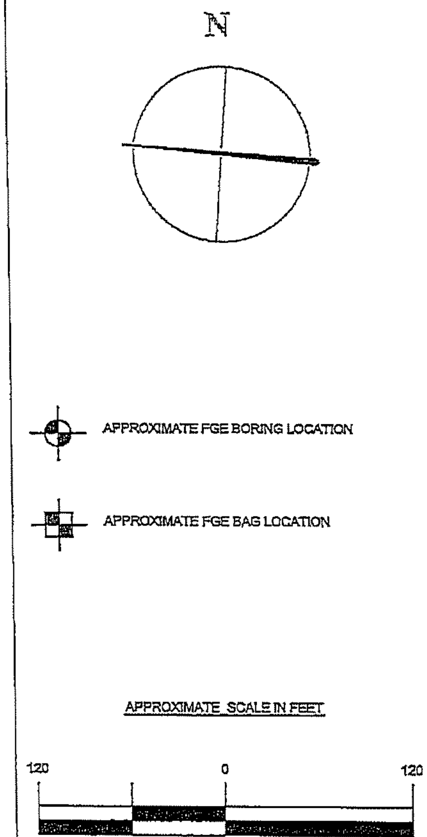
October 2012

Figure 1



PLAN PROVIDED BY WARREN S. UNEMORI ENGINEERING, INC. 2012

LEGEND



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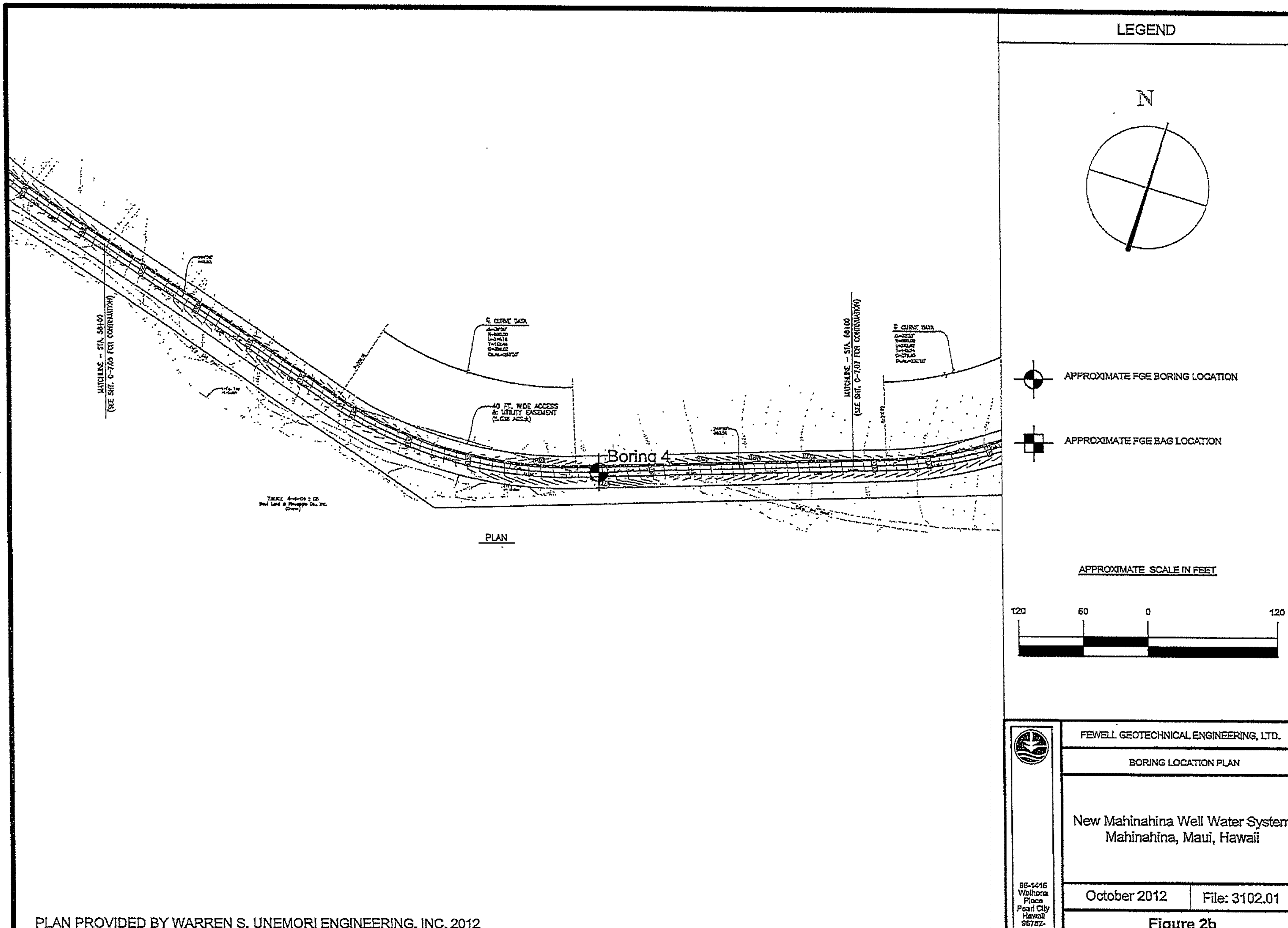
96-1416 Waihona Place Pearl City Hawaii 96782-

BORING LOCATION PLAN

New Mahinahina Well Water System
Mahinahina, Maui, Hawaii

October 2012	File: 3102.01

Figure 2a



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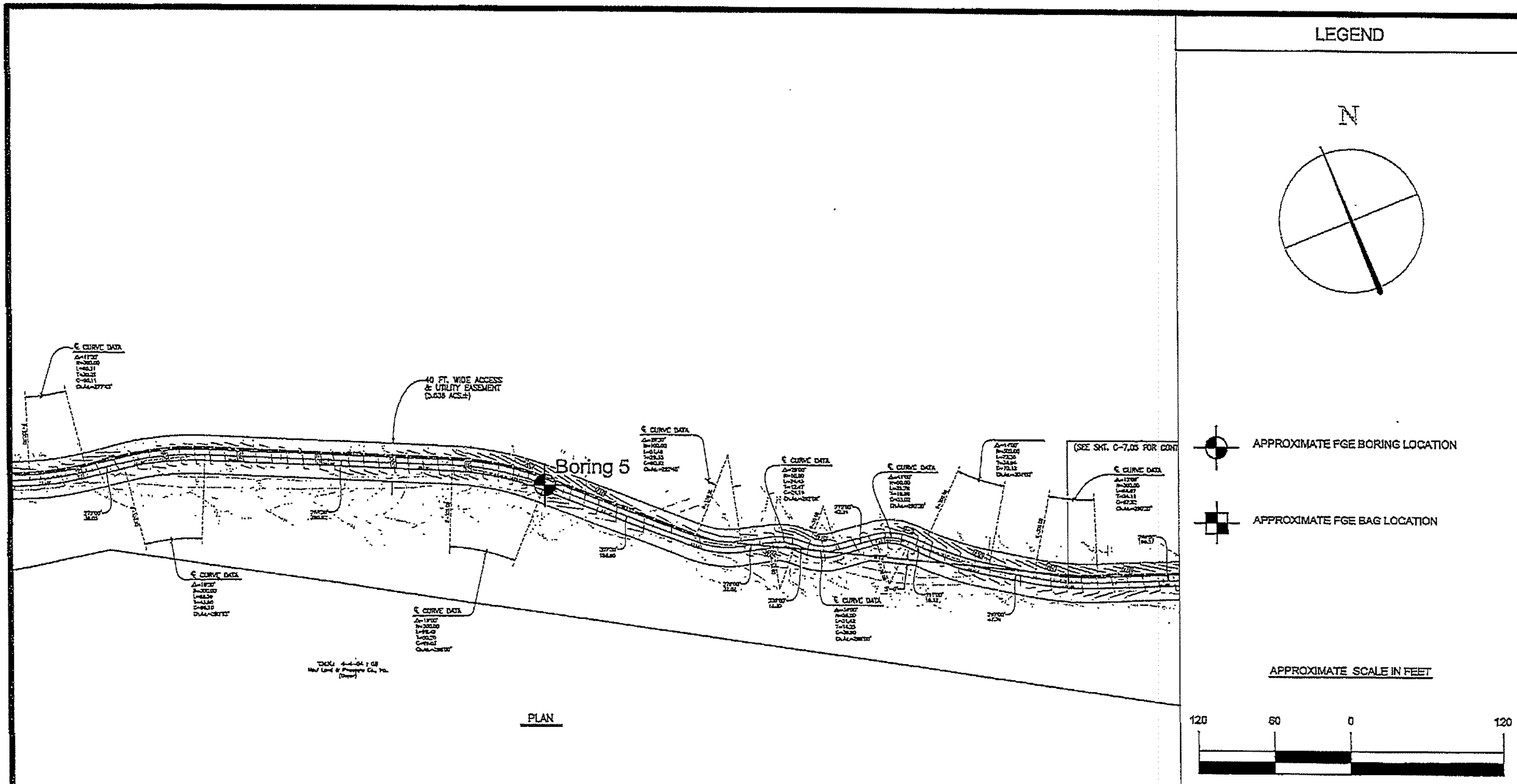
BORING LOCATION PLAN

New Mahinahina Well Water System
Mahinahina, Maui, Hawaii

October 2012 | File: 3102.01

Figure 2b



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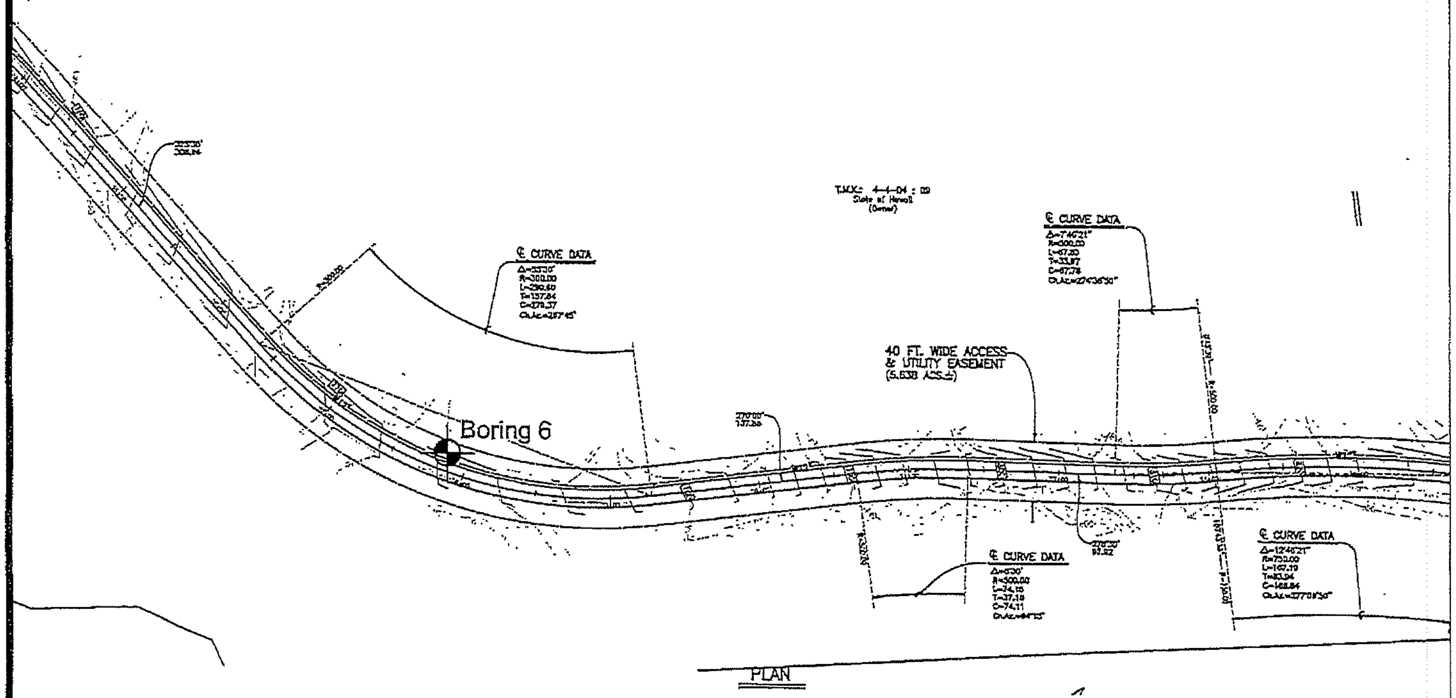
BORING LOCATION PLAN

New Mahinahina Well Water System
Mahinahina, Maui, Hawaii

October 2012 | File: 3102.01

Figure 2c



PLAN PROVIDED BY WARREN S. UNEMORI ENGINEERING, INC. 2012

LEGEND

N

APPROXIMATE FGE BORING LOCATION

APPROXIMATE FGE BAG LOCATION

APPROXIMATE SCALE IN FEET

120 60 0 120

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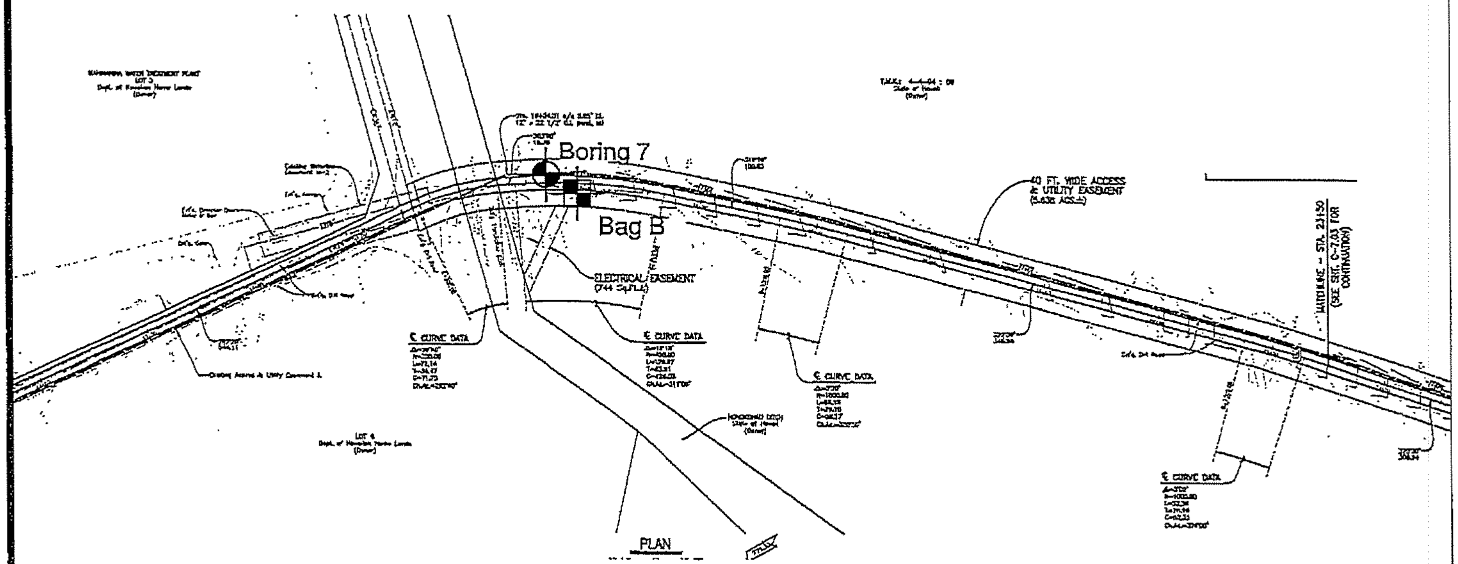
FEWELL GEOTECHNICAL ENGINEERING, LTD.

BORING LOCATION PLAN

New Mahinahina Well Water System
Mahinahina, Maui, Hawaii

October 2012 | File: 3102.01

Figure 2d



LEGEND

N

APPROXIMATE FGE BORING LOCATION

APPROXIMATE FGE BAG LOCATION

APPROXIMATE SCALE IN FEET

120 60 0 120

FEWELL GEOTECHNICAL ENGINEERING, LTD.

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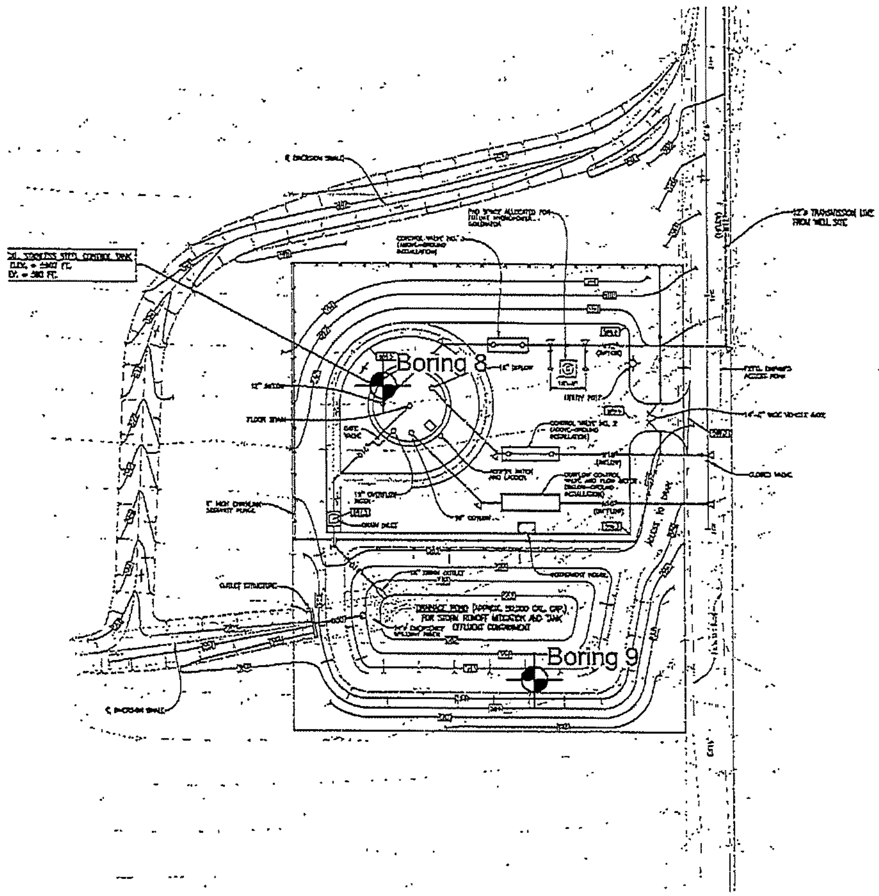
BORING LOCATION PLAN

New Mahinahina Well Water System
Mahinahina, Maui, Hawaii

October 2012 | File: 3102.01

Figure 2e

PLAN PROVIDED BY WARREN S. UNEMORI ENGINEERING, INC. 2012

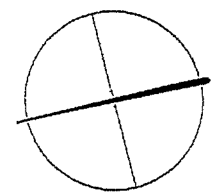


MIXING TANK SITE

PLAN PROVIDED BY WARREN S. UNEMORI ENGINEERING, INC. 2012

LEGEND

N



APPROXIMATE FGE BORING LOCATION

APPROXIMATE FGE BAG LOCATION

APPROXIMATE SCALE IN FEET

120 60 0 120

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96-1416 Waihona Place Pearl City Hawaii 96782-

BORING LOCATION PLAN

New Mahinahina Well Water System
Mahinahina, Maui, Hawaii

October 2012 | File: 3102.01

Figure 2f

F.G.E. Ltd.

Boring: 1 **File:** 3102.01
Project: New Mahinahina Well

Location: Mahinahina, Maui, Hawaii **Project Engineer:** TC
Surface Elevation: 1337'± **Field Engineer:** HW
Depth to Water: None Encountered (8/2/12 @ 7:25am) **Drafted by:** KSL
Date Completed: 8-1-12 **Date of Drawing:** October 2012

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT. *(x) See Legend	SAMPLE	DEPTH	CLASSIFICATION
						Reddish Brown Clayey SILT (MH), hard, moist
Torvane = 3,300 psf	35	88	54 (37)	1		
			79 (53)	2	5	
Torvane = 2,800 psf	41	80	34 (25)	3		(RESIDUAL)
						Reddish Brown and Gray Clayey SILT (MH) with remnant rock structure, hard, moist
			36 (26)	4	10	
Torvane = 4,000 psf	30	88	50/.3' (34/.3')	5	15	
LL=61, PI=21			23	6	20	
Direct Shear: Ø= 31° C= 500 psf 2.5% Swell	40	78	42 (29)	7	25	
0.2% Swell	34	80	32 (17)	8	30	
	36	85	74 (40)	9	35	(SAPROLITE)

Figure 3 a

F.G.E. Ltd.

Boring: 1
Project: New Mahinahina Well
File: 3102.01

Location: Mahinahina, Maui, Hawaii
Surface Elevation: 1337'±
Depth to Water: None Encountered (8/2/12 @ 7:25am)
Date Completed: 8-1-12

Project Engineer: TC
Field Engineer: HW
Drafted by: KSL
Date of Drawing: October 2012

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT. *(x) See Legend	SAMPLE	DEPTH	CLASSIFICATION
						Gray Highly Weathered Basalt (WH), soft to medium hard, broken
			R	10		
					40	Gray Silty Sand- and Gravel-Sized Rock Fragments (SM-GM), loose, moist
Gradation: 39% Gravel 40% Sand 21% Silt/Clay	26		10	11		
					45	
	14		68	12		Grades to very dense, dry
						(WEATHERED CLINKER)
					50	**BOH @ 50.0'**
					55	
					60	
					65	
					70	

Figure 3 b

F.G.E. Ltd.

Boring: 2 **File:** 3102.01
Project: New Mahinahina Well

Location: Mahinahina, Maui, Hawaii
Surface Elevation: 1314'±
Depth to Water: None Encountered (8/2/12 @ 7:28am)
Date Completed: 8-1-12

Project Engineer: TC
Field Engineer: HW
Drafted by: KSL
Date of Drawing: October 2012

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT. *(x) See Legend	SAMPLE	DEPTH	CLASSIFICATION
						Reddish Brown Clayey SILT (MH), hard, moist
0.2% Swell	22	94	21 (11)	1		
Consol.	40	83	22 (11)	2		
					5	
LL=52, PI=14	28	94	41 (22)	3		
	45	71	38 (20)	4		
					10	
	34	81	37 (19)	5		(RESIDUAL)
					15	Gray Clayey SILT (MH) with remnant rock structure, hard, moist
						(SAPROLITE)
Gradation: 62% Gravel 35% Sand 3% Silt/Clay			19 (10)	6		Gray and Black Well-Graded GRAVEL-Sized Basalt Fragments (GW) with sand, partially welded, loose to medium dense, dry
					20	
			9	7		
					25	(Aa CLINKER)
						Gray Highly Weatheredf BASALT (WH), soft to medium hard, broken
			50/.3'	8		
					30	
			38	9		
					35	BOH @ 35.0'

Figure 4

F.G.E. Ltd.

Boring: 3 **File:** 3102.01
Project: New Mahinahina Well

Location: Mahinahina, Maui, Hawaii **Project Engineer:** TC
Surface Elevation: 1314'± **Field Engineer:** HW
Depth to Water: None Encountered (8/1/12 @ 7:15am) **Drafted by:** KSL
Date Completed: 7-27-12 **Date of Drawing:** October 2012

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT. *(x) See Legend	SAMPLE	DEPTH	CLASSIFICATION
						Reddish Brown Clayey SILT (MH) hard, moist
0.1% Swell	43	78	34 (25)	1		
	43		36 (26)	2		
					5	(RESIDUAL)
						Reddish Brown and Gray Clayey SILT (MH) with remnant rock structure, hard, moist
			30 (23)	3		
	37		27 (21)	4		
					10	
			90 (60)	5		
					15	(SAPROLITE)
						BOH @ 15.0'
					20	
					25	
					30	
					35	

F.G.E. Ltd.

Boring: 4 **File:** 3102.01

Project: New Mahinahina Well

Location: Mahinahina, Maui, Hawaii **Project Engineer:** TC

Surface Elevation: 1148'± **Field Engineer:** HW

Depth to Water: None Encountered (8/2/12 @ 7:39am) **Drafted by:** KSL

Date Completed: 8-1-12 **Date of Drawing:** October 2012

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT. *(x) See Legend	SAMPLE	DEPTH	CLASSIFICATION
						Reddish Brown Clayey SILT (MH) with remnant rock structure, hard, dry
LL=54, PI=22	43	79	41 (29)	1		
Min. Elect. Resistivity =6,800 ohm-cm pH=4.9			36 (26)	2		
					5	At 4.5', grades to wet
			22 (17)	3		At 6.0', grades to very stiff
						(SAPROLITE)
						BOH @ 7.5'
					10	
					15	
					20	
					25	
					30	
					35	

Figure 6

F.G.E. Ltd.

Boring: 5
Project: New Mahinahina Well
File: 3102.01

Location: Mahinahina, Maui, Hawaii
Surface Elevation: 900'±
Depth to Water: None Encountered (8/2/12 @ 7:42am)
Date Completed: 8-1-12

Project Engineer: TC
Field Engineer: HW
Drafted by: KSL
Date of Drawing: October 2012

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT. *(x) See Legend	SAMPLE	DEPTH	CLASSIFICATION
LL=57, PI-26	31	73	83 (56)	1		Reddish Brown Clayey SILT (MH), with remnant rock structure, hard, dry
	25	91	78 (52)	2		**(SAPROLITE)**
					5	Gray Highly Weathered BASALT (WH), soft
			R	3		**BOH @ 6.0'**
					10	
					15	
					20	
					25	
					30	
					35	

Figure 7

F.G.E. Ltd.

Boring: 6
Project: New Mahinahina Well
File: 3102.01

Location: Mahinahina, Maui, Hawaii
Surface Elevation: 768'±
Depth to Water: None Encountered (8/2/12 @ 7:50am)
Date Completed: 8-1-12

Project Engineer: TC
Field Engineer: HW
Drafted by: KSL
Date of Drawing: October 2012

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT. *(x) See Legend	SAMPLE	DEPTH	CLASSIFICATION
						Reddish Brown Clayey SILT (MH), hard, dry
	34	88	43 (30)	1		(RESIDUAL)
Min. Elect. Resistivity = 7,000 ohm-cm pH=6.6 LL=59, PI=24			17 (14)	2		Reddish Brown and Gray Clayey SILT (MH) with remnant rock structure, very stiff, moist
					5	
			19 (15)	3		(SAPROLITE)
						BOH @ 7.5'
					10	
					15	
					20	
					25	
					30	
					35	

Figure 8

F.G.E. Ltd.

Boring: 7
Project: New Mahinahina Well
File: 3102.01

Location: Mahinahina, Maui, Hawaii
Surface Elevation: 721'±
Depth to Water: None Encountered (8/3/12 @ 7:20am)
Date Completed: 8-2-12

Project Engineer: TC
Field Engineer: HW
Drafted by: KSL
Date of Drawing: October 2012

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT. *(x) See Legend	SAMPLE	DEPTH	CLASSIFICATION
						Reddish Brown Clayey SILT (MH), hard, moist
Torvane = 3,400 psf	15	96	34 (25)	1		
	31	85	35 (25)	2		
					5	
Torvane = 3,000 psf			61 (41)	3		
						(RESIDUAL)
						Reddish Brown and Gray Clayey SILT (MH) with remnant rock structure, hard, moist
Torvane = 3,200 psf	27	71	21 (17)	4		
					10	
						(SAPROLITE)
			50/.5' (27/.5')	5		
						Gray Silty GRAVEL-Sized Rock Fragments (GM), dense, dry
					15	
						BOH @ 14.5'
					20	
					25	
					30	
					35	

F.G.E. Ltd.

Boring: 8
Project: New Mahinahina Well
File: 3102.01

Location: Mahinahina, Maui, Hawaii
Surface Elevation: 596'±
Depth to Water: None Encountered (8/3/12 @ 7::26am)
Date Completed: 8-2-12

Project Engineer: TC
Field Engineer: HW
Drafted by: KSL
Date of Drawing: October 2012

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT. *(x) See Legend	SAMPLE	DEPTH	CLASSIFICATION
						Reddish Brown Clayey SILT (ML), hard, dry
	25	79	81 (55)	1		
LL=43, PI=12 Torvane = 3,000 psf	37	82	29 (22)	2		At 3.0', grades to moist
					5	(RESIDUAL)
0% Swell	43	72	19 (16)	3		Reddish Brown Clayey SILT (MH) with remnant rock structure, very stiff to hard, moist
Direct Shear: Ø= 34° C= 1,800 psf 0.5% Swell	38	70	22 (17)	4		
					10	
						(SAPROLITE)
						Gray Highly Weathered BASALT (WH), soft to medium hard
	7	102	R 50/.3'	5 6		
					15	
			88/.8' (47/.8')	7		
					20	
			R	8		BOH @ 23.5'
					25	
					30	
					35	

Figure 10

F.G.E. Ltd.

Boring: 9 **File:** 3102.01
Project: New Mahinahina Well

Location: Mahinahina, Maui, Hawaii
Surface Elevation: 581'±
Depth to Water: None Encountered (8/3/12 @ 7:30am)
Date Completed: 8-2-12

Project Engineer: TC
Field Engineer: HW
Drafted by: KSL
Date of Drawing: October 2012

LAB TEST RESULTS	MOIST CONT. %	DRY DEN. PCF	BLOWS PER FT. *(x) See Legend	SAMPLE	DEPTH	CLASSIFICATION
						Reddish Brown Clayey SILT (ML), hard, dry
0.4% Swell	26	95	51 (35)	1		
	37	85	30 (23)	2		At 3.0', grades to moist
					5	
			43 (30)	3		
						(RESIDUAL)
						Reddish Brown and Gray Clayey SILT (MH) with remnant rock structure, very stiff, moist
	37	80	23 (18)	4		
					10	**(SAPROLITE)**
						BOH @ 10.0'
					15	
					20	
					25	
					30	
					35	

MAJOR SOIL TYPES

ML	Inorganic silts and very fine sands, rock flour, silty or clayey silts with slight plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
CH	Inorganic clays of high plasticity
OL	Organic silts and organic silty clays of low plasticity
OH	Organic clays of medium to high plasticity, organic silts
PT	Peat, humus, swamp soils with high organic contents
GW	Well-graded gravels, gravel-sand mixtures, little or no fines
GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well-graded sands, gravelly sand, little or no fines
SP	Poorly-graded sands, gravelly sand, little or no fines
SM	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures

MAJOR ROCK TYPES

BASALT

TUFF

DECOMPOSED ROCK

CORAL

Sampling Symbols

3" O.D. Relatively Undisturbed Sample

2" O.D. Standard Penetration Sample

3" O.D. Disturbed Sample

Shelby Tube

No Recovery

Core

Water Level

*(X) Equivalent Estimated SPT Blow Count

F.G.E.

BORING LOG LEGEND

New Mahinahina Well Water System
Mahinahina, Maui, Hawaii

File: 3102.01

October 2012

Figure 12

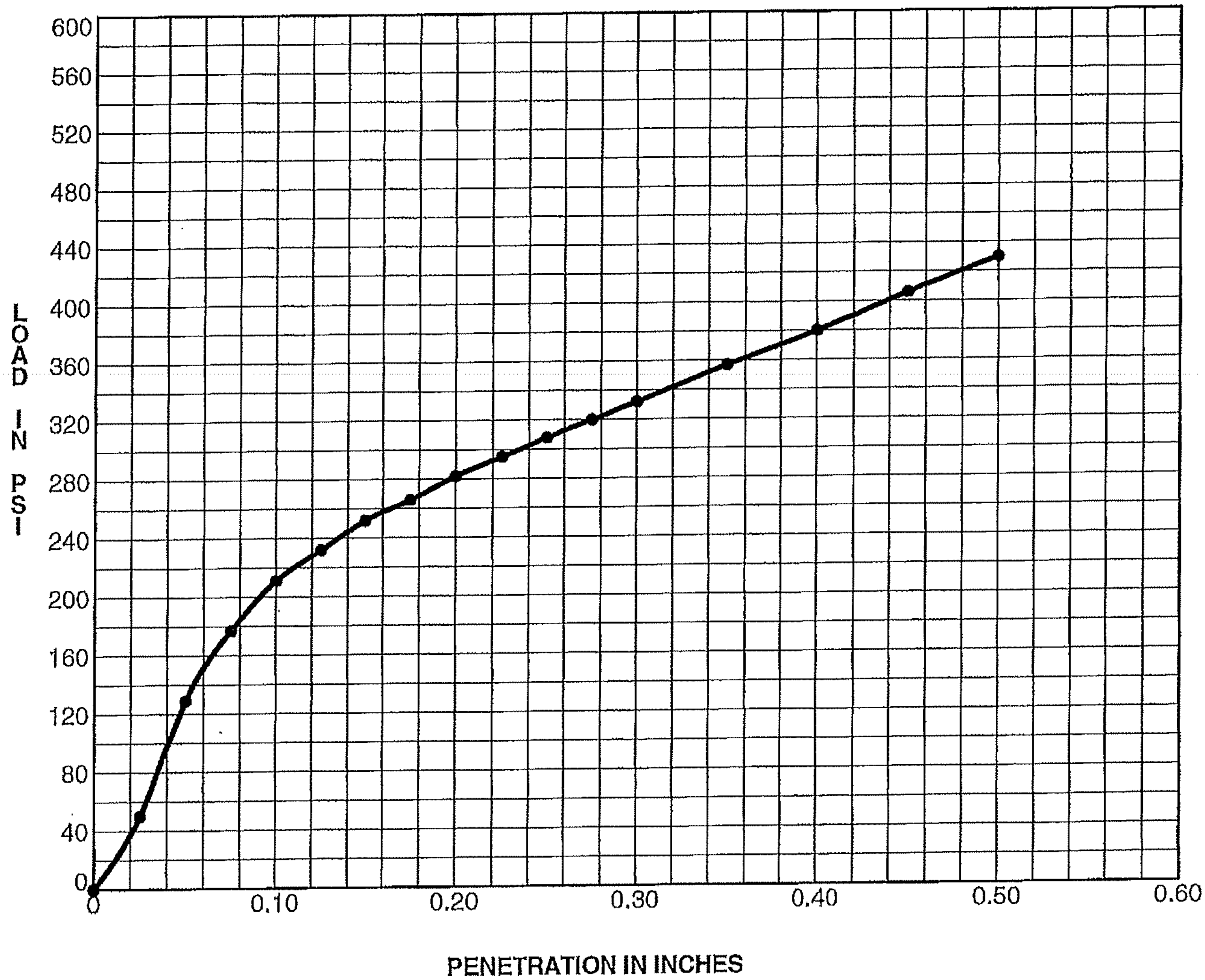
APPENDIX B

Laboratory Testing Summary

Project Designation: New Mahinahina Well Water System **File:** 3102.01

Location: Mahinahina, Maui, Hawaii

	Sample No.	Figure Designation
California Bearing Ratio Curves:	Bag A	13
	Bag B	14
Consolidation Curve:	2-2	15
Gradation Curves:	1-11	16
	2-6	17
Plasticity Chart:	1-6	18
	2-3	18
	4-1	18
	5-1	18
	6-2	18
	8-2	18
	Bag A	18
	Bag B	18
Summary of Laboratory Test Results		Table I



	Sample Identification	Classification	CBR	% Comp.	Max Den.	Opt. % MC	% Swell	LL	PI
●	Bag A	Reddish Brown Clayey SILT (MH)	22.0	96	97.0	29.0	0.9	57	25

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CALIFORNIA BEARING RATIO

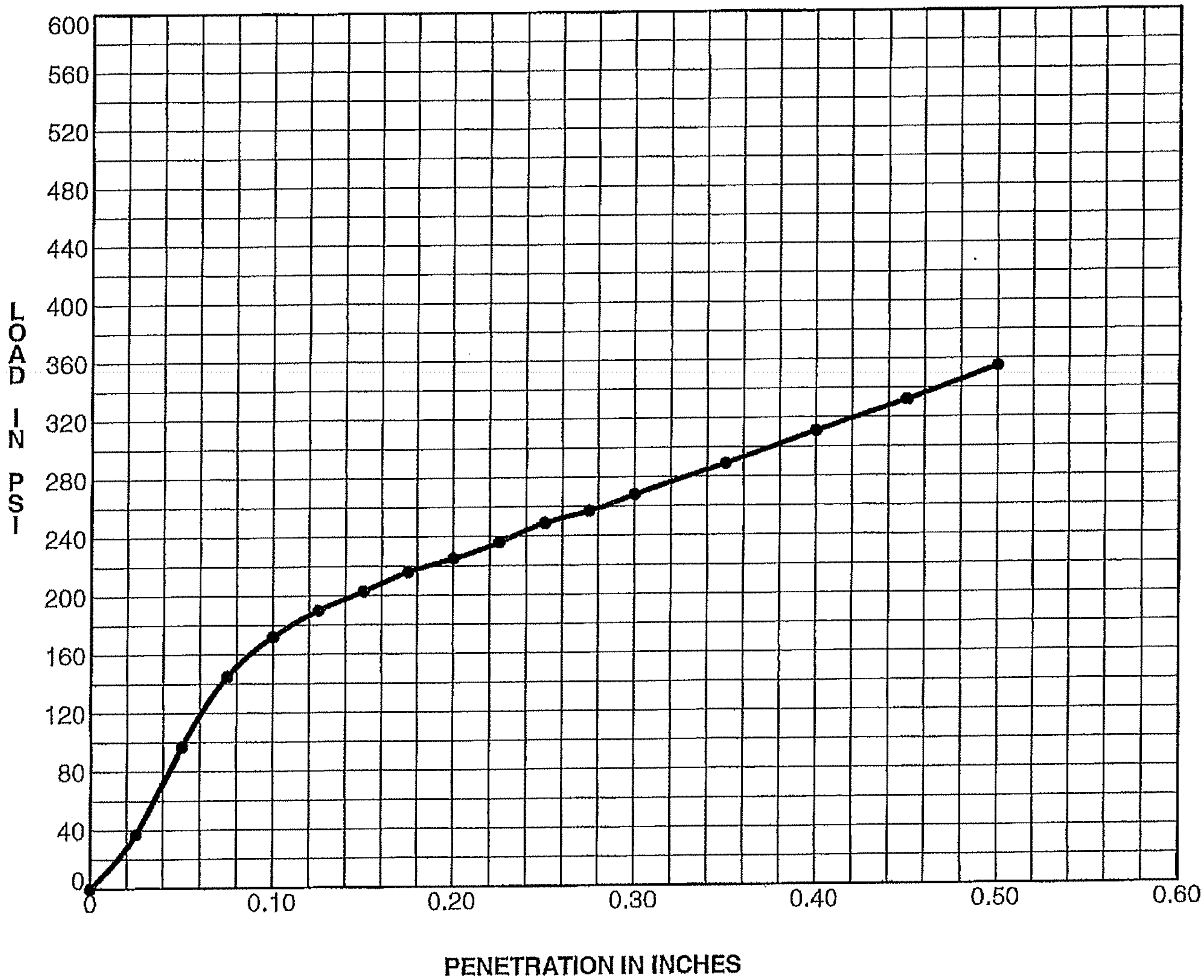
New Mahinahina Well

Mahinahina, Maui, Hawaii

File: 3102.01

October 2012

Figure 13



	Sample Identification	Classification	CBR	% Comp	Max Den.	Opt. % MC	% Swell	LL	PI
●	Bag B	Reddish Brown Clayey SILT (MH)	18.0	97	96.5	28.5	1.1	57	26

F.G.E. Ltd.

CALIFORNIA BEARING RATIO

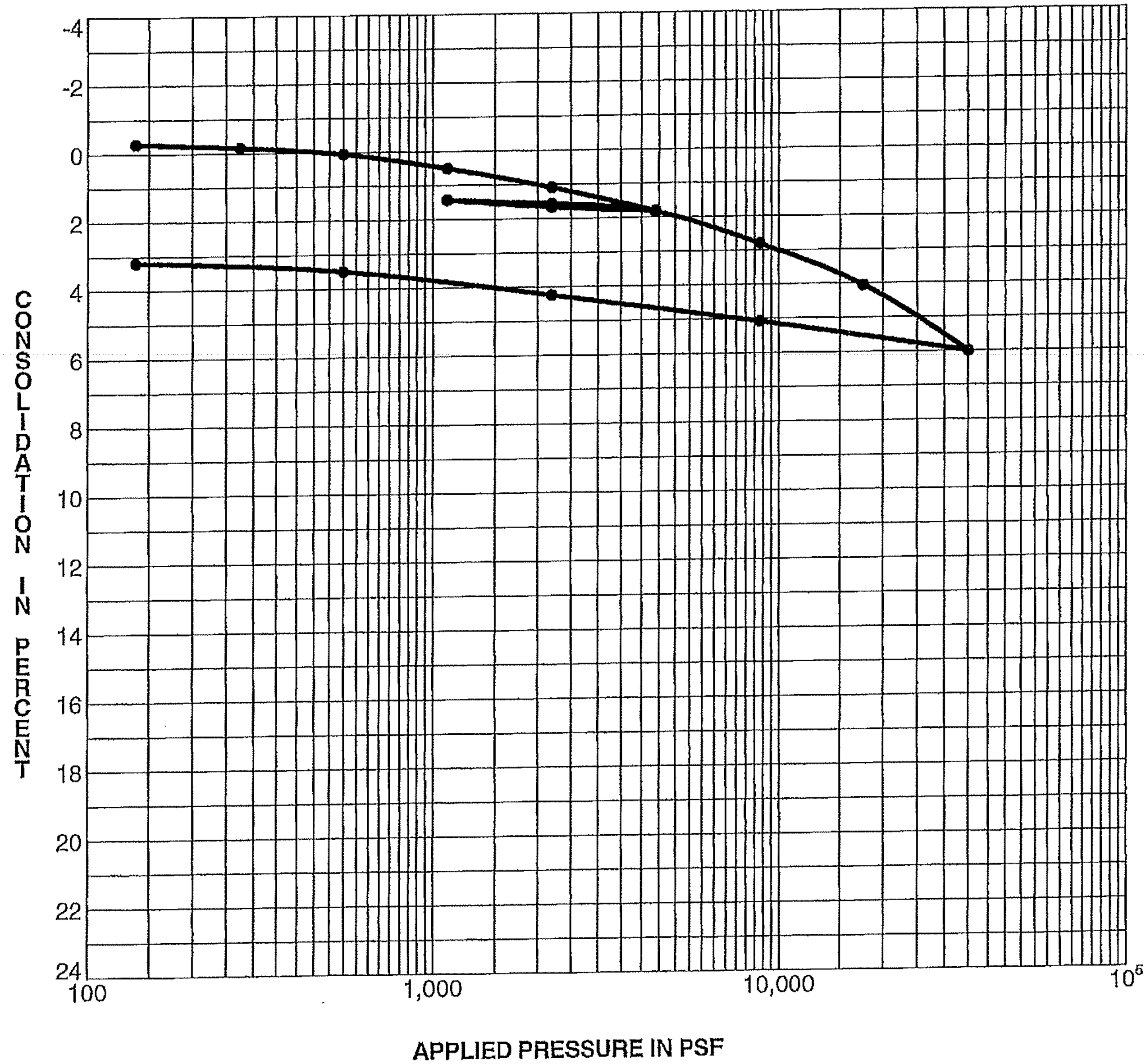
New Mahinahina Well

Mahinahina, Maui, Hawaii

File: 3102.01

October 2012

Figure 14



Sample Identification	Depth (feet)	Classification	LL	PI
2 - 2	3.0	Reddish Brown Clayey SILT (MH)		

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CONSOLIDATION CURVE

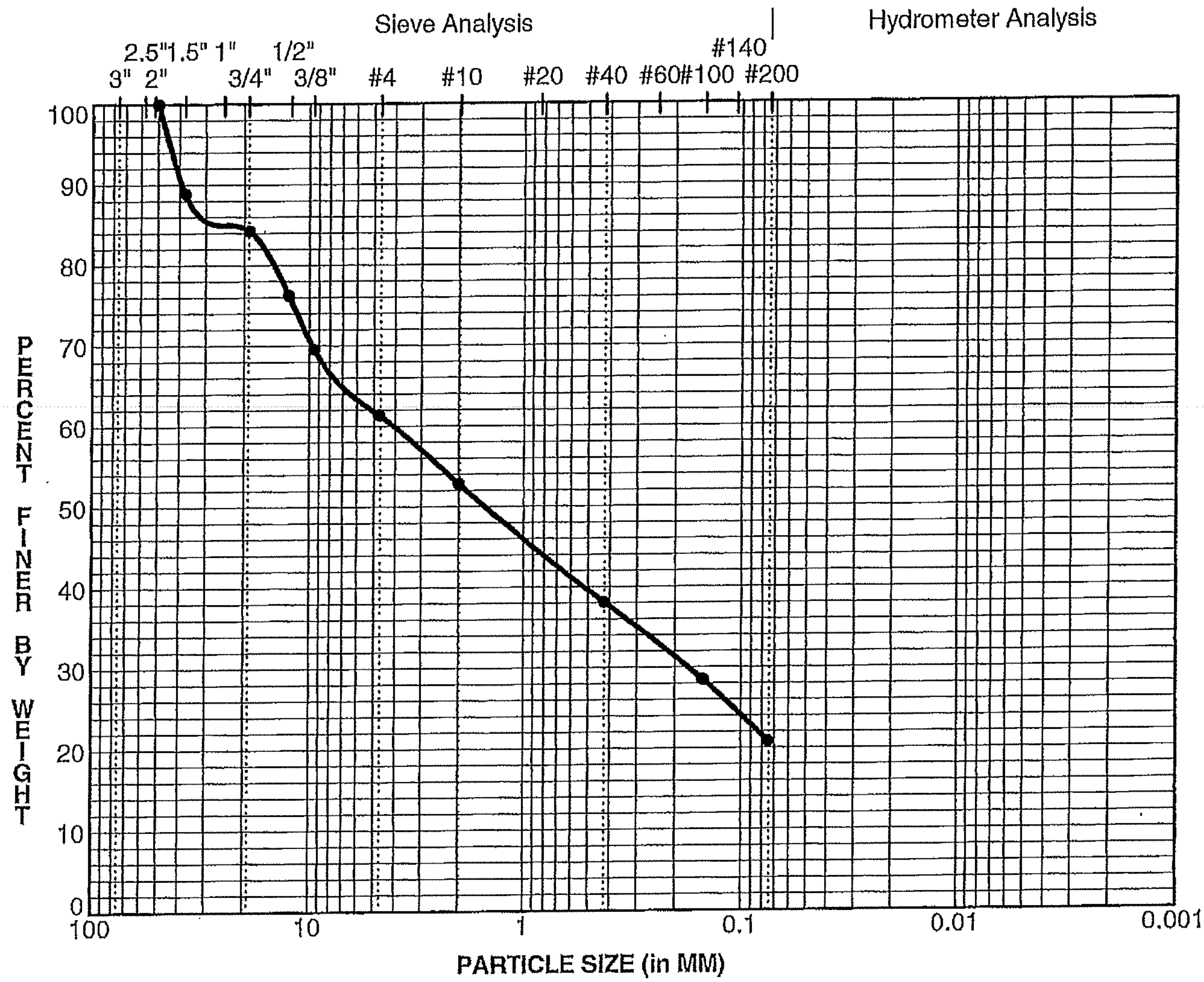
New Mahinahina Well

Mahinahina, Maui, Hawaii

File: 3102.01

October 2012

Figure 15



Gravel		Sand			Silt and Clay
coarse	fine	coarse	medium	fine	

	Sample ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	1 - 11	43.5	Gray Silty SAND & GRAVEL (SM-GM)	26					

	Sample ID	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt & Clay
●	1 - 11	43.5	50.0	4.1	0.18		39	41	21

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GRAIN SIZE DISTRIBUTION

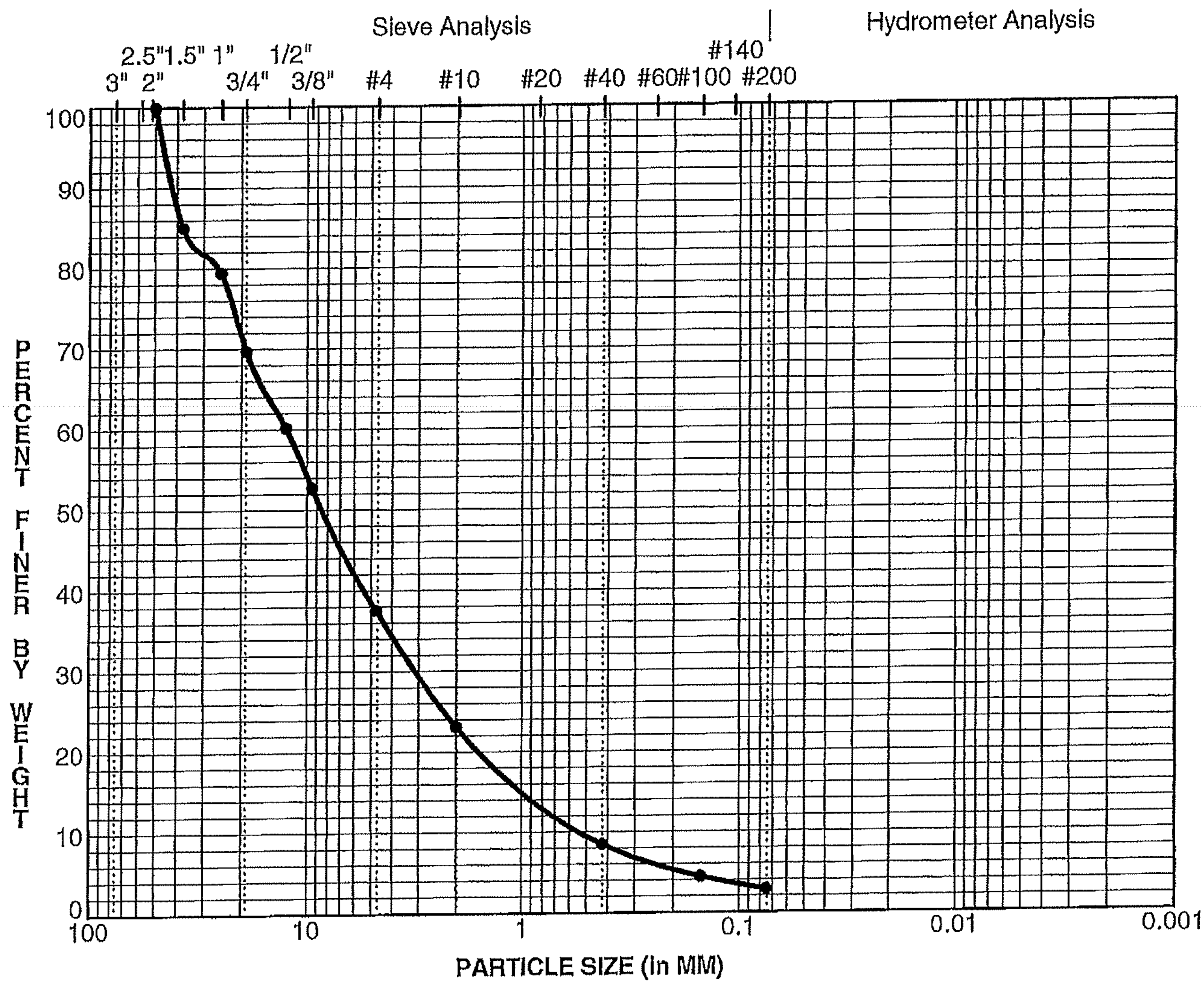
New Mahinahina Well

Mahinahina, Maui, Hawaii

File: 3102.01

October 2012

Figure 16



Gravel		Sand			Silt and Clay
coarse	fine	coarse	medium	fine	

	Sample ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	2 - 6	17.5	Gray Well-Graded GRAVEL (GW) w/ Sand					1	25

	Sample ID	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt & Clay
●	2 - 6	17.5	50.0	12.4	3.02	0.498	62	35	3

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GRAIN SIZE DISTRIBUTION

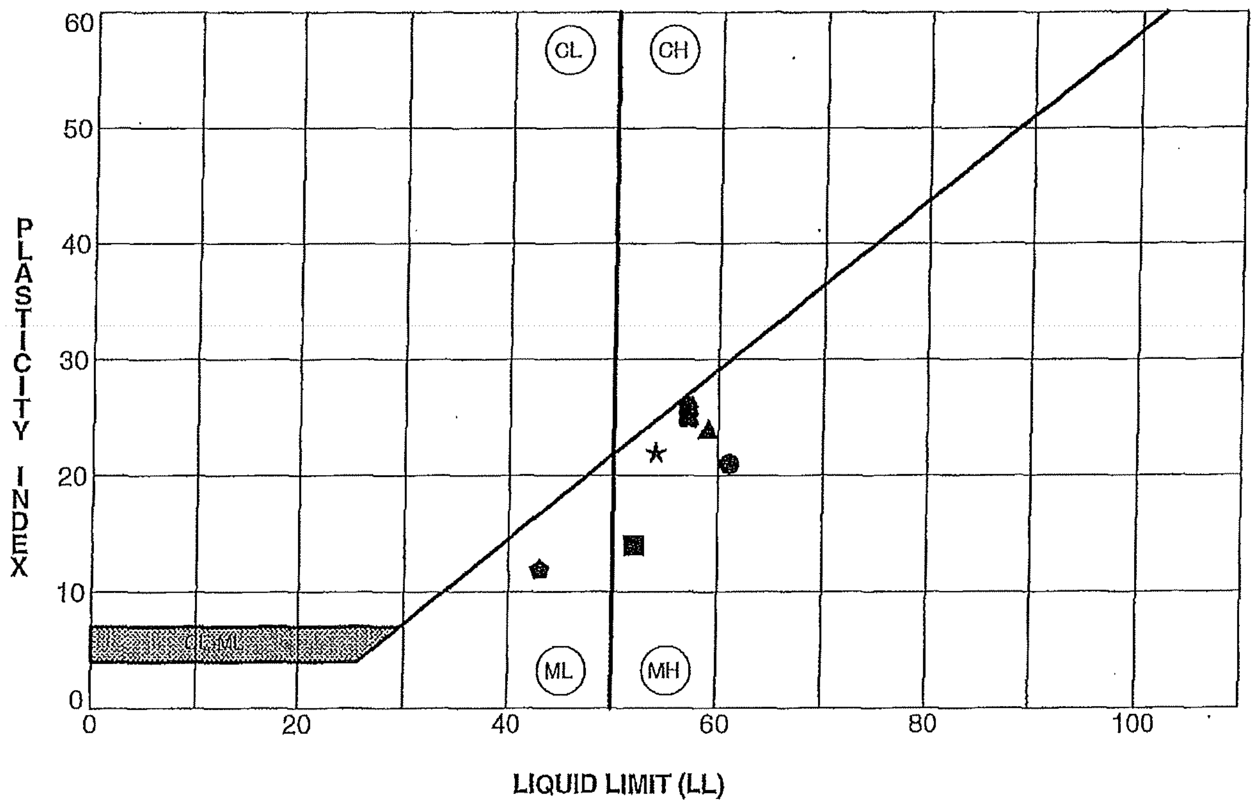
New Mahinahina Well

Mahinahina, Maui, Hawaii

File: 3102.01

October 2012

Figure 17



	Sample ID	Depth (ft)	LL	PL	PI	Classification
●	1 - 6	18.5	61	40	21	Reddish Brown Clayey SILT (MH)
■	2 - 3	5.5	52	38	14	Reddish Brown Clayey SILT (MH)
★	4 - 1	1.0	54	32	22	Reddish Brown Clayey SILT (MH)
◆	5 - 1	1.0	57	31	26	Reddish Brown Clayey SILT (MH)
▲	6 - 2	3.0	59	35	24	Reddish Brown Clayey SILT (MH)
⬟	8 - 2	3.0	43	31	12	Reddish Brown Clayey SILT (ML)
✖	Bag A	0.0	57	32	25	Reddish Brown Clayey SILT (MH)
⬢	Bag B	0.0	57	31	26	Reddish Brown Clayey SILT (MH)

F.G.E. Ltd.

PLASTICITY INDEX CHART

New Mahinahina Well
Mahinahina, Maui, Hawaii

File: 3102.01

October 2012

Figure 18

TABLE I

Summary of Laboratory Test Results

Sample No.	Depth (ft)	Moisture Content (%)	Dry Density (pcf)	Direct Shear		Liquid Limit	Plasticity Index	Torvane Shear (psf)	Gradation			USC	Swell (%)	CBR
				C (psf)	Phi (Deg.)				Gravel (%)	Sand (%)	Silt/Clay (%)			
1-1	1.0	35	88					3,500						
1-3	5.5	41	80					2,800						
1-5	13.5	30	88					4,000						
1-6	18.5					61	21					MH		
1-7	23.5	40	78	500	31								2.5	
1-8	28.5	34	80										0.2	
1-9	33.5	36	85											
1-11	43.5	26							39	40	21	SM-GM		
1-12	48.5	14												
2-1	1.0	22	94										0.2	
2-2	3.0	40	83											
2-3	5.5	28	94			52	14					MH		
2-4	8.5	45	71											
2-5	13.5	34	81											
2-6	17.5								62	35	3	GW		
3-1	1.0	43	78										0.1	
3-2	3.0	43												
3-4	8.5	37												
4-1	1.0	43	79			54	22					MH		
5-1	1.0	31	73			57	26					MH		
5-2	3.5	25	91											
6-1	1.0	34	88											
6-2	3.0					59	24					MH		

TABLE I (Continued)

Summary of Laboratory Test Results

Sample No.	Depth (ft)	Moisture Content (%)	Dry Density (pcf)	Direct Shear C (psf)	Direct Shear Phi (Deg.)	Liquid Limit	Plasticity Index	Torvane Shear (psf)	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	USC	Swell (%)	CBR
7-1	1.0	15	96					3,400						
7-2	3.0	31	85											
7-3	5.5							3,000						
7-4	8.5	27	71					3,200						
8-1	1.0	25	79											
8-2	3.0	37	82			43	12	3,000				ML		
8-3	5.5	43	72										0.0	
8-4	8.5	38	70	34	1,800								0.5	
8-6	13.5	7	102											
9-1	1.0	26	95										0.4	
9-2	3.0	37	85											
9-4	8.5	37	80											
Bag A	0.0					57	25					MH	0.9	22
Bag B	0.0					57	26					MH	1.1	18

APPENDIX C

Limitations

This report has been prepared for the exclusive use of **Warren S. Unemori Engineering, Inc.** for the **New Mahinahina Well Water System** in Mahinahina, Maui, Hawaii. In the completion of the investigation and the preparation of this report, we have strived to perform our services in a manner consistent with that level of care and skill ordinarily exercised by members of the geotechnical profession practicing under similar conditions in Hawaii. No other warranty, either expressed or implied, is made.

The analysis, conclusions, and recommendations submitted in this report are based in part upon the data obtained in the test borings, and upon the assumption that the soil conditions do not deviate from those observed. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that planned at the present time, Fewell Geotechnical Engineering, Ltd. (FGE) should be notified so that supplemental recommendations can be given. The conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are modified or verified in writing.

Unanticipated soil conditions are commonly encountered and cannot be fully determined by soil samples, test borings, or test pits. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. Some contingency funds are recommended to accommodate such potential extra costs.

The site investigation may not have disclosed the presence of underground structures, such as cesspools, drywells, storage tanks, etc. that may be present at the site. Should these items be encountered during construction, FGE should be notified to provide recommendations for their disposition. The cost for these services was not included within the fee for this investigation.

The scope of work for this investigation was limited to conventional geotechnical services and did not include environmental or archeological assessments or evaluations. Silence in the report regarding any archeological or environmental aspects of the site does not indicate the absence of potential environmental or archeological problems.

The boring locations were determined in the field based on measurements from reference stakes provided in the field by WSUE. Ground surface elevations at the boring locations were estimated from the Topographic Survey Map provided by WSUE. The locations and elevations of the borings should be considered accurate only to the degree implied by the methods used.

Groundwater was not encountered in any of the test borings of this investigation. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall and other factors not present at the time the measurements were taken.

FGE should be provided the opportunity for general review of the final design drawings and specifications to verify that the earthwork and foundation recommendations have been properly interpreted and implemented in the design and specification. If FGE is not afforded the privilege of making this recommended review, it can assume no responsibility for misinterpretations of the recommendations.

FGE should also be retained to provide periodic soil engineering services during construction. This is to observe compliance of the design concepts, specifications, and recommendations and to allow design changes in the event the subsurface conditions differ from that anticipated prior to construction. The recommendations contained herein are contingent upon adequate construction monitoring of the geotechnical phases of the construction by FGE.

SUBSURFACE INVESTIGATION REPORT FOR KAHANA WELL

APPENDIX I-2

GEOTECHNICAL INVESTIGATION REPORT
KAHANA PRODUCTION WELL CONTROL TANK
LAHAINA, MAUI, HAWAII

A report by:
HAWAII GEOTECHNICAL CONSULTING, INC.

July 22, 2018

ROBERT M. GIBBENS
LICENSED PROFESSIONAL ENGINEER
No. 10094-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

04/30/2020

SIGNATURE

EXPIRATION DATE
OF LICENSE

Hawaii Geotechnical Consulting
- I n c o r p o r a t e d -
P.O. Box 331223 • Kahului, Hawaii 96733 • Phone (808) 205-1727

July 22, 2018
File No. 18011.01

Mr. Ronald Fukumoto, P.E., L.S.
Fukumoto Engineering Inc.
1721 Wili Pa Loop, Suite 203
Wailuku, Hawaii 96793

Subject: **GEOTECHNICAL INVESTIGATION REPORT FOR KAHANA PRODUCTION WELL CONTROL TANK LAHAINA, MAUI, HAWAII**

Dear Mr. Fukumoto:

We are pleased to submit our Geotechnical Investigation Report for the Kahana Production Well Control Tank project in Lahaina, Maui, Hawaii. The enclosed report describes our subsurface investigation and presents our geotechnical recommendations for the water tank and support building foundations and mass grading.

We appreciate the opportunity to work with you on this project. If you should have any questions or require additional information, please contact us.

Sincerely,

HAWAII GEOTECHNICAL CONSULTING, INC.

Robert M. Gibbens, P.E.
Senior Geotechnical Engineer

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

1.1 Authorization

Hawaii Geotechnical Consulting, Inc. (HGC) was retained by Fukumoto Engineering, Inc. to conduct a geotechnical investigation for the proposed Kahana Production Well Control Tank project in Lahaina, Maui, Hawaii. The scope of our services was outlined in our August 22, 2017 proposal No. P-352R3.

