STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS

Land Development Division

Date: May 6, 2020

ADDENDUM NO. 2
TO
INVITATION FOR BIDS
IFB-20-HHL-025

KAU WATER SYSTEM IMPROVEMENTS – PHASE 1

Notice to All Prospective Offerors

This addendum is hereby made a part of the contract documents for Kau Water System Improvements – Phase 1, IFB-20-HHL-025, and it shall amend the said contract documents as detailed within this Addendum document.

APPROVED:

Stewart Matsunaga, Acting Administrator
Land Development Division
Department of Hawaiian Home Lands

Please execute and immediately return the receipt below to the Department of Hawaiian Home Lands via e-mail to: **Ms. Sara Okuda, at sara.t.okuda@hawaii.gov.**

Receipt of Addendum No.2 for Kau Water System Improvements – Phase 1, Invitation for Bids No.: IFB-20-HHL-025, is hereby acknowledged.

Signature: _____ _____
Print Name: Title

_____ _____
Name of Firm/Company Date

ADDENDUM NO. 2

IFB-20-HHL-025
KAU WATER SYSTEM IMPROVEMENTS – PHASE 1
KAMAOA, KAU, HAWAIʻI

The items listed hereinafter are hereby made a part of the contract for the above project and shall govern the work, taking precedence over previously issued plans and specifications governing the items mentioned:

I. SPECIFICATIONS

A. SECTION 02200 – EARTHWORK:

1. PART 3 – EXECUTION, 3.02. EXCAVATION, add the following sentence to paragraph B.1, Tank Foundation Excavation, on the fourth line, after the sentence that ends with the word, "material": The over-excavation shall be extended until the underlying clinker or basalt rock formation is encountered.

B. SECTION 16050 – BASIC MATERIALS AND METHODS

1. PART 2 – PRODUCTS, Added paragraph N. AUTOMATIC TELEPHONE DIALER SYSTEM.

C. SECTION 16100 – SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM

1. PART 1 – GENERAL, 1.2 SUMMARY, revised paragraph C to include wording on the future DWS Kau Baseyard. Added sentence "The SCADA System shall be a standalone system with the capability of telemetry to the future SCADA Master Station at the future DWS Kau Baseyard."
2. PART 1 – GENERAL, 1.2 SUMMARY, C, added "or approved equal".
3. PART 1 – GENERAL, 1.2 SUMMARY, C, revised paragraphs 1a and 1b. Added paragraph "c. Powerpack for 65536 Powertags".
4. PART 1 – GENERAL, 1.2 SUMMARY, C, removed paragraph 2.
5. PART 1 – GENERAL, 1.2 SUMMARY, C, revised paragraphs 3a, 3b, 3c, and 3d to include wording on the future Master Station at the DWS Kau Baseyard.
6. PART 1 – GENERAL, 1.2 SUMMARY, C, removed paragraph 3f.
7. PART 1 – GENERAL, 1.3 SUBMITTALS, C, removed paragraph 4.
8. PART 2 – PRODUCTS, 2.03 SCADA SYSTEM CONTROL AND DESCRIPTION, revised paragraph to include wording on the future DWS Kau Baseyard.
9. PART 2 – PRODUCTS, 2.04 MATERIALS AND EQUIPMENT, B, revised paragraph to include wording on the future DWS Kau Baseyard and RTU panel manufacturer.

10. PART 2 – PRODUCTS, 2.04 MATERIALS AND EQUIPMENT, C, added "or approved equal".
11. PART 2 – PRODUCTS, 2.04 MATERIALS AND EQUIPMENT, D, added "or approved equal".
12. PART 2 – PRODUCTS, 2.04 MATERIALS AND EQUIPMENT, D, revised paragraph 1 on the type of SCADA hardware.
13. PART 2 – PRODUCTS, 2.04 MATERIALS AND EQUIPMENT, removed paragraphs E, RADIO EQUIPMENT AND COMMUNICATIONS; F, RADIO EQUIPMENT; G, ANTENNA AND ACCESSORIES; H, RADIO HARDWARE.
14. PART 2 – PRODUCTS, 2.04 MATERIALS AND EQUIPMENT, added paragraph F. SHADE COVER.

II. PLANS

A. DRAWING CHANGES

The following plan sheet numbers have been revised and the revised drawings are reissued using Revision Delta 1, dated May 6, 2020:

1. Drawing No. C-5

   Revision includes adding to the call out of Item 38: AND 2 – SPARE 3/8" POLYETHYLENE TUBING

2. Drawing No. C-9

   Revision includes adding the call out: AND 2 – SPARE 3/8" POLYETHYLENE TUBING

3. Drawing No. C-10

   Revision includes adding the call out: AND 2 – SPARE 3/8" POLYETHYLENE TUBING (TERMINATE TUBING AT END OF THE 2-1/2" CONDUIT. ENDS OF SPARE TUBING SHALL BE PLUGGED OR CAPPED)

4. Drawing No. C-16

   Revision includes adding the call out: INCLUDE 2 – SPARE 3/8" POLYETHYLENE TUBING (TERMINATE TUBING AT END OF THE 2-1/2" CONDUIT. ENDS OF SPARE TUBING SHALL BE PLUGGED OR CAPPED)

5. Drawing No. S-3

Revised dimensions to 2'-0" in Details 1 and 3.

6. Drawing No. S-8

   Revised dimension to 2'-0" in Detail 1.

7. Drawing No. S-11

   Revised dimension to 2'-0" in Detail 3.

8. Drawing No. E-1

   Hawaiian Telcom Pull box added to Electrical Symbols. Hawaiian Telcom Notes added to sheet.

9. Drawing No. E-2

   Telephone Duct added to duct sections and schedule. Typical Duct Section revised to add warning tape over HTCO duct. Hawaiian Telcom Notes added to sheet.

10. Drawing No. E-3

    Telephone line added to Electrical Site Plan.

11. Drawing No. E-4

    Telephone line and telephone cabinet added to Control Valve Station and Flow Meter vault Electrical Plan.

12. Drawing No. E-6

    Telephone cabinet added to Detail 2.

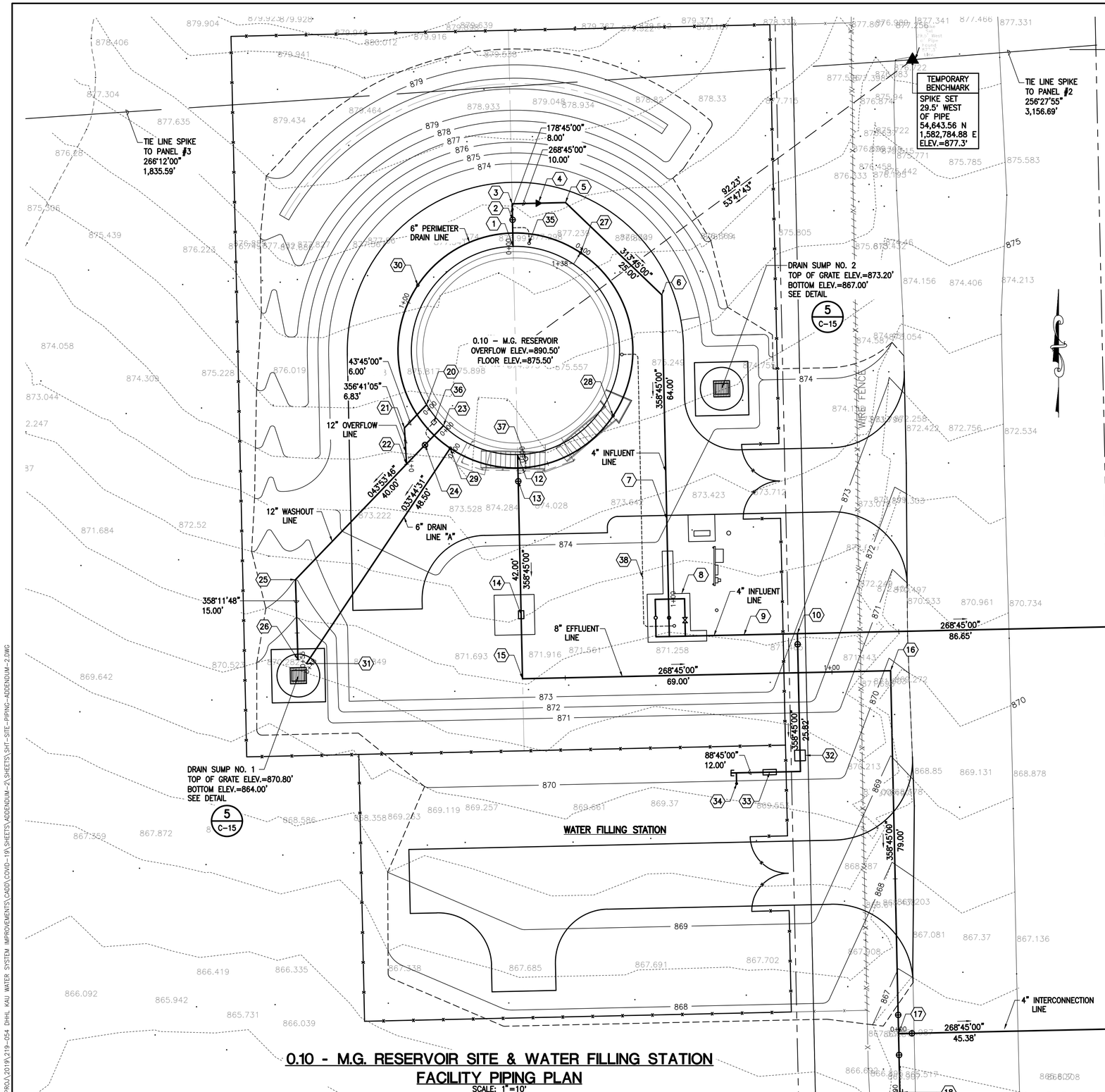
13. Drawing No. E-7

    Auto-dialer added to Detail 1. Removed previous Detail 2 and added new Detail 2 for auto-dialer.

14. Drawing No. E-8

    Detail 3 deleted.

END OF ADDENDUM NO. 2



0.10 - M.G. RESERVOIR SITE & WATER FILLING STATION FACILITY PIPING PLAN

SCALE: 1"=10'

1. STA. 0+00 (8" INFL. LINE)
BEGIN RESERVOIR INFLUENT LINE.
1–8" D.I. SOLID BODY SLEEVE, M.J.
NECESSARY 8" D.I. NIPPLE
FOR PROFILE, SEE SHEET C-7

2. STA. 0+05 (8" INFL. LINE)
1–8" G.V., M.J., 250#
1–VALVE BOX

3. STA. 0+08 (8" INFL. LINE)
1–8" 90° D.I. BEND, M.J.
1–CONC. BLOCK

4. STA. 0+12 (8"/4" INFL. LINE)
1–8"x4" D.I. REDUCER, M.J.

5. STA. 0+18 (4" INFL. LINE)
1–4" 45° D.I. BEND, M.J.
1–CONC. BLOCK

6. STA. 0+43 (4" INFL. LINE)
1–4" 45° D.I. BEND, M.J.
1–CONC. BLOCK

7. STA. 0+85 (4" INFL. LINE)
BEGIN RESERVOIR INFLUENT CONTROL VALVE STATION

8. STA. 1+04 (4" INFL. LINE)
RESERVOIR INFLUENT CONTROL VALVE STATION
FOR DETAIL, SEE SHEET C-9

9. STA. 1+21 (4" INFL. LINE)
END RESERVOIR INFLUENT CONTROL VALVE STATION

10. STA. 1+31 (4" INFL. LINE)
1" TYPE A SERVICE LATERAL FOR WATER FILLING STATION
1–1" BRONZE DOUBLE STRAP SERVICE SADDLE FOR 4" D.I. PIPE
SEE DWS STANDARD DETAILS L9 AND L10

11. STA. 1+94± (4" INFL. LINE)
END OF 4" INFLUENT LINE.
1–4"x4" D.I. TEE, M.J., WITH MEGALUGS
1–4" D.I. SOLID BODY SLEEVE, M.J., WITH MEGALUGS
2–4" G.V., M.J., 250#, WITH MEGALUGS
2–VALVE BOXES
2–4" TRANSITION COUPLINGS (ROMAC MACRO HP, OR APPROVED EQUAL)
1–CONC. BLOCK WITH STRUCT. STRUTS NECESSARY 4" D.I. NIPPLES FOR SCHEMATIC CONNECTION, SEE DETAIL 1 C-16

12. STA. 0+00 (8" EFFL. LINE)
BEGIN RESERVOIR EFFLUENT LINE.
1–8" D.I. SOLID BODY SLEEVE, M.J.
NECESSARY 8" D.I. NIPPLE
FOR PROFILE, SEE SHEET C-7

13. STA. 0+05 (8" EFFL. LINE)
1–8" G.V., M.J., 250#
1–VALVE BOX

14. STA. 0+30 (8" EFFL. LINE)
1–8" ELECTOMAGNETIC FLOWMETER (KROHNE WATERFLUX 3070C WITH FLEXPOWER, OR APPROVED EQUAL) 1 C-13
1–METER BOX
SEE DETAIL
1–8" FLANGE COUPLING ADAPTER (EBAA MEGA–FLANGE SERIES 2108, OR APPROVED EQUAL)
1–8" D.I. SOLID BODY SLEEVE, M.J.
1–8" D.I. PIPE ADAPTER, F.E.xP.E., 5'–0" LONG

15. STA. 0+42 (8" EFFL. LINE)
1–8" 90° D.I. BEND, M.J.
1–CONC. BLOCK

16. STA. 1+11 (8" EFFL. LINE)
1–8" 90° D.I. BEND, M.J.
1–CONC. BLOCK

STA. 1+79 (8" EFFL. LINE)=
17. STA. 0+00 (4"INTERCONNECTION LINE)
BEGIN 4" INTERCONNECTION LINE.
FOR PROFILE, SEE SHEET C-7
1–8"x4" D.I. TEE, M.J.
3–8" G.V., M.J., 250#
3–VALVE BOX
1–CONC. BLOCK

18. STA. 1+90 (8" EFFL. LINE)
END OF 8" EFFLUENT LINE
1–8" D.I. CAP WITH 2" CLEANOUT
1–CLEANOUT BOX
1–CONC. BLOCK

19. STA. 0+46± (4" INTERCONN. LINE)
END OF 4" INTERCONNECTION LINE.
1–4"x4" D.I. TEE, M.J., WITH MEGALUGS
1–4" D.I. SOLID BODY SLEEVE, M.J., WITH MEGALUGS
2–4" G.V., M.J., 250#, WITH MEGALUGS
2–VALVE BOXES
2–4" TRANSITION COUPLINGS (ROMAC MACRO HP, OR APPROVED EQUAL)
1–CONC. BLOCK WITH STRUCT. STRUTS NECESSARY 4" D.I. NIPPLES FOR SCHEMATIC CONNECTION, SEE DETAIL 1 C-16

20. STA. 0+00 (12" OVERFLOW LINE)
BEGIN RESERVOIR OVERFLOW LINE.
1–12" D.I. SOLID BODY SLEEVE, M.J.
NECESSARY 12" D.I. NIPPLE
FOR PROFILE, SEE SHEET C-8

21. STA. 0+06 (12" OVERFLOW LINE)
1–12" 45° D.I. BEND, M.J.
1–CONC. BLOCK

STA. 0+12.83 (12" OVERFLOW LINE)=
22. STA. 0+10 (12" WASHOUT LINE)
END OF 12" OVERFLOW LINE.
1–12"x12" D.I. WYE, M.J.
1–CONC. BLOCK

23. STA. 0+00 (12" WASHOUT LINE)
BEGIN RESERVOIR WASHOUT LINE.
1–12" D.I. SOLID BODY SLEEVE, M.J.
NECESSARY 12" D.I. NIPPLE
FOR PROFILE, SEE SHEET C-8

24. STA. 0+05 (12" WASHOUT LINE)
1–12" BFV, M.J., 250#
1–VALVE BOX

25. STA. 0+40 (12" WASHOUT LINE)
1–12" 45° D.I. BEND, M.J.
1–CONC. BLOCK

26. STA. 0+55 (12" WASHOUT LINE)
END OF 12" WASHOUT LINE.
PENETRATE WALL OF DRAIN SUMP
1–12" D.I. NIPPLE, 4'–0" LONG
1–12" D.I. SOLID BODY SLEEVE, M.J.
1–12" CHECK VALVE (TIDEFLEX TF–1, OR APPROVED EQUAL)

27. STA. 0+00 (6" PERIMETER DRAIN)
BEGIN 6" PVC PERIMETER DRAIN
HIGH POINT – PIPE INV. ELEV.=872.20
PROVIDE 4" OBSERVATION PORT 3 C-15
SEE DETAIL
FOR PROFILE, SEE SHEET C-8

28. STA. 0+34.55 (6" PERIMETER DRAIN)
PIPE INV. ELEV.=871.90
PROVIDE 4" OBSERVATION PORT 3 C-15
SEE DETAIL

STA. 0+69.11 (6" PERIMETER DRAIN)=
29. STA. 0+00 (6" DRAIN LINE "A")
BEGIN 6" PVC DRAIN LINE "A"
LOW POINT – PIPE INV. ELEV.=871.60
PROVIDE 4" OBSERVATION PORT 3 C-15
SEE DETAIL
1–6"x6" PVC TEE
FOR PROFILE, SEE SHEET C-8

30. STA. 1+03.66 (6" PERIMETER DRAIN)
PIPE INV. ELEV.=871.90
PROVIDE 4" OBSERVATION PORT 3 C-15
SEE DETAIL

31. STA. 1+38.21 (6" DRAIN LINE "A")
END OF 6" DRAIN LINE "A"
PENETRATE WALL OF DRAIN SUMP
1–6" D.I. PIPE NIPPLE, 4'–0" LONG
1–6" D.I. SOLID BODY SLEEVE, M.J.
1–6" CHECK VALVE (TIDEFLEX TF–1, OR APPROVED EQUAL)

32. 1" WATER SUPPLY LINE TO FILLING STATION
1–¾" WATER METER
1–TYPE B METER BOX AND COVER

33. 1" WATER SUPPLY LINE TO FILLING STATION
1–1" RPP BACKFLOW PREVENTER (WATTS SERIES 909QTS, OR APPROVED EQUAL)

34. 1" WATER SUPPLY LINE TO FILLING STATION
SMALL SPIGOT
SEE DETAIL 6 C-13

35. WATER SAMPLING STATION (INFLUENT)
SEE DETAIL 2 C-15

36. RESERVOIR LEVEL TRANSMITTER
SEE DETAIL 5 C-14

37. WATER SAMPLING STATION (EFFLUENT)
SEE DETAIL 2 C-15

38. PILOT CONTROL LINES
2 – ¾" POLYETHYLENE TUBING AND 2 – SPARE ¾" POLYETHYLENE TUBING WITHIN 2½" DIAMETER PVC SCH. 40 CONDUIT. FROM 4" RESERVOIR INFLUENT CONTROL VALVE TO CF–1 FLOAT CONTROL IN RESERVOIR. PROVIDE 18" MINIMUM COVER OVER CONDUIT. 1

GRAPHIC SCALE:
SCALE: 1" = 10'
10' 5' 0 10' 20'

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM 2	TN	

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

0.10 – M.G. RESERVOIR SITE & WATER FILLING STATION FACILITY PIPING PLAN

PAUL T. MATSUDA LICENSED PROFESSIONAL ENGINEER No. 10901–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. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16–115–2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DWG. NO. C-5
SHEET 7 OF 54

