DEPARTMENT OF HAWAIIAN HOME LANDS STATE OF HAWAII

August 24, 2012

ADDENDUM NO. 2

TO

PLANS, BID FORM, SPECIFICATIONS, CONTRACT AND BOND

FOR

MAKUU OFFSITE WATER SYSTEM PHASE 2 PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES

HALONA, PUNA, ISLAND OF HAWAII, HAWAII

IFB NO.: IFB-13-HHL-002

NOTICE TO ALL PROSPECTIVE BIDDERS

This addendum is hereby made a part of the PLANS, BID FORM, SPECIFICATIONS, CONTRACT AND BOND for the MAKUU OFFSITE WATER SYSTEM PHASE 2: PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES, HALONA, PUNA, ISLAND OF HAWAII, HAWAII, and it shall amend the said contract documents as detailed within this Addendum document

Jhi) Marat	Date <u>August 24, 2012</u>
Jobie M/K. Masagatani, Chairman Designate Hawaiian Homes Commission	
Please detach, execute, and return immediately, Home Lands, P. O. Box 1879, Honolulu, HI 96	the receipt below, to the Department of Hawaiiar 805, or transmit facsimile to (808) 620-9299.
PRODUCTION WELL, RESERVOIR AND S	UU OFFSITE WATER SYSTEM PHASE 2 UPPORTING FACILITIES, HALONA, PUNA
ISLAND OF HAWAII, HAWAII, is hereby ack	nowicagea.

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FOR

MAKUU OFFSITE WATER SYSTEM PHASE 2 PRODUCTION WELL, RESERVOIR AND SUPPORTING FACILITIES

HALONA, PUNA, ISLAND OF HAWAII, HAWAII

IFB NO.: IFB-13-HHL-002

APPROVED SUBSTITUTION - FINISH HARDWARE

The following finish hardware has been approved by Department of Hawaiian Homelands (DHHL) and County of Hawaii Department of Water Supply (DWS) for use on this project. As part of the substitution approval, the doors shall be able to accept the locks supplied by the DWS. The DWS will issue locksets (Corbin Russwin Model No. CL 3851 NZD 626) to the contractor for doors D/1, D/2 and D/4 as specified in the door hardware schedule SECTION 303.24 FINISH HARDWARE, Subsection E. SCHEDULE OF FINISHING HARDWARE, 2. Door Hardware Schedule.

<u>Item</u>	Brand	Substitute or Alternate Brand	Variance
08710/Hinges	McKinney TA2314 626	Ives 5BB1 626	None
08710/Hinges	McKinney TA2314 626 NRP	Ives 5BB1 626 NRP	None
08710/Hinges	McKinney TA2314 626	Stanley FBB191 626	None
08710/Hinges	McKinney TA2314 626 NRP	Stanley FBB191 626 NRP	None
08710/Lockset	Sargent 8265 LNL WBX	Schlage L9040 06A	None
08710/Lockset	Sargent 8265 LNL WBX 626	Best 45H 7LT 15H 626	None

CONTRACTOR'S SUBMITTALS - BID OFFER FORM

Delete the Bid Offer Form in its entirety and replace with Addendum No. 2 Bid Offer Form, attachment to this addendum. Only Article 5 - Basis of Bid has changes. These changes are denoted with an "*" by the Item Number and shown in bold type.

CONSTRUCTION PLANS

Replace Sheets C-1, C-3, C-4, C-5, C-6, C-7, C-8, C-10, C-12, C-15, M-1, M-2, M-3, M-5, M-7, A-2, A-3, A-5, S-4, S-6, S-9, S-10, S-11, E-4, E-11, E-12, E-13, E-17, E-19, E-20, E-21, E-22, E-23, E-24, E-25, E-26, E-27, E-28, E-29, E-30 and E-31with the attachment to this addendum:

Sheet C-1 - Notes

Sheet C-3 - General Plan

Sheet C-4 - Boring Logs

Sheet C-5 - Site Grading Plan

MAKUU OFFSITE WATER SYSTEM PHASE 2 (IFB-13-HHL-002) ADDENDUM NO. 2 Page 1 (August 24, 2012)

- Sheet C-6 Site Plan
- Sheet C-7 Drain & Water Profiles
- Sheet C-8 Reservoir Piping Sections
- Sheet C-10 Grated Drain Pit Details
- Sheet C-12 Well Pad Reinforcing Details
- Sheet C-15 Booster Pump Pad Reinforcing Details (Keonepoko-Nui well & Res. Site)
- Sheet M-1 Makuu Well Pump Details
- Sheet M-2 Makuu Well Pump Miscellaneous Details
- Sheet M-3 Makuu Well Pump Piping Pad Details
- Sheet M-5 Makuu Control Building Plan
- Sheet M-7 Keonepoko-Nui Booster Pump Piping Details
- Sheet A-2 Control Building Exterior elevations and Schedules
- Sheet A-3 Control Building Interior Elevations and Schedules
- Sheet A-5 Window and Flashing Details
- Sheet S-4 Reservoir General Notes
- Sheet S-6 Reservoir Foundation Section and Details
- Sheet S-9 Reservoir Foundation Plan and Roof Slab Plan
- Sheet S-10 Reservoir Elevation and Section
- Sheet S-11 Strand-Wound Wall Section and Details
- Sheet E-4 Electrical Work
- Sheet E-11 Electrical Work
- Sheet E-12 Electrical Work
- Sheet E-13 Electrical Work
- Sheet E-17 Electrical Work
- Sheet E-19 Electrical Work
- Sheet E-20 Electrical Work
- Sheet E-21 Electrical Work
- Sheet E-22 Electrical Work
- Sheet E-23A Electrical Work
- Sheet E-23B Electrical Work
- Sheet E-24 Electrical Work
- Sheet E-25 Electrical Work
- Sheet E-26A Electrical Work
- Sheet E-26B Electrical Work
- Sheet E-27 Electrical Work
- Sheet E-28 Electrical Work
- Sheet E-29 Electrical Work
- Sheet E-30 Electrical Work
- Sheet E-31 Electrical Work
- Sheet E-32 Electrical Work

TECHNICAL SPECIFICATIONS

- 1. Replace Technical Specifications Table of Contents in its entirety and replace with Addendum No. 2 Technical Specifications Table of Contents, attachment to this addendum.
- 2. Replace Technical Specification Section 303.07 Prestressed Concrete Tank in its entirety and replace with Addendum No. 2 Section 303.07 Prestressed Concrete Tank, attachment to this addendum.

MAKUU OFFSITE WATER SYSTEM PHASE 2 (IFB-13-HHL-002) ADDENDUM NO. 2 Page 2 (August 24, 2012)

- 3. Replace Technical Specification Section 303.16 Built-up Roofing in its entirety and replace with Addendum No. 2 Section 303.16 Built-up Roofing, attachment to this addendum.
- 4. Add Technical Specification Section 303.22A Louvers and Dampers, attachment to this addendum.

SUPPLEMENTAL FOUNDATION RECOMMENDATIONS

The Supplemental Foundation Recommendations by Fewell Geotechnical Engineering Ltd., dated January 5, 2005 is in attachment to this addendum.

REQUESTS FOR CLARIFICATION

Question 1:

Section 303.07.F.2.n states the Importance Factor shall be 1.5 while Sheet S-4 of the drawings states the Importance Factor is 1.25. ACI 350 and AWWA D110 use 1.25 for essential facilities while IBC 2006 uses 1.5 for essential facilities. It is our understanding that Hawaii has recently adopted IBC 2006. Please have the Engineer review and determine if the project should also include IBC 2006 as part of Section 303.07.F.1 and the General Notes on Sheet S-4 of the plans and if the Importance Factor for the project should include both 1.25 and 1.5.

Response:

(Section 303.07.F.2.n) The structural design shall be per ACI 350.3-06 or AWWA D110-04, therefore the Importance Factor shall be equal to 1.25.

Question 2:

Section 303.07.F.2 items k and l, state the Ss and S1 values are 201% of gravity and 88% of gravity, respectively. We were not able to locate these values in the referenced Geotechnical Investigation Report, dated November 2, 2004. However, we did visit the USGS website to get the code minimum seismic values, based on the proposed site coordinates, and obtained slightly different values of 2.203g and 0.926g, respectively. Please have the Engineer review and determine if the seismic design parameters found in the Specifications are site specific or if the minimum values provided by USGS's website are acceptable for the project.

Response:

(Section 303.07.F.2, item k and l) The seismic values, Ss and S₁ shall be revised to 2.21g and 0.93g respectively when using ACI 350.3-06 for the seismic design.

Question 3:

Section 303.07.F.2.f states the freeboard below top of wall shall be 2 ft. Due to the large seismic values expected at the site, the slosh wave height, calculated in accordance with Section 303.07.F.4.o, is greater than 2 ft. In order to prevent the slosh wave uplift from exceeding 90% of the roof's dead weight, the wall would need to be 22.75" tall or 9 inches greater than shown on the Drawings. Please have the Engineer review and determine if the freeboard value may be considered a minimum value and that the wall height may be increased.

Response:

(Section 303.07.F.2.f) The specified vertical freeboard distance shall be maintained, we would not expect the roof slab to lift from the interior columns where they are fully dowel. We prefer the roof slab be designed to resist the upward sloshing force produced by the design-level seismic event by

MAKUU OFFSITE WATER SYSTEM PHASE 2 (IFB-13-HHL-002) ADDENDUM NO. 2 Page 3 (August 24, 2012) designing the two-way roof slab for this force. We understand some contents of the tank could be lost through the roof slab/wall joint, but prefer this to the related adjustments that would occur if the height of the reservoir were to be increased.

Question 4:

Section 303.07.R.5.a states the polypropylene fibers in the shotcrete mix shall be fibrillated. Through extensive research and development, it has been determined the application, mixing and quality of the finished shotcrete is significantly improved if the fibers are not fibrillated. Please have the Engineer review and determine if non-fibrillated fibers are acceptable for the project.

Response:

(Section 303.07.R.5.a) The use of non-fibrillated polypropylene fibers is acceptable in the shotcrete mix.

Question 5:

Section 303.07.R.5.d states the polypropylene fibers are to be of high tensile strength. The manufacturers of the non-fibrillated polypropylene fibers no longer provide this property. Please note the non-fibrillated fibers will meet the ASTM requirements stated in Specification Section 303.07.R.c.

Response:

(Section 303.07.R.5.d) The strength requirement for the polypropylene fiber in the shotcrete has been removed since these fibers are provided as secondary reinforcing.

Question 6:

Section 303.27A states the exterior wall, roof and interior piping shall be coated but detail 1 of Drawing Sheet S-11 states the interior of the tank shall be painted with primer and two coats of epoxy paint. It is standard practice in Hawaii not to coat the interior of the tank, other than the pipes, as noted in the project Specification. Please have the Engineer confirm that Section 303.27A is the intended requirement for the project.

Response:

(Section 303.27A) The interior coating requirement was accidently left in place when the interior coating requirement was deleted from this project. This requirement has been removed from sheet S-11.

Question 7:

Drawing Sheet C-5 states the finished grade around the tank is 822.5 and Drawing Sheet C-8 provides a detail of the wall footing with a top of wall footing elevation exterior of the wall of 823.083 and depth of 1.5 feet (Elevation 821.583). The Reservoir details found on Sheets S-4 to S-19 provide a different wall footing detail and a minimum embedment of 18 inches stated on Detail 1 of Sheet S-6. Page 5 of the Geotechnical Investigation Report, dated November 2, 2004, requires the tank foundation to be embedded a minimum of 6 inches into the basalt rock. Please have the Engineer review and determine the required embedment elevation for the bottom of the tank wall footing.

Response:

MAKUU OFFSITE WATER SYSTEM PHASE 2 (IFB-13-HHL-002)

ADDENDUM NO. 2 Page 4 (August 24, 2012) (Sheet C-5) The design intent for determining the bottom of footing elevation is the locate the bottom of footing 18 inches below the adjacent grade to the reservoir wall footing. This will result in a 3 foot thick footing at the extreme condition.

Question 8:

Drawing Sheet C-5 provides dimensions to the outside face of wall and wall footing. The dimensions appear to be based on Sheet C-8, which vary from the minimum requirements provided in Reservoir details found on Sheets S-4 to S-19. Please have the Engineer review and determine if the dimensions should follow the minimum criteria established by the details shown on Sheets S-4 to S-19.

Response:

(Sheet C-5) The dimension to the outside edge of the reservoir footing have been coordinated by adjusting the structural detail on Sheet S-9, resulting in a 50 foot radius to the outside edge of the reservoir footing. Also the inside face of wall radius = 47'-0" dimension shown on S-9 governs over the outside face of wall dimension shown on C-5 and C-6.

Question 9:

Specification Section 303.07.F.2 items "d" and "e" state the floor and roof slopes, with high points at the center, shall be 1% and 1.5%, respectively. In order to optimize the construction of the tank by making all the columns the same length, please have the Engineer review and determine if the floor and roof slopes may both be 1.5%.

Response:

(Section 303.07.F.2, item d and e) The floor slope of the reservoir has been revised from 1.0% to 1.5%. Sheet S-11 has been revised to reflect this change.

Question 10:

Drawing Sheet S-8 shows the washout pipe 5 ft from the inside face of the wall and Sheet C-8 shows the washout pipe is 5 ft from the inside face of wall but also at the tank centerline. Please have the Engineer review and confirm that the washout pipe shall be located 5 ft from the Inside face of wall and that the floor shall have a high point at the center.

Response:

(Sheet S-8) The design intent is to show the pipe in question, 5 feet from the inside face of the wall. The reference to the tank centerline was accidently left there from when the pipe was located in the center of the tank.

Question 11:

The pipe entrance through floor details appear to be different on Drawing Sheets C-8, S-7 and S-8. The details shown on Sheets C-8 locate the connections between two pipes in the floor which will cause additional stresses in the floor should the pipe rotate or move. It is recommended that the details provided on sheet S-7 and S-8 be followed, Please have the Engineer review and determine if the use of the details on Sheets S-7 and S-8 are appropriate for the project.

Response:

Sheet C-8 has been revised in this addendum to match the structural drawing dimension.

MAKUU OFFSITE WATER SYSTEM PHASE 2 (IFB-13-HHL-002)

ADDENDUM NO. 2 Page 5 (August 24, 2012)

Ouestion 12:

Drawing Sheet C-8 shows the distance from the inside face of corewall to centerline of the pipe penetrating the floor as 5 ft. While Sheets S-7 and S-8 show the same dimension as a minimum value. Please have the Engineer review and determine if the distance from the inside face of corewall to the centerline of all the pipes penetrating the floor may be considered a minimum value and be adjusted from 5 ft to 6 ft. The modification will result in a more cost effective wall footing design at the location of the floor penetrations.

Response:

Sheet C-8 has been revised in this addendum to match the structural drawing dimension.

Question 13:

Drawing Sheet S-9 shows construction joints in the floor and roof. Detail 1 shows the floor placed in halves and Detail 2 shows the roof cast in quadrants. The floor and roof areas, 7,800 sq ft (+/-), of the proposed tank will allow a construction crew place, finish and cure the concrete in a single pour. Please have the Engineer review and determine if construction joints in the floor and roof may be considered optional.

Response:

(Sheet S-9) The construction joints in the floor and roof slab of the reservoir can be eliminated if the Contractor provides adequate resources when placing, finishing and curing the slabs. The Contractor shall be responsible for repairing any observed cracks or other defects in the slab work if joints are eliminated at no additional cost to DHHL. If these conditions are acceptable to the Contractor, an RFI can be submitted during construction requesting the joints be eliminated.

Question 14:

Detail 3 on Drawing Sheet S-8 shows the termination of the influent pipe at 14 ft above finished floor. In addition to the concrete pedestal surrounding the pipe, you may wish to have the Engineer review and determine if a thickened concrete splash pad on top of the floor around the pedestal will further prevent erosion of the floor concrete.

Response:

(Sheet S-8) We have not seen any excessive wear to the slab area surrounding elevated influent pipes, and it is believed that tank will commonly have some amount of water covering the floor helping to reduce or eliminate the wear to the concrete floor due to the cascading water. No change will be made at the base of the influent pipe.

Question 15:

We were unable to locate the friction coefficient between the underside of the tank floor and the aggregate base course material. Please have the Engineer or Geotechnical Engineer review and determine if it is acceptable to use a coefficient of friction of 0.45 at this interface.

Response:

The coefficient of friction is 0.50 per the Supplemental Foundation Recommendations by Fewell Geotechnical Engineering Ltd., dated January 5, 2005 in attachment to this addendum.

Question 16:

Drawing Sheet S-4 states the foundation design is based on Geotechnical Investigation by Fewelt Geotechnical

MAKUU OFFSITE WATER SYSTEM PHASE 2 (IFB-13-HHL-002)

ADDENDUM NO. 2 Page 6 (August 24, 2012) Engineering, LTD. (File 2460.01 Dated Nov 2, 2004 and Jan 5, 2005). We were able to locate the Report dated November 2, 2004, but could not find the January 5, 2005 report. We kindly request a copy of the January report, to ensure that all design parameters are implemented into the design of the tank.

Response:

The Supplemental Foundation Recommendations by Fewell Geotechnical Engineering Ltd., dated January 5, 2005 is in attachment to this addendum.

Ouestion 17:

Specification Section 303.07.Z states the requirements for the abrasive blasting of the exterior face of the corewall prior to the initial layer of shotcrete. Historically tanks that incorporate an initial layer of shotcrete use sandblasting to remove the laitance, form oils or other types of coatings referenced in the Section from the exterior face of the corewall. Sandblasting has a successful performance record on numerous tanks in Hawaii. Sandblasting will produce a concrete surface profile 3 (CSP 3) to ensure a mechanical bond between the initial layer of shotcrete and the natural gun surface profile of the initial layer of shotcrete will ensure a mechanical bond between subsequent layers of shotcrete applied per the requirements in Specification Section 303.07, Please have the Engineer review and determine that sandblasting, without a recovery system, as typically used on prestressed concrete tank projects in Hawaii is acceptable for the project.

Response:

The proposed sand blasting process can be used as requested, as long as the Department of Health requirements for sand blasting are satisfied.

Question 18:

Proposal Item No. 40 of the subject project shows a proposal quantity of 3 each grated drain inlets, but we are only able to locate 1 each of the drain inlets (Note No. 35 on Sheet C-6).

Response:

Proposal item 40 has been revised in this addendum, there is only one drain inlet. Sheet C-6 has been revised in this addendum.

Question 19:

Sheet S-11 says paint and primer 2 coats on the interior of tank. Spec section 303.27A-4 note H says NO PAINT. Please advise what is correct.

Response:

(Section 303.27A) The interior coating requirement was accidently left in place when the interior coating requirement was deleted from this project. This requirement has been removed from sheet S-11, Addendum No. 2.

Ouestion 20:

The dimension callouts of the elevation view of Sheet C-15 for the booster pump pad appears to be incorrect.

Response:

The dimension callouts have been revised on Sheet C-15, Addendum No. 2.

Question 21:

MAKUU OFFSITE WATER SYSTEM PHASE 2 (IFB-13-HHL-002) ADDENDUM NO. 2 Page 7 (August 24, 2012) In Sheet C-5, the difference between the elevation of the finished floor of the reservoir (824.0') and the elevation at the edge of the footing (822.5') is 1.5'. This does not match the details in S-6 to S-11. Please clarify.

Response:

The elevations shown on C-5 are correct – the structural details have been revised and shown in this addendum.

Question 22:

The outside face of footing is shown as R = 50' in Sheet C-5 but it is also shown as R = 49'-10" in Sheet S-9. Please clarify.

Response:

The diameter (R=50') shown on C-5 is correct – the dimension shown in the structural drawing has been revised and shown in this addendum.

FEDERAL WAGE RATE SCHEDULE

Replace the item 01f Federal Wage Rate Schedule with the attached Federal Wage Rate Schedule HI120001 Modification 9 8-10-12.

Bid Form

Project Identification: Makuu Offsite Water System Phase 2: Production Well, Reservoir and Supporting Facilities

Contract Identification and Number: IFB-13-HHL-002

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ARTICLE 1 - BID RECIPIENT

- 1.01 This Bid Is Submitted To: <u>Department of Hawaiian Home Lands</u>, 91-5420 Kapolei Parkway, Kapolei, Hawaii 96707
- 1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in the Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 - BIDDER'S ACKNOWLEDGMENTS

2.01 Bidder accepts all of the terms and conditions of the Advertisement and Instructions to Bidders, including without limitations those dealing with the dispositions of Bid security. The Bid will remain subject to acceptance for 120 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 - BIDDER'S REPRESENTATIONS

- 3.01 In submitting this Bid, Bidder represents that:
 - A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Addendum No.	Addendum Date
	

- B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Bidder is familiar with and is satisfied as to all Federal, State, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in SC-4.02, and (2) reports and drawings of a Hazard Environmental Conditions, if any, at the Site that have been identified in SC-4.06 as containing reliable "technical data."
- E. Bidder has considered the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder's safety precautions and programs.
- F. Based on the information and observations referred to in Paragraph 3.01.E above, Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of the Work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

J. Bidder will submit written evidence of its authority to do business in the State or other jurisdiction where the Project is located not later than the date of its execution of the Agreement.

ARTICLE 4 - BIDDER'S CERTIFICATION

- 4.01 Bidder further represents that:
 - A. This Bid is genuine and not made in the interest of or on the behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation;
 - B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid:
 - C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
 - D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:.
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;
 - "fraudulent practice" means an intentional misrepresentation of facts made (a) to
 influence the bidding process to the detriment of Owner, (b) to establish bid prices at
 artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and
 open competition;
 - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
 - "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 - BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

ITEM	EST.		UNIT	
NO.	QTY.	DESCRIPTION	PRICE	TOTAL

The contractor shall include furnishing and installing the following items, complete in place, including all mobilization, clearing, grubbing, removal of excess material, excavation, trench excavation, grading, pipe cushion details, backfill, compaction testing, pipe brackets, concrete thrust blocks, joint restraints, fittings, valves, pipes, nipples, testing, paving, pavement repair, temporary trench patching, reconstruction of road facilities, all driveway repairs, shoulder repairs, landscaping repairs, concrete, carpentry, roofing, hardware, painting, miscellaneous metals, instrumentation, planting, site work, and all incidentals, in place complete and operable per plans and specifications. All pipe shall be ductile iron pipe, Class 52, push on joints, unless otherwise specified. All fittings shall be mechanical joint, Class 250, unless otherwise specified. All work shall be according to the Plans, Specifications, and Water System Standards dated 2002, as amended, in place complete and ready for use.

	_	nd ready for use.	as amende	ed, in place	
I. M .	AKUU OF. LS	F-SITE ACCESS ROAD AND TRANSMISSION MAIN Mobilization and Demobilization for Makuu Off-site Access Road and Transmission Main. Lump Sum	\$	\$	
2	LS	Access Road Clearing and Grubbing, including removal of excess material and all incidentals as shown on the plans. (Approximately 5 acres). Lump Sum	\$	\$	
3	LS	Unclassified Access Road Excavation (approximately 4,379 cu. yds.) including all work preparatory to laying the next course or item of work, and all incidentals including hauling of excess excavated material to a designated fill site (see Sht C-27), as shown on the plans. Embankment fill (approximately 1,230 cu. yds.) is incidental. Lump Sum	\$	\$	
4	2,900	Cu. yds., Trench Excavation and backfill for waterlines and drainlines, without classification, including bedding per plans and specifications. Cu. Yds.	\$	\$	
5	8,370	Sq. yds., 2" Minimum Compacted thickness Asphalt Concrete Mix IV, inclusive of 4" minimum compacted thickness aggregate base course, including hauling, spreading, laying, rolling, compacting, and all incidentals, as shown in the plans, in place complete.	I		
		Sq. Yds.	\$	\$	
6	9,820	Lin. Ft., 6"x6" concrete header for access roadway pavement from sta 24+55 to sta 73+63.17 Lin. Ft.	\$	\$	

7	7,360	Lin. Ft., Furnish and install 12-inch ductile iron pipe, including polyethylene wrap and all incidentals necessary to complete the work in place, per plans and specifications.			
		Lin. Ft.	\$ <u> </u>	<u> </u>	
8	LS	Furnishing and installing ductile iron fittings, in place complete. Fittings shall be M.J. Class 250 unless otherwise noted. Furnishing and installing Megalug Resraints are incidental to this item.			
		The total weight of the fittings are approximate and are based on M.J. fittings.			
		12"x6" Tee	4	1,300	
		12"x8" Tee	3	1,020	
		6" Cap	4	120	
		8" Cap	3	135 2.575 X 1	
				2,575 Lbs	
		Lump Sum	\$	\$	
9	LS	Lump Sum, DWS 2500 concrete for reaction blocks and test blocks in place complete.	S		
		Lump Sum	\$	 \$	
10	9	Each, Furnish and install 12" Butterfly Valve, 250#, M.J., with Valve Box in place complete, per plans and specifications.			
		Each	\$	\$	
11	3	Each, Furnish and install 8" Gate Valve, M.J., with Valve Box in place complete, per plans and specifications.			
		Each	\$	 \$	
12	4	Each, Furnish and install 6" Gate Valve, M.J., with Valve Box in place complete, per plans and specifications.			
		Each	\$	 \$	
13	6	Each, Furnish and install 1" Air Relief Valve with Valve Box and appurtenances, in place complete, per plans and specifications.			
		Each	\$	<u> </u>	
14	4	Each, 2" Cleanout including manhole and appurtenances			
		Each	\$	\$	

15	1	Each, Furnish and install Cattle (pipe) gate including 3 padlocks, 2 gate stop posts, boulders to prevent vehicular tresspassing, all incidentals and appurtenances necessary to complete the work in place, per plans and specifications.	2		
		Each	\$	\$	
16	LS	Connect to existing mains and chlorination of new mains (see shee C-16 to C-19 and sheet C-26)			
		Lump Sur	n \$	\$	
17	LS	Testing and chlorination at "Makuu Farm and Agricultural Lots Subdivision, Phase I" waterlines; see State of Hawaii Special Conditions.			
		Lump Sur	n \$	\$	
18	AL	Corrective work on waterlines and appurtenances at "Makuu Farm and Agricultural Lots Subdivision, Phase I" and additional work a determined by the Engineer (A Contingency Item)			
		Allowance	e \$	100,000.00 \$	100,000.00
19	1	Each, Furnish and install Temporary Wooden Project Sign for USDA.			
		Each	\$	\$	
20	1	Each, Furnish and install Temporary Wooden Project Sign for DHHL.			
		Each	\$	\$	
21	LS	Furnish and install No Trespassing Signs, including posts, and No Off Road Driving Signs, including posts.			
		Lump Sur	n \$	\$	
22	LS	Field Office Lump Sur	n \$	\$	
23	LS	Temporary Erosion Control Measures for Off-Site Access Road at Transmission Main.	nd		
		Lump Sur	n \$	\$	
24	250	Cu. Yd., 2-Inch minimum thick gravel (coarse aggregate) topping shoulders.	on		
		Cu. Yds.	\$	\$	
		SUB-TOTAL MAKUU OFFSITE ACCESS ROAD AND TRANSMISSION MAIN (ITEMS 1 THROUGH 24 INCLUSIVE)		\$	

II. MAKUU OFF-SITE PRODUCTION WELL & 1.0 MG RESERVOIR SITE 25 LS Mobilization and Demobilzation for Makuu Off-site Production Well and 1.0 MG Reservoir. Lump Sum \$ 0.9 26 Acres, Site Clearing and Grubbing, including removal of excess material and all incidentals as shown on the plans. Acre 27 6,550 Cu. Yds., Unclassified Site Excavation including all work preparatory to laying the next course or item of work, and all incidentals including hauling of excess excavated material to a designated fill site, as shown on the plans. Cu. Yds. 28 290 Cu. Yds., Trench Excavation and backfill for waterlines and drainlines, without classification, including bedding per plans and specifications. Cu. Yds. 29 1.055 Sq. Yds., 2" Minimum Compacted thickness Asphalt Concrete Mix IV, inclusive of 6" minimum compacted thickness aggregate base course, including hauling, spreading, laying, rolling, compacting, and all incidentals, as shown in the plans, in place complete. Sq. Yds. 29a 86 Sq. Yds., 2" Minimum Compacted thickness Asphalt Concrete Mix IV, inclusive of 4" minimum compacted thickness aggregate base course, including hauling, spreading, laying, rolling, compacting and all incidentals, as shown in the plans, per plans and specifications. Sq. Yds. 30 62 Lin. Ft., Furnish and install 16-inch ductile iron pipe, including polyethylene wrap and all incidentals necessary to complete the work in place, per plans and specifications. Lin. Ft. 31 324 Lin. Ft., Furnish and install 12-inch ductile iron pipe, including polyethylene wrap and all incidentals necessary to complete the work in place, per plans and specifications. Lin. Ft. 32 4.040 Lbs, Furnishing and installing ductile iron fittings, in place complete. Fittings shall be M.J. Class 250 unless otherwise noted.

Lbs.

on M.J. fittings below. Fittings shall be all bell, C110 unless otherwise noted. 1 650 16" Tee 430 16" 1/4 Bend 1 16" Solid Body Sleeve 2 550 12" x 10" Reducer, SEB 1 190 12" 1/4 Bend 1 255 12" 1/8 Bend 1 215 2 12" 1/16 Bend 440 1 220 12" 1/32 Bend, MJxPE 12" Tee 2 800 12" Solid Body Sleeve 2 290 4.040 Lbs. Lbs. 33 17 Cu. Yds., DWS 2500 concrete for reaction blocks and test blocks in place complete. Cu. Yds. 34 1 Each, Furnish and install 16" Butterfly Valve, 250#, M.J., with Valve Box in place complete, per plans and specifications. Each 35 3 Each, Furnish and install 12" Butterfly Valve, 250#, M.J., with Valve Box in place complete, per plans and specifications. Each 36 1 Each, Furnish and install 1" Air Relief Valve with Valve Box and appurtenances, in place complete, per plans and specifications. Each 37 370 Lin. Ft., Furnish and install 6-inch Ø PVC Perforated Perimeter Drain pipe, inclusive of excavation, round drain rock, 30 mil filter fabric, observation ports, bends and appurtenant fittings, in place complete, per plans and specifications. Lin. Ft. Lin. Ft., Furnish and install 12-inch RCP Drain pipe and 38 140 appurtenances, in place complete, per plans and specifications. Lin. Ft. 39 Each, Construct 5-feet deep pump waste line drain inlet, inclusive of 1 structural excavation and backfill, in place complete per plans and specifications. Each

The total weight of the fittings above are approximate and are based

40	*	1	Each, Grated Drain Inlet including frame and grate, excavation and backfill, <u>16" Flap valve, F.E.</u> ; and appurtenant piping, rungs, concrete transition swale, in place complete per plans and specifications.			
			Each	\$	\$	
41	*	3	Each, Construct 8'-0" diameter by 8'-0" depth drain sump, with reinforced concrete cover, galvanized steel frame and inlet grate, including all incidentals, excavation and backfill, 16" Flap Valve, F.E. at Drain Pit No. 1, in place complete per plans and Each	\$	\$	
			Lacii	Ψ	φ	
42	*	LS	Furnish and install miscellaneous exterior site piping including but not limited to: exterior high pressure water line, reduced pressure zone backflow preventer, exterior piping from effluent line to chlorine residual analyzer, exterior air line for well level recording, exterior pressure sensing line for reservoir recording, sampling hose bibb connection and sampling spigot line at reservoir effluent line, all appurtenant fittings and incidentals, in place complete, per plans and specifications. Lump Sum	\$	\$	
43	*	LS	Furnish and install one (1) Vertical Submersible Deep Well Pump			
73		LS	and Motor Unit Complete: including Discharge Coumn Pipe, Lakewood check valves, surface plate assembly, power cable, Well Level Sensor Transmitter, PVC Sounding Tube Conduits (2) and all other appurtenant and connected components, in place complete, tested and fully operational, per plans and specifications.			
			Lump Sum	\$	<u> </u>	
44		LS	Furnish and install above ground pump piping, pump control valve, check valve, magnetic flow meter, gate valve, flow switch, air valve, vacuum release valve, digital pressure gauges, fittings, piping, incidentals and all otherwise itemized per plan and specifications, in place complete, tested and in proper operating condition:			
			a. 8-inch well pump control valve;b. 10-inch silent check valve;			
			c. 10-inch Mag-flow meter with mag transmitter;			
			d. 10-inch gate valve;e. Flow switch;			
			f. Air release valve;			
			g. Vacuum release valve;h. Above ground pump piping, fittings and other			
			connected appurtenances.	ø	.	
			Lump Sum	\$	\$	

45	LS	Furnish and install concrete and concrete work for deepwell pump pad, pump piping pad, pedestals and pipeline anchors (above and below ground), with reinforcing bars, inclusive of structural excavation and backfill, station elevation benchmark, per plans and specifications, in place complete. Lump Sum	\$ \$	
46	LS	1.0 Million Gallon Pre-Stressed Concrete Reservoir including subbase and base structural fill, 30 mil. PVC membrane, 6 mil. moisture barrier, pipe penetrations, influent, effluent, overflow, and cleanout pipelines, pipe supports, pipeline fittings, to exterior face of footing, footings, columns, walls and roof, vertical pre-stressing, wire-wrap with shotcrete cover, interior access ladder, exterior access stairs railings, security fence and gate at roof, hatches, water level indicator, vents, interior pipe coating and exterior finishes, station elevation benchmark, and all appurtenances and incidentals, as shown on the plans, in place complete, plus reservoir design calculations and construction drawings. Also, included is the requirement for test holes (probing) as required by DWS Standards Section 303.02.C.1d.		
		Lump Sum	\$ \$	
47	1	Each, Furnish and install Tank Level Pressure Transmitter including but not limited to piping, fittings, support pipe and appurtenances, and connection to washout line, as shown on the plans in place complete.		
		Each	\$ \$	
48	LS	Furnish and install 12-inch flow meter by-pass assembly including but not limited to 12-inch Mag-Flow 5100W meter unit with Mag 5000 signal converter and cables, piping, air release valves, fittings, pipe supports and straps, concrete pad and compacted base course, structural excavation and backfill; and all other connected appurtenances, in place complete per plans and specifications.		
		Lump Sum	\$ \$	
49	LS	Furnish and install Control building including masonry, concrete roof slab, roofing, sheet and miscellaneous metals, doors, windows, finish hardware, louvers, restroom fixtures, painting, footings, floor slab and equipment pads, sidewalk, base course, structural excavation and backfill; and all incidentals, in place complete per plans and specifications. Lump Sum	\$ \$	

50	* LS	Furnish and install all Chlorinator System, Capital Controls Advance Series 200, Eyewash/ Emergency Shower System, packaged booster pump station and appurtenant Plumbing, Electrical controls, sensing systems, Hydro-pneumatic Tank, Continuous Chlorine Residual monitor transmitter w/ housing, Chlorine Leak Detector and Sensors , Pressure relief valve, Pressure regulating valves, and all other incidentals and appurtenances, in place complete per plans and specifications. Lump Sum	 \$	
51	LS	Furnish and install Chlorine Solution Injector Assembly inlcusive of 1-inch corp stop, 1/2-inch PVC solution tube, 1-inch solution hose, 3-inch Ø PVC pipe, 1-inch ball valve, fittings, DWS standard meter box for 1 1/2-inch meter, excavation, backfill, base course, all other incidentals and appurtenances, in place complete per plans and specifications.		
		Lump Sum	 <u> </u>	_
52	LS	Furnish and install one sewage holding tank inclusive of excavation, backfill, high level alarm float switch, sewage tank float, and all other incidentals and appurtenances, in place complete per plans and specifications.		
		Lump Sum	 \$	_
53	20	Lin. Ft., Furnish and install 4-inch Ø PVC sewage pipe to sewage holding tank, including fittings, two 4-inch Ø PVC cleanout to grade (C.O.T.G.), excavation and backfill and all incidentals necessary to complete the work in place, per plans and specifications. Lin. Ft.	\$ \$	
54	1,006	Furnish and install 6'-0" high chain link fencing including concrete footings, braces, excavation, all incidentals and appurtenances necessary to complete the work in place, per plans and specifications.		_
		Lin. Ft.	\$ \$	_
55	1	Each, Furnish and install 14-feet wide double swing 6'-0" high chain link gate including padlock, security switch, all incidentals and appurtenances necessary to complete the work in place, per plans and specifications.		
		Each	\$ <u> </u>	_
56	LS	Temporary Erosion Control Measures for Off-Site Production Well and 1.0 MG Reservoir Site.		
		Lump Sum	\$ \$	

57	LS	Hydrostatic pressure testing and chlorination of reservoir and site piping, including all incidentals and appurtenances, in place complete.			
		Lump Sum	\$	\$	
58	LS	Provide and deliver to Hilo DWS Base Yard Spare Bearings and Seal only for this Well Project.			
		Lump Sum	\$_	\$	
59	LS	Furnishing, installing, and subsequent removal of pumping test equipment, if required, in accordance with the plans and specifications.			
		Lump Sum	\$_	\$	
60	170	Per Hour, Pumping Tests, in accordance with the plans and specifications.			
		Per Hour	\$_	\$	
61	AL	Allowance to compensate Owner's Hydro-Geologist Representative to monitor test pumping, well chlorination, and cleansing.			
		Allowance	\$_	10,000.00 \$	10,000.00
62	LS	Analytical Well Water testing, including all incidentals, in accordance with the plans and specifications.			
		Lump Sum	\$_	\$	
63	LS	Provide As-built drawings, Instructions, Maintenance and Parts List Manuals and deliver to the Department of Water Supply's Engineering Office in Hilo.			
		Lump Sum	\$_		
		<u> </u>	7		
		SUB-TOTAL MAKUU OFF-SITE PRODUCTION WELL & 1.0 MG RESERVOIR SITE		\$	
		(ITEMS 25 THROUGH 63, INCLUSIVE)			

III. KEONEPOKO NUI BOOSTER PUMP STATION SITE IMPROVEMENTS

64	LS	Mobilization and Demobilization for Keonepoko N Station Site Improvements	ui Booster Pum	np		
			Lump Sum	n	<u> </u>	
65	60	Cu. Yds., Trench Excavation and backfill without c including bedding per plans and specifications.	lassification,			
			Cu. Yds.	\$	\$	
66	26	Lin. Ft., Furnish and install 12-inch ductile iron pip polyethylene wrap and all incidentals necessary to c work in place, per plans and specifications.	_			
			Lin. Ft.	\$	\$	
67	150	Lin. Ft., Furnish and install 8-inch ductile iron pipe, polyethylene wrap and all incidentals necessary to c work in place, per plans and specifications.	_			
			Lin. Ft.	\$	<u> </u>	
68	560	Lbs, Furnishing and installing ductile iron fittings, i complete. Fittings shall be M.J. Class 250 unless of	•			
			Lbs.	\$	\$	
		The total weight of the fittings above are approximation M.J. fittings below. Fittings shall be all bell, C1 otherwise noted.		ed		
		12" x 8" Tee	34	40		
		12" 1/32 Bend		20 60 Lbs.		
69	2	Cu. Yds., DWS 2500 concrete for reaction blocks a place complete.	nd test blocks i	n		
			Cu. Yds.	\$	<u> </u>	
70	2	Each, Furnish and install 12" Butterfly Valve, 250# Valve Box in place complete, per plans and specific				
			Each	\$	\$	
71	1	Each, 8" Gate Valve, 200#, M.J., with Valve Box in	place complet	e		
			Each	\$	<u> </u>	
72	LS	Demolish and remove existing HELCo boxes. Con	tractor to test			
		prior to demolition.	Lump Sum	n \$	\$	

73	*	LS	Furnish and install concrete and concrete work for booster pump pad, booster pump piping pad, pedestals and pipe straps, flange supports, pipeline anchors (above and below ground), with reinforcing bars, inclusive of structural excavation and backfill, station elevation benchmark, per plans and specifications, in place Lump Sum		\$
74		LS	Furnish and install booster pump piping, pump control valves, Mag 5100W flow meters with Mag 5000 signal converters, flow switches, combination back pressure and remote control valve, pressure relief valves, gate valves, air release valves, pressure gauge assemblies, fittings, all other incidentals and appurtenances as per plans and specifications, in place complete, tested and in proper operating condition.	,	
			Lump Sum	\$	\$
75		LS	Furnish and install two (2) vertical turbine booster pumps and VHS motors, discharge heads and cans, all other incidentals and appurtenances as per plans and specifications, in place complete, tested and in proper operating condition.		
			Lump Sum	\$	
76		LS	Connection to existing 16" effluent line at station 0+00 Booster Pump Line, including cutting and removal of 6 l.f. of existing 16" pipe; installation of 16"x 8" tee, concrete block, 16" butterfly valve, 8" gate valve, valve boxes, 16" solid body sleeve, 6 l.f. of 16" pipe, 1" ARV unit and manhole; necessary nipples and items for testing, inclusive of trench excavation, backfill and bedding, per plans and specifications in place complete.		
			Lump Sum	\$	\$
77		LS	Connection to existing 12" water line at station 234+07.16 Keaau-Pahoa Rd., including cutting and removal of 6 l.f. of existing 12" and 8" pipe; removal of 12" 1/4 bend and concrete block, 12"x8" reducer; installation of 12" x8" tee, concrete block, 12" butterfly valve, 8" gate valve, valve boxes, 12" solid body sleeve, 8" solid body sleeve, 6 l.f. of 12" pipe, 6 l.f. of 8" pipe; necessary nipples and items for testing, inclusive of trench excavation, backfill and bedding, per plans and specifications in place complete. Lump Sum	\$	\$

78	LS	Removal of existing 12" water line at station 233+85.20 Keaau-Pahoa Rd., including cutting and removal of 30 l.f. of existing 12" pipe, 12" gate valve and valve box, 12" 1/4 bend, 12" cap, cleanout assembly and box, concrete blocks, inclusive of excavation and backfill, per plans and specifications in place complete.		
		Lump Sum	\$	\$
79	LS	Connection to existing 12" water line at station 233+82.86 Keaau-Pahoa Rd., including installation of 12" sleeve, 21 l.f. of 12" pipe, 12" 1/32 bend, concrete block, necessary nipples and items for testing, inclusive of trench excavation, backfill and bedding, per plans and specifications in place complete.		
		Lump Sum	\$	\$
80	LS	Keaau-Pahoa Road Reconstruction and Temporary Traffic Control Plan inclusive of full width paved shoulder reconstruction, excavation, glassphalt concrete base course, asphalt concrete Mix IV, milled rumble strips, pavement striping and pavement markers, in place complete per plans and specifications.		
		Lump Sum	\$	\$
81	LS	Temporary Erosion Contol Measures for Keonepoko Nui Booster Pump Station Site Improvements.	¢	¢
		Lump Sum	Þ	<u> </u>
82	LS	Provide and deliver to Hilo DWS Base Yard Spare Bearings and Spare Mechanical Seals.		
		Lump Sum	\$	\$
83	LS	Hydrostatic pressure testing and chlorination of piping and appurtenances, including all incidentals and appurtenances, in place complete.		
		Lump Sum	\$	\$
84	LS	Provide As-built drawings, Instructions, Maintenance and Parts List Manuals and deliver to the Department of Water Supply's Engineering Office in Hilo.		
		Lump Sum	\$	<u> </u>
		SUB-TOTAL KEONEPOKO BOOSTER PUMP		<u>(c</u>
		STATION SITE IMPROVEMENTS (ITEMS 64 THROUGH 84, INCLUSIVE)		φ

IV. MAKUU ELECTRICAL WORK

85	LS	Provide mobilization and demobilization for electrical work, including but not limited to field investigation and measurements, hauling, delivery and removal of equipment and cleanup and finishing work.			
		Lump Sum	\$	\$	
86	LS	Provide Radio Path Study per specifications Lump Sum	\$	\$	
87	LS	Provide exterior electrical work at Makuu Well Site for electrical services including riser conduits, service ductlines, handholes, concrete pads for utility equipment and service transformer, Pump System service/metering equipment, Auxiliary Stystem service/metering equipment, TVSS, all in accordance with utility company Rules and Regulations and Service Installation Manual. Lump Sum	\$	\$	
88	LS	Provide interior and exterior electrical work at Makuu Well Site for power and controls for Control Building, and Wellhead/ Piping Pad, including Motor Control Equipment, PNLBD A, RCDR Panel, SCADA Cabinet, Chlorinator Control Panel and related work, Chlorine and Ammonia Leak Detection and related work, pump and motor connections, control device connections, instrumentation connections, and related work as indicated. (10 percent of this item shall be paid separately under Item 92) Lump Sum	\$	\$	
89	LS	Provide interior and exterior electrical work at Makuu Well Site for receptacle and lighting system for Control Building and Wellhead/Piping Pad, including branch circuit wiring, receptacles, and lighting fixtures. Lump Sum	\$	\$	
90	LS	Provide electrical work at existing Keonepoko Nui Reservoir Site for demolition and new work for two new booster pumps, modification to existing pump controls, new pump controls, pump and motor connections, control device connections, SCADA Cabinet, and related work as indicated. (10 percent of this item shall be paid separately under Item 92.) Lump Sum	¢	\$	
		Lump Sum	Ψ	φ	

91	LS	Provide all work to assist with commissioning work by DWS to place into service the SCADA equipment and system at all Sites, start-up and testing; and pre-acceptance testing. (Configuration, set-up, and programming work by DWS.) (20 percent of this item shall be paid seperately under Item 92.)		
		Lump Sum	\$ \$	
92	LS	Provide testing for final acceptance for all electrical items, control functions, SCADA system, to obtain the proper operation at all Sites, to the satisfaction and acceptance of the Department. (20 percent of this item shall be paid separately under Item 92.)		
		Lump Sum	\$ \$	
93	LS	Provide for 60 days continuous operation of electrical and control systems at all Sites satisfactory to the Department after acceptance of the project. (This item shall be 20 percent of Items 90 and 91 and 10 percent of Items 87 and 89.)		
		Lump Sum	\$ \$	
94	LS	Furnish and deliver SCADA system equipment and accessories, Desktop Workstation and accessories, and Laptop Computer and accessories to the Department per specifications.		
		Lump Sum	\$ \$	
95	LS	Provide As-Built Drawings, Instruction, Maintenance, and Parts List Manuals for electrical work. Deliver to the Department's Hilo Baseyard in Hilo.		
		Lump Sum	\$ \$	
96	LS	Provide spare parts for electrical work as described in thespecifications. Deliver to the Department's Hilo Baseyard in Hilo.		
		Lump Sum	\$ \$	
97	AL	Provide allowance for payment to Hawaii Electric Light Co. and any other utility companies for electrical and telephone services and related costs. Include tree-triming in this allowance item.		
		Allowance	\$ 850,000.00 \$	850,000.00
		SUB-TOTAL MAKUU ELECTRICAL WORK (ITEMS 85 THROUGH 97 INCLUSIVE)	\$	

RECAPITULATION

I. MAKUU OFF-SITE ACCESS ROAD AND TRANSMISSION MAIN (ITEMS 1 THROUGH 23, INCLUSIVE)	\$
II. MAKUU OFF-SITE PRODUCTION WELL & 1.0 MG RESERVOIR SITE (ITEMS 25 THROUGH 63, INCLUSIVE)	\$
III. KEONEPOKO NUI BOOSTER PUMP STATION SITE IMPROVEMENTS (ITEMS 64 THROUGH 84, INCLUSIVE)	\$
IV. MAKUU ELECTRICAL WORK (ITEMS 85 THROUGH 97, INCLUSIVE)	\$
V. CONTINGENCY FUND FOR ENTIRE PROJECT (A Contingency Item)	\$ 1,300,000.00
TOTAL SUM BID	\$

Unit Prices have been computed in accordance with paragraph 11.03.B of the Standard General Conditions of the Construction Contract.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the contract Documents.

ARTICLE 6 - TIME OF COMPLETION

- 6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with paragraph 4.02 of the Agreement Between Owner and Contractor for Construction Contract and Section SC-03 of the DHHL Special Conditions on or before the dates or within the number of calendar days indicated in the Agreement.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damage.

ARTICLE 7 - ATTACHMENTS TO THIS BID

- 7.01 The following documents are attached to and made a condition of the Bid:
 - A. Required Bid security in the form of a Bid Bond (EJCDC No. C-430) or Certified Check (circle type of security provided);
 - B. List of Joint Contractors or Subcontractors;
 - C. Hawaii Products Preference schedule.
 - D. If applicable, Certification Form 1 verifying the participation in an apprenticeship program registered with the State Department of Labor and Industrial Relations (DLIR).
 - E. Tax Clearance Certificate from State Department of Taxation and Internal Revenue Service.
 - F. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in paragraph 18.10 of the General Conditions;
 - G. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048);
 - H. If Bid amount exceeds \$100,000, signed RD Instruction 1940-Q, Exhibit A-1, Certification for Contracts, Grants, and Loans.

ARTICLE 8 - DEFINED TERMS

8.01 The terms used in this Bid with the initial capital letters have the meanings indicated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 - BID SUBMITTAL

9.0	1 This Bid is submitte	d by:	
Ex	act Legal Name of Co	ompany (Bidder)	
The	e Bidder represents that	at it is: (Check one only)	
	A Hawaii business i	ncorporated or organized under	r the laws of the State of Hawaii; OR
	State of Hawaii, is	or shall be registered at the St	ated or organized under the laws of the tate of Hawaii Department of Commerce ion (DCCA-BREG) to do business in the
	State of incorporation	1:	_
Bic	lder is:		
	Sole Proprietor Par	tnership Corporation Join	t Venture 🗖 Other:
Fed	deral I.D. No.:	Hawaii Genera	l Excise Tax ID No.:
Sta	te Contractor License	No	
Bu	siness address		
		(Street Address, City, State	e, Zip Code)
Pay	yment address (other the	nan street address above)	
		(Street Address, City, State	e, Zip Code)
Tel	lephone No.: ()	Fax No.: ()	E-Mail address:

If Bidder is:

An Individual

Name (typed or printed):	SEAL,
B y:	if required by State
(Individual's signature)	
Doing business as:	
Partnership_	
Partnership Name:	SEAL,
By:	if required by State
(Signature of general partner attach evidence of authority to s	ign)
Nama (typed or printed):	
Name (typed or printed):	
Name (typed of printed).	_
	_
Corporation Corporation Name:	_
<u>Corporation</u>	
Corporation Corporation Corporation Name: State or Jurisdiction of Incorporation: Type (General Business, Profession, Service, Limited Liability): By:	
Corporation Corporation Corporation Name: State or Jurisdiction of Incorporation: Type (General Business, Profession, Service, Limited Liability):	
Corporation Corporation Corporation Name: State or Jurisdiction of Incorporation: Type (General Business, Profession, Service, Limited Liability): By:	
Corporation Corporation Corporation Corporation Corporation Name: State or Jurisdiction of Incorporation: Type (General Business, Profession, Service, Limited Liability): By: (Signature attach evidence of authority to sign)	CORPORATE SEAL,
Corporation Corporation Corporation Name: State or Jurisdiction of Incorporation: Type (General Business, Profession, Service, Limited Liability): By: (Signature attach evidence of authority to sign) Name (typed or printed):	CORPORATE

A Joint Venture

First Joint Venture Name:	SEAL,
By:	by State
(Signature of joint venture partner attach evidence of authority to	sign)
Name (typed or printed):	
Γitle:	
Second Joint Venture Name:	SEAL, if required
Ву:	by State
By:(Signature of joint venture partner attach evidence of authority	to sign)
Name (typed or printed):	
Γitle:	
Each joint venturer must sign. The manner of signing for each individual corporation that is party to the venture should be in the manner indicated	
Phone and FAX Numbers, and Address for receipt of official communication Business contact information:	ations, if differe

ALL JOINT CONTRACTORS OR SUBCONTRACTORS TO BE ENGAGED ON THIS PROJECT

The Bidder certifies that the following is a complete listing of all joint Contractors or Subcontractors covered under Chapter 444, Hawaii Revised Statutes, who will be engaged by the Bidder on this project to perform the nature and scope of work indicated pursuant to Section 103D-302, Hawaii Revised Statutes, and understands that failure to comply with this requirement shall be just cause for rejection of the bid.

The Bidder further understands that only those joint Contractors or Subcontractors listed shall be allowed to perform work on this project and that all other work necessary shall be performed by the Bidder with his own employees. If no joint Contractor or Subcontractor is listed, it shall be construed that all of the work shall be performed by the Bidder with his own employees.

The Bidders must be sure that they possess and that the Subcontractors listed in the proposal possess all the necessary licenses needed to perform the work for this project. The bidder shall be solely responsible for assuring that all the specialty licenses required to perform the work are covered in his bid.

The Bidder shall include the license number of the joint Contractors or Subcontractors listed below. Failure to provide the correct names and license numbers as registered with the Contractor's Licensing Board may cause rejection of the bid submitted.

Complete Firm Name of Joint Contractor or Subcontractor for Total Sum Bid	License Number	Nature and Scope of Work to be Performed

(Add additional sheets if necessary)

HAWAII PRODUCTS PREFERENCE

Section 103D-1002, Hawaii Revised Statutes (HRS), as amended by Act 175 (Session Laws of Hawaii 2009), provides preference for Hawaii products. The previous Hawaii products list established pursuant to HRS §103D-1002 was suspended effective July 1, 2009, and a new list has been published by the State Procurement Office (SPO). DHHL will be supplementing the list with additional approved products for this solicitation.