1.2 Purpose and Scope

The purpose of this geotechnical investigation was to explore and evaluate the site's subsurface conditions in order to provide geotechnical recommendations for the project's water tank foundation and support building. The site's groundwater conditions and construction considerations were also addressed. A description of the scope of work is presented below:

Phase 1 – Test Pit Field Investigation. A total of 3 test pits were excavated with a CAT 430D rubber-tired backhoe equipped with a 5-tooth, 24-inch wide bucket. Each test pit was excavated to an initial depth of 4 to 5 feet below the existing ground surface. The cut face of each test pit was hand logged and bulk, grab, and drive samples were obtained. After initial logging and sample collection, each test pit was excavated further. During the additional excavation, the disturbed soil was observed and sampled when changes were observed. The test pits were each excavated to a maximum depth of 6 feet below the existing ground surface to equipment failure. An engineer with HGC observed and directed the test pit investigation, maintained a log of the subsurface soils encountered, and collected disturbed bulk and grab samples as Well Tank as relatively undisturbed drive samples for laboratory testing. A description of the field investigation and the Logs of Test Pits are presented in Appendix A. The test pit locations are presented on the Test Pit Location Plan, Figure 1.

Phase 2 – Laboratory Testing. Laboratory tests were performed on bulk and grab samples as well as drive samples obtained during the field investigation. Laboratory tests were selected to verify field classifications and provide geotechnical parameters for use in design. Testing consisted of in-place dry density and moisture content, gradation and Atterberg limit tests. The laboratory test results and methods are described in Appendix B and on the Logs of Test Pits, where appropriate.

Phase 3 – Geotechnical Analysis. Our field observations and laboratory test results were analyzed in combination with the proposed construction plans. Our analysis focused on the water tank and support building foundations. The water tank and support building foundations were analyzed for bearing capacity and settlement using Terzaghi's bearing capacity equation and Peck's settlement equations.

Phase 4 – Geotechnical Report. This report was prepared to present our findings, conclusions, and recommendations regarding the geotechnical feasibility for water tank and support building foundations. Our report describes our field investigation and the site's general subsurface conditions. Discussions regarding critical geotechnical design issues and problem areas are presented. The report provides design level recommendations for the tank and support building foundations.

1.3 Site Location

The project site is located on the western flank of the West Maui Mountains in Kahana, Maui, Hawaii. The proposed site is located about 3 miles from the Pacific Ocean near Elev. 1325.

1.4 Site Description and Conditions

The site is currently houses the Kahana Production Well. A portion of the site's central region has been graded into a level gravel building pad with a 3 to 4 foot thick fill slope along its western edge and a 2 to 3 foot thick cut slope along its eastern edge. The existing site east of the level area slopes up from west to east at about 5 horizontal to 1 vertical (5h:1v) with an overall relief of 20 feet. The existing site west of the level area slopes down from east to west at about 5h:1v with an overall relief of 20 feet.

A deep gorge was observed north of the site.

END OF INTRODUCTION

2. PROJECT DESIGN CONSIDERATIONS

The following sections describe our understanding of the relevant project considerations. Our understanding is based on the provided plans and discussions with the project Civil Engineer. If final construction plans differ significantly, we should be notified in order to review the applicability of our recommendations.

2.1 Proposed Project/Development Plans

We understand that the proposed project will include the construction of a new 34,000 gallon stainless steel control water tank. The new tank will be about 19 feet in diameter and 20 feet tall. Grading for the proposed control tank site includes cuts of between 2 and 15 feet to achieve the finished floor elevation of 1315.

In addition to the control tank, a control building constructed of CMU, is planned at the site. The building will be single storied and 20 x 56 feet in plan area. Grading for the proposed control building will include cuts of between 1 and 10 feet to achieve the finished floor elevation of 1314.4.

Grading for the slopes east and west of the proposed new tank will include cuts of up to 10 feet east of the new tank and fills as thick as 2 to 3 feet west of the tank.

END OF PROJECT DESIGN CONSIDERATIONS

3. SUBSURFACE INVESTIGATION

On June 16, 2018, a subsurface investigation was performed along the proposed water tank site. The following sections describe our investigation.

3.1 Test Pits

A total of 3 test pits were excavated within the proposed tank site. One test pit was excavated within the control tank footprint, one test pit was excavated within the control building footprint and one test pit was excavated within the level pad area west of the tank. The test pits were excavated with a CAT 430D backhoe, equipped with an 24-inch wide, 5-tooth bucket. Each test pit was excavated to an initial depth of 4 to 5 feet below the existing ground surface. The cut face of each test pit was hand logged and grab, and bulk samples were obtained. After initial logging and sample collection, each test pit was excavated further. During the additional excavation, the disturbed soil was observed and sampled when changes were observed.

The test pits were each excavated to depths of 10 feet below the existing ground surface. An engineer with HGC observed and directed the test pit investigation, maintained a log of the subsurface soils encountered, and collected disturbed grab and bulk samples as well as drive samples for laboratory testing. A description of the field exploration and the Logs of Test Pits are presented in Appendix A. The test pit locations are presented on the Test Pit Location Plan, Figure 1.

3.2 Laboratory Testing

Laboratory tests were performed on grab and bulk samples as well as drive samples obtained during the field investigation. Laboratory tests were selected to verify field classifications and provide geotechnical parameters for use in design. Testing consisted of in-place dry densities and moisture content, gradation and Atterberg limit tests. The laboratory test methods and results are presented and described in Appendix A and B, respectively.

END OF SUBSURFACE INVESTIGATION

4. SUBSURFACE CONDITIONS

The following sections describe the subsurface soil and groundwater conditions encountered during our field investigation.

4.1 Residual Soils

The site was underlain by a residual (weathered in place from parent basalt) layer of orange brown silty sand with varying percentages of gravel and cobbles. The residual silty sand deposit was encountered from the ground surface to depths between 6 and 10 feet. The residual sand is generally medium dense within the upper 2 foot depths and dense below. In-place moisture contents ranged from 38 to 43 percent while in-place dry densities ranged from 70 to 76 pounds per cubic foot (pcf).

A layer of residual gravel with sand and silt was encountered within Test Pit No. 2. The residual gravel was encountered between the depths of 4 and 6 feet. The residual gravel was dense and moist.

4.2 Formational Basalt

Highly to completely weathered basalt was encountered in Text Pit No. 1 between the depths of 6 feet and the bottom of the excavation at 10 feet. The completely weathered basalt was broken and soft.

4.3 Groundwater Conditions

Groundwater was not encountered within our test pits. Groundwater levels within the project area will vary depending on seasonal rainfall and runoff conditions. Therefore, groundwater levels may vary from those presented above at the time of construction.

END OF SUBSURFACE CONDITIONS

5. DISCUSSION

Based on the results of our field exploration and geotechnical analysis, we believe that it is geotechnically feasible to construct the proposed water tank, provided the recommendations of this report are incorporated into the project's design and construction.

The upper soils are generally wet of their optimum moisture content. These soils may require drying in order to achieve adequate compaction. If the onsite soils cannot be compacted to at least 90 percent relative compaction due to excessive moisture, we recommend that 12 inches of Untreated Base Course be placed under both the slab and footings.

END OF DISCUSSION

6. ENGINEERING RECOMMENDATIONS

6.1 General

Foundation preparation and site grading can be developed in accordance with the following recommendations. Unless stated otherwise, the maximum dry density (MDD) and optimum moisture content (OMC) of all engineered fill referenced within this report is based on Laboratory Test Method ASTM D1557.

6.2.1 Ground Shaking

The proposed development is located in an area with some seismic activity and the proposed structures will likely be subjected to seismic shaking during their design life. The primary potential seismic hazard is ground shaking. We recommend that the proposed development be designed in accordance with the requirements of the latest (2006) edition of the International Building Code (IBC). According to Table 1613.52 of the 2006 IBC, the project site can be characterized by a Site Class of D.

6.2.2 Liquefaction

Liquefaction occurs in loose, saturated sands that are subjected to earthquake type motions. In sands where constant volume conditions are maintained during shaking (i.e., where no immediate drainage path exists), excess pore water pressures build quickly and as a result, soil strength is rapidly reduced and settlement occurs. Neither loose sands nor a shallow groundwater table underlie the site. Therefore no liquefaction-induced settlements are likely.

6.2.3 Other Seismic Considerations

The site is not located within an Earthquake Fault Zone. Therefore the likelihood of the ground surface rupturing due to faulting is considered to be low. Based on the materials encountered and the existing and planned topographic conditions, we do not expect seismic slope instability to be a concern. Due to the site's elevation, we do not believe that tsunamis are a potential threat.

6.3 Foundations

We believe that the proposed control tank and control building can be adequately supported on a continuous circular strip footing with a concrete slab on grade floor and a strip and spread footing foundation system with a concrete slab on grade floor, respectively, provided the recommendations for site preparation and engineered fill are followed (Sections 6.4.2 and 6.4.3, respectively). We recommend that the strip footing foundation for the control tank and control building be placed a minimum depth of 12 inches below the lowest adjacent grade. This embedment depth should provide a bearing surface consisting of native residual silty sand.

For a shallow foundation system designed with the recommendations presented above, an allowable bearing pressure of 2,975 pounds per square foot (psf) may be used. This bearing value is for total dead plus sustained live loads and may be increased by one-third for transient loads such as wind or seismic. We estimate that total and differential settlements should be less than ½-inch for foundations designed as described above.

Footings located near adjacent slopes should be embedded such that a minimum horizontal distance of 5 feet is maintained between the footing's bottom edge and the exposed slope face.

6.3.1 Lateral Resistance

Lateral resistance may be derived from passive resistance along the footing sides and friction along the footing bottoms. An allowable passive earth pressure of 275 psf per foot of depth may be used for design. We recommend that the lateral earth pressure of any footing be neglected for the upper 12-inches unless the surface around the footing is protected from erosion or disturbance by a slab, pavement, or some other form of confinement.

A coefficient of friction value of 0.45 may be used between the bottom of concrete footings and the underlying UTB or engineered fill. Sliding resistance should be calculated based on the dead load only.

6.3.2 Slab-on-Grade Floor

A concrete slab on grade floor bearing on compacted native residual silty sand may be used for the control tank and control building floors. The subgrade should be compacted to at least 90 percent of its MDD for a minimum depth of 12 inches.

If the subgrade soils are too wet to achieve at least 90 percent relative compaction we recommend that at least 12 inches of UTB be placed beneath the tank and building footings and slabs. The UTB should conform to Section 703.06 of the 2005 Hawaii Standard Specifications for Road, Bridge, and Public Works Construction (Standard Specifications) and should be compacted to at least 95 percent relative compaction as determined by ASTM D 1557.

6.4 Construction Considerations

The following recommendations are provided for foundation design and site fill. All site preparation and fill operations should be performed in accordance with the Standard Specifications.

6.4.1 Stripping and Grubbing

Prior to commencement of grading, the site should be cleared and grubbed to remove all organics, vegetation, and other deleterious materials in accordance with the Standard Specifications. The stripping and grubbing work should include the removal of topsoil that, in the judgment of the geotechnical engineer, is uncertified, compressible, collapsible, or contains significant voids. The voids caused by the removal of subsurface features such as trees, must also be processed and backfilled in accordance with the recommendations presented in this report.

6.4.2 Site Preparation

Based on our interpretation of the geotechnical subsurface profile, we anticipate that the soils exposed during construction will consist of medium dense to dense native silty sand. All footing areas and areas to be filled should be stripped and grubbed to expose a firm, non-yielding subgrade, free of large voids, organics, and deleterious materials.

Fill areas with ground slopes exceeding 5h:1v should be horizontally terraced prior to fill placement. The terraces should be extended through all loose slope material into competent native material.

6.4.3 Engineered Fill

The onsite residual soils are suitable for use as engineered fill provided all organics and rocks or clods larger than 6 inches in diameter are removed and the moisture content are within 3 percent of optimum. We anticipate that the onsite residual soils will likely possess in-place moisture contents which are too high for use as engineered fill without drying. Any imported fill required should consist of coarse-grained material with a maximum particle size of 6 inches. Additionally, any imported fill should possess a plasticity index less than 10 and should qualify as SW, SP, GP, GM, or SM in accordance with the Unified Soil Classification System.

All fill should be placed in successive horizontal lifts of not more than 12 inches in loose thickness for the full width of the area being filled. The fill should be moisture conditioned to within 3 percent of its OMC prior to being compacted to at least 90 percent of its MDD.

END OF ENGINEERING RECOMMENDATIONS

7. ADDITIONAL SERVICES

We recommend that a thorough review of the project plans and specifications be conducted before they are finalized to verify that our geotechnical recommendations have been properly interpreted and implemented during the design. If we are not accorded this review, we can assume no responsibility for misinterpretation of our recommendations. The review can be completed on a time-and-expense basis in accordance with our current Fee Schedule.

The construction process is an integral design component with respect to the geotechnical aspects of a project. Because geotechnical engineering is an inexact science due to the variability of natural processes and because we sample only a small portion of the soils affecting the performance of the proposed structures, unanticipated or changed conditions can be disclosed during grading. Proper geotechnical observation and testing during construction is imperative to allow the geotechnical engineer the opportunity to verify assumptions made during the design. Therefore, we recommend that Hawaii Geotechnical Consulting, Inc. be kept apprised of design modifications and construction schedules for the proposed development so that design changes can be made if subsurface field conditions warrant.

END OF ADDITIONAL SERVICES

8. LIMITATIONS

This report has been prepared for the exclusive use of Fukumoto Engineering, Inc. and their agents for specific application to the Kahana Production Well Control Tank project in Lahaina, Maui, Hawaii.

The findings, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted geotechnical engineering practice as it exists in the site area at the time of our study. No warranty is expressed or implied. The recommendations provided in this report are based on the assumption that our firm will conduct an adequate program of tests and observations during the construction phase in order to evaluate compliance with our recommendations. If the scope of the proposed construction, including the proposed loads, grades, or structural locations change from that described in this report, our recommendations should also be reviewed. We have not reviewed a final grading or building plan for the project.

Hazardous materials may have been discovered during the course of Hawaii Geotechnical Consulting, Inc.'s services. Hawaii Geotechnical Consulting, Inc. will assume no responsibility or liability whatsoever for any claim, loss of property value, damage, or injury that results from pre-existing hazardous materials being encountered or present on the project site, or from the discovery of such hazardous materials.

Nothing contained in this scope of work should be construed or interpreted as requiring Hawaii Geotechnical Consulting, Inc. to assume the status of an owner, operator, generator, or person who arranges for disposal, transport, storage, or treatment of hazardous materials within the meaning of any governmental statute, regulation, or order.

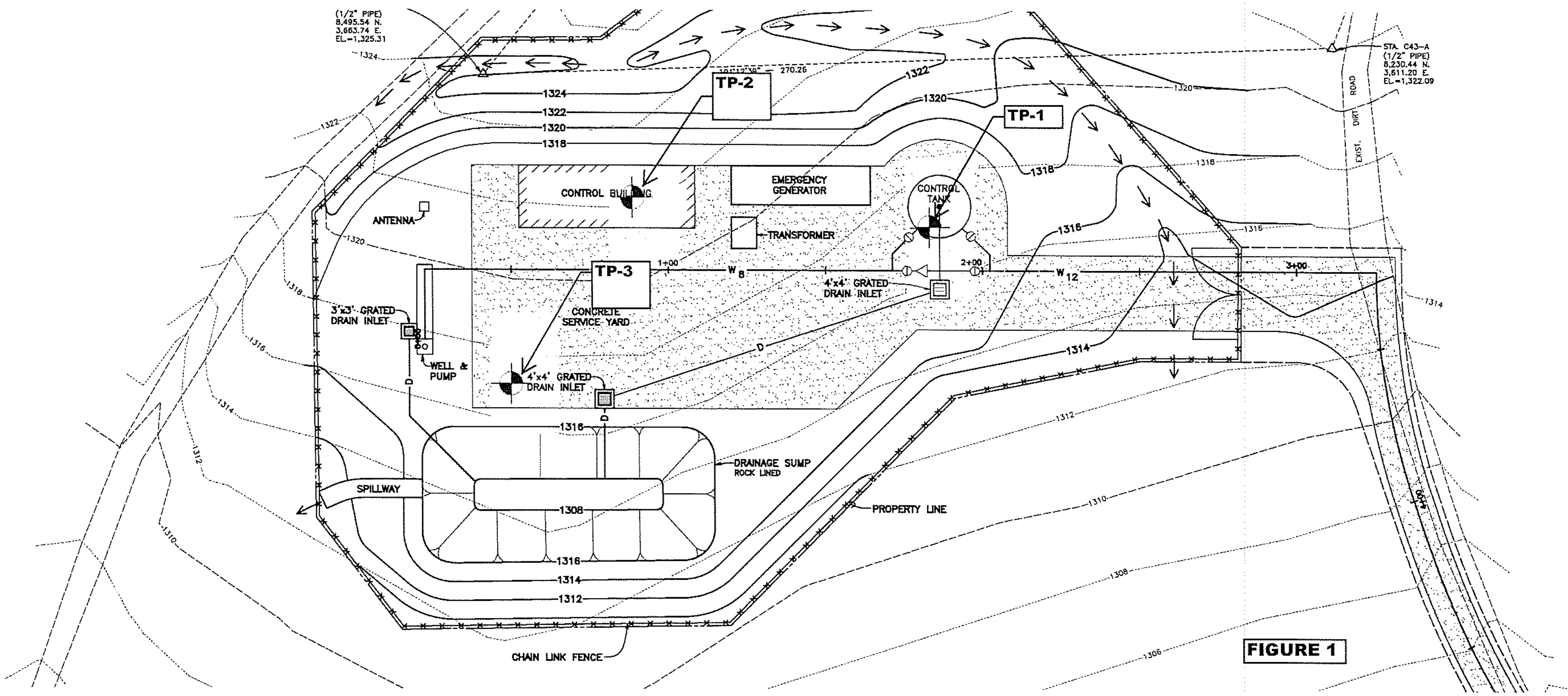
The client has the responsibility to see that all parties to the project, including the designer, contractor, subcontractor, etc., are made aware of this report in its entirety. This report contains information that may be useful in the preparation of contract specifications. However, the report is not designed as a specification document and may not contain sufficient information for this use without proper modification.

The recommendations contained in this report are based on our field observations and our present knowledge of the proposed construction. It is possible that soil conditions could vary between or beyond the areas observed. If soil conditions are encountered during construction which differ from those described herein, we should be notified immediately in order that a review may be made and any supplemental recommendations provided.

This report may be used only by the client and only for the purpose stated, within a reasonable time from its issuance. Land use, site conditions (both onsite and offsite) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Hawaii Geotechnical Consulting, Inc. of such intended use. Based on the intended use of this report, Hawaii Geotechnical Consulting, Inc. may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Hawaii Geotechnical Consulting, Inc. from any liability resulting from the use of this report by any unauthorized party.

END OF LIMITATIONS

FIGURES



(1/2" PIPE)
8,495.54 N.
3,663.74 E.
EL.=1,325.31
STA. C43-A
(1/2" PIPE)
8,230.44 N.
3,611.20 E.
EL.=1,322.09
EXIST. DIRT ROAD
270.26
TP-1
TP-2
TP-3
CONTROL BUILDING
EMERGENCY GENERATOR
TRANSFORMER
CONTROL TANK
ANTENNA
1+00
2+00
3+00
W 8
W 12
4'x4' GRATED DRAIN INLET
3'x3' GRATED DRAIN INLET
CONCRETE SERVICE YARD
WELL & PUMP
4'x4' GRATED DRAIN INLET
DRAINAGE SUMP
ROCK LINED
SPILLWAY
PROPERTY LINE
CHAIN LINK FENCE
1324
1322
1320
1318
1316
1314
1312
1310
1308
1306

FIGURE 1

APPENDIX A
Field Exploration

APPENDIX A
FIELD EXPLORATION

The subsurface exploration program for the proposed tank replacement included excavating a total of 3 test pits. The test pits were excavated to maximum depths of 10 feet below the existing ground surface. The approximate test pit locations are shown on the Test Pit Location Plan, Figure 1.

The Logs of Test Pits are presented as Figures A2 through A4 in Appendix A. The Logs of Test Pits describe the materials encountered, samples obtained, and show field and laboratory tests performed. The logs also show the test pit number, excavation date, name of the logger and drilling subcontractor and the groundwater level. A senior geotechnical engineer logged the materials encountered in accordance with the USCS. The boundaries between soil types shown on the logs are approximate because the transition between different soil layers may be gradual. Disturbed grab and undisturbed drive samples were obtained at locations determined during the field investigation.

The test pits were excavated with a rubber tired backhoe equipped with an 24 inch wide, 5-tooth bucket. Each test pit was excavated to an initial depth of 4 to 5 feet below the existing ground surface. The cut face of each test pit was then hand logged and disturbed grab and bulk samples were obtained where appropriate. After initial logging and sample collection, each excavatable test pit was extended further. During the additional excavation, the disturbed soil cuttings were observed and sampled when visual changes were observed.

Date Completed:	6/16/2018	**Water Depth:**	Not Encountered
Drilled By:	Alpha, Inc.	**Elevation:**	1317
Drilling Method:	Backhoe	**Location:**	Tank
Logged By:	R.M. Gibbens, P.E.		

Depth (feet)	Sample No.	GEOTECHNICAL DESCRIPTION	Penetrometer	Dry Density (pcf)	Moisture (%)	Additional Tests
1	1	SILTY SAND (SM) with Gravel brown/gray, dense, moist	--	72	40	Gravel = 24% Sand = 50% Silt/Clay = 26%
2						
3	2	SAND (SM) with some Silt orange brown, dense, moist	--	70	43	Gravel = 0% Sand = 84% Silt/Clay = 16%
4		Residual Soil				
5	3	SANDY SILT (ML) with trace Gravel orange brown, dense, moist	--	--	42	Gravel = 2% Sand = 44% Silt/Clay = 54%
6		Residual Soil				
7						
8	4	BASALT (WH/WC), broken, soft gray	--	--	40	Gravel = 32% Sand = 28% Silt/Clay = 40%
9						
10		Formation				
		Bottom of excavation at 10 ft. No free water observed Test pit backfilled with excavated material				

Hawaii Geotechnical Consulting, Inc.

Project No. 18011.01
Date: 7/20/2018

KAHANA PRODUCTION WELL
KAANAPALI, MAUI, HAWAII

LOG OF TEST PIT 1

FIGURE A1

Date Completed:	6/16/2018	**Water Depth:**	Not Encountered
Drilled By:	Alpha, Inc.	**Elevation:**	1322
Drilling Method:	Backhoe	**Location:**	Control Bldg.
Logged By:	R.M. Gibbens, P.E.		

Depth (feet)	Sample No.	GEOTECHNICAL DESCRIPTION	Penetrometer	Dry Density (pcf)	Moisture (%)	Additional Tests
1	1	SILTY SAND (SM) with Gravel orange brown, medium dense to dense, moist	--	75	40	Gravel = 2% Sand = 53% Silt/Clay = 45%
2						
3	2		--	70	39	Gravel = 2% Sand = 61% Silt/Clay = 37%
4		Residual Soil				
5	3	GRAVEL (GM) with Sand and Silt orange brown, dense, moist	--	--	48	Gravel = 52% Sand = 27% Silt/Clay = 21%
6		Residual Soil				
7						
8	4	SANDY SILT (ML) with Gravel and Cobble orange brown, dense, moist	--	--	43	Gravel = 30% Sand = 30% Silt/Clay = 40%
9						
10		Residual Soil				
		Bottom of excavation at 10 ft. No free water observed Test pit backfilled with excavated material				

Hawaii Geotechnical Consulting, Inc.

Project No. 18011.01
Date: 7/20/2018

KAHANA PRODUCTION WELL
KAANAPALI, MAUI, HAWAII

LOG OF TEST PIT 2

FIGURE A2

Date Completed: 6/16/2018 **Water Depth:** Not Encountered
Drilled By: Alpha, Inc. **Elevation:** 1317
Drilling Method: Backhoe **Location:** Pad
Logged By: R.M. Gibbens, P.E.

Depth (feet)	Sample No.	GEOTECHNICAL DESCRIPTION	Penetrometer	Dry Density (pcf)	Moisture (%)	Additional Tests
1	1	SILTY SAND (SM) with trace Gravel orange brown, medium dense to dense, moist	--	76	41	Gravel = 0% Sand = 52% Silt/Clay = 48%
2						
3	2		--	71	38	Gravel = 2% Sand = 59% Silt/Clay = 41%
4						
5	3		--	--	38	Gravel = 4% Sand = 50% Silt/Clay = 46%
6		Residual Soil				
7						
8	4	SILTY SAND (SM) with Gravel and Cobble orange brown, dense, moist	--	--	40	Gravel = 25% Sand = 40% Silt/Clay = 35%
9						
10		Residual Soil				
		Bottom of excavation at 10 ft. No free water observed Test pit backfilled with excavated material				

Hawaii Geotechnical Consulting, Inc.

Project No. 18011.01
Date: 7/20/2018

KAHANA PRODUCTION WELL
KAANAPALI, MAUI, HAWAII

LOG OF TEST PIT 3

FIGURE A3

APPENDIX B
LABORATORY TESTING

Laboratory testing was performed on selected drive and bulk samples to estimate their pertinent engineering characteristics. Testing was performed in accordance with ASTM Standards for Soil Testing, latest revision.

MOISTURE CONTENT AND DRY DENSITY

Natural moisture content and dry density tests were performed on multiple samples in accordance with ASTM D2216 and D2937, respectively. The results of these tests are presented on the Logs of Borings ad Logs of Test Pits in Appendix A.

GRAIN SIZE

Grain size analyses were performed on select samples in accordance with ASTM D2487. The results are presented on the Logs of Test Pits in Appendix A.

PLASTICITY

Atterberg limits tests were performed in accordance with ASTM D4318. The results of the tests are presented on the Logs of Test Pits in Appendix A.

BIOLOGICAL RESOURCES SURVEY FOR MAHINAHINA WELL AND TRANSMISSION LINE

APPENDIX J-1

OCT 26 2012

BIOLOGICAL RESOURCES SURVEY

for the

MAHINAHINA WELL & TRANSMISSION LINE PROJECT

LAHAINA, MAUI

by

Robert W. Hobdy
Environmental Consultant
Kokomo, Maui
October 2012

Prepared for:
Department of Water Supply
Maui County

BIOLOGICAL RESOURCES SURVEY
MAHINAHINA WELL AND TRANSMISSION LINE PROJECT
MAHINAHINA, LAHAINA, HAWAII

INTRODUCTION

The Mahinahina Well and Transmission Line Project lies on moderately sloping lands between one and two miles mauka of the Kapalua-West Maui Airport in northwestern West Maui (see Figure 1). The project consists of a 2 acre well site, a 5,000 foot transmission line and a 0.5 acre mixing tank site located adjacent to the existing Mahinahina Surface Water Treatment Plant. This biological resources study was initiated in compliance with environmental requirements of the planning process.

SITE DESCRIPTION

The project lies on former agricultural lands that were associated with both pineapple and sugar cane production. These fields have been abandoned for over 10 years and are currently overgrown with trees, shrubs and grasses. The well site is situated at the top, below the West Maui Forest Reserve at 1,340 feet elevation. The transmission line runs downhill on an old field boundary roadway adjacent to Onepeha Gulch, crosses the Honokohau Ditch and terminates near the mixing tank site and the Mahinahina Surface Water Treatment Plant at 625 feet elevation where it will enter the existing domestic water system. Soils along this route are deep silty clays of the Olelo, Alaeloa and Kahana soil series (Foot et al, 1972). Rainfall ranges from 50 inches per year at the well site at the top down to 40 inches per year at the bottom at the mixing tank site (Armstrong, 1983).

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna survey of the Mahinahina Well and Transmission Line project that was conducted in October 2012. The objectives of the survey were to:

1. Document what plant and animal species occur on the property or may likely occur in the existing habitat.

2. Document the status and abundance of each species.

3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.

4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.

5. Note which aspects of the proposed development pose significant concerns for plants or for wildlife and recommend measures that would mitigate or avoid these problems.

BOTANICAL SURVEY REPORT

SURVEY METHODS

A walk-through botanical survey method was used following routes that would ensure complete coverage of the property. Areas most likely to harbor native or rare plants were more intensively examined. Notes were made on plant species, distribution and abundance as well as on terrain and substrate.

DESCRIPTION OF THE VEGETATION

The vegetation on the well site, along the transmission line and at the mixing tank site corridor consists mostly of non-native, weedy species that have colonized the abandoned agricultural lands. A total of 77 plant species were recorded during the survey. Four non-native species, Formosa koa (*Acacia confusa*), sourgrass (*Digitaria insularis*), molasses grass (*Melinis minutiflora*) and Natal red top (*Melinis repens*), were found to be most common and together dominated the site. Just 4 native plant species were found in the project area, ni'ani'au or sword fern (*Nephrolepis exaltata*), koali 'awahia (*Ipomoea indica*), 'uhaloa (*Waltheria indica*) and ūlei (*Osteomeles anthyllidifolia*). All of these are indigenous native plants that are common in Hawaii and are also found on other Pacific islands.

DISCUSSION AND RECOMMENDATIONS

The vegetation within this project area is dominated by non-native species that have proliferated on this abandoned agricultural land. Just 4 native plant species were found during the survey, and these are all widespread and common in Hawaii. None of these native plants are of any particular environmental concern. No Endangered or Threatened species occur on or near this project area, nor were any species that are candidates for such status found. No special native plant habitats were observed.

West Maui has extensive areas of protected native habitat and there are a substantial number of Endangered species in this area which consists of dense native forests and summit bogs. The closest Endangered plants to this project area include, mahoe (*Alectryon macrococcus*) and (*Bonamia menziesii*) no common name, which are located in Honokowai Canyon about 1 mile to the southeast. Another Endangered species is kauila (*Colubrina oppositifolia*) which occurs in the Kapunakea Preserve about 2 miles to the southeast of the project. All of these species, and all of the rest of the Endangered plant species in this corner of West Maui, occur in well protected ecosystems in wet forests above this area. These areas are protected from ungulates and are not particularly susceptible to fire.

The proposed development of this domestic water system is not expected to result in any significant negative impacts to the botanical resources in this part of West Maui.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within four groups: Ferns, Confifers, Monocots and Dicots. Taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999).

For each species, the following information is provided:

1. Scientific name with author citation

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   Polynesian introduction = plants introduced to Hawai'i in the course of Polynesian migrations and prior to western contact.
   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.
   common = widely scattered throughout the area or locally abundant within a portion of it.
   uncommon = scattered sparsely throughout the area or occurring in a few small patches.
   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
FERNS			
ATHYRIACEAE (Lady Fern Family)			
Deparia petersenii (Kunze) M. Kato	------------------------	non-native	rare
NEPHROLEPIDACEAE (Sword Fern Family)			
Nephrolepis brownii (Desv.) Hovencamp & Miyamoto	Asian sword fern	non-native	uncommon
Nephrolepis exaltata (L.) Schott	*ni'ani'au*	indigenous	rare
PTERIDACEAE (Brake Fern Family)			
Cheilanthes viridis (Forssk.) Sw.	green cliff brake	non-native	rare
CONIFERS			
ARAUCARIACEAE (Araucaria Family)			
Araucaria columnaris (G. Forster) J.D. Hooker	Cook pine	non-native	rare
CUPRESSACEAE (Cypress Family)			
Callitris columellaris F. Mueller	white cypress-pine	non-native	rare
MONOCOTS			
ASPARAGACEAE (Asparagus Family)			
Furcraea foetida (L.) Haw.	Mauritius hemp	non-native	rare
BROMELIACEAE (Bromeliad Family)			
Ananas comosus (L.) Merrill	pineapple	non-native	uncommon
COMMELINACEAE (Spiderwort Family)			
Commelina diffusa N.L. Burm.	honohono	non-native	rare
HYDROCHARITACEAE (Frog's-bit Family)			
Vallisneria americana Michaux	tape grass	non-native	rare
POACEAE (Grass Family)			
Andropogon viriginicus L.	broomsedge	non-native	uncommon
Cenchrus echinatus L.	common sandbur	non-native	rare
Chloris barbata (L.) Sw.	swollen fingergrass	non-native	rare
Coix lacryma-jobi L.	Job's tears	non-native	rare
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	rare
Digitaria insularis (L.) Mez ex Ekman	sourgrass	non-native	common
Digitaria violascens Link	smooth crabgrass	non-native	rare
Megathyrsus maximus (Jacq.) Simon & Jacobs	Guinea grass	non-native	uncommon
Melinis minutiflora P. Beauv.	molasses grass	non-native	common
Melinis repens (Willd.) Zizka	Natal redtop	non-native	common
Paspalum conjugatum Bergius	Hilo grass	non-native	rare
Paspalum dilatatum Poir.	Dallis grass	non-native	rare
Paspalum urvillei Steud.	Vasey grass	non-native	uncommon
Setaria parviflora (Poir.) Kerguelen	yellow foxtail	non-native	rare
Urochloa mutica (Forssk.) T. Q. Nguyen	California grass	non-native	rare
Urochloa subquadripara (Trin.) R.D. Webster	------------------------	non-native	rare
DICOTS			
ANACARDIACEAE (Mango Family)			
Schinus terebinthifolius Raddi	Christmas berry	non-native	uncommon
APOCYNACEAE (Dogbane Family)			

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Asclepias physocarpa (E.Mey.) Schlecter	baloon plant	non-native	uncommon
ASTERACEAE (Sunflower Family)			
Acanthospermum australe (Loefl.) Kuntze	spiny bur	non-native	rare
Ageratina adenophora (Spreng.) King & Robinson	Maui pamakani	non-native	rare
Bidens pilosa L.	Spanish needle	non-native	rare
Conyza bonariensis (L.) Cronq.	hairy horseweed	non-native	uncommon
Crassocephalum crepidioides (Benth.) Moore	redflower ragleaf	non-native	rare
Emilia fosbergii Nicolson	red pualele	non-native	rare
Hypochoeris radicata L.	gosmore	non-native	rare
Pluchea carolinensis (Jacq.) G.Don	sourbush	non-native	rare
Senecio madagascariensis Poir.	fireweed	non-native	rare
Sonchus oleraceus L.	pualele	non-native	rare
Tridax procumbens L.	coat buttons	non-native	rare
BRASSICACEAE (Mustard Family)			
Lepidium virginicum L.	pepperwort	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea indica (J. Burm.) Merr.	koali 'awahia	indigenous	uncommon
Ipomoea obscura (L.) Ker-Gawl.	----------------	non-native	rare
CUCURBITACEAE (Gourd Family)			
Momordica charantia L.	bitter melon	non-native	rare
EUPHORBIACEAE (Spurge Family)			
Euphorbia heterophylla L.	kaliko	non-native	rare
Euphorbia hypericifolia L.	graceful spurge	non-native	rare
FABACEAE (Pea Family)			
Acacia confusa Merr.	Formosa koa	non-native	common
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	uncommon
Crotalaria brevidens Benth.	--------------------	non-native	uncommon
Crotalaria pallida Aiton	smooth rattlepod	non-native	rare
Crotalaria retusa L.	--------------------	non-native	rare
Indigofera hendecaphylla Jacq.	creeping indigo	non-native	rare
Indigofera suffruticosa Mill.	'inikō	non-native	uncommon
Leucaena leucocephala (Lam.) de Wit	koa haole	non-native	rare
Macroptilium atropurpureum (DC.) Urb.	siratro	non-native	rare
Macroptilium lathyroides (L.) Urb.	wild bean	non-native	rare
Senna occidentalis (L.) Link	coffee senna	non-native	rare
LAMIACEAE (Mint Family)			
Leonotis nepetifolia (L.) R. Br.	lion's ear	non-native	rare
LYTHRACEAE (Loosestrife Family)			
Lythrum maritimum Kunth	pūkāmole	non-native	rare
MALVACEAE (Mallow Family)			
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	non-native	rare
Sida rhombifolia L.	Cuban jute	non-native	rare
Sida spinosa L.	prickly sida	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Waltheria indica L.	'uhaloa	indigenous	uncommon
MELASTOMATACEAE (Melastoma Family)			
Clidemia hirta (L.) D.Don	Koster's curse	non-native	rare
Tibouchina herbacea (DC.) Cogn.	cane tibouchina	non-native	rare
MYRTACEAE (Myrtle Family)			
Psidium guajava L.	common guava	non-native	rare
Syzygium cumini (L.) Skeels	Java plum	non-native	rare
NYCTAGINACEAE (Four-o'clock Family)			
Boerhavia coccinea Mill.	scarlet spiderling	non-native	rare
ONAGRACEAE (Evening Primrose Family)			
Ludwigia octovalvis (Jacq.) Raven	primrose willow	non-native	rare
OXALIDACEAE (Wood Sorrel Family)			
Oxalis corniculata L.	'ihi, yellow wood sorrel	Polynesian	rare
PASSIFLORACEAE (Passion Flower Family)			
Passiflora suberosa L.	cork-bark passion flower	non-native	rare
PLANTAGINACEAE (Plantain Family)			
Buddleja asiatica Lour.	dog tail	non-native	uncommon
Plantago lanceolata L.	English plantain	non-native	rare
POLYGALACEAE (Milkwort Family)			
Polygala paniculata L.	fragrant milkwort	non-native	rare
PROTEACEAE (Protea Family)			
Grevillea robusta A. Cunn. ex R.Br.	silk oak	non-native	rare
ROSACEAE (Rose Family)			
Osteomeles anthyllidifolia (Sm.) Lindl.	'ūlei	indigenous	rare
VERBENACEAE (Verbena Family)			
Lantana camara L.	lantana	non-native	rare
Stachytarpheta jamaicensis (L.) Vahl.	Jamaica vervain	non-native	rare

FAUNA SURVEY REPORT

SURVEY METHODS

A walk-through survey method was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. Notes were made on species, abundance, activities and location as well as observations of trails, tracks, scat and signs of feeding. In addition an evening visit was made to the area to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*), the Hawaiian petrel (*Pterodroma sandwichensis*) or the Newell's shearwater (*Puffinus newelli*) in the area.

RESULTS

MAMMALS

Just two non-native mammals were seen during two site visits. Taxonomy and nomenclature follow Tomich (1986).

One mongoose (*Herpestes auropunctatus*) was seen along the transmission line road and tracks of a domestic dog (*Canis familiaris*) were seen at the well site where human activity occurs.

A few other non-native mammals would be expected to occur in this area. These include rats (*Rattus* spp.), mice (*Mus domesticus*) and feral cats (*Felis catus*). Rats and mice feed on seeds, fruits, bird eggs and herbaceous vegetation, while feral cats feed on these rodents and birds.

A special effort was made to look for sign of the Hawaiian hoary bat by making an evening survey at two locations in the project area. When present in an area these bats can be easily identified as they forage for insects, their distinctive flight patterns clearly visible in the glow of twilight. No bats were seen though visibility was excellent. In addition a bat detection device (Batbox IIID) was employed, set to the frequency of 27,000 hertz which these bats are known to use in echolocation. No bats were detected using this device either.

BIRDS

Birdlife was moderate in species representation and in total numbers within the project area. Twelve species of non-native species were seen during two site visits. Taxonomy and nomenclature follow American Ornithologists' Union (2011). Just one species was found to be common throughout the project area, the zebra dove (*Geopelia striata*). Less common were, house finch (*Carpodacus mexicanus*), spotted dove (*Streptopelia chinensis*), nutmeg mannikin (*Lonchura punctulata*), common myna (*Acridotheres tristis*), gray francolin (*Francolinus pondicerianus*) and the migratory kōlea (*Pluvialis fulva*). Of rare occurrence were, Java sparrow (*Padda oryzivora*), the migratory 'akekeke (*Arenaria interpres*), cattle egret (*Bubulcus ibis*), northern cardinal (*Cardinalis cardinalis*) and Japanese white-eye (*Zosterops japonicus*).

Department of Water Supply personnel say that they see a variety of other birds around the Mahinahina Surface Water Treatment Plant with its reservoir and irrigated lawns. They see the Endangered ae'o or Hawaiian stilt that occasionally visit the margins of their reservoir. The nēnē or Hawaiian goose also occasionally visit the irrigated lawns in flocks of up to 20 birds to feed on the grass. The pueo or Hawaiian owl has also been seen rarely, cruising the skies during the day, hunting for rodents.

An evening survey conducted at both the well site and the mixing tank site failed to pick up any calls from either the Hawaiian petrel or the Newell's shearwater. In West Maui these seabirds have their nesting burrows high in the mountains in wet fern forest. One adult bird in a pair, returning to its burrow with food for its young, will call out to its mate in the burrow which returns the call. These calls are loud and can be heard at great distances. No calls were heard.

The occasional presence of ae'o around the Mahinahina Reservoir and the occasional presence of the Endangered nēnē on the lawn of the Mahinahina Surface Water Treatment Plant, which both lie in the general vicinity of the proposed project should be addressed. While there is no control over when these birds may show up, and there is no obvious threat to them in the areas they would normally occupy, their Endangered status requires a precautionary approach. It is recommended that all employees that work around this facility and all selected contractors on the proposed project be educated about these birds legal status and the need to ensure they are not accidentally or intentionally harmed or harassed.

With the consideration of the above recommendations, it is determined that his proposed project is not likely to have a significant negative impact on the fauna resources in this part of West Maui.

REPTILES

One non-native garden skink (*Lampropholis delicata*) was seen in leaf litter in forest at the well site. This Australian skink is now widespread in Hawaii.

INSECTS

A total of 10 species of insects in five Orders were observed during two site visits. Taxonomy and nomenclature follow Nishida et al (1992). Of these three were widespread and common in the project area, the Sonoran carpenter bee (*Xylocopa sonorina*), the long-tailed blue butterfly (*Lampides boeticus*) and the Argentine ant (*Linepithema humile*).

Two dragonfly species were found to be native to Hawaii, the green darner (*Anax junius*) and the globe skimmer (*Pantala flavescens*), both of which are indigenous. The green darner is widespread in Hawaii as well as in the soutrhern U.S.A. and Mexico. The globe skimmer is found in the tropics and subtropics worldwide. Neither is of any conservation concern.

No Endangered or Threatened insect species were found during the survey and no known hosts of any such species were seen either.

DISCUSSION AND RECOMMENDATIONS

Out of all the fauna observed on the project area, just two indigenous dragonflies, the green darner and the globe skimmer are native species. Both of these insects are widespread and common in Hawaii and are found in other parts of the world as well. Neither are of any particular conservation concern. The project habitat has been altered by over a century of agricultural activity and is now overwhelmingly inhabited by non-native organisms. The immediate surrounding habitat is similar.

One potential threat posed by the project involves the Endangered seabirds the Hawaiian petrel (*Pterodroma sandwichensis*) and the Threatened Newell's shearwater (*Puffinus newelli*). These seabirds nest high in the mountains during the spring, summer and fall months. These birds fly over the lowlands during the late evening hours to reach their burrows and fly back to the ocean in the early dawn hours. These birds can be confused by bright lights and crash into poles, wires and other structures and be injured or killed by the strike or by vehicles or animals such as cats, dogs or mongoose. Young inexperienced birds, taking their inaugural fledgling flights in the late fall are particularly vulnerable. It is recommended that any significant outdoor flood lights or pole lights be hooded to direct the light downward to minimize the distractions and dangers to these birds.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within four groups: Mammals, Birds, Reptiles and Insects. For each species the following information is provided:

1. Common name
2. Scientific name
3. Bio-geographical status. The following symbols are used:

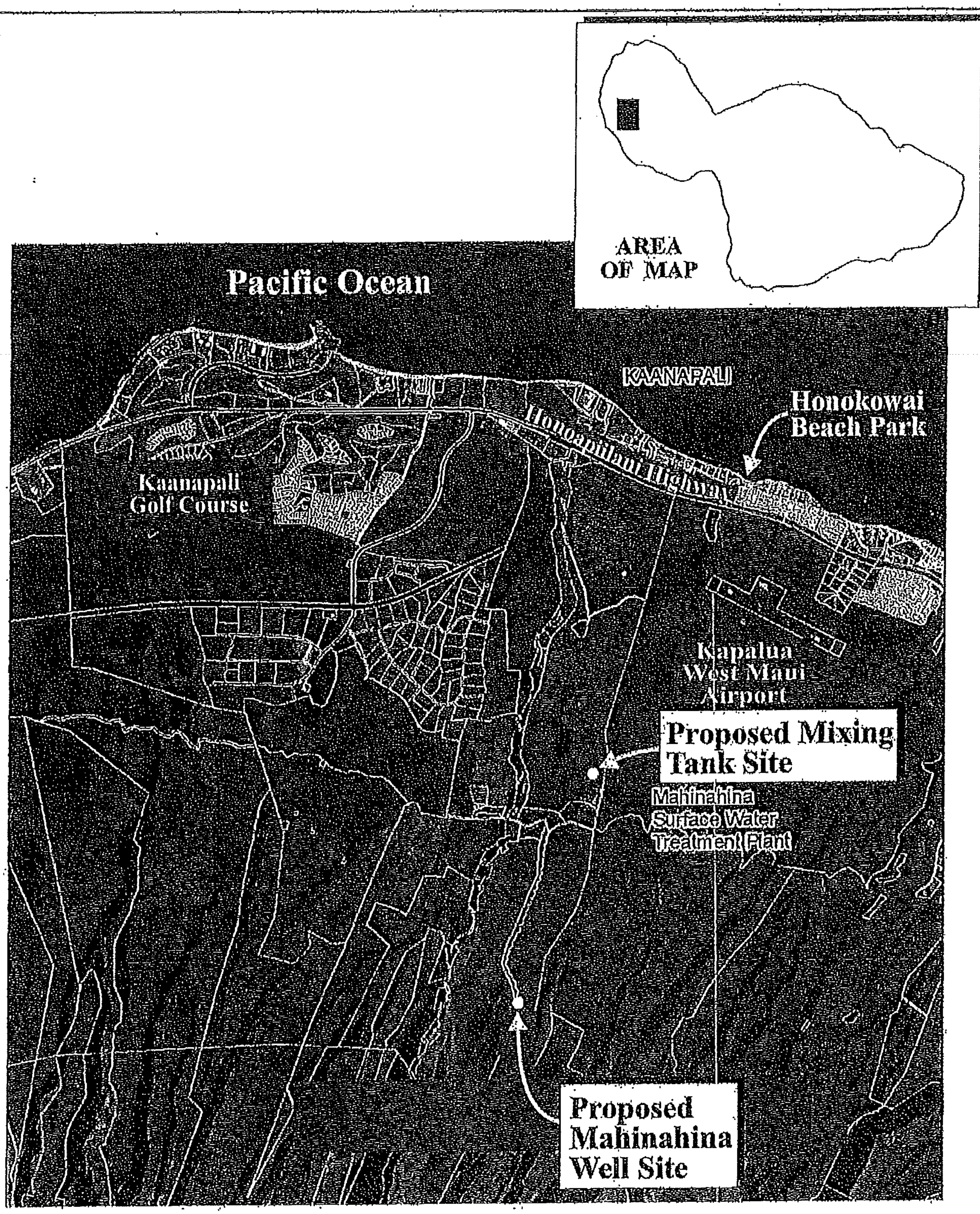
    endemic = native only to Hawaii; not naturally occurring anywhere else in the world.
    indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
    non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.
    migratory = spending a portion of the year in Hawaii and a portion elsewhere. In Hawaii the migratory birds are usually in the overwintering/non-breeding phase of their life cycle.

4. Abundance of each species within the project area:

    abundant = many flocks or individuals seen throughout the area at all times of day.
    common = a few flocks or well scattered individuals throughout the area.
    uncommon = only one flock or several individuals seen within the project area.
    rare = only one or two seen within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MAMMALS			
Herpestes auropunctatus Hodgeson	small Indian mongoose	non-native	uncommon
Canis familiaris L.	domestic dog	non-native	rare
BIRDS			
Geopelia striata L.	zebra dove	non-native	common
Carpodacus mexicanus Muller	house finch	non-native	uncommon
Streptopelia chinensis Scopoli	spotted dove	non-native	uncommon
Lonchura punctulata L.	nutmeg mannikin	non-native	uncommon
Acridotheres tristis L.	common myna	non-native	uncommon
Francolinus pondicerianus Gmelin	gray francolin	non-native	uncommon
Pluvialis fulva Gmelin	*kōlea*, Pacific golden-plover	migratory	uncommon
Padda oryzivora L.	Java sparrow	non-native	rare
Arenaria interpres L.	*'akekeke*, ruddy turnstone	migratory	rare
Bubulcus ibis L.	cattle egret	non-native	rare
Cardinalis cardinalis L.	northern cardinal	non-native	rare
Zosterops japonicus	Japanese white-eye	non-native	rare
REPTILES			
Lampropholis delicata De Vis	garden skink	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
INSECTS			
Order DIPTERA - flies			
CALLIPHORIDAE (Blowfly Family)			
Calliphora vomitoria L.	blow fly	non-native	uncommon
Order HYMENOPTERA - bees, wasps & ants			
APIDAE (Honey bee Family)			
Xylocopa sonorina Smith	Sonoran carpenter bee	non-native	common
FORMICIDAE (Ant Family)			
Linepithema humile Mayr	Argentine ant	non-native	common
VESPIDAE (Vespid Wasp Family)			
Vespula pennsylvanica Saussure	western yellowjacket	non-native	uncommon
Order LEPIDOPTERA - butterflies & moths			
LYCAENIDAE (Gossamer - winged Butterfly Family)			
Lampides boeticus L.	long-tailed blue butterfly	non-native	common
NYMPHALIDAE (Brush-footed Butterfly Family)			
Danaus plexippus L.	monarch butterfly	non-native	uncommon
Order ODONATA - dragonflies & damselflies			
AESHNIDAE (Hawker Dragonfly Family)			
Anax junius Drury	green darner	indigenous	rare
COENAGRIONIDAE (Damselfly Family)			
Enallagma civile Hagen	familiar bluet	non-native	rare
LIBELLULIDAE (Skimmer Dragonfly Family)			
Pantala flavescens Fabricius	globe skimmer	indigenous	uncommon
Order ORTHOPTERA - grasshoppers & crickets			
ACRIDIDAE (Grasshopper Family)			
Oxya japonica Thunberg	small rice grasshopper	non-native	rare



Source: Fukunaga & Associates, Inc.

Figure 1

Mahinahina Production Well
Improvements
Regional Location Map

NOT TO SCALE

MUNEKIYO & HIRAGA, INC.

Prepared for: County of Maui, Department of Water Supply

Figure 2 Transmission line corridor below the well site.

Figure 3 Lower portion of the transmission line corridor.
The Mahinahina Surface Water Treatment Plant is visible in the distance.

Figure 4 The transmission line crosses the Honokohau Ditch before reaching the bottom.

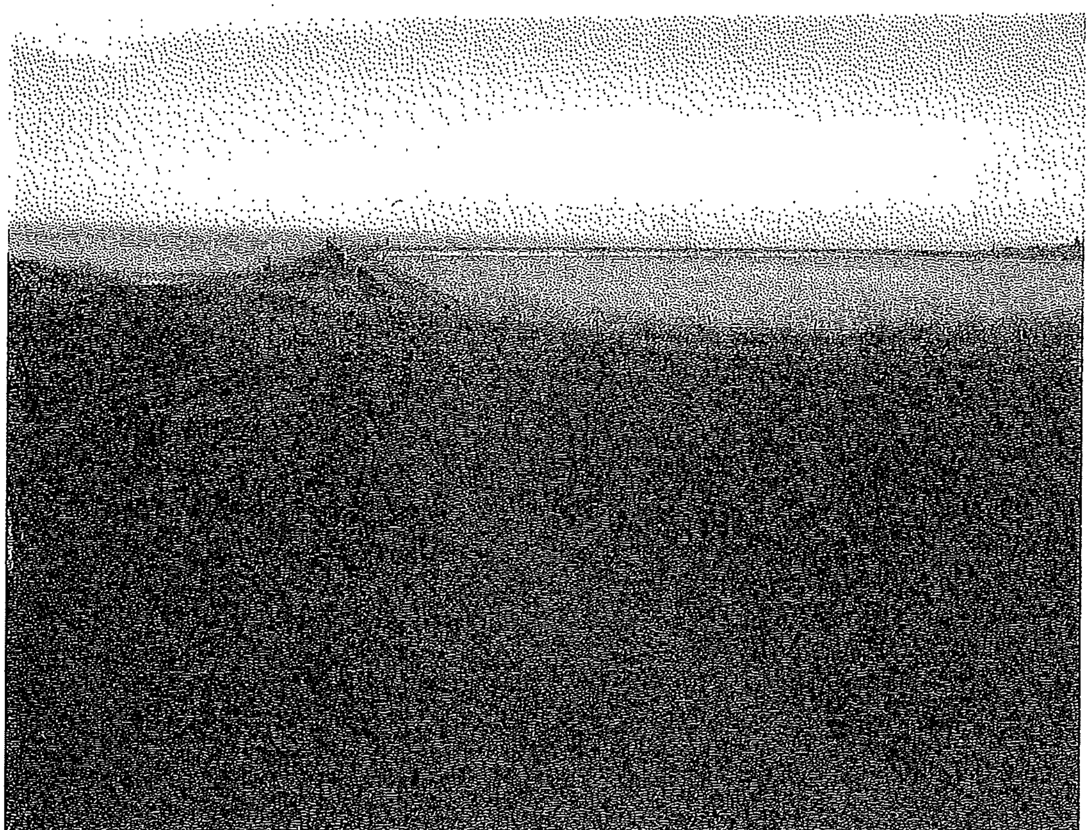


Figure 5 The transmission line passes alongside the new Mahinahina Reservoir above the treatment plant.


Figure 6 Mahinahina Surface Water Treatment Plant is located alongside the transmission line just above its terminus at the mixing tank site.

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BIOLOGICAL RESOURCES SURVEY FOR KAHANA WELL

APPENDIX J-2

BIOLOGICAL RESOURCES SURVEY

for the

WEST MAUI WELL No.2 EXPLORATORY PROJECT

KAHANA, LAHAINA, MAUI

by

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Kokomo, Maui
September 2013

Prepared for:
Department of Water Supply
Maui County

BIOLOGICAL RESOURCES SURVEY
WEST MAUI WELL No.2 EXPLORATORY PROJECT
KAHANA, LAHAINA, HAWAII

INTRODUCTION

The West Maui Well no. 2 Exploratory Project lies on a narrow ridge top in upper Kahana, West Maui, TMK (2) 4-3-01:17 (por.). This approximately one acre site is situated on abandoned agricultural land that is overgrown with grass (see Figures 1 and 2). This biological study was initiated in fulfillment of environmental requirements of the planning process.

SITE DESCRIPTION

This site lies on gently sloping former pineapple field land that is now overgrown with four-foot deep grass and a few scattered young trees. Two steep-sided forested gulches, Kahana Gulch and Kahana iki Gulch, run down on either side of this narrow ridge top (see Figures 3 and 4). This site lies between the elevations of 1,310 feet and 1,325 feet above sea level. The soil is classified as Olelo Silty Clay, 3 – 15% slopes (OFC) (Foote et al, 1972) which is a deep, well-drained, dark reddish-brown, strongly-acid soil. Annual rainfall averages between 70 inches and 75 inches with most falling during winter storms (Armstrong, 1983).

SITE HISTORY

This ridge top was once a native forest with a great variety of trees, shrubs, vines and ferns, including : 'ōhi'a (*Metrosideros polymorpha*), 'a'ali'i (*Dodonaea viscosa*), alahe'e (*Psydrax odorata*), lama (*Diospyros sandwicensis*), pūkiawe (*Leptecophylla tameiameiae*), ūlei (*Osteomeles anthyllidifolia*), 'ākia (*Wikstroemia oahuensis*), kilau fern (*Pteridium aquilinum* var. *decompositum*), 'ōkupukupu (*Nephrolepis exaltata*) and uluhe fern (*Dicranopteris linearis*). All of these and others still thrive in the nearby gulches.

In the early 1900s this ridge top was cleared and converted to pineapple agriculture. The site has been plowed, planted and cultivated for over 70 years. These fields were abandoned in the 1990s and the land has lain fallow for over 15 years.

Today the site is overgrown with a dense layer of grass and a few small trees are scattered throughout the area.

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna survey of the West Maui Well No.2 Exploratory project that was conducted in September 2013. The objectives of the survey were to:

1. Document what plant and animal species occur on the property or may likely occur in the existing habitat.

2. Document the status and abundance of each species.

3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.

4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.

BOTANICAL SURVEY REPORT

SURVEY METHODS

A walk-through botanical survey method was used following routes that would ensure complete coverage of the property. Areas most likely to harbor native or rare plants were more intensively examined. Notes were made on plant species, distribution and abundance as well as on terrain and substrate.

DESCRIPTION OF THE VEGETATION

The vegetation on the entire project area is a nearly monotypic stand of molasses grass (*Melinis minutiflora*) that is very dense and about four feet deep. Two other species are uncommon, the flooded gum (*Eucalyptus rudis*) and cane tibouchina (*Tibouchina herbacea*).

A total of only 8 non-native plant species were recorded during the survey. No native plant species were found in the project area.

DISCUSSION AND RECOMMENDATIONS

The vegetation within this project area is dominated by molasses grass, an aggressive, non-native species that forms a dense growth that covers 95% of the site. The remaining seven species are all non-native plants as well, and are of no conservation interest or concern. No native plant species were recorded.

As mentioned above, several common native species thrive in the nearby, steep-sided gulches where they have always grown. None of these are rare and none have protected status.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within two groups: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999).

For each species, the following information is provided:

1. Scientific name with author citation

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.

   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).

   Polynesian introduction = plants introduced to Hawai'i in the course of Polynesian migrations and prior to western contact.

   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.

   common = widely scattered throughout the area or locally abundant within a portion of it.

   uncommon = scattered sparsely throughout the area or occurring in a few small patches.

   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MONOCOTS			
BROMELIACEAE (Bromeliad Family)			
Ananas comosus (L.) Merrill	pineapple	non-native	rare
POACEAE (Grass Family)			
Andropogon virginicus L.	broomsedge	non-native	rare
Melinis minutiflora P. Beauv.	molasses grass	non-native	abundant
Paspalum conjugatum Bergius	Hilo grass	non-native	rare
Paspalum urvillei Steud.	Vasey grass	non-native	rare
DICOTS			
FABACEAE (Pea Family)			
Indigofera suffruticosa Mill.	'inikō	non-native	rare
MELASTOMATACEAE (Melastoma Family)			
Tibouchina herbacea (DC.) Cogn.	cane tibouchina	non-native	uncommon
MYRTACEAE (Myrtle Family)			
Eucalyptus rudis Endl.	flooded gum	non-native	uncommon

FAUNA SURVEY REPORT

SURVEY METHODS

A walk-through survey method was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. Notes were made on species, abundance, activities and location as well as observations of trails, tracks, scat and signs of feeding. In addition an evening visit was made to the area to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*), the Hawaiian petrel (*Pterodroma sandwichensis*) or the Newell's shearwater (*Puffinus newelli*) in the area.

RESULTS

MAMMALS

Sign of just one non-native mammal species was seen during two site visits to the project area. Taxonomy and nomenclature follow Tomich (1986).

Rooting activity of feral pigs (*Sus scrofa*) was seen along the margin of the project area. A few other non-native mammals would be expected to occur in the project area. These include rats (*Rattus* spp.), mice (*Mus domesticus*), mongoose (*Herpestes auropunctatus*) and possibly feral cats (*Felis catus*). Rats and mice feed on seeds, fruits, herbaceous vegetation and bird eggs, while mongoose and cats feed on these rodents and birds.

A special effort was made to look for sign of the Hawaiian hoary bat by making an evening survey at two locations in the project area. When present in an area these bats can be easily identified as they forage for insects, their distinctive flight patterns clearly visible in the glow of twilight. No bats were seen though visibility was excellent. In addition a bat detection device (Batbox IIID) was employed, set to the frequency of 27,000 hertz which these bats are known to use in echolocation. No bats were detected using this device either.

BIRDS

Birdlife was rather sparse on and around this dense molasses grass habitat. Taxonomy and nomenclature follow American Ornithologists' Union (2011). Just four bird species were seen. This included zebra dove (*Geopelia striata*), nutmeg mannikin (*Lonchura punctulata*), Japanese white-eye (*Zosterops japonicus*) and spotted dove (*Streptopelia chinensis*). None of these were common. A few other non-native bird species might be expected to occur here, including the house finch (*Carpodacus mexicanus*) and the common myna (*Acridotheres tristis*).

The native pueo or short-eared owl (*Assio flammeus sandwichensis*) was not seen but might be expected to be occasionally seen flying overhead looking for rodents. This site is too low in elevation for Hawaii's native forest birds that are restricted to higher elevations, beyond the range of mosquitoes and the avian diseases they carry and transmit.

The habitat here has nothing that would attract Endangered waterbirds, the ae'o or black-necked stilt (*Himantopus mexicanus knudseni*) and the 'alae ke'oke'o or Hawaiian coot (*Fulica alai*), or the Endangered nene or Hawaiian goose (*Branta sandvicensis*). None of these birds were seen.

An evening survey conducted at the proposed well site failed to pick up any calls from either the Endangered Hawaiian petrel or the Threatened Newell's shearwater. In West Maui these seabirds have their nesting burrows high in the mountains in wet fern forest. One adult bird in a pair, returning to its burrow with food for its young, will call out to its mate in the burrow which returns the call. These calls are loud and can be heard at great distances. No calls were heard.

INSECTS

A total of 10 species of insects representing six insect Orders were observed in the project area during two site visits. Taxonomy and nomenclature follow Nishida et al (1992). Most prevalent were the Asian ambrosia beetle (*Euwallacea fornicateus*), dung fly (*Musca sorbens*), honey bee (*Apis mellifera*), big-headed ant (*Pheidole megacephala*) and passion flower butterfly (*Argaulis vanillae*). Five other species were rare.

One indigenous green darner dragonfly (*Anax junius*) was seen flying over the project area. The green darner is widespread and common in Hawaii as well as across the southern USA and in Mexico. It is not of any particular conservation concern.

DISCUSSION AND RECOMMENDATIONS

The habitat on this one acre project area is nearly monotypic grassland. This is not conducive to biological diversity of animal life. Of a total of one mammal, four bird and ten insect species, only one dragonfly, the indigenous green darner was native in Hawaii and is common on all of the main islands.

No Threatened or Endangered animal species were found on the project site and none are known to occur in the adjacent gulches. No special animal Critical Habitats occur on the project area or on nearby lands.

One potential threat posed by the project involves the Endangered seabirds the Hawaiian petrel (*Pterodroma sandwichensis*) and the Threatened Newell's shearwater (*Puffinus newelli*). These seabirds nest high in the mountains during the spring, summer and fall months. These birds fly over the lowlands during the late evening hours to reach their burrows and fly back to the ocean in the early dawn hours. These birds can be confused by bright lights and crash into poles, wires and other structures and be injured or killed by the strike or by vehicles or animals such as cats, dogs or mongoose. Young inexperienced birds, taking their inaugural fledgling flights in the late fall are particularly vulnerable. It is recommended that any significant outdoor flood lights or pole lights be hooded to direct the light downward to minimize the distractions and dangers to these birds.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within three groups: Mammals, Birds and Insects. For each species the following information is provided:

1. Common name

2. Scientific name

3. Bio-geographical status. The following symbols are used:

   endemic = native only to Hawaii; not naturally occurring anywhere else in the world.

   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).

   non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.

   migratory = spending a portion of the year in Hawaii and a portion elsewhere. In Hawaii the migratory birds are usually in the overwintering/non-breeding phase of their life cycle.