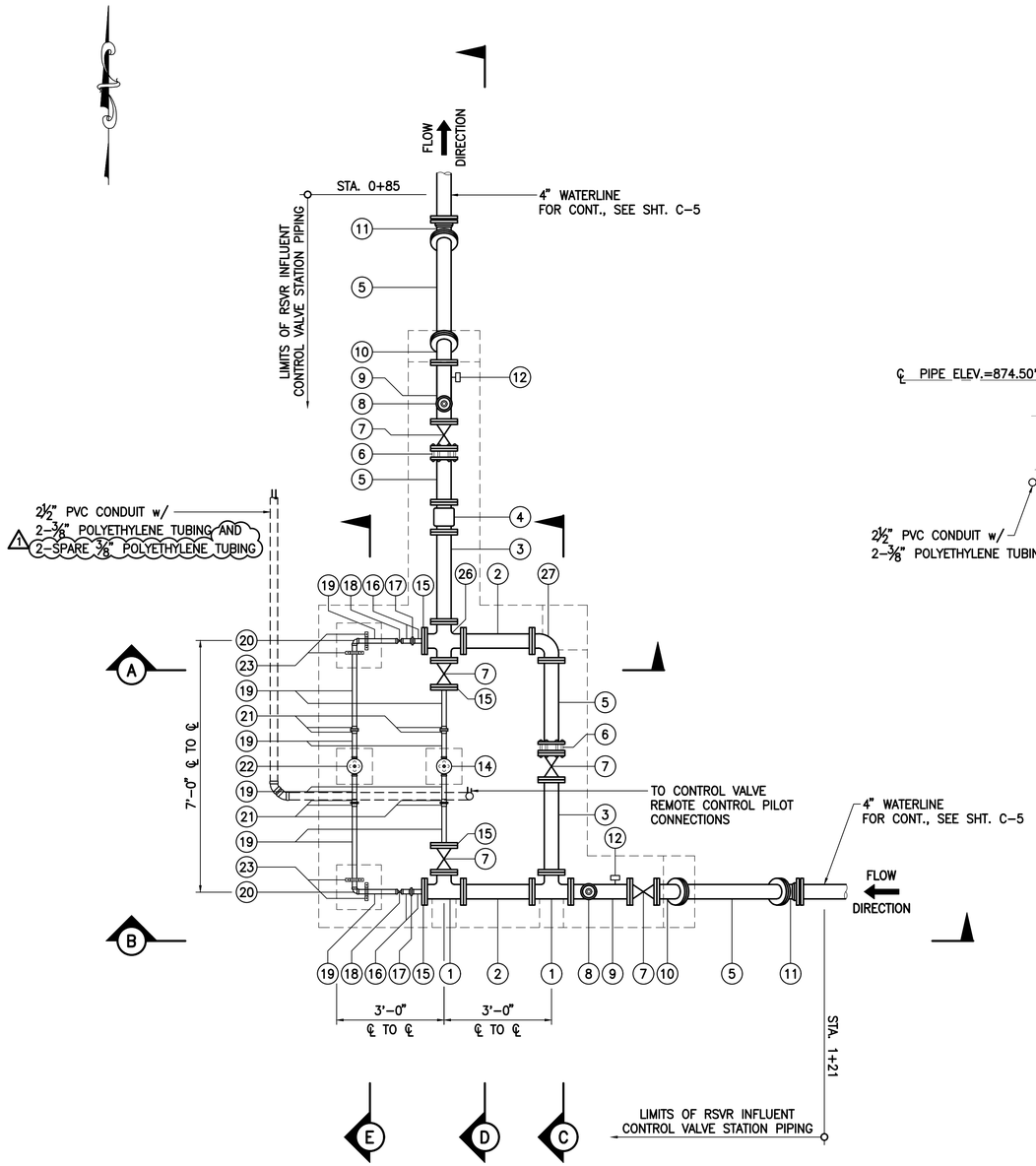
DESIGNED BY: TN CHECKED BY: TN DRAWN BY: SLP

G70 111 S. KING STREET, SUITE 170 HONOLULU, HAWAII 96813 808.523.5866 WWW.G70.DESIGN

FEBRUARY 2020

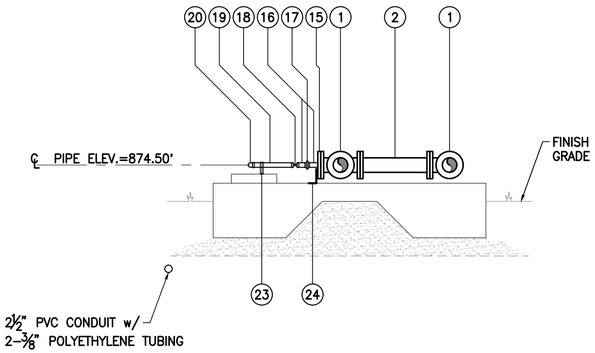
FILE | POCKET | FOLDER | NO.

O:\G70PROJ\2019\219-054 DHHL KAU WATER SYSTEM IMPROVEMENTS\CADD\COVID-19\SHEETS\ADDENDUM-2\SHEETS\SHT-SITE-PIPING-ADDENDUM-2.DWG



RESERVOIR INFLUENT CONTROL VALVE STATION PIPE ARRANGEMENT PLAN

SCALE: ½"=1'-0"



SECTION - A

SCALE: ½"=1'-0"

GRAPHIC SCALE:

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

2' 1' 6" 0 1 2 3 4

MATERIAL LIST

ITEM	DESCRIPTION
1	4"x4" D.I. TEE, F.E.
2	4" D.I. SPOOL, F.E.xF.E., 23" LONG
3	4" D.I. SPOOL, F.E.xF.E., 30" LONG
4	4" ELECTROMAGNETIC FLOWMETER KROHNE WATERFLUX 3070C WITH FLEXPOWER, OR APPROVED EQUAL.
5	4" D.I. ADAPTER, F.E.xP.E., CUT TO FIT
6	4" FLANGE COUPLING ADAPTER, ROMAC STYLE FCA501, WITH STAINLESS STEEL BOLTS, NUTS, AND ANCHOR PINS
7	4" GATE VALVE, CLASS 200, F.E., OS & Y, WITH HAND WHEEL
8	1" COMBINATION AIR VALVE ASSEMBLY, SEE DETAIL 2/C-16
9	4" D.I. SPOOL, F.E.xF.E., 20" LONG
10	4" 45° D.I. BEND, F.E.
11	4" 45° D.I. BEND, M.J., WITH MEGALUGS
12	PRESSURE GAGE ASSEMBLY, SEE DETAIL 4/C-16
13	4" D.I. SPOOL, F.E.xF.E., 19" LONG
14	1½" COMBINATION PRESSURE RELIEF AND REMOTE CONTROL VALVE, F.E., CLA-VAL MODEL NO. 56G-03KC WITH X101 VALVE POSITION INDICATOR, KO ANTI-CAVITATION TRIM, AND CF1-C1 FLOAT CONTROL. CRL RANGE: 20-200 PSI
15	4" BLIND FLANGE WITH 1½" NPT TAP
16	1½" BRASS NIPPLE, SCH. 40
17	1½" BRONZE UNION, S.E.
18	1½" BRASS BALL VALVE, S.E.
19	1½" BRASS PIPE, SCH. 40
20	1½" 90° BRASS ELBOW, S.E.
21	1½" FORD LOK-PAK METER COUPLING, CAT. NO. CF35-66, WITH STAINLESS STEEL BOLTS
22	1½" PRESSURE RELIEF VALVE, S.E., CLA-VAL MODEL NO. 50G-01 KC WITH X 101 VALVE POSITION INDICATOR AND KO ANTI-CAVITATION TRIM CRL RANGE : 20-200 PSI
23	STAINLESS STEEL PIPE STRAP FOR 1½" BRASS PIPE, SEE DETAIL 3/C-13
24	HOLD DOWN CLIP, SEE DETAIL 2/C-13
25	4"x4"x4"x4" D.I. CROSS, F.E.
26	4" 90° D.I. BEND, F.E.

NOTE:
1. ALL FLANGES SHALL BE ANSI B16.1, CLASS 125 UNLESS OTHERWISE NOTED.
2. ALL PIPE SUPPORT ASSEMBLES SHALL BE STAINLESS STEEL.
3. NUTS AND BOLTS SHALL BE STAINLESS STEEL.
4. PROVIDE FELT PAPER BETWEEN STAINLESS STEEL PIPE STRAP AND PIPE.
5. ALL CLAYTON VALVES SHALL BE EPOXY COATED INTERNALLY.

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM 2	TN	

PAUL T. MATSUDA
LICENSED PROFESSIONAL ENGINEER
No. 10901-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. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

RESERVOIR INFLUENT CONTROL VALVE STATION PIPE ARRANGEMENT PLAN, SECTION & MATERIAL LIST

DESIGNED BY: TN CHECKED BY: TN DRAWN BY: SLP

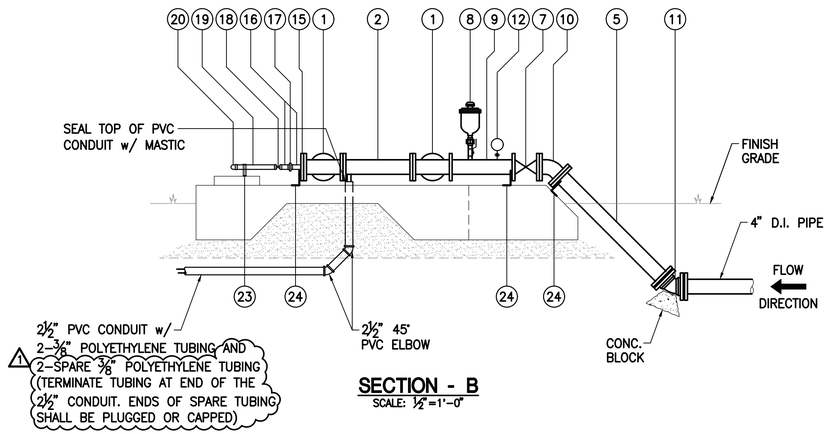
G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

FEBRUARY 2020

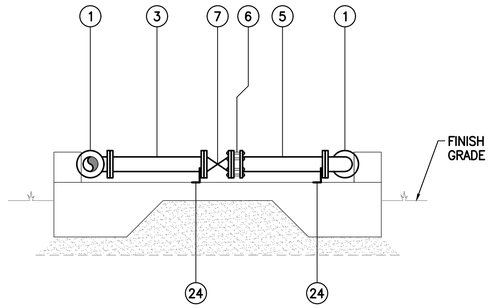
DWG. NO. C-9
SHEET 11 OF 54

FILE | POCKET | FOLDER | NO.

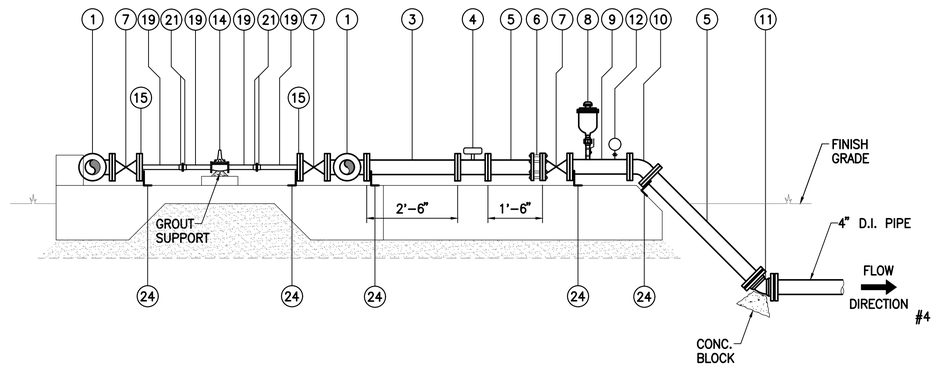
D:\GPROJ\2019\219-054 DHHL KAU WATER SYSTEM IMPROVEMENTS\CADD\COVID-19\SHEETS\ADDENDUM-2\SHEETS\SHT-14-1-ADDENDUM-2.DWG



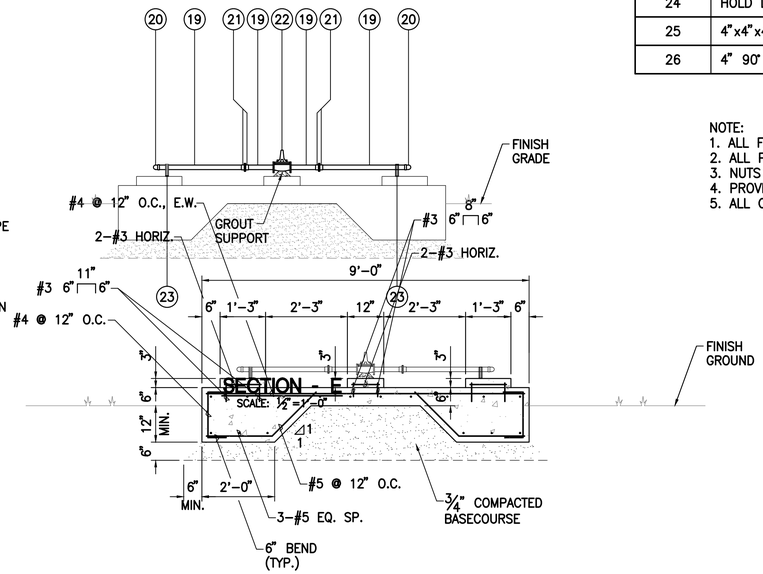
SECTION - B
SCALE: ½"=1'-0"



SECTION - C
SCALE: ½"=1'-0"



SECTION - D
SCALE: ½"=1'-0"



SECTION - E
SCALE: ½"=1'-0"

GRAPHIC SCALE:

SCALE: 1/2" = 1'-0"
2' 1' 6" 0 1 2 3 4

	MATERIAL LIST
ITEM	DESCRIPTION
1	4"x4" D.I. TEE, F.E.
2	4" D.I. SPOOL, F.E.xF.E., 23" LONG
3	4" D.I. SPOOL, F.E.xF.E., 30" LONG
4	4" ELECTROMAGNETIC FLOWMETER KROHNE WATERFLUX 3070C WITH FLEXPOWER, OR APPROVED EQUAL.
5	4" D.I. ADAPTER, F.E.xP.E., CUT TO FIT
6	4" FLANGE COUPLING ADAPTER, ROMAC STYLE FCA501, WITH STAINLESS STEEL BOLTS, NUTS, AND ANCHOR PINS
7	4" GATE VALVE, CLASS 200, F.E., OS & Y, WITH HAND WHEEL
8	1" COMBINATION AIR VALVE ASSEMBLY, SEE DETAIL 2/C-16
9	4" D.I. SPOOL, F.E.xF.E., 20" LONG
10	4" 45° D.I. BEND, F.E.
11	4" 45° D.I. BEND, M.J., WITH MEGALUGS
12	PRESSURE GAGE ASSEMBLY, SEE DETAIL 4/C-16
13	4" D.I. SPOOL, F.E.xF.E., 19" LONG
14	1½" COMBINATION PRESSURE RELIEF AND REMOTE CONTROL VALVE, F.E., CLA-VAL MODEL NO. 56G-03KC WITH X101 VALVE POSITION INDICATOR, KO ANTI-CAVITATION TRIM, AND CF1-C1 FLOAT CONTROL. CRL RANGE: 20-200 PSI
15	4" BLIND FLANGE WITH 1½" NPT TAP
16	1½" BRASS NIPPLE, SCH. 40
17	1½" BRONZE UNION, S.E.
18	1½" BRASS BALL VALVE, S.E.
19	1½" BRASS PIPE, SCH. 40
20	1½" 90° BRASS ELBOW, S.E.
21	1½" FORD LOK-PAK METER COUPLING, CAT. NO. CF35-66, WITH STAINLESS STEEL BOLTS
22	1½" PRESSURE RELIEF VALVE, S.E., CLA-VAL MODEL NO. 50G-01 KC WITH X 101 VALVE POSITION INDICATOR AND KO ANTI-CAVITATION TRIM CRL RANGE : 20-200 PSI
23	STAINLESS STEEL PIPE STRAP FOR 1½" BRASS PIPE, SEE DETAIL 3/C-13
24	HOLD DOWN CLIP, SEE DETAIL 2/C-13
25	4"x4"x4"x4" D.I. CROSS, F.E.
26	4" 90° D.I. BEND, F.E.

NOTE:
1. ALL FLANGES SHALL BE ANSI B16.1, CLASS 125 UNLESS OTHERWISE NOTED.
2. ALL PIPE SUPPORT ASSEMBLES SHALL BE STAINLESS STEEL.
3. NUTS AND BOLTS SHALL BE STAINLESS STEEL.
4. PROVIDE FELT PAPER BETWEEN STAINLESS STEEL PIPE STRAP AND PIPE.
5. ALL CLAYTON VALVES SHALL BE EPOXY COATED INTERNALLY.

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM 2	TN	

PAUL T. MATSUDA
LICENSED PROFESSIONAL ENGINEER
No. 10901-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. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

RESERVOIR INFLUENT CONTROL VALVE STATION
SECTIONS & MATERIAL LIST

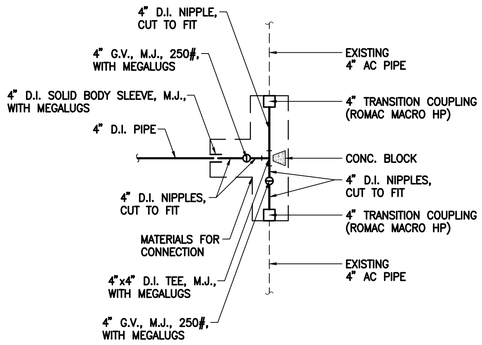
DESIGNED BY: TN CHECKED BY: TN DRAWN BY: SLP

G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

FEBRUARY 2020

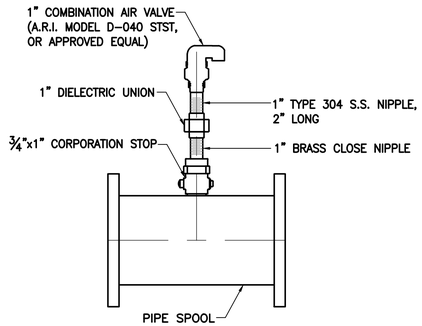
DWG. NO. C-10
SHEET 12 OF 54

FILE	POCKET	FOLDER	NO.

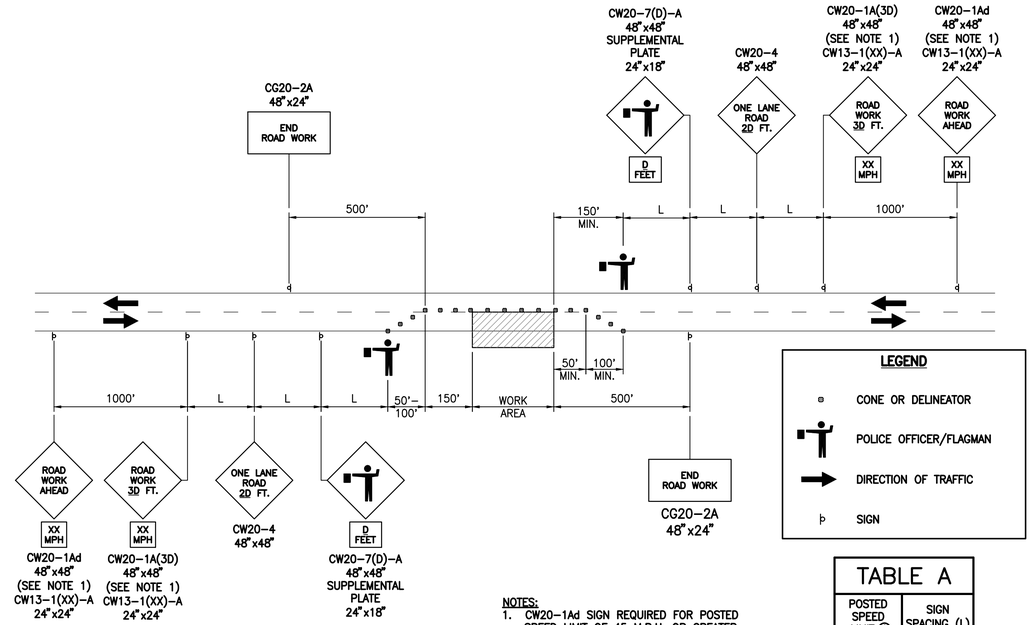


NOTE:
1. THE CONTRACTOR SHALL VERIFY LOCATION, OUTSIDE DIAMETER, AND INVERT ELEVATION OF THE EXISTING AC PIPE.
2. THE EXISTING AC PIPE CONTAINS ASBESTOS. REMOVAL AND DISPOSAL OF THE PIPE SHALL BE IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE, AND COUNTY RULES AND REGULATIONS. ONLY A QUALIFIED CONTRACTOR SHALL REMOVE AND DISPOSE OF THE AC PIPE.
3. DO NOT CUT EXISTING A.C. PIPE. FOR ALL PIPE CONNECTIONS AND WHERE PIPES ARE CALLED OUT TO BE CUT AND PLUG, THE EXISTING A.C. PIPE SHALL BE REMOVED AT ITS NEAREST JOINT.