Pursuant to HRS §103D-1002(b) (2) and Procurement Circular No. 2009-13, bidders intending to use Hawaii products should distribute the attached SPO-38, *Certification for Hawaii Product Preference*, to each of the manufacturers and producers of such products which bidders intend to use if the manufacturers and producers and their products are not listed on the SPO Hawaii Products List or in the DHHL's list below. The manufacturers and producers must complete and submit SPO-38 to DHHL. The form must be received by DHHL no later than **2:00 p.m., August 6, 2012.** Submittal by facsimile (808 620-9299) is acceptable. If DHHL receives and approves SPO-38s relating to this solicitation DHHL will issue an addendum listing the additional certified and qualified Hawaii products by **4:00 p.m., August 13, 2012.**

Bidders may claim a Hawaii product preference for products that it manufactures or produces with its own workforce and equipment. The SPO-38, *Certification for Hawaii Product Preference*, must be submitted in accordance with the procedures described above in order for Bidder to claim a Hawaii product preference for such Hawaii products Bidder intends to use in this work.

A partial list of approved products is provided below. The complete current list as compiled by the State Procurement Office is available at:

http://www4.hawaii.gov/spoh/HiProducts/hiProducts.htm

Preferences, Hawaii Products

CONSTRUCTION PRODUCTS AND SOIL AMENDMENTS/PRODUCTS

Aggregates — Basaltic Termite Barrier									
Product Subcategory as applicable	Effective	Revised	Manufacturer	Oahu	Maui	Hawaii	Kauai		
	11/03/09		Ameron International Corporation	X	X				
Product Subcategory as applicable	Effective	Revised	ck, Cinder, Limestone and Coral Manufacturer	Oahu	Maui	Hawaii	Kauai		
T I	11/03/09		Ameron International Corporation	X	X				
	10/23/09		CTS Earthmoving, Inc.			X			
	11/03/09	1/20/10	Delta Construction Corporation	X					
	12/14/09		Edwin Deluz Trucking & Gravel LLC			X			
	01/28/10		Goodfellow Bros., Inc.	X					

11/02/09		Grace Pacific	X		X	X
4/26/11		GW Construction			X	
11/03/09		Hawaiian Cement	X	X		
12/15/09		Jas. W. Glover, Ltd.			X	X
06/30/10		Kauai Aggregates				X
10/20/09	07/22/10	Sanford's Service Center, Inc.			X	
11/05/09		Tileco, Inc.	Х	X	X	X
11/03/09		West Hawaii Concrete			X	
11/02/09		Yamada and Sons, Inc.			X	

Aggregates — Recycled Asphalt and Concrete

Product Subcategory as applicable	Effective	Revised	Manufacturer	Oahu	Maui	Hawaii	Kauai
	12/15/09		Glover Honsador				X
	11/02/09		Grace Pacific	X			
	12/15/09		Jas. W. Glover, Ltd.	X		X	
	10/18/10		West Oahu Aggregate Co. Inc.	X			

Asphalt and Paving Materials - HI Products

Product Subcategory as applicable	Effective	Revised	Manufacturer	Oahu	Maui	Hawaii	Kauai
	06/15/10		Black Maui Rose LLC		X		
	12/22/09		Black Plumeria LLC	X			
	10/21/09	11/02/09	Grace Pacific Corporation	X		X	X
	12/05/09		Jas. W. Glover, Ltd.			X	X
	11/03/11		Maui Asphalt X-IV, LLC		X		
	10/28/09		Maui Paving LLC		X		
	11/20/09		Walker-Moody Pavement Products and Equipment	х	х	х	Х
	11/22/09		Yamada and Sons, Inc. dba YS Rock and Con-Agg of Hawaii			X	

Cement and Concrete Products

Product Subcategory as applicable	Effecti ^{ve} Date	Last Revised Date	Manufacturer	Oahu	Maui	Hawaii	Kauai
	11/03/09		Ameron International Corporation	X			
	01/19/10		BOMAT Ltd.	X	X	X	X
	12/15/09		Glover Honsador				X
	11/03/09		Hawaiian Cement	X	X		
	12/15/09		Jas. W. Glover, Ltd.			X	X
	12/15/09		Kohala Coast Concrete & Precast LLC			X	
	06/30/10		0. Thronas, Inc.				X
	11/05/09		Tileco, Inc.	X	X	X	X
	11/03/09		West Hawaii Concrete			X	

Product Effecti Date	Revised Date 0 9 04/15/10 0 9	Manufacturer Aloha Precast, Inc. Ameron International Corporation GPRM Prestress, LLC	Oahu X X	Maui X	Hawaii X	Kauai
Subcategory as applicable 7/12/1 11/03/0 08/02/10 11/03/0 12/15/0 11/03/0 06/30/	Date 0 04/15/10 0 04/15/10	Aloha Precast, Inc. Ameron International Corporation GPRM Prestress, LLC	X			Kauai
7/12/1 11/03/0 08/02/10 11/03/0 12/15/0 11/03/0 06/30/	9 04/15/10	Ameron International Corporation GPRM Prestress, LLC		X	v	
08/02/10 11/03/0 12/15/0 11/03/0 06/30/	9	GPRM Prestress, LLC	X		Λ	X
11/03/0 12/15/0 11/03/0 06/30/	9	GPRM Prestress, LLC				
12/15/0 11/03/0 06/30/			X	X	X	X
11/03/0 06/30/	9	Hawaii Concrete Products, Inc.	X			
06/30/		Kohala Coast Concrete & Precast LLC			X	
1	9	Ramtek Fabrication Co., Inc.	X	X	X	X
	10 02/26/10	Walker Industries, Ltd.	X	X	X	Х
Product Subcategory as applicable Effective	ve Revised	Manufacturer	Oahu	Maui	Hawaii	Kauai
11/20/0	9	Environmental Waste Management Systems, Inc.	Х	х	х	X
Septic Tanks 11/03/0	9	Ameron International Corporation	X			
11/05/0	9 02/26/10	Walker Industries, Ltd.	X	X	X	X
Product Subcategory Date	ve Revised	Manufacturer	Oahu	Maui	Hawaii	Kauai
as applicable 03/03/10	,	Universal Associates, Inc.	X			
03/03/10	<u>, </u>	Offiversal Associates, file.	Λ	<u> </u>		
Pipes-Aluminum and	l Galvanized					
Product Subcategory as applicable Effecti Date	ve Revised Date	Manufacturer	Oahu	Maui	Hawaii	Kauai
Pipes- Miscellaneo 11/03/0	9	Ameron International Corporation	х			
	oating, etc N	Miscellaneous				
Aluminum Docks, Fl						
Aluminum Docks, Fl Product Subcategory as applicable Effective	ve Revised	Manufacturer	Oahu	Maui	Hawaii	Kauai

Playground S	Surfaces						
Product Subcategory as applicable	Effective	Revised	Manufacturer	Oahu	Maui	Hawaii	Kauai
	01/07/10		Innovative Playgrounds and Recreation, Inc.	X	X	X	X
Signs - Traff	ic, Regulato	ory and Co		•		1	
Product Subcategory as applicable	Effective	Revised	Manufacturer	Oahu	Maui	Hawaii	Kauai
**	12/14/09		GP Roadway Solutions, Inc.	X	Х	X	X
	11/20/09		Safety Systems Hawaii, Inc.	X	Х	X	X
Product Subcategory as applicable	Effective	Revised	Manufacturer	Oahu	Maui	Hawaii	Kauai
	11/14/11		Big Rock Manufacturing	X	X	X	X
Soil Amendn	nents, Mulc	h, Compos	t		Τ		
Subcategory as applicable	Effective Date	Revised Date	Manufacturer	Oahu	Maui	Hawaii	Kauai
• •	10/16/09		Kauai Nursery & Landscaping, Inc.	X	Х	X	X
	10/20/09		Sanford's Service Center, Inc.			X	
Compost Filt	er			T	T	1	
Product Subcategory as applicable	Effective Date	Revised Date	Manufacturer	Oahu	Maui	Hawaii	Kauai
	01/25/10		EnviroTech BioSolutions Hawaii, Inc.	X	Х	X	X
	6/02/11		Certified Erosion Control Hawaii LLC	X	X	X	X

DESIGNATION O	DESIGNATION OF HAWAII PRODUCTS TO BE USED									
		Cost FOB Jobsite, Unloaded								
		Including Applicable General								
Description	Manufacturer	Excise and Use Taxes								
		\$								
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(Add additional sheets if necessary)

The Bidder agrees that preference for Hawaii products shall be taken into consideration to determine the low Bidder in accordance with said sections and the rules promulgated; however, the award of contract will be in the amount of the bid offered exclusive of any preferences.

It is further understood by the Bidder that if upon being granted Hawaii Products, and being awarded the contract, if the Bidder fails to use such products or meet the requirements of such preference, the Bidder shall be subject to penalties, if applicable.

APPRENTICESHIP AGREEMENTS

Section 103-55.6, Hawaii Revised Statutes (HRS), was added by Act 17 (Special Legislative Session 1, 2009), and provides the 5% bid adjustment for bidders that are parties to apprenticeship agreements. To be eligible for the preference, the bidder shall:

- 1. State the trades the bidder will employ to perform the work.
- 2. For each trade to be employed to perform the work, the bidder shall submit a completed signed original *Certification Form 1* verifying the participation in an apprenticeship program registered with the State Department of Labor and Industrial Relations (DLIR).
- 3. The *Certification Form 1* shall be authorized by an apprenticeship sponsor of the DLIR list of registered apprenticeship programs. The authorization shall be an original signature by an authorized official of the apprenticeship sponsor.
- 4. The completed *Certification Form 1* for each trade must be submitted by the bidder with the proposal. Previous certifications shall not apply.

Upon receiving *Certification Form 1*, DHHL will verify with DLIR that the apprenticeship program is on the list of apprenticeship programs registered with DLIR. If the program(s) are not confirmed by DLIR, the bidder will not qualify for the preference.

WATER NOTES

- ALL WORK SHALL CONFORM TO THE DEPARTMENT OF WATER SUPPLY'S "WATER SYSTEM STANDARDS", DATED 2002, AS AMENDED.
- 2. THE CONTRACTOR SHALL INFORM THE D.W.S. ENGINEER 72 HOURS PRIOR TO THE BEGINNING OF ANY WATERLINE WORK AND TWO WEEKS PRIOR TO ANY CONNECTION. CHLORINATION. SHUT-OFF OR RELOCATION WORK.
- 3. ALL EXISTING WATERLINES, WATERLINE APPURTENANCES AND OTHER UTILITY LOCATIONS SHOWN ON THE PLANS ARE OBTAINED FROM LATEST RELIABLE SOURCES. THE CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY THE EXACT LOCATION OF ALL UTILITIES IN THE FIELD AND SHALL BEAR ALL COST FOR ALL DAMAGES DURING THE CONTRACT PERIOD.
- 4. MINIMUM HORIZONTAL CLEARANCE BETWEEN WATERLINES AND OTHER UTILITIES SHALL BE 8 FEET UNLESS OTHERWISE SPECIFIED. MINIMUM VERTICAL CLEARANCE BETWEEN WATERLINE AND OTHER UTILITIES SHALL BE 12" PROVIDED CONCRETE JACKETS ARE USED, AND 18" IF NO JACKETS ARE USED.
- 5. ALL FITTINGS (CLASS 250 MINIMUM) AND ALL GATE VALVES (CLASS 200), SHALL BE DUCTILE IRON, WITH MECHANICAL JOINTS UNLESS OTHERWISE SPECIFIED. BUTTERFLY VALVES SHALL BE CLASS 250 WITH EPOXY COATED INTERIOR UNLESS OTHERWISE SPECIFIED.
- 6. THE CONTRACTOR SHALL PAY FOR ALL WORK, EQUIPMENT AND MATERIAL FURNISHED BY THE DWS.
- ALL CONNECTIONS TO EXISTING WATERLINES SHALL BE DONE BY THE D.W.S. CONTRACTOR SHALL PERFORM ALL NECESSARY EXCAVATION, BACKFILL, ROAD REPAIR. TRAFFIC CONTROL AND PROVIDE EQUIPMENT NECESSARY TO COMPLETE THE CONNECTION.
- 8. WHERE WATER SHUT-OFF OF MORE THAN 3 HOURS BECOMES NECESSARY, THE CONTRACTOR, AT HIS OWN COST, SHALL PROVIDE A TEMPORARY BY-PASS LINE THE D.W.S. ENGINEER SHALL DETERMINE BY-PASS LINE SIZE, IF NECESSARY, THE D.W.S. ENGINEER MAY REQUIRE A BY-PASS LINE, REGARDLESS OF THE EXPECTED WATER SHUT-OFF PERIOD.
- 9. ALL PIPELINES, 4" AND LARGER IN DIAMETER, SHALL BE DUCTILE IRON, PUSH ON JOINT CLASS 52, AND ALL PIPELINES SMALLER THAN 4" IN DIAMETER SHALL BE SOFT COPPER, TYPE K, UNLESS OTHERWISE SPECIFIED.
- 10. THE WATER LINE SHALL BE TESTED AT A MINIMUM OF 225 PSI OR 1 1/2 TIMES THE STATIC PRESSURE AT THE LOW POINT, WHICHEVER IS GREATER, UNDER DWS SUPERVISION JUST PRIOR TO PAVING.
- 11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CHLORINATION OF THE WATER SYSTEM AND SHALL BEAR ALL COSTS. THE PERSON(S) ENGAGED TO DO THE CHLORINATION WORK MUST HAVE THE APPROPRIATE LICENSE TO PERFORM THE WORK IN THE STATE OF HAWAII.
- 12. SOLDER AND FLUX SHALL CONTAIN NO MORE THAN 0.2% LEAD.
- 13. PIPE CUSHION FOR COPPER PIPES SHALL BE NO. 4 FINE, MANUFACTURED SAND.
- 14. EXISTING VALVES, F.H. UNITS, VALVE BOXES, FRAMES AND COVERS DESIGNATED "REMOVE AND SALVAGE" SHALL BE CLEANED OF DIRT, SCABS AND CONCRETE AND DELIVERED TO THE RESPECTIVE DWS BASEYARD. THIS WORK SHALL BE CONSIDERED INCIDENTAL TO THE VARIOUS BID ITEMS UNLESS SPECIFIED OTHERWISE.
- 15. EXISTING WATER LINES, VALVES, FITTINGS AND APPURTENANCES NOT DESIGNATED "REMOVE AND SALVAGE" SHALL BE ABANDONED IN PLACE. ALL EXPOSED VALVE BOXES, VALVES, PIPES AND APPURTENANCES SHALL BE REMOVED AND DISPOSED OF PROPERLY AT NOT COST TO THE DWS.
- 16. THE DWS WILL NOT ASSUME OWNERSHIP OF NOR GRANT ANY WATER SERVICE UNTIL THE WATER SYSTEM IS DEDICATED TO THE DWS ALONG WITH ALL NECESSARY EASEMENTS AND DOCUMENTS
- 17. WHEN COMPACTION TESTS ARE REQUIRED. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE THE DWS WITH PROCTOR RESULTS OF MATERIALS TO BE USED FOR THAT PORTION OF WORK REQUIRING COMPACTION. THESE RESULTS SHALL BE CERTIFIED AND SHALL BE FURNISHED TO DWS ONE WEEK PRIOR TO COMMENCEMENT OF WORK, COST FOR COMPACTION TESTS SHALL BE INCIDENTAL TO PIPELINE INSTALLATION.
- ALL NEWLY INSTALLED WATERLINES SHALL HAVE A BLUE WARNING TAPE LABELED "WATERLINE" PLACED DIRECTLY OVER THE COMPACTED CUSHION MATERIAL.
- CONSTRUCTION PROJECTS REQUIRING TEMPORARY WATER SERVICE SHALL BE METERED AND PAID FOR BY THE CONTRACTOR.
- 20. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RECORD DRAWINGS (AS-BUILT DRAWINGS) AND THE LICENSED ENGINEER SHALL CERTIFY THE DRAWINGS AS TO ACCURACY AND SUBMIT THE DRAWINGS AND AS-BUILT TRACINGS TO THE DWS.

GRADING NOTES

- 1. ALL GRADING WORK SHALL CONFORM TO CHAPTER 10 OF THE HAWAII COUNTY CODE. SHOULD A GRADING PERMIT BE REQUIRED, NO WORK SHALL COMMENCE UNTIL THE DEPARTMENT OF PUBLIC WORKS (DPW) APPROVES A GRADING PERMIT.
- 2. THE CONTRACTOR SHALL REMOVE ALL SILT AND DEBRIS DEPOSITED IN DRAINAGE FACILITIES. ROADWAYS AND OTHER AREAS RESULTING FROM HIS WORK, THE COSTS INCURRED FOR ANY NECESSARY REMEDIAL ACTION BY THE DPW SHALL BE PAYABLE BY THE CONTRACTOR.
- 3. THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL KEEP THE PROJECT AND SURROUNDING AREAS FREE FROM DUST NUISANCES. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION CONTROL RULES OF THE STATE DEPARTMENT OF HEALTH, HAR 11-60.1, FUGITIVE DUST
- 4. ALL GRADING OPERATIONS SHALL BE PERFORMED IN CONFORMANCE WITH THE APPLICABLE PROVISIONS OF THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 55, WATER POLLUTION CONTROL AND CHAPTER 54, WATER QUALITY STANDARDS. AND TO THE EROSION AND SEDIMENTATION CONTROL STANDARDS AND GUIDELINES OF THE DEPARTMENT OF PUBLIC WORKS, COUNTY OF HAWAII.
- 5. THE CONTRACTOR SHALL SOD OR PLANT ALL SLOPES AND EXPOSED AREAS. IMMEDIATELY AFTER THE GRADING WORK HAS BEEN COMPLETED.
- 6. FILLS ON SLOPES STEEPER THAN 5:1 SHALL BE KEYED.
- 7. THE CONTRACTOR SHALL INFORM THE DPW OF THE LOCATION OF THE DISPOSAL AND/OR BORROW SITE(S) REQUIRED FOR THIS PROJECT WHEN AN APPLICATION FOR A GRADING PERMIT IS MADE. THE DISPOSAL AND/OR BORROW SITE(S) MUST ALSO FULFILL THE REQUIREMENTS OF THE GRADING ORDINANCE.
- 8. NO GRADING WORK SHALL BE DONE ON SATURDAYS, SUNDAYS AND HOLIDAYS ANYTIME WITHOUT PRIOR APPROVAL FROM THE DEPARTMENT OF PUBLIC WORKS GRADING WORK ON NORMAL WORKING DAYS SHALL BE BETWEEN THE HOURS OF 8:00 A.M. TO 4:30 PM.

CONSTRUCTION NOTES

- SHOULD ANY UNANTICIPATED ARCHAEOLOGICAL SITE(S) BE UNCOVERED, ALL WORK SHALL CEASE IN THE IMMEDIATE AREA AND THE DLNR, HISTORIC PRESERVATION DIVISION (327-3690) (KONA OFFICE) SHALL BE NOTIFIED. NO WORK SHALL RESUME UNTIL CLEARANCE HAS BEEN OBTAINED FROM THE HISTORIC PRESERVATION DIVISION.
- 2. NO WORK SHALL BE DONE ON SATURDAYS, SUNDAYS, AND HOLIDAYS AT ANYTIME WITHOUT PRIOR APPROVAL FROM THE DEPARTMENT OF HAWAIIAN HOME LANDS. NORMAL WORKING HOURS SHALL BE BETWEEN 7:00 A.M. TO 3:30 P.M. MONDAY - FRIDAY.
- 3. CONTRACTOR SHALL APPLY AND PAY FOR ALL PERMITS. PERMITS SHALL INCLUDE. BUT NOT LIMITED TO DEPARTMENT OF HEALTH NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PERMITS FOR STORM WATER, HYDROSTATIC TEST AND DEWATERING DISCHARGES (IF APPLICABLE) PRIOR TO COMMENCING CONSTRUCTION.
- 4. THIS PROJECT SHALL BE SUBJECT TO THE DEPARTMENT OF WATER SUPPLY (DWS), COUNTY OF HAWAII, INSPECTIONS, CONTRACTOR SHALL COORDINATE WITH DWS AND DHHL FOR INSPECTIONS. AFTER CONSTRUCTION, DWS WILL DO THE OPERATION, REPAIR, AND MAINTENANCE OF THE WATER SYSTEM
- 5. UPON COMPLETION AND ACCEPTANCE OF THE PROJECT BY THE DHHL, THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER ONE (1) COMPLETE SET OF CERTIFIED AS-BUILT DRAWINGS. THE AS-BUILT DRAWINGS SHALL SHOW THE ACTUAL CONSTRUCTION SO THAT ANY FUTURE RENOVATIONS OR TIE-INS CAN BE ANTICIPATED ACCURATELY. (SEE SPECIFICATIONS FOR DETAILED REQUIREMENTS)
- 6. UPON COMPLETION AND ACCEPTANCE OF THE PROJECT BY THE DHHL. THE CONTRACTOR SHALL PREPARE AND SUBMIT TO THE ENGINEER AN ITEMIZED IN-PLACE COST LIST, TO THE SATISFACTION OF THE DEPARTMENT OF WATER SUPPLY (DWS). THIS IS REQUIRED FOR CONVEYANCE OF THE WATER SYSTEM TO DWS FOR OPERATION AND MAINTENANCE. IF THE BID PROPOSAL IS ITEMIZED. THEN THE PROPOSAL WITH AS-BUILT CHANGES NOTED WILL BE SUFFICIENT. IF THE BID PROPOSAL IS LUMP SUM, THEN THE CONTRACTOR SHALL PREPARE AN ITEMIZED IN-PLACE COST LIST FOR THE DWS. (FOR EXAMPLE, IF ALL ELECTRICAL WORK IS LUMP SUM, THEN CREATE AN ITEMIZED LIST OF EQUIPMENT INSTALLED).

DEPARTMENT OF LAND AND NATURAL RESOURCES (DLNR) NOTES:

- 1. CONTRACTOR AGREES TO INDEMNIFY, DEFEND AND HOLD THE STATE OF HAWAI'I, DEPARTMENT OF LAND AND NATURAL RESOURCES, HARMLESS FROM AND AGAINST ANY LOSS, LIABILITY, CLAIM OR DEMAND FOR PROPERTY DAMAGE, PERSONAL INJURY, AND DEATH ARISING OUT OF ANY ACT OR OMISSION OF THE CONTRACTOR RELATING OR CONNECTED WITH THIS PROJECT.
- 2. CONTRACTOR SHALL PROCURE AND MAINTAIN DURING THE ENTIRE PERIOD OF THIS PROJECT FROM AN INSURANCE COMPANY OR COMPANIES LICENSED TO DO BUSINESS IN THE STATE OF HAWAI'I, A POLICY OR POLICIES OF COMPREHENSIVE PUBLIC LIABILITY INSURANCE, IN AN AMOUNT OF \$500,000 PER INCIDENT / \$1,000,000 AGGREGATE INSURING THE STATE OF HAWAI'I AGAINST ALL CLAIMS FOR PERSONAL INJURY, DEATH, AND PROPERTY DAMAGE; THAT SAID POLICY SHALL COVER THE ENTIRE PROJECT AREA (TMK: (3)-1-5-08: 1, 3), INCLUDING THE DWS KEONEPOKO NUI WELL AND RESERVOIR SITE, & INCLUDING ALL IMPROVEMENTS AND GROUNDS AND ALL ROADWAYS OR SIDEWALKS ON OR ADJACENT TO THE SAID AREA IN THE CONTROL OR USE OF THE CONTRACTOR;
- 3. CONTRACTOR SHALL NOT CAUSE OR PERMIT THE ESCAPE, DISPOSAL OR RELEASE OF ANY HAZARDOUS MATERIALS EXCEPT AS PERMITTED BY LAW. CONTRACTOR SHALL NOT ALLOW THE STORAGE OR USE OF SUCH MATERIALS IN ANY MANNER NOT SANCTIONED BY LAW OR BY THE HIGHEST STANDARDS PREVAILING IN THE INDUSTRY FOR THE STORAGE AND USE OF SUCH MATERIALS, NOR ALLOW TO BE BROUGHT ONTO THI PROJECT AREA ANY SUCH MATERIALS EXCEPT TO USE IN THE ORDINARY COURSE OF BUSINESS OF THE CONTRACTOR, AND THEN ONLY AFTER WRITTEN NOTICE IS GIVEN TO THE STATE OF THE IDENTITY OF SUCH MATERIALS AND UPON THE STATE'S CONSENT WHICH MAY BE WITHHELD AT THE STATE'S SOLE AND ABSOLUTE DISCRETION. IF ANY LENDER OR GOVERNMENTAL AGENCY SHALL EVER REQUIRE TESTING TO ASCERTAIN WHETHER OR NOT THERE HAS BEEN ANY RELEASE OF HAZARDOUS MATERIALS BY THE CONTRACTOR, THEN THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REASONABLE COST THEREOF.

CONTRACTOR AGREES TO INDEMNIFY, DEFEND, AND HOLD THE STATE HARMLESS, FROM ANY DAMAGES AND CLAIMS RESULTING FROM THE RELEASE OF HAZARDOUS MATERIALS ON THE PROJECT AREA OCCURRING WHILE THE CONTRACTOR IS IN POSSESSION, OR ELSEWHERE IF CAUSED BY THE CONTRACTOR.

FOR PURPOSES OF THIS "HAZARDOUS MATERIAL" SHALL MEAN ANY POLLUTANT, TOXIC SUBSTANCE, HAZARDOUS WASTE, HAZARDOUS MATERIAL, HAZARDOUS SUBSTANCE, OR OIL AS DEFINED IN OR PURSUANT TO THE RESOURCE CONSERVATION AND RECOVERY ACT. AS AMENDED. THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT, AS AMENDED, THE FEDERAL CLEAN WATER ACT, OR ANY ORDINANCE, RULE, OR BY-LAW, WHETHER EXISTING AS OF THE DATE HEREOF, PREVIOUSLY ENFORCED, OR SUBSEQUENTLY ENACTED:

- 4. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE STATUTES, ORDINANCES, RULES AND REGULATIONS OF THE FEDERAL, STATE AND COUNTY OF HAWAI'I GOVERNMENTS RELATIVE TO THE RIGHTS GRANTED HEREIN;
- 5. IN THE EVENT ANY UNANTICIPATED SITES OR REMAINS SUCH AS BONE OR CHARCOAL DEPOSITS, HUMAN BURIALS, ROCK OR CORAL ALIGNMENTS, PAVINGS OR WALLS ARE ENCOUNTERED, CONTRACTOR SHALL STOP WORK AND CONTACT THE STATE HISTORIC PRESERVATION DIVISION AT (808) 692-8015, (601 KAMOKILA BLVD., ROOM 555, KAPOLEI, HI., 96707) IMMEDIATELY:
- 6. CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE ANY AND ALL REFUSE IT PRODUCES WITHIN THE PROJECT AREA;
- 7. NO OPEN BURNING OF ANY TYPE SHALL BE PERMITTED ON THE PROJECT AREA AND/OR THE SURROUNDING STATE LANDS;
- 8. CONTRACTOR SHALL USE APPROPRIATE PRECAUTIONS AND MEASURES TO MINIMIZE INCONVENIENCES TO SURROUNDING RESIDENTS, LANDOWNERS, AND THE PUBLIC IN GENERAL; AND
- 9. THE DEPARTMENT OF LAND AND NATURAL RESOURCES, LAND DIVISION, RESERVES THE RIGHT TO IMPOSE ADDITIONAL TERMS AND CONDITIONS AT ANY TIME IF IT DEEMS NECESSARY WHILE THIS PROJECT IS UNDER CONSTRUCTION, TO BEST SERVE THE INTEREST OF THE STATE.

SUBSURFACE INVESTIGATION REPORT RECOMMENDATIONS NOTES

SEE SHEET C-4 ADDENDUM NO.2, FOR

REVISED SUBSURFACE INVESTIGATION REPORT RECOMMENDATIONS NOTES

WATER NOTES (DEPARTMENT OF HEALTH)

- CHLORINATION OF WATER SYSTEMS
- 1. WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA STANDARD FOR DISINFECTING WATER MAINS, ANSI/AWWA C651-99, SECTION 4.4.3 CONTINUOUS—FEED METHOD.
- 2. THE STORAGE TANK SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA STANDARD FOR DISINFECTING WATER-STORAGE FACILITIES. ANSI/AWWA C652-92, SECTION 4.1, CHLORINATION METHOD 1.
- 3. LIQUID CHLORINE OR CALCIUM HYPOCHLORITE THAT HAS BEEN TESTED AND CERTIFIED AS MEETING THE SPECIFICATIONS OF ANSI/NSF STANDARD 60, DRINKING WATER TREATMENT CHEMICALS - HEALTH EFFECTS, SHALL BE USED FOR THE CHLORINATION OF THE WATER MAINS AND STORAGE TANK.
- 4. PRIOR TO CHLORINATION, THE WATER MAINS AND SHALL BE THOROUGHLY FLUSHED.
- 5. THE INTERIOR SURFACES OF THE WATER MAINS SHALL BE EXPOSED TO THE CHLORINATING SOLUTION, BY COMPLETELY FILLING THE MAIN TO REMOVE ALL AIR POCKETS. FOR A MINIMUM OF 24 HOURS AND THE FREE CHLORINE RESIDUAL SHALL NOT BE LESS THAN 10 PPM AFTER
- 6. SHOULD CALCIUM HYPOCHLORITE BE USED, NO SOLID AND/OR UNDISSOLVED PORTION OF THE COMPOUND SHALL BE INTRODUCED INTO ANY SECTION OF THE WATER MAINS AND STORAGE TANK TO BE CHLORINATED.
- 7. AT THE END OF THE 24 HOUR DISINFECTION PERIOD, REPRESENTATIVE SAMPLES SHALL BE TAKEN AND ANALYZED TO ASSURE A FREE CHLORINE RESIDUAL OF AT LEAST 10 PPM.
- 8. SHOULD THE FREE CHLORINE RESIDUAL RESULTS INDICATE ADEQUATE CHLORINATION, THE WATER MAINS AND STORAGE TANK SHALL BE THOROUGHLY FLUSHED AND FILLED WITH WATER FROM THE EXISTING SYSTEM AND AGAIN TESTED FOR FREE CHLORINE RESIDUAL. THE FLUSHING SHALL BE CONSIDERED ADEQUATE IF THE FREE CHLORINE RESIDUAL TEST RESULTS INDICATE THAT THE WATER IN THE WATER MAINS AND STORAGE TANK HAS A COMPARABLE CHLORINE RESIDUAL AS THE WATER IN THE EXISTING SYSTEM.
- 9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER DISPOSAL OF CHLORINATED WATER TO SAFEGUARD PUBLIC HEALTH AND ENVIRONMENT IN ACCORDANCE WITH APPLICABLE STATE DEPARTMENT OF HEALTH REQUIREMENTS. A NEUTRALIZING CHEMICAL SHALL BE APPLIED TO THE WATER TO BE WASTED TO THOROUGHLY NEUTRALIZE THE CHLORINE RESIDUAL REMAINING IN THE WATER IN ACCORDANCE WITH AWWA C651-99, SECTION 4.5.2, AND APPENDIX C.
- 10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH PRIOR TO THE START OF CONSTRUCTION, FOR THE DISPOSAL OF WATER USED FOR HYDROTESTING AND CHLORINATION.
- 11. FOLLOWING THE ACCEPTABLE FLUSHING OF THE WATER MAINS, TWO CONSECUTIVE SETS OF ACCEPTABLE SAMPLES, TAKEN AT LEAST 24 HOURS APART, FROM REPRESENTATIVE POINTS SHALL BE TAKEN AND SUBJECTED TO MICROBIOLOGICAL TESTS. FOR WATERLINES, AT LEAST ONE SET OF SAMPLES SHALL BE COLLECTED FROM EVERY 1,200 FEET OF THE NEW WATER MAIN, PLUS ONE FROM THE END OF THE LINE AND AT LEAST ONE SET FROM EACH BRANCH. FOR THE STORAGE TANK, THE SAMPLE SHALL BE COLLECTED FROM THE TANK'S EFFLUENT LINE SAMPLE TAP. POSITIVE OR INVALID TEST RESULTS WILL NOT BE ACCEPTABLE AND THE PROCESS WILL BE REPEATED.
- 12. ALL MEASUREMENTS FOR CHLORINE RESIDUAL SHALL BE ANALYZED USING E.P.A. APPROVED METHODS FOR DRINKING WATER.
- 13. ALL MICROBIOLOGICAL TESTS SHALL BE PERFORMED BY A LABORATORY APPROVED BY THE DEPARTMENT OF HEALTH, STATE OF HAWAII.
- 14. THE DEVELOPER/CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH ALL OF THE FOREGOING.
- 15. SEE ANSI/AWWA C651-99, SEC. 4.3.6 FOR SWABBING CHLORINATION PROCEDURES.

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

ENVIRONMENTAL PROTECTION NOTES (DEPARTMENT OF HEALTH)

1. IN ACCORDANCE WITH CHAPTER 11-55, WATER POLLUTION CONTROL AND CHAPTER 11-54, WATER QUALITY STANDARDS, TITLE 11, STATE ADMINISTRATIVE RULES, THE PROPERTY OWNER/DEVELOPER SHALL BE RESPONSIBLE FOR ENSURING THAT THE BEST MANAGEMENT PRACTICE (BMP) TO MINIMIZE OR PREVENT THE DISCHARGE OR SEDIMENTS, DEBRIS, AND OTHER WATER POLLUTANT INTO STATE WATERS IS PROVIDED.

ASPHALTIC CONCRETE (AC) PAVEMENT NOTE

1. CONSTRUCTION OF ALL ASPHALTIC CONCRETE (AC) PAVEMENT SHALL BE DONE IN ACCORDANCE WITH ALL APPLICABLE SECTIONS OF THE CURRENT "HAWAII STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, OF THE STATE DEPARTMENT OF TRANSPORTATION, HIGHWAYS DIVISION. THIS SUPERSEDES SECTION 303.32 (ASPHALTIC CONCRETE PAVEMENT) OF THE WATER SYSTEM STANDARDS.

EARTHWORK RECAPITULATION EXCAVATION | EMBANKMENT | AREA OF GRADING (C.Y.) (C.Y.) (ACRES) WELL SITE 6,550 0.9 ACCESS ROAD 4,379 1,230 3.6 TOTAL 10,929 1,230 4.5

EARTHWORK SUMMARY

EXCAVATION = 10,929 C.Y.

EMBANKMENT = 1,230 C.Y.

AREA OF GRADING = 4.5 AC.

1. THE EARTHWORK QUANTITIES ABOVE ARE APPROXIMATE AND ARE SHOWN FOR PERMIT PURPOSE ONLY.

\triangle	08/13/12	ADDENDUM NO.2: MOVED NOTES		ESH	
REVISION	DATE	DESCRIPTION		MADE BY	APPROVED
OF EN	R UNDER MY	AS PREPARED BY ME Y SUPERVISION. SURVEYORS HAWAII, INC. 4/30/2014	* PF	LICENSED ROFESSION ENGINEER No. 5292-	AL X
1		ENGINEER:	S SUI		RS

HONOLULU, HAWAII 96814 591-8116 HON. 885-4590 KAMUELA DEPARTMENT OF HAWAIIAN HOME LANDS MAKUU OFFSITE WATER SYSTEM PHASE 2: PRODUCTION WELL, RESERVOIR

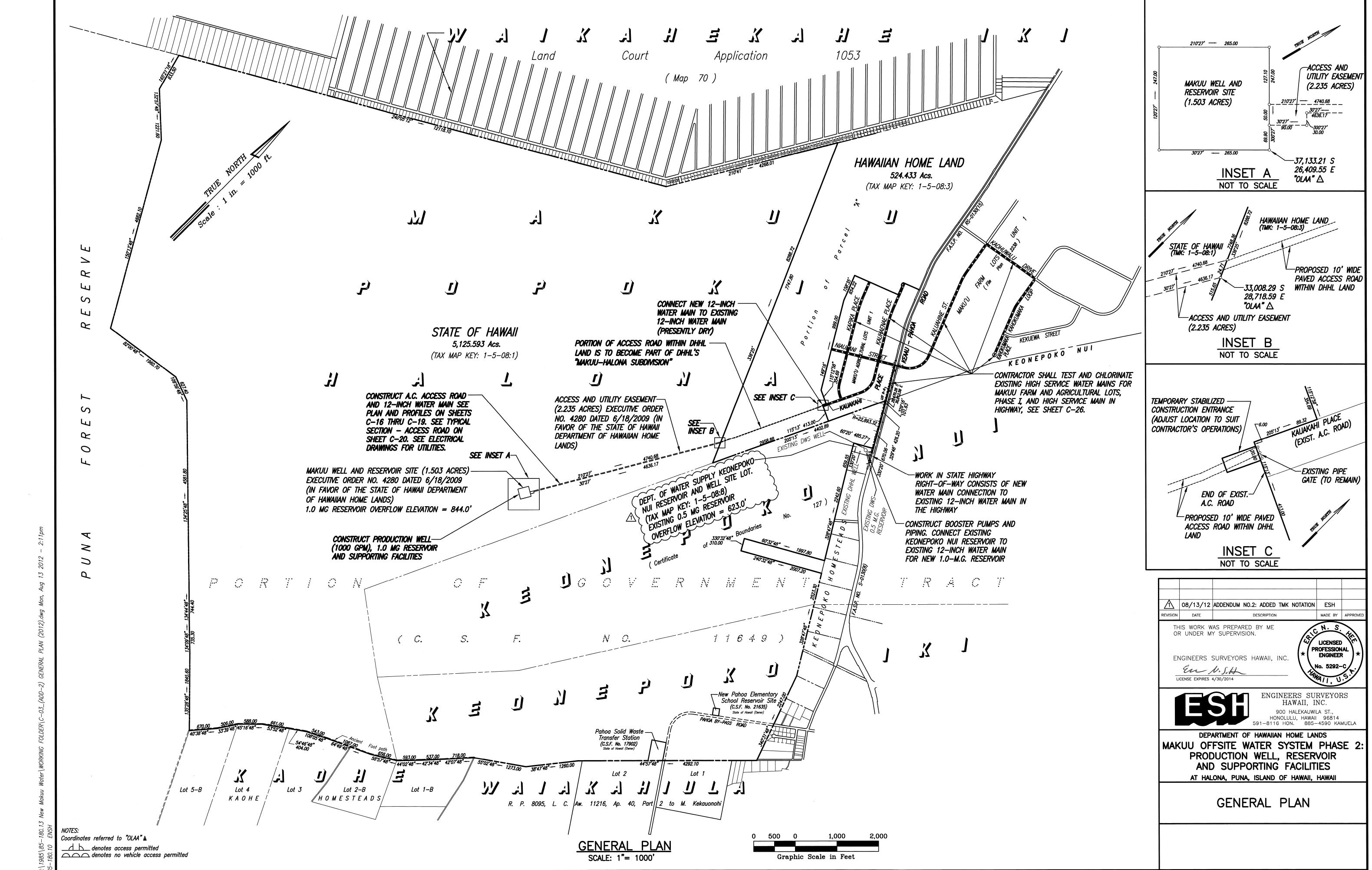
900 HALEKAUWILA ST.,

NOTES

AND SUPPORTING FACILITIES

AT HALONA, PUNA, ISLAND OF HAWAII, HAWAII

SHEET C-1 OF 97 SHEETS



SHEET C-3 of 97 sheets

FILE POCKET FOLDER NO

File: 2460.01 File: 2460.01 Boring: Boring: Makuu 844' 1.0M.G. Reservoir Phase 2 Makuu 844' 1.0M.G. Feservoir Phase 2 Project: Project Engineer: TJC Pahoa, Hawaii, Hawaii Project Engineer: TJC Location: Pahoa, Hawaii, Hawaii Location: Field Engineer: TJC Field Engineer: TJC Surface Elevation: 828' 828' * Surface Elevation: CPD Depth to Water: None Encountered Drafted by: CPD Depth to Water: None Encountered Drafted by: F.G.E. Ltd. FGELtd)6-1416 Waihona Place Date Completed: 96-1416 Waihona Place Date Completed: Date of Drawing: November 2004 Date of Drawing: November 2004 9-28-04 9-28-04 Pearl City, Hawaii Pearl City, Hawaii MOIST DRY BLOWS LAB MOIST DRY BLOWS LAB TEST CONT. DEN. PER CONT. DEN. PER TEST CLASSIFICATION CLASSIFICATION % PCF RESULTS FT. PCF FT. RESULTS Gray Moderately to Slightly Weathered Gray Slightly Weathered Highly Vesicular 90%REC NX Highly Vesicular BASALT (WM-WS), BASALT (WS), medium hard, occasionally 153%RQD CORE medium hard, occasionally broken broken to massive 75%REC NX At 4.5', grades to Reddish Gray, broken 0%RQD CORE 100%REC NX Gray Fresh Highly Vesicular BASALT (F), 100%REC NX 70%RQD CORE 93%RQD CORE hard, massive At 7.0', grades to hard, broken 100%REC NX Reddish Gray Moderately Weathered 100%REC NX 55%ROD CORE At 11.0', grades to massive Highly Vesicular BASALT (WM), medium 86%RQD CORE hard, to hard Gray Slightly Weathered Highly Vesicular Gray Fresh Slightly Vesicular BASALT (F), BASALT (WS), hard, massive At 14.5', grades to occasionally broken 100%REC 100%REC NX 100%RQDCORE 58%RQD CORE Gray Slightly Weathered to Fresh Highly Vesicular BASALT (WS-F), medium hard to hard, broken to occasionally broken 100%REC 100%REC NX At 20.5', grades to hard, massive 98%RQD CORE 93%RQD|COR BOH @ 24.5' Reddish Gray Slightly Weathered Highly Vesicular BASALT (WS), medium hard, occasionally broken BOH @ 25.5' File: 2460.01 File: 2460.01 Probe: Makuu 844' 1.0M.G. Reservoir Phase 2 Makuu 844' 1.0M.G. Reservoir Phase 2 Project: Pahoa, Hawaii, Hawaii Project Engineer: TJC Location: Project Engineer: TJC Location: Pahoa, Hawaii, Hawaii Field Engineer: TJC Surface Elevation: 827 Field Engineer: TJC Surface Elevation: 827' CPD Depth to Water: Drafted by: CPD None Encountered Drafted by: Depth to Water: None Encountered F.G.E. Ltd. 5-1416 Waihona Place Date Completed: 6-1416 Waihona Place Date Completed: 9-28-04 Date of Drawing: November 2004 Date of Drawing: November 200 Pearl City, Hawaii MOIST DRY MOIST DRY BLOWS **TEST** CONT. DEN. TEST CONT. DEN. PER PER CLASSIFICATION CLASSIFICATION RESULTS PCF % PCF FT. FT. RESULTS Gray Slightly Weathered Highly Vesicular Gray Slightly Weathered Highly Vesicular 41 sec. BASALT (WS), medium hard BASALT (WS), medium hard 42 sec. 52 sec. 112 sec 105 sec 53 sec. 54 sec 38 sec 36 sec. 128 sec At 7.0', grades to hard 201 sec 104 sec. 235 sec BOH @ 9.0' **BOH @ 4.0'**

SUBSURFACE INVESTIGATION REPORT RECOMMENDATIONS NOTES

SITE PREPARATION - PRIOR TO THE START OF THE ACTUAL GRADING OPERATIONS, HE SITE SHALL BE CLEARED AND GRUBBED TO REMOVE THE SURFACE VEGETATION, ORGANICS, AND OTHER DELETERIOUS MATERIALS. THIS MATERIAL WOULD BE UNSUITABLE FOR USE AS FILL, AND SHALL BE WASTED OFF SITE. THE CLEARING AND GRUBBING SHALL BE DONE IN ACCORDANCE WITH SECTION 201 OF THE 2005 HAWAII STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (STANDARD SPECIFICATIONS), ISSUED BY: STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION, HIGHWAYS DIVISION.

- SITE GRADING AFTER THE SITE PREPARATION HAS BEEN COMPLETED. THE GRADING OPERATIONS MAY BEGIN TO GENERATE THE PLANNED FINISHED GRADES. THE USE OF HEAVY ROCK EXCAVATING EQUIPMENT. SUCH AS LARGE RIPPER-EQUIPPED DOZERS AND TRACKHOE-MOUNTED HOERAMS, SHOULD BE ANTICIPATED TO FACILITATE THE REMOVAL OF THE HARD MASSIVE BASALT, WHICH WAS ENCOUNTERED AT DEPTHS OF LESS THAN FOOT IN THE TEST BORINGS AND IS EXPOSED AT THE GROUND SURFACE THROUGHOUT MOST OF THE GENERAL SITE AREA.
- 3. AFTER THE SITE GRADING HAS ATTAINED THE FINISH SUBGRADE LEVELS. THE TANK PAD SHALL BE PROOF-ROLLED TO DETERMINE IF ANY LOOSE CLINKER POCKETS, SOFT SPOTS, OR LARGE VOIDS IN THE UNDERLYING ROCK EXIST. THE PROOF-ROLLING SHALL CONSIST OF AT LEAST 6 PASSES OF A D-9 DOZER, OR EQUIVALENT, AND SHALL EXTEND AT LEAST 5 FEET LATERALLY BEYOND THE PERIMETER OF THE TANK AND ITS FOUNDATIONS. ANY POCKETS OF ASH OR LOOSE CLINKER ENCOUNTERED DURING THE PROOF-ROLLING OPERATIONS SHALL BE REMOVED DOWN TO THE UNDERLYING BASALT AND THE RESULTING DEPRESSION BACKFILLED IN ACCORDANCE WITH THESE RECOMMENDATIONS. WHERE CAVITIES OR VOIDS WITHIN THE ROCK ARE ENCOUNTERED, THEY SHALL BE FILLED WITH LOW-STRENGTH CONCRETE. SHOULD LARGER, I.E., GREATER THAN 2 FEET IN DEPTH, VOIDS OR CAVITIES BE ENCOUNTERED, FGE, LTD. SHOULD BE NOTIFIED FOR ADDITIONAL RECOMMENDATIONS.
- THE EXCAVATED SURFACE ASH AND CLINKER MAY BE RE-USED AS FILL AND BACKFILL PROVIDED ALL VEGETATION. DELETERIOUS MATERIALS, AND SOIL CLODS AND ROCK PARTICLES GREATER THAN 3 INCHES IN DIAMETER ARE REMOVED AND THEY ARE PLACED AND COMPACTED IN ACCORDANCE WITH THESE RECOMMENDATIONS. THE EXCAVATIONS WITHIN THE BASALT WILL LIKELY GENERATE MAINLY LARGE COBBLE- AND BOULDER-SIZED ROCK FRAGMENTS, WHICH ARE UNSUITABLE FOR USE IN THIN FILLS OR AS UTILITY TRENCH BACKFILL, WITHOUT SIGNIFICANT CRUSHING.

DUE TO THE RELATIVELY INSIGNIFICANT AMOUNTS OF THE SURFACE SOILS AND THE OVERSIZED MATERIALS ANTICIPATED TO BE GENERATED FROM THE ROCK EXCAVATIONS. THE USE OF IMPORTED FILL SHOULD BE ANTICIPATED TO COMPLETE THE SITE GRADING AND FOR UTILITY TRENCH BACKFILL. IMPORTED FILL SHALL CONSIST OF LOW EXPANSION GRANULAR SOIL, FREE OF ORGANICS, ROCKS AND CLODS GREATER THAN 3 INCHES IN DIAMETER. IT SHALL POSSESS A PLASTICITY INDEX OF LESS THAN 10 AND NO MORE THAN 1.5 PERCENT SWELL WHEN TESTING IN ACCORDANCE WITH ASTM D1883.

- FILL AND BACKFILL SHALL BE PLACED IN RELATIVELY LEVEL LIFTS NO GREATER THAN 8 INCHES IN LOOSE THICKNESS, MOISTURE CONDITIONED TO WITHIN 3 PERCENT OF ITS OPTIMUM MOISTURE CONTENT, AND UNIFORMLY COMPACTED TO AT LEAST 95 PERCENT RELATIVE COMPACTION.
- CUT SLOPES WITHIN THE BASALT SHALL BE SLOPED NO STEEPER THAN 1 HORIZONTAL TO 1 VERTICAL (1H:1V) FOR SLOPE HEIGHTS OF UP TO 5 FEET. SLOPES EXCEEDING THIS HEIGHT ARE NOT ANTICIPATED AT THIS TIME AND SHOULD BE INDIVIDUALLY EVALUATED, SHOULD THEY OCCUR.
- FOUNDATIONS THE PROPOSED TANK MAY BE ADEQUATELY SUPPORTED ON A FOUNDATION SYSTEM CONSISTING OF INDIVIDUAL SPREAD FOUNDATIONS AND EITHER A CONTINUOUS RING FOOTING OR THICKENED-EDGE SLAB FOUNDATION FOUNDED ON THE INTACT BASALT. THE CONTROL BUILDING SHALL BE SUPPORTED ON SIMILAR SHALLOW FOUNDATION SYSTEMS BEARING ON INTACT BASALT.

Pahoa, Hawaii, Hawaii

F.G.E. Ltd.

8. FOUNDATIONS BEARING UPON THE BASALT MAY BE DESIGNED FOR AN ALLOWABLE BEARING PRESSURE OF 8,000 P.S.F. THIS VALUE MAY BE INCREASED BY ONE-THIRD FOR SHORT TERM TRANSIENT LOADINGS. INDIVIDUAL SPREAD FOUNDATIONS SHALL HAVE A MINIMUM BASE WIDTH OF 18 INCHES. CONTINUOUS STRIP FOOTINGS AND THICKENED-EDGE FOUNDATIONS SHALL HAVE A MINIMUM WIDTH OF 12 INCHES. FOUNDATIONS SHALL BE EMBEDDED AT LEAST 6 INCHES INTO THE BASALT.

- 9 THE FOUNDATIONS SHALL BEAR ENTIRELY ON THE MASSIVE BASALT. SHOULD BOTH SOIL AND ROCK BE ENCOUNTERED IN THE FOOTING EXCAVATIONS, THE FOUNDATION EMBEDMENT SHALL BE INCREASED SUCH THAT THE ENTIRE FOUNDATION IS BEARING UPON BASALT.
- 10. THE BOTTOM OF THE FOUNDATION EXCAVATIONS FOR THE NEW RESERVOIR SHALL BE PROBED TO A DEPTH EQUAL TO ONE FOOTING WIDTH, OR TO A MINIMUM DEPTH OF 8 FEET BELOW THE BOTTOM OF FOUNDATION LEVEL, TO DETECT THE POSSIBLE PRESENCE OF VOIDS BENEATH THE FOUNDATIONS. AT LEAST ONE PROBE SHALL BE DRILLED NEAR THE CENTER OF EACH INDIVIDUAL SPREAD FOUNDATION, AND ONE PROBE DRILLED EVERY 10 FEET ALONG THE TANK'S PERIMETER FOUNDATION. ANY VOIDS DETECTED DURING THE PROBING OPERATIONS SHALL BE FILLED WITH LEAN CONCRETE.
- 11. THE BOTTOM OF ALL FOOTING EXCAVATIONS SHALL BE CLEANED OUT OF ALL LOOSE MATERIAL, PRIOR TO THE PLACEMENT OF REINFORCING STEEL AND CONCRETE. STEEL REINFORCEMENT OF THE FOUNDATIONS SHALL BE PROVIDED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE PROJECT STRUCTURAL ENGINEER.
- 12. TOTAL AND DIFFERENTIAL SETTLEMENTS EXCEEDING 1/4 INCH ARE NOT ANTICIPATED FOR FOUNDATIONS DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THESE RECOMMENDATIONS AND THE ASSUMED LOADING CONDITIONS INDICATED PREVIOUSLY IN THIS REPORT. SHOULD THE ACTUAL TANK LOADS EXCEED THESE ASSUMED LOADS, FGE, LTD. SHOULD BE NOTIFIED SO THAT ADDITIONAL RECOMMENDATIONS CAN BE PROVIDED, IF
- 13. CONCRETE SLABS-ON-GRADE CONCRETE SLABS-ON-GRADE MAY BE USED FOR THE TANK FLOOR PROVIDED THE GRADING RECOMMENDATIONS OF THIS REPORT ARE FOLLOWED. THIS WILL ASSURE THAT THE SLAB SUBGRADE CONSISTS OF INTACT BASALT, OR GRANULAR FILL, WHICH HAS BEEN UNIFORMLY COMPACTED TO AT LEAST 95 PERCENT RELATIVE COMPACTION.
- 14. THE CONCRETE SLAB SHALL BE UNDERLAIN BY AT LEAST 6 INCHES OF AGGREGATE FOR UNTREATED BASE (UTB). THE UTB SHALL CONFORM TO SECTION 703.06 OF THE STANDARD SPECIFICATIONS AND SHALL BE COMPACTED TO AT LEAST 95 PERCENT RELATIVE COMPACTION AS DETERMINED BY ASTM D 1557. WHERE INTACT BASALT IS ENCOUNTERED AT THE SUBGRADE LEVEL BENEATH THE TANK FLOOR SLAB, IT SHALL BE OVEREXCAVATED SUFFICIENTLY TO ALLOW PLACEMENT OF THE BASE COURSE MATERIAL.
- 15. STEEL REINFORCEMENT OF THE CONCRETE SLABS SHALL BE PROVIDED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE PROJECT STRUCTURAL ENGINEER.
- 16. <u>UTILITIES</u> UTILITIES SHALL BE INSTALLED AND BACKFILLED IN ACCORDANCE WITH THE GRADING RECOMMENDATIONS OF THIS REPORT AND THE SPECIFIC REQUIREMENTS OF EACH PARTICULAR UTILITY. UTILITY BACKFILLS SHALL BE PLACED AND COMPACTED UTILIZING THE APPROPRIATE MECHANICAL COMPACTORS AROUND AND ABOVE THE PIPES. JETTING OR PONDING OF THE BACKFILL AS A METHOD TO ACHIEVE COMPACTION IS NOT ALLOWED.
- 17. UTILITIES MAY BE FOUNDED IN PROPERLY COMPACTED FILL OR THE INTACT BASALT. WHERE SOFT SPOTS ARE ENCOUNTERED AT THE BOTTOM OF UTILITY EXCAVATIONS, THEY SHALL BE REMOVED DOWN TO THE PROPERLY COMPACTED FILL OR INTACT BASALT AND THE RESULTING DEPRESSION BACKFILLED IN ACCORDANCE WITH THE GRADING RECOMMENDATIONS. WHERE BOULDERS OR INTACT BASALT ARE ENCOUNTERED AT THE UTILITY INVERT LEVEL, THEY SHALL BE OVEREXCAVATED SUFFICIENTLY TO ALLOW THE PLACEMENT OF THE APPROPRIATE THICKNESS OF BEDDING INDICATED IN THE STANDARD SPECIFICATIONS. AT LEAST 6 INCHES OF PIPE CUSHION SHALL BE PLACED BENEATH THE PIPES FOUNDED IN BASALT.