4. Abundance of each species within the project area:

   abundant = many flocks or individuals seen throughout the area at all times of day.

   common = a few flocks or well scattered individuals throughout the area.

   uncommon = only one flock or several individuals seen within the project area.

   rare = only one or two seen within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MAMMALS			
Sus scrofa L.	feral pig	non-native	rare
BIRDS			
Geopelia striata L.	zebra dove	non-native	uncommon
Lonchura punctulata L.	nutmeg mannikin	non-native	uncommon
Zosterops japonicus Temminck & Schlegel	Japanese white-eye	non-native	uncommon
Streptopelia chinensis Scopoli	spotted dove	non-native	uncommon

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
INSECTS			
Order ARANAE - true spiders			
ARANEIDAE (Orb weaver Family)			
Argiope appensa Walkenaer	common garden spider	non-native	rare
SALTICIDAE (Jumping Spider Family)			
Menemerus bivittatus Dufour	gray wall jumper	non-native	rare
Order COLEOPTERA - beetles			
SCOLYTIDAE (Bark Beetle Family)			
Euwallacea fornicatus Eichhoff	Asian ambrosia beetle	non-native	uncommon
Order DIPTERA - flies			
MUSCIDAE (Housefly Family)			
Musca sorbens Wiedemann	dung fly	non-native	uncommon
Order HYMENOPTERA - bees, wasps, ants			
APIDAE (Honey Bee Family)			
Apis mellifera L.	honey bee	non-native	uncommon
FORMICIDAE (Ant Family)			
Pheidole megacephala Fabricius	big-headed ant	non-native	uncommon
VESPIDAE (Vespid Wasp Family)			
Vespula pennsylvanica Saussure	western yellowjacket	non-native	rare
Order LEPIDOPTERA - butterflies, moths			
CRAMBIDAE (Grass Moth Family)			
Spoladea recurvalis Fabricius	beet webworm moth	non-native	rare
NYMPHALIDAE (Brush Footed Butterfly Family)			
Agraulis vanillae L.	passion flower butterfly	non-native	uncommon
Order ODONATA - dragonflies, damselflies			
AESHNIDAE (Hawker Dragonfly Family)			
Anax junius Drury	green darner	indigenous	rare

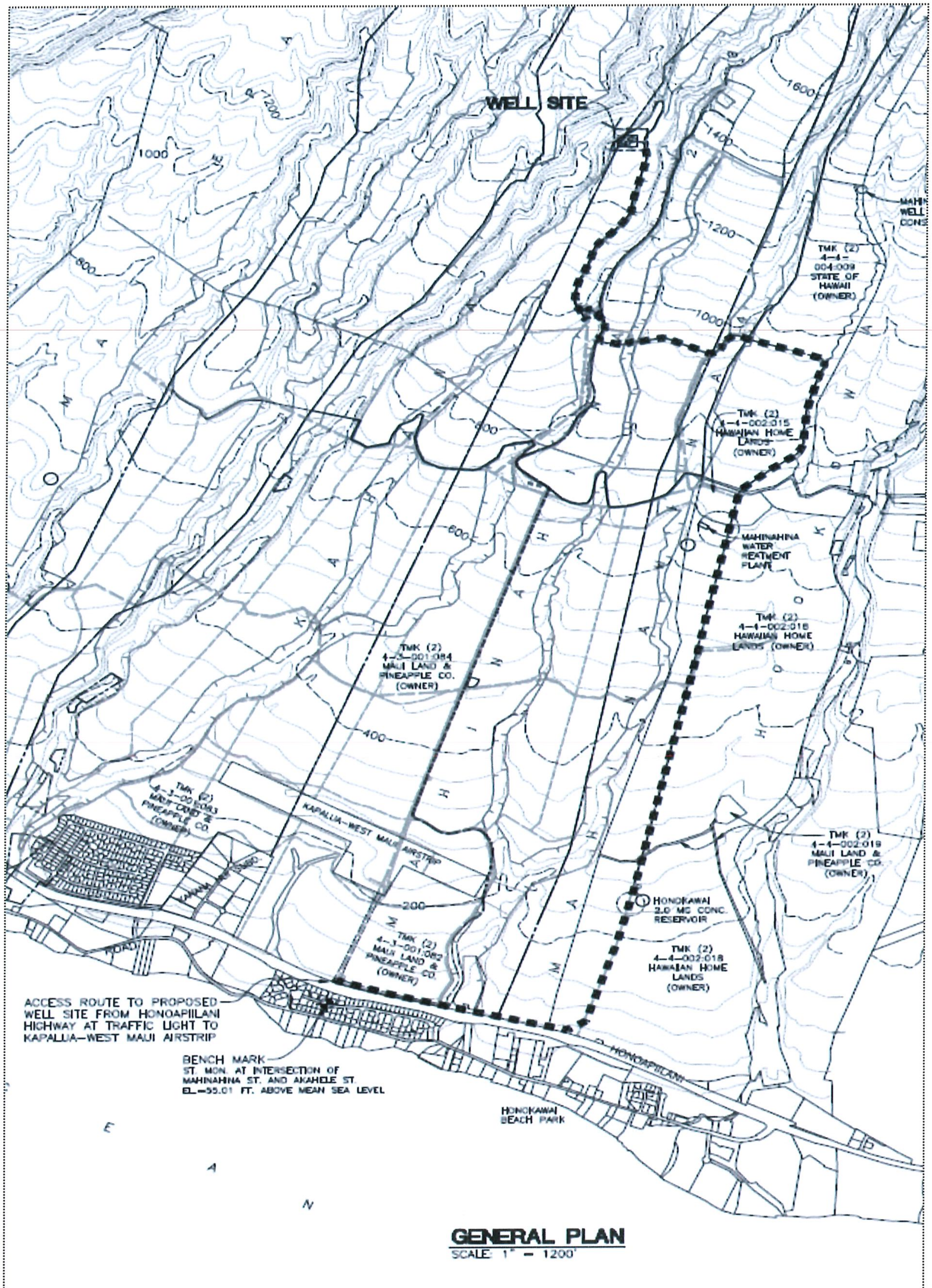

Figure 1. Project area in upper Kahana, West Maui.

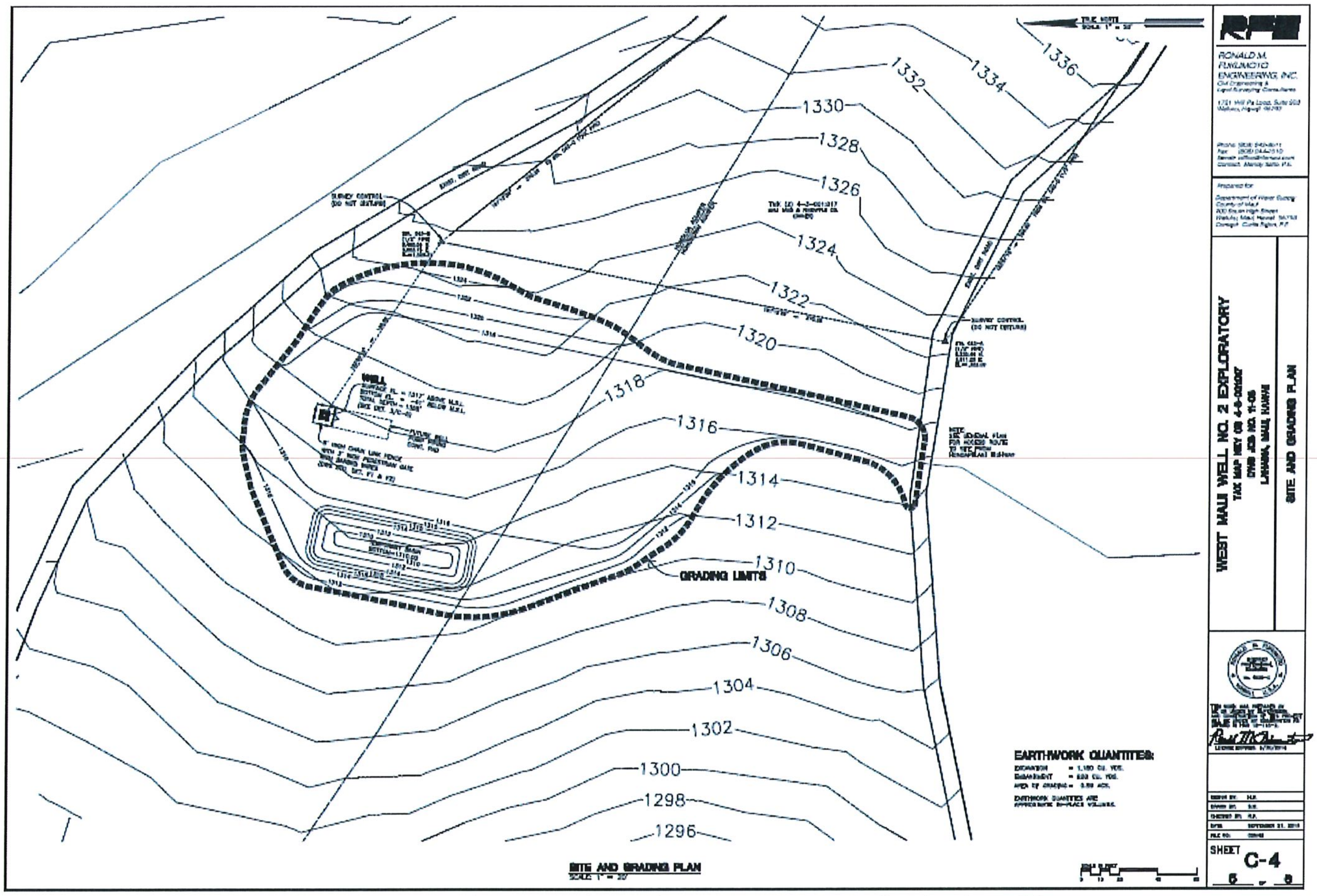

Figure 2. Project area is approximately 1 acre on a gently sloping ridge top.

Figure 3. Project area is a dense growth of molasses grass and a few trees.

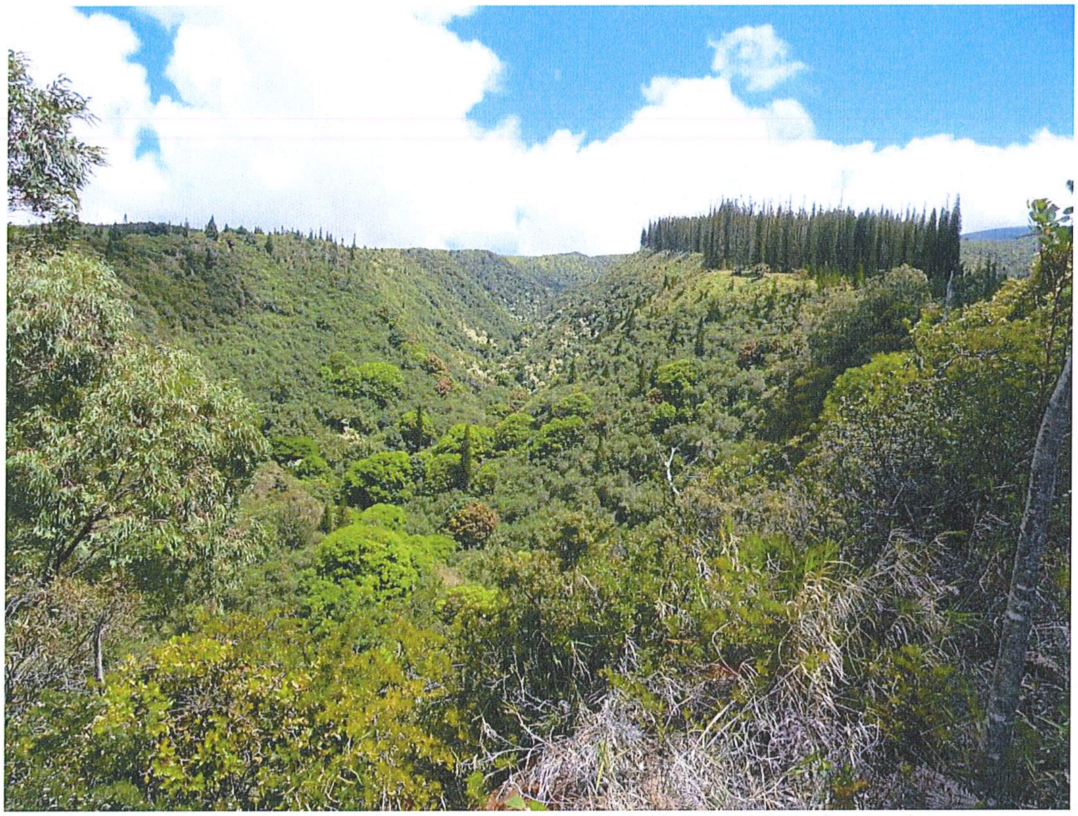

Figure 4. The densely forested Kahana Gulch running down along the north side of the project area on the adjacent ridge top.

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BIOLOGICAL RESOURCES SURVEY FOR KAHANA TRANSMISSION WATERLINE, ELECTRICAL LINE, AND 500,000 CONTROL TANK

APPENDIX J-3

BIOLOGICAL RESOURCES SURVEY

for the

WEST MAUI WATER SOURCE DEVELOPMENT PROJECT

KAHANA, LAHAINA, MAUI

by

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May 2018

Prepared for:
Department of Water Supply
Maui County

BIOLOGICAL RESOURCES SURVEY
WEST MAUI WATER SOURCE DEVELOPMENT PROJECT
KAHANA, LAHAINA, HAWAII

INTRODUCTION

The West Maui Water Source Development Project is located on the mid-slopes of the northwest part of West Maui in the lands of Kahana and Māhinahina. The project consists of the development of a well site, the installation of approximately 3,000 feet of electric powerline and the laying of approximately 13,000 feet of a water transmission line that will connect to the Māhinahina Water Treatment plant. This report summarizes the results of a survey and assessment of the biological resources on the above site and corridors.

SITE DESCRIPTION

The project area lies on the moderately sloping flank of West Maui between the large Kahana and Honokōwai gulches. The terrain consists of flat topped ridges separated by the smaller Kahanaiki and Māhinahina gulches. The well site is located at 1,320 feet elevation and the waterline corridor follows roadways down to the Māhinahina Water Treatment Plant at 640 feet elevation.

The vegetation on the ridge tops consists of dense growths of grasses and shrubs on former agricultural fields that have lain abandoned for 25 years. The small gulches are densely forested with trees and shrubs. Soils consist of variants of the Olelo, Kahana and Alaeloa series which are well-drained, silty clay loams of moderate depth (Foote et al, 1972). Rainfall ranges from 35 inches per year at the bottom elevations up to 50 inches per year at the top (Armstrong, 1983).

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna survey of the West Maui Water Source Development project that was conducted in May 2018. The objectives of the survey were to:

1. Document what plant and animal species occur on the property or may likely occur in the existing habitat.

2. Document the status and abundance of each species.

3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered (USFWS, 2016). If such occur, identify what features of the habitat may be essential for these species.

4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.

BOTANICAL SURVEY REPORT

SURVEY METHODS

A walk-through botanical survey method was used following routes that would ensure complete coverage of the property. Areas most likely to harbor native or rare plants were more intensively examined. Notes were made on plant species, distribution and abundance as well as on terrain and substrate.

DESCRIPTION OF THE VEGETATION

The vegetation in the project area is dominated by just three non-native plant species. By far the most abundant was Guinea grass (*Megathyrsus maximus*) which grows six to eight feet in height and so densely as to prevent most other plants from gaining a foothold. Only two other species were relatively common, koa haole (*Leucaena leucocephala*) and smooth rattlebox (*Crotalaria pallida*).

A total of 104 plant species were recorded during the survey. Besides the above (one abundant species and two common species), nineteen species were uncommon and eighty-two species were of rare occurrence.

Ten native species were recorded including two endemic species, kīlau fern (*Pteridium aquilinum* subsp. *decompositum*) and 'ōhi'a (*Metrosideros polymorpha* var. *glaberrima*). Eight species were indigenous, pala'ā fern (*Sphenomeris chinensis*), moa (*Psilotum nudum*), (*Cyperus polystachyos*) no common name, koali awahia (*Ipomoea indica*), ʻuhaloa (*Waltheria indica*), 'u'ulei (*Osteomeles anthyllidifolia*), 'a'ali'i (*Dodonaea viscosa*) and pōpolo (*Solanum americanum*).

DISCUSSION AND RECOMMENDATIONS

The entire project area is dominated by non-native plant species that have taken over agricultural fields that have lain fallow after being abandoned for over 25 years. Ten species of common native plants persist in small numbers, mostly along less disturbed field boundaries. These native species are widespread in Hawaii but rare of occurrences in this altered habitat. None are federally Endangered or Threatened species and carry no special protections or concerns.

No special recommendations are made with reference to plants. This project is not expected to result in any significant negative impacts on the botanical resources in this part of West Maui.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within three groups: Ferns, Monocots and Dicots. Taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999).

For each species, the following information is provided:

1. Scientific name with author citation

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.

   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).

   Polynesian introduction = plants introduced to Hawai'i in the course of Polynesian migrations and prior to western contact.

   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.

   common = widely scattered throughout the area or locally abundant within a portion of it.

   uncommon = scattered sparsely throughout the area or occurring in a few small patches.

   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
FERNS			
BLECHNACEAE (Chain Fern Family)			
Blechnum appendiculatum Willd.	palm fern	non-native	rare
DENNSTAEDTIACEAE (Bracken Family)			
Peteridium aquilinum (L.) Kuhn subsp. *decompositum*(Gaudich.) Lamoureux	kīlau	endemic	rare
LINDSAEACEAE (Lindsaea Fern Family)			
Sphenomeris chinensis (L.) Maxon	pala'ā	indigenous	rare
NEPHROLEPIDACEAE (Sword Fern Family)			
Nephrolepis brownii (Desv.) Hovencamp & Miyamoto	Asian sword fern	non-native	uncommon
POLYPODIACEAE (Polypody Fern Family)			
Phymatosorus grossus (Langsd. & Fisch.) Brownlie	laua'e	non-native	rare
PSILOTACEAE (Whisk Fern Family)			
Psilotum nudum (L.) P. Beauv.	moa	indigenous	rare
PTERIDACEAE (Brake Fern Family)			
Cheilanthes viridis (Forssk.) Sw.	green cliff brake	non-native	rare
Pityrogramma austroamericana Domin	gold fern	non-native	rare
THELYPTERIDACEAE (Marsh Fern Family)			
Cyclosorus parasiticus (L.) Farw.	parasitic maiden fern	non-native	rare
MONOCOTS			
ARACEAE (Aroid Family)			
Epipremnum pinnatum (L.) Engl.	pothos	non-native	rare
ASPARAGACEAE (Asparagus Family)			
Furcraea foetida (L.) Haw.	Mauritius hemp	non-native	rare
BROMELIACEAE (Bromeliad Family)			
Ananas comosus (L.) Merr.	pineapple	non-native	rare
COMMELINACEAE (Spiderwort Family)			
Commelina diffusa N.L. Burm.	honohono	non-native	rare
CYPERACEAE (Sedge Family)			
Cyperus polystachyos Rottb.	----------------------	non-native	rare
Kyllinga brevifolia Rottb.	kili'o'opu	non-native	rare
HYDROCHARITACEAE (Frog's-bit Family)			
Vallisneria spiralis L.	eel grass	non-native	rare
ORCHIDACEAE (Orchid Family)			
Spathoglottis plicata Blume	Phillipine ground orchid	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
POACEAE (Grass Family)			
Andropogon virginicus L.	broomsedge	non-native	uncommon
Chloris barbata (L.) Sw.	swollen fingergrass	non-native	rare
Chloris virgata Sw.	feather fingergrass	non-native	rare
Coix lachryma-jobi L.	Job's tears	non-native	rare
Digitaria bicornis (Lam.) Roem. & Schult.	Asian crabgrass	non-native	rare
Digitaria insularis (L.) Mez ex Ekman	sourgrass	non-native	uncommon
Digitaria violascens Link	smooth crabgrass	non-native	rare
Eleusine indica (L.) Gaertn.	wiregrass	non-native	rare
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	non-native	rare
Megathyrsus maximus (Jacq.) Simon & Jacobs	Guinea grass	non-native	abundant
Melinis minutiflora P. Beauv.	molasses grass	non-native	uncommon
Melinis repens (Willd.) Zizka	Natal redtop	non-native	uncommon
Oplismenus hirtellus (L.) P. Beauv.	basketgrass	non-native	rare
Paspalum conjugatum Bergius	Hilo grass	non-native	rare
Paspalum urvillei Steud.	Vasey grass	non-native	rare
Sacciolepis indica (L.) Chase	Glenwood grass	non-native	rare
Urochloa mutica (Forssk.) N. Q. Nguyen	Para grass	non-native	rare
DICOTS			
ACANTHACEAE (Acanthus Family)			
Thunbergia fragrans Roxb.	sweet clock-vine	non-native	rare
AMARANTHACEAE (Amaranth Family)			
Amaranthus spinosus L.	spiny amaranth	non-native	rare
ANACARDIACEAE (Mango Family)			
Schinus terebinthifolius Raddi	Christmas berry	non-native	uncommon
APIACEAE (Parsley Family)			
Centella asiatica (L.) Urb.	Asiatic pennywort	non-native	rare
APOCYNACEAE (Dogbane Family)			
Asclepias physocarpa (E. Mey.) Schlecter	balloon plant	non-native	uncommon
ASTERACEAE (Sunflower Family)			
Acanthospermum australe (Loefl.) Kuntze	spiny bur	non-native	rare
Ageratina adenophora (Spreng.) R. King & H. Robinson	Maui pāmakani	non-native	rare
Bidens pilosa L.	Spanish needle	non-native	rare
Conyza bonariensis (L.) Cronq.	hairy horseweed	non-native	uncommon
Crassocephalum crepidioides (Benth.) S. Moore	redflower ragleaf	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Elephantopus mollis Kunth	---------------------------	non-native	rare
Emilia fosbergii Nicolson	red pualele	non-native	uncommon
Emilia sonchifolia (L.) DC.	flora's paintbrush	non-native	rare
Hypochoeris radicata L.	gosmore	non-native	rare
Pluchea carolinensis (Jacq.) G. Don	sourbush	non-native	rare
Senecio madagascariensis Poir.	Madagascar fireweed	non-native	rare
Sonchus oleraceus L.	pualele	non-native	rare
Tridax procumbens L.	coat buttons	non-native	rare
Youngia japonica (L.) DC.	Oriental hawksbeard	non-native	rare
BRASSICACEAE (Mustard Family)			
Lepidium africanum (Burm.f.) DC.	African pepperwort	non-native	rare
Lepidium virginicum L.	Virginia pepperwort	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea indica (J. Burm.) Merr.	koali awahia	indigenous	rare
Ipomoea obscura (L.) Ker-Gawl.	obscure morning glory	non-native	rare
Ipomoea triloba L.	little bell	non-native	rare
CUCURBITACEAE (Gourd Family)			
Momordica charantia L.	bitter melon	non-native	rare
EUPHORBIACEAE (Spurge Family)			
Aleurites moluccana (L.) Willd.	kukui	Polynesian	rare
Euphorbia hypericifolia L.	graceful spurge	non-native	rare
FABACEAE (Pea Family)			
Acacia confusa Merr.	Formosa koa	non-native	rare
Canavalia cathartica Thouars	maunaloa	non-native	rare
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	rare
Crotalaria micans Link	Caracas rattlepod	non-native	uncommon
Crotalaria pallida Aiton	smooth rattlepod	non-native	common
Crotalaria retusa L.	rattleweed	non-native	rare
Desmanthus pernambucanus (L.) Thellung	slender mimosa	non-native	rare
Desmodium incanum DC.	Spanish clover	non-native	rare
Desmodium tortuosum (Sw.) DC	Florida beggarweed	non-native	rare
Desmodium triflorum (L.) DC.	three-flowered beggarweed	non-native	rare
Indigofera spicata Forssk.	creeping indigo	non-native	are
Indigofera suffruticosa	inikō	non-native	uncommon
Leucaena leucocephala (Lam.) de Wit	koa haole	non-native	common

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Macroptilium atropurpureum (DC.) Urb.	siratro	non-native	rare
Neonotonia wightii (Wight & Arnott) Lackey	glycine	non-native	uncommon
Pithecellobium dulce (Roxb.) Benth.	opiuma	non-native	rare
LAMIACEAE (Mint Family)			
Leonotis nepetifolia (L.) R. Br.	lion's ear	non-native	rare
LYTHRACEAE (Loosestrife Family)			
Cuphea carthagenensis (Jacq.) McBr.	tarweed	non-native	rare
MALVACEAE (Mallow Family)			
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	non-native	rare
Malvastrum coromandelianum (L.) Garcke	false mallow	non-native	rare
Sida spinosa L.	prickly sida	non-native	rare
Waltheria indica L.	'uhaloa	indigenous	rare
MELASTOMATACEAE (Melastoma Family)			
Tibouchina herbacea (DC.) Cogn.	cane tibouchina	non-native	uncommon
MELIACEAE (Mahogany Family)			
Melia azedarach L.	Pride of India	non-native	rare
MYRTACEAE (Myrtle Family)			
Eucalyptus comaldulensis Dehnh.	river red gum	non-native	rare
Eucalyptus rudis Endl.	desert gum	non-native	uncommon
Metrosideros polymorpha Gaud. var. *glaberrima* (H.Lev.) St.John	'ōhi'a lehua	endemic	rare
Psidium guajava L.	common guava	non-native	uncommon
Syzygium cumini (L.) Skeels	Java plum	non-native	rare
NYCTAGINACEAE (Four-o'clock Family)			
Boerhavia coccinea Mill.	scarlet spiderling	non-native	rare
ONAGRACEAE (Evening Primrose Family)			
Ludwigia octovalvis (Jacq.) Raven	Primrose willow	non-native	rare
PASSIFLORACEAE (Passion Flower Family)			
Passiflora suberosa L.	cork bark passion fruit	non-native	rare
PHYTOLACCACEAE (Pokeweed Family)			
Rivina humilis L.	coral berry	non-native	rare
PLANTAGINACEAE (Plantain Family)			
Buddleia asiatica Lour.	dog tail	non-native	uncommon
Plantago lanceolata L.	narrow-leaved plantain	non-native	rare
POLYGALACEAE (Milkwort Family)			
Polygala paniculata L.	root beer plant	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
PROTEACEAE (Protea Family)			
Grevillea robusta A. Cunn. Ex R. Br.	silk oak	non-native	rare
ROSACEAE (Rose Family)			
Osteomeles anthyllidifolia (Sm.) Lindl.	'u'ulei	indigenous	rare
SAPINDACEAE (Soapberry Family)			
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	rare
SOLANACEAE (Nightshade Family)			
Solanum americanum Mill.	pōpolo	indigenous	rare
VERBENACEAE (Verbena Family)			
Lantana camara L.	lantana	non-native	rare
Stachytarpheta cayennensis (Rich) Vahl	nettle-leaved vervain	non-native	rare
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain	non-native	rare

FAUNA SURVEY REPORT

SURVEY METHODS

A walk-through survey method was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. Notes were made on species, abundance, activities and location as well as observations of trails, tracks, scat and signs of feeding. In addition, an evening visit was made to the area to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*), the Hawaiian petrel (*Pterodroma sandwichensis*) or the Newell's shearwater (*Puffinus newelli*) in the area. Taxonomy and nomenclature follow Tomich (1986).

RESULTS

MAMMALS

No mammals or their signs were seen during the day in the project area due to the deep and dense nature of the vegetation.

A few non-native mammals however, would be expected to occur in the project area. These include feral pigs (*Sus scrofa*), rats (*Rattus* spp.), mice (*Mus domesticus*), mongoose (*Herpestes auropunctatus*) and possibly feral cats (*Felis catus*). Rats and mice feed on seeds, fruits, herbaceous vegetation and bird eggs, while mongoose and cats feed on these rodents and birds.

A special effort was made to look for sign of the Hawaiian hoary bat by making an evening survey at two locations in the project area. A bat detection device (Batbox IIID) was employed, set to the frequency of 27,000 hertz which these bats are known to use in echolocation. Prominent bat activity was detected at two of the three locations indicating a significant presence of bats.

BIRDS

Birdlife was moderate in both species diversity and in numbers observed. Taxonomy and nomenclature follow American Ornithologists' Union (2018). Thirteen species were identified during the survey. One species was common, the zebra dove (*Geopelia striata*). Five species were uncommon, the cattle egret (*Bubulcus ibis*), spotted dove (*Streptopelia chinensis*), nutmeg mannikin (*Lonchura punctulata*), black francolin (*Francolinus francolinus*) and gray francolin (*Francolinus pondicerianus*). Seven other birds were of rare occurrence.

Two speces were native to Hawaii. One pueo or Hawaiian short-eared owl (*Asio flammeus sandwichensis*) was seen during the evening survey hunting for rodents. Five kōlea or Pacific golden-plover (*Pluvialis fulva*) were gathering at the well site clearing for the evening.

None of the Endangered waterbirds, the ae'o or black-necked stilt (*Himantopus mexicanus knudseni*), the 'alae ke'oke'o or Hawaiian coot (*Fulica alai*), or the Endangered nēnē or Hawaiian goose (*Branta sandvicensis*) were seen.

An evening survey conducted along the transmission line corridors and at the proposed well site failed to pick up any calls from either the Endangered Hawaiian petrel, ua'u (*Pterodroma sandwichensis*) or the Threatened a'o (*Puffinus newelli*). In West Maui these seabirds have their nesting burrows high in the mountains in wet fern forest. One adult bird in a pair, returning to its burrow with food for its young, will call out to its mate in the burrow which returns the call. These calls are loud and can be heard at great distances. No calls were heard.

INSECTS

A total of 16 species of insects representing six insect Orders were observed in the project area during two site visits. Taxonomy and nomenclature follow Nishida et al (1992). Common species included, the southern house mosquito (*Culex quinquefasciatus*), long-tailed blue butterfly (*Lampides boeticus*), monarch butterfly (*Danaus plexippus*) and globe skimmer dragonfly (*Pantala flavescens*). Uncommon species included, dung fly (*Musca sorbens*), Australian hoverfly (*Simosyrplus grandicornis*), honeybee (*Apis mellifera*), big-headed ant (*Pheidole megacephala*), sleepy orange butterfly (*Eurema niccipe*), cabbage butterfly (*Pieris rapae*) and the small rice grasshopper (*Oxya japonica*). Five other insect species were rare.

Two dragonflies were indigenous native species, the green darner (*Anax Junius*) and the globe skimmer.

MOLLUSKS

One non-native mollusk, the giant African snail (*Achatina fulica*) was observed during the survey.

DISCUSSION AND RECOMMENDATIONS

The diversity of fauna species in this project area was somewhat moderate in this dense, deep non-native grassland/shrubland habitat. Species consisted of one mammal, thirteen birds, sixteen insects and one mollusk.

The one mammal was the endemic and Endangered Hawaiian bat that was detected in significant numbers. These bats are highly mobile and wide ranging, following spikes in activity of the insects they prey upon. Their Endangered status provides federal protections that must be addressed in the scheduling of project implementation.

Two native bird species were found during the survey. The kōlea is an indigenous, migratory bird that comes to Hawaii and other Pacific islands from their arctic breeding grounds to spend winter months in our warmer climates. They come in large numbers and utilize a wide range of habitats. They do not have any Endangered or Threatened status.

The pueo is an endemic race of the American short-eared owl but is not federally listed as Endangered or Threatened. They are widespread on Maui in open grasslands where they hunt for rodents.

Two indigenous dragonflies, the green darner and the globe skimmer are widespread and common throughout Hawaii and have no Endangered or Threatened status.

One potential threat posed by the project involves the Endangered seabirds the Hawaiian petrel (*Pterodroma sandwichensis*) and the Threatened Newell's shearwater (*Puffinis newelli*). These seabirds nest high in the mountains during the spring, summer and fall months. These birds fly over the lowlands during the late evening hours to reach their burrows and fly back to the ocean in the early dawn hours. These birds can be confused by bright lights and crash into poles, wires and other structures and be injured or killed by the strike or by vehicles or animals such as cats, dogs or mongoose. Young inexperienced birds, taking their inaugural fledgling flights in the late fall are particularly vulnerable. It is recommended that any significant outdoor flood lights or pole lights be hooded to direct the light downward to minimize the distractions and dangers to these birds.

With the above recommendations the West Maui Water Source Development Project is not expected to result in any significant negative impacts on the fauna resources in this part of West Maui.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within four groups: Mammals, Birds, Insects and Mollusks. For each species the following information is provided:

1. Common name

2. Scientific name

3. Bio-geographical status. The following symbols are used:

   endemic = native only to Hawaii; not naturally occurring anywhere else in the world.

   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).

   non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.

   migratory = spending a portion of the year in Hawaii and a portion elsewhere. In Hawaii the migratory birds are usually in the overwintering/non-breeding phase of their life cycle.

4. Abundance of each species within the project area:

   abundant = many flocks or individuals seen throughout the area at all times of day.

   common = a few flocks or well scattered individuals throughout the area.

   uncommon = only one flock or several individuals seen within the project area.

   rare = only one or two seen within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MAMMALS			
Lasiurus cinereus semotus H. Allen	'ōpe'ape'a, Hawaiian hoary bat	endemic	uncommon
BIRDS			
ARDEIDAE (Heron Family)			
Bubulcus ibis L.	cattle egret	non-native	uncommon
CARDINALIDAE (Cardinal Family)			
Cardinalis cardinalis L.	northern cardinal	non-native	rare
CETTIIDAE (Bush Warbler Family)			
*Cettia diphone*Kittlitz	Japanese bush warbler	non-native	rare
CHARADRIIDAE (Plover Family)			
Pluvialis fulva Gmelin	Pacific golden-plover	indigenous	rare
COLUMBIDAE (Dove Family)			
Geopelia striata L.	zebra dove	non-native	common
Streptopelia chinensis Scopoli	spotted dove	non-native	uncommon
ESTRILDIDAE (Estrildid Finch Family)			
Lonchura punctulata L.	nutmeg mannikin	non-native	uncommon
FRINGILLIDAE (Fringillid Finch Family)			
Carpodacus mexicanus Muller	house finch	non-native	rare
LEIOTHRICHIDAE (Leiothrix Family)			
Leucodioptron canorum L.	hwamei	non-native	rare
PHASIANIDAE (Pheasant Family)			
Francolinus francolinus L.	black francolin	non-native	uncommon
Francolinus pondicerianus Gmelin	gray francolin	non-native	uncommon
STRIGIDAE (Owl Family)			
Asio flammeus sandwichensis Bloxam	pueo, Hawaiian short-eared owl	Endemic	rare
STURNIDAE (Starling Family)			
Acridotheres tristis L.	common myna	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
INSECTS			
Order - DIPTERA - flies			
CULICIDAE (Mosquito Family)			
Culex quinquefasciatus Say	Southern house mosquito	non-native	common
MUSCIDAE (House Fly Family)			
Musca domestica L.	house fly	non-native	rare
Musca sorbens Wiedemann	dung fly	non-native	uncommon
SYRPHIDAE (Hoverfly Family)			
Simosyrphus grandicornis Macquart	Australian hoverfly	non-native	uncommon
Order - HEMIPTERA - true bugs			
CICADELLIDAE (Plant Hopper Family)			
Empoasca solana DeLong	Southern garden leaf hopper	non-native	rare
Order - HYMENOPTERA - bees, wasps, ants			
APIDAE (Honeybee Family)			
Apis mellifera L.	honeybee	non-native	uncommon
FORMICIDAE (Ant Family)			
Pheidole megacephala Fabricius	big-headed ant	non-native	uncommon
Order - LEPIDOPTERA - butterflies, moths			
CRAMBIDAE (Grass Moth Family)			
Spoladea recurvalis Fabricius	beet webworm moth	non-native	rare
LYCAENIDAE (Gossamer-winged Butterfly Family)			
Lampides boeticus L.	long-tailed blue butterfly	non-native	common
NYMPHALIDAE (Brush-footed Butterfly Family)			
Danaus plexippus L.	monarch butterfly	non-native	common
PIERIDAE (White and Sulfer Butterfly Family)			
Eurema niccipe Cramer	sleepy orange butterfly	non-native	uncommon
Pieris rapae L.	cabbage butterfly	non-native	uncommon
Order - ODONATA - dragonflies, damselflies			
AESHNIDAE (Hawker Dragonfly Family)			
Anax junius Drury	green darner dragonfly	indigenous	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
LIBELLULIDAE (Skimmer Dragonfly Family)			
Pantala flavescens Fabricius	globe skimmer dragonfly	indigenous	common
Order - ORTHOPTERA - grasshoppers, crickets			
ACRIDIDAE (Grasshopper Family)			
Oxya japonica Thunberg	small rice grasshopper	non-native	uncommon
TETTIGONIIDAE (Katydid Family)			
Elimaea punctifera Walker	katydid	non-native	rare
MOLLUSK			
ACHATINIDAE (Achatinid Snail Family)			
Lissachatina fulica Ferussac	African snail	non-native	rare

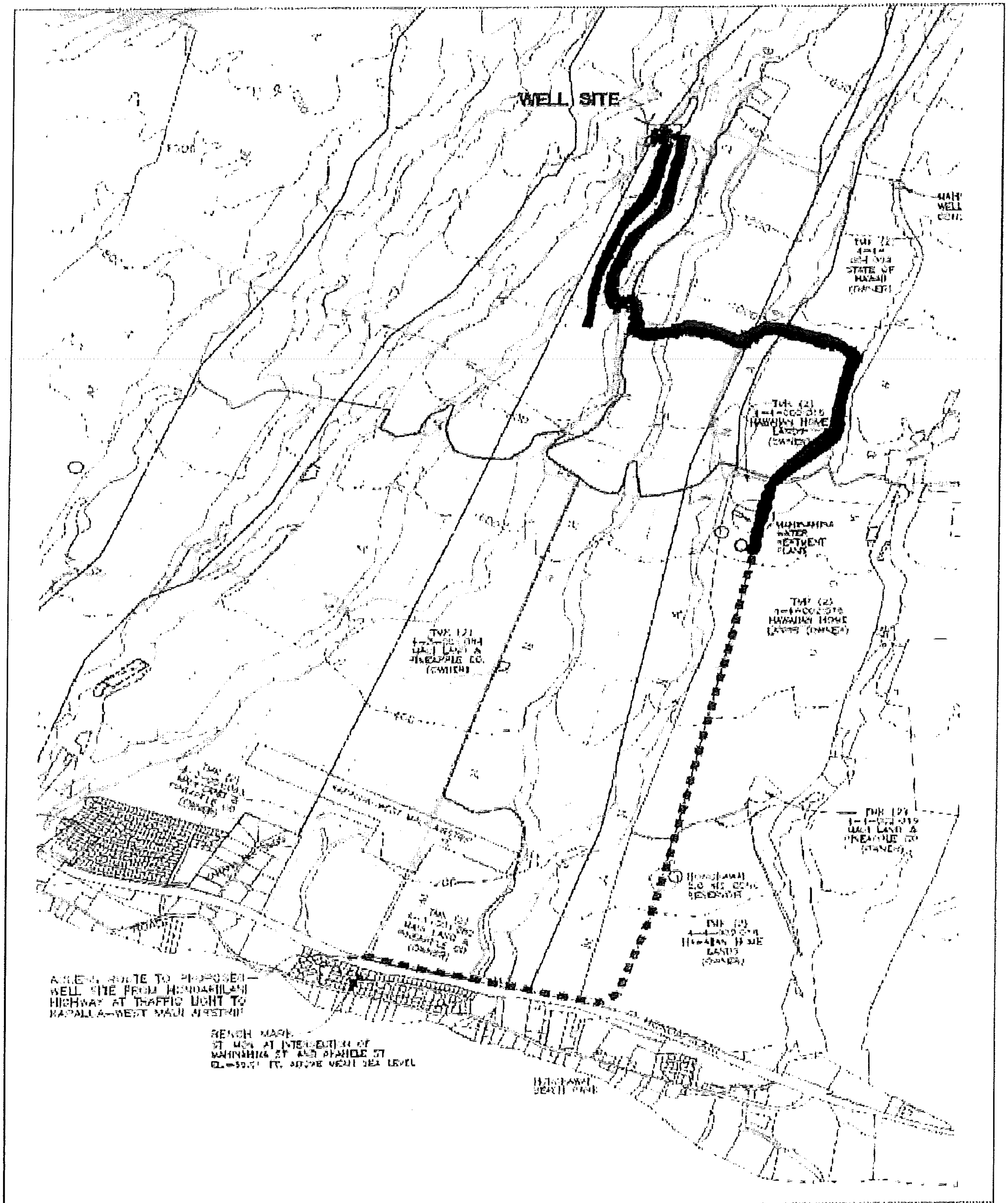

Figure 1. West Maui Water Source Development Project
Green - Maui Electric Line Extension   Red – New Water Line

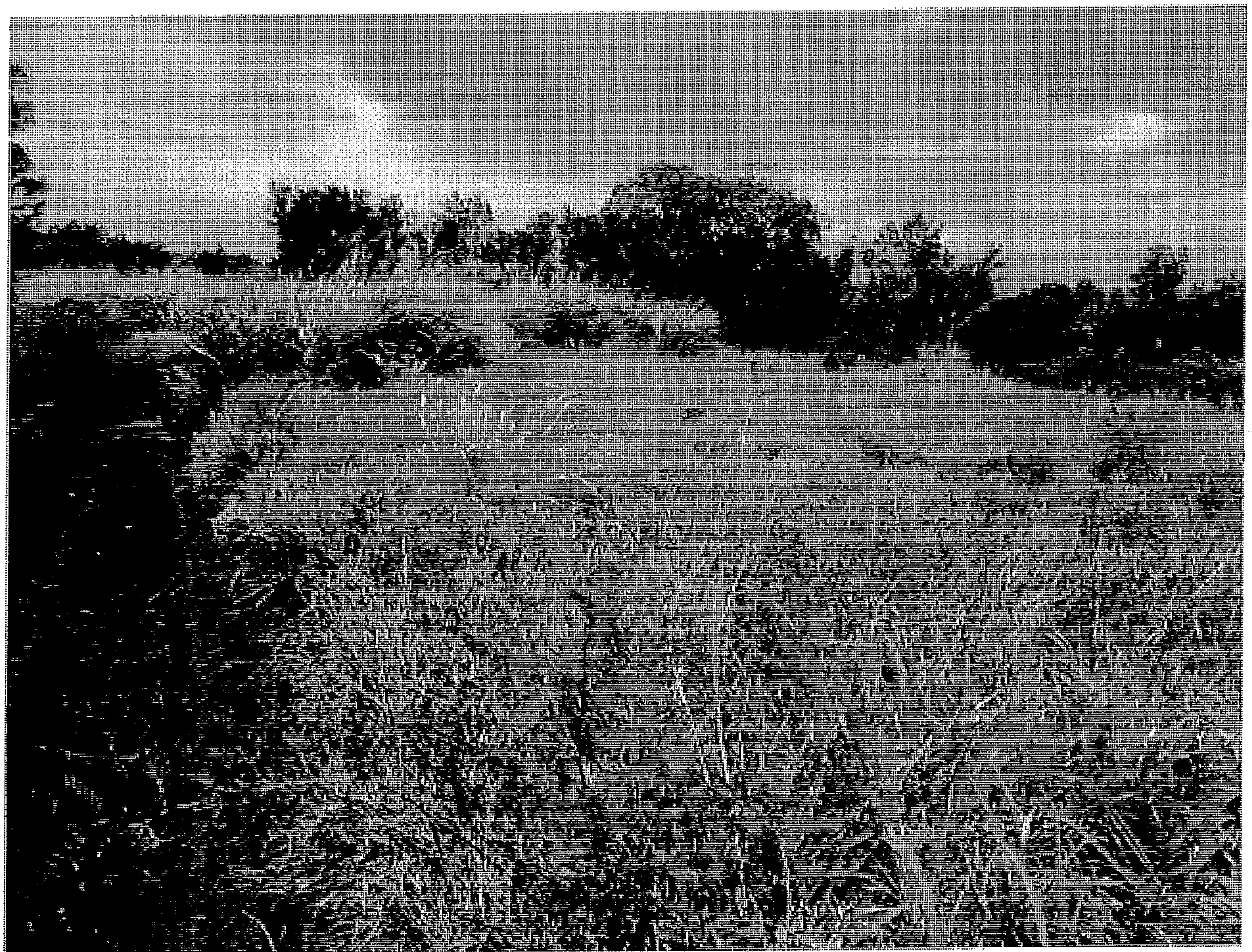

Figure 2. Typical dense grass habitat along the water transmission line corridor in the project area.

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ARCHAEOLOGICAL ASSESSMENT FOR KAHANA WELL

APPENDIX K-1

SCS Project Number 1480-AA-2

AN ARCHAEOLOGICAL ASSESSMENT FOR THE WEST MAUI WELL NO. 2 EXPLORATORY, DWS JOB NO. 11-06, LAHAINA, KAHANA AHUPUA'A, LAHAINA (KĀ`ANAPALI) DISTRICT, MĀUI, HAWAI'I [TMK (2) 4-3-001:017]

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ABSTRACT

At the request of Ronald M. Fukumoto Engineering, Inc., for the County of Maui Department of Water Supply, Scientific Consultant Services, Inc. (SCS) conducted Archaeological Inventory Survey on a c. 1-acre land parcel in Kahana Ahupua'a, Lahaina District, Māui [TMK: (2) 4-3-001:017]. Fieldwork did not lead to the identification of any historic properties, this presumed to be a function of wide-scale, industrial-level pineapple cultivation across the project area and beyond. No further archaeological work is recommended for the project area.

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INTRODUCTION

At the request of Ronald M. Fukumoto Engineering Inc, Scientific Consultant Services, Inc. (SCS) conducted an Archaeological Inventory Survey for a proposed County of Maui, Department of Water Supply exploratory well. The project area consists of a 0.89-acre portion of land owned by Maui Land and Pineapple Company, Inc., that is the proposed location for a well and construction staging area. The project area is located in Kahana Ahupua`a, Lāhainā District, Maui Island, Hawai`i (TMK (2) 4-03-001:017) (Figures 1, 2, 3, and 4). The work was requested to assess the presence/absence of archaeological sites in the project area, document the sites, and provide recommendations and significance assessments for the sites.

The overall purpose of the project was to determine the presence or absence of architecture, midden deposits, and/or artifact deposits on the surface of the project area, as well as assess the potential for the presence of subsurface cultural deposits. In addition, the report provides significance assessments and recommendations to the State Historic Preservation Division (SHPD) for the project. This Archaeological Assessment Report was written in lieu of an Archaeological Inventory Survey report due to the determination of "no findings" during fieldwork within the project area, per the State of Hawai`i Historic Preservation Division Guidelines for an Archaeological Assessment.

In brief, full pedestrian survey of the project area did not lead to the identification of any archaeological sites/historic properties. The project area occurs in fields previously subject to industrial-level pineapple production. Plastic remnants of this cultivation occur across the surface. The following provides an abbreviated environmental and historic background to the area, the results of the project, and recommendations.

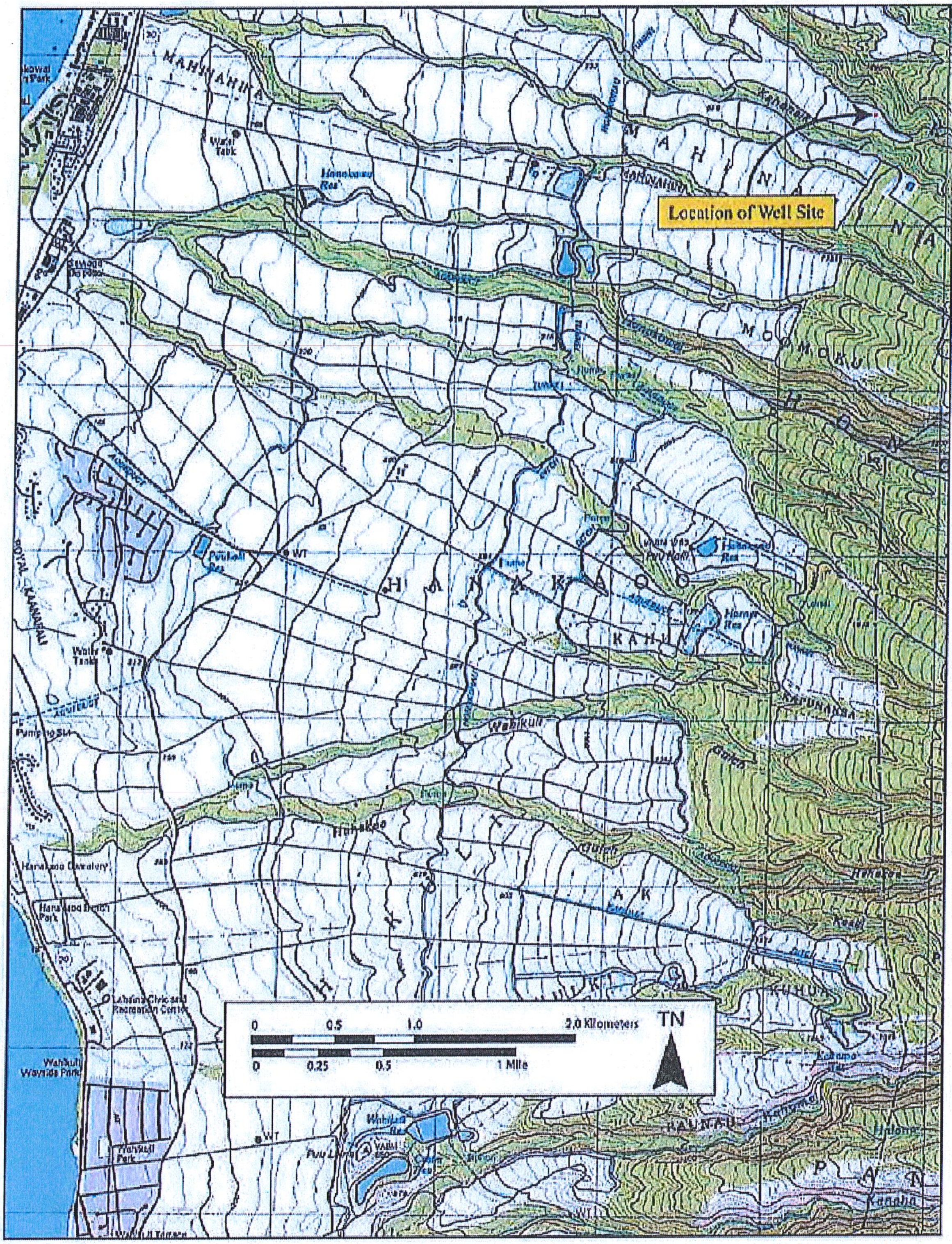

Figure 1: Portion of USGS Map Showing Location of Project Area.

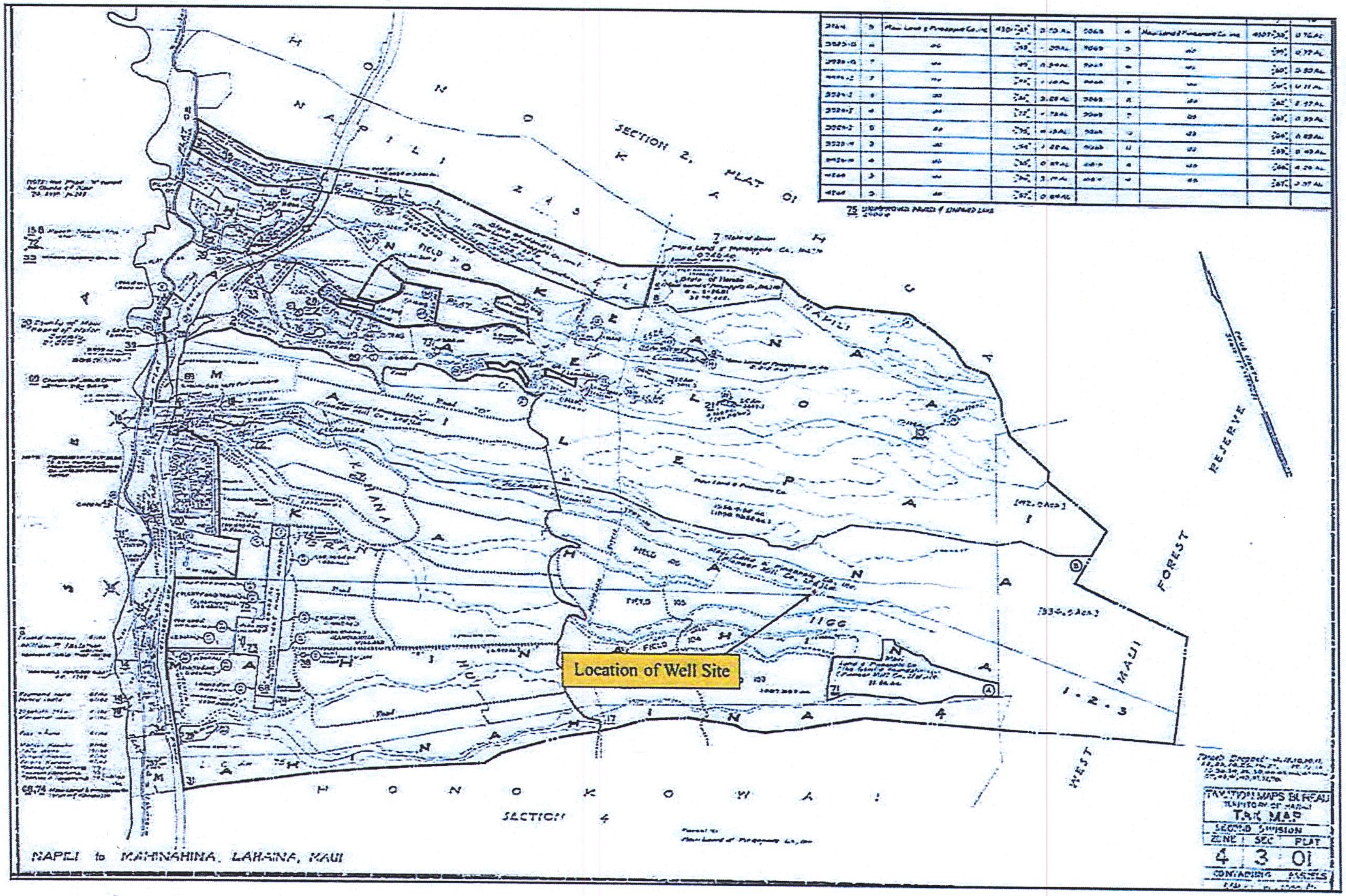

Figure 2: TMK (2) 2-1-08 Showing Location of Project Area.

Figure 3: Aerial Photograph Showing Location of Project Area (Google Earth 2013).

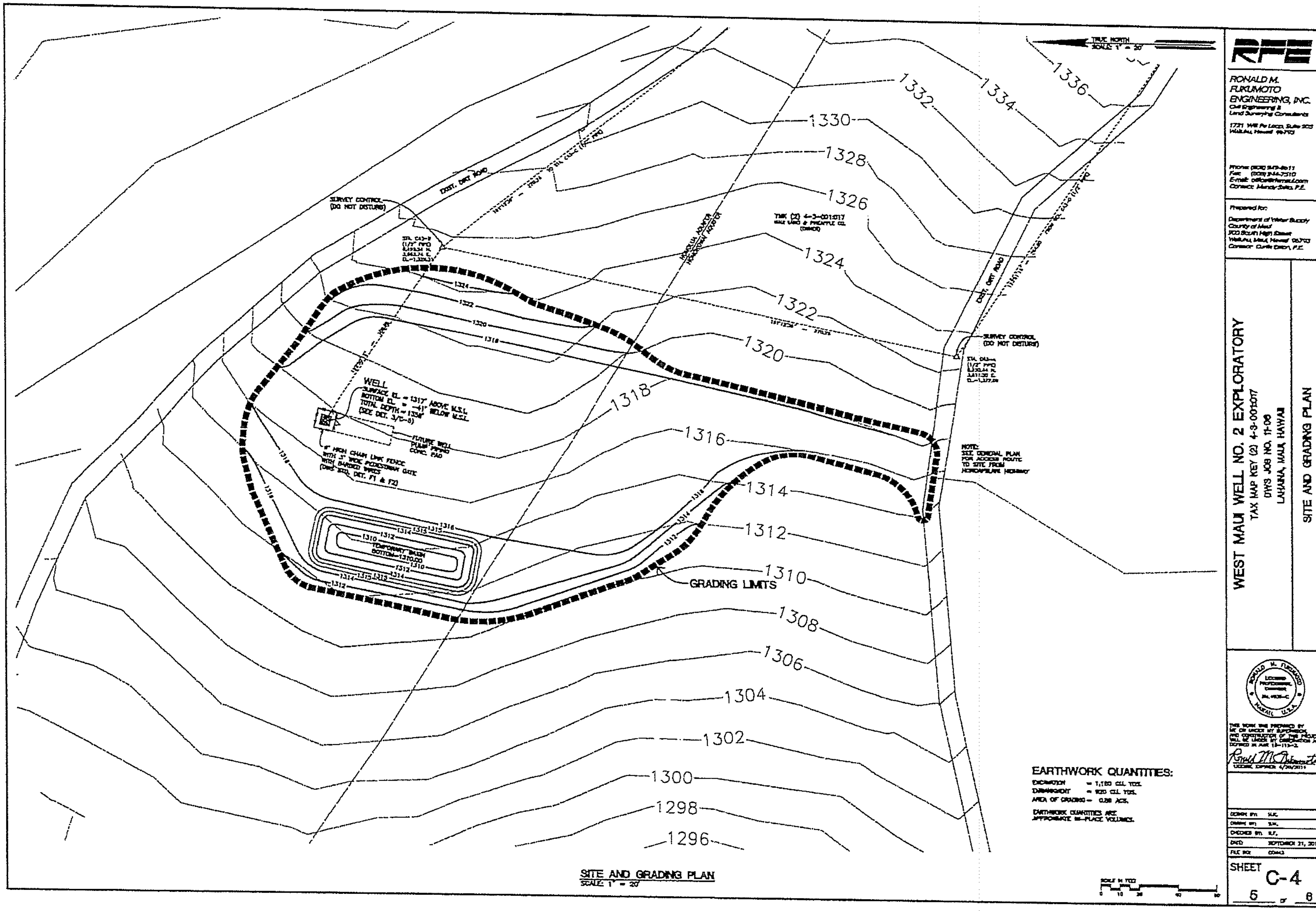

Figure 4: Plan Showing Layout of Proposed Well Site.

ENVIRONMENTAL SETTING

PROJECT AREA LOCATION AND ENVIRONMENT

The undeveloped subject parcel is located at an elevation of approximately 1315 feet A.M.S.L. and lies 4.8 km (3.0 miles) from the coast line (see Figure 1). The entire parcel is within a gently sloping, fallow pineapple field that is nearly completely overgrown with molasses grass (Figure 5). The subject parcel is bounded by Kahana Stream Gulch to the north, pineapple fields to the east, Kahanaiki Gulch to the south and fallow pineapple fields to the west (see Figure 4).

Within the fallow agricultural fields were non-native eucalyptus trees and molasses grass. Just outside the project area along the edge of the gulch were several species of native plants including *pukiawe (Leptecophylla tameiameiae), ohia (Metrosideros sp.), ulei (Osteomeles anthyllidifolia), kilau (Pteridium aquilinum) and huehue (Cocculus orbiculatus).*

Soils in the project area primarily consist of the Alaeloa Series (Foote *et al.* 1972:Sheet 92). These are well-drained soils occurring in upland locations and have developed in material weathered from in situ igneous rock (Ibid. 26). The basic stratigraphic profile consists of dark reddish brown silty clays overlying bedrock. The soils are fairly homogeneous. Rainfall associated with this area is estimated at 35" to 60" per year, and the soils are most commonly associated with pineapple, pasture, wildlife, house lots, and water supply. In addition to the Alaeoloa Series, ranges of the Kahana Series occurs in the area (Ibid. Sheet 92). These soils are very similar in texture and composition to the Alaeloa series and occur on smooth uplands.

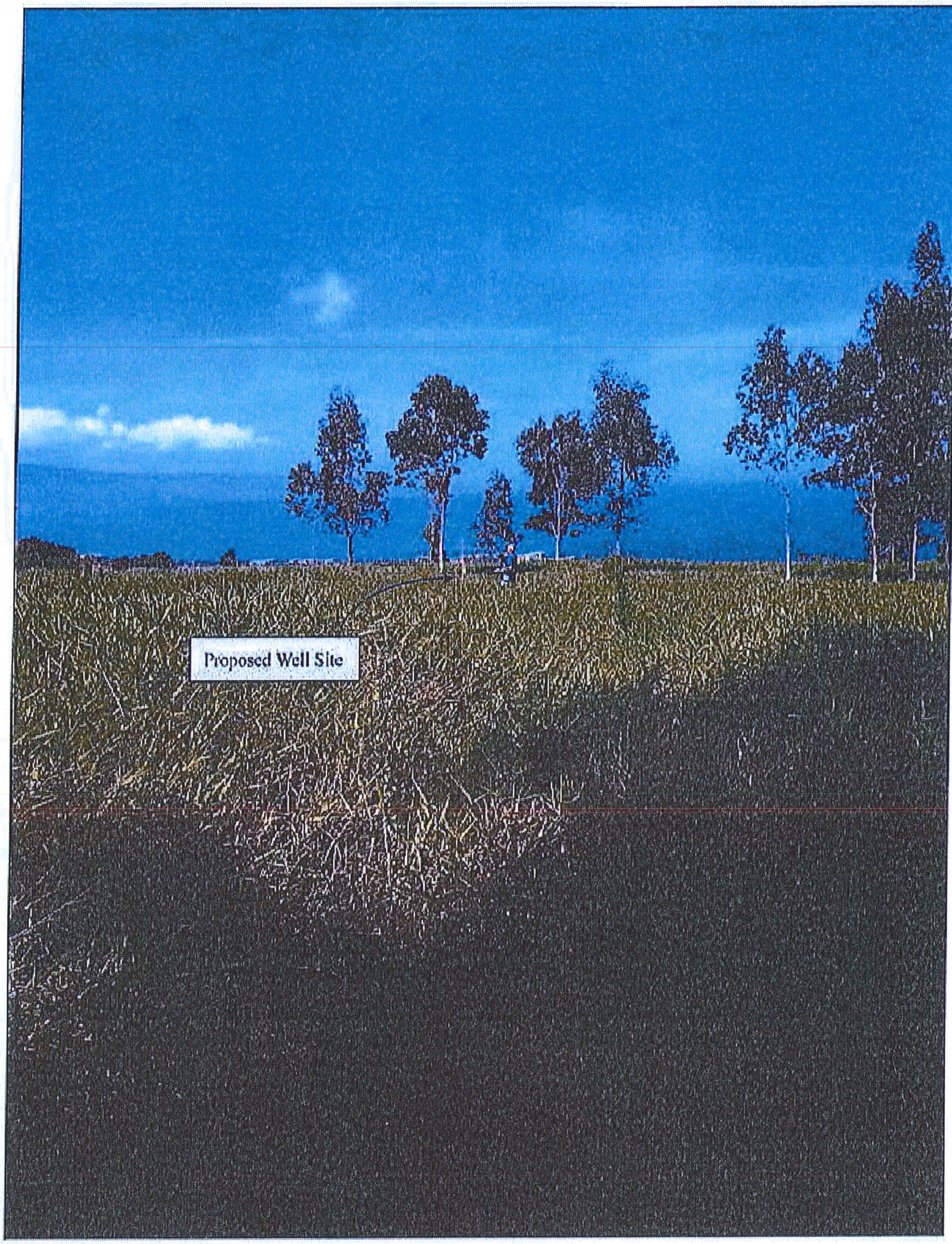

Figure 5: View West of Proposed Well Site.