1 C-16 CONNECTION SCHEMATIC DETAIL AT STA. 1+94+ (4" INFL. LINE) & STA. 0+46± (4" INTERCONN. LINE)
NOT TO SCALE



2 C-16 1" COMBINATION AIR VALVE ASSEMBLY DETAIL
NOT TO SCALE



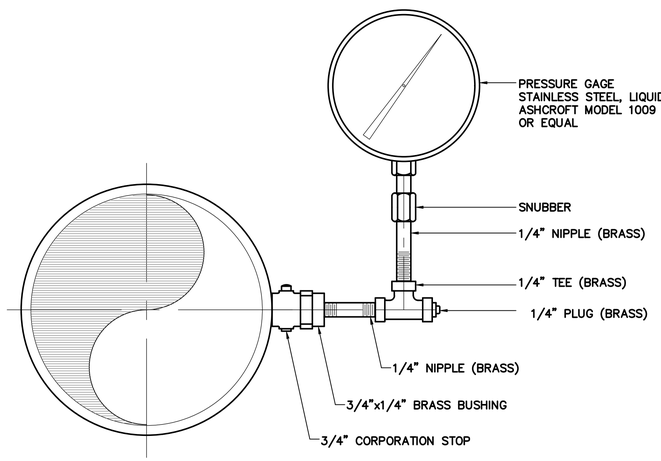
NOTES:
1. CW20-1Ad SIGN REQUIRED FOR POSTED SPEED LIMIT OF 45 M.P.H. OR GREATER.
2. ONE LANE ROAD (CW20-4) AND FLAGGER AHEAD (CW-20-7) SIGNS SHALL BE REMOVED OR COVERED WHEN NO WORK IS BEING PERFORMED AND LANE IS NOT CLOSED.
3. CONES OR DELINEATORS SHALL BE INSTALLED AT 10' O.C. MAX. SPACING
4. SIGN SPACING LENGTH (L) IS SHOWN IN "TABLE A"

TABLE A

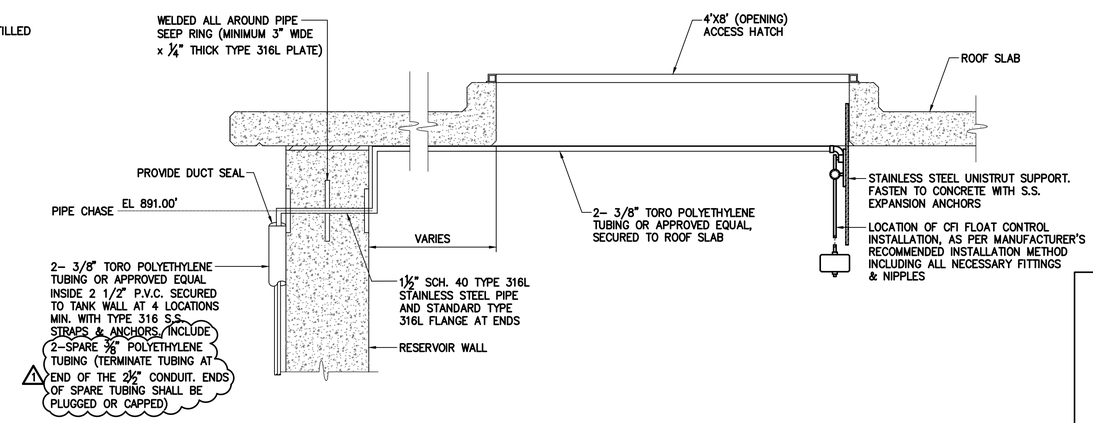
POSTED SPEED LIMIT ① (MPH)	SIGN SPACING (L) (FEET)
20	250
25	250
30	250
35	250
40	500
45	500
50	1000
55	1000

① USE ADVISORY SPEEDS WHEN POSTED

3 C-16 WORKING ON SHOULDER OR ROADSIDE (COUNTY) - TRAFFIC CONTROL PLAN
NOT TO SCALE



4 C-16 PRESSURE GAGE ASSEMBLY DETAIL
NOT TO SCALE



5 C-16 FLOAT CONTROL DETAIL
SCALE: ¾"=1'-0"

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM 2	TN	

PAUL T. MATSUDA LICENSED PROFESSIONAL ENGINEER No. 10901-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. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

TRAFFIC CONTROL PLAN & CIVIL DETAILS

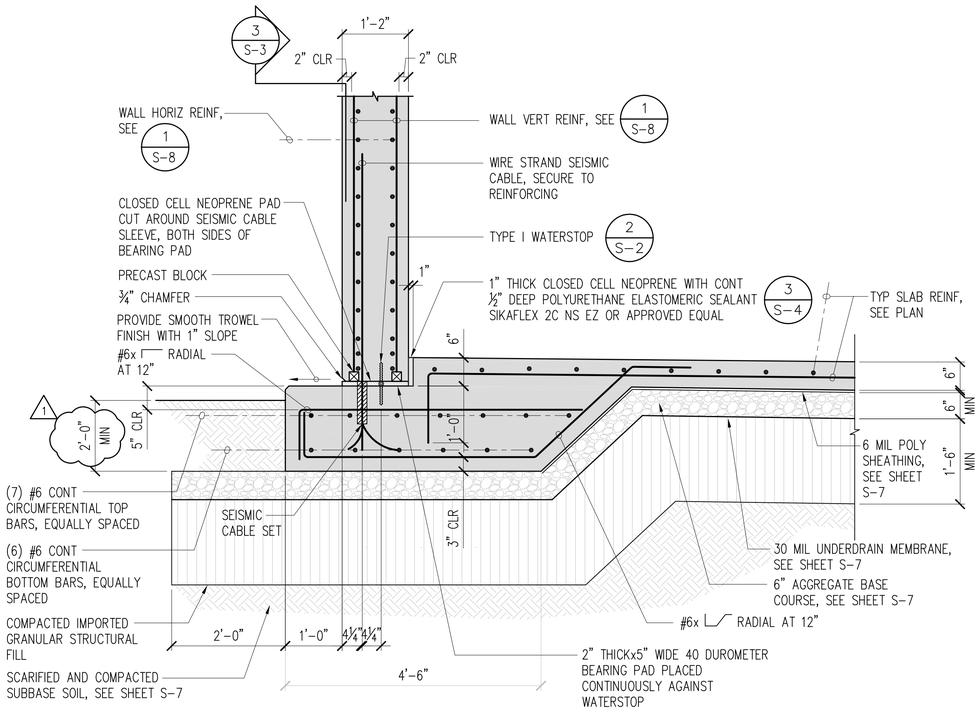
DESIGNED BY: TN CHECKED BY: TN DRAWN BY: SLP

GTO
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.GTO.DESIGN

FEBRUARY 2020

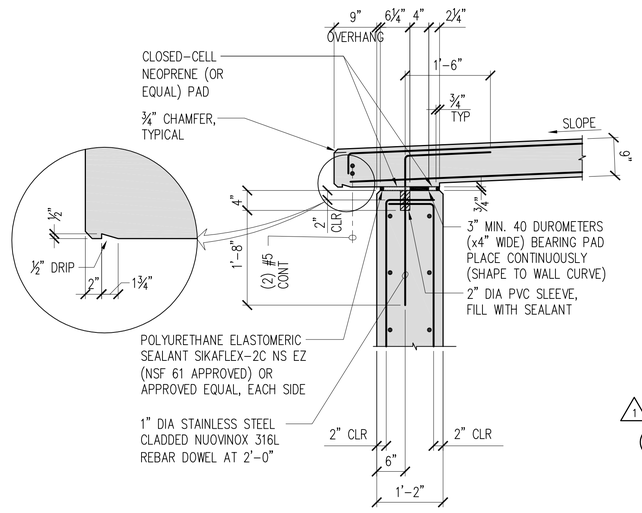
DWG. NO. C-16
SHEET 18 OF 54

FILE | POCKET | FOLDER | NO.



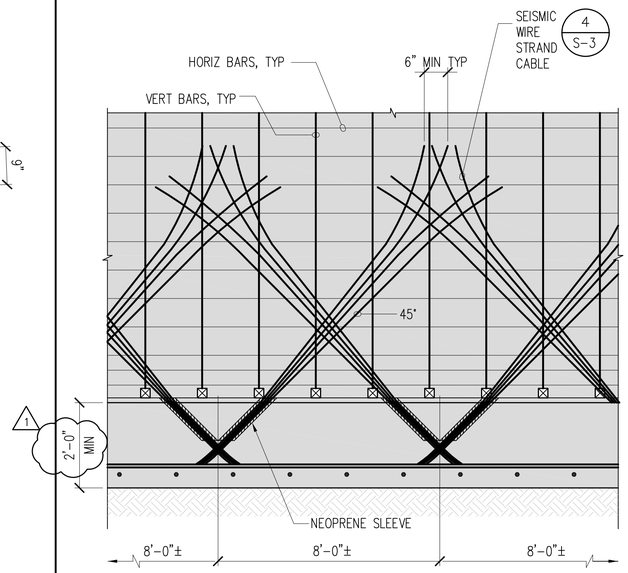
1 S-3 TYPICAL WALL FOOTING SECTION

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



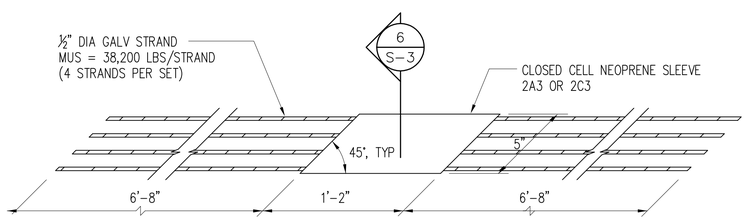
2 S-3 TYPICAL ROOF WALL JOINT

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



3 S-3 SEISMIC CABLE SPLAY

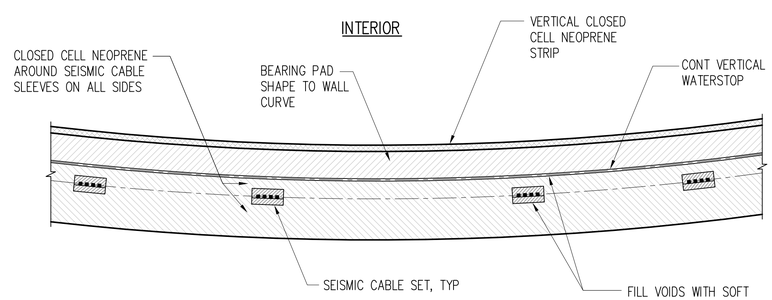
SCALE: 3/4" = 1'-0"



30 SETS TOTAL, PLACE 15 SETS IN EACH DIRECTION

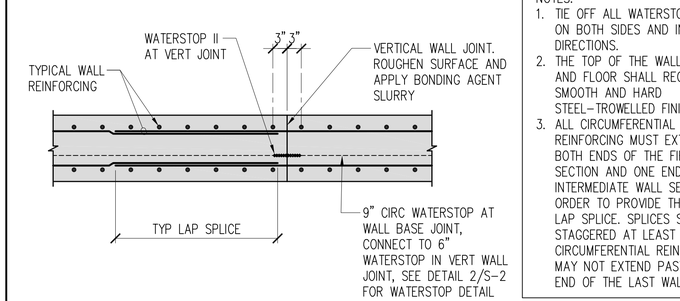
4 S-3 PLAN OF SEISMIC CABLE SET

NOT TO SCALE



5 S-3 WALL BASE JOINT PLAN VIEW

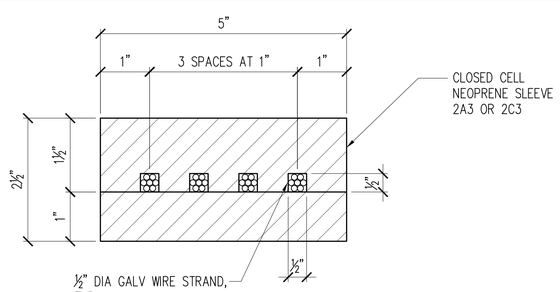
NOT TO SCALE



NOTES:
1. TIE OFF ALL WATERSTOPS AT 12" ON BOTH SIDES AND IN BOTH DIRECTIONS.
2. THE TOP OF THE WALL FOOTING AND FLOOR SHALL RECEIVE A SMOOTH AND HARD STEEL-TROWELLED FINISH.
3. ALL CIRCUMFERENTIAL REINFORCING MUST EXTEND PAST BOTH ENDS OF THE FIRST WALL SECTION AND ONE END OF ALL INTERMEDIATE WALL SECTIONS IN ORDER TO PROVIDE THE PROPER LAP SPLICE. SPLICES SHALL BE STAGGERED AT LEAST 2'-0". CIRCUMFERENTIAL REINFORCING MAY NOT EXTEND PAST EITHER END OF THE LAST WALL SECTION.

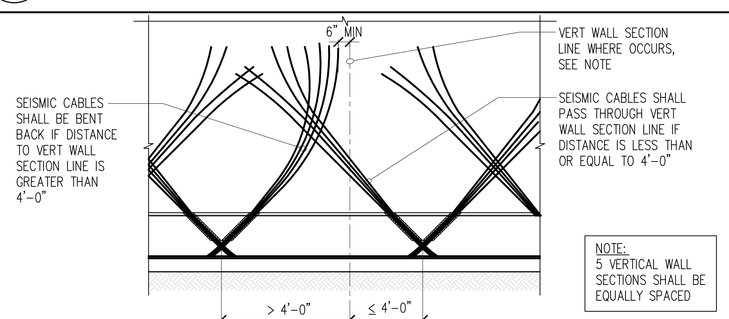
8 S-3 HORIZONTAL SECTION OF VERT WALL JOINT

NOT TO SCALE



6 S-3 SEISMIC CABLE SET SECTION

NOT TO SCALE



NOTE:
5 VERTICAL WALL SECTIONS SHALL BE EQUALLY SPACED

7 S-3 SEISMIC CABLE ELEVATION AT VERT WALL SECTION

NOT TO SCALE

0' 1' 2' 3' 4'

3/4" = 1'-0"

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM NO. 2	KAI	

JERRY S FUJITA
LICENSED PROFESSIONAL ENGINEER
No. 11573-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/04).

SIGNATURE
LICENSE EXPIRATION DATE: APRIL 30, 2022

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

RESERVOIR FOUNDATION SECTION AND DETAILS

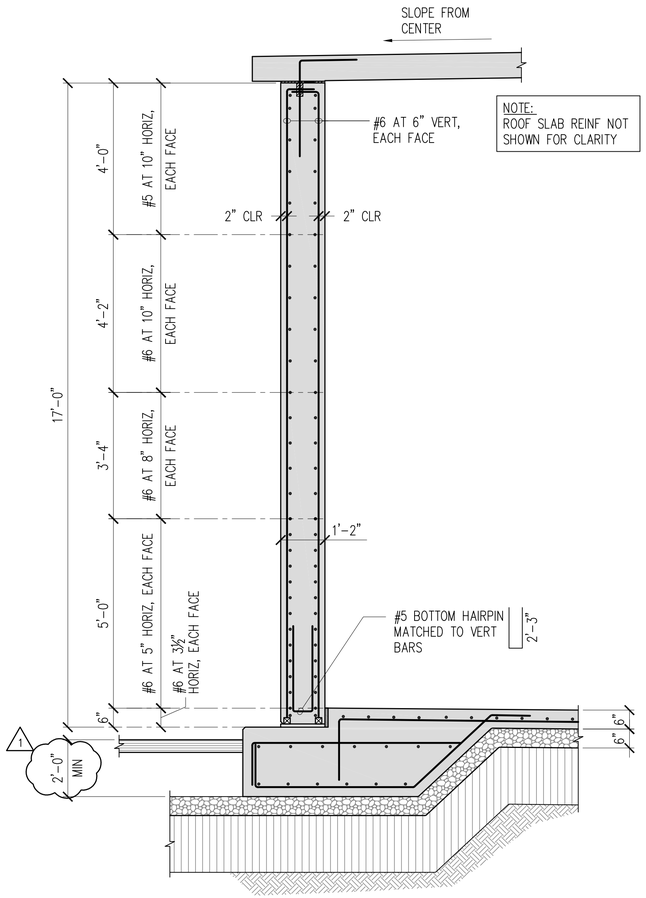
DESIGNED BY: DY CHECKED BY: JF DRAWN BY: CADD

G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

JANUARY 2020

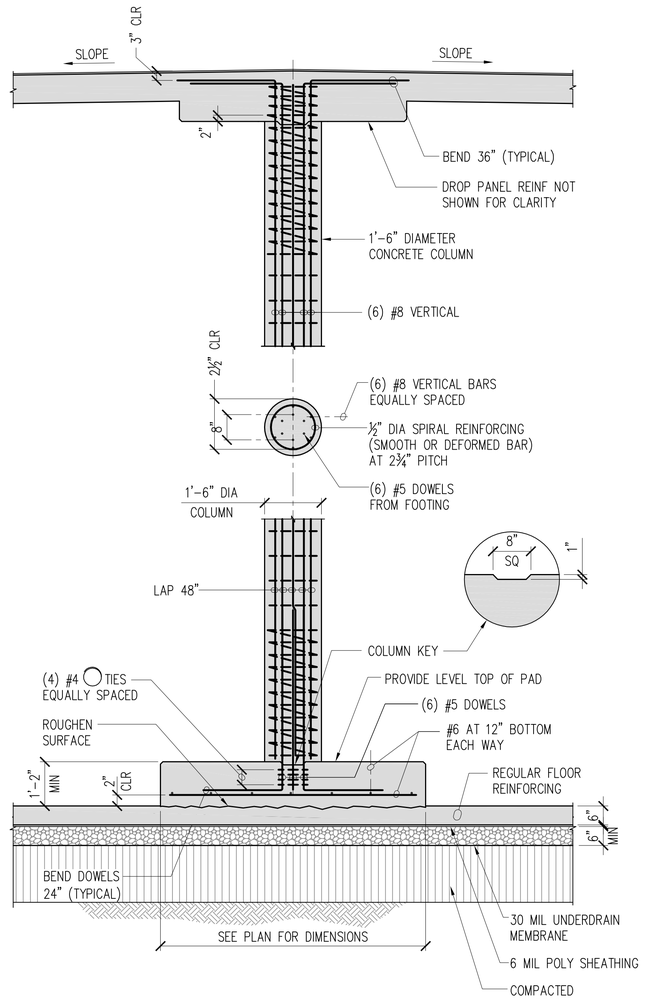
FILE	POCKET	FOLDER	NO.

DWG. NO.
S-3
SHEET 31 OF 52



1 S-8 REINFORCED CONCRETE RESERVOIR - TYPICAL WALL SECTION

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



2 S-8 COLUMN DETAIL

NOT TO SCALE

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM NO. 2	KAI	

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

RESERVOIR WALL AND COLUMN SECTION

JERRY S. FUJITA
LICENSED PROFESSIONAL ENGINEER
No. 11573-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXPIRATION DATE: APRIL 30, 2022

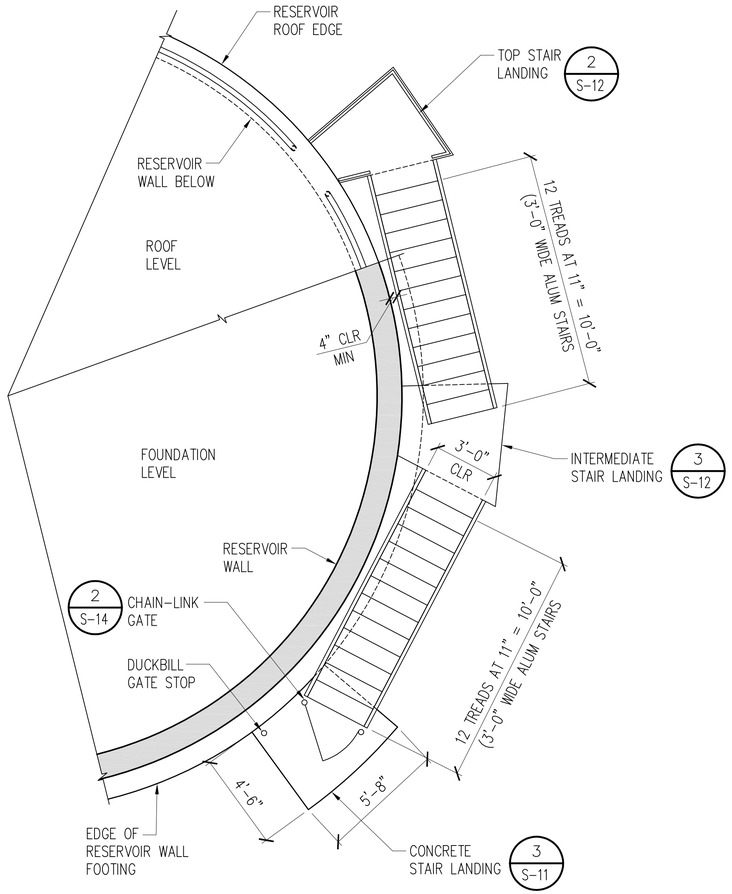
DESIGNED BY: DY CHECKED BY: JF DRAWN BY: CADD

G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

JANUARY 2020

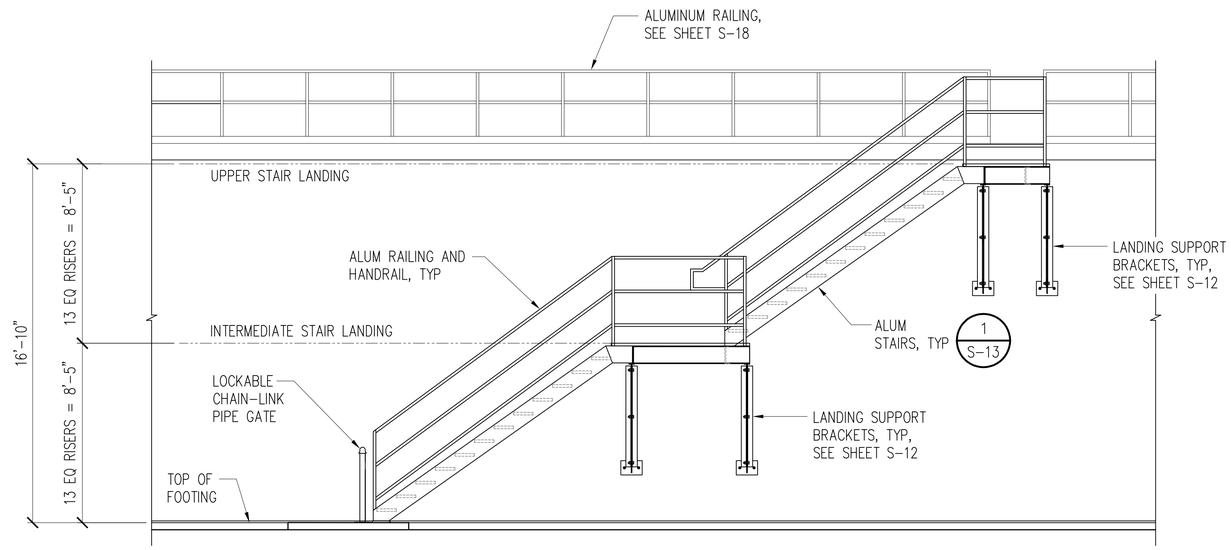
DWG. NO. S-8
SHEET 36 OF 52

FILE	POCKET	FOLDER	NO.