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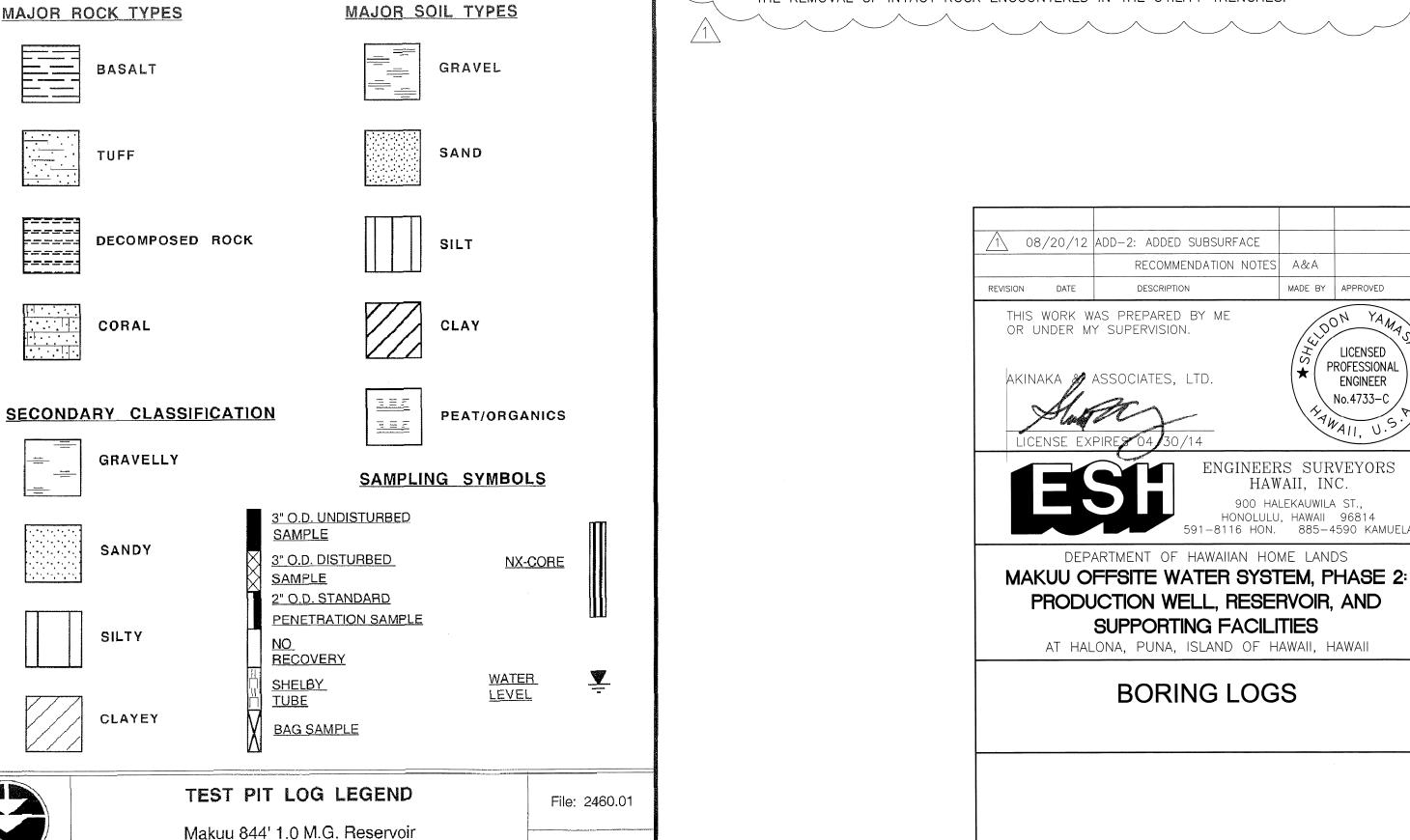
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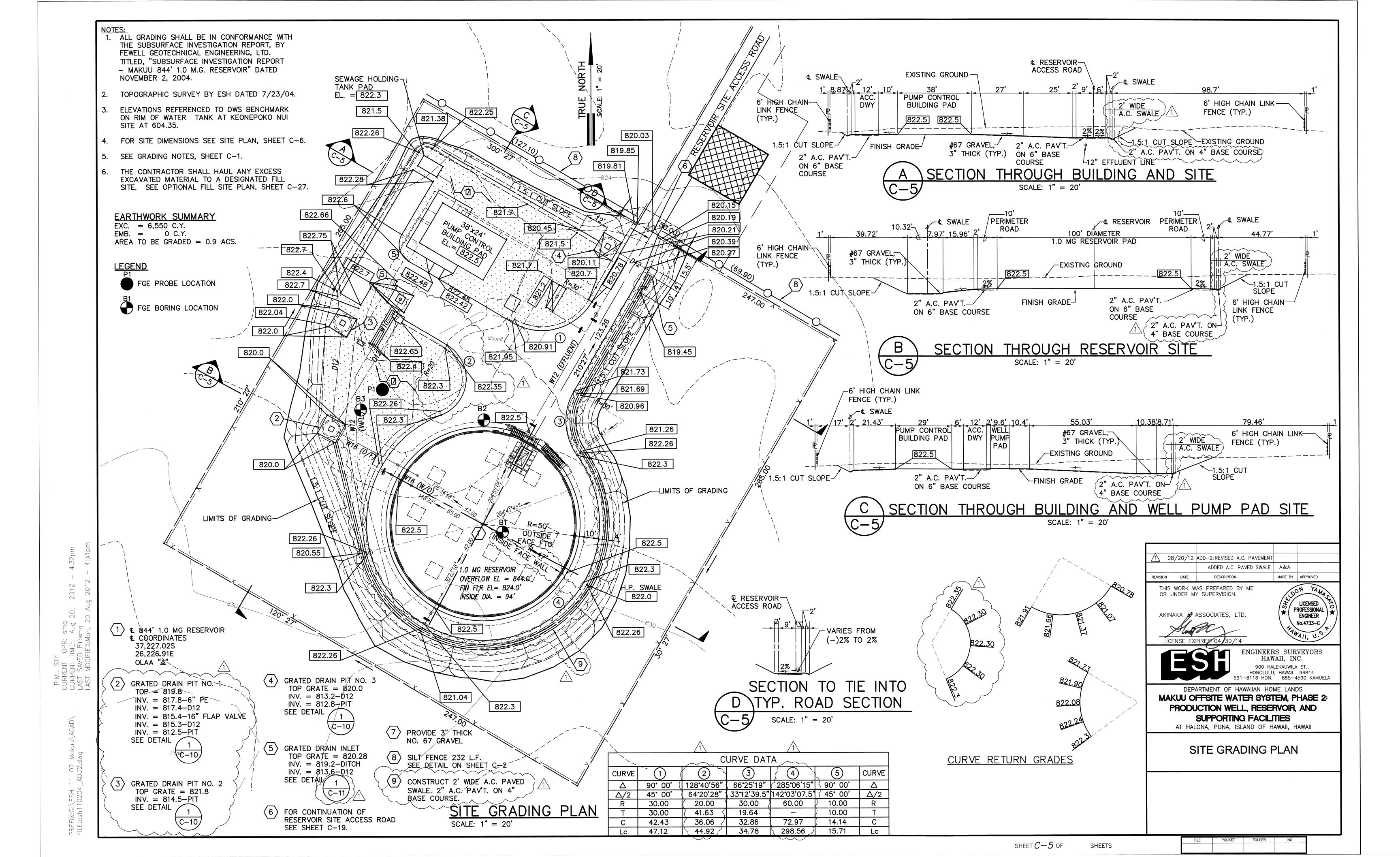
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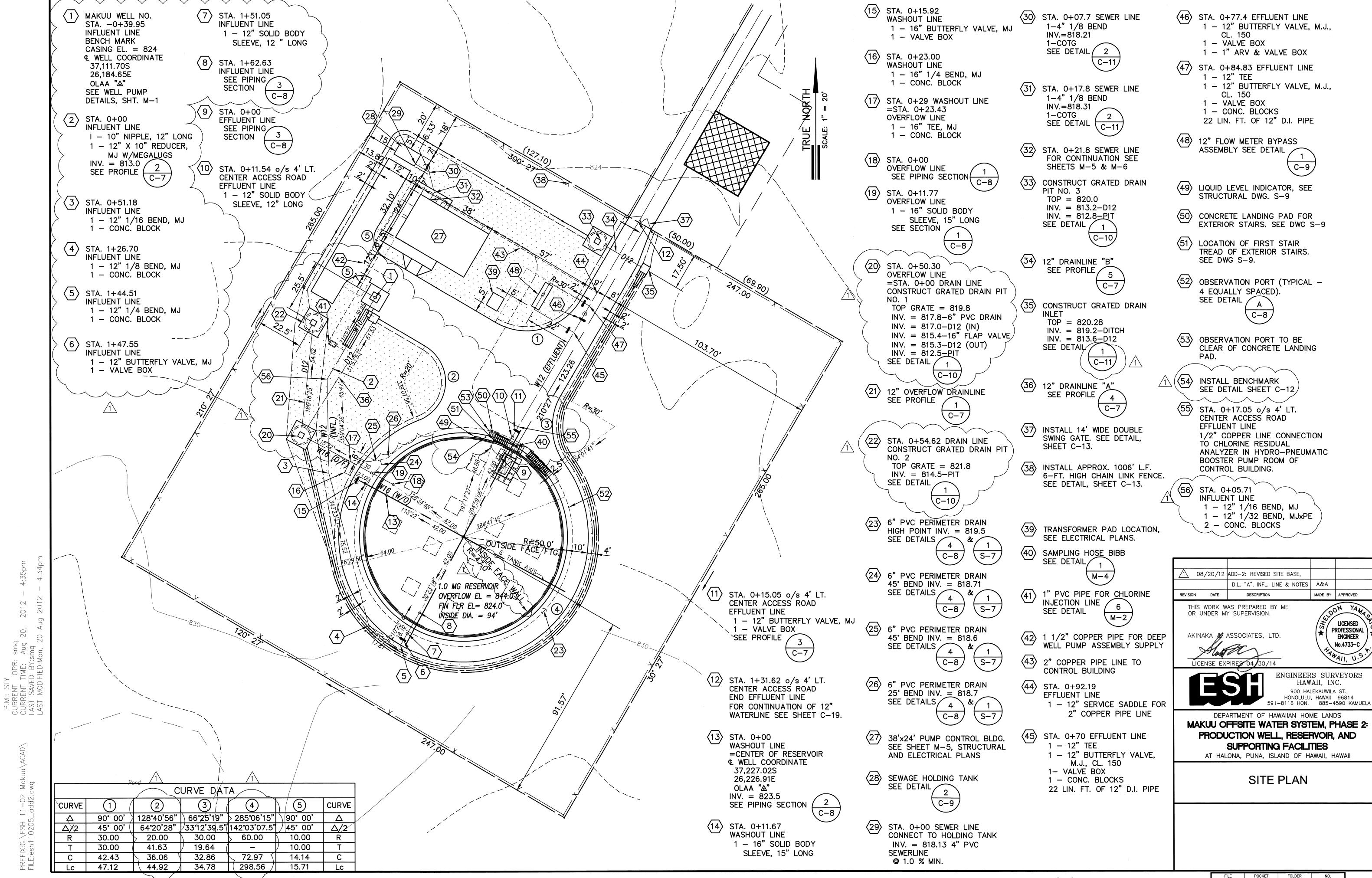
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18. THE USE OF ROCK EXCAVATING EQUIPMENT SHOULD BE ANTICIPATED TO FACILITATE THE REMOVAL OF INTACT ROCK ENCOUNTERED IN THE UTILITY TRENCHES.



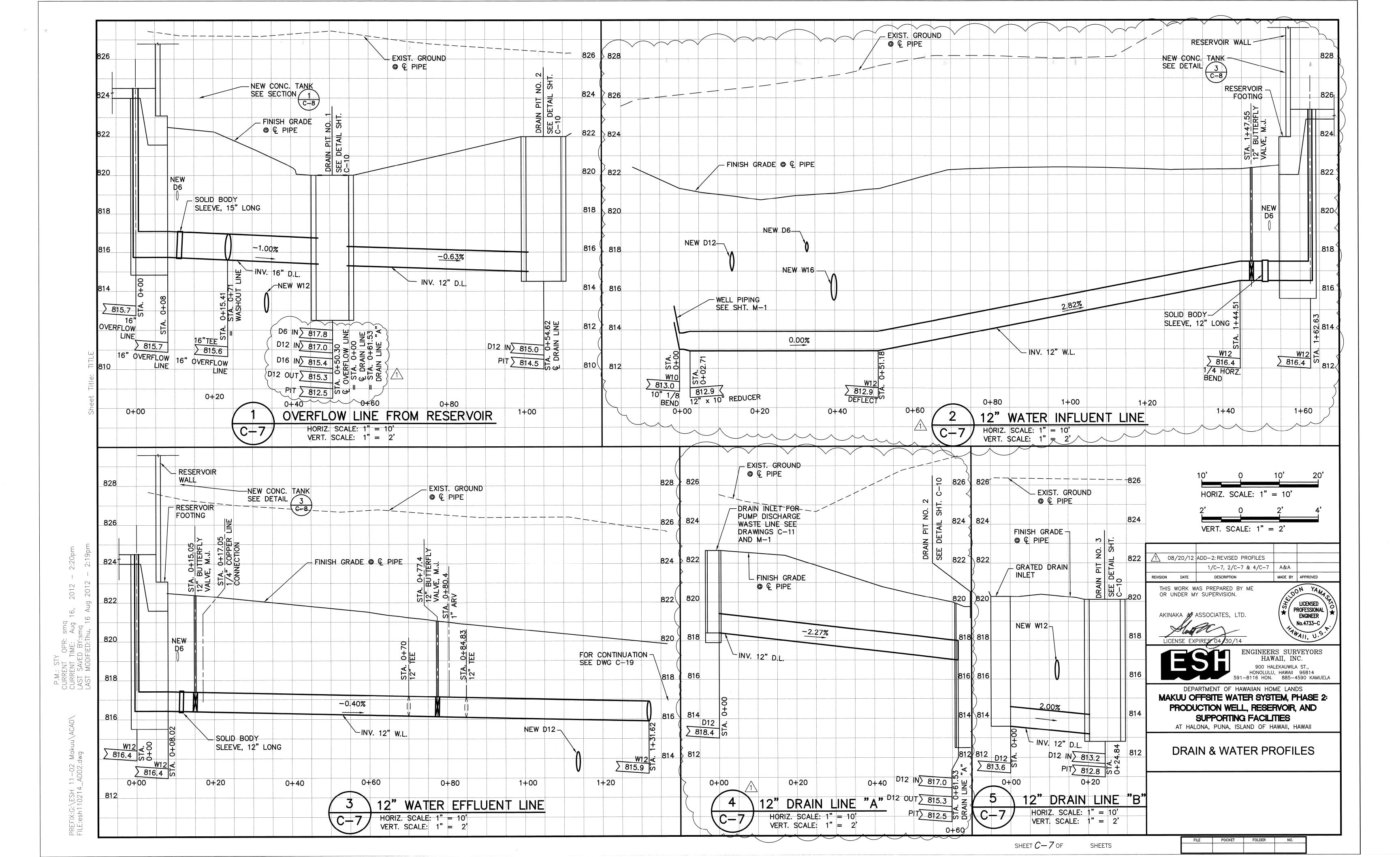
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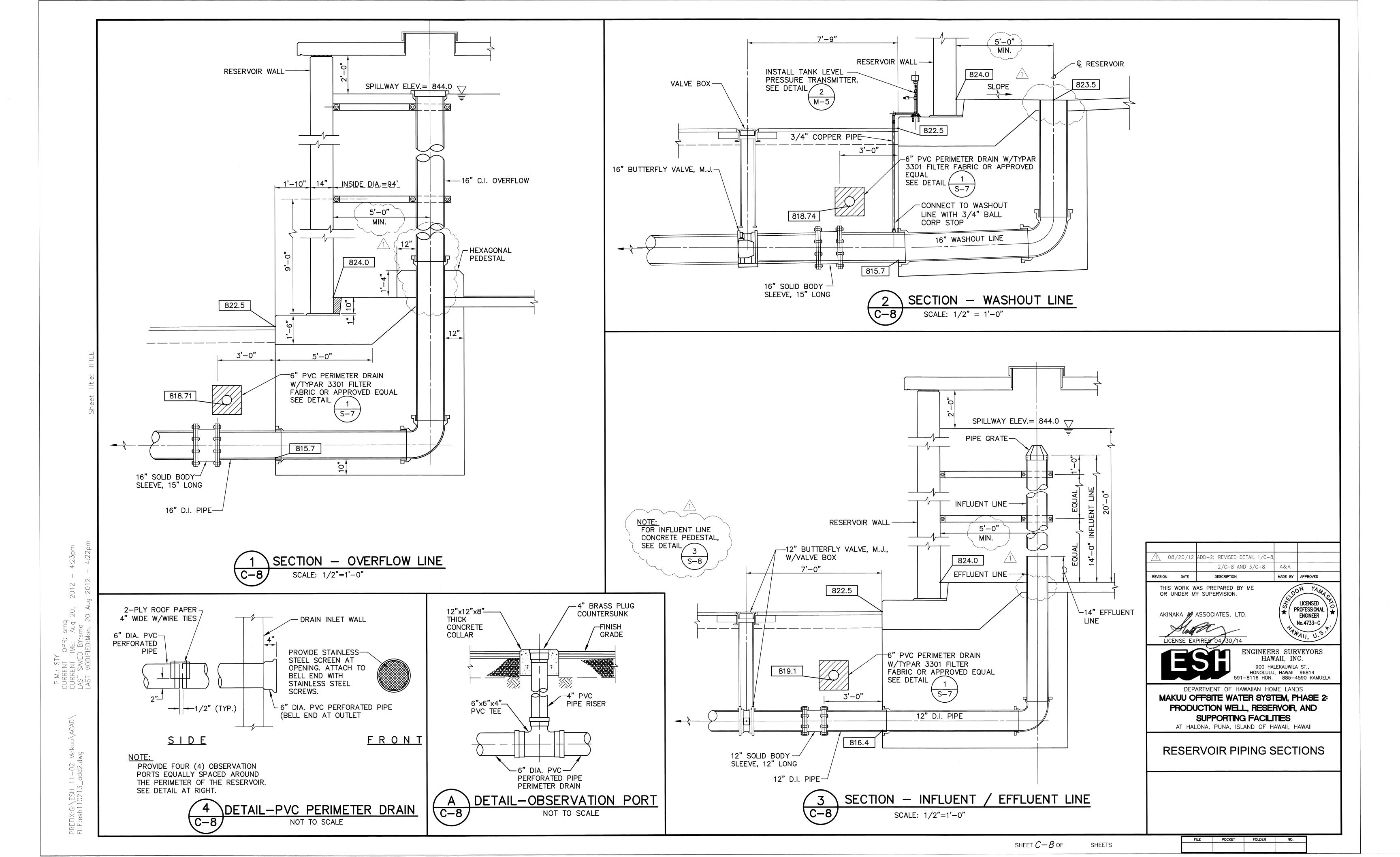


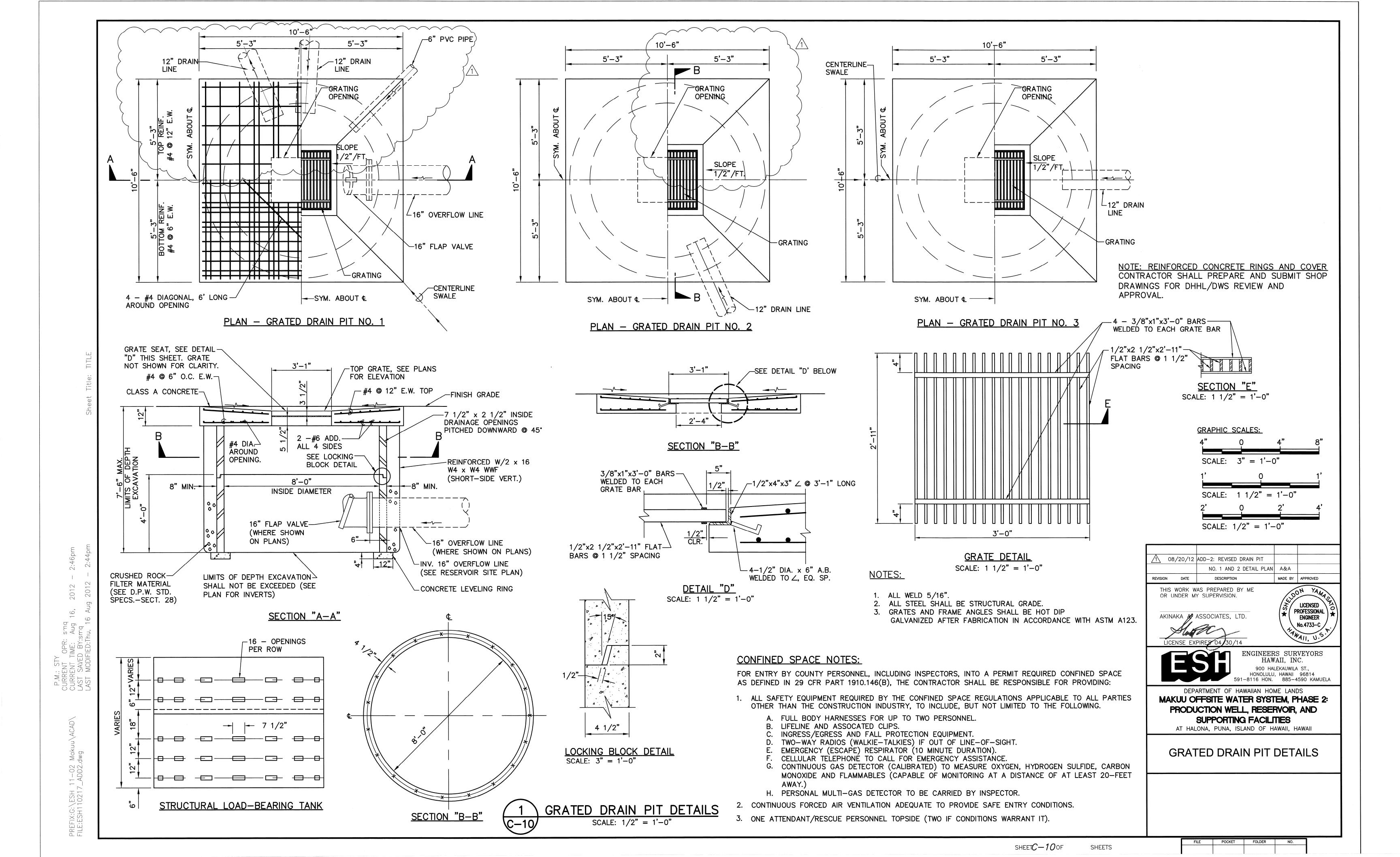


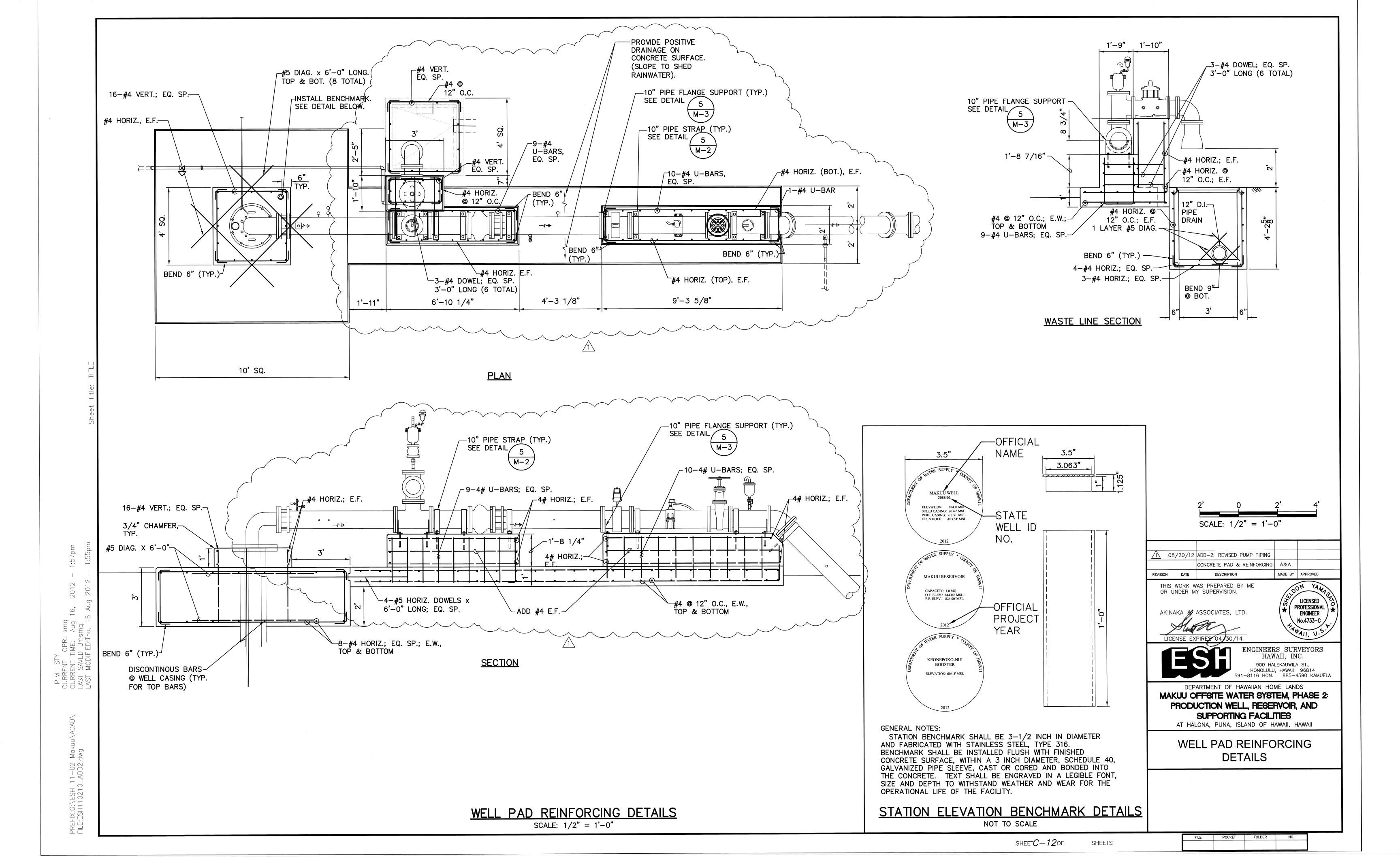
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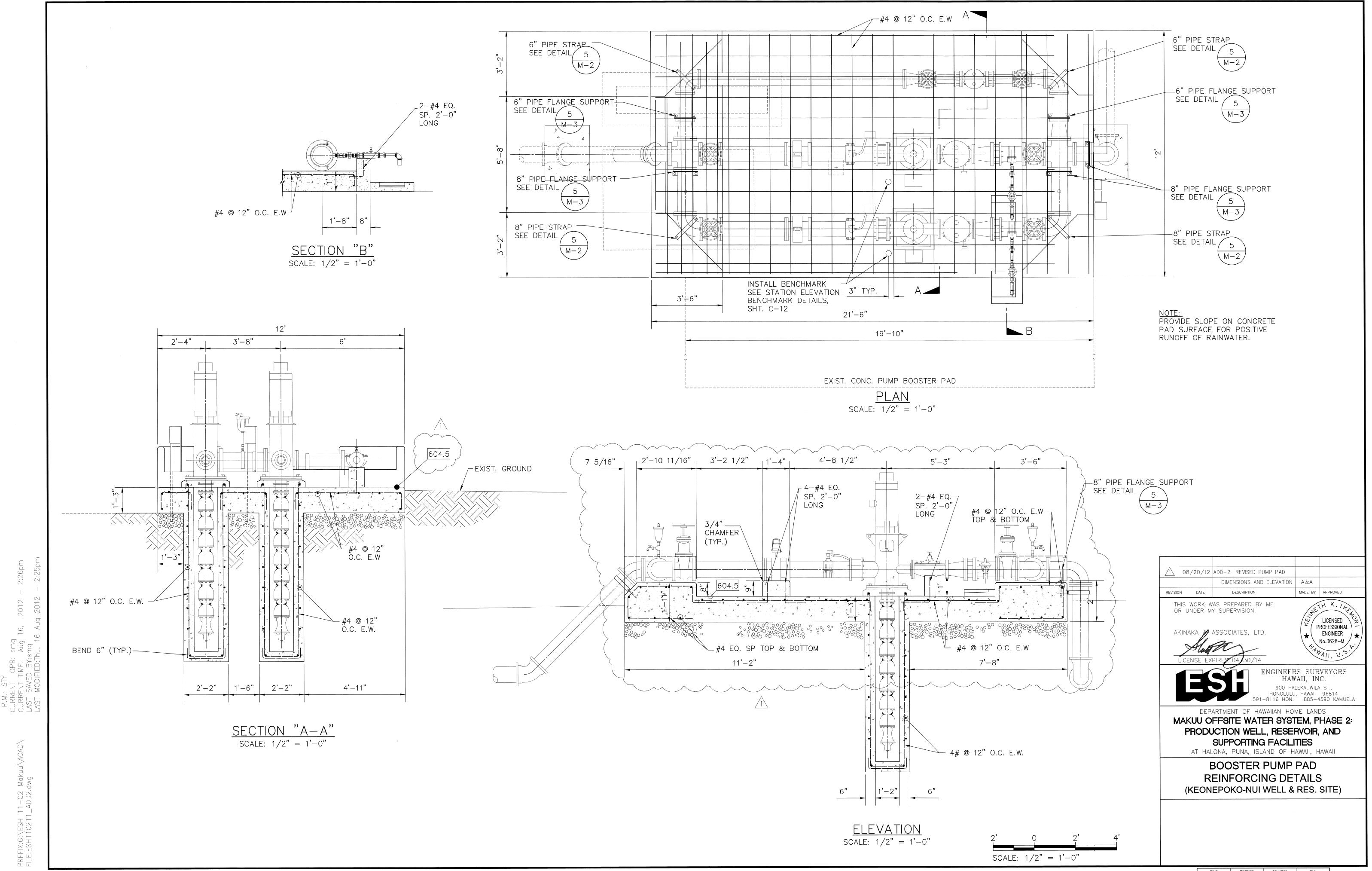
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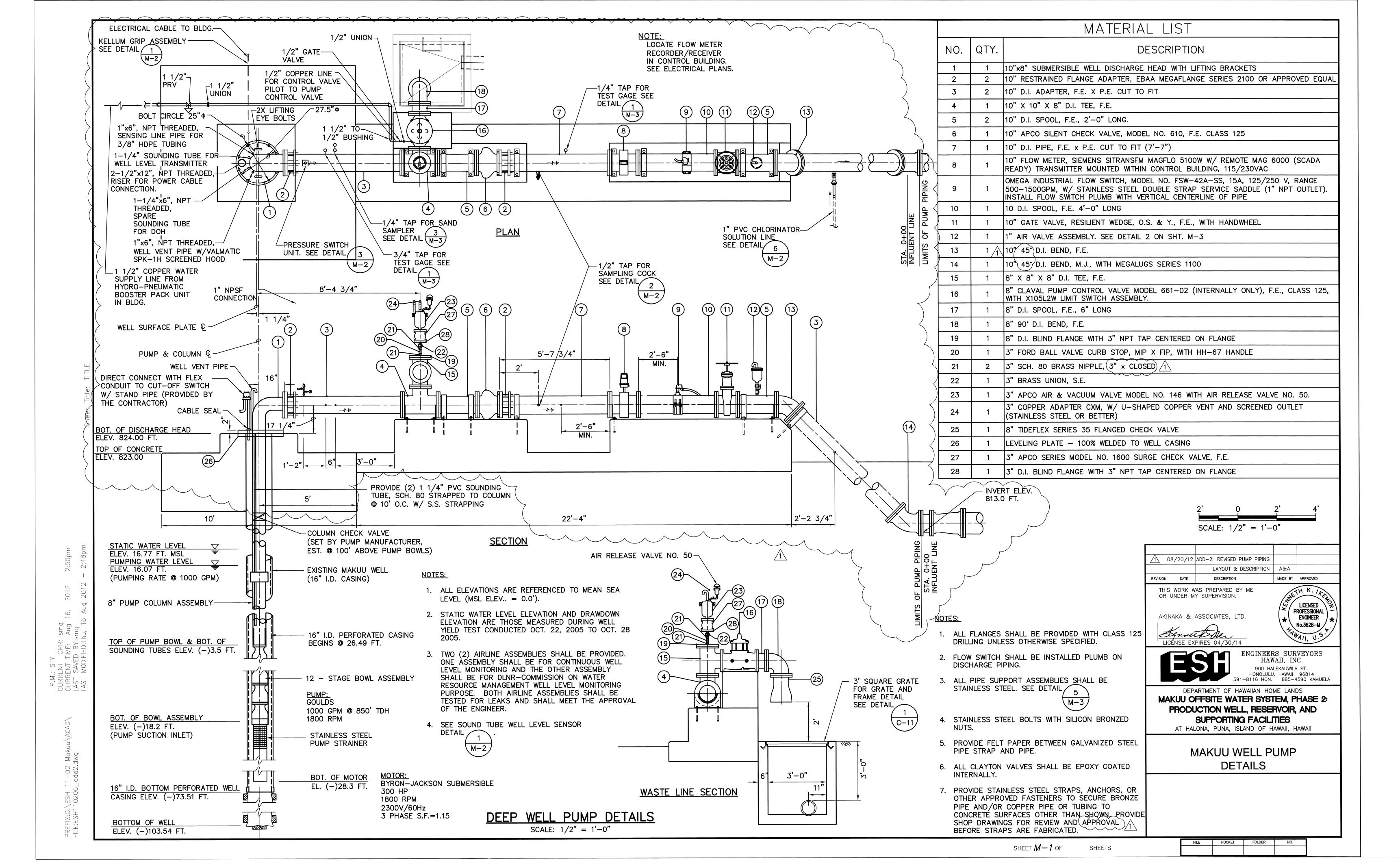


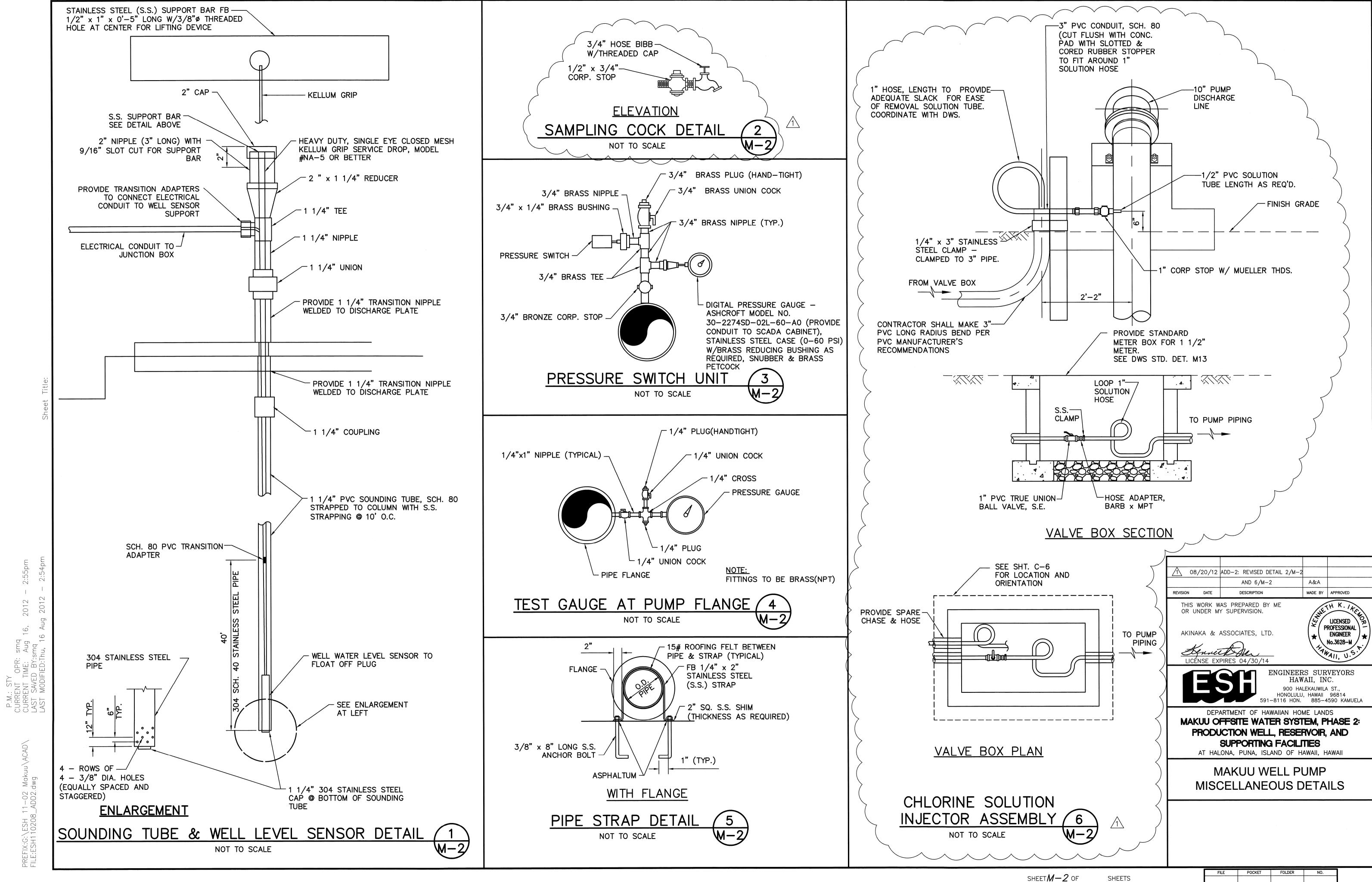




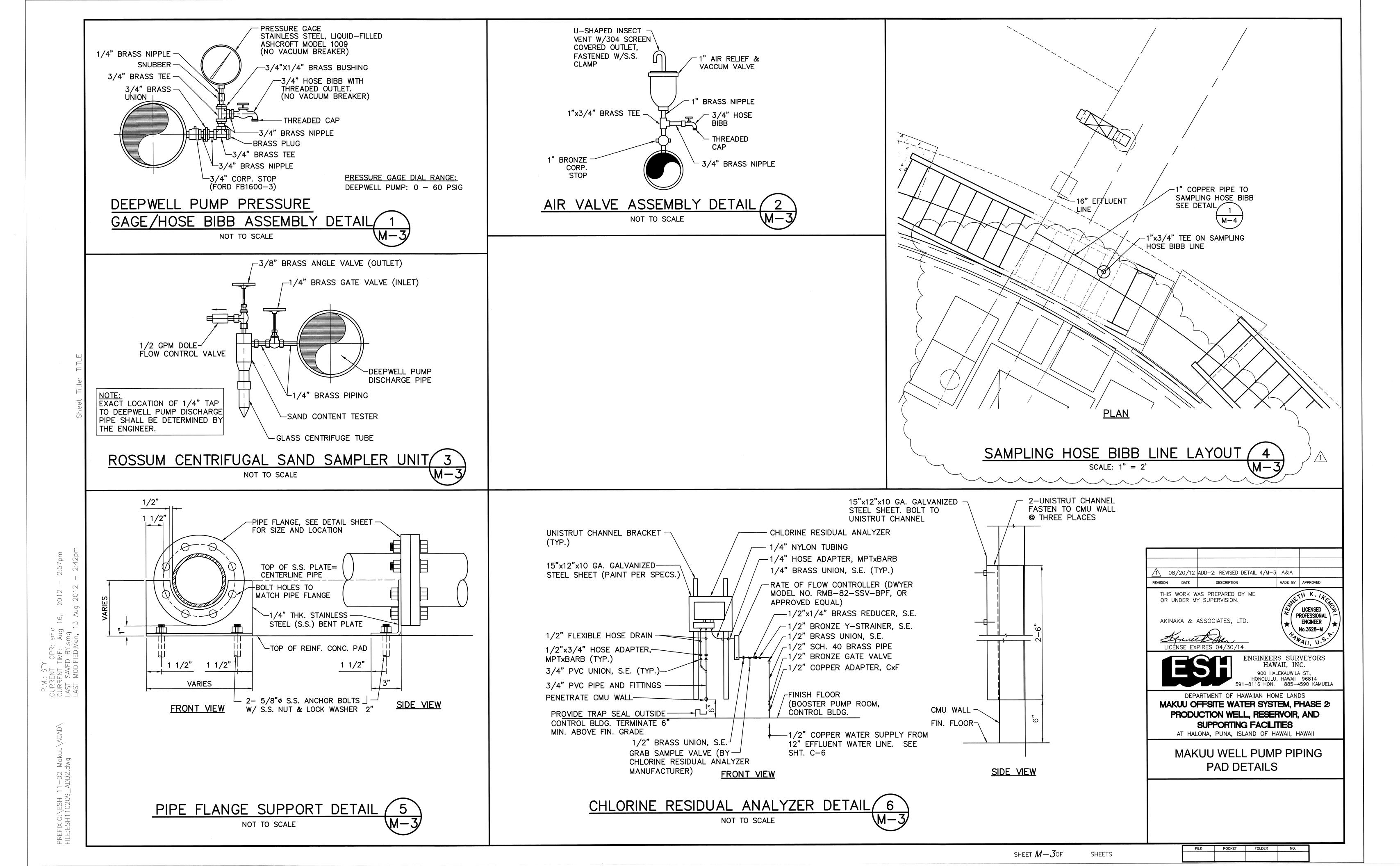
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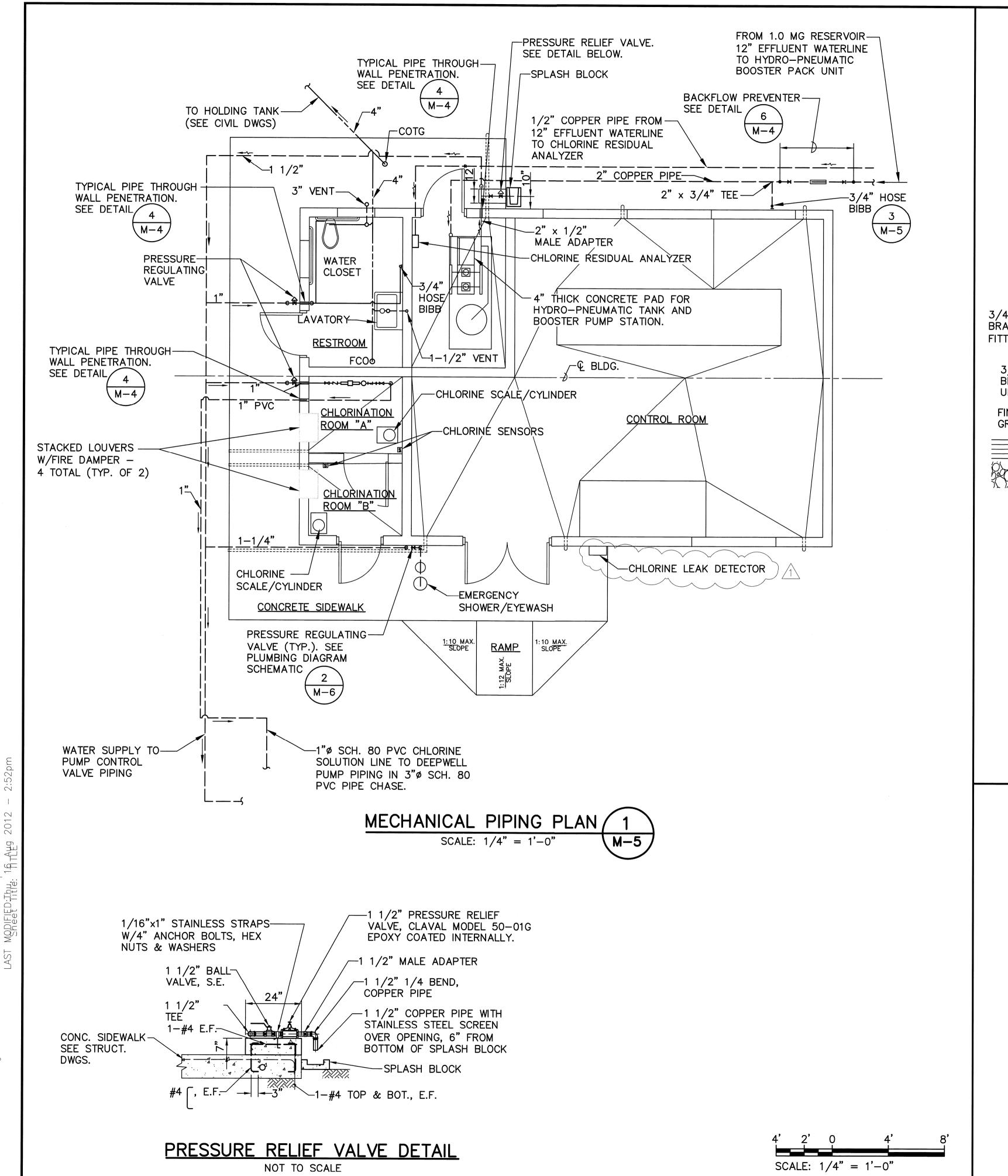
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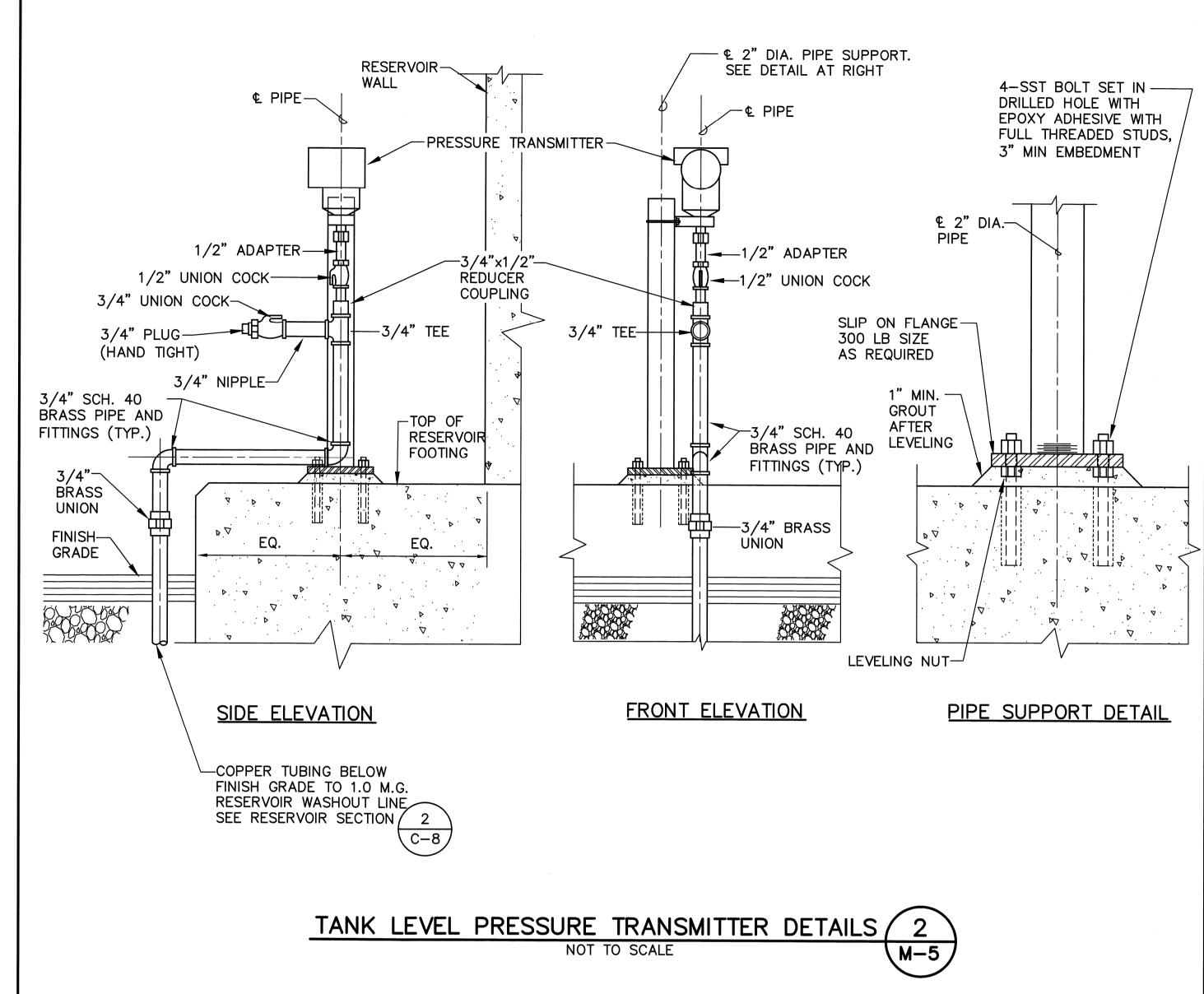
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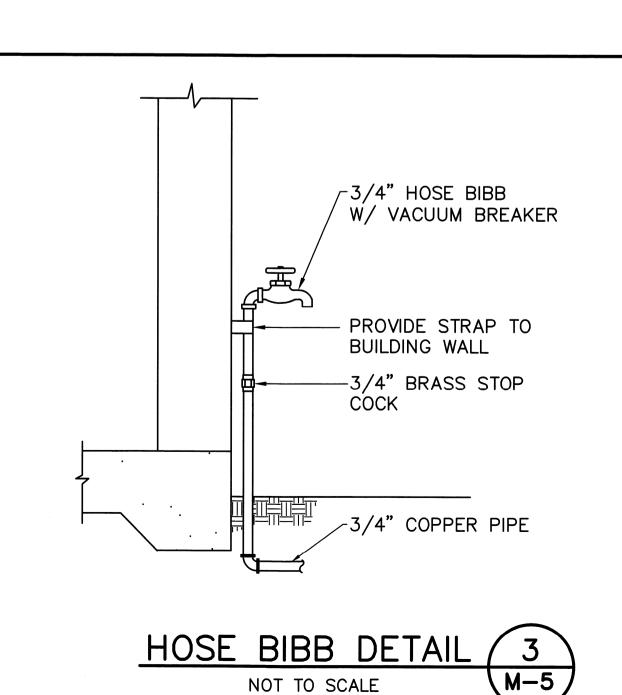


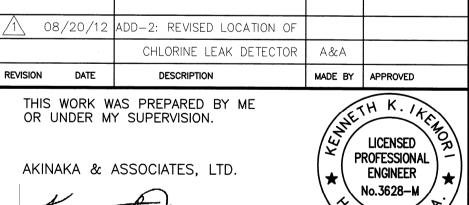


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AKINAKA & ASSOCIATES, LTD.