TRADITIONAL AND HISTORIC SETTING

The island of Maui ranks second in size of the eight main islands in the Hawaiian Archipelago. Pu`u Kukui, forming the west end of the island (1,215 m above mean sea level), is composed of large, heavily eroded amphitheater valleys that contain well-developed permanent stream systems that watered fertile agricultural lands extending to the coast. The deep valleys of the West Maui Mountains and their associated coastal regions have been witness to many battles in ancient times and were coveted productive landscapes.

PAST POLITICAL BOUNDARIES

Traditionally, the division of Maui's lands into districts (*moku*) and sub-districts was performed by a *kahuna* (priest, expert) named Kalaiha`ōhia, during the time of the *ali`i* Kaka`alaneo (Beckwith 1940:383; Fornander places Kaka`alaneo at the end of the fifteenth century or the beginning of the sixteenth century [Fornander 1919-20, Vol. 6:248]). Land was considered the property of the king or *ali`i `ai moku* (the *ali`i* who eats the island/district), which he held in trust for the gods. The title of *ali`i `ai moku* ensured rights and responsibilities pertaining to the land, but did not confer absolute ownership. The king kept the parcels he wanted, his higher chiefs received large parcels from him and, in turn, distributed smaller parcels to lesser chiefs. The *maka`āinana* (commoners) worked the individual plots of land.

In general, several terms, such as *moku*, *ahupua`a*, *`ili* or *`ili`āina* were used to delineate various land sections. A district (*moku*) contained smaller land divisions (*ahupua`a*) which customarily continued inland from the ocean and upland into the mountains. Extended household groups living within the *ahupua`a* were therefore, able to harvest from both the land and the sea. Ideally, this situation allowed each *ahupua`a* to be self-sufficient by supplying needed resources from different environmental zones (Lyons 1875:111). The *`ili `āina* or *`ili* were smaller land divisions next to importance to the *ahupua`a* and were administered by the chief who controlled the *ahupua`a* in which it was located (*ibid*: 33; Lucas 1995:40). The *mo`o`āina* were narrow strips of land within an *`ili*. The land holding of a tenant or *hoa `āina* residing in an *ahupua`a* was called a *kuleana* (Lucas 1995:61). The project area is located in the *ahupua`a* of Kahana, which literally translates to "cutting", as in a valley cutting through the mountain (Pukui *et al.* 1989:202).

TRADITIONAL SETTLEMENT PATTERNS

The Hawaiian economy was based on agricultural production and marine exploitation, as well as raising livestock and collecting wild plants and birds. Extended household groups settled in various *ahupua`a*. During pre-Contact times, there were primarily two types of agriculture, wetland and dry land, both of which were dependent upon geography and physiography. River valleys provided ideal conditions for wetland *kalo* (*Colocasia esculenta*) agriculture that incorporated pond fields and irrigation canals. Other cultigens, such as *kō* (sugarcane, *Saccharum officinaruma*) and *mai`a* (banana, *Musa* sp.), were also grown and, where appropriate, such crops as *`uala* (sweet potato, *Ipomoea batatas*) were produced. This was the typical agricultural pattern seen during traditional times on all the Hawaiian Islands (Kirch and Sahlins 1992, Vol. 1:5, 119; Kirch 1985). Between A.D. 600 and 1100, a period sometimes referred to as the Developmental Period, was the major focus of permanent settlement continued to be the fertile and well-watered windward valleys, such as those in the West Maui Mountains (Kirch 1985).

A general settlement model based on archaeological evidence has been suggested for the Kā`anapali District (Chapman and Kirch 1979; Kirch 1985). This model includes coastal marine foraging and fishing with more upland agricultural pursuits. In typical native Hawaiian fashion, dating at least from the later pre-Contact period (if not earlier), people in this area would have moved between the coast and the upland agricultural fields, exploiting the full range of resources available within the *ahupua`a*. Semi-permanent and permanent habitation probably occurred in both coastal and upland settings.

There are six bays located on Maui's west shore whose names begin with *Hono-*. These bays and coves include Honokahua, Honokeana, Honokōhau, Honokōwai, Honolua, and Hononana and are collectively known as *Hono a Pi`ilani,* literally meaning bays (*hono*) acquired or ruled by Pi`ilani (Pukui and Ebert 1985, Pukui *et al.* 1989, and Clark 1980). Kapalua is situated along this coast between Honokahua and Honokeana. The coastal and marine environments adjacent to the project area would have provided rich resources for traditional subsistence foragers and fishermen in ancient times.

A large number of fish species are found in the near-coastal waters: weke, surmullet (*Mulloidichthys auriflamma*); *kūmū* (goatfish, Paru*peneus prophyreus*); *mamo* (sergeant fish, *Abudefduf abdominalis*); *manini* (surgeonfish, *Acanthurus triostegus*); *palani* (surgeonfish, *Acanthurus bariene*); *nenue* (rudder or pilot fish, *Kyphosus fuscus*); *kōkala* (porcupine fish, *Diodon hystrix*); *hinalea* (wrasse, Family, Labridae); *uhu* (parrot fish, *Scarus perspicillatus*);

`ala`ihi (squirrel fish, *Holocentrus* sp.); *kala* (surgeonfish or unicorn fish, *Acanthurus* sp.); and *nehu* (anchovy, *Anchoviella purpurea*). In addition to a relatively high density of gastropods and pelecypods (including *pipipi*, black nerita, (*Nerita picea*) and *Littorina pintado*), at least five species of sea urchin have been noted: *Centrechinus paucispinus, Tripneustes gratilla, Podophora atrata, Heterocentrotus mammillatus,* and *Echinometra mathaei* (Kirch 1973).

Early archaeological surveys identified seven religious shrines (*heiau*) from Mahinahina to Honokōhau Ahupua`a (Thrum 1909, 1917; Walker 1931). Two *heiau*, both destroyed, were recorded between Kahana and Mailepai and to the northeast, in Honokahua Ahupua`a, Kahauiki Heiau, (Walker Site 16) was situated. *Heiau* indicate the presence of political power and the appropriate population to support it.

Traditionally, trails extended from the coast to the mountains, linking the two for both economic and social reasons. Kā`anapali District is noted for an *alaloa* (a long path or trail) that reportedly encircled the entire island. Walker (cited in Sterling 1998:46) wrote:

> The north end of Maui also is traversed by a paved trail. Sections of it can be seen from Honolua to Honokohau to Kahakuloa. It is paved with beach rocks and has a width of four to six feet....This trail is also spoken of as the Kihapiilani Trail.

In Maui (Walker Site 20), a large *luakini heiau* (*heiau* for human sacrifice), was reportedly located on a cliff on the east side of Honokōhau Valley, approximately 60 m above the shoreline just east of the Honokahua Burial Site, State Site No. 50-50-01-1342 (Walker in Sterling 1998:54). Most significantly, Kamakau (in Sterling 1998:55) reported oral history accounts of Waiuli Pit, a large 'death pit', at least one mile deep and extending below the water table. According to Kamakau, the bodies of dead commoners who resided in the areas from Lahaina to Kahakuloa, and the islands of Moloka`i and Lanai, were thrown into this pit.

Kamakau states:

> Waiuli was a death pit wherein the dead bodies of commoners were thrown. . . .At Waiuli (on Maui) directly back of Honkohau, Honolua, and Honokahua is a deep pit which was used as a burial place for bodies of the common people from Lahaina to Kahakuloa. The body of anyone from those regions who died on Moloka`i [*and Lanai*] was brought back and thrown into that pit. . . [*ibid*].

A *ko`a* (fishing shrine, Walker Site No. 17), located "[*makai*] to Honolua Park along the shore" (Honolua Ahupua`a), was described by Walker (Sterling 1998:53). He also reported oral history accounts of a *hōlua* (slide or sledding ramp) at Honolua Ahupua`a that was destroyed by the time of his survey (1920s–30s) by commercial agriculture.

Kamakau recounts the results of a war between Kauhi-pumai-kahoaka (or Kauhi-`aimoku-a-Kama) and Kamehameha-nui in 1735, both children of Kekaulike. Alapa`i of Hawai`i Island had joined forces with Kamehameha-nui and a year was spent preparing for the war "which swept the country" (Kamakau 1961:74). Alapa`i tactics included drying up some of the main streams, which in turn dried up the brooks and taro patches. This reduced food not only for Kahui's forces, but also the *maka`āinana*. His fighting force consisted of 8,440 warriors from all of the six districts of Hawai`i Island (*ibid*). Honokahua and Honolua Bays north of the project area became the gathering place for the forces of Peleioholani who had arrived from O`ahu with only 640 men to assist Kauhi. While attempting to unite its warriors with those of Kauhi, Peleioholani became surrounded by the army of Alapa`i.

Kamakau recorded:

> The hardest fighting even compared with that of Napili and at Honokahua in
> Kā `anapali, took place on the day of the attack at Pu`unēnē [in Honolua]. Pele-io-holani was surrounded on all sides, *mauka* and *makai*, by the forces of Alapa`i, let by Ka-lani-`opu`ū and Keoua. The two ruling chiefs met there again, face to face, to end the war and became friends again, so great had been the slaughter on both sides [Kamakau 1961].

Fornander stated:

> The fortune of the battle swayed back and forth from Honokawai to near into Lahaina; and to this day heaps of human bones and skulls, half buried in various places in the sand, attest the bitterness of the strife and the carnage committed... [1969:142]

EARLY HISTORIC

The traditional district of Kā`anapali, where the project area is located, consisted of five major stream valleys (Honokōwai, Kahana, Honokahua, Honolua, and Honokōhau), all of which were extensively terraced for wetland (*lo`i*) taro in early historic and later times (in Honokōhau, well into the 1930s). Honokahua Valley, to the north, was described as having wet taro lands, although of no great abundance (according to Handy quoting D.L. Fleming, in Sterling 1998:52).

Sweet potatoes were reportedly grown between Honokōhau and Kahakuloa Ahupua`a, presumably on lower *kula* lands and, south of the project area, Kahana Ahupua`a was known as a place of salt gathering for the people of Lāhainā (old spelling for village; Sterling 1998).

Most of the *ahupua`a* on the coast have been overshadowed by the famous roadstead and village that served as the capitol of the Hawaiian Kingdom after the conquest of Kamehameha I until 1855. The ethnographic and historic literature, often our only link to the past, reveal that the lands around Lāhainā were rich agricultural areas irrigated by aqueducts originating in well-watered valleys with permanent occupation predominately on the coast. Crops cultivated included coconut, breadfruit, paper mulberry, banana, taro, sweet potato, sugar cane, and gourds.

THE MĀHELE

In the 1840s, traditional land tenure shifted drastically with the introduction of private land ownership based on Western law. While it remains a complex issue, many scholars believe that in order to protect Hawaiian sovereignty from foreign powers, Kauikeaouli (Kamehameha III) was forced to establish laws changing the traditional Hawaiian economy to that of a market economy (Kame`eleihiwa 1992:169–70, 176; Kelly 1983:45, 1998:4; Daws 1968:111; Kuykendall 1938 Vol. I: 145). The Māhele of 1848 divided Hawaiian lands between the king, the chiefs, the government, and began the process of private ownership of lands. The subsequently awarded parcels were called Land Commission Awards (LCAs). Once lands were made available and private ownership was instituted the *maka`āinana* (commoners), if they had been made aware of the procedures, were then able to claim the plots which they had been cultivating and living. These claims did not include any previously cultivated but presently fallow land, stream fisheries, or many other resources necessary for traditional survival (Kelly 1983; Kame`eleihiwa 1992:295; Kirch and Sahlins 1992). If occupation could be established through the testimony of two witnesses, the petitioners were awarded the claimed LCA and were issued a Royal Patent after which they could take possession of the property (Chinen 1961:16). There are no LCA's associated with the current project area. Rather, land use records mostly reflect historic-era use of the lands.

HISTORIC LAND USE

An 1831 census estimated the entire population of Kā`anapali District to be 2,980 people, which was reduced to less than half (1,341) only five years later probably due to introduced diseases (Schmidt 1973). Whaling (centered on Lahaina Town) was the first commercial enterprise in West Maui, but it had more or less collapsed by the 1860s. Commercial sugarcane production was the next large capitalist venture in West Maui, starting as early as 1863, and it was focused between Kā`anapali and Lahaina.

The general area around and below the project area, which was located at the margins of sugar cane enterprises in West Maui (Dorrance and Morgan 2000), was most important as a center of commercial ranching (cattle raising) and, subsequently, pineapple production.

In the later nineteenth century, lands in West Maui became part of the Campbell Estate. This was also the time that the Honolua Ranch was first established. Cattle ranching began then and was continued by Henry Perrine Baldwin, who acquired the lands from the Campbell Estate in 1890 (Fredricksen and Fredricksen 2001). In addition to ranching, other early commercial activities included coffee farming.

David T. Fleming became manager of Honolua Ranch in 1911 (or 1912). Fleming was well-versed in pineapple production from the Ha`iku area and gradually began shifting the ranch's initiative to pineapple production. The Honolua Ranch/Baldwin Packers complex shifted from Honolua to Honokahua in 1915, and a pineapple cannery was constructed. A major commercial pineapple industry emerged in West Maui during the 1920s. The plantation communities of Honokahua and Nāpili emerged and developed as Honolua Ranch/Baldwin Packers pineapple operations grew. The population of the Lahaina area increased with the successful economic operations of the pineapple plantation. Baldwin Packers merged with Maui Pineapple Company in 1962 to form Maui Land and Pineapple Company, Inc. After this time, much of the Honolua Ranch lands were converted for resort development, a process that continues to this day. Both the Ritz-Carlton Kapalua and the Residences at Kapalua Bay are part of this ongoing process.

The Honokahua Historic District (Site 50-50-01-1591) is located north of the project area. This historic district includes the plantation village of Honokahua, the Baldwin Packers cannery and associated facilities, Honolua Ranch Stables, Honolua Ditch (constructed in 1902), the Maui Pineapple Company offices, the Honolua Store, plantation camp housing, and two churches (Fredricksen 2001).

The Honokahua Burial Site (50-50-01-1342), which contained over 2,000 Hawaiian burials, is included with five other traditional sites in the Honokahua Archaeological District (50-50-01-1340). The cemetery is included on the National Registry of Historic Places. The cemetery was used by Native Hawaiians from as early as A.D. 700 to 800 to as late as the early nineteenth century (Donham 2000).

Evidence of historic-era activity in and around the project area is evidenced by fallow pineapple fields and water transport ditches. For instance, located several hundred meters down slope (west) from the current project area, Honokohau Ditch is present. Designated as State Site No. -1591, the ditch runs perpendicular to the slope through multiple *ahupua`a*.at the c. 700-750 ft. elevation level. The ditch itself has an interesting history, as noted by Wilcox (1921). The ditch, primary composed of rock slab side walls, was originally constructed from 1902 and was completed in June, 1904. The ditch was built by Honolua Ranch, who also owned it, but Pioneer Mill financed the project and used the water. The ditch started at 700 feet above mean sea level and was completely re-built twice and renovated one time. Due to cracks, leakages, and sediment built up over time, a "new" Honokohau Ditch was constructed from June, 1912 and completed in November, 1913. The ditch was called "Honolua Ditch" by Maui Land and Pineapple Company and designated as Honokohau Ditch by the Pioneer Mill Company, even though it was the same ditch [Note: the current project area is noted as "Field 105" and when in use as field, was owned by Maui Land and Pineapple Company, Inc., although maps notate "Pioneer Mill Company, Ltd" beneath the ML&P designation]. In September, 1923 the entire ditch was re-lined, a process that took five years to complete. During this re-lining process, water was diverted from this ditch to the old, 1904 Honokohau Ditch which had been abandoned. The ditch still retains an important water transfer capacity today as it irrigates neighboring lands and brings potable water to the Lahaina area. At present times, the area contains fallow pineapple fields, and the area remains undeveloped.

PREVIOUS ARCHAEOLOGY

A majority of the previous archaeological work conducted in the Kahana-Ka`anapali area has occurred nearer the coastline, a symptom of much increased development from the 1980s through present times. A short history of these projects is presented, with a focus on the few projects conducted in more upland locations of the Kahana area, in more similar settings to the current project area.

The first study of the Kahana area, as with a vast majority of coastal Maui, was conducted by W. Walker on an island-wide survey that took place in 1931. Focused on monumental coastal sites, Walker noted a destroyed *heiau* at Kahana Point (Walker Site No. 12), one *heiau* that was washed away at Mailepai Point (Walker Site No. 13), and another destroyed *heiau*, named Hihiho which was located along a country road near Kalaeokaea Point (Walker

Site 14). There has been no on-ground confirmation of these structures since Walker's initial survey (Walker 1931).

Much archaeological work has been located in the gulches of the Kahana area, and provides overlapping lines of evidence for land use and habitation in the area. In 1974, Michael Kaschko of the Bishop Museum conducted a walk-through of select gulches for the U.S. Soil Conservation Service in conjunction with the Wailuku Flood Prevention Project and the Honolua Watershed. Kaschko's survey "noted numerous stone walls, terraces, alignments and a historic midden," (Kaschko 1974: 4, 5).

In 1977, Mikk Kaschko, Bion P. Griffin, George Lovelace and other employees of the Archaeological Research Center Hawai'i, Inc. (ARCH, Inc.) conducted survey and salvage excavations on select areas of Mahinahina Gulch for the Hawai'i Department of Transportation. Five gulches were surveyed and a total of five archaeological sites were located (Griffin and Lovelace 1977:11), and given State Site numbers. All of the sites detected by ARCH, Inc. were identified as prehistoric walls, one of which was previously detected in Kaschko's 1974 survey of the area (*ibid*: 14).

An Archaeological Reconnaissance Survey was performed by Robert J. Hommon and Hamilton M. Ahlo in 1982 ahead of an airstrip proposal by the Royal Hawaiian Air Service. Hommon and Ahlo did not identify any archaeological sites (Hommon and Hamilton 1982:8).

In 1983, Eric Komori of the Bishop Museum carried out archaeological investigations that included surface surveys and inspections of backhoe-disturbed soil in Kahana gulch. The work was done under contract to the U.S. Soil Conservation Service and was a follow-up to Kaschko's 1974 project. Seven sites were recorded by Komori's during these investigations: an overhang/shelter coupled with a 10 meter long segment of terraced earth, a platform bordered by terraces, a wall segment and two stone alignments, wall segments and terraces, a floodplain partitioned off from the rest of the landscape by stone walls and terraces, walls of stacked stone and a rock shelter containing a "hammer stone or unfinished *'ulu maika* (prehistoric Hawaiian game stone)" (Komori 1983:8).

Four projects overseen by Joseph Kennedy (two in 1986, one in 1990 and one in 1992) were located on properties nearer the coastline. Kennedy's first visit to the area in September of 1986 investigated and confirmed the ruins of a stone church dating to the mid-nineteenth century. Although Kennedy could find no record of a graveyard attached to the church, nor marked graves at the site, he could not discount the possibility of unmarked graves near the church (Kennedy 1986a:1–5). In November of 1986 Kennedy made a return visit to the area to take photographs, map the site, and search for burials. No burials were found on the property

(Kennedy 1986b:1–5). In 1990, Kennedy returned to the area for the third time to conduct an archaeological inventory survey of 50 acres of land near Kahana. The survey found two new sites: "a two tiered basalt rock platform and a single, crude petroglyph" (Kennedy 1991:4). At the behest of the State Historical Preservation Division, a test unit was placed near the rock platform in 1992. Excavations there found a burial, which was left *in situ* (Kennedy 1991:22).

In 1995, Fredericksen and Fredericksen (1995) conducted extensive investigations of a 4-acre parcel located to on the *makai* side of Honoapi`ilani Highway, down slope from the current project area, in TMK: (2) 4-3-005:071. A total of twenty-two stratigraphic trenches were mechanically (backhoe) excavated and two test units were manually excavated by researchers, all of which produced negative results. One historic site (50-50-01-4069) consisting of a stone bridge footing and retaining wall, a section of the old Pioneer Mill railway (Site -6478), and an historic grave site (Site 50-50-01-4072) were identified during the investigations. Fredericksen and Fredericksen (1995:20) state that there was no evidence of *in situ* historic or indigenous cultural deposits across the investigated parcel, as a majority of the parcel was grubbed and filled in recent times.

In 1999, Xamanek Researches conducted Archaeological Inventory Survey on a 1.4 mile (2.25 km) long by 40 feet (12 m) wide section of Honoapi`ilani Highway. During the survey three newly identified sites were documented. These sites include are: Site 50-50-01-4797, a pre-Contact habitation area; -4797 and -4798, two wall associated with Lower Honoapi`ilani Highway. Radiocarbon dating of a charcoal sample collected from Site -4797 yielded a date ranging from AD 1420 to 1660 with an intercept radiocarbon age of AD 1490 (Fredericksen and Fredericksen 2001:2). Site -4797 was interpreted as a coastal habitation site probably associated with marine resource utilization and as a "rare example of a surviving coastal habitation site along this heavily developed portion of the West Maui Coastline *(ibid*: 16). Thus, Site -4797 was found to be significant under Criteria A, C, and D of Federal and State historic preservation guidelines (*ibid*: 2 and 16).

Subsurface testing of Site -4797 could not be conducted during the Inventory Survey due to safety and access to private property issues. Thus, the extent of the site could not be determined. In 2001, Xamanek Researches returned to Site -4797 and conducted subsurface in the form of one 1.0 by 1.0 m hand excavated test unit, on private property, and four backhoe trenches within the County of Maui Right of Way (*ibid*: 3). The findings of the additional Inventory level work indicate a cultural layer interpreted as Site -4797 extended 150 m along the eastern side of Honoapi`ilani Highway between 1.1 to 1.5 m below the ground surface. A total of five pit features and two possible features extending approximately 78.0 m were noted in a wave cut profile on the west side of Honoapi`ilani Highway (*ibid*: 15).

None were dated due to the lack of datable material. Furthermore, no traditional Hawaiian artifacts were recovered during the excavation of three test units and nineteen trenches. Historic components of the sites (e.g., ceramics, glass) showed that the area was likely more intensively utilized during historic times, as was also evidenced by the lack of traditional-period artifacts at the sites.

In 2000, Scientific Consultant Services, Inc. conducted Archaeological Inventory Survey of approximately three acres of land (see Figure 7) located within the *ahupua`a* of Kahana, Kā`anapali District, Maui Island, Hawai`i [TMK: (2)-4-3-005:070] (Dega 2000), adjacent to previously mentioned Xamanek project area located in TMK: (2) 4-3-005:071 discussed in Fredericksen and Fredericksen (1995). A 100 percent pedestrian survey of the project area was conducted and revealed a section of the Old Pioneer Mill Railroad easement (Site -6478) running across the southeastern portion of the parcel. The existing railroad bed probably dates to 1919, when the railroad line ran from the Kā`anapali area to the Kahana area, and beyond. The second identified site (Site -4069) consisted of stone bridge footings and retaining walls. This site was identified in the northeastern portion of the project area and had previously been documented (Fredericksen and Fredericksen 1995). Limited testing in the form of six trenches was accomplished within undisturbed portions of the project area. Three trenches were sterile, one trench contained concrete water conduits and strata likely associated with the aforementioned railroad easement, and two trenches exhibited a profile of intensive oxidation and reduction layers. The clarity and breadth of the strata in the latter two trenches provides some evidence for a long-term commitment to agriculture. Several Land Commission Awards occurring on the parcel also attest to traditional agricultural practices on the parcel (taro and sweet potato cultivation). Overall, within a majority of the project area, the lack of surface and subsurface remains was partially attributable to historic-period, intensive landscape alterations. During the late 1800s to early 1900s, sugarcane was cultivated across the parcel. Railroad construction occurred in the early 1900s along the eastern portion of the project area. The expansion of the Honoapi`ilani Highway was completed in more recent times. The western flank of the parcel nearer the current project area was subject to limited grading and dumping activities.

Overall, the presence and documentation of a varied abundance of archaeological features in the general Kahana-Honokawai area indicates a strong history of settlement and land usage both by traditional Hawaiian peoples and Historic Period immigrants. Most of this occupation and land use occurred nearer the coastline and in the west Maui valleys, not the upland tablelands as is the current project area.

PROJECT AREA EXPECTATIONS

Based on archival research and previous archaeology conducted in the general upland, Kahana area, given the location of the project area, it was unlikely that traditional architectural remains or surface artifacts and midden scatters would be identified. This was primarily based on location within fallow pineapple fields. If the project area were in the gulches/valleys (i.e., Kahana Valley), expectations would have easily increased, given previous records of *lo`i* and house sites in those area. Historic-era landscape alterations through industrial-level cultivation were thought to preclude significant findings within the project area. There was also limited expectation for locations in the project area that would be amenable to yielding significant subsurface cultural deposits, given the absence of finds on such upland areas located above valleys/drainages in the past.

METHODS

Fieldwork was conducted on September 19, 2013 by SCS Archaeologist David Perzinski, B.A. under the overall guidance of Michael Dega, Ph.D. (Principal Investigator). The project area was delineated by survey flags within the fallow pineapple fields. UTM coordinates were entered into a Garmin GPS map 60CSx Global Positioning System for the flagged center of proposed well. Pedestrian survey consisted of a 100% visual inspection of the project area. Transects were spaced c. 5-10 m apart and laid on a north-south axis t cover the entirety of the project area. Surface visibility was low-moderate (see Figure 5). Photographs were taken of the project area, in addition to written notes pertaining to topography, the natural environment, and potential for sites. Given the location of the project area, within the fallow pineapple field, no subsurface testing was conducted.

Laboratory work was conducted in the Maui and Oahu offices of SCS and included drafting of project area locations maps, digitizing photographs, and reporting. All documentary materials are currently being curated at the SCS office on Oahu.

RESULTS OF FIELDWORK

Survey commenced in the southern portion of the subject parcel and stayed on the north-south axis through the project area. The area was transected multiple times, even though it was clear that the area of potential effect was a former pineapple field now completely covered in molasses grass, the latter a common secondary growth in fallow agricultural fields (see Figure 5). Below the thick ground cover, the soil consisted of dark reddish brown silty clay (Alaeloa

Series). Abundant plastic irrigation lines, common to pineapple cultivation, were scattered across the ground surface. No traditional Hawaiian or historic sites or deposits were encountered during the survey.

The current archaeological work did not lead to the identification of any historic properties. This may be the result of either Historic and/or modern era agricultural activities, which disturbs sites, and/or the fact that this area was not a primary location for pre-Contact habitation, agriculture, etc. These sites are most likely present in neighboring valleys (*i.e.*, Kahana Valley) and not on the tablelands.

The current project area was wholly constituted within a portion of "Field 105" as shown on plantation maps and TMK maps for the area (see Figure 2). Given plantation activities within the entirety of the project area, the lack of significant sites was somewhat expected prior to fieldwork.

CONCLUSION AND RECOMMENDATIONS

Inventory-level survey of the proposed West Maui Well No. 2 Exploratory, occurring on a c. 1-acre parcel in the Kahana uplands, did not lead to the identification of any significant sites. It is our estimation that the proposed undertaking, described above, would not have an adverse impact on any archaeological sites or features. No further archaeological/historical work is recommended for the project area. However, should the inadvertent discovery of significant cultural materials and/or burials occur during construction, all work in the immediate area of the find must cease and the SHPD be notified to discuss mitigation.

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HISTORIC PRESERVATION DIVISION
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March 11, 2014

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Honolulu, Hawaii 96814

LOG NO: 2014.01091
DOC NO: 1403MD18
Archaeology

Aloha Dr. Dega:

SUBJECT: **Chapter 6E-8 and 6E-42 Historic Preservation Review-**
Revised Draft Archaeological Assessment for the West Maui Well No. 2
Kahana Ahupua'a, Lahainā District, Island of Maui
TMK (2) 4-3-001:017 (por.)

Thank you for the opportunity to review the revised draft report titled *Archaeological Assessment for the West Maui Well No. 2 Exploratory, DWS Job No. 11-06, Kahana Ahupua'a, Lahaina (Kā'anapali) District, Maui, Hawai'i [TMK (2) (2) 4-3-001:017]* (Perzinski and Dega; March 2014), which we received on March 10, 2014.

This archaeological assessment was prepared for Ronald M. Fukumomto Engineering, Inc., on behalf of the County of Maui Department of Water Supply. This parcel is approximately one acre, and was previously subject to pineapple cultivation and is currently owned by the Maui Land and Pineapple Company, Inc. The Department of Water Supply is considering this parcel as a proposed location for a well and construction staging area. The parcel is currently undeveloped. It is bounded by Kahana Stream Gulch to the north, pineapple fields to the east, Kahanaiki Gulch to the south and fallow pineapple fields to the west.

Pedestrian survey fieldwork was conducted on September 19, 2013 by one archaeologist. Transects were spaced five to ten meters apart. Project visibility was low-moderate due to the parcel being completely covered in molasses grass. No subsurface testing was conducted.

The archaeological inventory survey does not document any historic properties, and has therefore been submitted as an archaeological assessment. This area has been recommended for no further work, and we concur with that recommendation.

The archaeological assessment meets the requirements of Hawai'i Administrative Rule 13-275-5 and is accepted as final. Please send one hardcopy of the final document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention SHPD Library. We request that for the Final document, and for all future submittals, individual names of SHPD employees not be included in report and plan submittals. Simply state that the SHPD Archaeology Branch and the Culture and History Branch will both be notified upon the inadvertent discovery of historic cultural remains or burial sites. Please contact me at (808) 243-4641 or Morgan.E.Davis@hawaii.gov for any concerns about this letter.

Mahalo,

Morgan E. Davis

Morgan E. Davis
Lead Archaeologist, Maui Island Annex

APPENDIX

ARCHAEOLOGICAL INVENTORY SURVEY

K-2

SCS PROJECT NO. 2225-2 AA

ARCHAEOLOGICAL INVENTORY SURVEY FOR THE PROPOSED WEST MAUI WATER SOURCE DEVELOPMENT PROJECT MAHINAHINA WELL (STATE WELL NO. 6-5638-004) (WEST MAUI WELL NO. 1) AND THE KAHANA WELL (STATE WELL NO. 6-5738-002) (THE WEST MAUI WELL NO. 2)

HONOKŌWAI, MĀHINAHINA, AND MĀHINAHINA 1, 2, 3 AHUPUA‘A, LAHAINA (KĀ‘ANAPALI) DISTRICT

ISLAND OF MAUI
HAWAI‘I
TMK: (2) 4-3-001:017 and 084;
(2) 4-4-002:014, 015, and 018; and
(2) 4-4-004:009, 011, and 019

Prepared by:
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ABSTRACT

At the request of the County of Maui, Department of Water Supply (DWS), Scientific Consultant Services, Inc. (SCS) conducted archaeological inventory survey (AIS) in advance of the proposed West Maui Water Source Development Project. The proposed project is needed to provide additional potable water sources to DWS West Maui Well System for future growth in the area and uses State of Hawai`i lands and County of Maui funding. The project entails the development (installation of permanent well pumps) of two groundwater wells: the Mahinahina Well (State Well No. 6-5638-004 or West Maui Well No. 1) and the Kahana Well (State Well No. 6-5738-002 or the West Maui Well No. 2). In addition, construction of related improvements is also necessary to connect the wells to the DWS West Maui Water System, which involves a Kahana Well Transmission waterline, a MECO Electic Line Extension (from the Kahana well site), and a 500,000 gallon control tank site.

An AIS was performed to identify the presence/absence of historic properties in the project area, assess the significance of any identified historic properties, to make a project effect determination, and to propose mitigation measures to address the project effect on historic properties, pursuant to Hawaii Administrative Rules (HAR) § 13-284 and HAR § 13-276. No federal funding or federal permits are involved with the current project. Full pedestrian survey of the project area was conducted in January, 2019. No excavation work was completed during this project, as was discussed with the SHPD (see above). A portion of one historic property was identified in the project area: Honokohau Ditch (Site -1591). A portion of the ditch is present in the western portion of the proposed pipeline corridor, just to the east of the existing DWS water treatment plant. The ditch passes through the project area to other west Maui lands. Overall, given the lack of surface finds, former land use in the project area (agricultural), and results of previous archaeological work in these fields, no further work is recommended for this project.

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INTRODUCTION

At the request of the County of Maui, Department of Water Supply (DWS), Scientific Consultant Services, Inc. (SCS) conducted Archaeological Inventory Survey in advance of the proposed West Maui Water Source Development Project. The proposed project is needed to provide additional potable water sources to DWS West Maui Well System for future growth in the area and uses State of Hawai`i lands and County of Maui funding. The project entails 11.5 acres for the development (installation of permanent well pumps) of two groundwater wells: the Mahinahina Well (State Well No. 6-5638-004 or West Maui Well No. 1) and the Kahana Well (State Well No. 6-5738-002 or the West Maui Well No. 2). In addition, construction of related improvements is also necessary to connect the wells to the DWS West Maui Water System, which involves a Kahana Well transmission waterline, a MECO Electric Line Extension (from the Kahana well site), and a 500,000 gallon control tank site.

The wells and associated infrastructure will be located in Honokōwai, Kahana, Māhinahina 1, 2, 3, and Māhinahina 4 Ahupua'a, Lahaina (Kā'anapali) District, Island of Maui, Hawai'i. The project area, encompassing 11.5 acres, is situated on lands owned by Maui Land and Pine (MPL) [TMK: (2) 4-3-001:017, 4-3-001:084, and 4-4-001:017]; lands owned by the State of Hawai'i [TMK: (2) 4-4-002:014, 4-4-004:009, 4-4-004:011, and 4-4-004:019; and lands owned by the Department of Hawaiian Homelands (DHHL) [TMK: (2) 4-4-002:015, and 4-4:002:018] (Table 1; Figures 1 through 5).

Consultation was undertaken with the State Historic Preservation Division (SHPD) in several letters from April 26, 2018 and July 6, 2018 from the County of Maui, with SHPD responding to several, including from dated August 16, 2018 (Log No:2018.01592; Doc No:1808MBF12), and further per AIS methodologies in August, 2018 (no letter was authored by SHPD for the consultation). Full pedestrian survey of the project area was conducted in January, 2019. No excavation work was completed during this project, as was discussed with the SHPD (see above). A portion of one historic property was identified in the project area: Honokohau Ditch (Site -1591). A portion of the ditch is present in the western portion of the proposed pipeline corridor, just to the east of the existing DWS water treatment plant.

PROJECT DESCRIPTION

The proposed project involves several components, which are listed below. The names of the landowners and the Tax Map Keys (TMK) of the properties that will be affected by the proposed project are presented in Table 1.

1. Mahinahina Well (West Maui Well No. 1)

    a) An estimated 500 gallons per minute (gpm) well pump
    b) An approximate 30,000 gallon control tank, chlorination system, supervisory control and data acquisition (SCADA) system, electrical equipment, control building, and related appurtenances
    c) Site development of approximately two (2) acres (grading, drainage, fencing, and landscaping)
    d) Electrical line extension from the existing Maui Electric Company (MECO) electric line to the well

2. Kahana Well (West Maui Well No. 2)

    a) An estimated 1,000 gpm well pump
    b) An Approximate 30,000-gallon control tank, chlorination system, SCADA system, electrical equipment, control building, and related appurtenances
    c) Site development of approximately one (1) acre (grading, drainage, fencing, and landscaping)
    d) Electrical site improvements, including offsite electric extension from the existing MECO electric line to the well site, transformer, and emergency generator

3. 500,000-Gallon Control Tank

    a) An estimated 500,000-gallon control tank, which will be located next to the Mahinahina Surface Water-Treatment Plant (SWTP) on an approximately 1.8-acre site
    b) Site development of approximately 1.8 acres (grading, drainage, fencing, and landscaping

4. Transmission Waterlines and Access Roads

    a) Mahinahina Well (West Maui Well No. 1) Transmission Waterline and Access Road: Approximately 6,500 feet of 12-inch waterline and access road connecting the West Maui Well No. 1 to the proposed estimated 500, 000-gallon control tank which will be located near the Mahinahina SWTP
    b) Kahan Well (West Maui Well No. 2) Transmission Waterline and Access Road: Approximately 7,500 feet of 8-inch or 12-inch waterline and access road

Table 1: Named of the Landowners and the Tax Map Key (TMK) of the Properties that will be Included in the Proposed Project.

Project Component	Landowner	TMK: (2)
Mahinahina Well (West Maui Well No. 1)	State of Hawai'i State of Hawai'i	4-4-004:011 4-4-004:009
Kahana Well (West Maui Well No. 2)	Maui Land and Pineapple Company, Inc. (MLP)	4-3-001:017
500,000-Gallon Control Tank	Department of Hawaiian Home Lands (DHHL)	4-4-002:018
Mahinahina Well (West Maui Well No. 1) Transmission Waterline, Access Road, and Maui Electric Line Extension	MLP MLP State of Hawai`i DHHL DHHL State of Hawai'i State of Hawai'i State of Hawai'i	4-4-001:017 4-3-001:084 4-4-002:014 4-4-002:015 4-4-002:018 4-4-004:009 4-4-004:011 4-4-004:019
Kahana Well (West Maui Well No. 2) Transmission Waterline, Access Road, and Maui Electric Line Extension	MLP State of Hawai'i State of Hawai'i	4-3-001:017 4-4-004:009 4-4-004:019

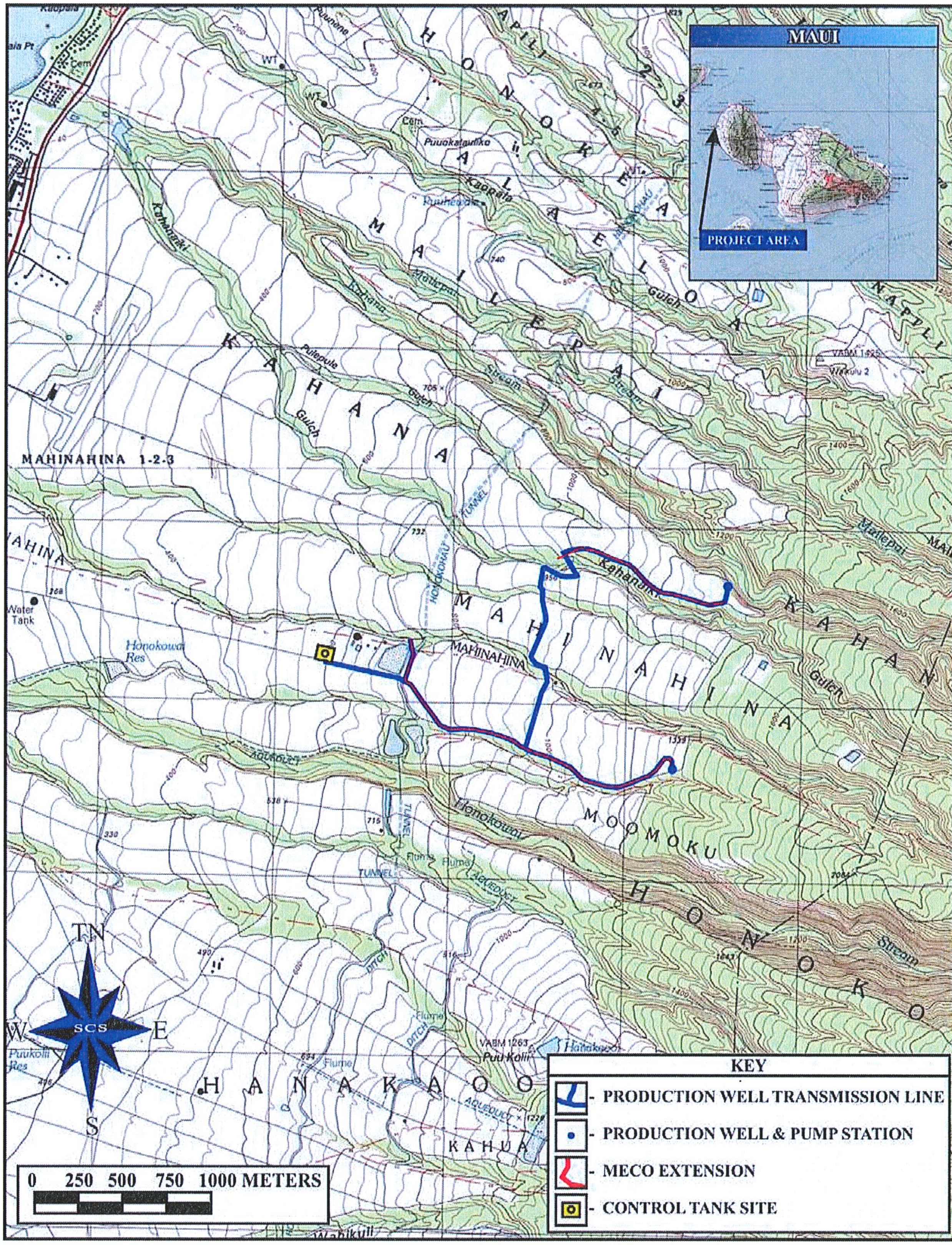

Figure 1: USGS Quadrangle (Makena, HI. 1995; 1:24,000) Showing Project Area Location.

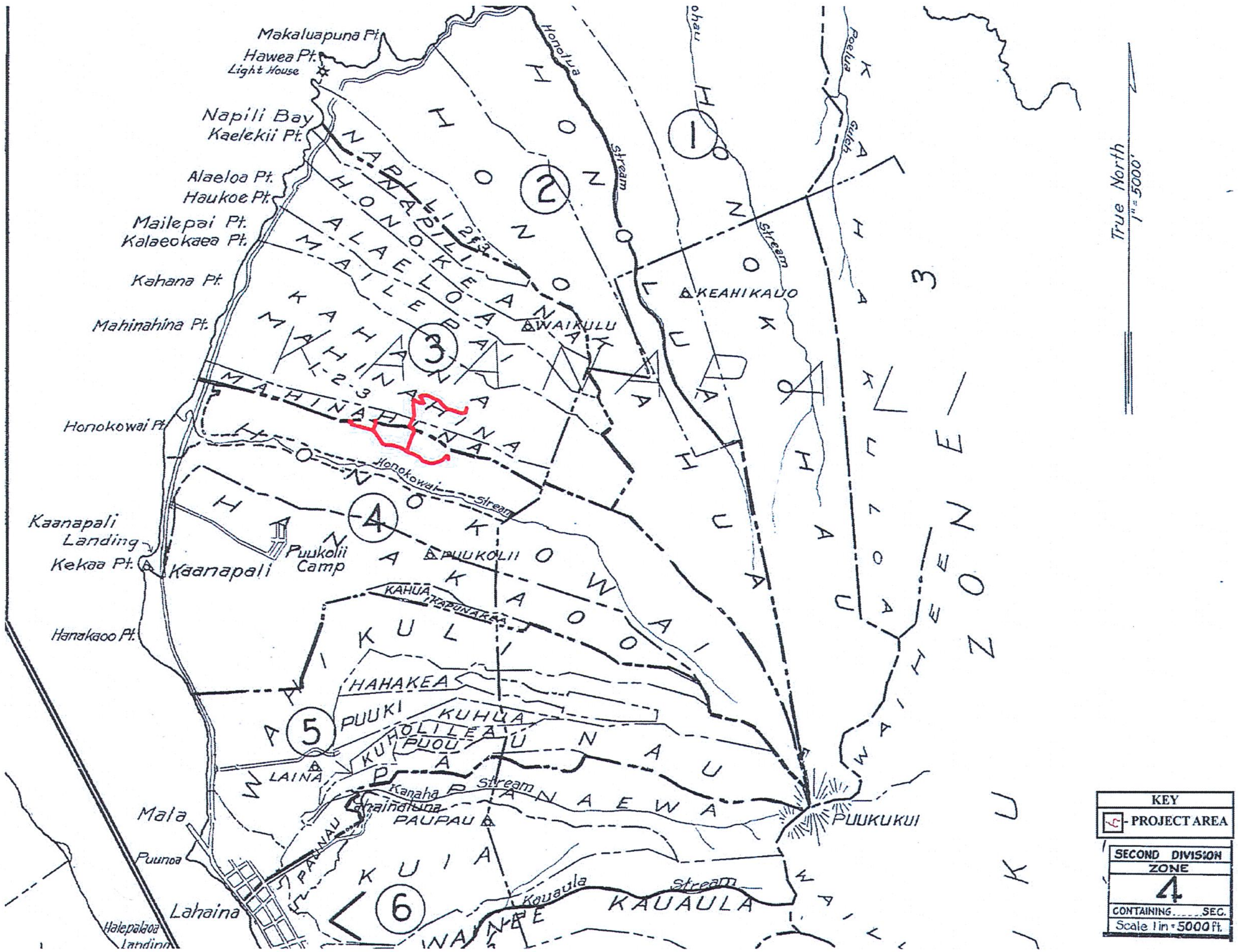

Figure 2: Tax Map Key [TMK: (2) Zone 4) Showing Project Area Location.

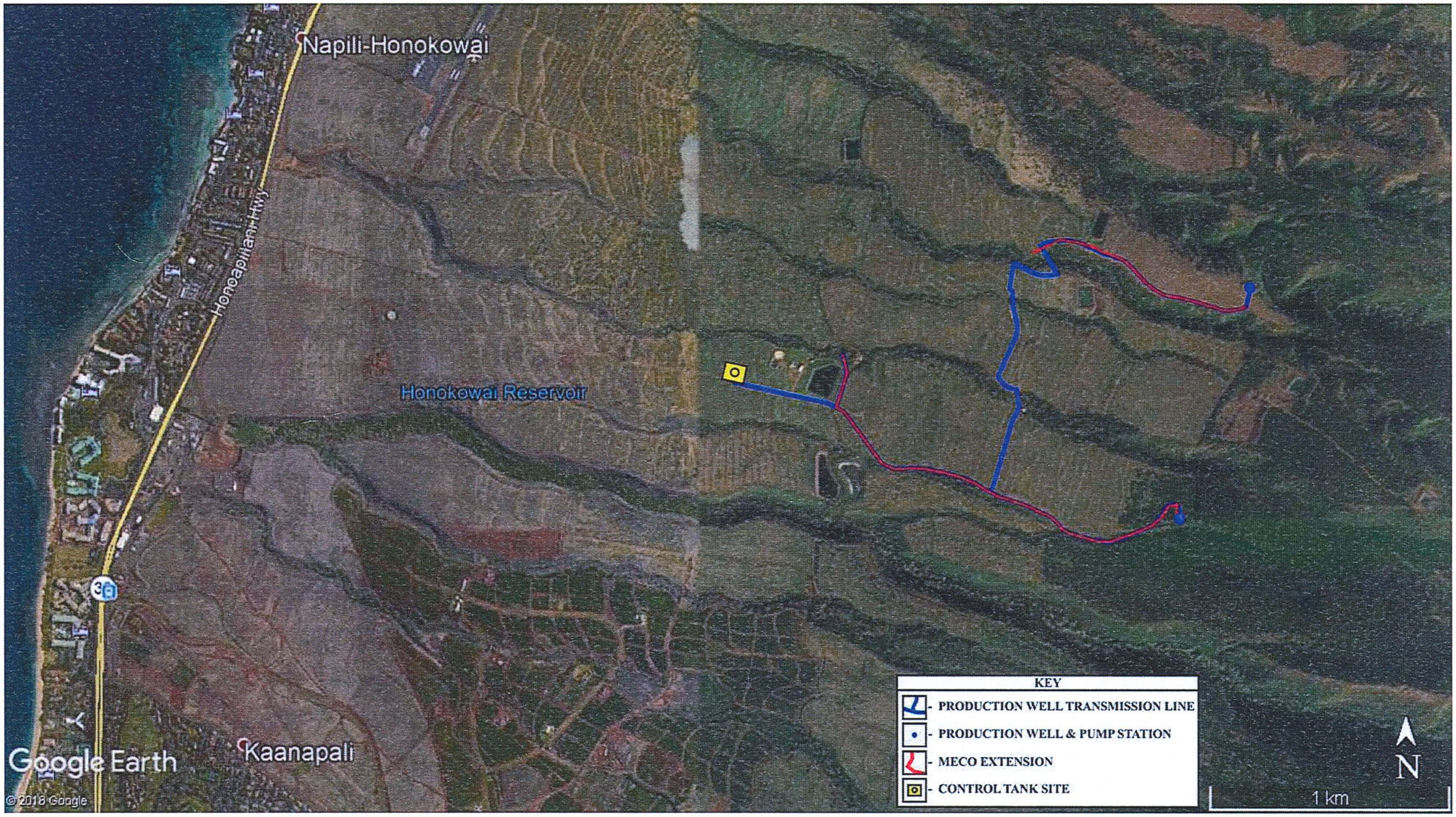

Figure 3: Satellite Photograph (Google Earth Image (Google 2018; Imagery Date 1/12/2013) Showing Project Area Location.

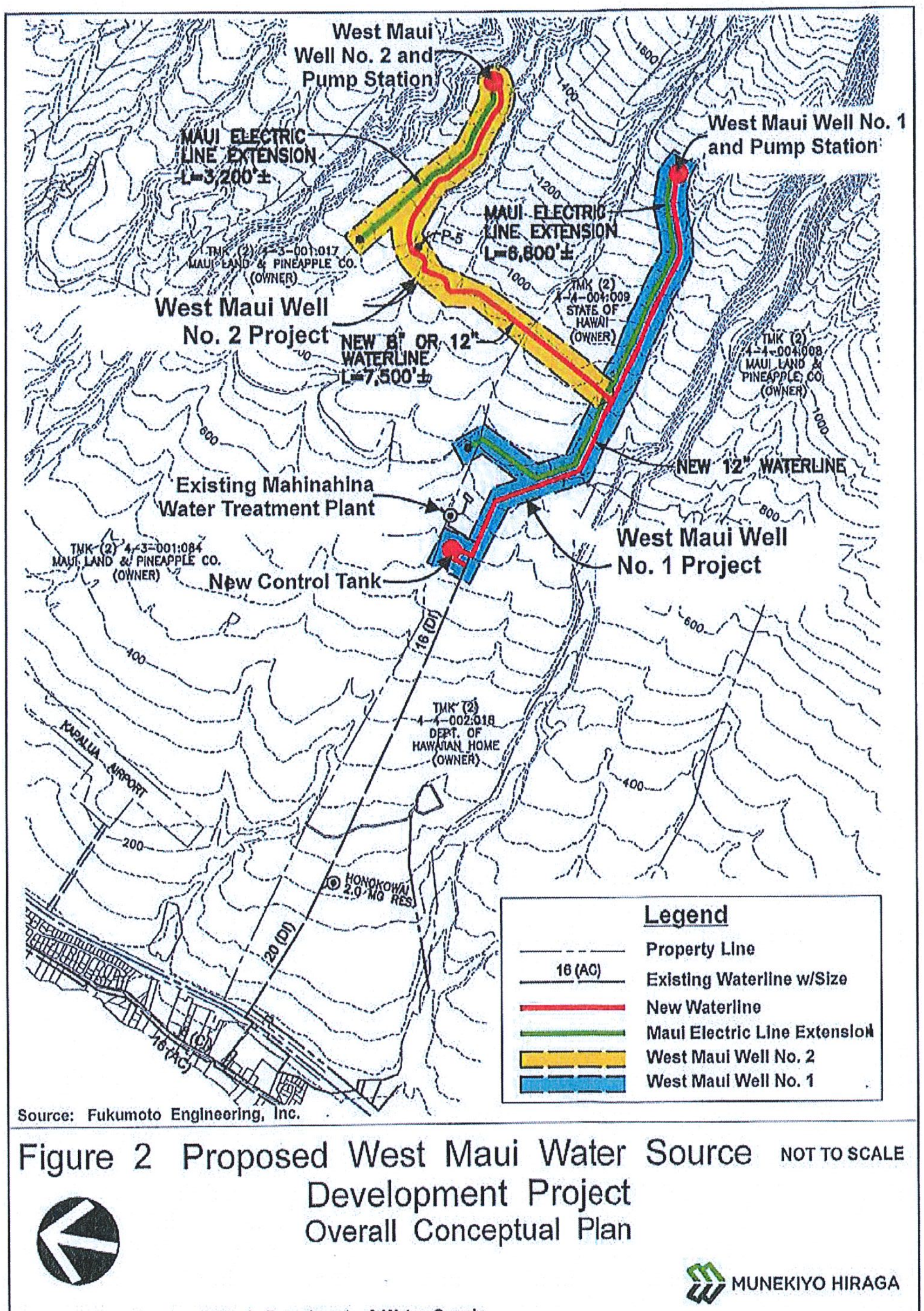

Figure 4: The Proposed West Maui Water Source Development Project Overall Conceptual Plan (Munekiyo Hiraga 2018).

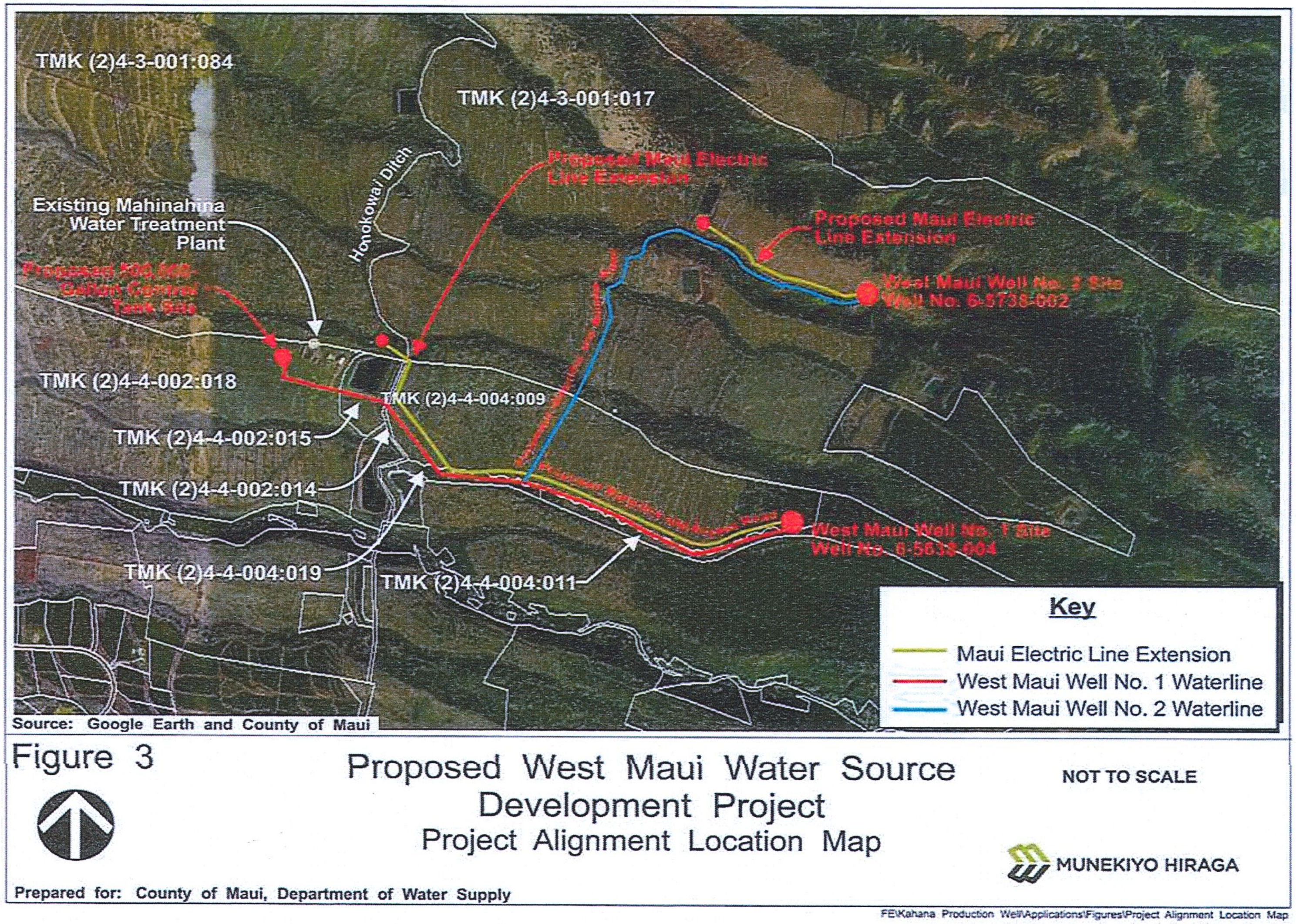

Figure 5: Project Alignment Map (Munekiyo Hiraga 2018). Note: Presence of Honokohau Ditch.

ENVIRONMENTAL SETTING

The island of Maui ranks second in size of the eight main islands in the Hawaiian Archipelago. The Island was formed by two volcanoes, Pu'u Kukui in the west and Haleakalā in the east. Pu'u Kukui, forming the west end of the island (1,215 m above mean sea level), is composed of large, heavily eroded amphitheater valleys that contain well-developed permanent stream systems that watered fertile agricultural lands extending to the coast. The deep valleys of West Maui and their associated coastal regions have been witness to many battles in ancient times and were coveted productive landscapes. These are joined together by an isthmus containing dry, open country or *kula*.

PROJECT AREA

The proposed well sites project area is situated northwestern slope of what is commonly referred to as the West Maui Mountains on the west side of the Island of Maui, in the traditional District of Kā'anapali, now known as Lahaina, and extends across the Ahupua'a of Honokōwai, Māhinahina, and Māhinahina 1, 2, 3. The project area is situated between approximately 2.0 and 3.5 miles inland from the coastline and extends approximately from 640 to 1320 feet above mean sea level (amsl). The land on which the exploratory wells are drilled will be located on slopes that gently to moderately grade to the north-northwest/south-southeast and are under the commercial cultivation of pineapple (see Figure 3). The Honokohau Tunnel traverses through the lower portion of the project area.

CLIMATE

The project area receives an average amount of precipitation, compared with other settled parts of Maui and the Hawaiian Islands, in general. According to Armstrong (1983), mean annual rainfall in the general area is approximately 76 cm (30 in.). Giambelluca et al. (2013) report *median* annual rainfall for the area of approximately 100 cm (40 in.). Part of the discrepancy between these rainfall data is probably due to the steeply increasing precipitation gradient east and southeast of the project area, as one moves up into the relatively wet flanks of West Maui. Regardless of which of these (30 or 40 in.) numbers is more typical of the local rainfall, a tremendous amount of through-flowing water from the West Maui uplands would have been available in traditional times in the Honokahua Stream and the smaller, but much closer, Napili Stream. Native Hawaiians utilized extensive irrigation techniques in this general region, as a way of capturing this great surplus of potable water.

SOILS

According to (Foote *et. al.* 1972: Sheet 93), the project area falls within four Soil Series (Figure 6), which are briefly described below:

- the Kahana Series, specifically Kahana silty clay, 7 to 15 percent (KbC), and Kahana silty clay, 3 to 7 percent slopes (KbB);
- Alaeloa Series, specifically Alaeloa silty clay, 15 to 35 percent slopes (AeC), Alaeloa silty clay, 7 to 15 percent slopes (AeE);
- the Olelo Series, specifically Oleleo silty clay, 3 to 15 percent (OFC), and
- Rough Broken and Stony Land (rRS).

THE KAHANA SERIES

Soils of the Kahana Series are well-drained soils, which derived from decomposing volcanic rock. Soils of this series can be found between 100 to 1,200 feet above mean sea level (amsl) in areas receiving 30 to 45 inches of annual rainfall. The surface layer of the KbC soils is generally about 14 inches thick. The subsurface layer consists of dark reddish brown silty clay, which is approximately 50 inches thick, and overlays saprolitic bedrock. The KbC soils exhibit moderately rapid permeability, slow to medium runoff, and a slight to moderate erosion hazard. The KbC soils are usually used in the commercial cultivation of sugarcane and pineapple and as residential areas (Foote et al. 1972:50-51). The KbB soils are similar to the KbC soils and used in the same manner, but the runoff rate is slow and the erosional hazard is slight (Foote et al. 1972:51).

THE ALAELOA SERIES

Like the soils of the Kahana Series, the soils of the Alaeloa Series are well-drained soils derived from decomposing volcanic rock found at high elevations, in this case, between 100 and 1,500 feet amsl. in areas receiving annual rainfall of 35 to 60 inches. The AeE surface layer extends 10 inches below surface and consists of dark reddish brown silty clay. The subsurface layer is approximately 48 inches thick, consists of dark red and red silty clay overlaying decomposing bedrock. The AeE soils exhibit moderately rapid permeability, medium runoff, and a moderate erosion hazard. The AeE soils are used in the commercial cultivation of pineapple, fruits, and garden vegetables; as ranchlands, wildlife habitats, and as residential area (Foote et al. 1972:26).

The AeC soils are similar to the AeE soils, but exhibit a slow to medium runoff and a slight to moderate erosion hazard. These soils are primarily used for the commercial cultivation of pineapple, with smaller properties serving as ranchlands and residential areas (Foote et al. 1972:26).

THE OLELO SERIES

In general, the soils of the Olelo Series are, also, are well-drained soils derived from decomposing volcanic rock occurring at high elevations on the Islands of Molokai and Maui. The Olelo Series can be found between 2,000 and 3,500 ft. amsl. in areas receiving 40 to 80 inches of annual rainfall on Maui. According to Foote et al. (1972:101-102), the OFC soil occurs on narrow to broad ridgetops, exhibit moderately rapid permeability, slow runoff, a slight erosion hazard, and a high acid content. The OFC soils are frequently used as woodlands and ranclands.

ROUGH BROKEN AND STONY LANDS

Foote et al. (1972:119) describe lands comprised of Rough Broken and Stony Lands (rRs) as consisting of "very steep, stony gulches… [where] [t]he local relief is generally between 25 and 500 feet." Rough Broken and Stony Lands range in elevation from around sea level to 3,000 amsl and occur in areas receiving 20 to 40 inches of rainfall annually. The rRS lands exhibit less than 20 inches of soil overlying bedrock or saprolitic rock, 3 to 25 percent of the ground surface is rocky, and runoff in these areas is rapid. In general, rRS lands are used as ranchlands, wildlife habitats, and watersheds.