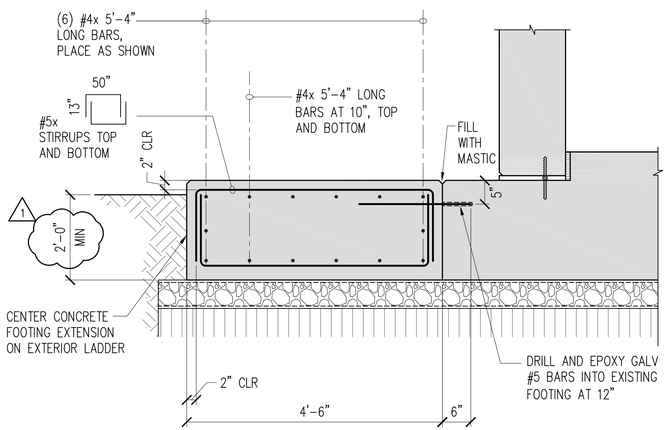
1 S-11 EXTERIOR STAIR AND LANDING PLAN

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



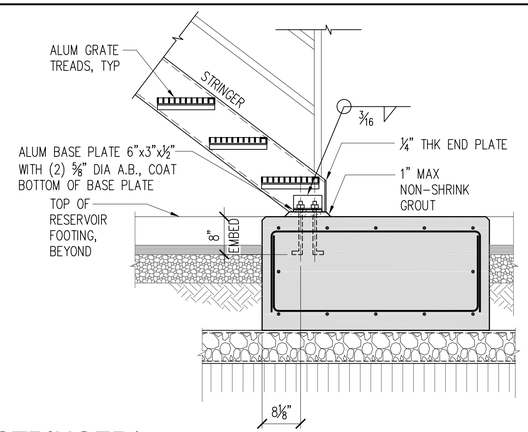
2 S-11 EXTERIOR STAIR ELEVATION

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



3 S-11 WALL FOOTING EXTENSION DETAIL

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



4 S-11 STRINGER/ STRINGERFOOTING CONNECTION

NOT TO SCALE

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM NO. 2	KAI	

JERRY S FUJITA
LICENSED PROFESSIONAL ENGINEER
No. 11573-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/04).

SIGNATURE
LICENSE EXPIRATION DATE: APRIL 30, 2022

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

RESERVOIR EXTERIOR STAIR PLAN AND DETAILS

DESIGNED BY: DY CHECKED BY: JF DRAWN BY: CADD

DWG. NO. S-11
SHEET 39 OF 52

G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

JANUARY 2020

FILE	POCKET	FOLDER	NO.

ELECTRICAL SYMBOLS

SYMBOL	DESCRIPTION
⊖	DUPLEX RECEPTACLE, NEMA 5-15R, 120V, MTD. +18" OR AS NOTED
⊖	DUPLEX RECEPTACLE, WITH GROUND FAULT CIRCUIT INTERRUPTER, NEMA 5-20R, 120V, MTD. +18" OR AS NOTED
	ELECTRICAL PANELBOARD
(J)	JUNCTION BOX, CEIL. MTD., 4-11/16" NOM.
(J)	JUNCTION BOX, WALL MTD., 4-11/16" NOM.
	JUNCTION BOX MTD. ON CHANNEL SUPPORT, SEE DETAIL 1/E-8
$a	LT. SW., 1P, CONTROLLING OUTLET(S) "a", MTD. +48" OR AS NOTED
(E)	EQUIPMENT CONNECTION
(PT)	PRESSURE TRANSMITTER CONNECTION
(LT)	LEVEL TRANSMITTER CONNECTION
(FM)	FLOW METER CONNECTION
(LS)	LIMIT SWITCH CONNECTION
(CV)	CONTROL VALVE CONNECTION
⊕	AREA LIGHT POLE
SPD	DENOTES "SURGE PROTECTIVE DEVICE"
WP	DENOTES "WEATHERPROOF"
SS	DENOTES "TYPE 316 STAINLESS STEEL"

SYMBOL	DESCRIPTION
	FLEXIBLE CONDUIT, LIQUIDTIGHT
	EXPOSED CONDUIT
	CONDUIT OR DUCTLINE BELOW REF. FL. OR GROUND
	CONDUIT CONCEALED ABOVE REF. FL., 3 WIRES WITH GROUND WIRE
	EXISTING UTILITY OVERHEAD LINES
	EXISTING DUCTLINE
A S 1-4E 1-1C	ELECTRIC/SIGNAL DUCTLINE WITH DESIGNATORS; ITEMS IN CIRCLE INDICATES DUCT SECTION TYPE, WITH DUCT COMPLEMENTS NOTED BELOW (TYPE "A" DUCT INDICATED WITH 1-4"E DUCT, AND TYPE "S" DUCT WITH 1-1"C DUCT; E=ELECTRIC, T=TELEPHONE, C=CONTROLS, I=INSTRUMENTATION, A=ANTENNA); SEE SHEET E-2 FOR DUCT SECTION DETAILS
	3'X5' HELCO CONCRETE HANDHOLE PER HELCO REQUIREMENTS AND APPROVAL
	2' X 4' HAWAIIAN TELCOM PULLBOX PER HAWAIIAN TELCOM REQUIREMENTS AND APPROVAL

NOTE:
NO HASH MARKS ON CONDUITS INDICATE 2 WIRES; ⫴ INDICATES 3 WIRES; ⫴ INDICATES 4 WIRES, ETC.

GENERAL CONSTRUCTION NOTES

1. CONTRACTOR SHALL COORDINATE ALL WORK WITH THE HAWAII ELECTRIC LIGHT COMPANY.
2. PROVIDE POLYOLEFIN 200LB TEST PULLCORD IN ALL EMPTY CONDUITS, UNLESS OTHERWISE NOTED.
3. ALL ELECTRICAL EQUIPMENT ENCLOSURES AND EQUIPMENT MOUNTING HARDWARE AND FASTENERS FOR OUTDOOR INSTALLATION SHALL BE TYPE 316 STAINLESS STEEL, UNLESS OTHERWISE NOTED.

HAWAIIAN TELCOM CONSTRUCTION NOTES

1. CONTRACTOR SHALL CONTACT HAWAIIAN TELCOM'S WEST HAWAII CONSTRUCTION ASSISTANT, AT LEAST 72 HOURS BEFORE INSPECTION IS REQUIRED.
2. ALL HAWAIIAN TELCOM DUCTS SHALL BE 2" PVC, MEETING SPECIFICATION GTS 8342. DUCTS PLACED UNDER BUILDING SLAB CAN BE SCHEDULE 40 PVC.
3. CONTRACTOR SHALL NOT PLACE ANY FOREIGN FACILITIES OVER THE TELEPHONE DUCTLINE SYSTEM.
4. AT RISER POLE OR AT BUILDING, DUCTS AND CONDUITS SHALL HAVE A MINIMUM RADIUS BEND OF 24 INCHES (SCHEDULE 40). TERMINATE THE DUCT 12" ABOVE GRADE AT THE RISER POLE. MINIMUM SWEEPS SHALL BE 25 FT. RADIUS, BOTH HORIZONTAL AND VERTICAL.
5. MAIN TELEPHONE CONDUIT SHALL ENTER THE TELEPHONE CABINET ON THE LEFT SIDE OF THE TELEPHONE CABINET.
6. A ROUND SOLID MANDREL, 12" LONG, AND 1/4" LESS THAN THE DIAMETER OF THE DUCT SHALL BE PULLED THROUGH EACH CONDUIT.
7. ALL HANDHOLES AND PULLBOXES SHALL BE PLACED IN AREAS THAT HAVE A SLOPE OF LESS THAN 10%.
8. ALL DUCTS, HANDHOLES AND PULLBOXES SHALL BE INSPECTED AND ACCEPTED BY HAWAIIAN TELCOM A MINIMUM OF 30 DAYS PRIOR TO REQUIRED SERVICE DATE.
9. ALL CONTRACTOR PLACED "INSIDE WIRE" SHALL BE LABELED WITH THE CIRCUIT NUMBER UTILIZING HELLMANN TYLON IMP 1.5 WHITE ID PLATE 3/4" X 1 1/2" (PRODUCT # IMP1.510M4) OR EQUIVALENT AND TERMINATED (BLUE/WHITE OR GREEN/RED PAIR) TO THE FIRST JACK WITHIN THE BUILDING.

DWG. NO.
E-1
SHEET 47 OF 54

RONALD N. S. HO & ASSOCIATES, INC.
ELECTRICAL ENGINEERS
BRYCE H. KANEMURA
LICENSED PROFESSIONAL ENGINEER
No. 16360-E
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE 2020.05.06
LICENSE EXP. DATE: APRIL 30, 2022

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM NO. 2	RHA	

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

ELECTRICAL SYMBOLS, GENERAL NOTES

DESIGNED BY: BHK CHECKED BY: BO DRAWN BY: BHK

G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

FEBRUARY 2020

FILE	POCKET	FOLDER	NO.

FILE PATH: Z:\ACAD\PROJECTS\219186\E001_219186-symbols.dwg CAD USER: BKanemura PLOT DATE: 2020.05.06 XREFS: | BHK-STAMP | _x219186-symbols |

DUCT SECTION BACKFILL NOTES:

TYPE "A" BACKFILL – EARTH & GRAVEL. ROCK SIZE TO BE 1" MAX. & THE MIXTURE TO CONTAIN NOT MORE THAN 50% BY VOLUME OF ROCK PARTICLES. 95% COMPACTION.

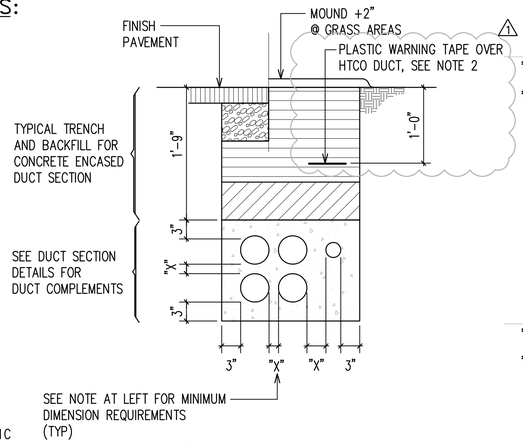
TYPE "B" BACKFILL – EARTH & GRAVEL. MIXTURE MUST PASS A 1/2" MESH SCREEN & CONTAIN NOT MORE THAN 20% BY VOLUME OF ROCK PARTICLES. 95% COMPACTION.

NOTE – IF NORMAL MATERIAL AT BOTTOM OF TRENCH IS NOT TYPE "B", AN ADDITIONAL 3" SHALL BE EXCAVATED & TYPE "B" BACKFILL PROVIDED.

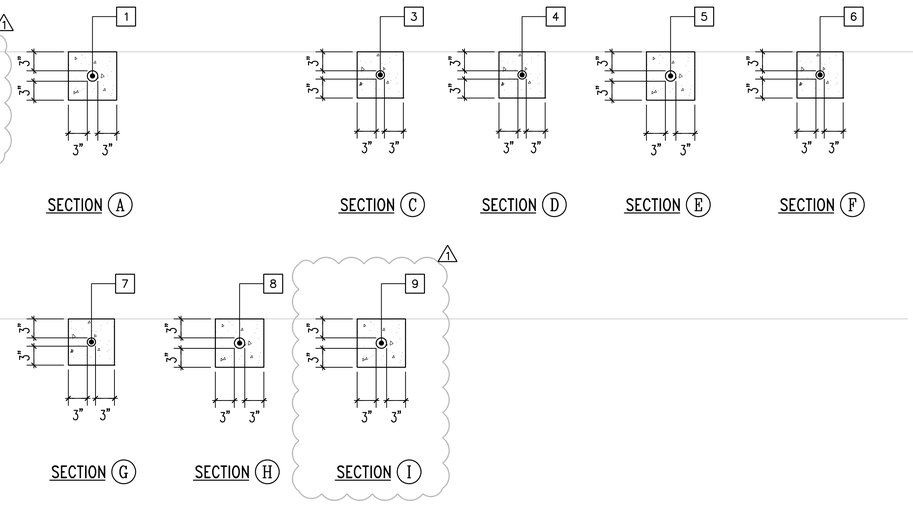
CONCRETE – 3" ENCASEMENT, 3000 psi COMPRESSIVE STRENGTH @ 28 DAYS.

DESIGNATION DESCRIPTIONS

ELEC = UTILITY CO. PRIMARY OR SECONDARY ELECTRIC
TEL = UTILITY CO. TELEPHONE
PWR = PRIMARY OR SECONDARY ELECTRIC
CTL = CONTROL
SIG = INSTRUMENTATION OR ANTENNA CABLE



TYPICAL DUCT SECTION



DUCT AND WIRE SCHEDULE

NO.	DUCT SIZE	WIRE SIZE	DESTINATION OR USE
1	2"	PC	HELCO SECONDARY
2			
3	1"	1-2/C#14 TWISTED, SHIELDED CABLES W/GND	INSTRUMENTATION FROM SCADA CABINET TO CONTROL VALVE STATION PRESSURE TRANSMITTER
4	1"	1-2/C#14 TWISTED, SHIELDED CABLES W/GND	INSTRUMENTATION FROM SCADA CABINET TO RESERVOIR LEVEL TRANSMITTER
5	2"	(2) FLOW METER CABLE	FLOW METER VAULT AND CONTROL VALVE STATION FLOW METER SIGNALS TO SCADA CABINET
6	1"	FLOW METER CABLE	FLOW METER VAULT SIGNAL TO SCADA CABINET
7	1"	2#12, 1#12 GND	120V POWER TO AREA LIGHT POLE
8	2"	ANTENNA CABLE	SCADA CABINET TO ANTENNA
9	2"	PC (SEE HTCO NOTE NO. 1)	TELEPHONE (CABLES BY HAWAIIAN TELCOM)
10			

NOTES:
1. ALL CONCRETE ENCASED DUCTS SHALL BE SCHEDULE 40 PVC.
2. PC INDICATES PROVIDE PULLCORD.

MINIMUM "X" DIMENSION
DUCT SEPARATION REQUIREMENTS

ELEC – ELEC = 1 1/2"

ELEC – TEL = 3"

TEL – TEL = 1 1/2"

ELEC – CTL/SIG = 3"

TEL – CTL/SIG = 1 1/2"

PWR – CTL/SIG = 3"

ELEC – PWR = 3"

TEL – PWR = 3"

PWR – PWR = 1 1/2"

CTL/SIG – CTL/SIG = 1 1/2"

MINIMUM OF 3" CONCRETE ENCASEMENT AROUND DUCTBANK

WHERE DUCTLINE CROSSES OVER WATER LINE, PROVIDE THE FOLLOWING:

1. 6" MINIMUM SEPARATION BETWEEN DUCTLINES AND WATER LINE.
2. PROVIDE CONCRETE JACKET AROUND DUCTLINES.
3. PROVIDE ONLY TYPE "B" BACKFILL AROUND WATER LINE.

HAWAIIAN TELCOM (HTCO) NOTES:

1. CONTRACTOR SHALL PLACE MULETAPE (WP 1800P) IN EACH DUCT THROUGHOUT ITS ENTIRE LENGTH WITH PROTRUSIONS OF 2 FEET IN MANHOLES AND HANDHOLES AT EACH END, AND 1 FOOT IN PULLBOXES. MULETAPE IS RATED FOR 1800 LB PULL AND HAS FOOTAGE MARKINGS FOR MEASURING DUCT LENGTHS.
2. CONTRACTOR SHALL PLACE 8-MIL ORANGE COLORED PLASTIC WARNING TAPE, NOT LESS THAN 4" WIDE, ENTIRE LENGTH OF TRENCH FOR ALL UNDERGROUND INSTALLATIONS. TAPE SHOULD READ "WARNING-STOP DIGGING-CALL HTCO, COMMUNICATIONS CABLE BURIED BELOW, FAILURE TO COMPLY COULD RESULT IN LEGAL ACTION".

DUCT SECTION DETAILS AND REQUIREMENTS

NOT TO SCALE

DWG. NO. **E-2**
SHEET 48 OF 54

RONALD N. S. HO & ASSOCIATES, INC.
ELECTRICAL ENGINEERS

BRYCE H. KANEMURA
LICENSED PROFESSIONAL ENGINEER
No. 16360-E
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE 2020.05.06
LICENSE EXP. DATE: APRIL 30, 2022

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM NO. 2	RHA	

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

DUCT SECTION DETAILS AND REQUIREMENTS

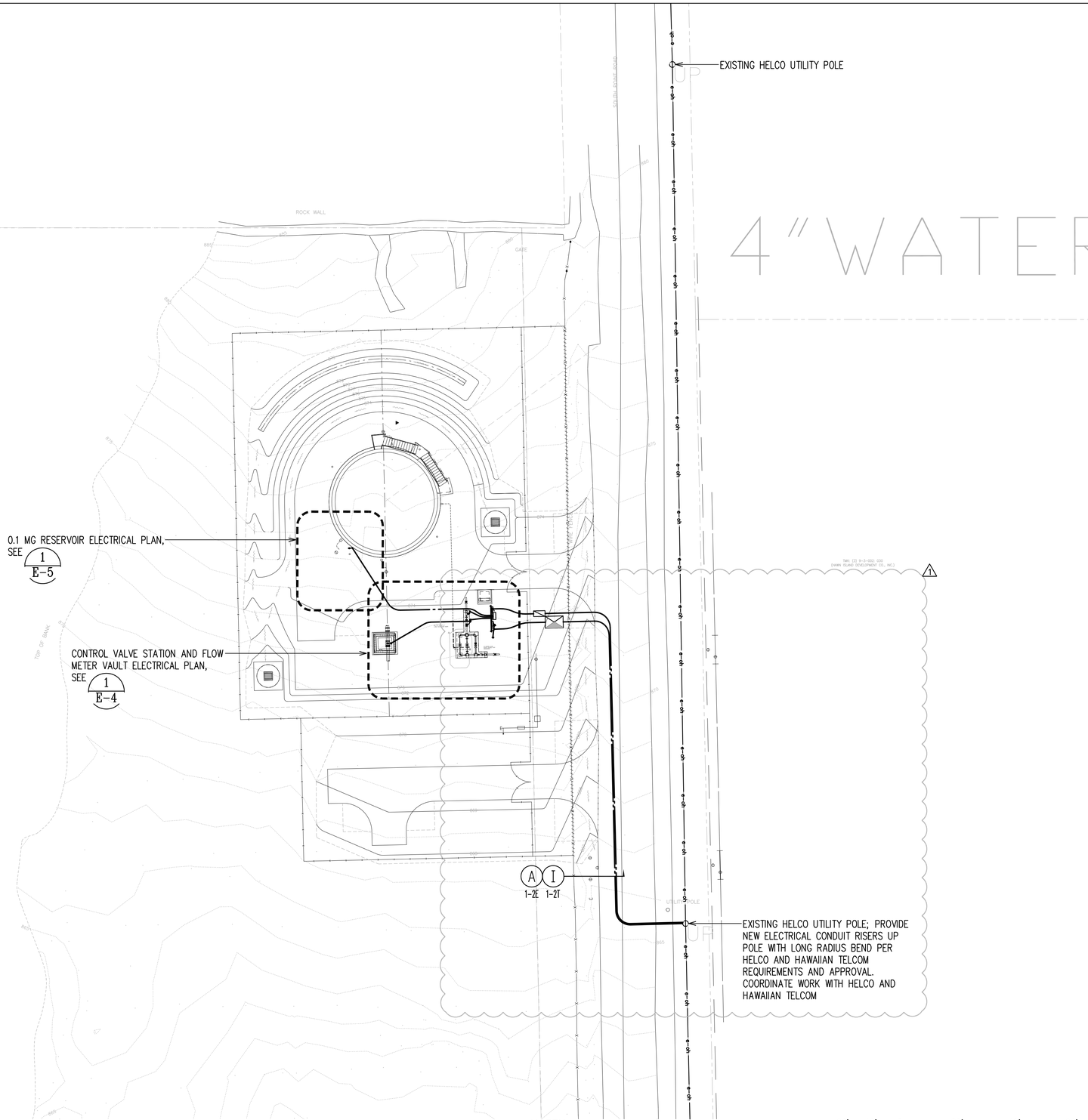
DESIGNED BY: BHK CHECKED BY: BO DRAWN BY: BHK

G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

FEBRUARY 2020

FILE	POCKET	FOLDER	NO.