LICENSE EXPIRES 04/30/14



ENGINEERS SURVEYORS HAWAII, INC. 900 HALEKAUWILA ST., HONOLULU, HAWAII 96814 591—8116 HON. 885—4590 KAMUELA

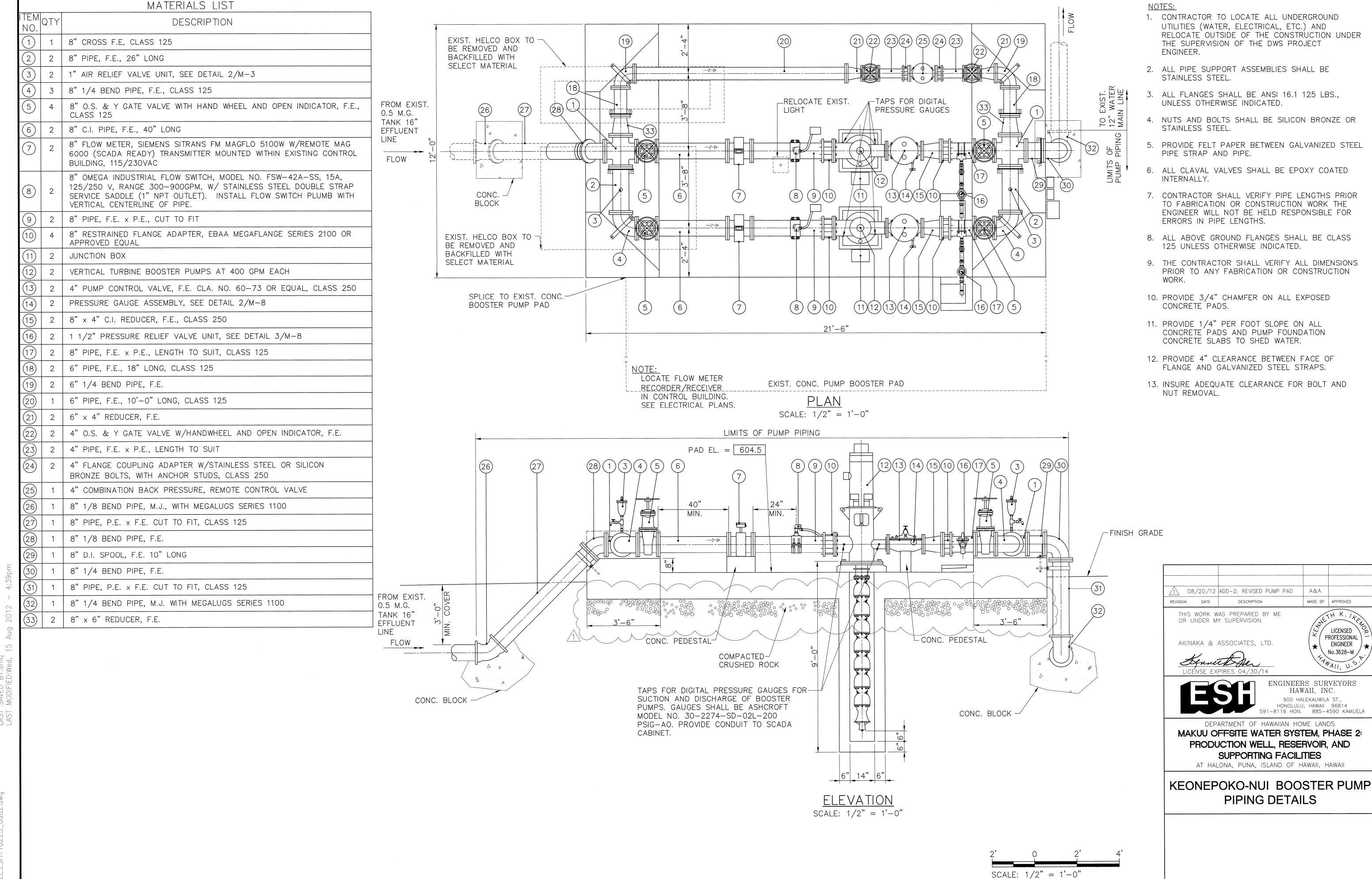
DEPARTMENT OF HAWAIIAN HOME LANDS MAKUU OFFSITE WATER SYSTEM, PHASE 2: PRODUCTION WELL, RESERVOIR, AND SUPPORTING FACILITIES AT HALONA, PUNA, ISLAND OF HAWAII, HAWAII

MAKUU CONTROL BUILDING

PLAN

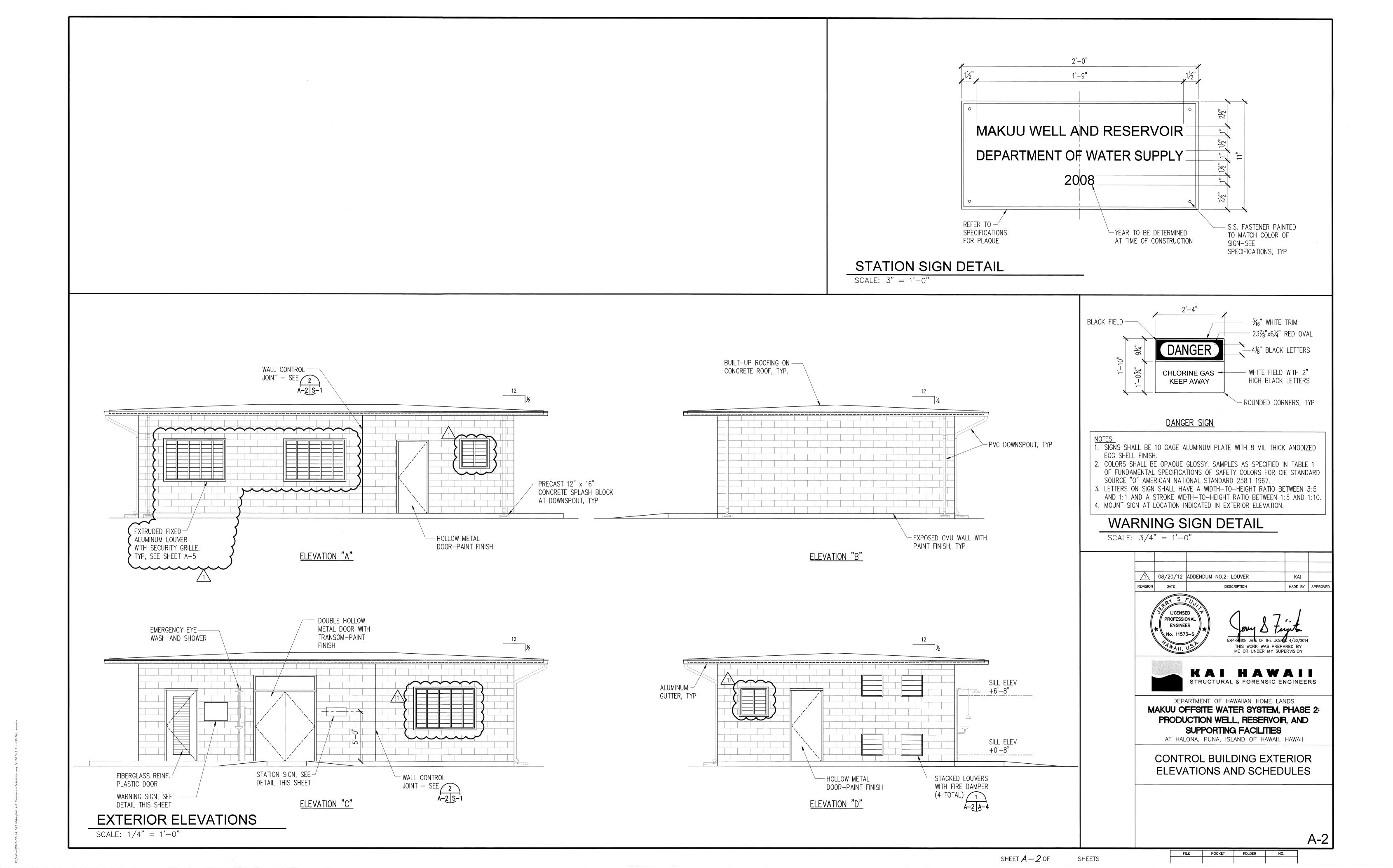
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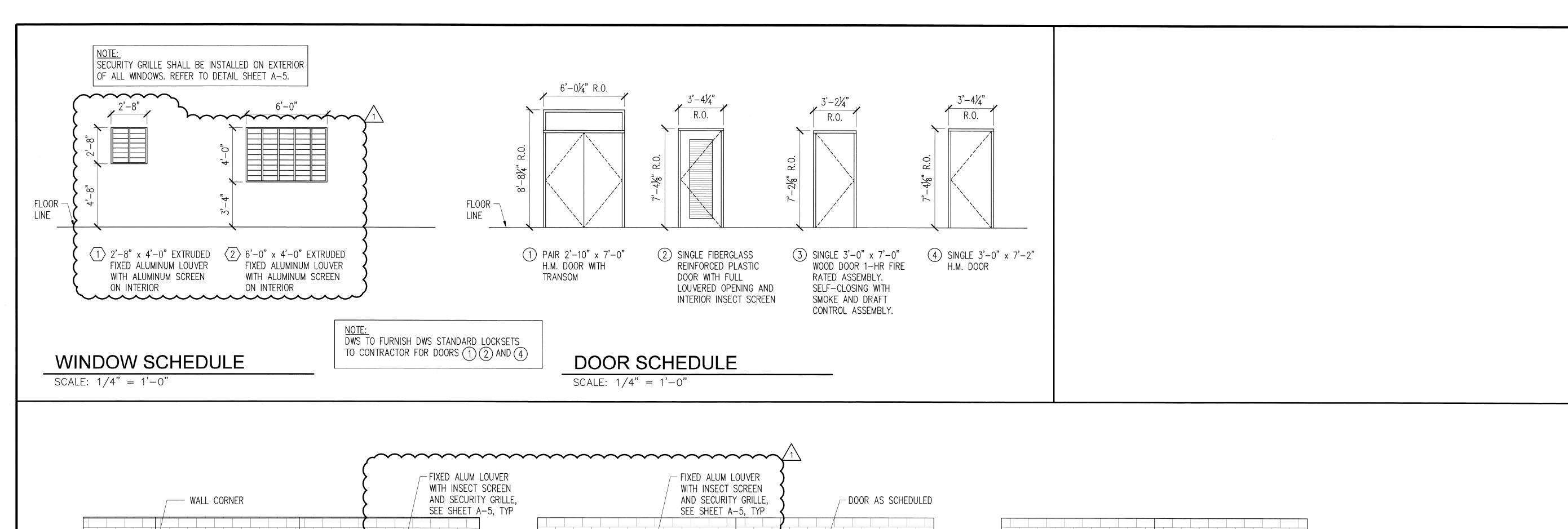
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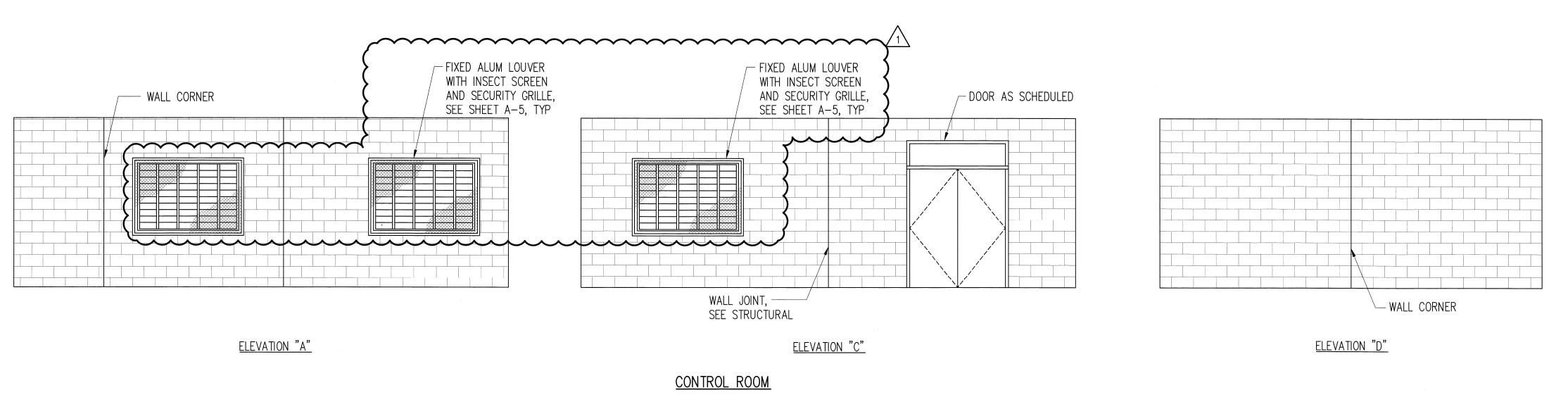


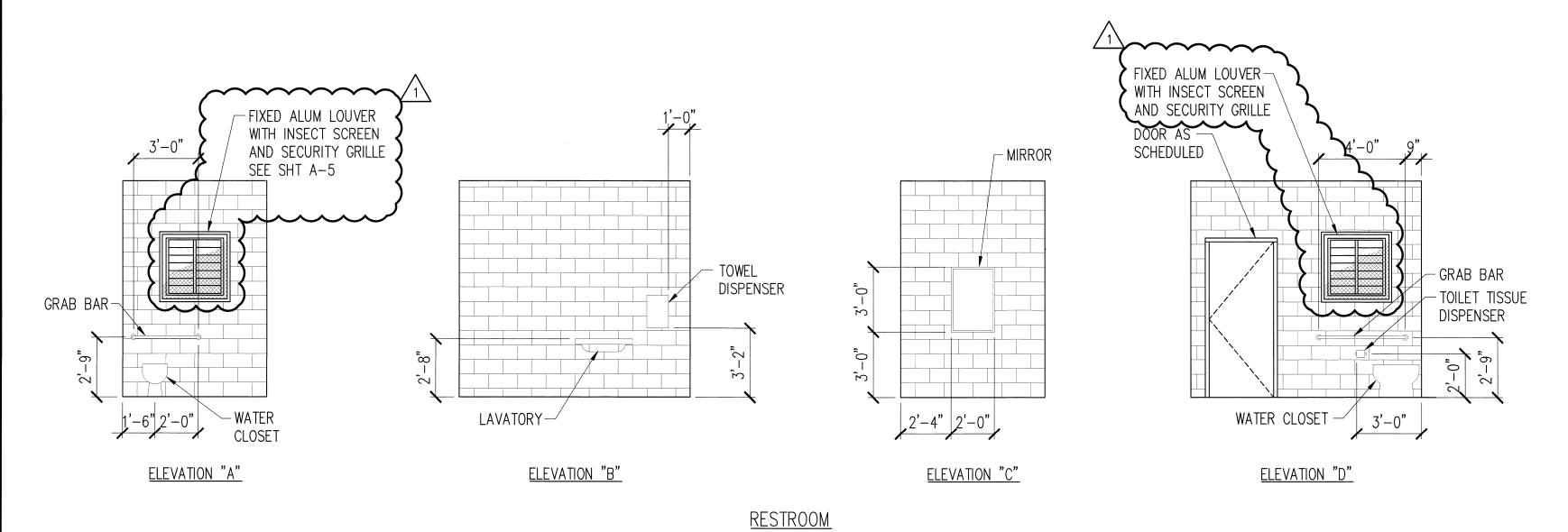
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	FI	FLOOR			WALL			CEILING				REMARKS
	CONCRETE	VINYL		CMU FLUSH JOINTS	WITH LOW MAINTENANCE	GLOSS FINISH PAINT ON		CONCRETE	GYP BOARD	PAINT FINISH		
CONTROL ROOM	•			•				•		•		
CHLORINATION ROOMS	•			•				•		•		1-HOUR FIRE RATED CEILING ASSEMBLY
RESTROOM	•			•				•		•		
PUMP ROOM	•			•				•		•		
OVERHANG SOFFIT								•		•		

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DEPARTMENT OF HAWAIIAN HOME LANDS MAKUU OFFSITE WATER SYSTEM, PHASE 2: PRODUCTION WELL, RESERVOIR, AND SUPPORTING FACILITIES

AT HALONA, PUNA, ISLAND OF HAWAII, HAWAII

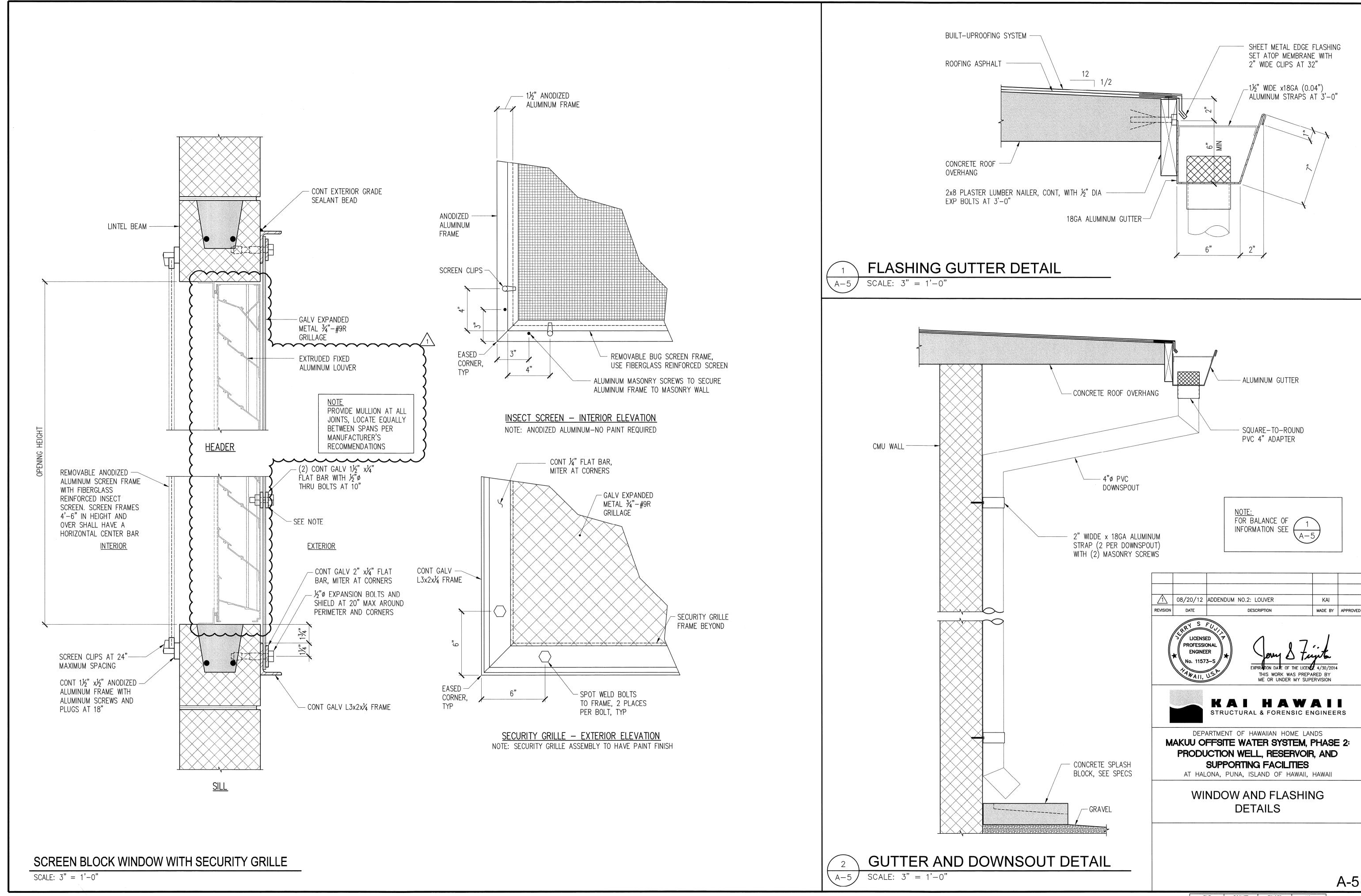
A-3

CONTROL BUILDING INTERIOR **ELEVATIONS AND SCHEDULES**

INTERIOR ELEVATIONS

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

SHEET A-3 OF



SHEET A-5 OF SHEETS

DESIGN CRITERIA NOTES

- 1. DESIGN REFERENCES
- A. ACI 350-06 CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES
- B. ACI 350.03-06 SEISMIC DESIGN OF LIQUID-CONTAINING CONCRETE STRUCTURES.
 C. AWWA D-110-10-04 WIRE-AND STRAND-WOUND CIRCULAR, PRESTRESSED CONCRETE WATER TANKS.
- 2. DESIGN LIVE LOAD ON ROOF IS 40 PSF.
- 3. SEISMIC DESIGN PARAMETERS
 A. SPECTRAL RESPONSE ACCELERATION (5% DAMPENING)



C. DESIGN SPECTRAL RESPONSE ACCELERATION $S_{DS} = 1.47g$ $S_{D1} = 0.62g$ 1

E. RESPONSE MODIFICATION FACTOR $R_1 = 3.25$ (ANCHORED, FLEXIBLE BASE)

4. ALLOWABLE SOIL PRESSURE IS 8,000 PSF ON BASALT AND 4,000 PSF WHEN BEARING ON AGGREGATE BASE RATHER THAN INTACT BASALT.

FOUNDATION

- 1. FOUNDATION DESIGN IS BASED ON GEOTECHNICAL INVESTIGATION BY FEWELL GEOTECHNICAL ENGINEERING, LTD. (FILE 2460.01 DATED NOV 2, 2004 AND JAN 5, 2005).
- 2. CONTRACTOR SHALL PROVIDE FOR DE-WATERING OF EXCAVATION FROM EITHER SURFACE WATER, GROUND WATER OR SEEPAGE.
- 3. CONTRACTOR SHALL PROVIDE FOR DESIGN AND INSTALLATION OF ALL CRIBBING, SHEETING AND SHORING NECESSARY TO PRESERVE EXCAVATIONS AND EARTH BANKS AND ADJACENT STRUCTURES AND PROPERTY FROM DAMAGE.
- 4. BLASTING WILL NOT BE ALLOWED ON THE PROJECT.
- 5. ANY SOFT SPOTS AND/OR LOOSE CLINKER ENCOUNTERED IN THE FOUNDATION EXCAVATIONS FROM PROOF-ROLLING OF D-9 DOZER CONSISTING OF AT LEAST SIX (6) PASSES, EXTENDING 5 FEET BEYOND THE PERIMETER OF THE TANK SHOULD BE REMOVED DOWN TO THE UNDERLYING BASALT AND THE RESULTING DEPRESSION BACKFILLED WITH STRUCTURAL FILL.
- 6. EXCAVATIONS FOR FOOTINGS SHALL BE APPROVED BY THE SOILS ENGINEER PRIOR TO PLACING THE CONCRETE AND REINFORCING. SOILS ENGINEER SHALL SUBMIT LETTER OF COMPLIANCE TO THE ENGINEER.
- 7. PROBE HOLES (3" MIN. DIAMETER×10 FT MINIMUM DEPTH) SHALL BE DRILLED AT EACH COLUMN FOOTING LOCATION, AT 10 FT ON CENTERS ALONG THE WALL FOOTING (SEE SHEET S-9). ADDITIONAL PROBE HOLES AT CLOSER SPACING SHOULD BE DRILLED IF CAVITIES AND/OR VOIDS ARE ENCOUNTERED DURING PROBING OPERATIONS. PROBE HOLES AND CAVITIES DISCOVERED SHALL BE BACKFILLED WITH CONTROLLED LOW STRENGTH MATERIAL (CLSM) WITH A SLUMP OF APPROXIMATELY 6 TO 9 INCHES. THE CLSM SHOULD BE INJECTED AT LOW TO MODERATE PRESSURES.
- 8. STRUCTURAL FILL SHALL BE NON-EXPANSIVE, GRANULAR SOIL WITH A PARTICLE SIZE OF NO GREATER THAN 3 INCHES IN MAXIMUM DIMENSION WITH BETWEEN 8 TO 20 PERCENT OF SOIL BY WEIGHT SHALL PASS THE #200 SIEVE. PLASTICITY INDEX OF THAT PORTION OF THE SOIL PASSING THE #40 SIEVE SHALL NOT BE GREATER THAN 10.
- 9. FILL AND BACKFILL SHALL BE PLACED IN UNIFORM LIFTS OF NO MORE THAN 8 INCHES IN LOOSE THICKNESS, MOISTURE—CONDITIONED TO WITHIN 3 PERCENT OF IT'S OPTIMUM MOISTURE CONTENT AND COMPACTED TO AT LEAST 95 PERCENT RELATIVE COMPACTION IN ACCORDANCE WITH ASTM D1883.
- 10. THE RESERVOIR FLOOR SLAB SHALL BE UNDERLAIN BY AT LEAST 6 INCHES OF AGGREGATE FOR UNTTREATED BASE (UTB). THE UTB SHALL CONFORM TO SECTION 703.06 OF THE 2005 STATE OF HAWAII STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

CONCRETE NOTES

1. CONCRETE - CLASSES

- A. RESERVOIR WALL 4,500
- B. COLUMNS AND ROOF SLAB Class DWS 4000 FIRST 4 1/2" ABOVE EACH POUR OF WALL TO BE Class DWS 4000
- 2. POUR OPENINGS (WINDOWS) SHALL BE PROVIDED IN FORMWORK FOR PLACING CONCRETE

C. FOOTING, FLOOR SLAB, AND CONCRETE JACKET UNDER FLOOR SLAB Class DWS 4000

IN WALLS.

MINIMUM POUR OPENING SIZE SHALL BE 24" X 24".

HORIZONTAL DISTANCE BETWEEN POUR OPENINGS SHALL NOT EXCEED EIGHT (8) FEET CENTER TO CENTER. MAXIMUM DISTANCE FROM POUR OPENING TO VERTICAL JOINT SHALL BE 36 INCHES.

CONCRETE DROP IN THE FORM SHALL NOT EXCEED FIVE (5) FEET. VERTICAL DISTANCE BETWEEN ROWS OF OPENINGS SHALL NOT EXCEED SIX (6) FEET.

3. RESERVOIR FLOOR SLAB SHALL BE CURED WITH 6" MINIMUM WATER POND AT HIGH POINT OF SLAB FROM FINAL SET UNTIL TANK IS TO BE CLEANED AND PLACED IN OPERATION.

CONCRETE NOTES (CONT)

- 4. LAPS SHALL BE 48 BAR DIA (24" MIN), UNLESS OTHERWISE NOTED SPLICES OF WALL HORIZONTAL REINFORCEMENT SHALL BE STAGGERED HORIZONTALLY BY MORE THAN TWO LAP LENGTHS ON CENTER AND SHALL NOT COINCIDE VERTICALLY BY MORE THAN EVERY THIRD BAR.
- 5. ALL EXTERIOR CONCRETE SURFACES SHALL RECEIVE AN ARCHITECTURAL FINISH AS SPECIFIED IN THE WATER SYSTEM STANDARDS, DIVISION 300, SECTION 303.03S, SURFACE FINISHES, UNLESS OTHERWISE SPECIFIED.
- 6. ALL EXPOSED CORNERS SHALL HAVE 3/4 INCH CHAMFERS.
- 7. USE OF POWDER DRIVEN FASTENERS SHALL NOT BE PERMITTED IN CONCRETE WALLS EXCEPT AS NOTED IN THE SPECIFICATIONS OR AS APPROVED BY THE BOARD OF WATER SUPPLY.
- 8. ALL ANCHORS AND INSERTS FOR SUSPENDING MECHANICAL AND ARCHITECTURAL WORK SHALL BE CAST—IN—PLACE WHEREVER POSSIBLE. WHEN ADDITIONAL FASTENERS ARE REQUIRED, ONLY THOSE THAT ARE ANCHORED IN DRILLED HOLES WITH THE APPROVAL OF THE BOARD OF WATER SUPPLY SHALL BE PERMITTED.

9. RESERVOIR WALL CONSTRUCTION TOLERANCES:

A. OUT OF ROUND TOLERANCES: 3/4" IN 50', 3/8" IN 10' AND 3/16" IN 2' FROM SPECIFIED CURVATURE.
B. VERTICAL ALIGNMENT: 3/8" + OR - FROM TOP OF WALL TO BOTTOM C. WALL THICKNESS: 1/8" + OR -.

10. TESTING OF CYLINDERS SHALL BE PAID FOR BY THE CONTRACTOR. SIX (6) CYLINDERS MIN PER ASTM C31 ARE REQUIRED PER CLASS OF CONCRETE POURED IN ANY ONE DAY'S OPERATION. THREE (3) CYLINDERS SHALL BE TESTED AT THE AGE OF 7—DAYS AND 28—DAYS, RESPECTIVELY AS PER ASTM C39.

REINFORCING STEEL

1. ALL REINFORCING STEEL SHALL BE DEFORMED BARS CONFORMING TO ASTM A615 GRADE 60.

A. FOOTING, CONCRETE JACKE	I, EIC. CAST AGAINST EART	1 3"
B. FOOTING, CONCRETE JACKE	IT, ETC. FORMED AND EXPOSI	ED
TO EARTH OR WEATHER -		 2"
C. COLUMNS —	·	2 1/2"
D. ROOF SLAB		
DV NOOT CEAS	L	
D. WALLS —		1 1 /2"
D. WALLS		1 1/2

STRAND-WOUND WALL NOTES

- 1. CIRCUMFERENTIAL PRESTRESSING NOTES:
- A. THE MAXIMUM STRESS TOLERANCE IN ANY STRAND AT ANY POINT AT ANY ELEVATION ON THE TANK WALL AT ANY TIME DURING WRAPPING OPERATIONS SHALL BE WITHIN ± 320 POUNDS FROM THE AVERAGE FORCE SETTING OF 14.950 POUNDS.
- B. THE CONTRACTOR SHALL PROVIDE A CONTINUOUSLY ELECTRONICALLY RECORDED FORCE APPLICATION GRAPH FOR THE FULL LENGTH OF ALL WRAPPED STRAND AS PERMANENT DOCUMENTED EVIDENCE THAT THE FORCE APPLICATION REQUIREMENTS HAVE BEEN MET. ALL SUCH FORCE READINGS MUST BE BASED ON CONTINUOUS SENSING OF THE STRAND BETWEEN THE TENSIONING DRUM AND THE WALL AS THE STRAND IS BEING LAID ON THE WALL.
- C. MANUAL, INDIVIDUAL, OR INTERMITTENT FORCE READINGS TAKEN WHEN THE STRAND IS IN FULL BODILY CONTACT WITH THE WALL WILL NOT BE ACCEPTED.
- D. FORCE READINGS BASED ON ANYTHING OTHER THAN INSTANTAEOUS MONITORING AS THE STRAND IS BEING TENSIONED WILL NOT BE ACCEPTED.
- E. INTERNAL TENDONS PLACED CIRCUMFERENTIALLY INSIDE THE COREWALL WILL NOT BE ACCEPTED FOR THIS METHOD.
- F. THE STRAND SHALL BE 3/8-INCH DIAMETER BEFORE GALVANIZING WITH A MINIMUM GALVANIZING OF 0.85 OUNCES PER SQUARE FOOT AND A MINIMUM BREAKING STRENGTH OF 21,400 POUNDS AFTER GALVANIZING.
- G. PRIOR TO APPLYING THE CIRCUMFERENTIAL PRESTRESSING STRAND, APPLY A 3/8-INCH THICK LAYER OF SHOTCRETE OVER THE ENTIRE COREWALL.
- H. IF MULTIPLE LAYERS OF STRAND ARE REQUIRED, PROVIDE 3/8—INCH MINIMUM THICKNESS OF SHOTCRETE COVERAGE BETWEEN LAYERS.
- I. PROVIDE 1 1/2 INCH MINIMUM OF SHOTCRETE COVERAGE OVER THE OUTER LAYER OF STRAND.
- J. ALL SHOTCRETE SHALL BE APPLIED WITH AN AUTOMATED PROCESS KEEPING THE NOZZLE AT A CONSTANT DISTANCE AND ANGLE AS IT TRAVELS AT A UNIFORM BI-DIRECTIONAL SPEED. FINAL SHOTCRETE COVER TO HAVE A NATURAL FUN FINISH.

STRAND-WOUND WALL NOTES (CONT)

- 2. VERTICAL PRESTRESSING NOTES
- A. PRESTRESSING STEEL SHALL BE 1 1/4-INCH DIAMETER THREADBARS MEETING THE TENSILE, PHYSICAL, AND DEFORMATION REQUIREMENTS OF ASTM A722, TYPE II BARS.
- B. THREADBARS WITH QUENCHED OR TEMPERED STEEL WILL NOT BE ALLOWED.
- C. THREADBARS SHALL BE COATED WITH UNOCAL SOLUBLE OIL 10 RUSTBAN OR EQUAL PRIOR TO INSTALLATION INTO THE PVC DUCT PIPE.
- D. THREADBARS SHALL HAVE A MAXIMUM CARBON CONTENT OF 0.55%.
- E. DEFORMATIONS SHALL BE UNIFORM AND SUCH THAT THE BAR MAY BE CUT AT ANY POINT AND INTERNAL THREADS OF THE PROPER NUT CAN BE FREELY THREADED ONTO THE BAR.
- F. MINIMUM ULTIMATE STRENGTH OF THE NUT MUST EQUAL AT LEAST 95% OF THE MINIMUM ULTIMATE STRENGTH OF THE BAR.
- G. DURING EACH WALL POUR, FLUSH THE VERTICAL THREADBAR PVC DUCTS WITH CLEAN WATER FROM A HOSE PLACED THROUGH AN OPENING IN THE WOODEN CAP OVER THE SQUARE TUBING AT THE TOP OF THE ROOF SLAB.
- H. EACH VERTICAL TENDON SHALL BE STRESSED TO PROVIDE AN AVERAGE OF 200 PSI FOR THE ENTIRE WALL SECTION AFTER ACCOUNTING FOR LONG-TERM LOSSES.
- I. GROUT PUMP EACH VERTICAL THREADBAR FROM THE BOTTOM GROUT CONNECTION WITH A 2-PART WATER INSENSITIVE EPOXY UNTIL THE ENTIRE NUT AT THE TOP ANCHOR CONNECTION HAS BEEN COVERED. DRYPACK THE REMAINDER OF THE TUBING WITH A 1-PART CEMENT TO 2-PARTS SAND MIX IMMEDIATELY AFTER THE INSIDE OF THE TUBING HAS BEEN COATED WITH EPOXY GROUT. IN LIEU OF DRYPACKING, THE TUBING MAY BE FILLED WITH PEA GRAVEL PRIOR TO PUMPING THE GROUT, AND THE ENTIRE TUBE MAY BE PUMPED FULL OF GROUT.
- 3. BUCKLING CRITERIA OF WALL DESIGN
- THE INTEGRITY OF THE WALL SHOWN ON THESE DRAWINGS IS STRICTLY PREDICATED ON THE FOLLOWING CONDITIONS:
- A. THE STRICT CONFORMANCE TO THE CLOSE STRESS—TOLERANCE AND OTHER REQUIREMENTS OF THE CIRCUMFERENTIAL PRESTRESSING INSTALLATION INDICATED IN THE CIRCUMFERENTIAL PRESTRESSING NOTES ABOVE AND ON OTHER PARTS OF THESE DRAWINGS AND IN THE TECHNICAL SPECIFICATIONS.
- B. SEE SPECIFICATIONS FOR OUT-OF-ROUND TOLERANCE.
- C. THERE SHALL BE NO BLOCK-OUTS OR OTHER TYPES OF WALL OPENINGS OTHER THAN THOSE SHOWN ON THESE DRAWINGS.
- 4. APPURTENANCE INSTALLATION NOTES:
- A. WHERE EXTERIOR APPURTENANCES REQUIRE ANCHORS TO BE PLACED IN THE WALL EXTERIOR, DRILL AND PLACE AFTER WRAPPING AND BEFORE SHOTCRETING. TAKE EXTREME CARE TO AVOID DAMAGING THE PRESTRESSING STRAND. PLACE A STEEL PIPE AROUND THE DRILL BIT TO KEEP THE BIT FROM COMING IN CONTACT WITH THE PRESTRESSING STRAND. INSTALL INSERTS BEFORE SHOTCRETING TO MARK HOLE LOCATIONS. FOR ALL TYPE OF ANCHORING SYSTEMS, INCLUDING DROP—IN AND EXPANSION WEDGE ANCHORS, FILL HOLE IN SHOTCRETE AND WALL WITH EPOXY BEFORE FINAL INSTALLATION OF ANCHORS TO ASSURE COMPLETE COVERAGE AND PROTECTION OF THE STRAND.
- B. ADHESIVE ANCHORS WITH 1 INCH MAXIMUM EMBEDMENT INTO THE SHOTCRETE MAY ONLY BE USED IN NON-STRUCTURAL APPLICATIONS AND WHEN APPROVED BY THE ENGINEER OF RECORD. WHEN DRILLING HOLES IN SHOTCRETE, THE DRILL SHALL BE EQUIPPED WITH A POSITIVE STOP TO PREVENT DRILLING MORE THAN 1 INCH IN DEPTH. USE EPOXY TO INSURE COMPLETE COVERAGE AND PROTECTION OF THE PRESTRESSING STRAND. DO NOT USE EXPANSION OR DROP-IN ANCHORS.
- C. USE STAINLESS STEEL BOLTS AND ANCHOR ASSEMBLIES UNLESS NOTED OTHERWISE. WHERE STAINLESS STEEL BOLTS OR ANCHORS ARE IN CONTACT WITH DISSIMILAR METALS, USE INSULATING SLEEVES AND PHENOLIC WASHERS TO ELECTRONICALLY ISOLATE THE BOLT.

RESERVOIR DRAWINGS AND DESIGN:

THE DRAWINGS PROVIDED HEREIN ARE TO BE USED BY THE RESERVOIR PROVIDER AS A REFERENCE TO ESTABLISH THE MINIMUM FEATURES, SIZE OF ELEMENTS AND AMOUNT OF REINFORCING TO BE PROVIDED IN THE RESERVOIR DESIGN. THE DRAWINGS HEREIN ARE NOT CONSTRUCTION DRAWINGS.

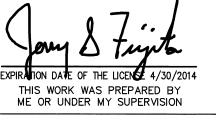
THE DESIGN AND PREPARATION OF THE RESERVOIR CONSTRUCTION DRAWINGS IS THE RESPONSIBILITY OF THE RESERVOIR CONTRACTOR AS DESCRIBED IN THE PROJECT SPECIFICATIONS. ONLY THE CONSTRUCTION DRAWINGS PREPARED BY THE RESERVOIR CONTRACTOR ARE TO BE REFERENCED FOR THE CONSTRUCTION OF THE RESERVOIR STRUCTURE.

THE DRAWINGS HEREIN MAY BE USED FOR THE FABRICATION AND INSTALLATION OF APPURTENANCES OF THE RESERVOIR STRUCTURE NOT SPECIFICALLY DETAILED IN THE RESERVOIR STRUCTURE CONSTRUCTION DRAWINGS PREPARED BY THE RESERVOIR CONTRACTOR..

8/20/12 ADDENDUM NO. 2 KAI

REVISION DATE DESCRIPTION MADE BY APPROVED







DEPARTMENT OF HAWAIIAN HOME LANDS

MAKUU OFFSITE WATER SYSTEM, PHASE 2:

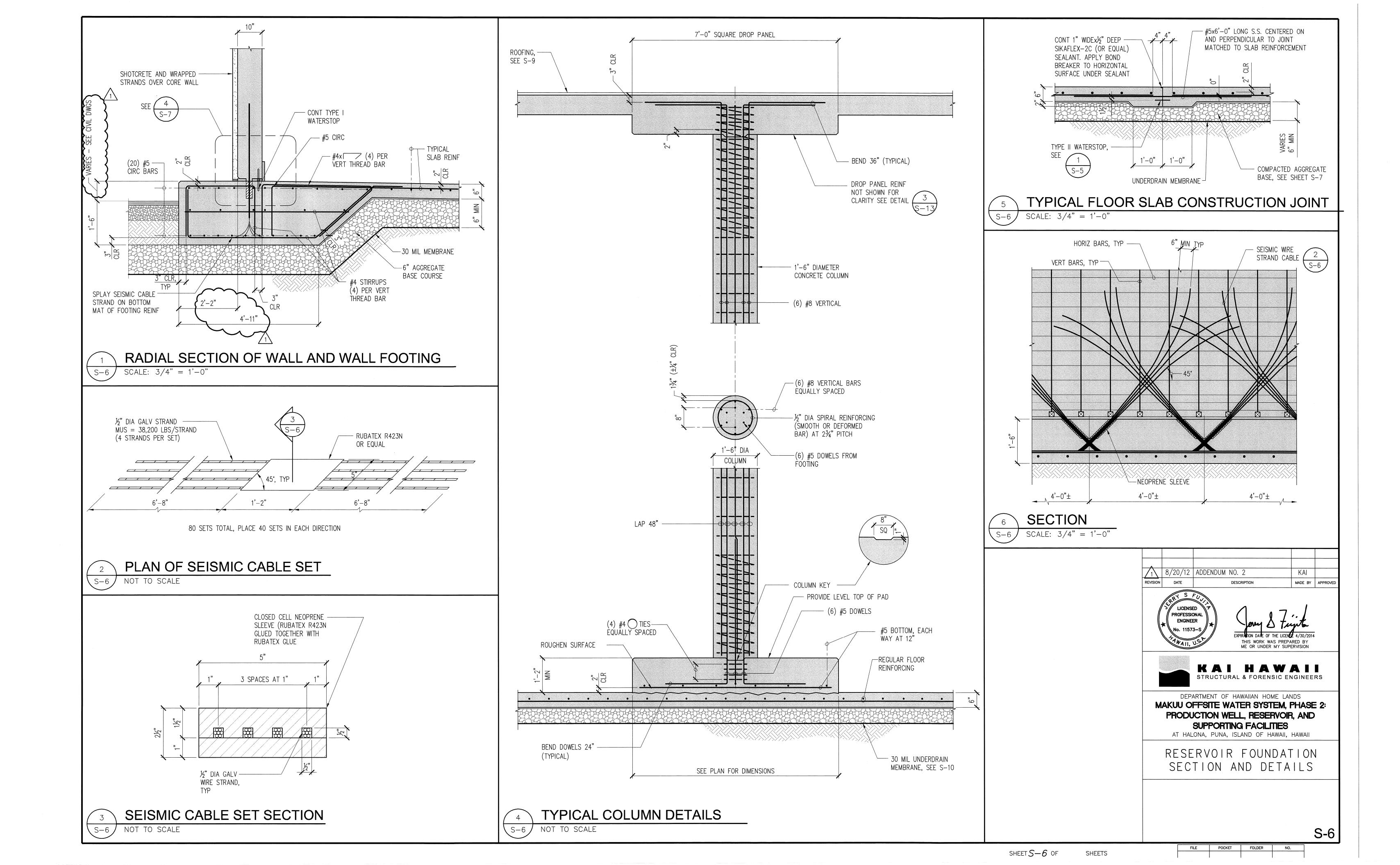
PRODUCTION WELL, RESERVOIR, AND

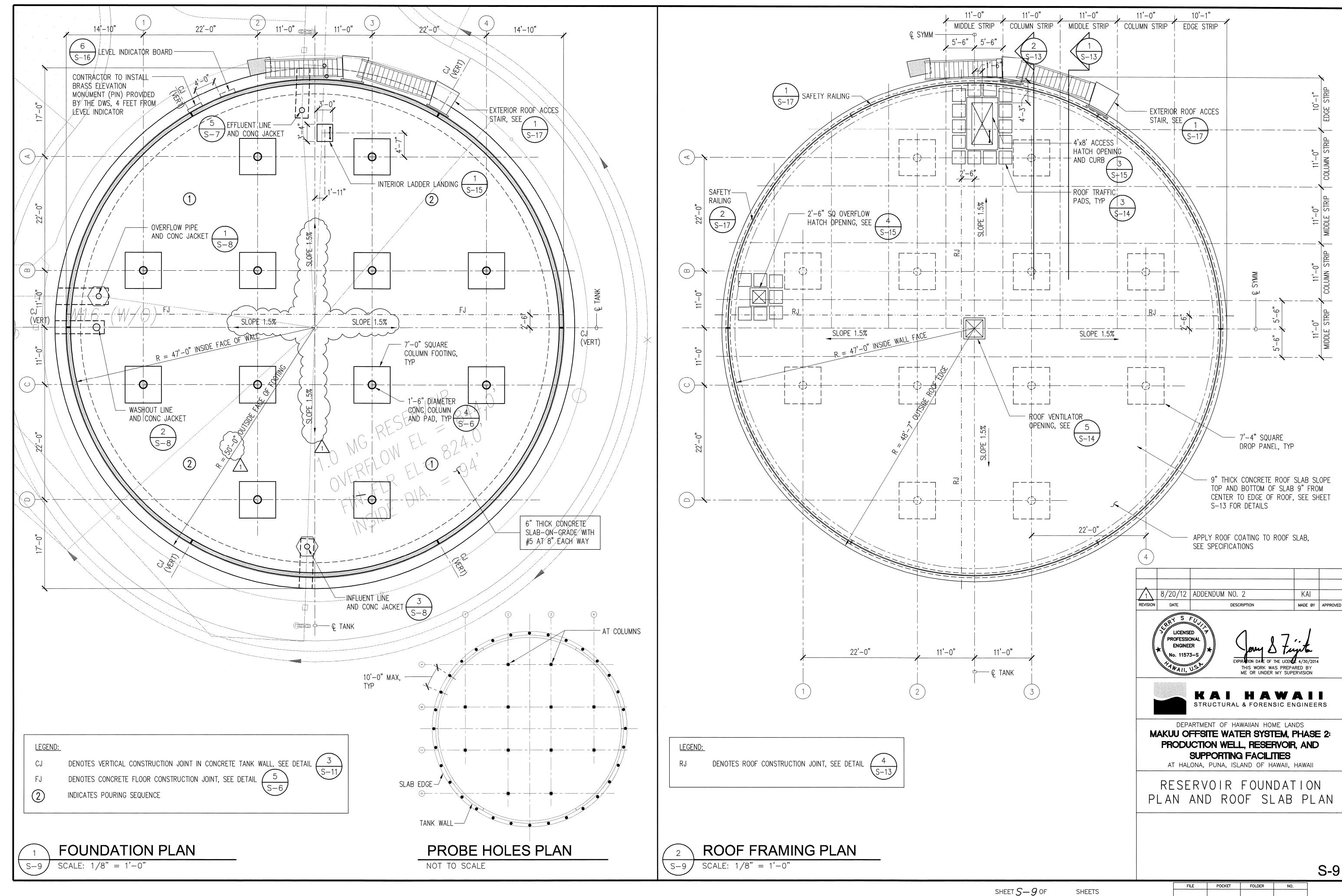
SUPPORTING FACILITIES

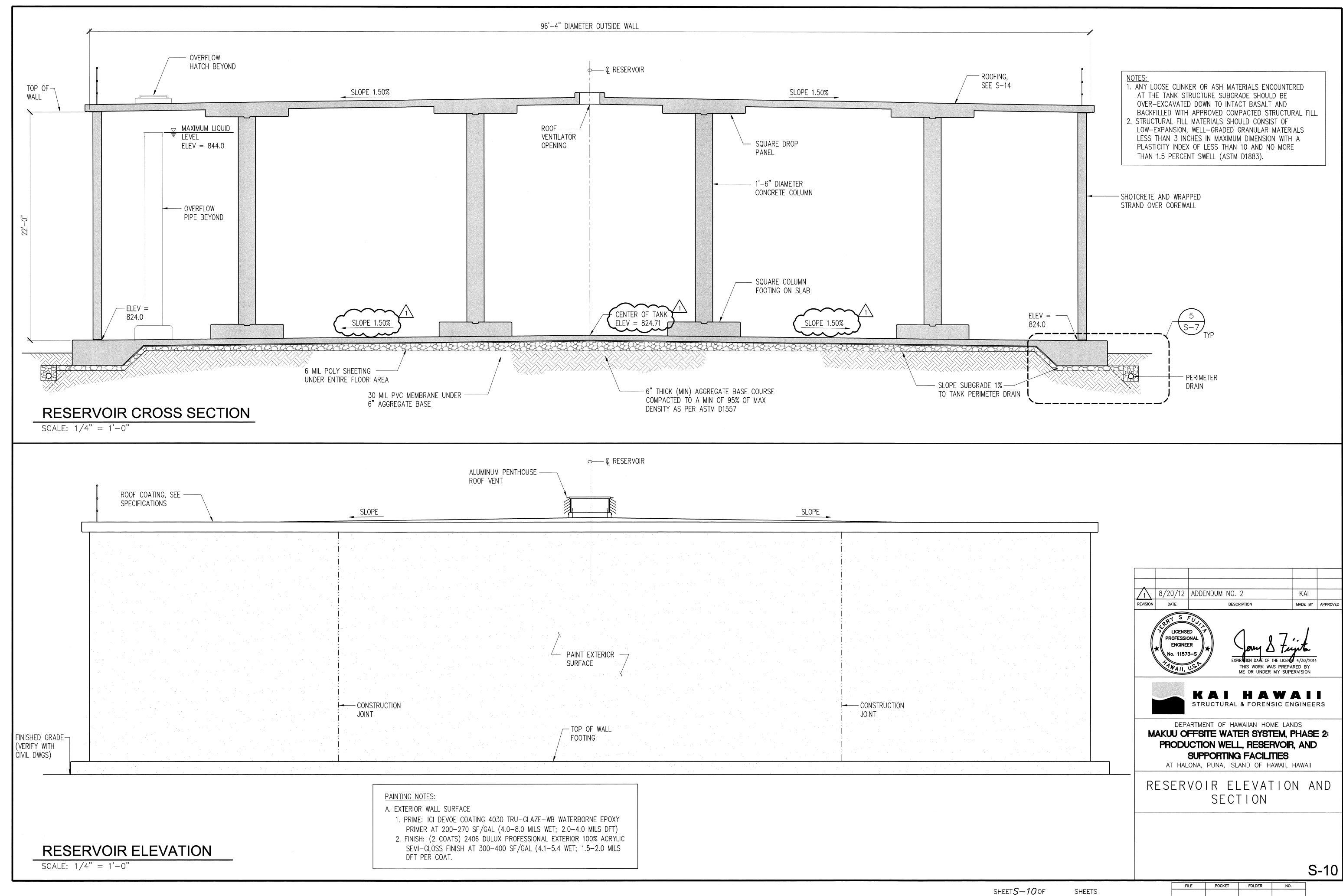
AT HALONA, PUNA, ISLAND OF HAWAII, HAWAII

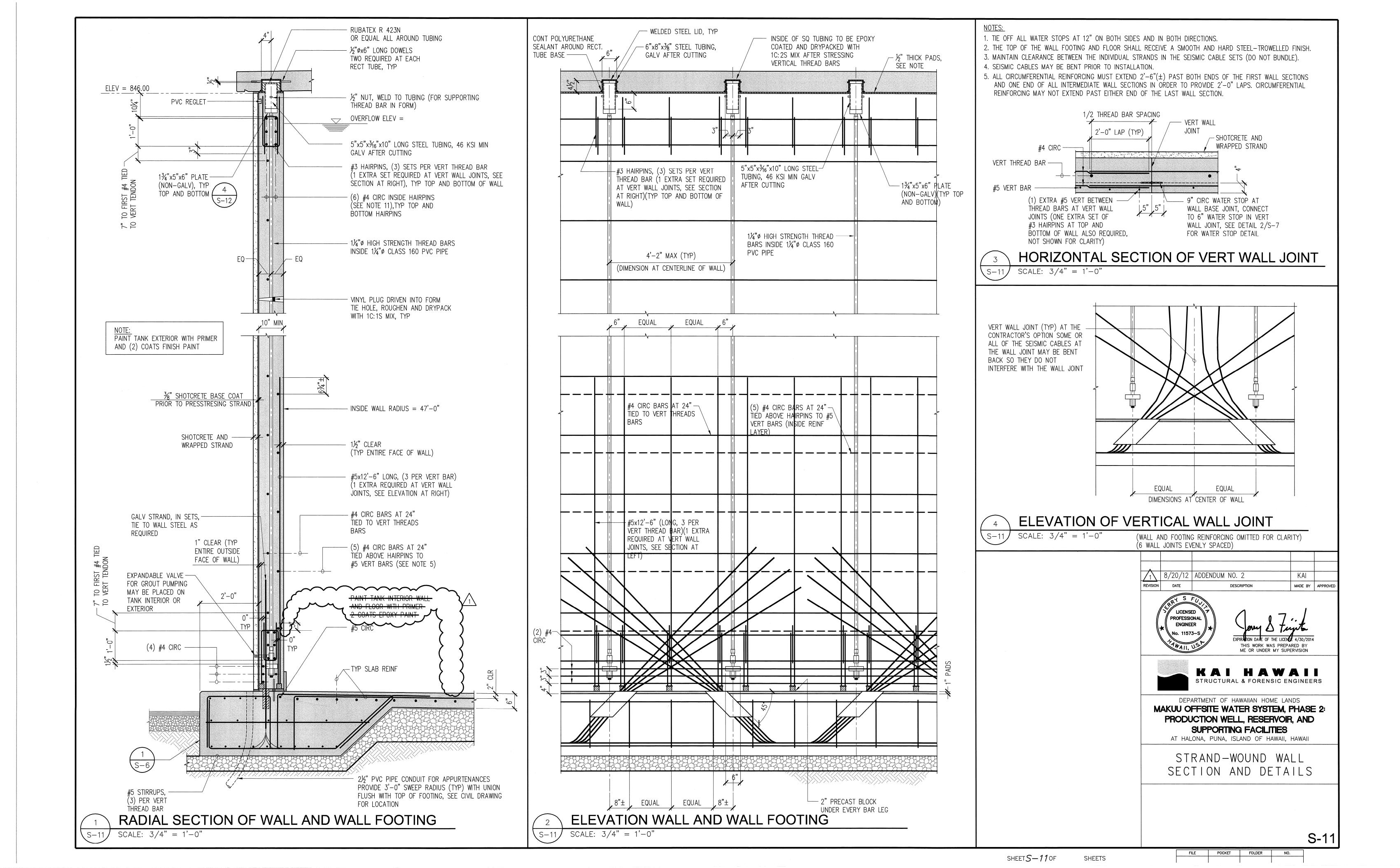
RESERVOIR GENERAL NOTES

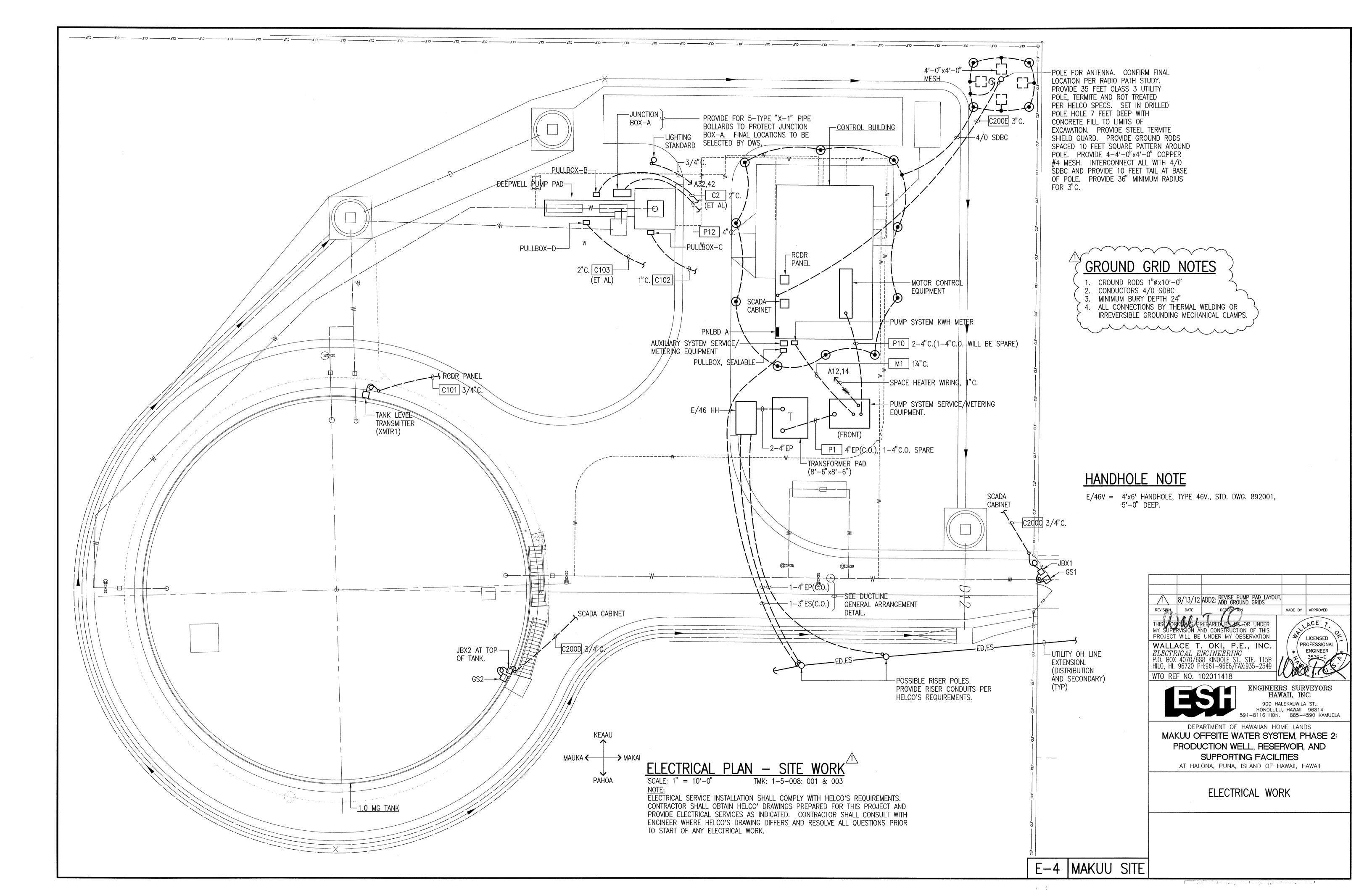
S-4

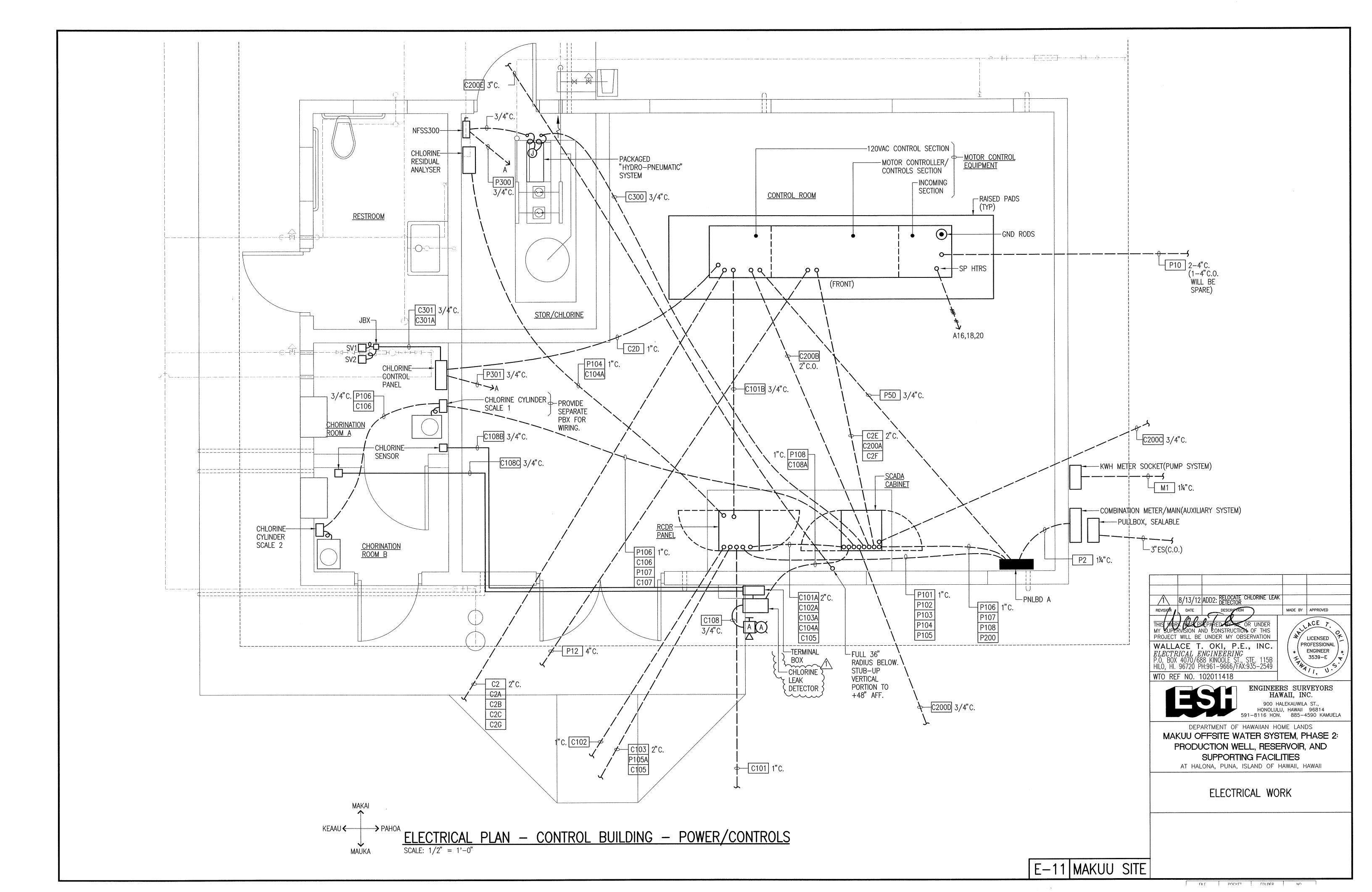


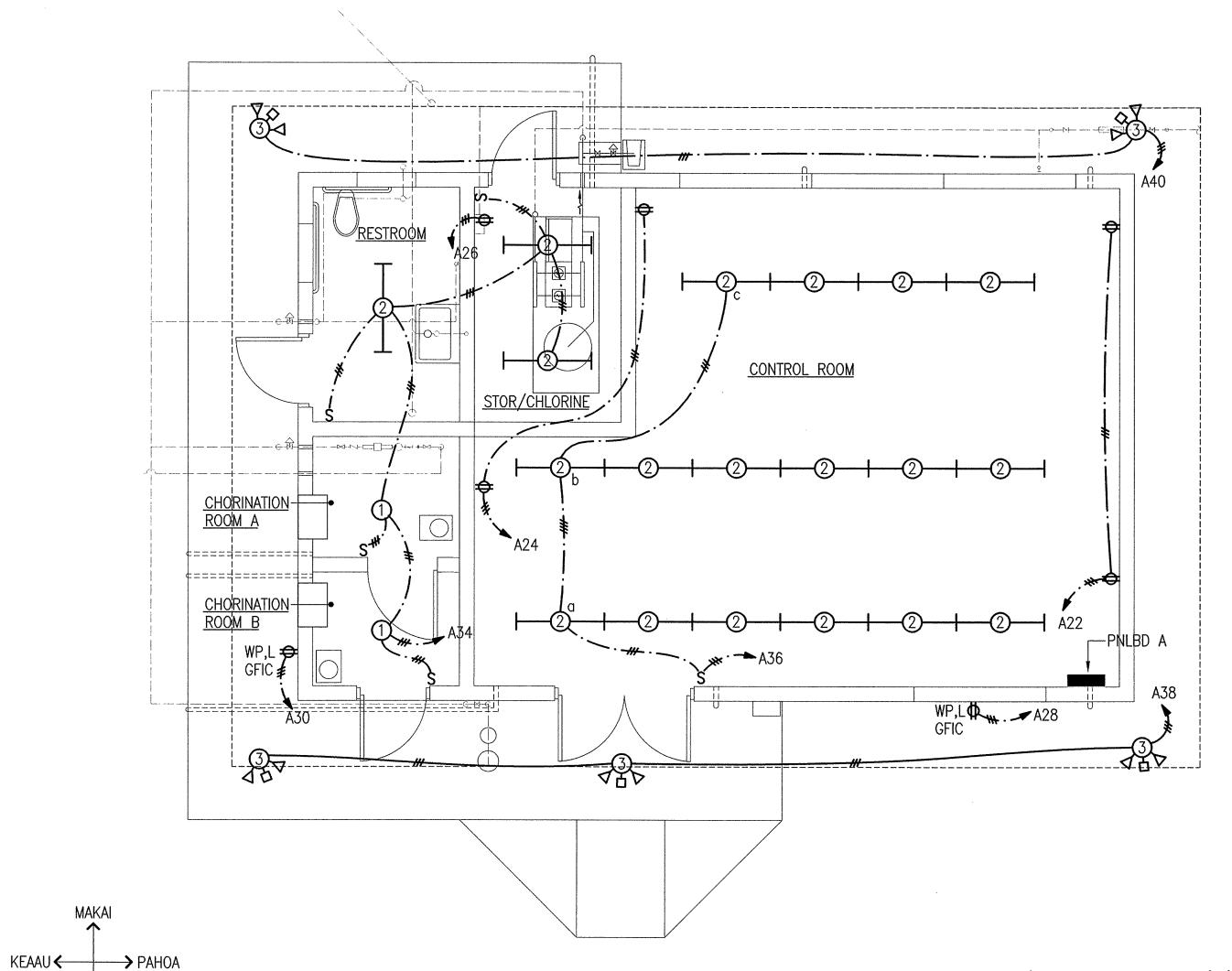










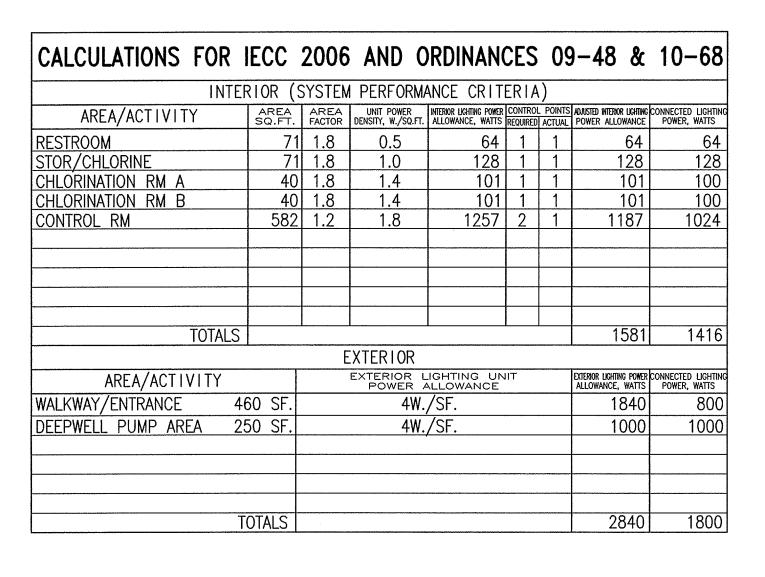


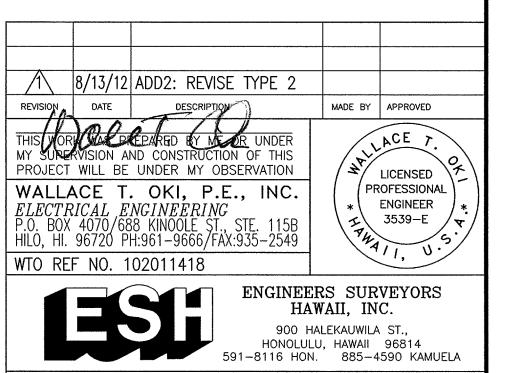
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LECTRICAL ALE: 1/4" = 1'-0"	PLAN	- CONT	ROL BUILE	DING -	GENERAL	POWER/I	RECEPTAC	CLE//LIG	HTING
nll. 1/4 - 1-0									

	*****	LBD_ A	240/120 VOLTS, 1 PHASE, 3 WIRE, NEUTRAL BUS, GROUND BUS, SURFACE MOUNTING, 225 A. MAIN BUS ONLY, COPPER, BOLT—ON BRANCH BREAKERS, FULL SIZE BREAKERS ONLY, 10,000 AIC, TYPEWRITTEN DIRECTORY									
	WIRE SIZE		SERVICE		BKR. POLE	CIR. NO.		CIR. NO.		BKR.	4 >FBVICE	WIRE SIZE
50	#12		PWR/MCE	20	1	1	L1	2	1	20	PRESSURE GAUGE	#12
01	#12		1/RCDR PNL	20	1	3	L2	4	1	20	CHLORINE SCALE 1	#12
02	#12		2/RCDR PNL	20	1	5	<u>L1</u>	6	1	20	CHLORINE SCALE 2	#12
03	#12		METER/RCDR PNL	20	1	7	L2	8	1	20	CHLORINE LEAK DETECTOR	#12
04			INE ANALYZER/RCDR PNL		1	9	<u> L1</u>	10			PFFB	
00	#12		TERM CAB	20	1	11	<u> L2</u>	12	1	20	SP HTR/S/ME	#12
00	#6	HYDRO)-PNEU SYSTEM	60	2_	13	L1	14	1	20	SP HTR/S.ME	#12
	#6	0111 05	NILLATOR COLUMN			15	<u> L2</u>	16	1	20	SP HTR/MCE	#12
01	#12		RINATOR CONTROL PANEL	20	1	17	L1	18	1	20	SP HTR/MCE	#12
-	#12	EF1		20	2	19	<u> L2</u>	20	1	20	SP HTR/MCE	#12
-			255	<u> </u>	_	21	LI	22	1	20	R-CONTROL RM	#12
-			PFFB			23	LZ	24	1	20	R-CONTROL RM	#12
-			PFFB PFFB			25		26	1	20	R-STOR/CHLORINE	#12
ŀ		*****	PFFB	<u> </u>		27	LZ	28		20	R-EXTERIOR	#12
ŀ			PFFB PFFB	<u> </u>		29		30	1	20	R-EXTERIOR	#12
-			PFFB			31	LZ	32	<u> </u>	20	R-LIGHTING STANDARDS	#12
-			PFFB PFFB			33		34		20		#12
-			PFFB			35	<u> L2</u>	36	<u> </u>	20	L-CONTROL RM	#12
			PFFB	ļ		37	L1	38	1	20	L-BLDG EXTERIOR	#12
-			PFFB	 		39	<u> L2</u>	40]	20	L-BLDG EXTERIOR	#12
L			PFFB			41	<u> L1</u>	42	1	20	L-LIGHITNG STANDARDS	#12

MAKAI

LIGHTI	N G F	IXTURE SCHEDULE
SYMBOL/TYPE	MOUNTING	LAMP DESCRIPTION
①	CEILING SURFACE	100W. DIE CAST CEILING BRACKET, SATIN A-19 ALUMINUM, PORCELAIN SOCKET, CLEAR 130V. GLASS GLOBE, VAPOR TIGHT, ROUGH NEOPRENE GASKETED. SERVICE
 2	CEILING SURFACE	2=F32/T8 4 FEET, FLUORESCENT LED LAMPHOLDER, BARE LAMP, WHITE METAL FRAME, 4 FEET ENCLOSED BALLAST HOUSING, CHANNEL TYPE, SNAP—ON END PLATES, LED ELECTRONIC SOLID STATE ENERGY (SEE SPECIFICATIONS) WITH LAMP TUBE GUARDS: FURNISH WITH LAMP TUBE GUARDS. (SEE SPECIFICATIONS)
3 □	CEILING SURFACE	2-COMPACT OUTDOOR LAMPHOLDER WITH MOTION FLUORESCENT ACTIVATED SENSOR, P.E. CONTROLLED, OR LED ADJUSTABLE SENSITIVITY AND DELAY. OUTDOOR FLOODLIGHTS (100W. INCAND EQUIVALENT MINIMUM)
H4	POLE MOUNTED	500W. QUARTZ HALOGEN EXTERIOR USE FLOODLIGHT, DIE CAST ALUMINUM HOUSING WITH CAST—IN FINS FOR HEAT DISSIPATION, "ANODAL" REFLECTOR OR EQUIVALENT, THERMAL SHOCK AND IMPACT RESISTANT TEMPERED GLASS LENS IN A DIE CAST ALUMINUM FRAME, SPRING LOADED STAINLESS STEEL LATCHES FOR POSITIVE SEALING, MEDIUM BEAM SPREAD, ADJUSTABLE AIM, THREADED BASE. USE WITH THREADED HUB COVER AND OUTLET BOX.

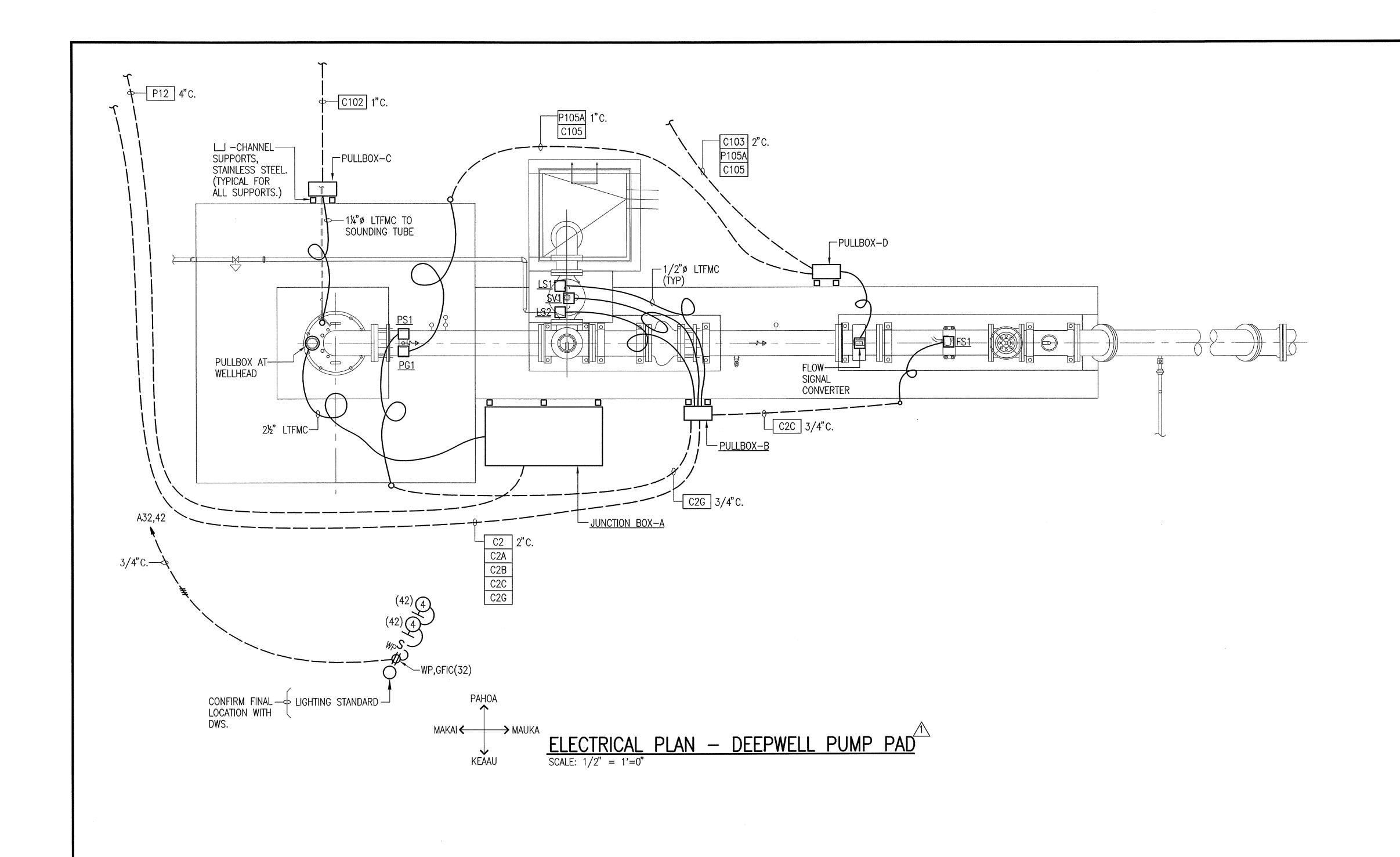


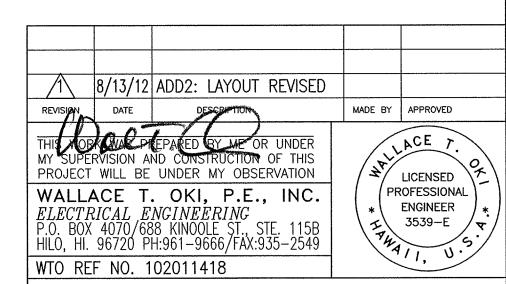


DEPARTMENT OF HAWAIIAN HOME LANDS MAKUU OFFSITE WATER SYSTEM, PHASE 2: PRODUCTION WELL, RESERVOIR, AND SUPPORTING FACILITIES

AT HALONA, PUNA, ISLAND OF HAWAII, HAWAII

ELECTRICAL WORK





ENGINEERS SURVEYORS
HAWAII, INC.

900 HALEKAUWILA ST.,
HONOLULU, HAWAII 96814
591-8116 HON. 885-4590 KAMUELA

DEPARTMENT OF HAWAIIAN HOME LANDS

MAKUU OFFSITE WATER SYSTEM, PHASE 2:

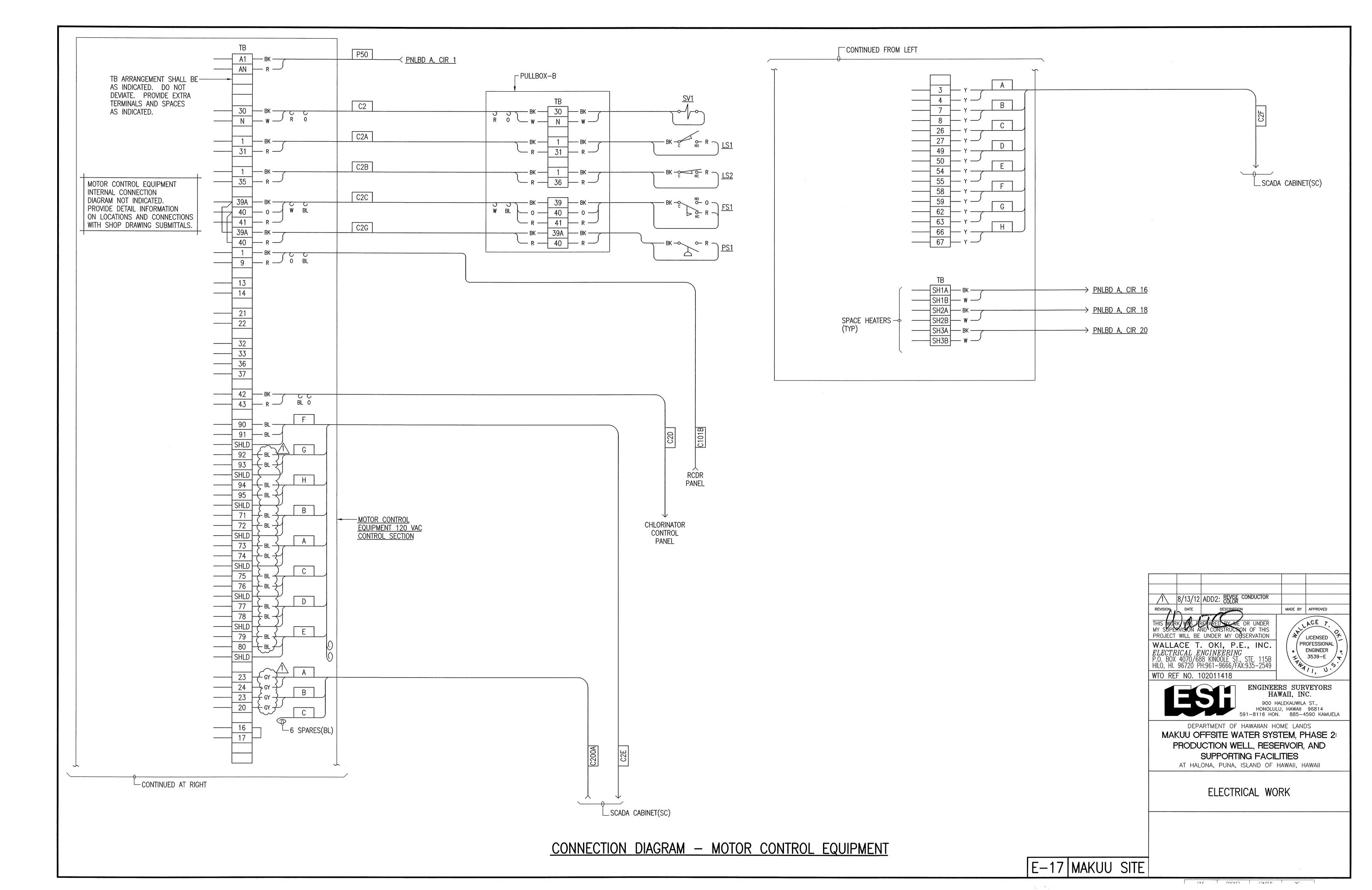
PRODUCTION WELL, RESERVOIR, AND

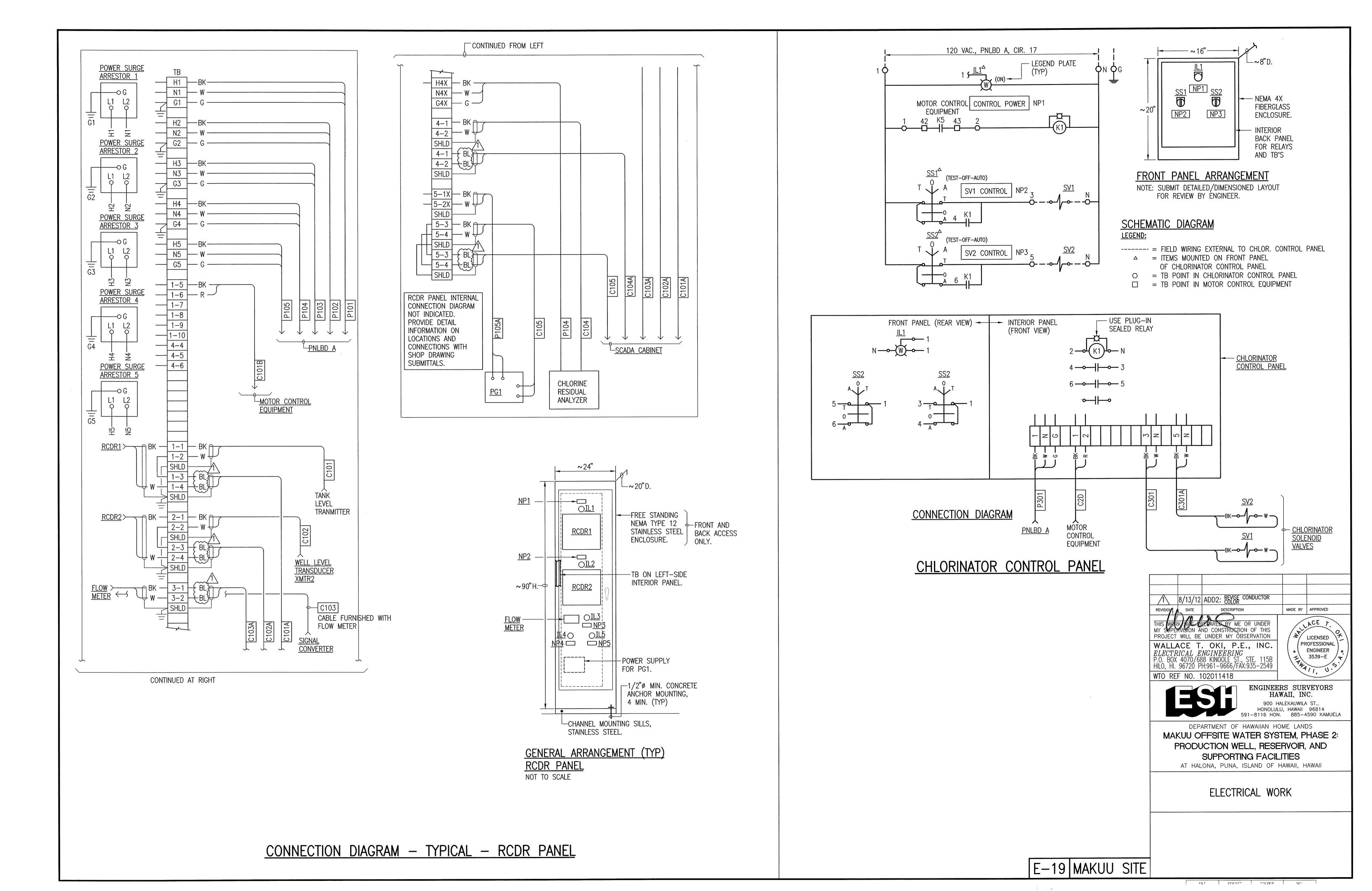
SUPPORTING FACILITIES

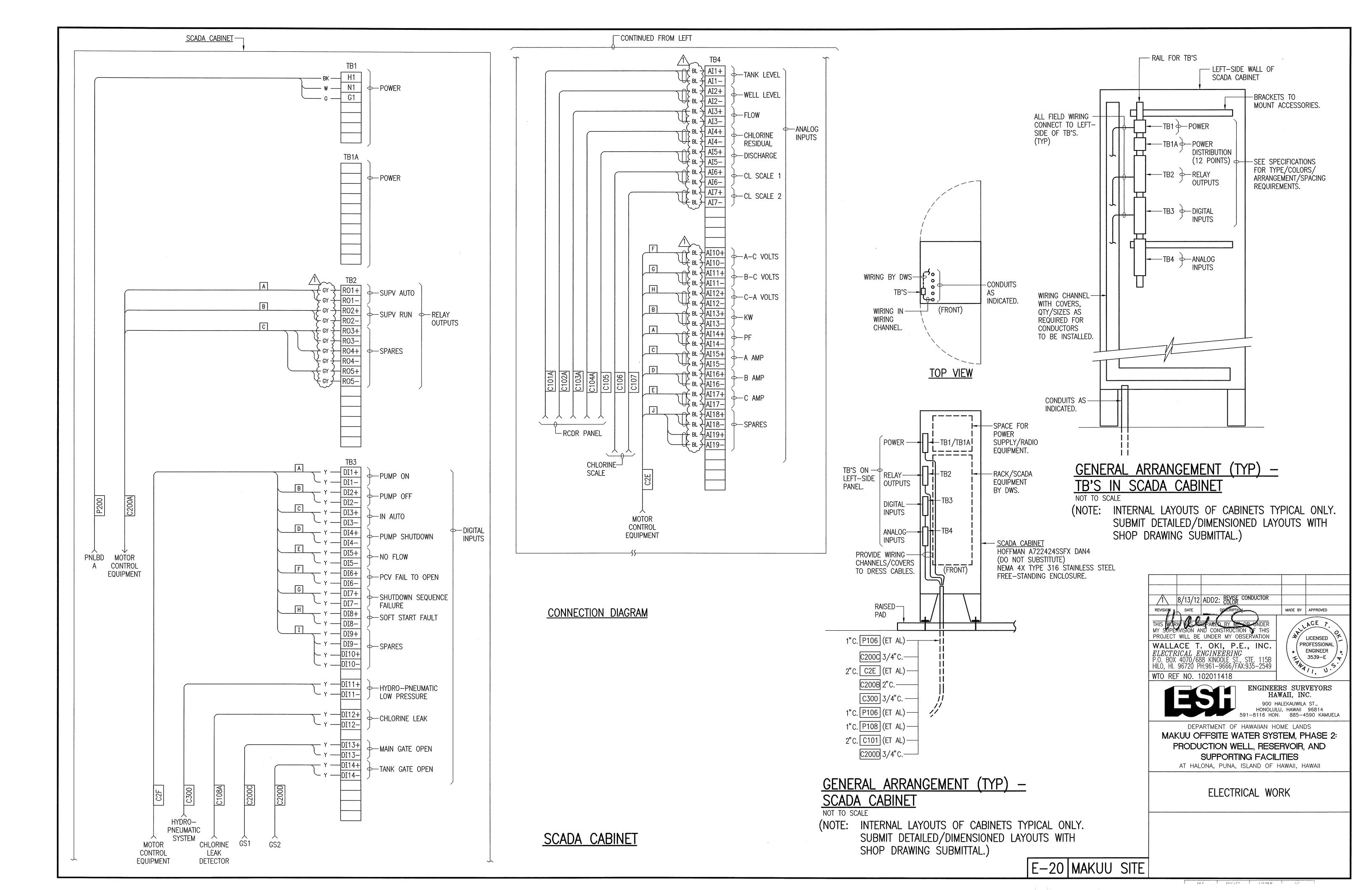
AT HALONA, PUNA, ISLAND OF HAWAII, HAWAII

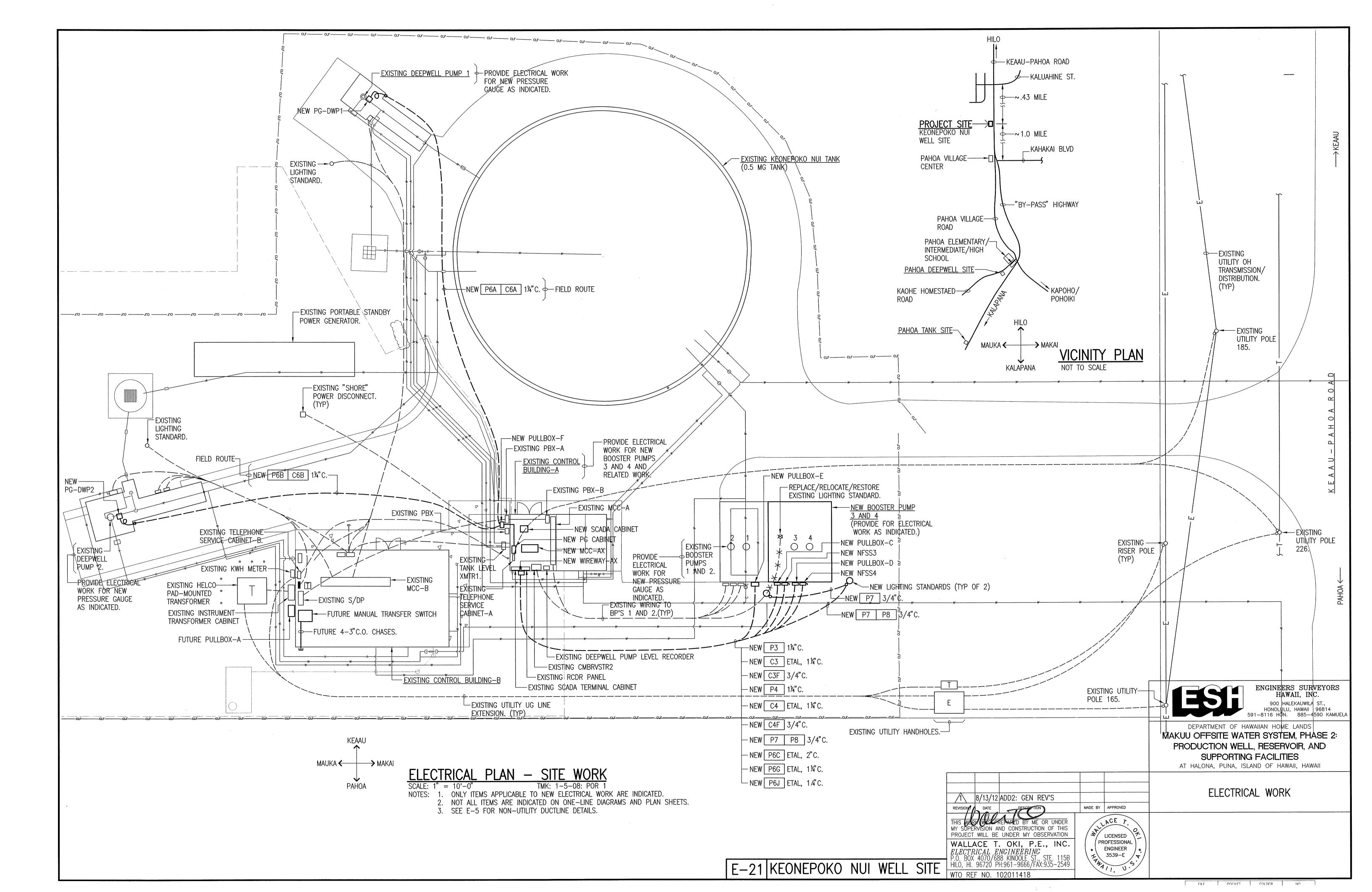
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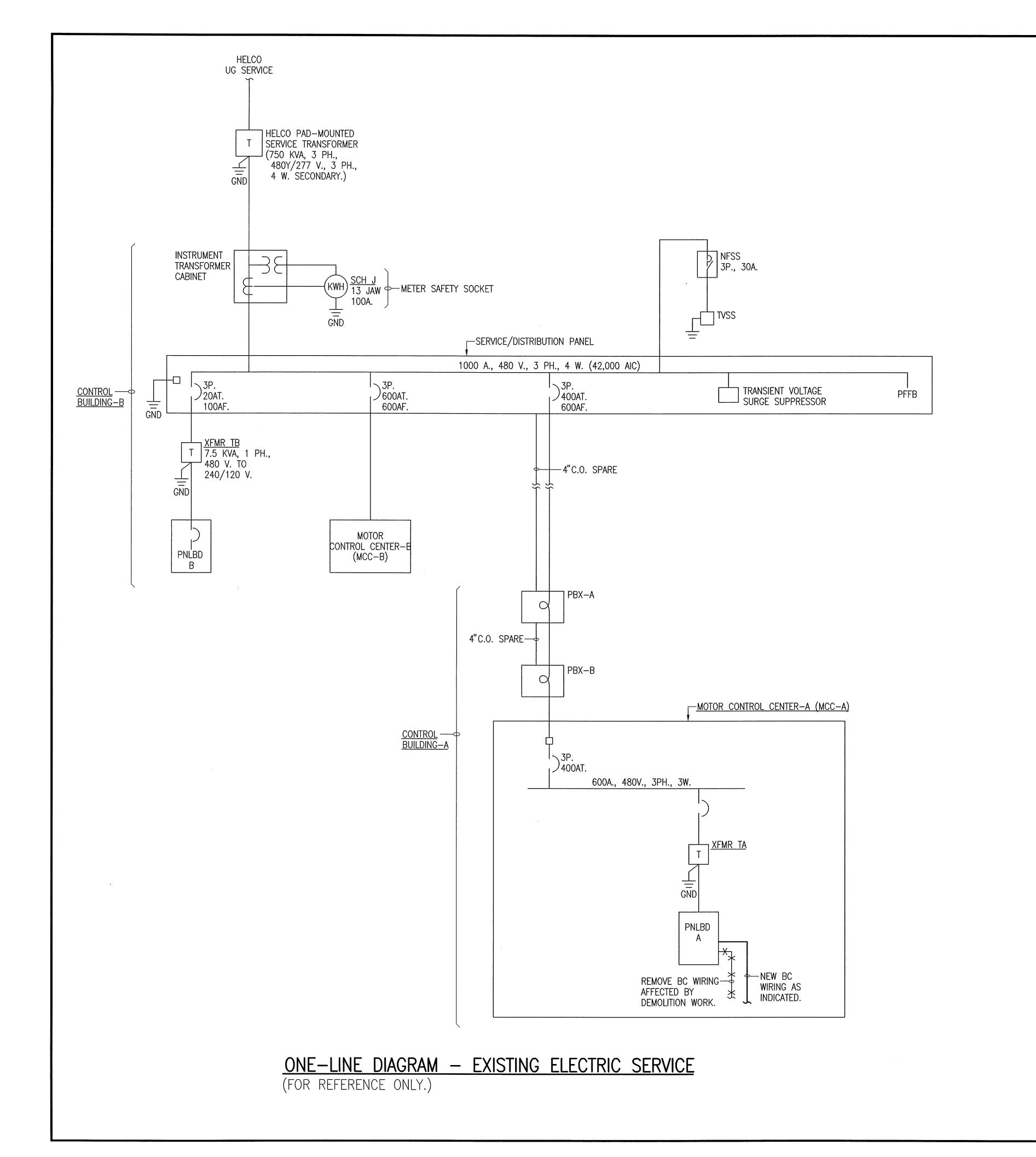
FILE POCKET FOLDER NO

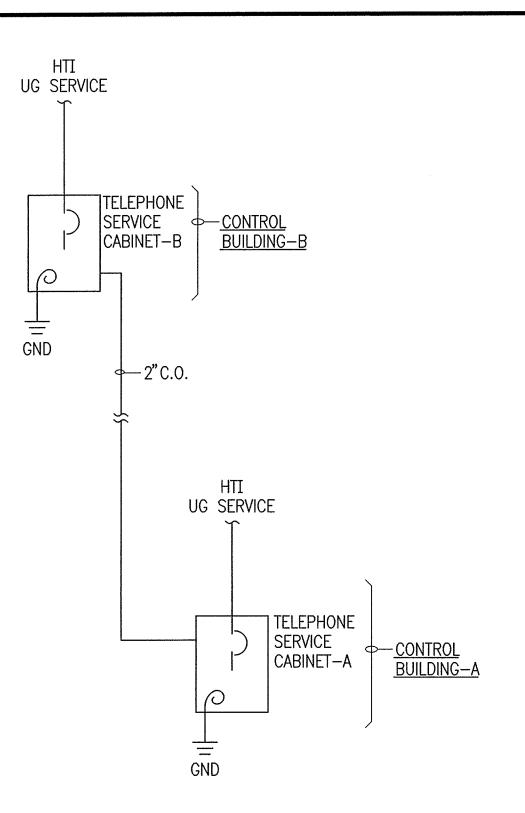




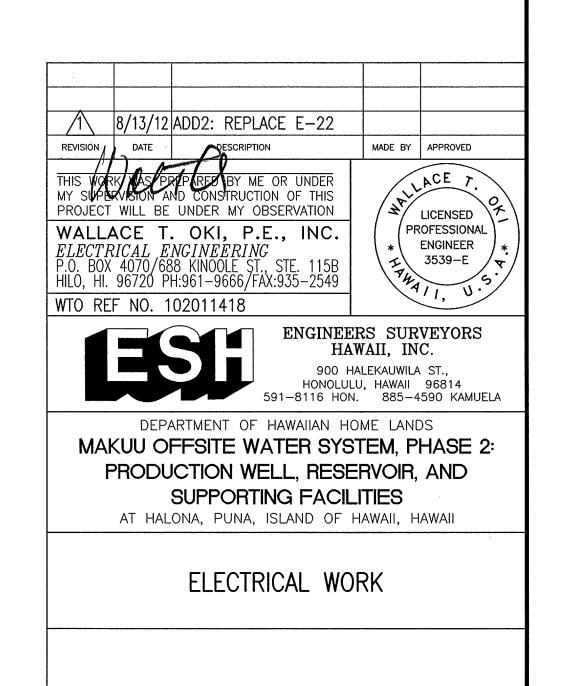






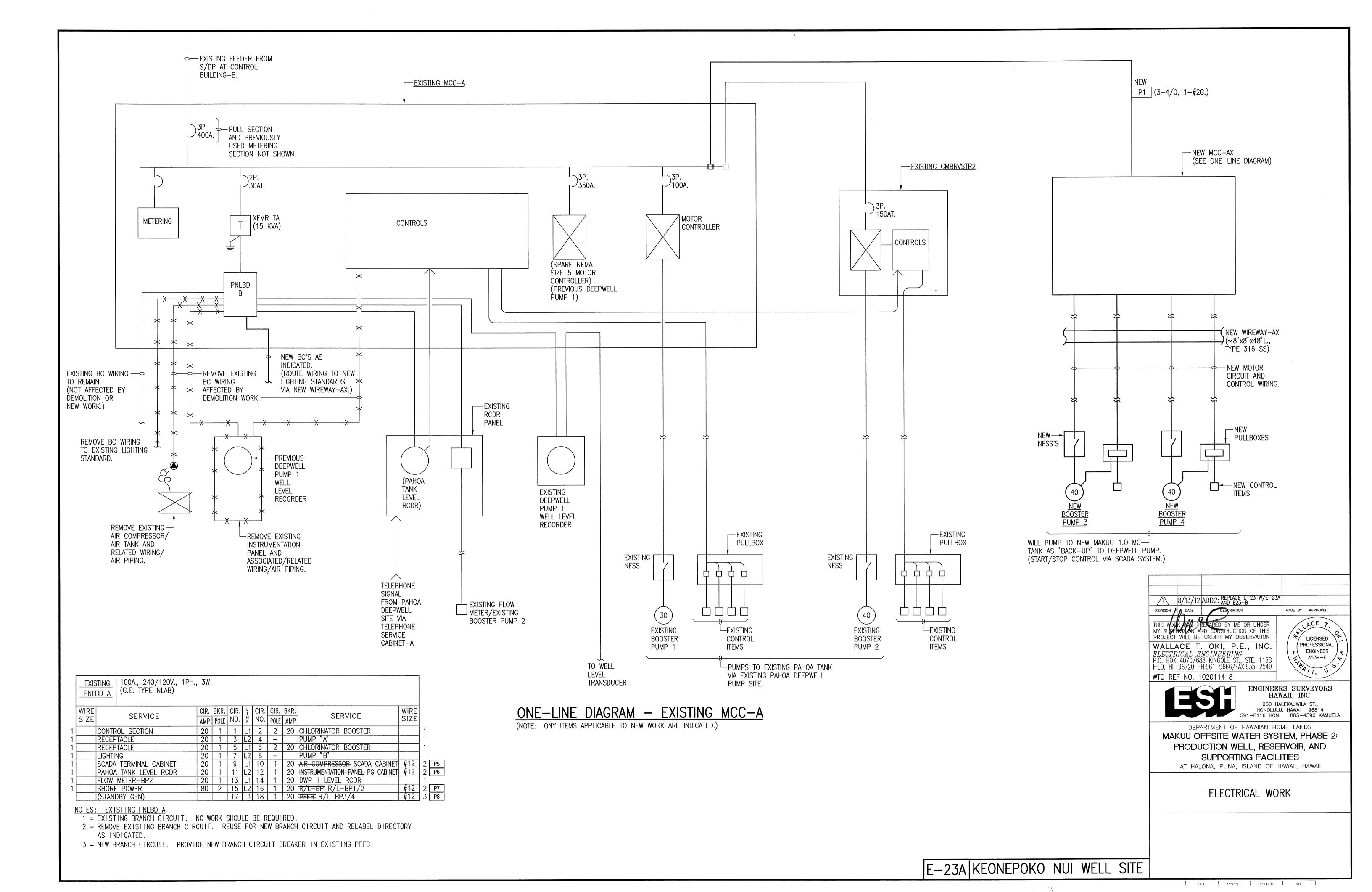


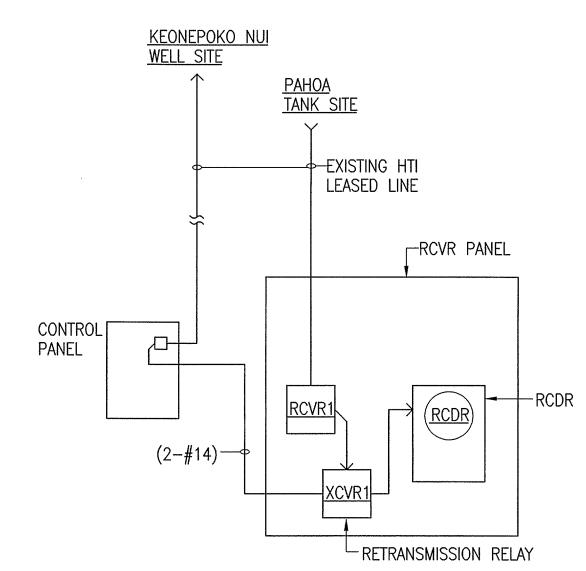
ONE-LINE DIAGRAM - EXISTING TELEPHONE SERVICE (FOR REFERENCE ONLY. NO NEW WORK SHOULD BE REQUIRED.)