TRADITONAL AND HISTORICAL CULTURAL CONTEXT

Archaeological settlement pattern data suggests that initial colonization and occupation of the Hawaiian Islands first occurred on the windward shoreline areas of the main islands between A. D. 850 and 1100, with populations eventually settling in drier leeward areas during later periods (Kirch 2011). Although coastal settlement was dominant, native Hawaiians began cultivating and living in the upland kula (plains) zones. Greater population expansion to inland areas began around the 14th century and continued through the 16th century. Large scale or intensive agriculture was implemented in association with habitation, religious, and ceremonial activities.

The Hawaiian economy was based on agricultural production and marine exploitation, as well as raising livestock and collecting wild plants and birds. Extended household groups settled in various ahupuaʻa. During pre-Contact times, there were primarily two types of agriculture, wetland and dry land, both of which were dependent upon geography and physiography. River valleys provided ideal conditions for wetland kalo (*Colocasia esculenta*) agriculture that incorporated pond fields and irrigation canals. Other cultigens, such as kō (sugar cane, *Saccharum officinaruma*) and maiʻa (banana, *Musa* sp.), were also grown and, where appropriate, such crops as ʻuala (sweet potato, *Ipomoea batatas*) were produced. This was the typical agricultural pattern seen during traditional times on all the Hawaiian Islands (Kirch and Sahlins 1992, Vol. 1:5, 119; Kirch 1985). Agricultural development on the windward side of

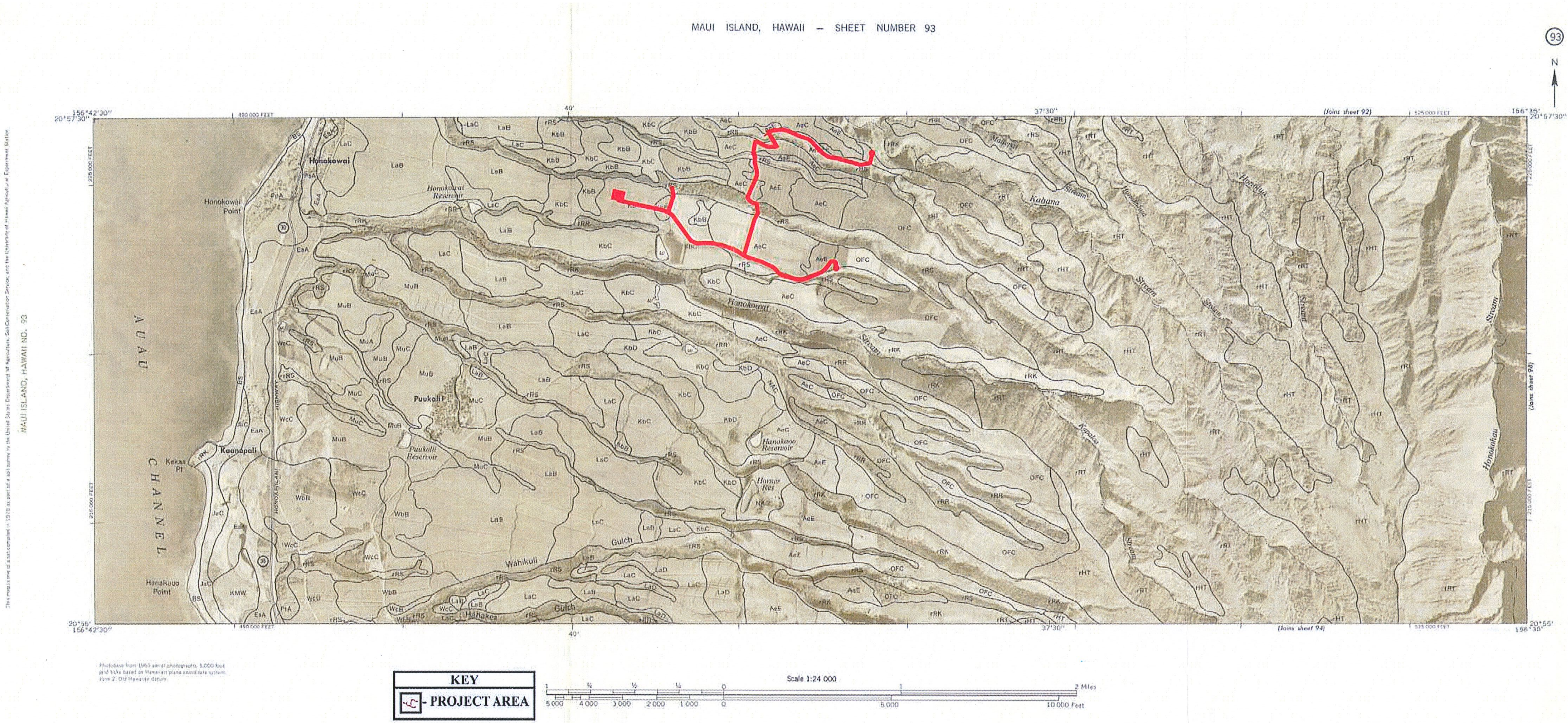

Figure 6: USDA Soil Survey Map Showing Soil Types within the Project Area (Foote et al. 1972: Sheet Number 93).

O'ahu was likely to have begun early (AD 1100–1300) during what is known as the Expansion Period (Kirch 1985).

This was the typical agricultural pattern seen during traditional times on all the Hawaiian Islands (Kirch and Sahlins 1992, Vol. 1:5, 119; Kirch 1985). Agricultural development on Maui was likely to have begun early in what is known as the Expansion Period (AD 1200-1400, Kirch 1985).

PAST POLITICAL BOUNDARIES

Traditionally, the Island of Maui was divided into twelve districts: Lāhainā, Kula, Honua'ula, Kahikinui, Kaupō, Kīpahulu, Hāna, Ko'olau, Hāmākualoa, Hāmākuapoko, Wailuku, and Kā'anapali (Sterling 1998:3; Figure 6). The division of Maui Island lands into districts (moku) and sub-districts was performed by a kahuna (priest, expert) named Kalaiha'ōhia, during the time of the ali'i Kaka'alaneo (Beckwith 1979:383; Fornander [1919-20, Vol. 6:248] places Kaka'alaneo at the end of the 15th century or the beginning of the 16th century). Land was considered the property of the king or ali'i 'ai moku (the ali'i who eats the island/district), which he held in trust for the gods. The title of ali'i 'ai moku ensured rights and responsibilities to the land, but did not confer absolute ownership. The king kept the parcels he wanted, his higher chiefs received large parcels from him and, in turn, distributed smaller parcels to lesser chiefs. The maka'āinana (commoners) worked the individual plots of land.

In general, several terms, such as moku, ahupua'a, 'ili or 'ili 'āina were used to delineate various land sections. A district (moku) contained smaller land divisions (ahupua'a), which customarily continued inland from the ocean and upland into the mountains. Extended household groups living within the ahupua'a were therefore, able to harvest from both the land and the sea. Ideally, this situation allowed each ahupua'a to be self-sufficient by supplying needed resources from different environmental zones (Lyons 1875:111). The 'ili 'āina or 'ili were smaller land divisions next to importance to the ahupua'a and were administered by the chief who controlled the ahupua'a in which it was located (Lyons 1875: 33; Lucas 1995:40). The mo'o'āina were narrow strips of land within an 'ili. The land holding of a tenant or hoa 'āina residing in an ahupua'a was called a kuleana (Lucas 1995:61).

The current project area is located within the ahupua'a of Honokōwai (bay drawing water), Kahana (cutting), Māhinahina (silvery haze, as in moonlight) 1, 2, 3, and Māhinahina 4, within the traditional District of Kā'anapali.

PRE-CONTACT PERIOD (PRE-1778)

A general settlement model based on archaeological evidence has been suggested for the Kāʻanapali District (Chapman and Kirch 1979; Kirch 1985). This model includes coastal marine foraging and fishing with more upland agricultural pursuits. In typical native Hawaiian fashion, dating at least from the later pre-Contact period (if not earlier), people in this area would have moved between the coast and the upland agricultural fields, exploiting the full range of resources available within the ahupuaʻa. Based on these observations, it is probable that the region in and around the project areas was inhabited and farmed, at least in later pre-Contact times through the early Historic Period (post-1778).

The current project is located in the traditional District of Kāʻanapali District, which is situated north of the traditional District of Lāhainā on the west side of the Island of Maui. The District extended north and west from Kekaʻa Point to ʻIli O Kukuipuka, encompassing five major stream valleys draining the leeward slopes of West Maui (i.e., Honokōwai, Kahana, Honokahua, Honolua, and Honōkohau) (Sterling 1998:46; Handy and Handy 2004:494). These valleys are "watered by the streams draining western slopes of the West Maui Watershed" (Handy and Handy 1972:494). "The valleys of Honokōhau, Honolua, and Honokōwai merge together at around 4,000 [amsl], below Lake Manowai where the headwaters begin (Anderson 2016:113). During the pre-Contact Period, these valleys were all productive wet taro (loʻi) lands, with extensive systems of terracing reported from early historic and later times, into the early 20th century.

It has been documented (Arago 1823:119-120, cited in Handy and Handy 1972:493) that the area surrounding the village of Lahaina was "dry and barren" at the time of contact with Westerners. In contrast, Fornander (1918-1919, Vol. 5: 540-541, cited in Handy and Handy 1972: 494) stated that Kekaʻa "once an area of intensive cultivation." Thus, it can be inferred that, traditionally, the entire northwest coast of Maui was under "continuous [loʻi] cultivation."

> Kekaa was the capital of Maui when Kakaalaneo was reigning over West Maui. ... Many houses were constructed and people cultivated a great deal of potatoes, bananas, sugar cane, and things of a like nature. I have been told that the country from Kekaa to Hahakea and Wahikuli - that country now covered by cactus, in a northwesterly direction from Lahaina-was all cultivated. This chief (Kakaalaneo) also planted bread fruit and *kukui* trees down at Lahaina. Some of these trees southwest of the Lahaina fort, were called the bread fruit trees of Kauheana. (Fornander 1918-19191, Vol. 5: 540-541, cited in Handy and Handy 1972: 494)

D.T. Fleming (cited in Handy 1940:106) substantiated Fornander's (1918-1919, Vol. 5: 540-541) inference when he visited the valleys of Honokōwai, Kahana, Honokahua, and Honolua. Of his observations, Fleming (cited in Handy 1942:106) states:

> ...Honokowai, Honokohua and Honolua, as well as Kahana, there was considerable taro raised in olden times; as a matter of fact, a great deal was raised in Honokowai, where there must have been 30 or 40 acres under cultivation at one time.

According to Handy and Handy (2004: 494), by 1934 commercial planting and the exhaustion of the soil had brought in root rot...." causing some of the lo'i to be abandoned and some to be replaced with rice fields in Honokōhau Ahupua'a, and quite possibly within the ahupua'a in which the current project is located.

In addition to watering the valleys, the above-mentioned streams provide water for the six bays located on the western shores of Maui. These bays and coves, whose names begin with *Hono-*, include Honokahua, Honokeana, Honokōhau, Honokōwai, Honolua, and Hononana, which are collectively known as "Hono a Pi'ilani"; literally meaning bays (hono) acquired or ruled by Pi'ilani (Pukui and Ebert 1986, Pukui et al. 1974, and Clark 1980).

The coastal and marine environments adjacent to the project area would have provided rich resources for traditional subsistence foragers and fishermen in the pre-Contact and early Historic Periods. A large number of fish species are found in the near-coastal waters: weke, surmullet (*Mulloidichthys auriflamma*); *kūmū* (goatfish, Paru*peneus prophyreus*); *mamo* (sergeant fish, *Abudefduf abdominalis*); *manini* (surgeonfish, *Acanthurus triostegus*); *palani* (surgeonfish, *Acanthurus bariene*); *nenue* (rudder or pilot fish, *Kyphosus fuscus*); *kōkala* (porcupine fish, *Diodon hystrix*); *hinalea* (wrasse, Family, Labridae); *uhu* (parrot fish, *Scarus perspicillatus*); *'ala'ihi* (squirrel fish, *Holocentrus* sp.); *kala* (surgeonfish or unicorn fish, *Acanthurus* sp.); and *nehu* (anchovy, *Anchoviella purpurea*). In addition to a relatively high density of gastropods and pelecypods (including *pipipi*, black nerita, (*Nerita picea*) and *Littorina*

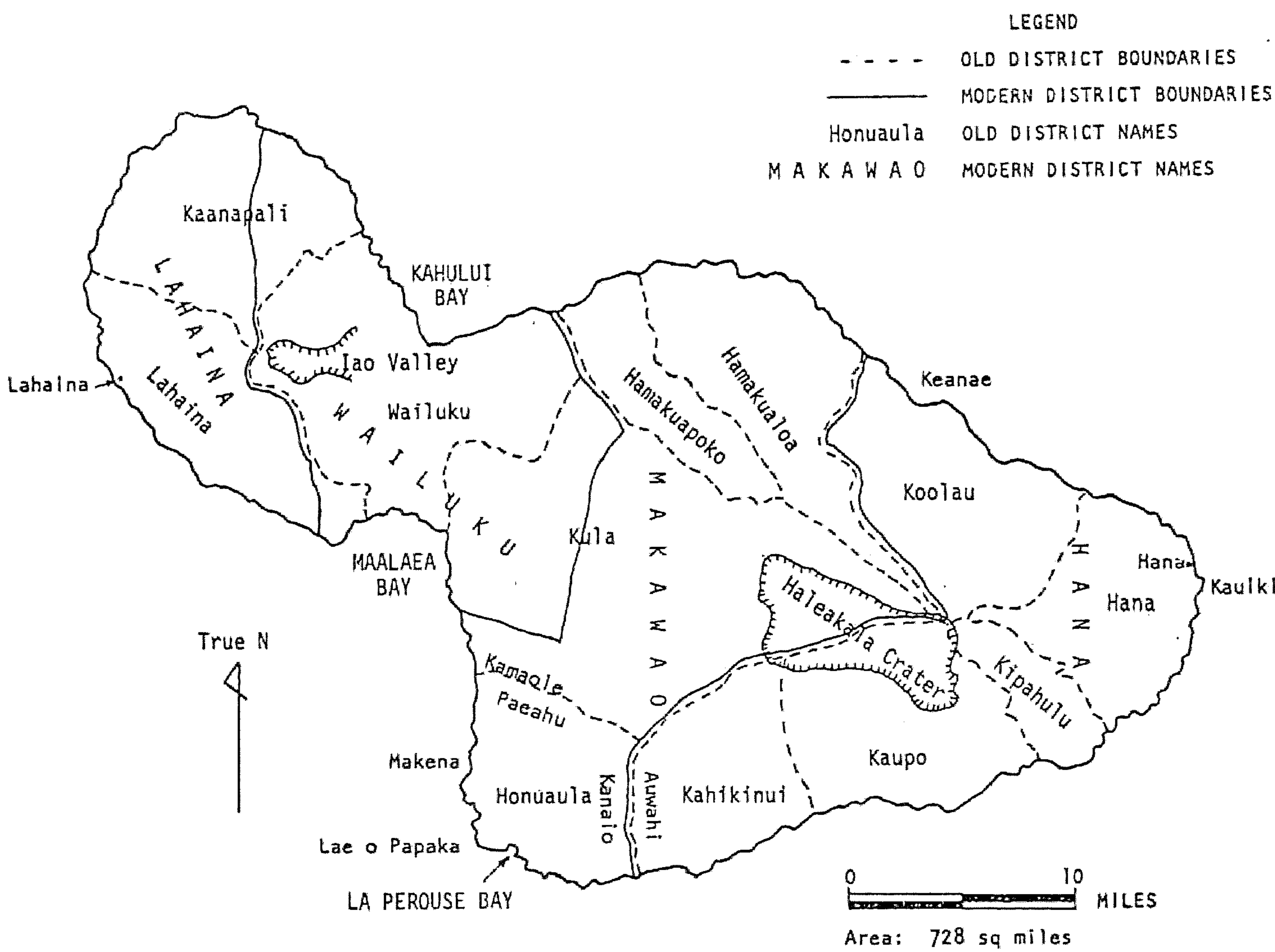

Figure 7: Ancient and Modern Districts of Maui (c. 1875; from Barrère 1975:31).

pintado), at least five species of sea urchin have been noted: Centrechinus paucispinus, Tripneustes gratilla, Podophora atrata, Heterocentrotus mammillatus, and Echinometra mathaei (Kirch 1973).

Kahana played another important role in traditional life, in addition to providing a substantial amount of taro. According to Rebecca Nuuhiwa, an informant for Elspeth Sterling (cited in Sterling (1998:50):

> The people of Lahaina gathered their salt at Kahana. It was said they carried the sea water to the depressions and then let it settle and dry out. They gathered their salt on dry days.

The Mahinahina 4 Ahupua'a is not directly mentioned in known traditional narratives, but descriptions of nearby ahupuaʻa can be used to infer some of its broad characteristics. Valleys originating high in the West Maui and bordering the Mahinahina Ahupuaʻa to the northand south all had extensive taro lands located in the valley bottoms, where terraces rose tier upon tier in symmetrical stone-faced lo'i (Handy and Handy 1972). Honokowai, itself, had been a canoe landing and was the last sandy inlet before the rocky shoreline of Mahinahina. Fresh water springs could be found at the water's edge of Honokōwai Bay (Clark 1980).

Most of the ahupuaʻa on the coast have been overshadowed by the famous roadstead and village that served as the capitol of the Hawaiian Kingdom after the conquest of Kamehameha I until 1855. The ethnographic and historic literature, often our only link to the past, reveal that the lands around Lāhainā were rich agricultural areas irrigated by aqueducts originating in well-watered valleys with permanent occupation predominately on the coast. Crops cultivated included coconut, breadfruit, paper mulberry, banana, taro, sweet potato, sugar cane, and gourds.

HEIAU FROM HONOKŌWAI TO HONOKAHUA AHUPUAʻA

Heiau indicate the presence of political power and the appropriate population to support it. Early archaeological surveys identified seven religious shrines (heiau) from Mahinahina to Honokōhau Ahupuaʻa (Thrum 1909, 1917; Walker 1931, Sterling 1998).

The early surveys of Thrum (1909, 1917) and Walker (1931) identified seven religious shrines (heiau) located between the ahupuaʻa of Honokōwai and Honōkohau. The closest heiau to any of the current project areas that was reported by these early surveys was Kahauiki Heiau (Walker Site No. 16, State Site 50-50-01-16) which was located in Honokahua Ahupuaʻa. This "small irregular platform" (Sterling 1998:52) was located "a short distance up the west side of a gulch of the same name" [i.e., Kahauili] ((Sterling 1998:52). This gulch drains into the eastern terminus of Honokahua Bay, on the other (northeast) side (from the project area) of the Honokahua Burial Site (State Site 50-50-01-1342). The remaining six heiau between Honokōwai and Honōkohau Ahupuaʻa documented by Walker (1931) and Thrum (1909, 1917) are as described as follows:

- Kahana Heiau (Walker Site No. 12, State Site 50-50-01-12), located along the seashore, destroyed (Mahinahina Ahupuaʻa);
- Hihiho Heiau (Walker Site No. 14, State Site 50-50-01-14), located along "County Road near Kalaeokaea Point" destroyed to build road (Mailepai or Kahana Ahupuaʻa);
- Mailepai Heiau (Walker Site No. 13, State Site 50-50-01-13), located near Mailepai Point, "washed away", destroyed (Mailepai Ahupuaʻa);
- Unnamed Heiau (Walker Site No. 15, State Site 50-50-01-15), located on a "bluff at south side of rocky cove between Alaeloa and Papaua Points" described as a "small rectangular enclosure" with a small platform in the interior SW corner (Alaeloa Ahupuaʻa);
- Honuaʻula Heiau (Walker Site No. 18, State Site 50-50-01-18), located at Honolua Gulch, described as the remains of old stone platforms and walls, with pavement in the entire interior (Honolua Ahupuaʻa);
- ʻIliʻilikea Heiau (Walker Site No. 19, State Site 50-50-01-19), located "on the top of ridge at west side of Punaha Gulch, just above the road", described as a site complex of enclosures, pavements, and burials occupying an area of at least 30,000 square feet (Honokōhau Ahupuaʻa) (Rogers and Rosendahl 1992).

Traditionally, trails extended from the coast to the mountains, linking the two for both economic and social reasons. Kāʻanapali District is noted for an alaloa (a long path or trail) that reportedly encircled the entire island. Walker (1931 cited in Sterling 1998:46) wrote:

> The north end of Maui also is traversed by a paved trail. Sections of it can be seen from Honolua to Honokohau to Kahakuloa. It is paved with beach rocks and has a width of four to six feet....This trail is also spoken of as the Kihapiilani Trail.

MĀHELE OF 1848

During the 1840s, one of the greatest historic events impacting the population of the Hawaiian Islands was the Māhele of 1848. Thought to have been created under pressure from foreigners, Kauikeaouli (Kamehameha III) passed laws resulting in the Māhele, which altered the system of land transactions and legal land ownership processes for the entire population of the islands:

> By mid-century, the fledgling [Hawaiian] Kingdom undertook the single most significant inducement to cultural change, the Great Māhele or division of lands between the king, chiefs, and government, establishing land ownership on a Western-style, fee-simple basis. From this single act, an entire restructuring of the ancient social, economic, and political order followed. (Kirch 1985:309)

The Māhele of 1848, as implemented under Kauikeaouli (Kamehameha III), divided lands between the king, the chiefs, the government, and began the process of the private ownership of land for the Hawaiian people. Awarded parcels were called Land Commission Awards (LCAs). Through this process, the maka'āinana (commoners), were able to claim the plots of land on which they had been cultivating and living. These claims did not include any previously cultivated, but presently fallow land, stream fisheries, or many other resources necessary for traditional survival (Kelly 1983; Kame'eleihiwa 1992:295; Kirch and Sahlins 1992). If occupation could be established through the testimony of two witnesses, the petitioners were awarded the claimed LCA and issued a royal patent after which they could take possession of the property.

Chinen (1961:3) further explains:

> It was in December of 1845 that a statute [the Māhele] was enacted creating The Board of Commissioners to Quiet Land Titles, commonly known as The Land Commission. The act also granted unto said Land Commission the authority to accept claims for land received prior to the enactment of the statute, to investigate said claims and to grant awards to the successful claimants. This statute paved the way for private ownership of lands [Land Commission Awards] in Hawai'i. Since the enactment of said statute thousands of land Commission Grants, Kamehameha Deeds, Public Works Grants, Land Patent Grants and other documents have been issued by the Hawaiian Government for lands sold and conveyed to individuals.

In retrospect, it appears that some of the only people who profited from the Māhele were those who were informed of the process and understood the requirements imposed by the new statute. The rest of the claimants failed to support their claims and lost lands that had been utilized by their lineal ancestors for generations.

HONOKŌWAI AHUPUA'A

The Indices of Land Commission Awards lists 114 grants totaling 186 'āpana (land parcel) in the Ahupua'a of Honokōwai. The Office of Hawaiian Affairs Kipuka Online Database (2016) indicates the 'Ili of Mo'omoku, which is located immediately adjacent to current project area, was claimed by Mikahela Kekau'ōnohi. Kekau'ōnohi was awarded 322.69 aces [291.37 acres according to the Kipuka Online Database (2016)], which were divided into four 'āpana under LCA 11216/Royal Patent 8531 (Waihona Aina Database 2019) (Appendix D). The Kipuka Online Database (2019) indicates remaining 4,974 acres of land within Honokōwai Ahupua'a were designated Crown Lands in 1848 (Figure 7).

MĀHINAHINA 1, 2, 3 AND KAHANA AHUPUAʻA

The Waihona Aina Database (2019) lists 7 LCAs claimed, with six LCAs awarded within the Ahupuaʻa of Kahana. None of these lands are within the current project area. Subsequently, the lands of Mahinahina 1, 2, 3, Kahana, and Kahananui, comprising 2, 675 acres, were sold to D. Baldwin, J.H. Pogue, and S. E. Bishop, in 1853, under Land Grant 1166 (Waihona Aina Online Database 2019, Kipuka Online Database 2016) (see Appendix D). No information was available for LCAs in the Ahupuaʻa of Māhinahina 1, 2, 3 on the Waihona Aina (2019) or the Kipuka (2016) Online Databases.

MĀHINAHINA 4 AHUPUAʻA

Four LCAs were claimed in Māhinahina 4 Ahupuaʻa, three of which are located in the eastern (makai) portion of the ahupuaʻa (see Figure 7); Kipuka Aina Online Database 2016). Charles Cockett claimed and was awarded one ʻāpana, comprised of 149 acres, under Royal Patent 415, in Māhinahina 4 Ahupuaʻa in 1846. Also under LCA 6539/Royal Patent 4130, Hoonoho was also awarded one ʻāpana, comprised of 25 acres in Mahinahina 4. Under LCA 4239/Royal Patent 4203, Kauka was awarded one ʻāpana, totaling 2.96 acres in Māhinahina 4 Ahupuaʻa, in 1848. Under LCA 8248/Royal Patent 4443, Kekalohe was awarded one ʻāpana, totaling 0.25 acres in Mahinahina 4 Ahupuaʻa, in 1848

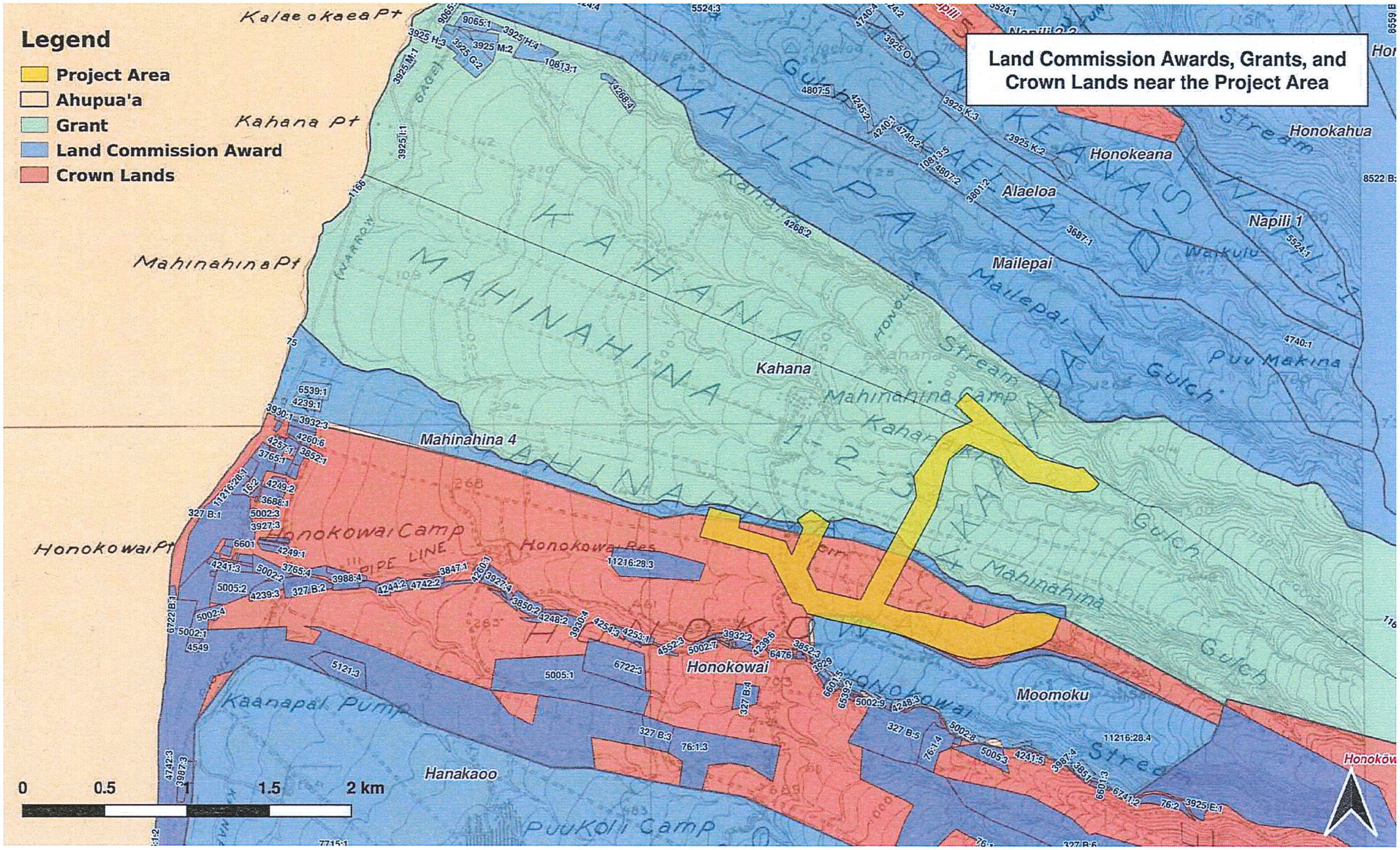

Figure 8: Map Showing Locations of Land Commission Awards, Land Grants, and Crown Lands in the Vicinity of the Project Area.

HISTORIC PERIOD (POST-1778)

An 1831 census estimated the entire population of Kā'anapali District as 2,980 people, which was reduced to less than half (1,341) only five years later (Schmidt 1973). Whaling (centered on Lāhainā Town) was the first commercial enterprise in West Maui, but it had more or less collapsed by the 1860s. Commercial sugarcane production was the next large capitalist venture in West Maui, starting as early as 1863, and it was focused between Kā'anapali and Lāhainā.

Once land became available through the Māhele, large grants of land in Districts throughout the Island were leased or sold to foreigners for commercial ventures. During the middle to late 19th century and into the 20th century, sugarcane and pineapple became dominant cash crops in Hawai`i, particularly in the project area and environs. The lands have not been used for anything but such industrial agriculture until modern construction commenced (water treatment plants, reservoirs, etc). Sugar cane production commenced in 1848 with the sugar mill in Lahaina, which by 1858 evolved into the Lahaina Sugar Company and by 1860, the Pioneer Mill company. Infrastructure was set nearer the coastline (railroads) and the upper elevation table lands (300ft-1000 ft amsl) from Lahaina to Kapalua were prime cultivation lands for these cash crops. The current project area, now an established County facility, was no exception, with sugar cane and especially pineapple, cultivated on its lands.

The general area around the project area, which was located at the margins of sugar cane enterprises in West Maui (Dorrance and Morgan 2000), was most important as a center of commercial ranching (cattle raising) and, subsequently, pineapple production.

In the later nineteenth century, lands in West Maui became part of the Campbell Estate. This was also the time that the Honolua Ranch was first established. Cattle ranching began then and was continued by Henry Perrine Baldwin, who acquired the lands from the Campbell Estate in 1890 (Fredericksen and Fredericksen 2001). In addition to ranching, other early commercial activities included coffee farming.

David T. Fleming became manager of Honolua Ranch in 1911 (or 1912). Fleming was well-versed in pineapple production from the Haiku area and gradually began shifting the ranch's initiative to pineapple production. The Honolua Ranch/Baldwin Packers complex shifted from Honolua to Honokahua in 1915, and a pineapple cannery was constructed. A major commercial pineapple industry emerged in West Maui during the 1920s. The plantation communities of Honokahua and Napili emerged and developed as Honolua Ranch/Baldwin Packers pineapple operations grew. The population of the Lāhainā area increased with the successful economic operations of the pineapple plantation. Baldwin Packers merged with MLP in 1962. After this time, much of the Honolua Ranch lands were converted for resort development, a process that continues to this day. The area in and around the six project areas, which is located at the margins of sugarcane enterprises in West Maui (Dorrance and Morgan 2000), was most important as a center of commercial ranching (cattle raising) and, subsequently, pineapple production.

The Honokahua Historic District (State Site 50-50-01-1340) includes the plantation village of Honokahua, the Baldwin Packers cannery and associated facilities, Honolua Ranch Stables, Honolua Ditch (constructed in 1902), the Maui Pineapple Company offices, the Honolua Store, plantation camp housing, and two churches (Fredericksen 2001).

By the mid-1800s the surrounding areas of the port of Lāhainā were being converted from traditional agriculture to commercial sugar cane. As early as 1849, Judge A.W. Parsons operated a sugar mill in Lāhainā. Henry Dickenson began a sugar plantation in 1859 that was quickly followed by the Pioneer Mill Co. By 1883, Pioneer Mill Co. had assets in excess of $50,000,000 (Simpich 1974). Pioneer Mills railroad extended from the center of Lāhainā Village to a point north, past Honokōwai to the town of Pu'ukoli'i in Hanaka'ō'ō (Condé 1975). Pioneer Mill Co. reorganized in 1900 at which time its cane fields were located along the coast for 10 miles with some areas extending back as far as two and one half miles:

> The bulk of the crop is raised on lands that range from 10 feet to 700 feet elevation above sea level; the highest being cultivated at 1500 feet [Condé and Best 1973:254].

Sugar would be processed and bagged at the mill in Lāhainā and then taken by train to the landing at Pu'u Keka'a (Black Rock). Other buildings had been constructed there to aid in the plantations activities, such as oil and molasses tanks, as well as a pavilion and some beach cottages on the beach for the use of Pioneer Mill Company's personnel (Clark 1980:61). The Kā'anapali Landing, used for sugar cane exports, was abandoned before World War II and by

1957 plans were in motion for a multi-million dollar resort to be built around Pu'u Keka'a. The shift to tourism in the 1950s sent the plantations into decline, however, the development of golf courses, hotels, condominiums, and shops have continued the popularity of region up to and including the present.

The cultivation of coffee had expanded to favorable lands on Maui by 1847-50 (Thrum 1876:46-48). According to Davis (1977:8):

> Although there is no specific reference as to Where these lands were located, it is likely that they included the major leeward valleys of West Maui as was the case with Kalihi and Manoa Valleys on the island of O'ahu. Over the next decade, blight seriously disrupted coffee production in the islands. Coffee holdings in the kula lands above the valleys which were more for the transformation gradually began switching over to the cultivation of sugar cane. Yet, as late as 1896, the Government of the Hawaiian Republic was still advocating the expansion of coffee culture in West Maui--and elsewhere (Dept. of Foreign Affairs 1896).

WAHI PANA (LEGENDARY PLACES)

"Wahi Pana" can be defined as celebrated or noted places or locations (Pukui and Elbert 1986:313, 376), and refers to legendary places or landmarks of historical significance. These places of note have distinctive features (*i.e.*, mountain peaks, streams, wind, rain, etc.) that are given specific names through which the history of an area is passed down from generation to generation through chants, legends, and songs. Very little information has been published in regard to the wahi pana of West Maui. Most of the available material refers to the Keka'a Point area, in Honokōwai Ahupua'a.

One of the most interesting areas in Honokōwai Ahupua'a is Keka'a Point, which literally translates as "the rumble, such sounds are said to be heard during storms" (Pukui et al. 1974:106)] Point.

According to legend (A.O. Forbes cited in Sterling 1998:48-49), the demigod Māui and his friend Moemoe lived at Keka'a. After a time, Māui traveled to Waihee, where he was making ready to ensnare the sun in an effort to help his mother by making the days longer. One day, Moemoe decided to search for Māui. When Moemoe found Māui making many unsuccessful attempts to lasso the sun, Moemoe shouted, “Thou will never catch the sun. Thou art an idle nobody.” Māui responded, “When I conquer my enemy, and my desire is attained, I will be your death."

After conquering the sun at Haleakalā and obtaining the suns promise to travel more slowly across the sky, Māui went in search of Moemoe. Māui found Moemoe near Keka‘a. When Moemoe saw Māui, he became very agitated and started running erratically back and forth. This angered Māui and he “leaped down and caught him on the upper side of Kekaa” where he was killed. Moemoe turned into a rock that is almost seven feet long and sits “on the lower side of the new road” (Sterling 1998:49).

More significantly, Keka‘a is also known as a leaping place of the soul (Leina-a-ka-uhane) “and many souls are known to come to this place” (Fornander cited in Sterling 1998:47).

> Only the spirits of subjects (makaainana) go to Kekaa; the souls of the farmers and the souls of the chiefs go to the volcano when they die. If they have friends there some of them are driven back *[whenever they reenter the body]* and live again. (Fornander cited in Sterling 1998:47)

The area around Keka‘a Point also was the setting of significant battles. Kamakau (1969:74) recounts the results of a war between Kauhi-pumai-kahoaka (or Kauhi-‘aimoku-a-Kama) and Kamehameha-nui in 1735, both children of Kekaulike. Alapa‘i of Hawai‘i Island had joined forces with Kamehameha-nui and a year was spent preparing for the war “which swept the country” (Kamakau 1961:74). “It is said that Alapa‘i proceeded with great severity against the adherents of Kauhi in Lahaina, destroying their taro patches and breaking down the watercourses out of Kauaula, Kanaha, and Mahoma [Kahoma] valleys” (Fornander 1969 cited in Sterling 1998:19). This reduced food for not only Kahuis forces, but also the food for the maka‘āinana. The fighting force of Alapa‘i consisted of 8,440 warriors from all of the six districts of Hawai‘i Island (Kamakau 1961:74). Honokahua and Honolua Bays north of the project area became the gathering place for the forces of Peleioholani who had arrived from O‘ahu with only 640 men to assist Kauhi. While attempting to unite its warriors with those of Kauhi, Peleioholani became surrounded by the army of Alapa‘i.

Kamakau (1961:74) recorded:

> The hardest fighting even compared with that of Napili and at Honokahua in Kāʻanapali, took place on the day of the attack at Puʻunēnē [in Honolua]. Pele-io-holani was surrounded on all sides, *mauka* and *makai*, by the forces of Alapaʻi, let by Ka-lani-ʻopuʻū and Keoua. The two ruling chiefs met there again, face to face…

Fornander (1969:142) stated:

> The fortune of the battle swayed back and forth from Honokawai to near into Lahaina; and to this day heaps of human bones and skulls, half buried in various places in the sand, attest the bitterness of the strife and the carnage committed…

And, according to Kamakau (1969:74):

> At Honokowai an engagement took place between the two armies, and the forces of Alapaʻi were slaughtered and fled to Keawawa.

PREVIOUS ARCHAEOLOGY

There have been numerous archaeological studies conducted in the vicinity of the current project area. An examination of past research within the vicinity of the project area has been utilized to surmise the site types that may potentially be encountered during the course of the project. The numerous archaeological sites recorded in the area consist mainly of traditional human burials identified during construction activities, as well as cultural remains relating to the both pre- and post-Contact Periods. Figure 9 provides closely related studies near the project area.

The early archaeological studies on Maui focused on the coastline. The earliest reported archaeological work conducted in the District of Lāhainā, was carried out by Winslow Walker (1931), under the auspices of the Bishop Museum, as part of an island-wide archaeological survey of Maui. After 1970, with the acceleration of resort development, formal surveys were conducted along the prime coastal areas.

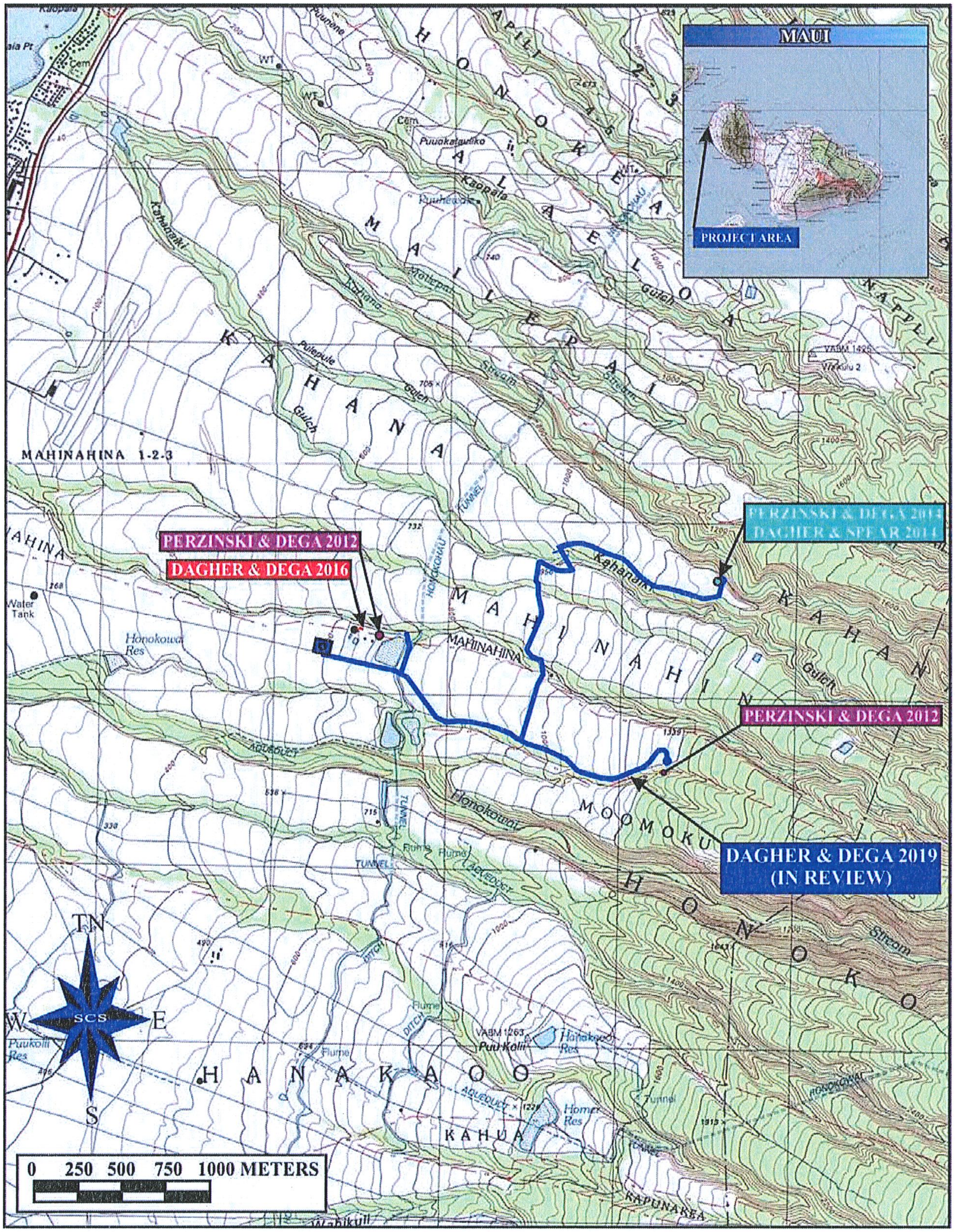

Figure 9: Previous Archaeology Nearby the Project Area.

HONOKŌWAI AHUPUA'A

A Statewide Inventory of Historic Places for Maui in 1973 located petroglyphs and stone wall alignments in two different sections of Honokōwai Gulch (Bishop Museum Sites -1207 and -1208; Bishop Museum Records). Archaeological survey of the Honoapi'ilani Highway corridor (Griffin and Lovelace 1977), between Honokōwai and 'Alaeloa Ahupua'a, recorded a buried midden deposit, a trail segment, a stone wall, and three retaining wall sections. The midden (State Site 50-50-01-225), located in Mahinahina Gulch, was interpreted as a temporary habitation site. Other studies in Kahana Ahupua'a yielded numerous traditional sites, including temporary habitations, midden deposits, and various stone stacking and alignment features consistent with inland agricultural features (e.g., Komori 1983; Walker and Rosendahl 1985; Kennedy and Denham 1992).

Generalizing about traditional settlement patterns in the area, Griffin and Lovelace (1977) suggested that the ahupua'a of Mahinahina was of relatively marginal agricultural value, and that occupation would have been limited to short-term visits, with primary residence at the coast of Mahinahina or even in Honokōwai.

The Archaeological Research Center Hawaii, Inc. (Davis 1977) conducted a surface survey of Honokōwai Gulch. During the survey, four sites (State Sites 50-50-01-228 through 231) were identified:

State Site 50-50-01- 228, irrigated agricultural complex on the south bank of Honokōwai Stream;

State Site 50-50-01-229, irrigated agricultural complex (remnant, recording incomplete) on the north bank of Honokōwai Stream;

State Site 50-50-01-230, irrigated agricultural complex (remnant) on the south bank of Honokōwai Stream; and

State Site 50-50-01-231, irrigated agricultural complex (recording incomplete) on the north bank of Honokōwai Stream.

Scientific Consultant Services, Inc. (Buffum and Spear 2002) conducted a program of Archaeological Monitoring in association with the construction of a small strip mall within

Honokōwai, Mahinahina Ahupua'a, Kā'anapali District, Maui Island, Hawai'i (TMK: (2) 4-4-001:057, 058, and 059). No historic properties were identified.

Scientific Consultant Services, Inc. (Monahan 2004) conducted an Archaeological Inventory Survey was conducted on a 3.054-acres of partially developed land in Honokōwai, Mahinahina 4 Ahupua'a, Lāhainā District, Maui Island, Hawai'i [TMK: (2) 4-3-006:002 and 069]. The survey resulted in negative findings. Subsequently, Dega (2005) conducted an addendum on this property, which also yielded negative findings.

Scientific Consultant Services, Inc. (Havel and Dega 2005), conducted an Archaeological Inventory Survey on 0.11 Acres of partially developed land in Honokōwai Ahupua'a, Lāhainā District, Maui Island, Hawai'i [TMK: (2) 4-4-001:106]. The extent of modern disturbance to the surface and subsurface contexts was evident throughout the study parcel and the survey resulted in negative findings.

Scientific Consultant Services, Inc. (Ogg and Dega 2007) conducted Archaeological Inventory Survey of TMK: (2)4-4-002:033 and (2)4-4-002:029], within Honokōwai Ahupua'a, Lahaina District, Maui Island, Hawai'i. In addition to a systematic pedestrian survey, eight stratigraphic trenches were excavated within the interior of the perimeter fence of the Lahaina Wastewater Reclamation Facility. Most of the trenches revealed evidence of historic sugar cane cultivation in the form of heavily disturbed/admixed soil and black plastic tubing used commonly in modern sugar cane irrigation. Subsurface testing was not conducted at the Lahaina Wastewater Pump Station No. 1, as the enclosure was too small and densely packed with its component buildings, pipelines and other facilities to be a practical place to excavate. The survey resulted in negative findings.

Scientific Consultant Services, Inc. (Perzinski and Dega 2012; Figure 8) conducted an Archaeological Field Inspection for the Mahinahina Production Well Improvements Project, located in Mo'omoku 'Ili, Honokōwai Ahupua'a, Lahaina District, Island of Maui [TMK: (2) 4-4-004:009 and (2) 4-4-002:018], which included a portion of the current project area. The Field Inspection resulted in the identification of a segment of the Historic Period Honokohau Ditch (State Site 50-50-01-1591). No additional historic properties were identified.

Scientific Consultant Services, Inc. (Andricci and Dega 2015) conducted an (Archaeological Inventory Survey in advance of the expansion of the existing AAAAA Rent-A-Space facility located in Honokowai, Mahinahina 4 Ahupua'a, Lahaina (Kā'anapali) District, Island of Maui, Hawai'i [TMK: (2) 4-4-001:026]. No historic properties were identified.

Scientific Consultant Services, Inc. (Dagher and Dega 2018) conducted an Archaeological Monitoring during all construction-related ground altering activities associated with the outdoor shower improvements at Honokowai Beach Park, Honokōwai Ahupua'a, Lahaina (Kā'anapali) District, Island of Maui, Hawai'i [TMK: (2) 4-4-001:46 por. & 47 por.]. No historic properties were identified.

Based on the background information, sites likely to be encountered in the project area may include early historic house foundations and other stone alignments, as well as historic artifacts (e.g., bottles, hardware, etc.). Traditional sites and artifacts reflecting more temporary habitation are also possible (*e.g.,* stone tool debris, midden, hearth deposits), but, given the relatively marginal conditions in the project area, extensive permanent habitation was less likely. Certainly the impact of decades of industrial pineapple cultivation would suggest a limited possibility for identifying intact cultural deposits or features.

KAHANA AHUPUA'A

Much archaeological work has been located in the gulches of the Kahana area, and provides overlapping lines of evidence for land use and habitation in the area. The Bishop Museum (Kaschko 1974) conducted an archaeological reconnaissance survey of select gulches for the U.S. Soil Conservation Service in conjunction with the Wailuku Flood Prevention Project and the Honolua Watershed. Kaschko (1974: 4, 5) "noted numerous stone walls, terraces, alignments and a historic midden." Archaeological Research Center Hawaii, Inc. (Griffin and Lovelace 1977), conducted survey and salvage excavations on select areas of Mahinahina Gulch for the Hawai'i Department of Transportation. Five gulches were surveyed and five archaeological sites were documented (Griffin and Lovelace 1977:11), all of which were initially identified by Kaschko (1974).

The Bishop Museum (Komori 1983) conducted archaeological surface surveys and inspections of backhoe-disturbed soil in Kahana Gulch. The work was done under contract to the U.S. Soil Conservation Service and was a follow-up to the work conducted by Kaschko (1974). Komori (1983) identified seven archaeological sites: an overhang/shelter with a 10 meter long segment of terraced earth, a platform bordered by terraces, a wall segment and two stone alignments, wall segments and terraces, a floodplain partitioned off from the rest of the landscape by stone walls and terraces, walls of stacked stone and a rock shelter containing a "hammer stone or unfinished 'ulu maika ([traditional] Hawaiian game stone)" (Komori 1983:8).

Archaeological Consultants Hawaii (Kennedy 1986a, b; 1990, 1992) conducted a series of archaeological projects along the Kahana the coastline. Kennedys (1986a) first visit to the area, in September of 1986, investigated and confirmed the ruins of an historic stone church dating to the mid-nineteenth century. Although Kennedy (1986a) could find no record of a graveyard attached to the church, nor marked graves at the site, he could not discount the possibility of unmarked graves near the church (Kennedy 1986a:1–5). In November of 1986 Kennedy (1986b) made a return visit to the area to take photographs, map the site, and search for burials. No burials were found on the property (Kennedy 1986b:1–5). In 1990, Kennedy (1991) returned to the area for the third time to conduct an archaeological inventory survey of 50 acres of land near Kahana. The survey found two new sites: "a two tiered basalt rock platform and a single, crude petroglyph" (Kennedy 1991:4). At the behest of the State Historical Preservation Division, a test unit was placed near the rock platform in 1992. Excavations there found a burial, which was left in situ (Kennedy 1991:22).

Xamanek Researches (Fredericksen and Fredericksen 1995) conducted an Archaeological Inventory Survey of a 4-acre parcel of land for the Kahana-Kai Subdivision, Kahana Ahupua'a, Kā'anapali District, Maui Island [TMK: (2) 4-3-005:071]. Twenty-two stratigraphic trenches were mechanically (backhoe) excavated and two test units were manually excavated by researchers, all of which produced negative results. One historic site (State Site 50-50-01-4069), which consists of an Historic stone bridge footing and retaining wall, a section of the old Pioneer Mill railway (State Site 50-50-01-6478), and an historic grave site (State Site 50-50-01-4072) were identified during the survey. Fredericksen and Fredericksen (1995:20) state that there was no evidence of in situ historic or indigenous cultural deposits, as a majority of the parcel was grubbed and filled in recent times.

Xamanek Researches (Fredericksen and Fredericksen 2001) conducted Archaeological Inventory Survey on a 1.4 mile (2.25 km) long by 40 feet (12 m) wide section of Lower Honoapi'ilani Road in Alaeloa, Mailepai, and Kahana Ahupua'a, Lahaina District, Maui Island [TMK: (2) 4-3-015). During the survey, three newly identified sites were documented. These sites are: State Sites 50-50-01-4797, a pre-Contact habitation area; -4797 and -4798, two wall associated with Lower Honoapi'ilani Highway. Radiocarbon dating of a charcoal sample collected from Site -4797 yielded a date ranging from AD 1420 to 1660 with an intercept radiocarbon age of AD 1490 (Fredericksen and Fredericksen 2001:2). Site -4797 was interpreted as a coastal habitation site probably associated with marine resource utilization and as a "rare example of a surviving coastal habitation site along this heavily developed portion of the West Maui Coastline (Fredericksen and Fredericksen 2001:16). Thus, State Site 50-50-01-4797 was found to be significant under Criteria A, C, and D of Federal and State historic preservation guidelines (Fredericksen and Fredericksen 2001: 2, 16).

Subsurface testing of State Site 50-50-01-4797 could not be conducted during the Inventory Survey due to safety and access to private property issues. Thus, the extent of the site could not be determined. In 2001, Xamanek Researches returned to State Site 50-50-01-4797 and conducted subsurface testing in the form of one 1.0 by 1.0 m hand excavated test unit, on private property, and four backhoe trenches within the County of Maui Right of Way (Fredericksen and Fredericksen 20013). The findings of the additional Inventory level work indicate a cultural layer interpreted as State Site 50-50-01-4797 extended 150 m along the eastern side of Honoapi'ilani Highway between 1.1 to 1.5 m below the ground surface. Five pit features and two possible features extending approximately 78.0 m were noted in a wave cut profile on the west side of Honoapi'ilani Highway (Fredericksen and Fredericksen 2001:15). None were dated due to the lack of datable material. Furthermore, no traditional Hawaiian artifacts were recovered during the excavation of three test units and nineteen trenches. Historic components of the sites (e.g., ceramics, glass) showed that the area was likely more intensively utilized during the Historic Period, as was also evidenced by the lack of traditional-period artifacts at the sites.

Scientific Consultant Services, Inc. (Dega 2001) conducted Archaeological Inventory Survey of approximately three acres of land (see Figure 7) located within the Ahupua'a of Kahana, Kā'anapali District, Maui Island, Hawai'i [TMK: (2) 4-3-005:070]. The Dega (2001) project area was located adjacent to the previously mentioned Fredericksen and Fredericksen (1995) project area located in TMK: (2) 4-3-005:071. A 100 percent pedestrian survey of the project area was conducted and revealed a section of the Old Pioneer Mill Railroad easement (State Site 50-50-03-6478) running across the southeastern portion of the parcel. The existing railroad bed probably dates to 1919, when the railroad line ran from the Kā'anapali area to the Kahana area, and beyond. The second identified site (State Site 5-50-03-4069) consisted of stone bridge footings and retaining walls. This site was identified in the northeastern portion of the project area and had previously been documented (Fredericksen and Fredericksen 1995). Limited testing in the form of six trenches was accomplished within undisturbed portions of the project area. Three trenches were sterile, one trench contained concrete water conduits and strata likely associated with the aforementioned railroad easement, and two trenches exhibited a profile of intensive oxidation and reduction layers. The clarity and breadth of the strata in the latter two trenches provides some evidence for a long-term commitment to agriculture. Several Land Commission Awards occurring on the parcel also attest to traditional agricultural practices on the parcel (taro and sweet potato cultivation). Overall, within a majority of the project area, the lack of surface and subsurface remains was partially attributable to historic-period, intensive landscape alterations. During the late 1800s to early 1900s, sugarcane was cultivated across the parcel. Railroad construction occurred in the early 1900s along the eastern portion of the project area. The expansion of the Honoapi'ilani Highway was completed in more recent times. The western flank of the parcel nearer the current project area was subject to limited grading and dumping activities.

Scientific Consultant Services, Inc. (Perzinski and Dega 2014; see Figure 8) conducted an Archaeological Inventory Survey on a c. 1-acre land parcel in Kahana Ahupua'a, Lahaina District, Maui [TMK: (2) 4-3-001:017], in a portion of the current project area. No historic properties were identified.

Overall, the presence and documentation of a varied abundance of archaeological features in the general Kahana-Honokōwai area indicates a strong history of settlement and land usage both by traditional Hawaiian peoples and Historic Period immigrants. Most of this occupation and land use occurred nearer the coastline and in the west Maui valleys, not the upland tablelands, as is the current project area.

MAHINAHINA 1, 2, 3 AHUPUA'A

Scientific Consultant Services, Inc. (Dagher and Dega 2016;see Figure 8) conducted an Archaeological Field Inspection and background study for a proposed Maui Police Department Communications Facility at the Mahinahina Water Treatment Plant, Mahinahina 1-2-3 Ahupua`a, Lahaina District, Maui Island, Hawai`i [TMK: (2) 4-3-001:084 por. (formerly 4-3-001:031 por.), which is located north of the current project area. No historic properties were identified.

MAHINAHINA 4 AHUPUA'A

Scientific Consultant Services, Inc. (McGerty and Spear 1996) conducted an Archaeological Inventory Survey of a 3.269-acre parcel in Mahinahina 4 Ahupua'a, Lāhainā District, Island of Maui, Hawai'i [TMK: (2) 4-3-006:003]. During the survey, seven sites, several of which consisted of stone alignments and low stacking features, all interpreted as early historic. A cemetery and the area directly around it (designated State Sites 50-50-01-4218 and -4219, respectively). Extensive trenching south of the cemetery did not yield any additional human remains or burials.

Scientific Consultant Services, Inc. (Monahan 2004) conducted an Archaeological Inventory Survey was conducted on a 3.054-acres of partially developed land in Honokōwai, Mahinahina 4 Ahupua'a, Lāhainā District, Maui Island, Hawai'i [TMK: (2) 4-3-006:002 and 069]. The survey resulted in negative findings. Subsequently, Dega (2005) conducted an addendum on this property, which also yielded negative findings.

Scientific Consultant Services, Inc. (Andricci and Dega 2015) conducted an (Archaeological Inventory Survey in advance of the expansion of the existing AAAAA Rent-A-Space facility located in Honokowai, Mahinahina 4 Ahupua'a, Lahaina (Kā'anapali) District, Island of Maui, Hawai'i [TMK: (2) 4-4-001:026]. No historic properties were identified.

PROJECT AREA EXPECTATIONS

Prior to fieldwork, archival and map work was done for the project area. Honokohau Ditch occurs on all USGS maps for the area. Thus, the crew understood that at least that site was present in the project area. Previous archaeology in adjacent environs (i.e., Perzinski and Dega 2012, 2014) did not lead to the identification of any significant sites. Expectations other historic sites, features, midden scatters, or artifacts were considered low as the project area and environs have been heavily utilized for pineapple cultivation in the recent past, with the ground surface and subsurface soils having been heavily modified through time, given intensive industrial-level pineapple cultivation. Beside the ditch, expectations for identifying other historic properties in the project area were low. These would have mostly consisted of other infrastructure related to cultivation of the area, including ditches, reservoirs, and lined drainages. None were identified.

METHODOLOGY

Full pedestrian survey of the project area was completed January 9 and 10, 2019 by SCS archaeologists Ian Bassford, B.A. and Derek Butler, B.A., under the direction of principal investigator Michael Dega, Ph.D. All portions of the project work areas were surveyed, with transects being c. 20 meters (m) apart as visibility was good. Transects were run on an east-west axis, with existing access roads (non-formal, dirt packed pineapple roads coursing through the now fallow pineapple fields) facilitating movement. The well areas, transmission waterline, electric line extension, and 50,000 gallon control tank site were also surveyed. No subsurface testing was conducted during the Field Inspection as expectations were very low for finding any significant subsurface cultural materials. This decision was vetted through consultation with the SHPD in August, 2018 (see above).

Pedestrian survey led to the documentation of a portion of Honokohau Ditch running through the project area. Notes were also taken on project landform and use through time, presence/absence of significant sites, and the general project area condition. Photographs were taken of the site as well as general overview of the project area. All field notes, digital photographs, and other materials related to the project are being curated at the SCS laboratory in Honolulu.

RESULTS OF FIELDWORK

A 100% pedestrian survey of the project work areas (see Figures 1-3; Figures 10 and 11) led to the identification of one site: the historic-period Honokohau Ditch. No other historic sites, features, midden scatters, or artifacts were identified. The project area and environs have been heavily utilized for pineapple cultivation in the recent past, with the ground surface and subsurface soils having been heavily modified through time, given intensive industrial-level pineapple cultivation. Beside the ditch, the survey area was negative for both surface materials and areas thought to potentially contain subsurface cultural materials.

A segment of the Honokohau Ditch (Site -1591) occurs in the lower, western portion of the project area, above the existing surface water treatment plant (Figures, 12-14). The ditch runs perpendicular to the slope and crosses a 12" waterline proposed for the project. However, the ditch will not be impacted by the proposed work (see below).

The ditch has an interesting history, as noted by Wilcox (1996). The ditch, primarily composed of rock slab side walls, was built from 1902 and was completed in June, 1904. The ditch was built by Honolua Ranch, who also owned it, but Pioneer Mill financed the project and used the water. The ditch started at 700 feet above mean sea level and was completely re-built twice and renovated one time. Due to cracks, leakages, and sediment built up over time, a "new" Honokohau Ditch was constructed from June, 1912 and completed in November, 1913. The ditch was called "Honolua Ditch" by Maui Land and Pineapple Company and designated as Honokohau Ditch by the Pioneer Mill Company, even though it was the same ditch. In September, 1923 the entire ditch was re-lined, a process that took five years to complete. During this re-lining process, water was diverted from this ditch to the old, 1904 Honokohau Ditch which had been abandoned. The ditch still retains an important water transfer capacity today as it irrigates neighboring lands and brings potable water to the Lahaina area.

Figure 10: General Project Area Overview. View to Northeast.


Figure 11: Overview of Project Area and Grasses. View to Northeast.

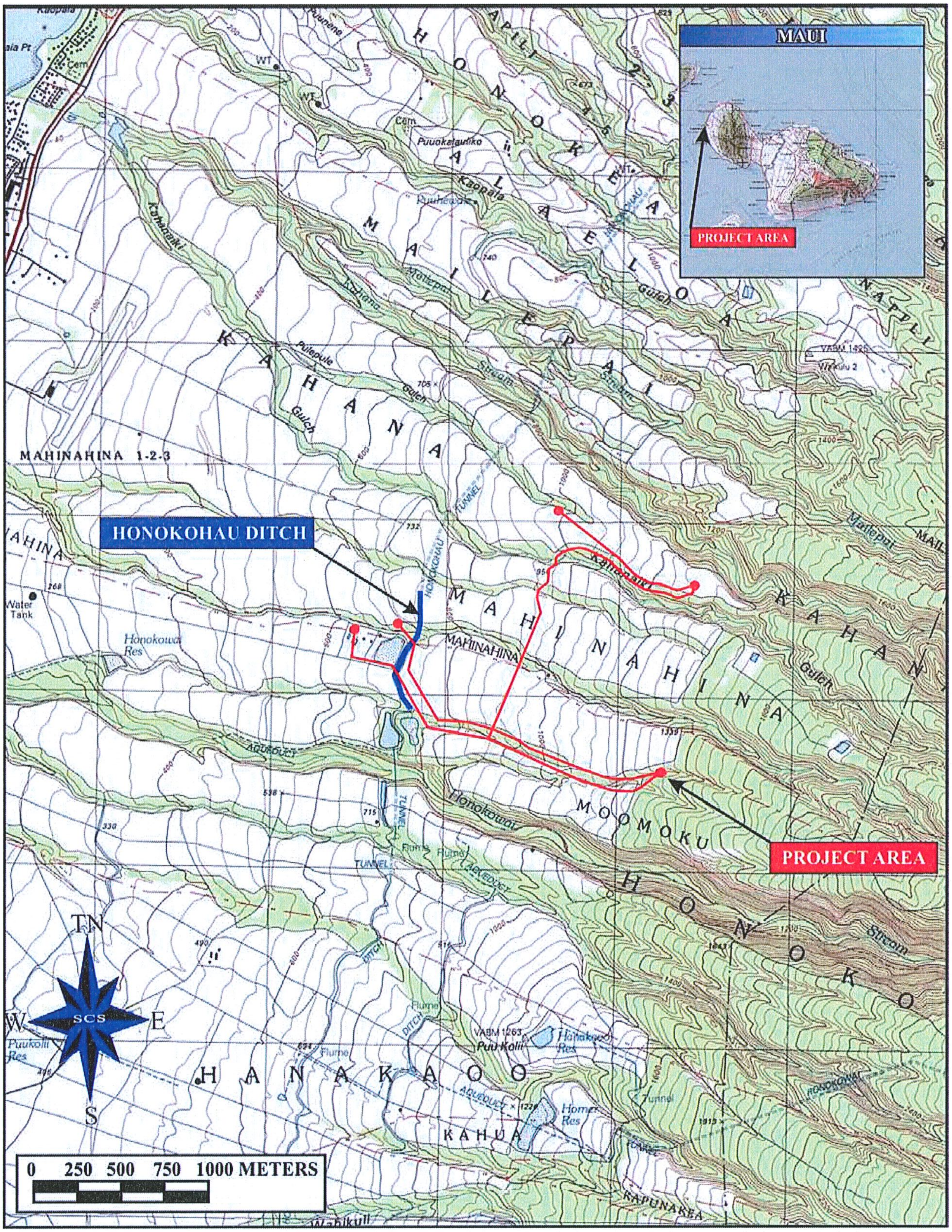

Figure 12: USGS Map (1983) Showing Course of Honokohau Ditch through Project Area.