FILE PATH: Z:\ACAD\PROJECTS\219186\E002_219186-duct sections.dwg CAD USER: BKonemura PLOT DATE: 2020.05.06 XREFS: | BHK-STAMP | _x219186-duct sections |



1 E-3 ELECTRICAL SITE PLAN
SCALE: 1"=20'

SCALE: 1"=20'
GRAPHIC SCALE
20' 10' 0 20' 40' 60'

DWG. NO. E-3
SHEET 49 OF 54

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM NO. 2	RHA	

RONALD N. S. HO & ASSOCIATES, INC.
ELECTRICAL ENGINEERS

BRYCE H. KANEMURA
LICENSED PROFESSIONAL ENGINEER
No. 16360-E
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE 2020.05.06
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

ELECTRICAL SITE PLAN

DESIGNED BY: BHK CHECKED BY: BO DRAWN BY: BHK

G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

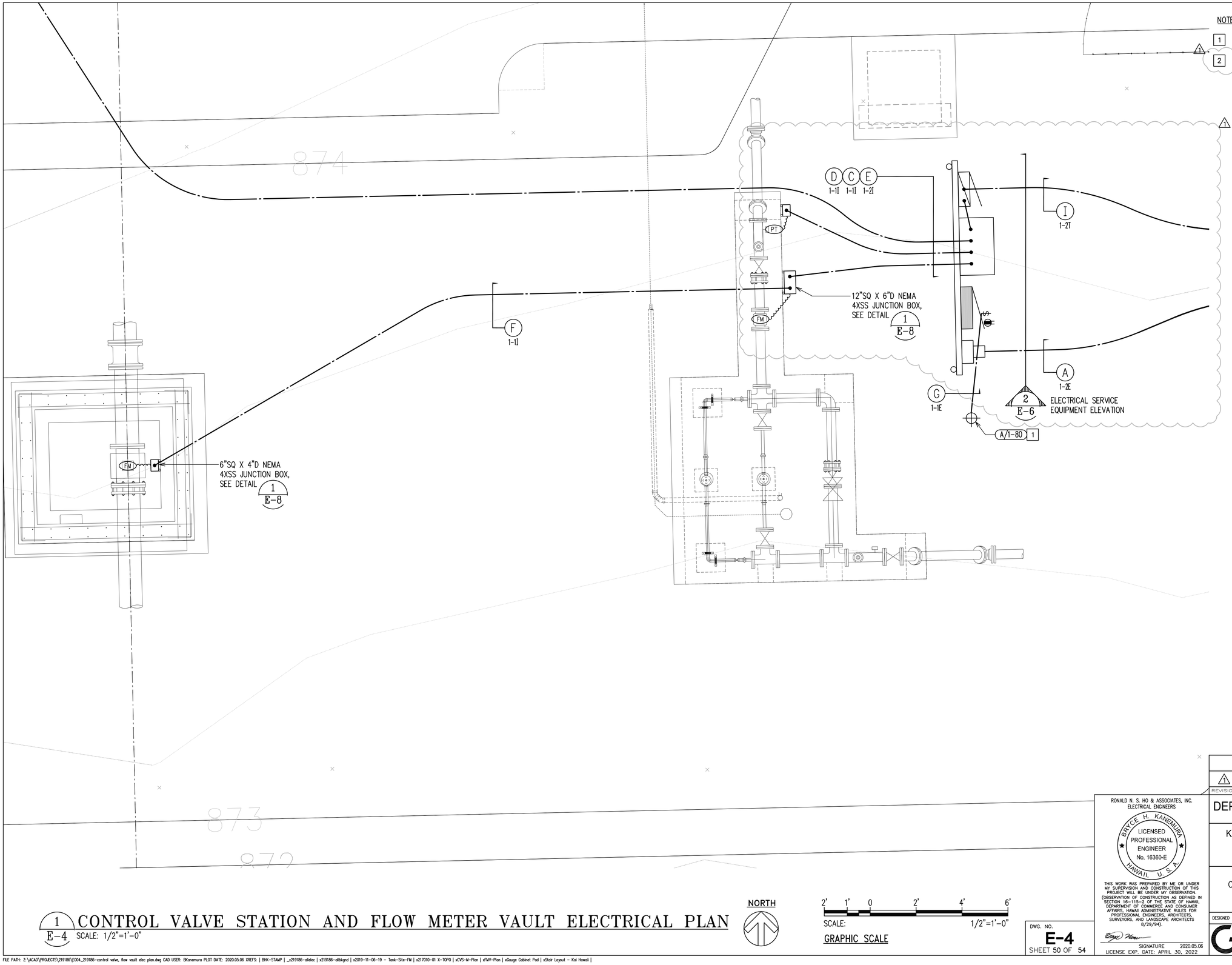
FEBRUARY 2020

FILE	POCKET	FOLDER	NO.

FILE PATH: Z:\ACAD\PROJECTS\219186\E003_219186-site plan.dwg CAD USER: BKanemura PLOT DATE: 2020.05.06 XREFS: | BHK-STAMP | _x219186-allelec | x219186-allbkgnd | x2019-11-06-19 - Tank-Site-FM | x2170110-01 X-TOPO | xCV5-M-Plan | xFMV-Plan | xGauge Cabinet Pad | xStair Layout - Kai Hawaii |

NOTES:

1. AREA LIGHT FIXTURE. SEE DETAIL 2/E-8.
2. NOT USED.



1 E-4 CONTROL VALVE STATION AND FLOW METER VAULT ELECTRICAL PLAN

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

NORTH

2' 1' 0 2' 4' 6'

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

GRAPHIC SCALE

DWG. NO. **E-4**

SHEET 50 OF 54

RONALD N. S. HO & ASSOCIATES, INC.
ELECTRICAL ENGINEERS

BRYCE H. KANEMURA
LICENSED PROFESSIONAL ENGINEER
No. 16360-E
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE 2020.05.06

LICENSE EXP. DATE: APRIL 30, 2022

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM NO. 2	RHA	

DEPARTMENT OF HAWAIIAN HOME LANDS

STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

CONTROL VALVE STATION AND FLOW METER VAULT
ELECTRICAL PLAN

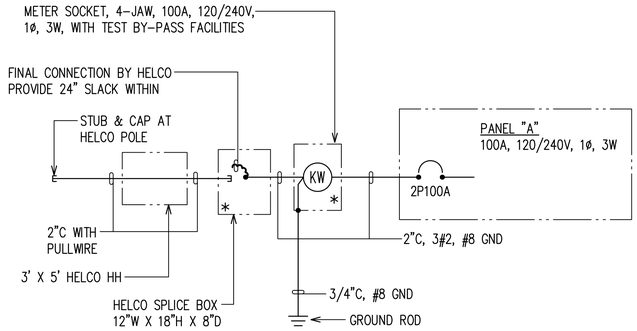
DESIGNED BY: BHK CHECKED BY: BO DRAWN BY: BHK

GTO
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

FEBRUARY 2020

FILE	POCKET	FOLDER	NO.

FILE PATH: Z:\ACAD\PROJECTS\219186\E004_219186-control valve, flow vault elec plan.dwg CAD USER: BKanemura PLOT DATE: 2020.05.06 XREFS: | BHK-STAMP | _x219186-afelec | x219186-altbkgnd | x2019-11-06-19 - Tank-Site-FM | x217010-01 X-TOPO | xCVS-M-Plan | xFMV-Plan | xGauge Cabinet Pad | xStair Layout - Kai Hawaii |



120/240V, 1ø SYSTEM SERVICE DATA:

1. SERVICE VOLTAGE: 120/240V, 1ø, 3W
2. LOAD DATA:
   CONNECTED: 2.3 KVA
   DEMAND: 1.6 KVA
3. SERVICE CONDUCTORS:
   1 SET: 3#2
4. METERING: HELCO STD. B-5; RATE G
5. TYPE: OVERHEAD/UNDERGROUND

NOTES: 1. * INDICATES PROVISION FOR HELCO SEALS AND OBTAIN HELCO APPROVALS

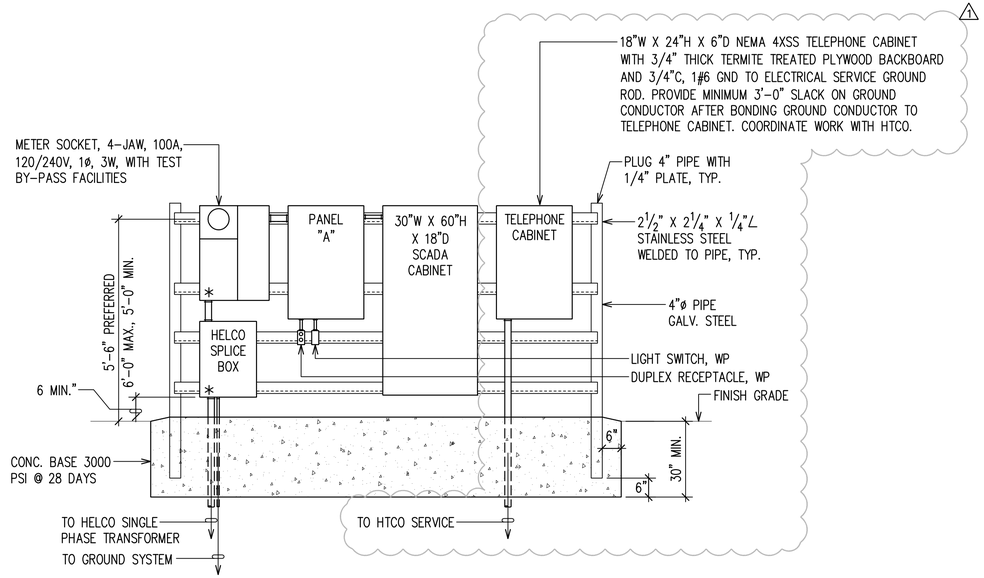
1/E-6 ONE-LINE DIAGRAM

NEW PANEL "A"	100 A MAIN BREAKER 240 / 120 VOLTS, 1-PHASE, 3-WIRE 10,000 A.I.C. MINIMUM INDUSTRIAL-BOLTED TYPE, WITH INTEGRAL SURGE PROTECTIVE DEVICE										
CKT. NO.	USE: L-LTS, R-RECEP, PFB-PROVISION FUTURE BKR., S-SPARE, F-FAN, W-WARMER	BREAKER POLE	BREAKER AMPS	WIRE SIZE	KVA ON BUSSES PHASE A	KVA ON BUSSES PHASE B	WIRE SIZE	BREAKER POLE	BREAKER AMPS	USE: L-LTS, R-RECEP, PFB-PROVISION FUTURE BKR., S-SPARE, F-FAN, W-WARMER	CKT. NO.
1	R	1	20	12	0.2					PFB	2
3	SCADA CABINET	1	20	12		0.5				PFB	4
5	GAUGE CABINET	1	20	12	0.5					PFB	6
7	L	1	20	12		0.1				PFB	8
9	S	1	20		0.5					SPD	10
11	S	1	20			0.5				-	12
	CONNECTED LOAD PER PHASE				1.2	1.1					
	DEMAND LOAD PER PHASE				0.8	0.8					

TOTAL CONNECTED LOAD (KVA)	2.3
DEMAND FACTOR	70%
TOTAL DEMAND LOAD (KVA)	1.6
HIGH LEG (AMPS)	7.0

LIGHT FIXTURE SCHEDULE

TYPE	LAMP/ WATTS	DESCRIPTION	MANUFACTURER OR PRE-APPROVED EQUAL
A	80W LED 3000'K 70 CRI	27" DIAMETER, CAST ALUMINUM HOUSING, SILICONE GASKETING, TYPE V DISTRIBUTION, FULL CUTOFF, STAINLESS STEEL HARDWARE, FIXED OUTPUT DRIVER 120, 5 YR, WARRANTY, UL LISTED, BRONZE FINISH, 48 LEDS, 530 MA, CONTROLLED VIA MANUAL LIGHT SWITCH	VISIONAIRE LIGHTING PRE-2-L SERIES, OR PRE-APPROVED EQUAL



NOTES:

1. "*" INDICATES PROVISION FOR HELCO SEALS.
2. OBTAIN HELCO SHOP DRAWING APPROVAL FOR PULLBOX AND METER SOCKETS.
3. ALL EQUIPMENT ENCLOSURES SHALL BE RATED NEMA 4XSS.
4. ALL SUPPORTS, FASTENING BOLTS, NUTS & WASHERS SHALL BE 316 STAINLESS STEEL.
5. GROUND AND BOND PER N.E.C.

2/E-6 ELECTRICAL SERVICE EQUIPMENT ELEVATION

NOT TO SCALE

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM NO. 2	RHA	

RONALD N. S. HO & ASSOCIATES, INC.
ELECTRICAL ENGINEERS
BRYCE H. KANEMURA
LICENSED PROFESSIONAL ENGINEER
No. 16360-E
HAWAII, U. S. A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE 2020.05.06
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

ONE-LINE DIAGRAM

DESIGNED BY: BHK CHECKED BY: BO DRAWN BY: BHK

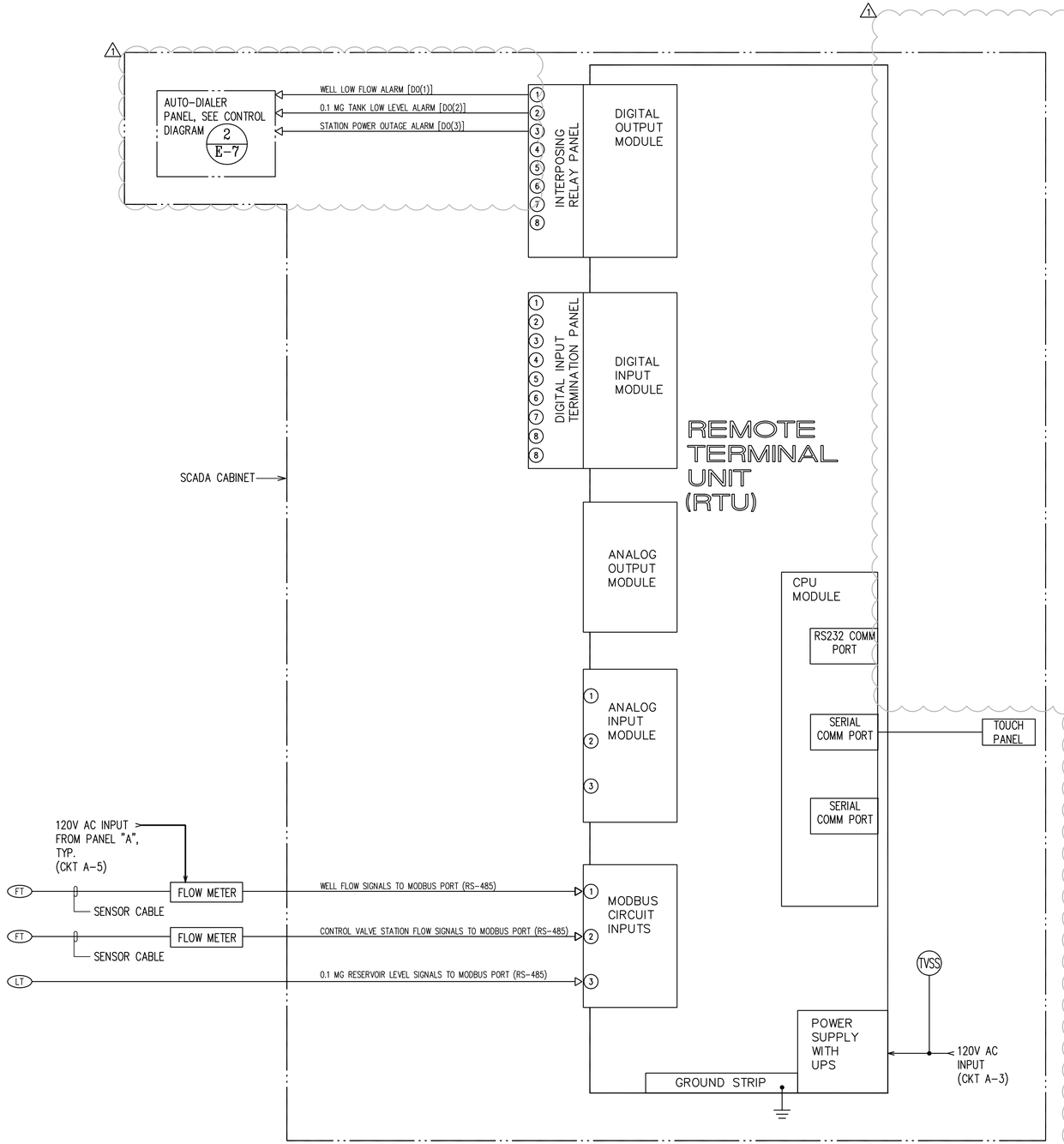
G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

FEBRUARY 2020

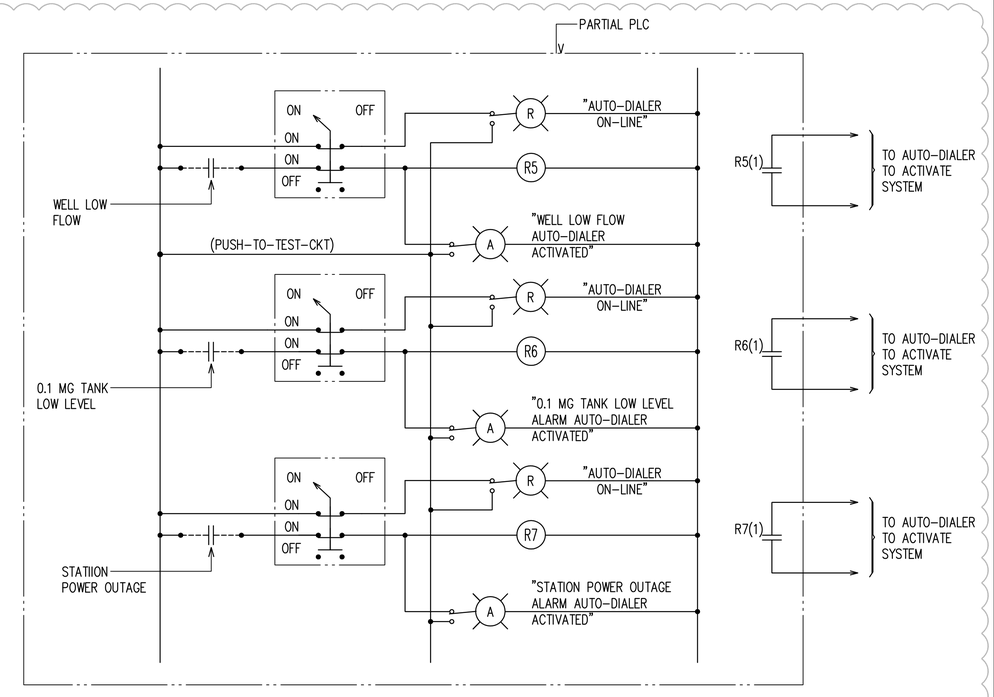
DWG. NO. E-6
SHEET 52 OF 54

FILE	POCKET	FOLDER	NO.

FILE PATH: Z:\ACAD\PROJECTS\219186\E006_219186-one line.dwg CAD USER: BKanemura PLOT DATE: 2020.05.06 XREFS: | BHK-STAMP | _x219186-one-line diagrams |



1 E-7 SCADA SYSTEM SCHEMATIC DIAGRAM



NOTE(S):

1. AUTO-DIALER ALARM CONTROL SYSTEM SHALL BE PART OF SCADA TOUCH PANEL.

2 E-7 AUTO-DIALER ALARM CONTROL DIAGRAM

REQUIRED MINIMUM SCADA INPUT POINTS AND MINIMUM PROVISIONS FOR ITEMS TO BE DISPLAYED / CONTROLLED ON TOUCH PANEL:

1. ENTIRE SITE OVERVIEW SCREEN THAT INCLUDES THIS STATION.
2. WELL PUMP STATION SITE SCREEN TO INCLUDE:
   a. WELL FLOW
   b. CONTROL VALVE FLOW
   c. 0.1 MG RESERVOIR LEVEL
3. INDIVIDUAL TREND SCREENS TO INCLUDE:
   a. WELL FLOW
   b. CONTROL VALVE FLOW
   c. 0.1 MG RESERVOIR LEVEL
4. ONE ALARM SCREEN TO INCLUDE A SUMMARY OF ALARMS AND A PAST HISTORY OF ALARMS.
5. SECURITY SCREEN THAT ALLOW ACCESS TO CONTROL SCREENS.