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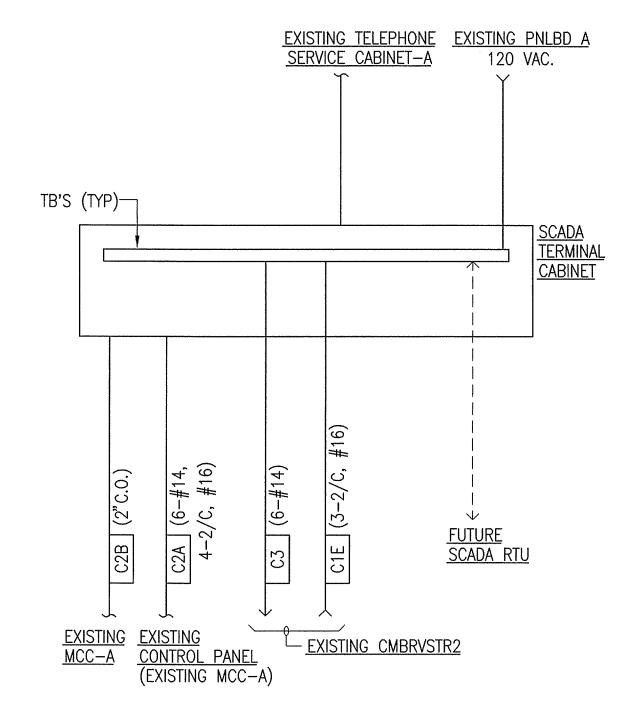
E-22 KEONEPOKO NUI WELL SITE



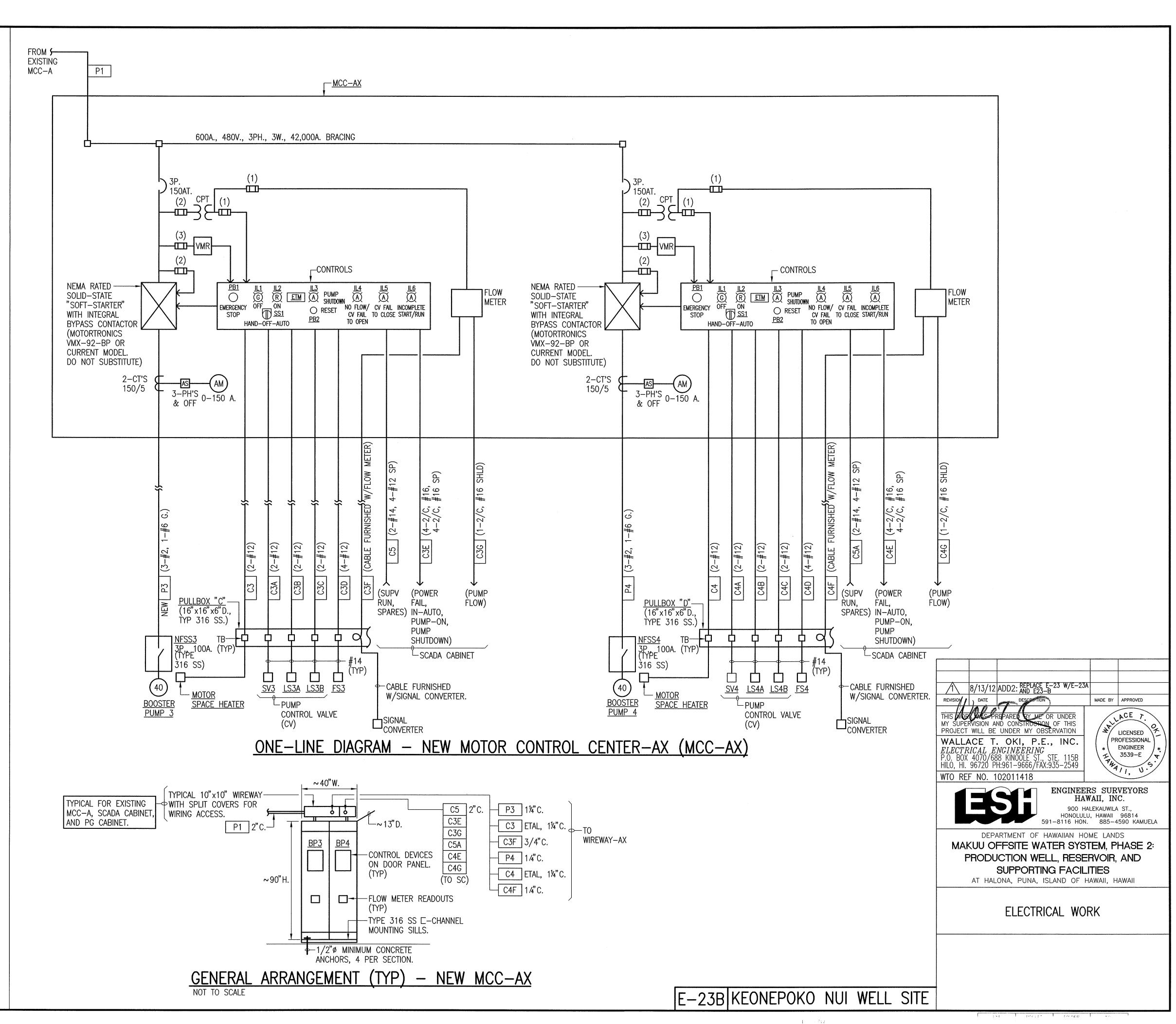


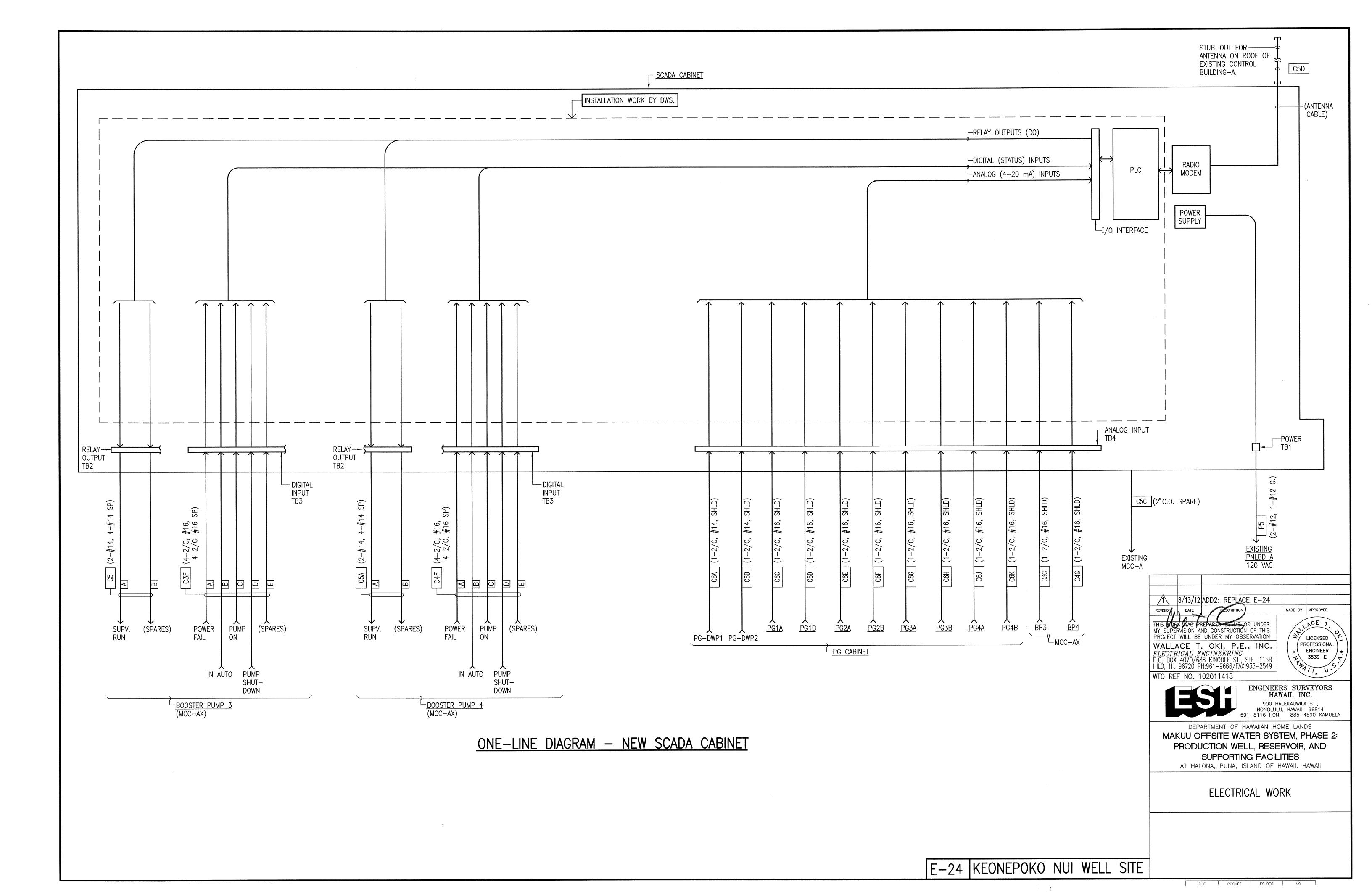
ONE-LINE DIAGRAM -EXISTING PAHOA DEEPWELL SITE

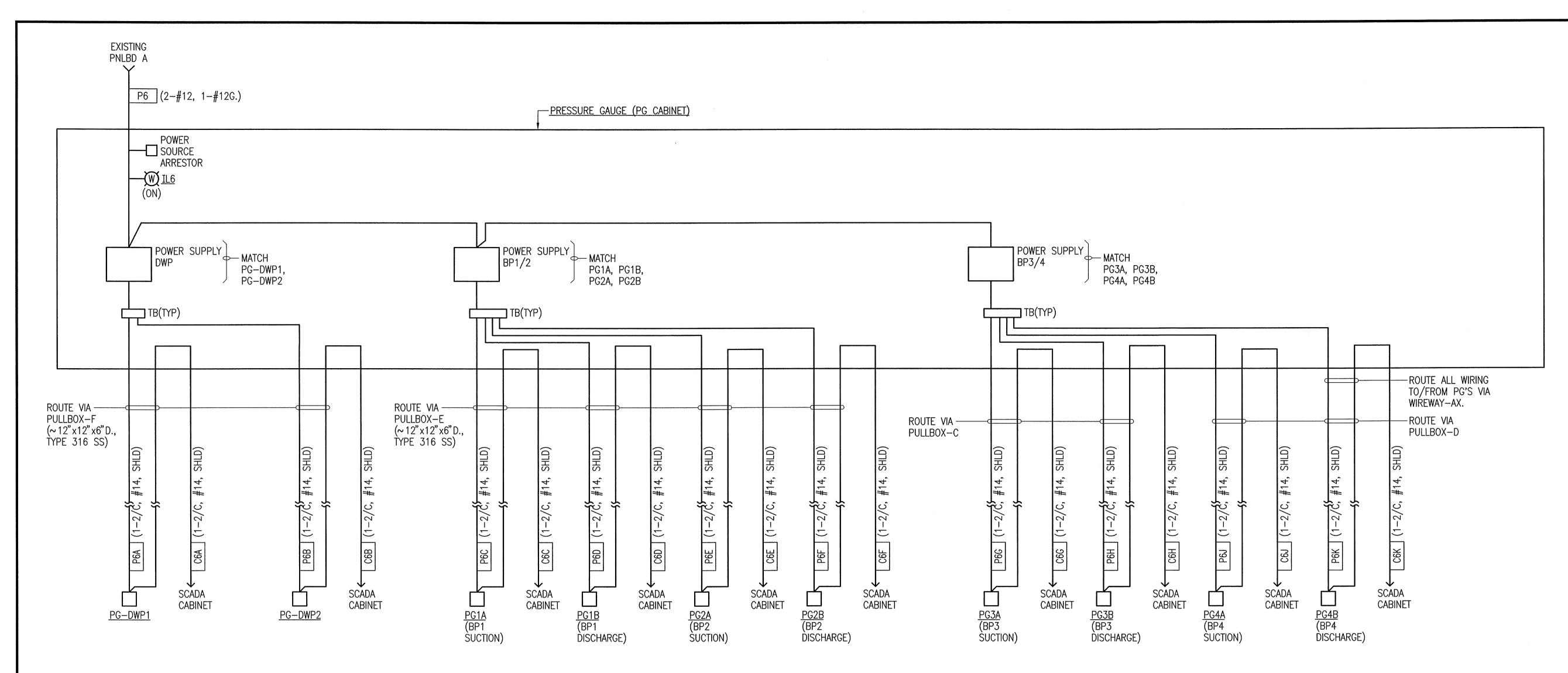
(FOR REFERENCE ONLY)



ONE-LINE DIAGRAM -EXISTING SCADA TERMINAL CABINET (FOR REFERENCE ONLY: NO WORK REQUIRED.)



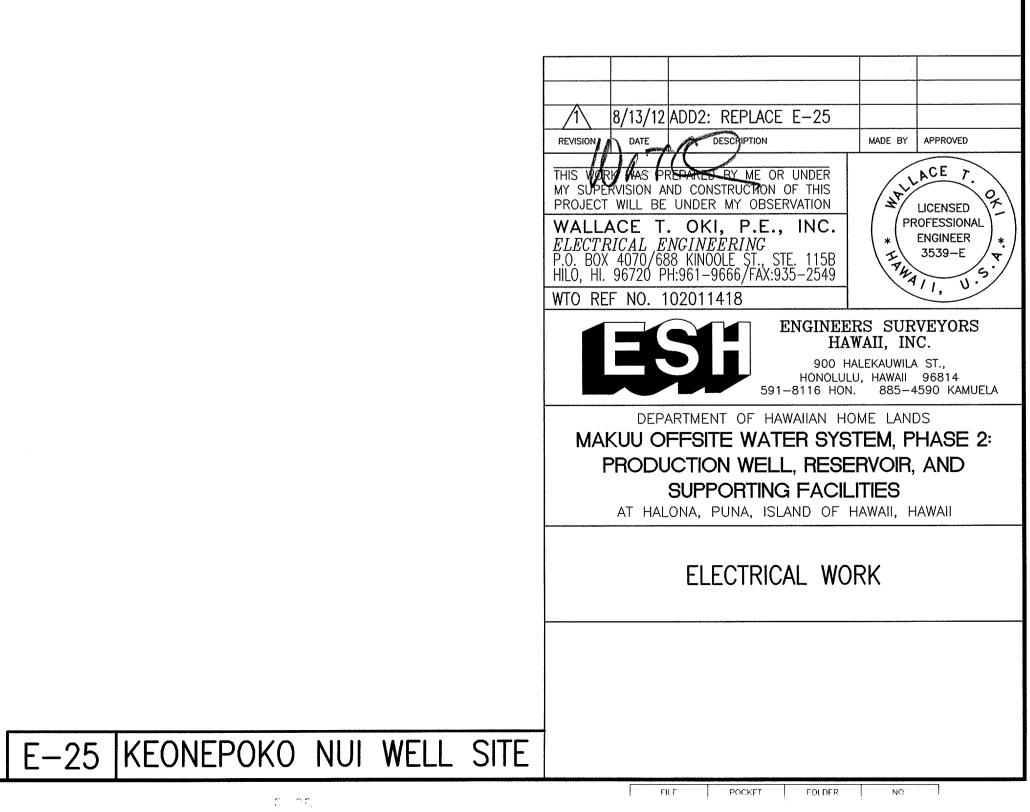


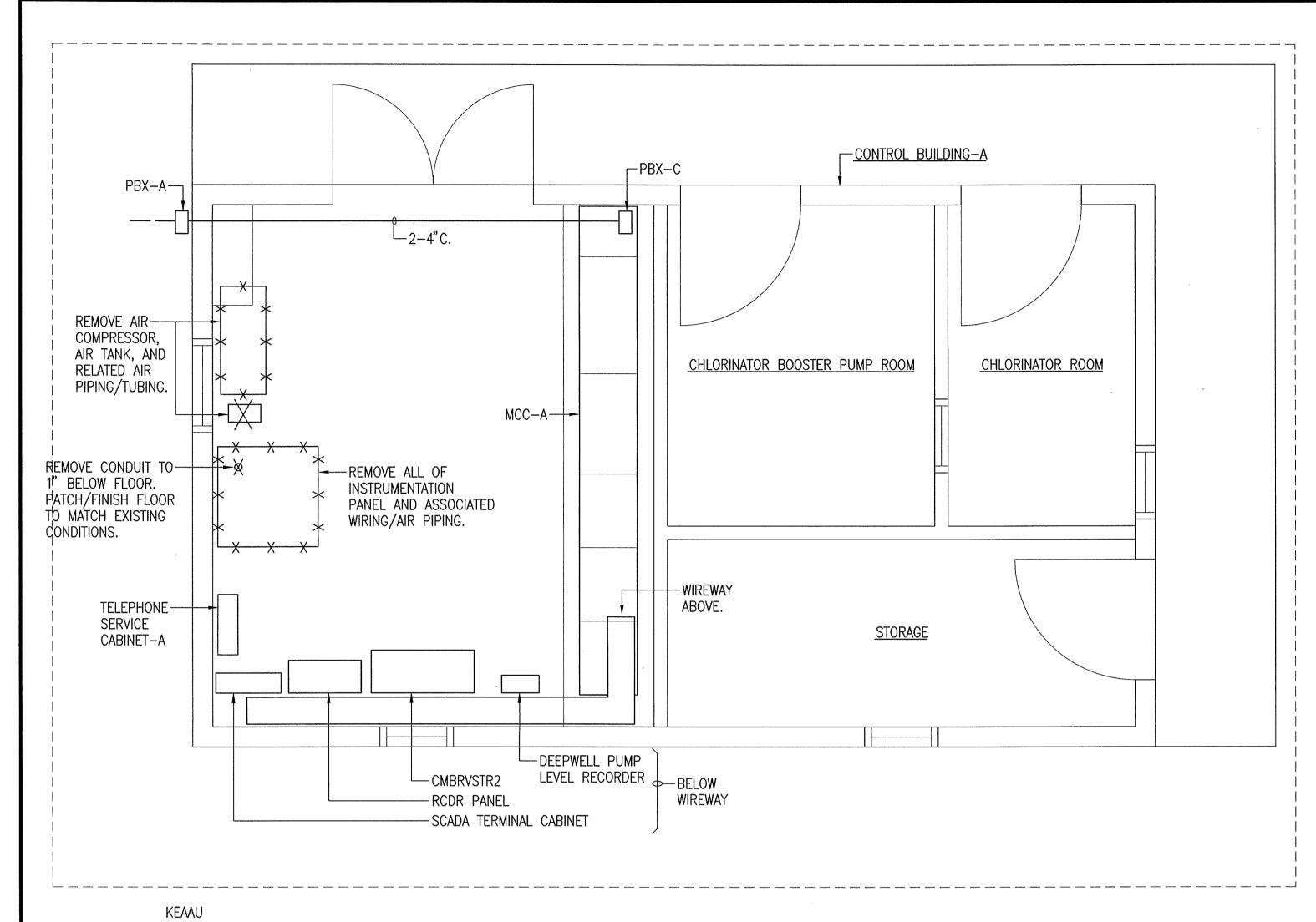


ONE-LINE DIAGRAM - NEW PRESSURE GAUGE (PG) CABINET

NOTES ON PG'S:

- PG-DWP1, PG-DWP2: PROVIDE IN ACCORDANCE WITH DETAIL 3 ON SHEET M-2.
 INCLUDE ALL REQUIRED PIPING/PIPE FITTINGS AND SHUT-OFF VALVES.
- 2. PG1A, PG1B, PG2A, PG2B: PROVIDE AS NOTED ON SHEET M-7 FOR DIGITAL PRESSURE GAUGES. INCLUDE ALL REQUIRED PIPING/PIPE FITTINGS AND SHUT-OFF VALVES.

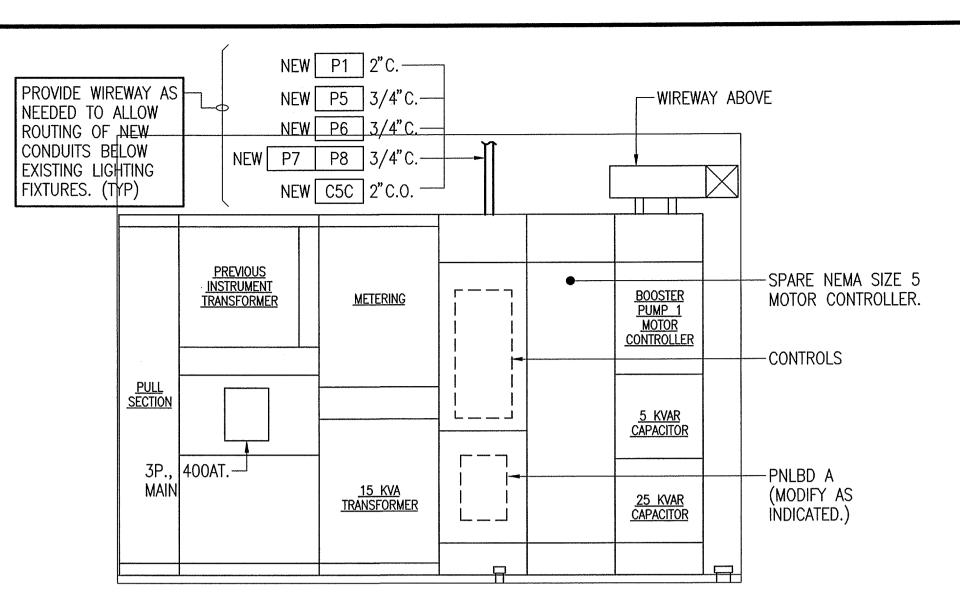




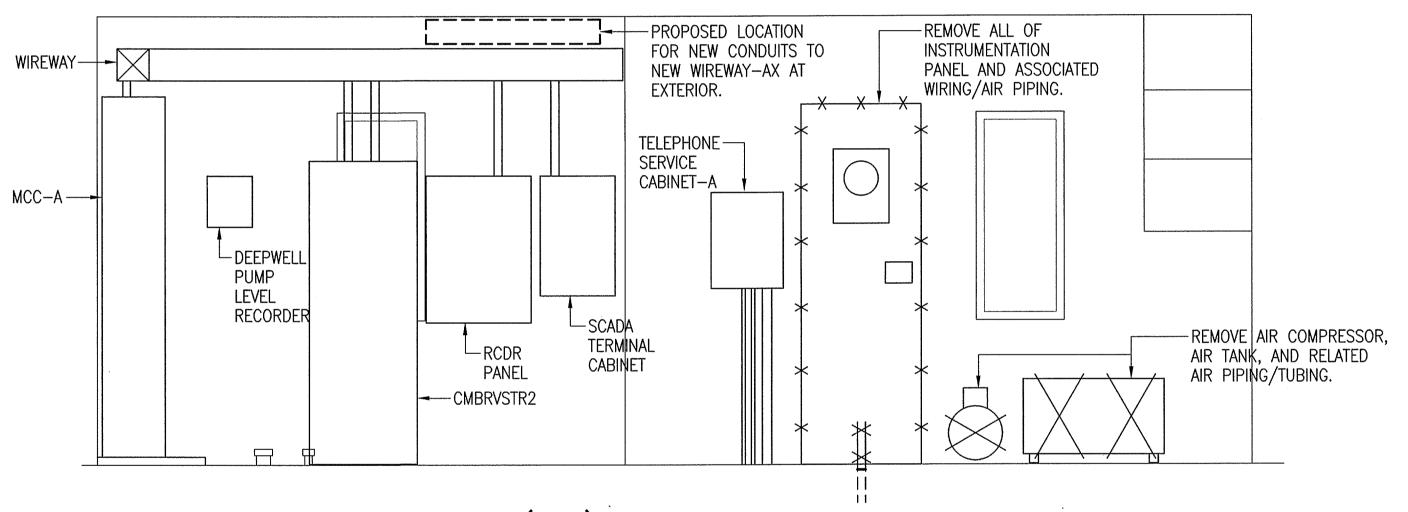
MAUKA - MAKAI <u>ELECTRICAL PLAN - EXISTING/DEMOLITION WORK - CONTROL BUILDING-A</u> SCALE: 1/2" = 1'-0" PAHOA (NOTE: ONLY ITEMS APPLICABLE TO NEW WORK ARE INDICATED.)

DEMOLITION NOTES

- 1. THE CONTRACTOR SHALL COORDINATE ALL WORK WITH THE ENGINEER IN THE FIELD DURING THE ACTUAL DEMOLITION WORK TO RESOLVE ALL QUESTIONS WHERE APPLICABLE.
- 2. DISCONNECT AND REMOVE THE EXISTING ELECTRICAL ITEMS AND THEIR ASSOCIATED WIRING AS INDICATED.
- 3. ALL REMOVED ITEMS SHALL REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL CONSULT THE OWNER FOR STORAGE AND/OR DISPOSAL INSTRUCTIONS.
- 4. ALL WIRING ASSOCIATED WITH ITEMS TO BE REMOVED SHALL BE DISCONNECTED AND REMOVED BACK TO LAST OVERCURRENT DEVICE, CONTROLLER, OR FIELD TERMINAL POINT.
- 5. ALL CONDUITS EMBEDDED IN WALLS TO REMAIN SHALL HAVE ALL WIRING REMOVED AND THE CONDUITS CAPPED AND/OR SEALED PRIOR TO THE WALLS BEING COVERED WITH NEW WORK.
- 6. EXISTING RECEPTACLES AND SWITCHES EMBEDDED IN WALLS TO REMAIN SHALL BE REMOVED AND THE OUTLETS COVERED WITH SOLID
- 7. DEVICE AND LIGHTING FIXTURE OUTLET BOXES NOT RE-USED FOR NEW WIRING SHALL BE COVERED WITH BLANK PLATES OR BOXES REMOVED AND OUTLET HOLE REPAIRED ARCHITECTURALLY.
- 8. THE CONTRACTOR SHALL COORDINATE/VERIFY ALL EXISTING BRANCH CIRCUITS AS APPLICABLE TO THE DEMOLITION WORK AND AS NECESSARY TO PROVIDE TEMPORARY POWER DURING THE VARIOUS PHASES OF CONSTRUCTION.
- 9. ALL EMBEDDED CONDUITS SHALL HAVE ALL WIRING REMOVED AND CONDUITS REMOVED OR ABANDONED AS APPLICABLE. ALL ABANDONED CONDUITS SHALL BE CAPPED AND/OR SEALED BY APPROVED METHODS.
- 10. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL EXISTING CONDITIONS. THE EXISTING CONDITIONS SHOWN ARE INTENDED TO BE AS COMPLETE AND ACCURATE AS POSSIBLE. HOWEVER, ALL ITEMS NOT SHOWN SHALL BE DEMOLISHED WHERE REQUIRED AT NO ADDITIONAL COST TO THE OWNER.



GENERAL ARRANGEMENT (TYP) -EXISTING MOTOR CONTROL CENTER-A (MCC-A)



GENERAL ARRANGEMENT (TYP) - EXISTING ELECTRICAL ITEMS NOT TO SCALE

> 1 8/13/12 ADD2. REPLACE E-26 W/E-26A THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS LACE 7 PROJECT WILL BE UNDER MY OBSERVATION LICENSED PROFESSIONAL WALLACE T. OKI, P.E., INC. ENGINEER ELECTRICAL ENGINEERING
> P.O. BOX 4070/688 KINOOLE ST., STE. 115B
> HILO, HI. 96720 PH:961-9666/FAX:935-2549 3539-E WTO REF NO. 102011418 ENGINEERS SURVEYORS HAWAII, INC.

HONOLULU, HAWAII 96814 591-8116 HON. 885-4590 KAMUELA

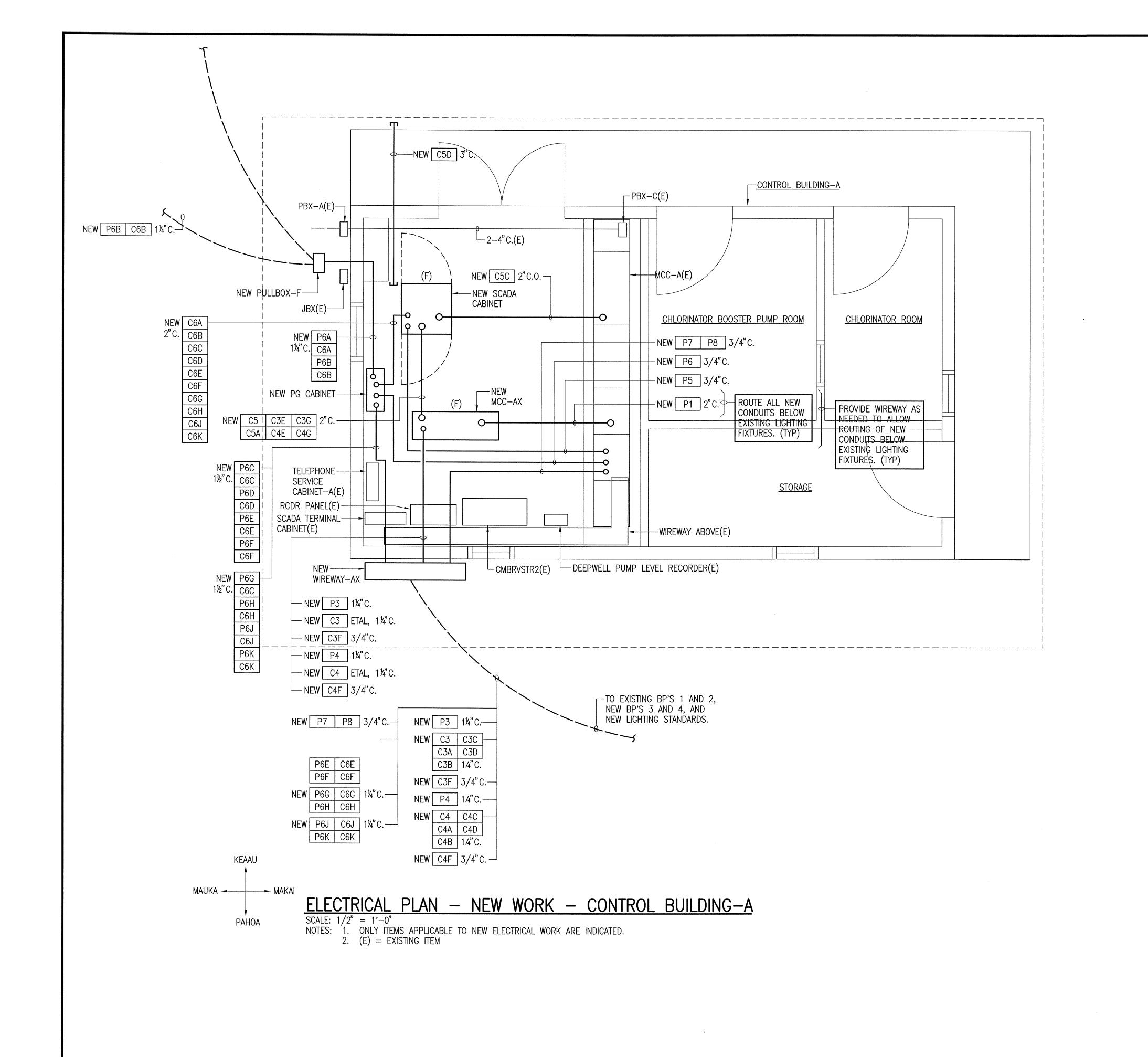
DEPARTMENT OF HAWAIIAN HOME LANDS MAKUU OFFSITE WATER SYSTEM, PHASE 2: PRODUCTION WELL, RESERVOIR, AND SUPPORTING FACILITIES AT HALONA, PUNA, ISLAND OF HAWAII, HAWAII

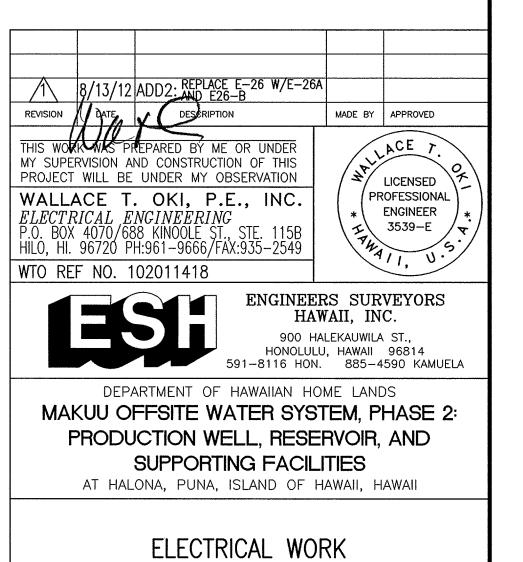
900 HALEKAUWILA ST.,

ELECTRICAL WORK

|E-26A|KEONEPOKO NUI WELL SITE

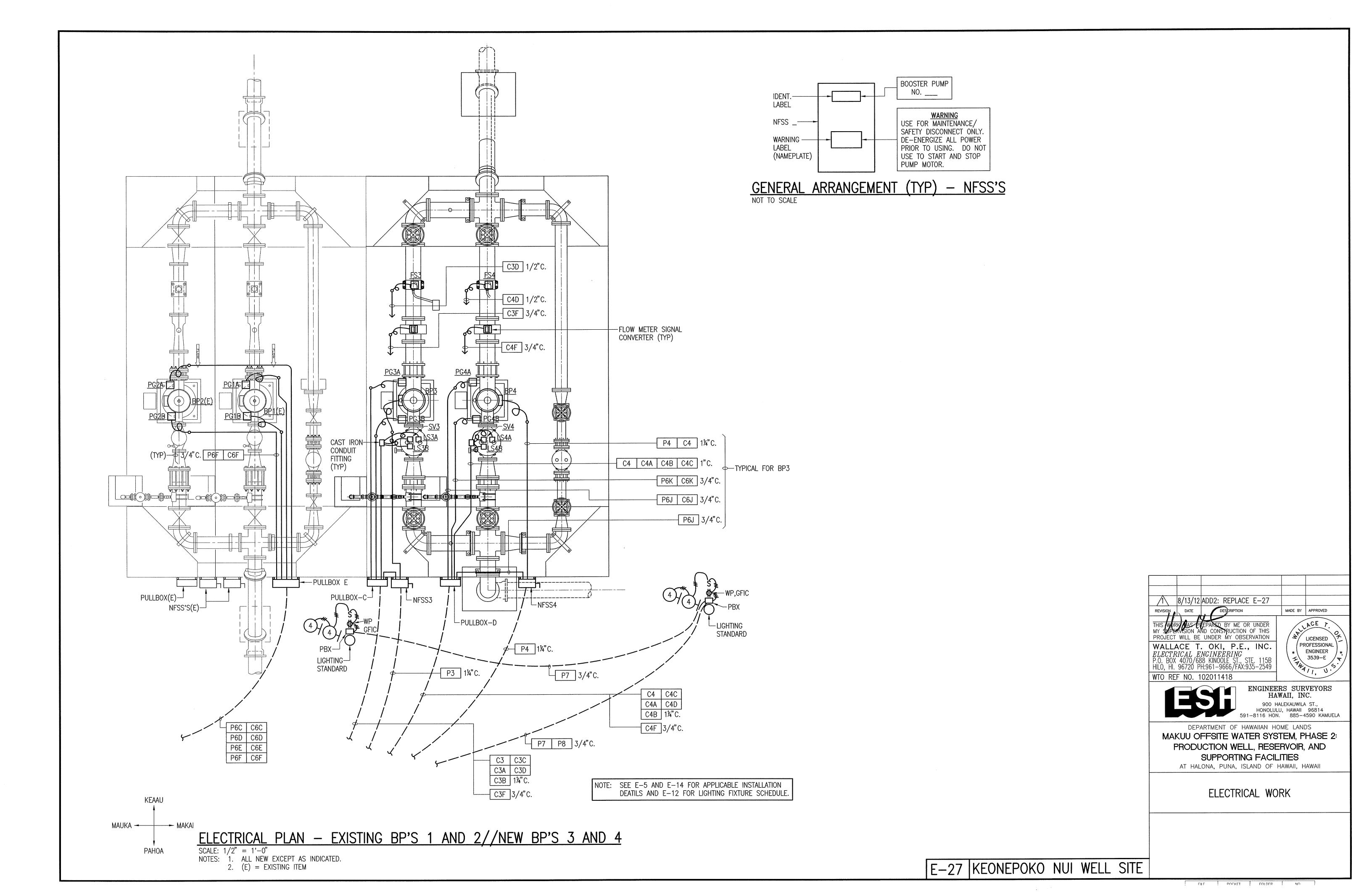
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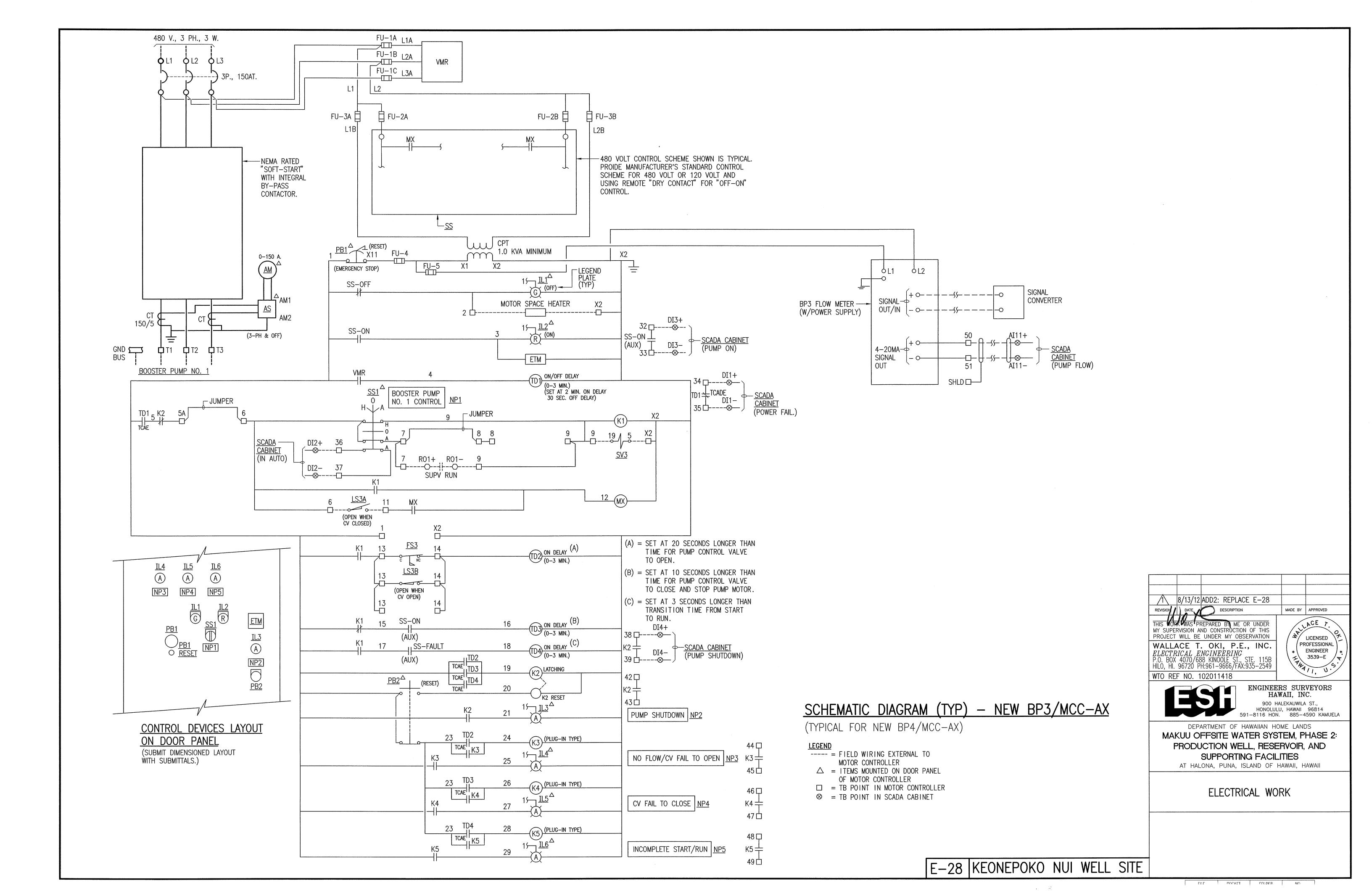


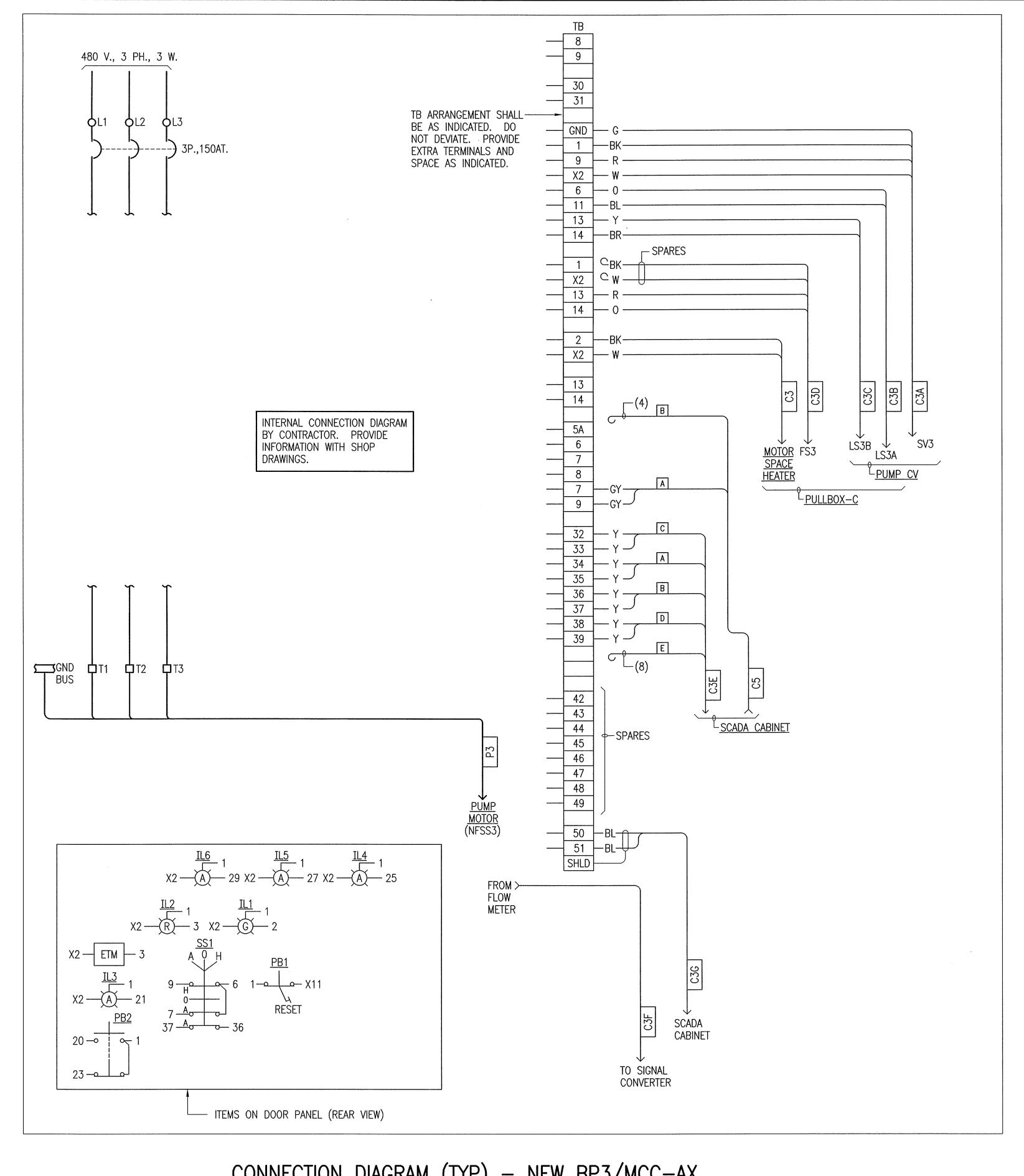


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E-26B KEONEPOKO NUI WELL SITE







CONNECTION DIAGRAM (TYP) - NEW BP3/MCC-AX

(TYPICAL FOR BP4/MCC-AX)

REVISION DATE DESCRIPTION MADE BY APPROVED

THIS WORK MAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION

WALLACE T. OKI, P.E., INC.

ELECTRICAL ENGINEERING
P.O. BOX 4070/688 KINOOLE ST., STE. 115B HILO, HI. 96720 PH:961-9666/FAX:935-2549

WTO REF NO. 102011418

ENGINEERS SURVEYORS HAWAII, INC.

900 HALEKAUWILA ST.,
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DEPARTMENT OF HAWAIIAN HOME LANDS

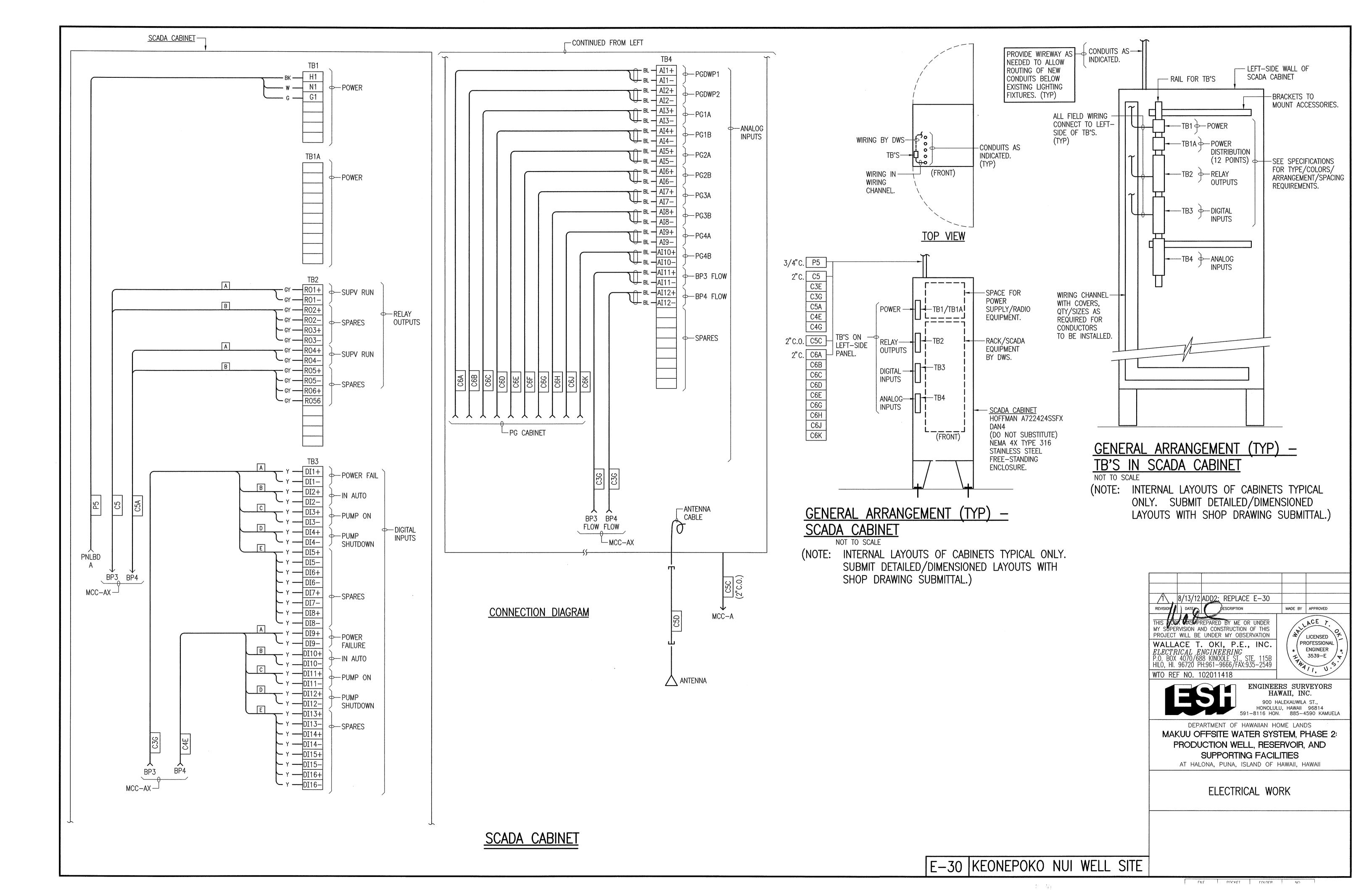
MAKUU OFFSITE WATER SYSTEM, PHASE 2:
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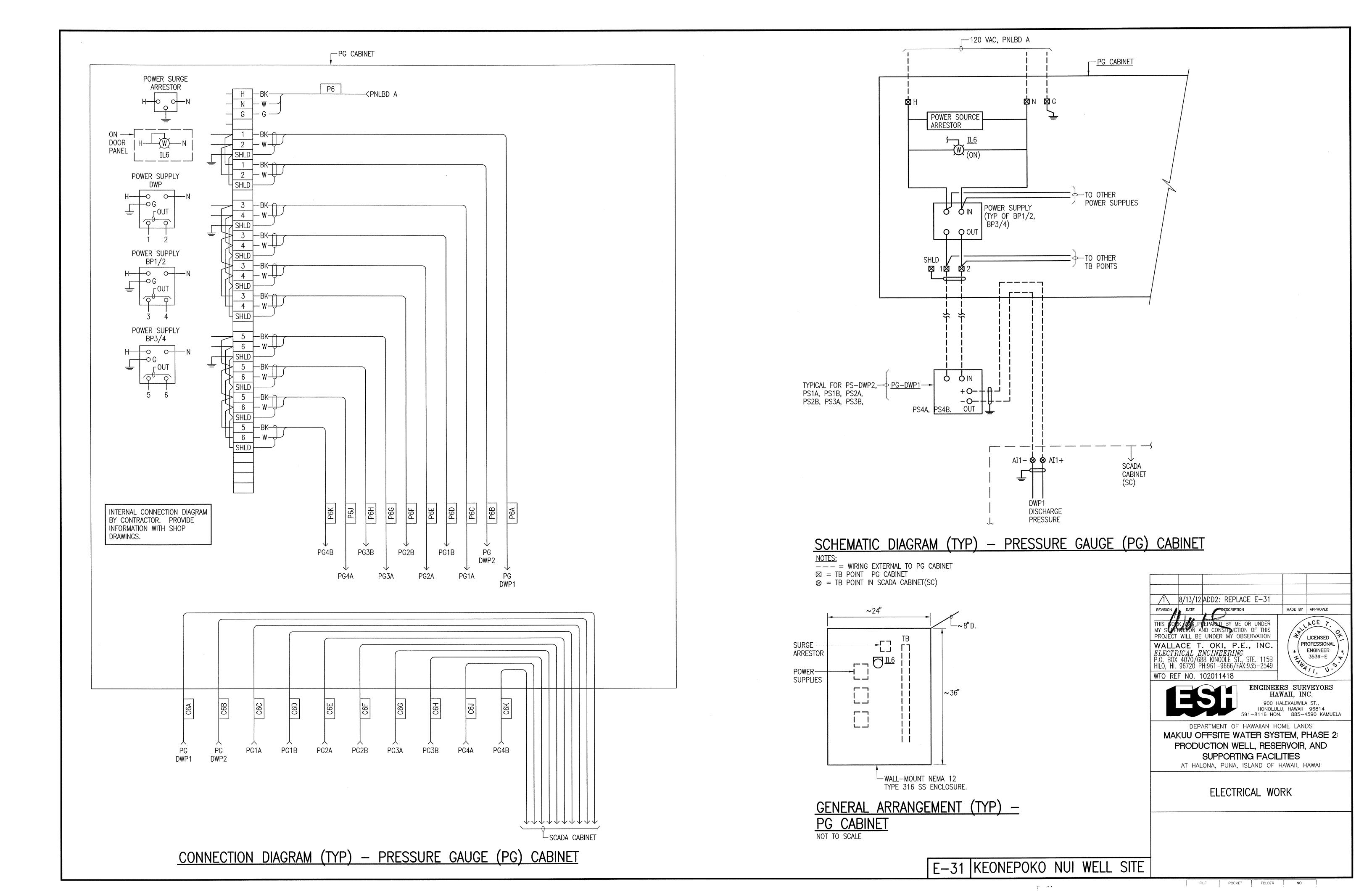
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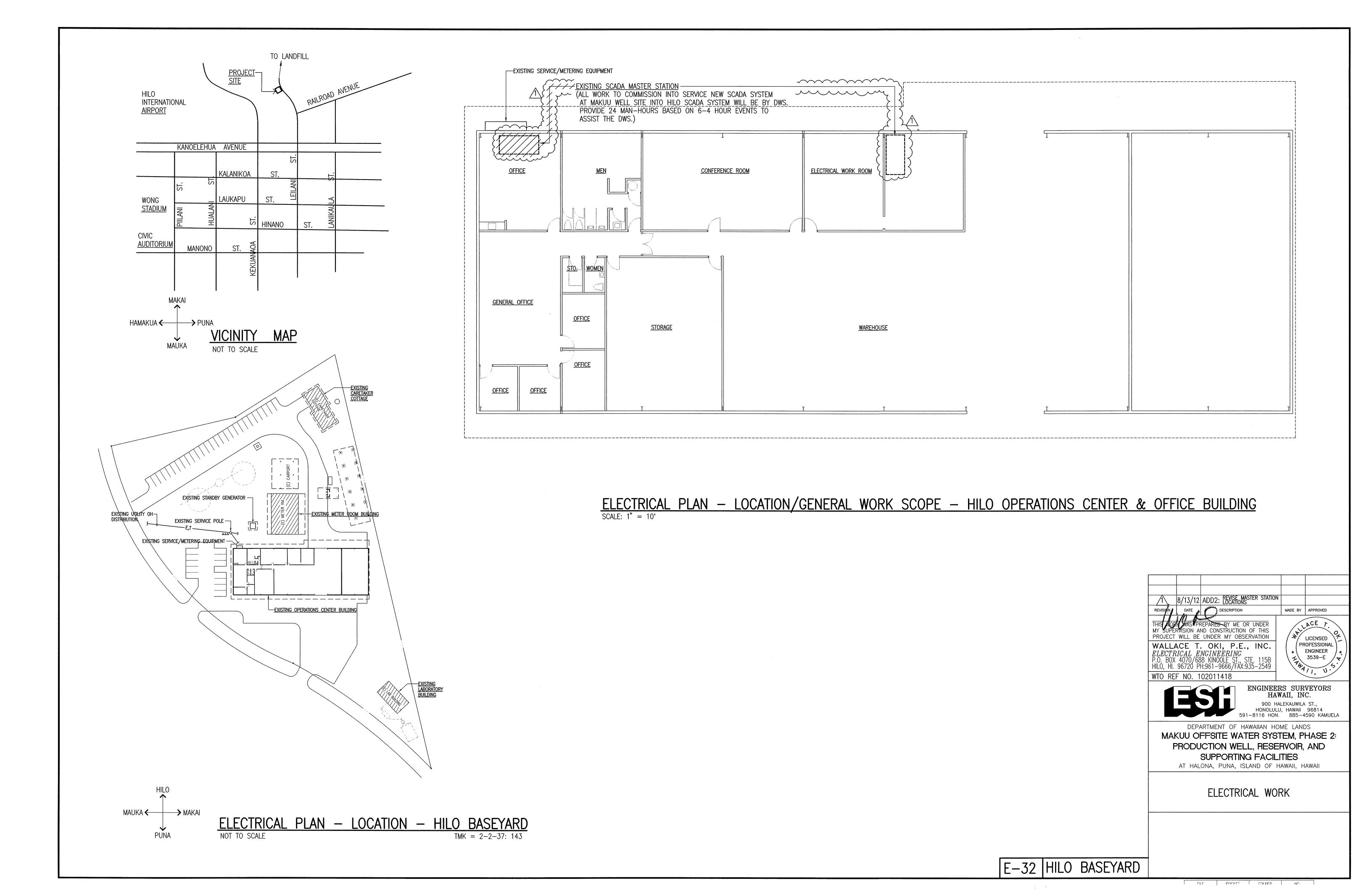
SUPPORTING FACILITIES
AT HALONA, PUNA, ISLAND OF HAWAII, HAWAII

E-29 KEONEPOKO NUI WELL SITE

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SPECIAL PROVISIONS FOR THE WATER SYSTEM STANDARDS

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WATER SYSTEM STANDARDS

<u>DIVISION 300</u> SECTION 303 - STRUCTURES

SECTION 303.07 PRESTRESSED CONCRETE TANK

A. DESCRIPTION

- 1. This section shall replace Water System Standards for the County of Hawaii Department of Water Supply, Section 303.07 "PRESTRESSED CONCRETE RESERVOIR" in its entirety.
- 2. This section covers the qualifications for the Tank Contractor and Designer and requirements for the tank design and construction materials used in the tank. This section also covers the furnishing and installation of seven-wire strand and bars for circumferential and vertical prestressing, respectively, of concrete walls and the complete shotcreting operations.