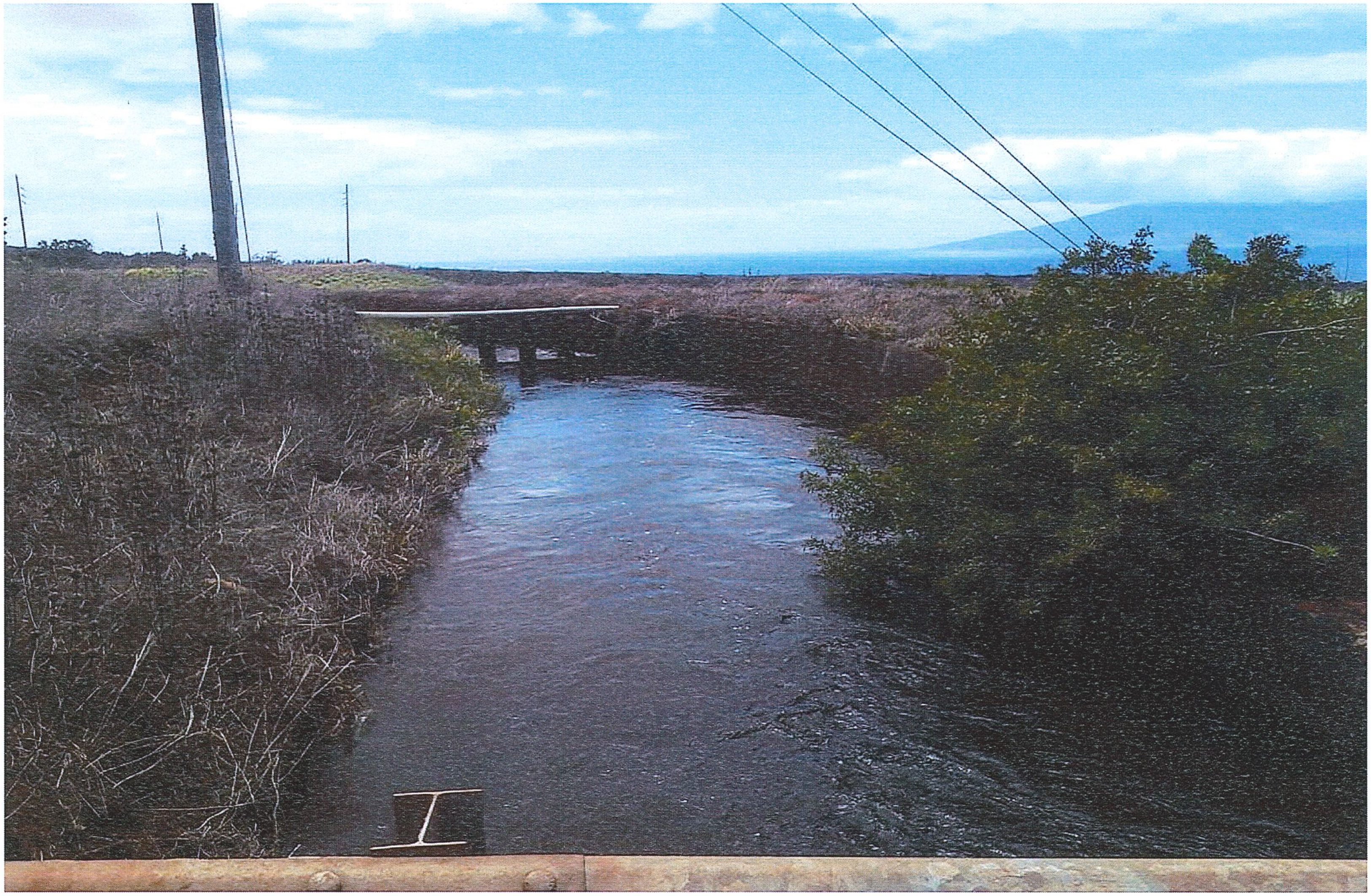

Figure 13: Site -1591 Honokohau Ditch. View to Southwest.

Figure 14: Site -1591 Honokohau Ditch. View to North.

CONCLUSION AND RECOMMENDATIONS

Full pedestrian survey of the project area was completed by SCS in January, 2019 and one site was identified, Honokohau Ditch. This site is designated as State Site No. -1591. No other sites were identified nor were areas identified that would be amenable to locating subsurface cultural deposits through excavation work. The project area landscape has been intensively modified for pineapple cultivation through time.

The ditch crosses the western portion of the current project area and over a location where a 12" waterline is proposed. To preserve the ditch, the waterlines will cross under the ditch. The lines will be installed by means of horizontal directional drilling (HDD) at a depth ranging from 8 to 10 feet. This will allow the waterlines to maintain a 3-foot vertical clearance to the base of the ditch. Originally, the proposed method of installing this pipeline involved trenching and backfilling across three possible jurisdictional drainages. The new method of installing the pipeline, through horizontal directional drilling, will preserve both the ditch and landscape with this less invasive technique.

Given the results of survey and the implementation of HDD beneath the ditch, no further work is recommended for the entirety of the project area and all improvements. However, should the inadvertent discovery of significant cultural materials occur during construction, all work in the immediate area of the find must cease and the SHPD be notified to discuss mitigation, if necessary.

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APPENDIX

L

CULTURAL IMPACT ASSESSMENT

SCS PROJECT NO. 2224-1 CIA

A CULTURAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED WEST MAUI WATER SOURCE DEVELOPMENT PROJECT MAHINAHINA WELL (STATE WELL NO. 6-5638-004) (WEST MAUI WELL NO. 1) AND THE KAHANA WELL (STATE WELL NO. 6-5738-002) (WEST MAUI WELL NO. 2)

HONOKŌWAI, KAHANA, MĀHINAHINA 1, 2, 3, AND MĀHINAHINA 4 AHUPUAʻA
LAHAINA (KĀʻANAPALI) DISTRICT
ISLAND OF MAUI
HAWAIʻI

TMK: (2) 4-3-001:017 and 084
(2) 4-4-002:014, 015, and 018 and
(2) 4-4-004:009, 011, and 019

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March 2019
DRAFT

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INTRODUCTION

At the request of Fukumoto Engineering, Inc., Scientific Consultant Services, Inc. (SCS) has prepared a Cultural Impact Assessment (CIA) in advance of the proposed West Maui Wells (Kahana and Mahinahina) Project. The proposed action involves the installation of two (2) groundwater wells: the Mahinahina Well (West Maui Well No. 1; State Well No. 6-5638-004), and the Kahana Well (West Maui Well No. 2; State Well No. 6-5738-002) and the construction of related improvements necessary to connect the wells to the County of Maui Department of Water Supply (DWS) West Maui Water System. The wells and associated infrastructure will be located in Honokōwai, Kahana, Māhinahina 1, 2, 3, and Māhinahina 4 Ahupuaʻa, Lahaina (Kāʻanapali) District, Island of Maui, Hawaiʻi. The project area is situated on lands owned by Maui Land and Pineapple Company, Inc. [TMK: (2) 4-3-001:017, 4-3-001:084, and 4-4-001:017]; lands owned by the State of Hawaiʻi [TMK: (2) 4-4-002:014, 4-4-004:009, 4-4-004:011, and 4-4-004:019; and lands owned by the Department of Hawaiian Homelands (DHHL) [TMK: (2) 4-4-002:015, and 4-4-002:018] (Figures 1through 4; Table 1).

The current CIA follows two (2) separate Final Environmental Assessments (EAs) which were previously prepared for the exploratory drilling of the wells. The negative Declarations (Findings of No Significant Impact) were published on July 23, 2011 for the Mahinahina Exploratory Well and on May 23, 2014 for the Kahana Exploratory Well, respectively, in the Office of Environmental Quality Control (OEQC) Environmental Notice.

The Hawaii State Office of Environmental Quality Control (OEQC 1997:11) states that "an environmental assessment of cultural impacts" gathers information about cultural practices and cultural features that may be affected by significant environmental effects:

Cultural impacts differ from other types of impacts assessed in environmental assessments or environmental impact statements. A cultural impact assessment includes information relating to the practices and beliefs of a particular cultural or ethnic group or groups.

The purpose of a Cultural Impact Assessment is to identify the possibility of previous and/or currently conducted traditional cultural practices and traditional resources procured within a project area and the greater ahupuaʻa, and then to assess the potential for impacts to these cultural resources.

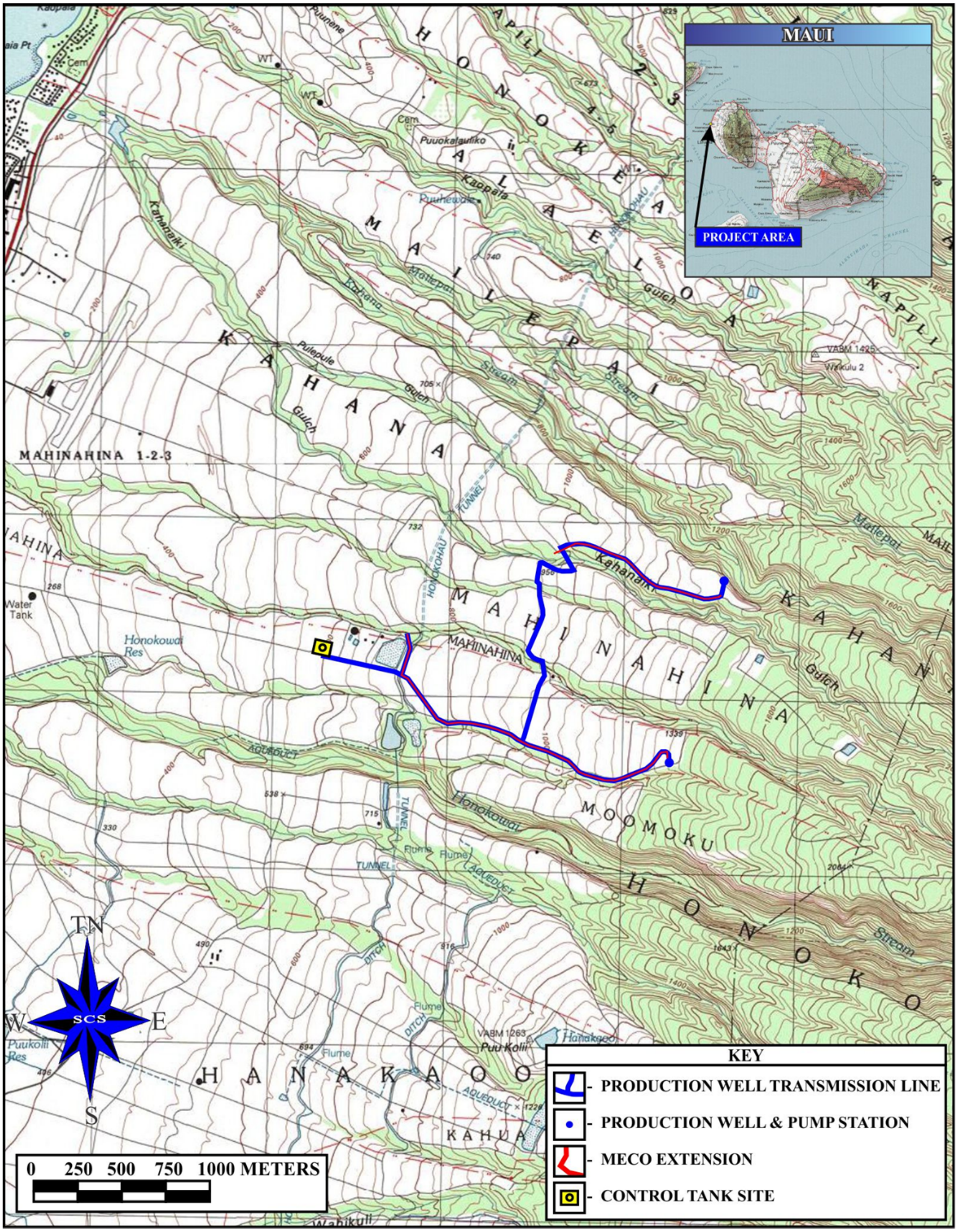

Figure 1: USGS (Lahaina, HI 1992 and Napili, HI 1997; 1:24,000) Quadrangle Maps Showing Project Area Location.

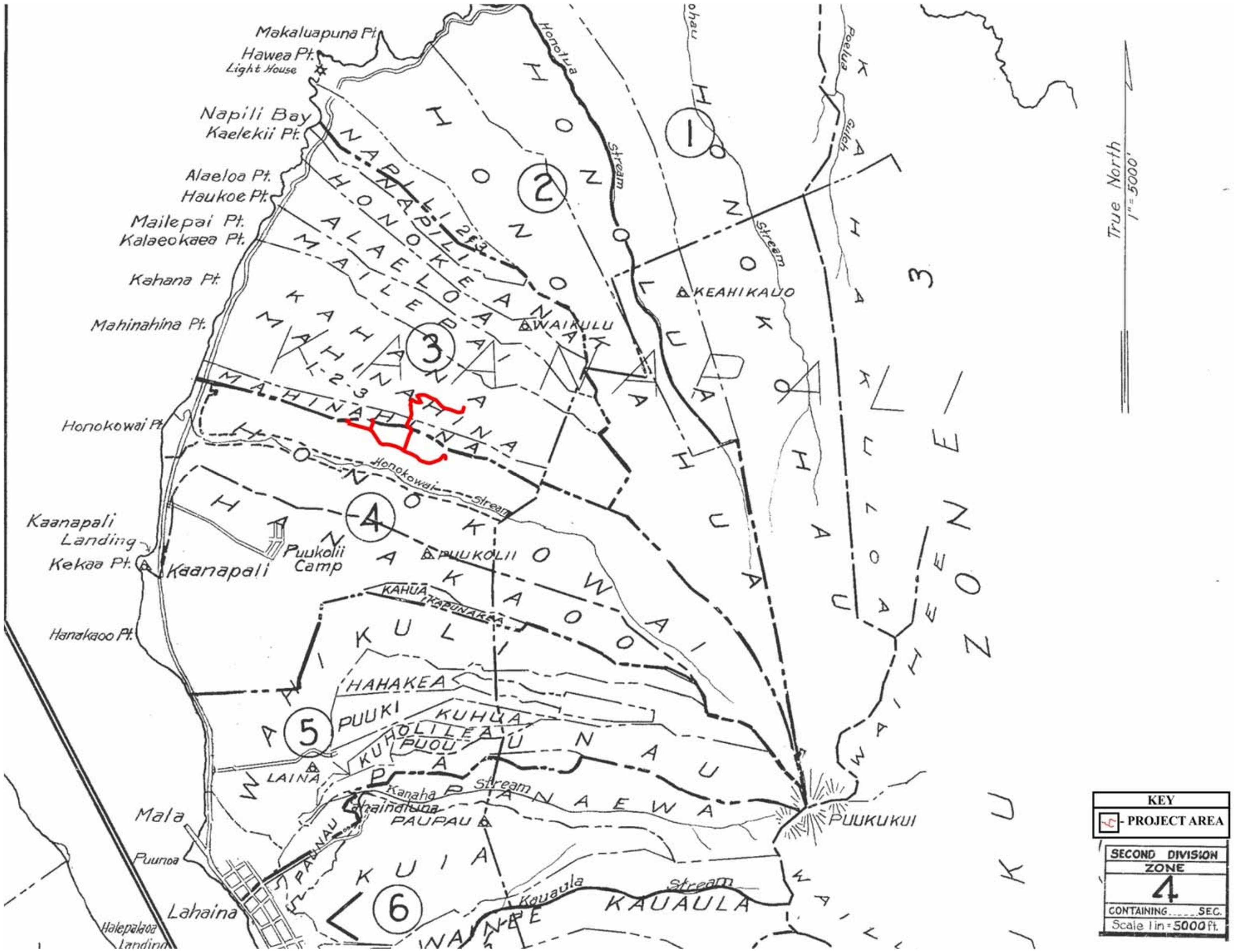

Figure 2: Tax Map Key [TMK: (2) Zone 4] Showing Project Area Location.

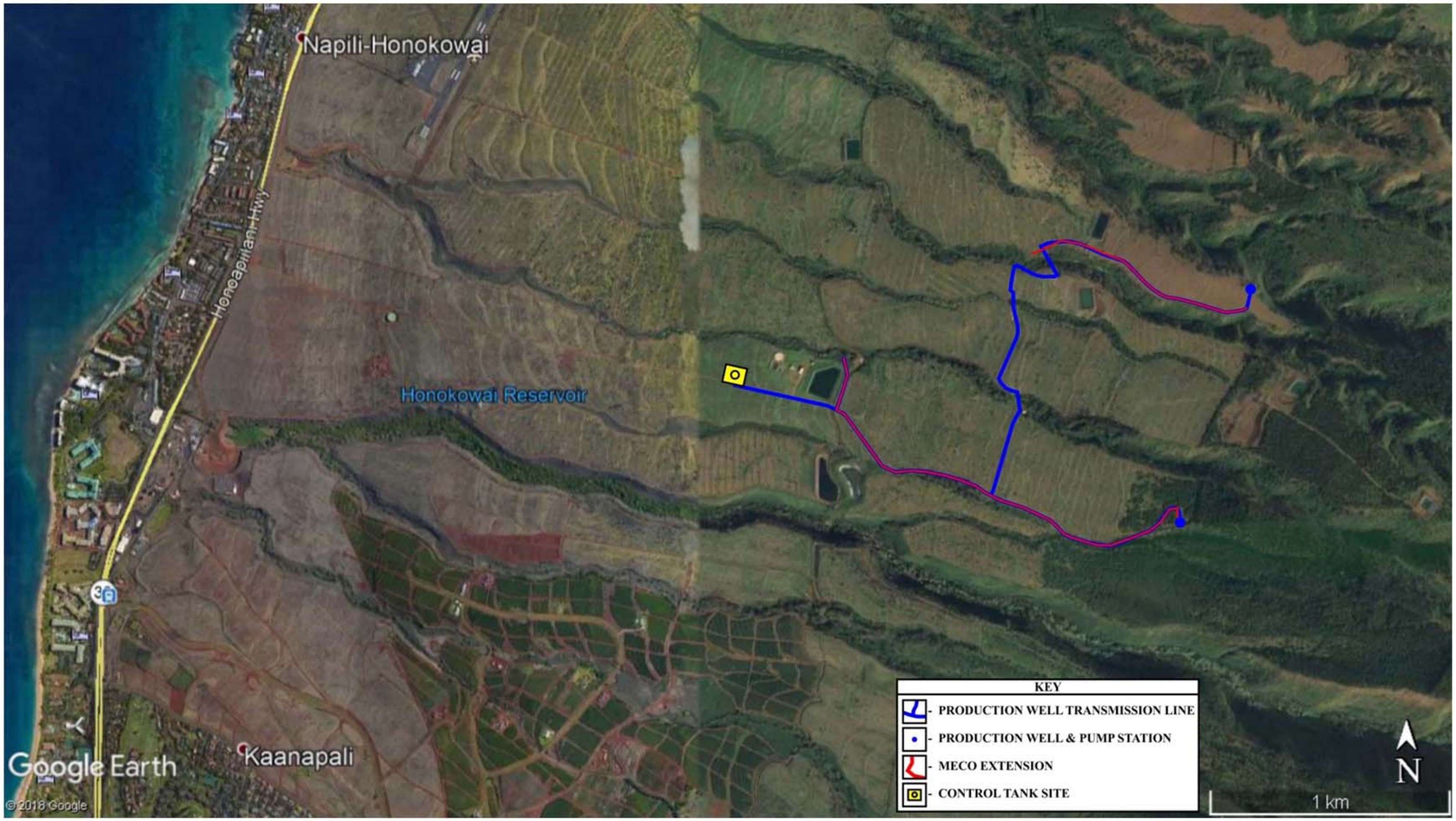

Figure 3: Satellite Image (Google Earth 2018, Imagery Date 1/12/2013) Showing Project Area.

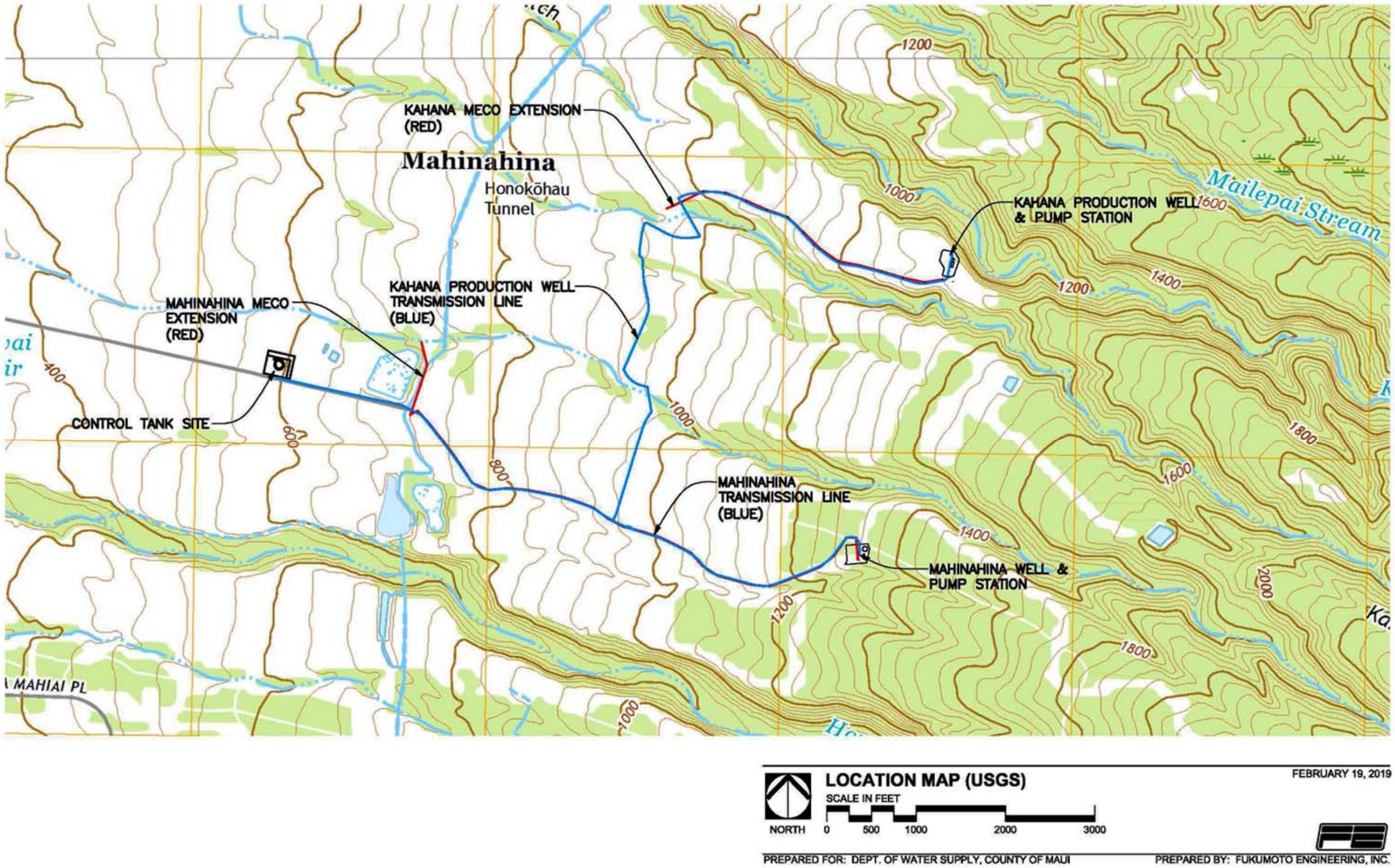

Figure 4: The Proposed West Maui Water Source Development Project Overall Conceptual Plan (Fukumoto Engineering Inc. 2019).

Table 1: Listing of Tax Map Keys (TMK), Landowners, and Project Component within the Proposed Project Area.

Project Component	**Landowner**	**TMK: (2)**
Mahinahina Well (West Maui Well No. 1)	State of Hawai‘i State of Hawai‘i	4-4-004:011 4-4-004:009
Kahana Well (West Maui Well No. 2)	Maui Land and Pineapple Company, Inc. (MLP)	4-3-001:017
500,000-Gallon Control Tank	Department of Hawaiian Home Lands (DHHL)	4-4-002:018
Mahinahina Well (West Maui Well No. 1) Transmission Waterline, Access Road, and Maui Electric Line Extension	MLP MLP State of Hawai‘i DHHL DHHL State of Hawai‘i State of Hawai‘i State of Hawai‘i	4-4-001:017 4-3-001:084 4-4-002:014 4-4-002:015 4-4-002:018 4-4-004:009 4-4-004:011 4-4-004:019
Kahana Well (West Maui Well No. 2) Transmission Waterline, Access Road, and Maui Electric Line Extension	MLP State of Hawai‘i State of Hawai‘i	4-3-001:017 4-4-004:009 4-4-004:019

PROPOSED PROJECT DESCRIPTION

The proposed project involves several components (see Figure 4), crosses a number of Tax Map Keys, and includes several landowners (see Table 1):

1. Mahinahina Well (West Maui Well No. 1)

    a) An estimated 500 gallons per minute (gpm) well pump
    b) An approximate 30,000 gallon control tank, chlorination system, supervisory control and data acquisition (SCADA) system, electrical equipment, control building, and related appurtenances
    c) Site development of approximately two (2) acres (grading, drainage, fencing, and landscaping)
    d) Electrical line extension from the existing Maui Electric Company (MECO) electric line to the well

2. Kahana Well (West Maui Well No. 2)

    a) An estimated 1,000 gpm well pump
    b) An approximate 30,000-gallon control tank, chlorination system, SCADA system, electrical equipment, control building, and related appurtenances
    c) Site development of approximately one (1) acre (grading, drainage, fencing, and landscaping)
    d) Electrical site improvements, including offsite electric extension from the existing MECO electric line to the well site, transformer, and emergency generator

3. 500,000-Gallon Control Tank

    a) An estimated 500,000-gallon control tank, which will be located next to the Mahinahina Surface Water-Treatment Plant (SWTP) on an approximately 1.8-acre site

    b) Site development of approximately 1.8 acres (grading, drainage, fencing, and landscaping

4. Transmission Waterlines and Access Roads

    a) Mahinahina Well (West Maui Well No. 1) Transmission Waterline and Access Road: Approximately 6,500 feet of 12-inch waterline and access road connecting Mahinahina Well (West Maui Well No. 1) to the proposed estimated 500, 000-gallon control tank which will be located near the Mahinahina SWTP

    b) Kahana Well (West Maui Well No. 2) Transmission Waterline and Access Road: Approximately 8,300 feet of 12-inch waterline and access road.

CULTURAL IMPACT ASSESSMENT METHODOLOGY

The Constitution of the State of Hawaiʻi clearly states the duty of the State and its agencies is to preserve, protect, and prevent interference with the traditional and customary rights of native Hawaiians. Article XII, Section 7 (2000) requires the State to "protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by *ahupua'a* tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778." Additionally, Article IX and XII, of the state constitution, other state laws, and the courts of the State, impose on government agencies a duty to promote and protect cultural beliefs and practices, and resources of native Hawaiians as well as other ethnic groups.

Kamehameha III (Kauikeaouli) preserved the peoples traditional right to subsistence. As a result, in 1850, the Hawaiian Government confirmed the traditional access rights to native Hawaiian ahupua'a tenants to gather specific natural resources for customary uses from undeveloped private property and waterways under the Hawaiian Revised Statutes (HRS) 7-1. In 1992, the State of Hawai'i Supreme Court, reaffirmed HRS 7-1 and expanded it to include, "native Hawaiian rights…may extend beyond the *ahupua'a* in which a native Hawaiian resides where such rights have been customarily and traditionally exercised in this manner" [Pele Defense Fund v. Paty, 73 Haw.578, 620, 837 P.2d 1247, 1272 (1992)].

Act 50, enacted by the Legislature of the State of Hawai'i (2000) with House Bill (HB) 2895, relating to Environmental Impact Statements, proposes that:

> …there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawaii's culture, and traditional and customary rights… [H.B. NO. 2895].

Act 50 also requires state agencies and other developers to assess the effects of proposed land use or shoreline developments on the "cultural practices of the community and State" as part of the HRS Chapter 343 (2001) environmental review process. It also re-defined the definition of "significant effect" to include "the sum of effects on the quality of the environment including actions that impact a natural resource, limit the range of beneficial uses of the environment, that are contrary to the State's environmental policies, or adversely affect the economic welfare, social welfare or cultural practices of the community and State." Cultural resources can include a broad range of often overlapping categories, including places, behaviors, values, beliefs, objects, records, stories, etc. (H.B. 2895, Act 50, 2000).

The purpose of a CIA is to identify the possibility of on-going cultural activities and resources within a project area, or its vicinity, and then assessing the potential for impacts on these cultural resources. The CIA is not intended to be a document of in depth archival-historical land research, or a record of oral family histories, unless these records contain information about specific cultural resources that might be impacted by a proposed project.

GEOGRAPHICAL EXTENT

As defined by the Hawaii State Office of Environmental Quality Control (OEQC 1997:11), the geographical extent should be greater than the area over which the proposed project will take place in order to ensure that cultural practices that occur outside of the project area, but which may still be affected, are included in the assessment. For example, a project that may not itself physically impact traditional gathering practices, but may block access to those locations would be included within the assessment. The concept of geographical expansion is recognized by using, as an example, "the broad geographical area, e.g. district or *ahupua'a.*" In some cases, the geographical extent could extend beyond the *ahupua'a* if cultural practices do so as well.

OEQC GUIDELINES FOR ASSESSING CULTURAL IMPACTS

According to the Guidelines for Assessing Cultural Impacts established by the Hawaii State Office of Environmental Quality Control (OEQC 1997:12):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religions and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural, which support such cultural beliefs.

The meaning of "traditional" was explained by in *National Register Bulletin*:

> "Traditional" in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations', usually orally or through practice. The traditional cultural significance of a historic property then is significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices. . . [Parker and King 1998:1]

This CIA was prepared as much as possible in accordance with the suggested methodology and content protocol in the Guidelines for Assessing Cultural Impacts (OEQC 1997:11-13). In outlining the "Cultural Impact Assessment Methodology," the OEQC (1997:11) states that:

> …information may be obtained through scoping community meetings, ethnographic interviews and oral histories…

This Cultural Impact Assessment was prepared in accordance with the Guidelines for Assessing Cultural Impacts (OEQC 1997:11-13). The Guidelines recommend that preparers of assessments analyzing cultural impacts adopt the following protocol:

- Identify and consult with individuals and organizations with expertise concerning the types of cultural resources, practices and beliefs found within the broad geographical area, e.g., district or ahupua'a;
- Identify and consult with individuals and organizations with knowledge of the area potentially affected by the proposed action;
- Receive information from or conduct ethnographic interviews and oral histories with persons having knowledge of the potentially affected area;
- Conduct ethnographic, historical, anthropological, sociological, and other culturally related documentary research;
- Identify and describe the cultural resources, practices and beliefs located within the potentially affected area; and
- Assess the impact of the proposed action. alternatives to the proposed action, and mitigation measures, on the cultural resources, practices and beliefs identified.

CULTURAL IMPACT ASSESSMENT CONTENTS

The Guidelines state that an assessment of cultural impacts should address, but not be limited to the following:

- Discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints or limitations which might have affected the quality of the information obtained.
- Description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.
- Ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained.
- Biographical information concerning the individuals and organizations consulted their particular expertise and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed their

particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area.

- Discussion concerning historical and cultural source materials consulted, the institutions and repositories searched and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations or biases.

- Discussion concerning the cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.

- Discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area affected directly or indirectly by the proposed project.

- Explanation of confidential information that has been withheld from public disclosure in the assessment.

- Discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.

- Analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place.

- A bibliography of references, and attached records of interviews which were allowed to be disclosed.

If on-going cultural activities and/or resources are identified within the project area, assessments of the potential effects on the cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

PROJECT METHODOLOGY

This report contains archival and documentary research, as well as communication with organizations and individuals having knowledge of the project area, its cultural resources, and its practices and beliefs. An example of the initial letter of inquiry is presented in Appendix A, copies of the posted newspaper notice and affidavit are presented in Appendix B, and an example of the follow up letter is presented in Appendix C. Signed information release forms are presented in Appendix D. This Cultural Impact Assessment was prepared in accordance with the suggested methodology and content protocol provided in the Guidelines for Assessing Cultural

Impacts (OEQC 1997:13), whenever possible. The assessment concerning cultural impacts may include, but not be limited to the following items discussed below.

ARCHIVAL RESEARCH

Archival research focused on a historical documentary study involving both published and unpublished sources. These included legendary accounts of native and early foreign writers; early historical journals and narratives; historic maps, land records, such as Land Commission Awards, Royal Patent Grants, and Boundary Commission records; historic accounts, and previous archaeological reports.

Historical and cultural source materials were extensively used and can be found listed in the References Cited portion of this report. Such scholars as Samuel Kamakau, Martha Beckwith, Jon J. Chinen, Lilikalā Kameʻeleihiwa, R. S. Kuykendall, Marion Kelly, E. S. C. Handy and E.G. Handy, John Papa ʻĪʻī, Gavin Daws, A. Grove Day, and Elspeth P. Sterling, and Mary Kawena Pukuʻi and Samuel H. Elbert continue to contribute to our knowledge and understanding of Hawaiʻi, past and present. The works of these and other authors were consulted and incorporated in this report where appropriate. Historic land use document research was supplied by the Waihona ʻAina (2019) Database, the Office of Hawaiian Affairs Kipuka Database (2016), and the County of Maui County Real Property Assessment Division Database (2019).

INTERVIEWS

In general, interviews are conducted in accordance with Federal and State laws and guidelines when knowledgeable individuals are able to identify traditional cultural practices and/or resources procured in the project area or in the environs. If they have knowledge of traditional stories, practices and beliefs, and resources associated with a project area or if they know of historical properties within the project area, they are sought out for additional consultation and interviews. Individuals who have particular knowledge of traditions passed down from preceding generations and a personal familiarity with the project area are invited to share their relevant information concerning particular cultural resources. Often people are recommended for their expertise, and indeed, organizations, such as Hawaiian Civic Clubs, the Island Branch of Office of Hawaiian Affairs (OHA), historical societies, Island Trail clubs, and Planning Commissions are depended upon for their recommendations of suitable informants. These groups are invited to contribute their input and suggest further avenues of inquiry, as well as specific individuals to interview. It should be stressed again that this process does not include formal or in-depth ethnographic interviews or oral histories as described in the OEQC's *Guidelines for Assessing Cultural Impacts* (1997). The assessments are intended to identify potential impacts to ongoing cultural practices, or resources, within a project area or in its close vicinity.

If knowledgeable individuals are identified, personal interviews are sometimes taped and then summarized. These draft summaries are returned to each of the participants for their review and comments. After corrections are made, each individual is to sign an information release form, making the interview available for this study. When telephone interviews occur, a summary of the information is also sent for correction and approval, or dictated by the informant and then incorporated into the document. If no cultural resource information is forthcoming and no knowledgeable informants are suggested for further inquiry, interviews are not conducted.

KA PA'A KAI O KA'AINA V. LAND USE COMM'N, STATE OF HAWAI'I

The Land Use Commission (LUC) is also required to apply the analytical framework set forth by the Hawaii Supreme Court in <u>Ka Pa'akai O Ka'Aina v. Land Use Comm'n, State of Hawai'i</u>, 94 Hawai'i 31, 7 P.3d 1068 (2000) (hereinafter, "***<u>Ka Pa'akai</u>***"). In this case, a coalition of native Hawaiian community organizations challenged an administrative decision by the Land Use Commission (the "***LUC***") to reclassify nearly 1,010 acres of land from conservation to urban use, to allow for the development of a luxury project including upscale homes, a golf course, and other amenities. The native Hawaiian community organizations appealed, arguing that their native Hawaiian members would be adversely affected by the LUC's decision because the proposed development would infringe upon the exercise of their traditional and customary rights. Noting that "[a]rticle XII, section 7 of the Hawaii Constitution obligates the LUC to protect the reasonable exercise of customarily and traditionally exercised rights of native Hawaiians <u>to the extent feasible</u> when granting a petition for reclassification of district boundaries," the Hawai'i Supreme Court held that the LUC did not provide a sufficient basis to determine "whether [the agency] fulfilled its obligation to preserve and protect customary and traditional rights of native Hawaiians" and, therefore, the LUC "failed to satisfy its statutory and constitutional obligations." <u>Ka Pa'akai</u>, 94 Hawai'i at 46, 53, 7 P.3d at 1083, 1090.

The Hawai'i Supreme Court in <u>Ka Pa'akai</u> provided an analytical framework in an effort to effectuate the State's obligation to protect native Hawaiian customary and traditional practices while reasonably accommodating competing private interests. In order to fulfill its duty to preserve and protect customary and traditional native Hawaiian rights to the extent feasible, the LUC must—at a minimum—make specific findings and conclusions as to the following:

A. the identity and scope of "valued cultural, historical, or natural resources" in the petition area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area;

B. the extent to which those resources--including traditional and customary native Hawaiian rights--will be affected or impaired by the proposed action; and

C. the feasible action, if any, to be taken by the LUC to reasonably protect native Hawaiian rights if they are found to exist.

See Ka Paʻakai, 94 Hawaiʻi at 47, 7 P.3d at 1084.

To fulfill these purposes outlined by Ka Paʻakai, the Cultural Impact Assessment has reviewed historical research and suggestions from contacts knowledgeable about traditional cultural practices which were conducted within the project area corridor and in the surrounding environs. The potential effect of the proposed project on cultural resources, practices or beliefs, its potential to isolate cultural resources, practices or beliefs from their setting, and the potential of the project to introduce elements which may alter the setting in which cultural practices take place has been analyzed, as required by the OEQC (1997).

ENVIRONMENTAL SETTING

The Island of Maui ranks second in size of the eight main islands in the Hawaiian Archipelago. Maui Island was formed by two volcanoes, Puʻu Kukui in the west and Haleakalā in the east. Puʻu Kukui, forming the west end of the island (1,215 m above mean sea level), is composed of large, heavily eroded amphitheater valleys that contain well-developed permanent stream systems that watered fertile agricultural lands extending to the coast. The deep valleys of West Maui and their associated coastal regions have been witness to many battles during the pre-Contact Period and were coveted productive landscapes. These are joined together by an isthmus containing dry, open country or kula.

PROJECT AREA

The proposed well sites project area is situated northwestern slope of what is commonly referred to as the West Maui Mountains on the west side of the Island of Maui, in the traditional District of Kāʻanapali, now known as Lahaina, and extends across the Ahupuaʻa of Honokōwai, Māhinahina, and Māhinahina 1, 2, 3. The project area is situated between approximately 2.0 and 3.5 miles inland from the coastline and extends approximately from 590 to 1320 feet above mean sea level (amsl). The land on which the exploratory wells are located slopes gently to moderately to the north-northwest/south-southeast and appears be under the commercial cultivation of pineapple (see Figure 3). The Honokohau Tunnel traverses through the lower portion of the project area.

CLIMATE

The project area receives an average amount of precipitation, compared with other settled parts of Maui and the Hawaiian Islands, in general. According to Armstrong (1983), mean annual rainfall in the general area is approximately 76 cm (30 in.). Giambelluca et al. (2013) report *median* annual rainfall for the area of approximately 100 cm (40 in.). Part of the discrepancy between these rainfall data is probably due to the steeply increasing precipitation gradient east and southeast of the project area, as one moves up into the relatively wet flanks of West Maui. Regardless of which of these (30 or 40 in.) numbers is more typical of the local rainfall, a tremendous amount of through-flowing water from the West Maui uplands would have been available in the Honokahua Stream and the smaller, but much closer, Napili Stream, during the pre-Contact Period. Native Hawaiians utilized extensive irrigation techniques in this general region, as a way of capturing this great surplus of potable water.

SOILS

According to (Foote *et. al*. 1972: Sheet 93), the project area falls within four Soil Series (Figure 5), which are briefly described below:

- the Kahana Series, specifically Kahana silty clay, 7 to 15 percent (KbC), and Kahana silty clay, 3 to 7 percent slopes (KbB);
- Alaeloa Series, specifically Alaeloa silty clay, 15 to 35 percent slopes (AeC), Alaeloa silty clay, 7 to 15 percent slopes (AeE);
- the Olelo Series, specifically Olelo silty clay, 3 to 15 percent (OFC), and
- Rough Broken and Stony Land (rRS).

THE KAHANA SERIES

Soils of the Kahana Series are well-drained soils, which derived from decomposing volcanic rock. Soils of this series can be found between 100 to 1,200 feet above mean sea level (amsl) in areas receiving 30 to 45 inches of annual rainfall. The surface layer of the KbC soils is generally about 14 inches thick. The subsurface layer consists of dark reddish brown silty clay, which is approximately 50 inches thick, and overlays saprolitic bedrock. The KbC soils exhibit moderately rapid permeability, slow to medium runoff, and a slight to moderate erosion hazard. The KbC soils are usually used in the commercial cultivation of sugarcane and pineapple and as residential areas (Foote et al. 1972:50-51). The KbB soils are similar to the KbC soils and used in the same manner, but the runoff rate is slow and the erosional hazard is slight (Foote et al. 1972:51).

THE ALAELOA SERIES

Like the soils of the Kahana Series, the soils of the Alaeloa Series are well-drained soils derived from decomposing volcanic rock found at high elevations, in this case, between 100 and 1,500 feet amsl. in areas receiving annual rainfall of 35 to 60 inches. The AeE surface layer extends 10 inches below surface and consists of dark reddish brown silty clay. The subsurface layer is approximately 48 inches thick, consists of dark red and red silty clay overlaying decomposing bedrock. The AeE soils exhibit moderately rapid permeability, medium runoff, and a moderate erosion hazard. The AeE soils are used in the commercial cultivation of pineapple, fruits, and garden vegetables; as ranchlands, wildlife habitats, and as residential area (Foote et al. 1972:26).

The AeC soils are similar to the AeE soils, but exhibit a slow to medium runoff and a slight to moderate erosion hazard. These soils are primarily used for the commercial cultivation of pineapple, with smaller properties serving as ranchlands and residential areas (Foote et al. 1972:26).

THE OLELO SERIES

In general, the soils of the Olelo Series are, also, are well-drained soils derived from decomposing volcanic rock occurring at high elevations on the Islands of Molokai and Maui. The Olelo Series can be found between 2,000 and 3,500 ft. amsl. in areas receiving 40 to 80 inches of annual rainfall on Maui. According to Foote et al. (1972:101-102), the OFC soil occurs on narrow to broad ridgetops, exhibit moderately rapid permeability, slow runoff, a slight erosion hazard, and a high acid content. The OFC soils are frequently used as woodlands and ranchlands.

ROUGH BROKEN AND STONY LANDS

Foote et al. (1972:119) describe lands comprised of Rough Broken and Stony Lands (rRs) as consisting of "very steep, stony gulches… [where] [t]he local relief is generally between 25 and 500 feet." Rough Broken and Stony Lands range in elevation from around sea level to 3,000 amsl and occur in areas receiving 20 to 40 inches of rainfall annually. The rRS lands exhibit less than 20 inches of soil overlying bedrock or saprolitic rock, 3 to 25 percent of the ground surface is rocky, and runoff in these areas is rapid. In general, rRS lands are used as ranchlands, wildlife habitats, and watersheds.

TRADITONAL AND HISTORICAL CULTURAL CONTEXT

Archaeological settlement pattern data suggests that initial colonization and occupation of the Hawaiian Islands first occurred on the windward shoreline areas of the main islands between A. D. 850 and 1100, with populations eventually settling in drier leeward areas during later periods (Kirch 2011). Although coastal settlement was dominant, native Hawaiians began cultivating and living in the upland kula (plains) zones. Greater population expansion to inland areas began around the 14th century and continued through the 16th century. Large scale or intensive agriculture was implemented in association with habitation, religious, and ceremonial activities.

The Hawaiian economy was based on agricultural production and marine exploitation, as well as raising livestock and collecting wild plants and birds. Extended household groups settled in various ahupuaʿa. Traditionally, there were two types of agriculture, wetland and dry land, both of which were dependent upon geography and physiography. River valleys provided ideal conditions for wetland kalo (*Colocasia esculenta*) agriculture that incorporated pond fields and irrigation canals. Other cultigens, such as kō (sugar cane, *Saccharum officinaruma*) and maiʿa (banana, *Musa* sp.), were also grown and, where appropriate, such crops as ʿuala (sweet potato, *Ipomoea batatas*) were produced. Traditionally, this was the typical agricultural pattern seen during the pre-Contact Period on all the Hawaiian Islands (Kirch and Sahlins 1992, Vol. 1:5, 119; Kirch 1985). Agricultural development on Maui was likely to have begun early in what is known as the Expansion Period (AD 1200-1400, Kirch 1985).

PAST POLITICAL BOUNDARIES

Traditionally, the Island of Maui was divided into twelve districts: Lāhainā, Kula, Honuaʻula, Kahikinui, Kaupō, Kīpahulu, Hāna, Koʻolau, Hāmākualoa, Hāmākuapoko, Wailuku, and Kāʻanapali (Sterling 1998:3; Figure 6). The division of Maui Island lands into districts (moku) and sub-districts was performed by a kahuna (priest, expert) named Kalaihaʻōhia, during the time of the ali‘i Kaka‘alaneo (Beckwith 1979:383; Fornander [1919-20, Vol. 6:248] places Kaka‘alaneo at the end of the 15th century or the beginning of the 16th century). Land was considered the property of the king or ali‘i ‘ai moku (the ali‘i who eats the island/district), which he held in trust for the gods. The title of ali‘i ‘ai moku ensured rights and responsibilities to the land, but did not confer absolute ownership. The king kept the parcels he wanted, his higher chiefs received large parcels from him and, in turn, distributed smaller parcels to lesser chiefs. The maka‘āinana (commoners) worked the individual plots of land.

In general, several terms, such as moku, ahupua‘a, ‘ili or ‘ili ‘āina were used to delineate various land sections. A district (moku) contained smaller land divisions (ahupua‘a), which customarily continued inland from the ocean and upland into the mountains. Extended household groups living within the ahupua‘a were therefore, able to harvest from both the land and the sea. Ideally, this situation allowed each ahupua‘a to be self-sufficient by supplying needed resources from different environmental zones (Lyons 1875:111). The ‘ili ‘āina or ‘ili were smaller land divisions next to importance to the ahupua‘a and were administered by the chief who controlled the ahupua‘a in which it was located (Lyons 1875: 33; Lucas 1995:40). The mo‘o‘āina were narrow strips of land within an ‘ili. The land holding of a tenant or hoa ‘āina residing in an ahupua‘a was called a kuleana (Lucas 1995:61).

The current project area is located within the ahupua‘a of Honokōwai (bay drawing water), Kahana (cutting), Māhinahina (silvery haze, as in moonlight) 1, 2, 3, and Māhinahina 4, within the traditional District of Kā‘anapali.

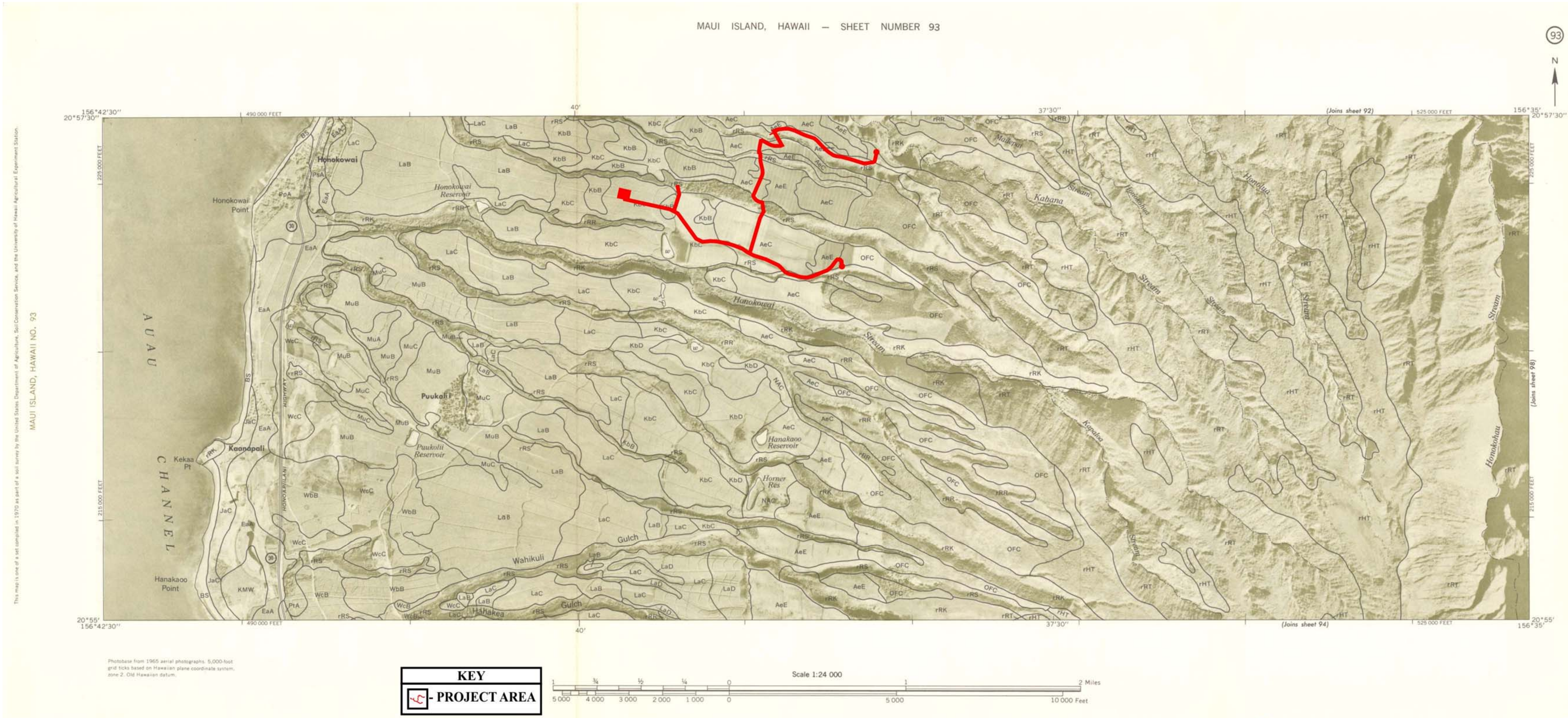

Figure 5: USDA Soil Survey Map Showing Soil Types within the Project Area (Foote et al. 1972: Sheet Number 93).

PRE-CONTACT PERIOD (PRE-1778)

A general settlement model based on archaeological evidence has been suggested for the Kāʻanapali District (Chapman and Kirch 1979; Kirch 1985). This model includes coastal marine foraging and fishing with more upland agricultural pursuits. In typical native Hawaiian fashion, dating at least from the later pre-Contact period (if not earlier), people in this area would have moved between the coast and the upland agricultural fields, exploiting the full range of resources available within the ahupuaʻa. Based on these observations, it is probable that the region in and around the project areas was inhabited and farmed, at least in later pre-Contact Period through the early Historic Period (post-1778).

The current project is located in the traditional District of Kāʻanapali District, which is situated north of the traditional District of Lāhainā on the west side of the Island of Maui. The District extended north and west from Kekaʻa Point to ʻIli O Kukuipuka, encompassing five major stream valleys draining the leeward slopes of West Maui (i.e., Honokōwai, Kahana, Honokahua, Honolua, and Honōkohau) (Sterling 1998:46; Handy and Handy 2004:494). These valleys are "watered by the streams draining western slopes of the West Maui Watershed" (Handy and Handy 1972:494). "The valleys of Honokōhau, Honolua, and Honokōwai merge together at around 4,000 [amsl], below Lake Manowai where the headwaters begin (Anderson 2016:113). During the pre-Contact Period, these valleys were all productive wet taro (loʻi) lands, with extensive systems of terracing which were reportedly used from the early Historic Period into the early 20th century.

It has been documented (Arago 1823:119-120, cited in Handy and Handy 1972:493) that the area surrounding the village of Lahaina was "dry and barren" at the time of contact with Westerners. In contrast, Fornander (1918-1919, Vol. 5: 540-541, cited in Handy and Handy 1972: 494) stated that Kekaʻa "once an area of intensive cultivation." Thus, it can be inferred that, traditionally, the entire northwest coast of Maui was under "continuous [loʻi] cultivation."

> Kekaa was the capital of Maui when Kakaalaneo was reigning over West Maui. ... Many houses were constructed and people cultivated a great deal of potatoes, bananas, sugar cane, and things of a like nature. I have been told that the country from Kekaa to Hahakea and Wahikuli - that country now covered by cactus, in a northwesterly direction from Lahaina-was all cultivated. This chief (Kakaalaneo) also planted bread fruit and *kukui* trees down at

> Lahaina. Some of these trees southwest of the Lahaina fort, were called the bread fruit trees of Kauheana. (Fornander 1918-1919, Vol. 5: 540-541, cited in Handy and Handy 1972: 494)

D.T. Fleming (cited in Handy 1940:106) substantiated Fornander's (1918-19191, Vol. 5: 540-541) inference when he visited the valleys of Honokōwai, Kahana, Honokahua, and Honolua. Of his observations, Fleming (cited in Handy 1942:106) states:

> …Honokowai, Honokohua and Honolua, as well as Kahana, there was considerable taro raised in olden times; as a matter of fact, a great deal was raised in Honokowai, where there must have been 30 or 40 acres under cultivation at one time.

According to Handy and Handy (2004: 494), by 1934 commercial planting and the exhaustion of the soil had brought in root rot…." causing some of the lo'i to be abandoned and some to be replaced with rice fields in Honokōhau Ahupua'a, and quite possibly within the ahupua'a in which the current project is located.

In addition to watering the valleys, the above-mentioned streams provide water for the six bays located on the western shores of Maui. These bays and coves, whose names begin with *Hono*-, include Honokahua, Honokeana, Honokōhau, Honokōwai, Honolua, and Hononana, which are collectively known as "Hono a Pi'ilani"; literally meaning bays (hono) acquired or ruled by Pi'ilani (Pukui and Ebert 1986, Pukui et al. 1974, and Clark 1980).

The coastal and marine environments adjacent to the project area would have provided rich resources for traditional subsistence foragers and fishermen in the pre-Contact and early Historic Periods. A large number of fish species are found in the near-coastal waters: weke, surmullet (*Mulloidichthys auriflamma*); *kūmū* (goatfish, Paru*peneus prophyreus*); *mamo* (sergeant fish, *Abudefduf abdominalis*); *manini* (surgeonfish, *Acanthurus triostegus*); *palani* (surgeonfish, *Acanthurus bariene*); *nenue* (rudder or pilot fish, *Kyphosus fuscus*); *kōkala* (porcupine fish, *Diodon hystrix*); *hinalea* (wrasse, Family, Labridae); *uhu* (parrot fish, *Scarus perspicillatus*); *'ala'ihi* (squirrel fish, *Holocentrus* sp.); *kala* (surgeonfish or unicorn fish, *Acanthurus* sp.); and *nehu* (anchovy, *Anchoviella purpurea*). In addition to a relatively high density of gastropods and pelecypods, including *pipipi*, black nerita (*Nerita picea*) and *Littorina* *pintado*), at least five species of sea urchin have been noted: Centrechinus paucispinus, Tripneustes gratilla, Podophora atrata, Heterocentrotus mammillatus, and Echinometra mathaei (Kirch 1973).

Kahana played another important role in traditional life, in addition to providing a substantial amount of taro. According to Rebecca Nuuhiwa, an informant for Elspeth Sterling (cited in Sterling (1998:50):

> The people of Lahaina gathered their salt at Kahana. It was said they carried the sea water to the depressions and then let it settle and dry out. They gathered their salt on dry days.

The Mahinahina 4 Ahupuaʻa is not directly mentioned in known traditional narratives, but descriptions of nearby ahupuaʻa can be used to infer some of its broad characteristics. Valleys originating high in the West Maui and bordering the Mahinahina Ahupuaʻa to the north and south all had extensive taro lands located in the valley bottoms, where terraces rose tier upon tier in symmetrical stone-faced loʻi (Handy and Handy 1972). Honokowai, itself, had been a canoe landing and was the last sandy inlet before the rocky shoreline of Mahinahina. Fresh water springs could be found at the water's edge of Honokōwai Bay (Clark 1980).

Most of the ahupuaʻa on the coast have been overshadowed by the famous roadstead and village that served as the capitol of the Hawaiian Kingdom after the conquest of Kamehameha I until 1855. The ethnographic and historic literature, often our only link to the past, reveal that the lands around Lāhainā were rich agricultural areas irrigated by aqueducts originating in well-watered valleys with permanent occupation predominately on the coast. Crops cultivated included coconut, breadfruit, paper mulberry, banana, taro, sweet potato, sugar cane, and gourds.

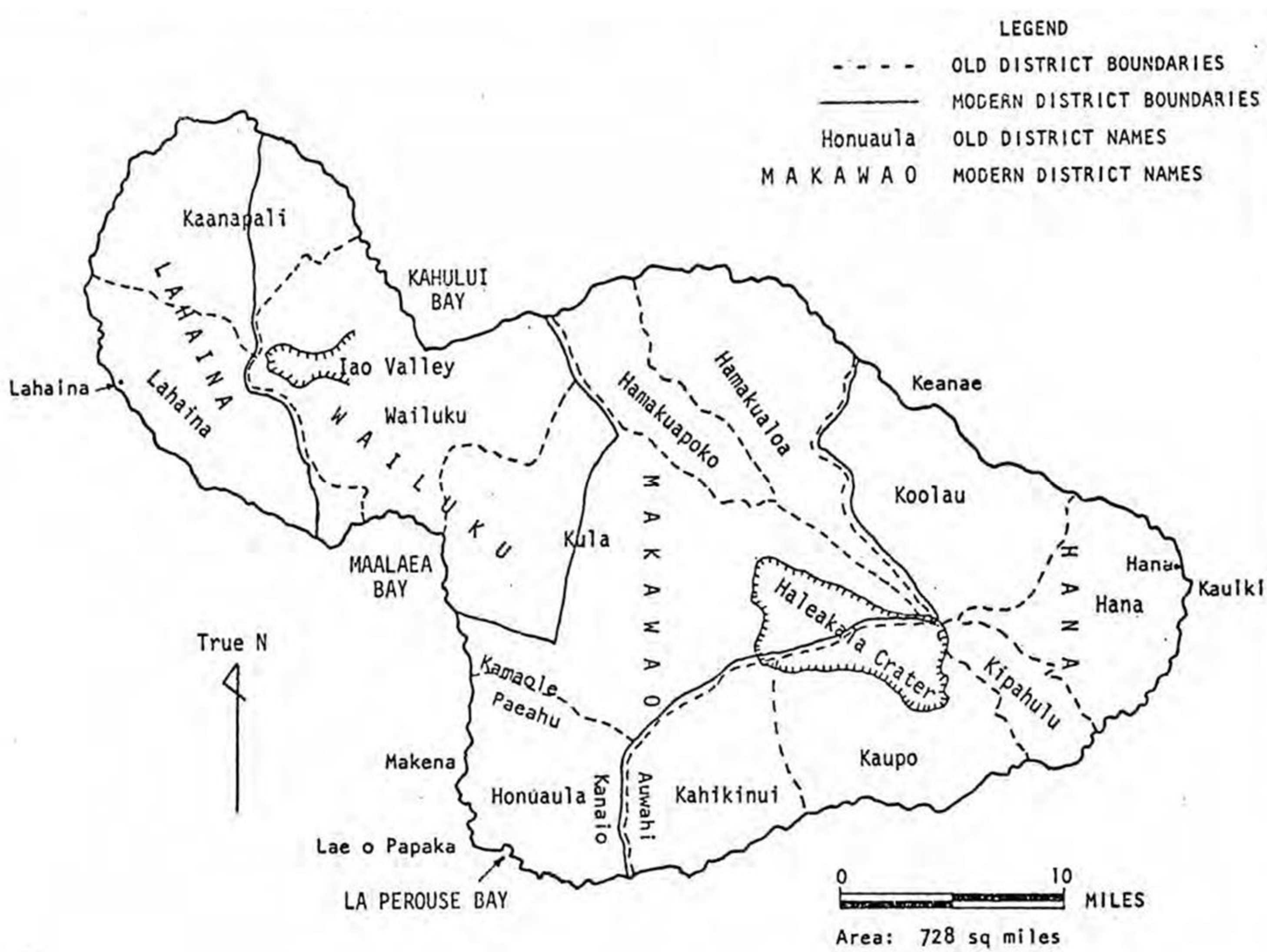

Figure 6: Traditional and Modern Districts of Maui (c. 1875; from Barrère 1975:31).

HEIAU FROM HONOKŌWAI TO HONOKAHUA AHUPUAʻA

Heiau indicate the presence of political power and the appropriate population to support it. Early archaeological surveys identified seven religious shrines (heiau) from Mahinahina to Honokōhau Ahupuaʻa (Thrum 1909, 1917; Walker 1931, Sterling 1998).