SCADA SYSTEM OPERATION NOTES:

1. THE NEW SCADA SYSTEM SHALL HAVE PROVISIONS TO BE CONNECTED TO THE FUTURE MASTER SCADA SYSTEM AT THE FUTURE DWS KAU BASEYARD.

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM NO. 2	RHA	

RONALD N. S. HO & ASSOCIATES, INC.
ELECTRICAL ENGINEERS
BRYCE H. KANEMURA
LICENSED PROFESSIONAL ENGINEER
No. 16360-E
HAWAII, U. S. A.

SIGNATURE 2020.05.06
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

SCADA SYSTEM SCHEMATIC DIAGRAM

DESIGNED BY: BHK CHECKED BY: BO DRAWN BY: BHK

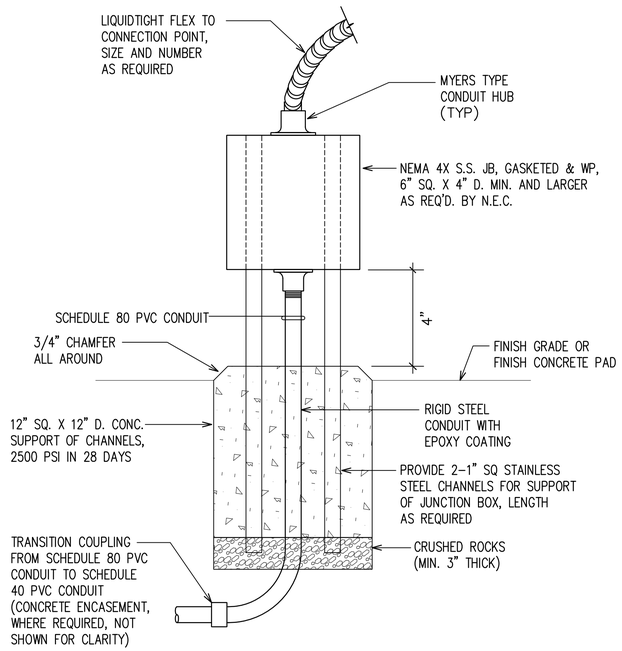
G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

FEBRUARY 2020

DWG. NO. E-7
SHEET 53 OF 54

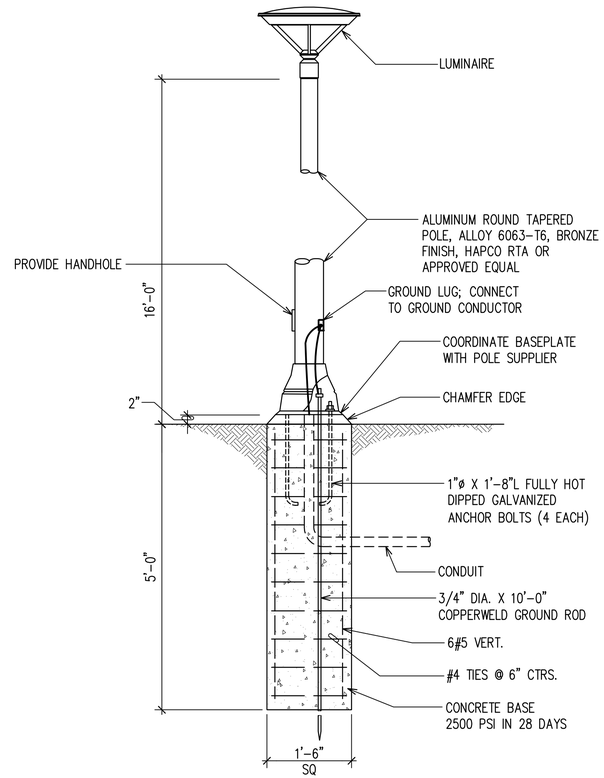
FILE	POCKET	FOLDER	NO.

FILE PATH: Z:\ACAD\PROJECTS\219186\E007_219186-scada diagram.dwg CAD USER: BKanemura PLOT DATE: 2020.05.06 XREFS: | BHK-STAMP | _x219186-scada-control diagrams |



NOTE:
1. ALL MOUNTING HARDWARE SHALL BE TYPE 316 STAINLESS STEEL.

1 / E-8 CHANNEL SUPPORTED JUNCTION BOX DETAIL
NOT TO SCALE



2 / E-8 AREA LUMINAIRE MOUNTING DETAIL
NOT TO SCALE

REVISION	DATE	BRIEF	MADE BY	APPROVED
1	5/6/20	ADDENDUM NO. 2	RHA	

RONALD N. S. HO & ASSOCIATES, INC.
ELECTRICAL ENGINEERS
BRYCE H. KANEMURA
LICENSED PROFESSIONAL ENGINEER
No. 16360-E
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION. (OBSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII, DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, HAWAII ADMINISTRATIVE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE 2020.05.06
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

KAU WATER SYSTEM IMPROVEMENTS - PHASE 1
KAU, HAWAII, HAWAII
IFB-20-HHL-025

MISCELLANEOUS ELECTRICAL DETAILS

DESIGNED BY: BHK CHECKED BY: BO DRAWN BY: BHK

G70
111 S. KING STREET, SUITE 170
HONOLULU, HAWAII 96813
808.523.5866
WWW.G70.DESIGN

FEBRUARY 2020

DWG. NO. E-8
SHEET 54 OF 54

FILE	POCKET	FOLDER	NO.

FILE PATH: Z:\ACAD\PROJECTS\219186\E008_219186-misc elec details.dwg CAD USER: BKanemura PLOT DATE: 2020.05.06 XREFS: | BHK-STAMP | _x219186-misc elec details |

SECTION 02200 – EARTHWORK

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

As specified in Section 02010.

1.02 WORK DESCRIPTION

Furnish all labor, materials, tools, and equipment necessary for site excavation, trench excavation, structural excavation, filling, backfilling, rough and finish grading, and related items necessary to complete all work shown on the Drawings and/or specified herein. All excavations are unclassified and will not be subject to additional cost to the Department.

1.03 STANDARDS

Work shall be in accordance with the "Standard Specifications for Public Works Construction", dated 1986 as amended, and the "Water System Standards", dated 2002 as amended, except as shown in the plans and specifications herewith. (Paragraphs concerning Measurement and Payment in the Sections are not applicable to this project.)

1.04 COORDINATION WITH OTHER SECTIONS

A. Demolition and removal as specified in Section 02050 - DEMOLITION AND REMOVAL WORK.

B. Clearing and grubbing as specified in Section 02110 - CLEARING AND GRUBBING.

1.05 ORDINANCES AND PERMITS

A. The Contractor shall comply with all applicable ordinances and regulations and obtain the required permits. All grading work shall comply with Chapter 10 of the Hawaii County Code, as amended.

B. The Contractor shall comply with the provisions of Chapter 11-55 Water Pollution Control and Chapter 11-54 Water Quality Standards of the Hawaii Administrative Rules, Department of Health, State of Hawaii.

1.06 EXISTING UTILITY LINES

The existence of active underground utility lines within the construction area is not definitely known other than those indicated in their approximate

locations on the Drawings. Should any unknown line be encountered during excavation, the Contractor shall immediately notify the Department of such discovery. The Department shall then investigate and issue instructions for the preservation or disposition of the unknown line. Authorization for extra work shall be issued by the Department only as it is deemed necessary.

1.07 LAYOUT OF PROJECT

The Contractor shall verify all lines, levels, elevations and improvements indicated on the drawings before any excavation begins. All lines and grades shall be verified by a Surveyor or Civil Engineer licensed in the State of Hawaii. Any discrepancy shall be immediately brought to the attention of the Department and any change shall be made in accordance with his instruction. Commencement of clearing and grubbing operations shall be construed to mean that the Contractor agrees that the existing grades and improvements are essentially correct as shown. The Contractor shall not be entitled to extra payment if existing grades and improvements are in error after his verification thereof, or if he fails to report the discrepancies before proceeding with any work whether within the area affected or not.

1.08 SUBMITTALS

A. Soil Testing Lab Accreditation: The Contractor shall retain and pay for an independent soil testing laboratory with at least one Licensed Civil Engineer specializing in Geotechnical Engineering to provide monitoring and testing services. The soil testing laboratory shall be accredited by the American Association of State Highway and Transportation Officials (AASHTO) or the American Association for Laboratory Accreditation and shall be accredited in the soils tests required under this contract. The soil testing laboratory shall meet the requirements of ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction.

The Contractor shall furnish to the Department for approval, a copy of the Certificate of Accreditation and Scope of Accreditation and latest directory of the accrediting organization for accredited laboratories. The scope of the laboratory's accreditation shall include the test methods required by the Contract.

The Contractor shall submit certified test results to the Department for review and approval. All test results must be approved before

the Contractor can proceed with placing subsequent layers or materials.

Should imported fill be utilized on this project, a sample of the proposed material should be submitted to the independent soil testing laboratory for testing. A letter from the testing laboratory stating that the imported material meets the requirements of this section shall be submitted to the Department prior to delivery of the material to the job site.

B. Field density tests shall be taken to determine whether the specified levels of compaction are being consistently attained. Testing shall be done as indicated.

1. Sub-grade for Asphalt Concrete Pavements: Testing shall be as specified in Section 02510 - ASPHALTIC CONCRETE PAVEMENT.

2. Structural and Yard Fill: One (1) compaction test for every 1500 square feet of each lift.

3. Trench Backfill: One (1) Compaction test per lift for every 200 lineal feet with a minimum of one (1) test per lift for each line.

C. The Contractor shall have the following documents available for the use of the Department's inspector at the job site:

1. Grading Ordinance (Chapter 10 of the Hawaii County Code).

2. Hawaii Administrative Rules, Chapter 11-55 Water Pollution Control and Chapter 11-54 Water Quality Standards, Department of Health, State of Hawaii.

3. ASTM D1557.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fill and Backfill Material

1. Yard fill: Yard fill shall be used for all areas required to raise the existing ground surface to the proposed finished subgrades (outside the tank structure). Fill materials shall be on-site or imported select fill materials, free from debris, perishable or combustible materials, sod, and stones larger than 3 inches in maximum dimension and shall have a laboratory California Bearing Ratio (CBR) value of 12 or higher and a swell potential of less than 1 percent when tested in accordance with ASTM D1883.

2. Structural Fill: Structural fill required under the tank structure shall consist of non-expansive select granular material, such as crushed coral or basalt. The material shall be well-graded form course to fine with particles no larger than 3-inches in largest dimension and shall contain between 10 and 30 percent passing the No. 200 sieve. The material shall have a CBR value of 20 or higher, and a swell potential of 1 percent or less when tested in accordance with ASTM D1883.

3. Aggregate Base Course and Select Borrow: Aggregate base course and select borrow shall conform to the County of Hawaii, Department of Public Works, "Standard Specifications for Public Works Construction", dated September 1986, as amended.

4. Imported fill materials shall be tested for conformance with these specifications prior to delivery to the project site for the intended use. Test results shall be submitted to the Department for approval prior to delivery to the project site.

5. Trench Backfill: Select granular backfill shall conform to the requirements of the "Standard Specifications for Public Works Construction", Department of Public Works, County of Hawaii, September 1986, as amended.

6. Cushion material for ductile iron water lines shall be 1-1/2" basecourse.

B. Temporary perimeter control shall have the following properties:

1. Compost Filter Sock: Compost filter sock shall utilize an outer layer of filtration mesh, and an inner layer of containment netting. All layers shall collectively enclose the compost filtration media. Compost filter sock shall be

installed as 12” nominal diameter as indicated on the project drawings, or as approved by the Department. Compost filter socks shall be BioSock™ as manufactured by EnviroTech BioSolutions, or approved equal.

2. Compost Filtration Media**:** Compost quality is an important consideration when designing a compost filter sock. Use of sanitized, mature compost will ensure that the compost filter sock performs as designed and has no identifiable feedstock constituents or offensive odors. The compost used in filter socks should meet all local, state, and Federal quality requirements. Biosolids compost must meet the Standards for Class A biosolids outlined in 40 Code of Federal Regulations (CFR) Part 503.

3. Wood Anchor Stakes**:** Wood anchor stakes shall have a nominal classification of ¾ by ¾ inch and minimum length of 16 inches. Larger sized wood anchor stakes may be installed at the discretion of the installer, or as specified by the Project Engineer. Do not use rebar or other metal rods. Where ground is rocky, use gravel bags to hold filter sock in place.

PART 3 - EXECUTION

3.01 GENERAL

A. No excavation or filling shall be undertaken until the area has been cleared and grubbed.

B. Install temporary perimeter control where shown on the drawing or ordered by the Department. Remove perimeter control upon completion of permanent BMP controls.

C. All excavation shall be protected and guarded against danger to life, limb and property.

D. Shoring, cribbing and lagging, as required to safely preserve the excavations and earth banks from damages resulting from the work, shall be provided and installed by the Contractor.

E. The Contractor shall at all times control the grading around building areas so that the ground is adequately sloped to prevent any water from flowing into building areas and open trench excavations. All excavations shall be kept free from standing water. The Contractor shall do all pumping and draining that may be necessary to remove

water to the extent required in carrying on the work. The Contractor shall obtain the National Pollutant Discharge Elimination System (NPDES) permit from the State Department of Health for any dewatering activities.

Lowering or raising of water table in areas where ground settlement or other detrimental effects may be induced is expressly prohibited. In such areas, the excavated spaces shall be sealed prior to the pumping of water or other approved means employed by the Contractor. The Contractor shall be responsible for disposal of the pumped liquids. Water from dewatering and other construction operations shall not be discharged directly into the storm drainage system. The method of discharge shall comply with Department of Health Regulations.

Construction equipment which require water in their operation shall not be used in the vicinity or within the building area without the approval of the Department.

F. Caution shall be exercised in all excavation work adjacent to existing trees which are to remain. All exposed fibrous and branch-type roots shall be carefully pruned or saw-cut to the extent required for excavation work. Every effort shall be taken to preserve the existing trees designated to remain and to minimize damage to said trees.

G. The Contractor shall use the best management practices to reduce the amount of soil erosion resulting from the grading work. Requirements of the National Pollutant Discharge Elimination System (NPDES) Permit, site specific Best Management Plan (BMP) shall become part of these specifications by reference.

The work areas and haul roads, including roadways leading to the project site, shall be continuously watered to prevent the generation of dust. Granular materials shall be spread over all unpaved haul routes. An 8-inch thick layer of #2 crushed rock shall be installed at delivery access points to reduce tracking mud onto public roadways.

All truck tires shall be free of mud before leaving the job site and entering a public roadway. The Contractor will clean all roads of mud and dirt resulting from his operations at no additional cost to the Department.

H. Landscaped areas shall be graded to conform to finish contours with allowance for the specified depth of topsoil, except at cut slopes 1 horizontal to 1 vertical or steeper.

I. Laying Out

1. The laying out of base lines, establishment of grades and staking out the entire work shall be done by a surveyor or a civil engineer licensed in the State of Hawaii, at the Contractor's expense. The Contractor shall be solely responsible for their accuracy. The Contractor shall erect and maintain substantial batterboards showing construction of lines and levels.

2. Should any discrepancies be discovered in the dimensions given in the plans, the Contractor shall immediately notify the Department before proceeding any further with the work. The Contractor shall be responsible for re-establishing property corners or survey control points which are destroyed by his operations.

3.02 EXCAVATION

A. General Requirements

1. Excavation shall be done so as to obtain the elevations called for on Drawings, allowing for fill, grading, topsoil and drainage away from buildings. Provide new swales as indicated.

2. The Contractor shall check electrical drawings for excavation of electrical trenches.

3. Usable Materials as approved by the Department shall be stockpiled (for later use as fill material) in a location approved by the Department. Crushing basalt fragments may be necessary prior to reuse in compacted fills.

4. Non-usable Material such as mud, soft material, and expansive soils and excess materials shall become the property of the Contractor and shall be disposed of outside the project boundary limits at locations that have been approved by the County of Hawaii.

5. Blasting as a means of excavation shall not be permitted.

6. Unsuitable subgrade soil, as determined by the Department, shall be excavated and removed by the Contractor.

B. Tank Foundation Excavation

1. Over-excavate a minimum of 2 feet below the bottom of the tank floor foundations and perimeter ring footing bottom elevation. The over-excavation shall be filled with compacted structural fill material. The over-excavation shall be extended until the underlying clinker or basalt rock formation is encountered. The over-excavation shall extend beyond the outside edge of the perimeter ring footing a minimum of 2 feet. The structural fill material is compacted to a minimum of 95 percent relative compaction.

C. Slabs-On-Grade and Influent Control Valve Station Foundation Excavation

1. Unless otherwise shown, all footings shall be founded on 12 inches minimum of compacted select granular fill. The select granular fill shall be compacted to a minimum of 90 percent relative compaction. In cut areas, the existing basalt rock shall be over-excavated to allow for the 12-inch fill layer.

2. Prior to placing the non-expansive select granular material, the subgrade soils shall be scarified to a depth of 8 inches, moisture-conditioned to at least 2 percent above the optimum moisture content, and compacted to a minimum of 90 percent relative compaction. The select granular fill and the underlying subgrade shall be wetted and kept moist until final placement of slab concrete. Where shrinkage cracks are observed after compaction of the subgrade the soils shall be prepared again as specified herein. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage shall require over excavation of the soft areas and replacement with engineered fill. The slab edges shall be backfilled tightly against the edges of the slabs with relatively impervious soils. The areas around slabs shall be graded to divert water away from the slabs and to reduce the potential for water ponding around the slabs.

D. Pavement Excavation

1. The subgrade soils shall be proof-rolled with a minimum 10-ton (static weight) vibratory drum roller a minimum of eight

passes. Soft or loose subgrade soils shall be removed and replaced with compacted select granular fill materials.

2. Where shrinkage cracks are observed after preparation of the subgrade, thoroughly moistening and recompacting the soil to close the cracks will be required. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavation of the soft areas and replacement with well-compacted engineered fill.
3. Paved areas shall be sloped to prevent ponding.

E. Trench Excavation

1. The Contractor shall do all necessary trench excavation to the depth required by the plans, including the excavation for pipe cushion. The excavation shall be unclassified and shall be performed regardless of the material encountered.

2. The minimum width of the trench at the top of the pipe, when placed, shall be a width which will permit the proper construction of joints and compaction of backfill around the pipe. The sides of the trench shall be vertical, unless otherwise approved by the Department. The maximum allowable width of the trench from the bottom of the excavation to a height of 12 inches above the pipe shall not exceed 12 inches on each side of the pipe when placed, unless otherwise approved by the Department.

3. When unsuitable material is encountered at the excavation, the Contractor shall be responsible for hauling and disposing of the material. The hauling and disposing shall be considered incidental to the excavation work. The Department shall determine if the excavation material is unsuitable.

4. The Contractor shall properly sheet and brace all trenches and excavations to render it safe and secure from possible slides and erosion. Sheeting and bracing of trenches shall be considered as incidental to the excavation work.

5. All trenches shall be kept free from surface run-off and any water during the trenching and installation, testing and backfilling of pipe. Discharge from dewatering operations shall not be drained directly onto any roadway or into any drainage system. The Contractor shall obtain the National Pollutant Discharge Elimination System (NPDES) permit

from the State Department of Health for any dewatering activities.

6. All open trenches shall be covered or barricaded during non-working hours. Traffic bearing covers shall be provided where applicable. No open trenches shall be allowed within the South Point Road roadway during non-working hours.

7. All excavated material shall be piled or stored so that it does not obstruct vehicular traffic or pedestrian walkways.

3.03 FILL AND BACKFILL

A. General Requirements

1. Filling operations shall be performed so as to bring the entire project area to the finished grades shown on the Drawings, allowing for gravel, concrete slab, or A.C. paving and base course.

2. At the time of compaction, the moisture content of fill and backfill material shall be such that the relative compactions specified can be obtained with the compacting equipment being used. At all times, it shall be the responsibility of the Contractor to employ such means as may be necessary to obtain a uniform optimum moisture content throughout the material being compacted.

3. Soft or loose soils that do not readily compact should be excavated and replaced with compacted structural fill at no cost to the Department.

4. All areas to receive fill shall be scarified, moisture conditioned to near optimum moisture content and compacted to a minimum of 95 percent relative compaction as determined by ASTM D1557.

5. All fill slopes shall be at 2:1 or flatter as shown on plans. Fill slopes exceeding 15 feet in height shall include benches a minimum of 8 feet in width with the benches constructed at intervals not exceeding 15 feet in vertical height.