In the event of a discrepancy between this section of the Specifications and any other section of the Specifications, this section shall govern. The words "stressing machine" may refer to either the circumferential wrapping or vertical post-tensioning machinery.

- 3. The Tank Contractor and Designer shall design, furnish and erect a prestressed concrete tank of the capacity shown on the Drawings, consisting of a concrete roof, concrete floor and a poured-in-place concrete core wall, post-tensioned vertically with steel rods and circumferentially with wrapped strand and protected with several coats of shotcrete and paint.
- 4. The tank shall conform to the dimensions and be equipped with the appurtenances shown on the Drawings and as specified herein.
- 5. Concrete work shall conform to the provisions of Sections 303.03A and 303.03B as supplemented and modified by this section.

B. <u>RELATED WORK:</u> Related work specified in other sections:

Section 303.03A – Concrete Work for Strandwrapped Prestressed Reservoir

Section 303.03B - Hot Weather Concreting Procedures

Section 303.03C - Epoxy Injection of Concrete Cracks

Section 303.07A - Earthquake Cables

Section 303.07B - Expansion and Contraction Joints

Section 303.07C - Tank Wall Base Joint

Section 303.12 – Reservoir Protection

Section 303.22A -Miscellaneous Specialties for Strandwrapped Prestressed Reservoir

Section 303.27A – Painting for Strandwrapped Prestressed Reservoir

C. WORK BY TANK CONTRACTOR, SUPERINTENDENT AND DESIGNER

- Due to the nature of the project, it is the intent of these Specifications to obtain a first class product with emphasis on overall safety, quality and quality control, both during and after the construction process.
- As evidenced by these Specifications and Drawings, a strong emphasis on performance has been made to assure that desired details and proven construction methods be utilized to provide the highest quality structure available. For example, the minimum design requirements listed, the minimum design and construction experience of the Tank Contractor and Designer, the stringent forming and pouring methods, the close tolerance continuously recorded circumferential and vertical prestressing and the automated shotcrete specified are only a few of many ways that will help prevent structurally deficient problems from occurring during the service life of the tank. It is imperative that the specified features of these Documents are strictly adhered to and only bids from Contractors that have a successful performance record in prestressed concrete tank construction be considered.
- 3. The qualified Tank Contractor shall submit with his bid the name and address of the Owner and completion dates and location of at least ten (10) tanks located within the United States that have been constructed by the Tank Contractor during the last five years. In order to meet the experience requirements, the ten (10) tanks shall be similar (i.e. freed wall base, poured-in-place corewall, externally machine strand wrapped, etc.) in design to the specified tank. Experience with tanks having fixed wall bases, mild-steel reinforced tank corewalls, shotcrete tank corewalls, precast tank corewalls or tank corewalls incorporating internal stressing systems or external wire wrapping (in lieu of strand wrapping) shall not be considered in meeting the required experience requirements.
- 4. The proposed Tank construction superintendent shall be currently employed by the qualified Tank Contractor and shall have been the tank construction superintendent for at least 3 strandwrapped prestressed concrete tanks during the last five years. The qualified tank superintendent shall have been in the direct employment of the qualified Tank Contractor for all three of the tanks listed and will be required to be on the project site in responsible charge, full-time, during all tank concrete construction activities.
- 5. A bid may not be considered responsive unless the Tank Contractor's, and associated Superintendent's, experience requirements have been submitted with the bid as specified in Section 303.07(E).
- 6. The Tank Contractor and Designer shall furnish the structural design for the tank, stamped by a Professional Civil or Structural Engineer registered in the State in which this tank will be built. The Professional Engineer shall have designed and be the Engineer of Record of at least five (5) tanks of the type specified in Section 303.07(C)(3) during the last five (5) years and must have worked a minimum of five (5) years in the full time employment of the qualified Tank Design firm.

7. A bid will not be considered responsive unless the Tank Contractor and Designer has submitted the name of his qualified Professional Engineer and the corresponding experience requirements of the Professional Engineer with the bid, as specified in Section 303.07(E).

D. PRESTRESSING WORK

1. No stressing system falling under any of the following requirements will be considered unless it has been successfully used on tanks of at least the same diameter, height and capacity. The Contractor shall submit with his bid the name and address of the Owner and the completion dates and location of at least ten (10) tanks located within the United States on which the proposed qualifying "stressing machine" and automated shotcrete equipment has been used within the past five (5) years. At the time of bid the qualified Tank Prestressor shall have a minimum of two operable strandwrapping and automated shotcrete machines meeting these requirements. Machines under construction shall not be considered in meeting the requirement of having two operable strandwrapping and automated shotcrete machines.

Descriptive literature shall also be submitted with the bid showing the proposed machinery with the recorders and a typical copy of an actual recording of the applied forces taken from one of the jobs on which such machinery has been used. Any stressing system that will not provide the substantial equivalent of the above requirements and experience will be rejected. This applies to the strand wrapping, tendon-stressing and automated shotcreting equipment.

- A bid will not be considered responsive unless such data and experience record has been submitted with the bid as required in Section 303.07(E). This applies to both the wrapping as well as the tendon stressing equipment.
- 3. The prestressing shall be done solely by the Tank Contractor and Designer which shall be a firm or individual(s) having the equivalent of at least ten (10) years continuous experience in the installation of the type of prestressing specified. Experience with internal tendon systems or external tendon systems, not machine strand wrapped, and experience with external wire wrapping in lieu of strand wrapping shall not be considered in meeting the required experience requirements. The Tank Contractor and Designer shall not subcontract the design, forming, concrete placing, prestressing (installation or stress application) or shotcreting work. Specialty work such as rebar installation, scaffolding and concrete finishing may be subcontracted to contractors experienced in these aspects of prestressed concrete tank construction. Employees hired directly by the Tank Contractor shall perform all other tank construction activities.
- 4. All tanks listed for the Prestressor's experience requirements must have been prestressed in the Prestressor's own name. Experience from personnel association with the Prestressor or hired by the Prestressor will not be considered unless the Prestressor can demonstrate that the work was contracted and performed directly by the listed Prestressor in its business name.

E. BID-SUBMITTAL REQUIRED BY CONTRACTOR

As further defined in Sections 303.07(C) and 303.07(D) of these Specifications, the following

information shall be included with the Contractor's Bid Submittal:

- 1. The name(s) of the proposed qualified superintendent who will be in direct charge of the tank construction for the full duration of the Contract.
- A list of at least three reservoir jobs successfully completed by each of the superintendents listed by the Tank Contractor, which shall include a tank description, the name and address of the Owner and the Project Design Consultant, and the approximate completion date of each tank.
- 3. The name and address of the Tank Contractor and Designer, if different than the Contractor, and a list of at least ten tanks, similar in design to the tank specified herein, successfully completed by the Tank Contractor during the last five years.
- 4. The name and address of the Owner and the completion dates and location of ten structures on which the proposed qualifying prestressing and automated shotcrete system, meeting the substance of these Specifications requirements, has been used during the last 5 years.
- 5. Descriptive literature of the wrapping, the vertical prestressing and the shotcrete machinery meeting all of these Specification requirements. Include in such data photographs or prints of the means of recording of both the circumferential and vertical prestressing applications and copies of actual photographs, print-outs or other records of applied wrapping forces (as well as force-elongation diagrams if available) taken from jobs in which the machinery has been used.
- 6. A written statement from the Tank Prestressor indicating that the Prestressor has a minimum of two operable strandwrapping and automated shotcrete machines meeting these specifications.
- 7. The name of the Professional Civil or Structural Engineer meeting the requirements of having designed five (5) tanks of the type of tank specified here-in during the last five (5) years and having been employed full time a minimum of five (5) years by the qualified tank Designer.
- 8. The complete tank structural design conforming to the requirements of Section 303.07(F). The submitted design shall include complete structural calculations for all major components of the tank and construction drawings detailing all major concrete reinforcing and prestressing requirements. The listed qualified Professional Engineer shall be sealed with a Civil or Structural Engineering stamp issued by the state where the tank shall be constructed, the complete tank design. The Design must be submitted with the bid to ensure compliance with the Specification requirements. Alternate tank designs or designs not in conformance to these Specifications will not be permitted and shall not be submitted.
- 9. The Contractor shall provide with the bid a consent of surety letter from the Tank Contractor's surety stating that the Tank Contractor's surety is prepared to provide a three (3) year maintenance bond, that the Tank Contractor's surety is Treasury listed for the contract

amount and that the Tank Contractor's surety is A.M. Best rated A12 or higher.

10. Failure to submit any of the above with the bid will cause the bid to be considered non-responsive and the bid can be rejected.

F. DESIGN

1. Minimum Requirements

These specifications reflect the mandatory minimum requirements that must be used as a basis for the tank design. The design of the tank shall meet the minimum design requirements per AWWA D110-04, Type I tank, ACI 350-06, including ACI 350.3-06, as well as, the requirements specified herein. The roof, columns, column footings and wall footing shall meet the requirements of Section 9.2.6 of ACI 350-06, which includes an environmental durability factor for flexural and tensile designs of conventionally reinforced concrete and limits the crack control value (Z) to less than 115 k/in. for one-way slab members.

2. Design Information

- a. Inside diameter: 94 FT.
- b. Water depth near wall: 20 FT. (above floor)
- c. Maximum water depth for overload: 20 FT. (above floor)
- d. Floor slope: **1.50**% (high point in center of tank)
- e. Roof slope: 1.5% (high point in center of tank)
- f. Freeboard below top of wall: 2.0 FT.
- g. Live load on roof: 40 PSF.
- h. Maximum backfill height: 0 FT. (above floor)
- i. Minimum backfill height: 0 FT. (above floor)
- j. Soil bearing capacity incl. soil and liquid loads: 8,000 PSF.
- k. Seismic: 0.2 second horizontal spectral response acceleration in percent of gravity (S_s): 221 % (ACI 350.03-06)
- Seismic: 1.0 second horizontal spectral response acceleration in percent of gravity (S₁): 93 % (ACI 350.03-06)
- m. Seismic Site Class: B (ACI 350.03-06)

n. Importance Factor: 1.25

Roof and Roof-Supports

- a. The roof will be a flat two-way slab poured-in-place reinforced concrete roof, having a minimum thickness of 9.0". The roof shall incorporate drop panels and shall be supported by round spiral-reinforced concrete columns, having a minimum diameter of 18".
- b. The concrete cover over regular reinforcing steel in flat roof slabs and over column ties or spiral reinforcing in columns shall be 1.75 inch nominal with a plus or minus 1/4" construction tolerance.
- c. Alternate roof designs such as post-tensioned, pretensioned, precast, dome, flat slab roofs without drop panels or waffle type roofs shall not be considered.
- d. Flat roofs with drop panels shall be designed in accordance with ACI 350-06. Full use may be made of the design data presented in the Concrete Reinforcing Steel Institute (CRSI) handbooks.

4. Wall

- a. Wall to Wall-Footing Connection: All walls shall be supported by solid neoprene bearing pads allowing free radial movement of the wall relative to the wall-footing. The walls shall be tied circumferentially to the wall-footing with seismic cables consisting of hot-dipped galvanized strands encased in closed cell sponge rubber sleeves permitting a radial free movement of the wall of at least 3/4". A continuous 9" x 3/8" PVC or rubber waterstop connection shall be provided in wall and wall-footing joint.
- b. Wall-Roof Connection: Flat roofs shall be supported by solid neoprene bearing pads allowing free radial movement of the wall relative to the roof or vice versa. An approved elastomeric sealant shall be provided between wall and roof when the specified backfill level is within 6 inches from the top of the wall. All radially free-floating roofs shall be tied circumferentially to the wall with special seismic connections permitting free radial movement of wall and roof.
- c. Minimum Total Wall Thickness At Any Height*: 12.25"
 - *) Thickness includes a poured-in-place corewall and a 1.5 inch minimum shotcrete cover over the circumferential prestressing strand. The corewall is that area of the wall, interior of all circumferential prestressing.
- d. Minimum Final Circumferential Prestressing Force for Water Load: The minimal "final" circumferential prestressing force to contain the hydrostatic load at the bottom of the wall shall be:

Pcw = 62.5 x(R) x (H) (lbs/ft of height).

in which: R = inside radius of wall (feet).

H = maximum overload water height (feet).

This force shall taper uniformly to zero at the \underline{top} of the maximum overload water height.

- e. Minimum Final Circumferential Prestress for Differential Temperature & Dryness Bending. (Pctd): The minimum total "final" circumferential compression at any height on the wall, for aboveground wall conditions (per these Specifications), shall be 200 psi over the water load and after deduction of all losses. This compression may taper to 50 psi at a distance six feet below the minimum backfill height elevation, if the tank is buried to this depth.
- f. Minimum Circumferential Backfill Force on Wall (P_{cb}):

 $P_{cb} = (h) x (p) x (R + 0.0833 t)$ (lbs/ft of height).

in which: R = inside radius of wall (feet).

h = height of soil above wall-footing (feet).

p = equivalent liquid backfill pressure (lbs/cf) under seismic loading.

t = total wall thickness including cover over prestressing strands (inches).

g. Minimum Final Vertical Prestress for Differential Temperatures & Dryness Bending (P_{vtd})

The minimum "final" vertical compression and the vertical prestressing force (P_{vtd}) for poured-in-place walls, at any point around the tank wall, shall be 200 psi minimum. Vertical prestressing shall be applied to the corewall prior to the circumferential strand wrapping operations.

- h. Maximum Final Stress in Circumferential.& Vertical Prestressing Steel (f_{se}): The final stress (f_{se}) in prestressing steel shall not be less than the value determined as follows:
 - 1) Start with the not-to-be-exceeded average initial steel stress. This value shall not exceed (0.70 and 0.75) M.U.S.* steel for the circumferential and vertical prestressing forces, respectively, based on a maximum stress tolerance of \pm 1.5% M.U.S. as evidenced by continuous electronic strip chart recordings taken from previous projects.

- 2) Deduct 25,000 psi for stress losses.
- 3) The balance is considered the final stress.

*) M.U.S. = Minimum Ultimate Strength.

- i. Minimum Initial-to-Final Stress Ratio (I.F. Ratio): The initial-to-final stress ratio is the value of the not-to-be-exceeded initial steel stress divided by the value of the final steel stress determined above under paragraph F(4)(h).
- j. Maximum Compressive Stress in Concrete Walls: The maximum compressive stress in concrete walls, under any combination of load conditions, at any stage during the construction and without any allowance for stress losses due to creep of steel and concrete, or due to elastic deformation of concrete, shall not exceed 0.55 fc.
- k. Minimum Total Overall Wall Thickness: The minimum overall wall thickness shall be no less than the minimum wall thickness shown under par. F(4)(c) or the value calculated below, whichever is greater:

$$t_{overall} = \frac{(P_{cw} + P_{ctd}) > + P_{cb}}{(0.55 f_c) (12)}$$
(inch)

1. Minimum Circumferential Prestressing Steel Requirement

in which: $P_{cw} =$ the minimum final circumferential pre-stressing force to contain the waterload (lbs/ft of height).

 $P_{\text{ctd}} =$ the minimum final circumferential pre-stressing force for differential temperature and dryness (lbs/ft of height).

$$\begin{split} f_{se} = & & \text{the final stress in the circumferential} \\ & & \text{prestressing strand (psi)}. \end{split}$$

m. Minimum Vertical Prestressing Steel Requirement

$$A_{vp} = \frac{P_{vtd}}{f_{se}} \quad (inch^2/ft \text{ of circumference})$$

in which: $P_{vtd} =$ the minimum final vertical prestressing force for differential temperature and dryness (lbs/ft of circumference).

 f_{se} = the final stress in the vertical pre-stressing bars (psi).

- n. Bottom Edge Restraint Reinforcing for Corewalls: Cast-in-place concrete tank walls, prestressed vertically with threadbar tendons, shall be reinforced near the inside face from the bottom of the tank wall with #5 bars with a length as specified on the Drawings and spaced no further apart than 18 inch on centers.
- o. Seismic Forces: Forces and moments resulting from water sloshing and seismic accelerations of roof, wall and water loads must be calculated in accordance with Chapter 6 Dynamic Pressure on Fluid Containers of Nuclear Reactors and Earthquakes publication TID-7024, distributed by the National Technical Information Service of the U.S. Department of Commerce or ACI 350.3-06.

p. Bearing Pads

- Tank walls and flat slab roofs shall be supported continuously around the circumference of the tank by neoprene bearing and closed cell neoprene sponge rubber pads.
- 2) The hardness of neoprene bearing pads shall be 40 durometer.
- 3) The minimum pad thickness under tank walls shall be 1 inch and under roof slab 1/2 inch.
- 4) The minimum total neoprene bearing pad width under tank walls shall be 3 inches and under roof slabs they shall be 2 inches.
- 5) All neoprene bearing pad areas shall take into account the total vertical force from roof, wall and backfill loads, including the downward drag on the wall when the backfill around the tank wall settles.
- 6) All neoprene bearing pad sections shall be based on continuous loading values not to exceed those allowed in the bearing pad design manuals.
- 7) The voids between bearing and closed cell neoprene rubber pads at wall and wall-footing and at wall and roof joints, shall be filled with soft mastic to ensure a substantially unrestrained free movement of wall and roof.

5. Wall-Footing Joint

- a. The circumferential wall-footing reinforcing, for differential dryness purposes, shall have a minimum total cross-sectional area no less than 0.5% of the wall-footing section excluding any reinforcement requirements for bursting forces due to water loads.
- b. Bursting forces caused by liquids acting on wall-footings shall be taken up fully by reinforcing steel in the radial or circumferential direction at steel stresses not exceeding 14,000 psi. No allowance shall be taken for soil passive lateral resistance effects on footings.
- c. Hinged or fixed wall to wall-footing connections shall not be considered.

- d. Radial and circumferential reinforcing bar diameter sizes shall not exceed 3/4 inch.
- e. Splices in parallel bars shall be adequately staggered to avoid more than one splice at any point around the circumference of the wall-footing.
- f. A continuous waterstop (6" x 3/8") shall be installed in all floor slab construction joints and bent upward to be welded to the bottom edge of the 9" circumferential waterstop connecting the wall to wall footing. See detail in project drawings.
- g. The minimum width of the wall-footing shall be 4.0 feet and the minimum thickness shall be 1.5 feet. The minimum embedment depth below the lowest adjacent grade shall be 1.5 feet.

6. Floor

- a. The floor slab thickness shall not be less than 6 inches nominal with a plus or minus construction tolerance of 1/4 inch, except at floor slab construction joints where the slab is thickened. See detail in project drawings.
- b. The floor reinforcing in each direction shall be no less than 1/2 percent of the nominal floor section with a maximum bar spacing of 12 inches. Floor thicknesses in excess of 8 inches shall have 2 layers of steel with the bottom mat at least 2 inches off the subgrade.
- c. Post-tensioning of floors is not required.

7. Column Footings

- a. All column footings shall be installed on top of the floor slab. The minimum size of these footings shall be as indicated on the Drawings.
- b. Reinforcing steel added to the floor steel at the columns shall be continuous without laps. The addition of such bars shall be in a way that the resulting steel distribution at the column footing is equally distributed in both directions.

8. Prestressing

- a. All vertical prestressing of tank walls shall be provided with 1.25" or 1.375" diameter steel thread-bars, with screw nut anchors, conforming to the material requirements in these Specifications. Wire or strand systems shall not be considered.
- All circumferential prestressing of tank walls shall be done with hot-dipped galvanized strand conforming to the material requirements in these Specifications.
 A prestressing system that relies on wire wrapping, including systems that pull the wire through a die to provide a tensioning force, will not be allowed.
- c. All circumferential wrapping forces shall be continuously electronically monitored

- and permanently recorded on graph paper while the steel strand is being wrapped around the tank.
- d. All vertical tendon forces and elongations shall be simultaneously, permanently monitored electronically and recorded on graph paper from start to finish of each stressing operation.
- e. Tank wall designs shall not be based on wrapping tolerances less than what the wrapping machinery can factually and continuously meet based on continuous electronically recorded printouts taken from earlier projects. If none exists, the bidder is not qualified to bid this project.
- f. Tank wall designs shall not be based on stress-tolerance and stress-loss deductions less than those shown under paragraph F4(h).
- g. Prestressing wall strands shall not be spaced vertically closer than 2.5 strand diameters nor less than 3/8 inch clear between individual strands.
- h. Each intermediate strand layer shall be covered with 3/8-inch thickness of shotcrete.
- i. The minimum thickness of cover over the final strand layer shall be 1.5 inches.
- The center-to-center spacing of the vertical prestressing tendons shall not exceed 50 inches.
- k. Tank wall prestressing systems based on jack-operated cable or rod type tendons, involving the circumferential movement of pre-stressing steel relative to the wall surface shall not be considered. Circumferential systems relying on strand cables placed inside of ducts (cast in the corewall) or manually around the exterior, will not be accepted.

9. Waterstops

- a. Waterstops shall conform to the material requirements outlined in Section 212.09 of the Water Systems Standards and Sections 303.07B and 303.07C.
- b. All floor construction joints shall incorporate a minimum 3/8" x 6" waterstop without a centerbulb.
- c. All wall to wall-footing connections shall incorporate a minimum 3/8" x 9" waterstop and shall have a 3/4" minimum centerbulb.
- d. All vertical wall joints shall incorporate a minimum 3/8" x 6" waterstop without a centerbulb.
- e. All construction joints in the roof, if they should exist, shall incorporate a minimum 3/8" x 6" waterstop. At Contractor's option waterstop may have a 3/8" minimum

centerbulb.

- G. <u>NON-RESPONSIVE BID:</u> The information required in Sections 303.07(C), (D) and (E) above shall be submitted with the bid proposal. Failure to submit such information if this alternative is selected for the tank design, will be deemed a material irregularity that could cause the bid to be rejected as non-responsive.
- H. <u>SHOP DRAWINGS:</u> Contractor shall submit shop drawings of the circumferential prestressing wrapping schedule and the intermediate lock-off elevations for the Engineer's approval before the wall pour is made.

I. PRODUCT DELIVERY, STORAGE AND HANDLING

- 1. Prestressing steel shall be adequately packaged against intrusion of chemical contaminants (from the atmosphere or otherwise) for the protection of the steel against physical damage and corrosion during (and subsequently as the result of) shipping and storage.
- 2. Prestressing steel that has sustained physical damage through rust or other means will be rejected.
- 3. All materials and prestressing material delivered to the job site shall be stored off the ground on planks, supported by 4" x 4" timber, which must be covered with polyethylene or sizalkraft paper to prevent any moisture from coming up from the bottom.
- 4. Reels of steel strand, prestressing tendons, anchorages, etc., shall be stacked neatly and as compact as possible.
- 5. All materials for tendons and all fabricated tendons shall be covered with tarpaulins in such a manner that they are not exposed to water, rain, moisture or dust.

J. SEVEN-WIRE STRAND

1. Hot-dipped galvanized seven-wire strand used for prestressing shall meet the following minimum requirements unless otherwise shown on the Drawings:

<u>Item</u>		Specification	
		Type A	Type B
a.	Nominal strand diameter	1/2"	3/8"
b.	Nominal area after galv.	0.153in^2	0.089 in ²
c.	Nominal weight/1000 LF	541 lbs.	303 lbs.
d.	Pitch (Strand diameters)	12-16	12-16
e.	Tensile strength (min.)	38,200 lbs.	21,400 lbs.
f.	Yield strength @ 1% extension (min)	28,500 lbs.	16,000 lbs.
g.	Elong. in 24" at fracture (min.)	4.5%	4.5%
h.	Weight of zinc coating (min.)	0.85 oz./ft. ²	0.85oz/ft^2

2. Hot-dipped galvanized seven-wire strand shall be manufactured in accordance with ASTM

A-416 prior to galvanizing. Each wire of the strand shall be individually hot-dipped galvanized before being stranded.

3. Single wire prestressing material shall not be substituted for seven-wire strand prestressing material.

K. HIGH-STRENGTH THREADBARS

- Deformations of the threadbars shall form a screw-thread suitable for mechanically coupling lengths of thread bar and also for positive attachment of anchor assemblies.
- 2. Deformations shall conform to ASTM A-722, Type II requirements and shall be uniform such that the bar may be cut at any point and the internal threads of a coupling can freely screw onto the bar. The bars and their deformations shall be hot rolled.
- 3. Tensile and Physical Properties shall meet the following requirements with bars being manufactured in accordance with ASTM A-722, Type II:

	<u>Item</u>	<u>Unit</u>	<u>Special</u>	<u>fications</u>
a.	Nominal diameter	inches	1.25	1.375
b.	Min. tensile force	kips (min.)	187	237
c.	Yield force at 0.2% offset	kips (min.)	150	190
d.	Elong. in 20 bar (diameter)	% (min.)	4	4
e.	Nom. cross-sectional area	sq. inches	1.245	1.577
f.	Nominal bar weight	lbs/ft.	4.39	5.56

Note: To provide reduced relaxation, more uniform elastic modulus and reduced residual stress in the critical thread area, only threadbars that are stress relieved after the threads are formed will be accepted. All threadbars shall be proof stressed after stress relieving and threading. Threadbars with cold rolled threads or threadbars with quenched or tempered steels will not be permitted. Threadbars shall have a maximum carbon content of 0.55 percent. Manufacturers with a minimum of 5 years of experience, under their current name, in the manufacturing of post-tensioning material meeting all the requirements of this specification will be accepted.

L. ANCHORAGES FOR VERTICAL POST-TENSIONED TENDONS

- 1. All post-tensioned prestressing shall be secured at the ends by means of approved permanent anchoring devices, which shall hold the prestressing steel at a force not less than 95% of the guaranteed minimum tensile strength of the prestressing steel.
- 2. The load from the vertical prestressing anchoring device shall be distributed to the concrete

through steel bearing plates of dimensions and details shown on the Drawings.

- 3. All vertical prestressing anchor plate dimensions, all dimensions relating to the conical hole in the top and bottom of the bearing plate (35° cone angle with the vertical), all steel tubing attached to the top bearing plate, and the spacing of all tendons shall strictly conform to the details shown on the Drawings.
- Fully-threaded anchor connections that incorporate a spherical-shaped bearing surface to match the conical surface in the bearing plate shall be used at both ends of the vertical prestressing bar.
- 5. The contact point of the spherical-shaped vertical prestressing bearing surface to conical hole shall be approximately 1/4" to 1/2" below the bearing plate surface.
- 6. Wedge anchors shall not be used for permanent anchor hardware.

M. TESTING OF PRESTRESSING MATERIAL

- 1. Contractor shall furnish at his own expense mill test certificates showing the dimensional and physical characteristics of each heat or reel of the prestressing steel to be furnished.
- 2. Contractor shall furnish evidence, to the satisfaction of the Engineer, prior to the preparation of shop drawings and installation of vertical tendons, that the proposed tendon anchorage system meets the requirements of these specifications. The Engineer may order additional tests to be taken. Should such additional tests not meet the specifications, the expenses of this testing shall be paid for by Contractor; otherwise such expenses shall be borne by the Owner.
- 3. Before any stressing operation may be started, Contractor shall calibrate all recording equipment at an approved testing laboratory to the satisfaction of the Engineer.
- 4. All continuous force readings for the vertical and circumferential prestressing operations shall be developed with electronic (or the substantial equivalent) force (strain gauge method) sensing transducers, all having a maximum nonlinearity error of \pm 0.5% and a maximum hysteresis error of \pm 0.25%.

N. ANCHOR POCKETS FOR VERTICAL TENDONS

- Anchor pockets for vertical prestressing tendons shall consist of steel cans, hot-dipped galvanized after cutting (unless shown otherwise on the Drawings) and welded to the top bearing plate.
- 2. Anchor pockets shall be adequately sealed from moisture and concrete intrusion by wooden lids and 2-inch wide plastic adhesive tape.
- 3. Anchor pockets for vertical prestressing tendons must have adequate provisions for flushing of ducts with water during wall concrete placement.

O. DUCTS FOR VERTICAL TENDONS

- 1. Duct enclosures for vertical prestressing steel shall be standard 1.25" or 1.375" diameter PVC pipe class 160 or class 200, respectively, unless otherwise specified on the Drawings.
- 2. All ducts shall be provided with expandable valves at the bottom of the duct to facilitate the injection of epoxy after prestressing.
- 3. All connection details shall be as shown on the Drawings.

P. EPOXY GROUT FOR VERTICAL TENDONS

- 1. The vertical tendon system shall provide complete 2-part epoxy protection of the prestressing steel inside a PVC duct and anchors.
- 2. The injection of Portland Cement grout into the vertical tendon ducts will not be accepted.
- Q. <u>PORTLAND CEMENT</u>: Portland Cement for the tank construction and shotcreting shall meet the requirements set out in Section 303.03A of these Special Provisions.

R. SHOTCRETE

- 1. Fine aggregates
 - a. Fine aggregates shall meet the requirements stated in Section 303.03A of these Special Provisions.
 - b. A well-graded coarse sand shall be used for all shotcrete applications.
 - c. Coarse sand shall generally consist of the following gradation:

Sieve Size	% Passing by Weight
3/8 inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30

No. 100 2-10

The fineness modulus shall fall between 2.70 and 3.00.

- d. Plastersand shall be used for shotcrete finish coat if a smooth finish (as opposed to "natural") is required on the Drawings.
- e. Plastersand shall meet the following gradation:

Sieve Size	% Passing by Weight
3/8 inch	100
No. 4	97-100
No. 8	90-98
No. 16	70-85
No. 30	35-55
No. 50	15-25
No. 100	2-8

The fineness modulus shall fall between 2.40 and 2.75.

2. Rebound

- a. Rebound is defined as aggregate mixed with some cements, which ricochets off the surface during the application of shotcrete because of collision with the harder surface, reinforcement, or with the aggregate particles themselves, the amount produced varies with the position of the work, air pressure, cement content, maximum size and grading of aggregate, amount of reinforcing and thickness of layer.
- b. Rebound materials may not be reused in any form for shotcrete.
- 3. Water: Water shall meet the requirements set out in Section 303.03A of these Special Provisions.
- 4. Air-Entrainment & Admixtures: _Air-entrainment and admixtures shall meet the requirements set out in Section 303.03A of these Special Provisions.
- 5. Fibrous Shotcrete Reinforcement

- a. All shotcrete, unless otherwise specified herein, shall be fibrous reinforced. Such material shall consist of 100 percent virgin polypropylene fibrillated or non-fibrillated fibers specifically manufactured for use as concrete/shotcrete secondary reinforcement. The required volume of fibers to be added per cubic yard of shotcrete shall be as specified below in Section 303.07(R)(6)a.
- b. Polypropylene fibers will help to provide greater control of cracking from drying shrinkage and thermal expansion/contraction, a reduction of permeability, an increased impact capacity, an improved shatter/abrasion resistance and added toughness of the shotcrete.
- c. The fibers shall be manufactured in accordance with applicable building codes and ASTM C-1116 Type III 4.1.3. and ASTM C-1116 (Ref. ASTM C-1018) Performance Level *I*₅ outlined in Section 21, Note 17. Fibrous concrete reinforcement shall be as manufactured by the FIBERMESH COMPANY, Chattanooga, TN [phone: (423) 892-7243], or equal.
- d. Acceptable polypropylene fibers shall have the following physical characteristics:
 - 1. Specific gravity = 0.91
 - 2. Tensile strength = 80-110 ksi
 - 3. Fiber length = graded per manufacturer

6. Shotcrete Proportioning

- a. Each cubic yard of mortar in the ready mix truck or mixer shall consist of 0.1% (1.5 lbs. per cubic yards) polypropylene fibers and a mix ratio of 3 lbs. of moist sand to 1 lb. of Portland cement. Up to 50 oz. of PRO-KRETE-R or POZZOLITH 300R may be added at the option of Contractor during warm weather conditions.
- b. Whenever night temperatures are expected to drop below 35F, "high early" Portland cement shall be used in lieu of regular Portland cement. Should "high early" Portland cement not be available, the mix design shall consist of a moist sand-Portland cement mix ratio, by weight, no greater than 2.59.
- c. If the batching procedure requires that smaller volumes of cement and sand be used, the required cement-to-sand ratio shall still be strictly maintained.
- d. Additives other than PRO-KRETE-R or POZZOLITH 300R (such as POZZOLITH 300N or others) shall not be used unless specifically approved by the Engineer, after careful consideration of its corrosive influence on prestressing steels.
- e. The total volumetric air content of the shotcrete before placement shall not exceed 7 percent (plus or minus one percent) as determined by ASTM C-173 or ASTM C-231.
- f. Unless otherwise shown on the Drawings, shotcrete cylinder strengths at 28 days

shall be no less than 4,000 psi. Higher shotcrete cylinder strengths shall not permit a reduction in the above specified cement contents. The cement content in the above mix designs may be increased should the specified 28-day strength requirement not be met.

g. The polypropylene fibers and admixtures shall be added to the shotcrete at the time it is batched and in the amounts as required here in. Such additives shall be mixed in strict conformance to the manufacturer's instructions and recommendations for uniform and complete distribution. Each certificate of delivery supplied by the shotcrete supplier shall indicate the additive trade name, manufacturer's name and amount per cubic yard added to each batch of shotcrete.

S. CIRCUMFERENTIAL PRESTRESSING EQUIPMENT

- 1. The circumferential stressing system shall produce a continuously, electronically (or substantial equivalent) monitored permanent stress or force recording along its full length as it is being applied and the stress variation in any strand at any point around the circumference shall not be greater than ± 1.5 percent of the ultimate strength of the steel. In addition to this recording, any system which deflects the tensioned prestressing material between the tensioning device and the wall after it has left the tensioning device, shall provide a similar continuously monitored stress or force record along its full length as it is being applied to the wall. These recordings shall show that either before or after deflection, that the stress variation in the prestressing material at any point around the circumference shall not be greater than ± 1.5 percent of the ultimate strength of the steel. Due to prior instances of force measurement inaccuracies and the inherent problems associated with hand-held stressometers, no manual recorded force readings will be accepted. This requirement shall be strictly adhered to.
- 2. Any wrapping that does not meet the stress tolerances specified and/or cannot meet the requirements of Section 303.07(S)(1), will not be accepted and will be removed at Contractor's expense. Contractor shall be responsible for all costs associated with meeting the specified tolerances.
- 3. Since wrapping systems which utilize single solid prestressing wire will not provide the desired bond between the prestressing wire and the shotcrete and since single solid prestressing wire will not provide an adequate safety factor against failure, only machine wrapping systems which utilize seven-wire prestressing strand wrapping will be allowed.
- 4. Since intermittent force applications can result in an unequal stress distribution around the wall (due to friction losses), the prestressing system shall be capable of applying a continuous wrapped force at any point around the circumference within the specified tolerances. Circumferential stressing systems based on Jack-operated cable or rod-type tendons will not be allowed.

T. CIRCUMFERENTIAL PRESTRESSING APPLICATION

1. Wrapped strand shall be anchored to the wall at least once for every coil or reel.

- 2. Permanently anchoring one strand to a previously wrapped strand will not be permitted.
- 3. Wrapped strand ends shall be joined by suitable splicing methods that shall develop 90% of the full strength of the strand.
- 4. Use of different alloys in the splicing material will not be permitted.
- 5. The clear vertical spacing between adjacent prestressing strands shall be 1.5 strand diameters or 3/8 inch, whichever is larger.
- 6. All wrapped strands not meeting the spacing requirements shall be spread by approved methods or shall be removed.

U. VERTICAL PRESTRESSING EQUIPMENT

- 1. The Contractor shall provide a continuously, electronically (or substantial equivalent), monitored force-elongation record of a permanent nature from zero to full force at the final lockoff for all of the vertical prestressing work.
- 2. The ordinate of the permanent recording shall show the elongation in inches and the abscissa shall show the force in pounds or kips.
- 3. Recording force and elongation readings manually will not be accepted.
- 4. The vertical tendon stressing machinery shall have automatic electronic tensioning cut-off devices or equivalent means to ensure that the specified force and elongation is not exceeded at any time during any tendon stressing operation.
- 5. The force readings at the end of the stressed bar, immediately after lock-off, for any stressing operation, on any tendon, shall not fluctuate more than \pm 1.5% (of the minimum ultimate strength of the steel) from the desired average force setting.
- 6. The maximum applied force for the final stressing operation, immediately after lock-off on any tendon, shall be no greater than 75% of the minimum ultimate strength of the steel.

V. VERTICAL PRESTRESSING INSTALLATION

- 1. The number and spacing of threadbars, if shown on the Drawings, shall be the minimum number provided and shall not be altered under any condition.
- 2. High-strength threadbars shall be used for vertical prestressing which meet the requirements of Section 303.07(K) of these Specifications.
- 3. The anchor hardware shall have a ball-shaped threaded nut that can be screwed down on to a matching cone shaped bearing surface in the bearing plate after the desired tension on the

- anchor hardware and/or prestressing steel has been applied.
- 4. Vertical tendon components shall be assembled off the ground and as detailed on the Drawings before they are installed in the forms.
- 5. Particular attention shall be given to sufficient taping of damaged joint connections and holes in PVC tubing.
- 6. Vertical prestressing tendons shall be accurately placed at the locations shown on the reservoir design drawings, or as approved by the Engineer, and shall be securely fastened in place to reinforcing steel and form ties to prevent movement during placement of concrete.
- 7. Placing of vertical tendons shall be done to proper locations, elevations and alignments, with a maximum tolerance of plus or minus 1/4 inch.
- 8. All vertical tendons shall be securely tied at the anchor plates and shall be tied to #4 circumferential bars at 2 feet intervals between the anchor plates, unless shown otherwise on the Drawings.
- 9. Anchor plates must be installed at right angles to the tendon alignment near the anchor. Anchor plates must be installed with long sides, if applicable, aligned parallel with the wall forms and secured to prevent rotation while concrete is placed. The maximum permissible misalignment of anchor plate to tendon alignment is plus or minus 2.5 degrees.
- 10. Unless indicated otherwise on the Drawings, the minimum concrete cover around metal anchor pockets and bearing plates shall be 1.5 inches.
- 11. The clearance between bottom anchor plate and waterstop in tank walls shall be no less than 2 inches or more than 4 inches.
- 12. All vertical tendons shall be flushed with water introduced through a taped-off hole in the wooden lids on the anchor pockets from the top immediately upon completion of the wall concrete vibrating operation.
- 13. Flushing of ducts shall not be accomplished by introducing water through the bottom connection.
- 14. Upon completion of the water flushing operation of vertical tendons, the ducts shall be given a short burst of compressed air from the top only to remove any accumulations of water at the bottom of the ducts.
- 15. Cleaning of tendons with air only, or removal of water with air introduced from the bottom connection, will not be permitted.
- 16. The vertical tendon shall be stressed to the level and following the procedure described below in the next section.
- 17. All ducts shall be clean and free of water and deleterious materials that would impair bonding

- of the grout or interfere with grouting procedures.
- 18. Grout injection pipes shall be fitted with positive mechanical shutoff valves, which shall not be removed within the first 24 hours after grouting is complete.
- 19. Grouting of tendons shall be started at the lowest grout connection.
- 20. Each vertical tendon duct shall be pumped until the entire nut at the top anchor has been covered. Pea gravel and/or clean sand may be placed (at Prestressor's option) in the tendon can as a filler material prior to epoxy pumping.
- 21. In cold weather, and especially during frosts, special precautions must be taken to avoid the freezing of grout. In the event that the grouting procedure cannot be postponed, the wall temperature must be kept above the freezing point with hot blankets or by other approved means.
- 22. Upon completion of the vertical stressing and grouting operation, all anchor pocket areas above the anchor nuts shall be drypacked with a 1 part cement to 2 parts sand mortar mix immediately after the epoxy coating on the inside can surface has become tacky, or alternately, the metal can may filled with concrete aggregates and epoxy.
- 23. The drypack surface shall be finished flush with the top of the square tube.
- 24. The rectangular tube shall be fit over the square tube and the sides of the tubes aligned as detailed. The gaps between the tubes shall be filled with sheets of closed cell neoprene as detailed. A steel cover plate shall be seal welded to the rectangular plate prior to placing the roof slab concrete.

W. <u>VERTICAL PRESTRESSING OPERATIONS</u>

- 1. The maximum initial electronically (or substantial equivalent) recorded steel stress shall not exceed 75 percent of the guaranteed minimum ultimate strength (M.U.S.) of the steel at any time during and after stressing.
- 2. Each vertical tendon in the wall shall be stressed to the value shown on the reservoir design drawings prior to installation of circumferential prestressing. The stressing of the tendons may be sequential around the tank circumference if a back-up jack is provided on site. In lieu of the Contractor providing a back-up jack, the tendons may be stressed in an every-other pattern around the tank requiring two trips around the tank in order to tension all the tendons.
- 3. The loss in stress in post-tensioned prestressing steel due to creep and shrinkage of concrete, creep of steel and sequence stressing shall be assumed as 25,000 psi.
- 4. The final force in the vertical tendon is the steel section multiplied by the final stress.
- 5. The final force shall be no less than the force shown on the reservoir design drawings.
- 6. An automatic, continuously electronically (or substantial equivalent) monitored and

- simultaneously recorded force-elongation reading must be made for each vertical stressing application.
- 7. The force-elongation reading must represent the true relationship between the elongation at any given point of the vertical stressing operation and the applied force on the prestressing steel at that same point.
- 8. The force-elongation relationship must be constantly maintained from the beginning, starting with the removal of the slack to the point of lock-off and complete release of the force on the vertical prestressing steel after retraction of the stressing piston or equivalent stressing device.
- 9. All electronically produced force-elongation readings during the vertical tendon stressing operations become the property of the Owner.
- 10. The ultimate initial prestressing force for vertical tendons shall not be applied until the concrete compressive strength in the wall shall have reached the specified 28-day strength.

X. CIRCUMFERENTIAL PRESTRESSING OPERATIONS

- 1. The maximum initial electronically (or substantial equivalent) recorded steel stress shall not exceed 70 percent of the guaranteed minimum ultimate strength (M.U.S.) of the steel at any time during or after stressing.
- 2. An automatic, continuously electronically (or substantial equivalent) monitored permanent recording of the applied force, at any point on the strand, at any point on and around the tank wall, must be made during the entire circumferential prestressing application. All such recordings must be based on a continuous sensing of the applied force on the strand between the tensioning drum and the wall as the strand is being wrapped and laid on the wall.
- 3. The force setting on wrapping and tendon stressing machinery shall be such that the applied forces fall within the specified minimum or maximum stress or force limitations; the force setting shall be corrected immediately when the applied force falls outside the required force tolerance limitations.
- 4. In the event that the stressing machinery is incapable of holding the applied forces within the specified stress or force limitations, the Engineer will order, at Contractor's expense, the removal and replacement of such machinery in favor of a different stressing process capable of maintaining such tolerance requirements.
- 5. The loss in the post-tensioned prestressing steel due to creep and shrinkage of concrete, creep of steel and sequence stressing shall be assumed as 25,000 psi.
- 6. The final stress is the average initial stress reduced by the assumed stress loss of 25,000 psi.
- 7. The final force in the prestressing strand is the steel section multiplied by the final stress.
- 8. The final force shall be no less than the force shown on the reservoir design drawings.

- 9. The continuous, electronically produced force application chart during the wrapping application becomes the property of the Owner.
- Manual, individual or intermittent force readings taken on wrapped strand in full bodily contact with the wall will not be accepted. Force readings based on anything other than instantaneous force readings, as the strand is being tensioned, and wrapped around the tank, will not be accepted.
- 11. Wrapping may start when the concrete has reached a compressive strength of 3,500 psi; however, under no circumstance shall the compressive stress, under any condition, exceed 55%.
- 12. In the event that gaps between the corewall and the wrapped strand develop that exceed 3/8 inch, wrapping shall be discontinued and the wall shall be built up with shotcrete to provide the proper curvature. Alternately, if approved by the Engineer, the gaps may be dry-packed after wrapping is completed and before shotcreting is started.
- 13. Wrapping over intermediate shotcrete coats or built-up shotcrete areas may commence 12 hours after the shotcrete has been applied or when the shotcrete has reached a strength of 250 psi, whichever is later.
- 14. Because prestressing material exposed to excessive temperatures greatly increases the possibility of irrevocable damage, such as steel embrittlement, stress corrosion, or wire splitting, the temperature of the prestressed material during application shall not be allowed to increase by more than fifty degrees at any time during such application due to the stressing technique. No system which creates a force by pulling prestressing material through a die will be allowed.

Y. SAFETY PRECAUTIONS

- 1. Every precaution shall be taken to keep personnel and visitors outside the danger area of breaking strands or bars.
- 2. At no time shall anyone stand in the line of stressed vertical tendons or stressed strand.
- 3. No work shall be performed by anyone, other than the prestressing crew, within 100 feet from the wrapping operation or the application of the vertical tendon stressing operation.
- 4. Where access to the site by unauthorized persons is outside the Contractor's control, while prestressing work is in progress, Contractor shall erect temporary protective fencing to prevent breaking strand from endangering such persons.
- 5. There shall be no welding to anchor plates after the vertical tendons have been assembled, neither shall prestressing steel be used as a "ground" for welding operations.

Z. ABRASIVE BLASTING

Exterior surfaces of the concrete corewall to be strandwrapped shall be abrasive blasted by a mechanical etching or shotblast system combined with a vacuum recovery system, or a self-contained waterblasting system. Systems that have not been used successfully in the past to prepare circular tank wall surfaces for shotcreting and strandwrapping or systems relying on sandblasting or steel shot without a vacuum system will not be allowed. The surface shall be sufficiently abrasive blasted to remove all laitance, form oil or other type of coatings. The surface shall be cut to a minimum CSP5 profile, as established by the International Concrete Repair Institute (ICRI), over a minimum of 90% of the surface being prepared as measured over any one square foot area. The prestressing subcontractor who is performing the abrasive blasting shall make available to the inspector ICRI sample coupons to assist in evaluating the abrasive cut.

AA. SHOTCRETE EQUIPMENT

1. Mixing: The mixing of shotcrete material shall be done in conformance with the requirements of Section 303.03A "Concrete Work for Strandwrapped Prestressed Reservoir."

2. Delivery Equipment

- a. The delivery equipment shall be of an approved design and size with a record of satisfactory results in similar previous work.
- b. The equipment shall be capable of discharging mixed materials into the hose under close control and shall be able to deliver a continuous smooth stream of uniformly mixed material at the proper velocity to the discharge nozzle, free of any kind of slugs.
- c. The equipment shall permit concrete, water and air to be distributed to the automated shotcrete tower through a swivel pin located at the center of the tank.
- d. The nozzle shall be of a design and size that will ensure a smooth and uninterrupted flow of materials.
- e. Delivery equipment shall be thoroughly cleaned at the end of each shift.
- f. Equipment parts shall be regularly inspected and replaced as required.
- 3. Air Supply: The air capacity of the compressor shall be large enough that the minimum amount of air to be available at the nozzle shall be no less than 400 CFM, irrespective of whether or not air from the same air supply is used for other purposes.

BB. SHOTCRETE APPLICATION PROCESS

- 1. Shotcrete shall be applied under the wet mix process only.
- 2. Nozzles shall be mounted on power driven machinery enabling the nozzle to travel parallel to the surface to be sprayed at a uniform linear or bi-directional speed.
- 3. The nozzle shall be kept at a uniform constant distance from the surface, always insuring a right angle spray of the material to the surface.
- 4. Hand operated nozzles and shotcreting operations dependent on the performance of the nozzleman will not be accepted except where additional shotcrete is needed to correct flat areas or for architectural surface treatments.
- Grout materials shall be delivered to the jobsite in ready-mix trucks from approved batching plants. However, job mixing will be accepted provided automatic weigh batch plants are used.
- 6. The sand, cement and water shall be premixed before being pumped through a 2" minimum hose by specially designed mortar pumps.
- 7. The high velocity impact of the shotcrete shall be developed pneumatically by injecting compressed air at the nozzle.

CC. SHOTCRETE PLACING AND FINISHING

- 1. General
 - a. Shotcrete shall be applied in a steady, uninterrupted flow.
 - b. Should the flow become intermittent for any cause, the machine operator shall direct the nozzle away from the work until it again becomes constant, or shut off the flow of materials.
- 2. Position of Pneumatic Nozzles: The nozzle shall be held at approximately right angles to the surface and shall be kept at a constant and proper distance, as dictated by good practice standards for the type of application, type of nozzle and air pressure employed.
- 3. Shotcreting More Than One Layer
 - a. Sufficient time shall be allowed for each layer of shotcrete to set up to prevent the next layer from sagging.
 - b. The shotcrete shall be started at the bottom of the wall and proceed upward until all wrapped strand has been covered. Subsequent shotcrete layers may be applied from the top down or from the bottom up at the discretion of the Contractor.

- c. While the nozzle travels around the wall, the nozzle shall be raised or lowered at a uniform rate in such a manner that an adequate overlapping of coatings and a uniform finish develops.
- d. The nozzle shall be spiralled up or down around the tank to either the top or the bottom of the wall or to the termination of the strand layer being covered.

4. Application of Shotcrete

- a. To ensure proper penetration around the strand and proper conveyance of the material through the hose, a 5" to 7" slump of the mortar at the pump is recommended.
- b. The application of the shotcrete in the number and thickness of layers specified in design drawings by Contractor is mandatory for proper penetration of shotcrete behind prestressing steel and to reduce shrinkage due to more uniform in-depth drying of the shotcrete. The moisture absorption by earlier applied layers is relied upon to improve the bond and strength of the material and to reduce drying shrinkage of the applied shotcrete.

5. Shotcrete Covercoats Over Wrapped Strand

- a. Each layer of wrapped prestressing steel shall be covered with shotcrete until a minimum cover of 3/8" over the steel has been obtained.
- b. The final covercoat, to make up for the full thickness of shotcrete over the outermost strand layer, shall be applied in at least 3 layers of equal thickness.
- c. Each layer of shotcrete shall be completed for the full circumference of the tank and substantially the full height of that layer before the next layer of shotcrete may be applied.

6. Coating Thickness

- a. All shotcrete coatings shall be built up in layers of approximately 3/8 inch in thickness until the final required thickness has been obtained.
- b. Unless otherwise shown on the Drawings, the minimum shotcrete cover over all wrapped steel shall be 1.5 inch.

7. Finish Coat

a. After the minimum shotcrete cover specified over the wrapped prestressing strand has been completed by the automated shotcrete procedure, and only if such finish requirements are shown on the Drawings, the exterior surface shall be given an acceptable float finish true to line and curvature and to details shown on the Drawings.

- b. If a float finish is required on the Drawings, plaster or hand-applied shotcrete may be used to build up and level the surface and to obtain the desired surface finish and projections.
- c. The finish coat mix (if a smooth float finish is required on the Drawings), shall consist of a minimum of one sack of cement for every 3-1/2 cubic feet of moist plaster sand.
- d. If no finish requirements are shown on the Drawings, it is intended to have a natural original gun finish of the shotcrete covercoat.

8. Protection of Adjacent Buildings and Surface

- Contractor shall take every possible precaution to protect adjacent buildings, concrete surfaces, vehicles, equipment, etc., from being damaged by overshooting shotcrete and by materials carried away by the wind.
- b. Overshot shotcrete and rebound materials deposited on the roof shall be removed before it adheres to the concrete surface.
- c. Contractor shall pay for all damages caused by his operations under this contract.
- DD. <u>SHOTCRETE TESTS:</u> Testing of shotcrete shall conform to Section 303.03A(DD) "Concrete Tests" of these Special Provisions.

EE. NOZZLEMAN REQUIREMENTS FOR HAND PLACED SHOTCRETE

- 1. To ensure a high quality shotcrete, the Contractor shall satisfy the Engineer that the nozzleman has had sufficient and acceptable experience in the application of structural shotcrete.
- 2. Experience gained on shotcrete pool and ditch construction will not be considered as experience for qualifying the nozzleman, unless approved by the Engineer.
- 3. The nozzleman shall be capable of applying thin coats of even and uniform thickness.
- 4. The nozzleman's skill will be tested and approved by the Engineer before he may start any work.

FF. RESTRICTIONS ON SHOTCRETE OPERATION

1. Shotcrete shall not be applied under such strong wind conditions that a considerable amount of cement and moisture will be removed by the wind from the mortar spray between the nozzle and the surface intended to have shotcrete applied.

- 2. The Contractor may apply shotcrete under the conditions specified herein solely at his own risk.
- 3. Whenever rain or frost has damaged shotcrete that has not had a chance to set up, such shotcrete shall be removed and replaced.
- 4. Contractor shall consult with the Engineer to determine whether or not the shotcrete damaged by rain or frost will be accepted before applying any additional layers of shotcrete.

GG. SHOTCRETE WATERCURING

- 1. Intermediate layers of shotcrete shall be kept damp by hand curing or other means no sooner than 12 hours after the shotcrete has been applied.
- 2. This watercuring is not required should additional shotcrete be applied on the entire wall surface within the following 12 hours.
- 3. An indiscriminate use of continuous watercure for intermediate layers shall be avoided.
- 4. Complete shotcrete surfaces, which do not receive any additional coatings, shall be watercured for a period of at least seven (7) days by encapsulating the shotcrete with plastic sheeting. Such plastic sheeting shall be lapped and sealed as necessary to properly cure the shotcrete. Membrane curing methods utilizing curing compounds or wax-based residuals will not be permitted.
- 5. Wall coatings, as specified in Section 303.27A, shall be applied no later than five (5) days after completion of the watercuring. If conditions make it impossible to apply coatings within the five (5) day period, shotcrete shall be watercured for a period of ten (10) days instead of the seven (7) days specified here-in.