The early surveys of Thrum (1909, 1917) and Walker (1931) identified seven religious shrines (heiau) located between the ahupuaʻa of Honokōwai and Honōkohau. The closest heiau to any of the current project areas that was reported by these early surveys was Kahauiki Heiau (Walker Site No. 16, State Site 50-50-01-16) which was located in Honokahua Ahupuaʻa. This "small irregular platform" (Sterling 1998:52) was located "a short distance up the west side of a gulch of the same name" [i.e., Kahauili] ((Sterling 1998:52). This gulch drains into the eastern terminus of Honokahua Bay, on the other (northeast) side (from the project area) of the Honokahua Burial Site (State Site 50-50-01-1342). The remaining six heiau between Honokōwai and Honōkohau Ahupuaʻa documented by Walker (1931) and Thrum (1909, 1917) are as described as follows:

- Kahana Heiau (Walker Site No. 12, State Site 50-50-01-12), located along the seashore, destroyed (Mahinahina Ahupuaʻa);
- Hihiho Heiau (Walker Site No. 14, State Site 50-50-01-14), located along "County Road near Kalaeokaea Point" destroyed to build road (Mailepai or Kahana Ahupuaʻa);
- Mailepai Heiau (Walker Site No. 13, State Site 50-50-01-13), located near Mailepai Point, "washed away", destroyed (Mailepai Ahupuaʻa);
- Unnamed Heiau (Walker Site No. 15, State Site 50-50-01-15), located on a "bluff at south side of rocky cove between Alaeloa and Papaua Points" described as a "small rectangular enclosure" with a small platform in the interior SW corner (Alaeloa Ahupuaʻa);
- Honuaʻula Heiau (Walker Site No. 18, State Site 50-50-01-18), located at Honolua Gulch, described as the remains of old stone platforms and walls, with pavement in the entire interior (Honolua Ahupuaʻa);
- ʻIliʻilikea Heiau (Walker Site No. 19, State Site 50-50-01-19), located "on the top of ridge at west side of Punaha Gulch, just above the road", described as a site complex of enclosures, pavements, and burials occupying an area of at least 30,000 square feet (Honokōhau Ahupuaʻa) (Rogers and Rosendahl 1992).

Traditionally, trails extended from the coast to the mountains, linking the two for both economic and social reasons. Kāʻanapali District is noted for an alaloa (a long path or trail) that reportedly encircled the entire island. Walker (1931 cited in Sterling 1998:46) wrote:

> The north end of Maui also is traversed by a paved trail. Sections of it can be seen from Honolua to Honokohau to Kahakuloa. It is paved with beach rocks and has a width of four to six feet….This trail is also spoken of as the Kihapiilani Trail.

MĀHELE OF 1848

During the 1840s, one of the greatest historic events impacting the population of the Hawaiian Islands was the Māhele of 1848. Thought to have been created under pressure from foreigners, Kauikeaouli (Kamehameha III) passed laws resulting in the Māhele, which altered the system of land transactions and legal land ownership processes for the entire population of the islands:

> By mid-century, the fledgling [Hawaiian] Kingdom undertook the single most significant inducement to cultural change, the Great Māhele or division of lands between the king, chiefs, and government, establishing land ownership on a Western-style, fee-simple basis. From this single act, an entire restructuring of the ancient social, economic, and political order followed. (Kirch 1985:309).

The Māhele of 1848, as implemented under Kauikeaouli (Kamehameha III), divided lands between the king, the chiefs, the government, and began the process of the private ownership of land for the Hawaiian people. Awarded parcels were called Land Commission Awards (LCAs). Through this process, the makaʻāinana (commoners), were able to claim the plots of land on which they had been cultivating and living. These claims did not include any previously cultivated, but presently fallow land, stream fisheries, or many other resources necessary for traditional survival (Kelly 1983; Kameʻeleihiwa 1992:295; Kirch and Sahlins 1992). If occupation could be established through the testimony of two witnesses, the petitioners were awarded the claimed LCA and issued a royal patent after which they could take possession of the property.

Chinen (1961:3) further explains:

> It was in December of 1845 that a statute [the Māhele] was enacted creating The Board of Commissioners to Quiet Land Titles, commonly known as The Land Commission. The act also granted unto said Land Commission the authority to accept claims for land received prior to the enactment of the statute, to investigate said claims and to grant awards to the successful claimants. This statute paved the way for private ownership of lands [Land Commission Awards] in Hawaiʻi. Since the enactment of said statute thousands of land Commission Grants, Kamehameha Deeds, Public Works Grants, Land Patent Grants and other documents have been issued by the Hawaiian Government for lands sold and conveyed to individuals.

In retrospect, it appears that some of the only people who profited from the Māhele were those who were informed of the process and understood the requirements imposed by the new statute. The rest of the claimants failed to support their claims and lost lands that had been utilized by their lineal ancestors for generations.

HONOKŌWAI AHUPUAʻA

The Indices of Land Commission Awards lists 114 grants totaling 186 ʻāpana (land parcel) in the Ahupuaʻa of Honokōwai. The Office of Hawaiian Affairs Kipuka Online Database (2016) indicates the ʻIli of Moʻomoku, which is located immediately adjacent to current project area, was claimed by Mataio Kekauʻōnohi. Kekauʻōnohi was awarded 322.69 aces [291.37 acres according to the Kipuka Online Database (2016)], which were divided into four ʻāpana under LCA 11216/Royal Patent 8531 (Waihona Aina Database 2019) (Appendix D). The Kipuka Online Database (2019) indicates remaining 4,974 acres of land within Honokōwai Ahupuaʻa were designated Crown Lands in 1848 (Figure 7).

MĀHINAHINA 1, 2, 3 AND KAHANA AHUPUAʻA

The Waihona Aina Database (2019) lists seven LCAs claimed, with six LCAs awarded within the Ahupuaʻa of Kahana. None of these lands are within the current project area. Subsequently, the lands of Mahinahina 1, 2, 3, Kahana, and Kahananui, comprising 2, 675 acres, were sold to D. Baldwin, J.H. Pogue, and S. E. Bishop, in 1853, under Land Grant 1166 (Waihona Aina Online Database 2019, Kipuka Online Database 2016) (see Appendix D). No information was available for LCAs in the Ahupuaʻa of Māhinahina 1, 2, 3 on the Waihona Aina (2019) or the Kipuka (2016) Online Databases.

MĀHINAHINA 4 AHUPUAʻA

Four LCAs were claimed in Māhinahina 4 Ahupuaʻa, three of which are located in the eastern (makai) portion of the ahupuaʿa (see Figure 7); Kipuka Aina Online Database 2016). Charles Cockett claimed and was awarded one ʻāpana, comprised of 149 acres, under Royal Patent 415, in Māhinahina 4 Ahupuaʻa in 1846. Also under LCA 6539/Royal Patent 4130, Hoonoho was also awarded one ʻāpana, comprised of 25 acres in Mahinahina 4. Under LCA

4239/Royal Patent 4203, Kauka was awarded one ʻāpana, totaling 2.96 acres in Māhinahina 4 Ahupuaʻa, in 1848. Under LCA 8248/Royal Patent 4443, Kekalohe was awarded one ʻāpana, totaling 0.25 acres in Mahinahina 4 Ahupuaʻa, in 1848.

HISTORIC PERIOD (POST-1778)

An 1831 census estimated the entire population of Kāʻanapali District as 2,980 people, which was reduced to less than half (1,341) only five years later (Schmidt 1973). Whaling (centered on Lāhainā Town) was the first commercial enterprise in West Maui, but it had more or less collapsed by the 1860s. Commercial sugarcane production was the next large capitalist venture in West Maui, starting as early as 1863, and it was focused between Kāʻanapali and Lāhainā.

Once land became available through the Māhele, large grants of land in Districts throughout the Island were leased or sold to foreigners for commercial ventures. During the middle to late 19th century and into the 20th century, sugarcane and pineapple became dominant cash crops in Hawai`i, particularly in the project area and environs. The lands have not been used for anything but such industrial agriculture until modern construction commenced (water treatment plants, reservoirs, etc). Sugar cane production commenced in 1848 with the sugar mill in Lahaina, which by 1858 evolved into the Lahaina Sugar Company and by 1860, the Pioneer Mill Company. Infrastructure was set nearer the coastline (railroads) and the upper elevation table lands (300ft-1000 ft. amsl.) from Lahaina to Kapalua were prime cultivation lands for these cash crops. The current project area, now an established County facility, was no exception, with sugar cane and especially pineapple, cultivated on its lands.

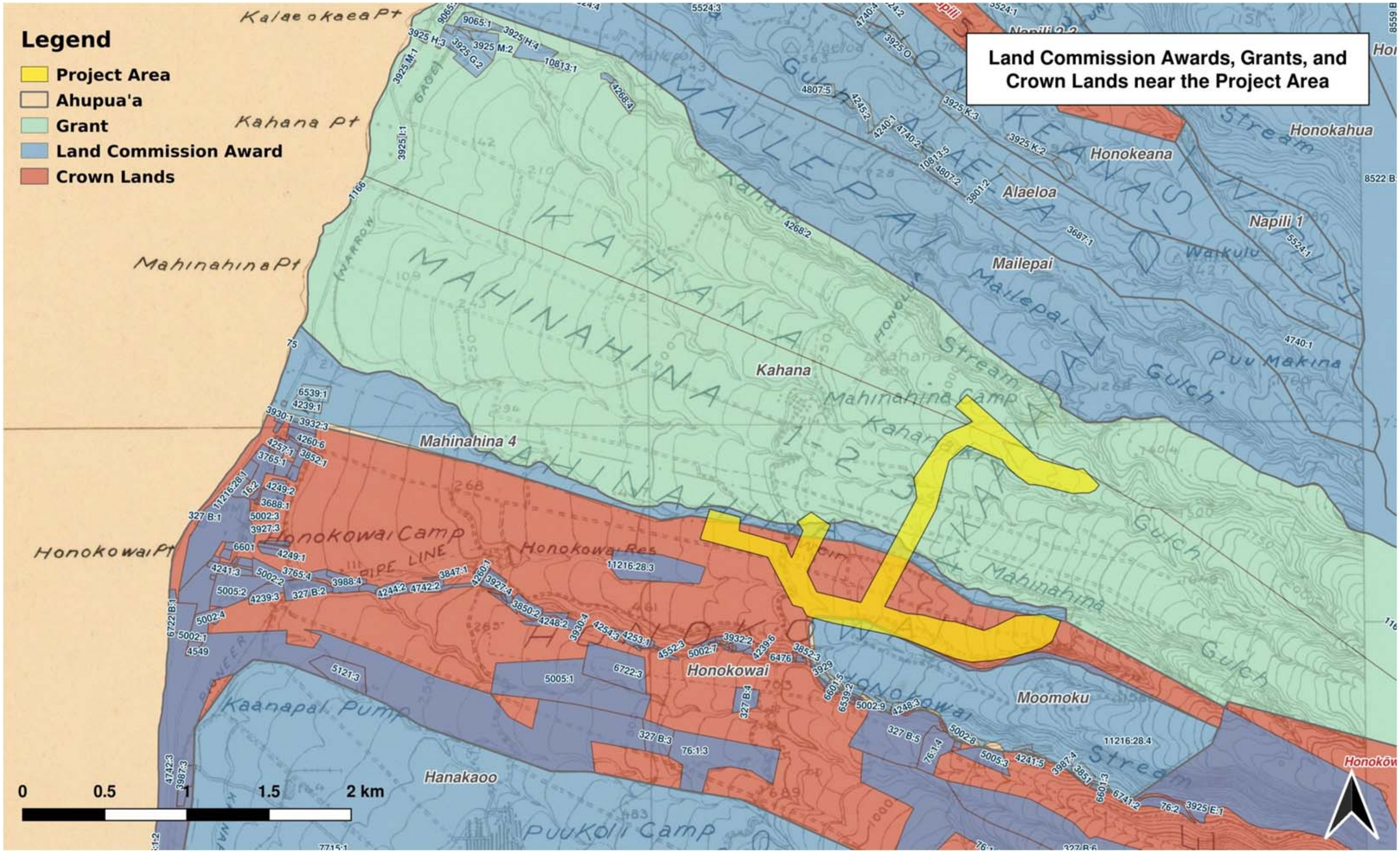

Figure 7: Map Showing Locations of Land Commission Awards, Land Grants, and Crown Lands in the Vicinity of the Project Area.

The general area around the project area, which was located at the margins of sugar cane enterprises in West Maui (Dorrance and Morgan 2000), was most important as a center of commercial ranching (cattle raising) and, subsequently, pineapple production.

In the later nineteenth century, lands in West Maui became part of the Campbell Estate. This was also the time that the Honolua Ranch was first established. Cattle ranching began then and was continued by Henry Perrine Baldwin, who acquired the lands from the Campbell Estate in 1890 (Fredericksen and Fredericksen 2001). In addition to ranching, other early commercial activities included coffee farming.

David T. Fleming became manager of Honolua Ranch in 1911 (or 1912). Fleming was well-versed in pineapple production from the Haiku area and gradually began shifting the ranch's initiative to pineapple production. The Honolua Ranch/Baldwin Packers complex shifted from Honolua to Honokahua in 1915, and a pineapple cannery was constructed. A major commercial pineapple industry emerged in West Maui during the 1920s. The plantation communities of Honokahua and Napili emerged and developed as Honolua Ranch/Baldwin Packers pineapple operations grew. The population of the Lāhainā area increased with the successful economic operations of the pineapple plantation. Baldwin Packers merged with MLP in 1962. After this time, much of the Honolua Ranch lands were converted for resort development, a process that continues to this day. The area in and around the six project areas, which is located at the margins of sugarcane enterprises in West Maui (Dorrance and Morgan 2000), was most important as a center of commercial ranching (cattle raising) and, subsequently, pineapple production.

The Honokahua Historic District (State Site 50-50-01-1340) includes the plantation village of Honokahua, the Baldwin Packers cannery and associated facilities, Honolua Ranch Stables, Honolua Ditch (constructed in 1902), the Maui Pineapple Company offices, the Honolua Store, plantation camp housing, and two churches (Fredericksen 2001).

By the mid-1800s, the surrounding areas of the port of Lāhainā were being converted from traditional agriculture to commercial sugar cane. As early as 1849, Judge A.W. Parsons operated a sugar mill in Lāhainā. Henry Dickenson began a sugar plantation in 1859 that was quickly followed by the Pioneer Mill Co. By 1883, Pioneer Mill Co. had assets in excess of $50,000,000 (Simpich 1974). Pioneer Mills railroad extended from the center of Lāhainā Village to a point north, past Honokōwai to the town of Puʻukoliʻi in Hanakaʻōʻō (Condé 1975). Pioneer Mill Co. reorganized in 1900 at which time its cane fields were located along the coast for 10 miles with some areas extending back as far as two and one half miles:

> The bulk of the crop is raised on lands that range from 10 feet to 700 feet elevation above sea level; the highest being cultivated at 1500 feet [Condé and Best 1973:254].

Sugar would be processed and bagged at the mill in Lāhainā and then taken by train to the landing at Puʻu Kekaʻa (Black Rock). Other buildings had been constructed there to aid in the plantations activities, such as oil and molasses tanks, as well as a pavilion and some beach cottages on the beach for the use of Pioneer Mill Company's personnel (Clark 1980:61). The Kāʻanapali Landing, used for sugar cane exports, was abandoned before World War II and by 1957; plans were in motion for a multi-million dollar resort to be built around Puʻu Kekaʻa. The shift to tourism in the 1950s sent the plantations into decline, however, the development of golf courses, hotels, condominiums, and shops have continued the popularity of region up to and including the present.

The cultivation of coffee had expanded to favorable lands on Maui by 1847-50 (Thrum 1876:46-48). According to Davis (1977:8):

> Although there is no specific reference as to Where these lands were located, it is likely that they included the major leeward valleys of West Maui as was the case with Kalihi and Manoa Valleys on the island of Oʻahu. Over the next decade, blight seriously disrupted coffee production in the islands. Coffee holdings in the kula lands above the valleys which were more for the transformation gradually began switching over to the cultivation of sugar cane. Yet, as late as 1896, the Government of the Hawaiian Republic was still advocating the expansion of coffee culture in West Maui--and elsewhere (Dept. of Foreign Affairs 1896).

WAHI PANA (LEGENDARY PLACES)

"Wahi Pana" can be defined as celebrated or noted places or locations (Pukui and Elbert 1986:313, 376), and refers to legendary places or landmarks of historical significance. These places of note have distinctive features (i.e., mountain peaks, streams, wind, rain, etc.) that are given specific names through which the history of an area is passed down from generation to generation through chants, legends, and songs. Very little information has been published in regard to the wahi pana of West Maui. Most of the available material refers to the Keka‘a Point area, in Honokōwai Ahupua‘a.

One of the most interesting areas in Honokōwai Ahupua‘a is Keka‘a Point, which literally translates as "the rumble, such sounds are said to be heard during storms" (Pukui et al. 1974:106)] Point.

According to legend (A.O. Forbes cited in Sterling 1998:48-49), the demigod Māui and his friend Moemoe lived at Keka‘a. After a time, Māui traveled to Waihee, where he was making ready to ensnare the sun in an effort to help his mother by making the days longer. One day, Moemoe decided to search for Māui. When Moemoe found Māui making many unsuccessful attempts to lasso the sun, Moemoe shouted, "Thou will never catch the sun. Thou art an idle nobody." Māui responded, "When I conquer my enemy, and my desire is attained, I will be your death."

After conquering the sun at Haleakalā and obtaining the suns promise to travel more slowly across the sky, Māui went in search of Moemoe. Māui found Moemoe near Keka‘a. When Moemoe saw Māui, he became very agitated and started running erratically back and forth. This angered Māui and he "leaped down and caught him on the upper side of Kekaa" where he was killed. Moemoe turned into a rock that is almost seven feet long and sits "on the lower side of the new road" (Sterling 1998:49).

More significantly, Keka‘a is also known as a leaping place of the soul (Leina-a-ka-uhane) "and many souls are known to come to this place" (Fornander cited in Sterling 1998:47).

> Only the spirits of subjects (makaainana) go to Kekaa; the souls of the farmers and the souls of the chiefs go to the volcano when they die. If they have friends there some of them are driven back *[whenever they reenter the body]* and live again. (Fornander cited in Sterling 1998:47).

The area around Keka‘a Point also was the setting of significant battles. Kamakau (1969:74) recounts the results of a war between Kauhi-pumai-kahoaka (or Kauhi-‘aimoku-a-Kama) and Kamehameha-nui in 1735, both children of Kekaulike. Alapa‘i of Hawai‘i Island had joined forces with Kamehameha-nui and a year was spent preparing for the war “which swept the country” (Kamakau 1961:74). “It is said that Alapa‘i proceeded with great severity against the adherents of Kauhi in Lahaina, destroying their taro patches and breaking down the watercourses out of Kauaula, Kanaha, and Mahoma [Kahoma] valleys” (Fornander 1969 cited in Sterling 1998:19). This reduced food for not only Kahui’s forces, but also the food for the maka‘āinana. The fighting force of Alapa‘i consisted of 8,440 warriors from all of the six districts of Hawai‘i Island (Kamakau 1961:74). Honokahua and Honolua Bays north of the project area became the gathering place for the forces of Peleioholani who had arrived from O‘ahu with only 640 men to assist Kauhi. While attempting to unite its warriors with those of Kauhi, Peleioholani became surrounded by the army of Alapa‘i.

Kamakau (1961:74) recorded:

> The hardest fighting even compared with that of Napili and at Honokahua in Kā‘anapali, took place on the day of the attack at Pu‘unēnē [in Honolua]. Pele-io-holani was surrounded on all sides, *mauka* and *makai*, by the forces of Alapa‘i, let by Ka-lani-‘opu‘ū and Keoua. The two ruling chiefs met there again, face to face…

Fornander (1969:142) stated:

> The fortune of the battle swayed back and forth from Honokawai to near into Lahaina; and to this day heaps of human bones and skulls, half buried in various places in the sand, attest the bitterness of the strife and the carnage committed…

and, according to Kamakau (1969:74):

> At Honokowai an engagement took place between the two armies, and the forces of Alapaʻi were slaughtered and fled to Keawawa.

PREVIOUS ARCHAEOLOGY

There have been numerous archaeological studies conducted in the vicinity of the current project area. An examination of past research within the vicinity of the project area has been utilized to surmise the site types that may potentially be encountered during the course of the project. The numerous archaeological sites recorded in the area consist mainly of traditional human burials identified during construction activities, as well as cultural remains relating to the both pre- and post-Contact Periods.

The early archaeological studies on Maui focused on the coastline. The earliest reported archaeological work conducted in the District of Lāhainā, was carried out by Winslow Walker (1931), under the auspices of the Bishop Museum, as part of an island-wide archaeological survey of Maui. After 1970, with the acceleration of resort development, formal surveys were conducted along the prime coastal areas.

Please note, Scientific Consultant Services, Inc. (Dagher and Dega 2019, in review; Figure 8) conducted an Archaeological Inventory Survey in advance of the current West Maui Water Source Development project: Mahinahina Well (West Maui Well No. 1; State Well No. 6-5638-004) and the Kahana Well (West Maui Well No. 2; State Well No. 6-5738-002). The project is located in Honokōwai, Kahana, Māhinahina 1, 2, 3, and Mahinahina 4 Ahupuaʻa, Lahaina (Kāʻanapali) District, Island of Maui, Hawaiʻi [TMK: (2) 4-3-001:017 and 084 (2) 4-4-002:014, 015, and 018 and (2) 4-4-004:009, 011, and 019]. During the survey, segment of the Honokohau Ditch/Tunnel (State Site 50-50-01-1591) was identified in the lower, western portion of the project area, above the existing surface water treatment plant.

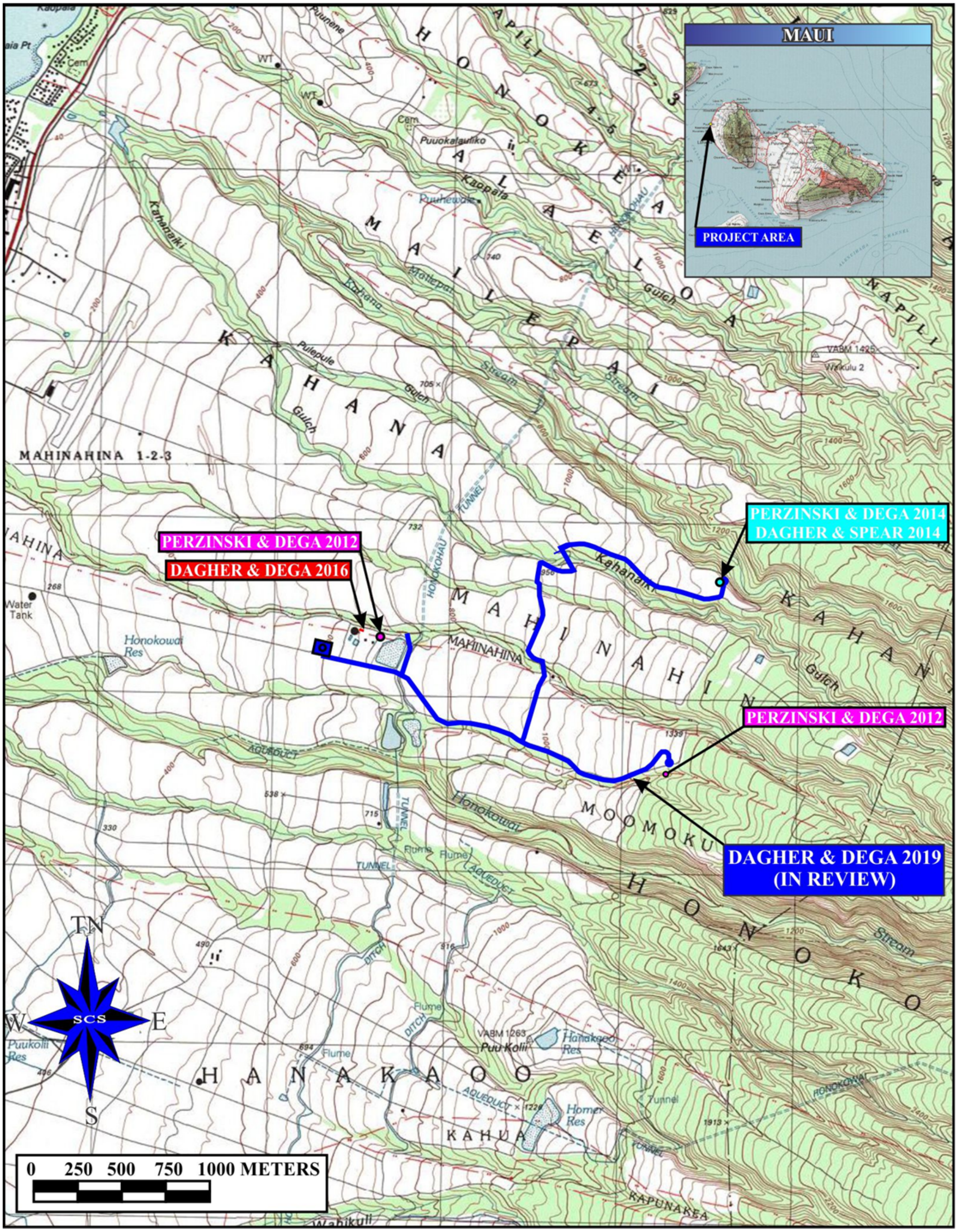

Figure 8: USGS (Lahaina, HI 1992 and Napili, HI 1997; 1:24,000) Quadrangle Maps Showing Previous Archaeology in Close Proximity to the Proposed Project Area.

HONOKŌWAI AHUPUA‘A

A Statewide Inventory of Historic Places for Maui in 1973 located petroglyphs and stone wall alignments in two different sections of Honokōwai Gulch (Bishop Museum Sites -1207 and -1208; Bishop Museum Records). Archaeological survey of the Honoapi‘ilani Highway corridor (Griffin and Lovelace 1977), between Honokōwai and ‘Alaeloa Ahupua‘a, recorded a buried midden deposit, a trail segment, a stone wall, and three retaining wall sections. The midden (State Site 50-50-01-225), located in Mahinahina Gulch, was interpreted as a temporary habitation site. Other studies in Kahana Ahupua‘a yielded numerous traditional sites, including temporary habitations, midden deposits, and various stone stacking and alignment features consistent with inland agricultural features (e.g., Komori 1983; Walker and Rosendahl 1985; Kennedy and Denham 1992).

Generalizing about traditional settlement patterns in the area, Griffin and Lovelace (1977) suggested that the ahupua‘a of Mahinahina was of relatively marginal agricultural value, and that occupation would have been limited to short-term visits, with primary residence at the coast of Mahinahina or even in Honokōwai. The Archaeological Research Center Hawaii, Inc. (Davis 1977) conducted a surface survey of Honokōwai Gulch. During the survey, four sites (State Sites 50-50-01-228 through 231) were identified:

State Site 50-50-01- 228, irrigated agricultural complex on the south bank of

Honokōwai Stream;

State Site 50-50-01-229, irrigated agricultural complex (remnant, recording incomplete) on the north bank of Honokōwai Stream;

State Site 50-50-01-230, irrigated agricultural complex (remnant) on the south bank of Honokōwai Stream; and

State Site 50-50-01-231, irrigated agricultural complex (recording incomplete) on the north bank of Honokōwai Stream.

Scientific Consultant Services, Inc. (Buffum and Spear 2002) conducted a program of Archaeological Monitoring in association with the construction of a small strip mall withinHonokōwai, Mahinahina Ahupua‘a, Kā‘anapali District, Maui Island, Hawai‘i (TMK: (2) 4-4-001:057, 058, and 059). No historic properties were identified.

Scientific Consultant Services, Inc. (Monahan 2004) conducted an Archaeological Inventory Survey was conducted on a 3.054-acres of partially developed land in Honokōwai, Mahinahina 4 Ahupuaʻa, Lāhainā District, Maui Island, Hawaiʻi [TMK: (2) 4-3-006:002 and 069]. The survey resulted in negative findings. Subsequently, Dega (2005) conducted an addendum on this property, which also yielded negative findings.

Scientific Consultant Services, Inc. (Havel and Dega 2005), conducted an Archaeological Inventory Survey on 0.11 Acres of partially developed land in Honokōwai Ahupuaʻa, Lāhainā District, Maui Island, Hawaiʻi [TMK: (2) 4-4-001:106]. The extent of modern disturbance to the surface and subsurface contexts was evident throughout the study parcel and the survey resulted in negative findings.

Scientific Consultant Services, Inc. (Ogg and Dega 2007) conducted Archaeological Inventory Survey of TMK: (2) 4-4-002:033 and (2) 4-4-002:029], within Honokōwai Ahupuaʻa, Lahaina District, Maui Island, Hawaiʻi. In addition to a systematic pedestrian survey, eight stratigraphic trenches were excavated within the interior of the perimeter fence of the Lahaina Wastewater Reclamation Facility. Most of the trenches revealed evidence of historic sugar cane cultivation in the form of heavily disturbed/admixed soil and black plastic tubing used commonly in modern sugar cane irrigation. Subsurface testing was not conducted at the Lahaina Wastewater Pump Station No. 1, as the enclosure was too small and densely packed with its component buildings, pipelines and other facilities to be a practical place to excavate. The survey resulted in negative findings.

Scientific Consultant Services, Inc. (Perzinski and Dega 2012; see Figure 8) conducted an Archaeological Field Inspection for the Mahinahina Production Well Improvements Project, located in Moʻomoku ʻIli, Honokōwai Ahupuaʻa, Lahaina District, Island of Maui [TMK: (2) 4-4-004:009 and (2) 4-4-002:018], which included a portion of the current project area. The Field Inspection resulted in the identification of a segment of the Historic Period Honokohau Ditch (State Site 50-50-01-1591). No additional historic properties were identified.

Scientific Consultant Services, Inc. (Andricci and Dega 2015) conducted an (Archaeological Inventory Survey in advance of the expansion of the existing AAAAA Rent-A-

Space facility located in Honokowai, Mahinahina 4 Ahupuaʻa, Lahaina (Kāʻanapali) District, Island of Maui, Hawaiʻi [TMK: (2) 4-4-001:026]. No historic properties were identified.

Scientific Consultant Services, Inc. (Dagher and Dega 2018) conducted an Archaeological Monitoring during all construction-related ground altering activities associated with the outdoor shower improvements at Honokowai Beach Park, Honokōwai Ahupuaʻa, Lahaina (Kāʻanapali) District, Island of Maui, Hawaiʻi [TMK: (2) 4-4-001:46 por. & 47 por.]. No historic properties were identified.

Based on the background information, sites likely to be encountered in the project area may include early historic house foundations and other stone alignments, as well as historic artifacts (e.g., bottles, hardware, etc.). Traditional sites and artifacts reflecting more temporary habitation are also possible (*e.g.,* stone tool debris, midden, hearth deposits), but, given the relatively marginal conditions in the project area, extensive permanent habitation was less likely. Certainly, the impact of decades of industrial pineapple cultivation would suggest a limited possibility for identifying intact cultural deposits or features.

KAHANA AHUPUAʻA

Much archaeological work has been located in the gulches of the Kahana area, and provides overlapping lines of evidence for land use and habitation in the area. The Bishop Museum (Kaschko 1974) conducted an archaeological reconnaissance survey of select gulches for the U.S. Soil Conservation Service in conjunction with the Wailuku Flood Prevention Project and the Honolua Watershed. Kaschko (1974: 4, 5) "noted numerous stone walls, terraces, alignments and a historic midden." Archaeological Research Center Hawaii, Inc. (Griffin and Lovelace 1977), conducted survey and salvage excavations on select areas of Mahinahina Gulch for the Hawaiʻi Department of Transportation. Five gulches were surveyed and five archaeological sites were documented (Griffin and Lovelace 1977:11), all of which were initially identified by Kaschko (1974).

The Bishop Museum (Komori 1983) conducted archaeological surface surveys and inspections of backhoe-disturbed soil in Kahana Gulch. The work was done under contract to the U.S. Soil Conservation Service and was a follow-up to the work conducted by Kaschko (1974). Komori (1983) identified seven archaeological sites: an overhang/shelter with a 10 meter long segment of terraced earth, a platform bordered by terraces, a wall segment and two stone alignments, wall segments and terraces, a floodplain partitioned off from the rest of the landscape by stone walls and terraces, walls of stacked stone and a rock shelter containing a "hammer stone or unfinished ʽulu maika ([traditional] Hawaiian game stone)" (Komori 1983:8).

Archaeological Consultants Hawaii (Kennedy 1986a, b; 1990, 1992) conducted a series of archaeological projects along the Kahana the coastline. Kennedys (1986a) first visit to the area, in September of 1986, investigated and confirmed the ruins of an historic stone church dating to the mid-nineteenth century. Although Kennedy (1986a) could find no record of a graveyard attached to the church, nor marked graves at the site, he could not discount the possibility of unmarked graves near the church (Kennedy 1986a:1–5). In November of 1986, Kennedy (1986b) made a return visit to the area to take photographs, map the site, and search for burials. No burials were found on the property (Kennedy 1986b:1–5). In 1990, Kennedy (1991) returned to the area for the third time to conduct an archaeological inventory survey of 50 acres of land near Kahana. The survey found two new sites: "a two tiered basalt rock platform and a single, crude petroglyph" (Kennedy 1991:4). At the behest of the State Historical Preservation Division, a test unit was placed near the rock platform in 1992. Excavations there found a burial, which was left in situ (Kennedy 1991:22).

Xamanek Researches (Fredericksen and Fredericksen 1995) conducted an Archaeological Inventory Survey of a 4-acre parcel of land for the Kahana-Kai Subdivision, Kahana Ahupuaʻa, Kāʻanapali District, Maui Island [TMK: (2) 4-3-005:071]. Twenty-two stratigraphic trenches were mechanically (backhoe) excavated and two test units were manually excavated by researchers, all of which produced negative results. One historic site (State Site 50-50-01-4069), which consists of an Historic stone bridge footing and retaining wall, a section of the old Pioneer Mill railway (State Site 50-50-01-6478), and an historic grave site (State Site 50-50-01-4072) were identified during the survey. Fredericksen and Fredericksen (1995:20) state that there was no evidence of in situ historic or indigenous cultural deposits, as a majority of the parcel was grubbed and filled in relatively recently.

Xamanek Researches (Fredericksen and Fredericksen 2001) conducted Archaeological Inventory Survey on a 1.4 mile (2.25 km) long by 40 feet (12 m) wide section of Lower Honoapiʻilani Road in Alaeloa, Mailepai, and Kahana Ahupuaʻa, Lahaina District, Maui Island [TMK: (2) 4-3-015). During the survey, three newly identified sites were documented: State

Sites 50-50-01-4797, a pre-Contact habitation area; -4797 and -4798, two wall associated with Lower Honoapiʻilani Highway. Radiocarbon dating of a charcoal sample collected from Site -4797 yielded a date ranging from AD 1420 to 1660 with an intercept radiocarbon age of AD 1490 (Fredericksen and Fredericksen 2001:2). Site -4797 was interpreted as a coastal habitation site probably associated with marine resource utilization and as a "rare example of a surviving coastal habitation site along this heavily developed portion of the West Maui Coastline (Fredericksen and Fredericksen 2001:16). Thus, State Site 50-50-01-4797 was found to be significant under Criteria A, C, and D of Federal and State historic preservation guidelines (Fredericksen and Fredericksen 2001: 2, 16).

Subsurface testing of State Site 50-50-01-4797 could not be conducted during the Inventory Survey due to safety and access to private property issues. Thus, the extent of the site could not be determined. In 2001, Xamanek Researches returned to State Site 50-50-01-4797 and conducted subsurface testing in the form of one 1.0 by 1.0 m hand excavated test unit, on private property, and four backhoe trenches within the County of Maui Right of Way (Fredericksen and Fredericksen 20013). The findings of the additional Inventory level work indicate a cultural layer interpreted as State Site 50-50-01-4797 extended 150 m along the eastern side of Honoapiʻilani Highway between 1.1 to 1.5 m below the ground surface. Five pit features and two possible features extending approximately 78.0 m were noted in a wave cut profile on the west side of Honoapiʻilani Highway (Fredericksen and Fredericksen 2001:15). None were dated due to the lack of datable material. Furthermore, no traditional Hawaiian artifacts were recovered during the excavation of three test units and nineteen trenches. Historic components of the sites (e.g., ceramics, glass) showed that the area was likely more intensively utilized during the Historic Period, as was also evidenced by the lack of traditional-period artifacts at the sites.

Scientific Consultant Services, Inc. (Dega 2001) conducted Archaeological Inventory Survey of approximately three acres of land (see Figure 7) located within the Ahupuaʻa of Kahana, Kāʻanapali District, Maui Island, Hawaiʻi [TMK: (2) 4-3-005:070]. The Dega (2001) project area was located adjacent to the previously mentioned Fredericksen and Fredericksen (1995) project area located in TMK: (2) 4-3-005:071. A 100 percent pedestrian survey of the project area was conducted and revealed a section of the Old Pioneer Mill Railroad easement (State Site 50-50-03-6478) running across the southeastern portion of the parcel. The existing railroad bed probably dates to 1919, when the railroad line ran from the Kāʻanapali area to the Kahana area, and beyond. The second identified site (State Site 5-50-03-4069) consisted of stone bridge footings and retaining walls. This site was identified in the northeastern portion of the project area and had previously been documented (Fredericksen and Fredericksen 1995). Limited testing in the form of six trenches was accomplished within undisturbed portions of the project area. Three trenches were sterile, one trench contained concrete water conduits and strata likely associated with the aforementioned railroad easement, and two trenches exhibited a profile of intensive oxidation and reduction layers. The clarity and breadth of the strata in the latter two trenches provides some evidence for a long-term commitment to agriculture. Several Land Commission Awards occurring on the parcel also attest to traditional agricultural practices on the parcel (taro and sweet potato cultivation). Overall, within a majority of the project area, the lack of surface and subsurface remains was partially attributable to historic-period, intensive landscape alterations. During the late 1800s to early 1900s, sugarcane was cultivated across the parcel. Railroad construction occurred in the early 1900s along the eastern portion of the project area. The expansion of the Honoapiʻilani Highway was completed relatively recently. The western flank of the parcel nearer the current project area was subject to limited grading and dumping activities.

Scientific Consultant Services, Inc. (Perzinski and Dega 2014; see Figure 8) conducted an Archaeological Inventory Survey on a c. 1-acre land parcel in Kahana Ahupuaʻa, Lahaina District, Maui [TMK: (2) 4-3-001:017], in a portion of the current project area. No historic properties were identified.

Overall, the presence and documentation of a varied abundance of archaeological features in the general Kahana-Honokōwai area indicates a strong history of settlement and land usage both by traditional Hawaiian peoples and Historic Period immigrants. Most of this occupation and land use occurred nearer the coastline and in the west Maui valleys, not the upland tablelands, as is the current project area.

MAHINAHINA 1, 2, 3 AHUPUAʻA

Scientific Consultant Services, Inc. (Dagher and Dega 2016;see Figure 8) conducted an Archaeological Field Inspection and background study for a proposed Maui Police Department Communications Facility at the Mahinahina Water Treatment Plant, Mahinahina 1-2-3 Ahupua`a, Lahaina District, Maui Island, Hawai`i [TMK: (2) 4-3-001:084 por. (formerly 4-3-001:031 por.), which is located north of the current project area. No historic properties were identified.

MAHINAHINA 4 AHUPUAʻA

Scientific Consultant Services, Inc. (McGerty and Spear 1996) conducted an Archaeological Inventory Survey of a 3.269-acre parcel in Mahinahina 4 Ahupuaʻa, Lāhainā District, Island of Maui, Hawaiʻi [TMK: (2) 4-3-006:003]. During the survey, seven sites, several of which consisted of stone alignments and low stacking features, all interpreted as early historic. A cemetery and the area directly around it (designated State Sites 50-50-01-4218 and -4219, respectively). Extensive trenching south of the cemetery did not yield any additional human remains or burials.

Scientific Consultant Services, Inc. (Monahan 2004) conducted an Archaeological Inventory Survey was conducted on a 3.054-acres of partially developed land in Honokōwai, Mahinahina 4 Ahupuaʻa, Lāhainā District, Maui Island, Hawaiʻi [TMK: (2) 4-3-006:002 and 069]. The survey resulted in negative findings. Subsequently, Dega (2005) conducted an addendum on this property, which also yielded negative findings.

Scientific Consultant Services, Inc. (Andricci and Dega 2015) conducted an (Archaeological Inventory Survey in advance of the expansion of the existing AAAAA Rent-A-Space facility located in Honokowai, Mahinahina 4 Ahupuaʻa, Lahaina (Kāʻanapali) District, Island of Maui, Hawaiʻi [TMK: (2) 4-4-001:026]. No historic properties were identified.

CONSULTATION

Consultation was conducted via telephone, e-mail, the U.S. Postal Service, and an in-person group interview. The initial letters of inquiry, an example of which is presented in Appendix A, were mailed between June 5, 2018 and January 7, 2019. Information pertaining to traditional cultural practices conducted within the project area itself or within the four ahupuaʻa (Honokōwai, Mahinahina 4, Mahinahina 1, 2, 3, and Kahana) within the proposed project, area was sought from the following forty-eight (48) individuals and organizations:

- P. Kaanohi Kaleikini, President, Hui Malama I Na Kupuna o Hawaii Nei;
- William Hoʻohuli, community member;
- Dr. Kamanaʿopono M. Crabbe, Office of Hawaiian Affairs;
- Leimana DaMate, Executive Director, Aha Moku Advisory Committee;

- Chris (Ikaika) Nakahashi, Cultural Historian, State Historic Preservation Division;
- Kealana Phillips, Burial Sites Specialist, State Historic Preservation Division;
- Roy Newton, Office of Hawaiian Affairs;
- Silla Kaina, Cultural Ambassador, Montage Kapalua Bay;
- Albert Perez, Executive Director, Maui Tomorrow Foundation;
- Lucienne de Naie, President, Maui Tomorrow Foundation;
- Keʻeaumoku Kapu, CEO, Aha Moku O Maui, Inc.;
- Maui Sierra Club;
- Kamika Kepaʻa, Native Hawaiian Preservation Council;
- Matthew Erickson, Hawaiian Civic Club, Lahaina Chapter;
- Uʻilani Kapu, Lahaina Representative, Aha Moku O Maui;
- Felimon Sadang, Kāʻanapali Representative, Aha Moku O Maui;
- Thelma Shimaoka, Office of Hawaiian Affairs;
- Torrie Nohara, Division of Forestry and Wildlife;
- Leslie Kuloloio, AHA Moku Advisory Committee;
- Patty Nishiyama, Nā Kupuna O Maui;
- Clifford Naeʽole, Cultural Resource Advisor/Public Relations, Ritz-Carlton, Kapalua;
- Dr. Kīʻope Raymond, Hawaiian Studies Program, Department of Humanities, University of Hawaii, Maui College;
- Dr. Scott Fisher, Associate Executive Director of Conservation, Hawaii Island Land Trust;
- Winnifred Lopez, community member;
- Tiare Lawrence, community member;
- Kumu Hula Kaponoai Molitau, cultural practitioner;

- Dr. Kaleikoa Ka‘eo, Hawaiian Studies Program, Department of Humanities, University of Hawaii, Maui College;
- Mrs. Blossom Feteirra, Executive Director, Friends of Moku‘ula;
- Rose Duey, cultural practitioner;
- Kumu Roselle Bailey, Kumu Hula, cultural practitioner;
- Hōkūao Pellegrino, Hui o Nā Wai ‘Ehā;
- Chris Brosius, Program Manager, West Maui Mountains Watershed Partnership;
- Pomaika‘i Kaniaupio-Crozier, Conservation Manager, Pu‘u Kukui Watershed Preserve;
- Bob Hobdy, Environmental Consultant;
- Pat Bily, Invasive Plant Specialist, formerly with the Nature Conservancy;
- M. Kaleokalani Manuel, Acting Planning Program Manager, Planning Office, Department of Hawaiian Homelands;
- Foster Ampong, Aha Moku O Maui;
- Louise Rockett, community member;
- Linda Magalianes, community member;
- Tamara Paltin, Maui County Council Member, Aha Moku Kā‘anapali;
- Malihini Keahi-Heath, Lahaina resident;
- Kaipo Kekona, Aha Moku O Maui member, Kā‘anapali Moku;
- Namea Keahi, Lahaina resident;
- Kaimaile Makekau, lineal descendant;
- Skye Kamaunu, community member;
- Ka‘ulu Nahooikaika, Olowalu resident;
- Nameaaea Hoshino, Lahaina resident;
- Kamana Kaaganui Ng, Lahaina resident

The follow-up letters of inquiry (see Appendix B) were mailed via e-mail and USPS between July 6, 2018 and January 31, 2019. Follow-up letters were mailed to all the above listed individuals and organizations, with the exception of those individuals and organizations that submitted responses to SCS prior to the January 31, 2019 mailing date. An example follow-up letter is presented in Appendix B.

A Cultural Impact Assessment Notice was published in the July 2018 issue of the OHA newsletter, *Ka Wai Ola* (see Appendix B). This notice stated that Scientific Consultant Services, Inc. is seeking information on cultural resources and traditional cultural activities in the area of the proposed project, provided locational information (i.e., the ahupuaʻa, traditional and modern names of the District, Island, State, and property Tax Map Key designations), and requested responses be sent within 30 days to Cathleen Dagher.

RESULTS

No responses were received as a result of posting a CIA notice in the OHA newsletter, *Ka Wai Ola.* However, community outreach yielded three responses via e-mail, one telephone interview, and one in-person group interview were conducted (see Interview Section). Based on these responses and interviews, assessment of the potential effects on cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

REPONSES

Chris (Ikaika) Nakahashi, Cultural Historian, State Historic Preservation Division

Mr. Nakahashi responded via an e-mail dated June 7, 2018. In his e-mail, Mr. Nakahashi provided the following recommendations:

> Mahalo for contacting me regarding the CIA for the proposed West Maui Wells Project in Honokōwai in Kāʻanapali, Maui.
> I recommend SCS to utilize the media (e.x. OHA's Ka Wai Ola, Maui News, etc.) to solicit additional information for this CIA.
> I recommend SCS to contact:

- Keʻeaumoku Kapu – Aha Moku o Maui Inc., kapukapuakea@gmail.com
- Hōkūao Pellegrino – Hui o Nā Wai ʻEhā, huionawai4@gmail.com

I recommend SCS to contact and meet with the native tenants and people that currently live or previously lived in the ahupuaʻa of Honokōwai on Maui for information about the cultural resources and practices for this CIA.

Please let me know if I can assist with anything else.
Ā hui hou,

Christopher "Ikaika" Nakahashi, M.S.
Cultural Historian
Department of Land & Natural Resources
State Historic Preservation Division

Bob Hobdy, Environmental Consultant

Mr. Hobdy responded via an e-mail dated August 7, 2018, stating:

Aloha Cathy,

I am familiar with the project area, having done the flora and fauna assessments for both well sites and their corridors down to the Mahinahina Water Treatment Facility. I also worked many years for the Forestry Division, maintaining fence lines and accessing Pu'u Kukui up the Haelaʻau Road.

Kahana Well – While doing the assessment for this project I found an old trail starting at the top of the old pineapple field that angled down into Kahana Gulch bottom at just under 1,200 feet elevation. There was a rock wall and some very old mango trees but no other signs of terracing. This was obviously used by someone into the modern historic period but does not show as a kuleana. It was probably used to grow upland crops on a small, seasonal scale but shows that people used the upper parts of their ahupua'a for agriculture and gathering. The ridge tops were cleared for pineapple agriculture in the 1920s and 30s and I know of no other traditional uses.

Mahinahina Well – I know of no sites near this well site but Honokowai Gulch has some old terracing at the 800 foot elevation that is the subject of recent restoration work and use. Similar uses could have been in the bottoms of this and other larger stream courses. The ridge tops were cleared for pineapple agriculture and tree planting projects by the Maui pineapple Company and the State.

I don't know of any individuals that can address your questions about uses in and around the project area.

I hope this helps.
Bob Hobdy

Concerns: None. However, Mr. Hobdy did note that cultural features, in the form of a trail, rock walls, and fruit trees were present and that the area in the vicinity of the Kahana Well was "used to grow upland crops on a small, seasonal scale [and] shows that people used the upper parts of their ahupua'a for agriculture and gathering. Mr. Hobdy stated, "Honokowai Gulch has some old terracing at the 800 foot elevation that is the subject of recent restoration work and use." He further notes that the ridge tops in these areas were cleared for the commercial production of pineapple as early as the 1920s or 1930s.

Tamara Paltin, Maui County Council Member, Aha Moku Kāʻanapali

Ms. Paltin responded via an e-mail dated January 5, 2019. In her e-mail, Ms. Paltin suggested M. Kaleokalani Manuel (Acting Planning Program Manager, Planning Office, Department of Hawaiian Homelands) as a cultural contact.

Concerns: None

INTERVIEWS

Scientific Consultant Services, Inc. conducted one interview, via telephone, and in in-person group interview, which are presented below.

ANONYMOUS

On July 23, 2018, SCS conducted one telephone interview with an individual who wished to remain anonymous:

Anonymous stated that one third of all of the ahupuaʻa on Maui were located within Lahaina District. This indicates, by inference, that the area was resource rich. Mokuʻula is one of the most significant sites in the District of Lahaina.

Traditional practices conducted during the pre-Contact to early post-Contact Period in Lahaina included gathering limu, fishing, and the cultivation of taro. ʻUlu, or breadfruit, was really popular and important as a food source in the Lahaina District.

Anonymous suggested SCS contact Keʻeaumoku Kapu, CEO Aha Moku o Maui, Inc.; Chris Brosius, Program Manager, West Maui Mountains Watershed Partnership; Bob Hobdy, Environmental Consultant; and Pat Bily, Invasive Plant Specialist, formerly with the Nature Conservancy, as they are knowledgeable about traditional cultural practices conducted in the vicinity of the project area.

Concerns: None. Scientific Consultant Services, Inc. did reach out to Keʻeaumoku Kapu, CEO Aha Moku o Maui, Inc.; Chris Brosius, Program Manager, West Maui Mountains Watershed Partnership; Bob Hobdy, Environmental Consultant; and Pat Bily, Invasive Plant Specialist, formerly with the Nature Conservancy, during the consultation process of the current CIA.

Consent: Anonymous provided consent to include the above summary of the July 23, 2018, telephone interview via an e-mail dated January 30, 2019.

GROUP INTERVIEW

In-person consultation was conducted on January 3, 2019 by SCS Senior Archaeologist Cathleen Dagher in the form of a group interview hosted by Ke‘eaumoku Kapu, CEO, Aha Moku O Maui, Inc. and U‘ilani Kapu, Lahaina Representative, Aha Moku O Maui. The semi-private meeting was held at the Na‘aikane O Maui Cultural Center, in Lahaina. The following twelve (12) individuals attended the evening interview:

- Ke‘eaumoku Kapu, CEO, Aha Moku O Maui, Inc.;
- U‘ilani Kapu, Lahaina Representative, Aha Moku O Maui;
- Kaimaile Makekau, lineal descendant resident of Mahinahina Ahupuaʻa;
- Louise Rockett, community member;
- Skye Kamaunu, community member;
- Kaipo Kekona, Aha O Moku, Kā‘anapali Moku;
- Tamara Paltin, Maui County Council Member, Aha Moku Kā‘anapali;
- Malihini Keahi-Heath, Lahaina resident;
- Namea Keahi, Lahaina resident;
- Nameaaea Hoshino, Lahaina resident;
- Kamana Kaaganui Ng, Lahaina resident;
- Ka‘ulu Nahooikaika, Olowalu resident

Of the twelve (12) individuals in attendance during the group interview, seven (7) spoke out and identified cultural practices and resources within the proposed project area and the surrounding environs. However, only one (1) of those individuals reviewed the interview summary and granted permission for its inclusion in this document:

Kaimaile Makekau, Lineal Descendant, Cultural Practitioner, and Resident of Honokōwai Ahupuaʻa

Kaimaile Makekau, lineal descendant, cultural practitioner, and resident of Honokōwai Ahupuaʿa, stated that she is a lineal descendant of Abner Paki, through her grandfather's mother, Cecilia Koomea Paki. The lands of Honokōwai Ahupuaʻa were Crown Lands, which were given to King Kekaulike's descendants during the Māhele under LAND COMMISSION AWARD 11216. These lands were stolen from her family 125 years ago by Maui Land and Pineapple, who subsequently removed any evidence of traditional Hawaiian cultural use from the ground surface.

Ms. Makekau's great grandmother, Cecilia Koomea Paki, won this land back from Maui Land and Pineapple, in United States Federal Court (Appendix F). Ms. Makekau stated that she owns lands within TMK: (2) 4-4-001 through 4-4-008 and that she owns one hundred percent undivided interest in 450 acres of land, of which 164 acres are located in the forest reserve, within TMK: (2) 4-4-007:006 and TMK: (2) 4-4-004:008, including the rights to the ground water and surface water. Ms. Makekau has, also, stated that she is the owner of Easement A and Easement B, which are located on TMK: (2) 4-4-001:052 and 079. She also owns TMK: (2) 4-4-001:034 and 017. The land on which West Maui Well No. 1 [Mahinahina Well] is located belongs to Ms. Makekau. She doesn't want anyone on her land. Anyone accessing her land without her permission is trespassing.

Ms. Makekau stressed that the project area lands are on Crown Lands and are not to be touched. There still are medicinal plants growing on her land and in the surrounding lands. ʿUhaloa [*Waltheria americana*], which is used to boost the immune system, grows everywhere. She planted 2 acres of dry taro (*Colocasia esculenta*), which she cultivates for food. There is ʿuhaloa [*Waltheria americana]* all around the property boundary. There is also a 6-acre koa forest in the upper portion of her property. There are two grave sites on the north side of the property.

Concerns: Ms. Makekau's primary concerns pertain to the ownership of the land and rights to the water. In addition, she is concerned about potential impact to the native plants on her property and the surrounding area, which are used for medicinal, and subsistence purposes.

Note, Ms. Makekau did not sign the formal information release form, but did grant her permission to include the above interview summary and to list summarize her concerns, in an email dated February 6, 2019 (see Appendix D), on the condition that the materials she provided were included in this document (Appendix F).

IN-PERSON GROUP INTERVIEW SUMMARY

The comments and concern of the remaining six (6) individuals who spoke out at the in-person group interview are generally summarized below, as their required signed information release forms were not received in time for publication. This summary is provided below and does not represent the comments of specific individuals.

One of the informants stated that the area below West Maui Well No.1 [Mahinahina Well] contains plants which are still gathered for a variety of traditional uses: koa (*Acacia koa*) forest, *ʻōhiʻa lehua* (*Metrosideros polymorpha*) trees, medicinal plants include native koʻokoʻolau (*Bidens wiebkei*), which is still used to treat congestion and respiratory ailments. Koʻokoʻolau is found between 1,000 to 1,400 feet [above mean sea level] and above. There is an introduced species of koʻokoʻolau, which is commonly found in the yards in Lahaina, but the native variety is only found at the higher elevations in the project area and surrounding environment. Pig and deer are currently hunted in this area as a food resource by members of the Hawaiian community.

The area immediately below West Maui Well No. 1 [Mahinahina Well] contains many native plants, at least five (5) or six (6) different types of medicinal plants and plants that are used for sustenance are growing in the area. Pua hilahila (*Mimosa pudica*) is not a native plant, but it is used for traditional medicinal purposes. Koa (*Acacia koa*), koaʻia (*Acacia koaia*), and *ʻōhiʻa lehua (Metrosideros polymorpha*) trees from the area are used for ceremonial and spiritual practices.

One of the participants said that the main road going up to West Maui Well No. 1 [Mahinahina Well] is located on the Honokōwai/Mahinahina 4 Ahupuaʻa boundary and that the main road going up the hill is built on an old ala hele (trail). There were people living in and around the project area in the past, in the pre-Contact and early Historic Periods that traveled via this trail.

There is a cemetery in the vicinity of West Maui Well No. 1 [Mahinahina Well], which was used during the Plantation Era, but it was also used by the families who were living in the area before the Plantation arrived. At least one of the graves was maintained until recently. A second cemetery, the Smith family cemetery, is located in close proximity to West Maui Well No. 2 [Kahana Well]. Relatives of the deceased are still taking care of the grave sites. The caves within the gulches in the project area and the adjacent lands are known to contain human burials. In addition, there are burials on the ridges and in the gulches within the project area and the adjacent lands.

One of the individuals present suggested SCS contact Felimon Sadang, Kāʻanapali Representative, Aha Moku O Maui; and Silla Kaina, Cultural Ambassador, Montage Kapalua Bay, as they are good people to talk to because they are knowledgeable about traditional cultural practices conducted in the vicinity of the project area. This individual also requested copies of the two earlier Environmental Impact Assessment reports (Fukunaga and Associates, Inc. 2011, Munekiyo and Hiraga, Inc.2014), which were prepared in advance or the installations of West Maui Well No. 1 [Mahinahina Well] and West Maui Well No. 2 [Kahana Well].

Note, Scientific Consultant Services, Inc. reached out to Felimon Sadang (via emails dated June 6, 2018; July 10, 2018; December 12, 2018; and January 7, 2019) and to Silla Kaina (via emails dated June 6, 2018; July 10, 2018; and January 7, 2019) in our effort to obtain information pertaining to traditional cultural practices in the vicinity of the current project area. Neither Mr. Sadang nor Ms. Kaina responded. SCS provided this individual access to the requested CIAs Fukunaga and Associates, Inc. 2011, Munekiyo and Hiraga, Inc.2014) via an e-mail dated January 7, 2019.

Another individual suggested SCS contact Kaimaile Makekau as she has knowledge about traditional cultural practices conducted in the area. Her family won their land back from Maui Land and Pineapple through a Royal Patent. Note, Ms. Makekau attended the in-person group interview and her comments and concerns are included in the report (see Kaimaile Makekau's interview summary above).

One of the individuals at the meeting said her/his mother was born at Puʿu Koliʿi, the largest of the sugar plantation villages in West Maui during the 1900s. Puʿu Koliʿi is located a short distance southwest of the current project. Her/his mother has many stories about the area and spoke many times about the caves in the area. Wauke and hala used to grow there, when this person's mother was young, and the women would gather there to make kapa and to do their crafting. There is a huge cemetery at Puʿu Koliʿi that may not be registered. A tutu of this individual's mother is buried there, but it isn't clear which tutu, because use of the cemetery extends so far back in time. There are coffee estates in Puʿu Koliʿi now. The water for Puʿu Koliʿi came from up top. There were about five lua in the area where her mother was from - the water source for the area was from a lua. This individual expressed concerns pertaining to the depletion of the water table and about current and future development impacting the Puʿu Koliʿi Cemetery.

One of the cultural informants stated that because this is a CIA, Hawaii Revised Statutes (HRS) §7-1, which pertains to native Hawaiian gathering rights, and HRS §1-1, which ensures those rights are not infringed upon, apply. This individual further cited Article 12, Section 7 of the State of Hawaii Constitution, which covers all of the Hawaiian rights and protects their kuleana rights to access the resources. Under Article 343, the County Planning Department has laws that have to be followed before a development can proceed. This individual raised a number of questions pertaining to native rights:

- As a kuleana landowner, what rights will be impacted by the proposed project?
- How will the kuleana rights to the water to affected?
- Will the right to malama the land will be denied and will their vested rights to the land are being given away?
- Will the view plan of ceremonial sites, including, and cultural landscapes be impacted? How does that personally or emotionally affect the kuleana land owner?

However, this individual raised the greater issue of once a native people are displaced from their land, denied the ability to practice traditional cultural activities, denied s and access to traditional subsistence and medicinal resources, denied access and rights to water, to the land and to their sacred places, and denied the ability to malama (take care of) their ancestors, the end result is cultural genocide.

This individual also mentioned the native Hawaiian burials along the ridges in and all of the ridges in the vicinity of the project area. This individual stated that the Kaimaile Makekau family is one of the prominent families from around the project area and that they are lineal descendants. This individual, also, named the other families (the Makekau family, the Abner Paki descendants, and the Shaw family) who are all lineal descendants and who possibly have burial plots in the vicinity of the project area. This individual further stated that there are LCAs in the vicinity of the project area and that they can be damaged by the current project.

CONCERNS:

Many of those who spoke out at the meeting were very concerned that traditional resources would be impacted by the proposed project. Water rights and access to the water is a major concern to the families living in the vicinity of the project area. Many felt that there is the potential for water to be taken away from the local Hawaiian population in an effort to provide water for tourists and for properties under private ownership. Access to the water could be blocked by fences and gates installed to protect the well impeding or preventing access was another concern expressed at the meeting. The water table is low now as a result of over tapping which occurred during the Plantation Era. Many stated that the water table is currently overdrawn causing the lands to dry up and crops to die as a result. Concern was expressed that land would no longer be able to sustain itself and that everything needed to sustain kuleana landowners will not be available. Access to, and distribution of, water are also paramount concerns that were discussed at the group interview.

Several in attendance expressed concerns regarding the potential of the proposed project impacting food resources in the form of feral axis deer and wild pigs that are actively hunted in the area. There is also the potential of the proposed project impacting access to and the procurement of the numerous traditional plants currently gathered from the project area and the surrounding environs for sustenance, ceremonial, and medicinal purposes.

Many of those present at the meeting expressed concerns that the traditional pre-Contact, and possibly Historic, human burials located in the caves and ridges within and around the project area would be impacted by the proposed project. In addition, there are known Historic burials, which may be impacted by the proposed project, as well. Kaimaile Makekau mentioned two graves sites on the north side of her property, the Smith Family Cemetery is located in close proximity to West Maui Well No. 2 [Kahana Well], and an Historic cemetery is located in close proximity to West Maui Well No. 1 [Mahinahina Well]. While it is not likely that the Historic cemetery at Puʽu Koliʽi will be impacted by the current project, the presence of this cemetery and that it's use pre-dates the Plantation Era further indicates the significance of this area during the pre- and post-Contact Periods.

One individual expressed stated the ʽaina is being commercialized. This same individual and one (1) other cultural informant mentioned the potential for vested rights to be taken away. The potential for religious rights would to be impacted if the view plane of ceremonial sites and cultural landscapes was obstructed by the either or both of the wells.

CULTURAL IMPACT ASSESSMENT SUMMARY

This Cultural Impact Assessment was prepared in accordance with the Guidelines for Assessing Cultural Impacts (OEQC 1997:11-13). The Guidelines recommend that a CIA consult relevant individuals/organizations, conduct ethnographic interviews and archival and historical research, identify cultural resources and practices located within the project area or in proximity, and finally, assess the impact of the proposed action and its mitigation measures on the cultural practices or resources identified.

IDENTIFED CULTURAL PRACTICES

Letters of inquiry were sent to forty-eight (48) individuals and organizations that may have knowledge or information pertaining to the collection of cultural resources and/or traditional cultural practices currently, or previously, conducted with the proposed project area or within the four ahupuaʻa containing the proposed project area. The consultation process resulted in SCS receiving written responses, via e-mail, from three (3) individuals, one (1) telephone interview, and one (1) in-person group interview with twelve (12) participants. None of those who provided written responses identified traditional cultural practices or expressed any concerns about the proposed West Maui Wells Project causing impacts to traditional cultural practices. However, one respondent had observed historic properties in the form of a trail, rock walls, and fruit trees in the vicinity of the Kahana Well (West Maui Well No. 2).

The individual who wished to remain anonymous identified cultural practices and resources in the general area of the proposed project area. Seven (7) of the twelve participants present at the in-person group interview identified numerous traditional cultural practices and resources within the proposed project area and the surrounding environs and expressed concerns about the proposed project adversely impacting these practices and resources. These practices and resources are detailed below.

GATHERING OF TRADITIONAL PLANTS

While not identified by the cultural informant contacted in this study as growing or cultivated in the project area or the adjacent lands, ʻulu or breadfruit (*Artocarpus communis*), was and continues to be a staple in the Hawaiian diet. "Anonymous" identified ʻulu as a "really popular and important as a food source in the Lahaina District." According to Neal (1965:302), early Polynesian arrivals to the Hawaiian Islands carried breadfruit trees with them on their voyage across the Pacific Ocean. Kirch (1985:215) writes "Nurturing and establishing these plantings in the new landfall, the first Hawaiian colonizers reproduced the basis of their subsistence economy."

ʻUhaloa (*Waltheria indica*), also known as hala ʻuhaloa, ʻalaʻala pū loa, hiʻa loa and kanaka loa, can be found within the proposed project area and the surrounding environment. According to the cultural informants who participated in the consultation process for this project, *ʻuhaloa* is currently used to stimulate the immune system and to treat congestion.

Neal (1965:575) states that "the bitter root is used medicinally by the Hawaiians, for it has the same effect as aspirin" and that the juice relieves sore throats. Pukui and Elbert (1986: 363) state that the "leaves and inner bark of the root are …used for tea or chewed to relieve sore throat." According to legend, ʻuhaloa plant is one of the many plants in which Kamapuaʻa, the pig demi-god, often manifests (Pukui and Elbert 1986: 363).

As these plants are cultivated and gathered from the current project and the surrounding environs for ceremonial, medicinal, and subsistence purposed, the issue of native Hawaiians being able to continue the cultural practices of cultivation and gathering these plant resources must be addressed prior to the commencement of the commercial development of the subject property (OEQC 1997:11).

HABITATION AND AGRICULTURE

One traditional practitioner and lineal descendant is currently living within the proposed project area and actively cultivating 2 acres of dry land taro on the property. Taro or kalo (*Colocasia esculenta*) was and continues to be an important staple in the Hawaiian diet. Dryland taro farming is currently being conducted in the project area, in the area containing West Maui Well No. 1 (Mahinahina Well). Neal (1965: 58) states that taro was brought to Hawaiʻi by the Polynesians on their voyages and that "it has been the principle food of the natives from the earliest times to the present." Kirch (1985:216) elaborates on the intricate intertwining Hawaiian system of agriculture:

> The Hawaiian planter commanded a sophisticated knowledge of his plants and their varieties (several hundred varieties of taro and sweet potato were named and recognized), of planting, tending, and harvesting methods, and of food preparation. His system of agriculture-along with an intricate web of social, religious, and political relationships - tied him to the land, to his chiefs, and to his gods, especially Lono, deity of fertility…

HUNTING

While hunting is not a traditional activity in the sense that native Hawaiians were actively hunting prior to the arrival of Westerners in 1778. Domestic pigs (puaʻa) were brought to the Hawaiian Islands by voyaging Polynesians and subsequently were "raised large numbers" as a food resource by the Polynesian settlers (Kirch 1973:2). Maly et al. (n.d.) suggest that pigs were introduced to the Hawaiian Islands "as early as the 4th century A.D." Maly et al. (n.d.) further state that:

> Originally, puaʻa enjoyed a close relationship with their human families and rarely strayed far from the kauhale (family compound). Well developed taro and sweet potato agriculture in ancient Hawaiʻi was incompatible with uncontrolled pigs, and there is every indication that pigs were both highly valued and carefully managed sources of protein. Puaʻa were an integrated part of Hawaiian households, and the common presence of pa puaʻa (pig pens) reflects the controlled, physically compartmentalized nature of pig management in traditional Hawaiʻi.

European pigs were brought to the Hawaiian Islands by Captain James Cook on his first voyage to the Islands in 1778 (Maly et al. n.d.). Subsequently many other introductions of European and Asian swine were brought to the Islands, which inevitably interbred with the Polynesian pig and displaced the original population (Maly et al. (n.d.). Currently, descendants of these animals are hunted by the Hawaiian population for sustenance within the project area and the surrounding environs.

Axis deer were introduced to the Hawaiian Islands during the 1860s as a gift to Kamehameha V (Lot) from Hong Kong. They were subsequently transported to the Island of Maui, during the 1950s, where hunting these deer was quickly adapted by native Hawaiians as a method of procuring food resources. The practice continues today and the axis deer within the project area and the surrounding environs are actively hunted by the Hawaiian population for subsistence.

MARINE RESOURCES

"Anonymous" identified the gathering limu, fishing as a traditional practices conducted during the pre-Contact to early post-Contact Period in the general of Lahaina District. While this activity is not conducted within the project area, the gathering of the marine resources continues to be practiced in the coastal regions of the ahupuaʻa in which the project area is located, as these items continue to be important food items in the Hawaiian diet. Kirch (1985:199) states, "The sea and its resources were vital to the lives of the Pacific Islanders, and the Hawaiians were no exception…Fish and shellfish provided the mains source of protein in the Hawaiian diet." Limu (seaweed), on the other hand, has multiple purposes. It was, and continues to be, used as a food resource, in food preparation, and as a condiment or relish. Limu is recognized for its medicinal properties, as well.

BURIALS, GRAVE SITES, AND HISTORIC CEMETERIES

Traditionally, the Hawaiians often buried their dead in caves and lava tubes. According to Kamakau (1987:38-43), in order to protect the remains of their loved ones from enemies who would desecrate them, native Hawaiians:

> …searched for deep pits (*lua meki*) in the mountains, and for hiding pits (*lua huna*) and hiding caves (*ana huna*) along the deep ravines and sheer cliffs frequented by the *koaʻe* birds.

Following contact with Westerners, human burials were often interred marked graves in family cemeteries. According to several of the cultural informants who were interviewed during the CIA consultation process, there are at two known family cemeteries in the vicinity of the two well sites, as well as the two graves Kaimaile Makekau mentioned on her land. The two family cemeteries are said to pre-date the Plantation Era, with their use continuing through the Plantation Era, and possibly, to the recent past, further indicating the area has been populated for many, many years and that the area was, and continues to be, rich in resources.

IMPACT ASSESSMENT

The information obtained during the consultation process reflects that the proposed project area is located in an area rich with traditional and customary practices conducted during the pre-Contact and early Historic Period. However, based on historical research and the above listed responses, it is reasonable to conclude that there is evidence of cultural practices related to Hawaiian rights related to gathering, access or other customary activities presently occurring in the project area or in the immediate vicinity.

Based on the information obtained during the consultation process portion of the current CIA, ground altering activities associated with the proposed West Maui Water Source Development project has the potential impact traditional native Hawaiian activities currently conducted within the proposed project area and in the adjacent lands.

CONCLUSION

Based upon this review and analysis, sufficient information has been provided in this document to determine that traditional cultural practices were previously, and continue to be, conducted within the project area and within the surrounding environs. This determination has been substantiated by the culture-historical background, the summarized results of prior archaeological studies in the project area and in the neighboring areas, and primarily in the concerns expressed by the cultural informants during the consultation process of the current CIA. Thus, it is the finding of the current analysis that specific valued cultural and historical activities are currently conducted within the project area.

The Environmental Assessment will address what efforts have been taken or have been proposed to mitigate the potential impacts to traditional resources and on-going traditional cultural practices within the proposed project area and the surrounding environs.

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APPENDIX A: EXAMPLE LETTER OF INQUIRY.

Aloha kāua,

Scientific Consultant Services, Inc. (SCS) is seeking information on cultural resources and traditional, previously or on-going, cultural activities within or near the proposed West Maui Wells (Kahana and Mahinahina) Project. The proposed well site involves the installation of two (2) groundwater wells: the Mahinahina Well (State Well No. 6-5638-004) or West Maui Well No. 1, and the Kahana Well (State Well No. 6-5738-002) or the West Maui Well No. 2, and the construction of related improvements necessary to connect the wells to the County of Maui Department of Water Supply (DWS) West Maui Water System. The wells and associated infrastructure will be located in Honokōwai, Māhinahina, and Māhinahina 1, 2, 3 Ahupua‘a, Lahaina (Kā‘anapali) District, Island of Maui, Hawai`i [TMK: (2) 4-3 and 4-4; see Table 1 for TMK listing] (Figures 1 through 3).

The purpose of this Cultural Impact Assessment (CIA) is to identify and understand the importance of any traditional Hawaiian and/or historic cultural resources or traditional cultural practices associated with the project area and the surrounding *ahupua‘a.* In an effort to promote responsible decision-making, the CIA will gather information about the project area and its surroundings through research and interviews with individuals that are knowledgeable about the area in order to assess potential impacts to the cultural resources, cultural practices, and beliefs identified as a result of the proposed project. We are seeking your *kōkua* and guidance regarding the following aspects of our study:

- General history as well as present and past land use of the project area
- Knowledge of cultural resources which may be impacted by future development of the project area (i.e. historic and archaeological sites, as well as burials)
- Knowledge of traditional gathering practices in the project area, both past and ongoing Cultural associations of the project area, such as legends, traditional uses and beliefs
- Referrals of kūpuna or elders and kama‘āina who might be willing to share their cultural knowledge of the project area and the surrounding ahupua‘a
- Due to the sensitive nature regarding iwi kūpuna or ancestral remains discovered, mana‘o regarding nā iwi kūpuna will be greatly appreciated
- Any other cultural concerns the community has related to Hawaiian cultural practices within or in the vicinity of the project area.

The CIA is in compliance with the Hawai‘i Revised Statute (HRS) Chapter 343 Environmental Impact Statements Law and in accordance with the State of Hawai‘i Department of Health's Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impacts* as adopted by the Environmental Council, State of Hawai‘i on November 19, 1997 (and revised in 2012).

According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control 2012:12):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs…The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural which support such cultural beliefs…

Enclosed are maps showing the locations of the proposed project area. Please contact me within 30 days at (808) 597-1182 or via e-mail (cathy@scshawaii.com) with any information or recommendations concerning this Cultural Impact Assessment.

Sincerely yours,

Cathleen Dagher
Senior Archaeologist

Attachments (3)

Table 1: Tax Map Keys within the Proposed Project Area.

Project Component	TMK: (2)	Landowner
West Maui Well No. 1	4-4-004:009 4-4-004:011	State of Hawaiʻi State of Hawaiʻi
West Maui Well No. 2	4-3-001:017	Maui Land and Pineapple Inc. (MLP)
500,000-Gallon Control Tank	4-4-002:018	Department of Hawaiian Homelands (DHHL)
West Maui Well No. 1 Transmission Waterline, Access Road, and Maui Electric Line Extension	4-4-001:017 4-3-001:084 4-4-002:014 4-4-002:015 4-4-002:018 4-4-004:009 4-4-004:011 4-4-004:019	MLP MLP State of Hawaiʻi DHHL DHHL State of Hawaiʻi State of Hawaiʻi State of Hawaiʻi
West Maui Well No. 2 Transmission Waterline, Access Road, and Maui Electric Line Extension	4-3-001:017 4-4-004:009 4-4-004:019	MLP State of Hawaiʻi State of Hawaiʻi

APPENDIX B: EXAMPLE FOLLOW-UP LETTER

Aloha kāua,

This is our follow-up letter to our June 6, 2018 letter which was in compliance with the statutory requirements of the State of Hawai`i Revised Statute (HRS) Chapter 343 Environmental Impact Statements Law, and in accordance with the State of Hawai`i Department of Health's Office of Environmental Quality Control (OEQC) Guidelines for Assessing Cultural Impacts as adopted by the Environmental Council, State of Hawai`i, on November 19, 1997.

At the request of Ronald Fukumoto, Fukumoto Engineering, Inc., Scientific Consultant Services, Inc. (SCS) is seeking information on cultural resources and traditional, previously or on-going, cultural activities within or near the proposed West Maui Wells (Kahana and Mahinahina) Project. The proposed well site involves the installation of two (2) groundwater wells: the Mahinahina Well (State Well No. 6-5638-004) or West Maui Well No. 1, and the Kahana Well (State Well No. 6-5738-002) or the West Maui Well No. 2, and the construction of related improvements necessary to connect the wells to the County of Maui Department of Water Supply (DWS) West Maui Water System. The wells and associated infrastructure will be located in Honokōwai, Māhinahina, and Māhinahina 1, 2, 3 Ahupua‘a, Lahaina (Kā‘anapali) District, Island of Maui, Hawai`i [TMK: (2) 4-3 and 4-4; see Table 1 for TMK listing].

The purpose of this Cultural Impact Assessment (CIA) is to identify and understand the importance of any traditional Hawaiian and/or historic cultural resources or traditional cultural practices associated with the project area and the surrounding *ahupua‘a.* In an effort to promote responsible decision-making, the CIA will gather information about the project area and its surroundings through research and interviews with individuals that are knowledgeable about the area in order to assess potential impacts to the cultural resources, cultural practices, and beliefs identified as a result of the proposed project. We are seeking your *kōkua* and guidance regarding the following aspects of our study:

- General history as well as present and past land use of the project area
- Knowledge of cultural resources which may be impacted by future development of the project area (i.e. historic and archaeological sites, as well as burials)
- Knowledge of traditional gathering practices in the project area, both past and ongoing Cultural associations of the project area, such as legends, traditional uses and beliefs
- Referrals of kūpuna or elders and kama‘āina who might be willing to share their cultural knowledge of the project area and the surrounding ahupua‘a
- Due to the sensitive nature regarding iwi kūpuna or ancestral remains discovered, mana‘o regarding nā iwi kūpuna will be greatly appreciated
- Any other cultural concerns the community has related to Hawaiian cultural practices within or in the vicinity of the project area.

The CIA is in compliance with the Hawaiʻi Revised Statute (HRS) Chapter 343 Environmental Impact Statements Law and in accordance with the State of Hawaiʻi Department of Health's Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impacts* as adopted by the Environmental Council, State of Hawaiʻi on November 19, 1997 (and revised in 2012).

According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control 2012:12):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs…The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural which support such cultural beliefs…

Please contact me within 30 days at (808) 597-1182 or via e-mail (cathy@scshawaii.com) with any information or recommendations concerning this Cultural Impact Assessment.

Sincerely yours,

Cathleen Dagher
Senior Archaeologist

Table 2: Tax Map Keys within the Proposed Project Area.

Project Component	TMK: (2)	Landowner
West Maui Well No. 1	4-4-004:009 4-4-004:011	State of Hawai‘i State of Hawai‘i
West Maui Well No. 2	4-3-001:017	Maui Land and Pineapple Inc. (MLP)
500,000-Gallon Control Tank	4-4-002:018	Department of Hawaiian Homelands (DHHL)
West Maui Well No. 1 Transmission Waterline, Access Road, and Maui Electric Line Extension	4-4-001:017 4-3-001:084 4-4-002:014 4-4-002:015 4-4-002:018 4-4-004:009 4-4-004:011 4-4-004:019	MLP MLP State of Hawai‘i DHHL DHHL State of Hawai‘i State of Hawai‘i State of Hawai‘i
West Maui Well No. 2 Transmission Waterline, Access Road, and Maui Electric Line Extension	4-3-001:017 4-4-004:009 4-4-004:019	MLP State of Hawai‘i State of Hawai‘i

APPENDIX C: *KA WAI OLA* NEWSLETTER NOTICE.

Scientific Consultant Services, Inc. (SCS) is seeking information on cultural resources and traditional, previously or on-going, cultural activities within or near a proposed West Maui Water Source Development Project, to be located in Honokōwai, Māhinahina, and Māhinahina 1, 2, 3 Ahupua‘a, Lahaina (Kā‘anapali) District, Island of Maui, Hawai‘i [TMK: (2) 4-4-004:009 4-4-004:011, 4-3-001:017, 4-4-002:018, 4-4-001:017, 4-3-001:084, 4-4-002:014, 4-4-002:015, 4-4-002:018, 4-4-004:019, 4-3-001:017]. Please respond within 30 days to Cathleen Dagher at (808) 597-1182.

APPENDIX D: SIGNED INFORMATION RELEASE FORMS

Inbox > Message Detail Entire thread

Subject: Re: Cultural Impact Assessment (CIA) in advance of the proposed West Maui Wells Project (SCS Proj 2224)]

From: Kaimaile Makekau <mahinahina11216@gmail.com> (Add as Preferred Sender)

Date: Wed, Feb 06, 2019 7:32 pm

To: Cathy <cathy@scshawaii.com>

I allow my submission only with the 7 pictures of my paperwork as exhibit that i do indeed own those lands...

APPENDIX E: LAND COMMISSION AWARDS AND LAND GRANTS

Grant Number(LG)	01166	Source Book:	**6**
Grantee:	Baldwin, D., J.F. Pogue & S.E. Bishop	Acreage::	2675 Acs
Ahupua`a	**Mahinahina, Kahana**	Year	**1853**
District:	Lahaina	Cancelled	False
Island	**Maui**	TMK	
Miscellaneous			

Statistics: 6439 characters 1102 words
No. 1166, Baldwin, D., J.H. Pogue & S.E. Bishop, Mahinahina, Kahana & Kahananui Ahupuaa, District of Lahaina, Island of Maui, Vol. 6, pps. 337-340 [LG Reel 2, 01478-01481.tif]

Helu 1166
PALAPALA SILA NUI

Ma keia palapala Sila Nui ke hoike aku nei o Kamehameha III, ke Alii nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la, nona iho, a no kona mau hope Alii, ua haawi lilo loa aku oia ma ko ano alodio ia D. Baldwin, J.H. Pogue a me S.E. Bishop i kela apana aina a pau e waiho la ma Mahinahina, Kahana a me Kahananui ma ka Mokupuni o Maui; a penei hoi ka waiho ana o na Mokuna.

E hoomaka ma kahakai ma ka palena o Kahananui a me Mailepai, a e holo ana ma ka palena o Mailepai a hiki aku i kuahiwi, Alaila e holo ma ka lapa o kuahiwi a i Honokawai, a holo ma ka palena o Honokawai a i kela aoao o Popolokuaamea, Alailae holo ikai ma ka palena o ko Kale Mahinahina a hiki i kahakai; Alaila ma kahakai aku no a hiki i kahi i hoomakai. Aia no ma ka olelo haole a neia palapala ke ana o ka moe ana o na aoao o me ka loihi.

Koe ke kuleana o na kanaka

Penei ka lilo ana aku o neia aina, he hapalua no D.B. Baldwin, he hapaha no J.F. Pogue, a he hapaha no S.E. Bishop.

[Page 338]

a maloko o ia Apana 2785 eka a oi iki aku, emi iki mai paha. Eia ke kumu o ka lilo ana; ua haawi mai oia iloko o ka waihona waiwai o ke Aupuni i na dala he $2675.00. Aka, ua koe i ke Aupuni na mine minerala a me na mine metala a pau.

No D. Baldwin, J.H. Pogue a me S.E. Bishop, ua aina ....

[End of Top Preview]

Add to Document Tray

[End of Preview]

.... Pogue and S.E. Bishop, each one undivided fourth part.

Containing 2675 Acres, more or less; excepting and reserving to the Hawaiian Government, all mineral or metallic Mines of every description.

To have and to hold the above granted Land in Fee Simple, unto the said John D. Baldwin, J.H. Pogue and S.E. Bishop, their Heirs and Assigns forever, subject to the taxes to be from time to time imposed by the Legislative Council equally, upon all landed Property held in Fee Simple. Provided always, and this grant is made upon the express condition, that they and their Heirs, Executors or Administrators shall, in all cases of dispute in relation to his or their rights, title or interest in the land hereby granted, or any part or parcel thereof, submit the same to the judicial tribunals of the Hawaiian Kingdom, and abide the final decisions of those tribunals, without seeking the intervention of any Foreign Nation or Representative; and in case he or they shall refuse so to do, his and their estate therein and all of his and their rights, title and interest therein, shall cease and determine, and the same shall be immediately forfeited and escheat to the Hawaiian Government.

In Witness Whereof, I have hereunto set my Hand, and caused the Great Seal of the Hawaiian Islands to be affixed, at Honolulu, this 30th day of August, 1853.

Kamehameha
Keoni Ana

[Land Patent Grant No. 1166, Baldwin, D., J.H. Pogue & S.E. Bishop, Mahinahina, Kahana & Kahananui Ahupuaa, District of Lahaina, Island of Maui, 2675 Acres, 1853]

Mahele Documents

Claim Number: 00075
Claimant: Cocket, Charles
Other claimant:
Other name: Cockett,Makapaa, Kale
Island: Maui
District: Kaanapali
Ahupuaa: Mahinahina 4
Ili: Mahinahina 4

Statistics: 13506 characters 2419 words
No. 75, Charles Cocket, Claimant, Maui, Lahaina, Maui June 14, 1846
F.R. 87-89v1

[Margin note:] Claimant notified the Board that he had left. See Shaw his agent October 3, 1848

Mr. Richards, Sir:
I feel sorry on being under the necessity of troubling you with this letter; but being [an] award that you are partly acquainted with the circumstances, and feeling confident you wish to see justice done every one, it emboldened one in sending it to you. On my arrival in Maui I commenced working for Hoopili Kane & continued doing so until his death. About two years previous to that occurrence, Hoopili gave me two lands as a remuneration for my services - one situated at Kaana pali; known by the name of Meahinahina, the other in Honokohoau by the name of Niula, after the death of Hoopili, Governor of Maui, Kakauluohi wished me to work for her as I had done for her Father. I refused to do so, as my time for the previous four years had nearly all been taken up in Hoapili's service, and I was afraid of having a repetition of it, if I engaged to work for her; on my refusal she threatened to take away the land of Honokohaou I called on you concerning it, when you were kind enough to go with me to her; you told her the consequences that may attend it if she took away the land. I was entitled to payment for four years labour since that time, until lately. I have been left in quiet possession of it; about twelve months ago Paki went to my land at Kaanapali & cut down all the Lauala, telling the person who had charge that the land belonged to him; since which time I have had no con..[?]. over the Natives, as they say the land belongs to Paki. With regard to my other land, Namoukao lately arrived from Oahu with orders from Kekuanaoa, saying the land is his, he has taken possession of it, and pulled up the chief part of the kalo. I therefore beg you will be pleased to advise me what to do, for I consider I shall be doing injustice to myself & children should I not endeavour to keep what I have worked hard for. I consider it wrong in the extreme that People should be exposed to the caprice of everyone who may have pretended claims to land & go at pleasure & rob it of what is growing on it. Why did they not claim it when Hoopili was alive, there was sufficient time for them to do so then, I have a large family, my land was their support, Why should I have that taken from me which I worked hard for, I consider I have been treated very ill, there has been no reason assigned to me for taking the land, neither had they any right to do so. I write in this manner, knowing that you, being the Father of a family will feel for me who has a large one of small children, hoping you will write and advise me what to do.
Signed, Charles Cockett

F.T. 133-134v1
Claim No. 75, Charles Cocket, Maui, December 25 [1846]

Auwae, sworn deposed, I know respecting the land of Cocket in Kanapali, named Mahinahina. Previous to the death of Nahinenaena Cocket worked as a Blacksmith for Hoapili; and subsequently Hoapili gave him that land. Hoapili told me to go & beg that land of Puniai who assented to giving him that land. Hoapili then sent for Cocket & told him: I have promised a land for you, near by Your Father-in-law. If you die before me then the land will return to the pre ....

.... t there and had all the original people who were residing there evicted, thus causing Cocket to be destitute. I have not seen the land again.
See page 664.

N.T. 664v3
No. 75, Charles Cocket, From pg. 322, August 23, 1850

M. Kekuanaoa had come before the land officers for C. Cocket's claim and stated, "C. Cocket has no interest at Niuula in Honokohau. I think it would be best for him to ask about the lands of Hoapili, where the land would be meted exactly as the amount Hoapili would give out, but this had been Kaikioewa's own land. He had bequested it to Moses Kekuaiwa upon his death and then to me upon Moses Kekuaiwa's death. It is mine now and that grant by Hoapili had been erroneous.

N.T. 111-112v10
Charles Cockett Vs. 6539 Hoonoho; 4239, Kaiama and Kaukau; 4248, Kekalohe; February 1852

These are husbandmen at Mahinahina, Kaanapali, Maui.

Hoonoho (tiller of the ground for the konohiki), sworn, In the year 1843, our land had become a grazing pasture because my work in the Mahinahina land of Charles Cockett had ended. Since that time I have not done any cultivation, not have I attended work for the konohiki and I have

not paid any taxes on that land to the present time. I also have not given a report to James Kanehoa of my status on this land, which he made his rounds on the land for statistics on the number of tenants and their work, however, I have always lived peacefully to the present time on my own
house site.

Charles Cockett: Hoonoho's statements are valid, he has not cultivated the land, he has not paid any taxes and his name is not in my book according to the law, because he has never attended work to the present time on my days. The fact that Hoonoho had surveying done on a land where on he has not cultivated is not right. I have compassion for him, for this reason the house site on which he lives presently shall be for him and his heirs permanently and for all time without any objections from me and as for the land that he has included with intention as his, he has no claim in it; however; I shall be pleased to let him till it under me without his claim.

Hoonoho: I hereby agree with Charles Cockett's views, because he has never reprimanded us, he has shown kindness only; therefore I will cultivate that land under Charles Cockett without claim on my part and the house site shall be mine forever because I have houses there and I have lived there for a long time.

Kaiama: (Husbandman) I did not file when the first call had come from the land officers, instead when J. Fuller came to survey the land and upon his suggestion

Kaiama: a claim was staked for me, but I did realize I had no right and that my action had been deceitful, therefore, I shall live under C. Cockett until death.

Kaukau: (another husbandman) I had set up a claim for myself in Makuahine, land of C. Cockett and was surveyed by J. Fuller but recently C. Cockett and I decided to separate my land section. I had hesitations about it so both parties agreed to go to the land officers. Work on this will be done when time is available.

[Award 75; R.P. 415; Mahinahina 4 Kaanapali; 1 ap.; 149 Acs; In claim 325 for Nowlein, Cocket says he lives in Waikapu]

Mahele Record: 03850

Claim Number:	03850
Claimant:	Paki, Abner
Other claimant:	
Other name:	
Island:	Maui
District:	Kaanapali
Ahupuaa:	Honokowai
Ili:	Kapili

Apana:	1	Awarded:	1
Loi:	10	FR:	
Plus:		NR:	128v6
Mala Taro:		FT:	266v7
Kula:	3	NT:	134v5
House lot:		RP:	4207
Kihapai/Pakanu:		Number of Royal Patents:	1
Salt lands:		Koele/Poalima:	No
Wauke:		Loko:	No
Olona:		Lokoia:	No
Noni:		Fishing Rights:	No
Hala:		Sea/Shore/Dunes:	No
Sweet Potatoes:		Auwai/Ditch:	No
Irish Potatoes:		Other Edifice:	No
Bananas:		Spring/Well:	No
Breadfruit:		Pigpen:	No
Coconut:		Road/Path:	No
Coffee:		Burial/Graveyard:	No
Oranges:		Wall/Fence:	No
Bitter Melon/Gourd:		Stream/Muliwai/River:	Yes
Sugar Cane:		Pali:	Yes
Tobacco:		Disease:	No
Koa/Kou Trees:		Claimant Died:	No
Other Plants:		Other Trees:	
Other Mammals:	No	Miscellaneous:	

Document Text

No. 3850, Paki, Kaanapali, Maui, January 17, 1848
N.R. 128v6

Greetings to the Land Commissioners: I hereby petition you all for my 10 lo`i, at Kapili in Honowai. A small loaloa* is there, and also a small waihae*.
It is finished.
PAKI

/* No data./

F.T. 266-267v7
Cl. 3850, Paki

Kaukau, sworn, I know the lands of Paki. They are in the ili of Kapili, Honokowai. They are as follows:

No. 1 is a kula land.
No. 2 is a kula land.
No. 3 is a kula land.
No. 4 is 4 lois of kalo land.
No. 5 is 6 lois of kalo land.

The claimant received these lands from his ancestors in the days of Kamehameha I and his title has never been disputed.

No. 1 is bounded:
Mauka and Lahaina sides by the creek & Meeau's land
Makai by Kaluaiuka's land
Kahakuloa by the pali of Honokowai.

No. 2 is bounded:
Mauka by Kahanaumeikai's land
Lahaina by the pali
Makai by my land
Kahakuloa by the creek of Honokowai.

No. 3 is bounded: Mauka and all sides by Kalaikini's land.

No. 4 is bounded:
Mauka by the King's poalima and my land
Lahaina by Honokowai pali
Makai by my land
Kahakuloa by Holona's land.

No. 5 is bounded:
Mauka by Kaukau's & Kahanaumaikai's land

Lahaina by the pali of Honokowai
Makai by Nahuli's land
Kahakuloa by Kahanaumaikai's land.

N.T. 134v5
No. 3850, Paki

Kaukau, sworn, He has seen 5 sections in the ili land of Kapili in Honokowai. Land from Paki's parents at the time of Kamehameha I, no objections, the boundaries are:

Section 1 - Potato pasture.
Mauka by Meeau's land, Stream
Lahaina by Honokowai stream
Makai by Kaluaiuka's land
Kahakuloa by Honokowai pali.

Section 2 - Pasture.
Mauka by Kahanaumeikai's land
Lahaina by Honokowai pali
Makai by Kaukau's land
Kahakuloa by Honokowai stream.

Section 3 - Pasture.
J. Kalaikini's boundaries all around.

Section 4 - 4 taro patches.
Mauka by The King's land (Poalima), Kaukau's land
Lahaina by Honokowai pali
Makai by Nahuli
Kahakuloa by Kahanaumaikai's land.

Work for award no 6600 has been included in award no 3850, these are similar.

[Award 3850; R.P. 4207; Kapili Honokowai Kaanapali; 3 ap.; 3.12 Acs]

03850 - No maps found.

Reference: | Doc: 5094 | Date Time: 1/23/2019 9:26:02 PM

Royal Patents: 8531

Royal Patent Number(RP)	8531	LCA Number:	11216*M
Patentee:	Kekauonohi, M.	Book:	37
Island:	**Maui**	Page	0
District:	Kaanapali	TMK	2-4-4-02, 04, 07
Ahupua'a	Moomuku	Miscellaneous	**contact Waihona for rest of document**

Ili

Document Text

No. 8531, Kekauonohi, M., Moomuku Ili, Honokowai Ahupuaa, District of Kaanapali, Island of Maui, Volume 37, unnumbered pps [RP Reel 17, 783-788.tif]

Land Patent No. S-8531 Issued In Confirmation of Land Commission Award

Whereas, the Board of Commissioners to quiet Land Titles, did, by their decision, award by Land Commission Award No. 11216:28 to M. Kekauonohi, an estate of Freehold Less than Allodial in the land hereafter described, and

Whereas, application has been made to the Commissioner of Public Lands by Pioneer Mill Company, Limited, claiming to be the present owner of said land for a Patent covering same, and

Whereas, this award was made by name only and a Certificate of Boundaries numbered 202, defining the boundaries of land herein described is recorded on pages 9-15 of Book No. 3 of Boundary Commission record for Maui, on file in the Office of the Commissioner of Public Lands, and

Whereas, the Government Commutation was released by Resolution of the Privy Council dated August 27, 1850, Volume 3, Pages 407-421 of the Privy Council records.

Now, Therefore, the Governor of the ~~Territory~~ State of Hawaii, in conformity with the laws of the ~~United States of America and of the Territory~~ State of Hawaii, by this Patent makes known to all men that he has this day granted and confirmed absolutely, in Fee Simple, unto M. Kekauonohi, all of the land situate at Moomuku, in the District of Kaanapali, Island of Maui, bounded and described ~~as follows~~: in the insert pages attached hereto and made a part hereof.

[following page]
Lele 1
Beginning at an iron pipe at high water mark at the North corner of this lele and the West corner of Lot 4, Honokowai Government Remnants, the co ordinates of said point of beginning referred to Government Trig. Station "Puu Kolii" being 9142.7 feet North and 12,923.3 feet West, as shown on Government Survey Registered Map No. 2534, and running by true azimuths:

1. 304° 37' 168.6 feet along said Lot 4 to an iron pipe at the North corner of Land Commission Award 3988:2 to Hilahila;
2. 5° 33' 109.6 feet along Land Commission Award 3988:2 to Hilahila;
3. 288° 11' 175.0 feet along same to an iron pipe;
4. 14° 15' 266.0 feet along Land Commission Award 4552:1 to Aumai to an iron pipe;
5. 3° 47' 104.9 feet along same to an iron pipe;
6. 102° 30' 156.6 feet along Lot 6, Honokowai Government Remnants and across Government Road to an iron pipe on the West side of said road;
7. 13° 15' 313.1 feet diagonally across said road to an iron pipe at the West corner of Land Commission Award4249:2 to Umeeui;
8. 285° 24' 223.9 feet along Land Commission Award4249:2 to Kameeui to an iron pipe;
9. 284° 16' 258.9 feet along same to an iron pipe;
10. 17° 14' 169.2 feet along the remaining portion of the Ahupuaa of Honokowai to an old post at the East corner of Land Commission Award3668:1 to Meeau;
11. 99° 07' 477.0 feet along Land Commission Award3688:1 to Meeau to an iron pipe on the East side of Government Road;
12. 99° 21' 73.3 feet across the road and along Land Commission Award 3688:1 to Meeau to an iron pipe on the East side of Government Road;
13. 18° 27' 38.8 feet along Land Commission Award 3688:1 to Meeau to an iron pipe on the East side of Government Road;
14. 101° 03' 135.6 feet along Lot 8, Honokowai Government Remnants and to the North edge of Honokowai Stream;
15. 124° 09' 56.0 feet along the North edge of Honokowai Stream;
16. 89° 26' 239.8 feet along same;
[following page]
Thence across a drainage ditch and following along the North edge of the Honokowai Stream to sea shore at high water mark, the direct azimuths and distances being:
17. 00° 35' 343.6 feet;
18. 80° 40' 177.7 feet;
19: 127° 11' 363.4 feet to a pipe;
Thence along sea shore at high water mark, the direct azimuths and distances being:
20. 222° 10' 857.9 feet to an iron pipe at the West corner of Land Commission Award 4552;5 to Aumai;
21. 217° 43' 360.4 feet along said L.C. Award to an iron pipe at the North corner of same;
22. 217° 26' 382.7 feet to the point of beginning.
Total area 19 18/100 Acres

Included within this Lele are the following:
Land Commission Award 4552:5 to Aumai 2.00
Land Commission Award 3765:1 to Aio 0.55
School Lot (Sch.Gr.16:2) 1.00
Government Main Road .53; [Total] 4 08/100
Leaving a net area of 15 10/100 Acres

Lele 2
Beginning at a pipe at the South corner of this lele, the East corner of Land Commission Award

4923:2 to Kalua and on the West boundary of L. C. A. 4254:1 to Kaumauma, the co ordinates of said point of beginning referred to Government Survey Trig. Station "Puu Kolii" being 8989.7 feet North and 12,214.9 feet West, as shown on Government Survey Registered Map No. 2534, and running by true azimuths:

1. 115° 18' 30" 301.5 feet along Land Commission Award4923:2 to Kalua to a pipe;
2. 204° 49' 104.8 feet along L.C. A. 3926:3 to Nika to a pipe;
3. 237° 38' 59.0 feet along Lot 3, Honokowai Government Remnants to & pipe;
4. 195° 45' 60.7 feet along same and along Land Commission Award3847:2 to Puhi to a pipe;
5. 303° 55' 287.7 feet along Land Commission Award4260:6 to Kaluaiuka to a pipe;
6. 37° 48' 48.8 feet along same to a pipe;
7. 22 ° 06' 123.8 feet along Land Commission Award4264:1 to Kaumauma to the point of beginning.

Area 1 29/100 Acres
Less Land Commission Award 4552:2 Aumai 32/100
Net area 0-97/100 Acres

[following page]
Lele 3
Beginning at a + on rock at the Northwest corner of this lele and on the North edge of Onepeha Gulch, the co ordinates of said point of beginning referred to Government Survey Trig. Station "Puu Kolii" being 7062.1 feet North and 5904.8 feet West, as shown on Government Registered Map No. 2534, and running by true azimuths:

1. 274° 56' 961.9 feet along the remaining portion of the ahupuaa of Honokowai to a + on rock on the East side of road;
2. 284° 58' 910.2 feet along same to a + on rock;
3. 20° 12' 346.8 feet along same to a + on rock in Onepeha Gulch;
4. 92° 35' 1608.6 feet down middle of Onepeha Gulch to a + on rock;
5. 142° 26' 310.6 feet along same to a + on rock;
6. 19° 36' 334.0 feet up gulch to the point of beginning.

Area 20 42/100 Acres.

Lele 4
Beginning at a + on rock on the West boundary of this lele, on the South side of old road and on the North edge of the Honokowai Gulch and about 700 feet above the Weir house, the co ordinates of said point of beginning referred to Government Survey Trig. Station "Puu Kolii" being 5211.6 feet North and 1884.5 feet West, as shown on Government Survey Registered Map No. 2534, and running by true azimuths:

1. 173° 25' 30" 427.0 feet along the remaining portion of the ahupuaa of Honokowai to a cross on rock;
2. 202° 10' 184.4 feet along same to a + on rock on the South edge of Onepeha Gulch;
3. 273° 56' 1003.8 feet along same to a + on rock in middle of Onepeha Gulch;
4. 294° 21' 1926.4 feet along same to concrete post on spur at junction of Onepeha and Nukunukuapuaa Gulches;

5. 284° 30' 680.0 feet along same down into Nukunukuapuaa Gulch to junction of said Gulch with Papanahoa Gulch;
6. 284° 30' 770.0 feet along same up middle of Papanahoa Gulch;
7. 266° 00' 530.0 feet along same up middle of Papanahoa Gulch;
8. 282° 54' 792.2 feet along same to a concrete post on the top of the North bank of the Papahahoa Gulch;
[following page]
9. 296° 00' 2971.1 feet along same to a 4 inch iron pipe on South edge of the Kaawaiki Gulch at a place called Ualakiekie;
10. 17° 13' 356.5 feet along West Maui Forest Reserve

8531 - No maps found.

APPENDIX F: KAIMAILE MAKEKAU LEGAL DOCUMENTS

THE ORIGINAL OF THE DOCUMENT
RECORDED AS FOLLOWS
STATE OF HAWAII

BUREAU OF CONVEYANCES
DATE JUN 17 1996 TIME 8:01
DOCUMENT NO. 96-080637

LAND COURT SYSTEM | REGULAR SYSTEM

AFTER RECORDATION, RETURN BY MAIL (XX) PICKUP ( )

MEYER M. UEOKA, ESQ.
UEOKA & UEOKA
2103 Wells Street
Wailuku, Maui, Hawaii 96793

TITLE OF DOCUMENT: JUDGMENT ON TITLE

PARTIES TO DOCUMENT:

PLAINTIFF: MAUI LAND & PINEAPPLE COMPANY, INC.

DEFENDANTS: J. A. NAHAKU, et al.

6676U/06:04:96

2ND CIRCUIT COURT
STATE OF HAWAII
FILED

1996 APR 30 PM 3:36

Y. PETRO
CLERK

Of Counsel:

CARLSMITH BALL WICHMAN
CASE & ICHIKI

TOM C. LEUTENEKER 721-0
Suite 400, One Main Plaza
2200 Main Street
Wailuku, Maui, Hawaii 96793
Telephone No. (808) 242-4535

Attorney for Plaintiff

IN THE CIRCUIT COURT OF THE SECOND CIRCUIT

STATE OF HAWAII

MAUI LAND & PINEAPPLE COMPANY, INC., Plaintiff, vs. J. A. NAHAKU, et al., Defendants.	CIVIL NO. 88-0068(3) JUDGMENT ON TITLE; EXHIBIT "A"

11:20.039

JUDGMENT ON TITLE

Pursuant to the Findings of Fact and Conclusions of Law, Order entered on March 8, 1996, and the record of this case,

IT IS HEREBY ORDERED, ADJUDGED and DECREED as follows:

1. The Mauka Boundary of Lele 4.

Judgment is entered in favor of Defendant State of Hawaii and against Plaintiff Maui Land & Pineapple Company, Inc., Defendants Makekau, and Defendants Kaimikaua, that the mauka boundary of Lele 4 is as described in the Boundary

I hereby certify that this is a full, true and correct copy of the Original.

Commission Report of 1925 on file in the Department of Land and Natural Resources, State of Hawaii, a copy of said Lele 4 description being also attached hereto as Exhibit "A" and made a part hereof and, accordingly, the disputed subject lands designated as Parcel 6, TMK: (2) 4-4-07, lying within the Ahupua'a of Honokowai are government owned, public lands which are a part of the Government (Crown) Land of Honokowai and within the West Maui Forest Reserve.

2. Title to Two of the 29 Shares in the Moomuku Hui - Makekau Claim.

Judgment is entered in favor of Defendant Makekau and against Plaintiff Maui Land & Pineapple Company, Inc. and, accordingly, Defendants Makekau own a 100% interest in 2 shares of the Moomuku Hui lands.

3. Title to Shares #17 Through #21 and #27B Through #29.

Judgment is entered in favor of Defendants Kaimikaua and against Plaintiff Maui Land & Pineapple, Inc. and, accordingly, Defendants Kaimikaua own a 1/8 interest in 7 1/2 shares of the Moomuku Hui lands, more specifically those 7 1/2 shares identified as Nos. 17 - 21 and 27B - 29, divided as follows:

John Kaimikaua	5/16 of one share
Edmund Kaimikaua	5/16 of one share
Charles Kaimikaua, Jr.	1/16 of one share
Loraine P. Puaoi	1/16 of one share
Ruth L. Poaipuni	1/16 of one share
Evelyn Kahee	1/16 of one share

DEPARTMENT OF)
COMMERCE AND CONSUMER)
AFFAIRS; DOES 1-10,)
DOES ENTITIES 1-10,)
and DOE GOVERNMANTAL))
AGENCIES 1-10,)
)
Defendants.)
)

FIRST AMENDED VERIFIED COMPLAINT TO RECOVER ASSESSED VALUE OF PROPERTY AND FOR CLEAR TITLE BY DEED

COMES NOW Plaintiffs Pro Se, **CHARLES KALEI MAKEKAU, STANLEY NAKAI MAKEKAU, ETHEL L. MAKEKAU NAHINU**, by and through her Attorney-in-Fact, **PAMELA NAHINU**, and **DEANNA P. MAKEKAU NAKAMOTO**, by and through her Attorney-in-Fact, **CHERYLANN P. CARAVALHO**, and files the following Complaint to Recover the Assessed Value of Property and for Clear Title by Deed.

1. Plaintiffs CHARLES KALEI MAKEKAU, STANLEY NAKAI MAKEKAU, ETHEL L. MAKEKAU NAHINU, by and through her Attorney-in-Fact, PAMELA NAHINU, and DEANNA P. MAKEKAU NAKAMOTO, by and through her Attorney-in-Fact, CHERYLANN P. CARAVALHO, are and at all times mentioned herein were residents of the State of Hawaii, County of Maui;

2. Defendant HARRY and JEANETTE WEINBERG FOUNDATION, INCORPORATED, is a foreign non-profit corporation formed in the State of Maryland, and registered to do and doing business in the State of Hawaii, County of Maui;

8. Said family member contacted the Makekau family of whom Plaintiffs are a part, of said Maui News legal notice;

9. Said information culminated in Civil Case No. 88-0068(3), "Maui Land and Pineapple Company, Ltd. versus J.A. Nahaku, et. al."

10. After four years of litigation under Civil No. 88-0068(3), based upon undisputed facts, this Court granted Plaintiffs Makekau an absolute seventy percent interest of the interest owned by the late Frank Clark in the Ili of Moomuku in the land of Honokowai on the Island of Maui, State of Hawaii; and also granted Plaintiffs Makekau a seventy percent interest in a 2/29ths interest, or a 4.828 percent undivided interest in the subject property (Lele 4 of the Hui of Moomuku). A copy of the Court's Order Granting Defendants Charles Kalei Makekau, Cecilia Makekau Napihaa, Ethel L. Makekau, Stanley N. Makekau, Dianna P. Nakamoto, Abel Kelii Makekau and Clinton Makekau's Motion for Partial Summary Judgment dated June 5, 1992 is attached hereto as Exhibit "A" and incorporated herein by this reference.

11. Thereafter, Civil Action 88-0068(3) concluded in Plaintiffs Makekau being awarded Judgment on Title of 100% interest in two shares of twenty-nine shares in the Moomuku Hui Lands, which lands are under L. C. Award 11216, Apana 28, Leles 1 (1.689 acre, Parcels 52, 79 and Easements A & B, 2 (0.97 acre, Parcel 34) and 3 (20.42 acre),

after this Court's Order dated June 5, 1992, Plaintiffs believe this action is timely.

24. Plaintiffs further allege that in 1914, Pioneer Mill Company, Ltd. drew up a lease agreement with a named Defendant in Civil No. 88-0068(30, Wahineaea Palau, one of Plaintiffs' ancestors;

25. A clear and proper survey was performed by Pioneer Mill Company as one of the conditions for said lease agreement. A true and correct copy of said lease agreement and survey is attached hereto as Exhibit "E" and incorporated herein by this reference;

26. Plaintiffs further allege that due to the deceptive acts of Defendant, PIONEER MILL COMPANY, in its recording of the property and false transactions, that Plaintiffs are entitled to treble damages under the Deceptive Trade Practices found in H.R.S. Section 481.

27. Plaintiffs substantiate the above-referenced Deceptive Trade Practices by the Affidavit of Officers of Defendant Pioneer Mill Company, Limited, a Hawaii corporation, which shows assets of all properties held in the name of the corporation. A true and correct copy of such Affidavit of Officers is attached hereto as Exhibit "F" and incorporated herein by this reference.

28. Defendant STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS recorded such Exhibit "F." Plaintiffs believe that such State agency knew or should have known that due to the fraudulent documents recorded with Defendant STATE OF

RESOURCES had the capability to ensure water rights' protection to Plaintiffs.

39. Plaintiffs further allege that such displacement was unknown to them for some seventy years, until the ruling of this Court in 1992;

40. Plaintiffs further allege that due to the partitioned parcel 52, that Plaintiffs be awarded three times the amount of the assessed value and for clear title by deed to said parcel 52.

41. Plaintiffs further allege that no subdivision or partitioning of the Moomuku Hui lands has taken effect since the Judgment on Title in 1996;

42. Plaintiffs further allege that while they have title to such lands, there is no clear title with which to achieve anything for the family such as use in collateral, subdividing for home lands, etc.

WHEREFORE, Plaintiffs pray that:

1. This Court award judgment to Plaintiffs in the amount of the assessed value of the property known as TMK (2) 4-4-001-052 from Defendants; and
2. This Court award treble damages to Plaintiffs based on the assessed value of a portion of the property known as TMK (2) 4-4-001-052 (1.154 acres) from Defendants;
3. This Court award to Plaintiffs the value of the improvements placed on the property known as TMK (2) 4-4-001-052 (1.154 acres);

RECORDED AS FOLLOWS
STATE OF HAWAII
BUREAU OF CONVEYANCES
DOCUMENT NO. Doc A – 60320573
DATE - TIME July 07, 2016 8:02 AM

LAND COURT | REGULAR SYSTEM

AFTER RECORDATION, RETURN BY MAIL (XXX) PICK-UP ( )

Kaimaile Precious Makekau
208 Auoli Drive
Makawao, HI 96768

DO NOT WRITE IN THIS SPACE

Tax Map Key Nos.: (2) 4-4-4-8 and (2) 4-4-7-6

QUITCLAIM DEED

THIS DEED, made this 27th day of June, 2016, by **JEFFERY N. MAKEKAU**, a single man, whose address is 1807 Ilima Place, Kihei, Hawaii 96753, (hereinafter referred to as "Grantor") and **KAIMAILE PRECIOUS MAKEKAU**, a single woman, whose address is 208 Auoli Drive, Makawao, Hawaii 96768, (hereinafter referred to as "Grantee").

W I T N E S S E T H:

That in consideration of the sum of TEN AND NO/100 DOLLARS ($10.00) and other valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, the Grantor does hereby release, remise and quitclaim unto the Grantee, as a Tenant in Severalty, and to their successors and assigns:

> All of that certain real property which is set forth and more particularly described in Exhibit "A" attached hereto and by reference made part hereof;

And all of the estate, right, title and interest of the Grantor, both at law and in equity, therein and thereto; The terms "Grantor" and "Grantee", or any pronoun in place thereof, as and when used hereinabove or hereinbelow, shall mean and include the masculine or feminine, the singular or plural number, individuals, trustees, partnerships, or corporations, and their and each of their respective successors in interest, heirs, personal representatives, successors in trust and assigns, and that if these presents shall be signed by two or more Grantors, all covenants and obligations of such parties shall be and for all purposes are deemed to be joint and several.

IN WITNESS WHEREOF, the undersigned executed these presents on the day and year first above written.

GRANTOR:

Jeffery Makekau

JEFFERY N. MAKEKAU

STATE OF HAWAII)
) ss.
COUNTY OF MAUI)
Second Judicial Circuit

Document Description: Quitclaim Deed

Document Date: 6/27/2016

Number of Pages: 3

On this 27 day of June, 2016, appeared **JEFFERY N. MAKEKAU**, to me personally known to be the person described in and/or satisfactorily proved to me to be the person described in and who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed.

L.S.

Name of Notary: David R. Spee
Notary Public, State of Hawaii
My commission expires: March 24, 2019

EXHIBIT "A"

All of the interest owned by the Stanley N. B. Makekau Revocable Trust dated September 9, 1991 in Land Commission award 11216:28 Lele 4 to M. Kekauonohi located at Moomuku, Honokowai, Lahaina, Maui, State of Hawaii, being Tax Map Key: (2) 4-4-4:8, containing an area of 286.20 acres, more or less.

All of the interest owned by the Stanley N. B. Makekau Revocable Trust dated September 9, 1991 in Land Commission award 11216:28 Lele 4 to M. Kekauonohi located at Moomuku, Honokowai, Lahaina, Maui, State of Hawaii, being Tax Map Key: (2) 4-4-7:6, containing an area of 164.0 acres, more or less.

Being all of the interest acquired by the Jeffery N. Makekau, by way of the following instrument:

QUITCLAIM DEED

Grantor:	Stanley N. B. Makekau, Trustee of the Stanley N. B. Makekau Revocable Trust dated September 9, 1991
Grantee:	Jeffery N. Makekau
Dated:	October 28, 2002
Recorded:	March 3, 2003, as Document No. 2003-037978

END OFEXHIBIT "A"

RUSH MOORE CRAVEN
SUTTON MORRY & BEH

ATTORNEYS AT LAW
A Partnership Including Law Corporations

Honolulu Office:
745 Fort Street
20th Floor, Hawaii Tower
Honolulu, Hawaii 96813
Telephone: (808) 521-0400
FAX: (808) 521-0597

Maui Office:
2200 Main Street
Suite 650
Wailuku, Hawaii 96793
Telephone: (808) 244-3332
FAX: (808) 244-5322

Guam Office:
414 West Soledad Avenue
Suite 207, GCIC Building
Agana, Guam 96910
Telephone: (671) 477-1542
FAX: (671) 477-2581

Micronesia Office:
P.O. Box 1491
Kolonia, Pohnpei
FSM 96941
Telephone: (691) 320-2868
FAX: (691) 320-5450

0811B

March 30, 1992

Charles K. Makekau
33905 Pacific Coast Highway
Malibu, California 90265

Re: MAUI LAND & PINEAPPLE COMPANY, INC. vs. NAHAKU, et al.; CIVIL NO. 88-0068(3); Grant of easement for roadway purposes over portion of Lele 4 of the Ili of Moomuku
Our File No. 14609

Dear Charles:

Enclosed is a recent letter and proposed grant of easement over the Moomuku Hui land in which you have an ownership interest. This grant of easement is over the existing road and is only for the purpose of allowing the Nature Conservancy the right to get the forest lands on the top of the West Maui mountains.

I am asking you to review the proposed grant of easement and I am recommending that you approve of the grant. Therefore, if you approve the grant of easement, please sign below and return this signed letter in the enclosed stamped, self-addressed envelope (I am also enclosing a copy of this letter for your files). Once I get your response, I will contact Maui Land & Pineapple Company. Please feel free to contact me if you have any questions.

Sincerely,

RUSH MOORE CRAVEN SUTTON
MORRY & BEH

Brian R. Jenkins

BRIAN R. JENKINS

BRJ:bjc

Encls.

cc: Cecilia Napihaa (w/o Encls.)
Abel Makekau (w/o Encls.)
Dianna P. Nakamoto (w/o Encls.)
Clinton Makekau (w/o Encls.)
Ethel Makekau (w/o Encls.)
Stanley Makekau (w/o Encls.)

MEMORANDUM FOR PRELIMINARY DESIGN INFORMATION

APPENDIX M

FUKUMOTO ENGINEERING, INC.
Civil Engineering & Land Surveying Consultants

Ronald M. Fukumoto, PE, LS
Michael E. Silva, PE, LS, LEED AP
1721 Wili Pa Loop, Suite 203
Wailuku, Hawaii 96793
Phone: (808) 242-8611
Email: office@femaui.com
Website: www.femaui.com

MEMORANDUM

Date: April 27, 2018

To: Curtis Eaton, PE / Department of Water Supply

From: Ronald Fukumoto, PE, LS

Subject: **KAHANA PRODUCTION WELL**

I. PURPOSE

The purpose of this memorandum is to present preliminary design information for review by the County of Maui, Department of Water Supply (DWS). This information and applicable revisions will be used to prepare construction documents for the Kahana Production Well.

II. DESCRIPTION

The DWS will implement the West Maui Water Source Development Project in the Mahinahina and Kahana areas in Lahaina, Maui. The project involves installing permanent well pumps in two groundwater wells, State Well No. 6-5638-004 (Mahinahina Well) and State Well No. 6-5738-002 (Kahana Well), constructing pump stations at those locations, and tying into the existing DWS water system at the Mahinahina Water Treatment Facility.

The exploratory portion of the Kahana Well was completed in 2017. The Kahana Well is a 20-inch diameter well drilled to a depth of about 1,378 feet below the ground surface. The ground surface is at an elevation of 1,317 feet above mean sea level. The resulting elevation of the bottom of the drilled hole is 61 feet below mean sea level. After placement of a 3-foot deep cement plug at the bottom of the drilled hole, the bottom of the well is 58 feet below mean sea level.

Water quality tests and pump tests indicate that the well is suitable for use as a permanent drinking water source. The water quality test results indicate good water quality with no detection of the majority of regulated contaminants. The water quality test results also indicate detection of a few regulated contaminants; however, their levels were significantly below allowable levels. The pump test results indicate a sustainable withdrawal rate of 1,000 gallons per minute.

The Kahana Production Well project involves development of the exploratory well into a new drinking water source and connecting it to the DWS water system. Enclosed for your review are the following items:

- Preliminary design submittal drawings including civil, structural, and electrical drawings (50% construction drawings)
- Preliminary opinion of probable construction costs
- Supplementary information from potential suppliers and subcontractors

Outlined below are descriptions of project components and a summary of probable construction costs.

III. COMPONENTS

A. Pump Station Site

1. Lot Size and Location: 1-acre lot on abandoned pineapple field about 2.4 miles East of Kapalua Airport.

2. Topography: Elevations of the site range from about 1,310 feet above mean sea level (AMSL) to about 1,326 feet AMSL. Existing ground slope is about 9 percent.

3. Grading: The pump station site includes the following major components: 11,000-square foot service yard, 180-square foot pump discharge piping pad, 1,100-square foot control building, 500-square foot emergency generator pad, 20-foot diameter control tank foundation, and 4,100-square foot drainage sump. About 0.75 acre will be flattened out to accommodate the major components. The remaining 0.25 acre will be sloped areas. Anticipated maximum cut and maximum fill is about 4 feet.

4. Drainage System: Drainage system consists of grassed swales, grated drain inlets, drain pipes, and a drainage basin. Grassed swales at upper property line intercept off-site runoff and channel the runoff around the site. Grated drain inlets in the service yard collect on-site runoff and drain pipes convey the runoff to the rock-lined drainage basin. The drainage basin will mitigate the increase in runoff due to development of the site. The drainage basin also receives water from the pump control valve ("dump valve") upon startup of the deep well pump, from the control tank washout line during tank cleaning, and from the control tank overflow spillway.

5. Landscape Planting and Irrigation System: There are no landscape plantings except for erosion control grass. There is no irrigation system.

6. Service Yard: Paved service yard consists of 6-inch concrete pavement on 4-inch to 6-inch layer of untreated base course.

7. Access Road: The access road will follow the route of the transmission pipeline. To provide all-weather access to the site, steep sections (8 percent and greater) will be paved with concrete and mildly sloped sections will either be paved with gravel or remain unpaved.

B. Well Pump

1. Pump Supplier and Installer

   Beylik Drilling & Pump Service, Inc.
   91-259A Olai Street
   Kapolei, Hawaii 96707
   Contact: Toni Gonsalves

2. Pump Data

Equipment Summary	
Output	1,000 gallons per minute
Total Dynamic Head	1,350 feet
Pump Manufacturer	Byron Jackson
Pump Size/Model	14EJYH-12 stage
Motor Manufacturer	Byron Jackson
Motor Size	500 horsepower
Motor Voltage/Phase	4,160 volts/3 phase
Motor Speed	1,800 revolutions per minute
Power Cable	#4 AWG, XLP, 5KV

3. Special Provisions

   a. Motor Cooling Shroud: Provide a custom designed submersible motor cooling shroud to be installed with the pumping unit to ensure proper motor cooling during pump operation.
   b. Thrust Bearing Construction: Provide extra heavy Kingsbury type thrust bearing sized to support a thrust load equal to calculated thrust at shutoff head or 1½ times calculated thrust at design head, whichever is larger.
   c. Discharge Column Pipe: Provide ASTM A-53 Grade B galvanized steel pipe with the size and thickness as detailed.
   d. Discharge Column Couplings: Provide same material as column pipe with API 8-Round threads.
   e. Centralizers: Install on the column pipe at 20-foot intervals for the lowest 100 feet of column pipe and at 100-foot intervals thereafter to center, stabilize, and properly cool the submersible motor in the well.

C. Control Tank

1. Tank Supplier and Installer

   The Core Group, Inc.
   10063 Lillywood Drive
   Boise, Idaho 83709

2. Tank Data

Summary	
Manufacturer	Tank Connection
Nominal Inside Diameter	18.46 feet
Nominal Eave Height	19.98 feet
Gross Capacity	39,479 gallons
Freeboard	2 feet
Operating Depth	17.72 feet
Net Capacity	35,475 gallons
Foundation Type	Concrete with base ring
Shell Material	Type 316 stainless steel

3. Tank Accessories

   a. Aluminum geodesic dome roof
   b. Shell manway

c. Inlet and outlet tank shell nozzles
d. Overflow spillway
e. Outside caged ladder
f. Square roof hatch
g. Roof vent with mesh screen

D. Control Building

1. General Design
   a. 56 feet by 20 feet with an area of 1,120 square feet
   b. Concrete slab on grade with concrete masonry unit walls and concrete roof with 3-foot roof overhang.
   c. Three separate rooms with exterior access including control room (for electrical equipment and well level equipment), chlorination room (for hypochlorination system), and mechanical room (for booster pump).

2. Building Components
   a. Walls and Footing: 8" concrete masonry unit walls on 2'-6" wide by 13" thick reinforced concrete spread footing.
   b. Floor Slab: 5" thick reinforced concrete on 4" thick cushion fill.
   c. Roof Structure: 4" thick pre-stressed concrete solid plank roof with 3" thick (minimum) cast-in-place concrete topping.
   d. Roofing: built-up roofing.
   e. Gutters and Downspouts: aluminum.
   f. Windows: Aluminum frame awning-type and aluminum fixed louver.
   g. Doors: Metal door and frame.
   h. Ventilation: For control room, split system air conditioner.

E. Mechanical Systems

1. Pump Discharge Line: Similar configuration as Wailuku Well Development including 8-inch pump discharge line consisting of deep well pump control valves with solenoid controls, venturi meter, and air and vacuum valve.

2. Well Level Control: Air bubbler system with compressor, stainless steel air lines, and pressure transmitter.

3. Disinfection System: Hypochlorination system consisting of two sodium hypochlorite tanks, two peristaltic pumps (Watson Marlow 530 process pump for low pressure applications up to 30 psi with manual control, remote control, analog speed control, and digital communication functions), and chemical-resistant tubing (Watson Marlow Marprene) for injection of solution into pump discharge line.

4. Water Booster Pump: Packaged booster pump system for supplying water for emergency eyewash and shower, and site water system.

5. Emergency Eyewash and Shower Station: Safety equipment located outside of chlorination room.

F. Electrical Systems

1. Electrical Distribution System to Site: Overhead line from existing Maui Electric transmission line to the site.

2. Emergency Generator

   a. Supplier: Hawthorne Cat
   b. Generator Data: Caterpillar Model 3512C rated at 1,500 kW standby, 4,160 volts, 3 phase, 60 hertz with sound attenuated 304 stainless steel enclosure (75-78 dBA at 50 feet).
   c. Fuel Tank: 5-day supply.
   d. Transfer Switch: Medium voltage automatic transfer switch rated at 5kW, 1,200 amp main bus with two 1,200 amp breaker in NEMA 3R enclosure. ATS will be located in control building.

3. Pump Station
   a. General: Similar configuration as existing Iao Tank Site Well, existing Wailuku Well, and proposed Mahinahina Well.
   b. Exterior: 3 phase transformer; two floodlights; one telemetry antenna pole; and pump discharge piping control circuits.
   c. Interior: Interior lighting; receptacles; and switchgear including utility company metering section, automatic transfer switch, building service panel, well pump starter/motor protection section, power factor capacitors and transient voltage surge suppression section, and supervisory control and data acquisition (SCADA) section.

G. Transmission Pipeline

1. Pipe: 12-inch ductile iron pipe, class 52, with polywrap. (Note that an 8-inch pipe will carry the 1,000 gpm pumping rate, but may experience excessive operational losses and possible negative pressure where the pipeline route flattens out between Sta. 45+00 and Sta. 81+86 due to the pressure reduction at 950 feet AMSL.)

2. Fittings and Valves: DWS standard materials.

3. Pressure Reducing Valve: Cla-Val 8-inch anti-cavitation pressure reducing valve (Model 90-01KO) set at same elevation (950 feet AMSL) as proposed pressure reducing valve for Mahinahina Permanent Well project.

IV. OPINION OF PROBABLE CONSTRUCTION COSTS

Total probable construction cost, including a 10 percent contingency factor, is $9.6 million.

The enclosed information includes cost estimates received from various potential suppliers and subcontractors. Twenty percent was added to these estimates to account for the general contractor markup on suppliers and subcontractors. (See attached spreadsheet for a breakdown of this amount.)

Thank you for reviewing this information. We look forward to receiving your comments to allow us to prepare the construction documents.

Enclosures
COM43B