6. Fill placed in areas which existing slopes are steeper than 5:1 (horizontal to vertical) shall be continually benched as the fill is brought up in lifts.

B. Yard Fill

Yard fill shall be placed in level lifts not exceeding 8 inches in loose thickness, moisture conditioned to at least 2 percent above the optimum moisture content and compacted to at least 90 percent of maximum density as determined by ASTM D1557.

C. Structural Fill for Tank Structure

Structural fill shall be placed in level lifts not exceeding 8 inches in loose thickness, moisture conditioned to at least 2 percent above the optimum moisture content and compacted to at least 95 percent of maximum density as determined by ASTM D1557.
Make allowance for leak detection layer directly under the tank floor. See structural plans for details.

D. Trench Backfill

1. Pipe Cushion

All trenches and excavations shall be backfilled within a reasonable time after the pipes are installed. The backfill material from the bottom of the excavation to 6 inches above the pipe shall be pipe cushion material. The backfill shall be placed in loose layers not to exceed 6 inches in depth along each side of the pipe and shall be compacted to at least 95 percent of maximum density as determined by ASTM D1557. Special care shall be taken to secure thorough compaction under the haunches and at the sides of the pipe and to ensure that the backfill material is in continuous and uniform contact with the pipe. Backfilling shall be done in a manner which avoids causing any movement of the pipe sections.

2. Select Granular Fill

The backfill shall be placed in loose layers not to exceed 8 inches and compacted with hand or pneumatic tampers to at least 95 percent of maximum density as determined by ASTM D1557. The backfill shall be brought up evenly on each side of the pipe to an elevation of 6 inches below the finished ground surface for unpaved areas, or 18 inches below top of pavement. Backfilling shall be done in a manner which avoids causing any movement of the pipe sections.

3. Base Course and Select Borrow Course

For roadway areas, the select borrow course and base course of the trench backfill shall be compacted to 95 percent of its maximum density and shall meet the requirements of the roadway pavement structure.

3.04 FINISH GRADING

Outdoor areas not covered by pavement or other finish surfaces shall be graded to finish grade and contours, with an allowance for gravel as shown on the plans.

3.05 CLEAN UP

Clean up and remove all debris accumulated from construction operations from time to time, when and as directed by the Department. Upon completion of the construction work and before final acceptance of the work, remove all surplus materials, equipment, etc., and leave entire job site clean and neat.

END OF SECTION

DIVISION 16 – ELECTRICAL

SECTION 16050 –BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 GENERAL CONDITIONS

The General Provisions and Special Provisions preceding specification shall govern this Section.

1.02 SUMMARY

A. This section provides the specifications for general electrical work. See other specification sections for more detailed specifications related to specific electrical systems.

B. Specification and Drawings complement each other and what is specified, scheduled or mentioned by one shall be binding as if called for by both. Specification and Drawings are intended to specify nature, quantity and quality of electrical work.

C. The Contractor shall furnish all labor, materials, tools, equipment, electricity, fuel, shipping and delivery, and appliances required to provide all Electrical Work, complete, as indicated on the drawings and/or as specified herein. The drawings note various sizes of equipment as determined for basis of design; the electrical work, however, shall be installed to comply with the equipment furnished by the successful supplier and shall be based on the approved shop drawing submittals. The work shall include but not necessarily be limited to, the following:

1. Complete underground service entrance raceways, including all handholes and pullboxes required for electric utility services.
2. Complete Hawaii Electric Light Company utility metering system, including all appurtenances for a complete system.
3. Complete service equipment and grounding system.
4. Complete electrical system for the tank site.
5. Coordination with Hawaii Electric Light Company for power services.
6. Connection and testing of appliances and equipment furnished by others requiring electrical connections.
7. Final adjustment and testing of the complete electrical installation.
8. The Contractor shall make arrangements with the Hawaii Electric Light Company for electrical service to the site, as indicated on plans. The Contractor shall provide service equipment and suitable metering provisions.
9. The Owner shall pay only non-recurring off-site power service charges incurred in providing this service but the Contractor shall pay for services

and all other work pertaining to this contract and shall coordinate the request and installation so service is available when required for testing and completion of the contract.

D. During bidding and construction, Contractor shall coordinate his work with utilities and other trades to avoid omissions and overlapping responsibilities. Electrical Contractor shall notify other trades and suppliers of project voltages and of existing equipment when new work must be compatible with existing conditions.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Materials Connected But Furnished & Installed Under Other Sections: This list is for the convenience of the Contractor, and materials connected are not necessarily limited by this list.

1. Level transmitters
2. Flow transmitters
3. Pressure transmitters
4. Meters and final connection of service provided by Hawaii Electric Light Company
5. Equipment utilizing electricity shall be provided by respective sections of this contract. Installation of equipment complete with power wiring and electric controls and interlock wiring shall be part of Electrical Work.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300 - SUBMITTALS.

B. Shop drawings and catalogue cuts for substitute materials shall clearly specify compliance with and/or deviation from specified material. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; and "achieve the same end use and results as materials formulated in accordance with the referenced publications". Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance. Review of shop drawings and catalogue cuts shall not release Contractor from complying with intent of specification and drawings. Partial or incomplete submittals will be returned without review.

C. Shop Drawings: Submit complete shop drawings and manufacturer's literature for the Engineer's review before any work is ordered or fabricated. All submittals shall bare the approval of the general contractor and the electrical contractor. Partial or incomplete submittals or submittals lacking the general contractor’s and electrical contractor’s approval will be returned without review. Submit manufacturer's literature for the following:

1. Panelboards
2. Enclosures and Cabinets
3. Junction Boxes

4. Receptacles
5. Conduit
6. Wiring
7. Nameplates
8. Light Fixtures

D. As-Built Drawings: Submit as-built drawings as specified under Section 01700 - CONTRACT CLOSEOUT.

1.05 GUARANTEE AND CERTIFICATE

Any item of material, apparatus, equipment furnished and installed, or constructed by the Contractor showing defects in design, construction, quality or workmanship within one year from the date of final acceptance by the Owner shall be replaced by such new material, apparatus or parts as may be found necessary to make such defective portion of the installation conform to the true intent and meaning of the specification and/or the drawings. Such repairs or replacement shall be made by the Contractor, free of all expense to the Owner.

1.06 COORDINATION WITH UTILITY COMPANIES AND OTHER TRADES

During bidding and construction, Contractor shall coordinate his work with utilities, and other trades to avoid omissions and overlapping of responsibilities.

1.07 CODES, REGULATIONS AND STANDARD SPECIFICATIONS

A. Work shall conform to latest edition of National Electrical Code.

B. Applicable rules, standards and specifications of following associations shall apply to materials and workmanship:

American National Standards Institute (ANSI)

American Society for Testing and Materials (ASTM)

Institute of Electrical and Electronics Engineers (IEEE)

National Electrical Manufacturer's Association (NEMA)

National Fire Protection Association (NFPA)

Underwriters' Laboratories, Inc. (UL)

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: All materials shall be new, except as specifically noted, and shall bear the label of Underwriters' Laboratories whenever standards have been established and label service is normally and regularly furnished by the agency.

B. Conduit:

1. Conduits: EMT and galvanized rigid steel, 3/4" minimum diameter with compression or threaded fittings, respectively. Aluminum conduits shall not be used.
2. Non-Metallic Conduit: PVC Schedule 40, 3/4" minimum diameter.
3. Flexible Conduit: 3/4" minimum, zinc-coated inside and outside; for damp, wet, moist, or corrosive areas -- liquid-tight with factory fittings and UV stabilized PVC jacket.

C. Conductors: Conductors shall be copper, No. 12 AWG minimum; No. 10 AWG and smaller, solid and round; No. 8 AWG and larger, 7 or 19 strands concentric. All conductors No. 6 and smaller shall be types THW for interior use or RHW for exterior use. All conductors No. 4 AWG and larger shall be type THWN-2 for interior use; or RHW-2 or USE-2 for exterior use.

D. Outlet and Small Junction Boxes: Pressed, zinc-coated steel, minimum nominal size 4", minimum depth 1-1/2", with raised cover- ring for devices in concrete masonry units. Exposed boxes and weather exposed boxes shall be ferrous alloy, prime painted and enamel finished, with threaded hubs for conduit connection. Surface mounted boxes shall be smooth walled with clean 90 degree corners.

E. Large Junction Boxes: For dry interior locations, the box shall be fabricated from NEC gauge galvanized steel with matching screw-on type cover, field punched knockouts. Flush mounted junction boxes shall have flange type covers. For exterior, damp, wet, or corrosive locations, boxes shall be NEMA 4X stainless steel (316), pad lockable. All screws and hardware shall be stainless steel (316).

F. Enclosures and Cabinets: Enclosures and cabinets for panelboards, enclosed circuit breakers, and safety disconnect switches shall be NEMA type, fabricated from galvanized steel, or as indicated, prime painted and enamel finished according to NEMA specifications. For dry interior locations, enclosures shall be NEMA 1. For exterior, damp, wet, or corrosive locations, enclosures shall be NEMA 4X stainless steel (316) with stainless steel (316) fasteners and hardware, pad lockable. Provide enclosures made of continuous welds. Enclosures made of bolted panels/parts will not be allowed.

G. Device and Cover Plates:

1. Device covers outlets in damp, wet, or corrosive locations shall be weatherproof with lockable stainless steel (316) covers. Covers shall permit plugs to be connected without compromising the integrity of the protective nature of the cover while in use.

H. Convenience Single and Duplex Receptacles:

1. Single and Duplex, 20 ampere, 125-volt, back and side wired, 3 wires, grounding type in ivory plastic body (provide red body for receptacles on emergency circuits), specification grade, with parallel and ground U-shaped slots. Enclose in outlet box and device plate. Hubbell SNAP5262, Leviton No. 5362 or pre-approved equal.

2. Ground Fault Circuit Interrupting (GFCI) receptacles shall be similar to the above except shall have test and reset switches and maximum allowable leakage current shall be 5 milli-amperes. Receptacles in damp and wet locations shall be of the GFCI type.

3. Receptacles installed in exterior, damp, or wet locations shall be UL Listed weather resistant per NEC 406.9(A).

I. Panelboard: Flush-mounted or surface-mounted as noted, ratings as indicated, 1-phase, 3WSN, ground bus, copper bussing, circuit breaker complement as shown, complete with lockable door, trim, type written directory, and 2-ply nameplate. Short circuit amperes interrupting capacity withstand ratings as indicated. Series rated panelboards not allowed. Full pole circuit breakers (half pole circuit breakers not allowed). Flush mounted panelboards shall be provided with flange type covers. Lockable with all new locks keyed alike. Eaton, Square D, General Electric, Siemens or pre-approved equal.

J. Surge Protective Device (SPD): Provide an SPD in panelboards where indicated on the drawings. Each SPD shall be bus connected for parallel operation, rated for 120/240V, 1-phase, 3-wire systems, and have a minimum surge rating of 50kA per phase. The SPD shall be UL 1449 and UL 1283 Listed (latest editions). Each SPD shall have LED status indicator lights.

K. Nameplates: Laminated nameplates shall be provided for each panelboard, junction box, and cabinet for identification purposes. Nameplates shall be laminated plastic shall be 1/8-inch thick Melamine plastic, black with white center core. Letters, numbers, symbols, or pictographs shall be incised a minimum of 1/32-inch into the plastic to expose the white core. Size of nameplate shall be 1-inch by 2-1/2 inches minimum. Lettering shall be minimum 1/4-inch high normal block lettering. Equipment designations shall be as indicated on the Drawings.

L. Light Switches: Single or double pole, 3 or 4 way, as required, non-mercury, quiet, 20 amperes, 120-277 volt, UL labeled AC type, silvered contacts, ivory, tumbler switch with endurance of 10,000 make-breaks. Enclose in outlet box and device plate.

M. Light Fixtures: Provide light fixtures complete with necessary lamps, ballasts, starters, and accessories, according to the "Light Fixture Schedule".

1. LED Drivers shall consist of a high frequency inverter, and power control and regulation circuitry. Drivers shall be Class 2 certified and meet safety standard UL 1310.

N. Automatic Telephone Dialer System:

1. United Security Products AVD-4040 or approved equal. The dialer shall be solid state component capable of dialing up to 8 telephone numbers, each up to 50 digits in length. Phone numbers and Standard pulse dialing or Touch Tone DTMF dialing are user programmable via the system's keyboard or remotely via Touch Tone telephone. In addition, the dialer shall:

a. Program 1 to 9 calling efforts

b. Program 1 to 3 message repeats

c. Record up to 7 outgoing messages

d. Program up to 4 separate input channels with individually enable/disable, entry/exit delay and activation options

e. Provide ability to program each channel's delay time, landline or cellular phone number to be dialed

O. Hardware, Supports, Backing, Etc.: All hardware, fasteners, supports, backing and other accessories necessary to install electrical equipment shall be provided. Wood materials shall be "wolmanized" treated against termites, iron or steel materials shall be galvanized for corrosion protection, and non-ferrous materials shall be brass or bronze. Installations in damp, wet, or corrosive locations shall be of stainless steel, 316.

PART 3 - EXECUTION

3.01 GENERAL

A. Rules and Permit: The entire installation shall be made in strict accordance with the latest rules and regulations of the National Board of Fire Underwriters, the currently adopted edition of the National Electrical Code and the Electrical Branch of the local Building Department. The Contractor shall obtain and pay for the electrical permit as required by local laws and rules. All work shall be inspected by the proper local authorities as it progresses. The Contractor shall pay all inspection fees and shall deliver certificates of completion and inspection to the Engineer before final payment will be made. Costs of permits and inspection fees shall be included in the Contractor's bid price.

B. Construction Methods: Construction shall conform to construction practices as recommended by the American Electricians Handbook by Croft (latest edition), Edison Electric Institute, National Electrical Code, National fire Protection Association, National Electrical Safety Code and applicable instructions of manufacturers of equipment and material supplied for this project.

C. Materials and Workmanship: All labor and materials of every kind shall be subject to the approval of the Engineer, who shall be afforded every facility for ascertaining the competence of such labor and examining such materials as they may deem necessary. Concealed work, handholes, and enclosures shall be reopened / opened at random as directed during inspections by the Engineer. Materials shall be new and shall bear the listed label of the Underwriters' Laboratories, Inc. Brand names and catalog numbers used in this specification indicate the standards of design and quality required. Substitution of other brands or catalog numbers shall conform to the requirements in the Bidding Documents. All high voltage work shall be performed by qualified electricians certified to work on high voltage systems.

D. Record Drawings: The Contractor shall maintain an accurate and adequate record of each change as it occurs, regardless of how ordered.

E. Drawings and Specification: This specification is intended to cover all labor, materials and standards of workmanship to be employed in the work

indicated on the Drawings and called for in the specification or reasonably implied therein. The Drawings and specification supplement one another. Any part of the work mentioned in one and not represented in the other, shall be done the same as if it has been mentioned in both. The Contractor shall not make alterations in the Drawings and specification.

F. Discrepancies and Interpretations:

1. Should the Contractor find any discrepancies in or omissions from any of the documents or be in doubt as to their meaning, he shall advise the Engineer who will issue any necessary clarification within a time period which does not disrupt the progress of the work.

2. All interpretation and supplemental instructions will be in the form of a written addenda to the Contract Documents.

3. Should any discrepancy arise from the failure of the Contractor to notify the Engineer, the higher quality or larger quantity of item shall prevail. The Engineer shall make the final interpretation and judgment.

4. In the event of a discrepancy between small scale drawings and large scale details, or between the Drawings and specification, on which is in violation of any regulations, ordinances, laws or codes, the discrepancy, if known by the Contractor, shall be immediately brought to the attention of the Engineer for a decision before proceeding with the particular work involved. Work carried out disregarding these instructions will be subject to removal and replacement at the Contractor's expense.

G. Symbols: The standard electrical symbols together with the special symbols, notes and instructions shown on the drawings indicate the work and outlets required and are all to be included as a part of this specification.

H. Coordination: This specification is accompanied by Drawings which contain floor plans of the buildings, sections and elevations, and site plans indicating locations of all outlets, service runs, and other electrical apparatus. These locations are approximate and, before installing, the Contractor shall study the adjacent architectural details and actually make the installation in the most logical manner. Any outlet, equipment, feeder, and circuit may be relocated within ten feet before installation at the direction of the Engineer. The circuit routing is typical only and may be varied in any logical manner.

3.02 INSTALLATION

A. Grounding:

1. All services, metallic enclosures, raceways, and electrical equipment shall be grounded according to requirements of NEC Article 250. At building, 3/4" x 10' copper ground rods, Copperweld Steel Company, shall be driven with top 12" below finished grade and shall be connected together with bare copper wire buried 12" below finished grade to obtain a ground of 25 ohms or less as measured by three point pot method with an electric ground megger. Connect ground to nearest cold water pipe (located within 10’ of entering the building), structural steel, and to building entrance equipment with bare copper. Ground and bond per the NEC and local authority having jurisdiction. Final connection to

equipment, raceways, grounding type receptacles and other metallic parts directly exposed to ungrounded electric conductors shall be No. 8 AWG minimum, copper, NEC type TW, green insulation. Use approved bonding terminal at panels.

2. Bond and ground all feeder conduits to panelboard enclosures.

B. Wiring System:

1. Below grade or in slab, use Schedule 40 PVC. Provide separate ground wire and rise out of ground with Schedule 40 PVC. Transition to rigid steel conduit within 6" of finished grade.
2. GRC shall be utilized above finished ground floor where exposed in interior locations below 96 inches above finish floor, exposed in locations under cover but not totally enclosed with walls, and exposed on the exterior of the building. GRC shall be supported off the finish floor with conduit support block.
3. All wiring shall be installed in conduits except as noted.
4. Conduit system shall be continuous from outlet to outlet and fitting to fitting so that electrical continuity is obtained between all conduits of the system.
5. Conduits cut square and inner edges reamed. Butt together evenly within couplings.
6. Make bends and offsets with hickey or conduit-bending machine. Do not use vise or pipe tee. Flattened or crushed conduit not acceptable.
7. Use of running threads not permitted. Where conduits cannot be joined by standard threaded couplings, approved water-tight conduit unions shall be used.
8. Cap conduits during construction with plastic or metal-capped bushings to prevent entrance of dirt and moisture. Swab all conduits and dry before installing wires. Provide removable watertight conduit seals on all conduits entering the building, or pad mounted equipment, where the conduit is connected to manholes, handholes, or other pad mounted equipment.
9. Pullstrings shall be placed in all empty / spare conduits ten feet in length or longer.
10. Install insulating bushings and two locknuts on each end of every conduit run at enclosures and boxes. Provide grounding bushings as required.

C. Conductors:

1. Mechanical means for pulling shall be torque-limiting type and not used for #2 AWG and smaller wires.
2. Pulling tension shall not exceed wire manufacturer's recommendations.
3. Where necessary, powdered soapstone may be used as a lubricant for drawing wires through conduit. No other means of lubricating will be allowed.

4. Form neatly in enclosures for minimum of crossovers. Tag all feeders and label all branch circuits in all enclosures and devices. Identify panel name and branch circuit number.
5. Color code feeder, branch circuit, and grounding conductors. Color for grounding conductors shall be green. Color for neutral conductors shall be white except for where neutrals of more than one branch circuit grouping are installed in the same raceway or enclosure, the other neutral shall be white with a colored stripe (other than green). The color coding for three-phase and single-phase circuits shall be as follows:

   208Y/120V, 3-phase, 4-wire:

   Black (Phase-A)

   Red (Phase-B)

   Blue (Phase-C)

   480Y/277V, 3-phase, 4-wire:

   Brown (Phase-A)

   Orange (Phase-B)

   Yellow (Phase-C)

   120/240V, 1-phase, 3-wire:

   Red and Black

D. Splicing of Wire and Cable:
   1. Wires shall be formed neatly in enclosures and boxes.
   2. Splices made according to NEC Article 110.
   3. Splices shall be reinsulated. Remove all sharp points that can pierce tape. Use Minnesota Mining and Manufacturing Co. "Scotch" #33 tape, or pre-approved equal. Splices in pull boxes shall be water-tight.

E. Trench Excavation:
   1. Dimensions and locations of trenches for pullboxes and ductlines shall be as indicated on drawings. Trench width and depths shall be sufficient to accommodate proper installation of conduit banks and cables.
   2. Where a trench is excavated on slope, sides are to be vertical, and depth measured at lowest side. All measurements are to be based on final grades.
   3. Bottom of trenches to be flat and smooth.
   4. Trenches shall be widened at pullbox sites to permit proper entry of ducts.
   5. All excavations for pullboxes in excess of the required depths shall be filled with concrete.
   6. Sheathing and bracing as required shall be provided to support sides of excavations from cave-ins.
   7. Excavated material may be placed alongside trench.

F. Backfill:

1. Backfilling shall be to finished grades indicated on accompanying drawings, and matching existing conditions.
2. Backfill material shall be completely free of wood or other debris.
3. Backfill material shall be placed in maximum of 12" layers in loose thickness before compacting. Backfill shall be thoroughly compacted with hand or mechanical tampers, and in no case shall tamping be accomplished by using the wheels or tracks of a vehicle.

G. Conduit and Duct Bank:

1. Bottom of trenches for all systems shall be clean, smooth and well graded prior to installation of conduits.
2. Saw cut, ream and taper ducts and conduits with manufacturers' approved tool.
3. Couplings and bells shall be tight to prevent entry of dirt into ducts and conduits.
4. Provide spacers to maintain proper separation between ducts.
5. Changes in direction of greater than 5° shall be accomplished by using special couplings or bends manufactured for this purpose. Where ducts enter pullboxes, they shall be terminated in end bells. Ducts shall be thoroughly cleaned before laying. When it is necessary to cut tapered end of duct at site, cut shall be made with saw and tapered with lathe designed to match original taper. Coordinate placement of duct runs with other utilities, structures, existing facilities and landscaping elements to avoid conflicts. When necessary, obtain acceptance from the Engineer for relocation and adjustments at no additional cost to the Owner.
6. Ducts shall be clean and free from debris and rubbish.
7. After each day's work, provide temporary conduit plugs at the end of conduit banks to prevent entry of dirt, rubbish, or debris.
8. Pass smooth bullet-shaped, blunt tip wooden test mandrel through the entire length of each duct or conduit to test for burrs and obstructions. Unless indicated otherwise, mandrel shall be 14" long and shall have diameter of 2" less than inside diameter of duct or conduit. If burrs or obstructions are encountered, that section shall be replaced at no additional cost to the Owner.
9. Unless indicated otherwise, install #12 AWG galvanized iron pulling wire or polypropylene cord in each conduit after testing.
10. Apply thin coat of sealing compound on ducts and conduits at couplings and bells.
11. Provide duct seals at each entry point into pullboxes to prevent water from flowing between pullboxes.

H. Finishing:

1. All cutting that may be required for complete installation of the electrical work shall be carefully performed, and all patching shall be finished in first-class condition by the Contractor.
2. Close unused knockouts in boxes or enclosures with metal cap that will maintain the rating of the box or enclosure.
3. Wipe clean all exposed raceways and enclosures with rag and solvent. Unfinished raceways and enclosures shall be primed and painted and finished to blend in with the surface it is mounted on. (Do not cover nameplates.) Factory finished enclosures shall not be painted, touch up where required.

I. Miscellaneous Details:

1. Complete all panel circuit directories, using typewriter. Verify "room" and "use" designations before typing.
2. Prime and paint all exposed conduits, hangers, and fasteners.
3. Furnish necessary test equipment and make all tests necessary to check for unspecified grounding, shorts and wrong connections. Correct faulty conditions, if any.
4. Tag all empty conduits in switchboard, panelboards, cabinets, at backboards, etc. and identify destination.
5. Provide arc flash warning labels on all electrical equipment as required by 2014 NEC Article 110.16 and 2015 NFPA-70E 130.5. The contractor shall attain all information required for the calculations, perform the calculations, and provide the labels at no additional cost.
6. Anchor all free-standing floor mounted electrical equipment, apparatus, and transformers. Provide additional bracing per the seismic conditions at the site.

3.03 TESTING AND INSPECTION

A. If the Engineer discovers any errors, the Contractor, at his own expense, shall go over all similar portions of the entire job, taking the necessary or directed remedial action.

B. After completion of all wiring, insulating resistance testing of all power and control circuits shall be performed with a 500-volt megger. The test on each circuit shall be performed for one minute in the presence of the Engineer or his representative, and a written test report of the results shall be submitted to the Engineer before acceptance can be obtained. Equipment which may be damaged during this test should be disconnected. The tests shall be performed with all other equipment connected to the circuit.

C. After the electrical system installation is completed, and at such time as the Engineer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of these specifications. The test shall be performed in the presence of the Engineer or his authorized representative. The Contractor shall furnish all instruments, electric power and personnel required for the tests.

D. Wherever test or inspection reveals faulty equipment or installation, the Contractor shall take corrective action, at his own expense, repairing or replacing equipment or installation as directed.

3.04 MEASUREMENT AND PAYMENT

A. General: No separate payments will be made for the work covered by the separate section of the 16000 series of these specifications. All costs in connection with furnishing and installing of the various items in accordance with standard practice, the details shown on the drawings and in accordance with these specifications, shall be included in the lump sum price of which the item is a part.

B. Compensation: Payment of the furnishing and installing of equipment will be made at the lump sum price bid of which the item is a part and shall be full compensation for all work in accordance therewith, complete and finished in accordance with the drawings and specifications.

END OF SECTION

DIVISION 16 – ELECTRICAL

SECTION 16100 – SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM

PART 1 – GENERAL

1.01 GENERAL CONDITIONS

This section covers the Supervisory Control and Data Acquisition (SCADA) system including equipment, wiring, adjustment and testing as indicated on the plans and specified herein.

As specified in Section 16000, Electrical. The provisions of these related sections apply to this section and work described in this section shall comply with them.

1.02 SUMMARY

A. Provide all articles, materials, equipment, operations, and services herein or on Drawings, including all labor, materials, taxes, fees, insurance, and incidentals required to insure completion.

B. Test Complete Installation: Installation shall be complete in every detail as specified and ready for use. Any item supplied by Contractor developing defects within one year of final acceptance by Owner shall be replaced by such materials, apparatus, or parts to make such defective portion of complete system conform to true intent and meaning of these Drawings and Specifications, at no cost to Owner.

C. System shall be comprised of one (1) new RTU panel at the new Kau Water System site. The new RTU system at the site shall be mounted within an enclosure and shall be compatible to communicate, via radio link to the Master SCADA system at the future DWS Kau Baseyard. Basic function of the Kau Water System RTU shall be to monitor on site conditions and receive supervisory signals from the future Master SCADA Station, and to telemeter the data, via radio telemetry. The SCADA System shall be a standalone system with the capability of telemetry to the future SCADA Master Station at the future DWS Kau Baseyard. This system shall require but not limited to the following work:

1. Providing one (1) RTU at the new Kau Water System site, including but not limited to the following major equipment or approved equal:

    a. Siemens Simatic Step 7 Professional with most current firmware version or approved equal

    b. Siemens Simatic WinCC V7 with most current version or approved equal, with

    c. Powerpack for 65536 Powertags

    d. APC Smart-UPS RT 1500VA with Smart-UPS (spare) Battery Pack uninterruptible power supply unit or approved equal

e. 8-Port Unmanaged Ethernet switch

f. Siemens 10” HMI Operator Panel or approved equal

g. 4RF Aprisa SR+ Remote Station radio or approved equal

h. Two (2) Power Supplies

i. One (1) Siemens TIA Portal V15 Professional Floating License

2. The SCADA communications systems shall be as indicated on the drawings and as follows:

a. Between the new Kau Water System site and the future DWS Kau Baseyard.

b. The system shall be used for transmitting alarms, status and telemetry, calculated data, diagnostic and error logging information from the remote RTU to the future Master SCADA Station. Remote RTU shall also be able to upload any portion of their database to the future Master SCADA Station upon request or event.

c. The RTU shall be able to receive commands and interrogation requests from the future Master SCADA System Computer, and to download the full Database, Application, Software, and Parameters, via the communications channel.

d. The RTU shall give the future Master SCADA System Computer operators full visibility and control of the remote RTU operation including database changes, parameter changes, and full remote diagnostics, as well as source-level application monitoring for the system engineer.

e. The RTU shall be able to communicate and exchange data with each other and/or with hierarchies in the system and to inform the future Master SCADA System about their activity.

f. Contractor shall coordinate the planning and construction of the SCADA system (programming, I/O list, etc.) with the Owner.

g. The Contractor shall furnish and install a SCADA ready enclosure as indicated on the plans and specified herein.

h. Contractor shall furnish a list of SCADA points for approval prior to fabrication of the SCADA RTU panel.

D. This system shall be an integrated system of hardware and firmware totally engineered, programmed, assembled and tested. System shall be complete with all appurtenances, whether specifically referenced herein or not, but which may be required for operation.

E. During bidding and construction, Contractor shall coordinate his work with other trades to avoid omissions and overlapping responsibilities. Electrical contractor shall notify other trades and suppliers of project voltages, including control voltages.

F. Work by Others: Instrument transmitters shall be provided by respective sections of this contract. Installation of equipment complete with power wiring and electric controls and interlock wiring shall be part of Electrical Work.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300 - SUBMITTALS.

B. Shop drawings and catalogue cuts for substitute materials shall clearly specify compliance with and/or deviation from specified material. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; and "achieve the same end use and results as materials formulated in accordance with the referenced publications". Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance. Review of shop drawings and catalogue cuts shall not release Contractor from complying with intent of specification and drawings. Partial or incomplete submittals will be returned without review.

C. Shop Drawings: Submit complete shop drawings and manufacturer's literature for the Engineer's review before any work is ordered or fabricated. All submittals shall bare the approval of the general contractor and the electrical contractor. Partial or incomplete submittals or submittals lacking the general contractor's and electrical contractor's approval will be returned without review. Submit manufacturer's literature for the following:

1. SCADA system components and equipment
2. Conductors and wiring
3. Wiring and functional or block diagrams
4. Manufacturer's recommendations for installation
5. Logic diagrams and ladder diagrams
6. Manufacturer's recommended list of spare parts for a one-year period of operation

D. As-Built Drawings: Submit as-built drawings as specified under Section 01700 - CONTRACT CLOSEOUT.

1.04 LOCAL SUPPORT

The manufacturer of the SCADA system supplied shall be represented by a company with offices in the State of Hawaii. This local office shall be capable of responding to requests for maintenance and repair to the system by having a technician skilled in the repair, maintenance and operation of the system at the job site within 24 hours of being notified. This local representative shall carry all spare parts which are recommended by the manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

Unless otherwise indicated, provide all first quality, new materials, free from any defects, in first class condition, and suitable for the space provided. New old stock materials shall not be furnished as new material and shall not be accepted. Provide materials approved by UL wherever standards have been established by that agency. Where two or more units of the same class of material or

equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

2.02 STANDARD PRODUCTS

Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design which conforms to the specifications.

2.03 SCADA SYSTEM CONTROL AND DESCRIPTION

The new system consists of one new SCADA/RTU system at the new Kau Water System site. The new SCADA/RTU shall be capable of communicating via radio link to the Master SCADA system at the future DWS Kau Baseyard.

2.04 MATERIALS AND EQUIPMENT

A. SCADA Ready Enclosure: The Contractor's SCADA work shall include terminating all telemetry inputs and outputs to terminal blocks within the SCADA enclosure as specified herein. Termination to an intermediate SCADA terminal cabinet shall not be accepted. Wiring shall be direct to SCADA enclosure. Termination shall be maintained tight to top, front of the enclosure's left side. Terminal blocks shall be neatly aligned in a single column and arranged in the following sequence from top to bottom: Power (Line), Power (Neutral), Power (Ground), Digital Inputs, Digital Outputs, Analog Inputs, and Analog Outputs. Terminal blocks shall be color coordinated in the following patterns:

SCADA ENCLOSURE TERMINAL BLOCK SCHEDULE

DESCRIPTION	COLOR	PART #
POWER (LINE)	BLACK	PHOENIX CONTACT UT4, 3045143
POWER (NEUTRAL)	WHITE	PHOENIX CONTACT UT4, 3045130
POWER (GROUND)	GREEN	PHOENIX CONTACT UT4, 3045156
DIGITAL INPUT	YELLOW	PHOENIX CONTACT UTTB4, 3035467
DIGITAL OUTPUT	GRAY	PHOENIX CONTACT UT2.5 - 3L, 3214259
ANALOG INPUT	BLUE	PHOENIX CONTACT UTTB4, 3044791
ANALOG OUTPUT	BLACK	PHOENIX CONTACT UTTB4, 3074282
ANALOG GROUND	GREEN	PHOENIX CONTACT UT2,5-PE 3044092
SPACER	RED	PHOENIX CONTACT UT4, 3045127

Terminal blocks shall maintain one block spacing between groups, with exception for Power (Line), Power (Neutral) and Power (Ground) which shall

be grouped together. Further, Digital Input, Digital Output, Analog Input and Analog Output shall be segmented into groupings of eight (8) blocks with one block spacing between groupings. Provide ground terminal blocks for each Analog Input and Analog Output for landing the shield wire.

Contractor's wiring shall be terminated to left side of terminal blocks, with negative on the base tier and positive on the top tier for double-level terminal blocks; with normally open (N.O.) on the base tier, common on the 2nd tier, and normally closed (N.C.) on the top tier for multi-level terminal blocks. Wiring shall be marked at both ends with printed wire labels or printed heat shrink tags. Wiring shall be color coordinated as follow:

SCADA ENCLOSURE WIRING SCHEDULE

DESCRIPTION	COLOR
POWER (LINE)	BROWN
POWER (NEUTRAL)	WHITE
POWER (GROUND)	GREEN
D.C. (+)	RED
D.C. (-)	BLACK
DIGITAL OUTPUT (N.O.)	PURPLE
DIGITAL OUTPUT (COMMON)	YELLOW
DIGITAL OUTPUT (N.C.)	ORANGE
ANALOG INPUT (+)	BLUE
ANALOG INPUT (-)	GRAY
ANALOG GROUND	GREEN
ANALOG OUTPUT (+)	BLUE
ANALOG OUTPUT (-)	GRAY
ANALOG GROUND	GREEN

B. The RTU equipment shall be microprocessor based, solid-state construction utilizing second source semiconductors, unless otherwise specified. Derate components to assure dependability and long-term stability. Provide printed or etched circuit boards of glass epoxy, hand or wave soldered, of sufficient thickness to prevent warping. Coat printed circuit boards in field-mounted equipment with 2 mils of solderable conformal coating complying with MIL-I-460-58B. Alignment and adjustments shall be noncritical, stable with temperature changes or aging and accomplished with premium grade potentiometers. Do not insert components of specially selected values into standard electronic assemblies to meet performance requirement. Use parts indicated in instruction manuals, replaceable with standard commercial components of the same description without degrading performance of

completed assembly. The RTU equipment shall be capable of communicating with the future DWS Kau Baseyard Master Station site PLC equipment. The RTU equipment shall be provided with a UPS system. The RTU shall have the capability to be expandable. RTU panel shall be fabricated by Control Systems West or approved equal.

C. Operator Interface Touchscreen shall be installed within the SCADA Enclosure door, such that it may be operated without opening the cabinet door. Contractor shall confirm mounting location height with Owner prior to installation. Touchscreen shall a have basic color screen.

   Touchscreens shall monitor and control local functions of the RTU and communicate to the RTU using Ethernet communication, through a DIN rail mounted switch in the RTU panel.

   The Touchscreen assembly shall be rated NEMA 4X and manufactured by Siemens or approved equal. A 10" Siemens KTP HMI panel or approved equal with 640x480 resolution shall be specified.

D. SCADA Hardware: The Contractor shall utilize as required the following list of approved or approved equal RTU hardware. Hardware shall be the latest version at the time of construction, during the commencement of electrical portion of work.

   1. Siemens Simatic Step 7 Professional, CPU
   2. Siemens SM1221, Digital Input
   3. Siemens SM1222, Digital Output
   4. Siemens SM1231, Analog Input 8AI
   5. Siemens SM1232, Analog Output
   6. Siemens PM1207, Power Switch
   7. Siemens XB008, 8-Port Unmanaged Industrial Ethernet Switch
   8. Siemens KTP1000, 10" Panel
   9. 24VDC, 3.5A Power Supply, Phoenix Contact QUINT-PS/1AC/24DC/3.5, PN# 2866747 (for radio and level transmitter only)
   10. 24VDC, 5A Power Supply, Phoenix Contact QUINT-PS/1AC/24DC/5, PN# 2866750 (for radio and level transmitter only)
   11. DIN Rails, 35mm x 7.5mm x 2000mm, Aluminum, Phoenix Contact PN# 0804681
   12. Terminal Block, Black, Phoenix Contact UT4, PN# 3045143
   13. Terminal Block, White, Phoenix Contact UT4, PN# 3045130
   14. Terminal Block, Green, Phoenix Contact UT4, PN# 3045156
   15. Terminal Block, Red, Phoenix Contact UT4, PN# 3045127
   16. Terminal Block, Blue, Phoenix Contact UT4, PN# 3044791
   17. Terminal Block, Yellow, Phoenix Contact UT4, PN# 3045114
   18. Terminal Block, Gray, Phoenix Contact U2.5-3L, PN# 3214259
   19. Terminal Block, Gray w/Black, Phoenix Contact UT2.5-3L, PN# 3214262

20. Fuse Terminal Block, Phoenix Contact, UK63-HESI, PN# 3004171
21. 1 Pole, 120/240VAC, 10A, Circuit Breaker, Rockwell 1489-A1C100
22. 2PDT, 24VDC Coil, 10A, Rockwell PN# 700-HC22Z24-3-4
23. Screw Terminal Base Socket, Black, Rockwell PN# 700-HN128
24. Relay Retainer Clips, Rockwell PN# 700-HN114
25. Diode, Motorola 1N4005
26. Terminal Block – Grounding Green/Yellow Phoenix Contact UT2,5-PE
27. Siemens 1241 Communications Module RS485/422 Modbus

E. Instrumentation System Transmitter Power Supply: The power supply shall be mounted in the SCADA cabinet and deliver regulated 24-36 volts DC power at a maximum current recommended by the analog transmitter supplier. The unit shall operate on 117 volts AC at 50-70 Hz. Load regulation shall be 150 mV maximum from no-load to full-load current. Line regulation shall be 150 mV from 105 to 135 volts AC.

F. Shade Cover: Provide shade cover to aid in viewing HMI panel.
   1. Collapsible when not in use
   2. Fully lockable
   3. Stainless steel
   4. Provide with type 316 stainless steel mounting hardware
   5. Shade Aide H87A485A or approved equal.

G. See Drawings for additional information on the recommended materials and equipment for the SCADA system.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS

A. Flush indicators, selector switches, pushbutton switches, and pilot lights in a logical arrangement.
   1. Mount devices listed, shown, or required for a complete and operable system in accordance with device manufacturer's instructions, these specifications, and as recommended in NEMA PB1.1.
   2. Ground control panel to safety ground of power source.
   3. Analog signals must use shielded pairs cabling.

3.02 PROGRAMMING:

A. Contractor shall coordinate all RTU programming with the Owner.

B. The RTU supplier and Contractor shall provide the complete PLC and HMI software with appropriate licenses and license keys programming and documentation for RTU to comply with the requirements set forth herein.

C. Contractor shall provide Owner with a copy of the implemented software.

3.03 COMMISSIONING: Instruments are to be commissioned under the direct supervision of a qualified representative of the instrument manufacturer. The Owner and or the Owner's representative shall have the right to witness any test, inspection, or calibration or start-up activity.

A. Test and exercise each device to demonstrate correct operation, first individually, then collectively as a functional network. Apply continuously variable analog inputs to verify proper operation and setting of analog devices and discrete devices (i.e. switches, etc.).

B. Unless otherwise specified, tests shall be made to cover at least five points: approximately 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of range. Individual device accuracy requirements shall be as specified by contract requirements or by published manufacturer accuracy specifications whenever contract requirements are not specified.

C. If test results conflict with calibration, the Contractor shall recalibrate and repeat test until test results prove calibration to be correct.

3.04 TEST REPORT: Prepare a test report showing actual value, instrument value, 4-20 mA value (at the RTU) for each test, and range of the instrument. Each test shall bear the signature of the contractor's representative who supervised the tests and the manufacturer's representative. Three copies of these reports in bound sets label "CALIBRATION DATA" are to be furnished to the Owner's Representative.

3.05 ADDITIONAL START-UP SERVICES: The Contractor shall include an additional two days of programming time and the cost for the RTU's programmer to visit the site for one of the days in the bid. This time may be used at the discretion of the Owner for additional programming, changes, and/or training. This time is over and above the work necessary to provide a complete and operable system.

3.06 GUARANTEE: The SCADA system, equipment, materials, and associated items shall be guaranteed against defective parts and operation due to faulty material or workmanship during the period of one year following acceptance and final payment by the Engineer. The Contractor shall make all repairs or replacements necessary to accomplish the required performance within the time specified by the Engineer and agreed to by the Contractor.

3.07 MEASUREMENT AND PAYMENT

A. General: No separate payments will be made for the work covered by the separate section of the 16000 series of these specifications. All costs in connection with furnishing and installing of the various items in accordance with standard practice, the details shown on the drawings and in accordance with these specifications, shall be included in the lump sum price of which the item is a part.

B. Compensation: Payment of the furnishing and installing of equipment will be made at the lump sum price bid of which the item is a part and shall be full compensation for all work in accordance therewith, complete and finished in accordance with the drawings and specifications.

END OF SECTION