HH. CLEANING AND WATERPROOFING

- 1. After construction is completed, the interior of the tank shall be completely hosed out and cleaned of all dirt and loose material.
- 2. Cracks in the floor slab, wall, footings, columns or roof slab, which may have developed from drying shrinkage, shall not be taped or chipped out and caulked. All cracks shall be pumped and sealed with a two-part water insensitive epoxy.

II. <u>DISINFECTING AND FILLING</u>

- 1. Disinfection of the tank shall only proceed after the tank has been leak tested and the interior pipe coating per the construction documents.
- 2. The disinfection of the tank shall be performed as described in the Water System Standards, Section 303.10 "Reservoir Leakage Test and Disinfection".

JJ. LEAK TESTING AND REPAIRS

1. Testing

- a. Leak testing of the tank shall be conducted prior to disinfection and shall follow the procedures described in the Water System Standards, Section 303.10 "Reservoir Leakage Test and Disinfection".
- b. Testing shall be completed before the tank is backfilled, if applicable.

2. Leak Detection Methods

- a. Leaks in floor construction joints may be detected with the aid of a diver.
- b. Mud or cement deposits on the floor, when stirred up, would flow to the leak and may indicate the leak locations.
- c. Honeycomb and cracks around waterstops may be detected through tapping with a hammer along the joint.
- d. The Engineer may require any of these procedures when cement seeding has not stopped the leaks.
- e. Leakage through joints, which may have resulted from bent over waterstops or honeycomb under or around waterstops may require the removal of concrete around the waterstops in suspected areas.
- f. Chipped out concrete areas shall be properly drypacked as specified in Section 303.03A(BB)(8) of these Special Provisions.

3. Acceptance

- a. Any cracks, voids, honeycomb or cold joints showing or causing running leaks of water, shall be epoxy pumped by qualified operators until such cracks and voids have been completely sealed. If requested by the Contractor to stop floor leakage and if allowed by the Owner, the floor may be covered with a minimum of two inches of water and pure cement shall then be spread evenly over the entire floor area at the rate of one sack of cement to every 1000 square feet of floor area. The floor shall not be allowed to dry after the application of cement. If the tank has been cement seeded and if the tank is drained during the warranty period, Contractor shall be given fourteen (14) days advance notice and Contractor shall promptly remove all cement residue from the tank floor and clean the tank to the Owner's satisfaction. The Owner shall pay for the subsequent tank disinfection and chlorination.
- b. The tank shall not be backfilled until and unless the Engineer has accepted the tests.
- c. This section shall be applicable during the entire specified warranty period of the

tank.

d. After the completion of the reservoir leakage test, the reservoir shall remain filled until the reservoir is chlorinated and placed in service.

KK. PAYMENT

Payment for the work in this section shall not be made separately, but will be included with the lump sum amount for the item this is apart as stated in the Proposal.

END OF SECTION

WATER SYSTEM STANDARDS

<u>DIVISION 300</u> SECTION 303 - STRUCTURES

SECTION 303.16 BUILT-UP ROOFING

Delete and replace subsection D. PRODUCTS; 1. ROOFING SYSTEM with the following:

1. ROOFING SYSTEM: Atactic Polypropylene (APP) modified asphalt membrane consisting of a durable, non-woven polyester mat, enhanced with continuous glass reinforced glass fiber strands in the machine direction saturated with APP and surfaced with mineral granules, in conformance with ASTM D6222, Type I, Grade 'G', such as 'Brai Supreme – APP Granule FR'. Color of granular finish to be selected by Department. Apply to roof deck with coat of asphalt primer designed for use on cast in place concrete, such as APP 180 FR. Color of granule finish to be selected from manufacturer's standard colors by Department of Water Supply. Apply to Roof Deck with coat of asphalt primer designed for use with cast-in-place concrete for manufacturers' 10-Year Material and Labor Warranty against leaks.

Delete item D.2 "SUMMARY OF MATERIALS PER 100 SQ. FT."

Delete and replace subsection G. "APLICATION" with the following:

G. <u>APPLICATION</u>: Apply roofing materials as specified and as recommended by manufacturer's printed application instruction. Roofing sheets to be continuously torch welded at seams.

303.22A LOUVERS AND DAMPERS

- 303.22A.01 GENERAL DESCRIPTION: This item of work shall include the furnishing of all labor, materials, tools and equipment necessary complete the miscellaneous iron and metal work as specified in DIVISION 300 CONSTRUCTION, Section 303.22.E MISCELLANEOUS IRON AND METAL WORK Aluminum of the Water System Standards, 2002, and as amended hereinafter as applicable to this project.
- 303.22A.02 <u>VENTILATION LOUVER WITH FIRE DAMPER</u>: The fire damper cover grill shall be designed for exterior use with louvers to prevent wind-blown rain from entering the damper with bug screen backing. A. Static fire dampers with curtain style blades meeting requirements of UL Standard 555, 7th Edition, and shall have a minimum fire resistance rating of 1 ½ hours. The fire damper shall be a galvanized steel frame and blades with a stainless steel closure spring, such as Model OFD-150, Type A by GREENHECK, Schofield, WI (www.greenheck.com), Phone: 715-359-6171.
 - A. Fire damper shall be a "static" damper designed to be installed "out-of-the-wall" which allows the damper unit to be installed into a wall opening and project into the interior space.
 - B. The damper curtain shall be activated with a fusible link at a minimum temperature of 212 degrees F, that can be replaced after it has been activated. The unit shall be designed to operate without the need for electrical power.
 - C. The factory sleeve of the damper shall be supplied as a single assembly.
 - D. Retaining Angles for the unit shall be factory-supplied, sized to provide installation overlap in accordance with manufacturer's UL listing.
 - E. Submit copies of product data demonstrating proposed damper unit meets or exceeds the specified requirements and include installation instructions and operations/maintenance manual.
- 303.22A.03 EXTRUDED ALUMINUM WEATHER-RESISTANT LOUVERS: The weather-resistant louvers shall have a nominal frame depth of 4-inches and louver blades shall be extruded aluminum, 6063-T6 with a minimum wall thickness of 0.08 inches. The blades shall be horizontal oriented at an approximate angle to horizontal of 37.5 degrees as detailed, such as Model 455XP by INDUSTRIAL LOUVERS, INC., Delano MN (www.industriallouvers.com) Phone: 763-972-2981.

- A. Performance Ratings: Product must be licensed to bear the AMCA Certified Ratings Seal for water and Air Performance. a. Based on testing 48 inches by 48 inches size unit in accordance with AMCA 500-L, maximum water penetration of .01 ounces at an airflow of 858.7 FPM.
- B. Free area shall be a minimum of 50%.
- C. Exterior Aluminum Sill: Provide sill flashing of same material and finish as louvers where indicated on the drawings.
- D. Louver bug screen shall be fiberglass reinforced with an anodized aluminum frame and be mounted to the inside face of the building wall as detailed.
- E. Fabricate as required for optimum performance with respect to water penetration, strength, durability, and appearance. Verify opening size and placement of louvers before fabrication.
- F. Include supports, anchorages and accessories required for complete assembly.
- G. Provide vertical mullions of type and spacing as recommended by the manufacturer. Continuous vertical louver assemblies are required. Maintain equal blade spacing to produce uniform appearance.
- H. Join frame and blade members to one another by mechanical fastener, except where field bolted connections between frame members are necessary due to size of louvers.
- I. Factory-applied coating shall comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process. Provide color as selected by BWS from standard colors.
 - 1. Prime Coat: Apply alkyd prime coat following chemical cleaning and pretreatment.
 - 2. Fluorocarbon Two Coat Coating:
 - a. Coating shall conform to AAMA 2605 High Performance Organic Coatings on Architectural Extrusions and Panels
 - b. Louvers to be finished with a minimum 1.0 mil (0.025 mm) thick full strength 70% resin, 2 coat Fluoropolymer system.
 - c. All aluminum shall be thoroughly cleaned, etched, and given a chromatic conversion pretreatment before application of coating.

303.22A.04 GALVANIZING

- A. Components specified as galvanized, shall be in accordance with ASTM A123 and all applicable documents listed there in.
- B. Where fabricated pieces are too large to be galvanized as a single unit, the fabricated piece may be broken down into smaller units to be welded or bolted together after galvanizing. The location of all added connections must be clearly identified as such on a shop drawing submitted to the Manager for approval.
- C. Galvanizing shall be repaired at all locations of welding in accordance with methods A1 or A3 of ASTM A780.
- D. Repairs of other defects such as those caused by inadequate surface preparation, failure to remove weld slag, rough welding, poor galvanizing practice or defects due to any other causes shall only be accepted or approved by the Manager after inspecting the item after delivered to the jobsite.

303.22A.05 FIRE DAMPER INSTALLATION

- A. Store and handle fire damper units as recommended by manufacturer.
- B. Check conditions of project prior to starting work. If anything needs to be addressed in order for the fire damper unit to be properly installed, contact the Contractor. The start of installation work will indicate the site conditions at the time were acceptable.
- C. Install dampers in accordance with manufacturer's UL Installation Instructions, labeling, and NFPA 90A at locations indicated on the drawings. Any damper installation that is not in accordance with the manufacturer's UL Installation Instructions must be approved prior to installation.
- D. Dampers must be accessible to allow inspection, adjustment, and replacement of components.
- E. Install damper unit square and free from racking. Do not compress or stretch the damper frame into the duct or opening

303.22A.06 EXTRUDED ALUMINUM LOUVER INSTALLATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance.

Proceed with installation only after unsatisfactory conditions have been corrected.

- B. Clean surface of opening thoroughly prior to beginning installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install louvers at locations as indicated on the drawings and in accordance with the manufacturer's instructions. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.
- D. Install joint sealant as specified in Section 303.21 CAULKING of these special provisions.
- E. Clean louver surface after installation and touch-up finish coating, repair or replace damaged products before Substantial Completion.

303.22A.07 PAYMENT

Payment for LOUVERS AND DAMPERS, including all specified finishes will be made as lump sum bid prices as described in the Bid. The lump sum prices shall represent full compensation for all materials, labor, tools, equipment and incidentals required to construct the reservoir and appurtenances in place complete as shown in the Drawings.

END OF SECTION



Oahu Office 96-1416 Waihona Place Pearl City, Hawaii 96782-1973 (808) 455-6569 FAX (808) 456-7062 E-mail: fge@fgeltd.com

Maui Office 360 Papa Place, Suite 103 Kahului, Hawaii 96732-2464 (808) 873-0110 FAX (808) 873-0906

File 2460.01 January 5, 2005

Akinaka & Associates, Ltd. 3049 Ualena Street, Suite 500 Honolulu, Hawaii 96819-1947

Attention:

Mr. Sheldon Yamasato

President

Subject:

Supplemental Foundation Recommendations

Makuu 844' 1.0 M.G. Reservoir

Makuu Offsite Water System, Phase 2

Pahoa, Hawaii, Hawaii

In accordance with the request of KAI Hawaii, Inc., the Project Structural Engineer, transmitted herein are supplemental recommendations for the design of the interior column foundations for the proposed Makuu 844' 1.0 M.G. Reservoir of the Makuu Offsite Water System, Phase 2, project in Pahoa, Hawaii, Hawaii.

We understand that, in order to provide a leak detection system beneath the reservoir, it is desired to support the tank's interior columns on individual spread foundations bearing directly upon the interior floor slab. The floor slab will be underlain by at least 6 inches of crushed aggregate over the site's intact basalt.

We recommend that individual spread foundations bearing upon the floor slab be designed for a reduced allowable bearing pressure of 4,000 p.s.f. This value may be increased by one-third for short-term wind and seismic loads. Foundations bearing upon the interior floor slab should have a minimum base width of 30 inches. A friction factor of 0.50 may be used between the bottom of the foundations and the floor slab, to resist sliding. The floor slab beneath the foundations should be designed for a Modulus of Subgrade reaction of 275 pounds per square inch per inch (psi/in).

The center of the column foundations should be probed to a depth of 8 feet below the slab subgrade level to detect the possible presence of voids within the underlying basalt. Any voids encountered should be filled with lean concrete.

These recommendations are provided to supplement those contained in our November 2, 2004 Subsurface Investigation report and do not supersede those recommendations, except where specifically applicable. The limitations of the November 2004 Report are also applicable to these supplemental recommendations.

File 2460.01 January 5, 2005 Page 2

We appreciate the opportunity to be of service to you and look forward to continuing our work with you on this and future projects. Should you have any questions regarding this report, or any aspects of the services which we provide, please do not hesitate to contact us.

Respectfully submitted,

FEWELL GEOTECHNICAL ENGINEERING, LTD.

By Timothy J. Cavanaugh, P.E.

tjc:ajs:fse

LICENSED PROFESSIONAL ENGINEER
No. 6619-C

General Decision Number: HI120001 08/10/2012 HI1

Superseded General Decision Number: HI20100001

State: Hawaii

Construction Types: Building, Heavy (Heavy and Dredging),

Highway and Residential

Counties: Hawaii Statewide.

BUILDING CONSTRUCTION PROJECTS; RESIDENTIAL CONSTRUCTION
PROJECTS (consisting of single family homes and apartments up
to and including 4 stories); HEAVY AND HIGHWAY CONSTRUCTION
PROJECTS AND DREDGING

Modification	Number	Publication	Date
0		01/06/2012	
1		01/13/2012	
2		01/20/2012	
3		01/27/2012	
4		02/10/2012	
5		03/02/2012	
6		03/30/2012	
7		07/06/2012	
8		08/03/2012	
9		08/10/2012	

ASBE0132-001 08/29/2010

Rates Fringes

Asbestos Workers/Insulator
Includes application of
all insulating materials,
protective coverings,
coatings and finishes to
all types of mechanical
systems. Also the
application of
firestopping material for
wall openings and

penetrations in walls, floors, ceilings and curtain walls	.\$ 36.65	22.24
BOIL0627-005 01/01/2012		
	Rates	Fringes
BOILERMAKER	.\$ 33.70	26.35
BRHI0001-001 08/29/2011		
	Rates	Fringes
BRICKLAYER		
Bricklayers and Stonemasons Pointers, Caulkers and	.\$ 33.90	22.62
Weatherproofers	.\$ 34.15	22.62
BRHI0001-002 08/29/2011		
	Rates	Fringes
Tile, Marble & Terrazzo Worker		
Terrazzo Base Grinders Terrazzo Floor Grinders	.\$ 32.34	22.62
and Tenders	.\$ 30.79	22.62
Workers	.\$ 34.15	22.62
CARP0745-001 08/29/2011		
	Rates	Fringes
Carpenters:		
Carpenters; Hardwood Floor		
Layers; Patent Scaffold		
Erectors (14 ft. and		
over); Piledrivers;		
Pneumatic Nailers; Wood		
Shinglers and Transit		
and/or Layout Man	.\$ 38.00	19.62
Millwrights and Machine		40.65
Erectors Power Saw Operators (2	.\$ 38.25	19.62

h.p. and over)	.\$ 38.15	19.62	
CARP0745-002 08/29/2011			
	Rates	Fringes	
Drywall and Acoustical Workers and Lathers	.\$ 38.25	19.62	
ELEC1186-001 02/19/2012			
	Rates	Fringes	
Electricians:			
Cable Splicers		26.22	
Electricians	-	24.99	
Telecommunication worker	.\$ 23.20	17%+6.35	
* ELEC1186-002 02/20/2011			
	Rates	Fringes	
Line Construction:			
Cable Splicers	.\$ 44.33	24.67	
Groundmen/Truck Drivers		20.89	
Heavy Equipment Operators		22.50	
Linemen		23.57	
Telecommunication worker	.\$ 23.20	17%+\$6.35	
ELEV0126-001 01/01/2012			
	Rates	Fringes	
ELEVATOR MECHANIC	.\$ 50.63	23.535+a+b	
a. VACATION: Employer contributes 8% of basic hourly rate for 5 years service and 6% of basic hourly rate for 6 months to 5 years service as vacation pay credit.			
b. PAID HOLIDAYS: New Year's Day, Day, Labor Day, Veterans' Day,			

after Thanksgiving Day and Christmas Day.

ENGI0003-002 08/29/2011

I	Rates	Fringes
Diver (Aqua Lung) (Scuba)		
Diver (Aqua Lung) (Scuba)		
(over a depth of 30 feet)\$	58.75	23.94
Diver (Aqua Lung) (Scuba)		
(up to a depth of 30 feet)\$	49.38	23.94
Stand-by Diver (Aqua Lung)		
(Scuba)\$	40.00	23.94
Diver (Other than Aqua Lung)		
Diver (Other than Aqua		
Lung)\$	58.75	23.94
Diver Tender (Other than		
Aqua Lung)\$	36.97	23.94
Stand-by Diver (Other than		
Aqua Lung)\$	40.00	23.94
Helicopter Work		
Airborne Hoist Operator		
for Helicopter\$		23.94
Co-Pilot of Helicopter\$		23.94
Pilot of Helicopter\$	38.86	23.94
Power equipment operator -		
tunnel work		
GROUP 1\$		23.94
GROUP 2\$		23.94
GROUP 3\$		23.94
GROUP 4\$		23.94
GROUP 5\$		23.94
GROUP 6\$		23.94
GROUP 7\$		23.94
GROUP 8\$		23.94
GROUP 9\$		23.94
GROUP 9A\$		23.94
GROUP 10\$		23.94
GROUP 10A\$		23.94
GROUP 11\$		23.94
GROUP 12\$ GROUP 12A\$		23.94 23.94
Power equipment operators:	30.33	23.94
GROUP 1\$	24 60	23.94
GROUP 2\$		23.94
GROUP 3\$		23.94
GROUP 4\$		23.94
GROUP 5\$		23.94
GROUP 6\$		23.94
GROUP G	30.20	23.94

GROUP	7\$	36.52	23.94
GROUP	8\$	36.63	23.94
GROUP	9\$	36.74	23.94
GROUP	9A\$	36.97	23.94
GROUP	10\$	37.03	23.94
GROUP	10A\$	37.18	23.94
GROUP	11\$	37.33	23.94
GROUP	12\$	37.69	23.94
GROUP	12A\$	38.05	23.94
GROUP	13\$	34.97	23.94
GROUP	13A\$	35.24	23.94
GROUP	13B\$	35.55	23.94
GROUP	13C\$	36.20	23.94
GROUP	13D\$	36.52	23.94
GROUP	13E\$	36.63	23.94

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

- GROUP 1: Fork Lift (up to and including 10 tons); Partsman (heavy duty repair shop parts room when needed).
- GROUP 2: Conveyor Operator (Handling building material); Hydraulic Monitor; Mixer Box Operator (Concrete Plant).
- GROUP 3: Brakeman; Deckhand; Fireman; Oiler; Oiler/Gradechecker; Signalman; Switchman; Highline Cableway Signalman; Bargeman; Bunkerman; Concrete Curing Machine (self-propelled, automatically applied unit on streets, highways, airports and canals); Leveeman; Roller (5 tons and under); Tugger Hoist.
- GROUP 4: Boom Truck or dual purpose "A" Frame Truck (5 tons or less); Concrete Placing Boom (Building Construction); Dinky Operator; Elevator Operator; Hoist and/or Winch (one drum); Straddle Truck (Ross Carrier, Hyster and similar).
- GROUP 5: Asphalt Plant Fireman; Compressors, Pumps, Generators and Welding Machines ("Bank" of 9 or more, individually or collectively); Concrete Pumps or Pumpcrete Guns; Lubrication and Service Engineer (Grease Rack); Screedman.
- GROUP 6: Boom Truck or Dual Purpose "A"Frame Truck (over 5 tons); Combination Loader/Backhoe (up to and including 3/4 cu. yd.); Concrete Batch Plants (wet or dry); Concrete

Cutter, Groover and/or Grinder (self-propelled unit on streets, highways, airports, and canals); Conveyor or Concrete Pump (Truck or Equipment Mounted); Drilling Machinery (not to apply to waterliners, wagon drills or jack hammers); Fork Lift (over 10 tons); Loader (up to and including 3 and 1/2 cu. yds); Lull High Lift (under 40 feet); Lubrication and Service Engineer (Mobile); Maginnis Internal Full Slab Vibrator (on airports, highways, canals and warehouses); Man or Material Hoist; Mechanical Concrete Finisher (Large Clary, Johnson Bidwell, Bridge Deck and similar); Mobile Truck Crane Driver; Portable Shotblast Concrete Cleaning Machine; Portable Boring Machine (under streets, highways, etc.); Portable Crusher; Power Jumbo Operator (setting slip forms, etc., in tunnels); Rollers (over 5 tons); Self-propelled Compactor (single engine); Self-propelled Pavement Breaker; Skidsteer Loader with attachments; Slip Form Pumps (Power driven by hydraulic, electric, air, gas, etc., lifting device for concrete forms); Small Rubber Tired Tractors; Trencher (up to and including 6 feet); Underbridge Personnel Aerial Platform (50 feet of platform or less).

GROUP 7: Crusher Plant Engineer, Dozer (D-4, Case 450, John Deere 450, and similar); Dual Drum Mixer, Extend Lift; Hoist and/or Winch (2 drums); Loader (over 3 and 1/2 cu. yds. up to and including 6 yards.); Mechanical Finisher or Spreader Machine (asphalt), (Barber Greene and similar) (Screedman required); Mine or Shaft Hoist; Mobile Concrete Mixer (over 5 tons); Pipe Bending Machine (pipelines only); Pipe Cleaning Machine (tractor propelled and supported); Pipe Wrapping Machine (tractor propelled and supported); Roller Operator (Asphalt); Self-Propelled Elevating Grade Plane; Slusher Operator; Tractor (with boom) (D-6, or similar); Trencher (over 6 feet and less than 200 h.p.); Water Tanker (pulled by Euclids, T-Pulls, DW-10, 20 or 21, or similar); Winchman (Stern Winch on Dredge).

GROUP 8: Asphalt Plant Operator; Barge Mate (Seagoing); Cast-in-Place Pipe Laying Machine; Concrete Batch Plant (multiple units); Conveyor Operator (tunnel); Deckmate; Dozer (D-6 and similar); Finishing Machine Operator (airports and highways); Gradesetter; Kolman Loader (and similar); Mucking Machine (Crawler-type); Mucking Machine (Conveyor-type); No-Joint Pipe Laying Machine; Portable Crushing and Screening Plant; Power Blade Operator (under 12); Saurman Type Dragline (up to and including 5 yds.); Stationary Pipe Wrapping, Cleaning and Bending Machine; Surface Heater and Planer Operator, Tractor (D-6 and similar); Tri-Batch Paver; Tunnel Badger; Tunnel Mole and/or Boring Machine Operator Underbridge Personnel Aerial Platform (over 50 feet of platform).

GROUP 9: Combination Mixer and Compressor (gunite); Do-Mor Loaderand Adams Elegrader; Dozer (D-7 or equal); Wheel and/or Ladder Trencher (over 6 feet and 200 to 749 h.p.).

GROUP 9A: Dozer (D-8 and similar); Gradesetter (when required by the Contractor to work from drawings, plans or specifications without the direct supervision of a foreman or superintendent); Push Cat; Scrapers (up to and including 20 cu. yds); Self-propelled Compactor with Dozer; Self-Propelled, Rubber-Tired Earthmoving Equipment (up to and including 20 cu. yds) (621 Band and similar); Sheep's Foot; Tractor (D-8 and similar); Tractors with boom (larger than D-6, and similar).

GROUP 10: Chicago Boom; Cold Planers; Heavy Duty Repairman or Welder; Hoist and/or Winch (3 drums); Hydraulic Skooper (Koehring and similar); Loader (over 6 cu. yds. up to and including 12 cu. yds.); Saurman type Dragline (over 5 cu. yds.); Self-propelled, rubber-tired Earthmoving Equipment (over 20 cu. yds. up to and including 31 cu. yds.) (637D and similar); Soil Stabilizer (P & H or equal); Sub-Grader (Gurries or other automatic type); Tractors (D-9 or equivalent, all attachments); Tractor (Tandem Scraper); Watch Engineer.

GROUP 10A: Boat Operator; Cable-operated Crawler Crane (up to and including 25 tons); Cable-operated Power Shovel,
Clamshell, Dragline and Backhoe (up to and including 1 cu. yd.); Dozer D9-L; Dozer (D-10, HD41 and similar) (all attachments); Gradall (up to and including 1 cu. yd.);
Hydraulic Backhoe (over 3/4 cu. yds. up to and including 2 cu. yds.); Mobile Truck Crane Operator (up to and including 25 tons) (Mobile Truck Crane Driver Required);
Self-propelled Boom Type Lifting Device (Center Mount) (up to and including 25 tons) (Grove, Drott, P&H, Pettibone and similar; Trencher (over 6 feet and 750 h.p. or more); Watch Engineer (steam or electric).

GROUP 11: Automatic Slip Form Paver (concrete or asphalt); Band Wagon (in conjunction with Wheel Excavator); Cable-operated Crawler Cranes (over 25 tons but less than 50 tons); Cable-operated Power Shovel, Clamshell, Dragline and Backhoe (over 1 cu. yd. up to 7 cu. yds.); Gradall (over 1 cu. yds. up to 7 cu. yds.); DW-10, 20, etc. (Tandem); Earthmoving Machines (multiple propulsion power units and 2 or more Scrapers) (up to and including 35 cu. yds., " struck" m.r.c.); Highline Cableway; Hydraulic Backhoe (over 2 cu. yds. up to and including 4 cu. yds.); Leverman; Lift Slab Machine; Loader (over 12 cu. yds); Master Boat Operator; Mobile Truck Crane Operator (over 25 tons but less than 50 tons); (Mobile Truck Crane Driver required); Pre-stress Wire Wrapping Machine; Self-propelled Boom-type Lifting Device (Center Mount) (over 25 tons m.r.c); Self-propelled Compactor (with multiple-propulsion power units); Single Engine Rubber Tired Earthmoving Machine (with Tandem Scraper); Tandem Cats; Trencher (pulling attached shield).

GROUP 12: Clamshell or Dipper Operator; Derricks; Drill Rigs; Multi-Propulsion Earthmoving Machines (2 or more Scrapers) (over 35 cu. yds "struck"m.r.c.); Operators (Derricks, Piledrivers and Cranes); Power Shovels and Draglines (7 cu. yds. m.r.c. and over); Self-propelled rubber-tired Earthmoving equipment (over 31 cu. yds.) (657B and similar); Wheel Excavator (up to and including 750 cu. yds. per hour); Wheel Excavator (over 750 cu. yds. per hour).

GROUP 12A: Dozer (D-11 or similar or larger); Hydraulic Excavators (over 4 cu. yds.); Lifting cranes (50 tons and over); Pioneering Dozer/Backhoe (initial clearing and excavation for the purpose of providing access for other equipment where the terrain worked involves 1-to-1 slopes that are 50 feet in height or depth, the scope of this work does not include normal clearing and grubbing on usual hilly terrain nor the excavation work once the access is provided); Power Blade Operator (Cat 12 or equivalent or over); Straddle Lifts (over 50 tons); Tower Crane, Mobile; Traveling Truss Cranes; Universal, Liebher, Linden, and similar types of Tower Cranes (in the erection, dismantling, and moving of equipment there shall be an additional Operating Engineer or Heavy Duty Repairman); Yo-Yo Cat or Dozer.

GROUP 13: Truck Driver (Utility, Flatbed, etc.)

GROUP 13A: Dump Truck, 8 cu.yds. and under (water level); Water Truck (up to and including 2,000 gallons).

GROUP 13B: Water Truck (over 2,000 gallons); Tandem Dump Truck, over 8 cu. yds. (water level).

GROUP 13C: Truck Driver (Semi-trailer. Rock Cans, Semi-Dump or Roll-Offs).

GROUP 13D: Truck Driver (Slip-In or Pup).

GROUP 13E: End Dumps, Unlicensed (Euclid, Mack, Caterpillar or similar); Tractor Trailer (Hauling Equipment); Tandem Trucks hooked up to Trailer (Hauling Equipment)

BOOMS AND/OR LEADS (HOURLY PREMIUMS):

The Operator of a crane (under 50 tons) with a boom of 80 feet or more (including jib), or of a crane (under 50 tons) with leads of 100 feet or more, shall receive a per hour premium for each hour worked on said crane (under 50 tons) in accordance with the following schedule:

Booms of 80 feet up to but
not including 130 feet or
Leads of 100 feet up to but
not including 130 feet 0.50
Booms and/or Leads of 130 feet
up to but not including 180 feet 0.75
Booms and/or Leads of 180 feet up
to and including 250 feet 1.15
Booms and/or Leads over 250 feet 1.50

The Operator of a crane (50 tons and over) with a boom of 180 feet or more (including jib) shall receive a per hour premium for each hour worked on said crane (50 tons and over) in accordance with the following schedule:

Booms of 180 feet up to and including 250 feet 1.25 Booms over 250 feet 1.75

ENGI0003-004 08/29/2011

F	lates	Fringes
Dredging: (Boat Operators)		
Boat Deckhand\$	34.97	23.94
Boat Operator\$	37.18	23.94
Master Boat Operator\$	37.33	23.94
Dredging: (Clamshell or		
Dipper Dredging)		
GROUP 1\$	37.69	23.94
GROUP 2\$	37.03	23.94
GROUP 3\$	36.63	23.94
GROUP 4\$	34.97	23.94
Dredging: (Derricks)		
GROUP 1\$	37.69	23.94
GROUP 2\$	37.03	23.94
GROUP 3\$	36.63	23.94
GROUP 4\$	34.97	23.94
Dredging: (Hydraulic Suction		
Dredges)		
GROUP 1\$	37.33	23.94
GROUP 2\$	37.18	23.94
GROUP 3\$	37.03	23.94
GROUP 4\$	36.97	23.94
Group 5\$	36.63	23.94
Group 6\$	36.52	23.94
Group 7\$	34.97	23.94

CLAMSHELL OR DIPPER DREDGING CLASSIFICATIONS

GROUP 1: Clamshell or Dipper Operator.

GROUP 2: Mechanic or Welder; Watch Engineer.

GROUP 3: Barge Mate; Deckmate.

GROUP 4: Bargeman; Deckhand; Fireman; Oiler.

HYDRAULIC SUCTION DREDGING CLASSIFICATIONS

GROUP 1: Leverman.

GROUP 2: Watch Engineer (steam or electric).

GROUP 3: Mechanic or Welder.

GROUP 4: Dozer Operator.

GROUP 5: Deckmate.

GROUP 6: Winchman (Stern Winch on Dredge)

GROUP 7: Deckhand (can operate anchor scow under direction of

Deckmate); Fireman; Leveeman; Oiler.

DERRICK CLASSIFICATIONS

GROUP 1: Operators (Derricks, Piledrivers and Cranes).

GROUP 2: Saurman Type Dragline (over 5 cubic yards).

GROUP 3: Deckmate; Saurman Type Dragline (up to and

including 5 yards).

GROUP 4: Deckhand, Fireman, Oiler.

ENGI0003-044 08/29/2011

1	Rates	Fringes
Power Equipment Operators (PAVING)		
(10) Cold Planer	37.40	25.33
and under)\$	36.57	25.33
(10)Soil Stabilizer\$		25.33
(11)Loader (over 2 1/2 cu. yds. to and including 5		
cu. yds.)\$ (3)Roller Operator (five	36.89	25.33
tons and under)\$	35.34	25.33
(5) Screed Person\$		25.33
(6)Combination Loader/Backhoe (up to 3/4		
cu.yd.)\$	34.63	25.33
(6)Concrete Saws and/or Grinder (self-propelled		
unit on streets, highways,		
airports and canals)\$ (6)Roller Operator (over	36.57	25.33
five tons)\$ (7)Combination	36.77	25.33
Loader/Backhoe (over 3/4		
cu.yd.)\$	35.61	25.33
(8) Asphalt Plant Operator\$		25.33
Asphalt Concrete Material		
Transfer\$	36.57	25.33
Asphalt Raker\$	35.61	25.33
Asphalt Spreader Operator\$		25.33
Grader\$		25.33
Laborer, Hand Roller\$	32.84	25.33

IRON0625-001 09/01/2011

1	Rates	Fringes
Ironworkers:\$	33.75	28.01

a. Employees will be paid \$.50 per hour more while working in tunnels and coffer dams; \$1.00 per hour more when required to work under or are covered with water (submerged) and when they are required to work on the summit of Mauna Kea, Mauna Loa or Haleakala.

LABO0368-001 08/29/2011

I	Rates	Fringes
Laborers:		
Driller\$	31.30	15.91
Final Clean Up\$	21.70	11.47
Gunite Operator & High		
Scaler\$	30.80	15.91
Laborer I\$	30.30	15.91
Laborer II\$	27.70	15.91
Powderman\$	31.30	15.91
Window Washer (bosun chair).\$	29.80	15.91

LABORERS CLASSIFICATIONS

Laborer I: Asbestos Removal Worker (EPA certified workers); Asphalt Laborer, Ironer, Raker, Luteman, and Handroller, and all types of Asphalt Spreader Boxes; Asphalt Shoveler; Assembly and Installation of Multiplates, Liner Plates, Rings, Mesh, Mats; Batching Plant (portable and temporary); Boring Machine Operator (under streets and sidewalks); Buggymobile; Burning, Welding, Signalling, Choke Setting, and Rigging in connection with Laborers' work (except demolition); Chainsaw, Faller, Logloader, and Bucker; Compactors (Jackson Jumping Jack and similar); Concrete Bucket Dumpman; Concrete Chipping; Concrete Chuteman/Hoseman (pouring concrete) (the handling of the chute from ready-mix trucks for such jobs as walls, slabs, decks, floors, foundations, footings, curbs, gutters, and sidewalks); Concrete Core Cutter (Walls, Floors, and Ceiling); Concrete Grinding or Sanding; Concrete: Hooking on, signaling, dumping of concrete for treme work over

water on caissons, pilings, abutments, etc.; Concrete: Mixing, handling, conveying, pouring, vibrating, otherwise placing of concrete or aggregates or by any other process; Concrete: Operation of motorized wheelbarrows or buggies or machines of similar character, whether run by gas, diesel, or electric power; Concrete Placement Machine Operator: operation of Somero Hammerhead, Copperheads, or similar machines; Concrete Pump Machine (laying, coupling, uncoupling of all connections and cleaning of equipment); Concrete and/or Asphalt Saw (Walking or Handtype) (cutting walls or flatwork) (scoring old or new concrete and/or asphalt) (cutting for expansion joints) (streets and ways for laying of pipe, cable or conduit for all purposes); Concrete Shovelers/Laborers (Wet or Drv); Concrete Screeding for Rough Strike-Off: Rodding or striking-off, by hand or mechanical means prior to finishing; Concrete Vibrator Operator; Coring Holes: Walls, footings, piers or other obstructions for passage of pipes or conduits for any purpose and the pouring of concrete to secure the hole; Curbing (Concrete and Asphalt); Curing of Concrete (impervious membrane and form oiler) mortar and other materials by any mode or method: Cut Granite Curb Setter (setting, leveling and grouting of all precast concrete or stone curbs); Cutting and Burning Torch (demolition); Dri Pak-It Machine; Falling, bucking, yarding, loading or burning of all trees or timber on construction site; Forklift (9 ft. and under); Grating and Grill work for drains or other purposes; Green Cutter of concrete or aggregate in any form, by hand, mechanical means, grindstone or air and/or water; Grout: Spreading for any purpose: Guinea Chaser (Grade Checker) for general utility trenches, sitework, and excavation; Headerboard Man (Asphalt or Concrete); Heat Welder of Plastic (Laborers' AGC certified workers) (when work involves waterproofing for waterponds, artificial lakes and reservoir, or heat welding for sewer pipes); Heavy Highway Laborer (Rigging, signaling, handling, and installation of pre-cast catch basins, manholes, curbs and gutters); High Pressure Nozzleman - Hydraulic Monitor (over 100# pressure); Installation of lightweight backfill; Jackhammer Operator; Jacking of slip forms: All semi and unskilled work connected therewithin; Laying of all multi-cell conduit or multi-purpose pipe; Lead base paint abatement laborers (EPA certified workers); Magnesite and Mastic Workers (Wet or Drv) (including mixer operator); Mason Tender, Mortar Man;

Mortar Mixer (Block, Brick, Masonry, and Plastering); Nozzleman (Sandblasting and/or Water Blasting): handling, placing and opertion of nozzle; Operation, Manual or Hydraulic jacking of shields and the use of such other mechanical equipment as may be necessary; Pavement Breakers; Paving, curbing and surfacing of streets, ways, courts, under and overpasses, bridges, approaches, slope walls, and all other labor connected therewith; Pilecutters; Pipe Accessment in place, bolting and lining up of sectional metal or other pipe including corrugated pipe; Pipelayer performing all services in the laying and installation of pipe from the point of receiving pipe in the ditch until completion of operation, including any and all forms of tubular material, whether pipe, metallic or non-metallic, conduit, and any other stationary-type of tubular device used for conveying of any substance or element, whether water, sewage, solid, gas, air, or other product whatsoever and without regard to the nature of material from which tubular material is fabricated; No-joint pipe and stripping of same, Pipewrapper, Caulker, Bander, Kettlemen, and men applying asphalt, Laykold, treating Creosote and similar-type materials (6-inch) pipe and over); Piping: resurfacing and paving of all ditches in preparation for laying of all pipes; Pipe laying of lateral sewer pipe from main or side sewer to buildings or structure (except Contactor may direct work be done under proper supervision); Pipe laying, leveling and marking of the joint used for main or side sewers and storm sewers; Laying of all clay, terra cotta, ironstone, vitrified concrete or other pipe for drainage; Placing and setting of water mains, gas mains and all pipe including removal of skids; Plaster Mortar Mixer/Pump; Pneumatic Impact Wrench; Portable Sawmill Operation: Choker setters, off bearers, and lumber handlers connected with clearing; Posthole Digger (Hand Held, Gas, Air and Electric); Power Broom Sweepers (Small); Preparation and Compaction of roadbeds for railroad track laying, highway construction, and the preparation of trenches, footings, etc., for cross-country transmission by pipelines, electrical transmission or underground lines or cables (by mechanical means); Raising of structure by manual or hydraulic jacks or other methods and resetting of structure in new locations, including all concrete work; Ramming or compaction; Riprap, Stonepaver, and Rock Slinger (includes placement of stacked concrete, wet or dry and loading, unloading, signaling, slinging and

setting of other similar materials); Rotary Scarifier (including multiple head concrete chipping Scarifier); Salamander Heater, Drying of plaster, concrete mortar or other aggregate; Scaffold Erector Leadman; Scaffolds: (Swing and hanging) including maintenance thereof; Scaler; Septic Tank/Cesspool and Drain Fields Digger and Installer; Shredder/Chipper (tree branches, brush, etc.); Stripping and Setting Forms; Stripping of Forms: Other than panel forms which are to be re-used in their original form, and stripping of forms on all flat arch work; Tampers (Barko, Wacker, and similar type); Tank Scaler and Cleaners; Tarman: Tree Climbers and Trimmers: Trencher (includes hand-held, Davis T-66 and similar type); Trucks (flatbed up to and including 2 1/2 tons when used in connection with on-site Laborers'work; Trucks (Refuse and Garbage Disposal) (from job site to dump); Vibra-Screed (Bull Float in connection with Laborers' work); Well Points, Installation of or any other dewatering system.

Laborer II: Air Blasting; Appliance Handling (job site) (after delivery and unloading in storage area); Asphalt Plant Laborer; Backfilling, Grading and all other labor connected therewith; Boring Machine; Bridge Laborer; Burning of all debris (crates, boxes, packaging waste materials); Chainman, Rodmen, and Grade Markers; Cleaning and Clearing of all debris; Cleaning, clearing, grading and/or removal for streets, highways, roadways, aprons, runways, sidewalks, parking areas, airports, approaches, and other similar installations; Cleaning or reconditioning of streets, ways, sewers and waterlines, all maintenance work and work of an unskilled and semi-skilled nature; Cleanup of Grounds and Buildings (other than "Light Clean-Up") (Janitorial Laborer); Clean-up of right-of-way; Clearing and slashing of brush or trees by hand or mechanical cutting; Concrete Bucket Tender (Groundman) hooking and unhooking of bucket; Concrete Forms; moving, cleaning, oiling and carrying to the next point of erection of all forms; Concrete Products Plant Laborers; Conveyor Tender (conveying of building materials); Cribbers, Shorer, Lagging, Sheeting, and Trench Jacking and Bracing, Hand-Guided Lagging Hammer Whaling Bracing; Crushed Stone Yards and Gravel and Sand Pit Laborers and all other similar plants; Demolition, Wrecking and Salvage Laborers: Wrecking and dismantling of buildings and all structures, with use of cutting or wrecking tools, burning or cutting,

breaking away, cleaning and removal of all masonry, wood or metal fixtures for salvage or scrap, All hooking, unhooking, signaling of materials for salvage or scrap removed by crane or derrick; Digging under streets, roadways, aprons or other paved surfaces; Chuck Tender, Outside Nipper; Dry-packing of concrete (plugging and filling of she-bolt holes); Excavation, Preparation of street ways and bridges; Fence and/or Guardrail Erector: Dismantling and/or re-installation of all fence; Finegrader; Firewatcher; Flagman (Coning, preparing, stablishing and removing portable roadway barricade devices); Signal Men on all construction work defined herein, including Traffic Control Signal Men at construction site; Garbage and Debris Handlers and Cleaners; Gas, Pneumatic, and Electric Tools, not listed Group 1 (except Rototiller); General Clean-up; sweeeping, cleaning, washdown, wiping of construction facility, and equipment (other than "Light Clean-up" [Janitorial] Laborer); General Excavation and Grading (all labor connected therewith); Digging of trenches, ditches and manholes and the leveling, grading and other preparation prior to laying pipe or conduit for any purpose; Excavations and foundations for buildings, piers, foundations and holes, and all other construction; General Laborer; Ground and Soil Treatment Work (Pest Control); Junk Yard Laborers (same as Salvage Yard); Landscape Nursery Laborers: Laser Beam "Target Man" in connection with Laborers' work; Layout Person for Plastic (when work involves waterproofing for waterponds, artificial lakes and reservoirs); Limbers, Brush Loaders, and Pilers; Loading, Unloading, carrying, distributing and handling of all rods and material for use in reinforcing concrete construction (except when a derrick or outrigger operated by other than hand power is used); Loading, unloading, sorting, stockpiling, handling and distribution of water mains, gas mains and all pipes; Loading and unloading of all materials, fixtures, furnishings and appliances from point of delivery to stockkpile to point of installation; hooking and signalling from truck, conveyance or stockpile; Material Yard Laborers; Pipelayer Tender; Pipewrapper, Caulker, Bander, Kettlemen, and men applying asphalt, Laykold, Creosote, and similar-type materials (pipe under 6 inches); Plasterer Laborer (including Hod Carrier); Preparation, construction and maintenance of roadbeds and sub-grade for all paving, including excavation, dumping,

and spreading of sub-grade material; Prestressed or precast concrete slabs, walls, or sections: all loading, unloading, stockpiling, hooking on of such slabs, walls or sections; Quarry Laborers; Railroad, Streetcar, and Rail Transit Maintenance and Repair; Removal of surplus material; Roustabout; Rubbish Trucks in connection with Building Construction Projects (excluding clearing, grubbing, and excavating); Salvage Yard: All work connected with cutting, cleaning, storing, stockpiling or handling of materials, all cleanup, removal of debris, burning, back-filling and landscaping of the site; Sandblasting (Pot Tender): Hoses and pots or markers; Scaffolds; Erection, planking and removal of all scaffolds used for support for lathers. plasters, brick lavers, masons, and other construction trades crafts; Scaffolds: (Specially designed by carpenters) laborers shall tend said carpenter on erection and dismantling thereof, preparation for foundation or mudsills, maintenance; Scraping of floors; Screeds: Handling of all screeds to be reused; handling, dismantling and conveyance of screeds; Setting, leveling and securing or bracing of metal or other road forms and expansion joints; Sheeting Piling/trench shoring (handling and placing of skip sheet or wood plank trench shoring); Ship Scalers; Sign Erector (subdivision traffic, regulatory, and street-name signs); Sloper; Slurry Seal Crews (Mixer Operator, Applicator, Squeegee Man, Shuttle Man, Top Man); Snapping of wall ties and removal of tie rods; Soil Test operations of semi and unskilled labor such as filling sand bags; Striper (Asphalt, Concrete or other Paved Surfaces); Tagging and Signaling of all building materials into high-rise units: Tool Room Attendant (Job Site): Traffic Delineating Device Applicator; Underpinning, lagging, bracing, propping and shoring, loading, signaling, right-of-way clearance along the route of movement, The clearance of new site, excavation of foundation when moving a house or structure from old site to new site; Utilities employees; Water Man; Waterscape/Hardscape Laborers; Wire Mesh Pulling (all concrete pouring operations); Wrecking, stripping, dismantling and handling concrete forms an false work.

Landscape & Irrigation Laborers

GROUP	1\$	21.70	8.52
GROUP	2\$	22.20	8.52
GROUP	3\$	18.20	8.52

LABORERS CLASSIFICATIONS

GROUP 1: Installation of non-potable permanent or temporary irrigation water systems performed for the purposes of Landscaping and Irrigation architectural horticultural work; the installation of drinking fountains and permanent or temporary irrigation systems using potable water for Landscaping and Irrigation architectural horticultural purposes only. This work includes (a) the installation of all heads, risers, valves, valve boxes, vacuum breakers (pressure and non-pressure), low voltage electrical lines and, provided such work involves electrical wiring that will carry 24 volts or less, the installation of sensors, master control panels, display boards, junction boxes, conductors, including all other components for controllers, (b) and metallic (copper, brass, galvanized, or similar) pipe, as well as PVC or other plastic pipe including all work incidental thereto, i.e., unloading, handling and distribution of all pipes fittings, tools, materials and equipment, (c) all soldering work in connection with the above whether done by torch, soldering iron, or other means; (d) tie-in to main lines, thrust blocks (both precast and poured in place), pipe hangers and supports incidental to installation of the entire irrigation system, (e) making of pressure tests, start-up testing, flushing, purging, water balancing, placing into operation all irrigation equipment, fixtures and appurtenances installed under this agreement, and (f) the fabrication, replacement, repair and servicing oflandscaping and irrigation systems. Operation of hand-held gas, air, electric, or self-powered tools and equipment used in the performance of Landscape and Irrigation work in connection with architectural horticulture; Choke-setting, signaling, and rigging for equipment operators on job-site in the performance of such Landscaping and Irrigation work; Concrete work (wet or dry) performed in connection with such Landscaping and Irrigation work. This work shall also include the setting of rock, stone, or riprap in connection with such Landscape, Waterscape, Rockscape, and Irrigation work;

Grubbing, pick and shovel excavation, and hand rolling or tamping in connection with the performance of such Landscaping and Irrigation work; Sprigging, handseeding, and planting of trees, shrubs, ground covers, and other plantings and the performance of all types of gardening and horticultural work relating to said planting; Operation of flat bed trucks (up to and including 2 1/2 tons).:

GROUP 2. Layout of irrigation and other non-potable irrigation water systems and the layout of drinking fountains and other potable irrigation water systems in connection with such Landscaping and Irrigation work. This includes the layout of all heads, risers, valves, valve boxes, vacuum breakers, low voltage electrical lines, hydraulic and electrical controllers, and metallic (coppers, brass, galvanized, or similar) pipe, as well as PVC or other plastic pipe. This work also includes the reading and interpretation of plans and specifications in connection with the layout of Landscaping, Rockscape, Waterscape, and Irrigation work; Operation of Hydro-Mulching machines (sprayman and driver), Drillers, Trenchers (riding type, Davis T-66, and similar) and fork lifts used in connection with the performance of such Landscaping and Irrigation work; Tree climbers and chain saw tree trimmers, Sporadic operation (when used in connection with Landscaping, Rockscape, Waterscape, and Irrigation work) of Skid-Steer Loaders (Bobcat and similar), Cranes (Bantam, Grove, and similar), Hoptos, Backhoes, Loaders, Rollers, and Dozers (Case, John Deere, and similar), Water Trucks, Trucks requiring a State of Hawaii Public Utilities Commission Type 5 and/or type 7 license, sit-down type and "gang" mowers, and other self-propelled, sit-down operated machines not listed under Landscape & Irrigation Maintenance Laborer; Chemical spraying using self-propelled power spraying equipment (200 gallon capacity or more).

GROUP 3: Maintenance of trees, shrubs, ground covers, lawns and other planted areas, including the replanting of trees, shrubs, ground covers, and other plantings that did not "take" or which are damaged; provided, however, that re-planting that requires the use of equipment, machinery, or power tools shall be paid for at the rate of pay specified under Landscape and Irrigation Laborer, Group 1; Raking, mowing, trimming, and runing, including the use of

"weed eaters", hedge trimmers, vacuums, blowers, and other hand-held gas, air, electric, or self-powered tools, and the operation of lawn mowers (Note: The operation of sit-down type and "gang" mowers shall be paid for at the rate of pay specified under Landscape & Irrigation Laborer, Group 2); Guywiring, staking, propping, and supporting trees; Fertilizing, Chemical spraying using spray equipment with less than 200 gallon capacity, Maintaining irrigation and sprinkler systems, including the staking, clamping, and adjustment of risers, and the adjustment and/or replacement of sprinkler heads, (Note: the cleaning and gluing of pipe and fittings shall be paid for at the rate of pay specified under Landscape & Irrigation Laborer(Group 1); Watering by hand or sprinkler system and the peformance of other types of gardening, yardman, and horticultural-related work.

LABO0368-003 08/29/2011

	Rates	Fringes
Underground Laborer		
GROUP 1	\$ 30.90	15.91
GROUP 2	\$ 32.40	15.91
GROUP 3	\$ 32.90	15.91
GROUP 4	\$ 33.90	15.91
GROUP 5	\$ 34.15	15.91
GROUP 6	\$ 34.25	15.91
GROUP 7	\$ 34.50	15.91

GROUP 1: Watchmen; Change House Attendant.

GROUP 2: Swamper; Brakeman; Bull Gang-Muckers, Trackmen; Dumpmen (any method); Concrete Crew (includes rodding and spreading); Grout Crew; Reboundmen

GROUP 3: Chucktenders and Cabletenders; Powderman (Prime House); Vibratorman, Pavement Breakers

GROUP 4: Miners - Tunnel (including top and bottom man on shaft and raise work); Timberman, Retimberman (wood or steel or substitute materials thereof); Blasters, Drillers, Powderman (in heading); Microtunnel Laborer; Headman; Cherry Pickerman (where car is lifted); Nipper; Grout Gunmen; Grout Pumpman & Potman; Gunite, Shotcrete Gunmen & Potmen; Concrete Finisher (in tunnel); Concrete Screed Man;

Bit Grinder; Steel Form Raisers & Setters; High Pressure Nozzleman; Nozzleman (on slick line); Sandblaster-Potman (combination work assignment interchangeable); Tugger

GROUP 5: Shaft Work & Raise (below actual or excavated ground

level); Diamond Driller; Gunite or Shotcrete Nozzleman;

Rodman; Groundman

GROUP 6: Shifter

GROUP 7: Shifter (Shaft Work & Raiser)

PAIN1791-001 07/01/2012

	Rates	Fringes
Painters:		
Brush		25.35
Sandblaster; Spray	\$ 34.10	25.35
PAIN1889-001 07/01/2011		
	Rates	Fringes
Glaziers	-	24.22
PAIN1926-001 07/01/2011		
	Rates	Fringes
Soft Floor Layers	\$ 28.12	20.98
PAIN1944-001 01/01/2012		
	Rates	Fringes
Taper	\$ 40.00	16.90
PLAS0630-001 08/29/2011		
	Rates	Fringes
PLASTERER	\$ 34.69	22.62
PLAS0630-002 08/29/2011		

	Rates	Fringes
Cement Masons: Cement Masons Trowel Machine Operators		22.62 22.62
PLUM0675-001 07/01/2012		
	Rates	Fringes
Plumber, Pipefitter, Steamfitter & Sprinkler Fitter	\$ 37.10	22.86
ROOF0221-001 09/25/2011		
	Rates	Fringes
Roofers (Including Built Up, Composition and Single Ply)	\$ 36.10	16.33
SHEE0293-001 08/28/2011		
	Rates	Fringes
Sheet metal worker	\$ 34.65	21.71
SUHI1997-002 09/15/1997		
	Rates	Fringes
Drapery Installer	\$ 13.60	1.20
FENCE ERECTOR (Chain Link Fence)	\$ 9.33	1.65
WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.		

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after

award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with characters other than "SU" denotes that the union classification and rate have found to be prevailing for that classification. Example: PLUM0198-005 07/01/2011. The first four letters, PLUM, indicate the international union and the four-digit number, 0198, that follows indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the rate.

Non-Union Identifiers

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union rates, LA indicates the State of Louisiana; 2004 is the year of the survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued

as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

WAGE DETERMINATION APPEALS PROCESS

- 1.) Has there been an initial decision in the matter? This can be:
- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations Wage and Hour Division U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

> Wage and Hour Administrator U.S. Department of Labor 200 Constitution Avenue, N.W.

Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION